



MINISTRY OF EDUCATION MALAYSIA

Integrated Curriculum for Secondary Schools

Curriculum Specifications

MATHEMATICS

Form 3



Curriculum Development Centre
Ministry of Education Malaysia
2003



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FORM 3**

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Ministry of Education Malaysia
Persiaran Duta
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RUKUNEGARA

DECLARATION

OUR NATION, MALAYSIA, being dedicated
to achieving a greater unity of all her peoples;
to maintaining a democratic way of life;
to creating a just society in which the wealth of the nation shall be equitably shared;
to ensuring a liberal approach to her rich and diverse cultural traditions;
to building a progressive society which shall be oriented to modern science and technology;

WE, her peoples, pledge our united efforts to attain these ends guided by these principles:

BELIEF IN GOD

LOYALTY TO KING AND COUNTRY

UPHOLDING THE CONSTITUTION

RULE OF LAW

GOOD BEHAVIOUR AND MORALITY

NATIONAL PHILOSOPHY OF EDUCATION

Education in Malaysia is an on-going effort towards developing the potential of individuals in a holistic and integrated manner, so as to produce individuals who are intellectually, spiritually, emotionally and physically balanced and harmonious based on a firm belief in and devotion to God. Such an effort is designed to produce Malaysian citizens who are knowledgeable and competent, who possess high moral standards and who are responsible and capable of achieving a high level of personal well being as well as being able to contribute to the harmony and betterment of the family, society and the nation at large.

PREFACE

Science and technology plays a critical role in meeting Malaysia's aspiration to achieve developed nation status. Since mathematics is instrumental in developing scientific and technological knowledge, the provision of quality mathematics education from an early age in the education process is important.

The secondary school Mathematics curriculum as outlined in the syllabus has been designed to provide opportunities for pupils to acquire mathematical knowledge and skills and develop the higher order problem solving and decision making skills that they can apply in their everyday lives. But, more importantly, together with the other subjects in the secondary school curriculum, the mathematics curriculum seeks to inculcate noble values and love for the nation towards the final aim of developing the wholistic person who is capable of contributing to the harmony and prosperity of the nation and its people.

Beginning in 2003, science and mathematics will be taught in English following a phased implementation schedule which will be completed by 2008. Mathematics education in English makes use of ICT in its delivery. Studying mathematics in the medium

of English assisted by ICT will provide greater opportunities for pupils to enhance their knowledge and skills because they are able to source the various repositories of mathematical knowledge written in English whether in electronic or print forms. Pupils will be able to communicate mathematically in English not only in the immediate environment but also with pupils from other countries thus increasing their overall English proficiency and mathematical competence in the process.

The development of this Curriculum Specifications accompanying the syllabus is the work of many individuals expert in the field. To those who have contributed in one way or another to this effort, on behalf of the Ministry of Education, I would like to express my deepest gratitude and appreciation.

(Dr. SHARIFAH MAIMUNAH SYED ZIN)
Director
Curriculum Development Centre
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LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
1.1 Understand and use properties of angles associated with transversal and parallel lines.	<ul style="list-style-type: none"> Explore the properties of angles associated with transversal using dynamic geometry software, geometry sets, acetate overlays or tracing paper. Discuss when alternate and corresponding angles are not equal. Discuss when all angles associated with transversals are equal and the implication on its converse. 	<ul style="list-style-type: none"> Identify: <ul style="list-style-type: none"> a) transversals b) corresponding angles c) alternate angles d) interior angles. Determine that for parallel lines: <ul style="list-style-type: none"> a) corresponding angles are equal b) alternate angles are equal c) sum of interior angles is 180°. Find the values of: <ul style="list-style-type: none"> a) corresponding angles b) alternate angles c) interior angles associated with parallel lines. 	The interior angles on the same side of the transversal are supplementary.	parallel lines transversal alternate angle interior angle associated corresponding angle intersecting lines supplementary angle acetate overlay

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LEARNING AREA:
LINES AND ANGLES II

Form 3

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>		<p><i>Students will be able to:</i></p> <ul style="list-style-type: none">iv. Determine if two given lines are parallel based on the properties of angles associated with transversals.v. Solve problems involving properties of angles associated with transversals.	<p>Limit to transversal intersecting parallel lines.</p>	

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
2.1 Understand the concepts of regular polygons.	<ul style="list-style-type: none"> • Use models of polygons and surroundings to identify regular polygons. • Explore properties of polygons using rulers, compasses, protractors, grid papers, templates, geo-boards, flash cards and dynamic geometry software. • Include examples of non-regular polygons developed through activities such as folding papers in the shape of polygons. • Relate to applications in architecture. 	<ol style="list-style-type: none"> Determine if a given polygon is a regular polygon. Find: <ol style="list-style-type: none"> the axes of symmetry the number of axes of symmetry of a polygon. Sketch regular polygons. Draw regular polygons by dividing equally the angle at the centre. Construct equilateral triangles, squares and regular hexagons. 	<p>Limit to polygons with a maximum of 10 sides.</p> <p>Construct using straightedges and compasses.</p> <p>Emphasise on the accuracy of drawings.</p>	<p>polygon regular polygon convex polygon axes of symmetry straightedges angle equilateral triangle square regular hexagon</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p> <p>2.2 Understand and use the knowledge of exterior and interior angles of polygons.</p>	<ul style="list-style-type: none"> Explore angles of different polygons through activities such as drawing, cutting and pasting, measuring angles and using dynamic geometry software. Investigate the number of triangles formed by dividing a polygon into several triangles by joining one chosen vertex of the polygon to the other vertices. 	<p><i>Students will be able to:</i></p> <ol style="list-style-type: none"> Identify the interior angles and exterior angles of a polygon. Find the size of an exterior angle when the interior angle of a polygon is given and vice versa. Determine the sum of the interior angles of polygons. Determine the sum of the exterior angles of polygons. 		<p>interior angle exterior angle complementary angle sum</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>	<ul style="list-style-type: none"> • Include examples from everyday situations. 	<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> v. Find: <ul style="list-style-type: none"> a) the size of an interior angle of a regular polygon given the number of sides. b) the size of an exterior angle of a regular polygon given the number of sides. c) the number of sides of a regular polygon given the size of the interior or exterior angle. vi. Solve problems involving angles and sides of polygons. 		

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p> <p>3.1 Understand and use properties of circles involving symmetry, chords and arcs.</p>	<ul style="list-style-type: none"> Explore through activities such as tracing, folding, drawing and measuring using compasses, rulers, threads, protractor, filter papers and dynamic geometry software. 	<p><i>Students will be able to:</i></p> <ol style="list-style-type: none"> Identify a diameter of a circle as an axis of symmetry. Determine that: <ol style="list-style-type: none"> a radius that is perpendicular to a chord divides the chord into two equal parts and vice versa. perpendicular bisectors of two chords intersect at the centre. two chords that are equal in length are equidistant from the centre and vice versa. chords of the same length cut arcs of the same length. Solve problems involving symmetry, chords and arcs of circles. 		<p>diameter axis of symmetry chord perpendicular bisector intersect equidistant arc symmetry centre radius perpendicular</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
3.2 Understand and use properties of angles in circles.	<ul style="list-style-type: none"> Explore properties of angles in a circle by drawing, cutting and pasting, and using dynamic geometry software. 	<ol style="list-style-type: none"> Identify angles subtended by an arc at the centre and at the circumference of a circle. Determine that angles subtended at the circumference by the same arc are equal. Determine that angles subtended: <ol style="list-style-type: none"> at the circumference at the centre by arcs of the same length are equal. Determine the relationship between angle at the centre and angle at the circumference subtended by an arc. Determine the size of an angle subtended at the circumference in a semicircle. 	<p>Include reflex angles subtended at the centre.</p> <p>Angle subtended by an arc is the same as angle subtended by the corresponding chord.</p>	<p>angle subtended semicircle circumference arc chord reflex angle centre</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
		vi. Solve problems involving angles subtended at the centre and angles at the circumference of circles.		
3.3 Understand and use the concepts of cyclic quadrilaterals.	<ul style="list-style-type: none"> Explore properties of cyclic quadrilaterals by drawing, cutting and pasting and using dynamic geometry software. 	i. Identify cyclic quadrilaterals. ii. Identify interior opposite angles of cyclic quadrilaterals. iii. Determine the relationship between interior opposite angles of cyclic quadrilaterals. iv. Identify exterior angles and the corresponding interior opposite angles of cyclic quadrilaterals.		cyclic quadrilateral interior opposite angle exterior angle

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>		<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> v. Determine the relationship between exterior angles and the corresponding interior opposite angles of cyclic quadrilaterals. vi. Solve problems involving angles of cyclic quadrilaterals. vii. Solve problems involving circles. 		

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
4.1 Represent and interpret data in pie charts to solve problems.	<ul style="list-style-type: none"> • Use everyday examples from sources such as newspapers, magazines, reports and the Internet. • Use calculators and computer software in constructing pie charts. 	<ul style="list-style-type: none"> i. Obtain and interpret information from pie charts. ii. Construct pie charts to represent data. iii. Solve problems involving pie charts. iv. Determine suitable representation of data. 	<p>Relate the quantities of the data to the size of angles of the sectors.</p> <p>A complete pie chart should include:</p> <ul style="list-style-type: none"> i) The title ii) Appropriate labels for the groups of data. <p>Pie charts are mainly suitable for categorical data.</p> <p>Include pictograms, bar charts, line graphs and pie charts.</p> <p>Discuss that representation of data depends on the type of data.</p>	<ul style="list-style-type: none"> sector pie chart angle suitable representation construct size of sector quantity data size of angle label title pictograms bar chart pie chart

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<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
4.2 Understand and use the concepts of mode, median and mean to solve problems.	<ul style="list-style-type: none"> • Use sets of data from everyday situations to evaluate and to forecast. • Discuss appropriate measurement in different situations. • Use calculators to calculate the mean for large sets of data. • Discuss appropriate use of mode, median and mean in certain situations. 	<ol style="list-style-type: none"> i. Determine the mode of: <ol style="list-style-type: none"> a) sets of data. b) data given in frequency tables. ii. Determine the mode and the respective frequency from pictographs, bar charts, line graphs and pie charts. iii. Determine the median for sets of data. iv. Determine the median of data in frequency tables. v. Calculate the mean of: <ol style="list-style-type: none"> a) sets of data b) data in frequency tables vi. Solve problems involving mode, median and mean. 	<p>Involve data with more than one mode.</p> <p>Limit to cases with discrete data only.</p> <p>Emphasise that mode refers to the category or score and not to the frequency.</p> <p>Include change in the number and value of data.</p>	<p>data</p> <p>mode</p> <p>discrete</p> <p>frequency</p> <p>median</p> <p>arrange</p> <p>odd</p> <p>even</p> <p>middle</p> <p>frequency table</p> <p>mean</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
5.1 Understand the concepts of indices.	<ul style="list-style-type: none"> Explore indices using calculators and spreadsheets. 	<ol style="list-style-type: none"> Express repeated multiplication as a^n and vice versa. Find the value of a^n. Express numbers in index notation. 	<p>Begin with squares and cubes.</p> <p>'a' is a real number.</p> <p>Include algebraic terms.</p> <p>Emphasise base and index.</p> $\underbrace{a \times a \times \dots \times a}_n = a^n$ <p>n factors</p> <p>a is the base, n is the index.</p> <p>Involve fractions and decimals.</p> <p>Limit n to positive integers.</p>	<p>indices</p> <p>base</p> <p>index</p> <p>power of</p> <p>index notation</p> <p>index form</p> <p>express</p> <p>value</p> <p>real numbers</p> <p>repeated multiplication</p> <p>factor</p>

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<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
5.2 Perform computations involving multiplication of numbers in index notation.	<ul style="list-style-type: none"> Explore laws of indices using repeated multiplication and calculators. 	i. Verify $a^m \times a^n = a^{m+n}$ ii. Simplify multiplication of: <ol style="list-style-type: none"> numbers algebraic terms expressed in index notation with the same base. iii. Simplify multiplication of: <ol style="list-style-type: none"> numbers algebraic terms expressed in index notation with different bases. 	Limit algebraic terms to one unknown.	multiplication simplify base algebraic term verify index notation indices law of indices unknown
5.3 Perform computation involving division of numbers in index notation.		i. Verify $a^m \div a^n = a^{m-n}$ ii. Simplify division of: <ol style="list-style-type: none"> numbers algebraic terms expressed in index notation with the same base. 	Emphasise $a^0 = 1$.	

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>		<p><i>Students will be able to:</i></p>		
<p>5.4 Perform computations involving raising numbers and algebraic terms in index notation to a power.</p>		<p>i. Derive $(a^m)^n = a^{mn}$.</p> <p>ii. Simplify:</p> <p>a) numbers</p> <p>b) algebraic terms</p> <p>expressed in index notation raised to a power.</p> <p>iii. Simplify multiplication and division of:</p> <p>a) numbers</p> <p>b) algebraic terms</p> <p>expressed in index notation with different bases raised to a power.</p> <p>iv. Perform combined operations involving multiplication, division, and raised to a power on:</p> <p>a) numbers</p> <p>b) algebraic terms.</p>	<p>$(a^m)^n = a^{mn}$</p> <p>m and n are positive integers.</p> <p>Limit algebraic terms to one unknown.</p> <p>Emphasise:</p> $(a^m \times b^n)^p = a^{mp} \times b^{np}$ $\left(\frac{a^m}{b^n}\right)^p = \frac{a^{mp}}{b^{np}}$	<p>raised to a power base</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
5.5 Perform computations involving negative indices.	<ul style="list-style-type: none"> Explore using repeated multiplications and the law of indices. 	i. Verify $a^{-n} = \frac{1}{a^n}$. ii. State a^{-n} as $\frac{1}{a^n}$ and vice versa. iii. Perform combined operations of multiplication, division and raising to a power involving negative indices on: a) numbers b) algebraic terms.	n is a positive integer. Begin with $n = 1$.	verify
5.6 Perform computations involving fractional indices.		i. Verify $a^{\frac{1}{n}} = \sqrt[n]{a}$. ii. State $a^{\frac{1}{n}}$ as $\sqrt[n]{a}$ and vice versa.	a and n are positive integers. Begin with $n = 2$.	

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>		<p><i>Students will be able to:</i></p> <p>iii. Find the value of $a^{\frac{1}{n}}$.</p> <p>iv. State $a^{\frac{m}{n}}$ as:</p> <p>a) $(a^m)^{\frac{1}{n}}$ or $(a^{\frac{1}{n}})^m$</p> <p>b) $\sqrt[n]{a^m}$ or $(\sqrt[n]{a})^m$</p> <p>v. Perform combined operations of multiplication, division and raising to a power involving fractional indices on:</p> <p>a) numbers</p> <p>b) algebraic terms.</p> <p>vi. Find the value of $a^{\frac{m}{n}}$.</p>	<p>Limit to positive integral roots.</p>	

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
5.7 Perform computation involving laws of indices.		<ul style="list-style-type: none"> i. Perform multiplication, division, raised to a power or combination of these operations on several numbers expressed in index notation. ii. Perform combined operations of multiplication, division and raised to a power involving positive, negative and fractional indices. 		

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
6.1 Understand and use the concept of expanding brackets.	<ul style="list-style-type: none"> • Relate to concrete examples. • Explore using computer software. 	<ol style="list-style-type: none"> Expand single brackets. Expand two brackets. 	<p>Begin with linear algebraic terms.</p> <p>Limit to linear expressions.</p> <p>Emphasise:</p> $(a \pm b)(a \pm b) = (a \pm b)^2$ <p>Include:</p> $(a + b)(a + b)$ $(a - b)(a - b)$ $(a + b)(a - b)$ $(a - b)(a + b)$	<p>linear algebraic terms</p> <p>like terms</p> <p>unlike terms</p> <p>expansion</p> <p>expand</p> <p>single brackets</p> <p>two brackets</p> <p>multiply</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
6.2 Understand and use the concept of factorisation of algebraic expressions to solve problems.	<ul style="list-style-type: none"> Explore using concrete materials and computer software. 	<ol style="list-style-type: none"> State factors of an algebraic term. State common factors and the HCF for several algebraic terms. Factorise algebraic expressions: <ol style="list-style-type: none"> using common factor the difference of two squares. 	<p>Emphasise the relationship between expansion and factorisation.</p> <p>Note that “1” is a factor for all algebraic terms.</p> <p>The difference of two squares means:</p> $a^2 - b^2$ $= (a \pm b)(a \mp b).$ <p>Limit to four algebraic terms.</p> $ab - ac = a(b - c)$ $e^2 - f^2 = (e + f)(e - f)$ $x^2 + 2xy + y^2 = (x + y)^2$ <p>limit answers to</p> $(ax + by)^2$ $ab + ac + bd + cd$ $= (b + c)(a + d)$	<p>factorisation</p> <p>square</p> <p>common factor</p> <p>term</p> <p>highest common factor (HCF)</p> <p>difference of two squares</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>	<ul style="list-style-type: none"> Explore using computer software. 	<p><i>Students will be able to:</i></p> <p>iv. Factorise and simplify algebraic fractions.</p>	<p>Begin with one-term expressions for the numerator and denominator.</p> <p>Limit to factorisation involving common factors and difference of two squares.</p>	<p>numerator denominator algebraic fraction factorisation</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
6.3 Perform addition and subtraction on algebraic fractions.	<ul style="list-style-type: none"> • Explore using computer software. • Relate to real-life situations. 	<ul style="list-style-type: none"> i. Add or subtract two algebraic fractions with the same denominator. ii. Add or subtract two algebraic fractions with one denominator as a multiple of the other denominator. iii. Add or subtract two algebraic fractions with denominators: <ul style="list-style-type: none"> a) without any common factor b) with a common factor. 	<p>The concept of LCM may be used.</p> <p>Limit denominators to one algebraic term.</p>	<p>common factor</p> <p>lowest common multiple (LCM)</p> <p>multiple denominator</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
6.4 Perform multiplication and division on algebraic fractions.	<ul style="list-style-type: none"> Explore using computer software. 	<ul style="list-style-type: none"> i. Multiply two algebraic fractions involving denominator with: <ul style="list-style-type: none"> a) one term b) two terms. ii. Divide two algebraic fractions involving denominator with: <ul style="list-style-type: none"> a) one term b) two terms iii. Perform multiplication and division of two algebraic fractions using factorisation involving common factors and the different of two squares. 	Begin multiplication and division without simplification followed by multiplication and division with simplification.	simplification

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
7.1 Understand the concepts of variables and constants.	<ul style="list-style-type: none"> Use examples of everyday situations to explain variables and constants. 	<ol style="list-style-type: none"> Determine if a quantity in a given situation is a variable or a constant. Determine the variable in a given situation and represent it with a letter symbol. Determine the possible values of a variable in a given situation. 	Variables include integers, fractions and decimals.	quantity variable constant possible value formula value letter symbol formulae

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
7.2 Understand the concepts of formulae to solve problems.		<ul style="list-style-type: none"> i. Write a formula based on a given: <ul style="list-style-type: none"> a) statement b) situation. ii. Identify the subject of a given formula. iii. Express a specified variable as the subject of a formula involving: <ul style="list-style-type: none"> a) one of the basic operations: +, −, ×, ÷ b) powers or roots c) combination of the basic operations and powers or roots. iv. Find the value of a variable when it is: <ul style="list-style-type: none"> a) the subject of the formula b) not the subject of the formula. v. Solve problems involving formulae. 	<p>Symbols representing a quantity in a formula must be clearly stated.</p> <p>Involve scientific formulae.</p>	<ul style="list-style-type: none"> subject of a formula statement power roots formulae

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
8.1 Understand and use the concepts of volumes of right prisms and right circular cylinders to solve problems.	<ul style="list-style-type: none"> • Use concrete models to derive the formulae. • Relate the volume of right prisms to right circular cylinders. 	<ol style="list-style-type: none"> i. Derive the formula for volume of: <ol style="list-style-type: none"> a) prisms b) cylinders. ii. Calculate the volume of a right prism in cubic units given the height and: <ol style="list-style-type: none"> a) the area of the base b) dimensions of the base. iii. Calculate the height of a prism given the volume and the area of the base. iv. Calculate the area of the base of a prism given the volume and the height. 	<p>Prisms and cylinders refer to right prisms and right circular cylinders respectively.</p> <p>Limit the bases to shapes of triangles and quadrilaterals.</p>	<p>derive prism cylinder right circular cylinder circular base radius volume area cubic units square rectangle triangle dimension height</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>		<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> v. Calculate the volume of a cylinder in cubic units given: <ul style="list-style-type: none"> a) area of the base and the height. b) radius of the base and the height of the cylinder. vi. Calculate the height of a cylinder, given the volume and the radius of the base. vii. Calculate the radius of the base of a cylinder given the volume and the height. viii. Convert volume in one metric unit to another: <ul style="list-style-type: none"> a) mm^3, cm^3 and m^3 b) cm^3, ml and l. 		<ul style="list-style-type: none"> cubic metre cubic centimetre cubic millimetre millilitre litre convert metric unit

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>		<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> ix. Calculate volume of liquid in a container. x. Solve problems involving volumes of prisms and cylinders. 	<p>Limit the shape of containers to right circular cylinders and right prisms.</p>	<p>liquid container</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
8.2 Understand and use the concept of volumes of right pyramids and right circular cones to solve problems.	<ul style="list-style-type: none"> • Use concrete models to derive the formula. • Relate volumes of pyramids to prisms and volumes of cones to cylinders. 	<ol style="list-style-type: none"> Derive the formula for the volume of: <ol style="list-style-type: none"> pyramids cones. Calculate the volume of pyramids in mm^3, cm^3 and m^3, given the height and: <ol style="list-style-type: none"> area of the base dimensions of base. Calculate the height of a pyramid given the volume and the dimension of the base. Calculate the area of the base of a pyramid given the volume and the height. 	Include bases of different types of polygons.	pyramid cone volume base height dimension

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>		<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> v. Calculate the volume of a cone in mm^3, cm^3 and m^3, given the height and radius of the base. vi. Calculate the height of a cone, given the volume and the radius of the base. vii. Calculate the radius of the base of a cone given the volume and the height. viii. Solve problems involving volumes of pyramids and cones. 		<p>height dimension</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
8.3 Understand and use the concept of volumes of sphere to solve problems.		i. Calculate the volume of a sphere given the radius of the sphere. ii. Calculate the radius of a sphere given the volume of the sphere. iii. Solve problems involving volumes of spheres.	Include hemisphere	sphere hemisphere solid composite solid combination volume radius
8.4 Apply the concept of volumes to solve problems involving composite solids.	<ul style="list-style-type: none"> • Use concrete models to form composite solids. • Use examples from real-life situations. 	i. Calculate the volume of a composite solid. ii. Solve problems involving volumes of composite solids.	Composite solids are combinations of geometric solids.	

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
9.1 Understand the concepts of scale drawings.	<ul style="list-style-type: none"> Explore scale drawings using dynamic geometry software, grid papers, geo-boards or graph papers. 	<p>i. Sketch shapes:</p> <ol style="list-style-type: none"> of the same size as the object smaller than the object larger than the object using grid papers. <p>ii. Draw geometric shapes according to scale $1 : n$, where $n = 1, 2, 3, 4, 5$, $\frac{1}{2}, \frac{1}{10}$.</p> <p>iii. Draw composite shapes, according to a given scale using:</p> <ol style="list-style-type: none"> grid papers blank papers. 	<p>Limit objects to two-dimensional geometric shapes.</p> <p>Emphasise on the accuracy of the drawings.</p> <p>Include grids of different sizes.</p>	<p>sketch draw objects grid paper geo-boards software scale geometrical shapes composite shapes smaller larger accurate size</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>	<ul style="list-style-type: none"> • Relate to maps, graphics and architectural drawings. 	<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> iv. Redraw shapes on grids of different sizes. v. Solve problems involving scale drawings. 	<p>Emphasise that grids should be drawn on the original shapes.</p>	<p>redraw</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
10.1 Understand and use the concepts of similarity.	<ul style="list-style-type: none"> Involve examples from everyday situations. 	<ol style="list-style-type: none"> Identify if given shapes are similar. Calculate the lengths of unknown sides of two similar shapes. 	Emphasise that for a triangle, if the corresponding angles are equal, then the corresponding sides are proportional.	shape similar side angle proportion centre of enlargement transformation
10.2 Understand and use the concepts of enlargement.	<ul style="list-style-type: none"> Explore the concepts of enlargement using grid papers, concrete materials, drawings, geo-boards and dynamic geometry software. Relate enlargement to similarity of shapes. 	<ol style="list-style-type: none"> Identify an enlargement. Find the scale factor, given the object and its image of an enlargement when: <ol style="list-style-type: none"> scale factor > 0 scale factor < 0. Determine the centre of enlargement, given the object and its image. 	Emphasise the case of reduction. Emphasise the case when scale factor = ± 1	enlargement scale factor object image invariant reduction size orientation similarity

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>		<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> iv. Determine the image of an object given the centre of enlargement and the scale factor. v. Determine the properties of enlargement. vi. Calculate the: <ul style="list-style-type: none"> a) scale factor b) the lengths of sides of the image c) the lengths of sides of the object of an enlargement. 	<p>Emphasise the method of construction.</p>	<p>properties</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>	<ul style="list-style-type: none"> Use grid papers and dynamic geometry software to explore the relationship between the area of the image and its object. 	<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> vii. Determine the relationship between the area of the image and its object. viii. Calculate the: <ul style="list-style-type: none"> a) area of image b) area of object c) scale factor of an enlargement. ix. Solve problems involving enlargement. 	<p>Include negative scale factors.</p>	<p>area</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
11.1 Understand and use the concepts of linear equations in two variables.	<ul style="list-style-type: none"> Derive linear equations in two variables relating to real-life situations. Explore using graphic calculators, dynamic geometry software and spreadsheets to solve linear equations and simultaneous linear equations. 	<ol style="list-style-type: none"> Determine if an equation is a linear equation in two variables. Write linear equations in two variables from given information. Determine the value of a variable given the other variables. Determine the possible solutions for a linear equation in two variables. 		equation variable linear equation value possible solution

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p> <p>11.2 Understand and use the concepts of two simultaneous linear equations in two variables to solve problems.</p>	<ul style="list-style-type: none"> • Use trial and improvement method. • Use examples from real-life situations. 	<p><i>Students will be able to:</i></p> <ol style="list-style-type: none"> Determine if two given equations are simultaneous linear equations. Solve two simultaneous linear equations in two variables by <ol style="list-style-type: none"> substitution elimination Solve problems involving two simultaneous linear equations in two variables. 	<p>Include letter symbols other than x and y to represent variables.</p>	<p>linear equation variable simultaneous linear equation solution substitution elimination</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
12.1 Understand and use the concepts of inequalities.	<ul style="list-style-type: none"> Use everyday situations to illustrate the symbols and the use of “>”, “<”, “≥” and “≤”. 	<ol style="list-style-type: none"> Identify the relationship: <ol style="list-style-type: none"> greater than less than based on given situations. Write the relationship between two given numbers using the symbol “>” or “<”. Identify the relationship: <ol style="list-style-type: none"> greater than or equal to less than or equal to based on given situations. 	<p>Emphasise that $a > b$ is equivalent to $b < a$.</p> <p>“>” read as “greater than”.</p> <p>“<” read as “less than”.</p> <p>“≥” read as “greater than or equal to”.</p> <p>“≤” read as “less than or equal to”.</p>	<p>inequality</p> <p>greater</p> <p>less</p> <p>greater than</p> <p>less than</p> <p>equal to</p> <p>include</p> <p>equivalent</p> <p>solution</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
12.2 Understand and use the concepts of linear inequalities in one unknown.		i. Determine if a given relationship is a linear inequality. ii. Determine the possible solutions for a given linear inequality in one unknown: a) $x > h$; b) $x < h$; c) $x \geq h$; d) $x \leq h$. iii. Represent a linear inequality: a) $x > h$; b) $x < h$; c) $x \geq h$; d) $x \leq h$. on a number line and vice versa.	h is a constant, x is an integer.	relationship linear unknown number line

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
	<ul style="list-style-type: none"> Involve examples from everyday situations. 	iv. Construct linear inequalities using symbols: <ol style="list-style-type: none"> " > " or " < " " ≥ " or " ≤ " from given information.		
12.3 Perform computations involving addition, subtraction, multiplication and division on linear inequalities.		i. State a new inequality for a given inequality when a number is: <ol style="list-style-type: none"> added to subtracted from both sides of the inequalities. ii. State a new inequality for a given inequality when both sides of the inequality are: <ol style="list-style-type: none"> multiplied by a number divided by a number. 	Emphasise that the condition of inequality is unchanged. Emphasise that when we multiply or divide both sides of an inequality by the same negative number, the inequality is reversed.	add addition subtract subtraction multiply multiplication divide division

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>		<p><i>Students will be able to:</i></p> <p>iii. Construct inequalities</p> <p>a) $x + k > m + k$</p> <p>b) $x - k > m - k$</p> <p>c) $kx > km$</p> <p>d) $\frac{x}{k} > \frac{m}{k}$</p> <p>from given information.</p>	<p>Information given from real-life situations.</p> <p>Include also $<$, \geq and \leq.</p>	<p>relation</p> <p>equivalent</p> <p>adding</p> <p>subtracting</p> <p>simplest</p> <p>collect</p> <p>isolate</p> <p>solve</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
12.4 Perform computations to solve inequalities in one variable.	<ul style="list-style-type: none"> Explore using dynamic geometry software and graphic calculators. 	<ol style="list-style-type: none"> i. Solve a linear inequality by: <ol style="list-style-type: none"> a) adding a number b) subtracting a number on both sides of the inequality. ii. Solve a linear inequality by <ol style="list-style-type: none"> a) multiplying a number b) dividing a number on both sides of the inequality. iii. Solve linear inequalities in one variable using a combination of operations. 	Emphasise that for a solution, the variable is written on the left side of the inequalities.	add subtract multiply divide

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
12.5 Understand the concepts of simultaneous linear inequalities in one variable.		i. Represent the common values of two simultaneous linear inequalities on a number line. ii. Determine the equivalent inequalities for two given linear inequalities. iii. Solve two simultaneous linear inequalities.	Emphasise the meaning of inequalities such as: i. $a < x < b$ ii. $a \leq x \leq b$ iii. $a \leq x < b$ iv. $a < x \leq b$ Emphasise that forms such as: i. $a > x < b$ ii. $a < x \geq b$ iii. $a < x > b$ are not accepted.	determine common value simultaneous combining linear inequality number line equivalent

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
13.1 Understand and use the concepts of functions.	<ul style="list-style-type: none"> Explore using “function machines”. 	<ol style="list-style-type: none"> State the relationship between two variables based on given information. Identify the dependent and independent variables in a given relationship involving two variables. Calculate the value of the dependent variable, given the value of the independent variable. 	Involve functions such as: <ol style="list-style-type: none"> $y = 2x + 3$ $p = 3q^2 + 4q - 5$ $A = B^3$ $W = \frac{1}{Z}$ 	function relationship variable dependent variable independent variable ordered pairs

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
13.2 Draw and use graphs of functions.		i. Construct tables of values for given functions. ii. Draw graphs of functions using given scale. iii. Determine from a graph the value of y , given the value of x and vice versa. iv. Solve problems involving graphs of functions.	Limit to linear, quadratic and cubic functions. Include cases when scales are not given.	coordinate plane table of values origin graph x -coordinate y -coordinate x -axis y -axis scale

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
14.1 Understand the concepts of rates and perform computations involving rate.	<ul style="list-style-type: none"> Use real-life situations that involve rate. 	<ol style="list-style-type: none"> Determine the rate involved in given situations and identify the two quantities involved. Calculate the rate given two different quantities. Calculate a certain quantity given the rate and the other quantity. Convert rates from one unit of measurement to another. Solve problems involving rate. 	Emphasise the units in the calculation.	rate quantity unit of measurement

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
14.2 Understand and use the concept of speed.	<ul style="list-style-type: none"> Use examples from everyday situations. 	<ol style="list-style-type: none"> Identify the two quantities involved in speed. Calculate and interpret speed. Calculate: <ol style="list-style-type: none"> the distance, given the speed and the time the time, given the speed and the distance. Convert speed from one unit of measurement to another. Differentiate between uniform speed and non-uniform speed. 	<p>Moral values related to traffic rules should be incorporated.</p> <p>Include the use of graphs.</p>	<p>speed distance time uniform non-uniform differentiate</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
14.3 Understand and use the concepts of average speed.	<ul style="list-style-type: none"> • Use examples from daily situations. • Discuss the difference between average speed and mean speed. 	<ul style="list-style-type: none"> i. Calculate the average speed in various situations. ii. Calculate: <ul style="list-style-type: none"> a) the distance, given the average speed and the time. b) the time, given the average speed and the distance. iii. Solve problems involving speed and average speed. 		average speed distance time acceleration retardation
14.4 Understand and use the concepts of acceleration.		<ul style="list-style-type: none"> i. Identify the two quantities involved in acceleration. ii. Calculate and interpret acceleration. 	Include cases of retardation. Retardation is also known deceleration.	

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
15.1 Understand and use tangent of an acute angle in a right-angled triangle.	<ul style="list-style-type: none"> • Use right-angled triangles with real measurements and develop through activities. • Discuss the ratio of the opposite side to the adjacent side when the angle approaches 90°. • Explore tangent of a given angle when: <ol style="list-style-type: none"> a) The size of the triangle varies proportionally. b) The size of angle varies. 	<ol style="list-style-type: none"> i. Identify the: <ol style="list-style-type: none"> a) hypotenuse b) the opposite side and the adjacent side with respect to one of the acute angles. ii. Determine the tangent of an angle. iii. Calculate the tangent of an angle given the lengths of sides of the triangle. iv. Calculate the lengths of sides of a triangle given the value of tangent and the length of another side. 	<p>Use only right-angled triangle.</p> <p>Tangent θ can be written as $\tan \theta$.</p> <p>Emphasise that tangent is a ratio.</p> <p>Limit to opposite and adjacent sides.</p> <p>Include cases that require the use of Pythagoras' Theorem.</p>	<p>right-angled triangle</p> <p>angle</p> <p>hypotenuse</p> <p>opposite side</p> <p>adjacent side</p> <p>ratio</p> <p>tangent</p> <p>value</p> <p>length</p> <p>size</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<i>Students will be taught to:</i>		<i>Students will be able to:</i>		
15.2 Understand and use sine of an acute angle in a right-angled triangle.	<ul style="list-style-type: none"> Explore sine of a given angle when: <ol style="list-style-type: none"> The size of the triangle varies proportionally. The size of the angle varies. 	<ol style="list-style-type: none"> Determine the sine of an angle. Calculate the sine of an angle given the lengths of sides of the triangle. Calculate the lengths of sides of a triangle given the value of sine and the length of another side. 	<p>Sine θ can be written as $\sin \theta$.</p> <p>Include cases that require the use of Pythagoras' Theorem.</p>	ratio right-angled triangle length value hypotenuse opposite side size
15.3 Understand and use cosine of an acute angle in a right-angled triangle.	<ul style="list-style-type: none"> Explore cosine of a given angle when: <ol style="list-style-type: none"> The size of the triangle varies proportionally. The size of the angle varies. 	<ol style="list-style-type: none"> Determine the cosine of an angle. Calculate the cosine of an angle given the lengths of sides of the triangle. Calculate the lengths of sides of a triangle given the value of cosine and the length of another side. 	<p>Cosine θ can be written as $\cos \theta$.</p> <p>Include cases that require the use of Pythagoras' Theorem.</p>	constant increase proportion

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p> <p>15.4 Use the values of tangent, sine and cosine to solve problems.</p>		<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> i. Calculate the values of other trigonometric ratios given the value of a trigonometric ratio. ii. Convert the measurement of angles from: <ul style="list-style-type: none"> a) degrees to degrees and minutes. b) degrees and minutes to degrees. iii. Find the value of: <ul style="list-style-type: none"> a) tangent b) sine c) cosine of 30°, 45° and 60° without using scientific calculator. iv. Find the value of: <ul style="list-style-type: none"> a) tangent b) sine c) cosine using scientific calculator. 	<p>Include angles expressed in:</p> <ul style="list-style-type: none"> i) degrees ii) degrees and minutes 	<p>degree minute tangent sine cosine</p>

LEARNING OBJECTIVES	SUGGESTED TEACHING AND LEARNING ACTIVITIES	LEARNING OUTCOMES	POINTS TO NOTE	VOCABULARY
<p><i>Students will be taught to:</i></p>		<p><i>Students will be able to:</i></p> <ul style="list-style-type: none"> v. Find the angles given the values of: <ul style="list-style-type: none"> a) tangent b) sine c) cosine using scientific calculators. vi. Solve problems involving trigonometric ratios. 		<ul style="list-style-type: none"> angle degree minute tangent sine cosine

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