SENIOR SCHOOL CURRICULUM DESIGN

GRADE 10

MATHEMATICS

KENYA INSTITUTE OF CURRICULUM DEVELOPMENT
2024

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Nurturing Every Learner's Potential

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NATIONAL GOALS OF EDUCATION

Education in Kenya should:

1. **Foster nationalism and patriotism and promote national unity.**

   Kenya's people belong to different communities, races and religions, but these differences need not divide them. They must be able to live and interact as Kenyans. It is a paramount duty of education to help young people acquire this sense of nationhood by removing conflicts and promoting positive attitudes of mutual respect which enable them to live together in harmony and foster patriotism in order to make a positive contribution to the life of the nation.

2. **Promote the social, economic, technological and industrial needs for national development.**

   Education should prepare the youth of the country to play an effective and productive role in the life of the nation.

   a) **Social Needs**

   Education in Kenya must prepare children for changes in attitudes and relationships which are necessary for the smooth progress of a rapidly developing modern economy. There is bound to be a silent social revolution following the wake of rapid modernisation. Education should assist our youth to adapt to this change.

   b) **Economic Needs**

   Education in Kenya should produce citizens with the skills, knowledge, expertise and personal qualities that are required to support a growing economy. Kenya is building up a modern and independent economy which is in need of an adequate and relevant domestic workforce.

   c) **Technological and Industrial Needs**

   Education in Kenya should provide learners with the necessary skills and attitudes for industrial development. Kenya recognises the rapid industrial and technological changes taking place, especially in the developed world. We can only be part of this development if our education system is deliberately focused on the knowledge, skills and attitudes that will prepare our young people for these changing global trends.

3. Promote individual development and self-fulfilment

Education should provide opportunities for the fullest development of individual talents and personality. It should help children to develop their potential interests and abilities. A vital aspect of individual development is the building of character.

4. Promote sound moral and religious values.

Education should provide for the development of knowledge, skills and attitudes that will enhance the acquisition of sound moral values and help children to grow up into self-disciplined, self-reliant and integrated citizens.

5. Promote social equity and responsibility.

Education should promote social equality and foster a sense of social responsibility within an education system which provides equal educational opportunities for all. It should give all children varied and challenging opportunities for collective activities and corporate social service irrespective of gender, ability or geographical environment.

6. Promote respect for and development of Kenya's rich and varied cultures.

Education should instil in the youth of Kenya an understanding of past and present cultures and their valid place in contemporary society. Children should be able to blend the best of traditional values with the changing requirements that must follow rapid development in order to build a stable and modern society.

7. Promote international consciousness and foster positive attitudes towards other nations.

Kenya is part of the international community. It is part of the complicated and interdependent network of peoples and nations. Education should therefore lead the youth of the country to accept membership of this international community with all the obligations and responsibilities, rights and benefits that this membership entails.

8. Promote positive attitudes towards good health and environmental protection.

Education should inculcate in young people the value of good health in order for them to avoid indulging in activities that will lead to physical or mental ill health. It should foster positive attitudes towards environmental development and conservation. It should lead the youth of Kenya to appreciate the need for a healthy environment.

LEARNING OUTCOMES FOR SENIOR SCHOOL

By the end of senior school, the learner should be able to:

1. Communicate effectively and utilise information and communication technology across varied contexts.
2. Apply mathematical, logical and critical thinking skills for problem solving.
3. Apply basic research and scientific skills to manipulate the environment and solve problems.
4. Exploit individual talents for leisure, self-fulfillment, career growth, further education and training.
5. Uphold national, moral and religious values and apply them in day to day life.
6. Apply and promote health care strategies in day to day life.
7. Protect, preserve and improve the environment for sustainability.
8. Demonstrate active local and global citizenship for harmonious co-existence.
9. Demonstrate appreciation of diversity in people and cultures.
10. Manage pertinent and contemporary issues responsibly.

THE SENIOR SCHOOL IN THE COMPETENCY BASED CURRICULUM (CBC)

Senior School is the forth level of Basic Education in the Competency Based Curriculum (CBC) that learners shall come to after the Pre-Primary, Primary and Junior School (JS). The essence of Senior School is to offer learners a Pre- University/ Pre- career experience where the learners have an opportunity to choose pathways where they have demonstrated interest and/or potential at the earlier levels. Senior school comprises three years of education for learners in the age bracket of **15 to 18 years** and lays the foundation for further education and training at the tertiary level and the world of work. In the CBC vision, learners exiting this level are expected to be ***engaged, empowered and ethical citizens*** ready to participate in the socio-economic development of the nation.

At this level, learners shall take **SEVEN (07) learning areas (LAs)** as recommended by the *Presidential Working Party on Educational Reforms* (PWPER). These shall comprise **Four Compulsory** learning areas, and Three learning areas opted for by the learner according to their choses Pathway. While English and Kiswahili are indicated as Compulsory, the learners who opt for these learning areas as their subjects of specialization shall go through a *differentiated curriculum* in terms of scope, experiences and assessment. Such learners shall; therefore, take *Advanced English* or *Kiswahili Kipevu* with additional two lessons. It is recommended that AT LEAST TWO learning areas should be from chosen Pathway. In exceptional cases, some learners may opt for ONE learning area from the chosen Pathway and a maximum of TWO learning areas from any of the three pathways; depending on the learner's career projections and with guidance by the principals at Senior School.

PROPOSED LIST OF SUBJECTS AT SENIOR SCHOOL

Compulsory Subjects	**Science, Technology, Engineering & Mathematics (STEM)**	**Social Sciences**	**Arts & Sports Science**
1. English 2. Kiswahili/KSL 3. Community Service Learning 4. Physical Education ***NB: ICT skills will be offered to all students to facilitate learning and enjoyment***	5. Mathematics/Advanced Mathematics 6. Biology 7. Chemistry 8. Physics 9. General Science 10. Agriculture 11. Computer Studies 12. Home Science 13. Drawing and Design 14. Aviation Technology 15. Building and Construction 16. Electrical Technology 17. Metal Technology 18. Power Mechanics 19. Wood Technology 20. Media Technology* **21.** Marine and Fisheries Technology*	22. Advanced English 23. Literature in English 24. Indigenous Language 25. Kiswahili Kipevu/Kenya Sign Language 26. Fasihi ya Kiswahili 27. Sign Language 28. Arabic 29. French 30. German 31. Mandarin Chinese 32. History and Citizenship 33. Geography 34. Christian Religious Education/ Islamic Religious Education/Hindu Religious Education 35. Business Studies	36. Sports and Recreation 37. *Physical Education (C)* 38. Music and Dance 39. Theatre and Film 40. Fine Arts

LESSON DISTRIBUTION AT SENIOR SCHOOL

The number of lessons in each of the compulsory learning areas shall be 4; while the optional areas shall be 6 lessons each. A lesson shall be 40 minutes. The "free" lessons shall be used for development of ICT skills, Pastoral Instruction Programme (PPI), projects, collaborative study and further reading.

ESSENCE STATEMENT

In Senior School, advanced Mathematics course builds on and deepens the competencies acquired by the learner from Junior school. It plays an important role in society through developing the learner's critical, creative and logical reasoning as well as analytical skills. Mathematics is critical in supporting other subjects for purposes of acquisition of competencies necessary for problem solving in day to day life. Mathematics is an essential element of communication. It enables one to explain, describe, illustrate, analyse, evaluate and represent information that bears critical components of populations that helps in decision making processes. Specifically, the subject is useful in computations particularly in Calculus, measurements, development of algebraic thinking and the study of geometry for the development of spatial relations as well as navigational skills. In addition, the course provides one with opportunities to study Statistics and Probability, which are critical in research and in understanding different population dynamics and phenomena. The course has explicitly suggested learning activities that focus on the mathematical process skills of problem solving, communication, connection, collaboration, reasoning and proof as core to acquisition of the desirable competencies. Key Pertinent and Contemporary Issues such as Life Skills, Financial Literacy, Citizenship and Education for Sustainable Development as well as Values are integrated into this Mathematics course to improve the social and economic wellbeing of the individual and the society.

The Advanced Mathematics course is a powerful tool in determining career choices in the field of Science, Technology, Engineering and Mathematics (STEM), Social Sciences, Sports Science and Arts. These careers spread across medical fields, engineering, research, actuarial science, architecture, technology fields, computer and data Science as well as entrepreneurship among others. The course is anchored on Sessional Paper no 1 of 2019 on policy framework for education and training for sustainable development, Vision 2030, which focuses on knowledge in science, technology and innovation and The

Constitution of Kenya 2010 that stipulates that every child has a right to education. Further, in line with Africa Agenda 2063, the course responds to the African Education Strategy which focuses on strengthening the Science and Mathematics curricula.

GENERAL LEARNING OUTCOMES

By the end of the course the learner should be able to:

a) Develop numerical computational skills, concepts and competencies for continuous learning and application of Mathematics,
b) Collect, analyse and represent data for informed decision-making in real-life situations
c) Evaluate and make financial decisions and transactions in real-life situations,
d) Develop spatial skills and model geometric structures in real-life situations,
e) Use digital technology for Mathematical manipulations, explorations, innovations, navigational skills and for further learning,
f) Develop critical and creative thinking, logical reasoning and analytical skills for problem-solving,
g) Use Mathematical concepts and skills to support other learning areas for further training, research and career development,
h) Develop confidence and interest in Mathematics as well as the coherence, utility and aesthetic nature of the subject for lifelong learning,
i) Demonstrate appropriate responsiveness to Pertinent and Contemporary Issues in the community and promote values for peaceful coexistence.

IDENTIFIED STRANDS

1. Numbers and Algebra
2. Measurements and Geometry
3. Statistics and Probability
4. Calculus

SUMMARY OF STRANDS AND SUB STRANDS

	Strand	Sub strand	Lessons
1	Numbers and Algebra	1.1 Real Numbers	6
		1.2 Indices and Logarithms	10
		1.3 Quadratic Expressions and Equations 1	15
2	Measurements and Geometry	2.1 Similarity and Enlargement	12
		2.2 Reflection and Congruence	12
		2.3 Rotation	10
		2.4 Angle Properties of a Circle	15
		2.5 Trigonometry 1	15
		2.6 Area of Polygons	14
		2.7 Area of a Part of a Circle	12
		2.8 Surface Area and Volume of Solids	16
		2.9 Linear Motion	15
3	Statistics and Probability	3.1 Statistics I	16
		3.2 Probability 1	12
			180

Note: The suggested number of lessons per Sub Strand may be less or more depending on the context.

STRAND 1.0: NUMBERS AND ALGEBRA
Sub Strand 1: Real Numbers

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
1.0 Numbers and Algebra	**1.1. Real Numbers** (8 lessons) ● *Classification of numbers* ● *Reciprocal of numbers.*	By the end of the sub-strand, the learner should be able to: a) classify whole numbers as odd, even, prime and composite in different situations, b) classify real numbers as rational and irrational in different situations, c) determine the reciprocal of real numbers by division, d) determine the reciprocal of real numbers by use of mathematical tables and calculators, e) apply reciprocal of real numbers in mathematical computations,	The learner is guided to: ● discuss with peers to identify and categorise whole numbers as odd, even, prime and composite. ● discuss in a group the meaning of real numbers, ● categorise real numbers as rational and irrational numbers ● work out the reciprocal of real numbers by division, ● read the values of the reciprocals of real numbers from mathematical tables, ● work out the reciprocal of real numbers using a calculator ● use reciprocal of real numbers to work out tasks,	How do we use real numbers in day-to-day activities?

		f) promote the use of real numbers in day-to-day activities.	● use digital devices or other resources such as books to work out the reciprocal of real numbers.	

Core Competencies to be developed:

- Communication and Collaboration: the learner discusses with peers to identify and categorise whole numbers as odd, even, prime, composite, rational, and irrational.
- Critical Thinking and Problem Solving: the learner uses the reciprocal of real numbers to work out mathematical tasks.
- Digital Literacy: the learner works out the reciprocal of real numbers from calculators and other digital devices.

Values:

- Unity: the learner discusses in a group and categorises real numbers as rational and irrational numbers.
- Responsibility: the learner takes care of calculators and mathematical tables when working out the reciprocal of real numbers.

Pertinent and Contemporary Issues (PCIs):

Life Skills: Self-esteem: the learner participates in the discussion on the concepts of rational and irrational numbers.

Sub Strand 2: Indices and Logarithms

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
1.0 Numbers and Algebra	**1.2. Indices and Logarithms** (8 lessons) • *Indices* • *Logarithms to base 10* • *Application of indices and logarithms*	By the end of the sub-strand the learner should be able to: a) express numbers in index form, b) derive the laws of indices using factors, c) apply the laws of indices in different situations, d) relate index notation to logarithm notation to base 10 e) determine common logarithms of numbers from mathematical tables and calculators, f) apply common logarithms in multiplication, division, powers and roots of numbers,	The learner is guided to: • write numbers in terms of bases and indices and share them with peers. • discuss in a group and generate the laws of indices. • use the laws of indices to work out mathematical computations • discuss in a group and relate index notation to logarithm notation to base 10 • read and obtain common logarithms of numbers from tables and calculators. • use common logarithms of numbers to work out mathematical tasks. • use digital devices or other resources to work out	Why do we use indices and logarithms?

		g) appreciate the use of indices and common logarithms in mathematical computations.	mathematical tasks involving common logarithms.	

Core Competencies to be developed:

- Learning to learn: the learner discusses in a group and generates the laws of indices.
- Digital literacy: the learner reads and obtains common logarithms of numbers from tables and calculators.

Values:

- Responsibility: the learner takes care of mathematical tables and calculators
- Respect: the learner appreciates the input of others while discussing in a group and relating powers of 10 to common logarithms.

Pertinent and Contemporary Issues (PCIs):

Life Skills - Self-awareness: the learner discusses in a group and relates powers of 10 to common logarithms and identifies the base.

Sub Strand 3: Quadratic Expressions and Equations

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
1.0 Numbers and Algebra	**1.3 Quadratic Expressions and Equations 1 (14 lessons)** ● *Quadratic expressions* ● *Quadratic identities* ● *Factorisation of quadratic expressions* ● *formation of quadratic equations* ● *Solution of quadratic equations by factorisation* ● *application of quadratic*	By the end of the sub-strand, the learner should be able to: a) form quadratic expressions from different situations, b) derive the quadratic identities from the concept of area, c) apply quadratic identities in numerical cases, d) factorise quadratic expressions in different situations, e) form quadratic equations in different situations, f) solve quadratic equations by factorization, g) apply quadratic equations to real life situations,	The learner is guided to: • generate quadratic expressions from given statements, • discuss with peers and come up with quadratic identities and write them on a chart. • discuss and use quadratic identities to evaluate numerical cases • discuss and work out factors of quadratic expressions. • work with peers to form quadratic equations from roots, statement and real-life cases, • work out factors of quadratic equations to	How do we apply the concept of quadratic equations?

	equations to real life situations	h) explore the use of quadratic equations in real life situations.	obtain solutions to the equations, • search on the use of quadratic equations using digital devices or other resources.	
Core Competencies to be developed: • Critical thinking and problem-solving: the learner interprets real-life cases to form and solve quadratic equations to get solutions to real-life cases. • Communication and collaboration: the learner discusses with peers and comes up with quadratic identities.				
Values: • Unity: the learner works with others to write quadratic identities on a chart. • Respect: the learner works with peers to form and solve quadratic equations to get solutions to real-life cases.				
Pertinent and Contemporary Issues (PCIs): Socio-economic and environmental issues - Social cohesion: the learner works with peers to form and solve quadratic equations to get solutions to real-life cases.				

Suggested Assessment Rubric: Numbers and Algebra

Indicators	**Exceeds Expectation**	**Meets Expectation**	**Approaches Expectation**	**Below Expectation**
Ability to classify whole numbers as odd, even, prime, and composite numbers, and real numbers as rational and irrational	The learner correctly and consistently classifies whole numbers as odd, even, prime, and composite numbers, and real numbers as rational and irrational	The learner correctly classifies whole numbers as odd, even, prime, and composite numbers, and real numbers as rational and irrational	The learner correctly classifies whole numbers as odd, even, prime, or composite numbers, or real numbers as rational and irrational	The learner correctly classifies whole numbers as odd, even, prime, or composite numbers,
Ability to determine the reciprocal of real numbers by division, tables and calculators	The learner consistently and accurately determines the reciprocal of real numbers by division, tables and calculators	The learner accurately determines the reciprocal of real numbers by division, tables and calculators	The learner accurately determines the reciprocal of real numbers by division or, tables or calculators	The learner partially determines the reciprocal of real numbers by division, or tables or calculators
Ability to apply reciprocal of real numbers in mathematical computations	The leaner systematically and accurately applies the reciprocal of real numbers in mathematical computations	The learner accurately applies reciprocal of real numbers in mathematical computations	The leaner partially accurately applies the reciprocal of real numbers in mathematical computations	The leaner partially applies the reciprocal of real numbers in mathematical computations with prompts

Indicators	Exceeds Expectation	Meets Expectation	Approaches Expectation	Below Expectation
Ability to derive and apply laws of indices.	The learner systematically and accurately derives and applies laws of indices	The learner accurately derives and applies laws of indices	The learner accurately derives or applies laws of indices	The learner partially derives or applies laws of indices
Ability to determine common logarithms of numbers from mathematical tables and calculators	The learner consistently and accurately determines common logarithms of numbers from mathematical tables and calculators	The learner accurately determines common logarithms of numbers from tables and calculators	The learner accurately determines common logarithms of numbers from mathematical tables or calculators	The learner partially determines common logarithms of numbers from mathematical tables or calculators
Ability to apply common logarithms in multiplication, division, powers, and roots of numbers	The learner appropriately and accurately applies common logarithms in multiplication, division, powers, and roots of numbers	The learner accurately applies common logarithms in multiplication, division, powers, and roots of numbers	The learner accurately applies common logarithms in multiplication or division or powers or roots of numbers	The learner partially applies common logarithms in multiplication or division of powers or roots of numbers
Ability to form quadratic	The learner consistently and correctly forms	The learner correctly forms quadratic	The learner partially forms quadratic	The learner partially forms quadratic expressions from

Indicators	**Exceeds Expectation**	**Meets Expectation**	**Approaches Expectation**	**Below Expectation**
expressions from different situations	quadratic expressions from different situations	expressions from different situations	expressions from different situations	different situations with assistance
Ability to derive quadratic identities from the concept of area	The learner consistently and correctly derives quadratic identities from the concept of area	The learner correctly derives quadratic identities from the concept of area	The learner partially derives quadratic identities from the concept of area	The learner partially derives quadratic identities in from the concept of area with assistance
Ability to factorise quadratic expressions in different situations	The learner systematically and correctly factorises quadratic expressions in different situations	The learner correctly factorises quadratic expressions in different situations	The learner partially factorises quadratic expressions in different situations	The learner partially factorises quadratic in different situations with prompts
Ability to form, solve, and apply quadratic equations in real-life situations	The learner systematically and accurately forms, solves, and applies quadratic equations in real-life situations	The learner accurately forms, solves, and applies quadratic equations in real-life situations	The learner partially accurately forms solves, and applies quadratic equations in real-life situations	The learner partially forms, or solves, or applies quadratic equations in real-life situations

STRAND 2.0: MEASUREMENTS AND GEOMETRY
Sub Strand 1: Similarity and enlargement

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
2.0 Measurements and Geometry	**2.1 Similarity and Enlargement** **(12 lessons)** ● *Similarity* ● *Enlargement* ● *Scale Factors* ● *Application of Similarity and Enlargement*	By the end of the sub-strand the learner should be able to: a) determine the centre of enlargement and the linear scale factor for similar figures, b) construct the image of an object under an enlargement given the centre and the linear scale factor, c) determine the area and volume scale factor of different figures and solids, d) relate linear scale factor, area scale factor, and volume	The learner is guided to: • discuss in a group and review the properties of similar figures and enlargement, • use an object and its image to establish the centre of enlargement and the ratio of the lengths of corresponding sides, Linear Scale Factor (L.S.F) • discuss in a group and draw on a plane surface the images of objects under enlargement given the centres and linear scale factors • draw on the Cartesian plane the images of objects under enlargement given the centres and linear scale factors.	How is similarity and enlargement applied in day-to-day life?

		scale factor in enlargements e) apply similarity and enlargement to real-life situations, f) appreciate the use of similarity and enlargement in real-life situations.	• discuss in a group and establish Linear Scale Factor (L.S.F) from similar plane figures. Work out the ratio of the area of similar plane figures, Area Scale Factor (A.S.F). Work out the ratio of volume of similar solids, Volume Scale Factor (V.S.F) • discuss in a group and establish the relationship between L.S.F, A.S.F and V.S.F using two similar solids. • work out tasks involving similarity and enlargements in real life situations. • use digital devices and other resources to learn more on the use and application of similarity and enlargement **Project** Use and improvise locally available materials to make sets of models of solids such as cubes, cuboids,	

			cylinders and spheres of different sizes using similarity and enlargement to be used as learning resources.	

Core Competencies to be developed:

- Communication and Collaboration: the learner discusses and recognises similar objects from their immediate environment.
- Creativity and Imagination: the learner makes models of solids of different sizes using similarity and enlargement concepts.

Values:

- Responsibility: the learner collects and takes care of objects from the immediate environment to recognize those that are similar and discusses what makes them similar.
- Integrity: the learner makes models with accurate measurements adhering to the concept of similarity and enlargement.

Pertinent and Contemporary Issues (PCIs):

- Social Cohesion: the learner works in a group to create models of various similar solids.
- Education for Sustainable Development - Environmental Education: the learner collects and uses objects from the immediate environment and discusses to recognize those that are similar.

Sub Strand 2: Reflection and congruence

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
2.0 Measurements and Geometry	**2.2 Reflection and Congruence (12 Lessons)** ● *Symmetry* ● *Reflection* ● *Equations of Mirror Lines* ● *Congruence*	By the end of the sub-strand, the learner should be able to: a) identify lines of symmetry in plane figures, b) determine the properties of reflection in different situations c) draw an image given an object and a mirror line on plane surface and Cartesian plane, d) determine the equation of the mirror line given an object and its image, e) carry out	The learner is guided to: • collect and observe different objects from the immediate environment and illustrate the lines and planes of symmetry. • use a plane mirror to locate the image of an object placed at a point in front of the mirror. • draw a plane figure and a mirror line on tracing paper. Fold the paper along the mirror line and trace out the plane figure. Use the two plane figures and the mirror line to generate the properties of reflection.	1. How do we use reflection in day-to-day life? 2. Where do we use congruence in real life?

		congruence tests for triangles, f) appreciate use of reflection and congruence in real-life situations.	• draw on plain paper a given object and a mirror line. Use the properties of reflection to locate the corresponding image • draw on a Cartesian plane given objects and mirror lines. Use the properties of reflection to draw the corresponding images. • construct a mirror line given an object and its image on a Cartesian plane. Work out the equation of the mirror line • work in a group and make paper cutouts of different identical shapes. Use the shapes to identify direct and opposite congruent shapes • use different triangles to establish the congruence tests; three sides (SSS), two sides and an included	

			angle(SAS), two angles and a side (AAS or SAA or ASA), and right angle, hypotenuse and side (RHS) • use digital devices to carry out reflection of different objects to generate images	

Core Competencies to be developed:

- Learning to Learn: the learner applies the properties of reflection to generate the image of an object on a given mirror line.
- Creativity and Imagination: the learner locates the image of an object placed at a point in front of a mirror.

Values:

- Responsibility: the learner cautiously takes care of the mirror used in reflecting corresponding images.
- Respect: the learner recognises the input of every member of the team as they work in groups to make paper cutouts of different identical shapes to identify direct or opposite congruent shapes.

Pertinent and Contemporary Issues (PCIs):

- Safety and Security: the learner in a group carefully uses the mirror to draw the image of an object given a mirror line.
- Environment and Technology: the learner selectively and cautiously collects and observes different objects from the immediate environment and identifies the lines and planes of symmetry.

Sub Strand 3: Rotation

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
2.0 Measurements and Geometry	**2.3 Rotation (10 lessons)** ● *Properties of rotation* ● *Rotation on different planes* ● *Rotational Symmetry* ● *Rotation and Congruence*	By the end of the sub-strand the learner should be able to: a) determine the properties of rotation in different situations, b) rotate an object, given the centre and angle of rotation on a plane surface and the Cartesian plane, c) determine the centre and angle of rotation given an object and its image, d) determine the order of rotational symmetry of plane figures, e) determine the axis and order of rotational symmetry in solids,	The learner is guided to: • demonstrate rotation using an actual or improvised clock. Discuss and explain the movement of the hour or minute hand • use an object and its image on a plane surface to discuss and generate the properties of rotation. • generate an image of an object given a centre and angle of rotation. • carry out rotation on a Cartesian plane given the object, centre, and angle of rotation • in a group, use construction to find the centre and angle	How is rotation applied in real-life situations?

		f) deduce congruence from rotation, g) appreciate the application of rotation in real-life situations.	of rotation given the object and its image on a plane surface and the Cartesian plane, • use paper cutouts of different plane figures to locate points of symmetry and establish the order of rotational symmetry • collect regular solids such as pyramids, triangular prisms, cones, tetrahedrons from the immediate environment and identify the axis to establish the order of rotational symmetry • use different objects and their images to identify the type of congruence in rotation • use digital devices and other resources to learn	

			more on rotation of plane figures and solids	

Core competencies to be developed:

- Critical thinking and Problem Solving: the learner draws objects and their images and through construction establishes the centres and angles of rotation.
- Communication and Collaboration: the learner discusses using an object and its image on a plane surface to generate the properties of rotation.

Values:

- Responsibility: the learner takes care of learning resources collected from the immediate environment to establish their axis and order of rotational symmetry
- Respect: learners appreciate each other's opinion as they discuss and draw the image under a rotation given the object, center and angle of rotation

Pertinent and Contemporary Issues (PCIs):

- Safety and Security: as the learner observes safety measures while making paper cutouts of different plane figures to locate the point and order of rotational symmetry.
- Environment and Technology: as the learner responsibly collects regular solids from the immediate environment to determine the axis and order of rotational symmetry.

Sub Strand 4: Trigonometry 1

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
2.0 Measurements and Geometry	**2.4 Trigonometry 1** (**15 lessons**) ● *Trigonometric ratios of acute angles* ● *Sines and Cosines of complementary angles* ● *Trigonometric ratios of special angle* ● *Application of trigonometric ratios*	By the end of the sub-strand, the learner should be able to: a) determine the trigonometric ratios of acute angles from, mathematical tables and calculators, b) relate sines and cosines of complementary angles, c) relate the sine, cosine and tangent of acute angles, d) determine trigonometric ratios of special angles: 30^o, 45^o, 60^o and 90^o using triangles,	The learner is guided to: • identify from the immediate environment shapes that make right-angled triangles. • draw right-angled triangles and use them to define and work out sine, cosine, and tangent ratios, • use mathematical tables and calculators to obtain trigonometric ratios, • generate a table of angles and their complements and determine their sines and cosines. Make observations and establish the	1. What is trigonometry? 2. How do we use trigonometry in real-life situations?

		e) apply trigonometric ratios to angles of elevation and depression f) reflect on the use of trigonometry in real-life situations	relationships between the sine and cosine ratios, • work in a group and using different acute angles, generate a table of the ratios of sine, cosine, and tangents to establish the relationship between sine, cosine, and tangent, • work in a group and use an isosceles right-angled triangle and an equilateral triangle to generate the trigonometric ratios of special angles 30o, 45o, 60o and 90o, • use trigonometric ratios to work out tasks related to triangles, • use a simple clinometer to measure the angle of elevation and depression	

			from a target object in the immediate environment, • use trigonometric ratios to work out tasks involving angles of elevation and depression, • use digital devices and other resources such as books, manuals, and journals to learn more about trigonometric ratios involving triangles, angles of depression, and elevation. **Project** Make a simple clinometer using locally available materials and use it as a learning resource	

Core Competencies to be developed:

- Creativity and Imagination: the learner makes a simple clinometer using locally available material and uses it as a learning resource
- Critical Thinking and Problem-Solving: the learner discusses and makes observations about the sine and cosine of complementary angles, and applies trigonometric ratios in the solution of triangles
- Digital literacy: the learner uses digital devices and other resources such as books, manuals, and journals to learn more about trigonometric ratios

Values:

- Responsibility: the learner takes care of mathematical tables and calculators used in determining trigonometric ratios
- Unity: the learner works in a group for instance when using an isosceles right-angled triangle and an equilateral triangle to generate the trigonometric ratios of special angles 30^o, 45^o, 60^o, and 90^o

Pertinent and Contemporary Issues (PCIs):

- Environmental Education and Protection: the learner identifies shapes in the immediate environment that have right-angled triangles, and makes a simple clinometer using materials from the immediate environment
- Parental Engagement and Empowerment: the learner gets support from parents/guardians to get resources to make a clinometer.

Sub Strand 5: Area of Polygons

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
2.0 Measurements and Geometry	**2.5 Area of Polygons (14 lessons)** • *Area of a triangle using* $Area = \frac{1}{2}abSinC$ • *Area of a triangle using Heron's formula* • *Area of quadrilaterals* • *Area of regular and irregular polygons*	By the end of the sub-strand the learner should be able to: a) derive the formula for the area of a triangle given two sides and an included angle, b) work out the area of a triangle given two sides and an included angle, c) determine the area of a triangle using Heron's formula, d) determine the area of quadrilaterals in different situations, e) work out the area of regular polygons of heptagon and octagon,	The learner is guided to: • discuss in groups and use trigonometric ratios to generate the formula for the area of a triangle given two sides and an included angle. For example, $Area = \frac{1}{2}abSinC$ • use the formula $Area = \frac{1}{2}abSinC$ to calculate the area of different triangular shapes, • use the Hero's Formula (Heron's Formula) to work out the areas of various triangles, • identify different quadrilaterals and work out their areas,	1. How do we work out the area of polygons? 2. How do we apply the concept of the area of polygons in real-life situations?

	• *Application of area of polygons*	f) determine the area of irregular polygons in different situations, g) explore the area of polygons as used in real-life situations.	• identify from the immediate environment objects in the shape of regular polygons and calculate the area of regular polygons up to decagons, • use objects from the immediate environment that have shapes of irregular polygons, discuss and work out their area, • research and discuss in a group the use of the area of polygons in real-life situations.	

Core Competencies to be developed:

- Critical Thinking and Problem Solving: the learner uses trigonometric ratios to generate the formula for a triangle given two sides and an included angle
- Creativity and Imagination: the learner identifies from the immediate environment objects in the shape of regular polygons and calculates their area.
- Learning to Learn: the learners research and discuss the use of the area of polygons in real-life situations

Values:

- Patriotism: the learner uses the objects from the environment and takes care of the environment
- Responsibility: the learner identifies objects from the immediate environment to use in calculating the area of regular polygons

Pertinent and Contemporary Issues (PCIs):

Environmental Education: the learner collects objects from the immediate environment to be used as learning materials

Sub Strand 6: Area of a Part of a Circle

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
2.0 Measurements and Geometry	**2.6 Area of a Part of a Circle** (12 lessons) ● *Area of an annulus* ● *Area of a sector of a circle* ● *Area of an annular sector* ● *Area of a segment* ● *Area of common region between two intersecting circles*	By the end of the sub-strand the learner should be able to: a) determine the area of an annulus in different situations, b) work out the area of a sector of a circle in real-life situations, c) determine the area of an annular sector in different situations, d) work out the area of a segment of a circle, e) determine the area of common region	The learner is guided to: • use circular shapes or objects to identify concentric rings formed by inner and outer space. Hence work out the area of the annulus, • work in a group, and use paper cutouts to make sectors of circles to determine their areas as part of a circle, • use different examples to illustrate and work out the area of an annulus sector for example area covered by a car wiper blade when cleaning the windscreen, • draw different segments of a circle and calculate their area, • draw illustrations of two intersecting circles to identify the	How do we use the concept of the area of a part of a circle in real life?

	• *Application on the use of the area of a part of a circle*	between two intersecting circles, f) apply the area of a part of a circle in real-life situations, g) explore the use of the area of a part of a circle in real-life situations.	common area between the two circles, hence work out the area, • relate and work out the area of a part of a circle in real life situations, • use digital devices and other resources to learn more about the area of a part of a circle. **Project** • make a dartboard of different numbers of concentric circles from locally available materials. Paint different colours on the annular sectors and the concentric circles. Discuss and create rules for playing and scoring the game. • make necklaces using beading techniques of different coloured annular sectors.	

Core Competencies to be developed:

- Creativity and Imagination: the learner makes an improvised dartboard of different numbers of concentric circles.
- Learning to Learn: the learner draws illustrations of two intersecting circles to identify the common area between the two circles.
- Communication and collaboration: the learners engage to improvise locally available materials to make dart boards and necklaces

Values:

- Responsibility: the learner makes darts board of different numbers of concentric circles from the immediate environment
- Unity: the learner collaborates in a group and uses paper cutouts to make sectors of circles to determine their areas as part of a circle

Pertinent and Contemporary Issues (PCIs):

- Parental Engagement and Empowerment: the learner engages parents in using locally available materials for making improvised necklaces.
- Environment Education: the learner sources for locally available materials to make necklaces and dart boards.
- Learner Support Programmes - Peer Support: the learner works with others to make necklaces using beading techniques of different coloured annular sectors.

Sub Strand 7: Surface Area and Volume of Solids

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
2.0 Measurements and Geometry	**2.7 Surface Area and Volume of Solids (15 lessons)** • *Surface Area of Solids* • *Volume of Solids*	By the end of the sub-strand, the learner should be able to: a) determine the surface area of prisms, pyramids, cones, frustums, and spheres, b) calculate the surface area of composite solids, c) calculate the volume of prisms, pyramids, cones, frustums, and spheres, d) determine the volume of composite solids, e) explore the use of the surface area and volume of solids in real-life situations.	The learner is guided to: • use models and nets of prisms, pyramids, cones, frustums, and spheres to calculate surface areas. • identify the components of a composite solid, calculate the surface area of each component and obtain the total surface area of the composite solid. • use models of a cone and a cylinder of the same height and base area and an appropriate substance such as sand or water, to demonstrate that the volume of the cone is a third of the volume of the cylinder.	1. How do we determine the surface area and volume of solids? 2. Why do we determine the surface area and volume of solids?

			• discuss in a group and work out the volume of prisms, pyramids, cones, frustums, and spheres. • discuss in a group the components of composite solids, work out the volume of the components and obtain the total volume. • use appropriate containers from the local environment to work out the volume and capacity of the prism, pyramid, cone, frustum and sphere. • use digital devices and other resources to work out the surface area and volume of solids	
Core Competencies to be developed: • Critical Thinking and Problem-Solving: the learner uses a cylinder and a cone of the same radius and height, and a substance such as sand or water, to determine the volume of a cone as a third the volume of a cylinder.				

• Creativity and Imagination: the learner uses a cylinder and a cone of the same radius and height, and a substance such as sand or water, to determine the volume of a cone as a third the volume of a cylinder.
Values: • Unity: the learner discusses in a group and establishes the relationship between the volume of a cone and the volume of a cylinder. • Respect: the learner listens to others' opinions as they discuss in groups and work out the volumes of prisms, pyramids, cones, frustums and spheres.
Pertinent and Contemporary Issues (PCIs): Environment and technology: as the learner collects and uses containers from the immediate environment and uses them to discuss and recognize their volumes.

Sub Strand 8: Vectors I				
Strand	**Sub Strand**	**Specific Learning Outcomes**	**Suggested Learning Experiences**	**Suggested Key Inquiry Questions**
2.0 Measurements and Geometry	**2.8 Vectors I** **(15 lessons)** • *Vector and scalar quantities.* • *vector notation* • *Representation of vectors* • *Equivalent vectors* • *Addition of vectors* • *Multiplication of vectors by scalar* • *Column vectors* • *Position vectors*	By the end of the sub strand the learner should be able to: a) explain vector and scalar quantities with illustrations b) use vector notations in different ways c) represent vectors geometrically in different situations d) identify equivalent vectors in different situations e) add vectors in different situations f) multiply vectors by scalars g) determine column vectors in different situations	The learner is guided to: ● search and brainstorm on the meaning of the terms vector and scalar quantities and illustrate giving examples. ● practice writing vector notations using charts ● illustrate vectors on charts, grids and regular plane figures, ● demonstrate equivalent vectors using charts, grids and Cartesian coordinates ● illustrate addition of vectors using charts and grids to get the resultant vector. ● illustrate multiplication of vectors by a scalar using charts and grids.	1. What are vectors? 2. Where is vectors used in real life situations?

	• *Magnitude of a vector* • *Midpoint of a vector* • *Translation vector*	h) determine position vectors in different situations i) work out magnitude of a vector in different situations j) determine the midpoint of a vector in different situations k) determine translation vector as a transformation l) appreciate the use of vectors in real life situations	• express vectors in column form from Cartesian planes, grids and charts. • discuss and illustrate position vectors using any arbitrary reference points like the origin. • work out magnitude of different vectors • find the midpoint of different vectors • use vectors to illustrate translation as a transformation • use digital devices to watch videos and play games involving vectors,	

Core competencies to be developed:

- Learning to learn: As the learner uses charts and grids to practice vector addition.
- Self-efficacy: As the learner shares and uses resources from the immediate environment such as plane figures or flip charts to demonstrate equivalent vectors.

Values:

- Responsibility: As the learner uses resources from immediate environment such as plane figures, flip charts and relate equivalent vectors

- Unity: As the learner searches and brainstorms on the meaning of the terms vector and scalar quantities and illustrates giving examples.

Pertinent and Contemporary Issues (PCIs):

- Education for sustainable Development - Environmental education as learners practice addition of vectors using charts and grids made from resources in the immediate environment.
- Learner Support Programme - Peer education: learners assist one another as they practice expressing vectors in column form from Cartesian planes, grids and charts.

Sub Strand 9: Linear Motion

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
2.0 Measurements and Geometry	**2.9 Linear Motion (15 lessons)** • *Distance, displacement, speed, velocity, and acceleration* • *Velocity and acceleration* • *Displacement time graph* • *Interpretation of displacement-time graph* • *Velocity time graph*	By the end of the sub-strand, the learner should be able to: a) explain the terms distance, displacement, speed, velocity and acceleration in real life situations, b) determine velocity and acceleration in different situations, c) draw a displacement-time graph of different situations, d) interpret displacement-time graph in different situations, e) draw a velocity-time graph from given tables in different situations,	The learner is guided to: • demonstrate motion by moving an object from a point to another for a specified distance and direction and state the meaning of the terms distance, displacement, speed, velocity and acceleration, • participate in a race of a specified distance. Record time taken by each learner and work out the velocity and acceleration of different learners, • work out the velocity and acceleration of movement of objects from one point another	1. What is speed? 2. How do we use displacement-time graphs in real life? 3. How do we use velocity-time graphs?

	• *Interpretation of velocity - time graph* • *Relative speed*	f) interpret velocity-time graph in different situations, g) determine relative speed of two moving bodies in different situations, h) appreciate use of linear motion in real life situations,	• use data of displacement and time to plot displacement-time graphs on a grid or Cartesian plane, • obtain information from a graph and examine it in relation to displacement, time and velocity, • use data of velocity and time taken to draw a velocity-time graphs on a grid or Cartesian plane, • obtain information from a graph and examine it in relation to velocity, time and acceleration, • observe two bodies in motion such as cars when overtaking or moving in opposite directions and work out the relative speed of these two bodies in motion, • use digital devices and other resources to explore more	

			on linear motion in day-to-day life.	

Core Competencies to be developed:

- Communication and Collaboration: the learner discusses different displacement-time graphs
- Self-Efficacy: the learner participates in a race of a specified distance, record time taken by a learner and work out the velocity and acceleration.
- Critical Thinking and Problem Solving: the learner observes two bodies in motion such as cars when overtaking or moving in opposite directions and works out the relative speed of the two bodies in motion.

Values:

- Responsibility: as the learner uses objects in motion such as thrown objects and many others to explain distance, displacement, speed, velocity and acceleration,
- Integrity: as the learner participates in a race of a specified distance, records time taken by each learner and accurately works out the velocity and acceleration of different learners,
- Unity: as the learner participates and collaborates in a race to record time taken by each learner and work out the velocity and acceleration of different learners.

Pertinent and contemporary Issues (PCIs):

- Learner Support Programmes-Sports and Games: the learner participates in a race of a specified distance, records time taken by each learner and works out the velocity and acceleration,
- Socio-Economic and Environmental Issues-Safety and Security: the learner observes the two bodies in motion such as cars when overtaking or moving in opposite directions and works out the relative speed of these two bodies in motion.

Suggested Assessment Rubric: Measurements and Geometry

Indicators	Exceeds Expectation	Meets Expectation	Approaches Expectation	Below Expectation
Ability to determine the centre of enlargement and the linear scale factor from similar figures	The learner systematically determines the centre of enlargement and linear scale factor from similar figures	The learner determines the centre of enlargement and linear scale factor from similar figures	The learner determines the centre of enlargement or linear scale factor from similar figures	The learner determines the centre of enlargement or linear scale factor from similar figures with assistance
Ability to construct the image of an object under an enlargement given the centre and the linear scale factor	The learner precisely constructs objects and their images under enlargement given the centre and the linear scale factor	The learner constructs objects and their images under enlargement given the centre and the linear scale factor	The learner partially constructs objects and their images under enlargement given the centre and the linear scale factor	The learner constructs objects and their images under enlargement given the centre and the linear scale factor with assistance
Ability to carry out enlargement on the Cartesian plane	The learner systematically carries out enlargement on the Cartesian plane	The learner carries out enlargement on the Cartesian plane	The learner partially carries out enlargement on the Cartesian plane partly accurately	The learner carries out enlargement on the Cartesian plane with assistance
Ability to determine linear, area and volume scale factors	The learner precisely determines linear, area and volume scale factors	The learner determines linear, area and volume scale factors	The learner determines either linear or area or volume scale factors	With assistance determines linear, area and volume scale factors

Indicators	Exceeds Expectation	Meets Expectation	Approaches Expectation	Below Expectation
Ability to apply similarity and enlargement to real life situations	The learner systematically Applies similarity and enlargement to real life situations	The learner applies similarity and enlargement to real life situations	The learner partially applies similarity and enlargement to some real life situations	The learner applies similarity and enlargement to real life situations with assistance
Ability to identify lines of symmetry of plane figures and properties of reflection	The learner precisely and correctly identifies lines of symmetry of plane figures and properties of reflection	The learner correctly identifies lines of symmetry of plane figures and properties of reflection	The learner correctly identifies lines of symmetry of plane figures or properties of reflection	The learner partially identifies lines of symmetry of plane figures or properties of reflection
Ability to draw an image given an object and a mirror line on a plane surface and Cartesian plane and determine the equation of the mirror line	The learner systematically and accurately draws an image given an object and a mirror line on a plane surface and Cartesian plane and determines the equation of the mirror line	The learner accurately draws an image given an object and a mirror line on a plane surface and Cartesian plane and determines the equation of the mirror line	The learner accurately draws an image given an object and a mirror line on a plane surface or Cartesian plane or determines the equation of the mirror line	The learner partially draws an image given an object and a mirror line on the plane surface or the Cartesian plane or determines the equation of the mirror line

Indicators	Exceeds Expectation	Meets Expectation	Approaches Expectation	Below Expectation
Ability to determine the properties of rotation and rotate an object, given the centre and angle of rotation	The learner comprehensively and correctly determines the properties of rotation and rotates an object, given the centre and angle of rotation	The learner correctly determines the properties of rotation and rotates an object, given the centre and angle of rotation	The learner correctly determines the properties of rotation or rotates an object, given the centre and angle of rotation	The learner partially determines the properties of rotation or rotates an object, given the centre and angle of rotation
Ability to determine the order of rotational symmetry in solids and relate rotation and congruence	The learner comprehensively and correctly determines the order of rotational symmetry in solids and relates rotation and congruence	The learner correctly determines the order of rotational symmetry in solids and relates rotation and congruence	The learner correctly determines the order of rotational symmetry in solids or relates rotation and congruence	The learner partially determines the order of rotational symmetry in solids or relates rotation and congruence
Ability to determine the trigonometric ratios of acute angles from right-angled triangles, mathematical tables, and calculators	The learner systematically and accurately determines the trigonometric ratios of acute angles from right-angled triangles, mathematical tables, and calculators	The learner accurately determines the trigonometric ratios of acute angles from right-angled triangles, mathematical	The learner partially determines the trigonometric ratios of acute angles from right-angled triangles, mathematical tables, and calculators	The learner determines the trigonometric ratios of acute angles from right-angled triangles, or mathematical tables, or calculators with assistance

Indicators	Exceeds Expectation	Meets Expectation	Approaches Expectation	Below Expectation
		tables, and calculators		
Ability to relate the sines, cosines, of complementary angles and sines, cosines, and tangents of acute angles	The learner logically and accurately relates the sines, cosines, of complementary angles and sines, cosines, and tangents of acute angles	The learner accurately relates the sines, cosines, of complementary angles and sines, cosines, and tangents of acute angles	The learner accurately relates the sines, cosines, of complementary angles or sines, cosines, or tangents of acute angles	The learner partially relates the sines, cosines, of complementary angles or sines, cosines, and tangents of acute angles
Ability to determine trigonometric ratios of special angles 30o, 45o, 60o and 90o using triangles,	The learner systematically and accurately determines trigonometric ratios of special angles 30o, 45o, 60o, and 90o using triangles	The learner accurately determines trigonometric ratios of special angles 30o, 45o, 60o, and 90o using triangles	The learner accurately determines trigonometric ratios of any two of the special angles 30o, 45o, 60o, and 90o using triangles,	The learner partially determines trigonometric ratios of any one of the special angles 30o, 45o, 60o, and 90o using triangles

Indicators	Exceeds Expectation	Meets Expectation	Approaches Expectation	Below Expectation
Ability to apply trigonometric ratios in the solution of triangles, angles of elevation, and depression	The learner appropriately and accurately applies trigonometric ratios in the solution of triangles, angles of elevation, and depression	The learner accurately applies trigonometric ratios in the solution of triangles, angles of elevation, and depression	The learner accurately applies trigonometric ratios in any two of either the solution of triangles or angles of elevation or depression	The learner partially applies trigonometric ratios in any one of either solution of triangles or angles of elevation or depression
Ability to determine the area of quadrilaterals, heptagons, octagons, and irregular polygons	The learner systematically and accurately determines the area of quadrilaterals, heptagons, octagons, and irregular polygons	The learner accurately determines the area of quadrilaterals, heptagons, octagons, and irregular polygons	The learner accurately determines the area of quadrilaterals, heptagons, octagons, or irregular polygons	The learner partially determines the area of quadrilaterals, heptagons, octagons or irregular polygons
Ability to determine the area of an annulus, sector, annular sector, and segment of a circle	The learner systematically and accurately determines the area of an annulus, sector, annular sector, and segment of a circle	The learner accurately determines the area of an annulus, sector, annular sector, and segment of a circle	The learner accurately determines the area of an annulus, or sector, annular sector, or segment of a circle	The learner partially determines the area of an annulus or sector or annular sector or segment of a circle

Indicators	Exceeds Expectation	Meets Expectation	Approaches Expectation	Below Expectation
Ability to determine the area of a common region between two intersecting circles	The learner systematically and correctly determines the area of the common region between two intersecting circles	The learner correctly determines the area of the common region between two intersecting circles	The learner partially determines the area of the common region between two intersecting circles	The learner partially determines the area of the common region between two intersecting circles with prompts
Ability to determine the surface area of prisms, pyramids, cones, frustums and spheres, and composite solids	The learner systematically and accurately determines the surface area of prisms, pyramids, cones, frustums, spheres, and composite solids	The learner accurately determines the surface area of prisms, pyramids, cones, frustums, spheres, and composite solids	The learner accurately determines the surface area of prisms, pyramids, cones, frustums, spheres, or composite solids	The learner partially determines the surface area of prisms, pyramids, cones, frustums, spheres, or composite solids.
Ability to determine the volume of prisms, pyramids, cones, frustums, spheres, and composite solids	The learner consistently and correctly determines the volume of prisms, pyramids, cones, frustums, spheres, and composite solids	The learner correctly determines the volume of prisms, pyramids, cones, frustums, spheres, and composite solids	The learner correctly determines the volume of prisms, pyramids, cones, frustums, spheres, or composite solids	The learner partially determines the volume of prisms, pyramids, cones, frustums, spheres, or composite solids

Indicators	Exceeds Expectation	Meets Expectation	Approaches Expectation	Below Expectation
Ability to represent vectors geometrically perform operations on vectors and determine the magnitude of vectors	The learner precisely and correctly represents vectors geometrically, performs operations on vectors and determines the magnitude of vectors	The leaner correctly represents vectors geometrically performs operations on vectors and determines the magnitude of vectors	The leaner correctly represents vectors geometrically performs operations on vectors or determines the magnitude of vectors	The learner partially represents vectors geometrically performs operations on vectors or determines the magnitude of vectors with assistance
Ability to determine translation vector	The learner systematically and accurately determines translation vector	The learner accurately determines translation vector	The learner partially accurately determines translation vector	The learner partially determines translation vector with assistance
Ability to determine displacement, speed, velocity, acceleration;	The learner explicitly and correctly determines displacement, speed, velocity, and acceleration	The learner correctly determines displacement, speed, velocity, and acceleration	The learner correctly determines displacement or speed or velocity or acceleration	The learner partially determines displacement or speed or velocity or acceleration with assistance
Ability to draw and interpret graphs of linear motion	The learner systematically and accurately draws and interprets graphs of linear motion	The learner accurately draws and interprets graphs of linear motion	The learner accurately draws or interprets graphs of linear motion	The learner partially draws or interprets graphs of linear motion

Indicators	Exceeds Expectation	Meets Expectation	Approaches Expectation	Below Expectation
Ability to define and solve problems involving relative speed	The learner correctly and accurately defines and solves problems involving relative speed	The learner correctly defines and solves problems involving relative speed	The learner correctly defines or solves problems involving relative speed	The learner partially correctly defines or solves problems involving relative speed

STRAND 3.0: STATISTICS AND PROBABILITY
Sub Strand 1: Statistics and Probability

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
3.0 Statistics and Probability	**3.1. Statistics I** **(16 lessons lessons)** • *Collection of Data* • *Frequency distribution table* • *Mean, Mode and Median of grouped and ungrouped data* • *Representation of Data* • *Interpretation of Data*	By the end of the sub-strand the learner should be able to: a) collect data from real-life sources, b) draw a frequency distribution table for grouped and ungrouped data, c) determine mean, mode and median of grouped and ungrouped data, d) represent data using histograms and frequency polygons, e) interpret data from histograms and frequency polygons,	The learner is guided to: • discuss with peers the meaning of the term data. Explore data sources and use different and appropriate methods to collect and record data, • use the collected data or any other data to prepare a frequency distribution table for an ungrouped data, • group collected data or any other data into appropriate classes and generate a frequency distribution table, • discuss in pairs and identify the modal class for grouped data, • use data collected from different sources and work out the mode,	1. What is statistics? 2. How do we represent data? 3. How do we use statistics in day to day life?

		f) promote data collection, organisation and representation for informed decision making.	median and mean for grouped and ungrouped data, • work in a group and use collected data to draw histograms (with equal and *unequal class-width)* and frequency polygons, • use the histograms and frequency polygons to examine data to make conclusions, • use digital devices and other resources to draw histograms and frequency polygons. **Project** - Identify a situation in the school or community that can be used for data collection, organisation and representation to guide the school or community to make informed decisions. Present and share findings to different groups of people such as school administrators, parents or local community leaders.	

Core Competencies to be developed:

- Critical thinking and problem solving: the learner uses the histograms and frequency polygons to examine data and make conclusions.
- Self-Efficacy: the learner discusses with peers the meaning of the term data and explores data sources.
- Digital literacy: the learner uses digital devices to draw histograms and frequency polygons to make conclusions.
- Communication and collaboration**:** learner presents and shares findings from data to different groups of people such as school administrators, parents or local community leaders.

Values:

- Integrity: the learner collects and records data accurately.
- Unity: the learner works in groups and uses collected data to draw histograms and frequency polygons.

Pertinent and Contemporary Issues (PCIs):

- Life Skills - Decision Making: the learner makes informed decisions from data interpretation from histograms and frequency polygons.
- Parental Engagement and Empowerment: the learner seeks support and guidance from parents or guardians to collect, organise and present data on an identified situation in the school or community.

Strand	Sub Strand	Specific Learning Outcomes	Suggested Learning Experiences	Suggested Key Inquiry Questions
3.0 Statistics and probability	**3.2 Probability 1** **(12 lessons)** ● *Experimental probability* ● *Probability space* ● *Mutually exclusive and independent events* ● *Laws of Probability* ● *probability tree diagrams*	By the end of the sub strand the learner should be able to: a) perform experiments involving probabilities in different situations, b) identify the range of probability in different situations, c) generate probability space of different events d) determine the probability of mutually exclusive and independent events e) apply the laws of probability in different situations, f) determine the probability of independent events using tree diagrams g) appreciate the application of	The learner is guided to: • carry out experiments in a group such as tossing coins or throwing dice to illustrate experimental probability, • discuss in a group the probabilities of events and show the range of probability. • list down all the possible outcomes of different events in real life situations • work out in pairs the probability of mutually exclusive events and independent events. • work out probability of events using addition and multiplication law • in pairs use tree diagram to work out probability of two	How is probability applied in real life situations?

		probability in real life situations.	independent and mutually events • discuss, create and play games related to probability. • use digital devices and other resources to learn more on probability	

Core competencies to be developed:

- Communication and collaboration: the learner carries out experiments such as tossing coins or throwing dice to illustrate experimental probability.
- Citizenship: the learner acknowledges Kenyan currency as they carry out experiments of tossing coins.
- Self-efficacy: the learner appreciates his/her ability to play games related to probability.

Values:

- Responsibility: the learner carefully tosses coins or throws dice to illustrate experimental probability.
- Social justice: the learner plays games where they accept there is winning or losing and acknowledging honest outcomes.

Pertinent and Contemporary Issues (PCIs):

- Social Cohesion: the learner interacts with others freely as they discuss, create and play games related to probability.
- Life skills and values education: the learner uses different experimental events and lists down all the possible outcomes which assist in decision making.

Suggested Assessment Rubric: Statistics and Probability

Indicators	Exceeds Expectation	Meets Expectation	Approaches Expectation	Below Expectation
Ability to draw a frequency distribution table for grouped and ungrouped data and determine mean, mode, and median	The learner accurately and systematically draws a frequency distribution table for grouped and ungrouped data and determines mean, mode, and median	The learner accurately draws a frequency distribution table for grouped and ungrouped data and determines mean, mode, and median	The learner accurately draws a frequency distribution table for grouped or ungrouped data or determines mean, mode, and median	The learner partially draws a frequency distribution table for grouped or ungrouped data or determines mean, mode or median
Ability to represent and interpret grouped data using histograms and frequency polygons	The learner systematically and accurately represents and interprets grouped data using histograms and frequency polygons	The learner accurately represents and interprets grouped data using histograms and frequency polygons	The learner accurately represents or interprets grouped data using histograms or frequency polygons	The learner partially represents or interprets grouped data using histograms or frequency polygons
Ability to perform experiments involving probabilities and identify the range of probability	The learner systematically and accurately performs experiments involving probabilities and identifies the range of probability	The learner accurately performs experiments involving probabilities and identifies the range of probability	The learner accurately performs experiments involving probabilities or identifies the range of probability	The learner partially performs experiments involving probabilities or identifies the range of probability

Indicators	Exceeds Expectation	Meets Expectation	Approaches Expectation	Below Expectation
Ability to generate probability space of different events and determine the probability of mutually exclusive and independent events	The learner systematically and accurately generates probability space of different events and determines the probability of mutually exclusive independent events	The learner accurately generates probability space of different events and determines the probability of mutually exclusive independent events	The learner accurately generates the probability space of different events or determines the probability of mutually exclusive or independent events	The learner partially generates probability space of different events or determines the probability of mutually exclusive or independent events
Ability to apply the laws of probability and determine the probability of independent events using tree diagrams	The learner precisely and correctly applies the laws of probability and determines the probability of independent events using tree diagrams	The learner precisely and correctly applies the laws of probability and determines the probability of independent events using tree diagrams	The learner correctly applies the laws of probability or determines the probability of independent events using tree diagrams	The learner partially applies the laws of probability or determines the probability of independent events using tree diagrams

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