MINISTRY OF EDUCATION MALAYSIA

Integrated Curriculum for Secondary Schools

SYLLABUS
MATHEMATICS

Curriculum Development Centre
Ministry of Education Malaysia
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PREFACE

Science and technology plays a critical role in realising Malaysia's aspiration to become a developed nation. Since mathematics is instrumental in the development of scientific and technological knowledge, the provision of quality mathematics education from an early age in the education process is thus important. The Malaysian school curriculum offers three mathematics education programs, namely Mathematics for primary schools, Mathematics and Additional Mathematics for secondary schools.

The Malaysian school mathematics curriculum aims to develop mathematical knowledge, competency and inculcate positive attitudes towards mathematics among pupils. Mathematics for secondary schools provides opportunities for pupils to acquire mathematical knowledge and skills, and develop higher order problem solving and decision making skills to enable pupils to cope with daily life challenges. As with other subjects in the secondary school curriculum, Mathematics aims to inculcate noble values and love for the nation in the development of a holistic person, who in turn will be able to contribute to the harmony and prosperity of the nation and its people.

Beginning 2003, English is used as the medium of instruction for Science and Mathematics subjects. The policy to change the medium of instruction for Science and Mathematics subjects follows a phased implementation schedule and is expected to be completed by 2008.

In the teaching and learning of Mathematics, the use of technology especially ICT is greatly emphasised. Mathematics taught in English, coupled with the use of ICT, provide greater opportunities for pupils to improve their knowledge and skills in mathematics because of the richness of resources and repositories of knowledge in English. Pupils will be better able to interact with pupils from other countries, improve their proficiency in English; and thus make the learning of mathematics more interesting and exciting.

The development of this Mathematics syllabus is the work of many individuals and experts in the field. On behalf of the Curriculum Development Centre, I would like to express much gratitude and appreciation to those who have contributed in one way or another towards this initiative.

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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 ongoing effort towards further 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 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 betterment of the family, the society and the nation at large.

INTRODUCTION

A well-informed and knowledgeable society well versed in the use of mathematics to cope with daily life challenges is integral to realising the nation's aspiration to become an industrialised nation. Thus, efforts are taken to ensure a society that assimilates mathematics into their daily lives. Pupils are nurtured from an early age with the skills to solve problems and communicate mathematically, to enable them to make effective decisions.

Mathematics is essential in preparing a workforce capable of meeting the demands of a progressive nation. As such, this field assumes its role as the driving force behind various developments in science and technology. In line with the nation's objective to create a knowledge-based economy, the skills of Research & Development in mathematics is nurtured and developed at school level.

As a field of study, Mathematics trains the mind to think logically and systematically in solving problems and making decisions. This discipline encourages meaningful learning and challenges the mind, and hence contributes to the holistic development of the individual. To this end, strategies to solve problems are widely used in the teaching and learning of mathematics. The development of mathematical reasoning is believed to be closely linked to the intellectual development and communication ability of pupils. Hence, mathematics reasoning skills are also incorporated in the mathematics activities to enable pupils to recognize, build and evaluate mathematics conjectures and statements.

In keeping with the National Education Philosophy, the Mathematics curriculum provides opportunities to pupils from various backgrounds and levels of abilities to acquire mathematical skills and knowledge. Pupils are then able to seek relevant information, and be creative in formulating alternatives and solutions when faced with challenges.

The general Mathematics curriculum has often been seen to comprise of discrete areas related to counting, measurement, geometry, algebra and solving of problems. To avoid the areas to be continually seen as separate and pupils acquiring concepts and skills in isolation, mathematics is linked to everyday life and experiences in and out of school. Pupils will have the opportunity to apply mathematics in different contexts, and see the relevance of mathematics in daily life.

In giving opinions and solving problems either orally or in writing, pupils are guided in the correct usage of language and mathematics registers. Pupils are trained to select information presented in mathematical and non-mathematical language; interpret and represent information in tables, graphs, diagrams, equations or inequalities; and subsequently present information clearly and precisely, without any deviation from the original meaning.

Technology in education supports the mastery and achievement of the desired learning outcomes. Technology used in the teaching and learning of Mathematics, for example calculators, are to be regarded as tools to enhance the teaching and learning process and not to replace teachers.

Importance is also placed on the appreciation of the inherent beauty of mathematics. Acquainting pupils with the life-history of well-known mathematicians or events, the information of which is easily available from the Internet for example, will go a long way in motivating pupils to appreciate mathematics.

The intrinsic values of mathematics namely thinking systematically, accurately, thoroughly, diligently and with confidence, infused throughout the teaching and learning process; contribute to the moulding of character and the inculcation of positive attitudes towards mathematics. Together with these, moral values are also introduced in context throughout the teaching and learning of mathematics.

Assessment, in the form of tests and examinations helps to gauge pupils' achievement. The use of good assessment data from a variety of sources also provides valuable information on the development and progress of pupils. On-going assessment built into the daily lessons allows the identification of pupils' strengths and weaknesses, and effectiveness of the instructional activities. Information gained from responses to questions, group work results, and homework helps in improving the teaching process, and hence enables the provision of effectively aimed lessons.

AIM

The mathematics curriculum for secondary schools aims to develop individuals who are able to think mathematically, and apply mathematical knowledge effectively and responsibly in solving problems and making decisions; and face the challenges in everyday life brought about by the advancement of science and technology.

OBJECTIVES

The mathematics curriculum for the secondary school enables pupils to:

1 understand definitions, concepts, laws, principles, and theorems related to Number, Shape and Space, and Relationship;

2 widen the use of basic operations of addition, subtraction, multiplication and division related to Number, Shape and Space, and Relationship;

3 acquire basic mathematical skills such as:

- making estimation and rounding;

- measuring and constructing;

- collecting and handling data;

- representing and interpreting data;

- recognising and representing relationship mathematically;

- using algorithm and relationship;

- solving problems; and

- making decisions.

4 communicate mathematically;

5 apply knowledge and skills of mathematics in solving problems and making decisions;

6 relate mathematics with other areas of knowledge;

7 use suitable technologies in concept building, acquiring skills, solving problems and exploring the field of mathematics;

8 acquire mathematical knowledge and develop skills effectively and use them responsibly;

9 inculcate a positive attitude towards mathematics; and

10 appreciate the importance and beauty of mathematics.

CONTENT ORGANISATION

The content of the curriculum is presented in three areas that are interrelated, that is, NUMBER, SHAPE and SPACE, and RELATIONSHIP. In everyday situations, an individual generally needs the following:

- knowledge and skills related to numbers such as counting and computing (NUMBER);

- knowledge and skills related to shapes and space such as recognising the properties of shapes and working with measurements (SHAPE and SPACE);

- knowledge and skills related to patterns, rules, general principles, laws, relations and others for the purpose of recognising and understanding relationships involving numbers and shape (RELATIONSHIP)

The teaching and learning of mathematics put emphasis on the understanding of concepts and the mastery of skills in the three areas stated above, as well as the use of mathematics to solve problems in various situations. As such, the following areas require attention during the teaching and learning process:

- development of problem solving skills that involves four main steps namely interpreting the problem, planning the strategy, carrying out the strategy, and reflecting on the solution obtained so that pupils can effectively solve problems in daily life;

- development of logical, systematic and creative thinking skills together with reasoning skills so as to produce an individual who is able to think logically and rationally; and

- inculcation of the intrinsic value of mathematics and the values of Malaysian society which include being systematic, accurate, diligent, confident, not wasteful, moderate and cooperative, all of which contribute towards becoming a responsible citizen.

CONTENT

This section outlines the important elements in each area, namely NUMBER, SHAPE and SPACE, and RELATIONSHIP followed by a list of topics that defines the scope for each area.

1. NUMBER

The understanding of numbers enables pupils to make calculations and estimates, and analyse and solve related problems. This area is a continuation of the primary school mathematics curriculum. The scope of this area is as follows:

1.1 Whole Numbers
- (a) Place value of digits in whole numbers.
- (b) Rounding whole numbers.
- (c) Addition, subtraction, multiplication and division involving whole numbers.

1.2 Fractions
- (a) Equivalent fractions.
- (b) Proper and improper fractions.
- (c) Mixed numbers.
- (d) Addition, subtraction, multiplication and division involving fractions.

1.3 Decimals
- (a) Conversion of decimals to fractions and vice versa.
- (b) Place value of digits in decimals.
- (c) Rounding decimals.
- (d) Addition, subtraction, multiplication and division involving decimals.

1.4 Percentages
- (a) Percentage and symbol.
- (b) Increase and decrease of a certain quantity in terms of percentage.
- (c) The use of percentages in comparison.

1.5   Negative Numbers
       (a)   The + and − signs in numbers.
       (b)   Integers.
       (c)   Negative fractions and negative decimals.
       (d)   Addition, subtraction, multiplication and
              division involving negative and positive
              numbers.

1.6   Multiples and Factors
       (a)   Prime numbers.
       (b)   Multiples.
       (c)   Common multiples and the lowest common
              multiple.
       (d)   Factors and prime factors.
       (e)   Common factors and the highest common factor.

1.7   Squares, Square Roots, Cubes and Cube Roots
       (a)   Squares.
       (b)   Square roots.
       (c)   Cubes.
       (d)   Cube roots.

1.8   Standard Form
       (a)   Significant figures.
       (b)   Numbers in standard form.
       (c)   Addition, subtraction, multiplication and
              division involving numbers in standard form.

1.9   Number Bases
       (a)   Numbers in base 2, 5 and 8.
       (b)   Place value of digits in numbers in base 2, 5 and
              8.
       (c)   Conversion of numbers in base 2, 5, 8 and 10
              from one base to another.

2. SHAPE and SPACE

Shape and space is an important component in the secondary school mathematics curriculum. Knowledge and skills in this area and their application in related topics is useful in everyday life. Improving understanding in this area helps pupils to effectively solve problems in geometry. At the same time, pupils can also improve their visual skills and appreciate the aesthetic value of shapes and space. The scope is as follows:

2.1   Basic Measurements
       (a)   Length.
       (b)   Mass.
       (c)   Time.

2.2   Lines and Angles
       (a)   Angles.
       (b)   Unit of measurement of angles.
       (c)   Types of angles.
       (d)   Intersecting lines.
       (e)   Properties of angles related to intersecting lines.
       (f)   Parallel lines.
       (g)   Properties of angles related to parallel lines.

2.3   Polygons
       (a)   Types of polygons.
       (b)   Line symmetry.
       (c)   Types of triangles.
       (d)   Properties of angles related to triangles.
       (e)   Types of quadrilaterals.
       (f)   Properties of angles related to quadrilaterals.
       (g)   Regular polygons.
       (h)   Properties of angles related to regular polygons.

2.4   Perimeter and Area
        (a)   Perimeter.
        (b)   Area of triangles and quadrilaterals.

2.5   Geometrical Construction
        (a)   Construction of a line segment, a triangle, a
                perpendicular bisector, a perpendicular to a line,
                an angle, an angle bisector, parallel lines and a
                parallelogram.
        (b)   Scale drawing.

2.6   Loci in Two Dimensions
        (a)   Locus of a moving point satisfying a condition.
        (b)   Two-dimensional locus of a point satisfying
                more than one condition.

2.7   Circles
        (a)   The circle and its parts.
        (b)   Circumference and arc length.
        (c)   Area of a circle and area of a sector.
        (d)   Properties of angles related to circles and cyclic
                quadrilaterals.
        (e)   Tangents to a circle.
        (f)   Properties of angles related to tangents to a
                circle.
        (g)   Common tangents to circles.

2.8   Geometric Solids
        (a)   Types of geometric solids.
        (b)   Nets.
        (c)   Surface area of geometric solids.
        (d)   Volume.

2.9   Pythagoras' Theorem
        (a)   Pythagoras' theorem.
        (b)   Converse of the Pythagoras' theorem.

2.10   Trigonometry
        (a)   Measurement of angles in degrees and minutes.
        (b)   Sine, cosine and tangent of an angle.
        (c)   Solution of triangles (based on the solution of
                right-angled triangles)

2.11   Bearings
        (a)   Compass directions.
        (b)   Bearings.

2.12   Angle of Elevation and Angle of Depression
        (a)   Angle of elevation.
        (b)   Angle of depression.

2.13   Lines and Planes in Three Dimensions
        (a)   Normal to a plane and the projection of a line
                onto a plane.
        (b)   Angle between a line and a plane.
        (c)   Angle between two intersecting planes.

2.14   Plan and Elevation
        (a)   Orthogonal Projections.
        (b)   Plans of solids.
        (c)   Front and side elevations of solids.

2.15   Earth as a Sphere
        (a)   Longitudes and latitudes.
        (b)   Distance along a meridian and along a parallel
                of latitude.
        (c)   Shortest distance on the earth's surface.
        (d)   Nautical mile and knot.

2.16   Transformation
(a)   Types of transformations – translation, reflection, rotation and enlargement.
(b)   Isometry and congruence.
(c)   Similar shapes.
(d)   Combination of transformations.

3. RELATIONSHIP

The relationships between several quantities can often be found in daily life. Therefore, the handling of relationships such as recognizing a formula or a law and making generalisations of a situation becomes a basic necessity. A relationship can be expressed in the form of a table, a graph, a formula, an equation or an inequality. The expression of the relationship in these forms becomes useful and an effective tool in problem solving and communication. The scope of learning is as follows:

3.1   Indices
(a)   Introduction to indices.
(b)   The laws of indices.

3.2   Algebraic Expressions
(a)   Representation of unknown by a letter of the alphabet.
(b)   Addition, subtraction, multiplication and division involving algebraic terms.
(c)   Algebraic expressions.
(d)   Addition and subtraction involving algebraic expressions.
(e)   Expansion and factorisation.
(f)   Algebraic fractions.
(g)   Addition, subtraction, multiplication and division involving algebraic fractions.

3.3   Algebraic Formulae
(a)   Variables and their representations by letters of the alphabet.
(b)   Algebraic formulae.
(c)   Subject of a formula.

3.4   Linear Equations
(a)   Linear equations in one unknown.
(b)   Simultaneous linear equations in two unknowns.

3.5   Linear Inequalities
(a)   The symbols $<$, $\leqslant$, $>$ and $\geqslant$.
(b)   Linear inequalities in one unknown.
(c)   Simultaneous linear equations in one unknown.

3.6   Quadratic Expressions and Equations
(a)   The expression $ax^2 + bx + c$.
(b)   Factorisation of a quadratic expression.
(c)   Quadratic equations.

3.7   Coordinates
(a)   The Cartesian coordinate system.
(b)   Distance between two points.
(c)   Mid-point between two points.

3.8   The Straight Line
(a)   The gradient of a straight line.
(b)   The intercepts on the x-axis and the y-axis.
(c)   The equation of a straight line $y = mx + c$.
(d)   Parallel straight lines.

3.9   Graphs of Functions
(a)   Functions.
(b)   Graphs of functions.

(c) The solution of an equation by graphical method.

(d) The region representing an inequality in two variables.

3.10 Gradient and the Area under a Graph
(a) Quantity represented by the gradient of a graph.
(b) Quantity represented by the area under a graph.

3.11 Ratios and Proportions
(a) The ratio of two quantities.
(b) The ratio of three quantities.
(c) Direct proportion.
(d) Rate.

3.12 Variations
(a) Direct variation.
(b) Inverse variation.
(c) Joint variation.

3.13 Matrices
(a) Introduction to matrices.
(b) Equal matrices.
(c) Addition, subtraction and multiplication involving matrices.
(d) The 2×2 identity matrix.
(e) The 2×2 inverse matrix.
(f) Solution of simultaneous linear equations in two unknowns by the matrix method.

3.14 Sets
(a) Introduction to sets.
(b) Equal sets, the empty set, subsets, the universal set and the complement of a set.
(c) Operations on sets.

3.15 Mathematical Reasoning
(a) Introduction to logic.
(b) Statements.
(c) Quantifiers - "all", "some".
(d) Operations on statements - "and", "or", "not".
(e) Implications - "if", "if and only if".
(f) Arguments - syllogism, modus ponens and modus tollens.
(g) Deduction and induction.

3.16 Statistics
(a) Collection of data.
(b) Frequency, frequency tables and class intervals.
(c) Pictograph, bar chart, pie chart and line graph.
(d) Histogram and frequency polygon.
(e) Cumulative frequency and the ogive.
(f) Measures of central tendency: mode, mean and median.
(g) Measures of dispersion: range and inter-quartile range.

3.17 Probability
(a) Sample spaces.
(b) Events.
(c) The probability of an event.
(d) The probability of complementary events.
(e) Combined events.
(f) The probability of combined events.