MATHEMATICS

PRIMARY SIX

P6

TEACHER'S GUIDE

EXPERIMENTAL VERSION

Kigali, 2022

FOREWORD

Dear teacher,

Rwanda Basic Education Board is honoured to present P6 Mathematics teacher's guide. This book serves as a guide to competence-based teaching and learning to ensure consistency and coherence in the learning of Mathematics content for primary six. The Rwanda educational philosophy is to ensure that learners achieve full potential at every level of education which will prepare them to be well integrated in society and exploit employment opportunities.

In line with efforts to improve the quality of education, the government of Rwanda emphasizes the importance of aligning teaching and learning materials with the syllabus to facilitate their learning process. Many factors influence what they learn, how well they learn and the competences they acquire. Those factors include the relevance of the specific content, the quality of teachers' pedagogical approaches, the assessment strategies and the instructional materials available.

The special attention was paid to the activities that facilitate the learning process in which learners can develop ideas and make new discoveries during concrete activities carried out individually or with peers. With the help of the teacher, learners will gain appropriate skills and be able to apply what they have learnt in real life situations. Hence, they will be able to develop certain values and attitudes allowing them to make a difference not only to their own life but also to the nation.

This is in contrast to traditional learning theories which view learning mainly as a process of acquiring knowledge from the more knowledgeable who is mostly the teacher. In the regard of competence-based curriculum, learning is considered as a process of active building and development of knowledge and skills by the learner where concepts are mainly introduced by an activity, situation or scenario that helps the learner to construct knowledge, develop skills and acquire positive attitudes and values.

The book provides active teaching and learning techniques that engage pupils to develop competences. In view of this, your role as a teacher is to:

- Plan your lessons and prepare appropriate teaching materials;
- Organize group discussions for pupils considering the importance of social constructivism suggesting that learning occurs more effectively when pupils work collaboratively with more knowledgeable and experienced people;
- Engage pupils through active learning methods such as inquiry methods, group discussions, research, investigative activities and group and individual work activities;
- Provide supervised opportunities for pupils to develop different competences by giving tasks which enhance critical thinking, problem solving, research, creativity and innovation, communication and cooperation;

- Support and facilitate the learning process by valuing pupils' contributions in the class activities;
- Guide pupils towards the harmonization of their findings;
- Encourage individual, peer and group evaluation of the work done in the classroom and use appropriate competence-based assessment approaches and methods.

To facilitate you in your teaching activities, the content of this book is self explanatory so that you can easily use it. It is divided in 3 parts:
The part I explains the structure of this book and gives you the methodological guidance;
The part II gives a sample lesson plan;
The part III details the teaching guidance for each concept given in the pupil's book.

Even though this teacher's guide contains the guidance on solutions for some activities given in the student-teacher's book, you are requested to work through each question before judging pupils' findings.

I wish to sincerely extend my appreciation to the people who contributed towards the development and the adaptation of this book, particularly REB staff who organized the whole process from its inception. Special appreciation goes also to teachers who supported the exercise throughout.
Any comment or contribution would be welcome for the improvement of this textbook for next versions.

Dr. MBARUSHIMANA Nelson

Director General of REB

ACKNOWLEDGEMENT

I wish to sincerely express my special appreciation to the people who played a major role in the editing and the adaptation of this teacher's guide for P6 Mathematics.

It would not have been successful without the participation of different education stakeholders to whom I would like to express my deep gratitude.

My thanks first go to the Rwanda Basic Education Board staffs and teachers who were involved in the editing and the adaptation of this book.

I owe gratitude to different organizations and schools in Rwanda that have allowed us to work with their professionals in the editing and adaptation of this book.

Joan MURUNGI,

Head of CTLR Department

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PART I: GENERAL INTRODUCTION

Mathematics is a very important subject as it provides concepts that help learners to be equipped with skills, attitudes and values applicable when solving real life problems.

Mathematics helps learners to think critically. It guides them to have the culture of saving, economic development, and it provides values that allow people to promote social cohesion.
On a basic level, Mathematics helps people to be able to count, add, subtract, multiply, and divide. At the psychological level, exposure to mathematics helps people in developing an analytic mind and assists them in better organization of ideas and accurate expression of thoughts.
At a more general level, far away from dealing with the higher mathematical concepts, the importance of mathematics for a common man is related to its application in science and technology and in the day-to-day activities of life.

1.1. The structure of the teacher's guide

This book is a teacher's guide for P6 Mathematics. It is designed to accompany P6 Mathematics Pupil's book and intends to help teachers to plan quality mathematics lessons during the implementation of competence-based curriculum.

As the name says, it is a guide that teachers can refer to when preparing their lessons. Teachers may prefer to adopt the guidance provided but they are also expected to be more creative and consider their specific classes' contexts and prepare accordingly.

In this regard, learning is considered as a process of active building and developing of knowledge and skills by the learner where concepts are mainly introduced by an activity, situation or scenario that helps the learner to construct knowledge develop skills and acquire positive attitudes and values.

The book provides active teaching and learning techniques that engage pupils to develop competences and achieve the expected objectives.

In addition, this book provides more guidance on the content, teaching resources, techniques and methods of teaching, learning activities and application activities.

This section presents the overall structure, the unit and sub-heading structure of Mathematics content. It will help teachers to understand the different sections of this guide and what they will find in each section.

Overall structure of this book:
This teacher's guide of P6 Mathematics is composed of three parts:

The Part I concerns general introduction
It discusses methodological guidance on how best to teach and learn Mathematics by developing competences in teaching and learning, address cross-cutting issues when teaching and learning and it provides guidance on assessment.

Part II presents a sample lesson plan.

This lesson plan serves to guide the teacher while planning his/her lessons depending on the nature of the topic to be taught, school environment, teaching aids and level of pupils.

The Part III is about **the structure of a unit** and **the structure of a lesson**.

This includes information related to the different components of the unit and these components are the same for all units.

Structure of a unit

Each unit is made of the following sections:

- **Unit title** from the syllabus.
- **Key unit competence**: It highlights what the learner will be able to do at the end of the unit.
- **Prerequisites**: This section indicates knowledge, skills and attitudes learnt in previous lessons or levels that are required for the success of the unit.
The competence-based approach calls for connections between units/ topics within a subject and interconnections between different subjects. The teacher will find an indication of those prerequisites and guidance on how to establish connections.

- **Cross-cutting issues to be addressed**: This section suggests cross cutting issues that can be integrated depending on the unit content. It provides guidance on how to come up with the integration of the issue. Note that the issue indicated is a suggestion; teachers are free to take another cross-cutting issue taking into consideration the learning environment.

- List of lessons/sub-headings in each unit

Each unit has a table showing a suggestion on the list of lessons, lesson objectives copied or adapted from the syllabus and the proposal on the number of periods for each lesson. Each lesson /subheading is then developed.

- Teaching techniques for every lesson

This section shows the lesson objectives, Prerequisites/Revision/Introduction, Teaching

resources, Learning activities and suggestion on answers for activities and application activities provided in the learner's book. However, instead of developing every lesson, some units have the general guidance on teaching and learning activities.

- End of each unit:
At the end of each unit the teacher's guide provides the following sections:
End unit assessment which provides the answers to questions of end unit assessment given in the pupil's book.

Structure of each lesson or sub heading
Each lesson/sub-heading is made of the following sections:
- Lesson /Sub heading title
- Prerequisites/Revision/Introduction: This section gives a clear instruction to teacher on the required skills necessary to effectively learn the lesson. It can also show the teacher how to start the lesson.
- Teaching and learning resources: This section suggests the teaching aids or other resources needed in line with the activities to achieve the learning objectives. Teachers are encouraged to replace the suggested teaching aids by the available ones in their respective schools and based on learning environment.
- Teaching and learning activities or teaching steps: This section provides a short description of the methodology and any important aspect to consider. It provides also answers to learning activities with cross reference to text book.

In a word, this part provides information and guidelines on how to facilitate pupils while working on learning activities. More other, it provides answers for some activities given in the pupil's book.

1.2 Methodological guidance

1.2.1 Developing competences

Since the year 2015 Rwanda shifted from knowledge based to a competency-based curriculum for pre-primary, primary and general secondary education. This called for changing the way of learning by shifting from teacher centered to a learner centered approach.

Teachers are not only responsible for knowledge transfer but also for fostering pupils' learning achievement and creating safe and supportive learning environment. It implies also that pupils have to demonstrate what they are able to transfer the acquired knowledge, skills, values and attitude to new situations.

Teaching Mathematics requires pupils to perform different tasks and activities. The competence-based curriculum employs an approach of teaching and learning based on discrete skills rather than dwelling on only knowledge or the cognitive domain of learning. It focuses on what learner

can do rather than what learner can memorize. Pupils develop competences through discussions in group work activities and the teacher facilitates them to discover new ideas and concepts by providing support where needed. After group discussions, pupils are given time to present their findings and then with the help of the teacher they harmonize their presentations and finally make a lesson summary.

In addition to the competences related to Mathematics, pupils also develop generic competences which should promote the development of the higher order thinking skills. Generic competences are developed throughout all units of Mathematics as follows:

Generic competences	**Ways of developing generic competences**
Critical thinking	All activities that require pupils to calculate, convert, interpret, analyse, compare and contrast, etc have a common factor of developing critical thinking into pupils.
Creativity and innovation	All activities that require pupils to apply skills in solving real life problems or to plot a pictograph of a given algebraic data have a common character of developing creativity into pupils.
Research and problem solving	All activities that require pupils to make a simple research in the library or on internet to find answers for given problems have a character of developing research and problem solving into pupils.
Communication	During Mathematics class, all activities that require pupils to discuss either in groups or in the whole class, present findings, debate etc, have a common character of developing communication skills.
Co-operation, interpersonal relations and life skills	All activities that require pupils to work in pairs or in groups have a character of developing cooperation and life skills among pupils.
Lifelong learning	All activities that instil in the learner the need for more learning have a common character of developing into learners a curiosity of applying the knowledge learnt in a range of situations. The purpose of such kind of activities is for life-long learning enabling pupils to be able to adapt to the fast-changing world and the uncertain future by taking initiative to update knowledge and skills with minimum external support.

The generic competences help pupils deepen their understanding of Mathematics and apply their knowledge in solving problems met in a range of situations.

1.2.2 Addressing cross cutting issues

Among the changes brought by the competence-based curriculum is the integration of cross cutting issues as an integral part of the teaching and learning process as they relate to and must be considered within all subjects to be appropriately addressed. The eight cross cutting issues identified in the national curriculum framework are: *Comprehensive Sexuality Education, Environment and Sustainability, Financial Education, Genocide studies, Gender, Inclusive Education, Peace and Values Education, and Standardization Culture*.

Some cross-cutting issues may seem specific to particular learning areas/subjects but the teacher needs to address all of them whenever an opportunity arises. In addition, pupils should always be given an opportunity during the learning process to address these cross-cutting issues both within and out of the classroom.

Below are examples of how crosscutting issues can be addressed:

Cross-Cutting Issue	**Ways of addressing cross-cutting issues**
Environment and Sustainability: Integration of Environment, Climate Change and Sustainability in the curriculum focuses on and advocates for the need to balance economic growth, society well-being and ecological systems. Student-teachers need basic knowledge from the natural sciences, social sciences, and humanities to understand to interpret principles of sustainability.	Using word problems from real life experience, Mathematics teacher should lead learners to make calculations and find the correct solution. Among them, teacher may include problems which help learners to understand and to interpret principles of sustainability.
Financial Education: The integration of Financial Education into the curriculum is aimed at a comprehensive Financial Education program as a precondition for achieving financial inclusion targets and improving the financial capability of Rwandans so that they can make appropriate financial decisions that best fit the circumstances of one's life.	Through different examples and calculations on word problems from real life experience of pupils, Mathematics teacher can lead pupils to discuss how to make appropriate financial decisions.
Gender: At school, gender will be understood as family complementarities, gender roles and responsibilities, the need for gender equality and equity, gender stereotypes, gender sensitivity, etc.	Mathematics teacher should address gender as cross-cutting issue through assigning leading roles in the management of groups to both girls and boys and providing equal opportunity in the lesson participation and avoid any gender stereotype in the whole teaching and learning process.
Inclusive Education: Inclusion is based on the	Firstly, Mathematics teacher needs to

right of all learners to a quality and equitable education that meets their basic learning needs and understands the diversity of backgrounds and abilities as a learning opportunity.	identify/recognize pupils with special needs. Then by using adapted teaching and learning resources while conducting a lesson and setting appropriate tasks to the level of pupils, they can cater for pupils with special education needs.
Peace and Values Education: Peace and Values Education (PVE) is defined as education that promotes social cohesion, positive values, including pluralism and personal responsibility, empathy, critical thinking and action in order to build a more peaceful society.	Through a given lesson, a teacher should: ▪ Set a learning objective which is addressing positive attitudes and values, ▪ Encourage pupils to develop the culture of tolerance during discussion and to be able to instil it in colleagues and cohabitants; ▪ Encourage pupils to respect ideas for others.
Standardization Culture: Standardization Culture in Rwanda will be promoted through formal education and plays a vital role in terms of health improvement, economic growth, industrialization, trade and general welfare of the people through the effective implementation of Standardization, Quality Assurance, Metrology and Testing.	With different word problems or charts related to the effective implementation of Standardization, Quality Assurance, Metrology and Testing, pupils can be motivated to be aware of health improvement, economic growth, industrialization, trade and general welfare of the people.

1.2.3 Guidance on how to help learners with special education needs

In the classroom, pupils learn in different ways depending on their learning pace, needs or any other special problem they might have. However, the teacher has the responsibility to know how to adopt his/her methodologies and approaches in order to meet the learning needs of each pupil in the classroom. Also teachers need to understand that pupils with special needs have to be taught differently or need some accommodations to enhance the learning environment. This will be done depending on the subject and the nature of the lesson.

In order to create a well-rounded learning atmosphere, teachers need to:

- Remember that pupils learn in different ways, so they need a variety of activities (e.g. role-play, music and singing, word games and quizzes, and outdoor activities);
- Maintain an organize classroom and limiting the distraction. This will help pupils with special needs to stay on track during lesson and follow instruction easily;
- Vary the pace of teaching to meet the needs of each child because some pupils process information and learn more slowly than others;
- Break down instructions into smaller, manageable tasks. Pupils with special needs often have

difficulty in understanding long-winded or several instructions at once. It is better to use simple, concrete sentences in order to facilitate them understand what you are asking.

- Use clear and consistent language to explain the meaning (and demonstrate or show pictures) if you introduce new words or concepts;
- Make full use of facial expressions, gestures and body language;
- Pair a pupil who has a disability with a friend. Let them do things together and learn from each other. Make sure the friend is not over protective and does not everything for the one with disability. Both pupils will benefit from this strategy;
- Use multi-sensory strategies. As all pupils learn in different ways, it is important to make every lesson as multi-sensory as possible. Pupils with learning disabilities might have difficulty in one area, while they might excel in another. For example, use both visual and auditory cues.

Below are general strategies related to each main category of disabilities and how to deal with every situation that may arise in the classroom. However, the list is not exhaustive because each child is unique with different needs and that should be handled differently.

Strategy to help pupils with intellectual impairment:

- Use simple words and sentences when giving instructions;
- Use real objects that pupils can feel and handle. Rather than just working abstractly with pen and paper;
- Break a task down into small steps or learning objectives. The pupil should start with an activity that she/he can do already before moving on to something that is more difficult;
- Gradually give the pupil less help;
- Let the pupil with disability work in the same group with those without disability.

Strategy to help pupils with visual impairment:

- Help pupils to use other senses (hearing, touch, smell and taste) and carry out activities that will promote their learning and development;
- Use simple, clear and consistent language;
- Use tactile objects to help explain a concept;
- If the pupil has some sight, ask him/her what he/she can see;
- Make sure the pupil has a group of friends who are helpful and who allow him/her to be as independent as possible;
- Plan activities so that pupils work in pairs or groups whenever possible.

Strategy to help pupils with hearing disabilities or communication difficulties

- Always get the pupils ‘attention before you begin to speak;
- Encourage the pupil to look at your face;
- Use gestures, body language and facial expressions;
- Use pictures and objects as much as possible.
- Keep background noise to a minimum.

Strategies to help pupils with physical disabilities or mobility difficulties:

- Adapt activities so that pupils, who use wheelchairs or other mobility aids, can participate.
- Ask parents/caregivers to assist with adapting furniture e.g. the height of a table may need to be changed to make it easier for a pupil to reach it or fit their legs or wheelchair under;
- Encourage peer support when needed;
- Get advice from parents or a health professional about assistive devices if the pupil has one.

Adaptation of assessment strategies:

At the end of each unit, the teacher is advised to provide additional activities to help pupils achieve the key unit competence. These assessment activities are for remedial, consolidation and extension designed to cater for the needs of all categories of students; slow, average and gifted pupils respectively. Therefore, the teacher is expected to do assessment that fits individual pupil.

Remedial activities	After evaluation, slow learners are provided with lower order thinking activities related to the concepts learnt to facilitate them in their learning. These activities can also be given to assist deepening knowledge acquired through the learning activities for slow pupils.
Consolidation activities	After introduction of any concept, a range number of activities can be provided to all pupils to enhance/ reinforce learning.
Extended activities	After evaluation, gifted and talented learners can be provided with high order thinking activities related to the concepts learnt to make them think deeply and critically. These activities can be assigned to gifted and talented learners to keep them working while other pupils are getting up to required level of knowledge through the learning activity.

1.2.4. Guidance on assessment

Assessment is an integral part of teaching and learning process. The main purpose of assessment is for improvement of learning outcomes. Assessment for learning/ Continuous/ formative assessment intends to improve pupils' learning and teacher's teaching whereas assessment of learning/summative assessment intends to improve the entire school's performance and education system in general.

Continuous/ formative assessment

It is an on-going process that arises during the teaching and learning process. It includes lesson evaluation and end of sub unit assessment. This formative assessment should play a big role in teaching and learning process. The teacher should encourage individual, peer and group

evaluation of the work done in the classroom and uses appropriate competence-based assessment approaches and methods.
Formative assessment is used to:

- Determine the extent to which learning objectives are being achieved and competences are being acquired and to identify which pupils need remedial interventions, reinforcement as well as extended activities. The application activities are done in the pupil book and they are designed to be given as remedial, reinforcement, end lesson assessment, homework or assignment.
- Motivate pupils to learn and succeed by encouraging them to read, or learn more, revise, etc.
- Check effectiveness of teaching methods in terms of variety, appropriateness, relevance, or need for new approaches and strategies. Mathematics teachers need to consider various aspects of the instructional process including appropriate language levels, meaningful examples, suitable methods and teaching aids/ materials, etc.
- Help pupils to take control of their own learning.

In teaching Mathematics, formative or continuous assessment should compare performance against instructional objectives. Formative assessment should measure the pupil's ability with respect to a criterion or standard. For this reason, it is used to determine what pupils can do, rather than how much they know.

Summative assessment

The assessment can serve as summative and informative depending to its purpose. The end unit assessment will be considered summative when it is done at end of unit and want to start a new one.
It will be formative assessment, when it is done in order to give information on the progress of pupils and from there decide what adjustments need to be done.
The assessment done at the end of the term, end of year, is considered as summative assessment so that the teacher, school and parents are informed of the achievement of educational objective and think of improvement strategies. There is also end of level/ cycle assessment in form of national examinations.

When carrying out assessment?

Assessment should be clearly visible in lesson, unit, term and yearly plans.

- Before learning (diagnostic): At the beginning of a new unit or a section of work; assessment can be organized to find out what pupils already know / can do, and to check whether the pupils are at the same level.
- During learning (formative/continuous): When pupils appear to be having difficulty with some of the work, by using on-going assessment (continuous). The assessment aims at giving pupils support and feedback.

- After learning (summative): At the end of a section of work or a learning unit, the Mathematics teacher has to assess after the learning. This is also known as Assessment of Learning to establish and record overall progress of pupils towards full achievement. Summative assessment in Rwandan schools mainly takes the form of written tests at the end of a learning unit or end of the month, and examinations at the end of a term, school year or cycle.

Instruments used in assessment.

- **Observation:** This is where the Mathematics teacher gathers information by watching pupils interacting, conversing, working, playing, etc. A teacher can use observations to collect data on behaviours that are difficult to assess by other methods such as attitudes, values, and generic competences and intellectual skills. It is very important because it is used before the lesson begins and throughout the lesson since the teacher has to continue observing each and every activity.
- **Questioning**

(a) Oral questioning: a process which requires a pupil to respond verbally to questions;
(b) Class activities/ exercises: tasks that are given during the learning/ teaching process;
(c) Short and informal questions usually asked during a lesson;
(d) Homework and assignments: tasks assigned to pupils by their tutors to be completed outside of class.

Homework assignments, portfolio, project work, interview, debate, science fair, Mathematics projects and Mathematics competitions are also the different forms/instruments of assessment.

1.2.5. Teaching methods and techniques that promote active learning in mathematics

The different learning styles for pupils can be catered for when the teacher uses active learning whereby pupils are really engaged in the learning process.

a) **The main teaching methods used in mathematics** are the following:
Dogmatic method: the teacher tells the pupils what to do and how to attempt. It is sometimes used when pupils need an example before applying what they learn. For example when introducing the conversion of units of measurements.

Inductive-deductive method: Inductive method is to move from specific examples to generalization and deductive method is to move from generalization to specific examples. In lower primary, inductive is more appropriate as pupils start by observing concrete objects before generalizing what they see.

Skills Laboratory method: Laboratory method is based on the maxim "learning by doing." It is a procedure for stimulating the activities of the pupils and to encourage them to make discoveries through practical activities. For example, pupils can measure the total length of square's sides before concluding on how to find its perimeter.

Problem solving method

The following are some active techniques to be used in Mathematics:

- Group work
- Research
- Probing questions
- Practical activities (drawing, plotting, tabulation, interpreting pictographs)
- Modelling
- Brainstorming
- Quiz Techniques
- Discussion technique
- Scenario building technique.

b) What is Active learning?

Active learning is a pedagogical approach that engages pupils in doing things and thinking about the things they are doing. Pupils play the key role in the active learning process. They are not empty vessels to fill but people with ideas, capacity and skills to build on for effective learning. Thus, in active learning, pupils are encouraged to bring their own experience and knowledge into the learning process.

The role of the teacher in active learning	**The role of pupils in active learning**
- The teacher engages pupils through active learning methods such as inquiry methods, group discussions, research, investigative activities, group and individual work activities. - He/she encourages individual, peer and group evaluation of the work done in the classroom and uses appropriate competence-based assessment approaches and methods. - He provides supervised opportunities for pupils to develop different competences by giving tasks which enhance critical thinking, problem solving, research, creativity and innovation, communication and	A pupil engaged in active learning: - Communicates and shares relevant information with peers through presentations, discussions, group work and other learner-centred activities (role play, case studies, project work, research and investigation); - Actively participates and takes responsibility for his/her own learning; - Develops knowledge and skills in active ways; - Carries out simple research/investigation by consulting print/online documents and resourceful people, and presents their findings; - Ensures the effective contribution of each

cooperation. - The teacher supports and facilitates the learning process by valuing pupils' contributions in the class activities.	group member in assigned tasks through clear explanation and arguments, critical thinking, responsibility and confidence in public speaking - Draws conclusions based on the findings from the learning activities.

c) **Main steps for a lesson in active learning approach**

All the principles and characteristics of the active learning process highlighted above are reflected in steps of a lesson as displayed below. Generally, the lesson is divided into three main parts whereby each one is divided into smaller steps to make sure that pupils are involved in the learning process. Below are those main parts and their small steps:

1) Introduction

Introduction is a part where the teacher makes connection between the current and previous lesson through appropriate technique. The teacher opens short discussions to encourage pupils to think about the previous learning experience and connect it with the current instructional objective. The teacher reviews the prior knowledge, skills and attitudes which have a link with the new concepts to create good foundation and logical sequencings.

2) Development of the new lesson

The development of a lesson that introduces a new concept will go through the following small steps: discovery activities, presentation of pupils' findings, exploitation, synthesis/summary and exercises/application activities.

- **Discovery activity**

Step 1

- The teacher discusses convincingly with pupils to take responsibility of their learning;
- He/she distributes the task/activity and gives instructions related to the tasks (working in groups, pairs, or individual to instigate collaborative learning, to discover knowledge to be learned).

Step 2

- The teacher lets pupils work collaboratively on the task;
- He/she then monitors how pupils are progressing towards the knowledge to be learned and boosts those who are still behind (but without communicating to them the knowledge).

- **Presentation of student-teachers' findings/productions**

- In this episode, the teacher invites representatives of groups to present their productions/findings.

- After three/four or an acceptable number of presentations, the teacher decides to engage the class into exploitation of pupils' productions.

❖ **Exploitation of** pupils**' findings/ productions**

- The teacher asks pupils to evaluate the productions: which ones are correct, incomplete or false;
- Then the teacher judges the logic of the pupils' products, corrects those which are false, completes those which are incomplete, and confirms those which are correct.

❖ **Institutionalization or harmonization (summary/conclusion/ and examples)**

The teacher summarizes the learned knowledge and gives examples which illustrate the learned content.

❖ **Application activities**

- Exercises of applying processes and products/objects related to learned unit/sub-unit
- Exercises in real life contexts;
- The teacher guides pupils to make the connection of what they learnt to real life situations. At this level, the role of teacher is to monitor the fixation of process and product/object being learned.

3) Assessment

In this step the teacher asks some questions to assess achievement of instructional objective. During assessment activity, pupils work individually on the task/activity. The teacher avoids intervening directly. In fact, results from this assessment inform the teacher on next steps for the whole class and individuals. In some cases, the teacher can end with a homework/ assignment. Doing this will allow pupils to relay their understanding on the concepts covered that day. Teacher leads them not to wait until the last minute for doing the homework as this often results in an incomplete homework set and/or an incomplete understanding of the concept.

1.2.6 Stages of concept development in primary

There are 3 main stages for concept development in mathematics for lower primary: Concrete stage, semi concrete and abstract stage.

- Concrete stage: In this stage, the teacher begins the lesson by modelling each mathematical concept with concrete materials. In other words, this stage is the "doing" stage, using concrete objects to model problems. Those materials are real objects that learners manipulate and discuss how to use them for better learning.

- Semi- concrete stage, visualization or representation: In this stage, the teacher transforms the concrete model into a representational (semi-concrete) level, which may involve drawings or

pictures; using circles, dots, and tallies; or using pictures for counting. In other words, this is the "seeing" stage that uses representations of the objects to model problems.

- **Abstract stage:** In this stage, the teacher models the mathematics concept at a symbolic level, using only numbers, notation, and mathematical symbols to represent the number of circles or groups of circles. The teacher uses operation symbols (+, –, x, :) to indicate addition, multiplication, or division. This is the "symbolic" stage, where students are able to use abstract symbols to model problems.

PART II: SAMPLE LESSON

School Name: ..... Primary School **Teacher's name: …**

Term	**Date**	**Subject**	**Class**	**Unit No**	**Lesson No**	**Duration**	**Class size**
.....	.../.../20...	Mathematics	P.6	1/16	2 of 18	40 min	……
Type of Special Educational Needs to be catered for in this lesson and number of learners in each category.				Eye defect - short sighted: The learner will be given the opportunityof sitting in front			
Unit title		Reading, Writing and Comparing Whole Numbers Beyond1,000,000					
Key Unit Competence:		To be able to read, write and compare whole numbersbeyond 1,000,000.					
Title of the lesson		Reading and writing numbers beyond 1,000,000 in words					
Instructional Objective		Using flash cards, learner will be able to write numbers beyond 1,000,000 in words correctly.					
Plan for this Class (location: in / outside)		Inside the classroom.					
Learning Materials (for all learners)		Manila cards or slips of paper, scissors to make cut outs of numbers, on flash cards.					
References		Learner's Book, page 1, Teacher's Book page 4 and Maths syllabus for upper primary.					
Steps and Timing		**Description of teaching and learning activity** After forming the groups, with the help of the teacher learners will manipulate, observe the number cards. Helped bythe teacher, they will be able to read andwrite numbers in words.				**Competences and Cross-Cutting Issues to be addressed**	
		Teachers activities		Learners activities			
Introduction: 5 mins		Teacher gives learners the number cards and asks them to match them through a matching game in activity 2 page 1.		Learners take the flash cards. Learners participate in the matching game.		Co-operation, interpersonal management developed through the inter- action in groups.	

	Teacher helps learners to understand the instructions. Teacher explains the reason for the matching game. Teacher gives feedback to the game.	Learners follow the number card and do as instructed in the Learner's Book, page 1. Learners present their working in front of the classroom.	Critical thinking developed through the analysis of the process of matching. Communication developed through discussions in groups.
Development of the lesson (25 minutes)	Teacher helps learners to understand well through working out the examples in the Learner's Book, pages 2. Writes down an example of numbers which are in figures to write in words. Write down numbers which are in figure in words. Teacher gives learners the first three questions Application 1.1 (page 3) in Leaner's book.	Learners attempt to repeat the worked example with the help of the teacher. Write the flowing numbers in words: a) 5, 600,002 b) 6,412,500 c) 4,678,479 d) 63,455,205 e) 82,999,555 **Answer** a) Five million, six hundred thousand two Six million, four hundred twelve thousand five hundred. c) Four million, six hundred seventy-eight thousand four hundred seventy-nine. d) Sixty-three million four hundred fifty-five thousand two hundred five. e) Eighty two million, nine hundred	Co-operation , interpersonal management developed through the interaction in groups. Communication developed through class discussions. Problem solving through writing given numbers in words correctly.

		ninety nine thousand five hundred fifty five.	
Conclusion 10 mins	-Teacher helps learners to summarize the lesson. Teacher gives learners the remaining four questions of Application 1.1 page 3.	When writing whole number in words you have to group digits in threes starting on the right of wholenumbers. Learners do the rest of Application 1. 1 on Page 3 of the Learner's Book. Learner will copy the given application as homework in their note-books and do the work at home.	Communication through exchanging ideas. Research problem solving through doing tasks given in homework when asking help. Critical thinking developed through the analysis of the questions.
Teacher self-evaluation	This teacher self-evaluation is done after teaching		

PART III: UNIT DEVELOPMENT

Unit 1: Reading, Writing and Comparing Whole Numbers beyond 1,000,000

1.1 Key unit competence

To be able to read, write and compare whole numbers beyond 1,000,000

1.2 Prerequisite knowledge and skills

Pupils will perform well in this unit if they have knowledge and mastery of the following: Counting, reading, writing, ordering, comparing, adding and subtracting, multiplying and dividing whole numbers from 0 up to 1,000,000.

1.3 Guidance on the introductory activity

- Introductory activity:

Given the 6 number cards each with the following digit: 2, 8,0, 4,6 and 5.

a) Form Different numbers and read them.

b) Compare the number formed

c) Add the pair of numbers you formed and read the answer.

Try to multiply each number by 50. How many digits are in the answer? Can you read the number obtained? Can you divide each obtained number by 5?

- Guidance:

- Invite learners to form groups and lead them to work on introductory activity to understand the concept of the whole numbers beyond 1,000,000;
- Allow learners present their findings;
- Harmonize their works and ensure that they got exact solution.

Answers:

a) There are many answers for this question depending on the group. For example, students can form the number 280,465 and 804,652.

When writing a number in words, group the digits of the number.

Look at the example: The number 280,465 can be read as " two hundred eighty thousand, four hundred sixty- five".

b) We can compare 280,465 and 804,652. We find 804652 > 280465.

c) We can add 280,465 and 804,652 as follows: 280,465 + 804,652= 1,085,117.

The multiplication: 280,465 x 50 = 14,023,250

Some numbers have more than 7 digits. It is difficult to read them.

Note: Some learners can fail to read the answer obtained. **Tell them that it is one of the objectives of the content of this unit. They are going to learn them in this unit**.

The division: 14,023,250 ÷ 5 = 2,804,650.

1.5. List of lessons

	Unit 1: Reading, writing and comparing whole numbers beyond 1 000 000		**24 periods**
	Lesson		**Number of Periods**
1	Introductory activity	Introduce the number beyond 1000000	1
2	Forming, reading and writing numbers beyond 1,000,000 in figures		1
3	Place Values of whole Numbers up to 7 digits		1
4	Comparing Numbers using <, > or =		2
5	Arranging numbers in ascending and descending order		1
6	Addition of whole numbers beyond 1,000,000		1
7	Solving related real life problems involving addition of whole numbers beyond 1,000,000		1
8	Addition and subtraction of whole numbers using wooden vertical abacus		2
9	Subtraction of numbers beyond 1,000,000		2
10	Solve real life problems involving subtraction of numbers beyond 1,000,000		1
11	Multiplying numbers beyond 1,000,000		2
12	Solving problems using calculation strategies on multiplication		1
13	Dividing numbers beyond 1,000,000		2
14	Solving problems using calculation strategies on division		1
15	Rounding off whole numbers to the nearest tens		2
16	Rounding off whole numbers to the nearest hundred and thousands		1
17	Rounding off whole numbers to the nearest ten thousands, hundred thousand and millions		1

18	End unit assessment		1
			24

Note: There are some lessons with practical activities found in the book "Mathematics kits, practical activities and experiments user guide". You will find them in the guidance developed below.

Guidance on different lessons

1.5.1 Lesson 1: Reading and writing numbers beyond 1,000,000 in words

a) Learning objectives

To read, write, form and read numbers beyond 1,000,000 in words.

b) Teaching resources

- Manila cards or slips of paper, markers, flash cards, pencils, pens, chalk and other materials that a teacher may see as important to achieve his/her objective.
- Student's book and other Reference books to facilitate research, Mathematical set, calculator, manila paper, markers, pens, pencils...
- Find materials appropriate for learners with special educational needs

c) Learning activities

- Help learners to form groups of a certain number according to classroom size and arrangement.
- Give mental work related to reading whole numbers.
- Review writing large numbers up to 1,000,000 in figures studied in P.5.
- Give each group cards where numbers are written in words and in figures and ask them to match a number and its related meaning in words.
- Take them through the **activity 1.1** in the Learner's Book.
- Guide learners as they match number in figures to their corresponding number words.
- Correct the errors in the use of English language.
- Ask learners who have the cards with numbers in figures to raise them up.
- Ask learners who have the cards with number in words to join the correspondence.
- Ask them to explain to the class.
- Invite the whole class match the corresponding numbers in figures to words as it is in **activity 1.1** in their books.
- Let them present their work.
- Applaud those who match the numbers correctly.
- Make sure that all learners are fully engaged in the lesson by using the methodology that involves all of them.
- Do not continue to another step without knowing the progress of the learners.
- Give learners opportunity to: discuss, present, write, make research and think critically through working together in groups, sharing roles in their groups.
- Ask learners to study the **examples 1and 2** in the Learner's Book.
- Refer to the study tip, and ask learners to read it aloud such that they internalize it.

- Ask learners to attempt **application activity 1.1 and 1.2**
- Correct their work.
- Give them feedback.
- Help them to make a summary, then make a conclusion.

Answers for activity 1.1

Try to work out given questions and find answers to be used when verifying answers for students.

Answers to Application 1.1

1. (a) Twelve million four hundred fifty six thousand six hundred seventy-eight.
   (b) Nine million seven hundred thousand nine hundred fifty-six.
   (c) nine million six hundred forty eight thousand two hundred.
   (d) Seven hundred twenty one million five hundred sixty nine thousand two hundred sixteen.
2. Four hundred fifty six thousand seven hundred.
2. Five million four hundred seventeen thousand two hundred fifty seven.
3. Four million five hundred sixty five thousand ninety.
4. Twelve million four hundred sixty eight thousand two hundred fifty.
5. Four million four hundred twelve thousand five hundred sixty seven.
6. Nine million nine hundred ninety eight thousand eight hundred eighty eight

Answers to application 1.2

(1) 15,356,413 (2) 83,066,230 (3) 800,018,717
(4) 456,545,200 (5) 512,549,000 (6) 19,000,000.

Remedial activity

Slow learners can read then write simple numbers given in figures in words:
(1) 542 (2) 2,340 (3) 53,167 (4) 863,427 (5) 907,700

Extended activity

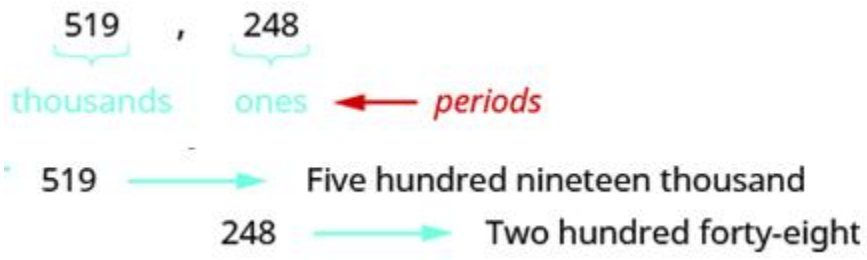
Fast learners can try to read and write more large numbers given in figures in words:
(1) 13,007,507 (2) 18,150,015 (3) 36,063,363
(4) 81,091,909 (5) 100,000,000 (6) 408,410,089

Additional content for the teacher:

Rule to follow when writing number in words:

When you write a whole number, you write out the number in words as well as in digits. To write a number in words, write the number in each period followed by the name of the period without the 's' at the end. Start with the digit at the left, which has the largest place value. The commas separate the periods, so wherever there is a comma in the number, write a comma between the words. The ones period, which has the smallest place value, is not named.

Example: 519 248 = 519,248



1.5.2 Lesson 2: Place Values and value of whole Numbers up to 7 digits

a) Learning objectives

Identify the place value of numbers formed by 7 digits ***number*** and Partition a 7 digit number into place values.

Develop the capacity of quick critical thinking.

b) Teaching resources and learning resources

- The table of place values;
- Number cards with different numbers beyond1000000;
- Different types of counters.
- Manila paper with place values and values digits for numbers, markers, flash cards, pencils, pens, chalk and other materials that a teacher may see as important to achieve his/her objective.
- Student's book and other Reference books to facilitate research,

c) Learning activities

- Guide learners to review the place value and value up to 7 digits done in primary 5
- Explain that, a table of place values is used for placing in the digits in their corresponding place value and that, periods are read out after every comma.
- When placing digits in the place value table, digits are started from the right, that is from (ones) to the left (millions).

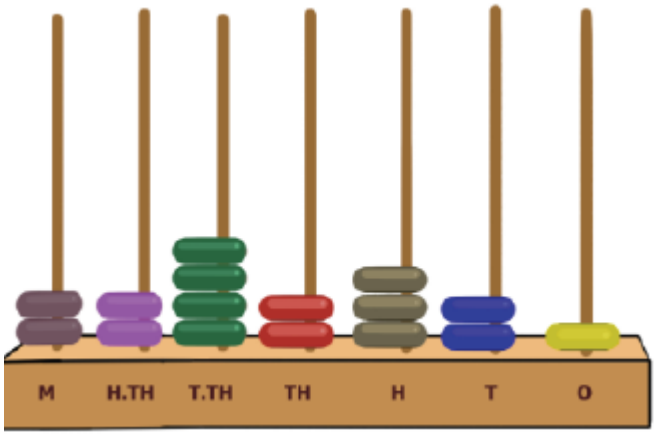
Millions			Thousands			Units		
			H	T	O	H	T	O
		5	6	0	0	0	0	2
Five			Six hundred			two		

- Take learners through the **learning activity** in the Learner's Book;
- Invite the groups to present the findings,
- Guide them to precise the number that results from 999,999 plus one and to give the place values for all digits for the number obtained.
- Choose seven learners and call them in front.

- Ask them to each pick one number card from the table
- Let them line with the number cards arranged according to the figure in the respective place value.
- Let the learners discuss the procedure as you guide them.

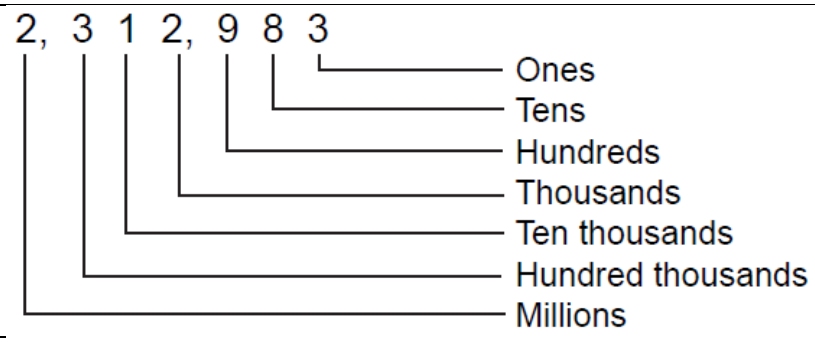
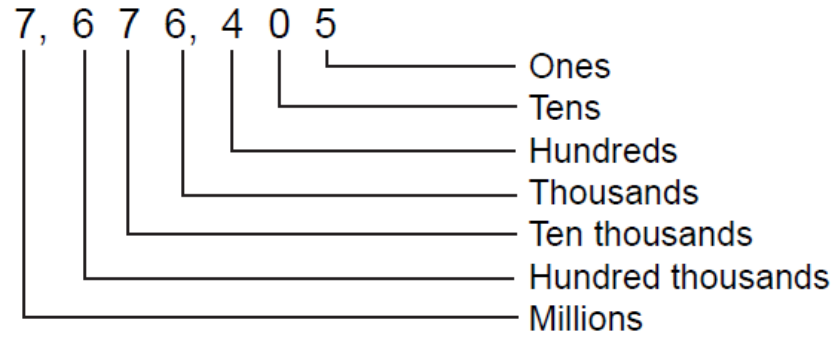
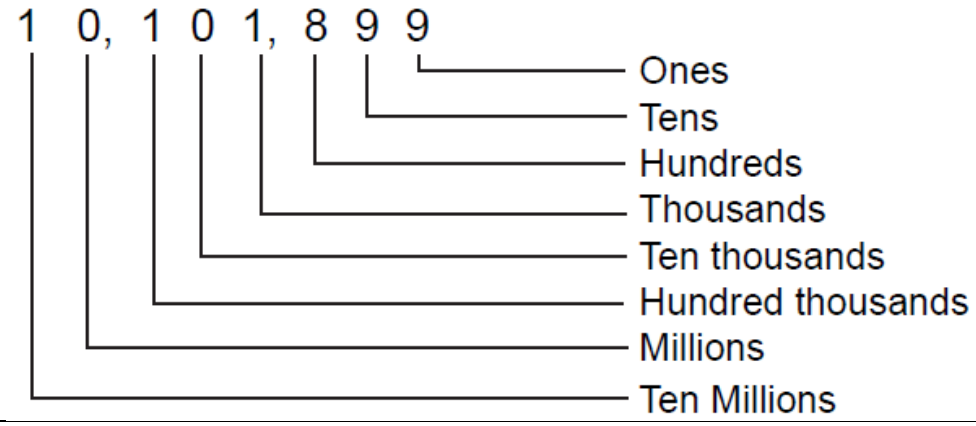
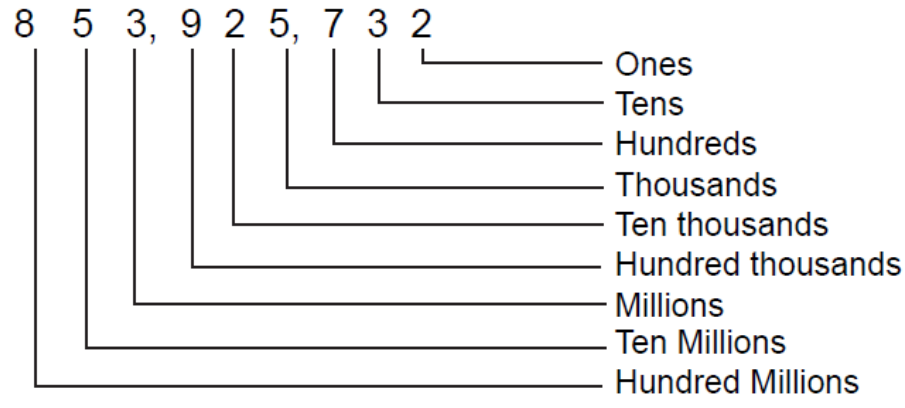
Practice:

- Use the abacus and let them use beads to represent numbers.



- Now ask learners to write their own numbers on slips of paper.
- Ask them to write down the place value of each digit on slips of paper, then their corresponding values.
- Now refer to the example on the prepared chart and guide learners as they follow the procedure by discussion.
- Refer them to the **example 1.3** in the Learner's Book.
- Let learners continue studying and discussing the steps.
- Ask them to write down numbers of their choice again, and then go through the procedure as explained in the examples.
- Provide application activities to be done by pupils (see application activity 1.3) and check their answers.
- Help them to harmonize what they think should be added.
- Give them time to sum up and then refer to the study tip.
- Emphasize that, in order to find the value of digits of given numerals, use a place value table. Then, to find the value, work out the product of the digit and its place value.
- Ensure every learner is actively involved.

d) Answers for application activity 1.3

1	**a**	
	b	
	c	
	d	

2)

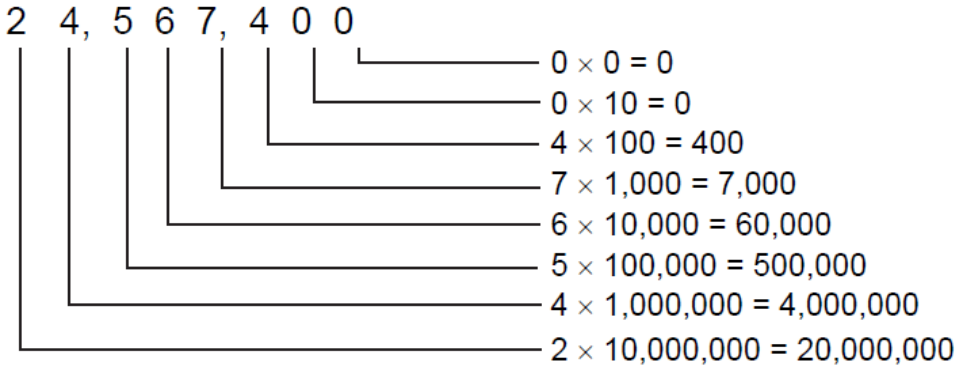
(a) 4 - Ones, 4 - Hundred thousand

(b) 9 - Ten thousands, 3 - Hundred millions
(c) 3 - Tens, 9 - Thousands
(d) 5 - Ones, 8 - Ten thousands, 4 - Millions

- Let learners attempt the following exercises.

3)

a



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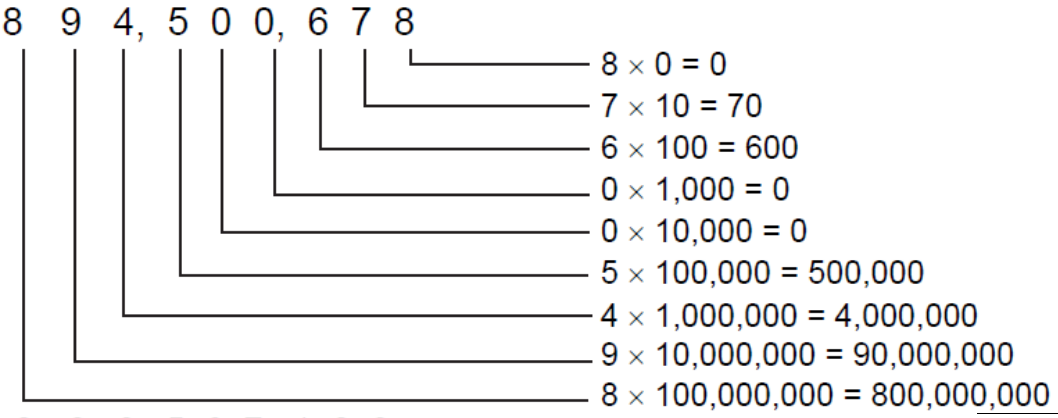

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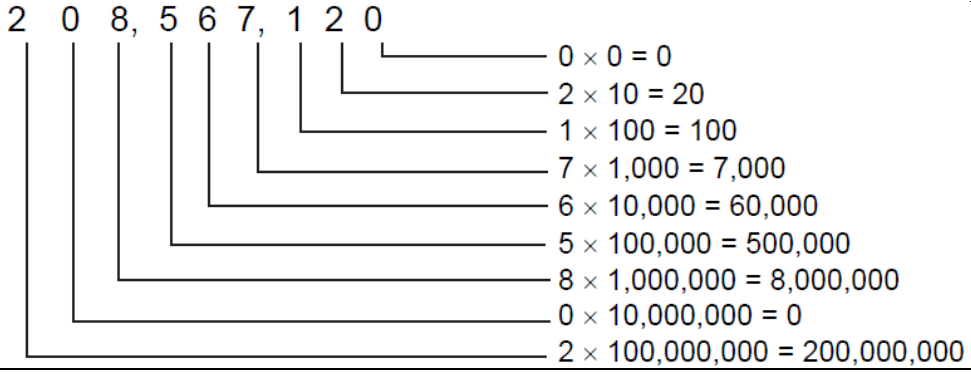
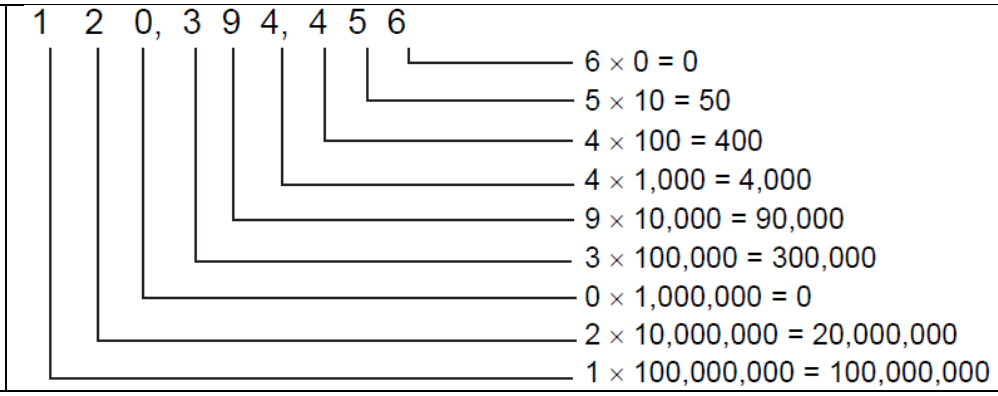


	d	

4)
(a) 5 x 100 = 500; 5 x 1,000 = 5,000 ; 4 x 100,000 = 400,000.
b) 3 x 10 = 30; 3 x 10,000 = 30,000; 8 x 10,000,000 = 80,000,000
c) 9 x 10 = 90 6 x 100,000 = 600,000; 1 x 100,000,000 = 100,000,000
d) 2 x 10 = 20; 9 x 10,000 = 90,000; 3 x 1,000,000 = 3,000,000

5. By multiplying 6 by its place value.

e) Additional activities

Remedial activity
Slow learners can find the place values of the underlined digits.
(1) 43<u>6</u> (2) 4<u>8</u>2 (3) 1,<u>5</u>67 (4) 4<u>6</u>,642 (5) 2<u>8</u>7,409

Extended activity

Fast learners can try to find the place value of a number given that;

(1) its value is 80,000 (2) its value is 8,000,000

(3) its value is 90,000,000 (4) its value is 300,000,000
(5) What is the product of the values of 8 and 2 in 1,848,212?

(6) What is the sum of the values of 6 and 9 in 9,604,050?

1.5.3 Lesson 3: Comparing numbers using <, > or =

a) Learning objectives

Knowledge:

Understand how to compare numbers beyond 1000000.

Skills:

Compare and order numbers beyond 1000000.

Values

Develop the capacity of quick critical thinking to compare quantities of things.

b) Teaching resources

- The table of place values;
- Number cards with different numbers beyond 1000000 in different colors;
- Local abacus and Different types of counters.

c) Learning activities

- Help them to form groups and give mental work as a review of the previous lesson.
- Distribute the learning materials in the respective groups.
- Take learners through the **learning activity** in the Learner's Book :
- Provide two sacks: one containing rice and the second any other thing you can compare and ask learners to explain which one is heavier than the other.
- Ask them to estimate the mass for each item then write them down.
- Lead learners to remember that; the symbol > means "greater than" < means "less than" or smaller than. Then, invite them to compare masses using comparison signs.
- Invite them to present their answers and discuss how to compare numbers.
- Let learners continue comparing numbers (on the manilla paper) of their own.
- Now refer learners to the examples on the chart, then study and discuss the **example 1, 2 and 3** in the Learner's Book.
- Invite learners to conclude on how to compare numbers and then read the Study tip.
- Let them write down their conclusion.
- Now ask learners to work in pairs the **Application activity 1.4** in the Learner's Book and then, mark their answers.

Note: Some learners may be confused with the signs for comparing numbers:

- Improvise methods of making them remember.
- The use of a place value table is the best method for comparing numbers.
- Let learners attempt the following activities depending on their results on the application activity 1.1:

Remedial activity

Let slow learners compare the pairs of numbers below using the symbols >, < or =.

(1) 617 .....413 (2) 218 ..... 281 (3) 451 ..... 432 (4) 804 082

Extended activity

Fast learners can try out the following;

1) 1 kg of stones ..... one kg of cotton wool
2) 1 tonne ..... 100 kg
3) 1,000 ml .....1000 cc
4) 1.2 litres ..... 2.1 millilitres
5) 10 grosses ..... 10 dozens
6) 15 litre bottles ..... 20 half litre bottles

d) answers for application activity 1.4

1. (a) 260,340< 60,430,730. (b) 8,855,631>.8,855,136
   (c) 302,831,547 >30,283,154. (d) 9,991,999 = 9,991,999

2 . Camille harvested more beans

3. Mukagasana deposited more money.

4. The school with 103,210Frw received less money.

5. Hospital B with 67,890patients admitted more patients

6. 1st district with 4,853,825 Frw collected more money.

1.5.4 Lesson 4: Arranging numbers in ascending and descending order

a) Learning objectives

Knowledge:

Understand the meaning of arranging numbers in ascending and descending order,

Skills:

Arrange numbers from the smallest to the biggest and vice versa.

Values

Develop the capacity of ordering objects depending on their quantities: from more to less number of them and vice versa.

b) Teaching resources

- The table of place values;
- Number cards with different numbers beyond 1000000;
- Different types of counters, slips of paper.

c) Learning activities

- Guide learners to make a review on the comparison of whole numbers which as it was handled in the previous lessons.
- Group the learners and invite them to carry out the **learning activity** from in the Learner's Book.
- Invite groups to present to the whole class their findings and to explain how they arranged numbers cards.

-Guide the whole class to:

- realize that in order to compare how bigger or smaller a number is than another, a place value table is used.
- Draw a place value table on the chalkboard and place in it the number on cards.

Millions			Thousands			Units		
H	T	O	H	T	O	H	T	O
		1	7	0	7	0	5	5
		1	7	7	0	5	5	0
		3	0	2	5	4	4	6
		3	2	0	5	4	4	6

- Confirm that the order of ascending is arranging from the smallest to the biggest number. That is: 942,407; 942,704; 1,496,066; 1,496,606. In descending order, the arrangement is: from the biggest to the smallest, so it is 1,496,066; 942,704; 942,407.

- Ask the learners to study the **example** in the Learner's Book and guide them to conclude that from the comparison of two numbers using the place value table, arrangement in increasing or decreasing order is a continuation where more than two numbers are compared.

- Guide learners to go through the study tip and use it to sum up the lesson.

- Assign pupils to work in pair the **Application activity 1.5** in the Learner's Book.
- Mark their work and give feedback.

Depending on their results, you can assign learners to work out the following:

Remedial activity

Slow learners can arrange the following numbers in:
(a) ascending order
(b) descending order
i) 746; 652; 1072; 6,142
ii) 1,555; 1,632; 1,028; 1,606
iii) 4,404; 4,044; 4,444; 4,404
iv)12,096; 12,960; 12,690; 12,069

Extended activity

Fast learners can arrange the following numbers in:

(a) Order the numbers in ascending order:

(b) Order the numbers in ascending order:

i) 11,011,011; 11,101,011; 11,011,111 11,001,101; 11,111,111.

ii) 15,150,015 15,015,015; 15,150,150 15,005,515; 15,155,105.

iii) 99,099,999 99,990,099 99,990,009 99,909,009 99,009,009.
iv) 101,101,101 101,100,011 111,111,111 100,111,111 101,110,011.

d) Answers for Application activity 1.5

1. Numbers arranged in ascending order

(a) 1,065,234; 1,065,342; 1,671,241; 1,673,421
(b) 2,033,874; 2,303,874; 2,330,874; 2,874,303
(c) 6,827,623; 8,279,625; 9,623,827; 9,827,623
(d) 4,116,305; 4,611,530; 11,046,305; 11,460,305
2. Numbers arranged in descending order
(a) 4,963,427; 4,724,963; 4,427,963; 4,369,427
(b) 8,693,306; 8,369,306; 8,306,396; 8,063,963
(c) 12,994,609; 12,499,906; 12,420,994; 12,042,994
(d) 6,253,311; 3,625,113; 625,311; 625,113

1.5.5 Lesson 5: Addition of whole numbers beyond 1,000,000

a) Learning objectives (formulated)

Knowledge:

Understanding the addition of **whole numbers beyond 1,000,000** with or without carrying

Skills:

Addition of **whole numbers beyond 1,000,000** with and without carrying.

Values

Having self confidence in performing the sum of objects.

b) Teaching resources

- The table of place values;
- Number cards with different numbers **whole numbers beyond 1,000,000** in different colors;
- Different types of counters;
- Local abacus.

c) Learning activities

- Take learners into respective groups of earners.
- Let learners recall how to add numbers.
- Distribute the prepared materials to the groups.
- Take groups through the **learning activity** in Learner's Book;
- Request them to work out the sum of the numbers.
- Invite groups to share with others in the whole class discussion.
- Guide the class to compare the answers from different groups and highlight the correct answer.
- Take pairs of learners through **example 1 and 2** in Learner's Book page 12 and 13.
- Ask learners to share what they have experienced in pairs and guide them to summarize what they learnt as it is given in the study tip.

Example : Add: 3,642,598; 1,386,513; 1,809, 429 and 5,149,823
(Arrange vertically according to place values

	M	HTh	TTh	Th	H	T	O
	3	6	4	2	5	9	8
	1	3	8	6	5	1	3
	1	8	0	9	4	2	9
+	5	1	4	9	8	2	3
1	**1**	**9**	**8**	**8**	**3**	**6**	**3**

Units

Add ones: 8 + 3 + 9 + 3 = 23, = 2 tens, 3 ones. Write 3 under ones, then carry 2 tens to the place value for tens.

Add tens: 2 + 9 + 1 + 2 + 2 = 16, = 1 hundred 6 tens. Write 6 tens under tens, then carry 1 to hundreds.

Add hundreds: 1 + 5 + 5 + 4 + 8 = 23, 2 thousands, 3 hundreds. Write 3 hundreds under hundreds, then carry 2 to thousands.

Thousands

Add thousands: 2 + 2 + 6 + 9 + 9 = 28, = 2 ten thousands, 8 thousands, write 8 under thousands and carry 2 ten thousands. Continue the method.

Add ten thousands: 2 + 4 + 8 + 0 + 4 = 18 = 1 hundred thousands, 8 ten thousands.

Add hundred thousands: 1 + 6 + 3 + 8 + 1 = 19 = 1 millions, 9 hundred thousands.

Millions

Add Millions: 1 + 3 + 1 + 1 + 5 = 11, 1 ten millions, 1 millions.

Explain thoroughly that, when we get a total with 2 digits, it means there are two groups. So we do what is known as carrying or re-grouping by writing the digit to the right in that very place value and carrying the second digit to the left to the next place value.

- Assign students to work individually the **application 1.6**, mark their work and give them the feedback.

d) Answers for application 1.6

(a) 7,308,172 (b) 4,694,056 (c) 9,731,680 (d) 12,598,799
(e) 18,088,079 (f) 10,014,864 (g) 16,067,812

1.5.6 Lesson 6: Solving related real life problems involving addition of whole numbers beyond 1,000,000

a) Learning objectives (formulated)

- Understand the method of solving word problem
- Solve word problems involving addition of whole numbers beyond 1,000,000.

b) Teaching resources

Text books, abacus, table of value, notebooks, pens, and real counters.

c) Learning activities

- Form manageable groups among the learners.
- Read for them the instruction of the leaning activity.
- Hand out the suggested instructional materials.
- Guide learners to solve some problems in a whole class discussion,
- Provide problems to be solved into groups: Let the learners carry out the learning activity as shown in the Learner's Book
- Allow each group to present its results before class.
- Next, give two examples on the chalkboard, one should be for adding things without carrying and the other with carrying.
- Concerning **the lesson on word problems involving addition**, help pupils to solve a one –step or a two-step problem: guide them to u*nderstand the problem, identify facts (givens and requests), draw visual representations and solve the problem using the addition.*
- *Invite leaners to present their answers and help them to highlight how to solve problems:*

  - Read the problem to understand it correctly,
  - When adding whole numbers, arrange the digits in the table according to place values.
  - If numbers do not have the same number of digits, use zeros to act as place holders to ensure proper alignment of each digit according to place values.
  - Start adding from right to the left, that is from ones to tens, thousands, ten thousands, hundred thousands and millions.
  - Other words used for addition include total, sum, altogether and combined

- Assign pupils to work in pair, work out problems of **application activity 1.7** to be solved into groups to be solved individually as an assessment
- Mark their answers and give them the feedback.
- Assign homework to all learners.

Depending on the results of the learners assign them the following:

Remedial and consolidation activity

Slow learners can try out simple addition problems.

(1) Add: 123 + 92 + 1 (2) 15 + 110 + 3,125 (3) 3 + 62 + 144 + 9,900

(5) In P.6, there are 14 boys and 26 girls. Find the total.

(6) In a school library, there are 144 Mathematics textbooks, 162 English textbooks, 162 Social Studies textbooks and 202 Science textbooks. How many textbooks are there?

Extended activity

Fast learners can try out more complex numbers.

1. Add: 2 groups of 11,076,820 and 3 groups of 19,446,213.
2. There are 4 peace baskets in a store. Each contains 1,672,015 beads. In the kitchen there are 3 peace baskets each containing 1,205,110 beads. What is the sum of all the beads?
3. Eleven water bottles contain 650 ml each. 6 other water bottles contain 500 m/*l* each. How many milliliters are in all the water bottles?

d) Answers for application 1.7

(1) In the two days, 9,591,075 litres were sold.

(2) The total number of books supplied by all three publishing companies is equal to 4,152,206 text books.

(3) 8,986,230 people participated in both marathons.

(4) The total sales of Kayitesi in the two years are equal to 4,893,705 kg.

1.5.7 Lesson 7: Addition and subtraction of whole numbers using wooden vertical abacus

a) Learning objectives

To apply addition and subtraction of a whole numbers in real life situations.

b) Teaching resources

Wooden Vertical Abacus with seven spike

c) Learning activities

Step 1: Read and understand the following problem (activity 1 **in practical activities for P6)**

For example:

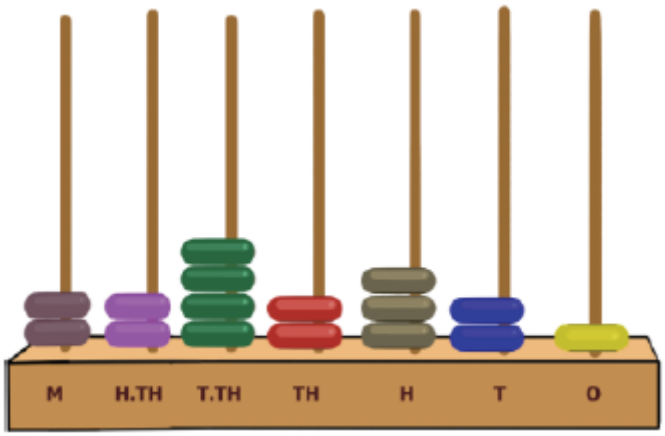
A dairy cooperative sold 1,213,231 litres of milk in January. On February, they sold 2,242,321 litres of milk. In March the amount of milk sold was 1, 121,111 litres of milk less than that of February.

i. How much milk did they sell in March?

ii. How much milk did they sell in three months?

Step 2: Get an empty wooden vertical abacus with seven spikes and label the spikes from right to left as ones, tens, hundreds, thousands, ten thousand, hundred thousand, and Millions.

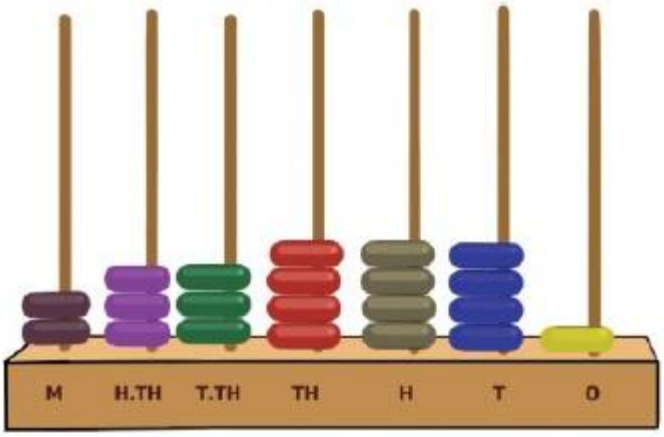
Step 3: Since the amount of milk sold in February is 2,242,321 litres of milk, then put beads on the abacus accordingly.



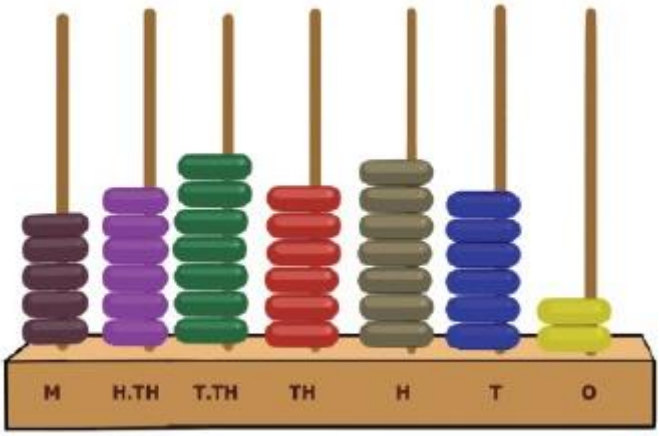
Step 4: To find the amount of milk sold in March, which was 1, 121,111 litres of milk less than that of February, and using the abacus in step 2 , remove some beads accordingly.

Record the number remaining on the abacus which becomes the sold milk of March.

Step 5: Now use the abacus in step 4 and add amount of milk sold in January (1,213,231 litres).



Step 6: To now add the amount of milk sold in February (2,242,321 litres) to that of March and January,



Now Record, the number represented on the abacus starting from left to right which is the total amount of milk sold in all the three months

Learners will find that:

When using abacus, we add by putting the given number of beads on the spikes then count the total beads per spike and subtract by removing beads from the spikes and count the remainder of the beads on the spike.
Therefore,

In step 3, the amount of milk sold in February is 2,242,321 litres

In step 4, the amount of milk sold in March is 1,121,210 litres.

In step 5, the amount of milk sold in both January and March is 2,334,441 litres.

In step 6, the amount of milk sold in all the three months is 4,576,762 litres.

1.5.8 Lesson 8: Subtracting numbers beyond 1,000,000

a) Learning objectives

Knowledge:

Understanding the subtraction of numbers beyond 1,000,000 with or without borrowing.

Skills:

Subtract a number from another without or with borrowing;

Values

Having self confidence in performing the difference two numbers beyond 1,000,000.

b) Teaching resources

- The table of place values;
- Number cards with different numbers beyond 1,000,000 in different colors;
- Different types of counters.
- Pens, calculators, notebooks, etc.

c) Learning activities

- Form groups of pupils and assign them to do the leaning **activity** where they have to: draw a table of place values, complete numbers in the table, perform the subtraction;
- Move around in the class for facilitating pupils where necessary;
- Invite some groups to present their findings and then help them to harmonize by explaining how to subtract numbers using a table of place values. Guide them to discover that this method is the same as *subtracting vertically or the standard written method*.

Example: Subtract: 1,467,342-984,607

Emphasize proper vertical arrangement of the digits in their respective place values. Then, subtract the digits in their corresponding place values.

	M	HTh	TTh	Th	H	T	O
	~~1~~	13~~4~~	16	6~~7~~	13	3~~4~~	12
–		9	8	4	6	0	7
		4	**8**	**2**	**7**	**3**	**5**

- Refer the learners to the **example1 and 2** in the Learner's Book,.
- Give some more examples for the learners to do more practice.
- Invite learners to discuss their experiences and lead them to explain how they subtract numbers and highlight their answers by reading and interpreting the study tip.
- Invite learners to do the **application activity 1.8** in the Learner's Book as assessment activity.
- collect the work, Mark it and give feed-back.

d) Answers for application activity 1.8

(1) 1,001,090 (2) 1,604,306 (3) 1,892,220
(4) 2,669,037 (5) 2,603,068 kg (6) 2,669,037 trees
(7) 1,008,000 FRW (8) 1,713,821 books (9) 4,228,508

1.5.9 Lesson 9: Solve real life problems involving subtraction of numbers beyond 1,000,000

a) Learning objectives

- *Understand the method of solving the problem involving subtraction*
- *Solve problems* involving subtraction of numbers beyond 1,000,000.

b) Teaching resources

- The table of place values;
- Number cards with different numbers beyond 1,000,000in different colors;
- Different types of counters.
- Pens, calculators, notebooks, etc.
- Book or wall chart with word problems.

c) Learning activities

- Group learners and distribute the instructional materials as suggested.
- Let the learners in their groups carry out the **learning activity** as laid out in the Learner's Book.
- Invite groups to present their answers to the whole class
- Guide the class to harmonize answers by highlighting the steps: u*nderstand the problem, identify facts (givens and requests), draw visual representations and solve the problem using the subtraction.*
- Refer the class to the example in the prepared chart or the example given in the textbook.
- Tell learners that when solving, the calculation can lead to the subtraction involving the borrowing or regrouping as the following example 1: Subtract: 8,712,013 − 3,258,609 =? (Arrange in vertical order by place values)

	M	HTh	TTh	Th	H	T	O
	8	~~5~~7	10~~1~~	11~~2~~	10	0~~1~~	13
−	3	2	5	8	6	0	9
	5	**4**	**5**	**3**	**4**	**0**	**4**

Units

Subtract ones: 3 − 9 (not possible) borrow 1 ten from 1 tens. 1 ten + 3 ones = 10 + 3 = 13, 13 − 9 = 4.
Subtract tens: 0 − 0 = 0.
Subtract hundreds: 0 − 6 (not possible, borrow 1 thousand from 2 thousands. 1 thousand = 10 hundreds 10 + 0 = 10, 10 −6 = 4.

Thousands
Subtract thousands: 1 − 8 (not possible, borrow 1 ten thousand from 1 ten thousands. 1 ten thousand = 10 thousands. 10 + 1 = 11, 11 − 8 = 3.
Subtract ten thousands: 0 − 5 (not possible, borrow 1 hundred thousands from 7 hundred thousands. 1 hundred hundreds = 10 ten thousands. 10 + 0 = 10, 10 − 5 = 5.
Subtract hundred thousands: 6 −2 = 4.

Millions
Subtract Millions: 8 − 3 = 5.
Explain the process such that all the learners get to understand better.
Refer to the example in the Learner's Book, page 18.
Answer any questions they ask to help them master the concept.

- Let the learners read in pairs the Study tip and thereafter, assign them to work individually the application 1.9 in the Learner's book.
- Mark their work and give feedback.
- Depending on the results, assign learners more consolidation and extended activities:

Remedial activity

Slow learners can try out simple subtraction problems.
(1) 554 − 217 (2) 316 − 305
(3) 666 − 333 (4) 23,268 − 12,048
(5) In a school of 900 learners, 493 are boy. How many are girls?

Extended activity

Fast learners may try out more challenging numbers:
1) 354,542,460 − 340 562,564
2) Ndukumana bought a plot of land at 345,687,000 FRW. He paid 250,000,000 FRW cash and promised to clear the remaining amount after one month. How much is he supposed to pay?

d) Answers for application activity 1.9

(1) The difference is 53,008 pens
(2) The number of boys is 1,973,743.
(3) The number of kilograms still in his store is 5,600,100 kg.
(4) Remained milk equal to 803,050 litres.
(5) There are 5703285 Animals that are not zebras.
(6) There are 8,576,750 kilograms remained.

1.5.10 Lesson 10: Multiplying numbers beyond 1,000,000

a) Learning objectives

a) Objectives

Knowledge:

Understanding the multiplication by a numbers beyond 1,000,000

Skills:

Multiplying numbers beyond 1,000,000.

Values

Show self confidence when performing the product of numbers beyond 1,000,000.

b) Teaching resources

Multiplication table, calculator, textbooks, wall charts with solved problems involving multiplication.

c) Learning activities

- Give mental work on previous lesson and invite learners to exchange ideas.
- Group learners and distribute the suggested instructional materials to each group.
- Invite groups to work out the learning activity from the Learner's Book.
- Invite groups to present their findings to the whole class..
- Guide them to harmonize answers and refer them to the **example 1 and 2** from the text book and others from the manilla paper. **Example**: Multiply: 55,243 × 160

Inform learners that there are two methods which can be applied: multiplying the multiplicand by ones, tens and hundreds separately, then add. Another method is about using the long method. In the example below, one method has been used. Endeavor to take them through the second method.

	5 5 2 4 3	
	× 1 6 0	
	0 0 0 0 0	(55,243 x 0)
	3 3 1 4 5 8 0	(55,243 x 60)
+	5 5 2 4 3 0 0	(55,243 x 100)
	8, 8 3 8, 8 8 0	

- Invite learners to read and internalize the Study tip related to multiplication.
- Provide application activity 1.11 to be done by pupils and check their answers and give them the feedback. Verify if learners are aware of the order of multiplication, i.e one by one of units, one by tens, one by hundreds etc.
- Depending on the results from the application activity1.11, give them the following:

Remedial activity

Let slow learners do the following question:

(a) 1000 x 15 (b) 50000 x 8 (c) 1520 x 12 (d) 2150 x 15

(e) There are 125 oranges in a sack. How many oranges are there in 15 such sacks?

Extended activity

Fast learners should work out more challenging questions:

(1) 3,567 × 2,105 (2) 47,798 × 135

(3) 354,687 × 90 (4) 567,897 × 952

(5) A train carries 6,500 passengers. How many people are carried by 450 such trains.

d) Answers for application activity 1.11

(1) It should deposit 12,512,500 FRW

(2) She must she save 1,200,000 FRW in order to facilitate her daughter to complete three years.

(3) There are 95,581,000 mangoes in the store.

(4) There 96,800,000 litres altogether.

(5) In one minute light travels 18,000,000,000 metres.

(6) They pay 6,170,000 FRW altogether.

(7) The same factory produces 9,000,000 pairs of shoes in 15 days if they work at the same rate.

1.5.11 Lesson 11: Dividing numbers beyond 1,000,000

a) Learning objectives

- Understand the meaning of division of a number by another**.**

Skills:

- Divide correctly a numbers beyond 1,000,000 by another number.

Values

Show the self confidence in performing the division of numbers beyond 1,000,000.

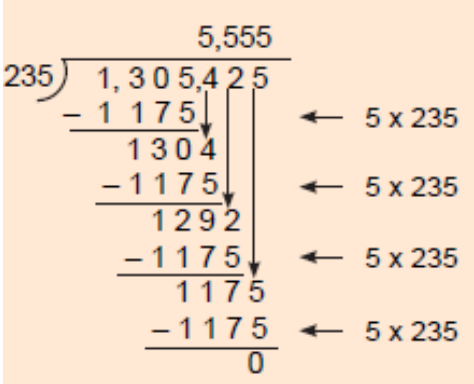
b) Teaching resources

- The table of place values;
- Different types of counters.
- Multiplication table for slow learners and calculators to verify if the answer is correct.

c) Learning activities

- Give mental work about simple division, e.g, 12 ÷ 6; 32 ÷ 8; 48 ÷ 6; 100 ÷ 20.
- Group the learners and distribute the suggested instructional materials to each group.
- Invite them to carry out the **learning activity** as suggested in the Learner's Book.
- Move around in the class for facilitating learners where necessary; ask probing questions guiding them to know that they divide starting by the left side and that they can take 2 digits when necessary**.**

- Invite some groups to present their work to the whole class.
- Harmonize answers by highlighting the standard method (vertical or long division) and that when dividing, we get the number of times a dividend is divided by the divisor. For example, 1305425÷235 = 5555 because 5555x235 =1305425.



- Lead the learners through more the examples such as example 1 and 2 in the Learner's Book .
- Invite learners to explain in their own words how to divide and lead them through the study tip given in the learners' book.
- Assign them the application activity 1.12 to be done individually, mark each student and provide feedback.
- Depending on the results, give students the appropriate consolidation activity:

Remedial activity

Slow learners can attempt these:

(a) 124 ÷ 4 (c) 200 ÷ 20

(b) 168 ÷ 4 (d) 960 ÷ 12

Extended activity

Fast learners can attempt the following:

(a) (246,334 x 12) ÷ 8 (b) (200 ÷ 20) x 10

(c) (625,103 x 24) ÷ 6 (d) (19,004 ÷ 12) x 12

d) Answers for application activity 1.12

(a) 77,948 (b) 238,927 (c) 35,041

(d) 130,986 (e) 65,846 saplings (f) 23,507 kg.

1.5.11 Lesson 11: Solving problems using calculation strategies on division

- Understand the meaning of equal division of a number of objects to a given number of people.

Skills:

- Divide equally and correctly a number of objects beyond 1,000,000 to a given number of people.

Values

Appreciate the use of division in real life situations.

b) Teaching resources

- The table of place values;
- Word problems from real life situations;
- Different types of counters.
- Multiplication table for slow learners and calculators to verify if the answer is correct.

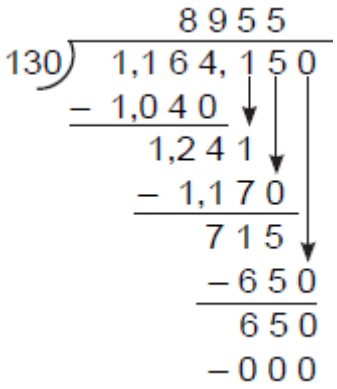
c) Learning activities

- Begin by giving some simple numbers on division
- Group learners and hand out the suggested instructional materials.
- Invite them to carry out the **learning activity** in the Learner's Book.
- Guide them as they carry out the activity.
- Invite each group to present its results.
- Harmonize answers by explaining the method used to solve problem: Guide them to u*nderstand the problem, identify facts (givens and requests), draw visual representations related to equal shares and solve the problem using the division;*
- Tell them that sharing, breaking into parts, distributing, rationing all mean dividing.
- Display the example you prepared on a chart or example 1 and 2 from the textbook. Allow them to ask questions where they have not understood.

Example: Divide: 1,164,150 ÷ 130

Ask them to copy the question on sheets of paper, then try to work it out.

Encourage them to use the long division method.



The divisor is a 3-digit number which is bigger than the first three digits in the dividend. So we start with 4 digits from the left of the dividend).

1,164 ÷ 130 = 8 rem 124, because 130 × 8 = 1,040.

1,241 ÷ 130 = 9 rem 71, because 130 × 9 = 1,170 715 ÷ 130 = 5 rem 65, because 130 × 5 = 650

650 ÷ 130 = 5 rem 0.

- Give some examples involving dividing numbers beyond 1,000,000.
- Let learners read and internalize the study tip and then, assign them the **Application activity 1.13** to be done in pairs.
- Note that division always tends to challenge most learners, Devise the simplest way they can carry it out efficiently.
- Mark their answers for **Application activity 1.13**, and give them the feedback.
- Depending on the results, assign them additional activities:

Remedial activity

Slow learners can work out simple division questions:

(1) 96 ÷ 12 = ? (2) 169 ÷ 13 = ? (3) 100 ÷ 25 = ?

(4) 540 ÷ 12 = ? (5) 108 ÷ 9 = ? (6) 960 ÷ 60 = ?

Extended activity

Fast learners can work out more challenging questions:

(1) 76,708,236 ÷ 132 (2) 75,433,088 ÷ 128

(3) 54,768,450 ÷ 150 (4) 34,801,756 ÷ 148

d) Answers for application activity 1.13

(1) Each employee can get 84,450 FRW
(2) Each member contributed 11,002 FRW
(3) 352,599 crates were packed
(4) Each employee received 211,555 FRW.
(5) 1,080,054 kg were being produced every month.

1.5.12 Lesson 12: Rounding off whole numbers to the nearest tens

a) Learning objectives

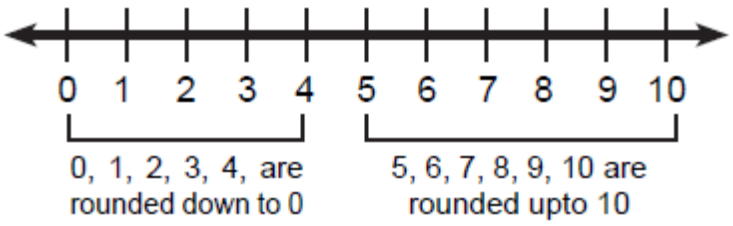
Find the number after rounding up or rounding down the given number such that the ones are represented by 0.

b) Teaching resources

- Wall chart with whole numbers and different problems,
- Table of place value, pens and notebooks.

c) Learning activities

- Distribute learners in groups and provide each group with the materials you prepared.
- Refer the learners to the **learning activity** in the Learner's Book.
- Let learners carry out the activity as you guide them.
- Invite them in a whole class discussion to make a discussion on answers.
- Harmonize them by explaining that "rounding off" means giving an approximate value of a given number with regard to the digits in the required place value and that place value to the right.
- Tell them that a number can either be rounded up, or down.
- Draw a number line on the chalk board and indicate numbers from 0 to 10. Show them the numbers that are nearer to zero than to 10.



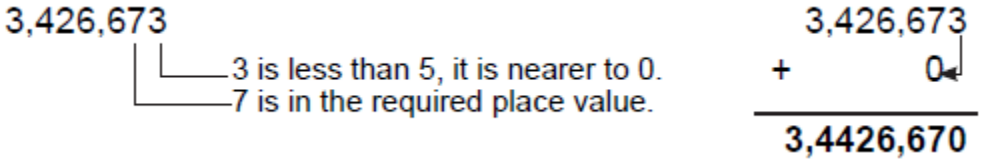
- Write an example on the chalkboard or use example1, 2 and 3 from the learner's books and invite learners to discuss them.

Example

Round off 3,426,673 to the nearest ten.

Allow learners to identify the place value of tens and the digit in it.

Tell them to indicate that digit as the "required place value."
Then look to the right and identify the digit nearer to the digit in the required place value.
Explain that, since the digit to be rounded is in tens, we consider the digit in the ones place value.
If the digit in the ones place value is either 0, 1, 2, 3 or 4, the whole number is rounded down.
That is, it is expressed as zero (0) and added to the digit in the required place value.
In this case it is 3.Since it is in the range 1 to 4, it rounded to 0.
Tell the learners that zero (0) is now added to 7. The place where 3 was is replaced by a zero.



So, 3,426,673 rounded to the nearest tens is 3,426,670.
Give other examples and explain the concept thoroughly and exhaustively.
Now refer to the examples in the Learner's Book, page 25 and 26.
- Let the learners read and internalize the study tip, then assign them to work in pairs the application activity 1.14. Mark their work and give feedback.
- Depending on the results, give them theadditional activities:

Remedial activity

Slow learners should attempt these:
1. Which numbers are nearer to zero (0) and which are nearer 10?
(a) 4 (b) 9 (3) 1 (c) 8 (d) 6
(e) 2, (f) 3 (g) 3 (h) 5
2. Round off to the nearest tens
((a) 17 (b) 12 (c) 27 (d) 34 (e) 29

Extended activity

Let fast learners round off the following to the nearest tens.

(a) 1,149,001 (b) 2,214,100 (c) 3,625,097
(d) 2,000,201 (e) 13,100,111 (f) 21,210,002

d) Answers for application activity 1.11

(1) (a) 4,856,800 (b) 6,789,740 (c) 2,234,590 (d) 3,654,870
(e) 62,453,790 (f) 5,459,600
(2) 6,753,930 (3) 690,000 (4) 699,000 (5) 540 plates.

1.5.13 Lesson 13: Rounding off a whole number to the nearest hundreds and thousands

a) Learning objectives

Find the number after rounding up or rounding down the given number such that the tens and ones are represented by 0.

b) Teaching resources

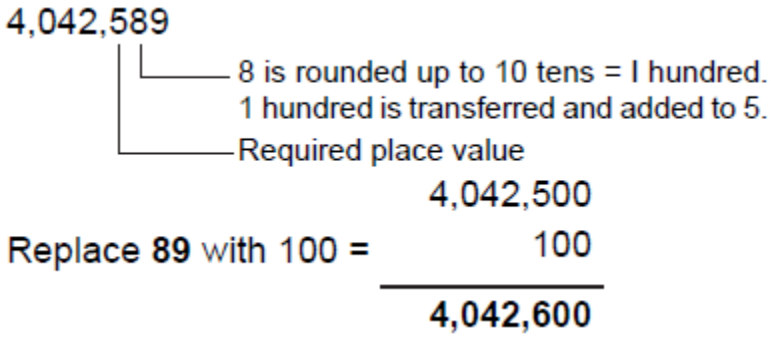
- Wall chart with whole numbers and different problems,

- Table of place value, pens and notebooks.

c) Learning activities

- Review rounding off to the nearest ten.
- Group the learners and distribute the learning aids.
- Guide the learners through the procedure of the **learning activity** in the Learner's Book.
- Move around to assist learners in their groups.
- Invite groups to present their findings.
- Basing on the learners' results and discussion, tell them that, when rounding off numbers to the nearest hundred, first consider the digit in the tens place value. If it is less than 5, round it down to zero (0). And add it to the digit in the hundreds place value. If the digit is 5, 6, 7, 8 or 9, round it up to 10 tens or 1 hundred. Add 1 hundred to the digit in the hundreds place value. Then all the digits to the right should be expressed as (00) (tens and ones).
- Write or dictate an example or rfer learners to example 1 and 2 from the learner's book.

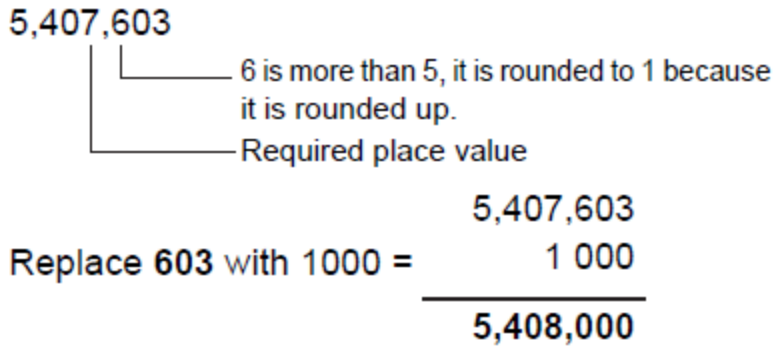
Example: Round off 4,042,589 to the nearest hundred.
Give learners a chance to locate and identify;
(i) the digit in the required place value.
(ii) the digit to the right of the required place value, and whether it is rounded down or up.
Now let them try to work it out.
Move around supervising them.
Now explain to those who got challenges as you demonstrate



- Then, introduce rounding off to the nearest thousand. Give an example and guide them through it.

Example: Round off 5,407,603 to the nearest thousand.

Learners should note that;
(a) the required place value is thousands.
(b) 7 is the digit in the required place value.
(c) 6 is the nearest digit to the right.
(d) 6 is rounded up because it is in the upper limit. 6 is rounded to 1 and 1 is a value of thousands that is1,000.
(e) the digits **603** are replaced with 000.



- Now embark on the examples in the Learner's Book.
- Follow the learners as they explain the procedure and give remarks.
- Invite learners to formulate the methods and steps to follow when rounding off the whole number to the nearest thousands, then make a class presentation.
- Guide them to the Study tip. Thereafter, assign them to work individually on the **application activity 1.15** and mark them to verify if the objectives are achieved.
- Depending on the results, assign them the following additional activities:

Remedial activity

Slow learners can try out the questions similar to the ones below.

Round off the following to the nearest hundred:

(1) 677 (2) 5,687 (3) 4,343 (4) 78,435 (5) 145,687

Round off the following to the nearest thousand:

(a) 45,685 (b) 23,452 (c) 67,465 (d) 23,576

Extended activity

Fast learners can be given more work as an extra-exercise especially word problems. For example;

1. Kayitesi bought a Laptop at 2,134,560 FRW. Round off the figure to the nearest thousands.
2. Nkundimana's monthly expenditure is 1,560,456 FRW. Round off the figure to the nearest hundreds.

d) Answers for application activity 1.15

1.(a) 3,654,600 (b) 22,987,700 (c) 564,324,000
(d) 3,890,700 (e) 4,361,400 (f) 12,642,300
2. (a) 6,069,000 (b) 8,523,000 (c) 64,565,000
(d) 70,310,000 (e) 4,236,000 (f) 17,100,000.

1.5.14 Lesson 14: Rounding off a whole number to the nearest ten thousands, hundred thousand and millions

a) Learning objectives

Find the number after rounding up or rounding down the given number such that the hundreds, tens and ones of a given period are represented by 000.

b) Teaching resources

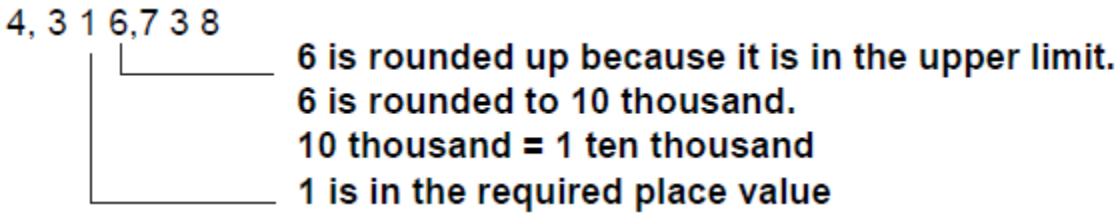
- Wall chart with whole numbers and different problems,

- Table of place value, pens and notebooks.

c) Learning activities

- Review rounding off to the nearest hundred and thousand.
-Form groups and ask learners to collect the prepared materials.
- Invite learners to carry out the **learning activity** in the Learner's Book.
- Move around to each group to support learners where necessary.
- Invite groups to present in a whole class discussion and moderate the discussion.
- Harmonize answers, and guide learners through the procedure, discuss it and make conclusions.
- Give other examples on the chalkboard or refer them to example 1, 2 and 3 and ask learners to discuss them.

Example: Round off 4,316,738 to the nearest ten thousand.
(i) 1 is in the required place value.
(ii) 6 is the nearest digit to the right so it is rounded up to 1 ten thousand.
(iii) 1 ten thousand is transferred to the digit in the required place value and that is 1.
(iv) **6,738** are removed and replaced with 0,000.
Now the procedure on actual working is:

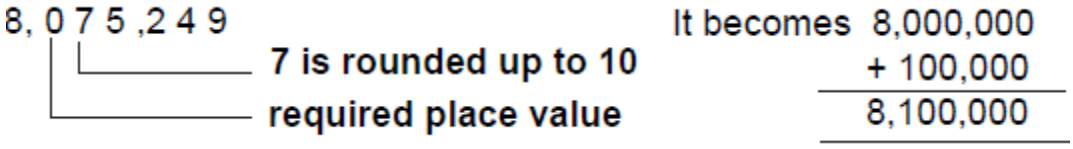


So 1 ten thousand is transferred and added to 1 in the ten thousands place value.

$$\begin{array}{r} 4{,}310{,}000 \\ +\quad 10{,}000 \\ \hline 4{,}320{,}000 \end{array}$$

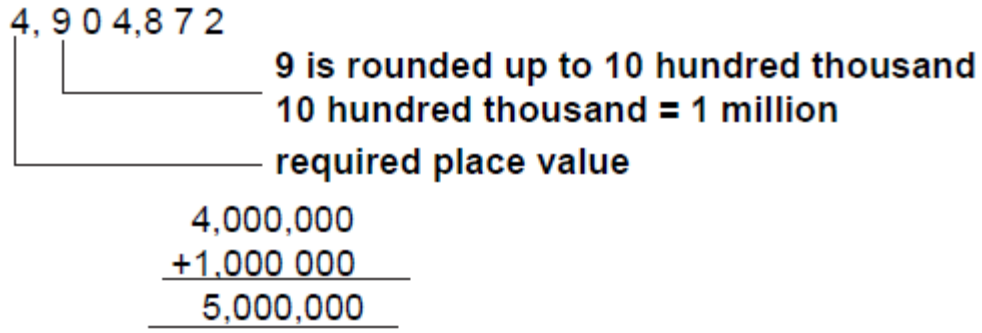
- Introduce rounding off to the nearest hundred thousand with the example.
Example: Round off 8,075,249 to the nearest hundred thousands.
Help learners to realize the following.
(i) 0 is in the required place value.

(ii) 7 is the nearest digit to the right.
7 is rounded up because it is in the upper limit.
7 is rounded to 10 ten thousands, 10 ten thousands = 1 hundred thousand.
75,249 are replaced with 00,000.
(iii) 1 hundred thousand is transferred to 0 hundred thousand and added to it.



So, 8,075,249 rounded off to the nearest hundred thousand is 8,100,000.
If time allows, cover rounding off to the nearest millions with the example such as the following.
Example: Round off 4,904,872 to the nearest million.
Learners are now familiar with the procedure, so they are expected to discuss effectively i.e,

(i) 4 is in the required place value.
9 is rounded up because it is in the upper limit.
9 is rounded to 10 hundred thousands,
10 hundred thousands = 1 million
Add 1 million to 4 million
Therefore, 904,872 is written as 000,000.



- Ask learners to explain in their own words the method for rounding of whole numbers and then lead them to read the Study tip.
- Invite them to work out in pairs the application 1.16. Mark the answers and give learners the feedback.

d) Answers to application 1.6
(a) 7,308,172 (b) 4,694,056 (c) 9,731,680 (d) 12,598,799
(e) 18,088,079 (f) 10,014,864 (g) 16,067,812

1.6. Answers for the end unit assessment

1. (a) Ten thousand (b) ones (c) Tens

Ten million Thousands Ten thousands

Hundred thousands Hundred thousands

2. (a) > (b) > (c) >

3. (a) 8,765,420 (b) 6,545,700 (c) 98,776,000 (d) 45,370,000
(e) 10,000,000 (f) 32,700,000

4. 1,000,000

5. 46,210,495 books

6. 502,920 eggs

7. 5,472,650 FRW

8. 9,796,817 textbooks

9. Five million six hundred seventy eight thousand nine hundred fifty.

10. Eight million four hundred thirty four thousand five hundred seventy nine.

11.

Quantity one	Sign	Quantity two	Total
1,456,776 kg	+	2,456,767 kg	3,913,543 kg
2,555,550 FRW	–	1,189,660	1,365,890 FRW
23,752 FRW	×	450	10,688,400 FRW
49,560,000 FRW	÷	7,080 FRW	7,000 FRW

12. (a) 47,350,184 bottles (b) 26,457,584 bottles

1.7 Additional activities for the whole unit

Consolidation Activities

1. Write the following in number words or in figure (a) 1,245,145 (b) 2,637,340 (c) Eleven million twenty-five thousand, one hundred eleven.
2. What is the place values of the underlined digits: (a) 1,009,667 (b) 5,264,568
3. Work out: (a) 9,876,444 + 1,776,000 (b) 265,468 × 456 (c) 2,233,942 ÷ 225

Extended activities

1. Munyaneza bought 20 kg of beans at 550 FRW per kg and 50 kg of sweet potatoes for 280 FRW per kg. If he paid 5,000 FRW including 2,800 of sweet potatoes.
   (a) How many kg of sweet potatoes did he pay for?
   (b) If he bought only 5 kg of beans. Was the money paid enough? Explain
   (c) Write all the required money in words:
2. For each month I save, 15,000 FRW from my salary.

(a) How much money will I save for 10 years?
(b) What is the value of 5 in the answer of (a)?

UNIT 2: MULTIPLICATION AND DIVISION OF INTEGERS

2.1 Key unit competence

To be able to multiply and divide integers.

2.2 Prerequisite knowledge and skills

Pupils will perform well in this unit if they have knowledge and mastery of the following: addition and subtraction of integers.

2.3 Cross-cutting issues addressed

Throughout the teaching process of this unit, it will be crucial to help learners to master the content and it is better to address cross-cutting issues where possible. In this unit, we will address the following cross-cutting issues as non-stand alone cross-cutting issues within classroom activities and through the development of the content.

- Peace and value education: First of all as a teacher you have to be a peace maker in your class and role model so that learners will imitate how you behave. When there is any conflict do not leave without helping to solve it within the lesson. Encourage learners to behave well, being humble, honest, etc.

- **Gender Education**: This cross-cutting issue will be addressed through giving equal opportunities to both boys and girls during the lesson.

2.4 Guidance on the introductory activity

- Introductory activity:

In Mathematics, operations on integers are performed in a range of situations. Suppose you are moving and counting from point A to point B with steps forward for a distance of 20 steps.

(a) What happens if you reach the point B and go back jumping 2 steps four times without changing the direction you are facing? Is the movement positive or negative?
(b) How many jumps are needed to cover the distance from point B to A? Give the mathematical operation used to get the answer.
(c) Consider the starting point A as zero. What will happen if you continue jumping and pass the starting point A four steps?
d) If the thermometer indicates that the temperature of an object is -2 degrees. What is the temperature of another object colder 5 times as the one measured by the thermometer?

- Guidance on the introductory activity:

- Invite learners to form groups and lead them to work on introductory activity to understand the concept of **multiple of a positive or negative number**;
- Allow learners present their findings;
- Harmonize their works and ensure that they got exact solution.

Answers:

a) If you reach the point B, you are at step 20, if you go back jumping 2 steps four times without changing the direction, you are at 8 steps from B, this is 12 steps from A.
b)) To cover the distance from point B to A, there are 20 jumps done backwards. This can be expressed by -20 because they are done backwards.
c) If A becomes point 0, if I continue jumping and pass the starting point A four steps, I will be in -4, this is the position at 4 steps before zero.
d) The second object has -2 degrees times 5 which is -10 degrees.
Note: Some learners can fail to answer to the question, t**ell them that this unit will help them understand how an integer can be multiplied by another number.**

2.5. List of lessons

	Unit 2: multiplication and division of integers	**8 periods**
	Lesson	**Number of Periods**
0	Introductory activity	1
1	Multiplying integers using counters	1
2	Multiplying integers using a number line	1
3	Multiplying integers without using a number line	1
4	Dividing integers using a number line	1
5	Dividing integers without using a number line	1
6	Solving problems involving multiplication and division of integers	1
7	End unit assessment	1

2.5.1 Lesson 1: Multiplying integers using counters

a) Learning objectives (formulated)
To explore the multiplication of integers practically using counters (or buttons) of different coloured faces.

b) Teaching resources
Red and blue counters, or Plastic pieces or laminated transparent counters whose one side is blue and other side is red.

c) Learning activities

- Guide learners in the whole class discussion by giving them instructions as follow:

- Consider the red side of the counter as positive (+) and the blue side of the counter as negative (–).

Positive Negative

- Multiplying two positive integers:

Take an example of **(+3) x (+2).** According to our coloured counters, (+3) x (+2) means make three groups each group having 2 counters placed with red faces facing up as below:

Ask learners to give how many counters are there in total. Which coloured faces are up? Deduce (+3) x (+2.

- Multiplying two negative integers: Take an example of **(– 2) x (– 4)**

Note that a negative sign on the multiplicand is **considered** and read as opposite: for example

(– 2) x (– 4) is read as the opposite of two groups of negative four. But we know that negative four is represented by four blue counters.

i. First, make two groups of four counters with blue face showing up and place them on a row.

ii. Since it's a negative two (-2) which means the opposite of two groups, we invert the blue faces of the counters to have the red faces showing on top.

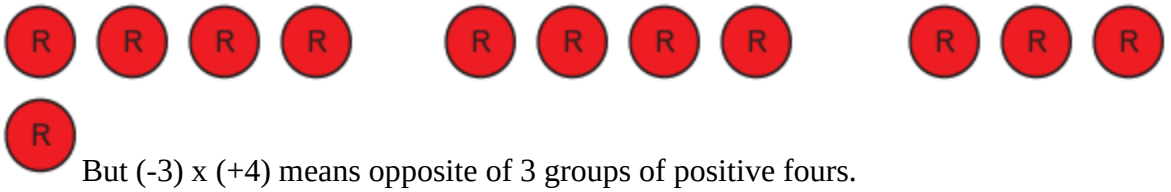
Note: We invert because of the negative sign on the multiplicand.

Ask learners to give the answer.

- Multiply a positive by a negative integer, take the example of **-3 x +4**

Since a negative means the opposite, (-3) x (+4) means opposite of 3 groups of positive fours.

Starting with 3 x (+4) means make three groups with each group having 4 counters placed in a row with red faces facing up as below.



But (-3) x (+4) means opposite of 3 groups of positive fours.

Since there is a negative which means opposite, we flip or invert the counters in each case putting the counters with blue faces facing up.

Ask learners to give how many counters and the colour they are and then to deduce -3 x +4

- Then, group learners and for each group, give them the counters and the working sheet on which there are integers to be multiplied.(see the book for practical activities in Mathematics).
- Invite groups to present their works in a whole class discussion.
- For each case, guide learners to summarize how to multiply integers using counters and the sign of answer to be found depending on the sign of terms: As observed from the results we note the following:

i. Multiplying two positive integers you get a positive Integer since according to our practical activity means picking red faced counters repeated number of times and placing them without inverting.
ii. Multiplying two negative integers gives a positive integer since it involves inverting the counters after repeatedly adding the blue counters. They are inverted to get the red faces up because of the negative sign of the multiplicand.
iii. Multiplying a negative integer and positive integer gives a negative integer. If it is the multiplicand which is negative, we invert the total counters and If tis the multiplier which is negative we don't invert the counters.

d) Answers for questions:

i) (+3) x (+2) = +6

ii) (– 2) x (– 4) = +8

iii) (-3) x (+4) = -12

2.5.1 Lesson 2: Multiplying integers using a number line

a) Learning objectives

- Describe the steps taken when multiplying and dividing integers

- Apply the concepts of multiplication to solve problems involving integers.
- Carry out multiplication of integers using a number line.
- Explain how integers change in multiplication.

b) Teaching resources

Number lines, wall charts with integers and number lines, textbooks, manila papers, pens, notebooks, counters.

c) Learning activities

- Ask learners to recite multiplication tables of 7, 8, 11.
- Ask learners to form groups and provide each group with the necessary materials.
- Assign groups to carry out the **learning activity** in the Learner's Book.
- Help learners to realize, as they present their reports, that 5 × 7 means 5 groups of 7 steps.
- Ask learners to give the interval covered if they started from 0 and arrive to 12 by the use of the number of jumps and the length of ne jump.
- Harmonize answers by highlighting that one jump has +4 and the number of jumps is 3 and then the interval covered is (+4) x3 = +12.

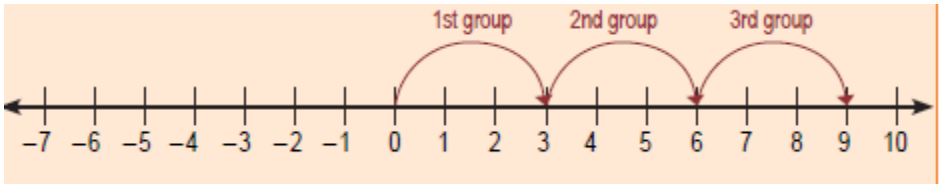
- Invite learners to take their rulers, draw number line and work out example 1, 2 and 3 from the learner's book.

- Motivate them to ask questions where necessary and provide well guided answers.

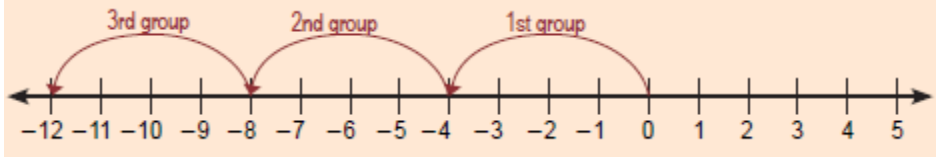
- Ask them to summarize how they can multiply integers using a number line.

- Invite them to read the study tip to internalize the way of multiplying:

- To multiply a positive integer by a positive, move to the positive side. For example (3) × (+3)



- To multiply a negative integer by a positive odd or even number, move to the negative side. (3) × (-4)



- To multiply a negative integer by a negative numbers, move to the positive side.

For example (-3)x (-2)

- Guide learners to summarize how multiplication change sign of factors: As observed from the results we note the following:

i. Multiplying two positive integers you get a positive Integer since according to our practical activity means picking red faced counters repeated number of times and placing them without inverting.
ii. Multiplying two negative integers gives a positive integer since it involves inverting the counters after repeatedly adding the blue counters. They are inverted to get the red faces up because of the negative sign of the multiplicand.
iii. Multiplying a negative integer and positive integer gives a negative integer

- Assign them to work individually the **application activity 2.1**, mark them and provide feedback.

- Depending on the results, assign them the following additional activities:

Remedial activities

Help slow learners to master the concept by using number lines to multiply more integers.

(a) 4 × +6 (b) 3 × –3 (c) 8 × +2

(d) 5 × –6 (e) 2 × +5 (f) 7 × –4

Extended activity

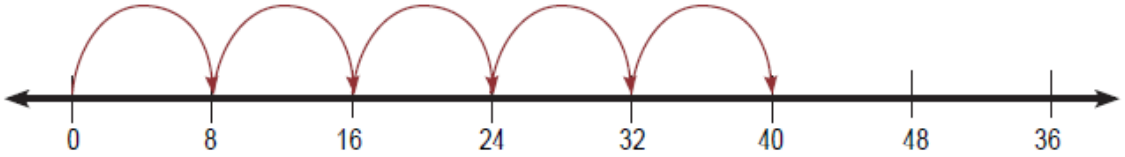
Prepare more work for the fast learners. Tell them to draw their own number lines as this helps them to perfect the skill.

(1) 8 × –3 (2) 6 × –7 (3) 4 × –9

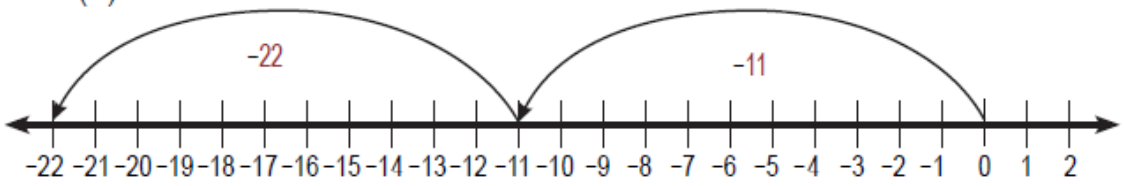
(4) 9 × +6 (5) 10 × +4 (6) –8 × –8

d) Answers for application activity 2.1

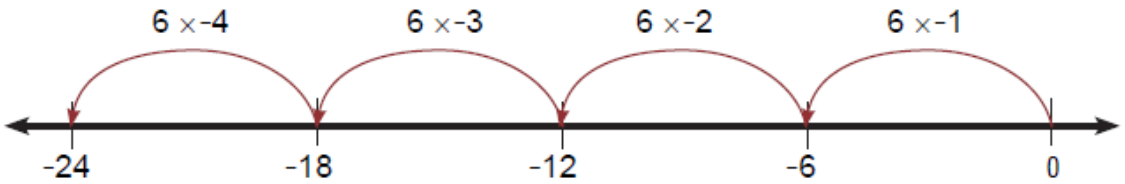
1 (a)


0
8
16
24
32
40
48
36

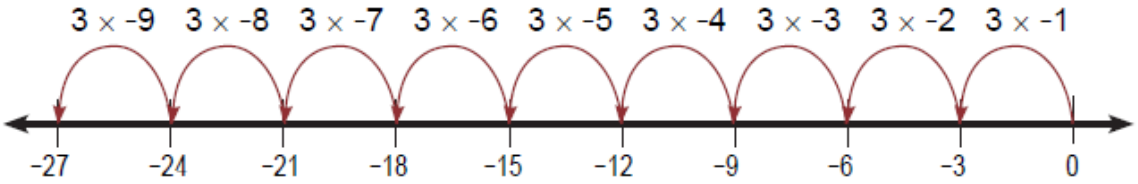
(b)


-22
-11
-22 -21 -20 -19 -18 -17 -16 -15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 0 1 2

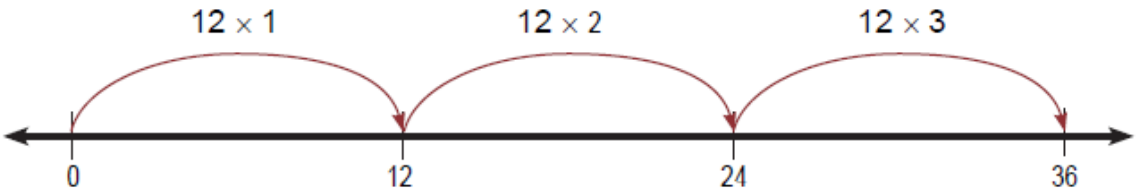
(c)

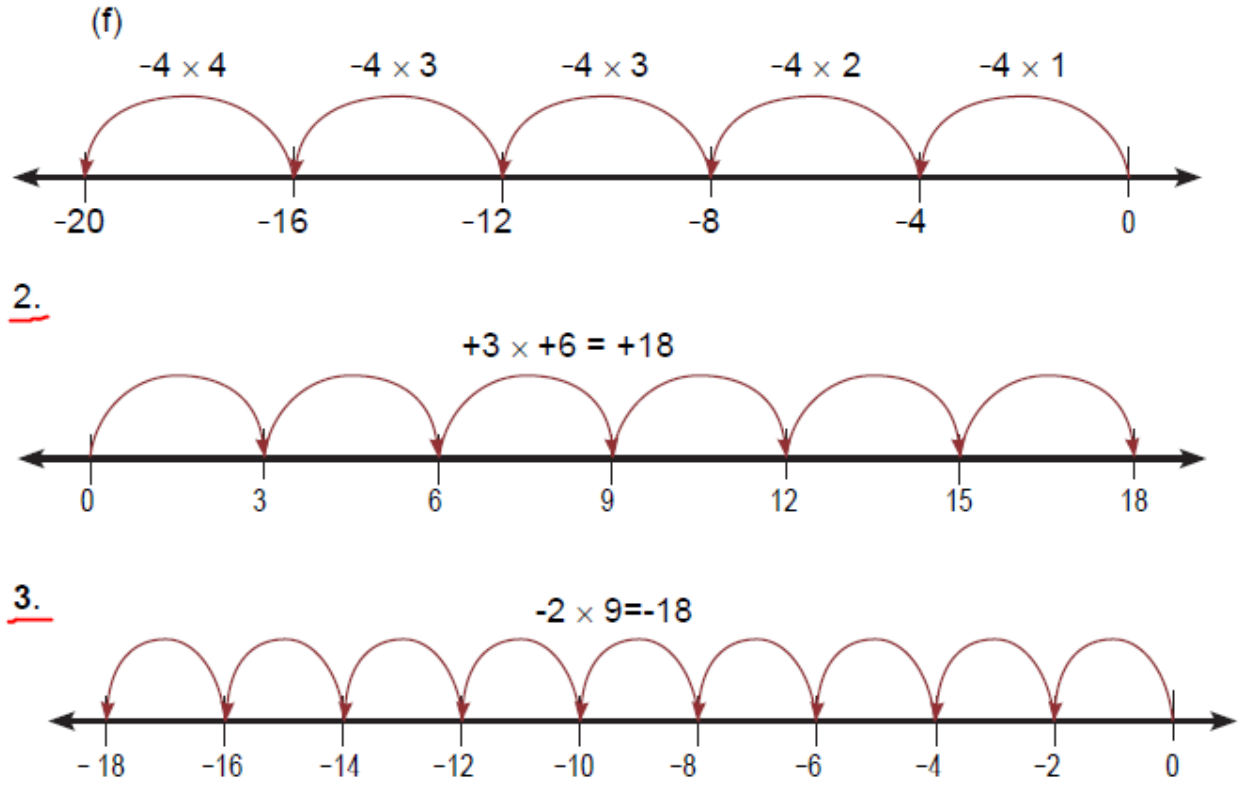

6 × -4
6 × -3
6 × -2
6 × -1
-24
-18
-12
-6
0

(d)


3 × -9
3 × -8
3 × -7
3 × -6
3 × -5
3 × -4
3 × -3
3 × -2
3 × -1
-27
-24
-21
-18
-15
-12
-9
-6
-3
0

(e)


12 × 1
12 × 2
12 × 3
0
12
24
36



2.5.3 Lesson 3: Multiplying integers without using a number line

a) Learning objectives

- Describe the steps taken when multiplying and dividing integers

- Apply the concepts of multiplication to solve problems involving integers.
- Carry out multiplication of integers without using a number line.
- Explain how integers change in multiplication.

b) Teaching resources

Pens, notebooks, textbooks, calculator.

c) Learning activities

- Use the flash cards to help learners recall that a positive times a positive gives a positive, a negative times a negative gives a positive, positive × negative gives negative and negative × positive gives a negative.
- Organize learners into manageable groups and provide each group with the necessary materials.
- Invite them to carry out the learning activity in the Learner's Book.
- Let the learners carry out the group presentation in a whole class discussion and finally come up with a general report.
- Help learners to harmonize their work.
- Guide learners through the examples on a displayed chart or example from learner's book:

Example 1	Example 2	Example 3
6 × + 3	-5 × - 2	+6 × -8
number: 6 × 3 = 18	number: 5 × 2 = 10	number: 6 × 8 = 48
signs: + × + = +	signs: - × - = +	signs: + × − = −
Therefore, +6 × + 3	Therefore -5 × - 2	Therefore +6 × -8
= +18	= + 10.	= −48.

- Give learners numbers to try out by answering them orally.
  e.g: +2 × +4, -2 × +9, -9 × +8, -8 × -12 etc.
- Encourage them to ask questions where they get challenges.
- Invite them to discuss the Study tip. Later, tell them to work individually the **application activity 2.2** in the Learner's Book.
- Mark their work and give them feedback.
- **Note**: The concept: negative × negative = positive confuses most learners. Ensure learners get the concept very well by highlighting **the opposite of the opposite** of something.
- Depending on the results, assign them the following additional activities:

Remedial activities

Prepare some simple numbers for slow learners;

(a) +5 × +3, (b) +4 × -2, (c) -7 × +2 (d) -5 × -2

(e) +8 × -9 (f) -7 × -9 (g) +6 × +7

Extended activities

You may have larger figures for fast learners to practice, for example;

(1) +23 × +6 (2) -25 × -8 (3) +55 × +5
(4) -130 × -7 (5) +15 × 234

d) Answers for application activity 2.2

(a) +16 (b) +40 (c) -70 (d) -54
(e) -96 (f) - 12 (g) +99 (h) +42
(i) +600 (j) -600 (k) -1500 (l) +12,423.

2.5.4 Lesson 4: Division integers using a number line

a) Learning objectives

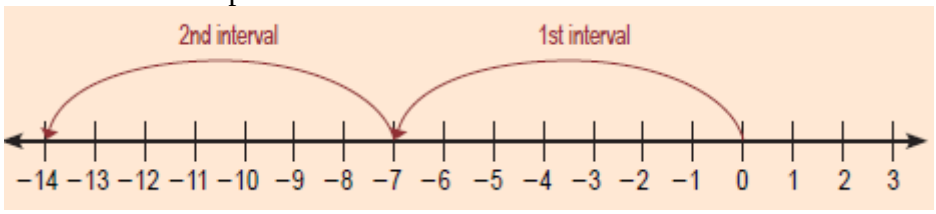
- Describe the steps taken when dividing integers
- Carry out division of integers using a number line.
- Apply the concepts of division to solve problems involving integers.
- Explain how integers change their sign in division.

b) Teaching resources

Number lines, wall charts with integers and number lines, textbooks, manila papers, pens, notebooks, counters.

c) Learning activities

- Review multiplying integers using a number line.
- Ask learners to form groups and provide each group with materials to use.
- Assign them to work on the learning activity in the Learner's Book and guide learners as they discuss.
- Instruct them through the activity
- Give them time for group presentation and later come up with harmonized answers. That is; there are 4 intervals. The division statement is 28 ÷ 7 = 4.
- Change the sign of numbers, that is -28, -21, etc. The division statement is
 -28 ÷ 7 = -4
- Remind them that division is the opposite of multiplication. And ask them to express the meaning of 4 or -4. Lead them to conclude that it is the length of one jump.
- Write another example on the chalkboard for class discussion or lead them through **example from the learner's book**. . Example; 14 ÷ 2; Explain that this means subtracting 2 repeatedly from 14. Count the number of times you subtract 2 from 14 to get zero. Allow them to count the number of times subtracted. Explain to the learners that the number of times becomes the answer. For example: -14 ÷ +7= ?



- Ensure that you have number lines drawn and labeled already on sheets of paper and more examples.

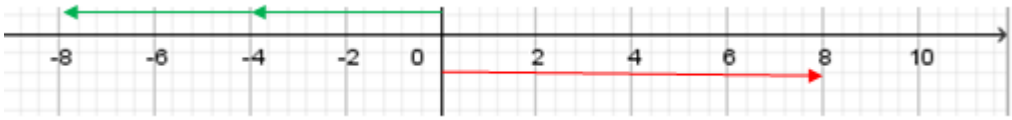
i) Example +18 ÷ +3= ?

+18 ÷ +3= +6(number of jumps in the same direction)

ii) Example (-24) ÷ (-6)= ?

(-24) ÷ (-6)= +4 (number of jumps in the same direction)

iii) Example (+8) ÷ (-4)= ?



(+8) ÷ (-4)= -2 (number of jumps in opposite direction).

- Give out some numbers for learners to share ideas in groups and ask them to use a number line to get the answer. For example: +18 ÷ 3, -18 ÷ 3, +24 ÷ 6, -24 ÷ 6.

- Guide learners as they read through and study the examples in Learner's Book.

- Guide them through the Study tip to conclude: Division is like repeated subtraction.

- Start from zero and make intervals equivalent to the divisor in length until you reach the dividend.
- The number of intervals becomes the answer.
- If the dividend is in the positive direction (quotient), the integer is positive.
- If the dividend is in the negative direction, the integer is negative.

Note: Dividing integers on number line may sometimes be confusing. Ensure that you give numerous examples.

- Invite them to work out **application activity 2.3**. Mark their work accordingly and give feedback.

- Depending on the results, assign them the following additional activities:

Remedial activities

Prepare simple numbers for slow learners to practice.

(a) +8 ÷ 2, (b) -8 ÷ 2, (c) +12 ÷ 3

(d) -12 ÷ 3 (e) +24 ÷ 6 (f) -30 ÷ 3

Extended activities

Prepare more work for fast learners.

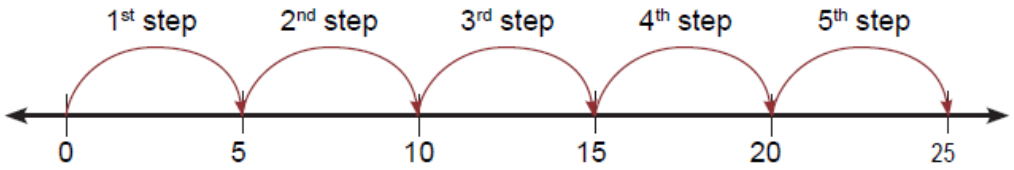
Let the learners draw number lines by themselves.

(a) +28 ÷ 7 (b) -32 ÷ 8 (c) +45 ÷ 9

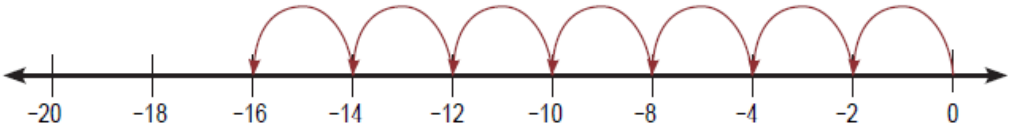
(d) -60 ÷ 15 (e) +45 ÷ 5 (f) 48 ÷ 4

d) Answers for application activity 2.3

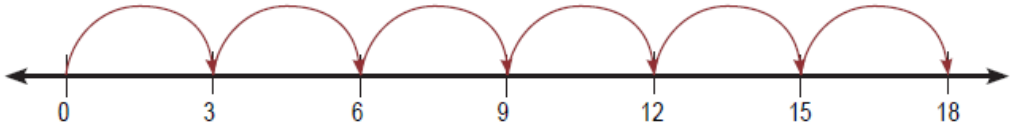
(a)



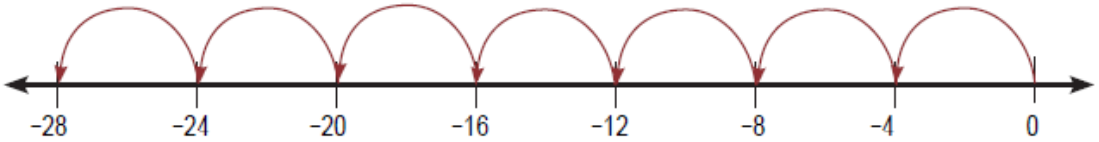
(b)



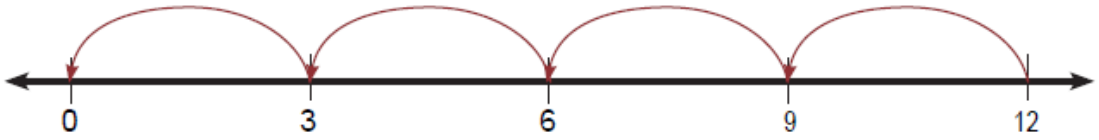
(c)



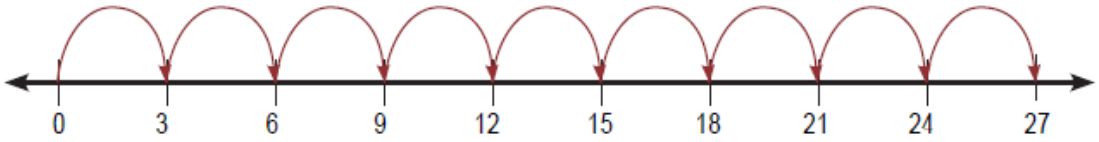
(d)



(e)



(f)



(g)

(h)

2.5.5 Lesson 5: Dividing integers without using a number line

a) Learning objectives

- Describe the steps taken when dividing integers
- Carry out division of integers without using a number line.
- Apply the concepts of division to solve problems involving integers.
- Explain how integers change their sign in division.

b) Teaching resources

Wall charts with integers and number lines, textbooks, manila papers, pens, notebooks, counters, calculator.

c) Learning activities

- Review how to multiply numbers without using a number line.
- Provide each group with flash cards having the learning activity from the Learner's book.
- Let them carry out the activity and later call groups for the presentation in a whole class discussion.
- Harmonize their work by highlighting that dividing integers of the same signs gives a positive integer and dividing integers with different signs gives a negative integer.
- Guide learners on how to divide signs and inform them that dividing integer signs is similar to multiplication. That is: positive ÷ positive = positive, negative ÷ negative = positive , positive ÷ negative = negative, negative ÷ positive = negative
- Guide learners through some examples on a displayed chart or examples from the learner's book.

Example 1	Example 2
+20 ÷ +5	-36 ÷ -9
number: 20 ÷ 5 = 4	number: (36 ÷ 9 = 4)
signs: + ÷ + = +	signs: - ÷ - = +
Therefore, +20 ÷ +5	Therefore-36 ÷ -9
= +4	= + 4.

- Assign more activities to discuss in groups:

(1) +12 ÷ +4 (2) -12 ÷ -4 (3) -48 ÷ +6 (4) -96 ÷ +12

Let them share the experience and refer to the Study tip from the learner's book.

- Give lots of practice especially through mental work and then, invite learners to work individually the **application activity 2.4** . Mark their work and give them feedback.
- Depending on the results, assign them the following additional activities:

Remedial activites:

Guide slow learners again using picture cards.

Allow them do work at their pace.

(a) -8 ÷ -2, (b) +10 ÷ -5 (c) -12 ÷ -2 (d) +15 ÷ 5 (e) +24 ÷ -3

Additional Exercise

Prepare more challenging work for fast learners by applying larger numbers

a) +6250 ÷ +125 = b) -35000 ÷ +700 = c) +2991600 ÷ -12465 =

d) Answers for Application activity 2.4

(a) -3 (b) +3 (c) -5 (d) +4

(e) +3 (f) +3 (g) +8 (h) +12

(i) +5 (j) +5 (k) -5 (l) +24

2.5.6 Lesson 6: Solving problems involving multiplication and division of integers

a) Learning objectives

- Carry out division of integers.
- Apply the concepts of division to solve problems involving integers.

b) Teaching resources

Wall charts with word problems involving integers, number lines, counters, textbooks, manila papers, pens, notebooks, calculators.

c) Learning activities

- Review multiplying and dividing integers with same and different signs.
- Ask learners to get into their groups.
- Provide each group with cards and markers.
- Guide them as they carry out the **learning activity** in the Learner's Book.
- Invite some groups to present answers in a whole class discussion;
- guide the whole class to harmonize answers.
- Guide learners through some examples such as example 1 and 2 from learner's boo which require reading and working out.
- Let learners share with whole class how they can solve a problem involving integers.
- Harmonize answers by explaining the method used to solve problem: Guide them to u*nderstand the problem, identify facts (givens and requests), draw visual representations related to the problem and solve the problem using the related operation;*
- Tell them that sharing, breaking into parts, distributing, rationing all mean dividing

-Discuss and guide learners through situations which are positive or negative.

Positive situations include; profits, goal scores, raise in temperatures and so on.

Negative situations include; debts, fall in temperatures, loss, buying on credit and so on.

- Give lots of practice especially through mental work and then, invite learners to work individually the **application activity 2.5**. Mark their work and give them feedback.

d) Answers for application activity 2.5

(1) 2,300 FRW (2) 6 mangoes (3) 500 FRW (4) 500 FRW

(5) 27oC (6) 1,440,000 FRW (7) -15oC (8) -15 points

2.6 Additional information for the teacher

Concerning the multiplication and division of integers, find more practical activities in the book "Mathematics practical activities and experiment user guide for Upper primary"

2.7 Answers for the end unit assessment

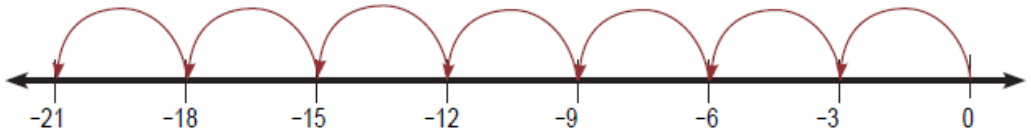
Depending on the time available, select questions that will help you to assess if the key unit competence was achieved.

Answers:

1. (a) +3 (b) -30 (c) +6 (d) 144 (e) -27 (f) -5

2. **(a)**

(b)



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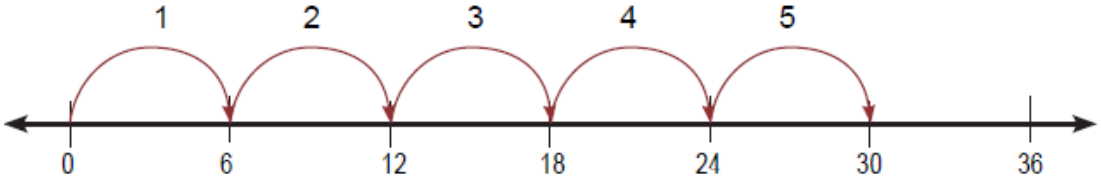

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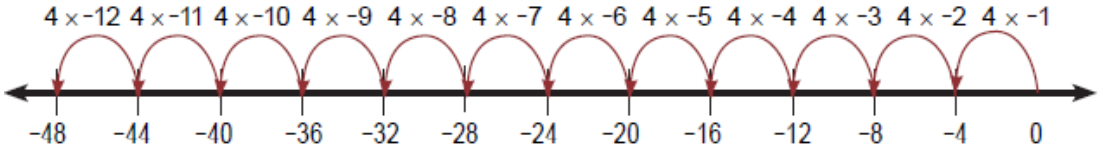

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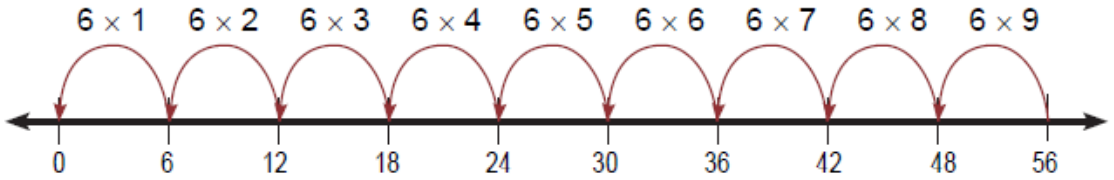

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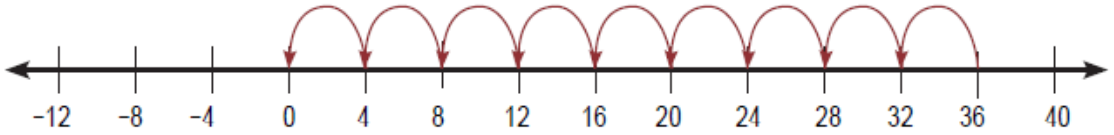


3. 4,800 FRW

4. debt of 2,000 FRW

5. 600 books

6. the two integers are +30 and -10

7. 400 FRW

8. 1,500 FRW

9. 200 FRW

10. 20 ÷ -4

2. 8 Additional activities

Consolidation activities

Set simple questions for the slow learners to practice. Encourage and guide them to understand words like quotient, share, distribute.

(1) Multiply: -4 by +3.
(2) What is the product of +2 and -5?
(3) What is the quotient of -9 and 3?
(4) Find the product of +3, -6 and +5
Give slow learners time for redoing worked examples and some other exercises.
Work out:
(a) (+131) × -78 (b) (+200) ÷ (-25) (c) (+27) ÷ (+9)
(d) -42 × -12 (e) 7800 ÷ (-100)

Extension Activities
(1) (-123) + (+23)) × ((+100) + (-75)
(3) (-807 × 100) ÷ 20
(4) Kantengwa stands on -12, she moves 5 steps forward positive integer and one step backward. At which integer is she standing on now?

UNIT 3: POWERS AND INDICES, LCM AND GCF

3.1 Key unit competence

To be able to use powers and indices, and apply the Lowest Common Multiple (LCM) and the Greatest Common Factor (GCF) when solving problems

3.2 Prerequisite

Pupils will easily learn this unit, if they have a good background on the following: to read, write, order, compare, add, subtract, multiply and divide numbers beyond 1000000.

3.3 Introductory activity and guidance

Introductory activity
The distance from the earth to the sun can be easily written in short as follows: 149.6×10^5
a) Have you ever come across numbers written in this form?
b) How is such form is helpful? Explain.

Guidance on the introductory activity:

- Invite pupils to read the scenario of introduction in the learner's book.
- Guide pupils to discuss and give examples of numbers written in form of powers they previously meet and where they saw them;
- Ask them to try to explain the meaning and advantage of expressions written in form of powers.

- Move around in the classroom to get aware of different suggestions and ask some probing questions where necessary.
- Invite all pupils to a whole class discussion and basing on their experience, prior knowledge and abilities shown in answering questions for this activity, open a discussion with probing questions to facilitate them to give their predictions and ensure that you arouse their curiosity on powers and main topics to be leant in this unit.

Answer:

The distance from the earth to the sun can be easily written in short as follows: 149.6 x 10^5

a) Yes we meet such numbers written in the form of powers when we were reading how to find the areas or volume of solids. For example: volume of a cube of side 10cm is

$$v = s.s.s = 10cm.10cm.10cm = (10cm)^3 = 10^3 cm^3$$

b) This fom called power form helps to simplify mathematics expressions.

3.4 Cross-cutting issues to be addressed

Throughout the teaching process of this unit, it will be crucial to help learners to master the content and it is better to address cross-cutting issues to show them the application of what they are learning in their real life.

So, in this unit, we will address the following cross-cutting issues as non-stand alone within classroom activities and through the development of the content.

Peace and value education: First of all as a teacher you have to be a peace maker in your class and role model so that learners will imitate how you behave. When there is any conflict do not leave without helping to solve it within the lesson. Encourage learners to behave well, being humble, honest, etc.

Gender Education: This cross-cutting issue will be addressed through giving equal opportunities to both boys and girls during the lesson.

Financial education: We will show that powers are used when calculating the amount of money received or to be deposited to the bank. It is also addressed when pupils discuss word problem involving how to use money

- **Environment and sustainability:** This will be addressed when pupils will be maintaining hygiene for their classroom and for materials they used.

3.5 List of lessons/sub-heading

	Powers and indices, LCM and GCF	**16 periods**
	List of lessons	**Number of Periods**
0	Introduction activity	1
1	Introduction to Indices	
2	Defining base and exponent	1
3	Multiplying and the law of multiplication of indices	1
4	Dividing and the law of division of indices	1
5	Multiplying and dividing indices	1
6	Finding unknown and the law of multiplying indices	1
7	Finding the unknown and the law of dividing indices	1

8	Finding the lowest common multiple (LCM) of numbers	1
9	Solving problems involving LCM	2
10	Factors of a whole number	1
11	Finding the greatest common factor (GCF) of numbers	1
12	Solving problems involving GCF	1
13	Finding the unknown number using LCM and GCF	1
14	End unit assessment	1

3.5.1 Lesson 1: Introduction to Indices

a) Learning objectives

-Define indices

- Write a number in form of product of its prime factors.

b) Teaching resources

- Wall chart with numbers written in form of powers,

- Pens, notebooks, and textbooks.

c) Learning activities

- Start with mental work on squaring numbers for example, 2 × 2, 4 × 4, 5 × 5 and so on.
- Ask learners to form groups.
- Invite them to study the multiplications in the **learning activity** in the Learner's Book.
- Let t them find out and record the number of times 2 has been multiplied and suggest another way such a sentence can be presented.

- Through a discussion, help learners to realize that the sentence can be written in short by writing 2 once, then counting the number of times it has been multiplied to write above 2. Therefore, $2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6$
- Write a similar example on the chalkboard and guide learners through it.
  Example: Write 8 × 8 × 8 × 8 × 8 × 8 in short.
- Explain to the learners that 8 has been multiplied by itself 6 times, so 8 must be written once and the number of times it has been multiplied written to the right above it;

That is $8 \times 8 \times 8 \times 8 \times 8 \times 8 = 8^6$

- Guide learners to define indices as of powers as numbers written in form of a^n **read as a power n** to mean that the number **a** has been multiplied repeatedly and n is the number of times it is repeated.
- Take the learners through the example1 and 2 in the Learner's Book as you emphasize the figure that must be written once and the one that should be written above it.
- Give them some examples involving finding the numbers that are **missing** to test whether they have understood.

For example: (a) $9 \times 9 \times 9 = \ldots^3$ (b) $11 \times 11 \times 11 \times 11 = 11^{\cdots}$

- Guide learners through the Study tip and assign them to work individually **application activity 3.1** in the Learner's Book.

- Mark their work and give them feedback.

- Depending on the results, assign them the following additional activities:

Remedial activities

Let slow learners try out the exercise below for more practice.

Fill in the missing numbers.

(a) $3 \times 3 \times 3 \times 3 = ...^4$… (b) $5 \times 5 \times 5 = ...^3$….

(c) $21 \times 21 \times 21 \times 21 = 21^{...}$ …. (d) Which is right? Is $4 \times 4 \times 4 = 4^3$ or 3^4

(e) Given $16 \times 16 \times 16 \times 16$, what is it equal to in short?

Extended activities

Let fast learners try out the exercise below.

(1) Given; $24 \times 24 \times 24 \times 24 \times 24 \times 24$.

(a) Write it in short.

(b) Give a reason as to why you have written it that way.

(2) Given that; $100 \times 100 \times 100 \times 100 = ...^4$

(a) What number is missing?

(b) Give a reason why you think it is the one that is missing.

d) Answers for application activity 3.1

1. (a) 7^5 (b) 6^7 (c) 10^5 (d) 8^3
   (e) 9^7 (f) 12^6
2. (a) 4^9 (b) 2^7 (c) 11^9 (d) 20^4
3. (a) 3 x 3 x 3 x 3 x 3 x 3 x 3 (b) 5 x 5 x 5 x 5 x 5 x 5 x 5 x 5 x 5
   (c) 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2
   (d) 100 x 100 x 100 x 100 x 100 x 100

3.5.2 Lesson 2: Defining base and exponent

a) Learning objectives

-Define indices

- Write a number in form of product of its prime factors.

b) Teaching resources

- Wall chart with numbers written in form of powers.

- Pens, notebooks, and textbooks.

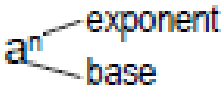
c) Learning activities

- Review the work taught in the previous lesson.

- Ask learners to form groups and guide them through the learning activity from the lerner's book.
- Guide them to come up with the correct answers, i.e, 7 is supposed to be multiplied and 4 is the number that shows the number of times 7 has been multiplied.
- Ask learners to give the general name of 7 and the general name of 4.
- Write an example on the chalkboard or use example 1 and 2 of the learner's book.

Example: Given the notation 4^3, which digit shows the
(a) exponent? (b) base?

- Explain to the learners that the number that represents the number of times a factor has been multiplied is the exponent or index. The number that should be multiplied by itself is the base.
- Ensure that learners learn how to read different notations/(powers). For example 4^3 is read as four to the power of 3 or three raised to the third power. And



- Explain that the plural for index is indices, such that learners do not get confused.
- Guide learners as they study the examples.
- Guide learners through the Study tip and then, assign them to work individually the **application activity 3.2** in the Learner's Book. Mark the answer and provide feedback.
- Depending on the results, assign them the following additional activities:

Remedial activity

Ask slow learners to read and then write the following notations in figures.

(1) six to the power of four. (2) four to the power of three.

(3) eight to the power of six. (4) two raised to the seventh power.

(5) nine raised to the second power.

(6) (a) 4,856,800 (b) 6,789,740 (c) 2,234,590

(d) 3,654,870 (e) 62,453,790 (f) 5,459,600

Extended activity

Fast learners can write the following notations in words:

(1) 5^3	(2) 4^6	(3) 2^{12}	(4) 12^3
(5) 7^2	(6) 11^3	(7) 8^7	(8) 8^4
(9) 10^4	(10) 15^{10}		

d) Answers for application activity 3.2

1. (a) 5 (b) 6 (c) 10 (d) 8 (e) 2

2. (a) 5 (b) 9 (c) 4 (d) 7 (e) 6

3. 9^6

4. 11 x 11 x 11 x 11 x 11 x 11 x 11

5. 6^{13} (Exponent 13, base 6)

3.5.3 Lesson 3: Multiplying and the law of multiplication of indices

a) Learning objectives

-Define the multiplication of indices

- Multiply numbers and expressions given in form of indices

b) Teaching resources

- Wall chart with numbers written in form of powers.

- Pens, notebooks, and textbooks.

c) Learning activities

- Begin the lesson with a review of the previous lesson. That is, display a card with a notation and ask learners to expand.

For example 4^6 , let the learners tell that $4^6 = 4 \times 4 \times 4 \times 4 \times 4 \text{ x } 4$.

- Ask learners to form groups.
- Let them carry out the **learning activity** in their groups as you supervise them.
- Give them time to present what they have agreed upon.
- Make a general harmonization, that is;

To expand and work out $6^2.6^5$ gives $(6 \times 6) \times (6 \times 6 \times 6 \times 6 \times 6) = 6^7$.

Six has been multiplied seven times. This is the same as keeping the base and adding the exponent: $6^2.6^5 = 6^{2+5} = 6^7$ because when compared, the results are the same.

- Conclude that when multiplying powers of the same base, we simply add the indices and maintain the base.
- Write an example which requires simplifying multiplication problems involving indices.

Example: work out: $8^3 \text{x } 8^4$.

Allow learners to expand, i.e $(8 \times 8 \times 8) \times (8 \times 8 \times 8 \times 8) = 8^7$

- Take learners through method 2 where they do not need to expand but to add the indices. For example, $7^2 \text{x } 7^5 = 7^{2+5} = 7^7$
- Guide learners as they study the example1 and 2 in the Learner's Book.
- Use the "Study tip" to emphasize that to multiply powers of the same base, add the indices or exponents.
- Assign learners to do the **application activity 3.3** in the Learner's Book. Mark the work and give them feedback.
- Depending on the results, assign them the following additional activities:

Remedial activity

Let slow learners try out the exercise below. Fill in the missing numbers:

(1) $3^4 \times 3^6 = 3^{(\_\_ + \_\_)}$ (2) $3^5 \times 3^3 = 3^{(\_\_ + \_\_)}$

(3) $2^3 \times 2^4 = 2^{(\_\_ + \_\_)}$ (4) $6^2 \times 6^4 = \square^{(2+4)}$

Extended activities:

Let fast learners try out the exercise below.

Use the law of indices in multiplication to work out.

(1) $a^8 \times a^2$	(2) $b^9 \times b^2$	(3) $c^7 \times c^5$	(4) $d^{10} \times d^6$
(5) $f^{12} \times f^4$	(6) $h^{15} \times h^5$	(7) $k^{18} \times k^{12}$	(8) $m^{20} \times m^{16}$

d) Answers for application 3.3

1.	(a) 6^5	(b) 9^4	(c) 10^{11}	(d) 12^9	(e) 4^8
	(f) 5^4	(g) 7^{10}	(h) 20^7		
2.	(a) 128	(b) 100,000	(c) 4,096	(d) 3,125	(e) 161,051

3.5.4 Lesson 4: Dividing and the law of division of indices

a) Learning objectives

-Define the division of indices

- Divide numbers and expressions given in form of indices

b) Teaching resources

- Wall chart with numbers written in form of powers.

- Pens, notebooks, and textbooks.

c) Learning activities

- Review the previous lesson.
- Organize learners in groups and ask them to discuss the contents in the activity.
- Discuss the results each group has got and later come up with one general result.

That is $6^5 \div 6^3 = \frac{\cancel{6} \times \cancel{6} \times \cancel{6} \times 6 \times 6}{\cancel{6} \times \cancel{6} \times \cancel{6}} = 6^2$, then $6^{5-3} = 6^2$

- Highlight that when you compare, the results are the same.
- Conclude that when you expand and divide numbers involving indices, you get the same result as when you subtract the index of the divisor from that of the dividend.
- Display a chart with worked out examples and guide learners as they study them.
- Take them through the examples in the Learner's Book. Ensure that both methods are practiced.
- Ask them to read the Study tip aloud to every one's satisfaction.
- Remind learners about the vocabulary related to division such that they may understand the law of indices in division. "The number that is to be divided by another number is the dividend. The number by which another is divided is the divisor. The result is the quotient."

For example; $24 \div 8 = 3$

Quotient

Divisor

Dividend

- Then, assign them to work individually the **application activity 3.4**.

- Depending on the results, assign them the following additional activities:

Remedial activity:

Let slow learners try out the exercise below.

Copy and complete the following:

(1) $3^6 \div 3^3 = 3^{\square - \square}$ (2) $6^5 \div 6^2 = 6^{\square - \square}$

(3) $11^6 \div 11^4 = 11^{\square - \square}$ (4) $7^4 \div 7^2 = 7^{\square - \square}$

(5) $13^6 \div 13^2 = 13^{\square - \square}$

Extended activity

Let fast learners try out the exercise below.

Use the law of indices in division to work out.

(1) $a^8 \div a^2$ (2) $b^9 \div b^2$ (3) $c^7 \div c^5$ (4) $d^{10} \div d^6$

(5) $f^{12} \div f^4$ (6) $h^{15} \div h^5$ (7) $k^{18} \div k^{12}$ (8) $m^{20} \div m^{16}$

3.5.5 Lesson 5: Multiplying and dividing indices

a) Learning objectives

Perform division and multiplication of numbers and expressions given in form of indices/powers.

b) Teaching resources

- Wall chart with numbers written in form of powers.

- Pens, notebooks, and textbooks.

c) Learning activities

- Review multiplying indices with and without the law of multiplying indices. Then review dividing indices with and without the law of dividing indices.
- Guide learners to form groups.
- Assign them through the learning activity in the Learner's Book.
- Invite groups to present findings. Then, Harmonize the activity by leading them to come up with a correct answer:

32 2 x 2 x 2 x 2 x 2 = 2^5 , 8 = 2 x 2 x 2 = 2^3 , 16 = 2 x 2 x 2x 2 = 2^4 .

- Explain that they can work out with or without the laws of multiplying and dividing indices. That is:

$$\frac{(2 \times 2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2)}{2 \times 2 \times 2 \times 2} = 2 \times 2 \times 2 \times 2 = 2^4$$

Or

$$\frac{(2 \times 2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2)}{2 \times 2 \times 2 \times 2} = 2^{(5+3)-4} = 2^{(8-4)} = 2^4$$

- Let the learners realize that both laws of multiplying and dividing indices have been combined in the working.
- Write an example or use the example from the Learner's Book on the chalkboard which require both multiplying and dividing indices. Learners should give their views about how it should be worked out.
- Then let them study and follow through. Guide them by elaborating the steps carried out.
- When you are satisfied that the learners have completely understood the concept, ask them to read the study tip.
- Then, assign them to work out the **application activity 3.5** from the Learner's Book. Mark their work and give feedback.
- Depending on the results, assign them the following additional activities:

Remedial activity:

Let slow learners try out the exercise below.

(a) $\frac{(2 \times 2 \times 2) \times (2 \times 2)}{(2 \times 2)}$ (b) $\frac{(3 \times 3 \times 3) \times (3 \times 3)}{(3 \times 3 \times 3)}$

(c) $\frac{(4 \times 4) \times (4 \times 4)}{(4 \times 4)}$ (d) $\frac{(5 \times 5 \times 5) \times (5 \times 5)}{(5 \times 5 \times 5 \times 5)} = 5^{-+--}$

(e) $\frac{(10 \times 10 \times 10 \times 10) \times 10}{(10 \times 10)} = 10^{-+--}$

Extended activity:

Let fast learners try out the exercise below.

1 (a) (27 x 81) ÷ 9 (b) (125 x 25) ÷ 25

(c) (1296 x 36) ÷ 216 (d) (42 x 7) ÷ 7

2 (a) $\frac{(9 \times 9 \times 9 \times 9) \times 9}{(9 \times 9 \times 9)}$ (b) $\frac{(12 \times 12 \times 12) \times 12}{(12 \times 12)}$

(c) $\frac{(20 \times 20 \times 20) \times 20}{(20 \times 20)}$ (d) $\frac{(22 \times 22 \times 22) \times 22}{(22 \times 22)}$

d) Answers for application activity 3.5

1. (a) $\frac{(a^1 \times a^1) \times (a^1 \times a \times a)}{(a_1 \times a_1 \times a_1)}$

(b) $\frac{(c^1 \times c^1 \times c^1 \times c^1 \times c^1) \times (c^1 \times c \times c \times c)}{(c_1 \times c_1 \times c_1 \times c_1 \times c_1 \times c_1)}$

(c) $\frac{(10^1 \times 10^1 \times 10 \times 10 \times 10) \times (10 \times 10 \times 10 \times 10 \times 10 \times 10)}{(10_1 \times 10_1)}$

2. (a) $q^{(4+5)-6} = q^3$ (b) $m^{(4+-2)-1} = m^1 = m$

(c) $8^{(-5+4)-2} = 8^{-3}$

3. (a) 5 (b) 16,807 (c) 121

3.5.6 Lesson 6: Finding unknown and the law of multiplying indices

a) Learning objectives

Perform multiplication of numbers and expressions given in form of indices/powers and deduce the missing number.

b) Teaching resources

- Wall chart with numbers written in form of powers.

- Pens, notebooks, and textbooks.

c) Learning activities

- Give mental work about multiplying indices. For example,

$2^3 \times 2^4 = ?$; $3^3 \times 3 = ?$; $4^5 \times 4^2 = ?$

- Review the previous lesson.
- Make a guided discussion as learners carryout the **learning activity** in the Learner's Book, in groups.
- Guide learners to realize that, the missing or unknown index is worked out using a simple equation of addition.
- Likely, working out in the activity would be, for example, 125 x 25 = 3,125.

Expressed in power form, it should be:

$5^3 \times 5^2 = 5^{3+2} = 5^5$.

$5^3 \times 5^? = 5^5$ finding the missing index, we state the indices as an equation.

3 + ? = 5 (solve for the missing by subtracting 3 from both sides)

3 - 3 + ? = 5 - 3

? = 2

So the missing or unknown index is 2.

- Write or dictate an example as learners write it down on slips of paper.

Example" $4^7 \times 4^y = 4^{10}$.

- Let learners initiate writing an equation of the indices.
- Move around seeking the correct one.
- Write it on the chalkboard; 7 + y = 10.
- Ask learners to solve it. Check for their working out as: 7 - 7 = 10 - 7. Therefore, y = 3.

Therefore, the unknown index is 3.

- Give more examples for the learners to practise. And refer them to the example1 and 2 in the Learner's Book.
- Guide them through the procedure, then they redo them again. Emphasize that, in order to find the unknown index, apply the law of multiplying indices. Then solve the equation formed.
- Let learners read the study tip in order to internalize the concept.
- Then, assign them to work in pairs the **application activity 3.6** in the Learner's Book.

Mark their work, then give feedback.
- Depending on the results, assign them the following additional activities:

Remedial activity:
Slow learners should re-do Application 3.6 then try this work.
Find the missing exponent

(a) $2^2 \times 2^{\square} = 2^3$ (b) $3^{\square} \times 3^3 = 3^5$ (c) $4^4 \times 4^{\square} = 4^6$

(d) $5^1 \times 5^{\square} = 5^2$ (e) $6^2 \times 6^{\square} = 6^3$ (f) $7^2 \times 7^{\square} = 7^4$

Extended activity:
Fast learners should attempt this exercise

(a) $6^m \times 6^{2m} = 6^6$ (b) $7^y \times 7^{(y-1)} = 7^7$ (c) $3^3 \times 3^1 = 3^x$

(d) $10^8 \times 10^{y-2} = 10^{10}$ (e) $12^{(x+2)} \times 12^3 = 12^8$ (f) $n^{(y-4)} \times n^2 = n^6$

d) Answers for application activity 3.6

(a) y = 1 (b) x = 4 (c) n = 4 (d) k = 3 (e) n = 16 (f) f = 1
(g) y = 12 (h) y = 8 (i) r = 0 (j) x = -3 (k) k = 9 (l) y = 1

3.5.7 Lesson 7: Finding the unknown and the law of dividing indices

a) Learning objectives
Perform the division of numbers and expressions given in form of indices/powers and deduce the missing number.

b) Teaching resources
- Wall chart with numbers written in form of powers.

- Pens, notebooks, and textbooks.

c) Learning activities
- Start with mental work on division of indices.
For example:
$2^3 \div 2^1 = 2^?$; $4^5 \div 4^4 = 4^2$; $6^{10} \div 6^5 = 6^?$
- Distribute learners in groups.
- Provide each group with the suggested learning materials.
- Guide the learners through the activity in the Learner's Book.
- Give them time to report their findings, then come up with a general report.
For example: $7^6 \div 7^? = 7^2$
Learners should realise that an equation for finding the unknown is formed. So in this case it should be: 6 - ? = 2.
Learners found missing numbers in Primary 4. They are expected to find it with ease.
? = 6 - 2
? = 4
- Now write a power notation with an unknown exponent.
For example, $5^x \div 5^7 = 5^4$

Let learners form an equation using exponents.
Check that they correctly write $x - 7 = 4$.
Follow their working out as follows:
$x - 7 = 4$
$x - 7 + 7 = 4 + 7$
$x = 11$
Therefore, the unknown index is 11.
- Refer the learners to the **example1 and 2** in the Learner's Book.
- Ask them to study and follow through the procedure. Explain instances where they get challenges.

Lead learners to realize that when finding the unknown exponent, they should first form an algebraic equation of indices, then solve for the unknown.
- Guide learners to read the Study tip to summarize the lesson.
- Assign them to work individually the application activity 3.7 from their exercise books. Mark their work, then give feedback.
- Depending on the results, assign them the following additional activities:

Remedial activities:
Slow learners should re-do Application 3.7.
Let them also try these:

(a) $3^n \div 2^x = 2^5$ (b) $5^y \div 5^3 = 5^4$ (c) $6^x \div 6^4 = 6^3$

(d) $10^m \div 10^9 = 10^1$ (e) $2^4 \div 2^3 = 2^?$ (f) $8^d \div 8^6 = 8^{12}$

Extended activities:
Fast learners should attempt this exercise.

(a) $2^4 \div 2^x = 2^5$ (b) $4^7 \div 4^y = 4^2$ (c) $7^9 \div 7^n = 7^{12}$

(d) $12^{13} \div 12^m = 12^7$ (e) $3^{2n} \div 3^4 = 3^4$ (f) $5^{3x} \div 5^1 = 5^5$

d) Answers to Application 3.7
(a) x = 2 (b) y = 3 (c) m = 6 (d) n = 3 (e) k = 6
(f) x = 2 (g) y = 2 (h) n = 4 (i) y = 4 (j) a = 12
(k) q = 8 (l) x = 2

3.5.8 Lesson 8: Finding the lowest common multiple (LCM) of numbers

a) Learning objectives
- Define the LCM of whole numbers

- Calculate the LCM of whole numbers.

b) Teaching resources
- Wall chart with numbers written in form of product of factors.

- Pens, notebooks, and textbooks.

c) Learning activities

- Start by asking learners to recite some of the multiplication tables: 4, 5, 6, 7, 8, 9, 11 and 12.
- Ask them to form groups and guide them as they carry out the **learning activity** in the Learner's Book.
- Ask learners to list the first 10 multiple of 8 and 12.
- Allow each group to report its findings and later discuss as a class to come up with a general report.
    - First ten multiples of 8 are, 8, 16, 24, 32, 40, 48, 56, 64, 72, 80.
    - First ten multiples of 12 are 12, 24, 36, 48, 60, 72, 84, 96, 108, 120.
    - The multiples which are common are 24 and 48, 72.
    - The lowest of the common multiples is 24.
- Display a chart with an example involving finding the LCM and discuss the example with the learners.
- Refer to the examples in the Learner's Book.
- Guide the learners through as you explain where challenges arise.
- Take learners through method 1 step by step and later through method 2.
- Emphasize to the learners that in method 1, the LCM is equal to the product of all prime factors.
- Give learners more examples and encourage them to use the table method of prime factorizing (method 1) so that they continue practicing it.
- Lead learners through the Study tip and use it to emphasize what you have just taught.
- Let learners attempt **Application 3.8** in the Learner's Book, page 49.
- Ensure that you make a review on prime numbers because some learners tend to mix up prime numbers with odd numbers. For example many learners confuse 9 to be a prime number.
- Depending on the results, assign them the following additional activities:

Remedial activity:

Let slow learners prime factorize the following numbers using both the prime factor tree or the table.

(1) Prime factorize 24
(2) Find the prime factors of 28
(3) List the prime factors of 30
(4) Prime factorize 36
(5) What are the prime factors of 40

Extended activity:

Fast learners can find LCM of more than 3 numbers. Find the LCM of the following:
(1) 8, 12, 16 and 24 (2) 5, 10, 15 and 20 (3) 7, 14, 21 and 28
(4) 6, 8, 9 and 12 (5) 12, 15, 18 and 24

d) Answers for application activity 3.8

(a) 24 (b) 144 (c) 77 (d) 96
(e) 60 (f) 300 (g) 450 (h) 1,260.

3.5.9 Lesson 9: Solving problems involving LCM

a) Learning objectives

- Define the LCM of whole numbers

- Calculate the LCM of whole numbers.

b) Teaching resources

- Wall chart with numbers written in form of product of factors.

- Pens, notebooks, and textbooks.

c) Learning activities

- Take learners through a quick review of the previous sub-unit in the Learner's Book.
- Ask to form groups and carry out the **learning activity** in the Learner's Book. Guide them as they work out.
- Let them report their findings and finally do it as class to come up with one conclusive answer.
- Help them to realize that the activity they carried out was another way of finding the LCM of 10 and 15.

Display a chart with an example and ask learners to read the example.

Example: A market vendor made 9 heaps of 5 oranges each and no orange remained. She later re-arranged the oranges and made 15 heaps of 3 oranges each and no oranges remained. What is the least number of oranges that she had?

- Let learners read the question and suggest what to do. Help them to realize that they have to find the LCM of 9 and 15.
- Guide them as they find the LCM by listing multiples and later by prime factorizing to come up with 45 oranges.

Take learners through the example in the Learner's Book.

- Allow learners to raise a few questions and later take them through the Study tip
- Invite learners to work individually the application activity 3.9 in the Learner's Book 50.
- Encourage learners to read every detail of the questions because failure to do so may lead to answering wrongly.
- Depending on the results, assign them the following additional activities:

Remedial activity:

1. Uwacu had some bananas. She divided them into 4 groups of 6 bananas each and no banana remained. She again divided them into 2 groups each of 12 bananas. How many bananas did she have?
2. What is the least number of fruits that one needs to make 5 groups of 6 fruits each or 3 groups of 10 fruits each?

Extended activity:

You can set more complex questions for fast learners and let them read and work out, for example;

1. The bell for the lower primary classes rings every after 30 minutes, that for the middle classes every after 40 minutes and that for the upper classes every after 60 minutes. After how many hours will they ring together?

2. The plane which goes to East African countries leaves the airport after every 60 minutes, that which goes to South Africa after every 80 minutes and that which goes to London after every 212 hours. After how many hours will the planes leave at the same time?

d) Answers to Application 3.9

(1) 300 min or 5 hrs 2) 45 books (3) 90
(4) 360 (5) 60 (6) 150

3.5.10 Lesson 10: Finding the greatest common factor (GCF) of numbers

a) Learning objectives

- Define the factors of a whole number

- Find the factors of whole numbers.

- Determine the common factors of whole numbers and deduce the greatest common factor.

b) Teaching resources

- Wall chart with numbers and their factors.

- Pens, notebooks, and textbooks.

c) Learning activities

- Start by asking learners what factors are, then list factors of numbers yoiudictate to them.

- Ask learners to form groups and guide them as they carry out the activityin the Learner's Book:

Find the factors of 24, 36 and 48.

List the factors that are common.

What is the greatest common factor of all the common factors?

- Ask each group to report its findings and later make one report out of the many.That is:

- factors of 24 are: 1, 2, 3, 4, 6, 8, 12, 24.
- factors of 36 are: 1, 2, 3, 4, 6, 9, 12, 18, 36.
- factors of 48 are: 1, 2, 3, 4, 6, 8, 12, 16, 24, 48.
- Listing the common factors gives 1, 2, 3, 4, 6 and 12.
- So the greatest of allthe common factors is 12.

- Explain to the learners that some people refer to the greatest commonfactor as the highest common factor.

- Write an example involving finding the GCF on the chalkboard and explain to the learners thoroughly.

- Guide learners through the examples in the Learner's Book.

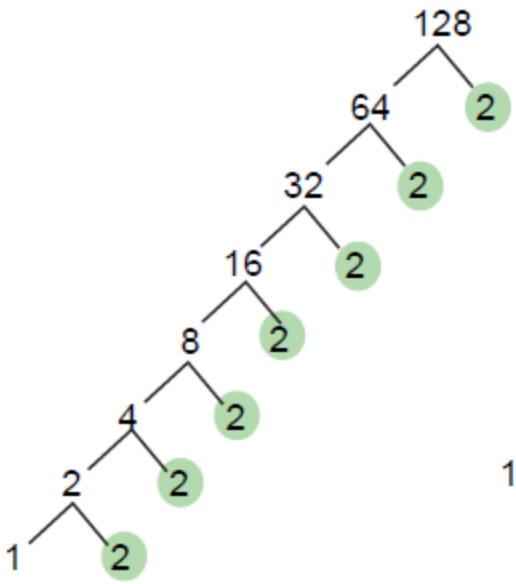
- Discuss the Study tip and use it to explain both methods further. Emphasise that to find GCF, list down all the factors of the given numbers,pick out the common factors then the greatest common factor.
- Invite learners to work individually the **application activity 3.10** in the Learner's Book.

- Depending on the results, assign them the following additional activities:

Remedial activities
Let slow learners find the GCF of simple numbers.
(1) Find the GCF of 4 and 6?
(2) Find the GCF of 6 and 8.
(3) What is the GCF of 4 and 8?
(4) Find the GCF of 9 and 12.
(5) What is the GCF of 5 and 10?
Extended activities
Fast learners can find the GCF and LCM of the following numbers:
Find the GCF and LCM of 20 and 36.
Work out the GCF and LCM of 42 and 64.
Find the GCF and LCM of 50 and 75.

d) Answers to application activity 3.10
Factors
1. (a) 30 = 1,2,3,5,6,10,,15,30;
40 = 1,2,4,5,810,20,40 The G.C.F=10
(b) 120 = 1,2,3,4,5,6,8,10,12,15,20,24,30,40,60,120
180 = 1,2,3,4,5,6,9,12,15,18,20,30,36,45,60,90,180
The G.C.F=60
(c) 180 = 1,2,3,4,5,6,9,10,12,15,18,20,30,36,45,60,90,180
240 = 1,2,3,4,5,6,8,10,12,15,16,20,24,30,40,48,60,80,120,240
The G.C.F=60
(d) 60 = 1,2,3,4,5,6,10,12,15,30,60
120 = 1,2,3,4,5,6,8,10,12,15,20,24,30,40,60,120
180 = 1,2,3,4,5,6,9,10,12,15,18,20,30,36,45,60,90,180,120
The G.C.F=60
(e) 60 = 1,2,3,4,5,6,10,12,15,20,30,60
120 = 1,2,3,4,5,6,8,10,12,15,20,24,30,40,60,120
The G.C.F=60
(f) 45 = 1,3,5,9,15,45
60 = 1,2,3,4,5,610,12,15,20,30,60
75 = 1,3,5,15,25,75

2. (a)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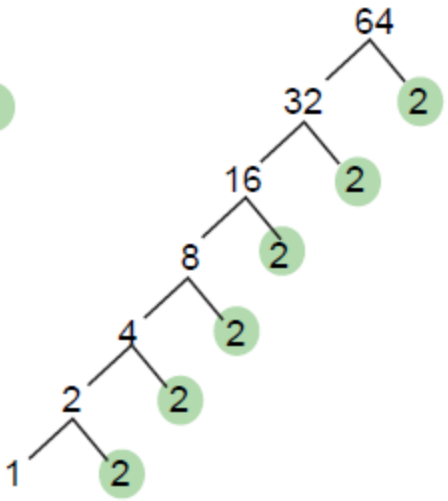
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4
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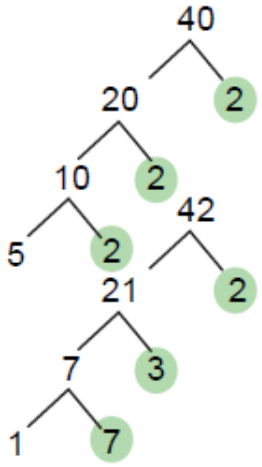
2
2
1
2

(b)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10
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5
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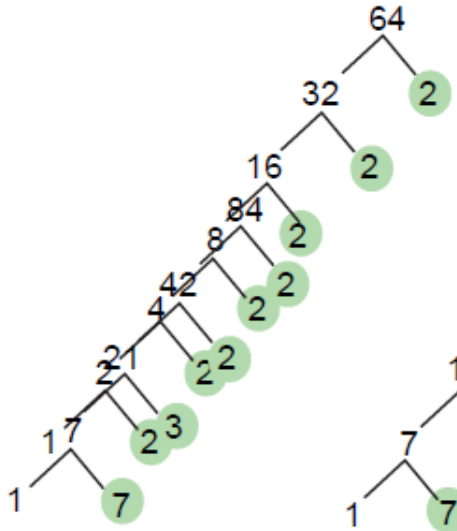
42
2
21
7
3
1
7

(c)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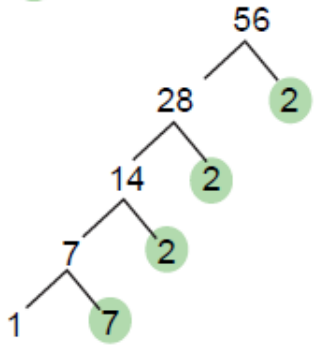
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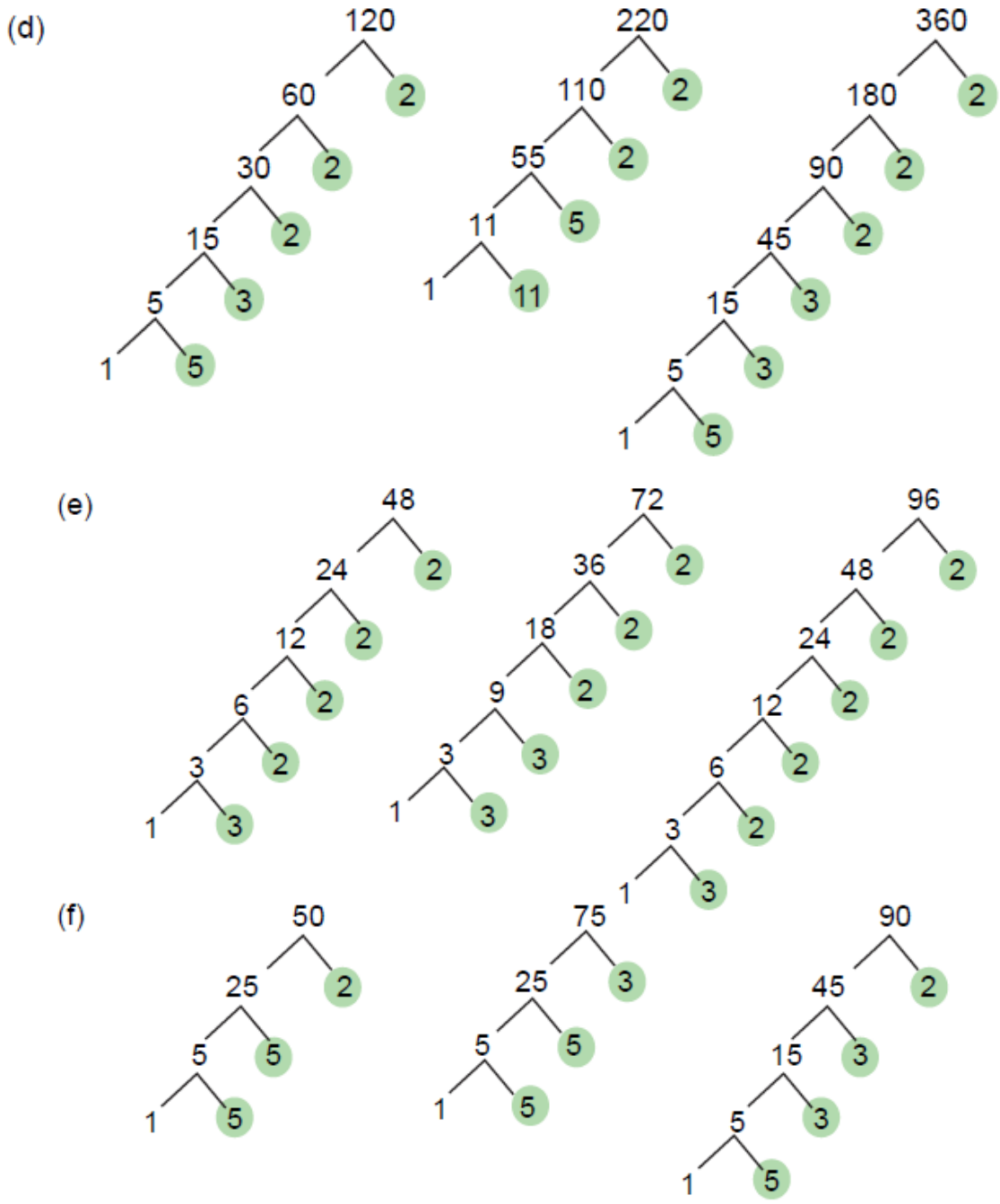


3.5.11 Lesson 11: Solving problems involving GCF

a) Learning objectives

- Find the factors of whole numbers.

- Determine the common factors of whole numbers and deduce the greatest common factor.

- Solve word problems involving the GCF.

b) Teaching resources

- Wall chart with numbers and their factors.

- Pens, notebooks, and textbooks.

c) Learning activities

- Review finding the GCF of numbers which was learnt in the previous lesson.
- Ask learners to form groups and carry out the learning activity from the Learner's Book.
- Let them present to the whole class what they found out.
- Write a general report on the chalkboard; for example;
    - Numbers that can divide 20 are 1, 2, 4, 5, 10, 20.
    - Numbers that can divide 45 are 1, 3, 5, 9, 15, 45.
    - Yes, there are numbers which are common to both lists and that is 1 and 5.
    - The greatest of those common numbers is 5.
- Help learners to realize that when they ask for numbers that divide others, they are asking for factors.
- Display a chart and use it to guide learners through the example on it.
- Refer to the example in the Learner's Book.
    - Ask learners to read the question and guide them through the working.
    - You can provide another example on the chalkboard for more practice.
      For example: Find the mass of the largest paper bag that you can use to pack rice from big sacks of 25 kg, 50 kg and 80 kg such that no rice remains in each of the sacks.
- Let learners read the question and discuss it. Help them to realize that they have to find the GCF of 25 and 50 which is 5.
- Guide learners through the Study tip and use it to emphasize the example that you have just used.
- Invite learners to work out the **application activity 3.11** from the Learner's Book. Mark their work and give feedback.
- Depending on the results, assign them the following additional activities:

Remedial activities

Let slow learners work out simple word problems to practice for example;
- What is the greatest number that can divide 4 and 6?
- Find the greatest number that can divide 6 and 8.
- Which is the largest number that can divide 12 and 15 without leaving a remainder?
- Given the number 6, 8 and 12, what is the greatest number that can divide each of them?

Extended activities

Fast learners can work out more challenging problems similar to the ones below.
Three friends harvested maize grain. The first harvested 950 kg, the second harvested 1050 kg and the third harvested 800 kg. They want to pack the maize grain into sacks such that non remains. What should be the mass of the sacks they must use?

d) Answers to application activity 3.11

(1) 18 (2) 5 litres (3) 12 kg (4) 30 kg (5) 2

3.5.12 Lesson 12: Finding the unknown number using LCM and GCF

a) Learning objectives

- Find the factors of whole numbers.

- Determine the missing number in the context where LCM and GCF are known.

- Solve word problems involving the LCM and GCF.

b) Teaching resources

- Wall chart with numbers and their factors.

- Pens, notebooks, and textbooks, calculator.

c) Learning activities

- Guide learners to review the meaning of the GCF.

- Invite them to join groups and let them study, then discuss the steps to be carried out in working out the learning activity in the Learner's Book.

- Assess each group's report and help to harmonize the work and come up with a general solution/correct answer.

- Learners should be led to discover that in the activity, two numbers whose LCM and GCF are given, one number is missing. In order to work out the missing number, the product of LCM and GCF is divided by the given number.

- Refer the learners to read and work on example1 and 2 from the Learner's Book.

- Guide them through the procedure step by step. Do not rush, otherwise some learners may become confused.

- Repeat going through the procedure several times for the benefit of slow learners.

- Write an example on the chalkboard and let learners attempt to work it out, as you supervise their working out.

Example: LCM of two numbers is 24. Their GCF is 4. One of the numbers is 12. Find the second number. Tell learners that:

Product of 2 numbers	=	product of LCM and GCF
2^{nd} number (x) x 12	=	24 x 4
2^{nd} number (x)	=	$\frac{^{2}\cancel{24} \times 4}{\cancel{12}_{1}}$
2nd number	=	8

Therefore, the second number is 8.

- Invite learners to read the study tip and use it as a summary of the lesson.
- Assign them to work out the a**pplication activity 3.12** in the Learner's Book. Mark their work and give feedback.
- Depending on the results, assign them the following additional activities:

Remedial activities

(a) The LCM of two numbers is 12. The GCF is 12. One of the numbers is 6. What is the other number?

(b) The LCM of two numbers is 6. The GCF is 3. If one of the numbers is 3, what is the other number?

(c) The GCF of two numbers is 3. The LCM is 18, One of the numbers is 9. Find the other number.

(d) One of the two numbers is 10. Their LCM is 10 and GCF is 5. What is the second number?

Extended activities

Fast learners work out more challenging problems similar to the ones below.

(a) The LCM of two numbers is 225. Their GCF is 15. One of the numbers is 75. Find the other number.

(b) GCF of two numbers is 12. The numbers are 36 and y. If the LCM is 144, what is the value of y?

(c) The LCM of two numbers is 1,440. The GCF is 10. One of the numbers is 160. Find the second number.

(d) The GCF of two numbers is 10. One of the numbers is 70. The LCM is 1,050. Find the other number.

d) Answers to application 3.12

(3) 45 (4) 90 (5) 15

(6) 16 (7) 15 (8) h = 12

3.6 End of Unit 3 Assessment

(1) a) 1 b) 32 c) 75 d) 53 e) 121 f) 133

(2) a) LCM =120; GCF = 60 b) LCM = 3312; GCF = 4

c) LCM = 180; GCF = 3

(3) 10 cm (4) 9:00 a.m (5) 12 litres (6) After 280 min/10:40 a.m

3.7 Additional activities

Consolidation Activity

1. Find the LCM and GCF of the following number:

(a) 132 and 120 (b) 40 and 60

2. Work out

(a) 34÷32 (b) 72÷7 (c) 24 ×23 ×22

Extended activity

(1) At Twelve Years Basic Education school two bells ring at 8:00 o'clock. If one rings after 40 minutes to indicate primary lesson period and the second rings after 50 minutes to indicate secondary lesson period. At what time will they ring at the same time again?

(2) Two lines of electricity have different intervals with lengths of 40 m for the first line and 50m for the second line. If the first poles of both lines are parallel, what shortest distance both poles will be parallel again? Explain your working out.

UNIT 4: OPERATIONS ON FRACTIONS

4.1 Key unit Competence

To be able to apply fractions in daily life situations and solve related problems

4.2 Prerequisites

Pupils will easily learn this unit, if they have a good background on the following:

- Reading, writing, illustrating, add and subtract fractions with the same-denominator, multiply and divide fractions (P4, unit 4)
- Equivalent fractions and operations (P5, unit 4),

4.3 Cross-cutting issues to be addressed

- **Gender balance**: provide equal opportunity to boys and girls in the lesson
- **Inclusive education**: promote education for all learners in the teaching and learning activities.
- **Environment and sustainability:** This will be addressed when pupils will be maintaining hygiene for their classroom and for materials they used.
- **Financial education:** addressed when pupils discuss word problem involving how to use a fraction of money and save another quantity.
- **Peace and values education:** addressed when pupils are encouraged to work collaboratively and peacefully in their group.

4.4 Guidance on introductory activity

Introductory activity:

Suppose that a pineapple is shared equally among 3 people.
(a) What portion/fraction does each person get?
(b) If two of them decide to combine their portions, what mathematical operations do they carry out?
(c) Find out some examples of equal sharing involving Mathematical operations in real life, and present them using fractions.

Guidance:

- Invite pupils to read the introduction in the learner's book and try to discuss answers in their groups.
- Bring the pineapple or orange divided in 3 equal parts and ask 3 learners to explain how they can share it;
- Ask two of them decide to combine their portions and say what mathematical operations they carry out;
- Move around in the classroom to get aware of different suggestions and ask some probing questions where necessary.
- Invite all pupils to a whole class discussion and basing on their experience, prior knowledge and abilities ask them to give some examples of equal sharing involving Mathematical operations in real life.

- Open a discussion with probing questions to facilitate them to give their predictions and ensure that you arouse their curiosity on what is going to be leant in this unit. This unit is aimed to help learners to know why is it necessary to study fractions so that they know how fractions may be applied in every day situation.

4.5 List of lessons/subheadings

	Operations on fractions	**16 periods**
	Lesson	**Number of Periods**
1	Introductory activity	1
2	Multiplying a whole number by a fraction	2
3	Multiplying a fraction by a whole number	1
4	Multiplying a fraction by a fraction	2
5	Finding reciprocals	1
6	Dividing a whole number by a fraction	2
7	Dividing a fraction by a whole number	1
8	Dividing a fraction by a fraction	2
9	Multiplying and dividing fractions	2
10	Solve problems involving multiplication and division fractions	2
11	End unit assessment	1

Guidance on different lessons

4.5. 1 lesson 1: Multiplying a whole number by a fraction

a) Objectives

Knowledge:

Understand the multiplication of a whole number by a fraction.

Skills:

Calculate the fraction of a whole number and the fraction of a number of objects.

Values

- Develop the capacity of quick critical thinking to find the difference of fractions.

- Develop the spirit of equal sharing.

- Show the concern of trustworthiness when sharing with others.

b) Teaching resources and learning resources

- Different objects to be cut: sugar cane, oranges, sticks, soap, sheets of paper, etc.
- Safe materials to be used: scissors or plastic knife to cut a whole into portions of equal sizes;
- Semi concrete objects: drawings illustrating different fractions, rectangles, squares, circles, etc.

d) Teaching and learning activities:

- Give mental work about what a fractions is, simple addition and subtraction of fractions.

For example, $\frac{1}{2}+\frac{1}{2}$, $\frac{1}{4}+\frac{3}{4}$, $\frac{1}{2}+\frac{1}{4}$, $\frac{2}{5}+\frac{1}{5}$.

$\frac{1}{2}-\frac{1}{4}$, $\frac{3}{4}-\frac{1}{2}$, $\frac{5}{6}-\frac{2}{6}$, etc.

- Group the learners and distribute the learning materials.
- Guide them through the activity in the Learner's Book, page 55.
- Facilitate the discussion about the activity.
- Harmonise the outcomes to come out with a general answer.
- Let them be familiar with the concept to develop.
- Explain that, the activity learners have been involved in is about multiplying a whole number by a fraction. 9 represents a whole and 1/2 represent one part of the whole number.

Multiplication statement is $9 \times \frac{1}{2} = \frac{9}{2} = 4\frac{1}{2}$, meaning, if joined; 4 whole beans and $\frac{1}{2}$ of a bean will be obtained.

Write an example on the chalkboard.

Example: $12 \times \frac{3}{4}$

Explain that, this multiplication statement means, "twelve three quarter". It is the same as adding $\frac{3}{4}$ twelve times.

That is, $\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}+\frac{3}{4}=\frac{36}{4}=9$

Like wise; $12 \times \frac{3}{4} = \frac{12}{1} \times \frac{3}{4} = \frac{12 \times 3}{1 \times 4} = \frac{36}{4} = 9$

So, $12 \times \frac{3}{4} = 9$ wholes.

- Let learners follow through the examples in the Learner's Book, page 55.
- Guide them through with clear explanations step by step.
- Learners should formulate their own questions relating to the lesson.
- Move around monitoring how they carry out the working.
- Contented that they have grasped the concept, let them give a report about their work.
- Let learners read the Study tip, as a summary of the lesson.
- Assign them to work out individually the **application activity 4.1**. Mark the work and give feedback.
- Depending on the results, assign them the following additional activities:

Remedial activity

Slow learners should attempt the exercise below:

(a) $2 \times \frac{1}{2}$ (b) $3 \times \frac{1}{4}$ (c) $4 \times \frac{1}{5}$ (d) $6 \times \frac{2}{3}$

(e) $10 \times \frac{1}{2}$ (f) $7 \times \frac{1}{7}$ (g) $12 \times \frac{2}{3}$ (h) $9 \times \frac{2}{9}$

Extended activity

Let fast learners multiply the following numbers:

(a) $70 \times 1\frac{1}{9}$ (b) $56 \times 4\frac{1}{7}$ (c) $101 \times 3\frac{1}{3}$ (d) $169 \times 1\frac{9}{12}$

(e) $262 \times \frac{1}{15}$ (f) $340 \times 3\frac{4}{5}$ (g) $506 \times 4\frac{1}{3}$ (h) $969 \times 5\frac{2}{13}$

4.5. 2 lesson 2: Multiplying a fraction by a whole number

a) Objectives

Knowledge:

Understand the multiplication of a whole number by a fraction.

Skills:

Calculate the fraction of a whole number and the fraction of a number of objects.

Values

- Develop the capacity of quick critical thinking to find the difference of fractions.

- Develop the spirit of equal sharing.

- Show the concern of trustworthiness when sharing with others.

b) Teaching resources and learning resources

- Different objects to be cut: sugar cane, oranges, sticks, soap, sheets of paper, etc.

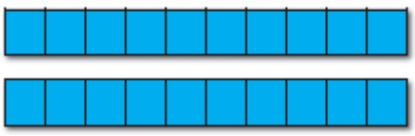
- Safe materials to be used: scissors or plastic knife to cut a whole into portions of equal sizes;

- Semi concrete objects: drawings illustrating different fractions, rectangles, squares, circles, etc.

d) Teaching and learning activities:

- Invite one pupil and guide him/her on how to demonstrate a fraction of a given number of objects: to count objects, divide them in a number of groups equal to the denominator , and then combine the number of groups which is equal to the numerator of a given fraction;

- Ask other pupils to say the total number of objects found in the new combination (group) of objects. For example: How many rods do we have? Find the 2 fives of them



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- Organize groups of pupils and guide them through the **learning activity** in the Learner's Book. You can also give them a fraction card and a whole number and ask pupils to find the number card which has the corresponding fraction of such a number.

- Move around in the classroom and provide probing questions for assistance.

- Invite some groups to present and guide the whole class to harmonize and show them that the result is the same as the product of the number and the fraction: 2 fives is $2 \times \frac{1}{5} = \frac{2}{5}$;

And 2 fives of 20 is $\frac{2}{5}(20)=\frac{2}{5}\times 20=\frac{2\times 20}{5}=\frac{40}{5}=8$

- Guide pupils to summarize how to multiply a fraction by a whole number and provide more examples such as example 1 and 2 from the learner's book.

Example: $\frac{3}{4}$ of 20 is $\frac{3}{4}(20)=\frac{3\times 20}{4}=\frac{60}{4}=15$.

- Guide learners through the examples in the Learner's Book page 57 and clearly show them that "of" means multiplication.

- Explain to them that to multiply a fraction by a whole number, they should write the whole number as a fraction by giving it denominator 1, then multiply the numerators and finally divide by the denominator.
- Give learners an example to work out in groups and check on each group to see whether they are following.

- Guide the learners through the Study tip and use it to emphasize what you have just taught.
- Explain to the learners why they should write whole numbers as fractions by writing 1 under them. Show them how to cancel if you are sure that they are good at multiplication and division.

- Assign the learners to do the **application 4.2**. Mark their answers and give feedback and help them do corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Slow learners can work out simple numbers for practice, for example;

(1) Find $\frac{1}{2}$ of 112, (2) Find $\frac{1}{3}$ of 15 (3) Find $\frac{1}{7}$ of 21

(4) what is $\frac{1}{5}$ of 35? (5) What is $\frac{1}{5}$ of 30? (6) What is $\frac{1}{12}$ of 36?

Extended activity:

Let fast learners work out more complex numbers: For example;

What is $4\frac{1}{2}$ of 124? (2) What is $3\frac{1}{4}$ of 168? (3) What is $6\frac{1}{5}$ of 50?

(4) Find $6\frac{2}{3}$ of 240 (5) Find $4\frac{7}{12}$ of 300

d) Answers for application 4.2.

1)	(a) 3	(b) 6	(c) 21	(d) 48
	(e) 145	(f) $1\frac{1}{5}$	(g) 9	(h) $1\frac{1}{2}$
2)	220 minutes	3) 261 chairs	4) 555books	5) 1196 oranges
6)	2	7) 15	8) 198	9) 756

4.5. 3 lesson 3: Multiplying a fraction by a fraction

a) Objectives

Knowledge:

Understand the multiplication of a fraction by a fraction.

Skills:

Calculate the product of fractions.

Values

- Develop the capacity of quick critical thinking to find the difference of fractions.

- Develop the spirit of equal sharing.

b) Teaching resources and learning resources

- Different objects to be cut: sugar cane, oranges, sticks, soap, sheets of paper, etc.

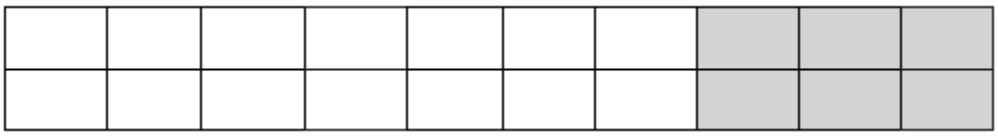
- Safe materials to be used: scissors or plastic knife to cut a whole into portions of equal sizes;

- Semi concrete objects: drawings illustrating different fractions, rectangles, squares, circles, etc.

d) Teaching and learning activities:

Start with mental work on multiplication and division. For example; 8 × 7, 4 × 9, 6 × 7,
48 4, 54 ÷ 9, 60 ÷ 5 and so on.

- Ask learners to form groups and provide each group with either paper or a manilla cards.
- Guide them as they carry out the **learning activity** in Learner's Book.
- Move around to each group to ask probing questions where necessary.
- Give them time to present and highlight report their findings and later come up with one report.
- Study the figure below and answer the questions that follow:



1. Write the portion of the colored fraction above.
2. Multiply it by 12
3. Write your answer on a piece of paper.
4. Read it loudly.

- Write an example that involves multiplying a fraction by a fraction on the chalkboard.

Example: Multiply

$$\frac{2}{5} \times \frac{1}{3} = \frac{2 \times 1}{5 \times 3} = \frac{2}{15}$$

- Explain to the learners that we multiply the numerators then the denominators.
- Refer Learners to the example 1 and 2 in the learner's book and guide learners as they study. Remind them that when a mixed number is included in the problem they should change it to an improper fraction first.
- Guide the learners through the Study tip and explain further.

- Ask learners to work out individually the **application activity 4.3** in the learner's book. Mark their answers and give feedback and help them do corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Let slow learners do more simple numbers to practice, for example;

1) $\frac{1}{3} \times \frac{1}{3} \times \frac{1}{3}$ (2) $\frac{1}{4} \times \frac{1}{2} \times \frac{1}{3}$ (3) $\frac{2}{5} \times \frac{1}{3} \times \frac{1}{2}$

(4) $\frac{2}{3} \times \frac{1}{4} \times \frac{1}{3}$ (5) $\frac{4}{5} \times \frac{1}{2} \times \frac{2}{3}$ (6) $\frac{2}{3} \times \frac{3}{4} \times \frac{1}{2}$

(7) $\frac{2}{5} \times \frac{3}{4} \times \frac{1}{3}$ (8) $\frac{5}{6} \times \frac{1}{2} \times \frac{2}{3}$

Extended activity

Fast learners should try out the following for more practice

(1) $1\frac{1}{4} \times 1\frac{1}{6} \times 1\frac{1}{3}$ (2) $2\frac{1}{2} \times 1\frac{3}{5} \times 3\frac{1}{4}$ (3) $7\frac{1}{3} \times 4\frac{1}{2} \times 3\frac{2}{11}$

(4) $8\frac{1}{4} \times 2\frac{3}{11} \times 4\frac{1}{5}$ (5) $4\frac{3}{8} \times 3\frac{3}{7} \times 5\frac{1}{6}$

d) Answers for the application activity 4.3

(a) $\frac{1}{54}$ (b) $\frac{9}{35}$ (c) $\frac{2}{15}$ (d) $\frac{1}{66}$

(e) $\frac{1}{12}$ (f) $1\frac{1}{20}$ (g) $3\frac{27}{40}$ (h) $\frac{1}{6}$

(i) $31\frac{1}{2}$ (j) $11\frac{3}{4}$ (k) $\frac{513}{680}$ (l) $26\frac{7}{12}$

4.5. 4 lesson 4: Reciprocal of a fraction or a whole number

a) Objectives

Knowledge:

Understand the meaning of the reciprocal for a number.

Skills:

Calculate the the reciprocal for a number.

Values

- Develop the critical thinking on the use the reciprocal of a number of objects in real life.

b) Teaching resources and learning resources

- Different objects to be cut: sugar cane, oranges, sticks, soap, sheets of paper, etc.
- Safe materials to be used: scissors or plastic knife to cut a whole into portions of equal sizes;
- Textbooks, pens, calculators, notebooks, etc.

d) Teaching and learning activities:

- Help learners to form groups and get the prepared materials.
- Ask them to write two numbers that they can multiply and get the product 1.
- Make sure that all learners are trying to find the second number if they have one of them;
- Invite them to mention the numbers they found in their respective group.
- Invite each group to write any fraction of their choice.
- Ask them to multiply the fraction by an unknown
- Request them to equate it to1.
- Calculate to find the value of the unknown.
- Let them explain what they have observed.
- Invite them for presentation in a whole class discussion;
- Guide them to discover that if one number is given, the number to be multiplied to it to get 1 is called the reciprocal of that number.

The reciprocal of a number x is the number $\frac{1}{x}$, The reciprocal of 5 is $\frac{1}{5}$. The reciprocal of $\frac{-2}{7}$ is $\frac{1}{\frac{-2}{7}}=\frac{-7}{2}$, because $\frac{-2}{7}\times\frac{-7}{2}=\frac{14}{14}=1$

- Take them through the **example 1 and 2** in Learner's Book.
- Let them compare their work with the one in the book.
- Provide more explanation about the working process.
- Give learners time for reading through the Study tip.
- Then, assign them to work individually the **application activity 4.4** in the Learner's Book. Mark their work and help them with corrections.

d) Answers to Application 4.4

1) (a) $\frac{1}{2}$ (b) 150,000frw

2) (a) $\frac{3}{8}$ (b) Ali got 200kg, Moses got 300kg Katto got 300kg

3) (a) $\frac{2}{5}$ (b) 12 $\frac{1}{2}$ litres

4) 24,000frw 5) 30 acres

4.5. 5 lesson 5: Dividing a whole number by a fraction

a) Objectives

Knowledge:

Understand how to divide a whole number by a fraction

Skills:

Divide a number of objects by a fraction.

Values

- Develop the critical thinking on the application of division of a number of objects by a fraction in real life.

b) Teaching resources and learning resources

- Different objects to be cut: sugar cane, oranges, sticks, soap, sheets of paper, etc.
- Safe materials to be used: scissors or plastic knife to cut a whole into portions of equal sizes;
- Textbooks, pens, calculators, notebooks, etc.

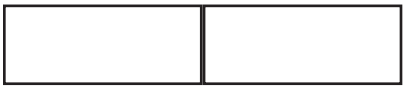
d) Teaching and learning activities:

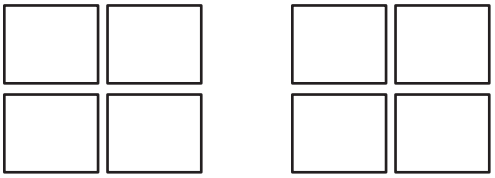
- Review finding reciprocals.

- Guide learners as they carry out the activity in the Learner's Book, page 62.
- Give them time to present their findings to the class.
- Group the learners and distribute the learning materials.

- Explain that the activity was involving dividing a whole number by a fraction. For example, 2 is the whole number.

- Cutting the 2 sheets into 4 equal parts is dividing.





Notably, each portion of a whole sheet is 1 out of 4 written as $\frac{1}{4}$

So, the division is about dividing 2 by $\frac{1}{4}$

- Form the diagrammatic expression above, 2 sheets of paper have been divided in 8 quarters.

Therefore, $2 \div \frac{1}{4} = 2 \text{ x } \frac{4}{1} = 8$ quarters.

Guide learners to note that given that $\frac{4}{1}$ is the reciprocal of $\frac{1}{4}$.

- Write an example on the chalkboard and ask learners to attempt it on slips of paper.

$15 \div \frac{2}{5} = ?$

Learners have already been exposed to finding reciprocals. They are expected to observe that the reciprocal of $\frac{2}{5}$ is $\frac{5}{2}$ and then to work out the multiplication expression:

$$15 \quad \frac{5}{2} = \frac{75}{2} = 37\frac{1}{2}$$

- Let learners study and follow through the example 1 and 2 from the learner's book.
- Ask them to use their own words to explain how to divide a whole number by a fraction; Then, take them through the Study tip as a summary of the lesson.

- Then, assign them to work individually the **application activity 4.6** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Slow learners should attempt the exercise below:

(a) $2 \div \frac{1}{2}$ (b) $2 \div \frac{1}{3}$ (c) $3 \div \frac{1}{3}$ (d) $4 \div \frac{1}{4}$

(e) $5 \div \frac{1}{5}$ (f) $5 \div \frac{2}{3}$ (g) $6 \div \frac{1}{2}$ (h) $10 \times \frac{1}{2}$

Extended activity

Let fast learners multiply the following numbers:

(a) $19 \times 4\frac{1}{9}$ (b) $24 \div 3\frac{1}{7}$ (c) $108 \div 10\frac{1}{8}$ (d) $156 \times 11\frac{4}{9}$

(e) $164 \times 24\frac{1}{7}$ (f) $207 \times 4\frac{1}{11}$ (g) $1{,}036 \times 4\frac{1}{3}$ (h) $1{,}646 \times 5\frac{1}{7}$

4.5. 6 lesson 6: Dividing a fraction by a whole number

a) Objectives

Knowledge:

Understand how to divide a fraction by a whole number.

Skills:

Divide a fraction of a number of objects by a number.

Values

- Develop the critical thinking on the application of division of fraction by a whole number.

b) Teaching resources and learning resources

- Different objects to be cut: sugar cane, oranges, sticks, soap, sheets of paper, etc.
- Safe materials to be used: scissors or plastic knife to cut a whole into portions of equal sizes;
- Textbooks, pens, calculators, notebooks, etc.

d) Teaching and learning activities:

- Start with simple mental work for example;

What do you get when you divide 1 orange into 2?

What does one get when he divides 1 pancake into 3?

- Draw an orange and divide it into two equal parts, each is $\frac{1}{2}$.

After, divide each half ($\frac{1}{2}$) into 3 parts.

- Now count the parts you have, read it loudly compared to the total similar parts of a whole - Get learners into their groups and provide each group with 10 fruits or circular cards.
- Guide them as they carry out the **learning activity** in the Learner's Book.
- Let each group present to the whole class what they get after carrying out the activity.
- Take learners through the **example 1 and 2** in the Learner's Book each time showing them clearly how to go over it.

Divide $\frac{1}{2}$ by 3.

The reciprocal of 3 is $\frac{1}{3}$

$\frac{1}{2} \div 3 = \frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$ (*Multiply by the reciprocal of the second fraction)*

Display a chart with examples and discuss each of them with the learners.

- Ask them to explain in their own words how to divide a fraction by a whole number: Come up with a common understanding and let learners read the study tip and allow them to ask questions if any.
- Then, assign them to work individually the **application activity 4.7** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Slow learners can carry out simple division of fractions for practice

(1) $\frac{1}{8} \div 4$ (2) $\frac{1}{6} \div 3$ (3) $\frac{4}{5} \div 5$ (4) $\frac{5}{12} \div 6$

Extended activity

Gifted learners can try out more complex numbers

(1) $2\frac{1}{2} \div 4$ (2) $3\frac{1}{4} \div 8$ (3) $4\frac{1}{5} \div 15$

(4) $7\frac{1}{2} \div 10$ (5) $5\frac{2}{3} \div 9$ (6) $4\frac{3}{4} \div 16$

d) Answers for application activity 4.7

(a) $\frac{5}{42}$ (b) $\frac{1}{12}$ (c) $\frac{2}{6}$ (d) $\frac{3}{5}$

(e) $\frac{7}{10}$ (f) $\frac{27}{52}$ (g) $\frac{7}{10}$ (h) $\frac{1}{2}$

(i) $\frac{5}{12}$ (j) $\frac{1}{10}$ (k) $\frac{1}{4}$ (l) $\frac{2}{9}$

4.5. 7 lesson 7: Dividing a fraction by a fraction

a) Objectives

Knowledge:

Understand how to divide a fraction by a fraction.

Skills:

Divide a fraction of a number of objects by a fraction.

Values

- Develop the critical thinking on the application of division of fraction by a fraction.

b) Teaching resources and learning resources

- Different objects to be cut: sugar cane, oranges, sticks, soap, sheets of paper, etc.
- Safe materials to be used: scissors or plastic knife to cut a whole into portions of equal sizes;
- Textbooks, pens, calculators, notebooks, etc.

d) Teaching and learning activities:

- Guide learners to review the previous lesson.
- Form groups and provide each group with the necessary materials.
- Invite groups to carry out the **learning activity** in Learner's Book.

- Give them time to present answers to the whole class and later come up with a general conclusion.
- Write an example that involves dividing a fraction by a fraction on the chalkboard.

Example: Divide: $\frac{2}{7} \div \frac{1}{3} =$

$$\frac{2}{7} \div \frac{1}{3} = \frac{2}{7} \times \frac{3}{1} = \frac{2 \times 3}{7 \times 1} = \frac{6}{7}$$

- Refer to the Learner's Book and guide them as they study the example1 and 2.
- Display a chart and let them explain in their own words how to divide a fraction by a fraction. Let them discover that they multiply the first fraction by the reciprocal of second fraction. Remind them that when a mixed number is included in the problem they should change it to an improper fraction first.
- Guide learners through the Study tip and explain further.
- Then, assign them to work individually the **application activity 4.8** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Let slow learners do more simple numbers to practice more for example;

1) $\frac{1}{3} \div \frac{1}{3}$ (2) $\frac{1}{4} \div \frac{1}{2}$ (3) $\frac{2}{5} \div \frac{1}{3}$

(4) $\frac{2}{3} \div \frac{1}{4}$ (5) $\frac{4}{5} \div \frac{1}{2}$ (6) $\frac{2}{3} \div \frac{3}{4}$

Extended activity

Fast learners should try out the following for more practice.

(1) $1\frac{1}{4} \div 1\frac{1}{6}$ (2) $2\frac{1}{2} \div 1\frac{3}{5}$ (3) $7\frac{1}{3} \div 4\frac{1}{2}$

(4) $88\frac{1}{4} \div 2\frac{3}{11}$ (5) $4\frac{3}{8} \div 3\frac{3}{7}$

d) Answers for application activity 4.8

(a) $3\frac{3}{8}$ (b) $2\frac{1}{2}$ (c) $2\frac{2}{9}$ (d) $3\frac{1}{9}$

(e) $2\frac{43}{55}$ (f) $2\frac{26}{33}$ (g) $2\frac{10}{27}$ (h) $\frac{89}{218}$

(i) $2\frac{298}{1083}$ (j) $1\frac{3}{7}$ (k) $\frac{2}{3}$ (l) $4\frac{1}{5}$

4.5. 8 Lesson 8: Solving Problems Involving Dividing Fractions

- Start with division mental work, for example; How many times does; 3 go into 24, 5 go into 30, 6 go into 42, 8 go into 72, 10 go into 70?
- Ask learners to form groups. Guide learners as they carry out the **learning activity** in the Learner's Book.
- Ask learners to present their answers and later discuss as a class to come up with uniform results.
- That is; cards that give the same answer are;

$\frac{3}{4}$ of a jerrycan = 15 litres

1 jrrycan = $15 \div \frac{3}{4}$ (divide by $\frac{3}{4}$)

Which is $15 \times \frac{4}{3}$ (multiply by the reciprocal) = 5 x 4 = 20 litres

- Refer to the examples from the Learner's Book and guide learners as they study.
- Display the chart you prepared and use the contents on it to explain further to the learners.

Example; A shopkeeper sold 80 kg of the beans he had. This was $\frac{4}{5}$ of the full sack. How many kg were in the full sack?

Ask learners to read the question and through a discussion help them to realise that, if $\frac{4}{5}$ of the full sack is 80 kg, then they have to divide 80 by $\frac{4}{5}$

Hence, $\frac{4}{5}$ of sack = 80 kg

1 sack = $80 \div \frac{4}{5}$

$= 80 \times \frac{5}{4} = 100$ kg

- Then, assign them to work individually the **application activity 4.9** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Let slow learners try out similar numbers but which are a bit simple for practice.

For example;

1. Mbabazi used 12 litres of water which was $\frac{3}{5}$ of a full jerrycan. How many litres does a full jerrycan hold?

2. It started raining when Mukandori had covered 50 metres of her journey to school.This was $\frac{2}{7}$ of the journey. How many metres are there from Mukandori's home to school?

3. Karekezi sold 24 of his goats. That was $\frac{3}{8}$ of the goats he had. How many goats did he have?

Extended activities

Fast learners can try out more complex numbers, for example;

1. A farmer sold 840 kg of coffee. This was $\frac{3}{7}$ of his harvest.

(a) Find the amount of coffee that he harvested.

(b) What is the fraction of coffee that remained?

(c) If he again sold $\frac{1}{2}$ of the remaining coffee, how many kg did he sell?

2. There were 4800 people in the stadium. This is $\frac{2}{5}$ of its capacity.

(a) What is the capacity of the stadium?

(b) What is the fraction of the seats that were not occupied?

(c) If $\frac{1}{3}$ of the people who were in the stadium were women, find the number of women who were there.

d) Answers for application activity 4.9

(1) 3 (2) 280 km (3) 40 hectares

(4) 50 questions (5) 100 pieces.

4.5. 9 lesson 9: Multiplying and Dividing Fractions

a) Objectives

Knowledge:

Understand how to combine multiplication and division of fractions in a single mathematical sentence.

Skills:

Divide and multiply fractions in a single expression.

Values

- Develop the critical thinking on the application of combined multiplication and division of fractions in real life.

b) Teaching resources and learning resources

- Different objects to be cut: sugar cane, oranges, sticks, soap, sheets of paper, etc.
- Safe materials to be used: scissors or plastic knife to cut a whole into portions of equal sizes;
- Textbooks, pens, calculators, notebooks, etc.

d) Teaching and learning activities:

- Review multiplying and dividing fractions.

Example:

$\frac{1}{2} \times \frac{1}{6}; \ \frac{2}{3} \times \frac{1}{2}; \ \frac{3}{5} \times \frac{3}{4}; \ \frac{9}{10} \times \frac{1}{3}; \ 3 \div \frac{1}{2}; \ \frac{3}{4} \div 2; \ \frac{1}{2} \div \frac{1}{4}$, etc.

- Group learners and distribute the learning materials.
- Let them get involved in the activity in the Learner's Book.
- Guide the learners through the procedure.
- Harmonize their outcomes.
- Let learners be familiar with the concept.
- Explain that the lesson is about combining multiplying and dividing fractions.
- Challenge learners to form a multiplication and division operations problem on slips of paper.
- Let them try to work them out, as you check on them.
- Write an example on the chalkboard. Interact with learners in developing the steps for its calculation.

Example: $\frac{3}{4} \times \frac{4}{9} \div \frac{5}{6}$

Learners should remind themselves about which operation is to be handled first. Let them use BODMAS (Brackets operation division multiplication, addition and subtraction). Follow the operations as stated.

They should observe that division is handled first. So it is $\frac{4}{9} \div \frac{5}{6}$ that is worked out first.

$\frac{4}{9} \div \frac{5}{6} = \frac{4}{9} \times \frac{6}{5} = \frac{8}{15}$

- Without shifting positions, $\frac{3}{4}$ is multiplied by the result from division.

So, $\frac{3}{4} \times \frac{8}{15} = \frac{2}{5}$

Note: Learners can multiply and get the fraction that is not simplified, take the answer as correct but tel them that it is necessary to simplify and get the final and correct answer.

- Lead learners into all the necessary steps so that they grasp the concept thoroughly.
- Refer to the **example 1 and 2** in the Learner's Book.
- Let learners study and follow through the steps of the calculation. Take time to explain exhaustively the concept.
- Lead learner to read and explain the Study tip. They should read it repeatedly as a summary of the lesson.
- Then, assign them to work individually the **application activity 4.10** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Slow learners should attempt the exercise below:

(a) $\frac{1}{2} \times \frac{1}{2} \div \frac{1}{2}$ (b) $\frac{1}{2} \times \frac{1}{3} \div \frac{1}{3}$ (c) $\frac{1}{3} \times \frac{1}{2} \div \frac{1}{2}$ (d) $\frac{1}{4} \times \frac{1}{2} \div \frac{1}{4}$

Extended activity

Let fast learners attempt the exercise below:

(a) $5\frac{2}{7} \times 7\frac{3}{4} \div 6\frac{2}{3}$ (b) $9\frac{3}{9} \times 8\frac{6}{7} \div 7\frac{2}{5}$

(c) $11\frac{3}{5} \times 7\frac{3}{4} \div 4\frac{3}{5}$ **(d)** $12\frac{1}{6} \times 1\frac{1}{6} \times 1\frac{7}{12} \div 9\frac{1}{4}$

d) Answers for application activity 4.10

(a) $1\frac{1}{8}$ (b) $1\frac{3}{5}$ (c) $\frac{6}{7}$ (d) $\frac{9}{16}$

(e) $1\frac{1}{2}$ (f) $1\frac{17}{18}$ (g) $2\frac{1}{10}$ (h) $3\frac{39}{44}$

(i) $4\frac{8}{9}$

(d) 50 questions (e) 100 pieces

4.6 Expected answers for the end unit assessment

1) (a) $\frac{4}{15}$ (b) $4\frac{4}{5}$ (c) $\frac{3}{5}$ (d) $1\frac{1}{2}$

(e) $23\frac{1}{3}$ (f) $137\frac{1}{4}$ (g) $\frac{1}{6}$ (h) $2\frac{16}{17}$

(i) 2 (j) $2\frac{1}{3}$

2) Food 384, 000frw , sch fees 160,000frw others 96,000frw

3) (a) $\frac{4}{15}$ (b) 225 saplings 4) 36km 5) 500ml 6) $12\frac{1}{2}$

4.7 Additional activities

Extension activities

Work out:

(1) $\frac{3}{5} \times \frac{2}{5}$ (2) $\frac{1}{2} \div \frac{1}{2}$

(3) Munyana shared an orange among her 3 children. She gave each child $\frac{1}{4}$ of the orange. What is the total fraction for all the children?

(4) $(3\frac{2}{5} \times 5) \div (\frac{1}{3} + \frac{1}{4}) =$

(5) In the action of helping refugees each has given $\frac{1}{2}$ of a bar soap. How many bars of soap were served if all refuges are 1000 people?

(6) Two third of the learners in primary 6 are girls. If the boys are 20, how many girls are in the classroom?

UNIT 5: ROUNDING AND CONVERSION OF DECIMALS FRACTIONS/NUMBERS

5.1 Key unit Competence

To be able to round off decimals, convert fractions to decimals and vice versa, matching fractions and decimals.

5.2 Prerequisites

Pupils will easily learn this unit, if they have a good background on the following:

- Reading, writing, and rounding off whole number to the nearest tens, hundreds thousands, etc (P6, unit 1)

5.3 Cross-cutting issues to be addressed

- **Gender balance**: provide equal opportunity to boys and girls in the lesson
- **Inclusive education**: promote education for all learners in the teaching and learning activities.
- **Environment and sustainability:** This will be addressed when pupils will be maintaining hygiene for their classroom and for materials they used.
- **Financial education:** addressed when pupils discuss word problem involving how to round off money to be taken from the banks.
- **Peace and values education:** addressed when pupils are encouraged to work collaboratively and peacefully in their group.

5.4 Guidance on introductory activity

Introductory activity:

Let's consider an example of school party where Primary 6 learners contributed to buy all items needed. After planning all needed items, they found that the quantity of rice needed for the party is 40.97 kg which is near 50 kg. Then they decided to buy 50 kg of rice instead of 49.97 kg.

(a) Why do you think Primary 6 learners prefer to buy 50 kg instead of 49.97 kg?

(b) Do you think both quantities: 50 kg and 49.97 kg are easily memorized?

(c) How is rounding off useful in daily life?

Guidance:

- Invite pupils to read the introduction in the learner's book and try to discuss answers in their groups.
- Invite them to a whole class discussion and ask learners them if they can easily read 49.97 kg on any balance they are used to see.
- Basing on their answers, experience, prior knowledge and abilities, ask them to name what primary six did by buying 50kg. Ask them if they meet such way of rounding number of objects in their real life.
- Open a discussion with probing questions to facilitate them to give their predictions and ensure that you arouse their curiosity on what is going to be leant in this unit. This unit is aimed to help learners to know why it is necessary to round of and convert fractions in every day situation.

5.5 List of lessons/subheadings

	Operations on fractions	**16 periods**
	Lesson	**Number of Periods**
0	Introductory activity	1
1	Rounding off decimal numbers to the nearest tenths	1
2	Rounding off decimal numbers to the nearest hundredths	1
3	Rounding off decimal numbers to the nearest thousandths	2
4	Rounding off decimal numbers to the nearest ten thousandths	1
5	Rounding off decimal numbers to the nearest hundred thousandth	1
6	Rounding off decimal numbers to the nearest millionths	1
7	Solving problems involving rounding off decimal numbers	1
8	Converting fractions into decimals	2
9	Converting decimals into fractions	2
10	Solving problems involving converting decimals into fractions and fractions into decimals	2
11	End unit assessment and remediation	1

Guidance on different lessons

5.5. 1 lesson 1: Rounding off decimal numbers to the nearest tenths

a) Learning objectives

Find the number after rounding up or rounding down the given number such that the number remains with only one digit (tenths) after the decimal point.

b) Teaching resources

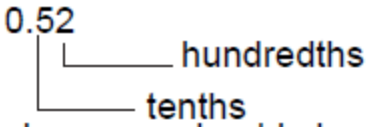
- Wall chart with decimal numbers and different problems,
- Table of place values of decimal numbers, pens and notebooks.

c) Learning activities

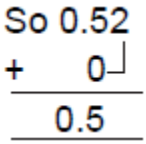
- Review rounding off whole numbers to the nearest tens, hundreds etc.
- Group the learners and distribute the learning/instructional materials.
- Let them carry out the **learning activity** as laid out in the Learner's Book.
- Guide the learners as they discuss about the activity, then give conclusive remarks.
- Give them time to present in a whole class discussion.
- Let them be familiar with the concept.
- Explain that the lesson is about rounding off the given decimal numbers to the nearest tenth.
- Provoke the learners to identify the place value for tenth in a given example, hence its digit.

Example: Round off 0.52 to the nearest tenth.

(i) Identify the place value for tenth.
(ii) What digit is in tenth?
(iii) Round off to the nearest tenth.



Learners should observe that 5 is in "tenth" place value.
- Let them know that rounding off decimals is almost similar to rounding off whole numbers: The next digit to the right is either rounded up or down.
In the case above, learners should observe that the digit to the right is 2.
- Basing on the experience about rounding off whole numbers, 2 is nearer to zero (0) than to 10. So, zero is added to the digit in the required place value then eliminate the place value to the right.



0.52 rounded to the nearest tenth is 0.5.
- Explain further that the answer must bear a digit in the tenth place value as the last to the right.
- Now let the learners play a matching game using cards.
Write several numbers on the chalkboard and ask learners to copy them on sheets of paper.
- In groups, let them flash cards bearing a rounded off decimal to the nearest tenth.
- Now refer to the examples in the Learner's Book and give more similar examples like the ones below:

(a) 0.92

Solution

$0.92 = \begin{array}{r} 0.9\,\cancel{2}^{0} \\ +\ 0 \\ \hline 0.9 \end{array}$

(Because 2 is nearer to 0.)

Therefore, 0.92 is rounded off to 0.9.

(b) 25.78

Solution

$25.78 = \begin{array}{r} 25.7\,\cancel{8}^{1} \\ +\ 1 \\ \hline 25.8 \end{array}$

(Because 8 is nearer to 1)

Therefore, 25.78 is rounded off to 25.8.

- Invite learners formulate in their own words how to **round off a decimal number to the nearest tenths** and share the outcomes of the discussions.
- Guide learners as they read through the Study tip in order to internalize it.
- Let them take notes. It is expected that learners may not get challenged because they have already been exposed to rounding up or down. Emphasize that "tenth" are also referred to as "one place of decimals".
- Then, assign them to work individually the **application activity 5.1** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Let slow learners study the number line below then round up or down the digits marked.

Extended activity

Fast learners can round off more numbers to the nearest tenth:

(1) 0.589 (2) 3.064 (3) 9.0825 (4) 12.0012

(5) 20.2010 (6) 141.769 (7) 200.200 (8) 301.0001.

d) Answers for application activity 5.1

1) (a) 0.9 (b) 8.5 (c) 13.0

(d) 2.2 (e) 15.0 (f) 18.3

2. (a) 56,748.9 (b) 875.4 (c) 264,537.2

(d) 12,354.7 (e) 0.9 (f) 456.0

5.5. 2 lesson 2: Rounding off decimal numbers to the nearest hundredths

a) Learning objectives

Find the number after rounding up or rounding down the given number such that the number remains only with 2 digits (tenths and hundredths) after the decimal point.

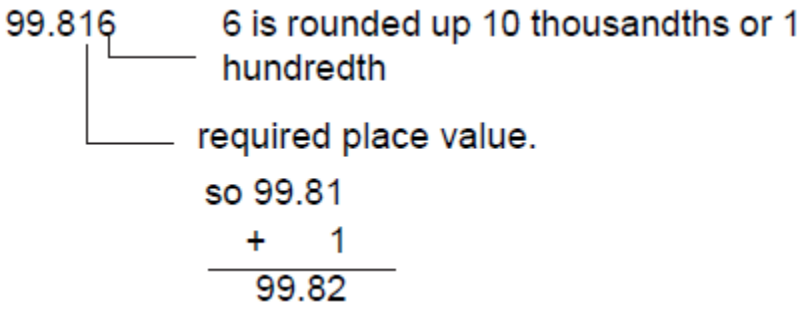
b) Teaching resources

- Wall chart with decimal numbers and different problems,
- Table of place values of decimal numbers, pens and notebooks.

c) Learning activities

- Take learners through a warm-up and help them to form groups.
- Give them prepared materials and guide the whole class to review rounding off to the nearest tenth.
- In groups, let learners carry out the **learning activity** in the Learner's Book.
- Guide them through the activity.
- Invite groups to present their answers to the whole class.
- Display the chart with the worked examples.
- Let the learners follow through the procedure as they discuss the contents of the example.
- Explain conclusively and give another example.

Example; Round off 99.816 to the nearest hundredth.



Therefore, $99.816 \approx 99.82$ (to the nearest hundredth).
- Now let learners follow through the example 1 and 2 in the Learner's Book.
- Guide them as they observe the procedure. On their own, let the learners formulate similar numbers.
- Let them discuss the procedure then share the outcomes.
- Let them proceed to the Study tip as conclusive remarks.
- Then, assign them to work individually the **application activity 5.2** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Let slow learners try out the following for more practice.

Which of the numbers below are nearer to 1.70?

(1) 1.61 (2) 1.67 (3) 1.60 (4) 1.69 (5) 1.65 (6) 1.62

Which of the decimals below are nearer 3.60?

(1) 3.61 (2) 3.69 (3) 3.64 (4) 3.67 (5) 3.62

Extended activity

Let fast learners practice more using the following;

Round off to the nearest hundredth.

(1) 131.0131 (2) 6.0004 (3) 19.9009 (4) 121.1212

Draw a number line and on it place the decimals below.

(1) 120.663 (2)120.667 (3) 120.669 (4) 120.661

d) Answers for Application activity 5.2

(a) 16.60 (b) 4.22 (c) 0.57 (d) 8.01
(e) 367.81 (f) 6.00 (g) 5.27 (h) 0.65
(i) 7.01 (j) 4.32 (k) 6.79 (l) 9.25

5.5. 3 lesson 3: Rounding off decimal numbers to the nearest thousandths

a) Learning objectives

Find the number after rounding up or rounding down the given number such that the number remains only with 3 digits (tenths, hundredths and thousandths) after the decimal point.

b) Teaching resources

- Wall chart with decimal numbers and different problems,
- Table of place values of decimal numbers, pens and notebooks.

c) Learning activities

- Review the previous lesson.
- Ask learners to mention examples of decimals in Thousandth.
- Record them on the chalkboard.
- In groups, let learners carry out the **learning activity** as you guide them.
- Invite groups to present answers. Explain that, Thousandth possess 3 decimal places. But, the decimal number to be rounded off possesses 4 decimal places or more.

- Further explain that, as experienced earlier, the digit to the right of the required place value is the one rounded up or down.
- Write an example on the chalkboard, and let the learners lead in explaining the procedure then round off to the nearest Thousandth.

Example

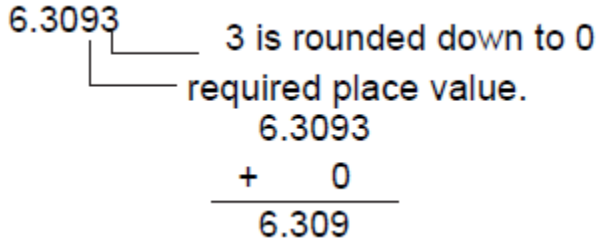
Round off 6.3093 to the nearest Thousandth.

Learners should observe that 9 is in the place value of Thousandth and 3 is the next digit to the right.

3 is rounded down because it is nearer to 0 Thousandth.

zero (0) is added to the digit in the Thousandth place value.

Explain each step of the working, that is;



So, 6.3093 ≈ 6.309 (rounded to the nearest Thousandth)

- Now let the learners study and follow through an example for group discussion.

Facilitate a discussion among them, then them share the opinions.

Representatives from each group flash the cards as members from another check it to see whether they got it right.

- Let learners internalize the concept by reading the Study tip.
- Then, assign them to work individually the **application activity 5.3** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial Activity

Slow learners can try out the following;

1. List the decimals between 1.026 and 1.035.
2. Round off 1.0268 to the nearest thousandth.
3. Round off 1.0264 to the nearest thousandth.

Extended activity

Let fast learners read and work out some word problems.

1. A village had an area of 10.3925 sq km. Approximately what was the area rounded to the nearest thousandth?
2. Round off to the nearest thousandth. (a) 146.07598 km (b) 200.89621 dam3

What is 9999.9999 nearer to? Round to the nearest thousandth

d) Answers for Application activity 5.3

(a) 2.799 (b) 12.342 (c) 5.687 (d) 125.821

(e) 1.469 (f) 25.010 (g) 7.236 (h) 34.697

(i) 0.697 (j) 67.798 (k) 89.836 (l) 295.211

5.5. 4 lesson 4: Rounding off decimal numbers to the nearest ten thousandths

a) Learning objectives

Find the number after rounding up or rounding down the given number such that the number remains only with 4 digits (tenths, hundredths, thousandths and ten thousandths) after the decimal point.

b) Teaching resources

- Wall chart with decimal numbers and different problems,
- Table of place values of decimal numbers, pens and notebooks.

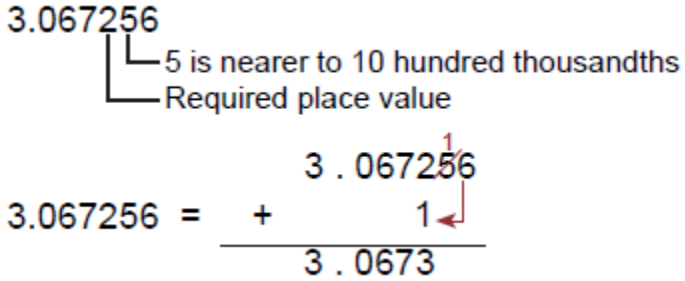
c) Learning activities

- Review the previous lesson.
- Guide learners to form groups and give them the necessary learning materials.
- Let them carry out the **learning activity** in the Leaner's Book as you guide them.
- Invite groups to present answers in a whole class discussion. Then, lead learners to observe that, ten Thousandth possess 4 decimal places. The number to be rounded off may have more than 4 decimal places.
- Explain that, as seen in the learning activity, the digit to the right of the digit in the ten Thousandth place value is the one rounded up or down.
- Give more examples by writing them on chalkboard or dictating them. Learners should attempt them in groups.

For example: Round off 3.067259.

- Learners find out that 2 is the digit in the required place value of ten Thousandth. The digit to the right of ten Thousandth is 5. Learners observe that 5 is in the upper limit. So 5 is rounded off to 10 hundred Thousandth. And 1 ten thousandth is added to 2 ten Thousandth to get 3 ten Thousandth.

In summary, it is worked out this way:



Therefore, 3.067259 rounded off to the nearest ten thousandth is 3.0673.

- Lead the learners through the **example 1 and 2** in the Learner's Book.
- Let learners read the Study tip as a summary of the lesson.
- Then, assign them to work individually the **application activity 5.4** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Slow learners should try out the following:

1. How many decimal places has a decimal number in the ten Thousandth place value?
2. List 5 decimal numbers in ten Thousandth.

Extended activity

Fast learners should attempt the following for more practice.

1. Add: 1.76586 and 17.6586. Round off the answer to the nearest ten thousandth.
2. Round off to the nearest ten thousandth:
   (a) 0.000493 g (b) 1.42560 m (c) 15.996981 litres
3. Winfred had 3.16753 hectares of land. She gave out 1.04694 to her children. How much did she remain with? Round off the answer to the nearest ten thousandth.

d) Answers for Application activity 5.4

(a) 0.0695 (b) 12.1068 (c) 482.0031 (d) 0.0025

(e) 5.0000 (f) 19.0028 (g) 0.9757 (h) 73.0101

(i) 1,206.07799 (j) 63,006.7099 (k) 723.9091 (l) 0.9178

5.5. 5 lesson 5: Rounding off decimal numbers to the nearest hundred thousandths

a) Learning objectives

Find the number after rounding up or rounding down the given number such that the number remains only with 5 digits (tenths, hundredths, thousandths, ten thousandths, hundred thousandths) after the decimal point.

b) Teaching resources

- Wall chart with decimal numbers and different problems,
- Table of place values of decimal numbers, pens and notebooks.

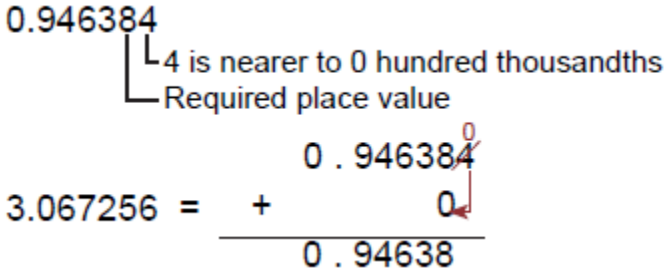
c) Learning activities

This lesson is taught like the previous lesson. When rounding off to the nearest hundred thousandths, the number of digits after the decimal point must be 5.

For example: Round off 0.946384 to the nearest hundredth thousandth.

Look for the following in their procedure:

8 is the digit in the required place value of hundred Thousandth. The digit to its right is 4. 4 is in the lower limit, it is rounded down to 0 hundred Thousandth. 0 hundred thousandth is added to 8 hundred thousandths.



0.946384 rounded off to the nearest hundred thousandth = 0.94638

Let learners follow through the procedure laid down in the examples in the Learner's Book. Guide them where necessary.

- Then, assign them to work individually the **application activity 5.5** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Slow learners should attempt out the following for more practice:

1. Underline the digit in the hundred thousandth place value.

(a) 0.426874 (b) 1.048969 (c) 12.2401375

2. State whether the digit you underlined is rounded up or rounded down.

Extended activity

Fast learners should attempt the following for more practice.

1. Area of a district is 401.073258 square kilometres. Round it off to the nearest hundred thousandth.
2. Distance from town A to town B is 7.012897 km. Round it off to the nearest hundred thousandth.
3. A sack of beans weighs 119,246,043 milligrams. Convert it to kilograms. Round off the answer to the nearest hundred thousandth.

d) Answers to application activity 5.5

(a) 1.10101 (b) 0.06329 (c) 0.00619 (d) 15.73913 (e) 92.09302
(f) 0.18531 (g) 100.68305 (h) 10.00000 (i) 45.78909

5.5. 6 lesson 6: Rounding off decimal numbers to the nearest to the nearest millionths

a) Learning objectives

Find the number after rounding up or rounding down the given number such that the number remains only with 6 digits after the decimal point.

b) Teaching resources

- Wall chart with decimal numbers and different problems,
- Table of place values of decimal numbers, pens and notebooks.

c) Learning activities

- Review the previous lesson.
- Let learners form groups and distribute the necessary learning materials.
- Take learners through the **learning activity** in the Learner's Book.
- Move around to monitor their work.
- Invite groups to present their answers in the whole class discussion.
- Harmonize the outcomes to get a general report.

-Explain that a decimal number rounded to the nearest millionth must possess 6 decimal digits after the decimal point. That is, it must have 6 decimal places.

- Write an example on the chalkboard for learners to practice on.

For example:

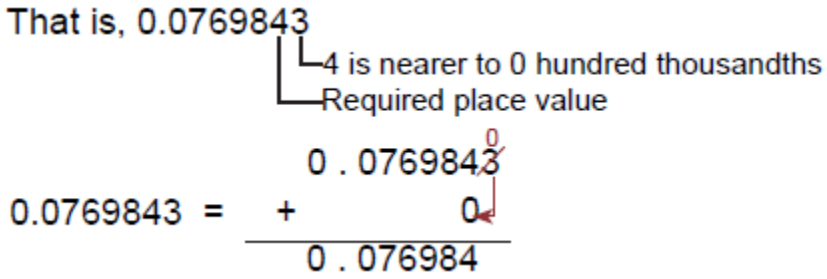
Round off 0.0769843 to the nearest millionth.

On slips of paper, let them write the decimal number, identify the digit in the millionth place value, then round it off.

Learners are expected to observe that 4 is in the millionth place value.

They are expected to remembered that 3, to the right of 4 is in the lower limit so, it is rounded down to 0 millionth.

Zero (0) is added to 4 to get 4.



- Therefore, 0.0769843 rounded off to the nearest millionth is 0.076984.

Learners formulate their own decimal numbers, then try to round off to nearest millionth.

- Facilitate their work to come up with a general opinion.

Lead them through the examples in the learner's Book.

- Learners read and internalize the Study tip.
- Then, assign them to work individually the **application activity 5.6** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Slow learners should attempt out the following for more practice:

Write the decimal numbers between the following:

(a) 0.1256730 to 0.1256734. Are the decimal numbers listed rounded up or down when rounding off to the nearest millionth?

(b) 3.0767515 to 3.0767519. Are the decimal numbers you listed rounded up or down when rounding off to the nearest millionth?

Extended activity

Fast learners should attempt the following for more practice.

(a) List 10 decimal numbers with 7 or more decimal places.

(b) Round off the decimal numbers in (a) above to the nearest millionth.

d) Answers to Application 5.6

(a) 0.125108 (b) 4.140732 (c) 0.050699 (d) 13.130364

(e) 1.110943 (f) 46.932834 (g) 0.834207 (h) 0.032197 (i) 85.073280

5.5. 7 Lesson 7: Solving problems involving rounding off decimal numbers

a) Learning objectives

Solve problems related to the finding of the number after rounding up or rounding down the given number.

b) Teaching resources

- Wall chart with problems on rounding off decimal numbers
- Table of place values of decimal numbers, pens and notebooks.

c) Learning activities

- Give mental work about rounding off decimal numbers so far experienced.

For example: Round off 0.26 to the nearest tenth, round off 0.43 to the nearest tenth, round off 3.092 to the nearest hundredth, round off 12.005 to the nearest hundredth.
- Review rounding off decimal numbers generally, noting what steps are taken.
- Group learners and let them study the **learning activity** in the Learner's Book.
Explain that rounding off is similar to approximation or estimation.
Tell learners that these can be applied in our daily life, to get figures that are easy to read, write or memorize.
For example: Population is sometimes estimated to round numbers easy to remember, like 12,000,000; 14,000,000 and so on.
Sometimes dimensions are not exact figures of the units used in measurements, for example, 9.8 metres, 13.1 kilometres. These are nearer to 10 metres and 13 kilometres approximately.
- Write some examples on the chalkboard for learners to practice.
For example: The length of a classroom is 6.42 metres. What is the length rounded to the nearest whole metre?
Working: Learners should note that in this question, they are to apply rounding off to the nearest ones. The digit in ones is 6. The digit to the right is 4. They should observe 4 is rounded to 0 tenth which is also carried to ones as 0 metres. So, 6 metres + 0 metres = 6 metres. Therefore, 6.42 metres rounded to the nearest whole metres is 6 metres.
However, explain that the dimensions do not increase in length or reduce. It is for simplicity purposes.
- Ask learners to contribute by listing things in real life that can be rounded off to different place values of units. Make a list on the chalkboard and facilitate a discussion about them.
- Guide them to come up with a general conclusion.
- Refer learners to the **example** in the Learner's Book. Follow through with the learners, then make a conclusion.
- Then, assign them to work individually the **application activity 5.7** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Slow learners should attempt out the following for more practice:
Round off the following as instructed:
(a) 1.3 cm to the nearest whole centimetre.
(b) 6.75 m to the nearest tenth.
(c) 0.957 km to the nearest hundredth.
(d) 10.42 kg to the nearest whole kilogram.

Extended activity

Fast learners should attempt the following for more practice.

Estimate as instructed.

(a) 3.56 kg to hectograms.

(b) 0.927 km to dams.

(c) 8,648.51 square kilometres to whole square kilometres.
(d) 164 square centimetres to square metres.

d) Answers to Application 5.7

(1) 1,672 kg (2) 177 cm (3) 869.3 kg (4) 10 sec
(5) 6.23 hectares (6) 3 kg (7) 1,467.5 (8) 236 km

5.5. 8 Lesson 8: Converting fractions into decimals

a) Learning objectives

Convert a fraction into decimal.

b) Teaching resources

- Wall chart with problems on the conversion of fractions into decimal numbers
- Table of place values of decimal numbers, pens and notebooks.

c) Learning activities

- Start with mental work on division. For example: 8 ÷ 4, 10 ÷ 2, 12 ÷ 6, 18 ÷ 3, 9 ÷ 3, 12 ÷ 4.
- Group the learners and distribute learning materials/aids.
- Let the learners carry out the **learning activity** as per instructions in the Learner's Book.
- Guide them as they carry out the matching. Now write the fraction $\frac{1}{4}$ on the chalkboard and ask the learners to change it into decimal. Many of the learners may seem confused and challenged. Explain that writing fractions in decimals is a way of expressing the given fractions with denominators 10, 100, 1000, etc and the number of zero(s) in the denominator denotes the number of places of digits a numerator is placed from the decimal point.

Explain further that to express $\frac{1}{4}$ as a decimal number,

(i) the denominator is expressed in terms of 100. It is done by multiplying by a common factor both in the numerator and denominator.

Learners suggest the numbers

$\frac{1}{4} \times \frac{?}{?} = \frac{?}{100}$

It is likely they will suggest 25.

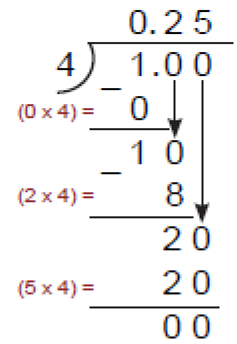
so $\frac{1}{4} \times \frac{25}{25} = \frac{25}{100}$

(ii) The denominator possesses 2 zeros, so the decimal formed possesses 2 places of decimal.

$\frac{25}{100} = 0.25$

- Explain that there is another method. It is carried out by dividing the numerator by the denominator.

That is; $\frac{1}{4}$ =

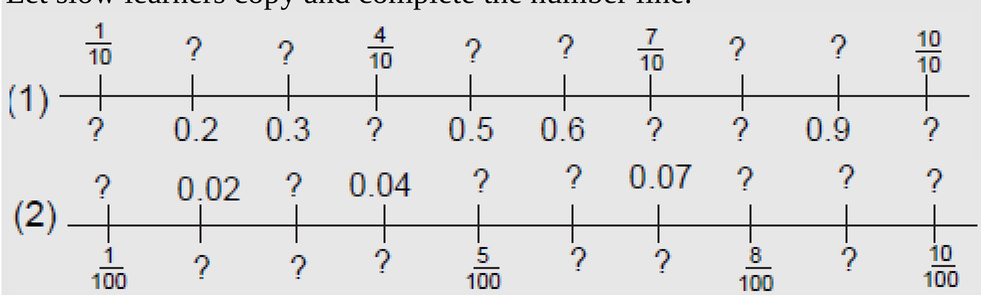


So, $\frac{1}{4} = 0.25$

- Write some more examples including mixed and recurring decimals on the chalkboard for the learners to do more practice using both methods.
- Now, distribute number cards; some showing fractions and others showing decimals.
- Let learners follow through as they discuss the procedure.
- Refer them to the **examples** in the Learner's Book. Lead them through as they ask questions. Explain to their satisfaction.
- Satisfied that they have grasped the concept, let them read and internalize the Study tip
- Then, assign them to work individually the **application activity 5.8** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Let slow learners copy and complete the number line.



Extended activity

Fast learners can try out more challenging questions.

Convert the following to decimal numbers.

(1) $\frac{3}{50}$ (2) $1\frac{1}{20}$ (3) $4\frac{3}{50}$ (4) $\frac{113}{4}$

(6) Kamali bought 1 kg of sugar. The bag got torn and 125 grammes got split. Express the remaining sugar as a decimal.

Answers to Application 5.8

(a) 0.65 (b) 0.3125 (c) 5.9 (d) 2.1

(e) 0.4 (f) 1.375 (g) 1.375 (h) 5.75

(i) 1.3636... (j) 1.333... (k) 0.111... (l) 0.666...

(m) 0.36... (n) 0.54... (o) 1.333... (p) 0.5

(q) 0.333... (r) 0.166... (s) 0.5 (t) 1.4

5.5. 9 Lesson 9: Converting decimals into fractions

a) Learning objectives

Convert decimals into fractions.

b) Teaching resources

- Wall chart with problems on the conversion of decimals into fractions.
- Table of place values of decimal numbers, pens and notebooks.

c) Learning activities

- Give mental work about the nature of common fractions and decimals.

For example; what is $\frac{50}{100}$ expressed as a decimal?

- Review the previous lesson.
- Make a guided discussion as learners carry out the **learning activity** in the Learner's Book in groups.
- Convert the following decimals into fractions and show your working out.

(a) 0.2 (b) 0.4.

- Present your answers to the class.

Explain that decimals can as well be written as fractions.

- Remind learners that decimals are small parts of 10, 100, 1,000 etc and that the number of zeros denotes the number of decimals and vice versa.

Write some examples on the chalkboard for the learners to do practice as they discuss.

Example: Change these decimals into common fractions.

(1) 0.4 - identify the place value of the last digit 4.

= 0.4 (4 is in tenth, so the denominator of tenth is 10).

= $\frac{4}{10}$ (the zero and decimal point on the left of 4 are deleted).

$0.4 = \frac{4}{10}$

It is normal to reduce to the lowest term.

$\frac{4}{10} \div \frac{2}{2} = \frac{2}{5}$

$0.4 = \frac{4}{10}$ or $\frac{2}{5}$

- Lead the learners through the example1 and 2 in the Learner's Book.

Give more examples or learners can formulate their own.

Example:

(a) $0.236 = \frac{\cancel{236}^{113}}{\cancel{1000}_{500}}$ (there are 3 decimal places, therefore, divide by 1,000 and simplify where possible)

$= \frac{113}{500}$

(b) $4.09 = \frac{409}{100}$ (there are 2 decimal places, therefore, divide by 100 and simplify where possible)

$= 4\frac{9}{100}$

- Explain exhaustively about the conversions in example 3 and 4 given in the learner's book. Give learners time to internalize the concept. Guide them as they discuss the procedure.
- Let learners play a matching game of flashing cards numbered with corresponding fractions and decimals in their groups.

e.g

$\frac{9}{100}$	→	0.09	$\frac{2}{3}$	→ 0.66...
0.15	→	$\frac{3}{20}$	$\frac{6}{11}$	→ 0.54...

- Guide learners as they read and discuss the Study tip.
- Then, assign them to work individually the **application activity 5.9** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

Let slow learners change the following to fractions.

(1) 0.9 (2) 0.4 (3) 1.6 (4) 0.1 11 (5) 2.7

(6) 2.8 (7) 3.2 (8) 1.8 (9) 0.444 (10) 0.375

Extended activity

Ask gifted learners to change to mixed fractions then reduce to the lowest terms.

(1) 6.075 (2) 12.0012 (3) 0.888

(4) 3.2333 (5) 10.0075 (6) 15.0625

d) Answers for application activity 5.9

(a) $\frac{617}{5000}$	(b) $19\frac{67}{100}$	(c) $195\frac{1}{125}$	(d) $10\frac{2}{25}$
(e) $17\frac{3}{10}$	(f) $13\frac{1}{2}$	(g) $54\frac{29}{1000}$	(h) $\frac{3}{8}$
(i) $\frac{32}{125}$	(j) $56\frac{7}{20}$	(k) $6\frac{9}{50}$	(l) $25\frac{1}{4}$
(m) $25\frac{3}{10}$	(n) $18\frac{3}{4}$	(o) $\frac{7}{8}$	(p) $\frac{1}{3}$
(q) $\frac{5}{9}$	(r) $\frac{4}{9}$	(s) $\frac{1}{8}$	

5.5.10 Lesson 10: Solving problems involving converting decimals into fractions and fractions into decimals

a) Learning objectives

Solve problem bout the conversion of decimals into fractions and fractions into decimals

b) Teaching resources

- Wall chart with problems on the conversion of decimals into fractions.
- Table of place values of decimal numbers, pens and notebooks.

c) Learning activities

- Review the previous lesson.
- Assign groups to carry out the **learning activity** in the Learner's Book and make a guided discussion. Think of a decimal number with three digits on the decimal place side.
  Write it on a piece of a paper.
  Give it to your colleague.
  Ask him/her to round it to the tenth place value and after convert it into a fraction.
  Discuss the whole process.
  Is the last finding looking the same as the first? Explain.
- Write some examples on the chalkboard for the learners to do practice as they discuss.
- Lead the learners through the **example** in the Learner's Book and guide them as they discuss the procedure.
- Guide learners as they read and discuss the Study tip.
- Then, assign them to work individually the **application activity 5.10** in the Learner's Book. Mark their work and help them with corrections.
- Tell learners to always read and interpret the word problems correctly before working them out.

d) Answers for application activity 5.10

(1) **231 and 3/4** (2) 0.58 (3) $9\frac{3}{5}$ (4) $\frac{1}{4}$

(5) $72\frac{\dot{3}}{100}$ (6) 12.2 (7) $140\frac{1}{7}$ (8) $3\frac{1}{7}$

5.6 Answers for the end of unit Assessment

1) (a) 12.46 (b) 877.00 (c) 324.67

2) (a) 123.9 (b) 457.6 (c) 65.5

3) (a) 23.457 (b) 0.577 (c) 567.683

4) 2.7

5) 0.875

6) (a) 9.6 sec (b) $9\frac{69}{100}$ 7) 3.53

8) $8\frac{1}{3}$km 9) 0.4545... 10) $\frac{65}{99}$

11) 4.2727... 12) $\frac{3}{5}$

5.7 Extension activities

1) Work out then convert either to fraction or to decimal:

(a) $12.234 + 0.134 =$

(b) $5\frac{9}{10} \div \frac{2}{5} =$

(c) $56.078 \times 11 =$

2) Round off to the nearest:

(a) Tenth

(i) $12.034 + 167.67 =$

(ii) $999.999 =$

(iii) $15623.292 - 89.003 =$

(b) Hundredth

(i) $34.4 + 1728.87 =$

(ii) $(78.12 + 12.006) \times 342 =$

UNIT 6: RATIOS, PROPORTIONS, PERCENTAGES AND MIXTURES

6.1 Key unit Competence

To be able to work out ratios, proportions, percentages and mixtures

6.2 Prerequisites

Pupils will easily learn this unit, if they studied well the following: Fractions, equivalent fractions (P5, unit 4).

6.3 Cross-cutting issues to be addressed

- **Gender balance**: provide equal opportunity to boys and girls in the lesson
- **Inclusive education**: promote education for all learners in the teaching and learning activities.
- **Environment and sustainability:** This will be addressed when pupils will be maintaining hygiene for their classroom and for materials they used.
- **Financial education:** addressed when pupils discuss word problem involving how to pay taxes in form of percentages of money received.
- **Peace and values education:** addressed when pupils are encouraged to work collaboratively and peacefully in their group.

6.4 Guidance on introductory activity

Introductory activity:

Look at your classmates:

(a) Find out the number of boys, then the number of girls. Can you express the number of boys or girls in terms percentage?

(b) Can you share 36 Mathematics textbooks to the two groups (boys and girls) in your classroom in the ratio of the number of pupils per group?

(c) Give other examples where the concepts of ratios, percentages and mixtures are used in real life.

Guidance:

- Invite pupils to read the introduction in the learner's book and try to discuss answers in their groups.
- Invite them to a whole class discussion and ask learners them if they can easily equally share a 36 Mathematics textbooks to different groups in the classroom.
- Basing on their answers, experience, prior knowledge and abilities, ask them to give the meaning of ratio, proportions and percentage in their real life.
- Open a discussion with probing questions to facilitate them to give their predictions and ensure that you arouse their curiosity on what is going to be leant in this unit. This unit is aimed to help learners to apply ratios, percentages and mixtures to solve some problems from real life.

6.5 List of lessons/subheadings

	Ratios, proportions, percentages and mixtures	**40 periods**
	Lesson	**Number of Periods**
0	Introductory activity	1
1	Converting percentages into decimals	1
2	Converting decimals into percentages	1
3	Converting percentages into fractions	1
4	Converting fractions into percentages	1
5	Comparing quantities as percentages	1
6	Comparing percentages as quantities	2
7	Increasing a Number by a Percentage	2
8	Decreasing a number by a percentage	2
9	More about increasing and decreasing quantities by percentage	2
10	Finding percentage increase and decrease	2
11	Finding percentage profit and percentage loss	1
12	Solving problems involving percentages	2
13	Finding ratios	1
14	Sharing quantities in ratios	2
15	Increasing and decreasing quantities in ratios	2
16	Finding the ratio of increase and decrease	2
17	Solving problems involving ratios	2
18	Finding indirect proportions	1
19	Finding the average price of a mixture	2
20	Finding quantity of one type of the mixture	1
21	Finding the price of one type of ingredient in the mixture	3
22	Finding both quantities of a mixture	2
23	Solving problems involving ratios, percentages, mixtures and inverse proportions	2
24	End unit assessment	1

Guidance on different lessons

6.5. 1 lesson 1: Converting percentages into decimals

a) Learning objectives

Solve problem on the conversion of percentage into decimals.

b) Teaching resources

- Wall chart with problems on the conversion of percentage into decimals.

c) Learning activities

- Give mental work on converting simple fractions to decimals.

For example, change the following to decimals

$\frac{1}{2}, \frac{2}{5}, \frac{7}{10}$

and so on.
- Let learners get into groups and carry out the activity in the Learner's Book, page 83.
- Share the main competence as converting percentages into decimals.
- Help learners to realize the shifting of the decimal point in relation to number of zeros in the denominator.

(1) $17\% = \frac{17}{100} = \frac{.17}{100} = 0.17$

- Help learners to note that the number of zeros in the denominator correspond to the number of decimal digits.

(2) $38\% = \frac{38}{100} = \frac{.38}{100} = 0.38$ (3) $9\% = \frac{9}{100} = \frac{.09}{100} = 0.09$

(4) $30\% = \frac{30}{100}$

first cancel out the zero in ones place value, meaning divide by 10.

$= \frac{3}{10} = \frac{3}{10} = 0.3$

- Encourage and allow learners to match as many question as they can.
- Assign a number of questions for group discussion: 23%, 67%, 82%, 91%, 156%, 4%, 2%, etc.
- Guide learners through the examples in the Learner's Book, pages 83 and 84.
- Invite them to summarize in their own words how they convert percentage into decimals.
- Then, take them through the Study tip as the summary.
- Then, assign them to work individually the **application activity 6.1** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity:
You may have lots of 2 digit percentages for the slow learners to change to decimals: 15%, 19%, 21%, 32%, 43%, 76%, 84%.

Extended activities:
Fast learners can attempt single digit percentages: 2%, 3%, 6%, 7%, m%, r%, x%.
They may also have 3 or more digit percentages: 113%, 159%, 417%, 2345%, abc%, rstv%.

d) Answers to Application 6.1

(a) 0.48 (b) 0.97 (c) 0.01 (d) 0.13 (e) 0.22 (f) 0.157 (g) 0.012 (h) 1.25
(i) 1.42 (j) 0.33 (k) 0.455 (l) 0.2075 (m) 0.622 (n) 0.566... (o) 0.8702.

6.5. 2 lesson 2: Converting decimals into percentages

a) Learning objectives

Solve problem on the conversion of decimals into percentages.

b) Teaching resources

- Wall chart with problems on the conversion of decimals into percentage.

c) Learning activities

- Review converting percentages into decimals.
- Ask learners to form groups.
- Guide them as they discuss the learning activity given in the Learner's Book, page 85.

- Invite groups to present answers to the whole class;
- Assess each group's report as you discuss with the learners to come up with one correct method.
- Help learners to harmonize their work.
- Provide more examples:

Example 1: Express 0.34 as a decimal.

Method 1: Help learners to realize that the number of decimal digits represent the number of zeros on the denominator.

$0.34 = \underset{100}{0.34} = \frac{34}{100} = 34\%$ Method 2: $0.34 = \frac{34}{100} \times 100\% = 34\%.$

Example 2: $0.06 = \underset{100}{0.06} = \frac{6}{100} = 6\%$ OR $\frac{6}{100} \times 100\% = 6\%$

- Give some questions about decimal numbers to be expressed as percentage for learners to discuss in groups. 0.17, 0.532, 7.44, 13.9
- Refer to the Learner's Book and guide learners through the example 1 and 2.
- Invite them to summarize in their own words how they convert decimals into percentage.
- Guide them through the Study tip as a summary.

Then, assign them to work individually the **application activity 6.2** in the Learner's Book. Mark their work and help them with corrections.

- Depending on the results, assign them the following additional activities:

Remedial activity

Guide slow learners as they use method 1 of matching zeros for the following; 0.19, 0.66, 0.39, 0.88, 0.04, 0.09 to change to percentages.

Extended activity

Prepare more work for fast learners including word problems. Example: About 0.05 of the chicken feeds is silver fish. Express that as a percentage.

d) Answers to Application 6.2

(a) 86% (b) 20% (c) 12% (d) 5%

(e) 56% (f) 12.5% (g) 7.5% (h) 146%.

(i) 120% (j) 19.5% (k) $33\frac{1}{3}\%$ (l) $54\frac{6}{11}\%$

(m) $55\frac{5}{9}\%$ (n) $63\frac{7}{11}\%$ (o) $44\frac{4}{9}\%$

6.5. 3 lesson 3: Converting percentages into fractions

a) Learning objectives

Solve problem on the conversion of percentage into fractions.

b) Teaching resources

- Wall chart with problems on the conversion of percentage into fractions.

c) Learning activities

- Give mental work on reducing fractions to be done.
- Form groups of learners.
- Invite groups to carry out the activity in Learner's Book, page 86.
- Let them present answers to the whole class discussion.
- Guide them through the example as you prepared on a chart:

Example

(1) Change 30% to a fraction.

$$30\% = \frac{30}{100} = \frac{3}{10}$$

Note: Express percentage as a fraction out of 100 first; Then reduce the fraction.

$$(2)\quad 64\% = \frac{64}{100} = \frac{16}{25}$$

$$(3)\quad 17\frac{1}{2}\% \text{ change to improper fraction first}$$

$$= \frac{(17 \times 2) + 1}{2} = \frac{35}{2} \text{ then express } \frac{35}{2}\% \text{ as a single fraction}$$

$$= \frac{35}{2} \times \frac{1}{100} = \frac{35}{200} = \frac{7}{40}$$

- Give work for group discussion;

$$18\%,\ 32\%,\ 22\frac{1}{2}\%,\ 66\frac{2}{3}\%,\ 1\frac{2}{3}\%$$

- Ask learners to present their work and guide them where you found mistakes.
- Guide learners through the suggested examples in the Learner's Book, page 86.
- Let learners explain in their own words how to convert percentage into fractions.
- Guide them through the Study tip as a summary.

Note: You may mix the two kinds of percentages (i.e, whole number and mixed number percentages) if the class learns fast. Alternatively, you may split them into 2 lessons. Give more time to learners when handling the mixed number percentages, for example,

$$3\frac{1}{3}\% \text{ etc.}$$

- Provide other more exercises for the next period that will enable learners to master the content.
- Then, assign them to work individually the **application activity 6.3** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the following additional activities:

Remedial activity

More work should be prepared to continue guiding the slow learners. 20%, 70%, 35%. Allow them more time when dealing with mixed fractions.

$$12\frac{1}{2}\%,\ 8\frac{1}{3}\%.$$

Extended activity

Prepare more challenging work for the fast learners for example; express the following as fractions.

(a) 125%, (b) 144%, (c) $4\frac{1}{6}$%, (d) $8\frac{3}{4}$%

(e) $12\frac{1}{2}$% of the people in town are traders. What fraction of the people in town are traders.

d) Answers to Application 6.3

(a) $\frac{2}{5}$ (b) $\frac{1}{2}$ (c) $\frac{1}{8}$ (d) $\frac{3}{4}$

(e) $\frac{1}{50}$ (f) $\frac{11}{100}$ (g) $\frac{2}{3}$ (h) $\frac{2}{25}$

(i) $\frac{17}{25}$ (j) $\frac{22}{25}$ (k) $\frac{9}{10}$ (l) $\frac{9}{20}$

(m) $\frac{6}{11}$ (n) $\frac{51}{100}$ (o) $\frac{1}{10}$ (r) $\frac{81}{100}$

(s) $\frac{43}{50}$ (t) $\frac{49}{500}$

6.5. 4 lesson 4: Converting fractions into percentages

a) Learning objectives

Solve problem on the conversion of fractions into percentages.

b) Teaching resources

Wall chart with problems on the conversion of fractions into percentages.

c) Learning activities

- Give mental work activity on simple equivalent fractions: multiplying fractions by whole numbers, converting mixed fraction to improper fractions.
- Guide learners to form groups and assign them to carry out the activity in the Learner's Book, page 87.
- Invite them to present answers to the whole class discussion and guide them through examples that you prepared on a chart.

Example: Express the following as a percentage;

(1) $\frac{2}{5}$ Help learners to realise that you multiply a fraction by 100%

$\frac{2}{5} \times 100\% = 40\%$

(2) $\frac{7}{10} = \frac{7}{10} \times 100\% = 70\%$

(3) $2\frac{1}{2} = \frac{(2 \times 2 + 1)}{2} = \frac{5}{2} = \frac{5}{2} \times 100 = 250\%$

- Emphasize that mixed numbers are first changed into improper fractions.
- Assign more group works to the learners for discussion.

For example

$\frac{4}{5}, \frac{32}{40}, 1\frac{4}{5}, 12\frac{1}{2}$

Ask learners to present their answers.

- Guide learners through the examples in the Learner's Book.
- Then, let learners explain in their own words how to convert fractions into percentages.
- Guide the learners through the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.4** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

d) Answers to Application 6.4

(a) 40%	(b) 314.3%	(c) 122.2%	(d) 550%
(e) 11.1%	(f) 87.5%	(g) 30%	(h) 37.5%
(i) 83.3%	(j) 40%	(k) 33.3%	(l) 66.6%
(m) 60%	(n) 54.5%	(o) 44.4%	

6.5. 5 Lesson 5: Comparing quantities as percentages

a) Learning objectives

Solve problem on the comparison of quantities as percentages.

b) Teaching resources

- Wall chart with problems on the comparison of quantities as percentages.

c) Learning activities

- Guide learners to review the multiplication of a fraction by a whole number.
- Put learners into manageable groups and invite each group to discuss the activity from the learner's book.
- Allow each group to present the findings in the whole class discussion add harmonize them.
- Guide learners through more examples:

1. Mukashyaka scored 17 marks out of 20. What was his percentage mark?

Form a fraction $\frac{17}{20}$

Convert the fraction into percentage.

$\frac{17}{20} \times 100 = 85\%.$

2. On a farm there are 29 cows, 15 goats and 6 sheep. Find the percentage of each kind of animal.

Get the total number of animals on the farm first.

Secondly form fraction of each kind of animal.

Change the respective fraction to percentage

Total	cows	goats	sheep
$29 + 15 + 6$	$\frac{29}{50} \times 100\%$	$\frac{15}{50} \times 100\%$	$\frac{6}{50} \times 100\%$
$= 50$	$= 58\%$	$= 30\%$	$= 12\%$

- Emphasize that the fraction formed is of the total quantity.
- Give another activity for group discussion.

Example In a school of 400 students, 200 are Africans, 128 are whites, the rest are Asians.
Find the percentage of: (a) Africans (b) Whites (c) Asians
Ask groups to present their work to the class and correct them where they go wrong.

- Guide them through the example 1 and 2 in the Learner's Book, page 89.
- Then, let learners explain in their own words how to compare quantities as percentages.
- Let the learners study the Study tip as a summary.
- Emphasise that we make the fraction of the total quantity then multiply by

$$100 \quad \frac{\text{Required}}{\text{Total}} \times 100\%$$

- Then, assign them to work individually the **application activity 6.5** in the Learner's Book.
Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:
Slow learners can work out simple word problems; e.g
1. In a family there are 5 members, 3 are females and 2 are males. Find the percentage of;

(a) males (b) females

2. A girl did ten numbers. She got 7 correct ones.

(a) What percentage did she pass?
(b) What percentage did she fail?

Extended activities
Prepare more challenging work for the fast learners. For example;
1. Uwacu cut her apple into 8 equal parts. She gave out 2 parts.
(a) What fraction remained?
(b) What percentage did she give out?
(c) What percentage remained?
2. Ntare has 200 Tshirts in his boutique. 70 are white, 110 are green and the rest are black. Find the percentage of each colour.
3. A baby spent 8 hours of the day sleeping. What percentage of the day did it sleep?

d) Answers to Application 6.5
1. (a) 75% (b) 50%

2. (a) 50% (b) 33.3%
3. 20% 4. 25% 5. 12 %.

6.5. 6 lesson 6: Comparing percentages as quantities

a) Learning objectives

Solve problem on the comparison of percentages as quantities.

b) Teaching resources

- Wall chart with problems on the comparison of percentages as quantities.

c) Learning activities

-Guide learners to review the content of previous lesson.
- Distribute learners in groups and let them do activity in the learner's Book, page 90.
- Guide them through the procedure.
- Harmonize answers to come up with correct answers.
- Explain the main competence of the lesson. That is, comparing percentages as quantities.
- In the activity, learners observed that percentages increased as quantities increased directly proportionally.
- When percentages increase to a total of 100%, the total of the quantities was realised.
  Write an example on the chalkboard for learners to practise.

Example: In a group, there are 40 men. This is 20% of all the group members. The rest are women. How many members are in the group?

Lead learners to realize that, out of every 100 group members, 20 are men.

Method 1	Method 2
Use grouping method.	First find the equivalent of 1%.
20% is equivalent to 40 members.	20% is equivalent to 40.
40% is equivalent to 80 members.	1% is equivalent to $\frac{40}{20}$.
60% is equivalent to 120 members.	Multiply by 100 to get the total.
80% is equivalent to 160 members.	100% is equivalent to $\frac{40^{2}}{20_{1}}$ x 100.
100% is equivalent to 200 members.	= 2 x 100
Therefore, there are 200 members.	= 200

- Let learners follow through again so that they get familiar with the concept.
- Refer to the example1 and 2 in the Learner's Book, page 91 and guide learners through, emphasis put in method 2 because it involves algebra.
- Ask learners to formulate their own problems, work them out as you monitor them.
- Then, let learners explain in their own words how to compare percentages as quantities.
- Let learners read the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.6** in the Learner's Book.
  Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Slow learners should attempt out the following for more practice:
Use grouping method.

1. 10% is equivalent to 10 cows. How many cows are there?
2. 50% is equivalent to 20 kg. How many kilograms are there?
3. 20% is equivalent to 15 pencils. How many pencils are in the box?

25% is equivalent to 20 books. How many books are there?

Extended activity

Fast learners should use method 2 to work out the following:

1. 2% of the farmers in a village grow rice. 300 farmers grow rice. How many farmers are in the village.
2. 6% of animals on a farm are sheep. If there are 24 sheep, what is the total of all animal?
3. 15% of learners in a school are in Primary 6. there are 45 learners in Primary 6. Find the total enrollment in the school.
4. $12\frac{1}{2}\%$% of Munyaneza's salary is spent on food monthly. If he spends 40,000 Frw on food, what is his salary?

d) Answers to Application 6.6

(1) 300 (2) 600 (3) 12,800

(4) 2,000 fish (5) 500 cars (6) 600 kg

6.5. 7 lesson 7: Increasing a number by a percentage

a) Learning objectives

Solve problems on how to increase a number by a percentage.

b) Teaching resources

- Wall chart with problems on the increasing of numbers by a percentage.

c) Learning activities

Begin with mental work activity on multiplying fractions by a whole number. For example $\frac{2}{5}\times 15$ and reducing a fraction for example reduce $\frac{20}{35}$ to the lowest terms.

- Ask learners to form groups.
- Guide them as they discuss the contents of the learning activity.

Dusabe had 100 Frw.

Her father increased it by 20%.

If it is reduced by 10%, how much will it be?

(a) How much money does she have now?

(b) How do you get the answer?

(c) Explain and present your answer to the class.

- Let each group present its finding and later come up with correct answers and methods. - - Write an example on the chalkboard.

Example: (1) Increase 70 by 30%.

Guide learners into finding out the meaning of increase.

Guide learners through the following examples involving increasing by a percentages.

Method 1

Steps, $\Rightarrow$ The original 70 is represented by 100%

$\Rightarrow$ Increase 100% by 30% = 100% + 30% = 130% of old amount

$\Rightarrow$ Multiply the new percentage by 70 = $\frac{130}{100} \times 70 = 91$

Method 2

Add: 70 plus (30% of 70)

$= 70 + (\frac{30}{100} \times 70)$

$= 70 + 21$

$= 91$

Example (2): Dukuze was getting wages of 4,000 Frw per day. Her wages were increased by 25%. Find her new wages.

Method 1

Original 100% = 4,000 Frw

Increase by 25% = 100% + 25%

= 125%

New wages = $\frac{125}{100} \times 4000$ Frw

= 5,000 Frw

Method 2

Add 4,000 Frw + (25% of 4,000 Frw)

= 4,000 Frw + $(\frac{25}{100} \times 4{,}000)$

= 4,000 Frw + 1,000 Frw

= 5,000 Frw

- Prepare some numbers for learners to discuss in groups:

Increase 50 by 40%

Bihizi scored 80% in term one. In term two his mark increased by 10%. Find his term two mark.

- Let them study the examples in the Learner's Book, page 92 and 93.
- Then, invite learners explain in their own words how to increase a number by a percentage.
- Guide them through the Study tip and use it to emphasize the procedure.
- Then, assign them to work individually the **application activity 6.7** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Prepare a few simple numbers for slow learners to practice, for example;

1. Increase 20 by 105%
2. Increase 10 by 20%.
3. Mutesi received 40 litres of milk in January. In February, the milk increased by 50%. How many litres did she get in February?

Extended activity:

Prepare more challenging numbers for the fast learners.

1. Increase 58 by 5%

2. Decrease 120 by $7\frac{1}{2}\%$
3. A poultry farm had 420 birds. The birds increased by $16\frac{2}{3}\%$. What is the new number of birds?
4. The number of animals in a park increased from 144 by $12\frac{1}{2}\%$. Find the new number of animals.

d) Answers to Application 6.7

(1) 65 mangoes (2) 840 people (3) 1,080 (4) 46,000
(5) 512 (6) 16,934.4 (7) 33,880

6.5. 8 lesson 8: Decreasing a number by a percentage

a) Learning objectives

Solve problem on how to decrease a number by a percentage.

b) Teaching resources

Wall chart with problems on the decreasing a number by a percentage.

c) Learning activities

- Give the whole class the simple mental work about multiplying a fraction by 100.

For example:

$\frac{1}{10} \times 100, \frac{1}{2} \times 100, \frac{5}{10} \times 100, \frac{50}{100} \times 100$, etc.

- Guide learners to form groups and distribute the learning materials.
- Involve the learners in the activity from the Learner's Book.
- Invite them to present answers on the chalkboard.
- Harmonize them and give a general method.
- Learners should observe that, decrease means reducing, therefore, the operation used is for subtraction (–).

The essence is, there is a reduction on each 100 of the old amount.

- Write an example and ask learners to try it using the method of grouping as it was done in the activity.

For example: The price of sugar was decreased by 10%. If the old price was 700Frw per kg, what is the new price?

Method 1

Each 100 Frw, decrease is 10 Frw

200 Frw, decrease is 20 Frw

300 Frw, decrease is 30 Frw

400 Frw, decrease is 40 Frw

500 Frw, decrease is 50 Frw

600 Frw, decrease is 60 Frw

700 Frw, decrease is 70 Frw

New price = old price - decrease

= 700 Frw - 70 Frw

= 630 Frw

New price is 630 Frw

Method 2

Workout the difference in percentage.

(100% - 10%) of old price = New price

= 0% of 700 Frw

= $\frac{90}{100} \times 700$

= 90 x 7

= 630 Frw

The new price is 630 Frw.

- Take learners through the example 1 and 2 from the Learner's Book. Give them time to follow the procedure as you guide them.
- Give learners more examples so that they concretize the concept.
- Let learners explain the method of decreasing a number by a percentage in their own words,
- Invite learners study and read the Study tip as the summary.
- Then, assign them to work individually the **application activity 6.8** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activities

Slow learners should attempt out the following for more practice:

(1) Decrease 58 by 10%. (2) Decrease 50 by 20%

(3) Decrease 100 by 20% (4) Decrease 400 by 50%

Extended activities

Fast learners should use method 2 to work out the following:

(1) Decrease 420 by $7\frac{1}{2}\%$ (2) Decrease 640 by $12\frac{1}{2}\%$

(3) A diary factory produced 2,400 cartons of milk daily. During drought season, the cartons decreased by $33\frac{1}{3}\%$. Find the number of cartons produced later.

d) Answers to Application 6.8

(1) 740 (2) 672 (3) 1,140 (4) 336 kg

(5) 3,760,000 (6) 358.000 (7) 63.630 kg (8) 800,800

(5) 720 (6) 80 learners

6.5. 9 lesson 9: More about increasing and decreasing quantities by percentage

a) Learning objectives

Solve problem on how to increase or decrease quantities by percentage.

b) Teaching resources

Wall chart with problems on the increasing or decreasing quantities by percentage.

c) Learning activities

- Guide learners on the review of the previous lesson.
- Form groups among the learners and lead them through the activity in the Learner's Book, page 96.
- Invite them to present their answers to the whole class,
- Explain the main concept of the lesson as finding the original quantity which was increased or decreased to result into given new quantity.
- Guide learners through the activity.

New amount = old amount + % increase

New amount = 100% + 40%

140% of old amount = 2,800 Frw

$$\text{Find 1\% of old amount} = \frac{\overset{200}{\cancel{28{,}000}}}{\underset{1}{\cancel{140}}} = 200 \text{ Frw}$$

The old amount is assumed to be 100%

100% of old amount = 200 x 100 = 20,000 Frw

Therefore, the amount was 20,000 Frw.

- Take learners slowly through all the steps without hurrying.
- The procedure and steps may seem not easy to grasp at first exposure. Improvise various methods to achieve the objective.
- Take learners through the procedure of the examples given in the learner's book.
- Ensure learners are completely conversant with every step and then, let them read and discuss the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.9** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Slow learners should re-do the Application in order to internalise the concept.

Extended activity

Fast learners attempt the exercise below:

(1) Decreased by $33\frac{1}{3}\%$, a number becomes 1,200. What is the number?

(2) Increased by $12\frac{1}{2}\%$, a number becomes 7,200. What is the number?

(3) Gasana harvested beans. She put them in a store. Next season, the produce increased by $37\frac{1}{2}\%$ after the harvest, She had 795 kg. What was the first harvest in kilograms?

(4) Price of a pair of shoes was decreased by $6\frac{1}{2}\%$ in the Christmas promotion. The new price became 63,900 Frw. What was the price before?

d) Answers to Application 6.9

(1) 500 (2) 40,000 (3) 800 kg (4) 2,000
(5) 50,000 (6) 1,200 (7) 80,000

6.5. 10 lesson 10: Finding percentage increase and decrease

a) Learning objectives

Solve problem on finding percentage increase and decrease.

b) Teaching resources

Wall chart with problems on finding percentage increase and decrease.

c) Learning activities

- Conduct a review on increasing and decreasing a given number by a given percentage.
- Provide groups with the necessary learning materials and assign them through the activity on page 97.
- Invite groups to present their findings to the class and guide the class to harmonize answers:

Learners should realize that they shaded 20 more squares so the fraction shaded is $\frac{20}{40}$.

Then they express the fraction as a percentage

i.e, $\frac{20^{5}}{40_{1}} \times 100 = 50\%$.

Learners observe that expressed as a percentage, the first 40 squares were increased by 20 which is half.

- Refer learners to the example on a prepared chart.

Example: The new fees structure in a school for P.6 is 25,000 Frw. Formerly they were paying 20,000 Frw. By what percentage was the fees increased?

Old fees = 20,000 Frw New fees = 25,000 Frw

The increase is the difference

25,000 - 20,000 = 5,000 Frw

Percentage increases means, how much was increased on each 100 of the old amount.

$$\%\text{increase} = \frac{\text{Increase}}{\text{Old amount}} \times 100\%$$

$$= \frac{5{,}000}{20{,}000} \times 100\%$$

$$= \frac{1}{2} \times 100\% = 25\%$$

Conclusively, 25 Frw is the amount that was increased on each 100 Frw of the old fees.

- Now refer to the examples about percentage decrease.

Example: A school had 500 learners last year. This year the number decreased to 450 learners. Calculate the percentage decrease.

Guide them to realise that in decrease, there is reduction in the previous amount.

After thorough discussion, learners should find out that, with percentage decrease, we find how many items have been deducted from each 100 of the previous amount.

So decrease = (500 - 450) learners

= 50 learners

Percentage decrease

$$= \frac{50}{500} \times 100\% = 10\%$$

The essence is, on every 100 learners of the previous year, 10 didn't report back this year.

- Guide learners through the examples in the Learner's Book.
- Let them discuss the procedure in their own words, then let them refer to the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.10** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial Exercise

Slow learners should attempt the exercise below:

1. The old number is 200. The new number is 250. What is the percentage increase?
2. The new number is 400. The old number is 300. What is the percentage increase?
3. The old amount is 1,000 Frw. The new amount is 800 Frw. Calculate the percentage decrease.
4. A paw-paw was costing 500 Frw. Now it costs 400 Frw. What is the percentage decrease?

Additional Exercise

Fast learners attempt the exercise below:

1. The population of a village was 40,000 people. Now it is 55,000. By what percentage has the population increased?
2. Thadeus bought a radio at 9,000 Frw. He later sold it at 8,000 Frw. Calculate the percentage decrease in the price.
3. The bus fare from a certain town to another was 11,000 Frw. Now it is 13,000 Frw. Calculate the percentage increase in the fare.

When 150 is increased by x%, it becomes 120. What is the percentage decrease?

d) Answers to Application 6.10

(1) 33.3% or $33\frac{1}{3}$ (2) 20% (3) 33.3% (4) 4.7%

(5) 20% (6) 15%

6.5. 11 lesson 11: Finding percentage profit and percentage loss

a) Learning objectives

Solve problem on percentage profit and percentage loss.

b) Teaching resources

Wall chart with problems on percentage profit and percentage loss.

c) Learning activities

- Review the work done in the previous lesson and then form groups of learners.
- Guide the learners through the activity in the Learner's Book, page 99.
- Invite them to present answers to the whole class.
- Get a collection of their procedure and answers and harmonize them in a whole class discussion:

Explain that profit is the more money we get after selling an item compared to its original cost. People are involved in business to make more money.

However, due to some unavoidable circumstances, instead a trader or business person may sell for less money than the amount used to purchase the item. This is called loss.

- Refer to the examples in the Learner's Book.:

Exhaustively explain the difference between percentage increase and percentage profit. Then the difference between percentage decrease and percentage loss.

Emphasize that:

Profit = Selling price - Buying/cost price

Loss = Buying/cost price - Selling price

Let learners realize that:

$$\text{Percentage profit} = \frac{\text{Profit}}{\text{Buying/cost price}} \times 100\%$$

$$\text{Percentage loss} = \frac{\text{Loss}}{\text{Buying/cost price}} \times 100\%$$

- Give more examples for emphasis on the chalkboard.

Example: Kabera bought a cow at 100,000 Frw. He later sold it at 120,000 Frw. Calculate his percentage profit.

Guide learners to find the profit realised.

Profit = Selling price - Buying/cost price

= 120,000 Frw - 100,000 Frw

= 20,000 Frw

$$\text{Percentage profit} = \frac{\text{Profit}}{\text{Buying/cost price}} \times 100\%$$

$$= \frac{20{,}000}{100{,}000} \times 100\%$$

$$= 20\%$$

- Invite learners to explain how to solve such a problem in their own words; then take them through the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.11** in the Learner's Book.

Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 6.11
(1) 20% (2) 16.6% (3) 20% (4) 20% (5) 10% (6) 20%.

6.5. 11 lesson 11: Solving problems involving percentages

a) Learning objectives

Solve problem on involving percentages.

b) Teaching resources

Wall chart with problems involving percentages.

c) Learning activities

- Guide learners to review percentage increase and decrease.
- Invite them to form groups and guide each group as they discuss and work out the questions in the learning activity from the learner's book.

A school admitted 200 learners in 2016. The number of learners admitted in 2017 increased by 20%. How many learners were admitted in 2017?

- Invite groups to present and explain your finding in a whole class discussion.
- Relate the discussion for the activity with the subtopic.
- Guide learners through examples on a displayed chart.

Example: Ndahiro increased on the transport fare of his taxi. The original fare was 300 Frw. Now it is 330 Frw. Calculate the percentage increase.

$$\text{Percentage increase} = \frac{\text{Difference in fare}}{\text{original fare}} \times 100\%$$

$$\text{Percentage increase} = \left(\frac{330 - 300}{300}\right) \times 100\%$$

$$\text{Percentage increase} = \frac{30}{300} \times 100\%$$

$$\text{Percentage increase} = 10\%.$$

- Now talk about percentage decrease and give an example

Example: A factory produced 9,000 bars of soap. In the next phase it produced only 8,640. What was the percentage decrease in production?

$$\text{Percentage decrease} = \frac{\text{Difference in production}}{\text{Original production}} \times 100\%$$

$$\text{Percentage decrease} = \frac{(9{,}000 - 8{,}640)}{9{,}000} \times 100\%$$

$$= \frac{360}{9{,}000} \times 100\% = 4\% \quad \text{Percentage decrease} = 4\%$$

- Guide learners as they study the examples in the Learner's Book, pages 100 and 101.
- Give a number for them to try out in groups.
- Guide learners through the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.12** in the Learner's Book.
Mark their work and help them with corrections.

- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Prepare a few simple numbers for the slow learners.

1. Martha weighed 20 kg in 2016. In 2017 her mass is 26 kg. Find her percentage increase in mass.
2. Calculate the percentage increase if 120 increases to 168.
3. What is the percentage decrease when 600C drops to 360C?
4. Find the percentage decrease when a learner reduces marks from 50% to 49%

Extended activity

Create more challenging questions to occupy the fast learners.

1. In the first quarter of the year, a trader sold 360 bags of coffee. In the second quarter, he sold 390 bags. Find the percentage increase in the sales of coffee.
2. 2,790 was increased by a certain percentage to 4,650. What was the percentage increase?
2. Calculate the percentage fall in the price of sugar from 1,240 Frw to 1178 Frw.

The population of a place was 14,480. Because of floods, the number reduced to 10,860. Find the percentage decrease in the population.

d) Answers to Application 6.12

(1) $16\frac{1}{2}$ litres	(2) 360 people	(3) 12%	(4) 40%
(5) 25%	(6) 50%	(7) 8%	(8) 14.2%

6.5. 12 lesson 12: Ratios

a) Learning objectives

Solve problem on involving ratios

b) Teaching resources

Wall chart with problems involving ratios.

c) Learning activities

- In groups, let learners carry out the activity in the Learner's Book and later make a presentation.
- Guide the learners through the examples on a displayed chart;

Example (1): A brother and a sister shared some books in the ratio 2 : 3. The brother got 8 books. How many books did the sister get?

Explain to the learners that, we write the parts in their respective positions.

Brother	:	Sister
2	:	3

Let them write the value where it belongs that is, under the ratio

B	:	S
2	:	3
8	:	?

Divide the value by the ratio part (Brother's part) i.e, $\frac{8}{2}=4$ then multiply the ratio part with the value by the quotient.

B	G
2	3
8	_____ books
$\frac{8}{2}=4$	$=3\times4$

The sister got 12 books.

Example (2): The ratio of goats to cows on a farm is 7:4. There are 42 goats on this farm. Find the number of cows on the farm.

Goats		Cows
7	:	4
42		_____ cows
$\frac{42}{7}$		4×6
$=6$		$=24$ cows

- Assign work for groups to discuss and present to the class. e.g,
    1. At a restaurant, milk is mixed with water to make tea. The ratio of milk to water is 3:2. If 10 litres of water is used, find the amount of milk.
    2. Kamikazi and Mukashaka contributed some money for a project. The ratio of the money was 8:5. If Mukashaka contributed 60,000 Frw.
    (a) How much did Kamikazi contribute?
    (b) What was their total contribution?
    (c) How much more did Kamikazi contribute than Mukashaka?
- Guide learners through the examples from the Learner's Book.
- Guide them through the Study tip.
- Then, assign them to work individually the **application activity 6.13** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Prepare simple questions for the slow learners e.g,

1. Uwilingiye and Ishaka shared fruits in the ratio 2:5. Uwilingiye got 6 apples. How many apples did Ishaka get?
2. The ratio of hens to cocks on a poultry farm is 5:1. There are 80 cocks. Find the number of hens.

Extended activity

Fast learners can be given more challenging questions. e.g,

1. A and B shared some beans in the ratio 3:4. A got 18 kg. How many kg did B get?
2. P, Q and R shared some money in the ratio 2 : 3 : 5. P got 5,000 Frw. How much did Q get?

d) Answers to Application 6.13

(1) 2:3 (2) 1:10 (3) 50:1 (4) 10:3

(7) 2:1 (8) 3:2 (33 cups of wheat and 22 cups of milk).

6.5. 13 Lesson 13: Sharing quantities in ratios

a) Learning objectives

Solve problem on sharing quantities in ratios

b) Teaching resources

- Wall chart with problems involving sharing quantities in ratios

c) Learning activities

- Review the previous lesson.
- Put learners in groups and let them carry out the activity in the Learner's Book, page 103.
- Invite groups to make a class presentation and harmonize answers:

Lead learners to observe the procedure as follows:

1st learner	2nd learner
3	5
3	5
3	5
+ 3	+ 5
12	20

So, the 1st learner gets 12 bottle tops while the 2nd learner gets 20 bottle tops.

They should note that; (12 + 20) gives 32 bottle tops.

- Give an example for the learners to apply the competence.

Example: Joan and James shared 2,000Frw in the ratio of 3:2. How much did each get?

- Explain that the method used in the activity cannot be suitable for large numbers.

So, there is a short appropriate method.

That is, we add the total shares first:

3 + 2 = 5 shares

Joan got 3 shares and James got 2 shares of the 5 shares. Then each share is expressed as a fraction.

Joan got $\frac{3}{5}$ and James got $\frac{2}{5}$ of the total amount of money.

So to get the amount of money each got, we multiply by the amount

Joan	James
$= \frac{3}{\cancel{5}_{1}} \times \cancel{2{,}000}^{400}$ Frw	$= \frac{2}{\cancel{5}_{1}} \times \cancel{2{,}000}^{400}$ Frw
= 3 x 400	= 2 x 400
= 1,200 Frw	= 800 Frw

- Let learners follow through the working again to internalize the concept.
- Lead them through the examples from the Learner's Book.
- Let them study the two methods and ask questions where they have challenges.
- Ask learners to formulate the method in their own words and guide the study the Study tip as a summary.

- Then, assign them to work individually the **application activity 6.14** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity
Give slow learners work which is easier for practice. Then they should re-do the Application to master the competences.

Extended activity
To the fast learners, give high order thinking questions which are more complex than the Application. This will invoke their critical thinking.

d) Answers to Application 6.14
(1) 1st share = 200, 2nd share = 300
(2) 1st share = 70 kg, 2nd share = 350
(3) Kaibanda's got 4,500 Frw, Mukamusoni got 7,500 Frw.
(4) One farmer got 75 kg, the other farmer got 50 kg.
(5) a) 560,000 b) 80,000 c) 1,200,000
(6) a) 400 boys b) 850 learners.

6.5. 14 lesson 14: Increasing and decreasing quantities in ratios

a) Learning objectives
Solve problem on increasing and decreasing quantities in ratios.
b) Teaching resources
Wall chart with problems involving increasing and decreasing quantities in ratios
c) Learning activities
- Give mental work about increasing and decreasing numbers, for example,
(a) increase 120 by 30
(b) decrease 100 by 20
(c) What is 17 plus 11?
- Guide the learners to form groups and invite them to work out the activity in the Learner's Book.
- Harmonize the presentation from different groups.
- Learners should have observed that each of the 5 groups had 6 counters.
If another group is formed of 6 more counters,
The new amount = 30 counters + 6 counters = 36 counters.
- Display a prepared chart with worked examples.

Example 1: Increase 630 kg in the ratio of 7:3.

Explain that when an amount is increased, the new amount is bigger than the old amount. So in this case, explain that we express the new part as a fraction of the old ratio. Then, we multiply by the old part.

The first to appear is the new part and the last is the old part:

Method 1

New part = 7

Old part = 3

$$\text{New amount} = \frac{\text{New part}}{\text{Old part}} \times 630$$

$$\text{New amount} = \frac{7}{\cancel{3}_{1}} \times \cancel{630}^{210}\ \text{kg}$$

$$= 7 \times 210$$

$$= 1{,}470\ \text{kg}$$

Method 2

3 parts = 630 kg

$$1\ \text{part} = \frac{630}{3}$$

$$= 210\ \text{kg}$$

Then we multiply by the new part

7 parts = 7 x 210 kg

$$= 1{,}470\ \text{kg}$$

- Alternatively, we can equate the old amount to the old part and work out the value of 1 part. Then give an example about decreasing quantities in ratio.

Example 1: Decrease 960 in the ratio of 3:5.

- Tell learners that the procedure is the same as that of increasing, but a less quantity than the old quantity is realized. Lead then through the procedure:

Method 1

New part = 3

Old part = 5

$$\text{New amount} = \frac{\text{New part}}{\text{Old part}} \times 960$$

$$\text{New amount} = \frac{3}{\cancel{5}_{1}} \times \cancel{960}^{192}\ \text{kg}$$

$$= 3 \times 192$$

$$= 576\ \text{kg}$$

Method 2

5 parts = 960

$$1\ \text{part} = \frac{960}{5}$$

$$= 192\ \text{kg}$$

Then we multiply by the new part

3 parts = 3 x 192 kg

$$= 576\ \text{kg}$$

- Now refer to the examples from the Learner's Book.

- Ask learners to formulate the method in their own words and guide the study the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.15** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Let slow learners try this work:

1. Increase 100 in the ratio of 2:1.
2. Decrease 200 in the ratio of 2:5.
3. Increase 500 in the ratio of 3:2.
4. Decrease 1,000 Frw in the ratio of 9:10.

Extended activity

Let fast learners try this work:

1. What do you get if you increase 42,096 in a ratio of 5:3?
2. A trader had capital of 6,743,800 Frw. The amount reduced in the ratio of 6:7. How much capital does she have now?
3. Having had a good harvesting season, Gasana's maize harvest increased from 5,093 kg on the ratio of 13:11. How many kilograms did he harvest?
4. Mukamusoni had 5,782,500 Frw on her account. She withdrew some money to pay school fees for her children. The amount decreased in the ratio of 7:9. How much money remained on her account?

d) Answers to Application 6.15

(1) 350 kg (2) 210 (3) 900 (4) 980
(5) 27,000 (6) 600 books (7) 1,400 litres
(8) 2,500 (9) 20,400.

6.5. 14 lesson 14: Finding the ratio of increase and decrease

a) Learning objectives

Solve problem on the ratio of increase and decrease

b) Teaching resources

Wall charts with problems involving the ratio of increase and decrease.

c) Learning activities

- Review the concept of increasing and decreasing quantities as ratios.
- Ask learners to form group and do the activity in the Learner's Book, page 107.
- Let them present answers of what they discovered.
- Write a general report on the chalkboard.

For example: The new amount is 600, the old amount is 400.

$$\text{The increase in ratio} = \frac{\text{New number}}{\text{Old number}} = \frac{600}{400} = \frac{3}{2} = 3:2$$

- Help learners to realize that, when finding the ratio of increase or decrease, the new amount is divided by the old amount, then reduced to the lowest terms.

Thereafter, the fraction is expressed as a ratio.

- Refer to the examples in the Learner's Book, page 107.
- Ask the learners to read the questions and guide them as they follow through the working.

Give another example on the chalkboard.

Ask learners to copy it down on slips of paper.

- Let them attempt working it out in their groups as you monitor them.

Example: The amount of milk produced by Uwacu's cows reduced from 1,200 littres to 1,000 litres daily. In what ratio did the milk decrease?

New amount = 1,000 litres, old amount = 1,200 litres

Let learners apply the method they used in the activity. That is, dividing the new amount by the old amount.

$$\text{Ratio of decrease} = \frac{\text{New number}}{\text{Old number}} = \frac{1,000}{1,200}$$

Learners reduce to the simplest terms to get $\frac{5}{6}$.

Then learners apply the concept of changing fractions to ratios $\frac{5}{6}$ = 5:6.

Therefore, the ratio of decrease in the milk production was 5:6.

- Lead the learners through the examples from the Learner's Book.
- Ask learners to formulate the method in their own words and guide the study the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.16** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial Exercise

Let slow learners try this work:

1. Muzamir had 40 sheep. After a year they increased to 60 sheep. Find the ratio of increase.
2. What is the ratio of decrease from 300 to 200?
3. What is the ratio of increase from 300 eggs to 1,000 eggs?
4. Find the ratio of decrease from 400 kg to 200 kg.

Additional Exercise

Let fast learners try this work:

1. 250 was increase in the ratio of 8:5. What was the increased number?
2. 1.750 Frw was decreased in the ratio 2:3. Calculate the new amount of money.
3. After increasing his egg production of 2,468 eggs in the ratio of 5:4, a poultry farmer boosted her egg production. How many eggs did she collect?
4. Gasana's salary of 56,000 Frw was reduced in the ratio of 6:7. What was his new salary?

d) Answers to Application 6.16

(1) 6:5 (2) 5:8 (3) 7:6 (4) 4:5

(5) 93,000 (6) 9:10 (7) 6:5 (8) 9:10.

6.5. 15 lesson 15: Solving problems involving ratios

a) Learning objectives

Solve problem involving ratios

b) Teaching resources

Wall charts with problems involving ratios.

c) Learning activities

- Give a review of the work involving ratios previously experienced, then form groups of learners.
- Assign groups to carry out the activity in the Learner's Book, page 108.
- Move around as you monitor how they go about it.
- Collect the outcomes from all the groups and come up with a general report.
- Lead learners to realize that by grouping 40 bottles tops in twos and threes, they are applying the concept of sharing in ratios.

So, twos = 2 + 2 + 2 + 2 + 2 + 2 +2 + 2 = 16

threes = 3 + 3 + 3 + 3 + 3 + 3 + 3 + 3 = 24

- Display the chart with the worked example.

Learners can now apply the knowledge they have learned about ratios.
- Give more examples to give the learners more practice.
- Move around supervising the work.
- Then they make a presentation to the whole class.

Explain that with word problems, reading, interpreting and understanding are the prerequisite for correct working out of word problems.
- Invite learners to follow through the examples in the Learner's Book.
- Ensure the learners are conversant with the vocabulary used in word problems.
- Guide the learners through the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.17** in the Learner's Book.

Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 6.17

(1) 250 Frw (2) 70 Rams (3) 350,000 (4) 9:7

(5) 93,000 (6) 3:2 (7) a) 160 b) 200

(8) a) 270 boys b) 600 learners.

6.5. 16 Lesson 16: Indirect proportions

a) Learning objectives

Solve problem involving indirect proportions.

b) Teaching resources

Wall chart with problems involving indirect proportions.

c) Learning activities
- Ask learners to form groups. Guide them as they discuss the activity from the learner's book and come up with the answer.
- Distribute learning materials to learners.
- Allow each group to give a presentation and harmonize the answers.

Explain indirect proportion: In indirect proportion, when the quantity increases the other decreases and vice versa.

Guide them through examples.

Example 1

6 girls sweep a classroom in 15 minutes. How long will 9 girls take to sweep the same class?

6 girls take 15 minutes

1 girl takes (15 × 6) = 90 minutes (she takes more time)

9 girls take $\frac{90}{9}$ minutes (9 girls share the work done by one girl)

= 10 minutes.

Example 2

14 men can build a fish pond in 10 days. How many men are needed to build the same size of a pond in only 4 days?

10 days need 14 men

1 day needs (10 × 14) = 140 men.

4 days need $\frac{140}{4}$ = 35 men

Let the learners present the work discussed.

- Let them study the examples given in the Learner's Book, page 110.

Example 1

8 days need 2 people to do the work
More people are needed, so multiply.
1 day needs (2×8) people
Then divide to share the work.

4 days needs $\frac{2 \times 8}{4}$ people

= 4 people

Example 2

10 days needs 8 builders to do the work
Multiply to increase the number of builders to share the work.
1 day needs (10×8) builders
Then divide to share the work.

5 days needs $\frac{10 \times 8}{5}$ = 16 builders

- Then, assign them to work individually the **application activity 6.18** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 6.18

(1) 1/2 of a day (2) 2 days (3) 32 sqm (4) 4 men (5) 9 min.

6.5. 17 Lesson 17: Finding the average price of a mixture

a) Learning objectives

Solve problem involving indirect proportions.

b) Teaching resources

Wall chart with problems involving indirect proportions.

c) Learning activities

- Review basic operations and average.
- Provide group with the necessary material and invite learners to discuss the content in the activity: Take 15 kg of millet with 20 kg of maize.

Ask how much 1 kg of beans and 1 kg of maize in the shop are.
Buy and mix them in a basket.
(a) Measure. How many kg do you get?
(b) Calculate the money you should have spent on your mixture.
(c) What do you notice?
(d) Why do you think it is important to study mixtures?
(e) Present and defend your answer.

- Guide learners as they find the equal shares. Give them chance to present their findings.

Use the activity to exploit the concept and through some examples:

Example: Ngabirano is a spice dealer. He mixed 8 kg of ginger powder at 200 Frw per kg and 2 kg of red pepper powder at 300 Frw per kg. Find the average price of the mixture.

Solution:

Product	Quantity	Unit cost	Amount
Ginger powder	8 kg	200 Frw per kg	1,600 Frw
Red pepper powder	2 kg	300 Frw per kg	600 Frw
TOTAL	10 kg		2,200 Frw

$$\text{Average price} = \frac{\text{Total Amount}}{\text{Total quantity}} = \frac{2200\ \text{FRW}}{10} = 220\ \text{Frw}$$

- Ensure that you explain the steps clearly to the learners.
- Allow them to ask questions and ensure that you answer them and where possible site **examples**.
- Give a question and let learners discuss it in groups.
- Allow the groups to present the work.

Question for discussion: A mandazi maker mixes the following items:

6 kg of baking flour at 1200 Frw per kg

1 kg of baking powder at 200 Frw per kg

2 kg of sugar at 800 Frw per kg.

Find the average price of the mixture that was used to make mandazi.

- Allow learners to study the example in the Learner's Book, page 111.
- Guide learners through the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.19** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

Remedial activity:

Guide slow learners with simple numbers and ask them to attempt this number. A trader mixed millet and cassava flour. He mixed 12 kg of cassava flour at 500 Frw per kg and 4 kg of millet at 700 Frw per kg. Calculate the average price of the mixture.

Extended activity:

Prepare more questions to help learners to revise as a way of practicing. A farmer grinds a mixture of maize bran and silver fish for his poutry. He mixes 13 kg of maize bran and 7 kg of silver fish. Maize bran cost 320 Frw per kg and silver fish cost 800 Frw per kg. Find the average price of making the mixture.

d) Answers to Application 6.19

(1) 560 Frw (2) 960 Frw (3) 77 Frw

(4) a) 150 Frw b) 20 kg.

6.5. 18 Lesson 18: Finding quantity of one type of the mixture

a) Learning objectives

Solve problem involving the calculation of a quantity of one type of the mixture

b) Teaching resources

- Wall chart with problems on the calculation of a quantity of one type of the mixture
- Mixture of different types and quantities.

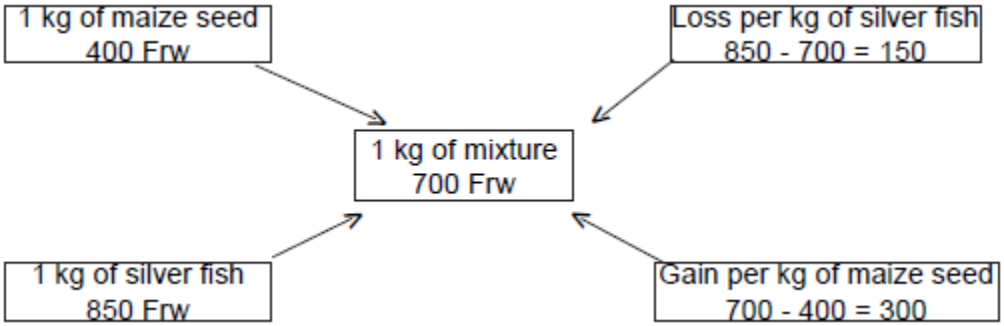
c) Learning activities

-Guide learners to review the method used when finding the price of one type of the mixture.
- Invite learners to groups let learners discuss the activity in the Learner's Book, page 112.
- Give an example to the learners and guide them through its procedure:

Munyaneza mixed 200 kg of maize seed which costs 400 Frw per kg with silver fish which costs 850 Frw per kg. He was making chick mash. He sold the mixture at 700 Frw per kg. How many kg of silver fish did he mix?

- Lead learners to realize that it is the mass of silver fish that is requested to be found.

Explain that, gain or profit on one type in the mixture, divided by the loss of the other type in the mixture, multiplied by the amount/mass of the mixture gives the amount of the type whose weight is not given.



- Lead the learners to realize that:

by selling 1 kg of maize seed at 400 Frw, and then selling 1 kg of the mixture at 700 Frw, a gain of (700 Frw - 400 Frw) = 300 Frw is realized.

And, by selling 1 kg of silver fish at 850, and then selling 1 kg of the mixture at 700 Frw, a loss of (850 Frw - 700 Frw) = 150 Frw is realized.

$$\text{So, } \frac{\text{loss on silver fish}}{\text{gain on maize seed}} \times \text{mass of mixture} = \text{mass of the other type}$$

$$\frac{150}{300} \times 200 = 100 \text{ kg of silver fish}$$

- Let the learners study and try to work out the examples below:

Ngarambe mixed 100 kg of soya beans which cost 200 Frw per kg with another type which cost 120 Frw per kg and sold the mixture at 170 Frw per kg.

Find the number of kg for the second type.

Show your working out then discuss your answer..

- Have a guided discussion with the learners such that they achieve the competence. Give some other examples.
- Let them study the example in the Learner's Book, page 112 and 113.

- Guide learners through the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.20** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 6.20

(1) 5 kg (2) 15 kg (3) 15 kg (4) 6 kg (5) 5 kg.

6.5. 19 Lesson 19: Finding the price of one type of ingredient in the mixture

a) Learning objectives

Solve problem on the determination of the price of one type of ingredient in the mixture

b) Teaching resources

- Wall chart with problems on determination of the price of one type of ingredient in the mixture
- Mixture of different types and quantities.

c) Learning activities

- Conduct a review on finding the average price of a mixture.
- Ask learners to form groups and assign them to do the activity from the learner's book.
- Give each group a chance to present.
- Inform the learners that they are going to learn how to find the price of only one item in the mixture.
- Guide learners through the example;

Mutesi sold 180 kg of red beans and white beans at 800 Frw per kg. 80 kg were for red beans at 300 Frw per kg. Calculate the price of one kg of white beans.

Steps: First find the total amount on the mixture. ie 180 × 800 = 144,000 Frw.

Then find the total amount of red beans 80 × 300 Frw = 24,000

Price of white beans:

$$= \frac{\text{Amount of mixture - amount of red}}{\text{Quantity of mixture - quantity of red}}$$

Whole procedure

Mixture: 180 × 800 Frw = 144,000 Frw

Red beans: 80 × 300 Frw = - 24,000 Frw

White beans: 100 120,000 Frw

Price of 1 kg of white beans = $\frac{120{,}000}{100}$ = 1,200 Frw

- Allow them to ask questions freely as you guide them.
- Let them study the examples in the Learner's Book.
- Guide learners through the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.21** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

Remedial activity:

Prepare a number for the slow learners.

1. A woman sold 50 red and green apples at 5000 Frw. He sold 30 red apples at 120 Frw each. Find the price of each green apple.
2. A farmer sold 70 hens and cocks at 360,000 Frw. He had 20 cocks which he sold at 8,000 Frw each. Find the price of each hen.
3. A business man bought 120 shirts and T-shirts all at 500,000 Frw. He bought 70 shirts each at 5000 Frw. What was the price of each T-shirt.

Extended activity:

For fast learner, prepare high order thinking numbers.

d) Answers to Application 6.21

(1) 50 Frw (2) 740 Frw (3) 653 Frw

(4) 2,000 Frw (5) 293 Frw

6.5. 20 Lesson 20: Finding both quantities of a mixture

a) Learning objectives

Solve problem on the determination of both quantities of a mixture.

b) Teaching resources

- Wall chart with problems on determination of both quantities of a mixture.
- Mixture of different types and quantities.

c) Learning activities

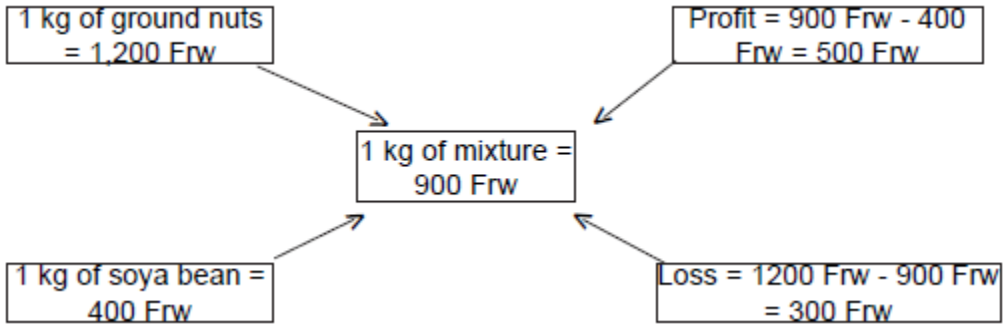
- Give mental work about finding loss and profit.

Then, using the unitary system, learners find the cost of the given quantities of items.

- In groups let learners discuss the activity in the Learner's Book, page 115.
- Guide the learners through an example:

Uwera mixed ground nuts with soya bean and formed 160 kg that she sold at 900 Frw each kg. She bought ground nuts at 1,200 Frw per kg and soya bean at 400 Frw per kg. Find the kilograms of each type she bought.

- Form a **mind map plan**.



- Lead the learners to note that;

The ratio of the mixture is 500:300, so the total is 500 + 300 = 800

For every 300 kg bought at 400 Frw, add 500 kg bought at 1,200 Frw.

Ground nuts bought at 1,200 Frw

$= \frac{500}{800} \times 160\ kg = 100\ kg$

Soya beans bought at 400 Frw

$= \frac{300}{800} \times 160\ kg = 60\ kg$

- Conclusively explain that, to find the quantities of the two types in a mixture, find the loss and profit and express them as ratio.
Then express each type as a fraction.
Multiply each fraction by the total mass of the mixture.
The results are the amounts of each type in the mixture.
- Display the chart with the prepared example.
- Let the learners in their groups discuss the procedure as you guide them.
- Lead the learners through the example in the Learner's Book, page 115
Ensure that the learners ably explain the procedure satisfactorily.
- Guide learners through the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.22** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 6.22

(1) First type = 24 kg Second type = 36 kg
(2) First type = 72 kg Second type = 45 kg
(3) First type = 30 kg Second type = 20 kg
(4) First type = 12 kg Second type = 8 kg
(5) First type = 6 kg Second type = 54 kg

6.5. 21 Lesson 21: Problems involving ratios, percentages, mixtures and inverse proportions

a) Learning objectives

Solve problem involving ratios, percentages, mixtures and inverse proportions.

b) Teaching resources

- Wall chart with problems problem involving ratios, percentages, mixtures and inverse proportions.
- Mixture of different types and quantities.

c) Learning activities

- Guide learners to review the previous lessons.
- Form groups of learners and lead them through the activity in the Learner's Book, page 116.
- Invite them to present findings and harmonize answers.
- Guide the learners through an example. Ensure that they get the idea very well.
- Display the chart with the prepared example.
- Let the learners in their groups discuss the procedure as you guide them.
- Lead the learners through the example in the Learner's Book.
- Ensure that the learners ably explain the procedure satisfactorily in their own words.
- Guide learners through the Study tip as a summary.
- Then, assign them to work individually the **application activity 6.21** in the Learner's Book.

Mark their work and help them with corrections.

- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 6.23

(1) 69 learners (2) 40 kg

(3) Novels = 80 textbooks, SST = 240 textbooks, Maths = 320 textbooks

English = 160 textbooks,

(4) 12 days (5) 4:3 (6) 8:3 (7) 300,000 Frw

(8) $66\frac{2}{3}\%$ (9) $\frac{1}{8}$ (10) 180 and 420

6.6 Answers for the end of unit 6 Assessment

(1) 4,000 m^2 (2) A : A + B + C (3) 14 days (4) 780 Frw

(5) 24 days (6) 69 learners (7) $7\frac{1}{2}$ questions (8) 4 people

(9) 83 days (10) 1,728 kg

6.7 Additional activities

Consolidation Activities

1. If you increase 12% on 20,000 Frw, what is the new amount?
2. How many learners can clean the classroom in 10 minutes working at the same rate if 5 learners can clean it in 15 minutes?
3. In community work, 20 boys and 25 girls attended. What is the ratio of boys to girls?

Extension activities

1. Munezero got 25 out of 30 and 45 out 50 in Maths quiz. Convert her total mark in percentage.
2. After three year of working very well with the salary of 43,000 Frw, Mugeni got a new salary of 47,300 Frw. What percentage was added to her salary?
3. How many more people are needed to plant trees on the land of 2 hectares working at the same rate in 5 days, if 15 people can plant the land of one hectare in 10 days?

UNIT 7: RELATIONSHIP BETWEEN VOLUME, CAPACITY AND MASS

7.1 Key unit Competence

To be able to convert between units of volume, capacity and mass of water.

7.2 Prerequisites

Pupils will easily learn this unit, if they have a good background on the measurements of capacity, measurements of mass and the volume of solids (P5, unit 7).

7.3 Cross-cutting issues to be addressed

- **Gender balance**: provide equal opportunity to boys and girls in the lesson
- **Inclusive education**: promote education for all learners in the teaching and learning activities.
- **Environment and sustainability:** This will be addressed when pupils will be maintaining hygiene for their classroom and for materials they used.
- **Peace and values education:** addressed when pupils are encouraged to work collaboratively and peacefully in their group.

7.4 Guidance on introductory activity

Introductory activity:

In daily life, people use different containers (bottles, jerry cans, buckets, etc to carry water or other liquids. Each container has volume, capacity and mass and when it is full of water it has a certain mass.

(a) Did you ever try to think about the relationship between the capacity of a bottle, the quantity of water to fill the bottle and the mass of the bottle full of water?

(b) Do you think that the volume of a container, its capacity and its mass may have a relationship? Explain.

Guidance:

- Invite pupils to read the introduction in the learner's book and try to discuss answers in their groups.
- Invite them to a whole class discussion and show them a bottle, water in a small jerry can and the balance. Ask learners to write down the capacity of the bottle and then discuss the volume of the bottle and the mass of a bottle containing the water.
- Basing on their answers, experience, prior knowledge and abilities, ask them to discuss the relationship between the capacity of the bottle and the mass of a bottle containing the water.
- Invite them to discuss the relationship between the mass of water that fill the bottle and the volume of that bottle.
- Open a discussion with probing questions to facilitate them to give their predictions and ensure that you arouse their curiosity on what is going to be leant in this unit.

7.5 List of lessons/subheadings

#	Unit 6: Relationship between volume, capacity and mass	8 periods
	Lesson	**Number of Periods**
0	Introductory activity	1
1	Revision on mass Measurements	1
2	Revision on capacity measurements	1
3	Measurement of volume	1
4	Relationship between units of volume, capacity and mass	2
5	Real life problems involving the conversion between units of volume, capacity and mass	1
6	End unit assessment	1

Guidance on different lessons

7.5. 1 lesson 1: Revision on mass Measurements

a) Learning objectives

Solve problem about the conversion of mass measurements.

b) Teaching resources

Wall charts with problems on the conversion of mass measurements.

c) Learning activities

- Start with mental work on measuring the mass.
- Ask learners to form groups and provide each group with the materials required to carry out the learning activity from the learner's book.
- Walk around supervising them as they carry out the activity.
- Help them where they have difficulty.
- Ask learners to bring stones or other materials to be used for measurement
- Ask them to measure and record.
- Ask each group to present what it has got as the answer.
- Give a general observation about the results of the activity to help the learners internalize the concept.
- Guide learners through the example in the Learner's Book, page 119.
- Give learners an example to work out in groups and check on each group to see whether they have worked it out correctly.

Example

a) 30dag = ...g

Help learners to understand the worked example step by step.

Step 1: Compare what is already known

1dag = 10 g

Step 2: Compare proportionality.

That is, if we have 30 dag, we get (30x 10 g) which is equal to 300g.

b) 2,500 g = ...kg

Help learners to know how you convert from the small unit to the big unit through this example.
Step 1: Compare what is already known.

$$1g \text{ is equal to } \frac{1}{1{,}000} kg$$

$$So\ 2{,}500g \text{ will be equal to } \frac{1}{1{,}000} kg \times 2{,}500$$
$$= 2.5kg$$

- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 7.1** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers for application activity 7.1

1) (a) 523,000 dg (b) 6,661,500 mg 2) 47,600 kg

3) 613 20 kg or 6.65 kg (4) 231.42 kg 5) 7,500 g

6) Harmonize the answers

7.5. 2 lesson 2: Revision on Capacity Measurement

a) Learning objectives

Solve problem bout the conversion of capacity measurements

b) Teaching resources

Wall chart with problems on the conversion of capacity measurements.

c) Learning activities

- Start with mental work about units of capacity and volume for example;
  (a) What is the standard unit for measuring capacity?
  (b) What is the smallest unit of capacity?
  (c) Mention the units of capacity in order, starting with hectolitres.
  (d) Find the volume of a cube of side 2 cm and so on.
- Form groups of learners and provide each group with the necessary learning materials.
- Guide groups to carry out the learning activity from the Learner's Book, page 121.
- Allow each group to present to the whole class the findings and then, harmonize results.
- Check if all groups have required materials

Ask them to fill a jerrycan with water.
After filling it, pour out water. Them fill it with a litre bottle.
Ask them to record as they fill the jerrycan.
Take them through an example.

Convert: a) 3,400*l* to *kl*

1kl is already equal to 1000l

$$3450l \text{ should be equal to } \frac{3450}{1000} = 3.45$$

- Lead learners through the examples from the Learner's Book, page 121.
- Give other examples to enable learners have more practice.

- Give learners chance to formulate their own conversion problems. Guide where they need help.
- Let learner's re-read the conversion table for capacity measurement.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 7.2** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Give a simple exercise to slow learners to use a table, then answer:

1) 2 *kl* = …..*litres* 2) 8 *dl* = ….*ml*

3) 8 *dl* = ….*ml* 4) 4 *hl* = ….*dl*

5) 3*l* = …..*cl* 6) 5 *dal* =… *dl*

Extended activity

Give a complex exercise to fast learners like this one.

1) Convert 800 *ml* to *dal* 2) Change 400 *l* to *hl*.

3) Convert 42 *cl* to *hl* 4) Change 16 *dal* to *kl*.

5) What is 12 *hl* in *kl*? 6) Find the equivalent of 752 *cl* in *l*.

d) Answers for application activity 7.2

(1) 250 jerrycans (2) 2/3 *l* (3) 500,000 *l*

(4) (a) 6 small jerrycans (b) 2 *litres*

(5) 16,240 *dl* (6) Harmonize answers

7.5. 2 Lesson 2: Measurements of Volume

a) Learning objectives

Solve problem bout the measurements of volume

b) Teaching resources

Wall charts with problems on the measurements of volume.

c) Learning activities

- Give mental work about units of measurement of volume. For example: What is the standard unit for measuring volume?
- Mention the smallest unit for measuring volume?
- Give the units of measurement of volume.
- Let learners form groups.
- Distribute the prepared learning materials.
- Assign learners to carry out the learning activity from the Learner's Book.
- Collect the suggested answers of all groups and harmonize them in a whole class discussion to come up with general out comes:

Explain to learners that volume is the space occupied by an object.

Objects have different sizes, so different units are used.

There are different shapes of objects, so different methods are applied to work out their volume.

Draw a table of conversion between units of volume.

m^3			cm^3			mm^3		

- Explain that it is rare to have units of volume in dam^3, hm^3 and km^3.
- Learners should observe that unlike in measuring areas, in which units have 2 places in the table, units of measuring volume have 3 places in the table.
It is so because cubic units mean the unit is multiplied thrice by its self.
For examples: cm x cm x $cm = cm^3$; m x m x $m = m^3$.
Write an example on the chalkboard.
Example: Convert $2m^3$ to cm^3.
Emphasize that a conversion table has to be used.

m^3			dm^3			cm^3		
		2	0	0	0	0	0	0

Write 2 in the first place under m^3.
Fill all the places to the right with zero (0) to the last place under cm3.
- Learners observe and read the numeral of units formed. It is: 2 m^3 = 2,000,000 cm^3.
Now introduce calculation method.
Example: A cuboid has length, width, height of 10 cm, 8 cm and 6 cm. Calculate its volume.
Learners experienced this concept in Primary 5.
They are expected to recollect that:
Volume of a cuboid = length x width x height
= l x w x h
= 10 cm x 8 cm x 6 cm
= 80 cm^2 x 6 cm
= 480 cm^3
- Invite learners to go through the examples from the Learner's Book, page 122 and let learners observe, study and conclude in their own words how conversions have been handled.
- Then, assign them to work individually the **application activity 7.3** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity
Let slow learners practice more by re-doing the application.

Extended activity:

Fast learners should do a more complex exercise.
1. Convert 0.42 m^3 to dm^3.
2. Convert 9.004 dm^3 to cm^3.
3. Chane 0.003 m^3 to mm^3.
4. Convert 60,000 cm^3 to m^3.
5. Change 1.75 dm^3 to mm^3.

d) Answers for application activity 7.3

1) (a) 3,000,000 cm^3 (b) 15,000 cm^3
(c) 600 *dm*3 (d) 32,000 *dm*3

2) (a) 4 *m*3 (b) 15,000 *cm*3 (c) 700 *cm*3

3) (a) 620 *mm*3 (b) 1,200 *cm*3 (c) 1,078 *m*3

4) 48,000,000 *cm*3

5) Check for accuracy

6) Teacher's discretion

7.5. 4 lesson 4: Relationship between units of volume, capacity and mass of water

a) Learning objectives

Establish the relationship between units of volume, capacity and mass of water

b) Teaching resources

Wall chart with units of volume, capacity and mass.

c) Learning activities

- Help learners to form groups of pupils.
- Make sure each group may have access to a cup and beam balance.
- Ask learners to measure the mass of water filled in a cup.
- Ask them to measure the mass of water contained in a cup and its capacity.
- Ask them to identify the volume of the cup.
- Let them discuss and come up with the relationship between these three units of measurements.
- Exchange the ideas by presenting their work.
- Help them to draw the table that shows the relationship of these unit. What is the relation of litre, kilogram and dm3?

Solution

With the help of conversion table: for water, we have the following:

m^3			dm3			cm^3			mm^3		
		kl	hl	dal	l	dl	cl	ml			
		t	q	mg	kg	hg	Dag	g	dg	cg	mg
					1						

So 1 *kg* = 1 *l* = 1 dm^3

- Explain to them that these units are related only when we are measuring water.
- Guide learners to study the examples from the Learner's Book.
- Give other examples so that learners can understand.

Examples: Relate volume of the figure below with its capacity.

Note: This activity may take some time as learners carry it out but its worthy it for the learners will clearly see the relationship between volume and capacity.

- Come up with a general conclusion after discussing as class, that is;

A cube of volume 1,000 cm^3 or 1 dm^3 can hold a litre of water.

1 litre = 1,000 cm^3 or 1 dm^3.

- Guide learners as they study the examples from the the Learner's Book.

- Give other examples so that learners can understand.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 7.4** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers for application activity 7.4

1) 1 *kg* = 1 *dm*3 = 1 l; 1 *g* = 1 *cm*3 = 1 *ml*;
1 *t* = 1 *m*3 = 1 *kl*; 1 *hg* = 100 *cm*3 = 1 *dl*

2) 20 litres

3) No, 1 *litre* of cooking oil has more mass than 1 *kg* of water.

4) Explain as discussed.

7.5. 5 lesson 5: Real life problems involving the conversion between units of volume, capacity and mass

a) Learning objectives

Solve real life problems involving the relationship between units of volume, capacity and mass

b) Teaching resources

- Wall chart with units of volume, capacity and mass.
- Word problems on the relationship between units of volume, capacity and mass.

c) Learning activities

- Request learners to recall the relationship of volume ,capacity and mass measurement.
- Help them to form groups.
- Request them to draw a table showing the relationship of these unit.
- Give them the activity from the Learner's Book.
- Ask them to fill the given measurement in the place on the drawn table.
- Request them to convert them in the same unit as required.
- Let them record the related units.
- Give them time to explain to the class how they have got the answer.
- Give them opportunity to go through the example given.
- Now assign the groups to solve word problems from the manila paper or on the chalk board.
- Invite groups with different answers and methods to present answers in a whole class discussion.
- Harmonize answers and highlight the methods of solving a word problem.
- Ask them to find out which may be the concern when converting their unit.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 7.5** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Slow learners can find the relationship between capacity and mass in case of water using numbers which are simple. For example;

Find the capacity of water with the following mass**.**

1. The water in Uwera's jerrycan weighs 5 kg. Find the capacity of the water in Uwera's jerrycan.
2. Mrs Mulenga used 25 kg of water when washing. Calculate the capacity of water she used.
3. Yesterday I drunk 1.8 kg of water, how much water in litres did I drink?

Extended activity

Gifted learners can try out more complex problems such as the ones below:

1. Mrs Nkusi used 32 kg of water to wash the clothes, 8.5 kg to mop, 12.8 kg to wash the utensils and 4.3 kg to cook.

(a) Find the total mass of water she used.
(b) Express the amount of water she used in decalitres.

1. Ndoori loaded 105 boxes of water on a truck each with water weighing 18 kg.

(a) Calculate the capacity of water he loaded.
(b) Express the water he loaded in dal.

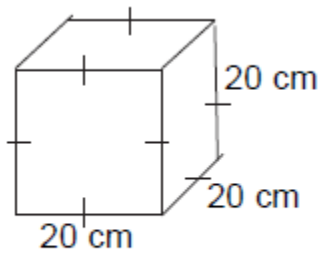
d) Answers for application activity 7.5

1) (a) 676,700 *cl* (b) 4,000,000 *g* (c) 98.65 *q* (d) 46,900 *ml*
(e) 1,700,000 cm3 (f) 32,500 *g*
2) 40 *l*, 40 *kg* 3) 10,000 *dm*2 4) 700 litres
5) (a) 10,000 *cm*3 (b) 100*q*
6) (a) 12,000,000 *cm*3 (b) 12 *m*3
7) (a) 2 *q* (b) 200,00 *ml*

7.6 Additional activities

Consolidation activities

Relate the capacity of the cube below with its volume.



since volume of a cube = s × s × s

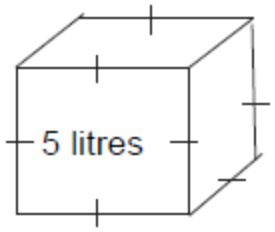
volume = 20 cm × 20 cm × 20 cm

= 8,000 cm^3

1,000 cm^3 = 1 litre

so 8,000 cm^3 = $\frac{8000}{1000}$

= 8 litres



since 1 litre = 1,000 cm^3
and 1,000 cm^3 = 1 dm^3
Then 5 litres = $5 \times 1{,}000\ cm^3$ or $5 \times 1\ dm^3$
= 5,000 cm^3 or 5 dm^3
So the volume of this cube is 5,000 cm^3 or 5 dm^3

Convert the following in given unit.

(a) 98,234 kg =…. m3

(b) 90 dm3 =…. kl

(c) 1ton =… g

(d) 12,641,564 g + 345,564 dag =… kl

Extension activities

(1) (1,243 *kg* + 23,453 cm3) × 22 = ……*kl*

(2) Munyana's cow gave birth to a calf. The cow gives her 10 *l* of milk a day. How many m3 does she collect in a month if her cow is milked the same amount everyday?

(3) Which bottle has the highest capacity than the other: a bottle of 5 *l* or that of 432 *ml*?

UNIT 8: SPEED, DISTANCE AND TIME

8.1 Key unit Competence

To be able to calculate speed, distance and time, solve problems that relate to different time zones and convert speed from km/hr to m/sec and vice versa

8.2 Prerequisites

Learners will perform well in this unit if they studied correctly the following:

- Solving problems involving time intervals (unit 8 of P5)

- Conversion of units of time: second, minutes, hours and days ((Unit 8 of P5)

-Conversion of length measurement (in P4)

8.3 Cross-cutting issues to be addressed

Throughout the teaching process of this unit, it will be crucial to help learners to master the content and it is better to address cross-cutting issues where possible. In this unit we will address the following Cross-cutting issues as non-standalone within classroom activities and through the development of the content.

Peace and value education: First of all, as a teacher, you have to be a peace maker in the class and role model so that learners will imitate how you behave. When there is any conflict do not leave without helping to solve it. Within the lesson, encourage learners to behave well, being humble, honest, etc.
Gender education: This cross-cutting issue will be addressed through giving equal opportunities to both boys and girls during the lesson.
Environment and sustainability: Through a problem, including the road where they pass let learner think of the usefulness of the roads and how they can take care of them.

8.4 Guidance on introductory activity

Introductory activity:
Imagine you are a business person who has to deliver goods to a customer, who also needs to distribute them to his or her customers.
(a) What should you do? Travel faster or slower? By which means?
(b) What might be the result for late delivery of goods to the customer?
(c) Do you think that there is a relationship between the time, the speed and the distance traveled? Establish that relationship.

Guidance:
-Help learners to form group before you assign them an activity.
- Invite them to read the introduction in the learner's book and try to discuss answers of questions in their groups.
- While they are doing the introductory activity, walk around while monitoring their work and helping where they have difficulties.

- Help learners to explain why some people who start moving from the same point at the same time to travel a same distance arrive at the same point at different times?
- Basing on their answers, experience, prior knowledge and abilities, Teacher helps learners to explain speed, distance and time.
- Open a discussion with probing questions to facilitate them to give their predictions and ensure that you arouse their curiosity on the relationship between time, distance and speed and solve related problems.

8.5 List of lessons/subheadings

	Content	Number of Periods
0	Introductory activity	1
1	Comparing the 12-hour format to the 24-hour format	1
2	Converting 12-hr format to 24-hr format and vice versa	1
3	The Concept of time zones	2
4	Solving mathematical problems relating to time zones	2
5	Speed in the motion	2
6	Converting the speed from km/hr to m/sec	2
7	Converting the speed from m/sec to km/hr.	2
8	Distance covered by a moving body	2
9	Speed and the time taken by a moving body to cover a certain distance	2
10	Moving bodies towards each other	2
11	Moving bodies towards each other	1
12	Moving bodies following each other	2
13	Calculating average speed	2
14	End unit assessment	1

Guidance on different lessons

8.5.1 Lesson 1: Comparing the 12-hour format to the 24-hour format

a) Learning objectives

Compare the time read on a 12-hour clock face and the time read on a 24-hour clock face

b) Teaching resources

Clock face, digital watch, wall charts with clock faces and digital watches indicating different times.

c) Learning activities

- In a whole class discussion, let learners have discussion on parts of the day (the day and night)
- Help learners to differentiate the two periods.

- Let them know that a day lasts 24 hours.
- As learners are organized in groups, distribute sheets of papers to each group and give them clear instructions:
    - Display charts showing the 12-hr format and 24-hr format faces.
    - Ask the learners to copy them onto the sheets of paper.
    - Guide them to discuss a.m. and p.m. time.
    - Let them compare the time readings on both clocks.
    - Ask learners to write compared time on the sheets of paper.
    - Let them discuss with other groups the comparisons.
- Lead them through the activity in the Learner's Book, page 127.
- Invite groups to present answers to the whole class
- Ask the learners to read the 12-hr format time relating it to 24-hr format time.
- Through question and answer, let learners respond to questions from their fellows.

Example: What is 3:00 p.m. in 24-hr format?

Express 19:00 hrs as 12-hr format time.

- Ask learners to explain how to read the time given by 12-hr format in 24-format.
- Refer to the examples in the Learner's Book, page 127 and 128.
- Ask oral questions about the lesson to help learners to conclude in their own words.
- Now let the learners read and discuss the Study tip as the summary.
- Invite them to work individually the application 8.1 from the leaner's book.

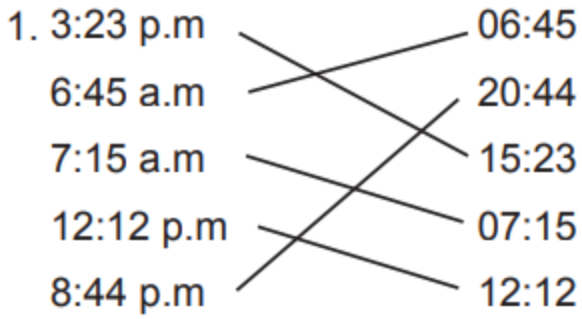
Note: Every learner should be actively involved.
In case you can get real clocks, use them for the benefits of understanding better.

- Give examples of business enterprises that use 24-hr format.
- Help slow learners to practice more comparing 12-hr format with 24-hr format.
- Depending on the results from the application activity, give them the consolidation activity to practice more reading of time of both the 12-hr format and 24-hr format.

Consolidation activity:

(a) 8:17 a.m. to 24-hr format.
(b) 12:03 p.m. to 24-hr format.
(c) 9:21 p.m. to 24-hr format.
(d) 07:49 hrs to 12-hr format.
(e) 21:20 hrs to 12-hr format

Answers of Application Activity 8.1



2. (a) 6:07 p.m = 18:07
(b) 12:15 p.m = 12:15
(c) 11:45 a.m = 11:45
(d) 7:05 p.m = 19:05

8.5.2 Lesson 2: Converting 12-hr format to 24-hr format and vice versa

a) Learning Objectives

-To change a.m. time to the 24-hr format, add 00:00 hours.
- To change p.m. time to the 24-hr format, add 12:00 hours.

b) Teaching resources and learning resources

-Clock face, digital watch, wall charts with clock faces and digital watches indicating different times

c) Teaching and learning activities:

- In the whole class, help learners to discuss on the relationship between a 12-hour clock and a 24-hour clock
- Help Learners to differentiate 12-hour clock and a 24-hour clock
-Help learners to form the small group
- Guide them to brainstorm/recall the previous lesson.
- Distribute sheets of paper to each group and give them clear instructions:

* Display charts showing Conversions of 12-hr format to 24-hr format and vice versa..
* Request them to match out the time given in the activity.
* Give them time to present their findings.
*Remind learners that a full day has 24 hours.
*Explain that a 12-hr format shows time twice in a single cycle of the 24-hr format.
* Facilitate them how to convert 12-hr format to 24-hr format, we should first observe if it is a.m. or p.m. time.
* Let them discuss with other groups the comparisons.

- Lead them through the activity in the Learner's Book, page 128-130.
- Invite groups to present their findings to the whole class

-In case it is a.m. time, it changes directly. That is, we add 00:00 to a.m. time. We do so because time has not reached or passed noon.
- If it is p.m. time, we change it by adding 12:00 hours. We do so because we count all the time from midnight or the beginning of a new day.
- Emphasise that 24-hr format is written with 4 digits.
- Guide the learners through the examples in the Learner's Book, page 130.
-Ask learners to formulate their own questions.
- Let one group challenge another for giving the correct conversion from 12-hr format to 24-hr format.
- Give some more examples as learners work them out on slips of paper.
- Evaluate their work.
-Let learnes to conclude and ask for the learner's opinions.
- Ask the learners todo individually the Application 8.2 in the Learner's Book, page 130.
-Emphasise the addition of 00:00 to a.m. time and 12:00 to p.m. time when converting to 24-hr format.
- Minutes passed 12:00, eg 12:05 p.m. and minutes passed midnight eg 12:15 a.m. may be confusing to the learners.
- Devise methods of simplicity to overcome the challenge.

Answers of Application Activity 8.2

(a) 16:21 hr (b) 17:56 hr (c) 09:12-hr (d) 08:45 hr (e) 00:46 hr (f) 10:43 hr
(g) 13:59 hr (h) 07:18 hr (i) 03:14 hr (j) 14:49 hr (k) 17:00 hr (l) 09:56 hr

Remedial Exercise

Let slow learners attempt the exercise below:
Ask the learners when the following activities take place then convert to 24-hr format.
(1) Time for entering the class.
(2) Time for break.
(3) Time for lunch.
(4) Time for ending lessons.
(5) Time of midday.
(6) Time of midnight.

Additional Exercise

Let fast learners attempt the exercise below:
(1) The time now is 5:17 p.m.. What time will it be 8 hours later? Convert to 24-hr format.
(2) It is midday. What will be the time 12 hours later? Change it to 24-hr format.
(3) If it is midnight, what time will it be 15 hours and 13 minutes later. Express as 24-hr format.
(4) It is 12:20 a.m. How long is the new day?
(5) 17 hours was the flight from New York to Kigali. A passenger left New York at 3:45 p.m.. At what time did he arrive in Kigali? Convert to 24-hr format.

8.5.3 Lesson 3: The Concept of time zones

a)Learning Objectives
-To explain the concept of time zones.
- State the time of each zone.
- Find time reading in the time zones.
b) Teaching resources and learning resources
-World map that show time zones or Atlas**.**
d) Teaching and learning activities
- In a whole class, let learners have discussion on concept of time zones.
-Help learners to form the small groups.
- Help them to discuss on causes of having different time in different region and give them time to share their discussion.
-Let them know that they are going to study time zone.
- Give out Atlases or let the learners use their own.
-Refer to the world map showing time zones on page 133.
- Guide the learners through the activity in the Learner's Book, page 132.
-give them the time to present their findings .
- Lead learners to realise that there are 24 time zones in the world.
- Each time zone is represented by 15^{o}.
- The international date line lies on a longitude of 180^{o} East of the Greenwich Meridian.
- Help them to identify the Greenwich meridian.
- Explain that, the Greenwich meridian is the most important longitude when determining the world time zones.
- According to the Learner's Book and let the learners study and analyze the example.
- Let the learners read and discuss the Study tip.
- Ask them to do individually the **Application 8.4** in the Learner's Book, page 134.
- Let learners present their work.
- After presentation let them write down the summary made in their books.
- In case you have availability of the internet, use it for more information and let learner to know
- Explain the concept of gaining time as one moves to West. and also of losing time as one moves to the East.
- Also explain that further from the international date line to the East, we lose a full day.
- Give learners more numbers as homework to help them understand the concept better.

Answers of Application 8.4

(a) 2:00 a.m.	(b) 5:00 p.m.	(c) 10:00 a.m.	(d) 12:00 noon
(e) 9:00 a.m.	(f) 7:00 p.m.	(g) 12:00 a.m.	(h) 12:00 noon

8.5.4 Lesson 4: Solving mathematical problems relating to time zones

a) Learning Objectives

-To find time of another time zone to the West.
-To find time of another time zone to the East.
-To solve mathematical problems that relate to time zones.

b) Teaching resources and learning resources
World map that show time zones or Atlas.

c)Teaching and learning activities
- In a whole class, help learners to have discussion on the concept of time zones.
-Help learners to form the small groups.
-Give out Atlases, World map or let the learners use their own if they have.
- Help learners to discover the time zones by using the world map.
- Guide the learners through the activity in the Learner's Book, page 134.
- Guide learners on how they can calculate the time of a particular place or town, by considering the position of the time zone it is further from the 00.
-Facilitate learners to perform some examples :

Example: It is 12:00 midnight in Greenwich. What time is it in Rwanda?

Solution: Rwanda lies on 300 longitude east of Greenwich.
Places to the East are later in time.
Places in the 1st zone to the East are 1 hour later.
Rwanda is in the 2nd time zone from Greenwich (0 time zone).
1st time zone = 1 hour
2nd time zone = 2 x 1 hour= 2 hours
Add 2 hours to the time in Greenwich 12:00 midnight is the end of the 24-hr day.
So a new day begin: 00:00 + 02:00 = 02:00. It is 2:00 a.m in Rwanda.
-Lead them to realize that Rwanda is 8 hrs ahead of America in time. If it is 4:00 p.m. in New York, it is 12:00 midnight in Rwanda.

- Facilitate learners to do the provided examples given in **Student's book** and work individually **application8.5** to check the skills they have acquired

Answers to Application 8.5:

(1) 5:00 p.m.	(2) 8:00 p.m.	(3) 12:00 midnight
(4) 3:00 a.m.	(5) 2:50 p.m.	(6) 8 hours

Remedial activity
(1) Given that 15^0 = 1 hour, calculate the hours in
(a) 45^0 (b) 60^0 (c) 90^0 (d) 180^0
(2) It is 2:00 am in New York. What is the time in Rwanda?

8.5.5 Lesson 5: Speed in the motion

a) Learning Objectives

-To describe the concept of speed in the motion**.**
-To calculate the speed**.**

b) Teaching resources and learning resources
Chart, Clock face, digital watch, wall charts with clock faces and digital watches indicating different times ; Map that show the speed covered and uncovered .

c) Teaching and learning activities:
-In group discussions, invite learners to do activity in learner' book on motion and related to the speed.
-Use gallery walk, learners share their answers to others by rotating and ask support on challenging points they faced in their group.
-Move around to see learners progress in their respective groups.
-Invite groups with different working steps to present their answers then, harmonize the presented answers.
-After doing activity 8.6, use different questions and guide learners to discover that the distance in metres that was covered by each individual in one second.
-Help learners to brainstorm and realize that each individual covered a different distance in one second; Though they all covered the same distance and help them to discover that the speed can be expressed by metres per second, (m/sec) or kilometers
per hour (km/hr) as units of speed.
- Facilitate them to do the provided examples given in **Student's book** and work individually **application 8.6** to check the skills they have acquired

Answers for application 8.6:

(1) 60 km/hr (2) 90 km/hr
3) (a) 40 km/hr (b) 50 km/hr (c) 40 km/hr
(4) 60 km/hr (5) 20 m/sec

8.5.6 Lesson 6: Converting the speed from km/hr to m/sec

a) Learning Objectives

-To Convert from km/hr to m/sec

b) Teaching resources and learning resources

-The chart that show how we convert from kilometer to metres and how we convert from hours to seconds.

-Flash cards

c) Teaching and learning activities:

-In group discussions, invite learners to do activity 8.7 in learner' book on Converting from km/hr to m/sec

-Use gallery walk, learners share their answers to others by rotating and ask support on challenging points they faced in their group.

-Move around to see learners progress in their respective groups.

-Invite groups with different working steps to present their answers then, harmonize the presented answers about conversion of kilometers to metres and hours to seconds.

-After doing activity 8.7, use different questions and guide learners to discover how to convert speed in km/hr to speed in m/sec.

-Facilitate learners to do the provided examples given in **Student's book** and work individually **application 8.7** to check the skills they have acquired.

Answers of application 8.7

1) (a) 25 m/sec (b) $16\frac{2}{3}$ m/sec (c) 50 m/sec (d) 15 m/sec (e) 70 m/sec

2) 200 m/sec 3) (a) 25 km/hr (b) $6\frac{17}{18}$ m/sec

4) 15 m/sec 5) 20 m/sec

Remedial activity

Let slow learners try out the following

Convert to m/sec

(1) 10 km/hr (2) 12 km/hr (3) 8 km/hr

(4) 20 km/hr (5) 6 km/hr

(6) A pedestrian walks 4 kilometers per hour to work. What is his speed in metres per second?

(7) A speed of 9 km/hr was moved by a road grader. Express it as metres per second.

(8) Kalisa rode a bicycle at a speed of 10 km/hr. Change it to metres per second.

Extended activity:

Let fast learners practice the following

(1) 1.2 km/hr (2) 3.6 km/hr (3) 14.4 km/hr (4) 32.4 km/hr

(5) Mutesi drove her car for 2 hours covering a distance of 144 km. Express her speed as metres per second.

(6) Tourists visited a National park. Their driver covered 240 km in 6 hours. What was his average speed in metres per second?

(7) A fire work was propelled at a speed of 720 km/hr. Express the speed as metres per second.

8.5. 7 Lesson 7: Converting the speed from m/sec to km/hr

a) Learning Objectives

-To Convert from m/sec to km/hr

b) Teaching resources and learning resources

-The chart that show how we convert from kilometer to metres and how we convert from hours to seconds and vice versa.

d) Teaching and learning activities:

-In group discussions, invite learners to do activity 8.8 in learner' book on Converting from m/sec to km/hr
-Use gallery walk, learners share their answers to others by rotating and ask support on challenging points they faced in their group.
-Move around to see learners progress in their respective groups.
-Invite groups with different working steps to present their answers then, harmonize the presented answers.
-After doing activity 8.8, use different questions and guide learners to discover how to Convert from m/sec to km/hr by using the following steps:

(i) Express 1m as a fraction of a kilometre, then multiply the number of metres by $\frac{1}{1000}$ kilometres. Remember 1 km = 1,000 m.
i.e. 1m = $\frac{1}{1000}$ km, 20 m = 20 × $\frac{1}{1000}$ km = $\frac{20}{1000}$ km

(ii) Express 1 second as a fraction of 1 hour. remember 1 hour = 3,600 seconds. It gives $\frac{1}{3600}$ of an hour.

(iii) Speed = distance per unit time

(iv) So we divide the fraction of a kilometre by the fraction of an hour.

(v) Apply division of fractions by multiplying by the reciprocal.

Example: Express 20 m/sec as km/hr

1000 m = 1 km
1m = $\frac{1}{1000}$ km
3600 sec = 1 hr
1 sec = $\frac{1}{3600}$ hr

20m/s = $20 \times \frac{1}{1000} \div \frac{1}{3600}$ hr
= $\frac{20}{1000} \times \frac{3600}{1}$
= 2 x 36
= 72 km/hr

Refer to the examples in the Learner's Book, page 139.
-Facilitate learners to do the provided examples given in **Student's book** and work individually **application 8.8** to check the skills they have acquired.

Remedial activity
Let slow learners try out the following
1. Express to km (don't reduce to lowest terms).

(a) 20 metres (b) 5 metres (c) 10 metres
(d) 15 metres (e) 30 metres
2. Express to hours.(do not reduce to lowest term)
(a) 5 seconds (b) 12 seconds (c) 15 seconds (d) 20 seconds
3. (a) An athlete covered a distance of 100 metres. Express the distance in kilometers.
(b) Tunga drives racing cars. He drove the first leg in 300 seconds. Express as hours.

Extended activity:

Let fast learners practice the following
1. Express to km/hr.
(a) 120 m/sec (b) 400 m/sec (c) 500 m/sec
(d) 14.4 m/sec (e) 3.6 m/sec
2. (a) 100 m for 20 seconds (b) 180 m for 40 seconds
3. (a) Mukayahi threw javelin. It covered 50 metres, it took 5 seconds to land. What was its speed in kilometres per hour?
(b) Richard was playing darts. He threw the spike for a distance of 5 metres. It lasted in air for 2 seconds. At what speed was the spike moving?

Answers of application 8.8.

1)	(a) 54 km/hr	(b) 162 km/hr	(c) 90 km/hr	(d) 360 km/hr
2)	720 km/hr	3) 36 km/hr	4) 24 km/hr	
5)	36 km/hr	6) 144 km/hr		

8.5.8 Lesson 8: Distance covered by a moving body

a) Learning Objectives

-To calculate the distance covered by a person or an object.

b) Teaching resources and learning resources

-The chart that shows the distance covered by a person or an object.

c) Teaching and learning activities:

As introduction, learners define the speed and remind the previous lesson.
-Ask learners mention the metric units of distance.
-In group discussions, invite learners to do **activity 8.9** in learner' book about calculation of the distance covered by a person or an object.
-Use gallery walk, learners share their answers to others by rotating and ask support on challenging points they faced in their group.
-Move around to see learners progress in their respective groups.

-Invite groups with different working steps to present their answers then, harmonize the presented answers.
-After doing activity 8.8, use different questions and guide learners to discover that the product of speed and time gives the distance . i.e. **Distance = Speed × Time**.

-Facilitate learners to do the provided examples given in **Student's book** and work individually **application 8.9** to check the skills they have acquired

Answers of application 8.9:

1) 10 km 2) 24 km 3) 400 km
4) 300 m 5) 120 km

Remedial activity
Let slow learners re-do activity 8.9. Emphasise application of multiplication of fractions when dealing with fractional time. Kilometres and metres are the commonly used units of distance when calculating distance. However, you can use other metric units of distance.

Extended activity:
Prepare more questions to help fast learners.
Calculate the distance, then complete the table.

Speed	Time	Working	Distance
10 m/s	5 seconds		
15 m/s	4 seconds		
20 m/s	6 seconds		
40 km	2 hours		
100 km	5 hours		

a) A certain distance is covered in 19 seconds. If the speed is $6\frac{1}{2}$ m/sec, calculate the distance.
(b) Uwera run a certain distance. She run at a speed of 9.8 m/sec. She covered it in 115 seconds. What distance did she cover?
(c) A moving body moved at a speed of 12.3 m/sec. It took 55 seconds. How long was the distance?
(d) A racing car was running at a speed of 333.3 km/hr. It covered the route in 9 hours. Calculate the distance it covered.
(e) Ali drove his car at 120.25 km/hr. He took 3 hours. calculate the distance he covered.
(f) The speed of a racing boat is 219 km/hr. It spent $3\frac{1}{3}$ hrs cruising. What distance did it cover?

8.5.9 Lesson 9: Speed and the time taken by a moving body to cover a certain distance

a)Learning Objectives

To calculate the time used by a person or an object to cover a certain distance

b) Teaching resources and learning resources

-Chart that show the time used by a person or an object to cover a certain distance.

d) Teaching and learning activities:

- Help learners to form the small groups.

-In group discussions, invite learners to do **activity 8.10** in learner' book about calculation of the time used by a person or an object to cover a certain distance.

-Use gallery walk, learners share their answers to others by rotating and ask support on challenging points they faced in their group.

-Move around to see learners progress in their respective groups.

-Invite groups with different working steps to present their answers then, harmonize the presented answers on calculation of the time used by a person or an object to cover a certain distance

-After doing activity 8.10, use different questions and guide learners to discover that the time is equal to the distance divided by the speed when the distance and speed are given. i.e

$$Time = \frac{dis\tan ce}{Speed}$$

-Facilitate learners to do the provided examples given in **Student's book** and work individually **application 8.10** to check the skills they have acquired

Answers of application 8.10

1) 3 hrs 2) 3 hrs 3) $1\frac{1}{2}$ hrs 4) 4 hrs

Remedial activity

Let slow learners calculate time given;

1. Distance is 40m, speed is 10 m/sec.
2. Distance is 50 m, speed is 5 m/sec.
3. Distance is 100 m, speed is 20 m/sec.
4. An athlete run a distance of 200 m at a speed of 10m/sec. calculate the time he took.
5. Distance is 10 km, speed is 5 km/hr.
6. Distance is 15 km, speed is 15 km/hr.
7. Distance is 20 km, speed is 10 km/hr.
8. A bus covered a distance of 100 km. Its speed was 50 km/hr. What time did it take?

Extended activity

Fast learners can calculate time given;

1. Distance is 1800 m, speed is 41 2 m/sec.
2. Distance is 960,120 m, speed is 12 m/sec.
3. Ikiza covered a distance of 1200 m from home to school. She was walking

at a speed of 1.5 m/sec. what time did she take?
4. Distance is 100 km, speed is 80 km/hr.
5. Distance is 575 km, speed is 92 km/hr.
6. Gasoma was driving his car at a speed of 132 km/hr. he covered a distance of 418 km. Calculate the time he took.

8.5.10 Lesson 10: Moving bodies towards each other

a) Learning Objectives
To calculate speed, time and distance of moving body towards each other.
b) Teaching resources and learning resources
Chart that shows the moving body towards each other.
c) Teaching and learning activities:
-Let learners to make a review on the previous lesson.
-Help them to form the small groups and guide the learners through the **activity 8.11** and moderate the discussion.
- Facilitate the learners to discover that two moving bodies towards each other take the same time to meet, but cover different distances.
- Guide learners to discover that the meeting time can be calculated basing on the time each can take to cover the whole distance.
-Help learners to explorer the following example:
Example: James and Alice were on opposite sides of a track. They run towards each other. James took 5 minutes to cover the track, Alice took 4 minutes. After how long did the two meet?

Solution:

James took 5 minutes
1 minute, he covered $\frac{1}{5}$ of the track.
Alice took 4 minutes
1 minute, she covered $\frac{1}{4}$ of the track.
In 1 minute, both covered $\frac{1}{5} + \frac{1}{4}$
$= \frac{4+5}{20}$
$= \frac{9}{20}$ of the track
Both met after;
whole distance divided by the time both met after 1 minute.
$1 \div \frac{9}{20} = 1 \times \frac{20}{9}$
$= \frac{20}{9} = 2\frac{2}{9}$ minutes.

-Invite groups with different working steps to present their answers then, harmonize the presented answers.
-Facilitate learners to do the provided examples given in **Student's book** and work individually **application 8.11** to check the skills they have acquired

Answers of application 8.11

1) 90 km, 70 km 2) 18 km/hr 3) After $2\frac{1}{2}$ hours
4) 200 km 5) 30 km/hr

Remedial activity:
Slow learners can try out the exercise below for practice.

1. Write one part of each of the following.
(a) 3 (b) 4 (c) 6 (d) 9 (e) 12
2. Calculate the following:

(a) $\frac{1}{2} + \frac{1}{2}$ (b) $\frac{1}{2} + \frac{1}{3}$ (c) $\frac{1}{3} + \frac{1}{4}$

Work out

(a) $1 \div \frac{1}{2}$ (b) $1 \div \frac{1}{3}$ (c) $1 \div \frac{1}{4}$

Extended activity:
Prepare more questions to help fast learners
Work out the following;
1. Nsenga travelled from town Q to town P. He took 3 hrs. Irebe covered the same distance, but from P to Q she took 4 hours. The distance was 140 km.
(a) At what time did both meet?
(b) Calculate the distance each covered when they met?
2. A bus started its journey from Kampala to Kigali. It took 8 hrs. A taxi started from Kigali to Kampala. It took 6 hours. The distance from Kigali to Kampala is 514 km.
(a) Calculate the time both met.
(b) What distance had each covered when they met?

8.5.11 Lesson 11: Moving bodies following each other

a) Learning Objectives

-Solving problems related to moving bodies following each other.

b) Teaching resources and learning resources

Chart that shows the moving body towards each other.

d) Teaching and learning activities:

-To make a review on previous lesson on calculating time.
-Help learners to form groups and guide the learners as they carry out the **activity 8.12** in the Learner's Book, page 145.
-After group discussions on the activity 8.12 ,invite learners to present their findings in the class.
- Help learners to harmonize theirs answers on solving problems related to moving bodies following each other.
- Facilitate learners to do the provided examples given in **Student's book** and work individually **application 8.12** to check the skills they have acquired.

Answers of application 8.12

1) 5 p.m. 2) 60 km/h 3) 180 km
4) (a) 3 hrs (b) 120 km

Remedial Exercise
Slow learners can try out the exercise below for practice.
1. Two boys run a distance of 50 metres. One was running at a speed of 25 m/sec and the other one was running at a speed of 10 m/sec. What was the difference between each one's time of arrival?
2. A motorcycle and a bicycle were moving in the same direction. Both covered 10 km. The motorcycle was moving at 10 km/hr. The bicycle was moving at 5 km/hr. What was the difference between their arrival time?
3. A dog run at 8 km/hr. A goat run at 4 km/hr. Both covered 8 km. What was the difference between their arrival time?

Additional Exercise
Prepare more questions to help fast learners
1. A car and a lorry were moving in the same direction. They started at the same time, same place. A car was moving at 120 km/hr and a lorry at 80 km/hr. Both covered 200 km. What was the difference in the time of arrival?
2. Both a cat and a kitten started running in the same direction. The cat was running at 4 m/sec while the kitten run at 2 m/sec. Both covered 10 m. Calculate the difference in time taken.
3. Two racing cars one was running at 225 km/hr. The other one was running at 250 km/hr. Both covered 1200 km. Calculate the difference in their arrival time.

8.5.12 Lesson12: Calculating average speed

a) Learning Objectives

-Be able to calculate average speed.

b) Teaching resources and learning resources

Chart that have some abbreviations related to new lesson and the formula of calculating average speed.

d) Teaching and learning activities:

-Make a small review on the previous lesson.
- Give some mental drills about speed.
- Help learners to form small groups according to your plan.
-In group discussions, invite learners to do **activity 8.13** in learner' book about calculation of average speed.
-Use gallery walk, learners share their answers to others by rotating and ask support on challenging points they faced in their group.
-Move around to see learners progress in their respective groups.

-Invite groups with different working steps to present their answers then, harmonize the presented answers on calculating average speed.
-After doing activity 8.13, use different questions and guide learners to discover that

$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

$$= \frac{\text{First distance + second distance}}{\text{First time + second time}}$$

-Facilitate learners to do the provided examples given in **Student's book** and work individually **application 8.13** to check the skills they have acquired

Answers of application 8.13

1)	40 km/hr	2)	60 km/hr	3)	96 km/hr	4)	42 km/hr
5)	72 km/hr	6)	$44\frac{2}{3}$ km/hr	7)	80 km/hr	8)	36 km/hr

Remedial activity
Give slow learners work which is simpler for practice.
1. A pedestrian walked a distance of 10 km to visit a friend. He took 2 hours. He returned through the same road. He took 3 hours. What was his average speed?
2. A tractor covered 40 km in 1 hour. It continued to another farm covering 80 km in 2 hours. What was its average speed?
3. A train covered 20 km in 1 hour. It covered another 40 k in 2 hours. Find its average speed.

Extended activity
Give fast learners complex numbers to work out.

1. Town P is 180 km from town R. A bus covered the distance in $1\frac{1}{2}$ hours.

It continued to another place 150 km away in 2 hours. It further went to another distance of 175km taking 3 hours. Calculate the average speed of the car.
2. Ali the driver of a pickup covered a certain distance at a speed of 65 km/hr. He took 3 hours to cover the distance. On his return journey, he took 2 hours. What was his average speed?
3. An aeroplane covered 1,200 km in 5 hours. On return, it traveled at a speed of 240km/hr. Calculate its average speed.

8.6 Answers of the end of unit 8 Assessment

1) (a) 10:00 a.m. (b) Angel's distance 60km, Karemera's distance 90 km
2) 250 km 3) 25 m/sec 4) 8:30 hr
5) (a) 140 km (b) 560 km
6) (a) 60 km (b) 100 km 7) 80 km/hr 8) 39 km/hr
9) 1:30 a.m. 10) 2:15 p.m.

8.7 Additional activities

Consolidation activities

Convert**:**

1) 90 km/h into m/sec
2) 60 m/sec into km/h
3)50km/h into m/se
4) Find the speed of a motorcyclist moves 150 km in 3 hours.

Extensional activities

1. From Moses' to Nadia's residence, there are 160 km, they agreed to meet at a certain place. They left their homes at 8:00 a.m.. Moses had a speed of 30 km/h while Nadia had a speed of 20 km/h.
(a) At what time did they meet?
(b) What distance did each cover before they met?
2. What distance did I cover if I drove from Kigali towards Huye for 2 hours at a speed of 55 km/h?

UNIT 9: SIMPLE INTEREST AND PROBLEMS INVOLVING SAVING

9.1 Key unit competence

Work out on simple interest and solve problems involving saving.

9.2 Prerequisites

Pupils will easily learn this unit, if they have a good background on money and its financial applications learnt in unit 9 of P5.

9.3 Cross-cutting issues to be addressed

Throughout the teaching process of this unit, it will be crucial to help learners to master the content and it is better to address cross-cutting issues where possible. In this unit, we will address the following cross-cutting issues as non-stand alone within classroom activities and through the development of the content. We will also emphasize on financial education as non-stand alone because this unit deals with money.

Peace and value education: First of all, as a teacher you have to be a peace maker in your class and role model so that learners will imitate how you behave. When there is any conflict do not leave without helping to solve it within the lesson. Encourage learners to behave well, being humble, honest, etc.

Gender education: This cross-cutting issue will be addressed through giving equal opportunities to both boys and girls during the lesson.

Financial education: This should be addressed via problems that imply the ways of using money that encourages learners in saving and investing. Within this unit ,this cross-cutting issue should be focused on because emphasis should be put on money issues, in daily life.

9.4 Guidance on introductory activity

Introductory activity:

A person put money in the bank for a year amounting to 200,000 Frw. The bank gave him/her 10 out of each 100 Frw for using his/her money.

(a) How much more money was he/she given?

(b) Why do you think we should save our money in the bank?

(c) Can you give different possibilities of using money and getting interest without saving it in the bank?

d) How does interest benefit us in our daily life?

Guidance:

This unit will be concerning simple interest and saving. This unit is mainly related to financial issues.

- Invite pupils to read the introduction in the learner's book and try to discuss answers in their groups.
- Invite them to a whole class discussion and ask groups to present answers they got when discussing
- Guide learners to explain more clearly the interest, its advantages and different ways in which we can get interest.

- Open a discussion with probing questions to facilitate them to give their predictions and ensure that you arouse their curiosity on what is going to be leant in this unit.

9.5 List of lessons/subheadings

	Unit 9: Simple interest and problems involving saving	**24 periods**
	Lesson	**Number of Periods**
0	Introductory activity	1
1	Calculating the simple interest	1
2	More about calculating simple interest	2
3	Solving problems involving simple interest	2
4	Calculating interest rate	2
5	Solving problems involving interest rate	1
6	Calculating principal	2
7	Solving problems involving principal	1
8	Calculating the time	1
9	Solving problems involving time	1
10	Calculating the amount of money	2
11	Solving problems involving amount of money	2
12	Different ways of saving and how saving can be done	2
13	Saving money in the bank or putting it in investments	1
14	Solving problems involving savings	2
15	End unit assessment	1

9.5. 1 Lesson 1: The simple interest

a) Learning objectives

- Define the simple interest
- Calculate the simple interest on the principal P invested in the period of T years with interest rate (R).

b) Teaching resources

- Wall chart with explanations of simple interest.
- Word problems on the simple interest.
- Textbooks, calculators,

c) Learning activities

- Give simple calculations about saving money as mental work, for example, supposing you have 500 Frw and you spend 300 Frw. How much do you save?
- Distribute the learners in groups and give out sheets of paper to each groups.
- Introduce the lesson as calculating simple interest.
- Guide the learners through the activity from the Learner's Book, page 151.

- Having sought the meaning of the terms, principal, time, rate and simple interest, check for their definitions.
- Distribute flashcards, some with the terms while others bear their definitions. For example,

Time	Interest percentage of the principal	Interest rate
Length of time for which the money is borrowed or lent	Any money lent or borrowed	Principal

- Give one flash card to each group.
- Ask a group representative to flash a card, then request the other to respond by flashing a card matching with the former.
- Let the learners carry on the activity until all cards are matched.
- Now mix all the cards on your table.
- Ask individual learners to take turns in pairing a term card with a definition. Ensure that all learners are involved.
- Now conclude by the remarks:

- Simple interest is the extra money paid to the money lender or bank customer or it is extra money paid by the bank or SACCO to the customer.
- Principal is any money lent, borrowed or saved in a bank or SACCO.
- Time is the period or length of time for which the money is borrowed, lent or saved.
- Rate is the interest percentage of the principal. It can be per month or per year (p.a).

- Explain that the calculation they have just carried out was about calculating simple interest. So, simple interest = Principal × Time × Rate
- Display the chart with worked example.

- Ask the learners to identify the **principal**, **time** and **rate**.

Let them follow through the working. Assist where necessary.
Guide the learners through the examples.
Explain that if time is given in months, express them in fractional years.
And, if rate is given as a fractional percentage, change it to a common fraction.

e.g 6 months = $\frac{6}{12}$ of a year or $\frac{1}{2}$ of a year.

Rate = $7\frac{1}{2}\% = \frac{7 \times 2 + 1}{2 \times 100} = \frac{14 + 1}{200} = \frac{15}{200}$

- Explain situation where rates are per month and when rates are per year.
- Guide the learners especially the slow learners on how to express fractional percentages as common fractions.
- Teach problems involving simple interest following the same procedure each time taking note of rate and time.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 9.1** in the Learner's Book.

Mark their work and help them with corrections.

- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Let slow learners calculate the simple interest given that;

1. (a) Principal is 20,000 Frw, time is 2 years, rate is 10% per year.

(b) principal is 30,000 Frw, time is 1 year, rate is 5% per year.

(c) Principal is 10,000 Frw, time is 2 years, rate is 20% per year.

2. Kwizera deposited 50,000 Frw in a bank. He was given an interest rate of 10% per year. The money was in the bank for 2 years. What was the simple interest?

Extended activity

1. a)Let fast learners calculate more challenging questions on simple interest

What is the interest on 116,500Frw after $2\frac{1}{2}$ years at $11\frac{1}{4}\%$ per month?

(b) Calculate the simple interest on 2,04600Frw after $5\frac{1}{4}$ years at 12% per year.

(c) An interest rate of $27\frac{1}{3}$ per year was offered on 3,069,000 Frw. If the time was 8 years, calculate the interest.

2. Yudesi borrowed 10,640,000 Frw from Amavubi Savings and credit Society. She was to pay back the money after $2\frac{2}{3}$ months at a rate of $6\frac{1}{2}\%$ per year.

Calculate the simple interest she paid back.

d) Answers to Application 9.1

(1) 20,000 Frw (2) 234,000 Frw (3) 480,000 Frw

(4) 360,000 Frw (5) 1,200,000Frw (6) 972,000 Frw.

9.5. 2 Lesson 2: More about calculating simple interest

a) Learning objectives

Calculate the simple interest on the principal P invested in the period of T years with interest rate (R).

b) Teaching resources

- Word problems on the simple interest.
- Textbooks, calculators,

c) Learning activities

- Give a warm-up exercise of your choice to the learners.
- Form groups among the learners.
- Let them get involved with the learning activity in Learner's Book, page 153.
- Invite groups to present answers and harmonize them to make a general report.

Explain the main competence of the lesson.

Tell learners that sometimes, considering interest, time can be in months and interest in fractional percentages.

So, the months are expressed as fractions of 12 months of a year.

4 months $= \frac{4}{12}$ of a year or $\frac{1}{3}$, 6 months $= \frac{6}{12}$ or $\frac{1}{2}$ of a year.

8 months $= \frac{8}{12}$ or $\frac{2}{3}$ of a year, 3 months $= \frac{3}{12}$ or $\frac{1}{4}$ of a year.

- Fractional percentages are expressed as fractions, that is:

$$2\frac{1}{3}\% = \frac{2 \times 3 + 1}{3} \div 100 = \frac{7}{3} \times \frac{1}{100} = \frac{7}{300},$$

$$12\frac{1}{2}\% = \frac{12 \times 2 + 1}{2} \div 100 = \frac{25}{2} \div 100 = \frac{25}{2} \times \frac{1}{100} = \frac{25}{200} \text{ and so on.}$$

- Give more examples of months and fractional percentages for learners to do more practice.
- Refer to the example from the Learner's Book, page 153.
-Considering the experience, the learners have been subjected to in handling months and fractional percentages, learners follow through as you guide them.
- Give similar examples in order to expose learners to more practice.

Example: Give that: Principle = 1,680,000 Frw, Interest rate = $12\frac{1}{2}\%$ and time = 8 months, calculate the simple interest.

$$\text{Simple interest} = P \times \frac{R}{100} \times T$$

$$= 1{,}680{,}000 \times 12\frac{1}{2}\% \times \frac{8}{12}$$

$$= 1{,}680{,}000 \times \frac{25}{200} \times \frac{8}{12}$$

$$= \overset{5600}{\cancel{1{,}680{,}000}} \times \frac{25}{\cancel{200}_{1}} \times \frac{\cancel{8}^{1}}{\cancel{12}_{3}_{1}}$$

$$= 5{,}600 \times 25 = 140{,}000 \text{ Frw}$$

- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 9.2** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activities

Slow learners attempt this work.

1. Convert to fractions.

(a) $9\frac{1}{2}\%$ (b) $6\frac{1}{4}\%$ (c) $12\frac{1}{4}\%$ (d) $20\frac{1}{5}\%$

2. Convert to years.

(a) 2 months (b) 4 months (c) 7 months (d) 9 months

3. Given that the principle is 10,000 Frw, rate is $12\frac{1}{2}\%$ and time is 6 months, find the simple interest.

Extended activities

Fast learners should attempt a more complex exercise.

1. Given; simple interest is 62,500 Frw, principle is 200,000 Frw and interest rate is $12\frac{1}{2}\%$, find time.

2. If principle is 1,460,000interest rate is $17\frac{1}{2}\%$ and time is 15 months, calculate simple interest.

d) Answers to Application 9.2

(1) 15,000Frw (2) 1,557,750Frw (3) 74,250 Frw (4) 240,000Frw

(5) 62,500Frw (6) 19,085 Frw (7) 319,375 Frw (8) 69,000 Frw

9.5. 3 Lesson 3: Word problems involving simple interest

a) Learning objectives

Solve problem involving simple interest

b) Teaching resources

- Word problems on the simple interest.
- Textbooks, calculators,

c) Learning activities

- Review the methods of working out simple interest.
- Form groups of learners and let them carry out the activity in the Learner's Book, page 154.
- Guide them in getting the correct answers.
- Invite groups to present their answers in a whole class discussion.
- Explain that the method of work is the same as that they learned in the previous two lessons. Learners have to read and understand the vocabulary in the problem.
- Ask learners to read the examples in the Learners Book, page 155.
- Let them explain in their own words what they learnt.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 9.3** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Let slow learners attempt this work.

1. Zanika saved 20,000 Frw in a bank. The interest rate was 20% per year. It took 2 years. Calculate simple interest.
2. A P.6 boy was saving 5,000 Frw in a SACCO. He was offered an interest rate of 25% per year. He kept it for 1 year. How much was the interest?
3. Phyllis borrowed 8,000 Frw. She paid the money in 3 years. The interest rate was 10% per year. How much interest did she pay?

Extended activity

Let fast learners formulate six problems, then calculate them.

d) Answers to Application 9.3

(1) 2,500 Frw (2) 72,000 Frw (3) 17,500 Frw (4) 180,000 Frw

(5) 19,500 Frw (6) 240,000 Frw.

9.5. 4 Lesson 4: Calculating interest rate

a) Learning objectives

Solve problem on interest rate

b) Teaching resources

- Charts with word problems on the interest rate.
- Textbooks, calculators,

c) Learning activities

- Review calculating simple interest.
- Ask learners to define the term "rate".
- Form groups and distribute sheets of paper.
- Lead the learners to work on the activity from the Learner's Book, page 156.
- Invite them to present answers and hHelp them to realize that:

$\frac{2,000 \times 100}{10,000 \times 1}$ is substituted from $\frac{\text{Interest} \times 100}{\text{Principal} \times \text{Time}}$

So, to calculate rate, we use $\frac{S.I \times 100}{P \times T}$

$$\text{Hence, Rate (R)} = \frac{\text{Interest} \times 100}{\text{Principal} \times \text{Time}}$$

From the above observation:

$$\text{Rate} = \frac{2,000 \times 100}{10,000 \times 1}$$

$$\text{Rate} = \frac{2 \times 10}{1 \times 1}$$

R = 20, but rate is a percentage, therefore, rate is 20% per year.

- Let learners form some more situations basing on the instructions in the activity.
- Evaluate the methods and results.

Emphasize that, in order to calculate rate, the fraction of interest out of the product of principal and time is expressed as percentage.

- Display a chart with examples similar to the ones in the Learner' Book, page 156.
- Let the learners follow through the two methods used.
- Explain that substitution is applied in method 2, then the unknown is formed.
- Refer to the examples in the Learner's Book, page156.
- Let the learners read, study and follow through each example.
- Repeat the procedure several times until the learners master and internalise the two methods.
- Give more examples and let the learners work them out on sheets of paper. Move around checking for the correct methods and answers.
- Let learners formulate their own and exchange them among the different groups.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.

- Then, assign them to work individually the **application activity 9.4** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Let slow learners calculate the rate as follows:

Find the rate percent (R) at which the interest on;

(1) 1,000 Frw for 1 year is 200 Frw.

(2) 5000 Frw for 2 years is 1000 Frw

(3) Principal is 1,000 Frw , time is 5 months, simple interest is 100 Frw. Calculate the rate percent (R) per month.

(4) After two years, Mrs mulisa paid an interest of 4,000 Frw. The bank had lent her 20,000 Frw Calculate the rate (r)

Extended activity:

Let fast learners try out the following exercise

Find the rate percent (R) given:

(1) Principal is 450,000 Frw, Time is $\frac{1}{3}$ of a year, interest is 115,000 Frw.

(2) Principal is 10,426,000 Frw, Time is $3\frac{1}{2}$ year , interest is 770,000 Frw.

(3) Princile is 1,407,000 Frw, time is $1\frac{3}{4}$ years, interest is 64,800 Frw.

(4) Tunga borrowed 12,000,000 Frw from a bank. He paid an interest of 600,000 Frw. He used the money for $3\frac{1}{3}$ months. What was the interest rate per year?

(5) Ineza invested 2,800,000 Frw in a company. She was offered an interest of 144,000 Frw. She invested it for $1\frac{1}{2}$ months. Calculate the rate percent (R) per month.

d) Answers to Application 9.4

(1) $8\frac{1}{3}\%$	(2) $3\frac{1}{8}$	(3) 25%	(4) 20%
(5) 2%	(6) 5%	(7) 5%	(8) $3\frac{1}{3}\%$

9.5. 5 Lesson 5: Problems involving interest rate

a) Learning objectives

Solve problem on interest rate

b) Teaching resources

- Charts with word problems on the interest rate.
- Textbooks, calculators,

c) Learning activities

- Conduct a review on the calculation of interest rate.
- Let learners form groups and guide them through the activity on page 157.
- Collect the different views and write them on chalkboard.
- Harmonize all presentations from the activity and develop a general report.

- Learners have already learned about calculating interest rate.
- Develop this competence further through questions, answers and calculations.
- Explain that in order to work out problems correctly, they have to read, interpret and understand what is needed.
- Ask learners to read the examples in the Learner's Book, page 157.
- Help them to perfect the reading skill.
- Let them explain the procedure and the method to be used.
- Let them follow through the calculations intently. They should ask questions where they have not understood. Explain to their satisfaction.
- Write an example on the chalkboard.
- Ask learners to read and interpret it. Then try with the calculation.

Example:

Three business partners wanted to boost their business. They sought for a loan of 4,800,000 Frw from a money lender. She offered them a monthly interest rate. If they invested the money for 8 months and paid an interest of 1,200,000 Frw, what was the interest rate offered?

- Tell learners to use any of the two methods.
- They are expected to observe that: principle = 4,800,000 Frw, interest = 1,200,000, time is 8 months and rate not given.
- In interpretation of the context, learners should realise that rate is per month, not per year, So, months are multiplied directly, not changed into years.

$$\text{Interest Rate} = \frac{\text{Simple interest} \times 100}{\text{Principal} \times \text{Time}}$$

$$= \frac{\overset{1}{\cancel{1{,}200{,}000}} \times \overset{25}{\cancel{100}}}{\underset{1}{\cancel{4{,}800{,}000}} \times 8}$$

$$= \frac{25}{8} = 4\frac{5}{8}\%$$

Learners formulate their own problems, calculate the interest rate and present their answers for evaluation.

- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 9.5** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 9.5

(1) $6\frac{1}{4}\%$ (2) 10% (3) 10% (4) $17\frac{1}{2}\%$ (5) 2%

9.5. 6 Lesson 6: Calculating principal

a) Learning objectives

Solve problem on the calculation of principal

b) Teaching resources

- Charts with word problems on the calculation of principal.
- Textbooks, calculators,

c) Learning activities

- Review saving money, then calculating rate.
- Distribute the learners in groups. Hand out sheets of paper to the learners.
- Let the learners carry out the activity in the Learner's Book, page159 as you guide them through.
- Concur with them by stressing that, in order to calculate principal, interest is divided by the product of rate and time. Then the fraction is multiplied by 100.

$$\text{Principal} = \frac{\text{Simple interest} \times 100}{\text{Rate} \times \text{Time}}$$

You should explain the concept clearly and comprehensively so that learners do not become confused.

Learners can also use another method which is;

$$S.I = P \times T \times \frac{R}{100}$$

Then, substitute to find the principal.

- Display the chart with worked example.
- Guide the learners through the two methods applied, that is;

$$S\,I = P \times T \times \frac{R}{100} \quad \text{and} \quad P = \frac{S\,I \times 100}{T \times R}$$

Be systematic such that the learners grasp the concept.

- Refer to the example in the Learner's Book. page 159. Learners should lead in explaining the flow of the steps. Help them where they get challenges.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 9.6** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Slow learners should try out the exercise that follows:

Calculate the principal if;

(1) Interest is 20,000 Frw , time is 1 year, rate is 20% per year.

(2) Interest is 5,000 Frw , time is 2years, rate is 10% per year.

(3) Butare got an interest of 4,000 Frw. He lent the money for $\frac{1}{2}$ of a year. How much did he lend out?

(4) An interest rate of 20% was offered for a certain amount. Ineza borrowed the amount for 2 years. She paid 15,000 Frw as interest. How much did she borrow?

Extended activity

Fast learners can work out the following exercises:

Find the principal, given that:

(1) Interest is 120,120 Frw time is 6 months, rate is $7\frac{1}{2}\%$ per year.

(2) Interest is 240,800 Frw time is 8 months, rate is $12\frac{1}{2}\%$ per year.

(3) Interest is 4,168,400 Frw time is $2\frac{1}{3}\%$ months, rate is $7\frac{1}{2}\%$ per month.

(4) At a rate of 3% per annum, Ingabire got 217,770 Frw as interest for the money she had deposited. The money lasted for $3\frac{1}{2}\%$ years in the bank. How much was the deposit?

(5) A co-operative society borrowed money from a bank. It had to pay back 5,642,865 Frw as interest. The rate was 20% per month. The money was on the account for $2\frac{1}{4}\%$ months. How much did the society borrow?

9.5. 7 Lesson 7: Solving problems involving principal

a) Learning objectives

Solve problem on the calculation of principal

b) Teaching resources

- Charts with word problems on the calculation of principal.
- Textbooks, calculators, etc.

c) Learning activities

- Give a warm-up exercise to learners as you may decide.
- Review work done on calculating principle.
- Group learners and let them do the activity from the learner's Book.
- Moderate, in a whole class discussion, the outcomes to get a general result.

Learners have already learned finding principle. This lesson is a continuation, only that it involves the use of descriptive words.

- Ensure learners read and understand the meaning of the problem. This will enable them interpret, understand and work out the problems correctly.
- Ask them to read repeatedly the examples from the Learner's Book.
- If the concept was well perceived in the previous lesson, learners will not get difficulties in working out the questions provided.
- Give examples for the learners to practice more.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 9.7** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 9.7

(1) 20,000Frw (2) 95,000 Frw (3) 162,500 Frw (4) 320,000 Frw
(5) 1,450,000Frw (6) 800,000 Frw (7) 200,000 Frw.

9.5. 8 Lesson 8: Calculating the time as period that the principal is invested

a) Learning objectives

Solve problem on the calculation of the time of investment

b) Teaching resources

- Charts with word problems on the calculation of time.
- Textbooks, calculators,

c) Learning activities

- Guide learners to review the concept of principal as money invested.
- Form manageable groups and distribute sheets of paper.
- Ask groups to read and carry out the activity as instructed in the Learner's Book, page 161. Guide them in doing it.
- Invite groups to present their answers in a whole class discussion and harmonize their answers. Explain that, to find time, simple interest is divided by the product of principal and rate. that is;

$$\text{Time} = \frac{\text{Simple interest}}{\text{Principal} \times \text{Rate \%}} \text{ or } \frac{\text{Simple interest}}{\text{Principal} \times \frac{\text{Rate}}{100}} \text{ or } \frac{\text{Simple interest} \times 100}{\text{Principal} \times \text{Rate}}$$

Further explain that the formula for finding simple interest can be used, then substitution done to find the unknown time.

- Display the chart with worked examples.

Example: Uwase invested 1,360,000 Frw in a company. She was offered 680,000 Frw as interest at a rate of 20% per year. For how long did she invest the money?

Working

Method 1

Principal is 1,360,000 FRW

Interest is 680,000 FRW

Rate is 20% per year

Time is ?

$$\text{Simple interest} = \text{Principal} \times \text{Time} \times \text{Rate}$$

$$680{,}000 = 1{,}360{,}000 \times T \times \frac{20}{100}$$

$$680{,}000 \times 100 = 1{,}360{,}000 \times T \times \frac{20 \times 100}{100}$$

$$\frac{\overset{1}{\cancel{680{,}000}} \times \overset{5}{\cancel{100}}}{\underset{2}{\cancel{1{,}360{,}000}} \times \underset{1}{\cancel{20}}} = \frac{\overset{1}{\cancel{1{,}360{,}000}} \times \overset{1}{\cancel{20}} \times T}{\underset{1}{\cancel{1{,}360{,}000}} \times \underset{1}{\cancel{20}}}$$

$$\frac{5}{2} = T$$

So time was $2\frac{1}{2}$ Years

Method 2

$$\text{Time} = \frac{\text{Simple interest} \times 100}{\text{Principal} \times \text{Rate}}$$

$$\text{Time} = \frac{\overset{1}{\cancel{680{,}000}} \times \cancel{100}}{\underset{2}{\cancel{1{,}360{,}000}} \times \underset{1}{\cancel{20}}}$$

$$\text{Time} = \frac{5}{2}$$

So time was $2\frac{1}{2}$ Years

- Ask for any challenge, in case there is any, and explain to the satisfaction of the learners.
- Refer to the example in the Learner's Book, page 162. Let learners follow through the steps.
- Explain further whenever there is a challenge.

If the learners have grasped the concept, give them some more examples for group discussion then make presentations.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 9.8** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Let slow learners try out the following;

1. In what time will 5,000 Frw yield on interest of 1,000 Frw at 10%?
2. A P.6 learner saved 4,000 Frw in a savings and credit society. She was given 1,000 Frw as interest. The rate was 20% per year. How long was the money saved?
3. In what time will 10,000Frw gain 2,000 Frw at a rate of 10% per year?
4. Mulenzi borrowed 6,000 Frw. He paid back 3,000 Frw at rate of 50%. For how long did he use the money.

Extended activity

Fast learners can work out more challenging questions for more practice.

1. In what time will 234,120 Frw yield 780,400 Frw at a rate of 25% p.a?
2. Lwakabamba invested 2,178,000 Frw. He was given 363,000 Frw as interest. If the rate was 20% per year, what time was the money invested?
3. In what time will 360,000 Frw amount to 480,000 Frw at 50% per year?
4. Calculate the time in which 4,800,000 Frw will amount to 6,000,000 Frw at $2\frac{1}{2}\%$ per year.

d) Answers to Application 9.8

(1) 2 years (2) 1 year (3) 8 months (4) 6 months.
(5) 1 year (6) 61 year (7) 10 years (8) 6 months.

9.5. 9 Lesson 9: The time of investment

a) Learning objectives

Solve problem on the calculation of the time of investment

b) Teaching resources

- Charts with word problems on the calculation of time.
- Textbooks, calculators,

c) Learning activities

- Form groups of learners and ensure you mix multi-ability learners with slow learners. This enables the slow learners to benefit from the fast learners.
- Distribute sheets of paper to individual groups and guide the learners to work out the activity from the Learner's Book, page 163.
- Since they have covered each term independently, there won't be any difficulties in working out the problems paused.
- Invite groups to present their findings; then, harmonize them in a whole class discussion.

- Now let the learners follow through the examples in the Learner's Book, page 163. Ensure learners read and understand what they are supposed to do.
- Give some more examples for more practice in groups and later allows each group to present their work. This will help them to internalize the concept.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 9.9** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 9.9

(1) 1 year (2) 5 years (3) 1 years (4) 212 years
(5) 6 years (6) 2 years.

9.5. 10 Lesson 10: Calculating the amount of money to earn after getting the interest

a) Learning objectives

Solve problem on the calculation of the amount of money earned after getting the interest.

b) Teaching resources

- Charts with word problems on the calculation of the amount of money earned after getting the interest.
- Textbooks, calculators,

c) Learning activities

- Give mental work about simple subtractions. For examples, 25 - 15, 100 - 91, 50 – 12, etc.
- Guide learners to review the previous lesson.
- Form groups of learners and give them instructional materials.
- Let groups get involved in working out the activity in the Learner's Book.

Invite them to present their findings and then, harmonize answers.

- Explain that the activity was about finding amount of money the investor can earn after getting the interest.
- Tell learners that amount is the total amount of money realized after adding principle and simple interest.

Explain that businesses work on this principle to balance their books.
Bank account balance on one's account is one way amount is applied in daily life.

- Write an example on the chalkboard and ask learners to copy it on slips of paper and attempt it:

Example: Ntwari deposited 2,400,000 Frw on his account in a bank. He was offered an interest rate of $33\frac{1}{2}\%$ per year. How much was on his account 2 year later?

- Let learners observe the principle, rate and time as earlier experienced.

Simple Interest

$= \text{Principle} \times \frac{\text{Rate}}{100} \times \text{Time}$

$= \cancel{2,400,000}^{800,000} \times \frac{100}{\cancel{300}_{1}} \times 2$

$= 800,000 \times 2$

$= 1,600,000 \text{ Frw}$

- Explain further that to get amount, simple interest is added to principle.

Total amount = Principle + Simple interest

= 2,400,000 Frw + 1,600,000 Frw

= 4,000,000 Frw

Therefore, 2 years later, Ntwari had 4,000,000 Frw on his account.

- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 9.10** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Slow learners attempt this work.

1. Ali borrowed 1,000,000 Frw from a SACCO. He was offered an interest rate of 10% per year. He paid 1 year later. How much did he pay back altogether?
2. Given; Principle = 20,000 Frw, time = 2 years, rate = 20%. Find the total amount.
3. Given; time = 3 years, principle = 50,00- Frw and rate = 50%. Find the amount.

Extended activity

Fast learners should attempt a more complex exercise.

1. Given; principle = 4,920,000 Frw, interest rate = $12\frac{1}{4}\%$ p.a and time = $1\frac{1}{3}$ years, calculate the amount.
2. If time is 9 months, interest rate is $7\frac{1}{2}\%$ and principle is 1,440,000Frw, find the amount.
3. Given; interest rate is $37\frac{1}{2}\%$ p.a, principle is 9,660,000Frw and time is 2 years 8 months, find the amount.
4. Given; rate is $9\frac{1}{4}\%$ p.a, time is 1 year 9 months and principle is 2,880,000Frw, calculate the amount.

d) Answers to Application 9.10

(1) 1,400,000 Frw (2) 2,0722,000 Frw (3) 4,979,000 Frw

(4) 437,000 Frw (5) 1,754,400 Frw (6) 2,437,500 Frw

(7) 2,043,750 Frw (8) 1,279,000 Frw (9) 3,680,000 Frw

(10) 1,132,800 Frw (11) 588,000 Frw (12) 1,530,000 Frw.

9.5. 11 Lesson 11: Problems involving amount of money earned

a) Learning objectives

Solve problem on the calculation of the amount of money earned after getting the interest.

b) Teaching resources

- Charts with word problems on the calculation of the amount of money earned after getting the interest.
- Textbooks, calculators,

c) Learning activities

- Guide learners to review the previous lesson.
- Group learners and provide them with learning materials
- Assign learners to work out the activity from the learner's book.
- Let different groups participate in the role-play to present their findings in a whole class discussion.
- Harmonize answers and explain that the main concept of this lesson, is to read and interpret the information that is provided in the problem.

In the previous lesson, learners worked out amount.

This one is a revision of the former lesson, but it involves the use of words to be interpreted.

- Guide them through the example from Learner's Book, page 166.
- Emphasize the importance of reading and understanding the words used in the problem.
- Let learners formulate their own problems involving amount.
- Move around while you monitor their work, then give conclusive remarks.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 9.11** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 9.11

(1) 991,200Frw (2) 2,580,000Frw (3) 1,650,000 Frw

(4) 2,160,000Frw (5) 1,530,000Frw (6) 295,680 Frw

(7) a) 400,000Frw b) 1,400,000Frw (8) 9,750,000 Frw.

9.5. 12 Lesson 12: Saving Money in the bank or putting it in investments

a) Learning objectives

Solve problem on saving money in the bank or putting it in investments.

b) Teaching resources

- Charts with word problems on saving money in the bank or putting it in investments.
- Textbooks, calculators,

c) Learning activities

- Introduce the lesson by reviewing and previewing money and its financial application, done in primary 4 and primary 5.

- Review work done in Primary 5 about budgeting, spending and saving money.
Ask learners to form groups.
- Distribute the prepared pretend money amounting to 20,000 Frw in different denominations to each group.
- Inform learners that they are going to learn about saving money.
- In their groups let learners discuss how they can spend the amount they possess and how saving can be done on the same amount.
Distribute flash cards or Manila cards to each groups.
- Ask each group to write different ways of saving from 20, 000 Frw.
- Remind them that they should not spend beyond their means. That will be wasting money.
So, they should at least save some little money from 20,000 Frw for future use.
- Guide them thoroughly through the activity as explained in the Learner's Book, page 167.
Example: You are aware that successful people, institutions and businesspeople save money in the banks or in investments.
(a) Suppose you are given 20,000 Frw, write down different ways of saving from it.

(b) Discuss and give an example of the following:
i) the advantage of saving money in the banks.
ii) the advantages of putting money in investments.
Then, let them make a presentation in class.
Prevail to give here and there, as you guide the learners.
Explain that, in real life, we should not spend all the money we receive.
Some is spent on priorities, as was learnt in P.5 and some of it is saved.
The money saved is called savings.
Give an example of how you would spend 20,000 Frw and how you would save from it.
Show that the savings should be reasonable, but not kept just for the sake of it.
- Refer to the example in the Learner's Book, page 167 and 168 and let the learners discuss them.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
Give them time to write summary in the note book.
Encourage learners always to save from the petty cash the parents give them for eats at school or pocket money.
Emphasize that it is advisable never to spend all the money one gets or receives.
Ask slow learners to write the different ways of saving from 5,000 Frw. Guide them in the exercise.
In case the fast learners are given 50,000 Frw , ask them to write different ways of saving from it.
- Then, assign them to work individually the **application activity 9.12** in the Learner's Book.
Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 9.12

(1) Teacher's discretion (2) 52,500 Frw
(3) a) 401,000 Frw b) 13,208,000 Frw
(4) 1,608,000 Frw (5) a) 1,750,000Frw b) 16,800,000 Frw
(6) a) 4,800,000Frw b) 8,800,000 Frw.

9.5. 13 Lesson 13: Problems involving savings

a) Learning objectives

Solving problems involving savings.

b) Teaching resources

- Charts with word problems involving savings.
- Textbooks, calculators,

c) Learning activities

- Let learners brainstorm about the importance of saving money.
- Distribute learners in manageable groups and distribute sheets of paper to each groups.
- Ask them to write down the places where money saved can be kept.
- Assess the list.

- In case the school can access places where saving are deposited, lead the learners through the activity in the Learner's Book, page 169.
- Access accounts balance sheets, in case the learners cannot access savings places.

Moderate the discussion, guiding where necessary.

Explain that savings should be kept in banks, savings cooperative societies (Sacco's) or in investments.

It is done so to keep one's savings safe, because these places offer security.

Explain further that banks, SACCOs or investments have another advantage of offering interest.

- Display the chart with prepared account balance statement and let the learners study it critically, then explain the content.

Explain that every date the savings are deposited in the bank, records of receipt are made. And every month or year an interest is calculated and added to the savings.

Any time a saver wants to know how much he/she has on the account, he/ she is given a slip of paper showing the total saving and total interest accrued. The sum is the account balance. The slip of paper is the account statement.

- Refer to the Learner's Book and guide the learners as they study the examples.

Guide them through the procedure.

- Explain in detail how shares in investment benefit the share holders.
- Advise the learners that when they grow and start earning money, they should always save some. And savings should be kept in banks, SACCOs or investment.
- Then, assign them to work individually the **application activity 9.13** in the Learner's Book.

Mark their work and help them with corrections.

- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Let slow learners calculate the total savings.

1. Kayabo is a teacher. He saves 10,000 Frw every month. How much does he save in 4 months?
2. Uwera is a meat seller. She saves 5,000 Frw every week. How much does she save in 3 months?
3. Umar is a taxi driver. He saves 1,000 Frw daily. How much does he save in 6 weeks**?**

Fast learners can work out more challenging questions.

Extended activity

1. Rebecca saves 46,500 Frw every fortnight. She is offered an interest of 3,000 Frw every month. What is her account balance after 123 months?
2. Savings amounting to 946,000 Frw were deposited in a bank. This was done every month. The bank offered an interest of 37,000 Frw every month. How much was on the account after one year and 2 months?
3. Hadija is a trader. She deposits 112,500 Frw on her account every fortnight. The bank offers her 6,000 Frw every month. How much would be on her account after 212 years?

d) Answers to Application 9.13

(1) a) 780 US dollars b) 4,280 US dollars (2) 504,000 Frw

(3) a) 540,000Frw b) 640,000 Frw (4) 340,000 Frw

(5) 50,000 Frw (6) 164,000 Frw

(7) a) 225,000Frw b) 14,225,000Frw 8) 1,680,000Frw.

9.6 Answers for the end of Unit Assessment

(1) 45,000Frw (2) 45,000Frw (3) 4 years

(5) 2 years (6) 400,000Frw (7) 619,800 Frw

(8) 52,000Frw (9) 3712% (10) Teacher's discretion

(11) 8,548,000Frw (12) 9,816,000Frw (13) 5%

(14) a) 480,000 Frw (15) a) 180,000Frw b) 660,000Frw.

UNIT 10: EQUIVALENT EXPRESSIONS AND NUMBER SEQUENCES

10.1. Key unit competence

To be able to write sequences of whole numbers, fractions and decimals

10.2. Prerequisites

Pupils will perform well in this unit if they studied correctly the following:

Solving questions related to number patterns (Studied in P4)

10.3. Cross-cutting issues

Throughout the teaching process of this unit, it will be crucial to help learners to master the content and it is better to address cross-cutting issues where possible. In this unit, we will address the following Cross-cutting issues as non-stand-alone within classroom activities and through the development of the content.

- **Peace and value education**: First of all, as a teacher, you have to be a peace maker in your class and role model so that learners will imitate how you behave. When there is any conflict do not leave without helping to solve it within the lesson. Encourage pupils to behave well, being humble, honest, etc.
- **Gender education:** This cross-cutting issue will be addressed through giving equal opportunities to both boys and girls during the lesson. Make sure all pupils have the same right.

10.4 Guidance on introductory activity

Introductory activity:

Pour 3 litres of water in a small jerrycan and mark the point. Remove the water and then get a soda bottle of 300 *ml*. Put the water in a bottle at a time as you pour in the same jerrycan until you fill it to the same level. What do you observe?

(a) Find out the number of soda bottles to fill the jerrycan at the same level as for 3litre bottles.

(b) After your experience, are 3 litters of water equivalent to 10 times the water in the bottle of soda containing 300 ml? Justify your answer.

Guidance:

- Help pupils to form group before you assign them an activity
- Invite them to read the introduction in the pupil's book and try to discuss answers of questions in their groups.
- While they are doing the introductory activity, walk around while monitoring their work and helping where they have difficulties.
- Open a discussion with probing questions to facilitate them to give their predictions and ensure that you arouse their curiosity on what is going to be leant in this unit. This unit is aimed to help pupils to explore the sequences of whole numbers, fractions and decimals.

10.5 List of lesson/Subheading

#	Content	Number of Periods
0	Introductory activity	1
1	Algebraic expressions	1
2	Equivalent expressions	1
3	Finding the missing consecutive numbers	2
4	Finding the missing consecutive fractions and decimals	1
5	Finding the general term/rule of a linear sequence	2
6	Finding the general term/rule of linear sequence for fractions and decimals	2
7	Finding the missing number or nth term in a linear sequence	2
8	Finding the missing fraction or nth term in a linear sequence	1
9	Finding the number sequence using the general term/rule	2
10	End unit assessment	1

10.5.1 Lesson 1. Algebraic expressions

a) Learning Objectives

To interpret the operation terms used.

b) Teaching resources and learning resources

Flashing cards, prepared chart, markers…

c) Teaching and learning activities:

- In formed groups, let pupils have discussion on unit to be learned.
- Give mental work about the meaning of some mathematical algebraic expressions.

  a + 5 = 10, what is the value of a?

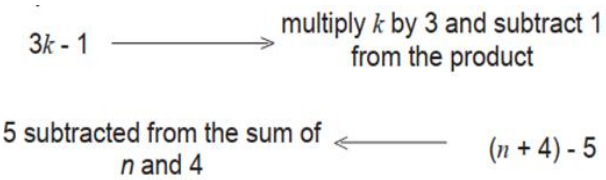
  4 + b = 12, what is the value of b? etc.
- Help pupils to form groups.
- Give learners suggested instructional materials.
- Introduce the activity to the learners.
- Guide them in their discussion and when the learners present their findings.
- Explain deeply of the stated algebraic expressions.

- Let the pupils study, read and explain the meaning of the algebraic expressions as given.
- Ensure they read repeatedly in order to grasp the meaning.
- Give some more examples on the chalkboard.
- Let the pupils copy the examples on slips of paper.
- Challenge them to read, then write their meaning.

  Example

  4 (3p - 5)
- It means 4 multiplied by the product of 3 and p minus 5.
- Let pupils give several other ways of reading and writing algebraic expressions.
- Ask the pupils to formulate their own algebraic expressions on flash cards.
- Let one group member flash a card, then the other group members reads the algebraic expression.
- Let them play an inter-groups game, flashing cards with written meaning of algebraic expressions while other group members flash the card with written algebraic expressions.

Example



There are many different ways of reading/writing the meaning of the given algebraic expressions.

- Try to exhaust them, advising about the correctness of the English language.
- Let the learners read loudly the Study tip.
- Afterwards, ask them to do Application 10.1.
- Mark their work and help them do corrections.

Remedial activities

Let slow learners try out the following:

(1) $d + 1$

(2) $k - 2$ (3) $p + 6$ (4) $x + 4$

(5) $3x$ (6) $2p$ (7) $4y$ (8) $9q$

(9) $10\ m$ (10) $2x + 1$

Extended activity

Let fast learners write the meaning of the following algebraic expressions.

(1) $\frac{3(4y - 5)}{2y}$ (2) $6(2p + 3) \div 3$ (3) $\frac{n - 3}{n + 2}$

(4) $\frac{1}{2}n\ (2n + 4)$ (5) $\frac{3}{5}(5q + 10) - 3$ (6) $4 \div \frac{1}{4}(p - 3)$.

d) Answers to Application 10.1

(1) 3(p-q)

(2) (3mn) /4

(3) (y + 6)/5

(4) 3(2x-6)

(5) 1/ 2 x y

(6) rs (p+ q)

10.5.2 Lesson 2. Equivalent expressions

a) Learning objectives

Be able to find equivalent expressions.

b) Teaching resources and learning resources

Char with worked examples and markers

c) Teaching and learning activities:

- Give the pupils some activity about, filling in the missing number.

  Example 4 +? = 10, ? + 7 = 11 and so on
- Organize the pupils in manageable groups and refer to the activity in the Learner's Book.
- Guide the learners in their group discussion.
- Display the chart with worked examples and guide the learners through the procedure.

- Write an example on the chalkboard. Ask learners in their groups to attempt it on slips of paper.
  Example: 6(x + 2) = 3(2x + 4)
- Ask learners in their groups to remove the brackets.$6x + 6 \times 2 = 2 \times 2x + 3 \times 4$
  6x + 12 = 6x + 12 (Both expressions are equivalent)
- Now refer to the examples in the Learner's Book.
- Let the pupils follow through them, as you guide them.
- Write some examples on the chalkboard. Then ask the pupils to find their equivalent expressions.
- Give pupils a chance to find expressions that are equivalent to the given statements.
- Move around assessing their work and helping those with difficulties.
- Pupil's involvement is very crucial in the learning process.
- Ensure all the pupils are actively involved.
- A lot of practice is necessary because some pupils may find it challenging.
- Let the pupils read and internalize the Study tip.
- Let them attempt Application 10.2.
- Mark their work and help them do corrections.
- Give them more work to try out in their free time. Distribute work into 2 categories.
- The first for pupils who are slow and other that are the fast.

d) Answer to application activity 10.2

(a) 4a + 2b = 4a +2b (b) 5x - 25 ≠ 5x - 5

(c) 9y + 12 = 9y +12 (d) 6q - 4 = 6q - 4

(e) 11m - 22n = 11 - 22n (f) 18x + 9 = 18x + 9

(g) 3y + 1 ≠ 3y + 2 (h) 28a - 2 ≠ 14a - 29

(i) 3x + 3 = 3x + 3 (j) 3y - 10 = 3y - 10

(k) 3m + 15 ≠ 5m + 15 (l) 5x - 7 = 5x - 7

10.5.3 Lesson 3. Finding the missing consecutive numbers

a) Learning Objectives

To finding the missing consecutive numbers

b) Teaching resources and learning resources

Chart with worked out example and other resources on your choice.

c)Teaching and learning activities:

- Group learners and distribute instructional materials you organized for the lesson.
- Using sheets of paper, let the learners work out the activity as instructed in the Learner's Book, page 175 and facilitate on some challenges.
- Write an example on the chalkboard.
- Let the learners copy it onto slips of paper provided, then try to work it out.

  Example:

  Find the missing numbers in the sequence

  3, 10, 17, 24, 31, ___, ___, ___, ___?

  Working

  Find the common difference

  (10 - 3 = 7), (17 - 10 = 7), (24 - 17 = 7), (31 - 24 = 7),
- The common difference is 7.
- So, add 7, to find the missing consecutive numbers.

  35 + 7 = 42, 42 + 7 = 49, 49 + 7 = 56, 56 + 7 = 63.
- Therefore, the missing numbers are 42, 49, 56 and 63.
- The explanation is extended for the learner's benefit to understand.
- All is summarized in the examples in the Learner's Book, page 176.
- Let the learners follow through the procedure, make discussion then share the outcomes with other groups.
- Let learners suggest their own sequences such that they have a common difference.
- Groups may challenge each other in working out the nth term as you guide them.
- They should cross-check the correctness of their work by listing all the terms.
- Start with simple sequences to enable the learners to understand easily.

- In each case, lead the learners to assess their work by listing all the terms to the required term.
- Let the learners read the Study tip aloud several times in order to internalize it.
- Let learners do the Application 10.3.
- Let them take notes.

Remedial activity

Guide slow learners with simple numbers

1. List to the 6^{th} term in the sequence: 2, 4, 6, 8, …
2. List to the 7^{th} term in the sequence: 1, 3, 5, 7, …
3. List to the 10^{th} term in the sequence: 9, 11, 13, 15, …
4. List to the 12^{th} term in the sequence: 3, 7, 11, 15, …

Prepare more questions to help fast learners

1. Find the 21^{st} term in the sequence: 2, 7, 12, 17, ...
2. Find the 49^{th} term in the sequence: 1, 12, 23, 34, ...
3. What is the 101^{st} term in the sequence: 11, 34, 57, 80, ...
4. Work out the 155^{th} term in the sequence: 7, 16, 25, 34, ...
5. Find the 185^{th} term in the sequence: 3, 10, 17, 24, 31, ...

d) Answers to Application 10.3

(a) 23, 28, 33, 38 (b) 13, 16, 19, 22

(c) 14, 17, 20, 23 (d) 21, 25, 29, 32

(e) 25, 31, 37, 43 (f) 47, 58, 69, 80

(g) 28, 34, 40, 46 (h) 61, 74, 87, 100

10.5.4 Lesson 4 Finding the missing consecutive fractions and decimals

a) Learning Objectives

To get the next fraction or decimal in a linear sequence

b) Teaching resources and learning resources

The chart with worked out example and markers

c) Teaching and learning activities:

- Introduce the lesson by forming groups and assigning mental work about finding consecutive numbers.

  Example

  (a) 0, 2, 4, 6, , , .

  (b) 1, 3, 5, 6, , , , .

  (c) (c) 1, 4, 9, 16, , , , .

  (d) (d) 2, 8, 14, 20, , , , .
- Review in detail finding missing consecutive numbers as learned in the previous lesson.
- Help learners to form groups.
- Let them be engaged in the activity in the learner's Book, page 177.
- Explain the main concept of the activity as finding the missing consecutive fractions.
- Tell learners that, as was done in the previous lesson, also consecutive fractions and decimals can be worked out the same.
- Display a chart with worked examples.
- Let learners follow the order of increase in them, then guide them to obtain the general answer in the conclusion.
- Write an example on the chalkboard and guide learners to copy it onto slips or sheets of paper you provided, then attempt it.

Example

Find the missing fractions.

$1, 1\frac{1}{4}, 1\frac{1}{2}, 1\frac{3}{4}, \_\_\_, \_\_\_, \_\_\_, \_\_\_.$

Learners should first work out the order of increase. This is done by finding a common difference between neighboring fractions.

Order of increase is: $1\frac{1}{4} - 1 = \frac{1}{4}$, $1\frac{1}{2} - 1\frac{1}{4} = \frac{1}{4}$, $1\frac{3}{4} - 1\frac{1}{2} = \frac{1}{4}$

So, the 5^{th} fraction is found by adding $\frac{1}{4}$ to $1\frac{3}{4}$=2.

The 6^{th} fraction is found by adding $\frac{1}{4}$ to 2 =$2\frac{1}{4}$ and so on.

- Carry out the same method with decimals.

- Give some examples about finding the missing decimals.
- Let learners carry out the activity in the Learner's Book.
- Refer learners to the example in the Learner's Book.

  Explain with emphasis the changing values in the place values of decimals:

  0.8 + 0.3 = 1.1, not 0.83.
- Give learners chance to formulate their own number sequences of fractions and decimals.
- Monitor their working out as you move from group to group.
- Let learners read the Study tip
- They should now attempt Application 10.4.
- Mark their work and help them in doing corrections.

Remedial activity

Slow learners should attempt the exercise below:

Find the missing fractions in the sequence.

(a) $\frac{1}{2}, 1, 1\frac{1}{2}, 2, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_.$

(b) $\frac{1}{3}, \frac{2}{3}, 1, 1\frac{1}{3}, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_.$

(c) 0.2, 0.4, 0.6, …

(d) 0.5, 1.0. 1.5, …

Extended activity

Fast learners should formulate more fractional and decimal sequences of their own and find the missing ones.

c) Answer to the application activity 10.4

(a) $7, 8\frac{1}{2}, 10, 11\frac{1}{2}$

(b) $7, 8\frac{1}{4}, 9\frac{1}{2}, 10\frac{3}{4}$

(c) $\frac{1}{32}, \frac{1}{64}, \frac{1}{128}, \frac{1}{256}$

(d) $4, 4\frac{2}{3}, 5\frac{1}{3}, 6$

(e) $2\frac{5}{12}, 2\frac{3}{4}, 3\frac{1}{12}, 3\frac{5}{12}$

(f) $4\frac{1}{5}, 5, 5\frac{4}{5}, 5\frac{3}{5}$

(g) 1.7, 2.1, 2.5, 2.9 (h) 2.2, 2.7, 3.2, 3.7

(i) 0.22, 0.27, 0.30, 0.33 (j) 2.23, 2.28, 2.33, 2.38

(k) 0.41, 0.51, 0.61, 0.71 (l) 0.80, 0.95, 1.10, 1.25

10.5.5 Lesson 5. Finding the general term/rule of a linear sequence

a) Learning Objectives

To find the general rule of a linear sequence.

b) Teaching resources and learning resources

Chart with worked out example and markers.

c)Teaching and learning activities:

- Review the previous work.
- Help learners to form groups.
- Let the learners observe the numbers given in the activity bellow.

  What is the rule for this number pattern? 80, 60, 40, …select the appropriate statement:

  (a) subtract 20.

  (b) add 20.

  (c) divide 20.

  Explain your answer to the class.
- Challenge the learners to deduce a rule for finding a mentioned position of an even number.
- In case most fail, explain that the simplest way of finding the required even number by position is using a generalized rule (2n - 2).

  Example: Find the 16th even number

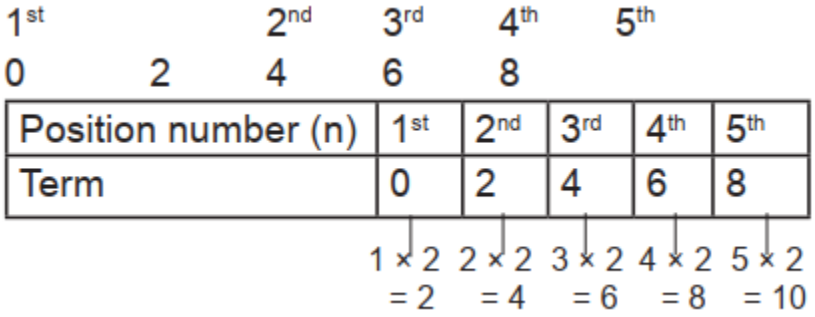
  n = 16, so (2n - 2) = (2 × 16 - 2) = (32 - 2) = 30
- Given an example from which to proceed.

  Example: Find the generalized rule for the sequence: 0, 2, 4, 6, 8, ...

Step 1: Find the common difference

(2 - 0 = 2), (4 - 2 = 2), (6 - 4 = 2), (8 - 6 = 2), so the common difference is 2.

Step 2: Multiply the position by the common difference.



Step 3: Compare the product and the term.

Note: Every term is 2 less than the product.

Step 4: If the position is n, and we multiply n × 2 to get the product 2n.

- To get the term, we get 2 less than 2n.
- So, the generalized rule for 0, 2, 4, 6, 8, n is 2n - 2.
- Explain that, to find a general rule for a given sequence, multiply the position number (n) by the common difference. Then compare the gained product and the term. Mark the difference.
- It may require to subtract, add, square or any other method.
- Follow the experienced procedure to explain how to get a general rule.
- Refer the learners to the example in the Learner's Book, page 178.
- Let them follow through, discuss and share the procedure and guide them where challenges arise.
- Give the learners more examples such that they do more practice.
- Prevail to help where they get challenges.
- Specify, (i) "common difference" and how to get it.
  (ii) "Terms"
  (iii) Comparison between the "product" and "term".
- At first some learners may be confused about the procedure. But, ensure thorough explanation with suitable examples that learners grasp the concept.

- Let the learner read and internalize the Study tip.
- Let them attempt Application 10.5.
- Mark their work and help them in doing corrections**.**
-

d) Answer to application activity

(a) 4n + 1 (b) 2n

(c) 8n + 3 (d) 5n + 2

(e) 4n + 2 (f) 3n

(g) 3n + 1 (h) 5n + 3

i) 6n + 2 (J) 2n+1

(k) 3n + 2 (l) 4n - 3

10.5.6. Lesson 6 Finding the general term/rule of linear sequence for fractions and decimals

a) Learning Objectives

To finding the general rule of linear sequence for fractions and decimals

b) Teaching resources and learning resources

Chart with worked out example.

c)Teaching and learning activities:

- Through students' discussion, review the previous lesson.
- Help learners form groups and carry out the activity in the Learner's Book.
- Learners are expected to have listed the missing fraction in the order:

  1, $1\frac{1}{2}$,2 ,$2\frac{1}{2}$,3, $3\frac{1}{2}$,4, $4\frac{1}{2}$,5.

- They learn finding the order of increase in the previous lesson, for this matter, the increasing order is adding $\frac{1}{2}$ to the previous number.

- Applying the concept of finding the general rule, learners are expected to have worked out like this:

Order of term	1st	2nd	3rd	4th	nth
Term	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	n
	$1 \times \frac{1}{2} + \frac{1}{2}$	$2 \times \frac{1}{2} + \frac{1}{2}$	$3 \times \frac{1}{2} + \frac{1}{2}$	$4 \times \frac{1}{2} + \frac{1}{2}$	$n \times \frac{1}{2} + \frac{1}{2}$

So, $n \times \frac{1}{2} + \frac{1}{2}$ satisfied the order of increase.

Therefore, the general rule is: $\frac{1}{2}$n +$\frac{1}{2}$

- Give an example of a decimal and let learners try it.
  Example: Find the general term/rule for the linear sequence:
  0,2, 0.5, 0.8,, , .
- Draw a table and fill is as follows:

Order of term	1st	2nd	3rd	nth
Term	0.2	0.5	0.8	

- Learners discover that the order of increase is:
  (0.5 - 0.2 = 0.3), (0.8 - 0.5 = 0.3)
  (1 x 0.3 + 0.2 = 0.5) (2 x 0.3 + 0.2 = 0.8) (n x 0.3 + 0.2)
  n x 0.3 + 0.2 = 0.3n + 0.2
  The general rule is 0.3n + 0.2
- Lead learners to find other general rules for fractions and decimals from other examples.
- Let them study and follow through the example in the Learner's Book.
  Conclusion
- Learner's study and read the Study tip
- Facilitate the slower learners.

- Let them attempt Application **10.6**
- Mark their work and help them do corrections.
- Let learners take notes.

Remedial activity

Let slow learners re-do Application 10.6 to master the concept.

Extended activity

Fast learners should attempt the exercise below:

Find the general term/rule for the linear sequences below:

(a) 0.02, 0.05, 0.08, …

(b) 0.15, 0.19, 0.23, …

(c) 1.04, 1.08, 1.12, 1.16, …

(d) 0.33, 0.44, 0.55, …

d) Answer for application

(a) $\frac{1}{5}n + 1$ (b) $\frac{2}{5}n + 2$ (c) $\frac{1}{4}n + 3$ (d) $\frac{2}{3}n$

(e) $\frac{5}{6}n$ (f) $\frac{2}{7}n + 5$ (g) $0.5n - 0.3$

(h) $(0.05n - 0.02) + 2$ (i) $0.4n + 0.1$ (j) $15n + 0.05$

10.5.7 Lesson 7: Finding the missing number or n^{th} term in a linear sequence

a) Learning Objectives

To find the missing number on n^{th} term in a linear sequence

b) Teaching resources and learning resources

Chart with worked out example

c) Teaching and learning activities:

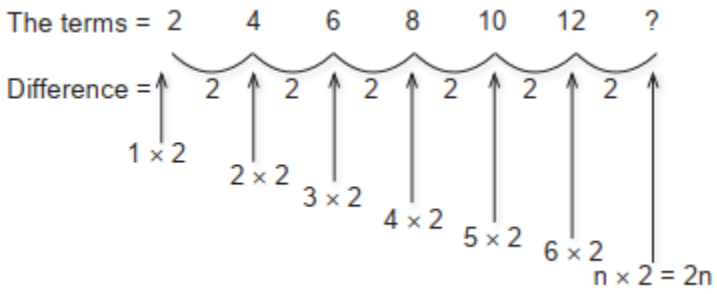
- To revise the previous work.
- Give learners oral activities concerning the previous lesson.
- Let them remember the main key concept of the first lesson.
- Facilitate learners in making groups.

- Distribute materials prepared to the learners and let them to do their task.
- Take them through the activity.

  Example: Find the generalized rule in the sequences 5, 8, 11, 14, 17, ...
- Let them discuss in their respective group.
- Facilitate their discussion with in the groups.
- Give them time to share with the whole class.
- Guide and orient their ideas.
- Write an example on chalkboard from the Learner's Book, page 181.
- Instruct them to work out it.
- Let them try to correct it under your facilitation.
- Provide time to compare their working steps with the one from their note books.

  Example: Find the 36^{th} term in the sequence 2, 4, 6, 8, 10, 12, ...

  The order = 1^{st}, 2^{nd}, 3^{rd}, 4^{th}, 5^{th}, 6^{th}, …, 36^{th}.



- Let them ask for clarification.
- Let them read Study tip in Learner's Book, page 181
- Let them do their own summary of the lesson.
- Help them to harmonize their work
- Take them through application in Learner 'S Book page 182
- Help them to make correction.
- Mark and give feedback, then they take notes.

Remedial activities

Let slow learners find the common difference for the sequences below.

(1) a) 11, 13, 15, 17, 19, 21, ...

b) Multiply the position by the common difference.

(2) a) 9, 13, 17, 21, 25, 29 ,.....

b) Multiply the position by the common difference

(3) a) Find the 2^{nd} even number

b) Find the 7^{th} even number.

Extended activities

Let the fast learners find the generalized rule for these sequences.

(2) 25, 34, 43, 52 ..... (3) 49, 64, 79, 94, ...

(4) 100, 121, 142, 163, ... (5) 55, 66, 77, 88, ...

d) Answer for application activity 10.7

(a) 47 **(b)** 39 **(c)** 102 **(d)** 123 **(e)** 52 **(f)** 282 **(g)** 295 **(h)** 601

10.5.8 Lesson 8: Finding the fraction or nth term in a linear sequence

- Through group discussion, review the previous lesson.
- Distribute the learners in their groups learning materials.
- Involve learners in the activity in the Learners Book.
- Monitor their working out, then harmonize their answers to come up with a general answer.
- Explain that this lesson is a continuation of finding the general rule of linear sequence of fractions.
- Tell learners that in this lesson, it is the value of the number in the required place that is found.
- Write an example on the chalkboard:

  Example: Find the 9^{th} term in the sequence:

  $\frac{3}{4}, 1\frac{1}{2}, 2\frac{1}{4}, \_\_\_, \_\_\_, \_\_\_, \_\_\_$

- Ask learners to work out the order of increase.

  i.e. $\frac{1}{2} - \frac{3}{4} = \frac{3}{2} - \frac{3}{4} = \frac{6}{4} - \frac{3}{4} = \frac{3}{4}$, $\frac{1}{2} - 1\frac{1}{2} = \frac{9}{4} - \frac{6}{4} = \frac{3}{4}$

- Let them order the terms, then find the general rule.

i.e. $1 \times \frac{3}{4} = \frac{3}{4}$p, $2 \times \frac{3}{4} = \frac{6}{4} = 1\frac{1}{2}$p, $3 \times \frac{3}{4} = \frac{9}{4} = 2\frac{1}{4}$p

The general term/rule is: $n \times \frac{3}{4} = \frac{3}{4}n$.

To find the 9th term, 9 is substituted for n.

This results into: $9 \times \frac{3}{4} = \frac{27}{4} = 6\frac{3}{4}$.

Therefore, the 9th term/rule is $6\frac{3}{4}$

- If time allows, let learners formulate their own linear fractional sequences and find the nth rule/term.
- Guide learners through the example in the Learner's Book.
- Let them follow through at their own pace, do not hurry them.
- Explain every step to the learners' satisfaction and understanding
- Let learners read the Study tip.
- They should now attempt Application 10.8 in the learner's Book.
- Mark their work and help them do corrections.
- Let them take their notes.

Remedial activity

Let slow learners re-do Application 10.8 to master the concept.

Extended activity

Fast learners should attempt the exercise below:

Find the general term/rule for the linear sequences below:

(a) Find the 11th term in: $\frac{2}{5}, \frac{4}{5}, 1\frac{1}{5}, 1\frac{3}{5}$, ___, ___, ___, ___.

(b) Find the 6th term in: $1\frac{1}{4}, 2\frac{1}{2}, 3\frac{3}{4}$, ___, ___, ___, ___.

(c) Find the 21st term in: $\frac{1}{8}, \frac{1}{4}, \frac{3}{8}, \frac{1}{2}$, ___, ___, ___, ___.

(d) What is the 46th term in: $\frac{2}{15}, \frac{4}{15}, \frac{6}{15}, \frac{8}{15}$, ___, ___, ___, ___.

d) Answer to application 10.8

(a) $3\frac{5}{6}$ (b) $7\frac{2}{3}$ (c) $9\frac{1}{3}$ (d) $20\frac{3}{4}$

(e) 15 (f) $5\frac{3}{4}$ (g) $25\frac{1}{10}$ (h) $25\frac{1}{4}$

10.5.9 Lesson 9: Finding the number sequence using the general term/rule

a) Learning Objectives

To find the number sequence using the general term/rule

b) Teaching resources and learning resources

Chart with a worked example and markers.

c) Teaching and learning activities:

- Give a warm-up exercise to learners to suit your purpose.
- Review finding general rule of numbers in a linear sequence.
- Let learners form group and distribute the necessary learning material.
- Let learners carry out the activity in the Learner's Book.
- Remind learners that they learned about finding the general term/rule of numbers in a linear sequence.
- Ask them to refer to their answers of the previous lesson, Application 10.5
- Let them read the general terms/rules they worked out as you write them on the chalkboard.
- With your aid, help learners to deduce the linear sequences for those general terms/rules.
  For example: What linear number sequence has a general term/rule 3n + 1?
- Get contributions from learners as you discuss with them.
- Let them follow the steps as laid down
- Step 1: Substitute the order of terms for "n" in the general rule:
  1st order = 3n + 1 = 3 x 1H = 3 + 1 = 4
  2nd order = 3n + 1 = 3 x 2H = 6 + 1 = 7

3rd order = 3n + 1 = 3 x 3H = 9 + 1 = 10

4th order = 3n + 1 = 3 x 4H = 12 + 1 = 13

- Learners realize that the linear sequence is: 4, 7, 10, 13, , , .
- On slips of paper, let learners try to find linear sequences of general term/ rules you give to them.
- Refer to example in the Learner's Book, page 184.
- Let them follow through as you guide them.
- Conclude by emphasizing that, finding the number sequences using the general term/rule, is an inverse operation of finding the general term/rule of a linear sequence.
- Learners read the Study tip, then attempt Application 10.9.
- Mark their work and help them do corrections.

Remedial activity

Let slow learners substitute the order of term, then solve:

(a) 2n: 1^{st} = 2 x 1=____ (b) 2n:2^{nd} = 2 x 2=____

(c) 2n: =___ =___=___ (d) 2n: = ____=____ = ____

(e) 2n: =___=___= ___ (f) 2n: =____=____=_____

Extended activity

Fast learners should find the linear sequences below:

a) 3n – 4 (b) 5n + 7

(c) $\frac{1}{2}$ n – 1 (d) $\frac{1}{4}$ n +) $\frac{1}{4}$

(e) 0.2n + 0.3 (f) 0.7n + 0.2

d) Answers to Application 10.9.

(a) 2, 4, 6, 8, , , , . (e) 3, 8, 13, 18, , , , .

(b) 5, 7, 9, 11, , , , . (f) 4, 8, 12, 16, , , , .

(c) 5, 8, 11, 14, , , , (g) 6, 7, 8, 9, , , , .

(d) 2, 5, 8, 11, , , , . (h) 1, 5, 9, 13, , , , .

(i) $\frac{3}{4}, 1\frac{1}{2}, 2\frac{1}{4}, 3, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_.$

(j) $\frac{1}{2}, 1, 1\frac{1}{2}, 2, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_.$

(k) $1\frac{5}{6}, 2\frac{2}{3}, 3\frac{1}{2}, 4\frac{1}{3}, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_.$

(l) $3\frac{5}{10}, 4\frac{2}{5}, 5\frac{5}{10}, 5\frac{4}{5}, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_.$

(m) 10, 20, 30, 40, , , , .

(n) 5, 9, 13, 17, , , , .

(o) 12, 20, 28, 36, , , , .

(q) 7, 14, 21, 25, , , , .

(r) 11, 19, 27, 35, , , , .

(s) 5, 6, 7, 8, , , , .

(t) 11, 12, 13, 14, , , , .

(u) 3, 8, 13, 18, , , , .

(v) $2\frac{3}{4}, 3\frac{1}{2}, 4\frac{1}{4}, 5, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_.$

(w) $\frac{3}{5}, 1\frac{1}{5}, 1\frac{4}{5}, 2\frac{2}{5}, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_.$

(x) $\frac{1}{2}, 1, 1\frac{1}{2}, 2, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_.$

(y) $4\frac{1}{3}, 4\frac{2}{3}, 5, 5\frac{1}{3}, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_.$

10. 6 End of unit assessment

1) (a) (n-6)2 (b) (m + n)/4 (c) 2x + 8 (d) 1(ab)

2) (a) 6x - 12 = 6x - 12 (b) 2y + 1 = 2y + 1

(c) 28k - 14 = 28k - 14 (d) 3x + 1 = 3x + 1

(e) 169m - 13n = 169m - 13n (f) 7x - 2 = 7x - 2

3) (a) 17, 21, 25, 29 (b) 19, 23, 27, 31

(c) 24, 29, 34, 39 (d) 15, 18, 21, 24

(e) 21, 26, 31, 36 (f) 18, 22, 26, 30

4) (a) 3n + 1 (b) 4n - 2 (c) 6n + 5 (d) 9n + 7

5) (a) 30 (b) 196 (c) 526 (d) 305

6) the answer for this question are:

(a) $2\frac{5}{6}, 3\frac{1}{2}, 4\frac{1}{6}, 4\frac{5}{6}$ (b) $4\frac{1}{5}, 5, 5\frac{4}{5}, 6\frac{3}{5}$ (c) $\frac{1}{32}, \frac{1}{64}, \frac{1}{128}, \frac{1}{256}$

10.7 Additional activities

(1) Group the similar terms and simplify:

a) 12ab + b = 10 - 11ab b) 2x - 7x - 5 = 9 + 3x

2. Fill in the missing numbers

a) 10, 21, 43, …, … b) 2, 3, 5, …, …

3. Find the missing numbers

(a) $1\frac{3}{4}, 1\frac{2}{4}, 1\frac{1}{4}$, …, …

(b) 0.25, 0.5, 0.75, …, …

(c) 1,000, 550, 100, …, …

UNIT 11: SOLVING SIMPLE ALGEBRAIC EQUATIONS AND INEQUALITIES

11. 1 Key Unit Competence

To be able to form and solve simple algebraic equations and inequalities.

11.2 Prerequisites

Pupils will easily learn this unit, if they studied well the following concepts learnt in unit 1 of P6: Addition and subtraction of numbers and comparison of numbers (P6, Unit 1)

11.3 Cross-cutting issues to be addressed

- **Gender balance**: provide equal opportunity to boys and girls in the lesson
- **Inclusive education**: promote education for all learners in the teaching and learning activities.
- **Environment and sustainability:** This will be addressed when pupils will be maintaining hygiene for their classroom and for materials they used.
- **Peace and values education:** addressed when pupils are encouraged to work collaboratively and peacefully in their group.

11.4 Guidance on introductory activity

Introductory activity:

Consider the following situation and answer the related questions: In a certain classroom, x represents the number of boys while the number of girls is 2 times the number of boys. The total number of students is 30.

(a) How do you think the above mathematical problem can be solved? Using arithmetic method or algebraic method?

(b) Try to change the above mathematical problem into algebraic equation nd find out the answer.

Guidance:

- Invite pupils to read the introduction in the learner's book and try to discuss answers in their groups.
- Invite them to a whole class discussion and let groups present their answers.
- Basing on their answers, experience, prior knowledge and abilities, ask them to discuss how they can express mathematically the situational problem using the mathematics expression. Let them mention the unknown in a problem from the real life situation.
- Open a discussion with probing questions to facilitate them to give their predictions and ensure that you arouse their curiosity on what is going to be leant in this unit.

11.5 List of lessons/subheadings

#	**Unit 11: Solving simple algebraic equations and inequalities**	**16 periods**
	Lesson	**Number of Periods**
0	Introductory activity	1

1	Like and unlike terms of algebraic expressions	2
2	Substituting algebraic expressions with addition and subtraction	1
3	Substituting algebraic expressions involving multiplication	1
4	Substituting algebraic expressions involving division	1
5	Simple algebraic equations with one unknown	2
6	Solving fractional algebraic equations	2
7	Solving problems involving equations	2
8	Solving algebraic inequalities with one unknown	1
9	Finding the solution set	1
10	Solving problems involving simple algebraic equations and inequalities	1
11	End unit assessment	1

11.5. 1 Lesson 1: Like and unlike terms of algebraic expressions

a) Learning objectives

Solve problems involving savings.

b) Teaching resources

- Charts with word problems involving savings.
- Textbooks, calculators,

c) Learning activities

- Start with addition and subtraction mental work.

For example; 12 pens + 8 pens, 15 boxes + 7 boxes, 25 books + 8 books, 18 apples - 6 apples, 27 oranges + 12 oranges and so on.

- Guide learners as they carry out the activity in the Learner's Book, page 187 in manageable groups.
- Allow each group to present the findings and later discuss as a class to come up with one report.
- Write an example which requires collecting like terms on the chalk board.

Example: Collect the like terms and simplify:

5 tomatoes + 6 onions + 3 tomatoes + 9 onions.

- Ask learners to read the example and later explain to them that like terms have items or expressions which are similar, where as unlike terms have items or expressions which are not similar.

So collecting like term, in the example will give us;

5 tomatoes + 3 tomatoes + 6 onions + 9 onions
= 8 tomatoes + 15 onions.

- Give another example which involves collecting like term and simplifying with more than one operation.

Example: Collect like terms and simplify;

7 mats + 10 stools + 3 mats - 4 stools (collect the like terms)
= 7 mats + 3 mats + 10 stools - 4 stools (now simplify)
= 10 mats + 6 stools.

- Refer to examples from the Learner's Book and guide the learners through them.
- Give them chance to ask each time they feel they have not understood.

- Explain to the learners that a "term" takes a sign that is before it.
For example, in 7y + 8x - 4y + x,
To collect like terms 7y will be followed by -4y. The term 4y moves with the sign before it,
hence; = 7y - 4y + 8x + x
= 3*y* + 9*x*

- Then, assign them to work individually the **application activity 11.1 and 11. 2** in the Learner's Book.

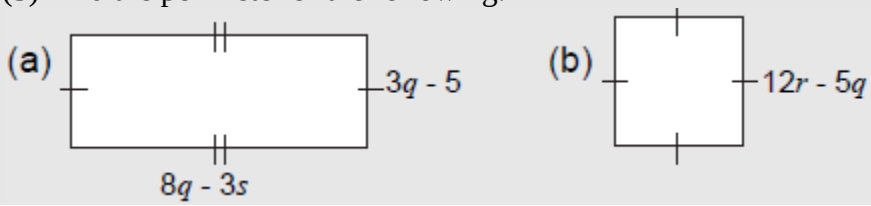
Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Slow learners can try out simple problems involving collecting like terms for example;
(1) 6*a* + 4*b* + 3*a* + 6*b* (2) 5*q* + 9*p* + 7*q* + 3*p*
(3) 7*m* + 3*n* + 2*m* + 6*n* (4) 3*x* + 7*y* + 4*x* - 3*y*
(5) 9*f* + 7*g* - 6*f* + 3*g* (6) 8*r* + 3*y* - 5*r* + 10*y*

Extended activity

Fast learners can carry out more complex problems for example;
(1) 3*ab* + 4*pq* + 5*ab* + 6*pq* (2) 7*xy* + 6*rs* - 2*xy* + *rs*
(3) 9*fg* - 4*mn* + 4*fg* - 2*mn* (4) 8*vw* - 7*jk* + 3*vw* - 5*jk*
(5) Find the perimeter of the following:



d) Answers to Application 11.1

(a) 9x (b) 4y (c) 3p + 4q
(d) 3mno + 6xy + 4ab (e) 4xyz
(f) 12a - 8d (g) 12x + 24m

e) Answers to Application 11.2

(a) 7xyz +abc-3xyr (b) 12x2y - 4xy2 - 6a - 19b
(c) 3x - xz + 6yx + 4tz (d) 17abfg - 3abcd - 5acd - 10defg
(e) 4abc + 2acd - 4bca (f) fgh + fjk + 3fkj
(g) 4pqr + 9prq - 4rxy (h) stu - 2tuv + 7rst

11.5. 2 Lesson 2: Substituting algebraic expressions with addition and subtraction

a) Learning objectives

Evaluate the algebraic expressions with addition and subtraction.

b) Teaching resources

- Charts with algebraic expressions and the values for the unknown.
- Textbooks, calculators,

c) Learning activities

- Start with mental work on phrases and expressions for example; what do the following mean?
  (a) $a + b$ (b) $a - b$ (c) $a - c + d$
  (d) $x - z + y$ (e) $x + y - z$ (f) $p + 2q - r$
- Ask learners to form groups and provide each group with cards and markers
- Guide learners as they carry out the learning activity in the Learner's Book, page 189.
- Conclude the activity by explaining to the learners the meaning of substitution.
- Write a few examples on the chalkboard for learners to discuss as class.

Example: Find the value of the following if;

$f = 8$, $g = 5$, $h = 6$, $k = 4$ and $m = 3$

(a) $f + k + h$ (b) $g + k - f$ (c) $k + h + m$ (d) $f + g - k$

- Ask learners to read the question and discuss each example as you work out.

(a) $f + k + h$	(b) $g + k - f$	(c) $k + h + m$	(d) $f + g - k$
$= 8 + 4 + 6$	$= g + k - f$	$= k + h + m$	$= \frac{f \times g}{k}$
$= 18$	$= 5 + 4 - 8$	$= 4 + 6 + 3$	$= 8 + 5 - 4$
	$= 9 - 8$	$= 10 + 3$	$= 13 - 4$
	$= 1$	$= 13$	$= 9$

- Explain to the learners that they should take note of the letters that are to be substituted to avoid making mistakes.
- Invite Learner's to refer to examples from learner's Book and guide them.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 11.3** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Let slow learners try out more substitution for more practice.

Find the value of the following if; $a = 10$, $b = 8$, $c = 5$ and $d = 11$.

1. Find the value of $b + d + a$
2. What is the value of $b - c + d$?
3. Find the value of $a + b - d$.
4. What is the value of $a + b + c$?
5. Work out; $a + b - c$.
6. What is the value of $a + d - c$?

Extended activities

Fast learners can try out more complex questions for practice:

If $p = 10$, $r = 5.4$, $s = 2$, $q = 12.5$ and $t = 4$

1. Find the value of $p + q + r$.
2. What is the value of $s + r + p$?
3. Work out, $q + t - r$
4. What is the value of $p - q + r$?

5. Work out; $p + r - s$.
6. Find the value of $t + p - q$.

d) Answers to Application 11.3

(a) 7 (b) 7 (c) 5 (d) 6
(e) 15 (f) 16 (g) 17 (h) 10
(i) 20 (j) 10 (k) 17 (l) 13
(m) 20 (n) 0 (o) 8.

11.5. 3 Lesson 3: Substituting algebraic expressions involving multiplication

a) Learning objectives

Evaluate the algebraic expressions with multiplication.

b) Teaching resources

- Charts with algebraic expressions involving multiplication and the values for the unknown.
- Textbooks, calculators,

c) Learning activities

- Give mental work about substitution with addition and subtraction.
- Let learners form groups and distribute the learning materials to them.
- Invite them to work out the activity from learner's book.
- Organize a whole class discussion and invite groups to present their answers.
- Check their work, harmonize answers and give a general observation.
- Explain that the lesson is about substitution with multiplication.
- Learners have been taught about substituting algebraic expression with addition and subtraction.
- In this lesson, they are going to learn about, finding the products of the substitute values.
- Give examples on the chalkboard. Let learners copy them on slips of paper and work them out in pairs.

Examples: Given that: a = 5, b = 7 and c= 10, find the values of

(a) ab - c (b) 4c + 2b - a

- Explain that before substituting, the terms have to be expanded first.

$ab - c = a \times b - c$
$a = 5, b = 7, c = 10$
$= 5 \times 7 - 10$
$= 35 - 10$
$= 25$

$4c + 2b - a$
$a = 5, b = 7, c = 10$
$= 4 \times c + 2 \times b - a$
$= (4 \times 10) + (2 \times 7) - 5$
$= 40 + 14 - 5$
$= 54 - 5$
$= 49$

- Invite learners to go through the examples from the Learner's Book.
- Let learners follow through to come up with a general observation.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 11.4** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Let slow learners attempt the exercise that follows:

Given that: e = 4, f = 5, g = 2, h = 3, find the value of these:

(a) ef (b) eg (c) fg (d) gh + e

(e) 2h - 3 (f) eg + f (g) 3h - g

Extended activity

Give fast learners an exercise which is complex to invoke critical thinking:

Given that: p = $\frac{1}{2}$, q = -4, r = $\frac{3}{4}$, s = -10, evaluate:

(a) 4p - 2q (b) 12r + 6p - s (c) $\frac{1}{5}$ s - 4q (d) $\frac{1}{2}$ p - 14q

(e) r + 4p - 3q (f) 25 - q3 + 8r (g) 10q - s2 + 2p (h) $\frac{1}{5}$ q – r

d) Answers to Application 11.4

(a) x = 480 (b) r = 76 (c) y = -22 (d) y = 72

(e) z = -20 (f) -48 (g) -60 (h) -134

(i) 0 (j) -18 (k) 4 (l) -38 (m) 300

(n) -33.3 (o) 24 (p) 5 (q) 7

(r) 557 (s) 42 (t) -64 (u) -304.

11.5. 5 Lesson 5: Substituting algebraic expressions involving division

a) Learning objectives

Evaluate the algebraic expressions involving division.

b) Teaching resources

- Charts with algebraic expressions involving division and the values for the unknown.
- Textbooks, calculators,

c) Learning activities

- Give warm-up exercise as you may desire.
- Give mental work involving division of simple numbers.
- Example: 12 ÷ 3, 24 ÷ 8, 36 ÷ 9, 45 ÷ 5, 50 ÷ 10, etc.
- Guide learners to form groups and carry out the activity from learner's book.
- Monitor their working out and harmonize the answers.
- Explain the main concept of the lesson.
- Tell learners that division is worked out after substituting the values of the letters.
- Give examples in order to explain the concept.

Example: If x = 9, y = -3, z = 12, work out the following:

(a) $\frac{x}{y}$ (b) $\frac{2z - 6}{x}$

$\frac{x}{y}$ means $x \div y$

$x = 9, y = -3$

$= 9 \div -3$ (apply division of integers)

$= -3$

$\frac{2z - 6}{x} = (2 \times z - 6) \div x$

$= (2 \times 12 - 6) \div 9$

$= (24 - 6) \div 9$

$= 18 \div 9$

$= 2$

- Give more examples for the learners to practice more.
- Give them chance to formulate their own algebraic expressions.
- Monitor their working out and help where learners have difficulties.
- Let learners read and study the examples on page 192.

Explain that where the numbers involve division with negatives, apply the concept of division of integers, that is how signs change.

- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 11.5** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Let slow learners attempt the exercise that follows:

Given that: a = 4, b = 6, c = 8, d = 10 work out the following:

(a) $\frac{2d}{a}$ (b) $\frac{ab}{c}$ (c) $\frac{d - b}{a}$ (d) $\frac{b + a}{d}$

(e) $\frac{2c}{2a}$ (f) $\frac{d + b}{c}$ (g) $\frac{bc}{a}$ (h) $\frac{d + c}{a}$

Extended activity:

Give fast learners an exercise which is complex to invoke critical thinking:

Given that: $p = -8, q = \frac{5}{9}, r = 12, s = -6$, evaluate:

(a) $\frac{rs}{p}$ (b) $\frac{9qrt}{s}$ (c) $\frac{1}{4}p \div 2r$ (d) $\frac{3qs}{2r}$

(e) $\frac{ps}{2r}$ (f) $\frac{qs}{2p}$ (g) $\frac{18q + 3s}{4r}$ (h) $\frac{6r - 2p}{4s}$

d) Answers to Application 11.5

(a) $-4\frac{1}{2}$	(b) 7	(c) -2	(d) $-6\frac{2}{9}$
(e) -18	(f) 4	(g) 3	(h) $-\frac{1}{2}$
(i) -16	(j) $\frac{8}{9}$	(k) $-2\frac{2}{5}$	(l) $-\frac{1}{24}$
(m) 12	(n) 51	(o) 34	

11.5. 6 Lesson 6: Simple algebraic equations with one unknown

a) Learning objectives

Solve simple algebraic equation with one unknown.

b) Teaching resources

- Charts with algebraic equation with one unknown.
- Textbooks, calculators,

c) Learning activities

- Start with simple mental work on missing numbers.

For example; What number do you add to 6 to get 10?

What number can one multiply 4 with to get 8?

What number can you subtract from 10 to remain with 3 and so on.

Put learners in groups and provide each group with a balance, fruits and seeds.

- Guide each group as they carry out the activity from learner's book and later help them to realize that equations must balance like the balances they are using.
- Explain to the learners that an equation is a mathematical statement with equal sides, that is, the "left hand side" should be equal to the "right hand side."

Write an example which requires learners to solve by subtracting;

Example; solve; $y + 8 = 12$

Ask learners to read the equation.

- Explain to them that to find the missing number they should subtract because subtraction is an inverse operation for addition.

So; $y + 8 = 12$

$y + 8 - 8 = 12 - 8$ (to balance the equation, subtract 8 from both sides)

$y + 0 = 4$

$y = 4$

Write another example which requires learners to solve by adding.

Example $p - 10 = 5$

- Let learners read the equation.
- Explain to them that to solve for the unknown in case of this example, they should add since addition is an inverse operation for subtraction.

So; $p - 10 = 5$

$p - 10 + 10 = 5 + 10$ (to balance the equation, add 10 to both sides)

$p + 0 = 15$

$p = 15$

- Write an example which requires learners to solve by dividing.

Example; solve $6y = 18$.

- Ask learners to read the problem and suggest what to do.
Help them to realize that 6*y* means 6 × *y* and that to solve multiplication of equations, we apply division because it is its inverse.
Take the learners through the working, that is:

$$6y = 18$$

$$\frac{6y}{6} = \frac{18}{6}$$

$$y = 3$$

- Give other examples including those involving multiplication. Help them to solve for the unknown.
- Refer to the Learner's Book and guide learners as they study the examples and discuss.
- Ensure that each learner participates in the discussion.
- Explain to the learners that when solving equations that involve addition, they should subtract and when solving equations that involve subtraction they should add.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 11.6** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Let slow learners solve more simple equations for practice.

(1) $k + 3 = 12$ (2) $m + 7 = 15$ (3) $n + 4 = 13$

(4) $p + 8 = 18$ (5) $q + 12 = 18$ (6) $x + 10 = 12$

(7) When a number is multiplied by 2, the result is 16 Find the number.

(8) What number can you multiply by 6 to get 24?

(9) Mbabazi multiplied a number by 7 and got 35 as the product. Find the number he used.

Extended activity

Fast learners can form and solve more equations for example;

(1) Angella had some rabbits. She bought 7 rabbits more. She now has 25 rabbits. Find the number of rabbits that she had before.

(2) Bizimana had some chapats. He made 35 more chapats. Now he has 58. Calculate the number of chapatis he had before.

(3) Annastazia planted 52 saplings. Some of the saplings dried up and she remained with 24. Find the number of saplings that dried.

(4) A number was multiplied by 8 and 7 was subtracted from its product such that 81 remained. Find that number.

(5) What number when multiplied by 5 and 13 is subtracted from the product gives 82?

d) Answers to Application 11.6

1) (a) x = 14 (b) r = 4 (c) y = -1 (d) y = 5

(e) z = 2 (f) m = 5 (g) p = 4 (h) q = 10 (i) x = 9

2) (a) y = 10 (b) x = 3.

11.5. 7 Lesson 7: Fractional algebraic equations

a) Learning objectives

Solve fractional algebraic equation with one unknown.

b) Teaching resources

- Charts with fractional algebraic equation with one unknown.
- Textbooks, calculators,

c) Learning activities

- Give learners simple algebraic equations to solve mentally.

Example: (a) x + 2 = 10 (b) y - 4 = 12 (c) m + 3 (d) p - 5 = 15

- Review the work done in the previous lesson.
- Let learners form groups and do the activity in the learner's book.
- Engage learners in the activity in the Learner's Book, page 195.
- Facilitate a discussion about the procedure, then the outcomes.
- Mention the main competence as solving fractional algebraic equations.
- Referring to the outcomes from the activity, expound on the idea of multiplying numbers by fractions.
- Write examples on the chalkboard and ask learners to copy them on to slips or sheets of paper. Then they try the numbers out.

Example 1

Solve: $\frac{2}{5}(y - 3) = 4$

Explain that it is better to do away with the denominator first. 5 is multiplied both sides.

$= \frac{5}{1} \times \frac{2}{5_1}(y - 3) = 4 \times 5$

$= 2(y - 3) = 20$

$= 2 \times y - 2 \times 3 = 20$

$= 2y - 6 = 20$

6 is added both sides to balance the equation.

$2y - 6 + 6 = 20 + 6$

$2y = 26$

Divide both sides by 2

$\frac{2y}{2} = \frac{26^{13}}{2_1}$

$y = 13$

So, the value of y is 13.

Example 2

$\frac{5x + 5}{6} = 5$

Explain that it is better to do away with the denominator first. 6 is multiplied both sides to eliminate the denominator.

$\frac{6^1}{1} \times \frac{5x + 5}{6_1} = 5 \times 6$

$5x + 5 = 30$

5 is subtracted both sides to balance the equation.

$5x + 5 - 5 = 30 - 5$

$5x = 25$

Divide both sides by 5.

$\frac{5x}{5} = \frac{25^5}{5_1}$

$x = 5$

Therefore, the value of x is 5.

- Refer the learners to the examples in the Learner's Book.
- Let learners follow through the procedure.
- Through question and answer, explain the steps thoroughly so that learners understand the concept very well.

- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 11.7** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Let slow learners solve the following equations:

(a) $\frac{1}{2}(2a + 2) = 3$ (b) $\frac{1}{2}(3k - 3) = 7$ (c) $\frac{1}{4}(4b + 8) = 4$

(d) $\frac{1}{5}(5a - 10) = 3$ (e) $\frac{1}{8}(6a - 15) = 7$ (d) $\frac{2}{5}(2a + 4) = 10$

Extended activity:

Give fast learners an exercise which is complex to invoke critical thinking:

Solve the following equations:

(a) $\frac{3}{4}(12a - 8) = \frac{2}{3}(6a - 12)$ (b) $\frac{9}{10}(5q + 25) = \frac{1}{4}(12q - 16)$

(c) $\frac{11}{12}(36r - 24) = \frac{5}{6}(24r + 12)$ (d) $\frac{17}{20}(40y + 60) = \frac{31}{40}(80y - 40)$

d) Answers to Application 11.7

(a) $x = 3\frac{1}{2}$ (b) p = 2 (c) m = 2 (d) a = 1

(e) x = 14 (f) m = 20 (g) x = 3 (h) $p = 9\frac{17}{28}$

(i) a = -113 (j) x = 3 (k) m = 4 (l) p = 4

(m) a = 16 (n) q = 3 (o) x - 9 (p) y = 7

(q) p - 12 (r) r = 2.

11.5. 8 Lesson 8: Problems involving equations

a) Learning objectives

Solve problems involving equations.

b) Teaching resources

- Charts with problems involving equations.
- Textbooks, calculators,

c) Learning activities

- Give learners mental work about simple application of equations.

Example: (a) To what number do you add to 7 to get 10?

(b) What number is added to 6 to get 9?

(c) Think of a number when you subtract 5, you get 1

- Guide learners to review the previous lesson.
- Form groups of learners and invite them to work out the activity from the Learner's Book.

- Invite them to present answers and then, harmonize them.

Explain to learners that equations can be applied in solving problems in our daily life.

There are many things we would like to find out but we do not know, so we apply equations.

- Display the chart with a worked example.

Let learners read the context repeatedly in order to group the meaning.

For **example**: The sum of 3 consecutive counting numbers is 24. What are the numbers?

Let learners realise that in the statement, non of the counting numbers has been given. It is their total that is given.

Lead them to an imagination of unknown numbers, the 1st number being expressed as a letter:

Let the 1st number be x.

Remind learners about increasing order of consecutive numbers.

They are supposed to state that: the 2nd number is 1 more, and the next is also 1 more than the previous number.

So, in this case, if 1st number is x

2nd number is x + 1

3rd number is x + 2

Sum is got as a result of adding all the numbers.

Lead learners to form and write an equation about the formed numbers:

i.e. x + (x +1) + (x + 2) = 24 (They should simplify the equation)

x + x + 1 + x + 2 (Collecting like terms)

x + x + x + 1 + 2 = 24

3x + 3 = 24 (subtract 3 from both sides)

3x + 3 - 3 = 24 - 3

3x = 21 (divide by 3 both sides to find the value of x) 2.

$$\frac{3x}{3} = \frac{21^{7}}{3_{1}}$$

$$x = 7$$

So, the values of the numbers are:

(x = 7), (x + 1) = 7 + 1 = 8, (x + 2) = 7 + 2 = 9

Therefore, the consecutive counting numbers are 7, 8 and 9.

- Guide learners to do the examples from the learner's book.

In case they do not grasp the idea at first hand, explain every detail in the statement in order for the learners to understand the context.

- Give several other examples in real life experience that solving problems involving equations.

Invite learners to explain in their own words how they can solve a problem involving an equation.

- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.

- Then, assign them to work individually the **application activity 11.8** in the Learner's Book.

Mark their work and help them with corrections.

- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Let slow learners solve the following equations:

1. The sum of two numbers is 10. One of them is 3. What is the other number?

2. The sum of two numbers is 12. One of them is 7. Find the second number.
3. The product of two numbers is 8. One of then is 4. What is the other number?
4. The perimeter if a square is 16 cm. What is each side?
5. The area of a rectangle is 20 cm2. Its length is 4 cm. What is its width?

Extended activity:

Give fast learners an exercise which is complex to invoke critical thinking:

Solve the following equations:

1. The sum of 4 consecutive counting numbers is 104. What are the numbers?
2. The sum of 5 consecutive counting numbers is 210. Find the 3rd number.
3. A mother is 24 years older than her daughter. In 8 year time, the mother will be double the age of the daughter,
   (a) How old is the daughter?
   (b) How old is the mother?
   (c) How old will the daughter be in 8 year's time?
   (d) Find the mother's age in 8 year's time.
4. The product of a number and 3 is the same as half the sum of that number and 5. What is the number?

d) Answers to Application 11.8

1) 8 2) 12 3) 10 cm 4) base = 12 cm

5) (a) 18 years (b) 48 years (c) 30 years (d) 60 years

6) 11, 12, 13 (7) 23, 24, 25, 26

11.5. 7 Lesson 7: Algebraic inequalities with one unknown

a) Learning objectives

Solve Algebraic inequalities with one unknown.

b) Teaching resources

- Charts with algebraic inequalities with one unknown.
- Textbooks, calculators,

c) Learning activities

- Review the previous lesson to be sure that learners have prerequisites for the new lesson.
- Form groups of learners and invite them to work on the activity from learner's book.
  Solve $2y + 26 > 6$ and show the working steps.
- Let them form an inequality and solve it.
- Invite each group to present the answers to the whole class.
- Guide the class to harmonize answers.
- Display a chart with an example similar to the one below.

  Example: Solve and write a solution set. $6m - 3 > 10$

  Ask learners to read the question and later ask them to solve it.

  Help them to realise that the solving is similar to that of equations.

  So; $6m - 8 > 10$

  (Add 8 to both sides)

  $6m - 8 + 8 > 10 + 8$

$6m > 18$ (Divide both sides by 6)

$$\frac{6m}{6} > \frac{18}{6}$$

$$m > 3$$

- Guide learners through the examples from Learner's Book, page 199.
You can give 2 more examples to the learners for them to discuss in groups as you guide them.
- Emphasize to the learners that when solving inequalities, the same procedures like those of solving equations are used. The only difference is that with inequalities the signs >, <, ≥ , ≤ are used .
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 11.9** in the Learner's Book.
Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Let slow learners solve simple inequalities and find solution sets.

(1) $y + 5 < 10$ (2) $y + 5 > 10$ (3) $y - 5 < 10$ (4) $y - 5 > 10$

(5) $5y < 10$ (6) $5y > 10$ (7) $\frac{y}{5} < 10$ (8) $\frac{y}{5} > 10$

Extended activity:

Fast learners can solve more complex inequalities and find the solution sets.

(1) $4k + 4 > 16$ (2) $2y - 9 < 9$ (3) $4k - 4 > 16$

(4) $3p + 5 > 11$ (5) $2(3k + 4) > 26$ (6) $2(2m + 4) < 24$

d) Answers to Application 11.9

(a) $x > -1$ (b) $x > 3\frac{2}{5}$ (c) $x > -9$ (d) $y < \frac{9}{2}$

(e) $y > 7$ (f) $-2 < x < 6$ (g) $x \leq 10$ (h) $x > -\frac{5}{3}$

(i) $x > -4$ (j) $x > -2$

11.5. 8 Lesson 8: Finding the solution set

a) Learning objectives

Solve inequality and determine the solution set.

b) Teaching resources

- Charts with problems involving inequalities and their solution sets.
- Textbooks, calculators, etc.

c) Learning activities

- Give learners mental work about simple values for inequalities.

Example:

(a) x is a number greater than 5. What are some of these numbers?

(b) y is a number less than 7. What are some of the numbers?

- Group the learners in manageable groups and let them do the activity from the learner's book.
- Follow their participatory work as you move from one group to another.
- Invite groups to present their findings in the whole class discussion, aacilitate their discussion and harmonize the outcomes.
- Explain that the lesson is about finding the possible values of the solved inequalities.

In the previous lesson, learners were taught how to solve inequalities.

Example: Solving $3x - 5 < 10$

$= 3x - 5 < 10$

$= 3x - 5 + 5 < 10 + 5$

$= 3x < 15$

$= \frac{13x}{13} < \frac{15^5}{31}$

$= x < 5$

So, today's lesson is about listing the possible values of x which satisfy the statement $x < 5$.
The numbers to be listed are less than 5. These numbers include positive and negative integers.
The list will continue to infinity because we cannot exhaust them.
Conclusively the solution is a set of all numbers x =... -1, 0, 1, 2, 3, 4 or
S= {... -1, 0, 1, 2, 3, 4}
It is this expression that is known as a solution set.
- Give learners another example to expose them more to finding the solution set.

Example: Find the solution set for $7y + 11 > 25$

Let learners solve the inequality first as earlier learnt.

$= 7y + 11 > 25$

$= 7y + 11 - 11 > 25 - 11$

$= 7y > 14$

$= \frac{17x}{17} < \frac{14^2}{71}$

$= y > 2$

Learners are expected to interpret the expression as "values of y greater than 21.

- Ask them to draw a number line and label the possible values.

- Explain that "less than" possible values are on the left of the number line. And, "greater than", possible values are on the right of th numbers line.

Learners observe that the possible values of y, greater than 2 include: 3, 4, 5, 6 and so on.
Therefore, the solution set is: the set of all y = (3, 4, 5, 6, , ,) or S= {3, 4, 5, 6,…}
- Let learners study the examples in the learner's book and guide them in interpreting the answers correctly.
- Emphasize that, solution set is a set of possible values of an unknown. And, a solution set is written inside curly brackets.

If the solution set values are "greater than", ellipsis should be put on the set.
Ellipsis is a sign of continuity to infinity.

- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 11.10** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Let slow learners label the solution sets given below on the number line.

(a) $y < 4$ (b) $x > -3$ (c) $m < 5$ (d) $x > -1$

(e) $x < 2$ (f) $y > 0$ (g) $k < -1$ (h) $n > 3$

Extended activity

Let fast learners solve and give solution sets for each of the following:

(a) $-3 \leq y < 15$ (b) $24 > m \geq 12$ (c) $48 \leq 6y \leq 6$

(d) $13 < 26\ m \leq 169$ (e) $30 \leq 5y \leq 15$ (f) $144 \geq 24\ x \geq 48$

d) Answers to Application 11.10

(a) x = (6, 7, 8, , ,) (b) y = (4, 5, 6, , ,)

(c) x - (, , , -1, 0, 1, 2, 3) (d) m = (, , , -1, 0, 1, 2, 3, 4)

(e) x = (2, 3, 4, , ,) (f) n = (4, 5, 6, , ,)

(g) q = (, , , -1, 0, 1, 2, 3) (h) y = (5, 4, 3)

(i) x = (4, 5, 6, 7) (j) m = (7, 6, 5, 5)

(k) x = (1, 2, 3, 4, 5) (l) y = (11, 10, 9, 8, 7, 6k 5, 4, 3).

11.5. 9 Lesson 9: Solving problems involving simple algebraic equations and inequalities

a) Learning objectives

Solve problems involving inequality and determine the solution set.

b) Teaching resources

- Charts with problems involving inequalities and their solution sets.
- Textbooks, calculators, etc.

c) Learning activities

- Guide learners to review how to solve inequalities as the prerequisites of the lesson.

Examples: (a) Solve $\frac{1}{2}\ p \geq 8$ (b) $2(x + 2) \leq 12$

- Ask learners to form groups and guide them as they discuss the activity from the learner's book.
- Allow each group to present its result and later come up with a general result.
- Display the chart with an example similar to the one below.

Example: Uwimana made cupcakes. She sold 17 cupcakes and those that remained were more than 5. How many cup cakes did she have made?

- Ask learners to read the question and form an inequality,
that is; let the number of cakes be *x*.

So x - 17 > 5 (Discuss each step as you work out)

x - 17 > 5 (Add 17 to both sides)

x - 17 + 17 > 5 + 17

x > 22

So the cup cakes that were made may have been (23, 24, 25, ...).

- Invite learners to study the example from the learner's book and guide them.
- Create more examples for learners to discuss in groups as you guide them.
  Explain to learners the words that mean less or greater than in word problems.

Words like more, above or higher may be used to mean greater, words like below or lower may be used to mean less.

- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 11.11** in the Learner's Book.
  Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Slow learners can form and solve simple inequalities for example;

1. When 7 is added to a number the result is greater than 10. What are the possible numbers?
2. When 5 is subtracted from a number, the difference is less that 6. What are the possible numbers?
3. When 3 is multiplied by a number the product is less than 18. What are the possible numbers?
4. When a number is divided by 4, the quotient is a number that is equal to 6. What are the possible numbers?

Extended activities:

Fast learners should attempt the exercise below:

1. There was some water in the tank. The builders used 83 litres and less than 20 litres of water were left. Find the amount of water which could have been in the tank.
2. Kagabo had cattle. 21 of his cows calved down and he now has 72 heads of cattle. How many heads of cattle had he at first?
3. Uwachu made some candles and packed 6 candles in each packet. She filled more than 12 packets. Find the number of candles she is likely to have made.
4. 34 of the Learners in the school come by bus. The Learners who come by bus are 240. Find the number of Learners in that school.

d) Answers to Application 11.11

1) (a) 13x = 4b + 1 (b) -7bcdef + 12bdecf

(c) 6xz + 5xyz - 2yz (d) y > 7

2) 40 (3) 26 (4) 6x + 15

5) (a) x = 5.5 cm (b) 32.5 cm (c) 11 cm

6) (a) 35 < x < 40 (b) 36, 38, 39

7) (a) x = (-2, -1, 0, 1, 2, 3) (b) x = (0, 1, 2, 3, 4, , ,)

(c) x = (3, 4, 5, 6, , ,) (d) x = -7

(e) x = =1 (f) x = 0

8) 210 FRW 9) 108 books

10) (a) 21 (b) 44 (c) 56 (d) 0

11) (a) 14 (b) $\frac{1}{8}$ (c) -24 (d) $\frac{1}{4}$

11.6 Answer end of Unit Assessment

(1) (a) 12x - 4b + 1 (b) 5bdef (c) 6xz + 5xyz - 2yz (d) y > 7

(2) The number is 40.

(3) x = 26

(4) P = (6x+15)cm, as x=12cm, P= 87cm

(5) a) x = 8 b) 35 cm c) 16 cm

(6) a) 35 < x < 40 years b) 36, 37, 38 or 39.

UNIT 12: REGULAR POLYGONS AND BEARINGS

12.1 Key Unit Competence:

- To be able to use bearings and compass points and understand the relationship between them.

- To use the angle sum of a triangle to determine the interior angles of regular polygons.

12.2 Prerequisites

Pupils will easily learn this unit, if they have a good background on the following:
- Drawing and construction of angles (P5, unit 11)
- Sum of angles for a triangle (P5, Unit 11).

12.3 Cross-cutting issues to be addressed

- **Gender balance**: provide equal opportunity to boys and girls in the lesson
- **Inclusive education**: promote education for all learners in the teaching and learning activities.
- **Environment and sustainability:** This will be addressed when pupils will be maintaining hygiene for their classroom and for materials they used.
- **Peace and values education:** addressed when pupils are encouraged to work collaboratively and peacefully in their group.

12.4 Guidance on introductory activity

Introductory activity:

Observe the classroom and identify polygons shaped objects and try to name them basing on the number of sides and angles.

(a) Is there in your class any object of 3 sides and 3 angles?
(b) Is there any object of 4 sides and 4 angles?
(c) Is there any object of 5 angles?
(d) How are the sides of the observed polygons?

Find out if they are all equal and name that regular polygon.

Guidance:

- Invite pupils to read the introduction in the learner's book and try to discuss answers in their groups.
- Invite them to a whole class discussion and let groups present their answers.
- Basing on their answers, experience, prior knowledge and abilities, ask them to discuss how they can name and differentiate polygons basing on shapes observed around them.
- Open a discussion with probing questions to facilitate them to give their predictions and ensure that you arouse their curiosity on what is going to be leant in this unit.

12.5 List of lessons/subheadings

	UNIT 12: Regular polygons and bearings	**16 Periods**
	Lessons	Number of Periods
1	Introductory activity	1
2	Definition of Polygon and their Examples	1
3	Investigating the central angle, interior and exterior angles of a polygon	2
4	Investigating the sum of interior and exterior angles of a regular polygon	1
5	Finding the interior and exterior angles of a regular polygon	1
6	Finding the sum of interior angles of a regular polygon	1
7	Exterior angles of regular polygons and their sum	1
8	Finding sides and apothem	1
9	Finding perimeter of regular polygons	1
10	Finding area of regular polygons	1
11	Finding bearings and compass points	2
12	Finding the bearing	1
13	Exploring the concept of tiling/ construction	1
14	End unit assessment	1

12.5. 1 Lesson 1: Definition of polygon and their examples

a) Learning objectives

Describe different types of polygons.

b) Teaching resources

- Charts with different types of polygons.
- Textbooks, calculators, etc.

c) Learning activities

- Preview 2D shapes: Let learners list examples of 2D shapes they learned in P.4.

The list should include; square, triangle, rectangle, parallelogram, rhombus, kite, trapezium and others.
- Form groups of learners and assign them to work out the activity from the Learner's Book, page 205.
- Invite learners in a whole class discussion and ask them to present their answers.
- Write their responses on the chalkboard and make the harmonization of answers.
Explain that all the shapes they mentioned are called polygons.
Guide learners to name polygons.
More examples of polygons should be listed from the above.
Tell the learners that a polygon is a simple closed figure/shape with straight line segments.
Further explain that, some polygons have equal sides and others have sides of different measurement.
- Distribute polygon cards of different shapes and let the learners study them, then mention their number of sides.
- Ask them how polygons are named; Then, write their contributions from the discussion.
Now display the prepared chart.
- Ask learners to compare the polygon cards with the shapes on the chart.
- Let them read loudly the number of sides and the corresponding name of the polygon.
- Now invite learners to study the examples in the Learner's Book, page 206.
- Let a volunteer display a polygon card at a time as other members tell its number of sides then name it.

Learners should read and recite the contents in the example repeatedly.

Let learners draw the shapes of the polygons on sheets of paper to internalise their conformation.
- Emphasize the nature of regular polygons and irregular polygons.
At this juncture, do not involve construction of regular polygons but base the teaching on the polygon cards.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 12.1** in the Learner's Book.
Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 12.1

1) (a) Pentagon (b) Septagon (c) Nuo-decagon
(d) Duodecagon (e) Square (f) Equilateral triangle
2) (a) 5 sides (b) 7 sides (c) 11 sides
(d) 12 sides (e) 4 sides (f) 3 sides.

12.5. 1 Lesson 1: The central angle, interior and exterior angles of a polygon

a) Learning objectives

Investigating the central angle, interior and exterior angles of a polygon

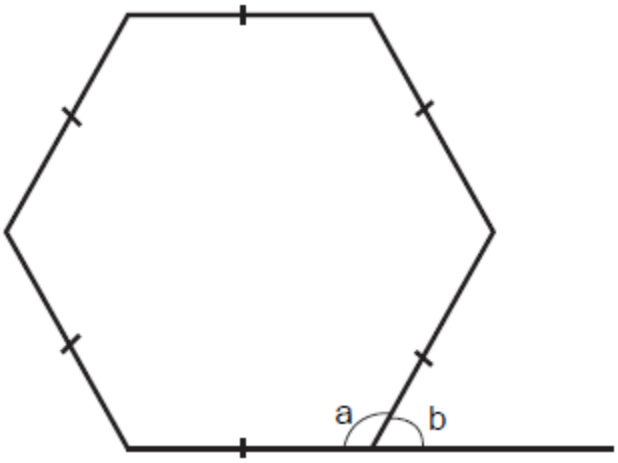
b) Teaching resources

- Charts with different regular polygons with central angle, interior and exterior angles.
- Textbooks, calculators, etc.

c) Learning activities

- Guide learners to review the names of polygons with their respective number of sides.
- Revisit the properties of regular polygons.
- From groups of learners and invite them to carry out the activity from the Learner's Book.
- invite groups to present answers in a whole class discussion, modulate the presentation and harmonize answers.
- Explain the meaning of interior angle and exterior angle.
- Refer to the examples through the procedure and methodology.
- Give learners time to study and follow through in order to internalize the procedure.
- Give more examples to the learners for more practice.

Example: Trace to draw a regular hexagon from a hexagon polygon card.



- Extend one edge using a ruler to form an interior angle and exterior angle. Name them a and b respectively.

Use a protractor to measure angle a and angle b. Angle a = 120o and angle b = 60^o.
Therefore, the interior angle a = 120^o and exterior angle b = 60^o.

- Give learners other polygon cards to do more practice.
- Move around the class supervising their work.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 12.2** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 12.2

Check for correct figure and measurement.

(a) Interior angle = 108^o, exterior angle = 72^o.
(b) Interior angle = 138^o, exterior angle = 52^o.
(c) Interior angle = 140^o, exterior angle = 40^o.
(d) Interior angle = 120^o, exterior angle = 60^o.
(e) Interior angle = 150^o, exterior angle = 30^o.
(f) Interior angle = 138^o, exterior angle = 52^o.
(g) Interior angle = 144^o, exterior angle = 36^o.

(h) Interior angle = 90^o, exterior angle = 90^o.
(i) Interior angle = 120^o, exterior angle = 60^o.
(j) Interior angle = 90^o, exterior angle = 90^o.
(k) Interior angle = 147^o, exterior angle = 33^o.
(l) Interior angle = 135^o, exterior angle = 45^o.

12.5. 3 Lesson 3: The sum of interior and exterior angles of a regular polygon

a) Learning objectives

Investigate the sum of interior and exterior angles of a regular polygon.

b) Teaching resources

- Charts with different regular polygons with sum of interior and exterior angles of a regular poly.
- Textbooks, calculators, etc.

c) Learning activities

- Give mental work about supplementary angles, for examples, what is the supplement of:
  (a) 120^o (b) 36^o (c) 90^o (d) 45^o, etc.
  Let them explain why they get those answers they have presented.
- Form groups of learners and assign them to work out the activity in the Learner's Book.
- Guide them through the procedure in groups.
- Ensure the learners use the necessary learning aids, i.e, polygon cards, ruler, sharp pencil, protractor and sheets of paper.
- Invite groups to present their answers in a whole class discussion and then, harmonize answers.
- Lead them to discover that by using a protractor to measure interior angles of a regular pentagon measures 108^o. Accept the error of 1^o more or less than 108^o. And, that a regular pentagon has 5 equal interior angles.

Ask them to add them.

- Move around while monitoring their work.

They are expected to have added like this:

$108^o + 108^o + 108^o + 108^o + 108^o = 540^o$

Therefore, the sum of interior angles of a regular pentagon is 540o.

- Let them proceed to measuring the exterior angles.
- Monitor how they display the skill. Advise where necessary.
- They may not be very precise in accuracy. Help them to achieve the goal.
- Lead them to realize that each exterior angle measures 72^o or close to 72^o.
- Let them add the 5 exterior angles, i.e., $72^o + 72^o + 72^o + 72^o + 72^0 = 360^o$.
- Learners present their findings to the class in their groups.
- Explain that the major competence is investigating the sum of interior angles and the sum of exterior angles of a regular polygon.
- Guide the learners through the examples in the Learner's Book.

- Strictly let learners discuss the sums of the interior and exterior angles by measuring not by use of a formula.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 12.3** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 12.3

(a) 540^o, 366^o (b) 900^o, 360^o (c) $1{,}260^o$, 360^o (d) 720^o, 360^o
(e) 1800^o, 360^o (f) 900^o, 360^o (g) $1{,}440^o$, 360^o (h) 360^o, 360^o
(i) 180^o, 360^o (j) 360^o, 36^o (k) 620^o, 360^o (l) $1{,}080^o$, 360^o.

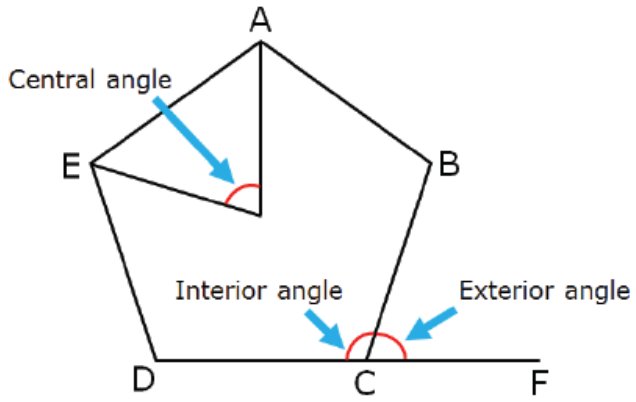
12.5. 4 Lesson 4: The interior and exterior angles of a regular polygon

a) Learning objectives

Find the interior and exterior angles of a regular polygon

b) Teaching resources

- Charts with different questions on interior and exterior angles of a regular polygon.



- Textbooks, calculators, etc.

c) Learning activities

- Guide learners to review exterior angles of regular polygons.
- Form groups of learners and assign them to work on the activity in the Learner's Book, page 210. Invite them to present answers in a whole class discussion and then, harmonize answers:
- Lead learners to realize that the relationship between the angles is that they are supplementary angles.
- Define interior angles as angles that lie inside the vertices of polygons.
- Lead learners to deduce that, the sum of the interior and exterior angles of a polygon is 180^0 (lie on a straight line).
- Distribute sheets of paper to the learners in groups.
- Tell them to draw polygons of their choice or you can distribute sheets of polygons.
- Let them extend lines (edges) to form exterior angles.
- Using protractors, let the learners measure the interior, then the exterior angle.
- Let them add them, then they discuss what the sum deduces.
- Now refer the learners to the examples in the Learner's Book, page 211.
- Let them follow through as you explain.

- Distribute flash cards.
- Let a participant in one group flash a card on which a certain angle is scribbled e.g.; 96^0 108^0 84^0 51^0 72^0 129^0

Then reciprocated by another member in another group flashing a supplementary one bearing an angle totaling to 180^0.

- Conclude by emphasizing that, the exterior angle and adjacent interior angle of a polygon are supplementary (add up to 180^0).
- Learners are expected to have been exposed to supplementary angles. Therefore the lesson should be oriented to that concept.
- Learners should practically measure the interior and exterior angles to prove that they are supplementary.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 12.4** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Let slow learners try out the following:

(1) 90_0 + = 180_0 (3) 63_0 + = 180_0 (5) 180_0 - = 45_0

(2) 135_0 + = 180_0 (4) + 17_0 = 180_0 (6) 180_0 - = 92_0

Extended activity:

Let fast learners try out the following:

1. The interior angle of a polygon is twice the size of the exterior angle.

(a) Calculate the size of the exterior angle.
(b) Find the interior angle.

2. The exterior angle of a polygon is 90_0 less than the interior angle.

(a) What is the size of the interior angle?
(b) Calculate the exterior angle.

3. The interior angle of a polygon is (r + 36_0) and the exterior angle is r_0.

(a) Calculate the size of the exterior angle.

d) Answers to Application 12.4

(1) a) 104^o b) 55^o c) 57^o d) 90^o
e) 40^o f) 115^o g) 71^o h) 57^o

(2) a) 60^o b) 135^o c) 122^o d) 45^o
e) 115^o f) 55^o g) 95^o h) 36^o

12.5. 5 Lesson 5: The sum of interior angles of a regular polygon

a) Learning objectives

Find the sum of interior angles of a regular polygon.

b) Teaching resources

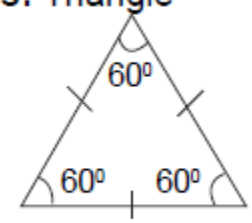
- Charts with different questions on interior angles of a regular polygon.
- Textbooks, calculators, etc.

c) Learning activities

- Guide learners to review the previous lesson.
- Let learners form group and carry out the activity from the Learner's Book, page 211.
- Invite groups to present answers in a whole class discussion and then, harmonize answers: Lead learners to realize that interior angle sum is got by adding all the inside angles of a regular polygon.
- Distribute the sheets of regular polygons.
- Let the learners measure the interior angles of each regular polygon.

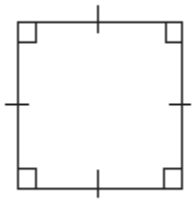
On sheets of paper, let them record the sum of the interior angles of each regular polygon.

Examples: Triangle



$= 60^0 + 60^0 + 60^0 = 180^0$

Regular quadrilateral:



$90^0 + 90^0 + 90^0 + 90^0 = 360^0$

Learners should measure and record interior angles for up to duo-decagon or more.

- Now refer to triangulation: Learners should be reminded how many triangles has each polygon. Basing on the experienced fact in the lower classes, that the interior angle sum of a triangle is 180^0, we can use it also to find the interior angle sum of a regular polygon.
- Referring to the poster of triangles in a polygon displayed yesterday, learners mention the number of triangles in each polygon.

Example: A hexagon has 4 triangles. But the interior angle sum of each triangle is 180^0. So, learners realize that when the number of triangles in a polygon are added together, the interior angle sum of a polygon is realized.

So, interior angle sum of hexagon = $180^0 + 180^0 + 180^0 + 1180^0 = 720^0$ or number of triangles multiply by 180^0.

- Let the learners draw polygons of their choice, triangulate them, then use the number of triangles to find the interior angle sum of the polygons drawn. They make a discussion then class presentation.

They poster their work for display in class.

- Emphasize the use of angle sum of triangles other than the use of improvised method of 180^0 (n - 2) where (n) is the number of sides. It helps the learners to practically discover the interior angle sum of a given polygon. The use of 180^0 (n - 2) can be used better when the polygon has so many sides.

So, Sum of interior angle = (n - 2) 180^o where (n) is the number of sides.

- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 12.5** in the Learner's Book.

Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

d) Answers to Application 12.5

1. (a) 1080^o (b) 900^o (c) $1,260^o$ (d) $1,440^o$
(e) 180^o (f) 360^o (g) 360^o (h) 720^o (i) 540^o.

2. (a) $1,620^o$ (b) $2,340^o$ (c) $2,700^o$ (d) $1,080^o$.

(e) $1,080^o$ (f) $1,260^o$ (g) $2,160^o$ (h) 360^o (i) $3,240^o$

3. (a) 4 sides (b) 5 sides (c) 6 sides (d) 7 sides (e) 9 sides (f) 10 sides.

12.5. 6 Lesson 6: Exterior angles of regular polygons and their sum

a) Learning objectives

Find exterior angles of regular polygons and their sum.

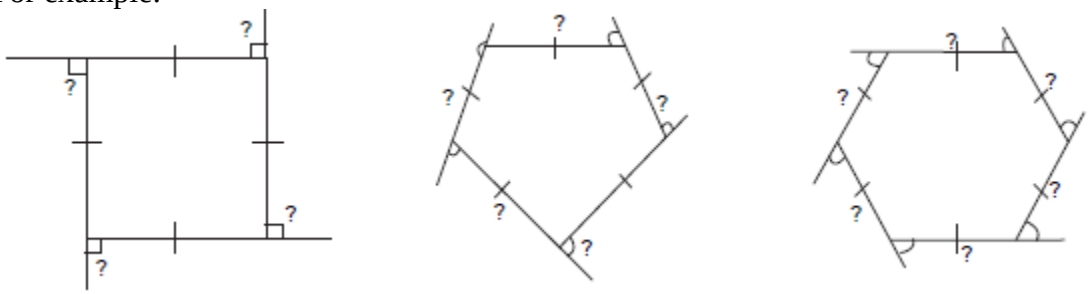
b) Teaching resources

- Charts with regular polygons
- Charts with different questions on exterior angles of regular polygons and their sum.
- Textbooks, calculators, etc.

c) Learning activities

- Guide learners to review the previous work.
- Help learners to form group and assign them to carry out the activity in the Learner's Book, page 213.
- Invite them to present their answers to a whole class discussion and then, harmonize answer and moderate a discussion about it.
- Distribute sheets of polygons to groups.
- Using a ruler and a pencil, let the learners extend lines along the angles of the polygons, then measure the angles formed between the extended lines and the edges of the polygons.

For example:



- Let learners discuss their observations.
- Guide learners to discover that all the angles outside the polygons are equal. In addition, these angles outside the polygons are called exterior angles.

Through measuring using a protractor, learners discover that;

- Each exterior angle of a regular equilateral triangle measures 120^o.
- Each exterior angle of a regular quadrilateral (square) measures 90^o.
- Each exterior angle of a regular pentagon measures 72^o.

- Let the learners continue measuring up to a duo-decagon.

Now, let the learners add all the exterior angles of each polygon. What do they observe by comparison?
- Lead learners to realize that; the exterior angle sum of a polygon is 360^o.

Bearing in mind that the exterior angle sum of a polygon is 360^o, we can find each exterior angle without measuring using;

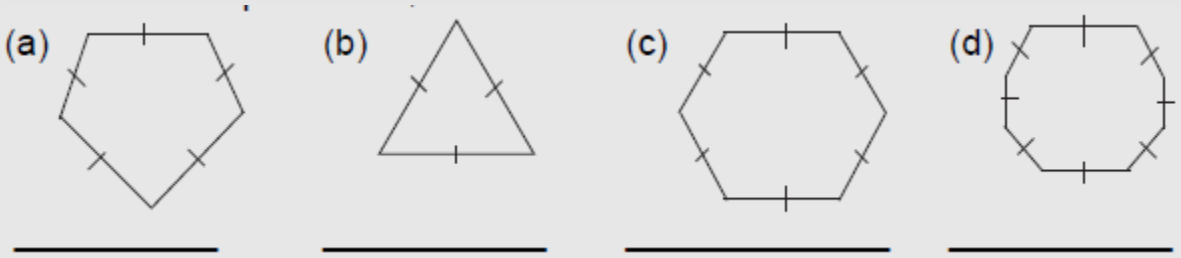
Each exterior angle of a regular polygon = $\frac{\text{Exterior angle sum}}{\text{Number of sides}}$

- Guide learners to study the examples from the Learner's Book, then discuss the procedure. Learners can find the unknown exterior angle, bearing in mind that all exterior angles add up to 360^0.
The activities and methodology above involves two subtopics; Exterior angle of a regular polygon and Exterior angle sum of polygons.
Exterior angles of regular polygons are equal, unlike irregular polygons.
Exterior angle sum of regular polygons is the same as angle sum of irregular polygons of the same type.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 12.6** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial ctivity:

Let slow learners try out the following:

1. Name the shapes below:



2. (a) What is the exterior angle of a regular triangle?

(b) Solve: (i) $p + p + p + p = 360^0$ (iii) $y + y + y + y + y + y = 360^0$
(ii) $m + m + m + m = 360^0$ (iv) $x + x + x + x + x + x + x + x = 360^0$

Extended activity:

Let fast learners do the exercise below:

1. What is the exterior angle of a regular polygon with these sides?

(a) 15 sides (b) 18 sides (c) 20 sides (d) 36 sides
2. Find the polygons with the exterior angles below;

(a) 45^0 (b) 60^0 (c) 12^0 (d) 18^0 (e) 30^0 (f) 20^0

d) Answers to Application 12.6

1. (a) 72^o (b) 90^o (c) 120^o
2. (a) 45^o (b) 36^o (c) 72^o (d) 40^o (e) 30^o
3. 6 sides
4. (a) Exterior angle 60^o, Interior angle 120^o (b) hexagon
5. (a) 60^o (b) 45^o.

12.5. 7 Lesson 7: Determination of sides and apothem of regular polygon

a) Learning objectives

Find sides and apothem of regular polygon.

b) Teaching resources

- Charts with different questions on the calculation of sides and apothem of a regular polygon.
- Textbooks, calculators, etc.

c) Learning activities

- Guide learners to review the previous work.

- Group learners and assign them to work out the activity in the Learner's Book, page 215.
- Invite groups to present answers in a whole class discussion and then, harmonize answers:
Learners should be led to realize that a pentagon has the number of triangles formed from its centre equal to the number of sides.
And, that every side (edge) of the triangle becomes the base of the formed triangle.
- Explain that the line from the centre which is perpendicular to the side (edge) of a regular polygon is called apothem.
The apothem, learners should observe, is the same as the height of the formed triangle.
- Lead learners in their groups to work and realize that, in order to find the area of a regular polygon, the area of each triangle is worked out using the side as the base and apothem as the height. i.e

$$\text{Area of 1 triangle} = \frac{1}{2} \times \text{side} \times \text{apothem}.$$

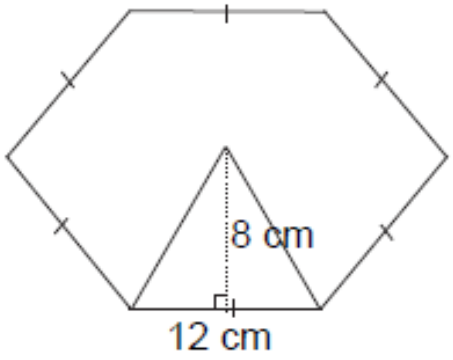
Then the area of all the triangles is added together.

OR: The area of 1 triangle is multiplied by the number of triangles that can be formed in a regular polygon.

i.e. Area of polygon = Number of triangles $\times$ ($\frac{1}{2} \times$ side $\times$ apothem).

Give an example and learners copy it onto sheets of paper and try it out:

Find the area of the hexagon below:



Learners should identify the side to be 12 cm and apothem to be 8 cm.
They should also observe that there are 6 triangles that can be formed in the regular hexagon.

$$\text{So; Area} = 6 \times (\frac{1}{2} \times \text{side} \times \text{apothem})$$

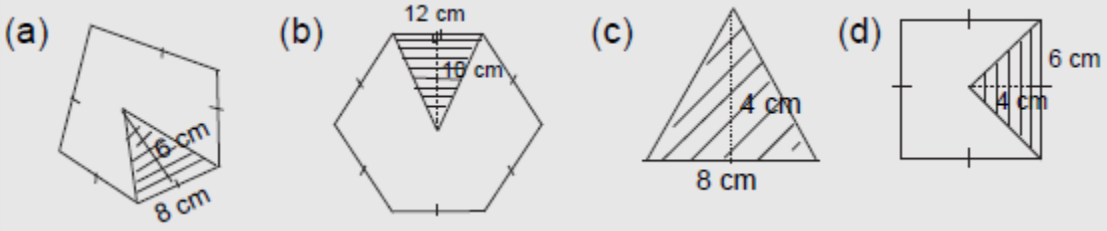
$$\text{Area} = 6 \times (\frac{1}{2} \times 12 \text{ cm} \times 8 \text{ cm})$$

$$\text{Area} = 6 \times 1 \times 6 \text{ cm} \times 8 \text{ cm} = 288 \text{ cm}^2$$

- Now refer learners to examples from the Learner's Book, page 215.
- Let the learners follow through the example as they discuss.
- Liken the side of the polygon to the base and apothem to height of a triangle for quicker understanding.
- Emphasize that area can only be worked out using the experienced method for regular polygons only.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 12.7** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity

Slow learners do this exercise;
Divide the polygons named below into triangles from the centre.
(1) Square (2) Pentagon (3) heptagon (4) Octagon (5) Decagon
(6) Find the area of the shaded part:



Extended activity

Gifted learners should do this exercise.

(a) Find the apothem of a square whose area is 96 cm2 and a side of 6 cm.

(c) Work out the side of a pentagon with apothem of 10 cm and area of 300 cm2.

(d) What is the name of a regular polygon with apothem 14 cm, side of 18 cm and an area of 882 cm^2?

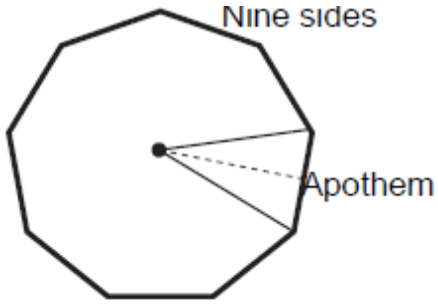
(e) Calculate for apothem of a regular octagon with side of 16 cm a nd area of 512 cm^2.

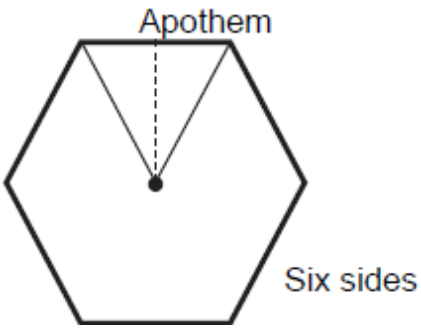
d) Answers to Application 12.7

(1) An apothem is the distance from the centre of a polygon perpendicular to the side of a polygon.

(2) Side is length from one end to another around a polygon.

(3)





(4) 6 cm (6) 4 cm (7) 6 cm.

12.5. 8 Lesson 8: Perimeter of regular polygons

a) Learning objectives

Find perimeter of regular polygons.

b) Teaching resources

- Charts with different polygons
- Charts with questions on the calculation of perimeter of regular polygons.
- Textbooks, calculators, etc.

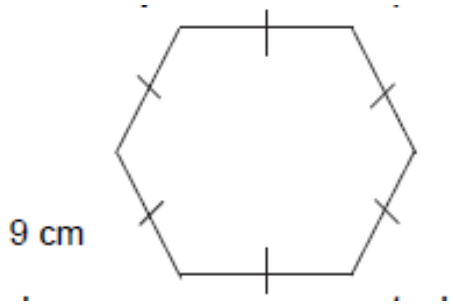
c) Learning activities

- Form groups of learners and motivate them to work on the activity in the Learner's Book, page 216.
- Learners should be challenged to remember perimeter. They should remember that; perimeter is the distance around an enclosed figure/shape.
- remember that learners have experienced finding perimeter of a triangle, square, rectangle. Now it is a continuation to find perimeter of other polygons like; pentagon, hexagon, heptagon and others.
- Distribute polygon cards in groups of learners.

Using strings, learners place them once around each polygon.
In each group, one participant records the distance after measuring the length from the ruler.
Learners realize that the distance measured on the string is the perimeter of the polygon.
Now introduce the calculation method.

- Draw a regular polygon and write the distance of one side. Learners copy it on to sheets of paper.
- Then ask learners to suggest how to find the perimeter of the polygon can be done.

Example: Find the perimeter of the polygon shown below;



Learners are expected to explain that, to find the perimeter, we add 9 cm six times because the polygon has 6 sides.
So perimeter = s + s + s + s + s + s
= 9 cm + 9 cm + 9 cm + 9 cm + 9 cm + 9 cm
= 54 cm

- Explain that alternatively, perimeter can be worked out by multiplying the distance of one side by the number of sides.
Perimeter = number of sides x side distance

- Lead learners to study the examples in the Learner's Book, page 216 and follow through the procedure.
- Using sheets of regular polygons, let learners use a string or centimetre ruler to measure the perimeter.
- Move around supervising their work.
The exercise is expected to be a simple one because the learners were exposed to measuring different shapes in P.4 to find perimeter. So devise means of making it simpler.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 12.8** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 12.8
(1) 32 cm (2) 50 cm (3) 21 cm (4) 30 cm
(5) 40 cm (6) 36 cm (7) 120 cm (8) 93 cm
(9) 115.2 cm.

12.5. 9 Lesson 9: Area of regular polygons

a) Learning objectives

Find area of regular polygons.

b) Teaching resources

- Charts with different polygons and their nets
- Charts with questions on the calculation of area for regular polygons.
- Textbooks, calculators, etc.

c) Learning activities

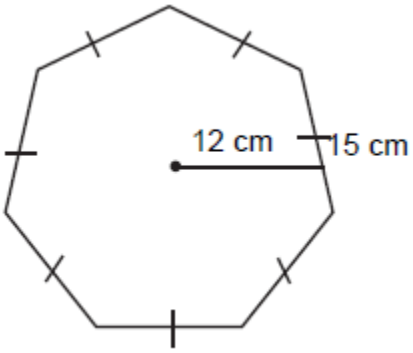
- Give mental work about names and properties of regular polygons.
- Form groups of learners and assign them to carry out the activity in the Learner's Book, page 218 in groups.
- Invite groups to present answers in a whole class discussion and then, harmonize answers.
- Guide the learners to deduce the area of regular polygons.

Learners discover that;

Area of a regular polygon = $\frac{1}{2}$ of apothem multiplied by its perimeter.

- Write an example on the chalkboard and ask the learners to copy it on the sheets of paper and using the method above, work out the area.

Example: Find the area of the polygon shown below.



Working

Apothem = 12 cm, side = 15 cm

Perimeter = $7 \times 15 = 105$ cm

But area = $\frac{1}{2} \times$ apothem $\times$ perimeter

Area = $\frac{1}{2} \times 12$ cm $\times 105$ cm

$= \frac{1260}{2} = 630$ cm^2

- Let learners follow through the examples in the Learner's Book, page 218.

Guide them through all the steps of the procedure.

- Learners formulate their own, work them out and discuss the outcomes.
- Using polygon cards and sheets of polygon, let learners measure the apothem and perimeter of every polygon.

Then let them use the appropriate method to calculate their area.

-Follow their work by moving from group to group.

-Let them hold a discussion, then present the outcomes.

-Devise means of making learners able to understand the concept clearly.

-More practical measuring of perimeter and apothem is desired to help the learners understand better.

- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 12.9** in the Learner's Book.

Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Let slow learners attempt the exercise below:
Find the area of the polygons below:

Polygon	Side	Apothem	Area
Equilateral triangle	9 cm	6 cm	?
Square	10 cm	7 cm	?
Pentagon	3 cm	2 cm	?
Hexagon	4 cm	3 cm	?

Extended activity:

Let fast learners attempt the exercise below:
1. The area of a regular polygon is 72 cm2. It has apothem of 6 cm, what is its perimeter?
2.The area of a regular polygon is 1,152 cm2. Its perimeter is 144 cm. Find the length of its apothem.
3. The area of a regular polygon is 1,372 cm^2. Calculate its apothem if its perimeter is 196 cm.

d) Answers to Application 12.9

(1) 60 cm^2 (2) 72 m^2 (3) 20,000 m^2 (4) 108 cm^2
(5) (a) 240 cm^2 (b) 240 cm^2 (6) 480 cm^2 (7) 480 cm^2
(8) 1,890 cm^2

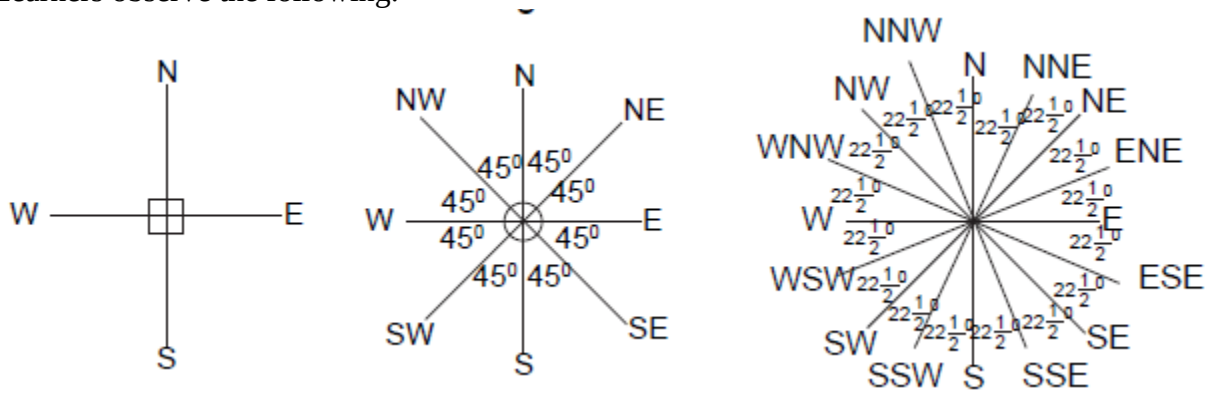
12.5. 10 Lesson 10: Bearings and compass points

a) Learning objectives
- Finding bearings of an object
- Use compass points to identify an object on the earth.

b) Teaching resources
- Compass, charts with images illustrating bearings.
- Textbooks, calculators, etc.

c) Learning activities
- Give mental work about the eight points of a compass.
- Form groups of learners and assign them to work out the activity from the Learner's Book, page 219.
- Invite groups to present answers in a whole class discussion and then, harmonize answers:
- Make use of a compass, if available to locate the points.
- Draw a compass on the classroom floor.
- Get a participant to stand in the middle. She turns according to instructions.

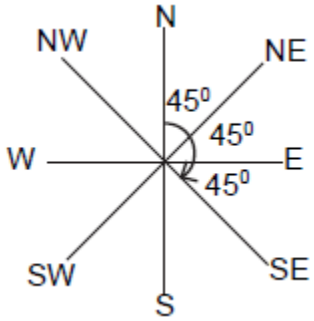
- Let the learners locate the North using the sunrise and sunset directions if the real compass is not available.
- Ask learners to demonstrate clock wise turning, then anti-clockwise turning.
On the compass, let learners observe the angles between the compass points.
Learners observe the following:



Turning from the North to the right is turning clock-wise and turning from the North to the left is anti-clockwise.
Turning can be done from one point to another clock-wise or anti-clockwise.

Example:

Keza was facing Northwards. She turned clock-wise through 135o. What was her new direction? Draw a sketch of a compass.



$45^0 + 45^0 + 45^0 = 135^0$

The direction is South East (SE)

- Invite learners to study the examples in the Learner's Book, page 220.
- Let learners by demonstration using the compass sketch on the classroom floor, prove the lay out and outcomes.
- Write more examples on the chalkboard as learners demonstrate to find the suitable directions. Then they draw the sketches on sheets of paper.
They formulate their own and use the compass sketches on sheets of paper to work out the problems.
- Engage learners in various turns in order to understand better.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 12.10** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:
Let slow learners find the new direction by turning;
(a) Clock-wise 90^0 from North (b) Anti-Clockwise 90^0 from North
(c) Clock-wise 45^0 from North (d) Anti-Clockwise 45^0 from North
(e) Clock-wise 900 from East (f) Clock-wise 90^0 from West.

Extended activity:
Let fast learners Find the new direction by turning;
(a) Clock-wise $157\frac{1}{2}$ degrees from South-West (b) Anti-Clockwise $67\frac{1}{2}$ degrees from NNE
(c) Clock-wise $112\frac{1}{2}$ degrees from ESE (d) Anti-Clockwise $247\frac{1}{2}$ degrees from WNW
(e) Anti-Clockwise 315 degrees from SSE (f) Clock-wise 270 degrees from NNW.

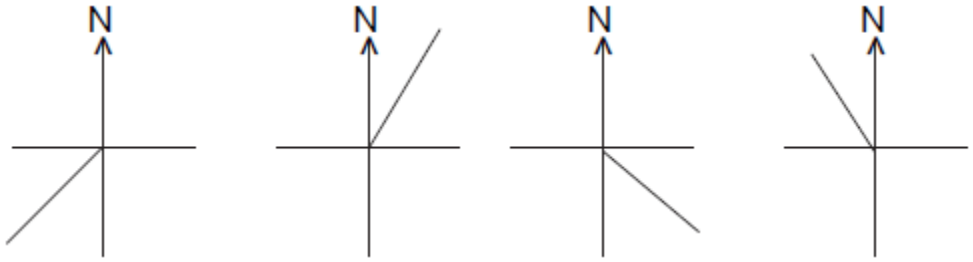
d) Answers to Application 12.10
(1) a) Northeast b) Southwest c) West d) North e) Northwest f) SSE
(2) a) N50oE b) 545oE c) W30oN d) W55oS.

12.5. 11 Lesson 11: Problems on bearing

a) Learning objectives
Finding bearings of an object

b) Teaching resources
- Compass and Charts with images illustrating bearings.
- Textbooks, calculators, etc.

c) Learning activities
- Guide learners to review the previous work.
- Form groups of learners and assign them to carry out the activity in the Learner's Book, page 221.
- Distribute sheets of paper with prepared compass sketches like the ones below:



- Using the protractors let the learners measure the angles clock-wise from the North compass point.
- Let learners discuss the outcomes and share with other classmates.
- Explain that the activities they are involved in are involving "finding bearing"

- Explain "bearing" as the angle between the North and the required direction turning clock-wise.
- Tell learners that bearing is expressed in degrees with 3 digits.

Learners should observe that the degrees do not exceed 90^0 in bearing and compass direction, but they are within the range of 90^0 between cardinal points near each other.

In true bearing and opposite bearing, learners observe that the bearing can be less than 90^o or more than 90^o.

- Lead the learners through the examples explaining bearing procedures.

Learners do more practice by forming their own problems.

- Involve learners in real practical work other than rendering them in imagination.
- Give learners the situations where opposite directions are carried out in real life, e.g learners going from home to school and back home, people travelling on journeys and returning, etc.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 12.11** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Let slow learners find the opposite directions for these compass directions.

(1) North (2) South (3) East

(4) West (5) North East (6) South West

(7) Musoni moved from North West to school. In which direction will she face going back home?

Extended activity:

Let fast learners attempt the exercise below:

The direction of the swimming pool from the parading ground is 027^0E.

(a) Draw a sketch.

(b) What is the direction of the parading ground from the swimming pool?

(c) Using the map of your local area, find the directions from one place to another, then find the opposite directions.

d) Answers to Application 12.11

(1) a) The bearing of x from y is 220°.
b) The bearing of p from o is 300°.
c) The bearing of w from u is 125°.
d) The bearing of A from B is 080°.

(2) The bearing of B from A is 278°.

(3) a) 090° b) 270° c) 142° d) 322°

(4) a) 230° b) 050° c) 130° d) 310°

12.5. 12 Lesson 12: The concept of tiling/ construction

a) Learning objectives

- Explore the concept of tiling/ construction
- Tile a small room.

b) Teaching resources

- Tiles of different 2D shapes, Charts with images of tiled surfaces, glue, square cards, Manila paper:

- Textbooks, calculators, etc.

c) Learning activities

This is a practical lesson: refer to the book for practical activities in Mathematics and consider the PRACTICAL ACTIVITY 13: Exploring the concept of tiling/ construction.

- Group learners and give them the suggested instructional materials.
- Guide the learners through the activity from the Learner's Book.
- Ensure you lead them to discover how the art of laying tiles, making beautiful patterns is done.
- Let learners in their groups explain the importance of tiling in their daily life.
- Invite groups to present their findings and then, harmonize them.
- Ensure every learner is hands-on through the lesson.
- Refer to examples and lead the learners through it as they practically simplify it.
- Evaluate how articulate and precise the learners display their skills.
- Guide them in even more practice of tiling different polygons cards to form different patterns.

Practically, you can guide learners to proceed as follows:

Step 1: Get a rectangular manila paper and the different squared cards.

Step 2: Use a ruler, measure the width and length of manila paper, and record it.

Step 3: Measure and record the length of the sides of the square card.

Step 4: By using glue, fix the square cards on manila paper such that no gaps are left in between.

How many squared cards have you glued to fill the whole Manilla paper?

Step 5: Now using the measurements in step 2, Find and record the area of a manila paper **A_1** as Length x width.

Area of the manila paper A1 = Length x width.

Step 6: Using measured length of the side of the squared card in step 3, find the area of the squared card **A2** as Side x side = **S2**

Area of the squared card A2 = Side x side = **S2**

Step 7: Divide the Area of the manila paper A1 in step 5 by Area of the squared card A2 to get the Number of squared cards expected to fit on the manila paper.

Step 8: Compare the results (number of squared cards) got in step 4 with that got in step 7.

How can you find the number of tiles necessary to fit the floor if you know the area of this floor?

$$\text{Number of squared cards} = \frac{\textbf{(Area of the manilla paper } A_1\textbf{)}}{\textbf{(Area of squared card } A_2\textbf{)}}$$

To find the number of tiles necessary to fit the floor, we take the area of the floor divided by the Area of one tile.

- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 12.12** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to application 12.12

Teacher should oversee and evaluate the activities, then advise accordingly.

12. 6 Answers for the end of unit assessment

(1) (a) 1,440° (b) 900°
(c) 1,080° (d) 540°
(e) 180° (f) 720°

(2) (a) 5 sides (b) 11 sides (c) 6 sides

(3) (a) 28°, 49°, 71°, 93°, 119°

(4) 24 cm (5) 62 cm^2 (6) 45° (7) 1,080 cm^2

(8) 090° (9) 45 cm (10) 12 sides (11) 270°

(12) a) Check for correct pattern (b) 100 tiles

(13) a) 090° b) 225° c) 045° d) 270°

(14) 215° (15) 040°

UNIT 13: CONSTRUCTION OF POLYGONS AND NETS FOR CUBOIDS AND PRISMS

13.1 Key unit Competence

To be able to construct polygons using a protractor, a ruler and a pair of compasses. Design nets to make cuboids and prisms.

13.2 Prerequisites

Learners will perform well in this unit if they studied correctly the following:

-2D shapes and their properties in P4.

-Types of lines and angles in P4.

Cube and cuboids in P5, regular polygons and bearing in P6,

13.3 Cross-cutting issues

Throughout the teaching process of this unit, it will be crucial to help learners to master the content and it is better to address cross-cutting issues where possible. In this unit we will address the following Cross-cutting issues as non-stand-alone within classroom activities and through the development of the content.

Peace and value education: As a teacher, you have to be a peace-maker in your class and role model so that learners will imitate how you behave. When there is any conflict, do not leave without helping to solve it within the lesson. Encourage learners to behave well, being humble, honest, etc.

Gender education: This cross-cutting issue will be addressed through giving equal opportunities to both boys and girls during the lesson.

13.4 Guidance on introductory activity

Introductory activity:

In our daily life we use some materials such as Boxes, rooms, bars of soap, etc are all cuboids with faces and edges. Some of these cuboids have volume or space to be used as storage of things. For example houses are built with rooms to accommodate people. To build a room of a house, the builders measure the sides of the floor and height of walls suitable to the owner.
Can you think on how the area of the faces of one room is measured?
To be concrete, use a box and try to calculate the total surface area of all 6 sides of a box (remember that one face is a rectangular shape). What do you notice?

Guidance

Before you start the lesson, first use warm-ups or energizers in order to engage learners into the lesson. Do not focus on this only, try to be creative.

-Help learners to form small groups and guide them to work on the introductory **activity 13**

-Provide learning materials accordingly to the given activities and give clear guidance and instructions to perform the activities.
-Give time to learners to read and analyse the given activity and let them discuss about different possible solutions of the activity.
-Walk around in different groups to provide advice and facilitations where necessary and remind them to justify and support their answer / findings.
-Basing on Students' experience, prior knowledge and abilities shown in answering the questions for the introductory activity, use different questions to prompt them to give their predictions and ensure that you arouse their curiosity on what is going to be leant in this unit.
-After presenting their finding, the teacher harmonizes and guides class discussions and interventions.

13.5 List of Lesson/Subheading

	Unit 13: construction of polygons and nets for cuboids and prisms	**24 periods**
	Content	**Number of Periods**
0	Introductory activity	1
1	Drawing triangles using a protractor and ruler	1
2	Drawing a square using a protractor and ruler	1
3	Drawing a rectangle using a protractor and ruler	1
4	Drawing a regular pentagon using a protractor and ruler	1
5	Drawing a regular hexagon	1
6	Constructing triangles using a pair of compasses and a ruler	1
7	Constructing a rectangle using a pair of compasses and a ruler	1
8	Finding perimeter of regular polygons	1
9	Constructing a square using a pair of compasses and a ruler	3
10	Finding the central angle and interior angle of a regular polygon	2
11	Constructing a regular pentagon and regular hexagon	3
12	Constructing a regular septagon and a regular octagon	2
13	Constructing a regular nonagon and decagon	2
14	Designing nets of cuboids, cubes and prisms	2
15	End unit assessment	1

13.5.1 Lesson 1: Drawing triangles using a protractor and ruler

a) Learning Objectives

To draw triangles using a protractor

b) Teaching resources and learning resources

Manila cards, scissors, markers and charts

d) Teaching and learning activities:

-Introduce the lesson starting with mental work on triangles e.g, name the types of triangles.
-Help learners to form small groups and discuss on the activity 13.1 in the Learner's Book, page 229.
-Using a protractor and a ruler, draw a right angle, angle 65^o and angle 120^o.
- Give chance to each group to present its findings.
-Guide learners through an example
E.g: Construct triangle ABC with AB = 7 cm, AC = 6 cm and angle BAC = 700.
- Guide learners through the steps;
Step 1: Draw a long line (the base line).
Step 2: Measure 7 cm and cut it off on the base line.
Step 3: Use protractor to draw 70^o at point A.
Step 4: Measure off 6 cm from A to make AC using ruler.
Step 5: Join point B to C using ruler and a pencil.
- Ensure that all measurements are accurate i.e. the line segments and the angles.
- Ask learners to study and work along the example in the Learner's Book, page 229.
- Move around observing the learners to ensure that they use the tools skillfully;measure angles and lengths accurately and use of sharp pencils.
- Emphasise on the right procedures, use of sharp pencils and avoiding to use thick lines.
- Help learners to discover that angles are represented as $\angle ABC = \angle B$.
- Always check through the learners construction to ensure accuracy.
- Let the learners read and analyse the Study tip.
- Then, assign them to work individually the **application activity 13.1** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial aactivity:

Give more numbers to slow learners where the lengths are whole numbers not decimal numbers and the angles assigned to them multiples of ten and acute.

Extended activities:

Prepare more numbers for the fast learners;
1. Draw triangle CDE with CD = 9 cm, EC = 7 cm and CDE = 800.
2. Draw triangle KLM such that KL = LM = 7.5 cm and KLM = 650.
3. Draw triangle XYZ where XY = 10 cm, X = 700 and Y = 700.
4. Draw triangle EFG where EF = 6.5 cm, angle E = F = 550

d) Answers for application 13.1

Guide the learners how to measure sides and angles correctly. Follow through.

13.5.2 Lesson 2: Drawing a square using a protractor and ruler

a) Learning Objectives

To draw a square by using a protractor

b) Teaching resources and learning resources

Manila cards, scissors, markers and charts.

d) Teaching and learning activities:

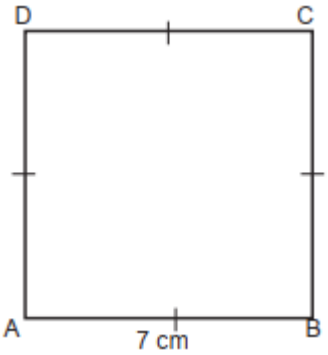
- Help learners to make a small review by naming 2-dimension shapes (triangle, square, rectangle and so on).
- Help learners to state the properties of a square.
- In groups guide learners to discuss on the activity 13.2 in the Learner's Book, page 233.
- Guide learners through an example.

Example: Draw a square ABCD whose side is 7 cm

- Guide learners through the steps with illustrations.

Note that these properties should be indicated;

- each angle is a right- angle or 90^0.
- all sides are equal.



(i) Begin with drawing a long straight line

(ii) Measure off 7 cm using a ruler to get points A and B.

(iii) Label the lengths.

(iv) At point A draw 900 using a protractor.

Emphasise that the vertical line at A must be long.

(v) At point B also draw 900 using a protractor.

Emphasise that the vertical line at B should be long.

(vi) Measure 7 cm from A following the vertical line. Where 7 cm mark is from A, label D.

(vii) Measure 7 cm from B following the vertical line. Where 7 cm mark is from B label C.

(viii) Join points C and D using a straight line.

(ix) Include the symbols for equal sides and right angles.

(x) Label it and name the square ABCD.

-Help learners to participle actively within the lesson by asking many questions as they can.

- Help learners to discover that drawing a square and a rectangle have the same procedures and follow the same step.

- Let learners in their respective group try out the examples in the Learner's Book, page 233 and help them to present their findings, then as a Teacher harmonise their answers.

-Then, assign them to work individually the **application activity 13.2** in the Learner's Book. Mark their work and help them with corrections.

- Depending on the results, assign them the remedial and extended activities:

Remedial Exercise
Let slow learners do the exercise below:
1. Draw a square whose sides are 4 cm.
2. Draw a rectangle CDEF of CD= 6 cm and CF = 3 cm.
Additional Exercise
Let fast learners attempt the exercise below:
1. Draw a square of sides 5.5 cm.
2. Draw a square whose side is 6.8 cm. Measure the diagonals of the square.

Answers to application 13.2
Guide the learners how to use a ruler and protractor precisely. Follow through.

13.5.3 Lesson 3: Drawing a rectangle using a protractor and ruler

a) Learning Objectives

To draw a rectangle using a protractor and ruler.

b) Teaching resources and learning resources

Manila cards, scissors, markers,compass and charts**.**

c) Teaching and learning activities:

-Give mental work about properties of a rectangle.
Example: (a) How many sides has a rectangle?
(b) Are all the four sides equal? Why?
(c) How many angles has a rectangle?
(d) Are they equal?
(e) What is the measure of each interior angle?

- Review the previous lesson.
- Help learners to form small groups and you distribute learning materials.
- Help them to discuss on the activity 13.3 in the Learner's Book
- Help learners to remember that:

(a) A rectangle has two opposite, equal parallel sides.
(b) The four angles of a rectangle are equal and they measure 90^o each.
- Refer to the example in the Learner's Book.
- Let learners read the statement and draw a sketch indicating all the information

that is given in the question.
- Move around guiding them on how to manipulate the instruments and drawing accurately.
- Draw the same on the chalkboard.
- Check well for sharpened pencils, ruler with straight edges and readable protractors.
- Let learners read step by step as they follow the instructions.
- Let learners take time to think about what is to be done in a step before embarking on it.
- Having finished step 4, declare that, the concept of drawing a rectangle using a protractor and ruler has been completed successfully.
- Ensure you check for accurate drawing of the 4 sides and 4 equal angles**.**
- Collect the instructional materials and their work on paper.
- Help learners to present their work by posting their work on manila cards for display.
- Let learners read the Study tip.
- Then, assign them to work individually the **application activity 13.3** in the Learner's Book. Mark their work and help them with corrections.

Answers to application 13.3

Move around the class supervising the activities. Evaluate their work and guide where necessary.

13.5.4 Lesson 4: Drawing a regular pentagon using a protractor and ruler

a) Learning Objectives

To draw regular pentagon using a protractor and ruler.

a) Teaching resources and learning resources

Manila cards, scissors, markers,compass and charts.

d) Teaching and learning activities:

-Start the lesson by naming 2-dimension shapes, angles on polygons and how to get them.
- Help learners to form small groups and ask them to carry out the activity 13.4 in the Learner's Book, page 236.
- Guide each group as they carry out the activity. Give them the time for presentation of their findings and harmonise their answers.
- Help them to discover how to draw regular pentagon using a protractor and ruler.

- Guide learners them through an example.

Example: Construct a pentagon ABCDE whose sides are 3.2 cm.
- Demonstrate each step to the learners as they work along.
- Step 1: Calculate the exterior and interior angle:

i.e - exterior angle of a regular polygon = $\frac{360^0}{\text{number of sides}}$

- exterior angle of a regular pentagon = $\frac{360^0}{5} = 72^0$

- Calculate the interior angle;
1800 - exterior angle = interior angle
1800 - 720 = 1080
(a) Draw a long straight base line.
(b) Measure off 3.2 cm and label points A and B.
(c) Use protractor and draw 1080 at point A. The angle should face to the right.
(d) Then use a protractor to draw 1080 at point B. The angle should face to the left.
(e) Start from A and move along the upward line to measure off 3.2 cm. Label point E.
(f) At point E, measure and draw 1080. It should face to the right.
(g) From point B, along the line going up, measure off 3.2 cm and label point C.
(h) The point where line from E meets line from C should be labeled D.
- Ensure that the final drawing is labeled and it is accurate.
- Help learners to attempt the example suggested in the Learner's Book, page 237.
- Guide learners through the Study tip.
- Sometimes it becomes a little hard for learners to draw angles bigger than 90^0 (obtuse angles). Ensure that you practice drawing such angles.

- Then, assign them to work individually the **application activity 13.4** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial Exercise
You may help the slow learners on a one-to-one basis and ask them to try out some construction for example, Construct a regular pentagon of sides 3 cm.
Additional Exercise
Let fast learners draw a regular pentagon of sides: (a) 4.5 cm (b) 3.8 cm

Answers of application 13.4

Learners should use well sharpened pencils. Check for accurate equal sides and equal interior angles of 108o. Follow through.

13.5.5 Lesson 5: Drawing a regular hexagon

a) Learning Objectives

To draw a regular hexagon.

b) Teaching resources and learning resources

Manila cards, scissors, markers,compass and charts.

d) Teaching and learning activities:

-Start with a small review on the previous lesson.
- Let learners form small groups and distribute to them the necessary learning materials.
- Help learners to discuss on the activity 13.5 in the Learner's Book.
- Facilitate the discussion and come up with a general report.
- Help learners to remember that the properties learned about a hexagon in Unit 12 are going to be used in this lesson.
- Help learners to discover how to draw a regular hexagon using a protractor and ruler correctly.
- Refer to the example in the Learner's Book.
- Ask learners to read it repeatedly in order to follow the instructions very well when drawing.
- Move around checking for straight-edged ruler, readable protractor scales
and well sharpened pencils.
- On sheets of paper, let learners draw a sketch of a hexagon with the properties given in the question.
- Check for: (a) side of 3.5 cm
(b) interior angle of 120o.
(c) symbols indicating equal sides.
(d) six sides
(e) vertices named STUVWX
- Draw a similar sketch on the chalkboard.
- Now lead learners through each step of drawing.
- Move around to all groups to monitor how they manipulate the instruments
and accuracy in drawing.
- Help learners to present their findings and harmonise their answers.

- Collect their work to be displayed in class.
- Let learners read the Study tip.
- Then assign them the Application 13.5.

- Help them where they get challenges.
- Mark their work and help them with corrections.
- Give extra exercise to all learners in form of assignment, revision work or homework such that learners do more practice.

Answers to application 13.5
Guide learners on how to handle and
manipulate protractor and ruler. Check
for accuracy.

13.5.6 Lesson 6: Constructing triangles using a pair of compasses and a ruler.

a) Learning Objectives

Constructing triangles using a pair of compasses and a ruler.

b) Teaching resources and learning resources

Manila cards, scissors, markers,compass and charts.

d) Teaching and learning activities:

- Start with a review on drawing lengths using ruler and pencil.
- In groups let learners discuss on the activity 13.6 in the Learner's Book, page 240.
- Guide each group as they discuss and construct.
- Guide learners through an example; illustrate and demonstrate the steps.

Example: Construct triangle ABC where AB = 8 cm, BC = 6 cm and AC = 5.5 cm.

- Guide learners through the steps:

(i) Help them to come up with a correct labeled sketch
(ii) Draw a long line using pencil and ruler.
(iii) Open or adjust your pair of compasses to measure 8 cm.
- Demonstrate using the chalkboard compasses.
- Ensure that every learner sees what you do.
- You may move to each group as you demonstrate, so that they see clearly.

(iv) Using the length measured, mark it on the line drawn in (ii). Draw the arcs using compasses.
(v) Label the points to make AB = 8 cm.
(vi) Now measure 5.5 cm using pair of compasses and a ruler.
(vii) Fix the compasses needle at A, draw an arc up.
(viii) Now adjust your compasses and measure 6 cm. Place the compasses needle at B and draw an arc of radius 6 cm up to meet the first arc you drew of radius 5.5 cm.
(ix) Hold a ruler and a pencil and draw;
- A straight line from A to the point where arcs meet.
- A straight line from B to the point where arcs meet
- Help learners to realize that the triangle is already done.

(x) Now ask a learner to come and label the constructed triangle.

- Ask learners to try out the steps you have done by constructing the same triangle.
- Help learners to work on the suggested example in the Learner's Book, page 240.
- Move around observing learners' work to ensure that they do the right things and facilitate the slower learners in their difficulties.
- Help learners to present their findings and harmonise their answers.
- You may spend the whole period just helping learners to try out examples. In the next lesson you may allow them to attempt the exercise.
- Guide learners through the Study tip.
- Help them to construct more triangles.
- Help them practice the skills to become perfect.
- Let learners attempt Application 13.6.

- Depending on the results, assign them the remedial and extended activities:

Remedial Exercise
Let slow learners re-do Application 13.6
Additional Exercise
Let fast learners construct the following;
(1) Triangle CDE with CD = 7 cm, DE = 8 cm, CE = 6 cm.
(2) Triangle XYZ with XY = 10 cm, XZ = 7.5 cm and YZ = XZ.
(3) JKL of sides 6.5 cm and measure angle JLK.
(4) Construct the following triangle:
(a) FGH where FG = 7 cm, G = 600 and GH = 6 cm.
(b) MNO with MN = MO = 7.5 cm and OMN = 450

d) Answers to application 13.6
Check for accuracy and follow through**.**

13.5.7 Lesson 7: Constructing a rectangle using a pair of compasses and a ruler

a) Learning Objectives

To construct rectangle using a pair of compasses and a ruler.

b) Teaching resources and learning resources

Manila cards, scissors, markers ,charts, compass and other facilitating resources.

c) Teaching and learning activities:

- Help learners to revise properties of rectangles and squares.
- Help learners to revise on how to construct a right angle.
- Help learners to form small groups then assign to each group the activity 13.7 in the Learner's Book, page 243.
- Move around to monitor the group discussion and give them the time of presentations of their findings and allow each group to display its work.
- Guide learners as you demonstrate the steps in the examples: Construct a rectangle KLMN such that KL = 7 cm and LM = 5 cm.
- Help learners to discover how to construct rectangle using a pair of compasses and a ruler through the following steps:

Steps:
(a) Draw a long straight line using ruler and sharp pencil.
(b) Using a pair of compasses, adjust it to make a length of 7 cm on a ruler.

(c) Cut off 7 cm from the line you drew in (b) using arcs.
(d) Label points K and L, 7 cm to make KL = 7 cm.
(e) Use pair of compasses and construct 90^0 at K then at L.
(f) Measure 5 cm using a pair of compasses from a ruler.
(g) Place the compasses needle at K and draw the arc to make a length

of 5 cm. Label the point N.
(i) Place the compasses with a length of 5 cm, at L and draw an arc to make segment LM = 5cm.
(j) Label the fully constructed rectangle correctly.
- Help learners to do many exercises of constructing rectangle using a pair of compasses and a ruler.
- Move around observing to help those with challenges.
- Let the fast learners now attempt the example in Learners Book, page 243.
- Ensure that every construction is accurately done.
- Help learners to present their work by posting their work on manila cards for display.
- Let learners read the Study tip.
- Then, assign them to work individually the **application activity 13.7** in the Learner's Book. Mark their work and help them with corrections.

Remedial Exercise
Let slow learners re-do Application 13.7.
Additional Exercise
Fast learners construct rectangles and triangles of the given sides;
(a) Rectangle with sides of 3.2 cm and 4.2 cm.
(b) Rectangle with sides of 3.8 cm and 4.6 cm.
(c) Rectangle with sides of 4.2 cm and 3.8 cm.
(d) Rectangle with length 5.6 cm and width 3.2 cm
(e) Rectangle with length 6.3 cm and width 3.8 cm

d) Answers to application 13.7
Check for proper interpretation of the instructions and accuracy.

13.5.8 Lesson 8: Constructing a square using a pair of compasses and a ruler

a) Learning Objectives

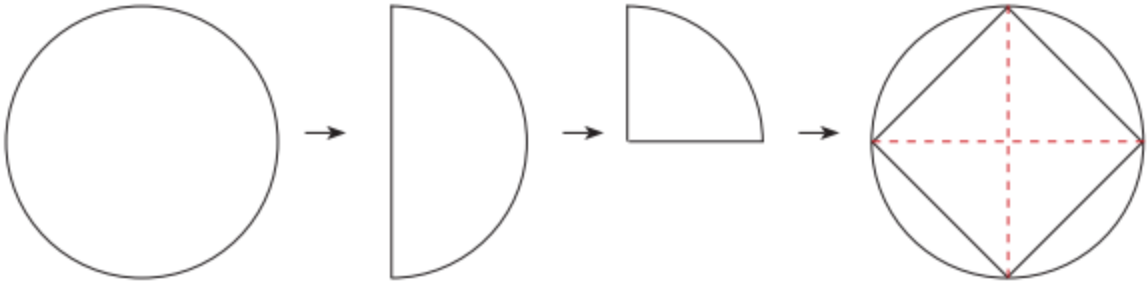
To construct a square using a pair of compasses and a rule.

b) Teaching resources and learning resources

Manila cards, scissors, markers , charts ,compass, pencil and other facilitating resources.

c) Teaching and learning activities:
-Start with mental work about the properties of a square.
- Help learners to review the previous work.
- Help learners to form small groups and assign them the activity 13.8.
- Let them access the suggested instructional materials.
- Help learners to be involved in the activity 13.8 in the Learner's Book

- Help learners to present their answers and moderate their findings to make a general report.
- Help Learners to discover the following shapes from the activity



- When measured, the sides have equal length. It has 4 sides. Even the angles are equal and all measure 90o. Therefore, it is a square.
- Refer to the example in the Learner's Book.
- Let learners read the instruction.
- They already learnt about properties of a square in P.4. So in construction, they are practically worked out and shown.
- Check for good working conditions of the instruments.
- On sheets of paper instruct learners to draw a sketch of a square with each side labelled 3.5 cm.
- Move around monitoring the sketch and advising accordingly.
- Demonstrate how to fix a pencil in compasses.
- The pencil should be firmly fixed into the compass.
- Let learners carry out step by step as instructed in the example.
- Demonstrate how to handle and manipulate a compass during construction.
- Guide learners through every step. Each learner must have a chance to be involved in the practice.
- Check for accuracy. Let learners repeat the construction process as many time they can.
- Finally let them poster their work. Then the teacher displays it in the class.
- Declare that the steps laid out in the example, are the ones used to construct a square accurately.
- Let learners read the Study tip.
- Let them attempt Application 13.8.
- Guide them whenever they need help.
- Mark their work as you check for accuracy in construction.

Remedial activities

Let slow learners should continue with re-doing the Application.

Fast learners can be given extra work of construction as the teacher may decide

d) **Answers to application 13.8**

Check for accurate construction of the equal sides and right angles. Follow through.

13.5.9 Lesson 9: Finding the Centre Angle of a Regular Polygon (40 minutes)

a) Learning Objectives

To find the Centre Angle of a Regular Polygon

b) Teaching resources and learning resources

Manila cards, scissors, markers ,charts ,compass, pencil and other facilitating resources.

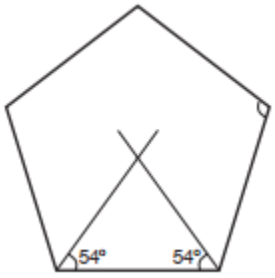
d) Teaching and learning activities:

- Help learners to revise the previous lesson.
-Help learners to form small groups.
- Help learners to discuss on the activity 13.9 in Leaner's Book and give them the suggested instructional materials.
- Help them through the procedure and the time of presentation of their findings, then harmonizes their outcomes and come up with a general report.
- Help learners to discover that when diagonals of a regular polygon intersect, they form equal angles at the centre. These angles are known as centre angles.
- Let learners observe that the number of centre angles is equal to the number of sides of a polygon.
- Help learners to refer to the examples in the Learner's Book.

Note to the teacher: Remember to make a correction in the student book Page 246

on example 1:It is 360^0 :5=72^0 because it is a pentagon

- Let learners draw a regular pentagon as formerly learnt in lesson 13.4
- Using a protractor let learners bisect two interior angles of 108o



Note:
A triangle will be formed.
It will have 2 base angles of 54o each.
Measure the angle formed at the centre.
Accurately measured, the angle at the centre is 72o.

- In case all the interior angles are bisected, learners will observe that each centre angle of a regular polygon is 72o.
- Angles at a point add up to 360o.
- In another instance, it has been observed that the number of centre angles is equal to the number of sides. So, by dividing the number of centre angles into 360o, each centre angles will be obtained.
- Lead learners through the rest of the steps in the examples in the Learner's Book.
- Learners observe that:

Centre angle of a regular pentagon= $\frac{\text{sum of centre angles}}{\text{Number of centre angles}}$

$$= \frac{360}{5} = 72^0$$

Centre angle of regular octagon = $\frac{360}{8} = 45^0$

-Help learners to discover that the value of a centre angle of a regular polygon is equal to the value of its exterior angle.
- Let learners read repeatedly the Study tip. It helps them to internalize the concept.

- Then, assign them to work individually the **application activity 13.9** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and additional exercise:

Remedial Exercise
Slow learners should continue with re-doing the Application to master the skill.
Additional Exercise
Fast learners should attempt the exercise below:
Draw the following regular polygons, bisect the interior angles, then find the centre angle of each of them.
(a) Square (b) Octagon (c) Equilateral triangle (d) Hexagon

d) answers to application 13.9

(a) 120o (b) 51o
(c) 40o (d) 36o
(e) 30o (f) 60o

13.5.10 Lesson 10: Constructing a regular pentagon and regular hexagon

a) Learning Objectives

To construct a regular pentagon and regular hexagon

b) Teaching resources and learning resources

Manila cards, scissors, markers, charts ,compass, pencil and other facilitating resources.

c) Teaching and learning activities:
-Start the lesson with mental work about the properties of a regular pentagon and regular hexagon.
- Make a small review on finding centre angles of regular polygons.
- Form groups among learners and distribute instructional materials.
- Help learners to discuss on the activity 13.10 in the Learner's Book.
- Lead learners through all the steps in the activity.
- Ensure learners use a sharpened pencil, ruler with straight edges, readable scales on the

protractor and a properly fixed pair of compasses.
- Move from one group to another supervising the activity.
- In case learners have difficulty, demonstrate using the chalkboard instruments.
- Move back to groups to check on the progress.

- Help learners to present their findings and harmonises their answers
- Help learners to discover that the polygon formed is a regular pentagon and that it has 5 equal sides

- Collect the work, post it and display it in the Mathematics corner.
- Help learners to refer to the examples in the Learner's Book.
- Let learners work individually and , demonstrate the skills they acquired in the activity.
- Move around monitoring every step.
- Ensure learners take time to carry out every step satisfactorily. Do not rush them.
- Let learners read the Study tip several times. This will help them to internalize the concept and achieve the competences desired.
- Then, assign them to work individually the **application activity 13.10** in the Learner's Book.

Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and additional exercise:

Remedial Exercise
Slow learners should continue with re-doing the Application to master the skill.
Additional Exercise
Fast learners should try out constructing regular pentagons and hexagons with different sides formulated by themselves.

d) **Answers to application 13.10**

Check for accurate measurement of the radius and centre angles of 72o for regular pentagons and 60o for regular hexagons. Check for equal arcs along the circle and straight edges. Follow through.

13.5.11 Lesson 11: Constructing a regular septagon and a regular octagon

a) Learning Objectives

To construct a regular septagon and a regular octagon

b) Teaching resources and learning resources

Manila cards, scissors, markers, charts,compass, pencil and other facilitating resources.

c) Teaching and learning activities:
- Give mental work about the properties of a regular septagon then after, about the properties of a regular octagon.
- Help learners to form small groups and give learners desirable learning materials

- Help learners to discuss on the activity 13.11 in the Learner's Book.
- Ensure that learners use instruments in good working condition.
- Learners have already been exposed to drawing septagons and octagons using a protractor and ruler.
- They have already learnt about finding the centre angles of regular polygons.
- It is upon this basis that learners build on to be able to construct regular polygons using compasses and ruler.
- Ask learners to draw sketches on sheets of paper you provided.
- Guide them as you monitor their procedure. Advise accordingly.

- Every step, write it on the chalkboard before they carry it out practically.
- Follow every step as you monitor the learners.

- Help learners to present their findings and harmonise their answers
- Help learners to discover that:

A septagon has 7 sides. It has 7 interior angles. Each interior angle of a septagon measures approximately 128^o. An octagon has 8 sides. It has 8 interior angles. Each interior angle of an octagon is 135^o.

- Now refer to the examples in the Learner's Book.
- Lead learners to study every step as you explain.
- Ensure they work according to the instructions in the steps.
- Ask the learners to read the Study tip. Let them contribute more according to their observations.
- Check on their practical skills and guide where necessary.
- Give as much practical work to learners for more practice.
- Guide them whenever they get challenged. The extra work may be in form of revision exercise, homework or assignment.

- Then, assign them to work individually the **application activity 13.11** in the Learner's Book. Mark their work and help them with corrections.

d) Answers to application 13.11

Check for accurate measurement of the radius and centre angles of 51o for regular septagon and 45^o for regular octagon.
Check for equal arcs along the circle and straight edges. Follow through.

13.5.12 Lesson 12: Constructing a regular nonagon and decagon

a) Learning Objectives

To construct a regular nonagon and decagon

b) Teaching resources and learning resources

Manila cards, scissors, markers, charts,compass, pencil and other facilitating resources.

d) Teaching and learning activities:

- Give mental work about the properties of a regular nonagon then after, about the properties of a regular decagon.
- Help learners to form small groups . Ensure that your groups have girls and boys. They should also be mixed with slow and fast learners.
- Let learners access the suggested instructional materials.
- Help learners to discuss on the activity 13.12 in the Learners Book.
- On sheets of paper, tell learners to draw sketches of a nonagon and decagon.
- Move around to check whether they have drawn the correct polygon.
- Guide them through the activity in the Learner's Book.
- Follow every step they carry out as mentioned in the activity in the Learner's Book.
- Help learners to present their finings and harmonise their answers

- Help Learners to discover that: A nonagon has a centre angle of 40^{o}, regular or equal sides which are eight. The interior angles of a regular nonagon measure 140^{0} and those of a regular decagon measure 144^{0}.
- Now refer learners to the examples in the Learner's Book.
- Let learners read the instructions.
- Ask them to interpret every step as they construct.
- Guide them through all the steps slowly, for the benefit of understanding the concept very well.
- Monitor every step to your satisfaction. Help learners with difficulties to achieve the desired skills.
- Let learners read the Study tip. They also contribute more according to their observation.
- Let them attempt Application 13.12.
- Guide them to construct correct polygons.
- Mark their work as you move from one group to another.
- Correct mistakes as you move.
- Give extra work to all learners for more practice.

d) Answers to application 13.12

Check for accurate measurement of the radius and centre angles of 40o for regular nonagon and 36o for regular decagon. Check for equal arcs along the circle and straight edges. Follow through.

13.5.13 Lesson 13: Designing nets of cuboids, cubes and prisms

a) Learning Objectives

To design nets of cuboids, cubes and prisms.

b) Teaching resources and learning resources

Manila cards, scissors, markers, charts, pencil and other facilitating resources.

c) Teaching and learning activities:

-Start by naming 3-dimensional objects.
- Help learners to identify faces, vertices and edges on 3D figures.
- In groups let learners discuss and count the faces as required in the activity 13.13
- Help learners to do it personally, in pairs or in a group.
- Help learners to get an empty box of chalk and unfold it carefully.
- Help learners to display the flat shapes that were folded to form it.
- Help learners to draw the net of the flat shapes displayed.
- Let each group present its findings. Then as a Teacher harmonizes the findings of learners.
- Help learners to realize that: **A prism is a 3-dimension objects and guide learners to sort out prisms, pyramids, e.t.c.**

- Help learners to discover general properties of prism: Opposite faces are equal; the faces are joined together.

-Help learners to realize that the name of the prism may depend on the opposite faces, e.g;
Triangular prism = opposite triangular faces (also called tetrahedron).
Square prism = opposite faces are square.
Rectangular prism = opposite faces are rectangles (also called cuboids).
Pentagonal prism = opposite faces are pentagons.
Hexagonal prism = opposite faces are hexagons, e.t.c.

- Guide them to cut open the objects/boxes that you requested them to bring or those you provided to them.
- Once boxes or objects are cut open, remind them of the faces.
- Let them identify the opposite faces.
- Fold back and help them to name the different prisms formed.
- Provide the pre-drawn nets and ask learners to discuss what prisms they form.
- Help learners to drawn nets and ask learners in groups to cut them out.
- Let them fold cut-outs made and form prisms.
- Let them name the prisms formed.
- Help learners to discuss on the example in the Learner's Book, page 257.
- Help learners to cut the objects to form faces, then use them to form nets for shapes.
- Encourage learners to collect as many 3-D items as they can for reference.
- Do not rush as you guide learners through the steps.
- Let the learners manipulate the material i.e; cutting out, folding, gluing, e.t.c.
- Guide them through the Study tip.

- Then, assign them to work individually the **application activity 13.13** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and additional exercise:

Remedial Exercise

Let slow learners draw as many nets as possible. Ask them to cut them out carefully, fold, glue or mask tape to form prisms. Let them name the prisms they have formed.

Additional Exercise

Let fast learners trace out nets and cut them out. Let them fold and glue them. Let them draw their own nets without tressing and form prisms.

d) Answers to application 13.13

Guide the learners to articulate the skill of accurate and precise drawing of faces and nets. Follow through.

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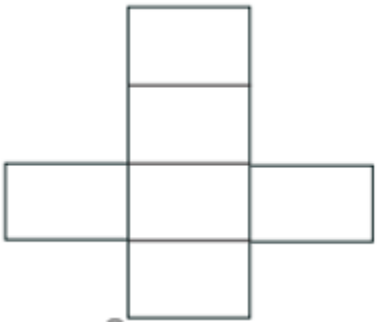

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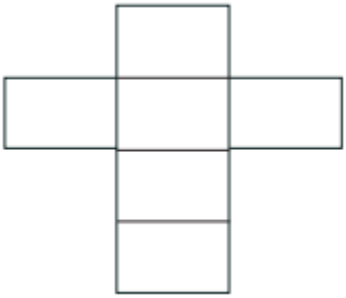

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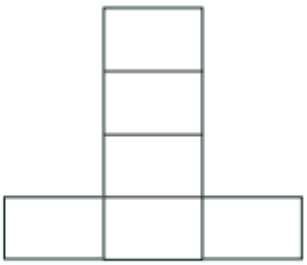
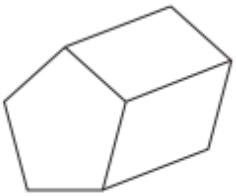


(d)

2 (a)



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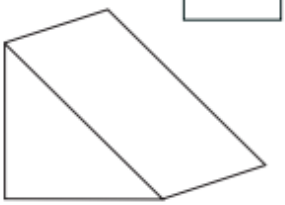

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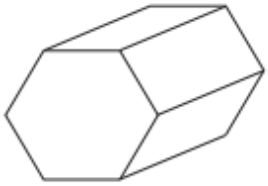
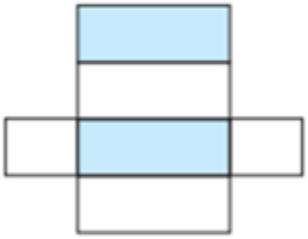


13.6 End of Unit 13 Assessment

1. Check for accurate equal measurement of 5.5 cm along all the 3 sides. Each interior angle has to be 60o. Follow through the accurate drawing.
2. Check for accurate drawing of 5 equal sides of 4.5 cm.
Check for accurate drawing of 5 equal interior angles of 108o each.

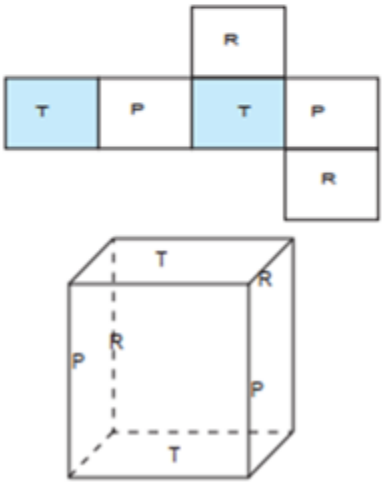
Follow through to check for accuracy in drawing a pentagon.
3. Check for accuracy in constructing sides and angles.
Follow through to assess the skill of construction using compasses.

4. (a)



(b)

5. (a)



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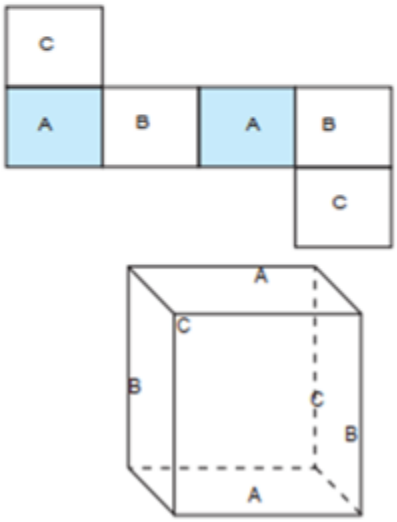


Numbers 6 to 9, supervise the activities as you guide the learners.
Check for accuracy in constructing sides and angles

UNIT 14: AREA BOUNDED BY A CIRCLE, SURFACE AREA OF CUBOIDS AND VOLUME OF A CYLINDER

14.1 Key Unit Competence

To be able to calculate the area enclosed by a circle, the surface area of cuboids and the volume of a cylinder.

14.2 Prerequisites

Pupils will easily learn this unit, if they have a good background on the ccircumference of a circle and the volume of cuboids and cubes (P5, unit 13)

14.3 Cross-cutting issues to be addressed

- **Gender balance**: provide equal opportunity to boys and girls in the lesson
- **Inclusive education**: promote education for all learners in the teaching and learning activities.
- **Environment and sustainability:** This will be addressed when pupils will be maintaining hygiene for their classroom and for materials they used.
- **Peace and values education:** addressed when pupils are encouraged to work collaboratively and peacefully in their group.

14.4 Guidance on introductory activity

Introductory activity:

Designers, Carpenters, Architects all use the concept of area in their work.
Area depicts the size of space on a flat surface.
a) Using a ruler, measure the sides of a gridded sheet of paper from your exercises book and find out how many small squares for the gridded sheet and find the total number of units squares it has. What is the surface of the gridded sheet of paper?
(b) Give examples real objects where the concept of area is used.

Guidance:

- Invite pupils to read the introduction in the learner's book and try to discuss answers in their groups.
- Invite them to a whole class discussion and ask learners if they can easily find the area of a gridded sheet of paper. Guide them to count the number of unit squares are on a gridded sheet of paper.
- Basing on their answers, experience, prior knowledge and abilities, ask them to give the meaning of area of a circular gridded sheet of paper.
- Open a discussion with probing questions to facilitate them to give their predictions and ensure that you arouse their curiosity on what is going to be leant in this unit.

14.5 List of lessons/subheadings

	UNIT 14: Area bounded by a circle, surface area of cuboids and volume of a cylinder	**(16 periods)**
#	**Lesson**	**Number of periods**
0	Introductory activity	
1	Estimating the area bounded by a circle using a squared paper	1
2	Exploring the area bounded by a circle using the concept of circumference and radius	1
3	Calculating the area of a circle using radius	1
4	Calculating the area of a circle given diameter	2
5	Calculating area of a circle using circumference	2
6	Finding the radius using area	1
7	Using the net of a cuboid to determine its surface area	1
8	Calculating the surface area of a cuboid	1
9	Finding the length of a cuboid	1
10	Finding the width of a cuboid	1
11	Finding the height of a cuboid	1
12	Exploring the volume of a cylinder	1
13	Finding volume of a cylinder	1
14	End unit assessment	1

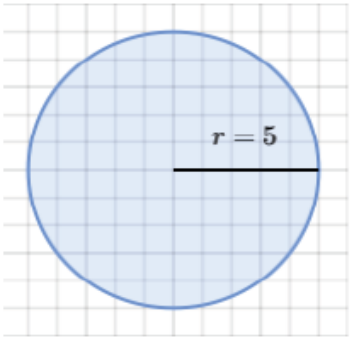
14.5. 1 Lesson 1: Estimating the area bounded by a circle using a squared paper

a) Learning objectives

Explore the area bounded by a circle using a squared paper

b) Teaching resources

Gridded sheets of paper, pair of compass, ruler.

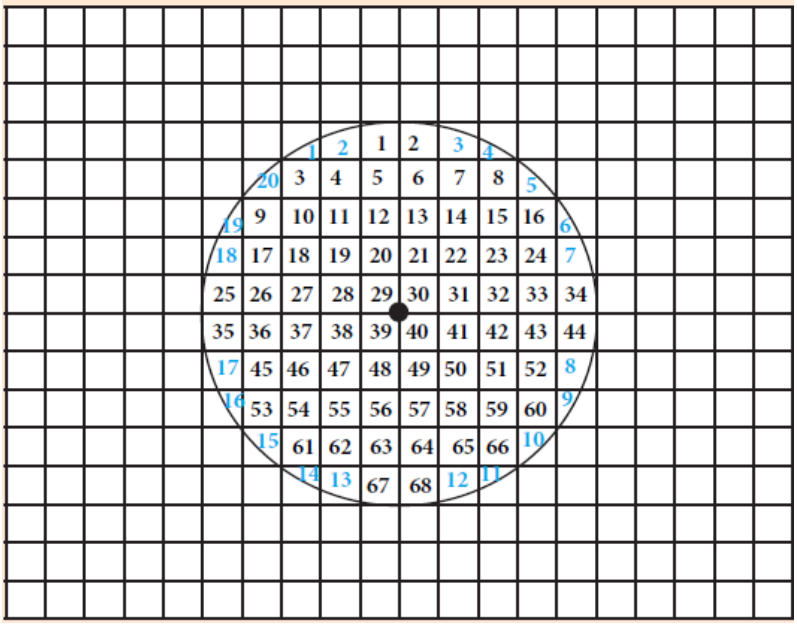


- Textbooks, calculators, etc.

c) Learning activities

Note: For more details on this lesson, see the practical activity 15 in the book for practical activities and experiments.

- Guide learners to review how to find the area of a rectangle and square.
- Form groups of learners, give them instructional materials and assign them to do the activity from the Learner's Book, page 261.
- Invite groups to present their findings to the whole class, and then harmonize answers:
Learners should discover that the number of square within the circle is its area.
- Let learners refer to the examples from the Learner's Book, page 262.



- Explain that; just like finding of area of a rectangle and square experienced in P.4, the area of a circle can be found by counting the number of squares enclosed in it.

Learners derived pi (π) in P.5 so, when the area of a circle is divided by the square of radius, an estimate of pi (π) is got.

In the example, learner should observe that there are 78 squares in the circle, hence the area is 78 squares or 78 square units.

The radius is 5 squares. So, when 5 is squared, 25 is got.

So, $\frac{Area}{r^2} = \pi$. When 28 is divided by 9, an estimate of 3.14 is realized, which is the value of pi (π).

- Ask learners to draw more circles of radii, 4cm, 3 cm and 6 cm.
- Let them find the respective area of each circle by counting squares. Then divide the area by the square of radius.
- Let the individual group make a class presentation after tabulating the results.

	Number of unit squares on radius	r x r = The square of the number of unit squares on radius	Total number of all squares	3.14 x (r x r)
Square 1 (r = **3**)				
Square 2 (r = **4**)				
Square 3 (r = **6**)				

- Assist where they find challenges.
- Guide learners through the examples on page 264. Explain the procedure to the satisfaction of learners.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 14.1** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Slow learners should attempt the exercise below:
Distribute 12 segments you have cut from a circular disk.
Locate a centre on sheets of paper.
Ask them to arrange them such that they form a circle.

Extended activities:

Let fast learners attempt the exercise below:
Distribute sheets of paper to the fast learners.
Ask them to use radius of 3 cm and draw a circle.
Let them cut the disk into 16 segments, then arrange them to approximate a parallelogram.
Using the established formula, ask them to calculate the area of the circle.
Let them attempt to find the area given the radii; r = 10 cm, r = 1.4 cm, r = 100 cm.

d) Answers to Application 14.1

The following answers are approximate figures. Consider answers nearer to:

1) (a) 28 squares (b) 50 squares (c) 113 square (d) 154 squares
(e) 200 squares (f) 314 squares (g) 254 squares (h) 380 squares
(i) 452 squares.

14.5. 2 Lesson 2: The area bounded by a circle using the concept of circumference and radius

a) Learning objectives

Explore the area bounded by a circle using the concept of circumference and radius.

b) Teaching resources

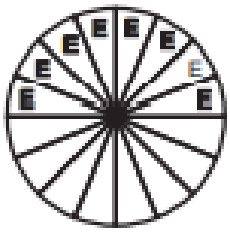
- Circular sheets divided into 4, 6, 8, 12 and 16 equal parts sectors.
- Textbooks, calculators, etc.

c) Learning activities

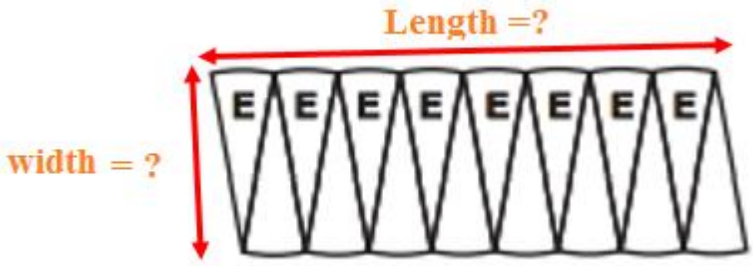
- Brainstorm the learners to give the meaning of area.
- Let them give examples of units of area.
- Remind them that area is the space enclosed by a boundary.
- Guide learners review finding the area of a rectangle and a square by counting squares.
- Form groups of learners and distribute learning materials.

Note: For more details, refer to practical number 16 in the book for practical activities and experiments.

i. Consider and arrange 16 sectors of a circular sheet half of them labeled D to form a circle.



ii. Rearrange these sectors to form a shape as shown below



How is the obtained figure? Does it make sense of a good rectangle? What is the length and width?

How does the figure become as the number of equal sectors of the circle is increasing?

How can you find the area of the obtained figure?

Remember that area of rectangle = Length x width

We see that as the number of equal sectors of the circle is increasing the figure becomes a good rectangle with Length = the half of the circumference of the circle, and Width = radius.

- Guide learners to conclude that as the area of rectangle = Length x width, and

$$\text{Area of circle} = (\text{the half of the circumference of the circle}) \times r = \frac{1}{2} \times 2\pi r \times r = \pi r^2$$

- Ask pupils to work out the following activities for assessment:
  a) Let learners explore the activity using 32 sectors from a circular sheet.
  b) Calculate the area of a circle whose radius 7cm and $\pi = 3.14$
- Finally let learners discover that; Area bounded by a circle = πr^2.
- Guide the learners through the steps, elaborating every step.
- Repeat the procedure whenever the learners get challenges.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 14.2** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 14.2

1) (a) 2,464cm^2 (b) 616 cm^2 (c) 154 cm^2 (d) 3,850 cm^2
   (e) 5,544 cm^2 (f) 124.74 m^2
2) 63,585 cmcm^2 3) 154 cm^2 4) 38.5 cm^2

14.5. 3 Lesson 3: The area of a circle given diameter

a) Learning objectives

Calculate the area of a circle given a diameter

b) Teaching resources

- Problems on the determination of area of a circle whose diameter is given.
- Textbooks, calculators, etc.

c) Learning activities

- Give mental work to learners involving changing diameter to radius and vice-versa. e.g diameter = 14cm, radius = ? Radius = 10 cm, diameter = ?
- Form groups of learners and distribute the learners in pairs.
- Lead the learners in carrying out the activity in the Learner's Book, page 265. Explain the procedure as you demonstrate.
- Now let learners in pairs practice the steps you demonstrated to them.
- Moderate the discussion and then, assess the presentation.
- Give learners more examples and move around manipulating the formula for calculating area of a circle
- Give credit to those who worked out the radius first in the activity and encourage those who failed to try harder next time.

- Write two examples on the chalkboard and ask learners to attempt them on the pieces of paper you provided.

Example: The diameter of a circle is 7cm. Calculate the area bounded.

$$\text{Radius} = \frac{\text{diameter (d)}}{2}$$
$$r = \frac{7}{2}\text{ cm}$$
$$\pi = \frac{22}{7}$$
$$A = \pi r^2$$
$$A = \pi \times r \times r$$

$$\text{Area} = \frac{\cancel{22}^{11}}{\cancel{7}_{1}} \times \frac{\cancel{7}^{1}}{\cancel{2}_{1}} \times \text{cm} \times \frac{7}{2}\text{ cm}$$
$$A = 11 \times 1\text{ cm} \times \frac{7}{2}\text{ cm}$$
$$A = \frac{77}{2}\text{ cm}^2$$
$$A = 38\frac{1}{2}\text{cm}^2$$
$$\text{Area is } 38\frac{1}{2}\text{cm}^2 \text{ or } 38.5\text{cm}^2$$

Now refer to the examples in the Learner's Book, page 265.

- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 14.3** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Let slow learners attempt the exercise below:

(1) Find the radius, give that the diameter is

(i) 28 cm (ii) 12 dm (iii) 42dm

(iv) 63cm (v) 21 m

(2) Calculate the area bounded by a circle given;

(a) diameter = 7cm

(b) diameter = 10cm

(c) diameter = 14 m

Extended activity:

Let fast learners attempt the exercise below:

(1) Calculate the area bounded by circles with a diameter of:

(i) 20 cm (ii) 3 cm (iii) 5 cm (iv) 7 m

(2) Calculate the area of a circle, given that.

(a) D = 0.98 m (b) D = 11.2 cm (c) D = 5.6 m

(d) D = $3\frac{1}{2}$ cm (b) D = $24\frac{1}{2}$ cm.

(3) The following are radii of circles. Calculate the area bounded.

(i) 49 cm (ii) 50 dm (iii) 6.3 m

(iv) $14\frac{1}{4}$ 1214 cm (v) 0.35 m

d) Answers to Application 14.3

1)	314 cm^2	2)	1,256 cm^2	3)	13.88 m^2	4)	61,600 cm^2
5)	1.54 m^2	6)	706.5 cm^2	7)	28.26 m^2		

14.5. 4 Lesson 4: Calculating area of a circle using circumference

a) Learning objectives

Calculate the area of a circle given a circumference

b) Teaching resources

- Problems on the determination of area of a circle whose circumference is given.
- Textbooks, calculators, etc.

c) Learning activities

- Guide learners to review the meaning of area and circumference.
- Form groups of learners and give them the instructional materials.
- Involve learners in the activity from the Leaner's Book, page 266.
- Invite learners to present answers and then, harmonize answers.
- Explain that much as we can use radius and diameter to calculate the area of a circle, we can as well use the circumference.
- Tell learners that the essence of using circumference is to retrieve the radius.

Write an example on the chalkboard and let learners copy it on slips of paper and try to work it out.

Example: The circumference of a circle is 44 cm. Calculate its area.

- Remind learners that circumference is the length around a circle. Area is the region that is bounded by the circle.

Some or all of them are expected to use the deduction from the activity to do the calculation.

Hence: circumference = 2pr

Step 1: Substitute the values of circumference (C) and p, then solve for radius (r).

$C = 2 \times \pi \times r$

$C = 44\ cm,\ \pi = \frac{22}{7},\ r = ?$

$44 = 2 \times \frac{22}{7} r$

$44 = \frac{44}{7} r$

$7 \times 44 = \cancel{7}^{1} \times \frac{44}{\cancel{7}_{1}} r$ (multiply by 7 both sides to eliminate 7)

$7 \times 44 = 44r$

$\frac{\cancel{308}^{7}}{\cancel{44}_{1}} = \frac{\cancel{44}^{1}}{\cancel{44}_{1}} r$

$7 = r$

So, the radius is 7 cm.

Now lead them to calculate area.

Area = πr^2

Area = π x r x r

Area = $\frac{22}{7}$ x 7 cm x 7 cm

Area = $\frac{22}{\cancel{7}_1}$ x $\cancel{7}^1$ cm x 7 cm

Area = 22 x 7 cm^2

Area = 154 cm^2

Therefore, the area of the circle is 154 cm^2.

- Ask learners to refer to the examples in the Learner's Book, page 266 and 267.
- Guide them through every step of the procedure.
  In case some learners seem to be confused, repeat explaining slowly but exhaustively to every learner's satisfaction.
- Give some more examples for learners to do more practice.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 14.4** in the Learner's Book.
  Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Slow learners should attempt the exercise below:

(a) The circumference of a circle is 314 cm. Find its radius.

(b) The circumference of a circle is 22 cm. Find its radius.

(c) Let learners re-do the application to understand the concept more.

Extended activities:

Let fast learners attempt the exercise below:

(a) The circumference of a circle is 35.2 cm. What is its radius?

(b) The circumference of a circle is 4,400 cm^2. Calculate its radius.

(c) The circumference of a circle is 52.8 m^2. Calculate its radius.

(d) Find the radius of a circle with circumference 9.68 m^2.

d) Answers to Application 14.4

1) 616 cm^2 2) 31,400 cm^2 3) 7,850 cm^2 4) 490.6 cm^2

5) 0.06 cm^2 6) 24.64 cm^2

14.5. 5 Lesson 5: Finding the radius using area

a) Learning objectives

- Calculate the radius using area
- Solve problems on the determination of radius using the area.

b) Teaching resources

- Problems on the determination of radius of a circular surface whose area is given.
- Textbooks, calculators, etc.

c) Learning activities

- Give mental work about multiplication table 7:

For example: 7 x 3, 7 x 9, 7 x 6, 7 x 12, etc

- Guide learners to review the work that was done in the previous lesson.
- Form groups of learners and distribute instructional materials.
- Engage learners in the activity from the learner's Book, page 268.
- Invite them to present their findings and harmonize answers:
- Explain the main competence of the lesson.

Tell learners that the activity leads to finding the radius given the area.

Display a worked example on a chart:

Example: The area of a circle is 154 cm2. What is its area?

Let learners read and understand the question.

Let them state the formula for area of a circle first: A = πr^2.

Then they should substitute the given values, then solve.

$A = 15\ cm^2,\ \pi = \frac{22}{7},\ r = ?$

$154 = \frac{22}{7} \times r^2$

$154 = \frac{22}{7} r^2$ (multiply by 7 both sides to eliminate the denominator)

$7 \times 154 = \frac{22}{7_1} r^2 \times \frac{1}{7}$

$1{,}078 = 22r^2$

$\frac{1{,}078^{49}}{22_1} = \frac{22_1}{22_1} r^2$ (divide by coefficient 22 by both sides)

$49 = r^2$ (find the square root on both sides)

$\sqrt{49} = \sqrt{r^2}$

$7 = r$

Therefore, the radius is 7 cm.

- Let learners study and read the example in the Learner's Book, page 268.
- Give some more examples for learners to do more practice.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 14.5** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

d) Answers to Application 14.5

1) 7 cm 2) r = 14 cm 3) 1.4 m 4) 100 cm
5) 70 cm 6) 50 cm.

14.5. 6 Lesson 6: Calculating the surface area of a cuboid

a) Learning objectives

- Calculate the surface area of a cuboid
- Solve problems on the determination of radius using the area.

b) Teaching resources

- Problems on the determination of the surface area of a cuboid.
- Squared paper and a pair of scissors.
- Solid form and nets of cuboids.
- Textbooks, calculators, etc.

c) Learning activities

- Take learners through the steps of calculating area of rectangles and squares.
- Ask them to mention objects which have rectangular and square faces.
- Form groups of learners and distribute materials (boxes and sheets of paper) to each group.
- Assign groups to work on the activity in the Learner's Book, page 269.
- Move around to each group and provide instructional support where necessary.
- Invite groups to present findings to the whole class and then, harmonize answers:

-Guide learners to discover that boxes provided have six faces and each face has a rectangular shape. They as well realize that the faces of some boxes are all equal.

- Learners are expected to have been exposed to shapes of cuboids and cubes.
- Explain that, each pair of opposite faces of a cuboid is equal.

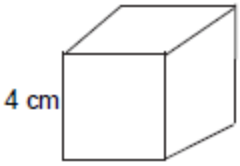
Cuboids have 3 pairs of equal opposite faces. Ask the learners to recognize these pairs of faces.

- Let them do the same with the faces of a cube and prove that they are all equal.
- Ask the learners to draw illustrations of the nets of the dismantled boxes.
- Let them locate the dimensions of each of the edges that form rectangles of the net.
- Guide them to calculate the area of each face, then add to find the total area.
- Explain that, the area of each surface of the cuboid is referred to as surface area.

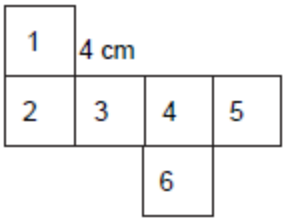
To find the surface area of a cuboid or cube, the sum of area bounded by the rectangular faces is calculated then added. Lead the learners through this experience.

- Explain that different shapes of nets can be obtained after dismantling the cuboid or cube. - Let learners observe this practically as you guide them.
- Guide learners to study the examples in the Learner's Book, page 269 and 270.
- Let learners scrutinize the shape and dimensions of the illustration of the box. Then study its net.
- Let them follow through the procedure of calculating surface area. Help them where they are challenged.
- Draw another illustration of a cube. Ask the learners to draw its net and calculate its surface area.

Example:



A net of a cube



Working

A cube has 6 faces

All the faces are square in shape.

Surface area of a cube is the sum of area bounded by all the 6 square faces.

All edges are equal.

Each edge is 4 cm.

Surface area = $6(s \times s)$

S.A = 6 (side × side)

S.A = $6 \times (4\text{ cm} \times 4\text{ cm}) = 6 \times 16\text{ cm}^2$

S.A = 96 cm^2

So the surface area is 96 cm^2

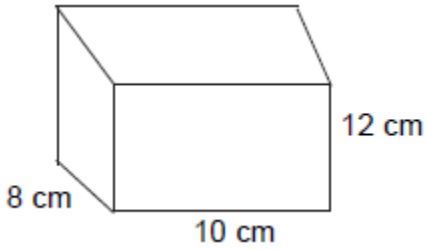
- Ask learners to draw illustrations of cuboids and cubes, draw their nets then calculate their surface area.
- Guide learners to recognize respective dimensions of the edges.
- Monitor their display of perfected skills.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 14.6** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the consolidation activities:

Consolidation activity:

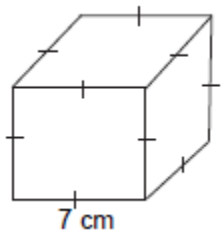
Let fast learners attempt the exercise below:

1. Draw 6 different nets of each of the following:

(a)



(b)



2. Calculate the surface area of the shapes above.

d) Answers to Application 14.6

The following answers are approximate figures. Consider answers nearer to:

(1) 412 cm^2 (2) $1{,}392\text{ cm}^2$ (3) 320 cm^2 (4) 746 cm^2

(5) $1{,}300\text{ cm}^2$ (6) $2{,}400\text{ cm}^2$

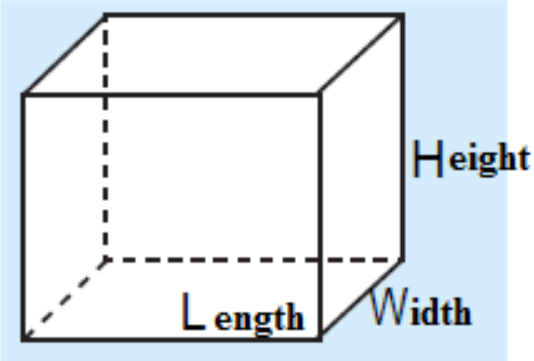
14.5. 7 Lesson 7: Finding the length of cuboids

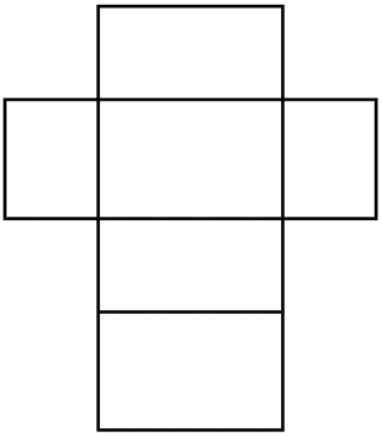
a) Learning objectives

- Calculate the length (edge) of the face of cuboids
- Solve problems on the determination of the length of the face for a cuboid.
- Textbooks, calculators, etc.

b) Teaching resources

- Solid form and nets of cuboids.



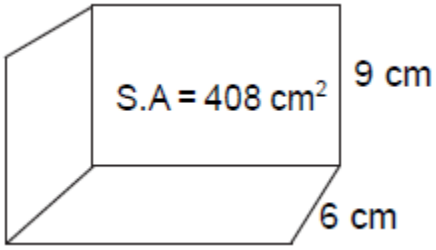


- Problems on the determination of the surface area of cuboids.
- Squared paper and a pair of scissors.
- Textbooks, calculators, etc.

c) Learning activities

- Guide learners to review how to calculate surface area in the previous lesson.
- Let learners get into groups and distribute to them the recommended learning aids.
- Assign them to work out the activity from the Learner's Book, page 271.
- Harmonize the outcomes to make a general report.
- Let learners observed that, they have been calculating for the value of length.
- Explain that if some of the values in the formula A = 2lw + 2lh + 2wh and one is left out, substitution is done, then solving helps to find the unknown value.
- Display the chart with a worked example.

Example: The shape below is a rectangular prism. Study it and answer the question given.



- Ask learners to state the formula for working out surface area of a cuboid.

S.A = 2(l x w) + 2(l x h) + 2(w x h)

S.A = 408 cm2, w = 6 cm, h = 9 cm, l = ?

- Substitute the given values and solve to find the unknown.

408 = 2(l x 6) + 2(l x 9) + 2(6 x 9)

408 = 2 x 6l + 2 x 9l + 2 x 54

$408 = 12l + 18l + 108$

$408 = 30l + 108$ (collect like terms)

$408 - 108 = 30l$

$300 - 30l$

$\frac{\overset{10}{\cancel{300}}}{\cancel{30}_1} = \frac{\cancel{30}^1}{30_1}l$

$10 = l$

Therefore length is 10 cm.

- Repeat the procedure so that learners grasp the concept.
- Invite learners to study the example from the Learner's Book, page 271 and let them study it and follow through.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 14.7** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities.

d) Answers to Application 14.7

(1) 7 cm (2) 7 m (3) 9 cm (4) 10 m (5) 7 cm (6) 13 m

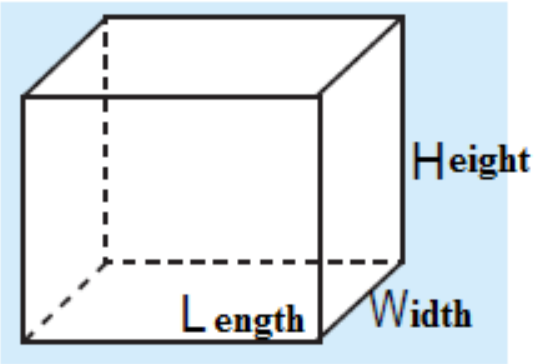
14.5. 8 Lesson 8: Finding the width of a cuboid

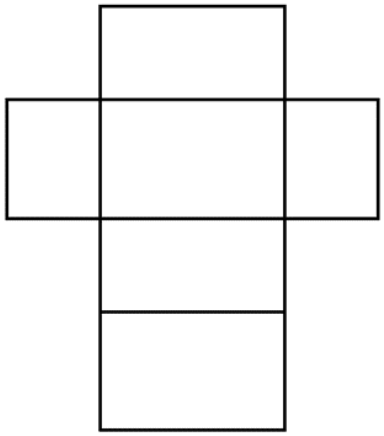
a) Learning objectives

- Calculate the width (edge) of the face of a cuboid
- Solve problems on the determination of the width of the face of a cuboid.
- Textbooks, calculators, etc.

b) Teaching resources

- Solid form and nets of cuboids.





- Squared paper and a pair of scissors.
- Textbooks, calculators, etc.

c) Learning activities

- Give learners mental work involving multiplication.

For example: 12 x 7, 13 x 3, 25 x 3, 11 x 9, 4 x 10 and so on.

- Guide learners to review the previous work.

- Guide learners to form groups and give them instructional materials.
- Let learners carry out the activity from the Learner's Book, page 272.
- Guide them to find the missing side.
- Harmonize the answers to get one general result.
- Learners have observed that in the activity, they are requested to find the value of width which is not given.
- Using the formula for finding surface area of a cuboid, S.A = 2(l x w) + 2(l x h) + 2(w x h), learners have understood that substitution is carried out, then solving for the unknown.
- Write an example or display the worked example on the chalkboard.

Example:

Surface area of a cuboid is 370 cm3. Its length is 11 cm, and height is 9 cm. What is its width?
Learners have already learnt about substituting in the known values. So they are expected to carry it out easily.

S.A = 2(l x w) + 2(l x h) + 2(w x h)
S.A = 370 cm2, h = 9 cm , l = 11 cm, w = ?
Substitute the given values and solve to find the unknown.
370 = 2(11 x w) + 2(11 x 9) + 2(w x 9)
370 = 22w + 198 + 18w
370 = 40w + 198 (collect like terms)
370 - 198 = 40w
172 - 40w

$$\frac{\overset{4.3}{\cancel{172}}}{\cancel{40}_1} = \frac{\cancel{40}_1}{\cancel{40}_1} w$$

$$4.3 = w$$

Therefore width is 4.3 cm.

- Invite learners to study the example in the Learner's Book, page 272.
Let them follow through as you guide them.
- Do it again until they have understood completely.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 14.8** in the Learner's Book.
Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Let slow learners attempt the exercise below:
(a) Given; surface area = 52 cm^2, l = 3 cm, h = 4cm, find w.
(b) Given; l = 3 cm, h = 3 cm, surface area = 54 cm^2, find w.
(c) Given; h = 4 cm, l = 5 cm, Surface are = 94 cm^2, find w.

Extended activities:

Let fast learners attempt the exercise below:

(a) The surface area of a cuboid is 88.6 cm^2. Its length is 5.2 cm and its height is 3 cm. Find its width.

(b) The length of a rectangular water tank is 10.5 m. Its height is 4.5 m and surface area is 244.t m^2. What is its width?

(c) The height of a box is 32 cm. The length is 64 cm. If the surface area is 13,312 cm^2. What is its width?

(d) Find the width of a rectangular container whose surface area is 222.32 m^2, length 9.8 m and height is 4.2 m.

d) Answers to Application 14.8

(1) 4 cm (2) 7 cm (3) 4.3 cm (4) 10 m
(5) 6.05 m (6) 11 m.

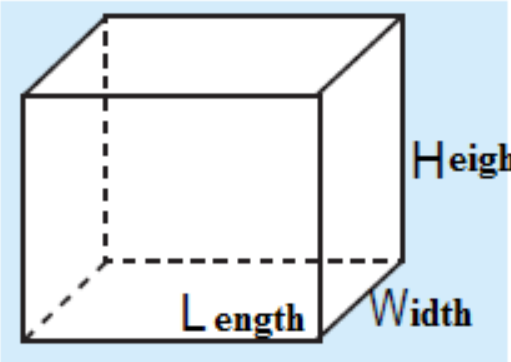
14.5. 9 Lesson 9: Finding the height of a cuboid

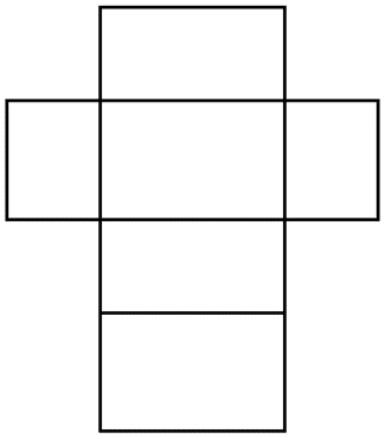
a) Learning objectives

- Calculate the height (edge) of a cuboid
- Solve problems on the determination of the height of a cuboid.
- Textbooks, calculators, etc.

b) Teaching resources

- Solid form and nets of cuboids.





- Squared paper and a pair of scissors.
- Textbooks, calculators, etc.

c) Learning activities

- Give learners mental work about estimating the length, width and height of walls of their classroom. (Use a ruler to confirm the measurements.
- Guide learners to review the work done in the previous lesson.
- Form groups of learners and give them instructional materials.
- Assign groups to carry out the activity in the Learner's Book, page 273.
- Invite groups to present answers and then, harmonize answers.
- Let them discover that the formula in the activity is assimilated to the formula for finding surface area of a cuboid.

So, learners have been involved in working out the unknown assimilated to height of a cuboid.

- Guide learners to study the example in the Learner's Book, page 274.

Learners observe that, the work is almost similar to the previous except in this instance, it is height which is worked out.
Learners follow through step by step slowly in order to understand the procedure.
- Guide them and assist where challenges arise.
- Encourage learners to divide slowly by simple common factors until division is completely done with.
- Give more examples and let learners calculate them on sheets of paper provided by the teacher.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 14.9** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Let slow learners attempt the exercise below:

(a) The length of a cuboid is 5 cm, its width is 3 cm and the surface area is 94 cm2. What is its height?

(b) Given length is 4 cm, width is 3 cm and surface area is 108 cm2, find the height.

Extended activity:

Let fast learners formulate their own questions and later alone calculate the height.

d) Answers to Application 14.9

(1) 4 cm (2) 40 cm (3) 5 m (4) 200 cm
(5) 5 m (6) 6 m.

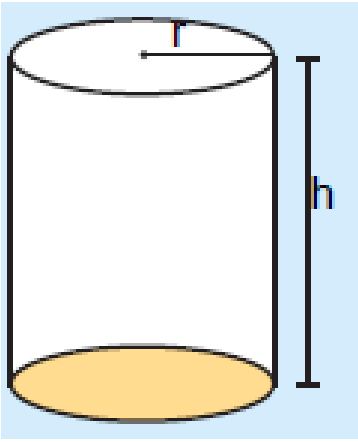
14.5. 10 Lesson 10: Exploring the concept of volume of a cylinder

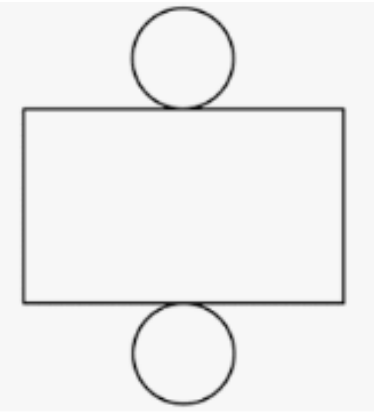
a) Learning objectives

- Explore the volume of a cylinder

b) Teaching resources

- Solid form and nets of cylinder.
- Wooden cylinder/ cylindrical piece of potato or sugar cane
- Problems on the determination of the volume of a cylinder.
- Textbooks, calculators, etc.



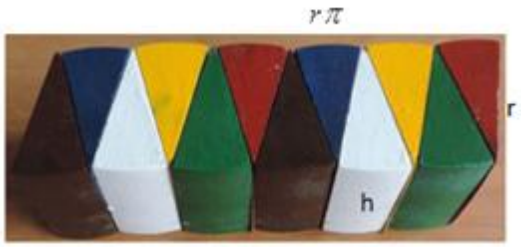


c) Learning activities

Note: For more detail, refer to practical activity 18 in the book for practical activities and experiments in Mathematics.

Step1: Take the wooden cylinder/ cylindrical piece of potato or sugar cane

Step 2: Take the same-colored pieces and place the 6 (2 same colored together form 1) different colored alternatively.



Step 3: Find the volume of this cuboid to obtain the approximate formula for the Volume of Right Circular Cylinder.

What is the shape of the base of the cylinder?

What is the shape of the base of the solid obtained

Step 5: Find the volume of the cylinder.

What is the formula for the area of a rectangle or parallelogram?

- Help learners to interpretation their findings: The segments approximately form a solid cuboid of height 'h', breadth 'r' and length 'πr'

The approximation of cuboid improves by increasing the number of segments/pieces.

The volume of the cylinder is the area of the base ($\pi \times r \times r = \pi r^2$) time the height h.

This is $\pi r^2 \times h$.

The formula for the volume of a cylinder is given by $\pi r^2 \times h$ =where r is the radius of the base and h is the height.

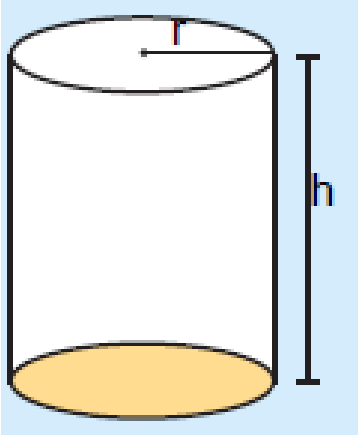
14.5. 11 Lesson 11: The volume of a cylinder

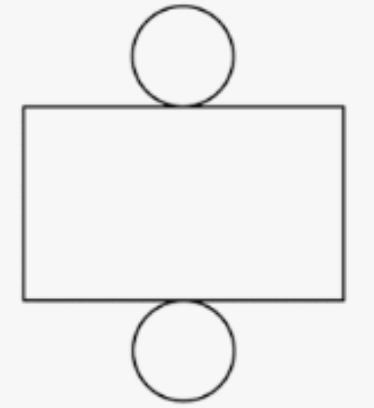
a) Learning objectives

Calculate the volume of a cylinder.

b) Teaching resources

- Solid form and nets of cylinder.
- Problems on the determination of the volume of a cylinder.
- Textbooks, calculators, etc.





c) Learning activities

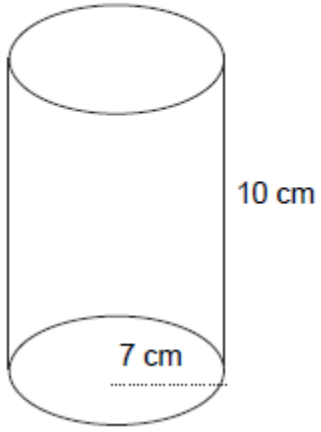
- Guide learners to review how to find the volume of a cuboid and a cube covered in P5.
- Ask the learners to recognize the area covered by the base of a cuboid and a cube.
- Let them give their views about the result of when the base area (area of one face) is multiplied by the height.
- Guide learners to form groups and then, give them the learning materials: Hand out sheets of paper and shapes of boxes and cylinders.
- Ask them to work out the activity from the learner's book.
- Invite them to present findings to the whole class; guide learners to harmonize answers and simplified steps.
- From the activity, the base of a box (cuboid is a rectangle and the base of a cylinder is a circle). To find the volume of a box (cuboid) the area of the base or area of one face is multiplied by the height, i.e Volume = (l × w) × h. Likewise, to find the volume of a cylinder, the area of the base or circular face is multiplied by the height.

Learners should recall that the area of a circle or circular face is found by: A = pr2. It is this area that is multiplied by the height (h) to get the volume hence;

Volume of a cylinder = area of the circular face × height.

Volume = $\pi r^2 \times h$

Example: Calculate the volume of the cylinder.



Ask learners to state the formula;

Volume of a cylinder = $\pi r^2 \times h$.

Let them mention the dimensions;

Radius is 7 cm, height is 10 cm.

The suitable $\pi = \frac{22}{7}$ because 7 cm is a multiple of 7.

So volume = ($\pi \times r \times r$) × h (substitute)

Volume = $\left(\frac{22}{\cancel{7}_1} \times 7 \times \frac{1}{\cancel{7}}\right) \times 10$ cm

Volume = (22 × 1 cm × 7 cm) × 10 cm = 1,540 cm^3

Note for the teacher: We do not have the exact value of the number pi (π), in primary we can use the approximate value equals to the fraction $\frac{22}{7}$.

Learners should know that (cm × cm) × cm = cm^3, hence the units of volume. Therefore the volume is 1,540 cm^3.

- Explain that the units of volume are cubic units, for example, cubic centimetres (cm^3), cubic decimetres (dm^3), cubic metres (m^3) and other cubic units.
- Guide learners to go through examples in the Learner's Book, page 275 and ask them to read and follow through.
- Explain the procedure articulately so that learners understand the concept thoroughly.
- Draw illustrations of cylinders with labeled radii and heights on the chalkboard.
- Ask the learners to copy them in their note books and calculate their volume.
- Move round supervising the exercise.
- Be more explicit when explaining how the volume of a cylinder might be found linking it to a cuboid, area of the base or one face multiplied by height.
- Ensure the formula of finding the volume of a cylinder is established but not simply stated.
- Ask them to cut the shapes and using glue, fix them onto manila cards with the working alongside the cut-outs. Hang them in the Mathematics corner.
- Guide learners through the Study tip as a summary use it to emphasize what you have just taught.
- Then, assign them to work individually the **application activity 14.10** in the Learner's Book. Mark their work and help them with corrections.
- Depending on the results, assign them the remedial and extended activities:

Remedial activity:

Let slow learners work out the following:

(1) $\frac{22}{7} \times 7 \times 7 \times 2$ (2) $\frac{22}{7} \times 7 \times 7 \times 3$ (3) $3.14 \times 10 \times 10 \times 5$

(4) $3.14 \times 2 \times 2 \times 10$ (5) $\frac{22}{7} \times 7 \times 7 \times 1$ (6) $3.14 \times 10 \times 10 \times 10$

Extended activity:

Solve the equation v = pr2h; find r given that;

(1) $V = 1{,}540,\ h = 10,\ \pi = \frac{22}{7}$ (2) $V = 6160,\ h = 10,\ \pi = 3\frac{1}{7}$

(3) $V = 1{,}570,\ h = 5,\ \pi = 3.14$ (4) $V = 12{,}560,\ h = 10,\ \pi = 3.14$

d) Answers to Application 14.10

(1) 2,310,000 cm^3 (2) 14 cm, 616 cm^2 (3) 1,540 m^3

(4) 14 m, 9,240 m^3 (5) 1,695.6 cm^3, 113.04cm^2 (6) 1,386 cm^2

14.6 Answers for the end of Unit assessment

(1) (a) A = 136 cm^2, V = 1,088 cm^3 (b) A = 28.3 cm^2, V = 226 cm^3

(2) A = 113.04 m^2 (3) V= 58.92 m^3 (4) 2.36 m^3 (5) V = 248 dm^3

(6) 6.22 m^3 (7) (a) 9,856 cm^2 (b) 1,386 cm^2 (c) 16,277.76 cm^2

(8) 7,065,000cm^2 9. (a) 69,300,000 cm^3 (b) 28,260,000 cm^3

UNIT 15: STATISTICS

15.1 Key unit competence

To be able to extend methods for collecting data, representing and interpreting it in order to answer a question or explore a hypothesis.

15.2 Prerequisites

To collect, represent and interpret data (Unit 17, P4)

Continuous and discrete quantitative data (Unit 14, P5)

Representing data on bar charts (Unit 14, P5)

Interpreting bar charts (Unit 14, P5)

Representing data using line graphs (Unit 14, P5)

Interpreting line graphs (Unit 14, P5)

15.3 Cross-cutting issues

Through out the teaching process of this unit, it will be crucial to help learners to master the content and it is better to address cross-cutting issues where possible. In this unit, we will address the following Cross-cutting issues as non-stand-alone within classroom activities and through the development of the content.

- **Peace and value education:** As a teacher, you have to be a peace maker in your class and role model so that learners will imitate how you behave. When there is any conflict do not leave without helping to solve it within the lesson. Encourage learners to behave well, being humble, honest, etc.
- **Gender Education:** This cross-cutting issue will be addressed through giving equal opportunities to both boys and girls during the lesson.

15.4 Guidance on introductory activity

Guidance

- Before you start the lesson, first use warm-ups or energizers in order to engage learners into the lesson.
- Help learners to form group before you assign them an activity.

- Invite them to read the introduction in the learner's book and try to discuss answers of questions in their groups.
- While they are doing the introductory activity, walk around while monitoring their work and helping where they have difficulties.
- Invite them to a whole class discussion and ask learners to explain why some people record data of some things.
- Basing on their answers, experience, prior knowledge and abilities, ask them to try to explain data, frequency and tally.
- Open a discussion with probing questions to facilitate them to give their predictions and ensure that you arouse their curiosity on what is going to be leant in this unit. This unit is aimed to help learners to explore the relationship between data, frequency and tallies,

Possible answers to introductory activity

Teacher will receive different answers from students' discussion and help them to harmonize them from sub question (a) to (d)

15.5 List of Lesson/Subheading

	UNIT 15: STATISTICS	**16 periods**
#	**Lessons**	**Number of Periods**
0	Introductory activity	1
1	Collecting the data to investigate a question	1
2	Exploring a question using a tally to complete a frequency table.	1
3	Interpreting the data in frequency tables	2
4	Representing the data in a bar chart	2
5	Interpreting the data in a bar chart	2
6	Representing Data in Pie Charts	2

7	Interpreting the data in pie charts to draw a conclusion	2
8	Collect the data, summarize it in a table and represent in a bar chart or a pie chart	2
9	End unit assessment	1

15.5.2 Lesson 2: Collecting the data to investigate a question

a) Learning Objectives

Be able to collect the data to investigate a question

b) Teaching resources and learning resources

Manila cards, scissors, markers and masking tape and other resources that the teachers can use to achieve his/her goals.

c) Learning activities:

- Start with a review of a few things about statistics using questions.
- Help learners to form groups and provide each group with marks of the same value.
- Guide learners as they carry out the activity in the Learner's Book, page 279.
- Allow each group to present its findings and present the number of marks recorded up with a single table as a report.
- Let learners do the example in the Learner's Book, page 279.
- Remind learners that mass is presented in groups of fives using tallies.
- You many ask a few oral questions to check whether the learners were following:
  (a) How many times does 33 kg appear?
  (b) How many learners had 42 kg?
- Bring out a question that needs investigating a question.
  Example: Which type of food do the children of P.6 feed on most in their homes?
- Create initials for each type of food for easy recording for example "R" for rice, "P" for posho, "C" for cassava, "S" for sweat potatoes and "B" for banana.
- Let the learners' collect data and help them to harmonize them.

- Guide the learners as they discuss the Study tip.
- Guide the learners to present their findings.
- Let the learners attempt Application 15.1.
- Mark their work and help them do corrections.
- Let each child say what they eat as you record.
- Organize data in the table you prepared on the chart. Ensure that every learner participates.
- Emphasize to the learners that tallies must be presented in fives. Explain to the learners that "frequency" is the same as number of times or occurrences.

c) Answer to application activity 15.1

1) (a)

Marks	Tally	Frequency
55	III	3
56	I	1
57	III	3
59	I	1
60	I	1
61	I	1
63	I	1
65	I	1
66	IIII	4
67	I	1
68	IIII	4
70	𝍸	5
71	III	3
72	II	2
73	IIII	4
74	II	2
78	I	1
83	𝍸	5
85	I	1
Total		44

(b) 44 learners

2) (a)

Kilograms	Tally	Frequency
1	|||	5
2	|	9
3	|||	10
4	|	17
5	|	10
6	|	9
Total	|	60

(b) 60 kg

15.5.3 Lesson 3: Interpreting the data in frequency tables

a) Learning Objectives

Be able to interpret the data in frequency tables

b) Teaching resources and learning resources

Prepared chart, markers and other resources that will help the teacher to achieve a goal.

c) Teaching and learning activities:

- Revise by presenting data in tables.
- Guide the learners to form groups and guide them as they carry out the activity in the Learner's Book, page 281.
- Display a chart you prepared and ask learners to study the table on it.
  Example: Saplings that a person planted in the first 4 months of the year.

Months	Tally	Frequency
Jan	𝍸 𝍸 𝍸 𝍸 |	21
Feb	𝍸 𝍸 𝍸 |	16
Mar	𝍸 𝍸 𝍸 𝍸 |||	23
April	𝍸 |||	8

(a)Which month had the least number of saplings planted?

(b) How many saplings were planted in Jan?

(c) How many more saplings were planted in March than in February?

- Let learners answer questions about the table.
- You can ask oral questions and each time encourage learners to answer fully.
- Refer to the Learner's Book and guide learners as they study the example.
- Form more questions to help learners interpret the table fully.

Example

(a) Which age group has the least number of learners?

(b) If all learners who are 13 and 14 years supervise 2 learners of other age groups, how many learners does each one supervises?

- Encourage learners to study every data of the table and answer using complete sentences. This will help them to develop the language as well.
- Guide learners as they discuss the Study tip.
- Let them attempt the Application 15.2.
- Mark their work and help them do the corrections.
- Let them take notes in their exercise books.

Remedial activity

Let slow learners copy and complete the frequency tables:
Animals at Manzi's farm

Animal	Tally	Frequency
Goats	𝍸 𝍸 𝍸 𝍸 𝍸	_____
Sheep	_____	9
Cattle	𝍸 𝍸 𝍸 𝍸 |||	_____
Rabbits	_____	35
Pigs	𝍸 𝍸 𝍸 𝍸 𝍸 |	_____
Total		

Bottles of drinks Uwachu sold at her restaurant

Drinks	Tally	Frequency
Soda	𝍸 𝍸 𝍸 𝍸 |	_____
Juice	_____	32
Milk	_____	24
Water	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	_____
Omusururu	_____	17
Total number of bottles		

Let fast learners copy and answer questions about the table below.

Babies who were immunised at Butaro Hospital.

Months	Tally	Frequency
Jan	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸	_____
Feb	𝍸 𝍸 𝍸 𝍸	_____
Mar	𝍸 𝍸 𝍸 𝍸 |||	_____
April	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 ||	_____
May	𝍸 𝍸 𝍸 𝍸 𝍸 |||	_____
June	𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 ||||	_____
Total		

(a) Complete the table.
(b) How many months are shown on the table?
(c) Which month registered the highest number of babies?

d) Answers to Application 15.2

1) (a) 48 saplings (b)Eucalyptus and cypress (c) 20 saplings (d) 26 saplings

2) (a) 12 learners (b) 13 years (c) 46 learners

15.5.4 Lesson 4: Representing the data in a bar chart

a) Learning Objectives

To represent the data in a bar chart

b) Teaching resources and learning resources

Prepared chart, markers and other resources that will help the teacher to achieve a goal.

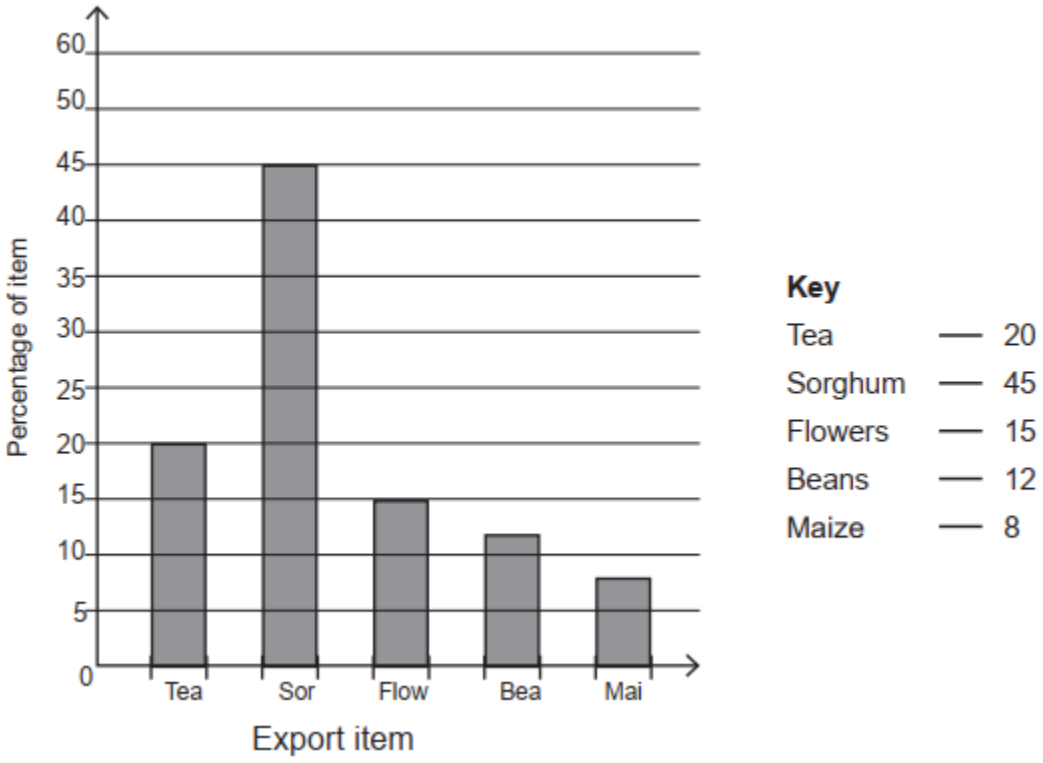
c) Teaching and learning activities:

- Review interpreting frequency tables which were done in the previous subtopic using the chart you displayed.
- Facilitate learners in group formation and guide them as they carry out the activity in the Learner's Book, page 283.

- Give chance to each group to present their work.
- Come up with a general presentation.

  That is; A suitable scale for the vertical axis should be picked on, and in this case each small square representing 10 would work.

  Next we represent the data in the graph.



- Explain to the learners the importance of choosing a suitable scale. A scale helps us to draw an appropriate graph, that is one which is not too big if the data is of large numbers.
- You may ask a few questions to check whether the learners were following.
- Refer to the Learner's Book and lead learners through the example.
- Give learners different groups of data and ask them to choose suitable scales.

Example

Subject	Science	Maths	English	SST
Marks	60	85	70	80

- Here the suitable vertical scale will be 1 small square equal to 10.
- Guide learners through the Study tip.
- Let the learners attempt Application 15.3.
- Mark their work and help them to do corrections.

Remedial activity

Let both slow and fast learners collect data from 60 respondents concerning:

Favorite subject

House work which people participate in most.

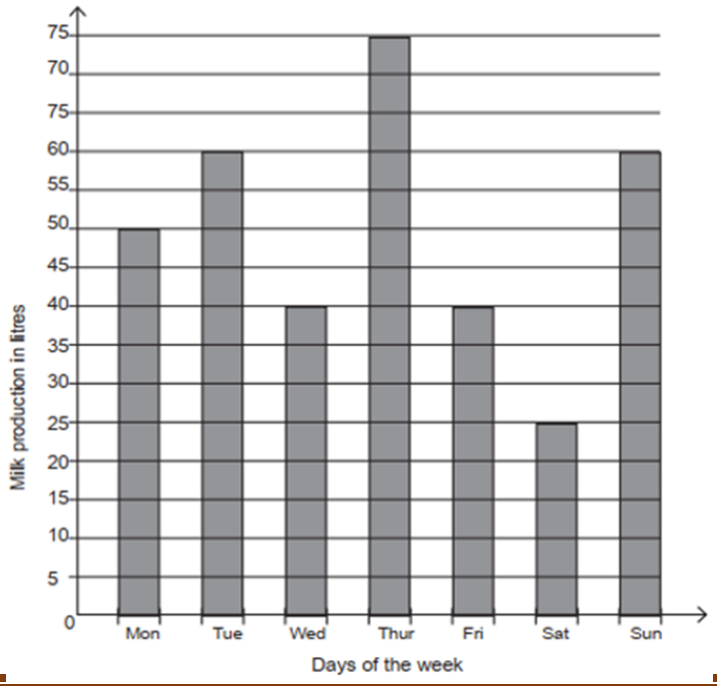
(a) In both questions learners should collect data.

(b) Organize data in frequency tables.

(c) Represent the data in bar charts.

d) Answers to Application 15.3

1) (a) Bar graph showing litres of milk on a farm in a week.

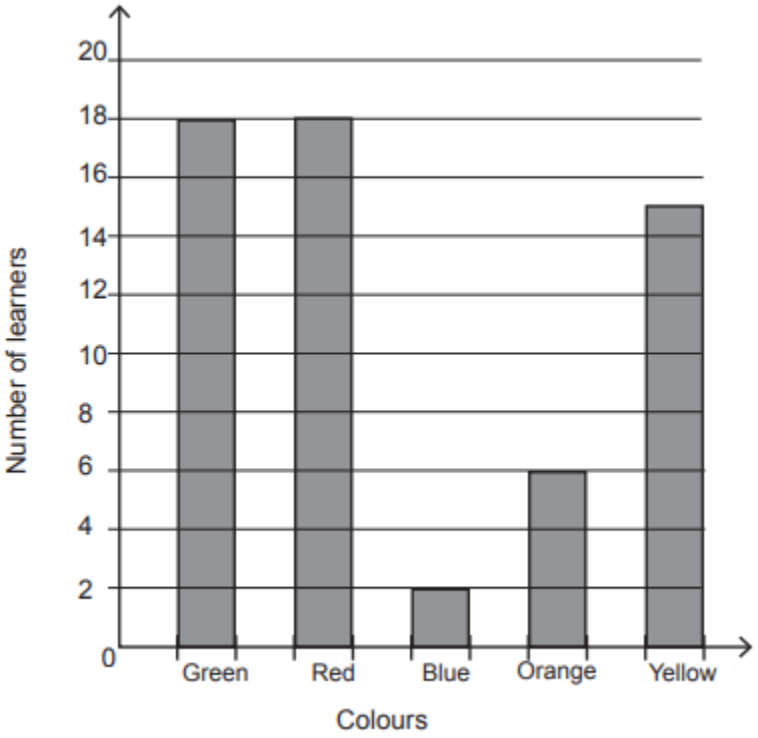


(b) 360 litres were produced in the week.

2) (a) Frequency table for best colors of clothes.

Colour of the clothes	Tally	Frequency
Green	𝍸 𝍸 𝍸 |||	18
Red	𝍸 𝍸 𝍸 |||	18
Blue	|||	3
Orange	𝍸 |	6
Yellow	𝍸 𝍸 𝍸	15
Total		60

(b) A bar chart showing the best colors of clothes that P.6 learners picked



15.5.5 Lesson 5: Interpreting the data in a bar chart

a)Learning Objectives

Be able to interpret the data in a bar chart

b) Teaching resources and learning resources

Prepared chart,markers and other teaching resources that can help the teacher to achieve his/her goals.

c) Teaching and learning activities:

- To start by representing data in bar charts using the chart you used in the previous lesson.
- Help learners to form groups.
- Facilitate each group as they discuss while carrying out the activity in the learner's book, page 285.
- Facilitate each group to present its report and later make a class discussion to come up with one general report.
- The diagram in the activity is a bar chart/graph.
- The title to the graph can be "trays of eggs collected by Uwera weekly.
- Number of trays are represented on the vertical axis while days of the week are represented on the horizontal axis.
- Display a chart you prepared and use it to teach interpreting data in a bar chart.
- Let learners study the graph and answer oral questions about it.
- Refer to the example in the Learner's Book, page 285.
- Let the learners study the scales and tell what each scale represents.
- Guide learners through each question while encouraging them to answer in full.
- Facilitate the weaker learners.
- Form other questions that can help learners to exhaustively interpret the graph.

Example

(a) In which month did Mr. Muhire export:

i) The least number of tonnes of Maize?

ii) The highest number of tonnes of maize?

(b) What is represented on the horizontal axis?

(c) What is represented on the vertical axis?

- Let learners read and interpret the Study tip.

- Let them attempt Application 15.4.
- Explain to the learners that bar charts and bar graphs are the same. Explain that some times the bars on a chart are horizontal.

Remedial activities

Let slow learners interpret tables similar to the one below.

The table shows favourite sauce of a grade 6 class.

Type of sauce	meat	peas	beans	fish	G nuts
Number of Learner's	12	10	24	6	14

1. How many learners like ground nuts?
2. Which type of sauce is most liked by the learners?
3. Which type of sauce is least liked by the learners?
4. How many more learners like beans than meat?
5. If 3 of the learners who like peas are boys, how many girls like peas?

Extended activities:

Fast learners can also interpret data in tables but this time using more complex questions.

Type of animal	cattle	sheep	rabbit	goats	Cats
Number of animals	60	20	40	25	5

1. What is the most uncommon animal at the farm?
2. If 1/5 of the goats on the farm are bull goats, how many bull goats are at the farm?

3. Express rabbits at the farm as a fraction of all the animals at the farm.

4. Express the cattle at the farm as a percentage of all the animals at the farm.

5. If 1/2 of the sheep at the farm give birth to 2 lambs each, how many sheep will be at the farm?

e) Answers to Application 15.4

1) The answer are the following

(a) week 2 and week 5 (b) week 3

(c) 190 kg (d) 133,000 Frw

2) The answer are the following

(a) English (b) Science and Mathematics

(c) 20 copies (d) 375,000 Frw

(e) 360 copies

15.5.6 Lesson 6: Representing Data in Pie Charts

a) Learning Objectives

Be able to represent Data in Pie Charts

b) Teaching resources and learning resources

Prepared chart, markers and other learning resources that can help the teachers to achieve his/her goal.

c) Teaching and learning activities:

Start with mental work on multiplication of a fraction by a whole number.

Example

$\frac{1}{2} \times 40,\ \frac{1}{3} \times 90,\ \frac{1}{4} \times 80,\ \frac{1}{5} \times 100,\ \frac{1}{6} \times 60,\ \frac{2}{5} \times 50,\ \frac{3}{8} \times 160$ and so on.

- Ask learners to form groups and provide each group with a manila sheet, ruler, colored pencils, and a compass.
- Guide learners as they carry out the activity in the Learner's Book, page 288.

- Allow each group to present its report and later give a general report. That is; a circle which is big enough to be drawn and divided into 5 parts.
- Multiply each fraction by 360^o gives;
- We notice that the sum of the products of each fraction is equal to 360^o.
- Help learners to realize that what they are going to learn requires them to change fractions into degrees by multiplying given fractions by 360^0.
- Display a chart with an example similar to the one below to read the question and later work out.

  Example

If 1 /4 of the learners in a school are in the drama club, 1/ 3 are in the debate club and 5/12 are in science club. Represent the data above in a pie chart.

- Explain to the learners the meaning of a pie chart. Help them to realize that pie charts are also called circle graphs.
- Tell learners that since they have to present data in a circle, they must first change the data into degrees. Hence the portion for:

$$\text{Dram club} = \frac{1}{4} \times 360^\circ = 90^0.$$

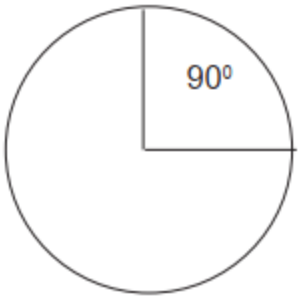
$$\text{Debate club} = \frac{1}{3} \times 360^\circ = 120^0$$

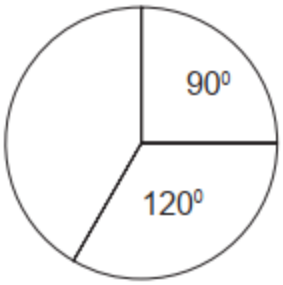
$$\text{Science club} = \frac{5}{12} \times 360^\circ = 150^0.$$

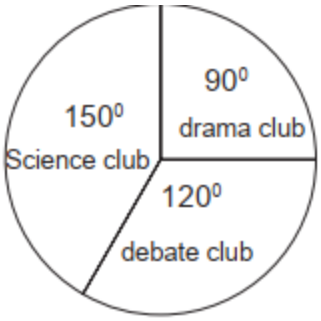
- Now guide learners as they transfer the data they have gotten as degrees to the circle measuring the angles using protractor.

- Step 1: Draw a circle

Step 2: Measure 90^0, 120^0, now the remaining angle is 150^0.







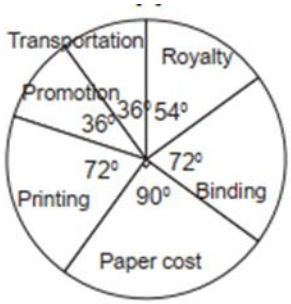
- Refer to the Learner's Book, page 288 and guide them through the example.
- Give learners chance to ask questions and later guide them through the accurate measurement of sector angles in degrees.
- Take learners through the Study tip and ask them to mention any other organization or professionals who use circle graphs.
- Let learners attempt **Application 15.5.**
- Emphasize to the learners that the outer scale of the protractor should be used when measuring angle. Ensure that they measure accurately to avoid wrong presentation.

Remedial activity

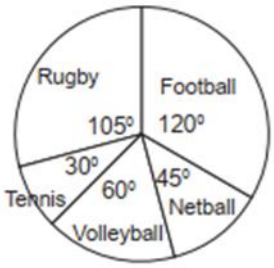
Let both slow and fast learners list 3 major events they carry out at school every day which require time. Present time spent on each event as a fraction out of the hours they spend at school. Change the time to degrees and finally represent the data in a pie chart

d) Answers to Application 15.5

1)



2)



15.5.7 Lesson 7: Interpreting the data in pie charts to draw a conclusion

a) Learning Objectives

To interpret the data in pie charts to draw a conclusion

b) Teaching resources and learning resources

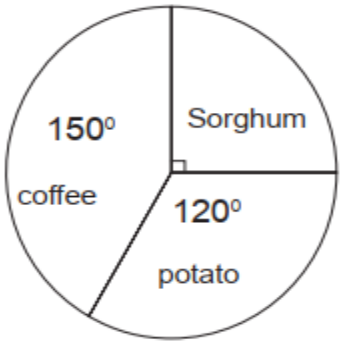
Prepared chart, manila cards, markers and other resources that can help the teacher to achieve his/her goal.

c) Teaching and learning activities:

- Through group review representing data in pie charts using simple data.
- Ask learners to form groups and guide them as they carry out the activity in the Learner's Book, page 289.
- Allow each group to present their findings and later discuss to come up with a single presentation.
- Display a chart with an example of a pie chart and ask learners to study it, then ask a few questions about it.

Example

The circle graph below shows crop cover at Mrs. Gasabo's farm.



Which crop covers the biggest part of the land?

(2) How big is the sector for sorghum?

(3) If Mrs. Gazebo's Garden has an area of 72 acres, find the size of the land covered by potato and so on.

- Help learners to realize that all they need is to study the graph, read the questions and understand, then work out.
- Refer to the Learner's Book and guide learners as they study the example and work out each part of it.
- Let learners read and internalize the Study tip.
- Use the Study tip to emphasize what you have just taught.
- Let learners attempt Application **15.6.**
- Ensure that learners practice multiplication of fractions by whole numbers since it is a concept they apply when interpreting pie charts.

- Help learners to realize that all they need is to study the graph, read the

questions and understand, then work out.

- Refer to the Learner's Book and guide learners as they study the example

and work out each part of it.

- Let learners read and internalize the Study tip.
- Use the Study tip to emphasize what you have just taught.
- Let learners attempt Application 15.6.
- Ensure that learners practice multiplication of fractions by whole numbers since it is a concept they apply when interpreting pie charts.

- Remind learners that a right angle is 900, so even if 900 is not indicated on a pie chart, they should just know how to go over it.

Remedial activity

Slow learners can try out the exercise below to help them master their cancellation skill.

Example

(1) 100 25 × 360 = (2) 100 40 × 360 = (3) 100 60 × 360 =

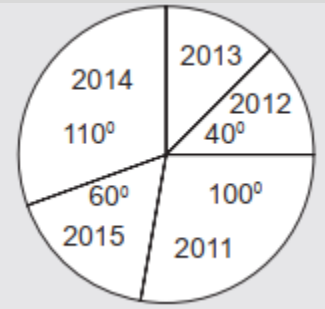
(4) 360 45 × 720 = (5) 360 90 × 720 = (6) 135 360 × 720 =

(7) 12 30 × 360 = (8) 15 30 × 360 = (9) 20 30 × 360 =

Additional Exercise

Fast learners can copy and answer questions for the pie chart below.

The graph below shows a company's sales for 5 years.



A company raised 56 million dollars.

(a) Find the size of the sector for the year 2013.

(b) In which year did the company realize the highest sales?

(c) How much did the company raise in 2012?

(d) In which year did the company realize the greatest decrease in sales?

(e) If 1 dollar = 880 Frw, how much Rwandan francs did the company raise in the year 2015?

(f) Find the percentage sales for 2015

d) Answers to Application 15.6

1) (a) Taxi (b) 40,000 people

(c) 16,000 people

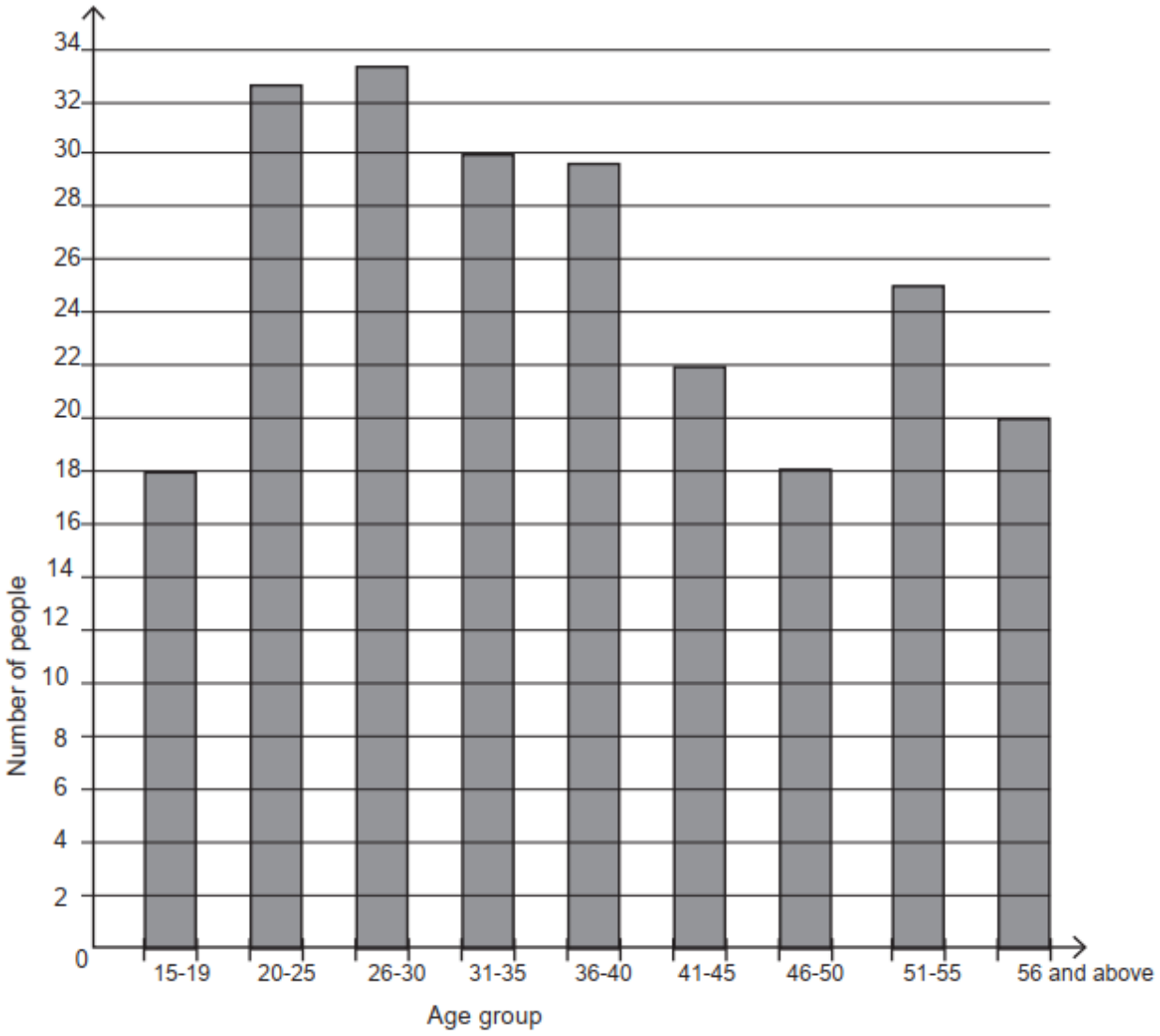
2) (a) 162 3% or 16.6% (b) 90 pigs (c) 225,000 Frw

10.6 End of unit assessment

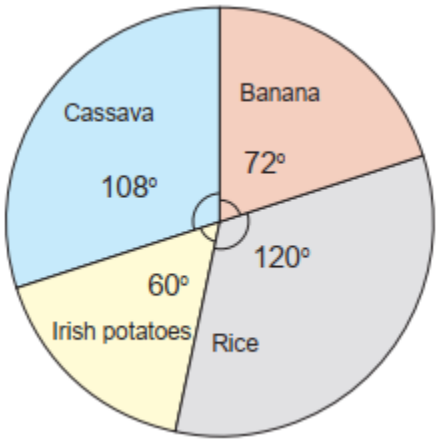
1)

Height in Cm	Tallies	Frequency
118	|||	4
125	𝍸 |	6
128	𝍸 𝍸 |	11
130	𝍸 ||||	9
132	|||	3
134	||	2
138	|	1
140	|	1
142	|	3
Total		40

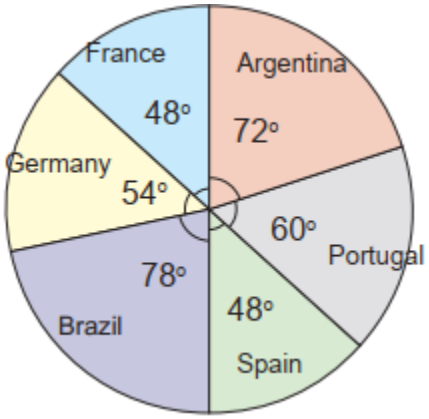
A bar chart showing age groups of people in a certain village on the voter's register.



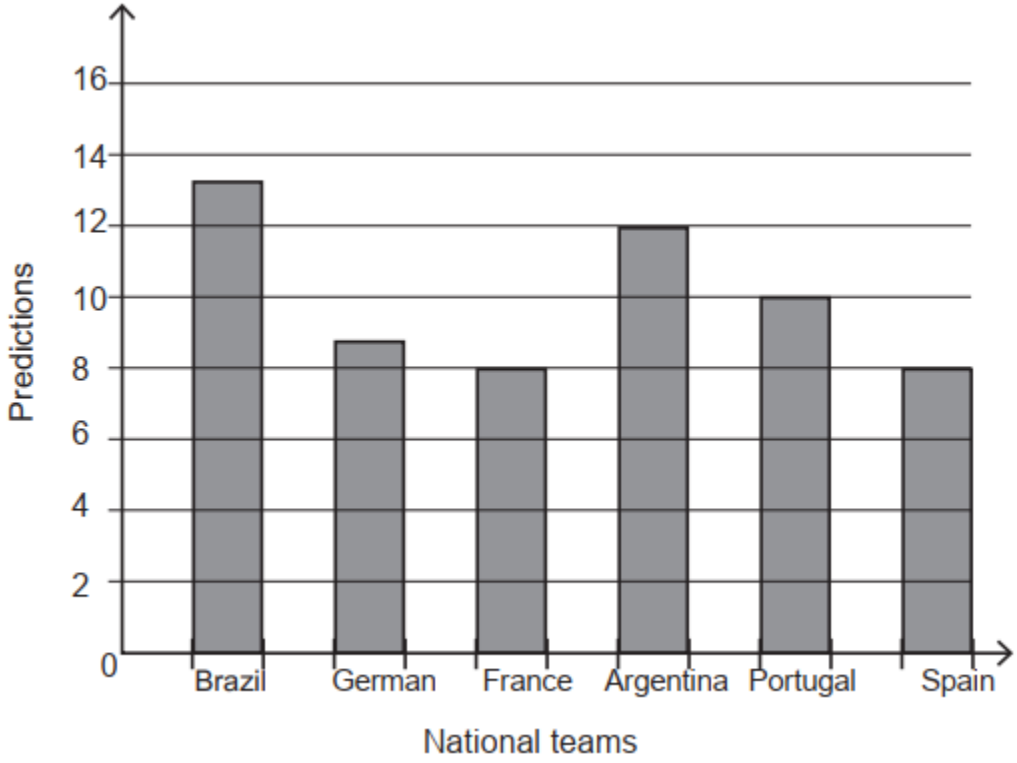
3) Pie chart representing most liked food by P.6 learners



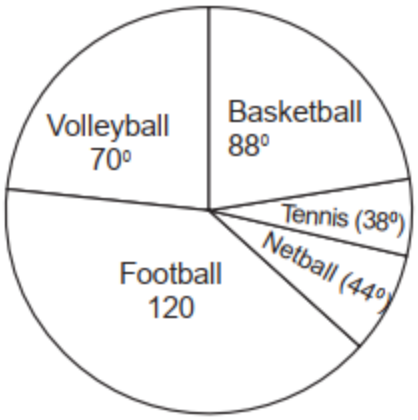
4) Pie chart showing predictions for the world cup winner.



Bar graph showing predictions for the world cup winner



5) Pie chart showing games played by different people in our village



6) (a) $26\frac{2}{3}\%$ (b) 17 learners

(c) 12 learners

7) (a) 1 square = 8 litres of milk

(b) none

(c) 96 litres

(d) Thursday and Saturday

(e) 35,200 Frw

UNIT 16: PROBABILITY

16.1 Key unit competence

To be able to order events in terms of likelihood (impossible, equally likely, certain).

16.2 Prerequisites

Pupils will easily learn this unit, if they studied well the content for unit 15 of P5 where they learnt Vocabulary of chance, experiments and chances.

16.3 Cross-cutting issues to be addressed

- **Gender balance**: provide equal opportunity to boys and girls in the lesson
- **Inclusive education**: promote education for all learners in the teaching and learning activities.
- **Environment and sustainability:** This will be addressed when pupils will be maintaining hygiene for their classroom and for materials they used.
- **Peace and values education:** addressed when pupils are encouraged to work collaboratively and peacefully in their group.

16.4 Guidance on introductory activity

Introductory activity:

Things in nature have no law of happening. Some things occur by chance. Some things must happen; some have even chance of happening, while others are practically impossible. For example, before any Football match starts, the spectators are not sure who will win. The chance of winning the game is equal at the beginning. At the end of the game, different possible outcomes or results may occur.

(a) With support of examples could you predict how the different possible outcomes or results will look like?

(b) Do you think that to have the same score in a football match is certain to happen? equally likely to happen? or impossible to happen? Justify your answer.

Guidance:

- Invite pupils to read the introduction in the learner's book and try to discuss answers in their groups.
- Invite them to a whole class discussion and let groups present their answers.
- Basing on their answers, experience, prior knowledge and abilities, ask them to discuss different examples of impossible, certain and equal likely events.
- Open a discussion with probing questions to facilitate them to give their predictions and ensure that you arouse their curiosity on what is going to be leant in this unit.

16.5 List of lessons/subheadings

	UNIT 12: Regular polygons and bearings	**16 Periods**
	Lessons	Number of Periods
0	Introductory activity	1
1	Vocabulary of chance: impossible, certain.	1
2	Vocabulary of chance: equally likely, events, chance, unlikely, likely	2

3	Using expected outcomes of experiment to decide how likely an event is to happen	2
4	Determining the likelihood of events	2
5	End unit assessment	1

16.5. 1 Lesson 1: The use of vocabulary of chance: impossible, certain.

a) Learning objectives

Use of impossible and certain as vocabularies of chance.

b) Teaching resources

Coins, dice, Flash cards words written on them: **certain, likely, equally likely, unlikely, impossible.**.

- Textbooks, calculators, etc.

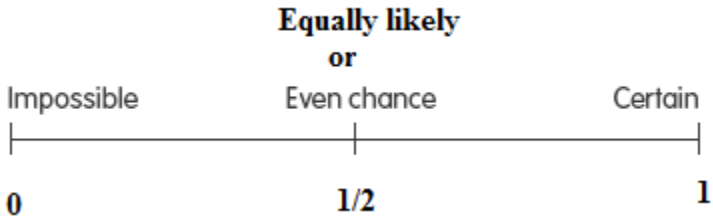
c) Learning activities

- Ask learners to form groups and provide each group a coin.
- Ask groups to toss a coin many times and ask them to say which event is described by the following words: **certain, equally likely, unlikely, impossible.**

Note: you can use flash cards written on them **certain, likely, equally likely, unlikely, or impossible.**

i. Getting a head, …….
ii. Getting a head and tail at the same time.
ii. A lion eats meat - ……...
iii. A cow has 3 legs - …..
iv. Mukamana who will visit us is a girl. ……..

- Guide learners as they discuss and help them to conclude on the meaning of each event, when it is used and guide them to find more examples from real life situations.
- Help them to complete them on the probability line:



- To assess the class, provide more and simple events and ask them to discuss their likelihood.

For example: Complete by: **certain, equally likely or impossible.**

1) Today we have a sunny day, it is going to rain: It is …….
2) APR is playing football with Rayon Sport; It is ……..…APR can win.

16.5. 2 Lesson 2: The use of vocabulary of chance: equally likely, even chance, unlikely, likely

a) Learning objectives

Use of equally likely, even chance, unlikely, likely as vocabularies of chance.

b) Teaching resources

Coins, dice, Flash cards and words written on them: **certain, likely, equally likely, unlikely, impossible.**.
- Textbooks, calculators, etc.

c) Learning activities

- Start by playing a Bingo game as was done in P4.
- Form groups of learners.
- Invite them to work out the activity in the Learner's Book, page 293.
- Invite groups to present answers, guide them and moderate the discussion.
- Help them to harmonize answers.
- Introduce learners to a betting game using a coin.
- Let learners discuss the likelihood of getting a tail when a coin is tossed.

Learners should observe that a coin has 2 faces, the head and the tail. Demonstrate to show these faces to the learners.

Ask those who think that the **"tail"** is likely to face up. Count them and write the number on the chalkboard.

- Now ask those who think it will be a "**head**" facing up. Record the number as well.
- Toss the coin and let all the learners view what is on top.

Did learners who have chosen a face ensure it is a must to show up?

Explain that, when a coin is tossed, there is equal likelihood for any of the two faces showing up.

- Guide them to conclude that it is **equally likely** a tail shows up.
- Let the learners play more games of tossing a coin.

- Invite learners to join groups, give them dice and guide them how to roll a die.

- According to the number facing up when they roll a die, invite them to discuss and formulate the event with the following likelihood: **certain, likely, equally likely, unlikely, impossible.**

Example: getting an odd number: it is **equally likely**.

- Motivate them to discuss the following events and ask them to place a flash card with the appropriate likelihood when you roll a die:

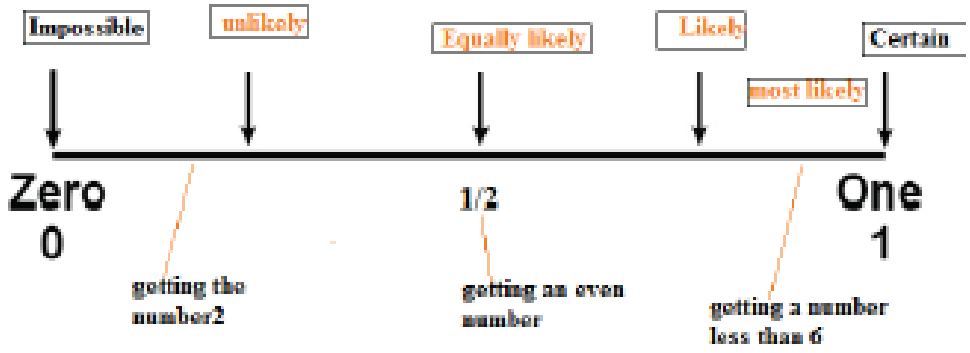
i. Getting a number greater than 6: ……

ii. Getting the number 2: …..

iii. getting an even number: …….

iv. getting a number less than 6: ……

- Draw a probability line and show where you can place the probability of each event as they mentioned: The answer is the following:



- Ask them to mention things that happen by chance and it is not easy to predict them.
- Suggest more and use the language of chance to explain their likelihood, then order the events.

Example

It will rain tonight
A lion eats grass.
An in-half cow will deliver a male calf.

- Lead learners to competently use the vocabulary of chance. Notably they are expected to give.

It will rain tonight - equally likely.
A lion eats grass - impossible.
An in-half cow will deliver a male calf - even chance.
So guide them to conclude that the order of events is impossible, equally likely, likely.

- Let the learners throw a die several times, betting on which number shows up.
- Explain the likelihood of any number showing up, a pair of numbers showing up or all faces showing up at once.
- Refer to the examples in the Learner's Book, page 294. Let the learners follow through as they discuss. Prevail to explain the likelihood.

- Invite learners to read, discuss and internalize the Study tip as a summary.
- Assign learners to work in group and do the a**pplication 16.1** in the Learner's Book, page 294.
- Mark their answers and provide feedback to learners.
- Ensure you do your best to satisfy the learners as to the use of the vocabulary of chance.
- Explain thoroughly the likelihood of different events and as to how they can be ordered.

d) Answers to Application 16.1

1. (a) likely (b) certain (c) likely (d) certain
   (e) likely (f) impossible (g) unlikely (h) impossible.
2. (a) something can't happen (b) I t must happen
   (c) Even chances of happening (d) It may happen
   (e) The chances of something to happen are very few.
3. Teacher assesses the statements.

16.5. 3 Lesson 3: Using expected outcomes of experiment (data) to decide how likely an event is to happen

a) Learning objectives

Use equally likely, even chance, unlikely, likely as vocabularies of chance.

b) Teaching resources

Coins, dice, Flash cards written on them **certain, likely, equally likely, unlikely, impossible.**.
- Textbooks, calculators, etc.

c) Learning activities

- Guide learners to review the previous concepts.
- Group the learners.
- Refer to the **learning activity** in the Learner's Book, page 295.
- Let them carry it out in their groups guided by the teacher.
- Explain that prepared data can be used to find the possibility of something to happen.
- Display the chart with prepared data.
- Let the learners study then read through.

- Let them discuss it and make presentations.
- Explain further relating to the data below;
- The table below shows rainfall received in Bunagana in 2016.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall in (mm)	182	184	262	286	275	202	192	216	258	262	204	198

(i) More rain will be received in December 2017 than in December 2016.
(ii) Two rain seasons are experienced in Bunagana every year.
(iii) Most rainfall was experienced in April.
(iv) The dry season starts in May.

Likelihood
(i) Even chances
(ii) Likely
(iii) Certain
(iv) Impossible

- Ask learners to order the events.
- Use more data for learners to explore more, for example, temperature for the 12hrs of a day, enrollment in schools for years and so on.
- Refer learners to the examples from the Learner's Book, page 295.
- Guide the learners as they read through and discuss about the data and the likelihood for different events.
- Let them read through and internalize the Study tip.
- Then let the learners do **application 16.2**, Learner's Book, page 296.
- Learners should make up their own statements for likelihood and order the events many times in order to internalize the concept of probability.

Remedial exercise
1. Give more extra exercises to all learners.
2. Define and give two examples of impossible and possible events.
3. In a box of chalk, 20 pieces are blue, 30 pieces white, 25 pieces are green, 15 pieces are yellow, and other 15 pieces of chalk are orange. If you want to take one chalk randomly, find:
(a) The probability of getting white chalk.
(b) The probability of getting orange chalk.

d) Answers to Application 16.2
1. (a) 0.001 (c) 1.001 (h) 4
(i) –8 (l) 100^{o}
2. The probability is 4 out of 52 cards in the deck.
3. (a) Probability greater than 4 is 2 out of 6.
(b) No because the highest number on a die is 6.
4. Probability is 1 out of 4.
5. Probability of getting queen of a heart is 1 out of 52.

16.5. 4 Lesson 4: Determining the likelihood of events

a) Learning objectives
Use equally likely, even chance, unlikely, likely as vocabularies of chance.
b) Teaching resources
- Coins, dice, Flash cards written on them **certain, likely, equally likely, unlikely, and impossible.**
- Problems involving the likely hood of events.
- Textbooks, calculators, etc.

c) Learning activities
This lesson is taught like the previous lesson. Only different activities and examples are to be found:

Example 1:

Provide an activity of students to arrange the probabilities of the spinner landing on
a) blue b) red c) pink d) not blue

Landig on a red		
Landig on a blue		
Landig on a Pink		
Landig Not on a blue		

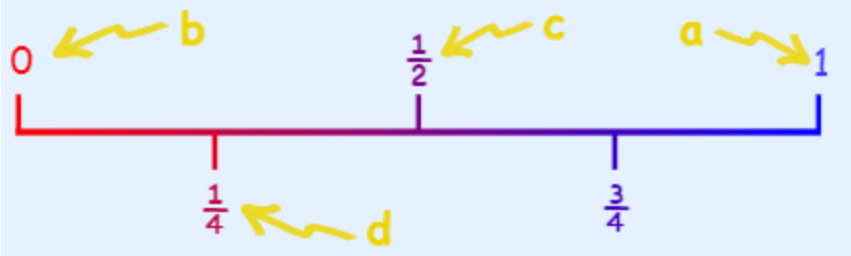
Example 2: here we show the probability that:

a) The sun will rise tomorrow

b) I will not have to learn mathematics at school

c) If I flip a coin it will land heads up

d) Choosing a red ball from a bag with 1 red ball and 3 green balls.



16. 6 Answers for end of Unit assessment

1. (a) Impossible (b) Unlikely (c) Certain (d) Certain
2. (a) likely (b) even chance (c) likely
3. 3 out of 6 (4) 1 out of 52
5. (a) 1 out of 6 even chance (b) 1 out of 3 even chance
(c) Certain (d) even chance, even chance, certain.

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