Ministry of Education and Training

Mohloli oa Thuto

Grade 10 and 11 Mathematics Syllabi 2020

Table of Contents

Introduction

Grade 10 and 11 Mathematics Syllabi form part of the integrated curriculum. This curriculum is basically intended to draw together knowledge, skills, attitudes and values from different subject areas to develop a more powerful understanding of key ideas which can be connected and related in meaningful ways by both learners and teachers. Development of this syllabus was based on five Curriculum Aspects which highlight the life challenges and contexts in which the learner is expected to function as an individual and a member of a society. These are: Effective Communication; Awareness of Self and Others; Environmental Adaptation and Sustainable Development; Health and Healthy Living; and Production and Work-related Competencies.

The solid foundations of Mathematics concepts and skills have been laid in previous grades. The syllabus materials for previous grades were intended to enable learners to take their first steps on a pathway of active and independent learning. These materials were also aimed at building on and reinforcing the skills and attitudes to learners. These curriculum materials are envisioned to prepare learners to become progressively more autonomous learners throughout their academic journey. The current Grade 10 and 11 Mathematics Syllabi have been developed in the manner that resonates with the previous curriculum materials. The designed Learning Outcomes and activities have been deliberately developed to advance mathematics conceptual development. In fact, they are intended to nurture learners and to foster positive and enthusiastic attitudes towards mathematics learning.

Teaching approaches

Teachers are encouraged to use a wide variety of teaching techniques, including group work, practical exercises and activities involving the wider community. The emphasis on practical activities is made because they promote mathematics conceptual development to learners, and also stimulate their curiosity and foster an active approach to learning. The role of the teacher is to facilitate active learning, rather than a teacher-centred didactic approach. Teachers are also advised to improvise and, where applicable, use concrete materials from the immediate environment to enhance learners' understanding of mathematics concepts. Mathematics concept development should start with manipulation of concrete objects before introducing the abstract ideas. The general aim of teaching mathematics concepts is to equip learners with knowledge and skills which can enable them to develop investigative and analytical skills. As a result, learners would acquire critical and logical thinking.

Promotion of values and attitudes

Grade 10 and 11 Mathematics Syllabi were developed following the guidelines of curriculum and assessment policy framework (2009), which one of its goals is to promote values and attitudes to learners. The LOs as well as suggested activities have been developed with the purpose of addressing this issue. This syllabus targets to promote positive attitude, acceptable morals, teamwork and adherence to ethical issues. Considering that values and attitudes have been addressed extensively in relevant subject areas, this syllabus put more focus on the specific values and attitudes which are as follows: cooperation, confidence, honesty, appreciation, patience and objectivity. It is hoped that this will help learners to become credible individuals and also build good relations that will lead to their harmonious coexistence.

Promotion of Financial Literacy

The Grade 10 and 11 Mathematics Syllabi were developed with the commitment of promoting financial literacy among the Basotho children. Mathematics teaching and learning processes have been considered as an appropriate platform to relay messages covering financial education. The intention is to equip learners with requisite skills which will enable them to manage their finances in a manner that could sustain them in future. In this syllabus, learners will be engaged in various activities that require them to calculate value of money, interpret information which empowers them to make informed financial decisions and be conscious of benefits of saving money. It is therefore believed that learners will understand the importance of money in their lives. They will also become critical consumers who will avoid wasteful spending and being drowned in unnecessary debts. Financial literacy will also help learners to become responsible citizens who value the importance of paying taxes.

Consideration of inclusive education

The Ministry of Education and Training (MoET) is committed to ensure successful integration of learners with special educational needs (LSEN) into regular schools. Hence it has developed legal and policy frameworks which advocate for improving access to quality education to all learners, including LSEN. Teachers are therefore, advised to adapt suggested activities in the syllabus to cater for different educational needs of LSEN. Teachers are requested to ensure that the LSEN actively participate in all classroom activities. However, where necessary, teachers are advised to prepare individualised education programmes (IPE) for every learner with special educational needs present in the classroom.

Content presentation

The main areas covered by Grade 10 and 11 Mathematics syllabi include: numbers, shapes, measurements, transformations, sets, ratios, algebra, probability and statistics. The Learning Outcomes are arranged in such a way that concepts show logical connections in order to facilitate continuous learning. This arrangement also allows for the progressive development of content complexity. However, this is not binding, teachers may follow a different pattern when planning their lessons. The Grade 10 and 11 Mathematics Syllabi have followed an approach which bears a resemblance of the syllabus materials of the previous grades. The intention was to ensure continuity in Mathematics conceptual development. Apart from that, the aim is to promote strong understanding and connection between Mathematics concepts and content with those of other subject areas. When planning Mathematics lessons, teachers are expected to make some connections with content from other subject areas, where possible. This creates an overall learning opportunity that integrates and balances concept development, skill acquisition and application.

Mathematical skills help learners to make sense of the world in terms of order, beauty and consistency by noticing size, shape and position. They help to make connections, to see order and logic. Seeing patterns, making predictions, estimating, determining rates of change, demonstrating, problem-solving and critical thinking are all necessary in real-life situations. Learners should learn Mathematics in ways that allow them to discover relationships, develop understanding and the growth of thinking. Mathematics is a tool in other fields: it is a service subject, and therefore should be taught as a tool in the context of its application in real-life. The

Grade 10 and 11 Mathematics Syllabi promote acquisition and application of mathematical skills for effective participation in scientific, technological and socio-economic development. It also develops appreciation among learners for contribution of mathematical skills in different fields. Most importantly, it promotes development of positive attitudes towards Mathematics as a foundation for further learning and career development.

Layout and presentation of the syllabus

The subject matter is divided into a number of **Learning Outcomes** (the terms "learning objectives" or "learning intentions" are often used in other contexts.

Learning outcome: a statement in measureable terms of what a learner should know, understand or be able to do by the end of a given segment of the syllabus. For each targeted **learning outcome**, details are given of: the key **concepts, skills, values and attitudes** which underpin its successful attainment.

Concept: a general idea which emerges from a specific situation; once understood it can be applied to different contexts to promote understanding. For example, the concept of the family emerges from awareness of the familiar unit in which people live; it can be applied to groups of animals, plants or words which naturally belong together.

Skills: abilities which every learner is expected to acquire to help them learn and live well in society; they can be mental, physical or social.

- **Suggested learning experiences**: teaching and learning activities designed to enable learners to achieve a given learning outcome. This is not exhaustive, and the teacher is free to use other complementary activities.
- **What to assess**: in this column**,** the **learning outcome** is broken down into several specific, measurable and observable points, against which the teacher can check the learners' progress. These focus on the process and characteristics of learning rather than the final outcome.
- **Suggested resources:** a list of possible items, materials, persons etc. which may be used to help achieve a given learning outcome. This is designed to help all teachers, however many or few resources may be available in their schools and communities.

Principles of assessment

Assessment and curriculum are closely integrated and mutually supportive. The 2009 *Curriculum and Assessment Policy* introduces continuous assessment (CASS) as a key strategy to reform education. Continuous assessment is an on-going system of monitoring and assessing learners' progress. It is closely integrated with the teaching and learning process and actually supports learning. It is formative assessment, done in the school environment through daily teaching. It can also be achieved through projects, quizzes, tests, interviews and observations.

In the context of Lesotho, it has been decided to merge formative assessment and assessment for learning, moving away from the traditional ways of testing, which have been found to be severely limiting. Testing through examinations and tests provides learners with marks or grades. However, it does not give any indication of what the learner is actually able to do. Instead of marks or grades, the new methods of assessment will generate statements about each learner's progress and ability. These will help learners, their teachers and future teachers, their parents and guardians as well as education policy makers to know exactly what a learner has learned and is capable of doing, also indicating areas where remedial work is needed. A further disadvantage of conventional testing is that teachers feel under pressure to "teach for the exam" and ignore aspects of the curriculum which will not be examined.

The syllabus is presented in such a way that, along with each learning outcome, assessment criteria guide the teacher in what to assess to determine whether the learning outcome has been successfully achieved, partially achieved or not yet achieved. Teachers should share Learning Outcomes and success criteria with learners so that learners know what they are learning and the standards they are aiming for. They should also provide feedback (which may be oral or written) that helps learners to identify improvement. Both the teacher and the learner will reflect on learners' performance and learners will learn **self-assessment techniques** to discover areas for improvement. This promotes a more active approach to learning and recognises that both motivation and self-esteem are crucial for effective learning and progress, and that these can be increased through effective assessment techniques. In addition to self-assessment, peer-assessment is a useful tool which will be used where appropriate.

Grade 10 Mathematics Syllabus
Overview.

At the end of Grade 10, learners should be able to:
1. form and interpret sets of ordered pairs. 2. demonstrate understanding of calculations involving universal set containing up to three sets. 3. find squares, square roots, cubes and cube roots by applying prime factorisation. 4. find a general rule for quadratic sequences. 5. demonstrate understanding of optimisation of measures on areas and volumes. 6. calculate interior and exterior angles of irregular polygons. 7. demonstrate understanding of use of angle properties of a circle. 8. demonstrate understanding of use of properties of a tangent at a circle. 9. use angle properties of a circle to solve problems. 10. demonstrate understanding of calculations involving surface area and volume of solids. 11. demonstrate understanding of relationship between geometrical vectors. 12. describe and perform enlargement with negative and fractional scale factor. 13. demonstrate understanding of describing and performing a combination of transformations. 14. use given data to solve problems on simple and compound interest. 15. draw and interpret graphs in practical situations. 16. expand and factorise quadratic expressions. 17. demonstrate understanding of basic operations on algebraic fractions. 18. demonstrate understanding of calculations involving fractional indices. 19. demonstrate understanding of solving indicial equations. 20. perform calculations involving matrices. 21. solve probability problems of combined events using tree-diagram of two or more events. 22. present and interpret statistical data. 23. present and analyse data using measures of spread.

24. evaluate and generate relations and functions.
25. draw and interpret quadratic and cubic graphs.
26. draw and interpret inverse and exponential graphs.
27. solve linear inequalities in two variables.
28. solve inequality problems using linear programming.
29. locate points and regions using loci.
30. calculate dimensions of triangles using sine and cosine formula.
31. draw and interpret bearings involving three journeys.

Grade 10 Mathematics Syllabus
Activity plan.

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
1. form and interpret sets of ordered pairs.	**Concepts** Universal set Ordered pairs **Skills** Classification Manipulation Communication Interpretation	• Teacher and learners review set notation used for describing relationship between two sets. • Teacher and learners review mappings. • Learners, guided by a teacher, use functions to generate sets of inputs and outputs. • Learners write input and output as coordinates. • Teacher and learners deduce the concept of ordered pairs. • Learners list the ordered pairs as elements of a set. • Teacher provides a variety of scenarios that require learners to represent three sets in different Venn diagrams. • Learners represent the given sets using a Venn diagram. • Learners identify members of each set which do not appear in the other set. • Learners find the number of elements of each set in the universal set. • Learners form and describe sets using appropriate notation.	sort materials according to their common features. form a bigger set that contains formed sets. describe universal set. use appropriate notation to describe the sets. represent the formed sets using a Venn diagram. form and describe sets from different scenarios using appropriate notation. form and describe sets of different types of numbers. establish the relationship of any two sets in the universal set. solve problems involving set notations.	Materials from the immediate environment Mathematics kit Teacher's Guide

		• Learners establish the relationship of any three sets in the universal set. • Learners solve problems involving set notations.		

Learning Outcome: at the end of Grade 10, learners should be able to:	**Concepts and skills**	**Suggested learning experiences**	**What to assess: the teacher should assess learner’s ability to:**	**Resources**
2. demonstrate understanding of calculations involving universal set containing up to three sets.	**Concepts** Sets Universal set Venn diagram Set notation Number of elements Subsets Disjoint sets Maximum Minimum **Skills** Classification Listing Manipulation Communication Interpretation counting	• Teacher and learners review set notations including number of elements in a set and subsets. • Learners, under the guidance of a teacher, represent number of elements in a universal set using Venn diagram of up to three sets. • Learners find the number of elements in each region within the universal set. • Teacher provides learners with different scenarios involving calculations of maximum and minimum number of elements. • Teacher guides learners to use the formula for determining number of elements for the specified set within the universal set $n(\xi) = n(A) + n(B) + n(A \cup B)' - n(A \cap B)$ • Learners find maximum and minimum number of elements.	represent number of elements in a universal set using Venn diagram of up to three sets. find the number of elements in each region/subset in the universal set. calculate maximum and minimum number of elements. find maximum and minimum number of elements. solve problems involving calculations of number of elements in a set.	Mathematical kit

		• Learners solve problems involving calculations of number of elements in a set.		

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
3. find squares, square roots, cubes and cube roots by applying prime factorisation.	**Concepts** prime factorisation squares square roots cubes cube roots index notation **Skills** simplification Manipulation Logical thinking Critical thinking	• Teacher and learners review: prime factorisation, squares, square roots, cubes and cube roots. • Learners express perfect squares as product of prime factors in index notation. • Learners identify the type of numbers within the indices • Leaners find the square roots of perfect squares expressed as product of their prime factors. • Learners change non perfect squares into perfect squares by multiplying by positive integer *k*. • Learners express perfect cubes as product of their prime factors in index notation. • Learners find the lowest common factor of numbers within the indices. • Leaners find the cube roots of perfect cubes expressed as product of their prime factors. • Learners change non perfect cubes into perfect cubes by multiplying by positive integer *k*. • Learners solve problems involving squares, square roots, cubes and cube roots.	express perfect squares as product of prime factors in index notation identify the type of numbers within the indices find the square roots of perfect squares expressed as product of their prime factors. change non perfect squares into perfect squares by multiplying by positive integer *k*. express perfect cubes as product of their prime factors in index notation. identify the type of numbers within the indices find the cube roots of perfect cubes expressed as product of their prime factors change non perfect cubes into perfect cubes by multiplying by positive integer *k*.	Mathematics kit

			solve problems involving squares, square roots, cubes and cube roots.	

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner’s ability to:	Resources
4. find a general rule for quadratic sequence.	**Concepts** Sequences: arithmetic quadratic General rule first difference second difference Simultaneous equations **Skills** Ordering Manipulation Calculation Interpretation Logical thinking Critical	• Teacher and learners review generation of number sequences from a given rule. • Teacher and learners review general rule for arithmetic sequence. • Learners form sequences using consecutive square numbers. • Learners establish a rule of the sequence. • Learners predict the subsequent terms. • Teacher and learners deduce the algebraic representation of a general rule of the form: $t_n = an^2 + bn + c$ • Learners find a general rule of a given quadratic sequence. • Learners solve problems involving quadratic sequences.	form sequences using consecutive square numbers. establish a rule of the sequence. predict the subsequent terms. deduce the algebraic representation of a general rule. find a general rule of a given quadratic sequence. solve problems involving quadratic sequences.	Mathematics kit
5. demonstrate understanding of optimisation of measures on areas and volumes.	**Concepts** Limits of accuracy: lower bound upper bound Area Volume Optimisation minimum maximum **Skills** Ordering Manipulation	• Teacher and learners review: lower bound, upper bound and minimum or maximum. • Teacher and learners review perimeter of a given shape. • Learners under guidance of a teacher use lower and upper bounds to find maximum and minimum area of a shape. • Learners solve problems that involve optimisation of area. • Learners under guidance of a	find maximum and minimum area of a shape. solve problems that involve optimisation of area. optimise volume. solve problems involving optimisation of area and volume.	Mathematics kit

	Calculation Interpretation Logical thinking Critical thinking	teacher use lower and upper bounds to optimise volume. • Learners solve problems involving optimisation of area and volume		

Learning Outcome: at the end of Grade 10, learners should be able to:	**Concepts and skills**	**Suggested learning experiences**	**What to assess: the teacher should assess learner's ability to:**	**Resources**
6. calculate interior and exterior angles of irregular polygons.	**Concepts** Angles Interior and exterior Irregular polygon: convex concave Angle properties of a polygon **Skills** Manipulation Measurement Accuracy Logical thinking Critical thinking	• Teacher and learners review difference between regular and irregular polygons. • Teacher and learners review calculation of interior and exterior angles of regular polygons. • Teacher and learners review finding sum of irregular polygons using the idea of triangles. • Learners measure all interior angles of irregular polygon. • Learners calculate sum of interior angles of the irregular convex polygons. • Learners deduce the general formula for calculating sum of interior angles of irregular convex polygons. • Learners compare formulae for calculating sum of interior angles of irregular convex and regular polygons.	measure all interior angles of irregular polygon. calculate sum of interior angles of the irregular convex polygons. calculate sum interior angles of irregular convex polygons. compare formulae for calculating sum of interior angles of irregular convex and regular polygons. measure all exterior angles of irregular convex polygon. calculate sum of exterior angles of the irregular convex polygons. compare the sum of exterior angles of irregular and	Mathematics kit

		• Learners measure all exterior angles of irregular convex polygon. • calculate sum of exterior angles of the irregular convex polygons. • Learners compare the sum of exterior angles of irregular and regular polygons. • Learners use angle properties to calculate exterior and interior angles of irregular polygons. • Learners calculate sum of interior angles of irregular concave polygons. • Learners calculate sum of exterior angles of irregular concave polygons.	regular polygons. use angle properties to calculate exterior and interior angles of irregular polygons. calculate sum of interior angles of irregular concave polygons. calculate sum of exterior angles of irregular concave polygons.	

Learning Outcome: at the end of Grade 10, learners should be able to:	**Concepts and skills**	**Suggested learning experiences**	**What to assess: the teacher should assess learner's ability to:**	**Resources**
7. demonstrate understanding of use of angle properties of a circle.	**Concepts** Angles Angle properties of a circle: perpendicular bisector of a chord, equal chords, intersecting chords **Skills** Manipulation	• Teacher reviews parts of a circle and angle properties. • Learners draw a circle and one chord inside. • Learners find a perpendicular bisector of a chord by folding papers or construction. • Learners under guidance of a teacher deduce that perpendicular bisector of a chord passes through a centre.	draw a circle and one chord inside. find a perpendicular bisector of a chord by folding papers or construction. identify that perpendicular bisector of a chord passes through a centre. draw equal chords inside a	Mathematics kit

	Measurement Accuracy Logical thinking Critical thinking	• Learners draw equal chords inside a circle. • Learners find a perpendicular bisector of each chord by folding a paper or construction. • Learners measure the distance of each chord from the centre. • Learners under guidance of a teacher deduce that the distance between the perpendicular bisector of each chord from the centre are equal. • Learners draw two chords crossing each other inside a circle. • Learners measure the distance between point of intersection and each point at a circumference. • Learners under guidance of a teacher deduce intersecting chord theorem of the form $AP \times PB = CP \times PD$, where AB and CD are chords intersecting at P. • Learners solve problems that require the use of chord properties.	circle. find a perpendicular bisector of each chord by folding a paper or construction. measure the distance of each chord from the centre. identify that the distance between the perpendicular bisector of each chord from the centre are equal. draw two chords crossing each other inside a circle. measure the distance between point of intersection and each point at a circumference. use intersecting chord theorem. solve problems that require the use of chord properties.	

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
8. demonstrate understanding of use of properties of a tangent at a circle.	**Concepts** Angle at a centre Tangent theorem, **Skills** Manipulation Measurement Accuracy Logical thinking Critical thinking	• Teacher reviews parts of a circle. • Learners draw a line touching a circumference of circle at one point (tangent). • Learners draw a line from centre of a circle to a point where a tangent touches a circumference. • Learners measure angle at a point of contact. • Learners under guidance of a teacher deduce that a radius and tangent are perpendicular. • Learners draw two tangents from the same point outside the circle. • Learners measure the lengths of each tangent from the points on the circumference to the point of intersection. • Learners under guidance of a teacher deduce that tangents from the same point are equal. • Learners find the relationship between angles at a centre of circle and a point of intersection of the tangents. • Learners solve problems involving use of tangent theorem.	draw a line touching a circumference of circle at one point (tangent). draw a line from centre of a circle to a point where a tangent touches a circumference. measure angle at a point of contact. identify that a radius and tangent are perpendicular. draw two tangents from the same point outside the circle. measure the lengths of each tangent from the points on the circumference to the point of intersection. identify that tangents from the same point are equal. find the relationship between angles at a centre of circle and a point of intersection of the tangents. solve problems involving use of tangent theorem.	Mathematics kit

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
9. use angle properties of a circle to solve problems.	**Concept** Angle properties: angles in semicircle, angle at a centre, angles in the same segment, opposite angle in a quadrilateral, alternate segment rule **Skills** Manipulation Measurement Accuracy Logical thinking Critical thinking	• Teacher reviews parts of a circle • Learners draw a circle and divide it into two equal parts. • Learners draw two chords from the ends of a diameter to the same point at circumference of a circle. • Leaners measure angle at the circumference of a circle. • Learners under guidance of a teacher deduce that angle in semicircle is right-angle. • Learners find the relationship between angle at a centre and angle at the circumference. • Learners use property of angle at the centre to calculate angles. • Learners under the guidance of the teacher use the property of the angle at the centre to deduce that angles in the same segment are equal. • Learners calculate angles using angles in the same segment property • Learners under the guidance of the teacher use the property of the angle at the centre to deduce that opposite angles in the cyclic quadrilateral. • Learners calculate angles using opposite angles in the cyclic quadrilateral • Learners under the guidance of the teacher use the property of the angle at the centre to deduce alternate segment rule	measure angle at the circumference of a circle. identify that angle in semicircle is right-angle. find the relationship between angle at a centre and angle at the circumference. use property of angle at the centre to calculate angles. identify that angles in the same segment are equal. calculate angles using angles in the same segment property identify opposite angles in the cyclic quadrilateral. calculate angles using opposite angles in the cyclic quadrilateral. identify alternate segment rule. calculate angles using alternate segment rule. solve problems involving angle properties of a circle.	Mathematics kit

		• Learners calculate angles using alternate segment rule. • Learners solve problems involving angle properties of a circle.		

Learning Outcome: at the end of Grade 10, learners should be able to:	**Concepts and skills**	**Suggested learning experiences**	**What to assess: the teacher should assess learner's ability to:**	**Resources**
10. demonstrate understanding of calculations involving surface area and volume of solids.	**Concept** Surface area Volume Solids: cone pyramid sphere **Skills** Manipulation Measurement Accuracy Logical thinking Critical thinking	• Teacher reviews volumes of prisms. • Learners describe pyramid, cone and cylinder. • Learners draw nets and form models of cones, pyramids and sphere. • Learners derive surface area of a cone using its model. • Learners derive surface area of pyramid. • Learners derive surface area of sphere. • Learners calculate surface area of cones, pyramid and sphere. • Learners derive volume of a square-based pyramid using prism of the same sizes of height and base. • Learners derive volume of a cone using a cylinder of the same sizes of height and base. • Learners under the guidance of a teacher deduce formula for	describe pyramid, cone and cylinder. draw nets and form models of cones, pyramids and sphere. derive surface area of a cone using its model. derive surface area of pyramid. derive surface area of sphere. calculate surface area of cones, pyramid and sphere. derive volume of a square-based pyramid using prism of the same sizes of height and base. derive volume of a cone using a cylinder of the same	Mathematics kit

		volume of sphere. • Learners calculate volume of cones, pyramid and sphere.	sizes of height and base. identify formula for volume of sphere. calculate volume of cones, pyramid and sphere.	

Learning Outcome: at the end of Grade 10, learners should be able to:	**Concepts and skills**	**Suggested learning experiences**	**What to assess: the teacher should assess learner's ability to:**	**Resources**
11. demonstrate understanding of relationship between geometrical vectors.	**Concept** Vector**:** parallel, non-parallel, base, position **Skills** Manipulation Logical thinking Critical thinking	• Teacher and learners review vector notation, addition and subtraction of vectors and scalar multiplication. • Learners represent addition of two vectors diagrammatically. • Learners describe addition of vectors using vector notation. • Learners represent subtraction of two vectors diagrammatically. • Learners describe subtraction of vectors using vector notation. • Learners deduce that subtraction of vectors is addition of vectors in opposite direction. • Learners multiply a given vector by different scalars and represent each of them diagrammatically. • Learners under the guidance of teacher deduce parallel vectors. • Learners identify parallel vectors.	represent addition and subtraction of two vectors diagrammatically. describe addition and subtraction of vectors using vector notation. recognise that subtraction of vectors is addition of vectors in opposite direction. multiply a given vector by different scalars and represent each of them diagrammatically. identify parallel vectors. solve problems involving parallel vectors.	Mathematics kit

		• Learners solve problems involving parallel vectors. • Learners under the guidance of a teacher use parallel vectors to deduce base vectors. • Learners represent vectors using base vectors. • Learners plot the given points on the Cartesian plane. • Learners find column vectors for given points presented on the Cartesian plane from the origin. • Learners under the guidance of a teacher deduce position vectors. • Learners represent position vectors using vector notion. • Learners solve problems involving position vectors.	use parallel vectors to deduce base vectors. represent vectors using base vectors. plot the given points on the Cartesian plane. find column vectors for given points presented on the Cartesian plane from the origin. represent position vectors using vector notion. solve problems involving position vectors.	

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
12. describe and perform enlargement with negative and fractional scale factor.	**Concept** Enlargement Scale factor: negative fractional **Skills** Manipulation Drawing Logical thinking	• Teacher reviews enlargement with positive scale factors. • Teacher provides learners with diagrams showing enlargement with negative scale factor. • Learners explore ways of finding centre and scale factor. • Learners under the guidance of the teacher deduce that the centre is located between the object and	explore ways of finding centre and scale factor. enlarge shapes given dimensions with centre and negative scale factor. describe enlargements involving negative scale factor.	Mathematics kit

	Critical thinking	the image. • Learners enlarge shapes given dimensions with centre and negative scale factor. • Learners describe enlargements involving negative scale factor. • Teacher provides learners with diagrams showing enlargement with fractional scale factor. • Learners explore ways of finding centre and scale factor. • Learners under the guidance of the teacher deduce that the centre is located between the object and the image • Learners under the guidance of the teacher deduce that the enlargement has fractional scale factor. • Learners enlarge shapes given dimensions with centre and fractional scale factor. • Learners describe enlargements involving fractional scale factor. • Learners solve problems involving enlargements.	provides learners with diagrams showing enlargement with fractional scale factor. explore ways of finding centre and scale factor. enlarge shapes given dimensions with centre and fractional scale factor. describe enlargements involving fractional scale factor. Learners solve problems involving enlargements.	

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
13. demonstrate understanding of describing and performing a combination of transformations.	**Concepts** Translation Reflection Rotation Enlargement **Skills** Manipulation Drawing Logical thinking Critical thinking	• Teacher review translation, reflection, rotation and enlargement. • Learners perform translation on a given shape then perform reflection on its image. • Teacher introduces notation used in performing combination of transformations. • Learners perform different combinations with other transformations. • Learners solve problems involving combinations of up to three transformations	perform translation on a given shape then perform reflection on its image. introduces notation used in performing combination of transformations. perform different combinations with other transformations. solve problems involving combinations of up to three transformations.	Mathematics kit
14. use given data to solve problems on simple and compound interest.	**Concepts** Interest: compound simple Percentages **Skills** Critical thinking Logical thinking Manipulation	• Teacher reviews calculation of rate and percentage. • Learners explore ways of calculating simple interest. • Teacher introduces a formula for calculating simple interest. • Learners calculate simple interest using a formula. • Learners explore ways of calculating compound interest. • Learners under the guidance of a teacher deduce a formula for calculating compound interest. • Learners calculate compound interest using a formula. • Learners generate data from simple and compound interest be presented graphically.	calculate simple interest using a formula. explore ways calculating compound interest. use a formula for calculating compound interest. generate data from simple and compound interest be presented graphically. draw and interpret graphs using generated data. solve problems involving simple and compound interest.	Mathematics kit

		• Learners draw and interpret graphs using generated data. • Learners solve problems involving simple and compound interest.		

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
15. draw and interpret graphs in practical situations.	**Concepts** Graphs Cost and consumption: bills, tax, fuel Motion/Kinematics: distance-time, Speed-time, acceleration and retardation **Skills** Manipulation Drawing Logical thinking Critical thinking	• Teacher reviews graphs of simple and compound interest. • Teacher creates scenarios that involve calculation of cost and consumption. • Learners creates data from the given scenarios. • Learners draw and interpret graphs of cost and consumption. • Learners draw distance-time using given data. • Learners calculate gradient of distance-time. • Learners under guidance of a teacher deduce that the gradient of distance-time is speed. • Learners draw speed-time using given data. • Learners calculate gradient of speed-time. • Learners under guidance of a teacher deduce that the gradient of speed-time is acceleration. • Learners interpret given graphs	draw and interpret graphs of cost and consumption. draw distance-time using given data. calculate gradient of distance-time. find that gradient of distance-time is speed. draw speed-time using given data. calculate gradient of speed-time. find that the gradient of speed-time is acceleration. interpret given graphs and describe every step of a journey. identify shapes that form area	Mathematics kit

		and describe every step of a journey. • Learners identify shapes that form area under the graph. • Learners calculate and describe area under the graph. • Learners solve problems that involve graphs in practical situations.	under the graph. calculate and describe area under the graph. solve problems that involve graphs in practical situations.	

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
16. expand and factorise quadratic expressions.	**Concepts** Quadratic expression Term: variable coefficient **Skills** Manipulation Measurement Accuracy Logical thinking Critical thinking	• Teacher reviews expansion and factorisation of expressions. • Learners identify and collect like terms in an expression that can reduce to the form $an^p + bn^{p-1} + an^{p-2}$ where a, b, c are integers, and $p = 2$. • Learners expand expressions with single brackets, where the coefficient of the multiplier variable is greater than one. • Learners factorise expressions which can reduce to single bracket. • Learners expand quadratic expressions with double brackets. • Learners factorise quadratic	identify and collect like terms in an expression that can reduce to the form $an^p + bn^{p-1} + an^{p-2}$ where a, b, c are integers, and $p = 2$. expand expressions with single brackets, where the coefficient of the multiplier variable is greater than one. factorise expressions which can reduce to single bracket. expand quadratic expressions with double brackets. factorise quadratic expressions,	Mathematics kit

		expressions, where $a > 1$. • Learners solve problems that reduce to quadratic expressions.	where $a > 1$. solve problems that reduce to quadratic expressions.	
17. demonstrate understanding of basic operations on algebraic fractions.	**Concepts** Fractional equations Numerator Denominator Lowest Common Multiple (LCM) BODMAS/ BIDMAS **Skills** Manipulation Logical thinking Critical thinking	• Teachers reviews prime factorisation to find LCM and HCF. • Learners find LCM using pairs of algebraic expressions. • Learners add or subtract two fractions with the same algebraic denominator. • Learners add or subtract two fractions with different algebraic denominator. • Learners multiply or divide two algebraic fractions. • Learners simplify algebraic fractions. • Learners solve problems that can reduce to algebraic fractions.	find LCM using pairs of algebraic expressions. add or subtract two fractions with the same algebraic denominator. add or subtract two fractions with different algebraic denominator. multiply or divide two algebraic fractions. Learners simplify algebraic fractions. solve problems that can reduce to algebraic fractions.	Mathematics kit

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
18. demonstrate understanding of calculations involving fractional indices.	**Concepts** Basic operations Indices Laws of indices: $a^b \times a^c = a^{b+c}$ $a^b \div a^c = a^{b-c}$ $a^{-d} = \frac{1}{a^d}$ $a^0 = 1$ $(a^m)^n$ Exponent Power Base **Skills** Evaluation Manipulation Critical thinking	• Teachers and learners review the laws of indices. • Learners, under guidance of the teacher, express perfect squares from square root form to index form. • Learners express perfect squares from n^{th} root form to index form. • Learners, under guidance of the teacher, calculate indices of the form: $(\frac{a}{b})^m = \frac{a^m}{b^m}$ $(\frac{a}{b})^{\frac{m}{n}} = \frac{a^{\frac{m}{n}}}{b^{\frac{m}{n}}}$ • Learners, under guidance of the teacher, calculate indices of the form: $a^{-d} = \frac{1}{a^d}$ $a^{-\frac{m}{n}} = \frac{1}{a^{\frac{m}{n}}}$ • Learners, under guidance of the teacher, calculate indices of the form: • $(\frac{a}{b})^{-\frac{m}{n}} = (\frac{b}{a})^{\frac{m}{n}} = \frac{b^{\frac{m}{n}}}{a^{\frac{m}{n}}}$ • Learners solve problems involving fractional indices.	express perfect squares from square root form to index form. express perfect squares from n^{th} root form to index form. calculate indices of the form: $(\frac{a}{b})^m = \frac{a^m}{b^m}$ $(\frac{a}{b})^{\frac{m}{n}} = \frac{a^{\frac{m}{n}}}{b^{\frac{m}{n}}}$ calculate indices of the form: $a^{-d} = \frac{1}{a^d}$ $a^{-\frac{m}{n}} = \frac{1}{a^{\frac{m}{n}}}$ calculate indices of the form: $(\frac{a}{b})^{-\frac{m}{n}} = (\frac{b}{a})^{\frac{m}{n}} = \frac{b^{\frac{m}{n}}}{a^{\frac{m}{n}}}$ solve problems involving fractional indices.	Mathematics kit

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
19. demonstrate understanding of solving indicial equations.	**Concepts** Standard form Equations: linear fractional Indicial equations of the form: $a^x = b$ $a^{x+1} = b$ $a^x + a^{x+1} = b$ (where a and b are positive integers) Lowest common multiple (LCM) BODMAS/ BIRDMAS Numerator Denominator **Skills** Classification Manipulation Communication Interpretation	• Teacher and learners review numbers written in standard form. • Learners, under teacher's guidance, perform calculations involving addition and subtraction of numbers written in standard form. • Teacher and learners review laws of indices and order of operations. • Learners, under the teacher's guidance, solve basic indicial equations of the form $a^x = b$ by equating the exponents. • Learners, under the teacher's guidance, solve basic indicial equations of the form $a^{x+1} = b$ by equating the exponents. • Learners, under the teacher's guidance, solve basic indicial equations of the form: $a^x + a^{x+1} = b$ by equating the exponents.	perform calculations involving addition and subtraction of numbers written in standard form. solve basic indicial equations of the form $a^x = b$ by equating the exponents. solve basic indicial equations of the form $a^{x+1} = b$ by equating the exponents. solve basic indicial equations of the form $a^x + a^{x+1} = b$ by equating the exponents.	Mathematics kit
20. perform calculations involving matrices.	**Concepts** Matrices Order Multiplication Scalar	• Teachers and learners review: the order of matrices, multiplication of matrices of any order by a scalar, multiplication of matrices of any order and	identify diagonals in a 2 by 2 matrix. calculate the determinant of a 2 by 2 matrix A.	Mathematics kit

	2 by 2 matrix of the form: $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ Determinant expressed as: $detA = ad - bc$.	identity matrices (I). • Learners identify diagonals in a 2 by 2 matrix. • Learners, under guidance of the teacher, calculate the determinant of a 2 by 2 matrix A. • Teacher introduces a concept inverse of a matrix.	calculate the inverse of matrices using formula.	

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
20. continues	Inverse of a matrix expressed as: $A^{-1} = \frac{1}{detA}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$ (where $detA \neq 0$.) Invertible matrix ($detA = 0$) Simultaneous equations **Skills** Manipulation Critical thinking Logical thinking	• Learners, under guidance of the teacher, calculate the inverse of matrices using formula: $A^{-1} = \frac{1}{detA}\begin{pmatrix} d & -b \\ -c & a \end{pmatrix}$ • Learners, under guidance of the teacher, establish whether a matrix is invertible or not from its determinant. • Learners, under guidance of the teacher, deduce that the product of a matrix with its inverse is identity matrix. • Learners solve problems involving determinants and inverses of matrices. • Teacher creates a scenario in which information is expressed as	establish whether a matrix is invertible or not from its determinant. find that the product of a matrix with its inverse is identity matrix. solve problems involving determinants and inverses of matrices. interpret scenario and write equations in matrix form. identify coefficient matrix, variable matrix and constants matrix. write coefficient matrix,	Mathematics kit

		two equations in two variables. • Learners, under guidance of the teacher, write these equations in matrix form. • Learners, under guidance of the teacher, identify coefficient matrix, variable matrix and constants matrix and write those in the form: $AX = B$. • Learners find the inverse of matrix A. • Learners, under guidance of the teacher, multiply both sides by the inverse, to obtain: $X = A^{-1}B$. • Learner solve simultaneous equations using matrices. • Learners solve problems involving determinants, inverses and simultaneous equations.	variable matrix and constants matrix in the form: $AX = B$. find the inverse of matrix A. solve for X by multiplying both sides with the inverse of A, to obtain: $X = A^{-1}B$. solve simultaneous equations using matrices. solve problems involving determinants, inverses and simultaneous equations.	

Learning Outcome: at the end of Grade 10, learners should be able to:	**Concepts and skills**	**Suggested learning experiences**	**What to assess: the teacher should assess learner's ability to:**	**Resources**
21. solve probability problems of combined events using tree-diagram of two or more events.	**Concepts** Probability Possibility space diagram Sample space Combined events Tree diagram Mutually exclusive	• Teacher and learners review probability of: two combined events and the use of a possibility space diagram and a tree diagram. • Teacher creates a scenario in which the words and/or are	express the given scenarios using the notation: $P(A\ and\ B) = P(A) \times P(B)$ $P(A\ or\ B) = P(A) + P(B)$ $P(A\ or\ B) = P(A) + P(B)$	Mathematics kit

	events Disjoint sets Intersecting sets **Skills** Classification Manipulation Communication Interpretation	used. • Learners, under guidance of the teacher, express the scenarios using the notation: $P(A\ and\ B) = P(A) \times P(B)$ $P(A\ or\ B) = P(A) + P(B)$ • Teacher creates scenarios that involve two sets that intersect to express the probability of one event or the other as: $P(A\ or\ B) = P(A) + P(B)$ $P(A\ and\ B)$ • Learners express the probability of one event or the other as: • $P(A\ or\ B) = P(A) + P(B)$ • $P(A\ and\ B)$ • Learners find the probability of each event. • Teacher creates scenarios that involve probabilities of more than two events. • Learners draw tree diagram of more than two events. • Learners list the outcomes of probabilities of more than two events. • Learners solve probability problems of more than two events using the tree diagram.	$P(A\ and\ B)$ express the probability of one event or the other as: $P(A\ or\ B) = P(A) + P(B)$ $P(A\ and\ B)$ find the probability of events in given situations. draw tree diagram of more than two events. list the outcomes of probabilities of more than two events. solve probability problems of more than two events using the tree diagram.	

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
22. present and interpret statistical data.	**Concepts** Frequency: $frequency = frequency\,density \times class\,width$ Frequency polygon Histogram Height Class Width Frequency density Area: $area = class\,width \times height$ Stem-and-leaf table **Skills** Drawing Estimation Interpretation Manipulation	• Teacher and learners review bar chart. • Learners identify and mark the midpoints of the top parts of the bars on the bar chart. • Learners then join the midpoints by straight line segments to form a frequency polygon. • Learners group the given distribution into equal class intervals from the given scenarios. • Teacher introduces class intervals as a feature that differentiates between a bar chart and a histogram. • Teacher and learners deduce the lower bounds and the upper bounds in the given intervals. • Learners find upper and lower bounds of the given class intervals. • Teacher introduces the relationship between class width, height and area of each bar in the histogram. • Learners find the unknown value given area, class width or height of the bar.	identify and mark the midpoints of the top parts of the bars on the bar chart. join the midpoints by straight line segments to form a frequency polygon. solve problems involving frequency polygons. group the given distribution into equal class intervals. find the upper and the lower bounds of the given class intervals. find the unknown value given any of the quantities, area, class width and height of the bar as related by the formula: $area = class\,width \times height$ group the given distribution into unequal class intervals and find a unit for comparing the class widths. calculate the number of units per	Mathematics kit

		• Teacher creates a scenario where a distribution is to be grouped into unequal class intervals. • Learners group the given distribution into unequal class intervals and find a unit for comparing the class widths.	bar, using the given unit. divide the frequencies by the number of units per bar to find the frequency density per bar.	

Learning Outcome: at the end of Grade 10, learners should be able to:	**Concepts and skills**	**Suggested learning experiences**	**What to assess: the teacher should assess learner's ability to:**	**Resources**
22. continues.		• Learners calculate the number of units per bar, using the given unit. • Teacher introduces the relationship between the class width (units), frequency density (height) and the frequency (area) of each bar. • Learners find the frequency density per bar by dividing the frequencies with the number of units per bar. • Learners use the number of units to establish the upper bounds of the frequencies. • Learners use frequency density to identify height of each bar.	use the number of units to establish the upper bounds of the frequencies. use frequency density to identify height of each bar. draw a histogram with the class widths defined by the number of units and the frequency densities. solve problems involving histograms. draw the stem and leaf diagram using given data. identify the mode, the median	

		• Learners draw a histogram with the class widths defined by the number of units and the frequency densities. • Teacher introduces stem and leaf diagram as a way to represent data. • Learners draw the stem and leaf diagram using given data. • Learners identify the mode, the median and the range from the given stem and leaf diagram. • Learners solve problems involving frequency polygons, histograms and the stem and leaf diagrams.	and the range from the given stem and leaf diagram. solve problems involving the stem and leaf diagram.	

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
23. present and analyse data using measures of spread.	**Concepts:** Cumulative frequency curve Percentile Quartile Scatter plot Discrete data Independent variable Dependant variable Line of best fit Correlation **Skills:** Plotting Drawing Estimation Interpretation Manipulation	• Teacher and learners review range, cumulative frequency curve and the median from the cumulative frequency curve. • Teacher introduces the measures of spread which are percentiles and quartiles. • Learners, under guidance of the teacher, find the percentiles using the cumulative frequencies. • Learners, under guidance of the teacher, find the quartiles using the cumulative frequencies. • Teacher introduces the scatter plot which is drawn using axes and plots in the form of dots. • Learners, under guidance of the teacher, draw scatter plots from given data. • Learners, under guidance of the teacher, discuss the behaviour of the plots by considering the pattern and direction. • Teacher introduces the idea of 'line of best fit' and correlation to interpret the behaviour of the data from the scatter plot. • Learners interpret the behaviour of the plots on a scatter plot to determine the correlation.	find the percentiles using the cumulative frequencies. find the quartiles using the cumulative frequencies. draw scatter plots from given data. interpret the behaviour of the plots on a scatter plot to determine the 'line of best fit' and correlation. solve problems involving scatter plot, line of best fit and correlation.	Mathematics kit

		• Learners solve problems involving scatter plot, line of best fit and correlation.		

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
24. evaluate and generate relations and functions.	**Concepts** Relations Functions Notation Domain Range Inverse functions Composite **Skills** Classification Logical thinking Critical thinking Evaluation Substitution	• Teacher and learners review types of relations and linear functions from graphs. • Teacher introduces notation to express functions. • Teacher introduces domain and range to represent input and output of a function. • Learners, under guidance of the teacher, define a function under a given domain. • Learners evaluate functions. • Learners solve problems involving evaluation and generation of functions. • Teacher and learners discuss the effect of using output on reversed order of operations to find the result. • Teacher and learners discuss the results to establish how reversing the order of operations affect output in relation to the input. • Teacher introduces the inverse function and its notation. • Teacher introduces how to find the inverse functions algebraically. • Learners find the inverses of functions using algebraic	express functions using function notation. define domain and range in representing input and output of a function. define a function under a given domain. evaluate functions. solve problems involving evaluation and generation of functions. define inverse function and its notation. finding inverse functions algebraically. find the inverses of functions using algebraic method. solve problems involving inverse function evaluate composite functions. solve problems involving inverse and composite	Mathematics kit

		method. • Teacher introduces composite functions and the notation. • Learners evaluate composite functions. • Learners solve problems involving inverse and composite functions.	functions.	

Learning Outcome: at the end of Grade 10, learners should be able to:	**Concepts and skills**	**Suggested learning experiences**	**What to assess: the teacher should assess learner's ability to:**	**Resources**
25. draw and interpret quadratic and cubic graphs.	**Concepts** $xy-$plane Coordinates Straight lines: Gradient y −intercept Axis of symmetry Turning point Roots Tangent Discriminant **Skills** Plotting Calculation Critical thinking Logical thinking Manipulation	• Teacher and learners review: • graphs of linear equations of the form $y = mx + c$.(drawing graphs and writing equations from graphs). • Teacher introduces the general orientation of the non-linear graphs: parabola on nature of $a > 0$ or $a < 0, b$ and c. • Under guidance of the teacher learners use the equation $y = ax^2 + bx + c$ to find the corresponding y values. • Learners draw the graph of $y = ax^2 + bx + c$ and check on nature of a, b and c. • Learners find the corresponding values of x and y for the given	use the equation $y = ax^2 + bx + c$ to find the corresponding y values. draw the graph of $y = ax^2 + bx + c$ and check on nature of a, b and c. find the corresponding values of x and y for the given value of x or y using the graph. sketch the parabola using the discriminant, axis of symmetry, roots and the turning point. solve problems involving	Mathematics kit

		value of x or y using the graph. • Teachers emphasises the behaviour of the graph for discriminant $b^2 - 4ac > 0, < 0$ and $= 0$. • Under guidance of the teacher leaners sketch the parabola using the discriminant, axis of symmetry, roots and the turning point. • Learners solve problems involving discriminant. • Teacher and learner review graphs of a straight line • Learners draw graphs of $y = mx + c$ and $y = ax^2 + bx + c$ on the same plane. • Learners solve for the intersection using the graphs. Learners find the range of points in which either graph is greater or less.	discriminant. draw graphs of $y = mx + c$ and $y = ax^2 + bx + c$ on the same plane. solve for the intersection using the graphs. find the range of points in which either graph is greater or less. draw a tangent to a given curve and use it to find an estimate of the gradient of the curve at a given point. solve problems involving linear graph, parabola and tangent. draw a cubic graph to find the intercepts.	

Learning Outcome: at the end of Grade 10, learners should be able to:	**Concepts and skills**	**Suggested learning experiences**	**What to assess: the teacher should assess learner's ability to:**	**Resources**
25. continues.		• Teacher introduces a tangent to a curve. • Learners draw a tangent to a given curve and use it to find an estimate of the gradient. • Learners solve problems involving linear graph, parabola and tangent.	draw a tangent and use it to find an estimate of the gradient at a given point. solve problems involving cubic graphs. integrate the graphs and use	

		• Teacher introduces how to draw cubic graph using a table of points. • Learners draw a cubic graph to find the intercepts. • Learners draw a tangent and use it to find an estimate of the gradient at a given point. • Learners solve problems involving cubic graphs.	them to solve problems.	
26. draw and interpret inverse and exponential graphs.	**Concepts** xy - plane Coordinates Straight lines: Gradient y −intercept Axis of symmetry Turning point Roots Tangent **Skills** Plotting Calculation Critical thinking Logical thinking Manipulation	• Teacher introduces inverse graphs and emphasises the restrictions. • Learners draw and analyse the inverse graphs. • Learners draw tangent and use it to find an estimate of the gradient of the graph. • Learners solve problems involving inverse graphs. • Teacher introduces the exponential graphs. • Leaners draw and analyse the exponential graphs. • Leaners draw tangent and use it to find an estimate of the gradient of the graph. • Leaners solve problems involving exponential graphs. • Leaners integrate the graphs and use them to solve problems.	draw and analyse the inverse graphs. draw tangent and use it to find an estimate of the gradient of the graph. solve problems involving inverse graphs. draw and analyse the exponential graphs. draw tangent and use it to find an estimate of the gradient of the graph. solve problems involving exponential graphs. integrate the graphs and use them to solve problems.	Mathematics kit

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
27. solve linear inequalities in two variables.	**Concepts** Linear inequality Inequality signs Solution set Cartesian coordinates (xy −plane) Number line **Skills** Graphing Manipulation Plotting Calculation Logical thinking Critical thinking	• Learners, under the guidance of the teacher, represent inequalities using horizontal and vertical number lines. • Learners list solution sets of graphed linear inequalities in one unknown. • Learners, under the guidance of the teacher, represent inequalities of the form $a < x < b$ using a line segment. • Learners list solution set of the inequality of the form $a < x < b$. • Learners list solution sets of inequalities from given number line. • Teacher and learners review plotting of straight line graphs. • Learners, under the guidance of the teacher, represent inequalities of the form $a < x < b$ using xy −plane. • Learners represent solution sets graphically. • Learners show inequality graphs of the form $y = mx + c$ by shading wanted region. • Learners list solution sets of inequalities. • Learners solve problems using	represent inequalities using horizontal and vertical number lines. list solution sets of graphed linear inequalities in one unknown. represent inequalities of the form $a < x < b$ using a line segment. list solution set of the inequality of the form $a < x < b$. list solution sets of inequalities from given number line. represent inequalities of the form $a < x < b$ using xy −plane. represent solution sets graphically. show inequality graphs of the form $y = mx + c$ by shading wanted region. list solution sets of inequalities. solve problems using	Mathematics kit

		inequalities.	inequalities.	

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
28. solve inequality problems using linear programming.	**Concepts** Linear inequality Inequality signs: open and/or closed dots broken and/or solid lines testing above/below lines Cartesian coordinates (xy −plane) Number line Region Constraint Objective function Optimisation **Skills** Graphing Manipulation Plotting Calculation Logical thinking Critical thinking	• Teacher ad learners review linear programming involving three inequalities. • Learners, under guidance of the teacher, draw inequalities involving more than three constraints. • Learners shade unwanted region in those constraints. • Learners use the objective function to optimise. • Learners draw graphs of linear programming and use them to maximise and minimise. • Teacher engages learners into making their own linear programming question from practical activities. • Learners solve problems involving linear programming.	draw inequalities involving more than three constraints. shade unwanted region within constraints. use the objective function to optimise. draw graphs of linear programming and use them to maximise and minimise. generate linear programming question from practical activities. solve problems involving linear programming.	Mathematics kit

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
29. locate points and regions using loci.	**Concepts** Line bisector Angle bisector Arcs Mediator Equidistant Locus Points Region Journeys 3D loci **Skills** Drawing Scaling Interpretation Shading Measuring Accuracy Manipulation Logical thinking Critical thinking	• Teacher and leaners review construction of shapes. • Learners, under guidance of the teacher use appropriate scale to construct shapes. • Learners bisect sides and/or angles to mark intersection. • Learners, under guidance of the teacher, find locus of points around a boundary and/or inside a boundary. • Teacher guides learners in finding a point and/or a region defined by loci. • Learners find a point and/or a region defined by loci. • Learners shade a region. • Learners solve problems involving loci. • Teacher guides learners into a scenario leading 3D loci. • Learners describe loci in 3D using a point, line and their combination. • Learners solve problems involving 3D loci.	use scale to construct a shape. bisect sides and/or angles to mark intersection. find locus of points around and/or inside a boundary. find a point and/or a region defined by loci. shade a region. solve problems involving loci. describe loci in 3D using a point, line and their combination. solve problems involving 3D loci.	Mathematics kit

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
30. calculate dimensions of triangles using sine and cosine formula.	**Concepts** SOHCAHTOA Right-angled triangle Pythagoras theorem Complementary Supplementary Proportionality Sine formula: $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$. Cosine formula: $a^2 = b^2 + c^2 - 2bcCosA$ Area of a triangle **Skills** Identification Calculation Interpretation Deduction Logical thinking Critical thinking	• Teacher and learners review types of angles properties and trigonometric ratios. • Learners state a pair of angles whose sum is $90°$. • Learners use calculators to compare the values of the cosines and sines of angles whose sum is $90°$. • Learners, under guidance of the teacher, generalise that $\sin\theta = \cos(90-\theta)$ $\cos\theta = \sin(90-\theta)$. • Learners solve problems involving complementary angles. • Learners state a pair of angles whose sum is $180°$. • Learners use calculators to compare the values of the cosines and sines of angles whose sum is $180°$. • Teacher and learners generalise that $\sin\theta = \sin(180-\theta)$ $\cos\theta = -\cos(180-\theta)$. • Learners solve problems involving supplementary angles. • Teacher introduces the concept sine formula using proportionality of angle and distance. • Learners state situations in which proportionality holds. • Learners identify and name sides in	state a pair of angles whose sum is $90°$. compare the values of the cosines and sines of angles whose sum is $90°$. generalise that $\sin\theta = \cos(90-\theta)$ $\cos\theta = \sin(90-\theta)$. solve problems involving complementary angles. state a pair of angles whose sum is $180°$. compare the values of the cosines and sines of angles whose sum is $180°$. generalise that $\sin\theta = \sin(180-\theta)$ $\cos\theta = -\cos(180-\theta)$. solve problems involving supplementary angles. state situations in which proportionality holds. identify and name sides in	Mathematics kit Calculator

		relation to their angle. • Teacher and learners deduce that: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$. • Learners solve for sides and angles using sine formula.	relation to their angle. find length sides and angles using sine formula.	

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
30. continues		• Teacher introduces cosine formula as a formula that is used in calculations involving right angled and non-right angled triangles. • Learners draw acute angled triangle and name sides and angles. • Learners draw a perpendicular height from one of the vertex to the opposite side. • Learners use Pythagoras's Theorem to find two expressions for the height (*h*). • Learners form an equation using the two expressions. • Learners find an expression for cosine to eliminate one variable. • Learners rearrange the equation	draw acute angled triangle and name sides and angles. draw a perpendicular height from one of the vertex to the opposite side. use Pythagoras's Theorem to find two expressions for the height (*h*). form an equation using the two expressions. find an expression for cosine to eliminate one variable. rearrange the equation to find three forms of the cosine formula.	

		to find three forms of the cosine formula. • Teacher and learners review calculation of area of a right angled triangle. • Teacher introduces the formula for calculating area of a non-right angled triangle involving sides and angles of the triangle. • Learners draw acute angled triangle and drop a height (*h*) from one vertex. • Learners express the height in terms of the sine of an angle and substitute height in the expression $\frac{1}{2}bh$.	draw an acute angled triangle and drop a height (*h*) from one vertex. express the height in terms of the sine of an angle. calculate area by using formula for calculating area of a non-right angled triangle. relate $\frac{1}{2}acSinB$ to $\frac{1}{2}bh$	

Learning Outcome: at the end of Grade 10, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
30. continues.		• Learners calculate area by using formula for calculating area of a non-right angled triangle. • Learners, under guidance of the teacher, relate $\frac{1}{2}acSinB$ to $\frac{1}{2}bh$. • Learners find the shortest distance given appropriate information about a non-right angled triangle. • Learners solve problems involving sides, angles and areas in a non-right angled triangle.	find the shortest distance given appropriate information about a non-right angled triangle. solve problems involving shortest distance in a triangle. solve problems involving sides, angles and areas in a non-right angled triangle.	
31. draw and interpret bearings involving three journeys.	**Concepts** Bearings Journeys Properties of angles Parallel lines North line Cardinal points Scale **Skills** Drawing Representation Measurement Scaling Conversion Accuracy Estimation Recording Reporting Critical thinking	• Teacher and learners review bearing involving single and two stage journeys. • Teacher and learners review angle properties and measuring angle between north line and line of journey in clockwise direction. • Teacher introduces the idea of bearings for locating positions in three stage journeys. • Learners interpret given diagrams illustrating bearings. • Learners measure length between two points. • Learners calculate bearings. • Learners describe three stage journeys using bearings. • Learners represent a scaled bearing diagrammatically from given three stage journeys.	interpret given diagrams illustrating bearings. measure length between two points. measure angle between north line and line of journey in clockwise direction. calculate bearings. describe three stage journeys using bearings. represent scaled bearing diagrammatically from given three stage journeys. use trigonometry to solve problems involving bearing	Mathematics kit Mathematical set of instruments Navigation compass

	Logical thinking Manipulation	• Learners use trigonometry to solve problems involving bearing and vice versa. • Learners solve problems involving interpretation and drawing of bearings for three journeys.	and vice versa. solve problems involving interpretation and drawing of bearings for three journeys.	

Grade 11 Mathematics Syllabus
Overview

At the end of Grade 11, learners should be able to:
1. find a general rule for cubic sequence. 2. demonstrate understanding of calculations involving mixed solids. 3. calculate appreciation and depreciation. 4. evaluate and generate composite functions and their inverses. 5. describe and transform figures using stretch. 6. describe and transform figures using shear. 7. transform figures using matrices. 8. apply trigonometric ratios and formulae on 3D figures. 9. describe and prove similarity and congruency of shapes. 10. apply variations of quantities.

Grade 11 Mathematics Syllabus
Activity plan.

Learning Outcomes: at the end of Grade 11, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
1. find a general rule for cubic sequence.	**Concepts** Sequences: arithmetic quadratic General rule first difference second difference **Skills** Classification Manipulation Communication Interpretation	Teacher and learners review: • quadratic sequences. • volumes of solids. • Teacher provides learners with cubes of different dimensions. • Learners calculate volumes of the given cubes and arrange them in ascending order. • Learners recognise patterns in a sequence. • Learners extend a sequence to the required term. • Learners generalise a sequence as simple algebraic statement (n^{th} term). • Learners continue a given number sequence of the form: $an^p + bn^{p-1} + cn^{p-2} + dn^{p-3}$ where a, b, c are integers, and $p = 3$.	calculate volumes of the given cubes and arrange them in ascending order. recognise patterns in a sequence. extend a sequence to the required term. generalise a sequence as simple algebraic statement (n^{th}) term. continue a given number sequence of the form: $an^p + bn^{p-1} + cn^{p-2} + dn^{p-3}$ where a, b, c are integers, and $p = 3$.	Materials from the immediate environment Mathematics kit Teacher's Guide

2. demonstrate understanding of calculations involving composite solids.	**Concepts** Surface area Volume Composite solids: cone, pyramid, cylinder, sphere	• Teacher reviews surface area and volume of cone, pyramid and sphere. • Learners explore composite solids in their immediate environment. • Learners present their findings.	sort materials according to their common features. form a bigger set that contains formed sets. describe universal set.	Materials from the immediate environment Mathematics kit Teacher's Guide

Learning Outcomes: at the end of Grade 11, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
2. cont.	**Skills** Manipulation Measurement Accuracy Logical thinking Critical thinking	• Teacher provides learners with a variety of composite solids. • Learners identify solids that form a composite solid. • Learners calculate required dimensions of composite solids. • Learners calculate volumes and surface areas of composite solids. • Learners solve problems that require application of composite solids (quantity survey).	use appropriate notation to describe the sets. represent the formed sets using a Venn diagram. form and describe sets from different scenarios using appropriate notation. form and describe sets of different types of numbers. establish the relationship of any two sets in the universal set. solve problems involving set notations.	
3. demonstrate understanding of calculating appreciation and depreciation (decay) of assets.	**Concepts** Appreciation: capital currency Depreciation: Compound decay Simple decay Percentages	• Teacher review calculations involving simple and compound interest. • Learners under the guidance of the teacher mention assets they know. • Learners identify assets that increase/decrease in value with time.	calculate capital and currency appreciation. solve problems involving types of appreciation. describe depreciation and its types.	

Learning Outcomes: at the end of Grade 11, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
3. cont.		• Teacher introduces idea of appreciation and its types. • Learners under the guidance of a teacher calculate capital and currency appreciation. • Learners solve problems involving types of appreciation. • Teacher introduces depreciation and its types. • Learners calculate simple decay using idea of simple interest. • Learners calculate compound decay using the idea of compound interest. • Learners calculate value of given assets using formula for compound decay. • Learners solve problems involving depreciation.	calculate simple decay using idea of simple interest. calculate compound decay using the idea of compound interest. calculate value of given assets using formula for compound decay. solve problems involving depreciation.	
4. evaluate and generate composite functions and their inverses.	**Concepts** Relations Functions Notation Domain Range Inverse functions Composite	• Teacher reviews calculation involving functions and their inverses. • Teacher introduces composite functions and the notation. • Learners distinguish between a product of functions and composite function notation.	describe composite functions and the notation. distinguish between a product of functions and composite function notation.	

			evaluate composite functions.	

Learning Outcomes: at the end of Grade 11, learners should be able to:	**Concepts and skills**	**Suggested learning experiences**	**What to assess: the teacher should assess learner's ability to:**	**Resources**
4. cont.	**Skills** Classification Logical thinking Critical thinking Evaluation	• Learners, under the guidance of a teacher, evaluate composite functions. • Learners explore whether composite functions are commutative. • Learners under guidance of the teacher deduce that composite functions are not commutative. • Learners solve problems involving composite functions. • Learners find an inverse of composite function of the form $[g(f(x))]^{-1}$ • Learners find the composite of	explore whether composite functions are commutative. prove that composite functions are not commutative. solve problems involving composite functions. find an inverse of composite function of the form $[g(f(x))]^{-1}$ find the composite of inverses of the form: $g^{-1}f^{-1}(x)$. prove that $[g(f(x))]^{-1} \neq$	

		inverses of the form: $g^{-1}f^{-1}(x)$. • Learners deduce that $[g(f(x))]^{-1} \neq g^{-1}f^{-1}(x)$. • Learners prove that $[g(f(x))]^{-1} = f^{-1}g^{-1}(x)$. • Learners solve problems that involve composite functions.	$g^{-1}f^{-1}(x)$. • Learners prove that $[g(f(x))]^{-1} = f^{-1}g^{-1}(x)$. Learners solve problems that involve composite functions.	

Learning Outcomes: at the end of Grade 11, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
5. describe and transform figures using stretch.	**Concepts** Stretch Invariant line Shear factor (±) **Skills** Drawing Manipulation Critical thinking Logical thinking	• Teacher reviews drawing and description of enlargement. • Learners explore ways of finding invariant line and stretch factor. • Learners guided by a teacher deduce the stretch factor. • Learners stretch shapes given dimensions with invariant line and stretch factor. • Learners describe stretch on the given shapes. • Teacher provides learners with diagrams showing stretch with both negative and positive stretch factors. • Learners solve problems involving stretch.	explore ways of finding invariant line and stretch factor. stretch shapes given dimensions with invariant line and stretch factor. describe stretch on the given shapes. solve problems involving stretch.	
6. describe and transform figures using shear.	**Concepts** Shear Invariant line Shear factor (±) **Skills** Drawing Manipulation Critical thinking Logical thinking	• Teacher reviews drawing and description of stretch. • Learners explore ways of finding invariant line and shear factor. • Learners under the guidance of the teacher deduce the shear factor. • Learners shear shapes given dimensions with invariant line and shear factor.	explore ways of finding invariant line and shear factor. shear shapes given dimensions with invariant line and shear factor. describe shear on the given shapes.	

Learning Outcomes: at the end of Grade 11, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
6. cont.		• Learners describe shear on the given shapes. • Teacher provides learners with diagrams showing shear with both negative and positive factors. • Learners solve problems involving shear.	solve problems involving shear.	
7. transform figures using matrices.	**Concepts** Base vector Matrices: Column 2×2 order Inverse matrix Identity matrix Object Image Area **Skills** Manipulation Critical thinking Logical thinking	• Teacher and learners review types of transformation and properties as well as matrix multiplication. • Learners, guided by a teacher, represent coordinates using matrices. • Learners, under guidance of a teacher, multiply coordinate matrix by transformation matrix to obtain image matrix. • Learners write coordinates from the image coordinate matrix. • Learners plot the coordinates of the object and the image. • Learners identify and describe the type of transformation.	represent coordinates using matrices. multiply coordinate matrix by transformation matrix to obtain image matrix. write coordinates from the image coordinate matrix. write coordinates from the image coordinate matrix. plot the coordinates of the object and the image. identify and describe the type of transformation.	Mathematics kit

Learning Outcomes: at the end of Grade 11, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner’s ability to:	Resources
7. cont.		• Learners, under guidance of a teacher, find transformation matrix using object matrix and image matrix. • Learners find transformation matrix using object matrix and image matrix. • Teacher introduces the use of base vectors for finding the transformation matrices. • Learners find transformation matrices using base vectors. • Learners find object matrix using transformation matrix and image matrix. • Learners, assisted by a teacher identify features common to matrices of each type of transformation. • Learners identify features common to matrices of each type of transformation. • Learners identify and describe the type of transformation from the features of a transformation matrix.	find transformation matrix using object matrix and image matrix. find transformation matrices using base vectors. find object matrix using transformation matrix and image matrix.	

Learning Outcomes: at the end of Grade 11, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
8. apply trigonometric ratios and formulae on 3D figures.	**Concepts** Trigonometric ratios sine, cosine and tangent functions Sine formula Cosine formula Common angles 3D figures Unit circle Reference angle Graphs of sine functions Graphs of cosine functions Unit circle **Skills** Modelling Drawing/sketching Visualisation Manipulation Estimation	• Teacher and learners review three dimensional figures, quadrants, trigonometric ratios sine formula, cosine formula, complementary and supplementary angles. • Learners, assisted by a teacher, model 3D figures using manipulatives. • Learners model 3D figures using manipulatives. • Learners, assisted by the teacher, sketch the models. • Learners sketch the models. • Teachers introduces calculation of lengths and angles in 3D figures, using trigonometric ratios, sine formula and cosine formula. • Learners calculate lengths and angles in 3D figures. • Learners solve problems involving trigonometry in 3D figures. • Learners, under guidance of the teacher, identify various right-angled triangles from the centre of the circle with radius as the hypotenuse.	sketch the models. calculate lengths/distances and angles in 3D figures. calculate lengths/distances and angles in 3D figures. solve problems involving trigonometry in 3D figures. identify various right-angled triangles from the centre of the circle with radius as the hypotenuse. use reference angle(s) in a unit circle to represent, complementary, supplementary and reflex angles.	Moulding materials Straws

Learning Outcomes: at the end of Grade 11, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
8. cont.		• Teacher introduces reference angle(s). • Learners, guided by the teacher, use reference angle(s) in a unit circle to represent, complementary, supplementary and reflex angles. • Learner, assisted by the teacher, find pairs of coordinates involving angle and sine of an angle $(\theta, sin\theta)$and then plot the graph of $y = sin\theta$. • Learners identify common angles with the same value of sine. • Learners use the unit circle to locate the common angles with the same sine. • Learners repeat the above three processes for graphs of $y = cos\theta$ and $y = tan\theta$. • Learners solve problems involving graphs of functions of sine, cosine and tangent.	find pairs of coordinates involving angle and sine of an angle $(\theta, sin\theta)$ and then plot the graph of $y = sin\theta$. identify common angles with the same value of sine. use the unit circle to locate the common angles with the same sine. solve problems involving graphs of functions of sine, cosine and tangent	

Learning Outcomes: at the end of Grade 11, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
9. describe and prove similarity and congruence of shapes.	**Concepts** Corresponding sides Similarity Congruence Proof Postulates Linear scale SSS, SAS, AAS and RHS **Skills** Estimation Manipulation Critical thinking Logical thinking	Teacher and learners review transformation (isometric) • Teacher guides learners to identify corresponding sides and angles in a pair of shapes. • Learners identify corresponding sides and angles. • Teacher provides several pairs of congruent shapes. • Learners, under guidance of a teacher, identify pairs of shapes that have corresponding sides and angles which are equal. • Teacher introduces postulates for congruency. • Teacher emphasises equality of sides and equality of angles, SSS, SAS, AAS and RHS. • Learners under the guidance of a teacher use a table to show proofs of congruence. • Learners solve problems involving identification and proofs of congruent shapes. • Learners, under the guidance of a teacher, identify pairs of shapes that have corresponding sides with	identify corresponding sides and angles. identify pairs of shapes that have corresponding sides which are equal and corresponding angles which are equal. use a table to show proofs of congruence. solve problems involving identification and proofs of congruent shapes. identify pairs of shapes that have corresponding sides which have a common ratio and corresponding angles which are equal. use a table to show proofs of similarity. solve problems involving identification and proofs of similar shapes.	

		common ratios and equal angles.		

Learning Outcomes: at the end of Grade 11, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
9. cont.		• Teacher introduces postulates for similarity. • Teacher emphasises proportionality of sides and equality of angles. • Teacher emphasises inclusion of a conclusion to end a proof. • Teacher, guides learners in using a table in providing proofs. • Learners use a table to show proofs of similarity. • Learners solve problems involving identification and proofs of similar shapes. • Learners use linear scale to calculate areas and volumes of similar figures. • Learners solve problems involving areas and volumes of similar figures. • Learners solve problems involving identification and proofs of congruent shapes	use linear scale to do calculations involving areas and volumes of similar figures. solve problems involving identification and proofs of congruent shapes and similar shapes. solve problems involving areas and volumes of similar figures.	

		and similar shapes.		

Learning Outcomes: at the end of Grade 11, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
10. express direct, inverse (indirect), joint and combined variation in algebraic terms to find unknown quantities.	**Concepts** Indices Variation Direct variation Inverse variation Constant of variation (k) Notation (α) **Skills** Estimation Manipulation Critical thinking Logical thinking	• Teacher and learners review indices, proportion, direct proportion and inverse proportion. • Teacher introduces direct variation and its notation: $y \;\alpha\; x^n$ where $n \in \mathbb{Q}$ • Teacher and learners mention and discuss example leading to direct variation. • Learners, assisted by the teacher, express each relation in the form of an equation: $y = kx^n$ • Teacher creates scenarios leading to calculation of ***k***. • Learners, guided by a teacher, rewrite the given equations to solve for ***k***. • Teacher creates scenarios leading to calculation of one of the variables. • Learners, guided by the teacher, rewrite the given equations to solve for one of	express each relation in the form of an equation: $y = kx^n$ rewrite the given equations to solve for ***k***. rewrite the given equations to solve for one of the variables. solve problems involving direct variations. express each relation in the form of an equation: $y = \frac{1}{x^n}$ rewrite the given equation in terms of ***k***. rewrite the given equations to solve for one of the variables.	Mathematics kit

		the variables.		

Learning Outcomes: at the end of Grade 11, learners should be able to:	**Concepts and skills**	**Suggested learning experiences**	**What to assess: the teacher should assess learner's ability to:**	**Resources**
10. cont.		• Learners solve problems involving direct variations. • Teacher introduces inverse/indirect variation: $y \, \alpha \frac{1}{x^n}$ where $n \in \mathbb{Q}$ • Teacher and learners mention and discuss example leading to inverse/indirect variation • Learners, guided by the teacher, express each relation in the form of an equation: $y = \frac{1}{x^n}$ • Teacher creates scenarios leading to calculation of ***k***. • Learners, assisted by the teacher, rewrite the given equation in terms of ***k***. • Teacher creates scenarios leading to calculation of one of the variables. • Learners, assisted by the teacher, rewrite the given equations to solve for one of the variables.	solve problems involving inverse/indirect variations. express the relation in the form of an equation: $y = kx^m z^n$ rewrite the given equation in terms of ***k***. rewrite the given equation to solve for one of the variables. solve problems involving joint variations. express the relation in the form of an equation: $y = \frac{kx^m}{z^n}$ rewrite the given equation in terms of ***k***.	

		• Learners solve problems involving inverse/indirect variations.	rewrite the given equation to solve for one of the variables.	

Learning Outcomes: at the end of Grade 11, learners should be able to:	Concepts and skills	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
10. cont.		• Teacher introduces joint variation and its notation: $y \; \alpha \; x^m z^n$ where $m, n \in \mathbb{Q}$ • Teacher and learners mention and discuss example leading to joint variation. • Learners, guided by a teacher, express the relation in the form of an equation: $y = kx^m z^n$ • Teacher creates scenarios leading to calculation of ***k***. • Learners, guided by a teacher, rewrite the given equation in terms of ***k***. • Teacher creates scenarios leading to calculation of one of the variables. • Learners, guided by a teacher, rewrite the given equation to	solve problems involving combined variations. solve problems involving variations.	

		solve for one of the variables. • Learners solve problems involving joint variations.		

Learning Outcomes: at the end of Grade 11, learners should be able to:	**Concepts and skills**	**Suggested learning experiences**	**What to assess: the teacher should assess learner's ability to:**	**Resources**
10. cont.		• Teacher introduces combined variation and its notation: $y \, \alpha \frac{x^m}{z^n}$ where $m, n \in \mathbb{Q}$ • Teacher and learners mention and discuss examples leading to combined variation. • Learners, guided by the teacher, express the relation in the form of an equation: $y = \frac{kx^m}{z^n}$ • Teacher creates scenarios leading to calculation of ***k***. • Learners, guided by the teacher, rewrite the given equation in terms of ***k***. • Teacher creates scenarios leading to calculation of one of the variables. • Learners, guided by a teacher, rewrite the given equation to		

		solve for one of the variables. • Learners solve problems involving combined variations. • Learners solve problems involving variations.		