

STANDARDS FOR SECONDARY EDUCATION

MATHEMATICS

Quality Assurance and Development Services
Ministry of Education, Youth and Sports 2004



MATHEMATICS

Content Standard No. 1

Understand thoroughly the classification of the real number system, number base system, number patterns, and use related concepts to solve problems.

Learning Outcomes

First Form

- 1.1 Identify the set of natural numbers, whole numbers, integers.
- 1.2 Summarize the classification of rational numbers, irrational numbers, and describe the union of rational and irrational numbers.
- 1.3 Distinguish between even and odd numbers.
- 1.4 Describe positive integers as being prime or composite numbers.
- 1.5 State the place value of a digit in a numeral in any base.
- 1.6 Convert base ten numbers to other bases, and convert other base numbers to base ten.
- 1.7 Determine the sequence of numbers that has a recognizable pattern.
- 1.8 Apply the concept of real numbers, base numbers, and sequence to solve problems.

Content Standard No. 2

Understand the concept of factors, prime factors, multiples, numbers as a product of factors, H.C.F., L.C.M. and solve problems involving these concepts.

Learning Outcomes

First Form

- 2.1 List the set of factors, common factors, multiples, and common multiples for a given positive integer.
- 2.2 List the set of prime factors of a given number; express a number as a product of its prime factors and in index form.
- 2.3 Compute the H.C.F. and L.C.M. for two or more positive integers.
- 2.4 Solve word problems involving factors, multiples, H.C.F. and L.C.M.

Content Standard No. 3

Apply the various number properties and laws used when simplifying expressions.

Learning Outcomes

First Form

- 3.1 Define and use the identity property for the addition and for the multiplication of numbers.
- 3.2 Find the inverse of a number under addition and under multiplication.
- 3.3 State whether a set of numbers is closed under an operation.
- 3.4 Apply the commutative, associative, and distributive laws for addition and multiplication of numbers.

Content Standard No. 4

Understand the concept of set language, represent a set and its members graphically, and use sets to solve problems when numerical information is given for the universal set and its subsets.

Learning Outcomes

First Form

- 4.1 Describe a well defined set, use set notation to describe mathematical statements, list elements of set, and give using set-builder notation.
- 4.2 Differentiate between finite and infinite sets.
- 4.3 Identify an empty set.
- 4.4 Differentiate between sets which are equivalent and sets which are equal.

Second Form

- 4.5 Identify and construct subsets of a given set, and calculate the number of subsets of a set of n-elements.
- 4.6 Describe the universal set for a given set of data, and find the complement of a given set, given the universal set.
- 4.7 Determine and count the elements in the union and intersection of sets.
- 4.8 Describe the disjoint set
- 4.9 Construct and use Venn diagrams to represent complement of sets, the intersection of two sets, and the union of two sets.
- 4.10 Construct and use Venn diagrams to represent subsets of sets.
- 4.11 Illustrate a disjoint set on a Venn diagram.
- 4.12 Solve problems involving the use of Venn diagrams.

Content Standard No. 5

Construct Venn diagrams and use to find the number of elements in certain subsets, to interpret statements, and to make valid and logical conclusions.

Learning Outcomes

Third Form

- 5.1 Construct and use Venn diagrams with not more than three subsets to represent the complement of a set, the intersection of two sets, the union of two sets, and the subsets to represent subsets of sets.
- 5.2 Illustrate a disjoint set on a Venn diagram with not more than three subsets.
- 5.3 Solve problems involving the use of Venn diagrams.
- 5.4 Use Venn diagrams to solve problems and to illustrate situations involving conclusions made from statements.

Content Standard No. 6

Perform computations using the order of arithmetic operations involving whole numbers, fractions, mixed numbers, and decimals; and understand the concept of percentage, convert fractions to decimals and percentages and vice-versa and use to solve word problems.

Learning Outcomes

First Form

- 6.1 Define and calculate the value of defined and undefined arithmetic operations.
- 6.2 Perform basic and mixed operations involving whole numbers, common fractions with like and unlike denominators, improper fractions and mixed numbers using the order of arithmetic operation.
- 6.3 Calculate any fraction of a given quantity and express one quantity as a fraction of another.
- 6.4 Perform basic and mixed arithmetic operations involving decimals.
- 6.5 Calculate any percentage of a given quantity and express one quantity as a percentage of another.
- 6.6 Convert fractions to decimal, fractions to percentages, percentages to decimals and vice versa.
- 6.7 Solve word problems involving fractions, decimals and percentages.

Content Standard No. 7

Compute arithmetic mean from raw data, compare two or more similar quantities, and find how quantities change by the inverse ratio of another quantity.

Learning Outcomes

First Form

- 7.1 Calculate the average or the arithmetic mean of a set of quantities.
- 7.2 Evaluate the ratio of two or more similar quantities.
- 7.3 Connect quantities of different kinds in the form of a rate.
- 7.4 Calculate direct and indirect proportion.

Content Standard No. 8

Understand the concepts of rounding off numbers, reciprocal, squares, square root of a number, representation of rational numbers in scientific notation or standard form, emphasize their importance in everyday life and use to solve problems.

Learning Outcomes

First Form

- 8.1 Approximate a given value to the nearest whole number, correct to the nearest multiple of ten, and correct to any decimal place
- 8.2 Approximate recurring decimals

Second Form

- 8.3 Approximate a given value correct to any significant figures, and use estimates as a guide to calculate an approximate value.
- 8.4 Find the reciprocal of a number, the square of a number using calculators and three-figure mathematical tables.
- 8.5 Find the square root of a number by using prime factors, calculators and three-figure mathematical tables.
- 8.6 Express small and large numbers in standard form.
- 8.7 Add, subtract, multiply, and divide and perform mixed operations in standard form.
- 8.8 Solve word problems involving approximations, estimations, and numbers in standard form.

Content Standard No. 9

Understand the structure of the metric system, convert within their sub-units and recognize that all measurements are approximate, that the accuracy of a measurement is dependent on both the measuring instrument and the measurer, and use maps and scale drawings.

Learning Outcomes

First Form

- 9.1 Recall and identify the basic unit of length.
- 9.2 Identify common units of length, their multiples and sub-multiples of the base unit, and convert units of length within the metric system.
- 9.3 Recall and identify the basic units of mass, time, temperature, and speed and their multiples and sub-multiples of the base unit.
- 9.4 Convert units of mass within the metric system.
- 9.5 Understand time using the 12 hour clock and the 24 hour clock systems, and convert units of time from the 12-hour clock to the 24-hour clock and vice versa.

- 9.6 Distinguish between Celsius and Fahrenheit temperature scales and convert temperature from one scale to another and vice versa.
- 9.7 Define speed and find its derivatives within the metric system.

Second Form

- 9.8 Make suitable measurements on maps and use them to determine distances and areas.
- 9.9 Make suitable measurements on scale drawings and use them to determine distances and areas

Content Standard No. 10

Understand the concept of perimeter, area, volume and surface area, and use the concept to solve problems involving polygons, circles, prisms, complex, and compound figures.

Learning Outcomes

First Form

- 10.1 Calculate the perimeter and area enclosed by a triangle, square, rectangle, circle, kite, rhombus, parallelogram, and trapezium.
- 10.2 Solve word problems involving perimeter and area of polygons and circles.

Second Form

- 10.3 Calculate the volume and surface area of a cube, cuboid, and cylinder.
- 10.4 Calculate the perimeter and area of complex and compound figures.
- 10.5 Solve word problems involving volume and surface area of right prisms.

Third Form

- 10.6 Calculate the volume and surface area of pyramids and spheres, and solve word problems
- 10.7 Calculate the volume of a triangular prism, square based pyramid, a rectangular based pyramid, a cone, and a sphere.
- 10.8 Solve word problems involving volume of right pyramids and spheres.

Content Standard No. 11

Determine the area of sectors, segments, and arc length, and use to solve word problems.

Learning Outcomes

Third Form

- 11.1 Find radius and diameter of a circle and determine the length of a chord.
- 11.2 Calculate the areas of sectors of circles using angles at the center whose measure are factors of 360° (for e.g. 15° , 45° , 60°).
- 11.3 Calculate the areas of minor or major segments.
- 11.4 Calculate the length of an arc of a circle using angles at the center whose measure are factors of 360° (for e.g. 15° , 45° , 60°).
- 11.5 Solve word problems involving length of an arc, area of a sector, and area of segments.

Content Standard No. 12

Find ratio of areas and ratio of the volume of similar shapes

Learning Outcomes

Third Form

- 12.1 Find the ratio of the areas of two similar shapes.

12.2 Find the ratio of the volume of two similar solids.

Content Standard No. 13

Understand the concept of a point, line segments, lines, rays, angle,s and properties of polygons and circles, and use to solve problems.

Learning Outcomes

First Form

- 13.1 Define a point, a line segment, a line, a ray, and parallel and perpendicular lines.
- 13.2 Draw, measure, and identify right angles, straight angles, acute angles, obtuse, angles and reflex angles, and find the complement and supplement of an angle.
- 13.3 List the elements of a triangle and state the properties of a scalene triangle, an isosceles triangle, an equilateral triangle, an acute-angled triangle, an obtuse-angled triangle, and a right-angled triangle.

Second Form

- 13.4 State properties of similar triangles and state the four sets of conditions for congruency of two triangles.
- 13.5 Solve word problems involving similar and congruent triangles.
- 13.6 List the elements of a quadrilateral and state the properties of a rectangle, square, trapezium, kite, parallelogram, rhombus, convex, and re-entrant polygons.
- 13.7 Define the circumference, radius, and diameter of a circle.

Third Form

- 13.8 Define the chord, a segment, a semi-circle, and the sector of a circle.

Content Standard No. 14

Define and describe different types of solids and use to solve problems.

Learning Outcomes

Second Form

- 14.1 State properties of a cube, cuboids, a triangular prism, a sphere, a square-based pyramid, a cylinder, a rectangular-based pyramid, a tetrahedron, and a cone.
- 14.2 Solve problems involving solids.
- 14.3 Calculate the volume and capacity of the region enclosed by a combination of basic solids.

Content Standard No. 15

Describe the geometrical transformation for which the position and/or dimensions of a shape are changed, and describe the relation between any point (or object point or pre-image point) and its image point under any of the transformations.

Learning Outcomes

Third Form

- 15.1 Identify and demonstrate that a plane shape has translational symmetry when it moves along a straight line.
- 15.2 Identify and demonstrate a line of symmetry, point symmetry and mirror symmetry.
- 15.3 State the relationships between an object and its image in a plane when it is translated, reflected and rotated in the plane.

- 15.4 State the relationships between an object and its image in a plane under a given enlargement in that plane.
- 15.5 Locate the image of an object under any transformation or combined transformation, and identify the transformation/s given an object and its image.

Content Standard No. 16

Use instruments and construct angles, not limited to ruler and protractor only, to perform geometrical constructions, and identify angles produced by intersecting lines to solve problems

Learning Outcomes

First Form

- 16.1 Use ruler and compass to construct, measure, and bisect angles, line segments, parallel and perpendicular lines.

Second Form

- 16.2 Use ruler and compass to construct a triangle given the three sides, given two angles and one side, given two sides and the angle between them.

Third Form

- 16.3 Use ruler and compass to construct rectangles, squares, parallelograms, a rhombus and a kite.
- 16.4 Identify adjacent angles with a common vertex and that lie on opposite sides of common a arm.
- 16.5 Use intersecting lines and perpendicular lines to identify vertically opposite angles, alternate angles, corresponding angles, and interior and exterior angles.
- 16.6 Solve word problems involving intersecting lines.

Content Standard No. 17

Understand the concept of Pythagoras' theorem and its derivatives as a fundamental and very important theorem in mathematics, and use it to solve triangles.

Learning Outcomes

Second Form

- 17.1 Use Pythagoras' Theorem to solve simple problems.
- 17.2 Recognize a Pythagorean triple.

Third Form

- 17.3 Determine the tangent, sine, and cosine ratio of acute angles in right-angled triangles.
- 17.4 Calculate the angle of elevation and the angle of depression.
- 17.5 Solve word problems involving triangles

Content Standard No. 18

Solve geometrical problems involving the properties of triangles, quadrilaterals, and the angle properties of polygons and circles

Learning Outcomes

Second Form

- 18.1 Use the following theorems
- (a) the sum interior angles in a triangle is 180°
 - (b) exterior angle of a triangle is equal to the sum of the opposite interior angles
 - (c) two sides of an isosceles triangle are equal (an equilateral triangle is a special isosceles)

- (d) the sum of four interior angles of a quadrilateral is equal to 360^0 or four right angles
- (e) the sum of four exterior angles of a quadrilateral is equal to 360^0 or four right angles
- (f) the opposite sides of a quadrilateral are equal; the opposite angles are equal; and the diagonals bisect each other.

Third Form

- (g) the sum of interior angles of an n -sided convex polygon is $(2n - 4)$ right angles or $90^0(2n - 4)$ or $180^0(n - 2)$
- (h) the sum of exterior angles of an n -sided polygon is four right angles or 360^0 .
- (i) the angle which an arc of a circle subtends at the center is twice that which it subtends at any point on the remaining part of the circumference
- (j) angles in the same segment of a circle are equal
- (k) angles in a semi-circle are right angled
- (l) opposite angles of a cyclic quadrilateral are supplementary
- (m) the exterior angle of a cyclic quadrilateral is equal to the interior opposite angle
- (n) the tangent of a circle is perpendicular to the radius of that circle at the point of contact
- (o) the tangents to a circle from an external point are equal

18.2 Solve word problems involving properties of polygons and circles,

Content Standard No. 19

Determine the gradient on straight lines, and the mid-point and the length of lines when the coordinates of any two points are given.

Learning Outcomes

Third Form

- 19.1 Solve problems involving the gradient of lines.
- 19.2 Given the coordinates of two points, determine the coordinates of the mid-point of the line segment.
- 19.3 Given the coordinates of two points, determine the length of the line segment joining them.

Content Standard No. 20

Find the position of an object relative to another, give accurate ideas of shapes and dimensions of solids, and find distances between points on the earth's surface and determine their positions.

Learning Outcomes

Fourth Form

- 20.1 Find bearing and distances.
- 20.2 Use the properties of the faces, edges, and vertices of simple solids to draw two dimensional representations.
- 20.3 Calculate the distance between two points on the earth, measured along parallels of latitude or meridians of longitude.
- 20.4 Determine the latitude and longitude of a point on the earth's surface given its distance from another point on the same parallel of latitude or on the same meridian of longitude.

Content Standard No. 21

Understand the processes of reasoning with algebraic entities to generalize and represent in symbolic form, and perform arithmetic operations involving algebraic terms, algebraic expressions, and algebraic fractions.

Learning Outcomes

First Form

- 21.1 Define algebra and the importance of algebra.
- 21.2 Use symbols to represent an algebraic statement.
- 21.3 Identify a term, the coefficient of a term, and an algebraic expression
- 21.4 Perform basic and combined arithmetic operations with algebraic terms.
- 21.5 Apply the distributive law to insert and remove brackets.
- 21.6 Substitute numbers for algebraic symbols in simple algebraic expressions

Content Standard No. 22

Perform operations involving directed numbers, algebraic fractions, and simplify fractions that need the process of factorization.

Learning Outcomes

First Form

- 22.1 Represent numbers on a real number line.
- 22.2 Define directed numbers and the absolute value of numbers.
- 22.3 Find the additive inverse of a positive and negative number.
- 22.4 Perform addition, subtraction, multiplication and division with directed numbers.

Second Form

- 22.5 Perform arithmetic operations involving algebraic fractions with like and unlike terms, and fractions with brackets.
- 22.6 Find the equivalent of any algebraic fraction by using the basic operations of multiplication and division.

Third Form

- 22.7 Perform multiplication and division of algebraic fraction by canceling common factors or by factorizing the denominator or numerator or both the numerator and the denominator.
- 22.8 Add and subtract algebraic fractions by factorizing the denominator, by finding the L.C.M. of the denominators expressing the fractions with common denominators, or by adding terms in the numerators as necessary.
- 22.9 Find the value of the unknown for which the fractions and expressions are not defined.

Content Standard No. 23

Understand the concept of factorization and the methods of factorization, and use to solve problems.

Learning Outcomes

First Form

- 23.1 Factorize algebraic expressions using the distributive law, using the highest common factor and by using the method of grouping.

Third Form

23.2 Factorize expressions of the form $a^2 + 2ab + b^2$, where a , b and c are integers.

23.3 Factorize expressions of the form $a^2 - b^2$, where a and b are integers.

Content Standard No. 24

Understand the concept of linear equations, show connections between two or more related quantities in a formula, and use to solve word problems.

Learning Outcomes

First Form

24.1 Write algebraic equations equal to a numeric value or an algebraic expression.

24.2 Solve linear equations involving arithmetic operations.

24.3 Solve linear equations involving the unknown on both sides, brackets, fractions, and formulae.

24.4 Solve linear equations involving fractions.

Second Form

24.5 Change the subject of a formula connected by a plus sign, minus sign, when a symbol is connected to one side of a formula as a product or as a quotient and formula involving roots and powers.

24.6 Change the subject of a formula by factorization

Content Standard No. 25

Find the solution of linear inequalities in one unknown, and illustrate the solution set of inequalities on a number line or on a Cartesian plane.

Learning Outcomes

Second Form

25.1 Write linear inequalities to represent algebraic statements.

25.2 Solve inequalities involving arithmetic operations.

25.3 Solve inequalities containing brackets and fractions and the unknown quantity on both sides.

25.4 Solve simple word problems involving simple inequalities, inequalities with brackets, and inequalities with fractions.

25.5 Illustrate the solution set of an inequality on a number line and on a Cartesian plane.

Content Standard No. 26

Understand the concept of the laws of indices and use to solve problems.

Learning Outcomes

Second Form

26.1 Calculate an algebraic quantity multiplied by itself repeatedly.

26.2 Multiply and divide algebraic quantities with the same base.

26.3 Raise the power of a quantity to a power.

26.4 Raise any quantity to the zero index, and calculate the quantity with a negative index.

Third Form

- 26.5 Calculate the quantity with a fractional index.
- 26.6 Solve equations using the laws of indices.

Content Standard No. 27

Understand and apply the concept of simultaneous linear equations.

Learning Outcomes**Third Form**

- 27.1 Solve simultaneous linear equations in two unknowns algebraically by the method of elimination and substitution.
- 27.2 Solve linear and non-linear equations in two unknowns simultaneously.
- 27.3 Use linear equations to solve word problems simultaneously.

Content Standard No. 28

Understand and apply the concept of quadratic equations and the methods of factorization.

Learning Outcomes**Third Form**

- 28.1 Solve quadratic equations by factorization, completing the square, and the quadratic formula.
- 28.2 Solve problems involving quadratic equations

Content Standard No. 29

Understand the concept of variation and perform calculations and representations of direct, indirect, and joint variation, and apply to the solution of word problems.

Learning Outcomes**Fourth Form**

- 29.1 Perform calculations and represent direct variations, inverse variations, and joint variations symbolically.
- 29.2 Solve word problems involving variations.

Content Standard No. 30

Understand the concept of business arithmetic, and apply to solve everyday life problems.

Learning Outcomes**First Form**

- 30.1 Define and calculate profit, loss, discount.

Second Form

- 30.2 Define installment buying, commission, sales tax, and income tax, and express them as percentages and use in calculation when given as percentage.

- 30.3 Solve word problems involving profit and loss, discount, installment buying, commission, sales tax, and income tax.
- 30.4 Calculate interest, principal, time, rate, or amount involving simple or compound formula.
- 30.5 Solve word problems involving simple and compound interest.
- 30.6 Solve problems involving water bills, light bills, telephone bills, currency conversion, wages, and salaries.

Third Form

- 30.7 Solve problems involving investments, appreciation, depreciation, and insurance.

Content Standard No. 31

Understand the concept of relations, mapping, the Cartesian plane, and simple graphs, and apply in solving problems.

Learning Outcomes

First Form

- 31.1 Define a Cartesian plane.
- 31.2 Define relations, mappings and types of mapping and use arrow diagrams to represent the relation.
- 31.3 Define a set of ordered pairs and identify the domain and range (image).

Second Form

- 31.4 Given a scale plot and identify positions of points and coordinates as a set of ordered pairs.
- 31.5 Construct and complete a table of values.
- 31.6 Plot and draw continuous and discontinuous graphs on a Cartesian plane.
- 31.7 Solve simple problems using continuous and discontinuous graphs.

Third Form

- 31.8 Draw and use distance-time and speed-time graphs to determine speed and total distance traveled.

Content Standard No. 32

Understand the concept of linear functions and graphs and use to solve problems.

Learning Outcomes

Third Form

- 32.1 Define a linear function: $y = mx + c$
- 32.2 Construct and complete a table of values for a linear function, given a set of values for x . Plot a graph for the set of an ordered pair.
- 32.3 Describe the gradient of a line as the rate of change of y compared with x or as a ratio of its vertical rise to its horizontal shift. Identify a positive or negative gradient, a zero, and an undefined gradient.
- 32.4 Calculate the gradient of a straight-line graph. Determine the equation of a line when given the graph of the line, when given the coordinates of two points on the line, and when given the gradient and one point on the line.
- 32.5 Solve simultaneous linear equations graphically.

Content Standard No. 33

Understand the concept of non-linear functions and graph, and apply in the solution of problems.

Learning Outcomes

Third Form

- 33.1 Define a quadratic function: $y = ax^2 + bx + c$.
- 33.2 Construct and complete a table of values for a non-linear function, given a set of values for x . Plot a graph for the set of ordered pairs.
- 33.3 Draw a graph for the set of ordered pairs of a quadratic function and determine the roots of the given function.
- 33.4 Given a quadratic function $y = ax^2 + bx + c$, find the minimum and maximum values of its turning points.
- 33.5 Use the graph of quadratic functions to solve simple problems.
- 33.6 Recognize the relation between the tangent of a certain angle and the gradient of a curve, and determine the gradient of a curve for a given point.

Content Standard No. 34

Understand the concept of functions and functional notation and use to solve problems.

Learning Outcomes

Fourth Form

- 34.1 Define and differentiate between a function and a relation.
- 34.2 Use and interpret functional notations such as $f(x)$, $g(x)$, $f^{-1}(x)$ and their compositions.
- 34.3 Derive the expression for the inverse of a function and find its value.
- 34.4 Express composite functions as a single function and determine whether the composite of two functions may be commutative.

Content Standard No. 35

Understand the concept of exponential functions, inverse functions and cubic functions and use to solve problems.

Learning Outcomes

Fourth Form

- 35.1 Define an exponential function, an inverse function, and a cubic function.
- 35.2 Plot, draw, and identify the graph of exponential function, an inverse function, and a cubic function.
- 35.3 Solve problems involving exponential growth. (eg. population growth, compound growth).
- 35.4 Find values of x at the point where the graph of an inverse function and linear functions intersect.

Content Standards No. 36

Understand the concept of analyzing and interpreting statistical data, the measures of central tendency, frequency and cumulative distribution, and the measure of dispersion and use to solve problems.

Learning Outcomes

First Form

- 36.1 Provide, classify, and tabulate statistical information of everyday life situations.
- 36.2 Present and interpret data on bar graphs and pictograms.

Second Form

- 36.3 Present and interpret data on pie charts, and line graphs.
- 36.4 Determine any of three statistical averages for a given set of numbers
- 36.5 Construct simple frequency and grouped frequency tables for a given set of data and determine the mean, median, and mode from the frequency distribution and grouped distribution.

Third Form

- 36.6 Present and interpret data on a histogram.
- 36.7 Draw and use histograms and frequency polygons to represent grouped and ungrouped frequency distribution.

Fourth Form

- 36.8 Construct a cumulative frequency table for a given set of data and represent on a cumulative frequency curve.
- 36.9 Calculate standard deviation, percentile, range, inter-quartile range and semi-inter-quartile range from raw data, ungrouped data, and grouped data.

Content Standard No. 37

Understand the concept of experimental and theoretical probability.

Learning Outcomes

Fourth Form

- 37.1 Determine experimental probabilities of simple events and recognize the probability of a certain outcome and of an impossible outcome
- 37.2 Find the sum of the probabilities of all possible outcomes.
- 37.3 Calculate theoretical probabilities of simple equally likely outcomes.

Content Standard No. 38

Understand the concept of the trigonometric values, define the circular functions of angle θ° for $-360^\circ \leq \theta \leq 360^\circ$ and recognize trigonometrical ratios of special angles in surd form, and apply trigonometrical rules to problems involving triangles.

Learning Outcomes

Fourth Form

- 38.1 Calculate the sine, cosine and tangent value of θ lying between 0° and 180° .
- 38.2 Calculate the sine, cosine and tangent value of θ lying between 180° and 360° .

- 38.3 Recognize the value of all trigonometric ratios in all the four quadrants.
- 38.4 Determine the trigonometrical ratios of 0° , 30° , 45° , 60° , 90° , 180° , 270° , 360° in surd form.
- 38.5 Draw the graph of the circular function sine, cosine and tangent for $-360^\circ \leq \theta \leq 360^\circ$.
- 38.6 Use trigonometric formula to solve simple geometrical and algebraic problems.

Content Standard No. 39

Understand concepts of vectors and matrices and use to solve problems.

Learning Outcomes

Fourth Form

- 39.1 Identify the different types of matrices used to represent information and give the order of the matrix.
- 39.2 Perform addition, subtraction and multiplication of matrices.
- 39.3 Perform multiplication of matrices by a scalar quantity.
- 39.4 Recognize a singular and a non-singular matrix.
- 39.5 Evaluate the determinant of a 2×2 matrix and find the inverse of a non-singular 2×2 matrix.
- 39.6 Use matrices as operators to solve simultaneous linear equations.
- 39.7 Use matrices to solve simple geometrical and algebraic problems

Content Standard No. 40

Understand the concept of matrices and determine a 2×1 matrix associated with properties of transformation.

Learning Outcomes

Fourth Form

- 40.1 Determine 2×1 matrix associated with translation, rotation, reflection, and enlargements.

Content Standard No. 41

Understand the concept of vectors, addition, and the triangle and parallelogram law to solve problems and perform addition, subtraction, scalar multiplication, and computing magnitude of vectors.

Learning Outcomes

Fourth Form

- 41.1 Define a vector. Recognize a unit vector as a vector of unit length.
- 41.2 Add vectors using the triangle and parallelogram laws.
- 41.3 Perform subtraction of vectors.
- 41.4 Determine the magnitude of a vector.
- 41.5 Perform multiplication of vectors by a scalar.
- 41.6 Associate a position vector to the origin of a Cartesian plane.
- 41.7 Use vectors to discover and prove properties of shape.