REPUBLIC OF RWANDA

MINISTRY OF EDUCATION

MATHEMATICS SYLLABUS FOR ORDINARY LEVEL S1-S3

Kigali, 2015

MATHEMATICS SYLLABUS FOR ORDINARY LEVEL S1 – S3

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FOREWORD

The Rwanda Education Board is honored to provide syllabuses which serve as official documents and guides to competency based teaching and learning in order to ensure consistency and coherence in the delivery of quality education across all levels of general education in Rwandan schools. The Rwandan education philosophy is to ensure that young people, at every level of education, achieve their full potential in terms of relevant knowledge, skills, and appropriate attitudes that help them to integrate well into society and to take advantage of employment opportunities.

In line with efforts to improve the quality of education, the Government of Rwanda emphasizes the importance of aligning syllabuses and teaching, learning, and assessment approaches in order to ensure that the educational system is producing the kind of citizens the country needs. Many factors influence what children are taught, how well they learn, and the competencies they acquire. Among such factors are: the relevance of the syllabus, the quality of teachers' pedagogical approaches, assessment strategies, and the instructional materials available. The ambition to develop knowledge based society and the growth of regional and global competition in the job market have necessitated the shift to a competency based syllabus. With the help of teachers, whose role is central to the success of the syllabus, learners will gain appropriate skills and the ability to apply what they have learned in real life situations. Hence, they will make a difference not only in their own lives, but also in the success of the nation.

I wish to sincerely extend my appreciation to the people who contributed to the development of this document, particularly the Rwanda Education Board (REB) and its staff who organized the whole process from its inception. Special appreciation goes to the development partners who supported the exercise throughout. Any comment or contribution is welcomed for the improvement of this syllabus.

GASANA I. Janvier

Director General REB

ACKNOWLEDGEMENT

I wish to sincerely extend my special appreciation to the people who played a major role in the development of this syllabus. It would not have been successful without the participation of a range of education stakeholders and the financial support from different donors. For this, I would like to express my deep gratitude.My thanks firstly goes to the Rwanda Education leadership who supervised the curriculum review process and the Rwanda Education Board staff who were involved in the conception and writing of the syllabus. I wish to extend my appreciation to teachers from pre-primary to university level for their valuable efforts during the conception of the syllabus.

I owe gratitude to the different education partners such as UNICEF, UNFPA, DFID and Access to Finance Rwanda for their financial and technical support. We also value the contribution of other education partner organisations such as CNLG, AEGIS Trust, Itorero ry'Igihugu, Center for Gender Sudies, Gender Monitoring Office, National Unit and Reconciliation Commission, RBS, REMA, Handicap International, Wellspring Foundation, Right To Play, MEDISAR, EDC/L3, EDC/Akazi Kanoze, Save the Children, Faith Based Organisations, WDA, MINECOFIN and local and International consultants. Their respective initiatives, co- operation and support significantly contributed to the successful production of this syllabus by the Curriculum and Pedagogical Material Production Department (CPMD).

Dr. Joyce MUSABE

Head of CPMD

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1. INTRODUCTION

1.1 Background of curriculum review

The motivation for reviewing the ordinary level Mathematics syllabus is to ensure that the syllabus is responsive to the needs of the learner and to shift from knowledge based learning to competence based learning. Emphasis is no longer on passive acquisition of knowledge, but on the development of skills and attitudes required to ensure the learner is competent in the application of knowledge.

The new Mathematics syllabus guides the interaction between the teacher and the learner in the learning processes and highlights the competencies a learner should acquire during and at the end of each learning unit.

Learners will have the opportunity to apply Mathematics in different contexts and discover its importance in daily life. Teachers will help learners appreciate the relevance and benefits of studying this subject.

The new Mathematics syllabus is prepared for learners in all ordinary levels and must be taught six periods per week.

1.2 Rationale of teaching and learning Mathematics

1.2.1 Mathematics and society

Mathematics plays an important role in society through training the mind to think abstractly and logically, for purposes of counting, calculation, measurement, and the study of shapes and motion. It is also used in natural sciences, engineering, medicine, finance, and social sciences. Applied Mathematics, like statistics and probability, plays an important role in game theory, in conducting a national census, in scientific research, etc. In addition, some cross cutting issues such as financial awareness are incorporated into some of the Mathematics units to improve the social and economic welfare of the Rwandan society.

Mathematics is key to achieving Rwanda’s education ambition of developing a knowledge based and technology led economy. Mathematics provides learners the necessary knowledge required for achieving this ambition. Moreover, Mathematics supports the learning of other subjects, which lends to the overall effectiveness of Rwanda’s enhanced educational curriculum. This new syllabus will address gaps in the Rwanda’s current education system, which lacks the appropriate skills and attitudes needed for achieving Rwanda’s education ambitions.

1.2.2 Mathematics and learners

Learners need enough basic Mathematics competencies to be effective members of the Rwandan society. For example, in order for learners to be responsible community members, they must be able to critically interpret the information they receive. Information pertaining calculations will require basic Mathematics competency. Basic Mathematics competencies needed include the ability to estimate, measure, calculate, interpret statistics, assess probabilities, and read commonly used mathematical representations and graphs.

Therefore, acquiring Mathematics competencies will equip learners with the knowledge, skills, and attitudes necessary for success in an era of rapid technological growth and socio-economic development. Mastery of basic mathematical ideas and computations will help learners become more confident problem-solvers. It will promote systemic and critical thinking, develop imagination and creativity, and boost self-confidence and adaptability.

Mathematics plays an important role at all levels of study as the learning process requires learners to engage in practical problem-solving and investigative activities, which the learning of Mathematics helps to support.

1.2.3 Competencies

Competence is defined as the ability to perform a particular task successfully, resulting from having gained an appropriate combination of knowledge, skills, and attitudes.

The Mathematics syllabus gives learners the opportunity to develop different competencies in addition to the generic competencies.

Generic competencies and broad Mathematics competencies are described below and in the learning objectives highlighted on a yearly basis and in each of the learning units. Teachers will ensure that learners participate in learning activities that help learners acquire the desired knowledge, skills, and attitudes.

Generic competencies and values

Critical and problem solving skills: Learners use different techniques to solve mathematical problems they will encounter in real life. They are prompted to think in mathematical terms, such as constructing and applying mathematical ideas and concepts. The acquisition of such skills will help learners to think imaginatively and broadly so as to evaluate and find solutions to problems encountered in real life situations.

Creativity and innovation: The acquisition of such skills will help learners to take initiative and use their imagination to generate new ideas and construct new concepts. Learners will improve these skills through Mathematics competitions and other activities.

Research: This will help learners find answers to questions based on existing information and concepts as well as to explain phenomena based on findings from gathered information.

Communication in official languages: Learners are able to effectively communicate their findings through explanations, arguments, and drawing relevant conclusions. Teachers, irrespective of whether they are language instructors, will ensure learners use the language of instruction properly. This will help learners communicate more effectively in written and spoken language and to do so in proper English and/or Kinyarwanda.

Cooperation, inter personal management, and life skills: Learners participate in cooperative learning groups to promote higher achievement than do competitive and individual work. This will enhance learners' ability to collaborate with others as a team and to practice positive ethical moral values and respect for the rights, feelings, and views of others.

Lifelong learning: The acquisition of such skills will help learners to build on their knowledge and enhance their skills with minimum external support and to adapt to changes in their environments. This will keep learners stay abreast on new discoveries and best practices.

Broad Mathematics competencies

During and at the end of the learning process, the learner should be able to:

- Use correctly mathematical language, vocabularies, and symbols in developing mathematical concepts and solving problems in Mathematics
- Think logically, creatively, and coherently.
- Apply acquired knowledge in Mathematics to solve problems encountered in everyday life.
- Adapt the acquired concepts to the study of other subjects.
- Model correctly a given mathematical situation using a picture or a mathematical sentence while solving Mathematics problems related to daily life situations.

- Read and interpret a graph.
- Use acquired mathematical skills to build team spirit, collaboration, self-confidence, and time management without supervision.
- Use ICT tools to explore Mathematics (examples: calculators, computers, mathematical software, etc.).

Mathematics and developing competencies

The national policy documents based on national aspirations identify some ‘basic competencies’ alongside ‘generic competencies’’ that will develop higher order thinking skills and the ability to apply the knowledge and skills acquired to real life situations. Through observations, constructions, hands-on practice, using symbols, applying and generalizing mathematical ideas, and presenting information learned during the learning process, the learner will not only develop deductive and inductive skills, but also acquire cooperation, communication, critical thinking, and problem solving skills. Teacher will have a better idea if such competencies have been acquired through end of learning unit presentations. Learners will develop these competencies through group work and cooperative learning, which in turn will promote interpersonal relationships and teamwork.

The acquired knowledge in learning Mathematics should lend to developing a responsible citizen who uses scientific reasoning and is confident in reasoning independently. The learner should show respect for individual attitudes, protecting the environment, and complying with the scientific method of reasoning. The scientific method should be applied with the necessary rigor and intellectual honesty to promote critical thinking.

2. PEDAGOGICAL APPROACH

The purpose of shifting the curriculum from knowledge to competence based is to transform learning so that learning is effective, enjoyable, and habit forming.

2.1 Role of the learner

In a competence based syllabus, the learner is the principal actor of his/her education. He/she is not an empty bottle to fill. Taking into account the initial capacities and abilities of the learner, the syllabus lists learning activities under each unit to engage learners in participating in the learning process.

The teaching-learning processes will be tailored towards creating a learner friendly environment based on the capabilities, needs, experiences, and interests of the learner. The following is a list of learner roles and expectations:

- Learners will actively acquire knowledge individually or in groups. From the learning theory, learners will move from a concrete understanding of concepts to pictorial and abstract understanding. Therefore, learning opportunities should be given to learners which allow them to manipulate concrete objects and use models.
- Learners will be encouraged to use calculators. This will prepare them for real life situations, particularly in work settings where a calculated will be used. Frequent use of calculators can enhance learners' understanding and mastering of arithmetic.
- Learners will work on one competency at a time in the form of concrete units with specific learning objectives, which are broken down into knowledge, skills, and attitude.
- Learners will be encouraged to do research and present their findings in group.
- A learner is expected to be cooperative. Learners will work in diverse group settings to increase tolerance and understanding of diversity.

- Learners will be responsible for their own participation and ensure the efficacy of their work.
- When in group settings, learners will seek help from teachers only when the entire group has agreed to seek assistance.
- Learners will encourage active participation from all group members and will discourage others from taking credit of work they did not contribute to. Learners are discouraged from monopolizing work tasks and responsibilities.

2.2 Role of the teacher

In a competencebased syllabus, the teacher actsas a facilitator, organiser, advisor, conflict resolver, and role model. A teacher's specific duties in acompetence-based approach are as follows:

- He/she is a facilitator whose role is to provide opportunities for learners with interesting and challening problems that they can solve given their capabilities and the resources available.This requires elaborative class preparation to plan learning activities andidentify where such activities will take place and if any assistance is required.
- He/she is an organizer whose role is to organize the learners inside and outside the classroom and engage them in participatory and interactive learning activities, which will be carried out independently, in pairs, or in groups. To ensure that the learning is personalized, participatory, and co-operative, the teacher must identify the needs of the learners, the nature of the learning to be done, and the means to shape learning experiences accordingly.
- He/she is an advisor whose role is to provide counseling and guidance to all learners, particulalry those with special needs. He/she will comfort and encourage learners to actively participate in the learning process by valuing learners' contributions to learning activities.

- He/she is a conflict-solver whose role is to assist in conflict resolution when learners are working in groups. For example, should members of a group have problems assigning tasks, teahcers should constructively intervene to assist learners in resolving the issue.
- He/she is a role model who role is to be impartial and account for the needs of each learner, particularly for slower learners and those with physical disabilties. He/she may do so by providing remedial activities to reinforce lessons learned.

Please be aware that this list in not exhaustive.

2.3 Special needs education and inclusive approach

All Rwandans have the right to education regardless of their needs. As such, they have the right to access and gain from the same menu of educational programs provided by the Government of Rwanda. This is true for learners whose different ways of living and learning do not align to that of the majority. This difference can either be emotional, physical, sensory, and/or intellectual, which is traditionally known as having some sort of mental retardation or learning challenge.

These learners are equally entitled to benefit from the free and compulsory basic education provided in public schools. Therefore, the school's role is to enroll them and set strategies to provide effective learning. In this way, the teacher is requested to consider each learner's needs during teaching and throughout the learning process. Assessment strategies and conditions should also be standardised to the needs of these learners. Detailed guidance for each category of learners with special education needs is provided for in the guidance for teachers.

3. ASSESSMENT APPROACH

Assessment is the process of evaluating the teaching and learning processes through collecting and interpreting evidence of each learner's progress in learning and to make a judgment about a learner's achievements measured against defined standards. Assessment is an integral part of the teaching learning processes. In the new competence based curriculum, assessment must also be competence based whereby a learner is given a complex situation related to his/her everyday life and asked to try to overcome the situation by applying what he/she has learned.

Assessment will be organized at the following levels: School-based assessment, district examinations, national assessment (LARS), and national examinations.

3.1. Types of assessment

3.1.1 Formative and continuous assessment (assessment for learning)

Formative assessments help to check the efficiency of the learning process. It is done within the teaching/learning process.Continuous assessment involves formal and informal methods used by schools to check whether learning is taking place. When a teacher is planning his/her lesson, he/she should establish criteria for performance and behavior changes at the beginning of a unit. Then at the of end of each unit, the teacher should ensure that all the learners have mastered the stated key unit competencies based on the criteria stated at the beginning of the unit before moving on to the next unit. The teacher will assess how well each learner has mastered both the subject and the generic competencies described in the syllabus. From these assessments, the teacher will gain a holistic understanding of the learner's progress in mastering the subject. The teacher will use one or a combination of the following: (a) observation (b) pen and paper (c) oral questioning.

3.1.2 Summative assessment (assessment of learning)

When assessment is used to record a judgment of a competence or performance of the learner, it serves a summative purpose. Summative assessments provide a picture of a learner's competence or progress at any specific moment. The main purpose of summative assessment is to evaluate whether learning objectives have been achieved and to use the results for the ranking or grading of learners for deciding on progression, for selection into the next level of education, and for certification. This assessment should have an integrative aspect whereby a student must be able to show mastery of all competencies.

A summative assessment can be an internal (such as a classroom examination), school based, or external assessment (such as a national examination). School based summative assessments should take place once at the end of each term and once at the end of the year. The average scores for school summative assessments for each subject will be weighted and included in the final national examinations grade. Average school based assessment scores will contribute to a certain percentage of the final grade. As teachers gain more experience and confidence in assessment techniques, average school based assessments, in the third year of the implementation of the new curriculum, will contribute to 10% of the final grade, but will progressively increase in significance. Districts will be supported to continue their initiatives to organize a common test per class for all schools to evaluate the performance and achievement levels of learners in individual schools. External summative assessment will be done at the end of Primary 6, S 3, and S6.

3.1 Record keeping

This is gathering facts and evidence from assessment instruments and using them to judge the student's performance by assigning an indicator against the set criteria or standard. Whatever assessment procedures used shall generate data in the form of scores which will be carefully be recorded and stored in a portfolio because they will contribute for remedial actions, for alternative instructional strategy and feed back to the learner and to the parents to check the learning progress and to advice accordingly or to the final assessment of the students.

This portfolio is a folder (or binder or even a digital collection) containing the student's work as well as the student's evaluation of the strengths and weaknesses of the work. Portfolios reflect not only work produced (such as papers and assignments), but also it is a record of the activities undertaken over time as part of student learning. Besides, it will serve as a verification tool for each learner that he/she attended the whole learning before he/she undergoes the summative assessment for the subject.

3.2 Item writing in summative assessment

Before developing an assessment tool, a plan or specification of what is to be tested or examined must be specified to show the units or topics to be tested on, the number of questions in each level of Bloom's taxonomy, and the marks allocated for each question. In a competency based curriculum, questions from higher levels of Bloom's taxonomy should be given more weight than those from knowledge and comprehension level. Before developing an assessment tool, the item writer must ensure that the test or examination questions are tailored towards competency based assessment by doing the following:

- Identify topic areas to be tested on from the subject syllabus.
- Outline subject matter content to be considered as the basis for the test.
- Identify learning outcomes to be measured by the test.
- Prepare a table of specifications.
- Ensure that the verbs used in the formulation of questions do not require memorization or the mere recalling of answers only, but testing broad competences as stated in the syllabus.

Structure and format of examination

There will be one paper in Mathematics at the end of Secondary 3. The paper will be composed by two sections, where the first section will be composed with short answer items or items with short calculations which include the questions testing for knowledge and understanding, investigation of patterns, quick calculations and applications of Mathematics in real life situations.

The second section will be composed with long answer items or answers with simple demonstrations, constructions, calculations, simple analysis , interpretation and explanations. The items for the second section will emphasize on the mastering of Mathematics facts, the understanding of Mathematics concepts and its applications in real life situations. In this section, the assessment will find out not only what skills and facts have been mastered, but also how well learners understand the process of solving a mathematical problem and whether they can link the application of what they have learned to the context or to the real life situation. The Time required for the paper is three hours (3hrs).

The following topic areas have to be assessed: algebra; metric measurements (money & its application); proportional reasoning; geometry; statistics and probability. Topic areas with more weight will have more emphasis in the second section where learners should have the right to choose to answer 3 items out of 5.

3.3 Reporting to parents

The wider range of learning in the new curriculum means that it is necessary to think about how to share learners' progress with parents. A single mark is not sufficient to convey the different expectations of learning which are in the learning objectives. The most helpful reporting is to share where students are doing well and where they need to improve.

4. RESOURCES

4.1. Learning/teaching materials

The following is a list of learning/teaching materials and/or equipment needed:

- Materials for group work and presentations: Computers (desk tops and/or laptops), projectors, manila papers, and markers.
- Materials for drawing and measuring geometrical figures, shapes, and graphs: Geometric instruments, ICT tools such as geogebra, Microsoft student ENCARTA, etc.
- Materials forenhancing research skills: Textbooks and the internet (A list of textbooks to consult is provided in the reference section at the end of the syllabus. These books are provided in hardcopy and/or softcopy).
- Materials to encourage the development of mathematical models: Scientific calculators, Math type, Matlab, etc.

The technologyused in teaching and in the learning of Mathematics should be regarded as tools to enhance the teaching and learning process. Such technology does not replace teachers.

4.2. Human Resources

In order to effectively implent this curriculum, joint collaboration of educators at all levels is needed. Given the material requirements, teachers are expected to accomplish their noble roles as stated above. As for head teachers and directors of studies, they are required to follow-up and assess the teaching and learning of this subject. These combined efforts will ensure bright careers and lives for learners as well as the contemporary development of the country.

Mathematics teachers at the ordinary level should have a firm understanding of mathematical concepts at the leavel he/she teaches. He/she should be well qualified to teach Mathematics. He/she should have a firm ethical conduct and possess the qualities of a good facilitator, organizer, problem solver, listener, and adviser. He/she is required to have basic skills and competency of guidance and counseling because students may come to him or her for advice.

Skills required for teaching Mathematics

Mathematics teachers should have the following skills, values, and qualities:

- Engage learners in variety of learning activities.
- Use multiple teaching and assessment methods.
- Adjust instruction to the level of the learners.
- Creatively and innovatively facilitate learning.
- Be a good communicator and organizer.
- Councel and advice students.
- Be passionate about learner's acquiring knowledge, skills, and values.
- Link Mathematics to other subjects and real life situations.
- Have a good mastery of the Mathematics content.
- Have good classroom management skills.

5. SYLLABUS UNITS

5.1. Structure of the syllabus units

Mathematics subject is taught and learnt in lower secondary education as a core subject, i.e. in Senior 1, Senior 2, and Senior 3 respectively. At every grade, the syllabus is structured to account for topic areas, sub-topic areas, and where applicable, broken down further to promote the uniformity, effectiveness, and efficiency of teaching and learning Mathematics. The units have the following elements:

- Each unit contains a certain number of lessons.
- Each of the unit's key unit competencies is describe in the key unit competency box. All teaching and learning activities should focus on achieving this end.
- Each key unit competency is broken into three types of learning objectives as follows:
    - Type I: Learning objectives related to knowledge and understanding (Type I learning objectives are also known as lower order thinking skills or LOTS).
    - Type II and Type III: Learning objectives related to the acquisition of skills, attitudes and values (Type II and Type III learning objectives are also known as higher order thinking skills or HOTS. These learning objectives are considered the ones targeted by the present reviewed curriculum.
- The content of each unit indicates the scope of what is to be taught and learnt as they relate to learning objectives.
- Each unit provides a list of suggested learning activities that are expected to engage learners in as much of an interactive learning process as possible. This process is learner-centered and takes a participatory approach). This list of learning activities is not exhaustive.
- Each unit is linked to other subjects, assessment criteria, and materials (or resources) needed in the teaching and learning process.

The Mathematics syllabus for ordinary level has six topic areas: Algebra, measures, proportional reasoning, geometry, statistics, and probability. There are nine units in Secondary1, eleven in Secondary 2 and thirteen in Secondary3.

5.2. Secondary 1 syllabus units

5.2.1 Key competencies by the end of Secondary 1

By the end of Secondary 1 (S1), a student of Mathematics should be able to:

- Correctly use simple language structure, vocabulary, and suitable symbolism for ordinary level Mathematics.
- Correctly carry out numerical calculations.
- Solve simple equations of an unknown.
- Use methodical and coherent reasoning in solving mathematical problems.
- Solve problems related to percentage, unitary method, movement, interest, division, surface area, and volume of figures.
- Use geometrical instruments to correctly draw figures and describe these figures using appropriate terms.
- Locate area position from numerical data.
- Make simple charts, graphs, or diagrams from a series of a statistical data.
- Interpret simple diagrams and statistics, recognisingthe ways in which representations can be misleading.
- Determine the probability of an event happening under equally likely assumptions.

5.2.2. Secondary 1 unit contents

<table>
<tr><td colspan="5">TOPIC AREA: ALGEBRA</td></tr>
<tr><td>S.1 Mathematics</td><td colspan="3">Unit 1: Sets.</td><td>No. of periods :30</td></tr>
<tr><td colspan="5">Key unit competency: To be able to use sets, Venn diagrams, and relations to represent situations and solve problems.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr>
<td>- Define and give examples of sets.
- Indicate what a specified region in a Venn diagram represents, using connecting words (and, or, not) or set notation.
- Show how sets are used in representing given information.
- Observe a contextual problem that involves sets, record the solution using set notation, and give explanations.
- Demonstrate algebraic and graphical reasoning through the</td>
<td>- Use sets to group and classify according to given conditions.
- Use Venn diagrams to represent information.
- Find intersection, union, complement, difference, and symmetrical difference on sets.
- Represent relations between sets as mappings and graphs.
- Use sets and relations to solve problems.</td>
<td>- Appreciate how sets, Venn diagrams, and relations can be used to represent situations mathematically.</td>
<td>- Set concept: Definition of set, notation, examples (subsets of natural numbers like even numbers, odd numbers, prime numbers, etc.), cardinal number, Venn diagrams, complement, intersection, union, set difference, symmetric difference.
- Relations: Mappings, ordered pair, Cartesian product, domain and range, graph of a relation, equivalence relation (reflexive, symmetric, and transitive),particular relations(function, mapping, injection/one to one, surjection/onto, bijections/one to one and onto).
- Inverse relation, composite relations.</td>
<td>- In groups, learners act as various Venn diagrams with rules for sets (e.g. students are numbered and sort themselves according to different rules like even numbers, odd numbers, prime numbers, etc.)
- Represent practical experiences in Venn diagrams and using the notation and symbols of sets, including, union ($\cup$), intersection ($\cap$), subset ($\subset$), complement, difference, symmetrical difference (Δ).
- In pairs, create sets of ordered pairs using the Cartesian product
- In pairs, explore relations between sets (objects, shapes, and numbers) and define domain and range, and create mappings.
- Individually, illustrate given relations</td>
</tr>
</table>

study of relations. - Identify different types of relations between sets.				between sets of numbers using a Cartesian plane and show its elements in terms of couples/ordered pairs. - In groups, investigate when inverse relations are possible and identify the criteria. - In pairs, verify if a given relation is an equivalence relation or a composite one.
Links to other subject: *Any subject where classification is important (e.g. biology, geography, physics, financial education).*				
Assessment criterion: *Can use sets, Venn diagrams, and relations to represent situations and solve problems.*				
Materials: *Cards for acting out scenarios.*				

<table>
<tr><td colspan="5">TOPIC AREA: ALGEBRA</td></tr>
<tr><td>S.1 Mathematics</td><td colspan="3">Unit 2: Sets of numbers.</td><td>No. of periods:36</td></tr>
<tr><td colspan="5">Key unit competency: To be able to use operations to explore properties of sets of numbers and their relationships.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr><td>- Identify sets of numbers (natural, integer, rational, and real) and relationships between them.
- Illustrate different sets of numbers on a number line.
- Show that irrational numbers cannot be expressed exactly as a decimal.</td><td>- Carry out mathematical operations on sets of numbers.
- Work systematically to determine the operation properties of sets of numbers.
- Determine the hierarchy of sets of numbers and explain its relationship with operations.
- Convert between decimal and fraction representations of rational numbers.</td><td>- Appreciate that rational numbers can be represented exactly as a fraction or a decimal which may terminate or recur.
- Appreciate that the number line is incomplete without the irrational numbers which cannot be written exactly as a decimal.</td><td>- Vocabulary and notations for different sets of numbers.
- Set of numbers and its subsets: Natural numbers, integers, rational numbers, irrational numbers, and real numbers.
- Four operations and properties on sets of numbers.
- The relationship between sets of numbers.</td><td>- In groups, add, subtract, multiply, and divide pairs of natural numbers. For which of these operation(s) is the answer always/sometimes/never a natural number. Repeat for integers, rational numbers, and real numbers.
- Individually, construct a Venn diagram to illustrate the relationship between two or more sets of numbers.
- In pairs, investigate the decimal representation of rational numbers and determine why the decimal is terminating or recurring.</td></tr>
<tr><td colspan="5">Links to other subject: Biology, English, computer science, geography, chemistry, physic, economics, finance, accounting, construction etc.</td></tr>
<tr><td colspan="5">Assessment criterion: Can use operation to explore properties of sets of numbers and their relationships.</td></tr>
<tr><td colspan="5">Materials: Text books, manila paper, and calculators.</td></tr>
</table>

<table>
<tr><td colspan="5">TOPIC AREA: ALGEBRA</td></tr>
<tr><td>S.1 Mathematics</td><td colspan="3">Unit 3: Linear functions, equations, and inequalities.</td><td>No. of periods:36</td></tr>
<tr><td colspan="5">Key unit competency: To be able to represent and interpret graphs of linear functions and apply them in real life situations; solve linear equations and inequalities; appreciate the importance of checking solutions; and represent the solution.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr>
<td>-Define a linear function and recognize its graph.
-Illustrate that a linear function is written in the form $y = mx + c$, where c is the y-intercept, m is a measure of steepness, and the solution of the equation $0 = mx + c$ is the x-intercept.
-Explain what is meant by the solution of a linear equation and inequality.</td>
<td>- Plot linear functions on the Cartesian plane.
- Interpret the graph of a linear function linking the parameters of the function with the features of the graph, including intercepts and steepness.
- Solve linear equations and the solution graphically.
- Solve linear inequalities in one unknown and represent the solution on a number line.
- Check solutions to equations and inequalities by substituting one side of</td>
<td>- Appreciate the importance of checking solutions when solving an equation or inequality and represent the equation in a graph and number line.</td>
<td>- Linear functions: Definition, notation and examples; $y = mx + c$; Cartesian plane and coordinates; graph of linear function and its features (intercepts, steepness).
- Equations and inequalities with one unknown: Solve linear equations with one unknown and represent the solution graphically; solve linear inequalities in one unknown and represent the solution on a number line; model and solve problems using linear functions, equations, and inequalities.</td>
<td>- In groups, systematically investigate different values of m and c in $y = mx + c$ (best done using graph plotting software) to develop intuitive understanding. Generalize how to find intercepts and determine steepness. Plot some examples by hand to illustrate findings
- In pairs, solve linear equations and relate the solution to a graph.
- In pairs, solve linear inequalities and record solutions on a number line.
- In groups, research contexts where linear functions, equations, and inequalities</td>
</tr>
</table>

	the original equation. - Use linear functions, equations, and inequalities to model situations and solve problems.			are relevant. Present finds to class.

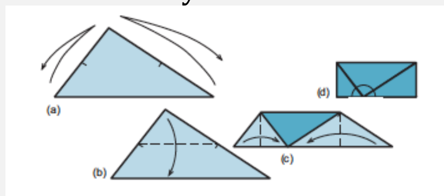
Links to other subject: *Science and economics.*

Assessment criterion: *Can represent and interpret graphs of linear functions and apply them in real life situations. Cans solve linear equations and inequalities, appreciate the importance of checking solution, and represent the solution.*

Materials: *Digital technology such as graph plotting software.*

<table>
<tr><td colspan="5">TOPIC AREA: METRIC MEASUREMENT (MONEY)</td></tr>
<tr><td>S.1 Mathematics</td><td colspan="3">Unit 4: Percentage, discount, profit, and loss.</td><td>No. of periods:12</td></tr>
<tr><td colspan="5">Key unit competency: To be able to solve problems that involves calculating percentage, discount, profit, loss, and other financial calculations.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr><td>- Explain how to calculate discount, commission, profit and loss, simple interest, tax.</td><td>- Use percentages to calculate discount, commission, profit, loss, interest, taxes
- Solve problems involving: Discount, commission, profit, loss, loans, savings, tax and insurance.</td><td>- Appreciate the role money plays in our lives.
- Be honest in managing and using money.
- Appreciate that saving and investing money can increase your wealth.
- Appreciate the importance of paying taxes.</td><td>- Percentages.
- Discount.
- Commission.
- Profit and loss.
- Loans and savings (simple interest only).
- Tax and insurance.</td><td>- In groups research and discuss the use of percentages in business, households, and personal finance. Prepare a poster.
- In groups, determine the best value for money with different discount arrangements.
- In pairs, solve problems involving simple interest, discount, profit, and loss.</td></tr>
<tr><td colspan="5">Links to other subject: Personal finance, economics, entrepreneurship, finance, accounting, business administration, and other related fields.</td></tr>
<tr><td colspan="5">Assessment criterion: Can solve problems that involve calculating percentage, discount, profit, loss, and other financial calculations.</td></tr>
<tr><td colspan="5">Materials: Coins, bills, receipts, electronic material, ATM cards.</td></tr>
</table>

TOPIC AREA: PROPORTIONAL REASONING				
S.1 Mathematics	**Unit 5:** Ratio and proportions.			**No. of periods:**12
Key unit competency: To be able to solve problems involving ratio and proportion.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Express ratios in their simplest form. - Identify a direct and indirect proportion. - Differentiate direct from indirect proportion.	- Compare quantities using proportions. - Share quantities in a given proportion or ratio. - Apply ratio and unequal sharing to solve given problems. - Solve real life problems involving direct and indirect proportions using tables and graphs. - Interpret ratio and proportions in practical contexts.	- Appreciate the importance of multiplication when working with ratio and proportion.	- Ratio, proportion, and sharing. - Applying ratio and proportion in practical and everyday contexts. - Direct and indirect proportional relationships in practical contexts.	- In groups, solve problems involving direct and inverse proportions, ratios, and sharing. Adjust recipe amounts for different numbers of people. - In pairs, match different representations of ratios and proportions including simplest form. - In groups, interpret and explain ratios and proportions in maps, scale drawings, and models. - In pairs, solve problems in practical contexts involving direct and indirect proportions using tables of values and graphs.
Links to other subject: *Subjects that require proportional reasoning such as biology, physics, computer science, chemistry, economics, personal finance etc.*				
Assessment criterion: *Can solve problems involving ratio and proportion in a variety of contexts.*				
Materials: *Calculators and digital materials such as computers, software, interactive multi-media content.*				

<table>
<tr><td colspan="5">TOPIC AREA: GEOMETRY</td></tr>
<tr><td>S.1 Mathematics</td><td colspan="3">Unit 6: Points, lines, and angles.</td><td>No. of periods:36</td></tr>
<tr><td colspan="5">Key unit competency: To be able toconstruct mathematical arguments using the angle properties of parallel lines.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr>
<td>- Recognize that the position of an angle at a point sum to 360^o; angles at a point on a straight line sum to 180^0.
- Distinguish and recognize vertically opposite, corresponding, alternate, and supplementary angles.</td>
<td>- Use knowledge of angle properties of parallel lines and shapes to construct arguments when finding missing angles in geometric diagrams.
- Construct and calculate angles.</td>
<td>- Appreciate the need to give reasons when developing solutions to missing angle problems.
- Value a variety of different approaches to reach the same conclusion.</td>
<td>- Segments, rays, lines, and acute, right, obtuse and reflex angles.
- Parallel and transversal lines and their properties.
- Constructing mathematical arguments using angle properties of parallel lines and shapes.</td>
<td>- Fold a paper triangle to bring all angles together at a point. In groups discuss why this works.


- In pairs, draw two parallel lines and a transversal, identify all angles that are equal (measure to check). Identify vertically opposite, corresponding, alternate, and supplementary angles. Create a glossary of terms.
- In groups, solve missing angle problems, giving reasons for each step in the process.</td>
</tr>
<tr><td colspan="5">Links to other subject: Physics, construction, engineering, geography, fine arts, scientific drawing.</td></tr>
<tr><td colspan="5">Assessment criterion: Can construct mathematical arguments using the angle properties of parallel lines.</td></tr>
<tr><td colspan="5">Materials: Manila papers, geometrical instruments, Digital technology such as graph plotting software, interactive multimedia content.</td></tr>
</table>

<table>
<tr><td colspan="5">TOPIC AREA: GEOMETRY</td></tr>
<tr><td>S.1 Mathematics</td><td colspan="2">Unit 7: Solids.</td><td colspan="2">No. of periods :24</td></tr>
<tr><td colspan="5">Key unit competency: To be able to select and use formulae to find the surface area and volume of solids.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr><td>- Explain the surface area of a solid as the area of the net.
- Illustrate the volume as the space occupied by a solid.
- Distinguish between surface area and volume and know the correct units.</td><td>- Derive the surface area for prisms and cylinders.
- Calculate the surface area and volume of common geometrical solids using formulas where necessary.
- Distinguish between surface area and volume and select appropriate formulae and units to use in various contexts.</td><td>- Appreciate the difference between surface area and volume.
- Recognize solids in the environment.</td><td>- Components of solids: Faces, vertices, and edges.
- Surface area and volume of a prism, pyramid, cylinder, cone and sphere.
- Formulae for surface area and volume.</td><td>- In small groups, count the number of faces (f), number of vertices (v), and number of edges(e) for a variety of solid figures with polygonal faces. Look for relationships (e.g. Euler's rule(f+v=e+2))
- In groups, investigate the relationship between the surface area of cuboids, prisms, pyramids, cylinders, and their nets. Generalize.
- In pairs (or teacher demonstration), measure the diameter of an orange then peel carefully and arrange the peel into circles with the same diameter as the orange. How many circles does the peel fill? (Roughly four). Relate to formula.
- In groups, select appropriate methods and units when solving problems concerning the volume and surface area of solids e.g. design solids with a volume of $1000cm^3$, minimizing their surface area; what is the greatest volume cylinder that can be made from a sheet of A4 paper.</td></tr>
<tr><td colspan="5">Links to other subject: Subjects that require calculating volume and area such as physics, construction, engineering, geography, fine arts, scientific drawing.</td></tr>
<tr><td colspan="5">Assessment criterion: Can select and use formulae to find the surface area and volume of solids.</td></tr>
<tr><td colspan="5">Materials: Solid figures, paper, scissors, glue, calculators, oranges.</td></tr>
</table>

<table>
<tr><td colspan="3">TOPIC AREA: STATISTICS AND PROBABILITY</td><td colspan="2"></td></tr>
<tr><td>S.1 Mathematics</td><td colspan="3">Unit 8: Statistics (ungrouped data).</td><td>No. of periods:24</td></tr>
<tr><td colspan="5">Key unit competency: To be able tocollect, represent, and interpret quantitative discrete data appropriate to a question or problem.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr>
<td>-Define quantitative data and qualitative data.
-Differentiate discrete and continuous data.
-Present data on a frequency distribution.
-Define mode and median of given statistical data.
-Recognize formulae used to calculate the mean and median.
-Read diagram of statistical data.</td>
<td>- Apply data collection to carry out a certain research.
- Represent statistical information using frequency distribution tables, bar charts, histograms, polygons, pie charts, or pictogram.
- Determine the mode, mean, and median of statistical data.
- Interpret correctly graphs involving statistical data.</td>
<td>- Help in decision making and draw conclusions.
- Self-confidence and determination.
- Develop competitiveness.
- Appreciate the importance of order in daily activities.
- Develop research and creativity.
- Respect each other.</td>
<td>- Definition of data.
- Types of data: Qualitative, quantitative, discrete, and continuous data.
- Collecting data.
- Frequency distribution.
- Measures of central tendency: Mode, mean, median, quartiles (1st, 2nd, 3rd quartiles, inter-quartile range).
- Data display: Bar chart, histogram, frequency polygon, pie chart, pictogram.
- Reading statistical graphs.
- Converting statistical graphs into frequency tables.</td>
<td>- In groups, collect data for a given situation such as height, weight, color, blood group, age, marks etc.
- Discuss whether it is quantitative or qualitative data, continuous or discrete data. Make a frequency distribution table for each case.
- In groups, observe and collect data for a given situation such as height, weight, ages, marks etc., and determine, mode, mean and median.
- In groups, draw a bar chart, a histogram, frequency polygons, and a pie chart corresponding to the data collected. Compare results.</td>
</tr>
</table>

				- In pairs, calculate the quartiles, the inter-quartile range, and represent them graphically - Individually, in the given bar chart, histogram, polygon, and pie chart, identify mode, create a frequency table, and find mean and median. work in group - Given a graph, indicate/estimate where the mode, mean, median can be found.

Links to other subject: *Subjects that data collection, representation, and interpretation such as biology, geography, physics, computer science, finance, economics, engineering etc.*

Assessment criterion: *Can consistently make appropriate data collection and data representations to solve a problem and draw conclusions consistent with findings.*

Materials: *Text books, paper, geometrical instruments, and Digital technology such as graph plotting software, interactive multimedia content, calculators.*

<table>
<tr><td colspan="5">TOPIC AREA: STATISTICS AND PROBABILITY</td></tr>
<tr><td>S.1 Mathematics</td><td colspan="3">Unit 9:Probability</td><td>No. of periods:6</td></tr>
<tr><td colspan="5">Key unit competency: To be able todetermine the probability of an event happening using equally likely events or experiments.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr><td>- Define an event and explain why probabilities can only be between 0 (impossible) and 1 (certain).
- Explain that probabilities can be calculated using equally likely outcomes (e.g. tossing a coin or dice, drawing a card from a deck) or estimated using experimental data (e.g. weather, sports, arriving late to school).
- Demonstrate that the more data collected, the better the estimate of the probability.</td><td>- Calculate the probability of an event where there are equally likely outcomes e.g. heads or tails on a coin, a score on a dice.
- Estimate probabilities using data.</td><td>- Appreciate that the chance of an event happening is given by its probability which is number between 0 (impossible) and 1 (certain).
- Distinguish when an experiment is necessary to find a probability and that more data improves the estimate.</td><td>- Definition of event and outcome.
- Examples of random events.
- Probability of equally likely outcomes through experiments like tossing a coin or dice, etc.
- Estimation of probabilities where experimental data is required.</td><td>- In groups, think and debate chance situations such as playing cards, tossing a coin, rolling dice. What are the chances of getting a particular outcome? Introduce probability scale.
- Consider playing football, basketball ball, volleyball, hand ball or any other game. Discuss the chance of a win, lose or draw. Use results to estimate probabilities.
- Investigate the relationship between experimental and calculated probability by tossing a dice or coin many times and estimating the probability of a particular outcome. Plot a graph to show the experimental probability and note how that tends to the calculated probability.</td></tr>
<tr><td colspan="5">Links to other subject: Subjects where probability is important such economics, finance, physics, chemistry, biology.</td></tr>
<tr><td colspan="5">Assessment criterion: Can use appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations.</td></tr>
<tr><td colspan="5">Materials: Dice, coins, playing cards, graph paper.</td></tr>
</table>

TOPIC AREA: STATISTICS AND PROBABILITY				
S.1 Mathematics	**Unit 9:**Probability			**No. of l periods:**6
Key unit competency: To be able todetermine the probability of an event happening using equally likely events or experiments.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Define an event and explain why probabilities can only be between 0 (impossible) and 1 (certain). - Explain that probabilities can be calculated using equally likely outcomes (e.g. tossing a coin or dice, drawing a card from a deck) or estimated using experimental data (e.g. weather, sports, arriving late to school). - Demonstrate that the more data collected, the better the estimate of the probability.	- Calculate the probability of an event where there are equally likely outcomes e.g. heads or tails on a coin, a score on a dice. - Estimate probabilities using data.	- Appreciate that the chance of an event happening is given by its probability which is number between 0 (impossible) and 1 (certain). - Distinguish when an experiment is necessary to find a probability and that more data improves the estimate.	- Definition of event and outcome. - Examples of random events. - Probability of equally likely outcomes through experiments like tossing a coin or dice, etc. - Estimation of probabilities where experimental data is required.	- In groups, think and debate chance situations such as playing cards, tossing a coin, rolling dice. What are the chances of getting a particular outcome? Introduce probability scale. - Consider playing football, basketball ball, volleyball, hand ball or any other game. Discuss the chance of a win, lose or draw. Use results to estimate probabilities. - Investigate the relationship between experimental and calculated probability by tossing a dice or coin many times and estimating the probability of a particular outcome. Plot a graph to show the experimental probability and note how that tends to the calculated probability.
Links to other subject: *Subjects where probability is important such economics, finance, physics, chemistry, biology.*				
Assessment criterion: *Can use appropriate mathematical concepts and skills to solve problems in both familiar and unfamiliar situations.*				
Materials: *Dice, coins, playing cards, graph paper.*				

5.3. Secondary 2 syllabus units

5.3.1Key competencies by the end of Secondary 2

By the end of Secondary 2 (S2), a student of Mathematics should be able to:

- Correctly use simple language structures, vocabulary, and the symbols found in the second year of the Mathematics program.
- Efficiently carry out numerical and literal calculations.
- Solve equations and inequalities of the first degree in $\mathbb{R}$.
- Recognize and justify congruent shapes.
- Calculate the component of a vector.
- Identify the image of a figure under a transformation and use the properties of transformations to solve related problems.
- Use methodical and coherent reasoning in solving mathematical problems.
- Collect quantitative data appropriate to the problem or investigation, taking into account possible biases and extend the knowledge to grouped data.

5.3.2. Secondary 2 unit contents

<table>
<tr><td colspan="5">TOPIC AREA: ALGEBRA</td></tr>
<tr><td>S.2 Mathematics</td><td colspan="3">Unit 1: Indices and surds.</td><td>No. of periods:18</td></tr>
<tr><td colspan="5">Key unit competency: To be able todetermine the probability of an event happening using equally likely events or experiments.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr><td>- Recognize laws of indices.
- Represent very small numbers or large numbers in standard form.
- Define and give examples of surds.
- Identify properties of surds.
- Recognize the conjugates of surds.</td><td>- Perform operations on indices and surds.
- Solve simple equations involving indices and surds.
- Use standard form to represent a number.
- Apply properties of indices to simplify mathematical expressions.
- Apply properties of surds to simplify radicals.
- Compute rationalisation of denominator on surds.</td><td>- Appreciate the importance of indices and surds in solving mathematical problems.
- Show concern of self-confidence, determination, and group work spirit.</td><td>- Indices/powers or exponents: Definition, properties indices.
- Applications of indices: Ssimple equations involving indices; standard form.
- Surds/radicals: Definition, examples; properties, simplification, operations, rationalisation of denominator.
- Square roots calculation methods: Factorization, general method, estimation.</td><td>- In pairs, learners think of two numbers or more that different powers but the same base. Multiply and divide these numbers. Draw conclusions.
- In groups, express the given larger numbers or smaller numbers in standard form.
- Solve given equations involving indices.
- Individually, simplify surds by rationalizing the denominators.
- In groups, express each of the given surd as the square root of a single number.
- In groups, discuss and reduce surds to the simplest possible surd form.
- Find the square roots of given numbers by using the square roots method and calculators.</td></tr>
<tr><td colspan="5">Links to other subject: Physics, chemistry, biology, computer science, economics, finance, etc.</td></tr>
<tr><td colspan="5">Assessment criterion: Can use rules of indices and surds to simplify mathematical situation involving indices and surds.</td></tr>
<tr><td colspan="5">Materials: Calculator.</td></tr>
</table>

TOPIC AREA: ALGEBRA				
S.2 Mathematics	**Unit 2:** Polynomials.			**No. of periods:**30
Key unit competency: To be able toperform operations, factorise polynomials, and solve related problems.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Define polynomial. - Classify polynomials by degree and number of terms. - Recognize operation properties on polynomials. - Give common factor of algebraic expressions.	- Perform operation of polynomials. - Expand algebraic expression by removing brackets and collecting like terms. - Apply operation properties to carry out given operation of polynomials. -Factorize a given algebraic expression using appropriate methods. -Expand algebraic identities.	- Appreciate the role of numerical values of polynomials and algebraic identities in simplifying mathematical expressions. - Develop critical thinking and reasoning. - Ability to classify and follow orders to perform a given task.	- Definition and classification of polynomials including homogeneous polynomials, monomials, binomials, trinomials, and polynomial of four term. - Operations on polynomials. - Numerical values of polynomials. - Algebraic identities. - Factorization of polynomials by: Common factors, grouping terms, algebraic identities, zeros (roots) of polynomials, factorization of quadratic expressions(sum and product).	- In groups, classify polynomials according to their degree or to the number of terms. Discuss and perform operations on polynomials. Expand and factorize given mathematical expressions.
***Links to other subject**: Subjects where polynomials are important such as physics, chemistry, etc.*				
***Assessment criterion:** Can perform operations, factorise polynomials, and solve related problems.*				
***Materials:** Textbook, papers, calculators.*				

TOPIC AREA: ALGEBRA				
S.2 Mathematics	**Unit 3:** Simultaneous liner equations and inequalities.			**No. of periods:**30
Key unit competency: To be able solve problems related to simultaneous linear equations and inequalities and represent thesolutions graphically.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Define simultaneous linear equations and give examples. - Show whether a given simultaneous linear equation is independent, dependent, or inconsistent. - Recognize the forms of compound inequalities with one unknown and give examples.	- Solve simultaneous linear equations in two variables. - Model and solve mathematical word problems using simultaneous equations. - Solve compound inequalities in one variable.	- Appreciate the importance of solving problems related to simultaneous linear equations and inequalities. - Be accurate in solving system of linear equation and inequalities. - Develop self confidence in solving systems of linear equations and inequalities in one variable.	- Definition and examples of simultaneous linear equations in two variables and inequalities in one variable. - Types of simultaneous linear equations (independent simultaneous linear equations, dependent simultaneous linear equations, and inconsistent/incompatible simultaneous linear equations) - Solving simultaneous linear equations in two unknowns using algebraic methods: Substitution, comparison, elimination, and Cramer's rule. - Inequalities of the types: $A.B > 0$, $A.B \geq 0$, $A.B < 0$, $A.B \leq 0$, $\frac{A}{B} > 0$, $\frac{A}{B} \geq 0$, $\frac{A}{B} < 0$, $\frac{A}{B} \leq 0$. -Compound inequalities or system of two inequalities in one unknown.	- In pairs, show whether a given system of 2 linear equations is independent, dependent, or inconsistent. - In group, discuss different methods for solving simultaneous linear equations and use one of them(your choice) to solve a given simultaneous linear equations. - Individually, solve problems involving simultaneous equations. - In pairs, solve given simultaneous inequalities in two unknowns and given compound inequalities.
***Links to other subject**: Subjects where simultaneous linear equations and inequalities are needed.*				
***Assessment criterion:** Can solve related simultaneous linear equations and inequalities and represent the solutions graphically.*				

Materials: *Textbooks, papers, calculators, textbooks, papers.*				
TOPIC AREA: ALGEBRA (PROPORTIONS REASONING)				
S.2 Mathematics	**Unit 4:** Multiplier for proportional change.			**No. of periods:**12
Key unit competency: To be able use a multiplier for proportional change.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Recognize the properties of proportions. - Express ratios in their simplest form. - Share quantities in a given proportion or ratio.	- Solve problems in real life involving multiplier proportion change. - Apply multipliers for proportional change to solve given problem. - Use multiplier for proportional change to find the new quantities. - Use “decreased by n%” and “increased n%”.	- Be honest in sharing with other. - Develop critical thinking in terms of proportion multiplier for proportional change.	- Increasing quantities by n%. - Decreasing quantities by n%. - Calculation of proportional change using multiplier.	- In groups, solve problems involving multiplier for proportional change. - Individually, solve problems involving decreased by n% and increased by n%.
Links to other subject*: Economics, entrepreneurship, finance, accounting, business administration, and other related fields.*				
Assessment criterion: *Can explain the importance of money in connection to real life.*				
Materials: *Textbooks, coins, bills, geometrical instruments, receipts, digital material such as interactive multimedia content , ATM cards.*				

TOPIC AREA: GEOMETRY				
S.2 Mathematics	**Unit 5:** Thales theorem.			**No. of periods:**12
Key unit competency: To be able useThales' theorem to solve problems related to similar shapes and determinetheir lengths and areas.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Identify and name triangles or trapeziums from parallel and transversals intersecting lines. - State Thales' theorem and its corollaries.	- Associate extended proportions in the triangles. - Apply Thales' theorem and its corollaries to solve problems on proportions of triangles, trapeziums. - Discuss the converse of Thales' theorem.	- Develop habit of actively participating, self-confidence, determination, and team spirit. - Appreciate the importance of solving daily activities involving midpoint theorem and Thales' theorem, its converse,and application.	- Midpoint theorem. - Thales' theorem and its converse. - Application of Thales' theorem in calculating lengths of proportions segments (in triangles, trapeziums).	- In groups, solve problems involving midpoint theorem for a given situation. - In groups, discuss and solve mathematical problems involving the applications of Thales' theorem.
Links to other subject*: Technical and scientific drawing, physics.*				
Assessment criterion: *Can use Thale's theorem to solve problems related to similar shapes and determine their lengths and areas.*				
Materials: *Geometrical instruments.*				

<table>
<tr><td colspan="5">TOPIC AREA: GEOMETRY</td></tr>
<tr><td>S.2 Mathematics</td><td colspan="3">Unit 6:Pythagoras's theorem.</td><td>No. of lessons:12</td></tr>
<tr><td colspan="5">Key unit competency: To be able to find the length of each side of a right angle triangles using Pythagoras' theorem.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr><td>- State Pythagoras' theorem.
- Identify the hypotenuse from the three sides of a right angle triangle.
- List properties of a right angled triangle.</td><td>- Use Pythagoras' theorem to find the lengths of the sides of right angle triangles.
- Apply Pythagoras' theorem to solve problems in a range of contexts.
- Demonstrate Pythagoras' theorem in a real life situation.</td><td>- Appreciate the role of Pythagoras' theorem in solving daily life activities.
- Develop confidence and accuracy in constructing shapes.
- Develop team spirit and respect the views of others.</td><td>- Pythagoras' theorem.
- Demonstration of Pythagoras' theorem.
- Applications of Pythagoras' theorem in calculating the length of any side of a right angle triangle.
- Word problems.</td><td>- In groups, find the squares of given sides of a triangle, verify relationship between the sum of the squares of shorter sides, and the square of the longer side.
Discuss whether a triangle is a right angle triangle given the length of sides, and give the properties.
- Individually, using Pythagoras' theorem, find the length of the hypotenuse if the other sides of the right angle are given.
- In groups, learners demonstrate Pythagoras' theorem by measuring the areas of squares on sides of right angled triangles and explore Pythagorean dissections by cutting and reassembling parts.</td></tr>
<tr><td colspan="5">Links to other subject: Technical and scientific drawing, optics.</td></tr>
<tr><td colspan="5">Assessment criterion: Can find the length of each side of a right angle triangle using Pythagoras's theorem.</td></tr>
<tr><td colspan="5">Materials: Geometrical instruments, calculators.</td></tr>
</table>

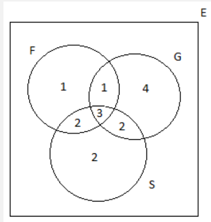
<table>
<tr><td colspan="5">TOPIC AREA: GEOMETRY</td></tr>
<tr><td>S.2 Mathematics</td><td colspan="3">Unit 7: Vectors.</td><td>No. of periods:18</td></tr>
<tr><td colspan="5">Key unit competency: To be able to solve problems doing operation on vectors.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr><td>- Define a vector.
- Represent a vector ina Cartesian plane.
- Differentiate between vector quantities and scalar quantities.
- Show whether vectors are equal.</td><td>- Use vector notations correctly and perform operations on vectors.
- Find the components of a vector in a Cartesian plane.
- Find the magnitude of a vector.</td><td>- Appreciate the importance of vectors in motion.
- Show self-confidence and determination while solving problems on vectors.</td><td>- Concept of a vector: Definition and properties of a vector, notation.
- Vectors in a Cartesian plane.
- Components of a vector in the Cartesian plane.
- Equality of vectors.
- Operations on vectors: Addition, subtraction, multiplication by a scalar.
- Magnitude of a vector as its length.</td><td>- In groups, graphically add and subtract given consecutive or any vectors using the parallelogram rule.
- In groups or individually, graphically multiply a given vector by a scalar.
- In groups, perform multiplication of vectors by a scalar, addition, or subtraction of vectors given their components.
- Individually, calculate the magnitude of vectors given their components.</td></tr>
<tr><td colspan="5">Links to other subject: Physics.</td></tr>
<tr><td colspan="5">Assessment criterion: Can solve problems doing operations on vectors.</td></tr>
<tr><td colspan="5">Materials: Geometrical instruments, calculators.</td></tr>
</table>

TOPIC AREA: GEOMETRY				
S.2 Mathematics	**Unit 8:** Parallel and orthogonal projections.		**No. of periods:**12	
Key unit competency: To be able to transform shapes under parallel or orthogonal projections.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Identify an image of a figure under parallel projection. - Identify an image of a figure under orthogonal projection.	- Construct an image of an object or geometric shape under parallel projection and orthogonal projection.	- Show the importance of parallel and orthogonal projection in various situations. - Develop critical thinking and reasoning skills, while transforming shapes under parallel or orthogonal projection. - Be accurate in construction of figures and their images under parallel or orthogonal projection. - Develop confidence in solving problems related to the transformation of shapes under parallel or orthogonal projection.	- Definition ofparallel projection and oorthogonal projection. - Properties of oorthogonal and parallel projection. - Image of geometric shape under parallel projection and oorthogonal projection.	- In groups, observe drawings of different objects and their images involving parallel or orthogonal projection. Discuss and deduce properties and type of projection used.
***Links to other subject**: Technical and scientific drawing.*				
***Assessment criterion:** Can transform images of figures using parallel or orthogonal projections.*				
***Materials:** Geometrical instruments, calculators.*				

<table>
<tr><td colspan="5">TOPIC AREA: GEOMETRY</td></tr>
<tr><td>S.2 Mathematics</td><td colspan="3">Unit 9: Isometries.</td><td>No. of periods:30</td></tr>
<tr><td colspan="5">Key unit competency: To be able to transform shapes using congruence, central symmetry, reflection, translation, and rotation.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr><td>- Identify an image of a figure under central symmetry, reflection, translation, rotation.</td><td>- Construct the image of a point, a segment, a geometric shape, under central symmetry, reflection, translation, rotation.
- Find the coordinates of an image of an object under central symmetry, reflection, translation, rotation.</td><td>- Appreciate that translation, rotation and reflection play important roles in various situations.
- Develop team spirit.
- Develop confidence in constructing an image of a point, a segment, a geometric shape under any isometry.
- Develop accuracy in constructing shapes under isometries.</td><td>- Definition of central symmetry, reflection, translation, rotation.
- Construction of an image of an object/geometric shape undercentral symmetry, reflection, translation, rotation.
- Properties and effects of central symmetry, reflection, translation, rotation.
- Composite transformations up to three isometries.</td><td>- In groups, construct the image of a given object under central symmetry.Compare the image to the initial object, and then discuss and deduce the applied properties.
- Repeat the above activity for reflection, translation or rotation.
- In pairs, given an object and its image find the center of symmetry, line of symmetry or the translation vector, the center of rotation, and angle of rotation.
- Individually, construct the images of a given object under successive transformations.</td></tr>
<tr><td colspan="5">Links to other subject: Physics, ICT, engineering, technical and scientific drawing.</td></tr>
<tr><td colspan="5">Assessment criterion: Can transform shapes using congruence, central symmetry, reflection, translation, and rotation.</td></tr>
<tr><td colspan="5">Materials: Geometrical instruments, calculators.</td></tr>
</table>

TOPIC AREA: STATISTICS AND PROBABILITY				
S.2 Mathematics	**Unit 10:** Statistics (grouped data).			**No. of periods:**30
Key unit competency: To be able to collect, represent, and interpret grouped data.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Define grouped data and represent grouped data on a frequency distribution. - Identify mode, middle class, modal class, and median of given grouped statistical data. - Read diagram of grouped statistical data.	- Apply data collection to carry out research. - Represent grouped statistical information using histograms, polygons, frequency distribution tables,and pie charts. - Calculate the mode, mean, and median of statistical data. - Interpret correctly the graph of grouped statistical data.	- Appreciate howdata collection, data representation, and data interpretationcan be used for solving real life situations. - Appreciate the importance of data in investigating social phenomenon and decision making. - Cultivate team spirit and respect the views of others. - Develop accuracy in reading graphs.	- Definition and examples of grouped data. - Grouping data into classes. - Frequency distribution table for grouped data. - Cumulative frequency distribution table. - Measures of Central tendency for grouped data(mean, median, mode, and range for grouped data). - Graphical representation of grouped data (polygons, histograms, superposed polygons).	- In groups, collect data for a given set such as height, weight, ages, or marks in any subject, group them in a given interval, and then represent them in a frequency distribution table. Determine the middle, modal, mean and median classes. Then draw histograms, frequency polygons, and superimposed frequency polygons and interpret the results. Infer conclusion. - Convert statisticalgraphs into frequency tables and find measures of central tendency using graphs.
***Links to other subject**: History, biology, geography, physics, computer science, finance, etc.*				
***Assessment criterion:** Can collect, represent, and interpret grouped data.*				

Materials: *Calculators, graph papers.*

TOPIC AREA: STATISTICS AND PROBABILITY				
S.2 Mathematics	**Unit 11:** Tree and Venn diagrams.			**No. of periods:**12
Key unit competency: To be able to determine probabilities and assess likelihood by using tree and venn diagrams.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Define mutually exclusive and independent events. - Count the number of branches and total number of outcomes on a tree diagram.	- Construct and interpret a tree diagram correctly. - Use Tree and Venn diagrams to determine probability.	- Appreciate the importance of probability to find the chance happening for an event to happen. - Show curiosity to predict what will happen in the future. - Promote team work and self-confidence.	- Tree diagram. - Total number of outcomes. - Determining probability using Tree and Venn diagrams. - Mutually exclusive and independent events.	- In groups, for a given task, construct a tree diagram corresponding to that situation and determine the number of branches. Calculate required probability. - Analyze a given situation, present it using a Venn diagram. In the Venn diagram E= {pupils in class of 15}, G={girls}, S={Swimmers}, F={Pupils who are Christians}. A pupil is chosen at random. Find the probability that  the pupil: a) can swim b) is a girl swimmer c) is a boy swimmer who is Christian. Two pupils are chosen at random. Find the probability that: a) both are boys b) neither can swim c) both are girls swimmers who are Christians. - For given tasks on events, suggest whether events are mutually exclusive or independent or neither.
Links to other subject*: Financial education, physics, chemistry, biology, physical education, sports etc.*				
Assessment criterion: *Can determine probabilities and assess likelihood using Tree and Venn diagrams.*				
Materials: *Dice, coins, playing cards, calculators, balls.*				

5.4. Secondary 3 syllabus units

5.4.1 Key competencies by the end of Secondary 3

By the end of Secondary3 (S3), a student of Mathematics should be able to:

- Accurately carry out numerical and literal calculations.
- Solve problems that involve sets of numbers using Venn diagram.
- Graphically represent a function of the first degree, a function of the second degree, and point by point.
- Solve equations, inequalities, and the systems of the first degree in two unknowns.
- Apply compound interest in daily life situations.
- Calculate the side lengths, angles, and areas of right angle triangles and other geometric shapes.
- Represent and interpret graphs of linear and quadratic functions.
- Construct mathematical arguments using circle theorems.
- Construct the image of a geometric figure under composite transformations.
- Collect bivariate data to investigate possible relationships through observations.

5.4.2 Secondary 3 unit contents

TOPIC AREA: ALGEBRA				
S.3 Mathematics	**Unit 1:**Problem sets.			**No. of periods:**6
Key unit competency: To be able to solve problem sets.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Express a mathematical problem set using a Venn diagram. - Represent a mathematical problem using a Venn diagram.	- Use Venn diagram to represent a mathematical problem set. - Interpret, model, and solve a mathematical problem set.	- Develop clear, logical and coherent thinking skills in solving real life problems involving sets. - Appreciate the importance of representing and solving a mathematical problem set using Venn diagrams.	- Mathematical problem sets. - Analysis and interpretation of a problem using set language (intersection, union). - Representation of a problem using Venn diagrams. - Modelling and solving a problem.	- In groups, analyse information given in a Venn diagram and solve related questions. - In groups, discuss a situation involving set theory. Represent it using Venn diagrams. Form an equation and solve related questions.
Links to other subject*: Subjects where classification is needed such as biology, geography, physics, financial education.*				
Assessment criterion: *Can solve problem sets.*				
Materials: *Calculators.*				

<table>
<tr><td colspan="5">TOPIC AREA: ALGEBRA</td></tr>
<tr><td>S.3 Mathematics</td><td colspan="3">Unit 2: Number bases.</td><td>No. of periods:12</td></tr>
<tr><td colspan="5">Key unit competency: To be able to represent numbers in different number bases and solve related problems.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr><td>- List the digits used in a given base.
- Convert numbers from base ten to any other base and vice versa.</td><td>- Carry out addition, subtraction, multiplication, and division on numbers bases.
- Solve equations involving bases.</td><td>- Develop clear, logical and coherent thinking while solving problem sets.
- Appreciate the importance of bases in various contexts.</td><td>- Definition and examples of different number bases.
- Converting a number from base ten to any other base like base 2, 3, or 5 and vice versa.
- Converting a number from one base to another (e.g. base 2 to base 3).
- Addition and subtraction exercises on number bases.
- Multiplication and division exercises on number bases.
- Solving equations involving number bases.</td><td>- In group, convert a given number from base ten to any other base and vice versa. Convert numbers from any base that is not base ten to another. Discuss and carry out operations on number bases.
- In groups, solve equations involving bases.</td></tr>
<tr><td colspan="5">Links to other subject: ICT, etc.</td></tr>
<tr><td colspan="5">Assessment criterion: Can represent numbers in different number bases and solve related problems.</td></tr>
<tr><td colspan="5">Materials: Calculators.</td></tr>
</table>

TOPIC AREA: ALGEBRA				
S.3 Mathematics	**Unit 3:** Algebraic fractions.			**No. of periods:**24
Key unit competency: To be able to perform operations on rational expressions and use them in different situations.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Define an algebraic fraction. - State the restriction on the variable in algebraic fraction. - Recognise the rules applied to addition, subtraction, multiplication, division and simplification of algebraic fractions.	- Perform operations on algebraic fractions. - Solve rational equations with linear denominators. - Simplify algebraic fractions.	- Develop clear, logical and coherent thinking while working on algebraic fractions. - Show patience, mutual respect, tolerance, team spirit, and curiosity in group activities while solving and discussing mathematical situations involving algebraic fractions.	- Definition and examples of an algebraic fraction. - Restrictions on the variable or conditions of existence of an algebraic fraction. - Simplification of algebraic fractions. - Addition or subtraction of algebraic fractions with linear denominators. - Multiplication or division and simplification of two algebraic fractions. - Solution of rational equations with linear denominators.	- In groups, state the restrictions on the variable given algebraic fractions. Carry out different operations for given algebraic fractions and simplify. Then present and explain the findings. - Individually, Solve given rational equations.
***Links to other subject**: Physics and phenomenon involving calculating distance and motion.*				
***Assessment criterion:** Can perform operations on rational expressions and use them in different situations.*				
***Materials:** Calculators.*				

<table>
<tr><td colspan="5">TOPIC AREA: ALGEBRA</td></tr>
<tr><td>S.3 Mathematics</td><td colspan="3">Unit 4: Simultaneous linear equations and inequalities.</td><td>No. of periods:18</td></tr>
<tr><td colspan="5">Key unit competency: To be able to solve word problems involving simultaneous linear equations and inequalities.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr><td>- Define simultaneous linear inequalities in two unknowns.
- Give examples of simultaneous linear inequalities in two unknowns.
- Show solution set of simultaneous linear equations and inequalities in two unknowns given their graphs.</td><td>- Solve graphically simultaneous linear equations and inequalities in two unknowns.
- Interpret graphical solutions of simultaneous linear equations and inequalities in two unknowns.
- Solve word problems leading to simultaneous linear equations.</td><td>- Appreciate how simultaneous linear equations in two unknowns are important to represent and solve mathematical word problems.
- Develop clear, logical, and coherent thinking while solving simultaneous linear equations and inequalities in two unknowns.
- Show patience, mutual respect, tolerance, team spirit, and curiosity in group activities while solving and discussing mathematical situations involving simultaneous linear equations and inequalities in two unknowns.</td><td>- Graphical solution of simultaneous linear equations in two unknowns.
- Solving word problems involving simultaneous linear equations in two unknowns (graphically or algebraically).
- Definition and examples of simultaneous linear inequalities in two unknowns.
- Solving simultaneous linear inequalities in two unknowns.</td><td>- In groups, solve given simultaneous linear equations and inequalities in two unknowns graphically.
- Solve word problems involving simultaneous linear equations.
- Observe a given graphical representation of simultaneous linear equations and inequalities in two unknowns and deduce or show the solution set.</td></tr>
<tr><td colspan="5">Links to other subject: Physics, financial education.</td></tr>
<tr><td colspan="5">Assessment criterion: Can solve problems involving simultaneous linear equations.</td></tr>
<tr><td colspan="5">Materials: Geometrical instruments, calculators.</td></tr>
</table>

TOPIC AREA: ALGEBRA				
S.3 Mathematics	**Unit 5:** Quadratic equations.			**No. of periods:**24
Key unit competency: To be able to solve quadratic equations.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Define quadratic equations. - State methods used to solve a quadratic equation.	- Solve quadratic equations. - Model and solve problems involving quadratic equations. - Solve equations reducible to quadratic.	- Develop clear, logical and coherent thinking in solving quadratic equations - Appreciate the importance of quadratic equations in solving word problems. - Promote team work when working in groups while solving quadratic equations. - Show patience, mutual respect, tolerance, and curiosity when discussing and solving problems involving quadratic equations.	- Definition and example of quadratic equation. - Solving quadratic equations by factorization, graphs, completing squares, quadratic formula, synthetic division. - Problems involving quadratic equations. - Using factorization and Horner's method in solving quadratic equations.	- In groups, discuss and use factorization or any other method to solve given quadratic equations. - Model given mathematic problems using quadratic equations and solve them. - Use factorization and Horner's method to solve quadratic equations.
***Links to other subject**: Physics, financial education.*				
***Assessment criterion:** Can solve word problems involving quadratic equations.*				
***Materials:** Geometrical instruments, calculators.*				

TOPIC AREA: ALGEBRA				
S.3 Mathematics	**Unit 6:** Linear and quadratic functions.			**No. of periods:**24
Key unit competency: To be able to solve problems involving linear or quadratics functions and interpret the graphs of quadratic functions.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Define a Cartesian equation of a straight line. - Define quadratic function. - List the characteristics of linear or quadratic function. - Differentiate linear from quadratic functions.	- Determine Cartesian equations of straight lines, coordinates of vertices, the equation of axis of symmetry. - Determine the intercepts of a quadratic function. - Sketch and draw graphs from a given function. - Use linear or quadratic function to solve problems in various situations and interpret the results.	- Develop clear, logical and coherent thinking in solving linear and quadratic functions. - Appreciate the importance of linear and quadratic functions in learning other subjects. - Show patience, mutual respect, tolerance, team spirit, and curiosity in solving and discussions problems involving linear and quadratic functions.	- Linear functions: Slopes, Cartesian equations, conditions for lines to be parallel or perpendicular. - Quadratic functions: Table of values, vertex of parabola, axis of symmetry, intercepts, and graph in Cartesian plane.	- In group, determine the equation of a straight line passes through a) a point and given its slope b) two points c) a point and parallel to a given line d) a point and perpendicular to a given line. - Individually, given a quadratic function, determine whether its graph is concave up or down and determine the intercepts and the vertex. Make a table of values and sketch the parabola.
Links to other subject*: Physics.*				
Assessment criterion: *Can solve problems involving linear or quadratic functions and interpret the graphs of quadratic functions.*				
Materials: *Geometrical instruments, calculators.*				

TOPIC AREA: ALGEBRA (MONEY)				
S.3 Mathematics	**Unit 7:** Compound interest, reverse percentage, and compound proportional change.			**No. of periods:** 20
Key unit competency: To be able to solve problems involving compound interest, reverse percentage and proportional change usingmultipliers.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Define compound interest, reverse percentage, compound proportional change, and continued proportional. - Find reverse percentages in a given mathematical problem. - Determine a compound interest in a given mathematical problem. - Simplify ratio in their simplest form.	- Solve problems involving reverse percentages and compound interest - Apply compound interest in solving mathematical problems involving savings or calculations in any other financial activity. - Apply reverse percentage and compound proportional change in solving real life mathematical problems.	- Appreciate the role of compound interest in banking and financial activities. - Appreciate that in the case of compound interest, saving and investing money can increase the value of wealth. - Show concern for paying taxes and being honest in daily activities involving money. - Develop logical and critical thinking while solving problems involving compound interest, reverse change, and continued proportional change.	- Reverse percentages. - Compound interest and its applications in contextual situations (e.g. in banking and financial activities). - Compound proportional change or continued proportions.	- In groups, solve given problems involving reverse percentages and compound interest. - Compare the overall values of different goods and draw conclusions. - In group, solve problems involving compound proportional change or continued proportions.
***Links to other subject**: Economics, entrepreneurship, financial education and other related fields.*				
***Assessment criterion:** Can use mathematical concepts and skills to solve problems involving compound interest, reverse percentage, and proportional change.*				
***Materials:** Textbooks, coins, bills, geometrical instruments, receipts, digital material such as interactive multimedia content, ATM cards, calculators.*				

TOPIC AREA: ALGEBRA (MONEY)				
S.3 Mathematics	**Unit 8:** Right angle triangles.			**No. of periods:**18
Key unit competency: To be able to find lengths of sides and angles in right angle triangles using trigonometric ratios.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Give and define the elements of a right angle triangle. - Show relationship between the elements of a right angled triangle.	- Use Pythagoras' theorem to find the relationship between the elements of a right angle triangle. - Solve problems about right angle triangle using the properties of elements of a right angle triangle and Pythagoras' theorem.	- Appreciate the importance of right angle triangles in various situations. - Promote team work. - Show patience, mutual respect, tolerance, and curiosity in solving and discussion problems involving right angle triangles.	- Median through the vertex of the right angle. - Height using the vertex of a right angle triangle and the sides of the right angle triangle. - Height using the vertex of a right angle triangle and the lengths of the segments on the hypotenuse. - Determining the sides of right angle triangles given their orthogonal projection on the hypotenuse. - Trigonometric ratios in a right angle triangle: Sine, cosine, and tangent.	- In group, find the missing lengths of a triangle. For each case, draw clear diagrams before calculating the lengths of the sides. - In pairs, given two sides of right angle triangle, but not hypotenuse, find the length of the hypotenuse. calculate the length of height and the median corresponding to that hypotenuse. - In groups, given lengths of segments defined by the height on the hypotenuse, find the length of sides of that triangle, the height and the median. - Individually, given acute angle and length of one side, use sine, cosine, and tangent to find the length of the other sides.
***Links to other subject**: Technical and scientific drawing.*				
***Assessment criterion:** Can construct mathematical arguments about right angle triangles to solve related problems.*				
***Materials:** Calculators, geometrical instruments.*				

TOPIC AREA: GEOMETRY (SHAPE AND ANGLES)				
S.3 Mathematics	**Unit 9:** Circle theorem.			**No. of periods:**18
Key unit competency: To be able to construct mathematical arguments about circles and disks and use circle theorem to solve related problems.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Recognise and identify the elements of a circle. - Identify angle properties in a circle.	- Find the length of elements of a circle. - Calculate the area of disk and its sector. - Use the angle properties of lines in circles to solve problems. -Use tangent properties to solve circle problems.	- Develop clear, logical, and coherent thinking. - Appreciate the importance of circle theorems in dividing into sectors. - Promote team work when working in groups. - Show patience, mutual respect, tolerance, and curiosity in solving and discussion problems involving circle theorems and disk.	- Elements of a circle and disk: Center, radius, diameter, circumference, area, chord, tangent, secant, sector. - Circle theorems: First circle theorem (angles at the centre, and at the circumference), second circle theorem (angle in a semicircle), third circle theorem (angles in the same segment), fourth circle theorem(angles in a cyclic quadrilateral), fifth circle theorem (length of tangents), sixth circle theorem (angle between circle tangent and radius), seventh circle theorem (alternate segment theorem), eighth circle theorem (perpendicular from the centre and bisects the chord).	- In groups, discuss and solve determine the areas, lengths, and ratios of two concentric circles. - In pairs, for given circles involving arcs, find theminor arc length, major arc length, minor sector area, and major sector area. - In groups, discuss the properties of points in a cyclic quadrilateral. - In groups, discuss the properties of chords involving circle theorem.
***Links to other subject**: Technical and scientific drawing.*				
***Assessment criterion:** Can construct mathematical arguments about circles and disks and use circle theorem to solve related problems.*				
***Materials:** Calculators, geometrical instruments.*				

TOPIC AREA: GEOMETRY				
S.3 Mathematics	**Unit 10:** Collinear points and orthogonal vectors.			**No. of periods:**6
Key unit competency: To be able to apply properties of collinearity and orthogonality to solve problems involving vectors.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- State the conditions and properties of collinearity and orthogonality.	- Use definition and properties to show whether three given points are collinear or not and whether two vectors are orthogonal or not.	- Appreciate the use of properties of collinearity and orthogonality to solve problems about vectors in two dimensions. - Show patience, mutual respect, tolerance, and curiosity in solving and discussing problems involving vectors in two dimensions.	- Conditions for points to be collinear and vectors to be orthogonal. - Problems about points and vectors in two dimensions.	- In group, discuss whether three points are collinear in a given situations. Discuss whether vectors are parallel ororthogonal.
***Links to other subject**: Technical and scientific drawing, physics, chemistry*				
***Assessment criterion:** Can apply properties of collinearity and orthogonality to solve problems involving vectors.*				
***Materials:** Calculators, geometrical instruments.*				

<table>
<tr><td colspan="6">TOPIC AREA: GEOMETRY</td></tr>
<tr><td>S.3 Mathematics</td><td colspan="3">Unit 11:Enlargement and similarity in 2D.</td><td colspan="2">No. of periods:22</td></tr>
<tr><td colspan="6">Key unit competency: To be able to solve problems regarding shape enlargement and similarities in 2D.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2" colspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr><td>- Define enlargement.
- Define similarity.
- Identify similar shapes.
- List properties of enlargement and similarities.</td><td>- Determine the linear scale factor of an enlargement.
- Find the centre of an enlargement.
- Construct an image of an object that has been enlarged.
- Use properties of enlargement and similarities to transform a given shape.
- Find lengths of sides, area, and volume of similar shapes.
- Construct an image of an object under composite and inverse enlargement.</td><td>- Appreciate the importance of enlargement and similarities to transform shapes.
- Show patience, mutual respect, tolerance, and team work while solving and discussing problems involving enlargement and similarities.</td><td>- Definition of enlargement.
- Definition similarity.
- Examples of similar shapes (similar triangles, similar cylinder, etc.).
- Properties of enlargement and similarities.
- Determining linear scale factor of enlargement
- Determining the centre of enlarged shape.
- Finding lengths of sides of similar shapes using Thales theorem.
- Areas of similar shapes.
- Volumes of similar objects.
- Composite and inverse enlargements</td><td colspan="2">- In groups, construct images of enlarged shapes and compare the new shapes to their initial forms. Discuss the properties of enlargement and similarities used to transform these shapes to their new forms.
- In pairs, construct an image of a given object under composite and inverse enlargement.
- Individually, show similar shapes in a variety of shapes and find the linear scale factor and centre of enlargement for each case.
- In groups, find the area and volume of given similar shapes and solids.</td></tr>
<tr><td colspan="6">Links to other subject: Technical and scientific drawing, physics, engineering, construction.</td></tr>
<tr><td colspan="6">Assessment criterion: Can solve problems regarding shape enlargement and similarities in 2D.</td></tr>
<tr><td colspan="6">Materials: Geometrical instruments.</td></tr>
</table>

<table>
<tr><td colspan="5">TOPIC AREA: GEOMETRY</td></tr>
<tr><td>S.3 Mathematics</td><td colspan="3">Unit 12: Inverse and composite transformations in 2D.</td><td>No. of periods:12</td></tr>
<tr><td colspan="5">Key unit competency: To be able to solve problems involving the inverse and composite transformations of shpaes.</td></tr>
<tr><td colspan="3">Learning objectives</td><td rowspan="2">Content</td><td rowspan="2">Learning activities</td></tr>
<tr><td>Knowledge and understanding</td><td>Skills</td><td>Attitudes and values</td></tr>
<tr><td>- State and explain properties of composite and inverse transformations in 2D.
- Identify type of transformation used in given drawings in 2D.
- Show an image of an object from different transformed shapes in 2D.</td><td>- Construct an image of an object under composite and inverse transformation in 2D
- Solve problems involving inverse and composite transformations in 2D.</td><td>- Appreciate the importance of inverse and composite transformations to transform shapes.
- Show patience, mutual respect, tolerance, and curiosity in solving and discussing problems involving inverse and composite transformations.</td><td>- Composite transformations.
- Composite translations in 2D.
- Composite reflections in 2D.
- Composite rotations in 2D.
- Mixed transformations in 2D.
- Inverse transformations in 2D.</td><td>- Individually, construct an image of a given object under inverse and composite transformations in 2D.
- In groups, observe, discuss, and show images of objects from given different transformed shapes in 2D and give the properties of inverse and composite transformations used to transform these shapes.
- In pairs, construct images of objects under mixed transformations.</td></tr>
<tr><td colspan="5">Links to other subject: Technical and scientific drawing, physics, engineering, construction.</td></tr>
<tr><td colspan="5">Assessment criterion: Can solve problems involving the inverse and composite transformations of shapes.</td></tr>
<tr><td colspan="5">Materials: Geometrical instruments.</td></tr>
</table>

TOPIC AREA: STATISTICS AND PROBABILITY				
S.3 Mathematics	**Unit 13:** Statistics (bivariate data).		**No. of periods:**12	
Key unit competency: To be able to collect, represent, and interpret bivariate data.				
Learning objectives			**Content**	**Learning activities**
Knowledge and understanding	**Skills**	**Attitudes and values**		
- Define bivariate data. - Make a frequency distribution table of collected bivariate data. - Interpret scatter diagrams. - Identify type of correlation on a scatter diagram.	- Draw scatter diagram for bivariate data and indicate the type of correlation. - Analyze a scatter diagram and infer conclusion.	- Develop clear, logical, and coherent thinking while drawing conclusion related to bivariate data or scatter diagrams. - Appreciate the use of scatter diagrams to represent information. - Show patience, mutual respect, tolerance, and curiosity in collecting, representing, interpreting bivariate data.	- Definition and examples of bivariate data. - Frequency distribution table of bivariate data. - Scatter diagram. - Types of correlation: Positive and negative correlations.	- In groups, collect bivariate data and organize them in frequency distribution tables and plot them on a scatter diagram. - In pairs, analyse given information on the graphs (scatter diagrams), determine the correlation between the data.Analyse and interpret the data and infer conclusion.
***Links to other subject**: All subjects.*				
***Assessment criterion:** Can collect, represent, and interpret bivariate data.*				
***Materials:** Geometrical instruments, Digital technology such as graph plotting software, interactive multimedia content.*				

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7. APPENDIX: SUBJECTS AND WEEKLY TIME ALOCATION FOR O'LEVEL

Core subjects	Weight (%)	Number of Periods per week (1 period = 40 min.)		
		S1	S2	S3
1. English	11	5	5	5
2. Kinyarwanda	7	3	3	3
3. Mathematics	13	6	6	6
4. Physics	9	4	4	4
5. Chemistry	9	4	4	4
6. Biology and Health Sciences	9	4	4	4
7. ICT	4	2	2	2
8. History and Citizenship	7	3	3	3
9. Geography and Environment	7	3	3	3
10. Entrepreneurship	4	2	2	2
11. French	4	2	2	2
12. Kiswahili	4	2	2	2
13. Literature in English	2	1	1	1
Sub Total		**41 periods**	**41 periods**	**41 periods**
II. Elective subjects: Schools can choose 1 subject				
Religion and Ethics	4	2	2	2
Music, Dance and Drama	4	2	2	2

Fine arts and Crafts	4	2	2	2
Home Sciences	4	2	2	2
Farming (Agriculture and Animal husbandry)	4	2	2	2
III. Co-curricular activities (Compulsory)				
Physical Education and Sports	2	1	1	1
Library and Clubs	2	1	1	1
Total number of periods per week	**100**	**45**	**45**	**45**
Total number of contact hours per week		**30**	**30**	**30**
Total number of hours per year (39 weeks)		**1170**	**1170**	**1170**