Ministry of Education and Training

GRADE 9 MATHEMATICS SYLLABUS 2020

NCDC

Table of Contents

Introduction

Grade 9 Mathematics Syllabus forms 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 9 Mathematics Syllabus has 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 9 Mathematics syllabus was 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 9 Mathematics Syllabus is committed to 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 9 Mathematics syllabus 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 9 Mathematics Syllabus has 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 9 Mathematics Syllabus promotes 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 9 MATHEMATICS
OVERVIEW

At the end of Grade 9, learners should be able to:

1. describe and interpret universal set containing three sets using Venn diagrams and appropriate set notation.
2. form sets of different types of numbers.
3. express natural numbers as products of their prime factors.
4. use four basic operations on directed numbers in practical situations.
5. find a general rule of arithmetic sequences.
6. find the upper and lower bounds to specified accuracy.
7. expand and factorise algebraic expressions.
8. calculate angles using their properties.
9. draw graphs of linear equations of the form $y = mx + c$.
10. describe symmetry in 3-D shapes.
11. describe and perform reflection.
12. describe and perform rotation on simple plane figures.
13. describe and perform enlargement with positive scale factor on simple plane figures.
14. demonstrate understanding of conversions involving percentages, fractions and decimals.
15. calculate quantities using ratios and percentages.
16. demonstrate an understanding of rate in practical situations.
17. read and use linear scale of different instruments.
18. calculate area of n-sided regular polygons.
19. find surface area of prisms.
20. calculate volume of prisms.
21. solve linear fractional equations with algebraic denominator.
22. solve simultaneous equations using graphing and substitution methods.
23. change the subject of a formula involving two or more operations.
24. use basic operations on decimals.
25. solve probability problems of combined events.

26. use trigonometric ratios to calculate sides in a right-angled triangle.
27. demonstrate understanding of calculations involving vectors.
28. demonstrate understanding of calculations involving matrices.
29. find mean, mode and median from ungrouped and grouped data.
30. demonstrate understanding of relations and functions.
31. solve linear inequalities up to two variables.
32. use basic operations on numbers in an index form.
33. express numbers in standard form.
34. demonstrate understanding of bearings of two journeys.

GRADE 9 MATHEMATICS
ACTIVITY PLAN

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
1. describe and interpret universal set containing three sets using Venn diagrams and appropriate set notation.	**Concepts** Sets Universal set Compliment of a set Venn diagram Joint and disjoint sets Set notation: ∪, ∩, ∈, ∉, ∅, { } ⊆, ⊂, ⊄, n(A), A', ξ **Skills** Classification Manipulation Communication Interpretation	**Teacher and learners review:** • set notation used to describe two sets. • compliment of a set and a number of elements in a set. • Learners, under the guidance of the teacher, brainstorm different combinations of three sets. • Teacher provides learners with a variety of scenarios that will require them 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 from different scenarios using appropriate notation.	represent three sets in different Venn diagrams. identify members of each set. identify members of each set which do not appear in the other set. form sets from different scenarios using appropriate notation. find the number of elements of each set in the universal set. describe sets from different scenarios using appropriate notation. solve problems involving set notations.	Materials from the immediate environment Mathematics kit

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

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
2. form sets of different types of numbers.	**Concepts** Sets Types of numbers: natural numbers, odds, evens, primes, multiples, factors, squares, cubes (include roots), integers Venn diagram Set notation **Skills** Classification Manipulation Communication Interpretation	• Teacher and learners review types of numbers. • Learners list sets of types of numbers using set braces - { }. • Learners represent members of a universal set using Venn diagram of up to three sets. • Learners establish the relationship between any three sets in the universal set. • Learners describe sets of numbers in words. • Learners describe sets of numbers using set notation. • Learners find the number of elements in each set in the universal set. • Learners identify compliment(s) of each set.	list sets of types of numbers using set braces - { }. represent members of a universal set using Venn diagram of up to three sets. establish the relationship between any three sets in the universal set. describe sets of numbers in words. describe sets of numbers using set notation. find the number of elements in each set in the universal set. identify compliment(s) of each set.	Mathematics kit

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
3. express natural numbers as products of their prime factors.	**Concepts** Prime factors Natural numbers Indices Lowest common multiple Highest common factor **Skills** Manipulation Communication Calculation Interpretation	• Teacher and learners review prime factors. • Under the guidance of the teacher, learners express a number as a product of its prime factors diagrammatically. • Learners express a given number as a product of its prime factors. • Learners list prime factors of a given number. • Learners express the number as a product of its prime factors using indices. • Learners express their chosen natural numbers as products of their prime factors. • Learners find LCM using the idea of prime factorisation. • Learners find HCF using the idea of prime factorisation. • Learners solve problems involving prime factorisation.	use diagrammatic representations to add and subtract directed numbers. use diagrammatic representations to multiply and divide directed numbers solve problems involving directed numbers. work out given exercises involving directed numbers. express their chosen natural numbers as products of their prime factors. find LCM using the idea of prime factorisation. find HCF using the idea of prime factorisation. solve problems involving	Mathematical kit

			directed numbers in real life situations.	

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
4. use four basic operations on directed numbers in practical situations.	**Concepts** Directed numbers Basic operations $(+, -, \times, \div)$ **Skills** Classification Manipulation Communication Interpretation	• Teacher and learners review directed numbers. • Learners, under the guidance of the teacher, play games involving win and lose leading to the use of directed numbers. • Teacher provides learners with tasks requiring use of diagrammatic representations. • Learners use diagrammatic representations to add and subtract directed numbers. • Learners use diagrammatic representations to multiply and divide directed numbers. • Learners work out given exercises involving directed numbers. • Teacher creates scenarios that involve operation on directed numbers to show the importance of longer-term financial planning and debt management. • Learners interpret the	use diagrammatic representations to add and subtract directed numbers. use diagrammatic representations to multiply and divide directed numbers. work out given exercises involving directed numbers. interpret the scenarios and work out the answers by using directed numbers. solve problems involving directed numbers in real life situations.	Mathematics kit

		scenarios and find out answers using directed numbers. • Learners solve a wide range of problems involving directed numbers in real life situations.		

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
5. find a general rule of arithmetic sequences.	**Concepts** Sequences: 　arithmetic 　geometric General rule Terms Common ratio Common difference **Skills** Ordering Manipulation Calculation Interpretation Logical thinking Critical thinking	• Teacher and learners review generation of number sequences from a given rule. • Learners form arithmetic sequences using number table up to 100. • Learners establish a rule of the sequence. • Learners predict the subsequent terms. • Teacher and learners deduce the algebraic representation of a general rule. • Learners find a general rule of a given arithmetic sequence. • Learners form geometric sequences using multiplication table. • Learners establish a rule of the sequence. • Learners predict the subsequent terms. • Learners find a general rule of a given geometric sequence. • Learners solve problems	form arithmetic sequences using number table up to 100. establish a rule of the sequence. predict the subsequent terms. find a general rule of a given arithmetic sequence. form geometric sequences using multiplication table. establish a rule of the sequence. predict the subsequent terms. find a general rule of a given geometric sequence. solve problems involving arithmetic and geometric	Mathematics kit

		involving arithmetic and geometric sequences.	sequences.	

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources

6. find the upper and lower bounds to specified accuracy.	**Concepts**
	Limits of accuracy:
	  lower bound
	  upper bound
	Place value
	Rounding off
	Significant figure
	
	Skills
	Ordering
	Manipulation
	Calculation
	Interpretation
	Logical thinking
	Critical thinking
		• Teachers and learners review rounding off numbers to a specified number of significant figures.
		• Learners measure lengths of different objects and write them to the nearest 10th, 1 and 10.
		• Learners round off given numbers to the nearest 1000th up to 1000.
		• Learners list a solution set of numbers which when rounded to nearest 10 the answer is 20.
		• Teacher guides learners to establish upper and lower limits.
		• Learners solve problems that involve limits of accuracy.
			measure lengths of different objects and write them to the nearest 10th, 1 and 10.
			
			round off given numbers to the nearest 1000th up to 1000.
			
			list a solution set of numbers which when rounded to nearest 10 the answer is 20.
			
			find upper and lower limits.
			
			solve problems that involve limits of accuracy.
				Mathematics kit

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
7. expand and factorise algebraic expressions.	**Concepts** Like terms Expansion Factorisation **Skills** Manipulation Calculation Logical thinking	• Teacher and learners review directed numbers. • Learners, under the guidance of the teacher, simplify expressions by collecting like terms. • Learners expand expressions with single brackets. • Learners factorise expressions with single brackets. • Learners solve given exercise on expansion and factorization. • Learners expand expressions with double brackets. • Learners factorise quadratic expressions, where $a = 1$. • Learners solve given exercise on expansion and factorization involving quadratic expressions.	simplify expressions by collecting like terms. expand expressions with single brackets. factorise expressions with single brackets. solve given exercise on expansion and factorization. expand expressions with double brackets. factorise expressions with quadratic expressions where a = 1. solve given exercise on expansion and factorization involving quadratic expressions.	Mathematics kit

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
8. calculate angles using their properties.	**Concepts** Angles Properties of angles: Angles in a triangle Vertically opposite angles Angles formed by parallel lines Angles in a quadrilateral Angle properties of a polygon **Skills** Manipulation Measurement Accuracy Logical thinking Critical thinking	**Teacher and learners review:** • angles in a triangle. • vertically opposite angles. • angles formed by parallel lines. • angles in a quadrilateral. • angles at the point. • complementary angles and supplementary angles. • Learners draw polygons. • Learners measure angles in the polygon and find their sum of the angles. • Teacher introduces the general formula for calculating interior angles of polygons. $$\text{Sum of interior angles} = 180(n-2)$$ where $n =$ number of sides. • Learners calculate sum of interior angles of given polygons. • Learners calculate interior angles and number of sides of given polygons using the formula.	draw polygons and measure the angles. find the sum of the angles in the polygon. calculate sum of interior angles of given polygons using the formula. calculate interior angles of given polygons using the formula. calculate number of sides of given polygons using the formula. measure exterior angles and find their sum. calculate the sum of exterior angles. calculate number of sides of polygons using the formula.	Mathematics kit

		• Teacher provides learners with different regular polygons. • Learners measure exterior angles and find their sum. • Learners deduce the sum of exterior angles. • Learners, calculate number of sides of polygons using the formula.		
Learning Outcomes: at the end of Grade 9, learners should be able to:	**Concepts, skills, values and attitudes**	**Suggested learning experiences**	**What to assess: the teacher should assess learner's ability to:**	**Resources**
8. cont.		• Teacher introduces the general formula for calculating exterior angle of regular polygons. $\text{Exterior angle} = \frac{360}{n}$, where $n = $ number of sides. • Learners calculate exterior angles of given regular polygons using the formula. • Learners solve problems involving angle properties.	calculate exterior angles of given regular polygons using the formula. solve problems involving angle properties.	Mathematics kit
9. draw graphs of linear equations of the form $y = mx + c.$	**Concepts** xy −plane Coordinates Straight lines: gradient y intercept	• Teacher and learners review vertical and horizontal linear graphs. • Learners, under the guidance of the teacher, plot and join the coordinates to form lines from an experiment.	plot and join the coordinates to form lines from an experiment. compare the formed line with the horizontal and vertical lines.	Mathematics kit Graph book

| | **Skills**
Plotting
Calculation
Critical thinking
Logical thinking
Manipulation | • Learners compare the formed line with the horizontal and vertical lines.
• Learners generate the line graph from the given coordinates.
• Learners, under the guidance of the teacher deduce slope and y intercept of a linear graph.
• Learners, under the guidance of the teacher write the equation of the straight line.
• Teacher gives learners the values of x and the equation of a straight line. | generate the line graph from the given coordinates.

write the equation of the straight line.

find corresponding y values and draw the graph.

use linear graphs involving conversions in practical situations. | |

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
9. cont.		• Learners find corresponding y values and draw the graph. • Learners use linear graphs involving conversions in practical situations. • Learners solve problems involving use of the equation of a straight line.	solve problems involving use of the equation of a straight line.	
10. describe symmetry in 3D shapes.	**Concepts** Symmetry: line plane rotational axis of rotation order of rotation Prisms Pyramids Cylinder **Skills** Manipulation Measurement Accuracy Logical thinking Critical thinking	**Teacher and learners review:** • line(s) of symmetry in a plane. • order of rotational symmetry of 2D shapes. • Learners use available resources to make 3D shapes. • Learners cut the 3D shapes into 2 equal parts. • Learners establish possible number of cutting the shape in to two equal parts. • Teacher and learners deduce the concept of plane of symmetry. • Learners identify the number of planes of symmetry on the given 3 D shapes. • Learners solve problems	use available resources to make 3D shapes. cut the 3D shapes into 2 equal parts. find possible number of cutting the shape in to two equal parts. identify the number of planes of symmetry on the given 3 D shapes. solve problems involving planes of symmetry.	Mathematics kit

		involving planes of symmetry.		

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
11. describe and perform reflection.	**Concepts** Reflection Mirror line/line of reflection Object Image Orientation Four quadrants **Skills** Manipulation Measurement Plotting Drawing Accuracy Logical thinking Critical thinking	**Teacher and learners review:** • drawing of lines. • reflection along the horizontal and vertical lines. • Learners plot and join given points to form a shape on the Cartesian plane. • Learners, under the teacher's guidance, reflect shapes along the axes in four quadrants. • Teacher asks learners to explore the position of other lines of symmetry using the drawn shapes. • Learners reflect given shapes along the line of the form $y = mx + c$. • Learners identify line of reflection given object and image. • Learners construct a line of reflection on a plain sheet given object and image. • Learners fully describe the reflection given object and	plot and join given points to form a shape on the Cartesian plane. reflect shapes along the axes in four quadrants. reflect given shapes along the line of the form $y = mx + c$. identify line of reflection given object and image. construct a line of reflection on a plain sheet given object and image. describe the reflection given object and image. solve problems involving reflection of objects.	Mathematics kit

		image. • Learners solve problems involving reflection of objects.		

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
12. describe and perform rotation on simple plane figures.	**Concepts** Rotation Centre of rotation Angle of rotation Direction: clockwise anticlockwise Orientation **Skills** Manipulation Measurement Plotting Drawing Accuracy Logical thinking Critical thinking	• Teacher and learners review rotation through angles 90° and 180° and a centre located at one vertex of a shape. • Learners, under the guidance of the teacher, engage in activities that involve rotation of concrete shapes through a specified angle and centre of rotation. • Learners explore rotation of shapes through a variety of angles about a given centre in different directions. • Learners explore rotation of shapes through a specified angle about different centres in all directions. • Learners compare orientation of shapes in these cases. • Learners, under the guidance of the teacher, find a centre and an angle by construction. • Learners find the position of centre of rotation given image and object.	rotation of shapes through a variety of angles about a given centre in different directions. rotate of shapes through a specified angle about different centres in all directions. compare orientation of shapes in these cases. find a centre and an angle by construction. find the position of centre of rotation given image and object. find an angle of rotation and the direction. solve problems involving rotation with a centre at the origin.	Mathematics kit

		• Learners find an angle of rotation and the direction. • Learners solve problems involving rotation with a centre at the origin.		

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
13. describe and perform enlargement with positive scale factor on simple plane figures.	**Concepts** Enlargement Scale factor Centre Orientation Size **Skills** Manipulation Measurement Plotting Drawing Accuracy Logical thinking Critical thinking	• Learners tour the school campus and identify similar objects with different sizes. • Learners sketch the objects identified during the tour. • Learners explore relationship between the corresponding sides of the given shapes. • Teacher and learners deduce enlargement. • Teacher provides learners with objects and images. • Learners join the corresponding vertices with the extended straight lines. • Learners identify a point where the lines intersect. • Learners measure the distance between the intersection point and corresponding vertices. • Teacher and learners deduce scale factor and centre of enlargement. • Learners find the scale factor and centre of enlargement given object and image.	establish the relationship between the corresponding sides of the given shapes. identify a point where the lines intersect. measure the distance between the intersection point and each corresponding vertex. find the scale factor and centre of enlargement given object and image. enlarge objects given positive scale factor centre of enlargement. solve problems involving enlargement with a positive scale factor.	Mathematics kit

		• Learners enlarge objects given positive scale factor. • Learners solve enlargement problems with a positive scale factor.		

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
14. demonstrate understanding of conversions involving percentages, fractions and decimals.	**Concepts** Conversions Percentages Fractions Decimals **Skills** Manipulation Measurement Estimation Accuracy Comparison Logical thinking Critical thinking	• Teacher and learners review conversions of percentages, fractions and decimals. • Teacher provides learners with scenarios involving financial transactions that lead to recurring decimals. • Learners convert given fractions to percentages then to recurring decimals. • Learners explore conversions of given recurring decimals into percentages and fractions. • Learners convert given recurring decimals into percentages and fractions. • Learners solve problems involving conversion of percentages, fractions and recurring decimals.	convert given fractions to percentages then to recurring decimals. convert given recurring decimals into percentages and fractions. solve problems involving conversion of percentages, fractions and recurring decimals.	Mathematics kit

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources

15. calculate quantities using ratios and percentages.	**Concepts**
	Ratio
	Percentage:
	  increase
	  decrease
	Reverse percentages
	Comparison of quantities
	Borrowing
	Savings
	
	Skills
	Manipulation
	Measurement
	Estimation
	Accuracy
	Comparison
	Logical thinking
	Critical thinking
		• Teacher and learners review ratio, and percentage.
		• Teacher provides learners with scenarios involving financial transactions that lead to increase, decrease and reverse percentages.
		• Learners calculate % increase and % decrease from given scenarios.
		• Learners, under the guidance of the teacher, explore different ways of determining a reverse percentage.
		• Learners calculate reverse percentage using the catalogue from nearby shops.
		• Learners engage in activities involving comparison of three quantities using ratio.
		• Learners divide a quantity in a given ratio of the form $a:b:c$.
		• Learners solve problems involving percentages and ratios.
			calculate % increase and % decrease from given scenarios.
			
			calculate reverse percentage using the catalogue from nearby shops.
			
			divide a quantity in a given ratio of the form $a:b:c$.
			
			solve problems involving percentages and ratios.
				Mathematics kit
				
				Financial institutions

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources

16. demonstrate an understanding of rate in practical situations.	**Concepts**
	Proportion:
	  direct
	  inverse
	Rate
	Measurement
	Investment
	Ways of payment:
	  cash, cheque, credit and debit cards
	Debt management
	
	Skills
	Estimation
	Measurement
	Recording
	Reporting
	Critical thinking
	Logical thinking
	Manipulation
		• Teachers and learners review ratio.
		• Teacher and learners explore different scenarios that show increase of quantities.
		• Learners identify quantities that increase in the same ratio.
		• Learners calculate quantities that involve direct proportion.
		• Teacher and learners deduce the concept of direct proportion.
		• Learners identify quantities that decrease in the same ratio.
		• Teacher and learners deduce the concept of direct proportion.
		• Learners calculate quantities that involve direct proportion.
		• Learners apply proportion to interpret and use representative scales to solve problems.
		• Teacher and learners review speed as one form of rate.
			identify quantities that increase in the same ratio.
			
			calculate quantities that involve direct proportion.
			
			identify quantities that decrease in the same ratio.
			
			calculate quantities that involve direct proportion.
			
			apply proportion to interpret and use representative scales to solve problems.
			
			use different measures of rate.
			
			calculate interest rates given a wide range of financial products.
			
			solve problems involving calculations of rates.
				Mathematics kit
				
				Financial institutions

		• Teacher and learners explore the use of different measures of rate. • Learners calculate interest rates given a wide range of financial products. • Learners solve problems involving calculations of rates.		

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
17. read and use linear scale of different instruments.	**Concepts** Linear scale: 　Vernier calliper 　micrometre 　screw gauge Measurement Diameter **Skills** Estimation Measurement Recording Reporting Critical thinking Logical thinking Manipulation	**Teacher and learners review:** - measurement of lengths, angles, capacity, temperature, time and mass. - conversion of units. - Teacher and learners explore measurement using a Vernier calliper. - Learners identify the smallest division on the scale. - Learners measure the diameters of different circular objects in turns and compare results. - Teacher demonstrates the proper way of reading the scale. - Teacher and learners explore measurement using a micrometre screw gauge. - Learners identify the smallest division on the scale. - Learners measure the diameters of different circular objects in turns and compare results.	identify the smallest division on the scale. measure the diameters of different circular objects in turns and compare results. demonstrate the proper way of reading the Vernier calliper scale. identify the smallest division on the scale. measure the diameters of different circular objects. demonstrate understanding of the proper way of reading the micrometre screw gauge scale. use scales to measure. solve problems involving measurement and scale	Mathematics kit

| | | • Teacher demonstrates the proper way of reading the scale.
• Learners use scales to measure.
• Learners solve problems involving measurement and scale reading. | reading. | |

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
18. calculate area of *n*-sided regular polygons.	**Concepts** Polygons Symmetry Area Apothem **Skills** Manipulation Substitution Evaluation Critical thinking	• Teacher and learners review perimeter of polygon. • Teacher and learners review area of polygons. • Teacher and learners review line of symmetry of shapes. • Learners construct an equilateral triangle. • Learners draw lines of symmetry of an equilateral triangle. • Learners locate centre of the triangle and drop a perpendicular line to one of the sides. • Learners measure the perpendicular height. • Teacher introduces the concept apothem. • Learners use formula of a triangle to find area. • Learners find areas of other equilateral triangles. • Learners construct a square and draw lines of symmetry to locate centre. • Learners measure the	construct an equilateral triangle. draw lines of symmetry of an equilateral triangle. locate centre of the triangle and drop a perpendicular line to one of the sides. measure the perpendicular height(apothem). find areas of equilateral triangles using formula. construct a square and draw lines of symmetry to locate centre. measure apothem. count the number of triangles formed and calculate the total area.	Mathematical kit

		perpendicular distance from the centre to the side.	calculate areas of given squares using the same procedure.	
		• Learners count the number of triangles formed and calculate the total area.		

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
18. cont.		• Learners calculate areas of given squares using the same procedure. • Learners repeat procedure for other regular polygons. • Learners solve problems involving areas of polygons.	solve problems involving areas of polygons.	
19. find surface area of prisms.	**Concepts** Regular-based prisms: rectangular triangular pentagonal hexagonal Properties of prisms: number of faces, edges and vertices **Skills** Manipulation Measurement Accuracy Logical thinking Critical thinking	• Teacher and learners review types of prisms using their properties. • Learners sketch nets of pentagonal and hexagonal prisms and calculate their base areas using given dimensions. • Learners calculate area of the remaining faces. • Learners find the sum of areas of all faces. • Learners deduce a formula for calculating total surface area of pentagonal and hexagonal prisms. • Learners calculate the total surface area of the given pentagonal and hexagonal prisms using a formula.	sketch nets of pentagonal and hexagonal prisms. calculate base areas of pentagonal and hexagonal prisms using given dimensions. calculate area of the other faces. find the sum of areas of all faces. calculate the total surface area of the given pentagonal and hexagonal prisms using a formula.	Mathematics kit

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
20. calculate volume of prisms.	**Concepts** Regular-based prisms: rectangular triangular pentagonal hexagonal Properties of prisms: number of faces, edges and vertices **Skills** Manipulation Measurement Accuracy Logical thinking Critical thinking	• Teacher and learners revise calculations of volumes of triangular prisms and cylinders. • Learners find number of faces, edges and vertices of pentagonal and hexagonal prisms. • Learners measure dimensions of the given prisms. • Learners calculate base area of the given prisms. • Learners multiply base area by height to get the volume. • Teacher and learners deduce the formula for calculating the volume of pentagonal base prisms. • Learners calculate volumes of different polygonal prisms. • Learners solve problems involving volume of prisms.	find number of faces, edges and vertices of pentagonal and hexagonal prisms. measure dimensions of the given prisms. calculate base area of the given prisms. multiply base area by height to get the volume. calculate volumes of different polygonal prisms. solve problems involving volume of prisms.	Mathematics kit

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
21. solve linear fractional equations with algebraic denominator.	**Concepts** Linear equations Fractional equations Numerator Denominator Lowest common multiple(LCM) BODMAS/ BIRDMAS **Skills** Classification Manipulation Communication Interpretation	• Teacher and learners review solutions of linear equations with one unknown. • Teacher and learners review solutions simple linear equations with numeric denominators. • Teacher and learners review LCM of algebraic fractions. • Learners engage in activities that involve finding the subject of the formula in fractional equations. • Learners find solutions of the given fractional equations. • Teacher provides learners with scenarios that will lead to linear fractional equations with algebraic denominator. • Learners solve problems involving linear fractional equations with algebraic denominator.	find the subject of the formula in fractional equations. solve fractional equations. solve problems involving linear fractional equations.	Mathematics kit

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
22. solve simultaneous equations using graphing and substitution methods.	**Concepts** Simultaneous equations Linear graphs Cartesian coordinates **Skills** Interpretation Plotting Graphing	• Teacher and learners review solution of linear equations with one unknown. • Teacher and learners review linear graphs. • Teacher creates scenarios that lead to formulation of pairs of simultaneous. • Learners formulate a pair of simultaneous equations from given scenarios. • Learners create a word problem from given pairs of simultaneous equations. • Learners solve a pair of simultaneous equations using graphs. • Learners solve a pair of simultaneous equations using substitution method. • Learners solve problems involving simultaneous equations	formulate a pair of simultaneous equations from given scenarios. create a word problem from given pairs of simultaneous equations. solve a pair of simultaneous equations using graphs. solve a pair of simultaneous equations using substitution method. solve problems involving simultaneous equations.	Mathematical kit

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
23. change the subject of a formula involving two or more operations.	**Concepts** Formulae Subject of the formulae Four basic operations **Skills** Classification Manipulation Communication Interpretation	• Teacher and learners review change of subject of simple formulae. • Teachers provide learners with formula involving at least two operations: $y = mx + c$ • Learners make m the subject of the formula • Learners change the subject of formula involving two or more operations	make m the subject of the formula. make the subject of the formula involving two or more	Mathematical kit
24. use basic operations on decimals.	**Concepts** Four operations Place value Reciprocal **Skills** Classification Manipulation Communication Interpretation	• Teacher and learners review operations of fractions and decimals • Teacher creates a situation whereby a fraction of a piece of a whole is used. • Learners solve problems from situations involving multiplication of a decimal by decimal. • Teacher creates a situation whereby a fraction of a piece of a whole is shared. • Learners solve problems from situations involving division of	solve problems from situations involving multiplication of a decimal by decimal. solve problems from situations involving division of a decimal by decimal.	Mathematical kit

		a decimal by decimal		

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
25. solve probability problems of combined events.	**Concepts** Probability Possibility space diagram Sample space Combined events Tree diagram Avoiding risk **Skills** Classification Manipulation Communication Interpretation	• Teacher and learners review probability of two combined events. • Teacher creates scenarios that promote awareness of the consequences of gambling and ways of avoiding scams and identity theft. • Teacher and learners review possibility space diagram to create sample space • Teacher demonstrates to learners how to draw a tree diagram to create a sample space for two combined events • Learners draw tree diagram of two events from possibility space • Learners compare outcomes obtained from the possibility space and the tree diagram • Learners solve probability problems of two events	draw a tree diagram of two events. compare outcomes obtained from the possibility space and the tree diagram. solve probability problems of two events using the tree diagram.	Mathematical kit

		using the tree diagram		

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
26. use trigonometric ratios to calculate sides in a right-angled triangle.	**Concepts** Hypotenuse Opposite Adjacent Trigonometric ratios: Sine Cosine Tangent **Skills** Identification Sketching Calculation Interpretation Logical thinking	• Teachers and learners review use of Pythagoras theorem • Teacher guides learners to identify sides of a right-angled triangle as hypotenuse, opposite or adjacent. • Learners sketch and identify sides of a right-angled triangle. • Teacher guides learners to draw a right-angled triangle of angle $30°$. • Learners measure and record all lengths. • Learners work out ratio of $\frac{opp}{hyp}$. • Learners compare their answers of $\frac{opp}{hyp}$ .. • Under guidance of a teacher, learners calculate sine of $30°$. • Learners compare $\sin30°$ with $\frac{opp}{hyp}$. • Teacher and learners deduce sine ratio as $\sin\theta = \frac{opp}{hyp}$.	identify sides of a right-angled triangle. draw a right-angled triangle of angle $30°$. measure and record all lengths. compare their answers of $\frac{opp}{hyp}$. calculate sine of 30. compare $\sin30°$ with $\frac{opp}{hyp}$. deduce sine ratio as $sin\theta = \frac{opp}{hyp}$. deduce $\cos\theta$ and $\tan\theta$. solve problems involving sin, cos and tan.	Mathematics kit

		• Teacher guides learners to repeat the same procedure to deduce $\cos\theta$ and $\tan\theta$. • Learners solve problems involving sin, cos and tan.		

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
27. demonstrate understanding of calculations involving column vectors.	**Concepts** Vectors Addition Subtraction Multiplication Scalar Vector direction Magnitude $\left\|\overrightarrow{AB}\right\| or \|a\|$ $=\sqrt{x^2 + y^2}$ **Skills** Drawing Calculation Accuracy Critical thinking Logical thinking Manipulation	• Teachers and learners review vector representation using letters and diagrammatical vector representation. • Teachers and learners review addition of matrices. • Teacher creates scenarios that will illustrate addition and subtraction of vectors. • Learners add vectors numerically and diagrammatically. • Learners subtract vectors numerically and diagrammatically. • Teacher creates scenarios that will illustrate multiplication of vectors by a positive and negative scalar. • Learners multiply vectors by positive and negative scalar. • Learners represent the above vectors diagrammatically and compare their diagrams. • Learners apply Pythagoras	add vectors numerically and diagrammatically. subtract vectors numerically and diagrammatically. multiply vectors by positive and negative scalar. represent the vectors diagrammatically and compare their diagrams. solve problems involving vectors.	Mathematical kit

		theorem to find the magnitude(length) • Learners solve problems involving vectors.		

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
28. demonstrate understanding of calculations involving matrices.	**Concepts** Matrices Order Multiplication Scalar **Skills** Critical thinking Logical thinking Manipulation	• Teachers and learners review the order of matrices. • Teachers and learners review scalar multiplication of vectors. • Learners multiply matrices of any order by a scalar. • Learners solve problems involving matrix multiplication by scalar. • Teachers create scenarios that will illustrate matrix multiplication. • Teacher guides learners to acknowledge the importance of the order of matrices in matrix multiplication. • Learners test the possibility of matrix multiplication • Under the guidance of the teacher, learners perform matrix multiplication. • Learners solve problems involving matrices multiplication	multiply matrices of any order by a scalar. solve problems involving matrix multiplication by scalar. test the possibility of matrix multiplication. perform matrix multiplication. solve problems involving matrix multiplication.	Mathematical kit

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
29. find mean, mode and median from ungrouped and grouped data	**Concepts** Mean Mode Median Pie chart Cumulative frequency curve Data **Skills** Estimation Measurement Recording Reporting Critical thinking Logical thinking Manipulation	• Teachers and learners review finding measures of central tendencies from ungrouped data. • learners find measures of variables including height and shoe size. • Learners list the measured values of the variable. • Learners arrange the measured values in order of size and find the middle value(s). • Learners find the median from the given ungrouped data. • Learners, under the guidance of the teacher, create a frequency table of ungrouped data. • Learners find median, mode and mean from the frequency table. • Learners create a frequency table of ungrouped data. • Learners plot and draw cumulative frequency curve.	list the measured values of the variable. create a frequency table of ungrouped data. find median, mode and mean from the frequency table of ungrouped data. create a cumulative frequency table from frequency table. plot and draw cumulative frequency curve. find the median from the cumulative frequency curve. create a frequency table of grouped data. find median group, modal group and estimated mean from	Mathematical kit Graph books Mathematical set

		• Learners find the median from the cumulative frequency curve • Learners create a frequency table of ungrouped data. • Learners find the median group, modal group and estimated mean from the frequency table of grouped data • Learners solve problems involving statistics	the frequency table of grouped data. solve problems involving statistics.	

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources

30. demonstrate understanding of relations and linear functions.	**Concepts**
	Relations:
	   one-to-one
	   one-to-many
	   many-to-one
	   many-to-many
	
	Linear Functions
	
	Skills
	Classification
	Logical thinking
	Critical thinking
	Evaluation
	Substitution
		• Teacher creates scenarios that illustrate types of relations between entities.
		• Learners classify given relations.
		• Teachers and learners review linear mappings.
		• Learners classify given mappings under relations.
		• Teacher introduces mapping as a function.
		• Teacher introduces function notation.
		• Teacher and learner review equations of linear graphs.
		• Learners write linear equations using function notation.
		• Learners evaluate given linear functions.
		• Learners draw graphs of linear functions.
		• Learners find function from the given graph.
		• Learners solve problems involving functions.
			classify given relations.
			
			classify given mappings under relations.
			
			write linear equations using function notation.
			
			evaluate given linear functions.
			
			draw graphs of linear functions.
			
			find function from the given graph.
			
			solve problems involving functions.
				Mathematical kit

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
31. solve linear inequalities in up to 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	list solution sets of inequalities from given number line. represent solution sets graphically. show inequality graphs of the form $y = mx + c$ by shading **wanted** region. list solution sets of the given inequalities. solve problems using inequalities.	Mathematical kit Mathematical set Graph books

		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 inequalities.		

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
32. use basic operations on numbers in an index form.	**Concepts** Basic operations Indices Exponent Power Base **Skills** Evaluation Manipulation	• Teachers and learners review expression of numbers in index form and vice-versa. • Teachers and learners review expanded notation. • Learners deduce $a^b \times a^c = a^{b+c}$. • Learners simplify expressions of the form $a^b \times a^c$. • Learners deduce $a^b \div a^c = a^{b-c}$. • Learners simplify expressions of the form $a^b \div a^c$. • Teacher guides learners using $a^b \div a^c = a^{-d}$ to deduce that $a^{-d} = \frac{1}{a^d}$. • Teacher guides learners to notice that $a^b \div a^c$ may reduce to a^{-n}.	deduce $a^b \times a^c = a^{b+c}$. simplify expressions of the form $a^b \times a^c$. deduce $a^b \div a^c = a^{b-c}$. simplify expressions of the form $a^b \div a^c$. use $a^b \div a^c = a^{-d}$ to deduce that $a^{-d} = \frac{1}{a^d}$. deduce $a^0 = 1$ solve problems involving a^0. deduce $a^3 \pm a^2 \neq a^3 \times a^2$. solve problems of the form $a^3 \pm a^2$. use $\frac{1}{a^n}$ to show that	Mathematical kit

		• Learners deduce $a^0 = 1$ • Learners solve problems involving a^0. • Learners under teacher guidance deduce $a^3 \pm a^2 \neq a^3 \times a^2$. • Learners solve problems of the form $a^3 \pm a^2$. • Learners use $\frac{1}{a^n}$ to show that $\frac{1}{a^{-n}} = a^n$ • Learners solve problems of the form $\frac{1}{a^{-n}}$.	$\frac{1}{a^{-n}} = a^n$. solve problems of the form $\frac{1}{a^{-n}}$.	

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
33. express numbers in standard form.	**Concepts** Indices Exponent Power Base Standard form Notation **Skills** Evaluation Manipulation	• Teacher and learners review multiplication and division of numbers by powers of 10. • Learners express powers of 10 in index form. • Learners multiply and divide by powers of 10 up to 10 000. • Learners multiply and divide by powers of 10 up to 10 000 in index form. • Teacher gives learners problems that lead to finding the first non-zero digit so that the value of the number is an integer in the range $1 \leq a < 10$. • Learners write the number so that it is in the range $1 \leq a < 10$. • Teacher introduces standard form. • Learners express various numbers in standard form. • Teacher and learners review multiplication and division of indices.	express powers of 10 in index form. multiply and divide by powers of 10 up to 10 000. multiply and divide by powers of 10 up to 10 000 in index form. find the first non-zero digit so that the value of the number is an integer in the range $1 \leq a < 10$. write the number so that it is in the range $1 \leq a < 10$. find direction and count the number of steps moved to reach the first non-zero digit from the decimal point. express various numbers in standard	Mathematical kit

		• Teacher introduces multiplication and division of numbers in standard form. • Learners multiply numbers in standard form. • Learners divide numbers in standard form.	form. multiply numbers in standard form. divide numbers in standard form.	

Learning Outcomes: at the end of Grade 9, learners should be able to:	Concepts, skills, values and attitudes	Suggested learning experiences	What to assess: the teacher should assess learner's ability to:	Resources
34. demonstrate an understanding of bearings of two journeys.	**Concepts** Bearings Properties of angles Parallel lines North line Cardinal points **Skills** Drawing Representation Measurement Scaling Conversion Accuracy Estimation Recording Reporting Critical thinking Logical thinking Manipulation	• Teacher and learners review bearing of a single journey • Teacher and learners review angle properties • Teacher and learners engage in treasure finding game using bearing. • Learners establish strategies for locating treasure. • Teacher introduces the idea of bearings for locating positions in two stage journeys. • Learners interpret given diagrams illustrating bearings. • Learners measure length between two points. • Learners measure angle between north line and line of journey in clockwise direction. • Learners calculate bearings. • Learners describe two stage journeys using bearings. • Learners represent bearing diagrammatically from given two stage journeys.	establish strategies for finding location using bearings. interpret given diagrams which illustrate bearings. measure length(s) between two points. measure angle between north line and line of journey in clockwise direction. calculate bearings. describe two stage journeys using bearings. represent bearing diagrammatically from given two stage journeys. solve problems involving interpretation and drawing of bearings.	Mathematical kit

		• Learners solve problems involving interpretation and drawing of bearings.		