Mathematics

Why it is necessary to learn mathematics

Mathematics is highly important to develop human mind. It enables a person to think logically and systematically, to analyse various problems or situations, to anticipate, to plan, to make decisions, to solve problems and to apply mathematics to daily life. Mathematics serves as a tool for learning science, technology and other disciplines. It is therefore useful to life, enhancing quality of life and enabling people to live in harmony.

What is learned in mathematics

The learning area of mathematics is aimed at enabling all learners to continuously learn mathematics in accord with their potentiality. The areas prescribed for all learners are as follow:

- **Numbers and Operations:** the numerical concepts and sense of perception; real number system; the properties of real numbers; the operation of numbers; ratio; percentage; problem-solving involving numbers; and the application of numbers for real life
- **Measurement:** length; distance; weight; area; volume and capacity; money and time; measuring units; estimation for measurement; trigonometric ratio; problem-solving regarding measurement; and application of measurement for various situations
- **Geometry:** the geometric figures and the properties of one-dimensional geometric figures; visualisation of geometric models; geometric theories; and geometric transformation through translation, reflection and rotation
- **Algebra:** pattern; relationship; function; sets and their operations; reasoning; expression; equation; equation system; inequality; graph; arithmetic order; geometric order; arithmetic series; and geometric series

- **Data Analysis and Probability:** determining an issue; writing questions; determining methods of study; data collection; systematisation and presentation; central tendency and data distribution; data analysis and interpretation; opinion polling; probability; application of statistical knowledge and probability; application of probability for explaining various situations as well as for facilitating decision-making for real life
- **Mathematical Skills and Processes:** problem-solving through diverse methods; reasoning; communication; presentation of mathematical concepts; linking mathematics with other disciplines; and attaining ability for creative thinking

Learners' Quality

Grade 3 graduates

- Have numerical knowledge, understanding and sense of cardinal numbers not more than 100,000, and zero as well as operation of numbers; solve problems involving addition, subtraction, multiplication and division; and be aware of validity of the answers
- Have knowledge and understanding of length, distance, weight, volume, capacity, time and money; measure correctly and appropriately; and apply knowledge of measurement for solving problems
- Have knowledge and understanding of triangle, quadrilateral, circle, ellipse, cuboid, sphere and cylinder as well as point, line segment and angle
- Have knowledge and understanding of pattern and explain relationship
- Collect and analyse relevant data and information about themselves and their surroundings; use pictograms and bar charts for discussing various issues
- Apply diverse methods for problem-solving; use mathematical knowledge, skills and processes appropriately for solving problems, suitably present reasoning for decision-making and appropriately present the conclusion, use mathematical language and symbols for communication, as well as accurate and appropriate presentation of mathematical concepts; link various bodies of mathematical knowledge; link mathematics with other disciplines; and attain for creative thinking

Grade 6 graduates

- Have numerical knowledge, understanding, and sense of cardinal numbers and zero, fractions, decimals of not more than three places, percentages, operation of numbers and properties of numbers; solve problems involving addition, subtraction multiplication and division of cardinal numbers, fractions, decimals of not more than three places and percentages; be aware of validity of the answers; and find estimates of cardinal numbers and decimals of not more than three places
- Have knowledge and understanding of length, distance, weight, area, volume, capacity, time, money, direction, diagrams and size of angles; measure correctly and appropriately; and apply knowledge of measurement for solving problems
- Have knowledge and understanding of characteristics and properties of triangles, squares, circles, cuboids, cylinders, cones, prisms, pyramids angles and parallel lines
- Have knowledge and understanding of patterns and explain their relationships and solve problems involving patterns; analyse situations or problems and write them in the linear equations with an unknown and solve them.
- Collect and present data and information and discuss various issues from pictograms, bar charts, comparative bar charts, pie charts, line graphs and tables; and apply knowledge of basic probability for projecting various possible situations
- Apply diverse methods for problem-solving, using mathematical and technological knowledge, skills, and processes appropriately; suitably provide reasoning for decision-making and appropriately present the conclusions; use mathematical language and symbols for communication as well as accurate and appropriate presentation of mathematical concepts; link various bodies of mathematical knowledge and link mathematical knowledge with other disciplines; and attain ability for creative thinking

Grade 9 graduates

- Understand concepts of numbers, ratio, proportion, percentage, real numbers expressed in exponential notation with integer indices, square root and cube root of real numbers; carry out operations involving integral numbers, fractions, decimals, exponents, square roots and cube roots of real numbers; apply numerical knowledge to real life
- Have knowledge and understanding of surface areas of prisms and cylinders, and volume of prisms, cylinders, pyramids, cones and spheres; appropriately choose units of the various systems of measuring length, area, and volume; and apply knowledge of measurement to real life
- Construct and explain stages of constructing two-dimensional geometric figures with compass and straight edge; explain characteristics and properties of three-dimensional geometric figures, i.e., prisms, pyramids, cylinders, cones and spheres
- Understand properties of congruence and similarities of triangles, parallels, Pythagoras' theorems and converse; apply these properties for reasoning and problem-solving; and understand geometric transformation through translation, reflection and rotation
- Visualise and explain characteristics of two-dimensional and three-dimensional geometric figures
- Analyse and explain relationships of patterns, situations or problems; and can use single-variable linear equations, two-variable linear equation systems, single-variable linear inequality, and graphs in problem-solving
- Determine an issue, write questions about a problem or a situation, determine methods of study and collect and present data by utilising pie charts or any other forms of presentation
- Understand concepts of the measures of central tendency, arithmetic mean, median, and mode of non-frequency distribution data, and apply them to statistical data and information
- Understand the concepts of random sampling and probability; apply knowledge of probability for projecting and for decision-making

- Apply diverse methods for problem-solving; avail mathematical and technological knowledge, skills and processes appropriately to solve problems; suitably provide reasoning for decision-making and appropriately present the conclusion; use mathematical language and symbols for communication; present mathematical concepts accurately and clearly; link various bodies of mathematical knowledge; link mathematical knowledge, principles and processes with other disciplines; and attain ability for creative thinking

Grade 12 graduates

- Have concepts of the real number system, absolute values of real numbers and real numbers expressed in radicals and in exponential notation with rational indices; find estimates of real numbers expressed in radicals and exponents through appropriate calculation methods; and apply properties of real numbers
- Apply knowledge of trigonometric ratio for estimating distance and height, and solve measurement problems
- Have concept of sets and their operation; and apply knowledge of Venn-Euler diagrams for problem-solving and checking validity of reasoning
- Understand and apply reasoning through induction and deduction
- Have concepts of relation and function and apply it for problem-solving
- Understand concepts of arithmetic sequence, geometric sequence and find general terms; understand the concepts of the sums of the first n terms of arithmetic and geometric series, using formulas
- Know and understand the concept of solving equations and inequalities with one variable (degree not more than two); and use graphs of equations, inequalities or functions for problem-solving
- Understand simple methodology for opinion polling; choose central tendency suitable to data and objectives; find arithmetic mean, median, mode, standard deviation and percentile of data; analyse data and apply results of data analysis for facilitating decision-making

- Understand concepts of random sampling and probability; apply knowledge of probability for projection and for decision-making
- Apply diverse methods for problem-solving; avail of mathematical and technological knowledge, skills and processes for appropriately solving problems; suitably provide reasoning for decision-making and appropriately present the conclusions; use mathematical language and symbols for communication; present mathematical concepts accurately and clearly; link various bodies of mathematical knowledge, principles, and processes with other disciplines; and attain ability for creative thinking

Strand 1: Numbers and Operations

Standard MA1.1: Understanding of diverse methods of presenting numbers and their application for real life

Grade-level Indicators

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
1. Write and read Hindu-Arabic and Thai numerals showing quantity of objects or cardinal numbers not exceeding 100, and 0. 2. Compare and arrange sequence of cardinal numbers not exceeding 100, and 0.	1. Write and read Hindu-Arabic and Thai numerals and written forms showing quantity of objects or cardinal numbers not exceeding 1,000, and 0. 2. Compare and arrange sequence of cardinal numbers not exceeding 1,000, and 0.	1. Write and read Hindu-Arabic and Thai numerals and written forms showing quantity of objects or cardinal numbers not exceeding 100,000, and 0. 2. Compare and arrange sequence of cardinal numbers not exceeding 100,000, and 0.	1. Write and read Hindu-Arabic and Thai numerals and written forms showing cardinal numbers, 0, fractions, and one-place decimals. 2. Compare and arrange sequence of cardinal numbers and 0, fractions, and one-place decimals.	1. Write and read fractions, mixed numbers and decimals with not more than 2 places. 2. Compare and arrange sequence of fractions and decimals with not more than 2 places. 3. Write fractions in decimal form and percentages; write percentages in the forms of fractions and decimals, and write decimals in the forms of fractions and percentages.	1. Write and read decimals with not more than 3 places. 2. Compare and arrange sequence of fractions and decimals with not more than 3 places. 3. Write decimals in the form of fractions and write fraction in form of decimal.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
1. Specify or give examples and compare added integral numbers, subtracted integral numbers, 0, fractions and decimals. 2. Have concept of real numbers expressed in exponential notation with integer indices and write numbers in scientific notation.	1. Write fractions in the form of decimals and write circulating decimals in form of fractions. 2. Distribute prescribed real numbers and give examples of rational and irrational numbers. 3. Explain and specify square roots and cube roots of real numbers. 4. Apply knowledge of ratio, fraction and percentage to solve problems.	-	1. Show relationships of various numbers in the real number system. 2. Have concepts of absolute values of real numbers. 3. Have concepts of real numbers expressed in exponential notation with rational indices, and real numbers expressed in radicals.

Strand 1: Numbers and Operations

Standard MA1.2: Understanding of the results of operations of numbers, the relationships of operations, and the application of operations for problem-solving

Grade-level Indicators

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
1. Add, subtract and mix addition and subtraction of cardinal numbers not exceeding 100, and 0, as well as be aware of the validity of the answers. 2. Analyse and find answers to problems and mix-problems of cardinal numbers not exceeding 100, and 0, as well as be aware of the validity of the answers.	1. Add, subtract and mix addition and subtraction of cardinal numbers not exceeding 1,000, and 0, as well as be aware of the validity of the answers. 2. Analyse and find answers to problems and mix-problems of cardinal numbers not exceeding 1,000, and 0, as well as be aware of the validity of the answers.	1. Add, subtract and mix addition and subtraction of cardinal numbers not exceeding 100,000, and 0, as well as be aware of the validity of the answers. 2. Analyse and show method of finding answers to problems and mix-problems of cardinal numbers not exceeding 100,000, and 0, as well as be aware of the validity of the answers.	1. Add, subtract and mix addition, subtraction, multiplication and division of cardinal numbers and 0, as well as be aware of the validity of the answers. 2. Analyse and show method of finding answers to problems and mix-problems of cardinal numbers and 0, as well as be aware of validity of the answers, and be able to construct problems.	1. Add, subtract and mix addition and subtraction of fractions, as well as be aware of the validity of the answers. 2. Add, subtract and mix addition and subtraction of decimals with answers in decimals of not more than 2 places, as well as be aware of the validity of the answers. 3. Analyse and show method of finding answers to problems and mix-problems of cardinal numbers,	1. Add, subtract and mix addition, subtraction, multiplication and division of fractions, mixed numbers and decimals, as well as be aware of the validity of the answers. 2. Analyse and show method of finding answers to problems and mix-problems of cardinal numbers, fractions mixed numbers, decimals and percentages, as well as be aware of the validity of the answers,

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
1. Add, subtract, multiply and divide integral numbers for the purpose of problem-solving; be aware of validity of the answers; explain the results obtained from the addition, subtraction, multiplication, and division, and explain the relationship between addition and subtraction, and between multiplication and division of integral numbers. 2. Add, subtract, multiply and divide fractions and decimals for the purpose of problem-solving; be aware of the validity of the answers; explain the results of the addition, subtraction, multiplication and division; and explain	1. Find square root and cube root of integral numbers by separating factors for the purpose of problem-solving as well as be aware of the validity of the answers. 2. Explain the results of finding square root and cube root of integral numbers, fractions and decimals, and express the relationship between exponents and roots of real numbers.	-	1. Understand concepts and find results of addition, subtraction, multiplication and division of real numbers; understand real numbers expressed in exponential notation with rational indices, and real numbers expressed in radicals.

Strand 1: Numbers and Operations

Standard MA1.2: Understanding of the results of operations of numbers, the relationships of operations, and the application of operations for problem-solving

Grade-level Indicators					
Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
-	-	-	3. Add and subtract fractions with same denominator.	fractions, decimals and percentages, as well as be aware of the validity of the answers, and construct problems using cardinal numbers.	and construct problems using cardinal numbers.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
relationships between addition and subtraction, and between multiplication and division of fractions and decimals. 3. Explain the results of expression in exponential notation of integral numbers, ratios and decimals. 4. Multiply and divide real numbers in the form of exponents with the same bases and integer indices.			

Strand 1: Numbers and Operations

Standard MA1.3: Use of estimation in calculation and problem-solving

Grade-level Indicators					
Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
-	-	-	-	1. Make approximate estimates of integers of 10, 100 and 1,000 of cardinal numbers.	1. Make approximate estimates of various integers of cardinal numbers. 2. Make estimates of decimals of not more than 3 places.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
1. Use estimation appropriately in various situations, as well as for considering the validity of answers.	1. Find estimates of square root and cube root of real numbers, which can be applied for problem-solving, as well as be aware of the validity of the answers.	-	1. Find estimates of real numbers expressed in radicals and real numbers expressed in exponents through appropriate methods.

Strand 1: Numbers and Operations

Standard MA1.4: Understanding of the numerical system and the application of numerical properties

Grade-level Indicators					
Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
-	-	-	-	-	1. Use communicative, associative and distributive properties in calculation. 2. Find highest common factor (H.C.F.) and lowest common multiples (L.C.M.) of cardinal numbers.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
1. Apply the knowledge of properties of integers for problem-solving.	1. Explain the relationships between real numbers, rational numbers, and irrational numbers.	-	1. Understand the properties of real numbers relating to addition and multiplication, equality and inequality.

Strand 2: Measurement

Standard MA2.1: Understanding of the basics of measurement; ability to measure and to estimate the size of objects

Grade-level Indicators

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
1. Tell length, weight, volume, and capacity using non-standard units of measure. 2. Tell period of time, number and names of the days of the week.	1. Tell length in metres and centimetres, and compare length using the same unit. 2. Tell weight in kilogrammes and grammes, and compare weight using the same unit. 3. Tell volume and capacity in litres, and compare volume and capacity. 4. Tell total amount of money from coins and bank notes. 5. Tell the time on a clock dial (period of 5 minutes).	1. Tell length in metres, centimetres and millimetres using appropriate measuring tools, and compare length. 2. Tell weight in kilogrammes and grammes using appropriate weighing machine, and compare weights. 3. Tell volume and capacity in litres and millilitres using appropriate measuring tools, and compare weight and capacity	1. Tell the relationship between measuring units for length, weight, volume or capacity and time. 2. Find the area of a rectangle. 3. Tell the time on a clock dial; read and write the time using numerals; and tell length of time. 4. Estimate length, weight and volume or capacity.	1. Tell the relationship between measuring units for length, weight and volume or capacity. 2. Find the perimeter of quadrilaterals and triangles. 3. Find the area of rectangles and triangles. 4. Measure the size of angle. 5. Find volume or capacity of cuboids.	1. Explain a route or indicate positions of various objects by specifying direction and real distance from pictures, maps and diagrams. 2. Find the area of quadrilateral. 3. Find the circumference and the area of circles.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
-	1. Compare measuring units for length and area of the same and different systems and choose appropriate measuring units. 2. Appropriately estimate time, distance, area, volume and weight, and explain the method used for estimation. 3. Appropriately choose estimation for measurement.	1. Find the surface area of prisms and cylinders. 2. Find the volume of prisms, cylinders, pyramids, cones and spheres. 3. Compare units for measuring volume or capacity of the same or different systems and choose appropriate units of measure. 4. Appropriately use estimation for measurement.	1. Apply knowledge of trigonometric ratio of angles in estimating distance and height.

Strand 2: Measurement

Standard MA2.1: Understanding of the basics of measurement; ability to measure and to estimate the size of objects

Grade-level Indicators					
Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
-	6. Tell the days, months and year from a calendar.	using the same units. 4. Tell the time on a clock dial (period of 5 minutes); read, write and tell the time using numerals. 5. Tell the relationship between measuring units for length, height and time. 6. Read and write amount of money using numerals.	-	-	-

Grade-level Indicators			Interval Indicators
Grade 7	Grade 8	Grade 9	Grades 10-12
-	-	-	-

Strand 2: Measurement

Standard MA2.2: Solving measurement problems

Grade-level Indicators					
Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
-	1. Solve problems of measurement of length, weight, volume and money.	1. Solve problems of measurement of length, weight, volume, money and time. 2. Read and keep record of income and expenses. 3. Read and keep record of activities or events, specifying the time.	1. Solve problems of measurement of length, weight, volume, money and time. 2. Read and keep record of income and expenses. 3. Read and keep record of activities or events, specifying the time.	1. Solve problems of the area and the perimeter of quadrilaterals and triangles.	1. Solve problems of the area and the perimeter of quadrilaterals and circles. 2. Solve problems of the volume and the capacity of cuboids. 3. Draw diagrams showing positions of objects and travel routes.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
-	1. Apply knowledge of length and area for problem-solving.	1. Apply knowledge of length and area for problem-solving.	1. Solve problems on length and height using trigonometric ratio.

Strand 3: Geometry

Standard MA3.1: Ability to explain and analyse two-dimensional and three-dimensional geometric figures

Grade-level Indicators

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
1. Distinguish triangles, quadrilaterals, circles and ellipses.	1. Identify two-dimensional geometric figures in the form of triangles, quadrilaterals, circles or ellipses. 2. Identify three-dimensional figures in the form of cuboids, spheres or cylinders. 3. Distinguish between rectangles and cuboids, and between circles and spheres.	1. Identify two-dimensional geometric figures that are components of an object in the form of a three-dimensional geometric figure. 2. Identify two-dimensional geometric figures with axis of symmetry from a given figure. 3. Write linear points, straight lines, rays, parts of straight lines, angles and symbols.	1. Identify kinds, names and components of angles and write symbols. 2. Identify a parallel and use symbols to indicate kind of parallel. 3. Identify components of a circle. 4. Identify a rectangle, a square or a rectangle. 5. Identify two-dimensional geometric figures with axes of symmetry, and identify the number of axes.	1. Identify the characteristics of various kinds of three-dimensional geometric figures. 2. Identify the characteristics, the relationship and of various kinds of quadrilaterals. 3. Identify the characteristics, the components, the relationships of various kinds of triangles.	1. Identify kinds of two-dimensional geometric figures that are components of three-dimensional geometric figures. 2. Identify the characteristics of diagonals in various kinds of quadrilaterals. 3. Identify which pair of straight lines is parallel.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
1. Draw and explain steps of basic geometric construction. 2. Draw two-dimensional geometric figures by using basic geometric construction, and explain steps of construction without emphasising proof. 3. Search, observe and project geometric properties. 4. Explain the characteristics of three-dimensional geometric figures. 5. Identify two-dimensional images from front view and side view of a given three-dimensional geometric figure.	-	1. Explain the characteristics and the properties of prisms, pyramids, cylinders, cones and spheres.	-

Strand 3: Geometry

Standard MA3.1: Ability to explain and analyse two-dimensional and three-dimensional geometric figures

Grade-level Indicators					
Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
-	-	-	-	-	-

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
6. Draw or create a three-dimensional figure from a cube, when given two-dimensional image from front view, side view and top view.			

Strand 3: Geometry

Standard MA3.2: Ability in visualisation, spatial reasoning and application of geometric models for problem-solving

Grade-level Indicators					
Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
-	1. Draw two-dimensional geometric figures using geometric models.	1. Draw two-dimensional geometric figures given in various models. 2. Identify various geometric figures in the surroundings.	1. Use geometric figures in designing.	1. Draw angles using a protractor. 2. Draw rectangles, triangles, and circles. 3. Draw parallels using a set square.	1. Draw cuboids, cylinders, cones, prisms and pyramids from nets of three-dimensional geometric figures or two-dimensional geometric figures given. 2. Draw various kinds of quadrilaterals.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
-	1. Use properties of congruence of triangles and those of parallels for reasoning and problem-solving. 2. Use Pythagoras' Theorem and converse for reasoning and problem-solving. 3. Understand and apply geometric transformation through translation, reflection and rotation. 4. Identify images from translation, reflection and rotation of models, and explain the method of obtaining the images when given certain models and images.	1. Use properties of similar triangles for reasoning and problem-solving.	-

Strand 4: Algebra

Standard MA4.1: Understanding and ability to analyse patterns, relations and functions

Grade-level Indicators					
Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
1. Tell the numbers and relations in patterns of numbers that increases by 1s and 2s, and decreases by 1s. 2. Identify the forms and relations in patterns in which forms are related in one of the following respects: shape, size or colour.	1. Tell the numbers and relations in patterns of numbers that increases by 5s, 10s and 100s, and decreases by 2s, 10s and 100s. 2. Identify the forms and relations in patterns in which forms are related in one of the following respects: shape, size or colour.	1. Tell the numbers and relations in patterns of numbers that increases by 3s, 4s, 25s and 50s, and decreases by 3s, 4s, 5s, 25s and 50s and in repeated patterns. 2. Identify the forms and relations in patterns in which forms are related in two of the following respects: shape, size or colour.	1. Tell the numbers and the relations in patterns of number which increases or decreases in equal amount each time. 2. Identify the forms and relations in patterns of a given form.	1. Tell the numbers and relations in patterns of given numbers.	1. Solve problems of pattern.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
1. Analyse and explain relations of a given pattern.	-	-	1. Have concept of sets and their operation. 2. Understand and use reasoning through induction and deduction. 3. Have concept of relation and function, and show relation and function through various methods, e.g., tables, graphs and equations. 4. Understand concept of sequence and express general terms of finite sequence. 5. Understand concepts of arithmetic and geometric sequences, and express general terms of arithmetic and geometric sequences.

Strand 4: Algebra

Standard MA4.2: Ability to apply and to interpret algebraic expressions, equations, inequalities, graphs and other mathematical models to represent various situations and to apply them for problem-solving

Grade-level Indicators					
Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
-	-	-	-	-	1. Write an equation based on a situation or problem, solve the equation and check the answer.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
1. Solve simple linear equations with one variable. 2. Write linear equations with one variable from simple situations or problems. 3. Solve problems involving simple linear equations with one variable, and be aware of the validity of the answer. 4. Draw a graph on the plane of the rectangular coordinate system showing the relationship of the two sets of quantities given. 5. Read and interpret the meaning of the graph on the plane of the rectangular coordinate system given.	1. Solve problems of linear equations with one variable, and be aware of the validity of the answer. 2. Find coordinates of points and explain the characteristics of geometric figures obtained from translation, reflection and rotation on the plane of the rectangular coordinate system.	1. Apply knowledge of linear inequalities with one variable for problem-solving, and be aware of the validity of the answer. 2. Write a graph showing link of two sets of quantities with linear relationship. 3. Draw graphs of linear equations with two variables. 4. Read and interpret meaning of systems of linear equations with two variables and other graphs. 5. Solve systems of linear equations with two variables, apply them for problem-solving, and be aware of the validity of the answer.	1. Draw Venn-Euler diagrams and apply for problem-solving. 2. Check the validity of reasoning using Venn-Euler diagrams. 3. Solve equations and inequalities with one variable (degree not more than two). 4. Construct relations or functions from situations or problems and apply them for problem-solving. 5. Apply graphs of equations, inequalities and functions for problem-solving. 6. Understand the concepts of the sums of the first n terms of arithmetic series, and find the sums of arithmetic series using applicable formulas.

Strand 5: Data Analysis and Probability

Standard MA5.1: Understanding and ability to apply statistical methodology for data analysis

Grade-level Indicators					
Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
-	-	1. Collect and categorise data about themselves and the surroundings in daily life. 2. Read data from simple pictograms and bar charts.	1. Collect and categorise data. 2. Read data from pictograms, bar charts and tables. 3. Draw pictograms and bar charts.	1. Draw bar charts with shortening of lines to represent numbers. 2. Read data from comparative bar charts.	1. Read data from line graphs and pie-charts. 2. Draw comparative bar charts and line graphs.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
-	1. Read and present data using pie-charts.	1. Set up an issue and write questions about it and set appropriate methods of study and of data collection. 2. Find arithmetic mean, median and mode of non-frequency distribution data, and make appropriate selection for utilisation. 3. Present data in appropriate forms. 4. Read, interpret and analyse the data obtained from presentations.	1. Understand simple methodology for opinion polling. 2. Find arithmetic mean, median, mode, standard deviation and percentile of data. 3. Select central tendency suitable to data and objectives.

Strand 5: Data Analysis and Probability

Standard MA5.2: Application of statistical methodology and knowledge of probability for valid estimation

Grade-level Indicators					
Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
-	-	-	-	1. Tell whether a described situation: - definitely happens; - may or may not happen; - definitely not happens.	1. Explain events by terms with similar meaning to: - definitely happens; - may or may not happen; - definitely not happens.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
1. explain which, events described, are more likely to happen.	1. Explain events described: - which definitely happens; - which definitely not happens; - which are more likely to happen.	1. Find probability of events from random sampling with equal probability for each result, and apply knowledge of probability for valid projection of events.	1. Apply opinion poll results for projecting events that may happen in given situations. 2. Explain random sampling, events, probability of events, and apply results obtained for projecting events that may happen in given situations.

Strand 5: Data Analysis and Probability

Standard MA5.3: Application of knowledge of statistics and probability for decision-making and problem-solving

Grade-level Indicators					
Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
-	-	-	-	-	-

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
-	-	1. Apply knowledge of statistics and probability for decision-making. 2. Discuss possible errors in presenting statistical data.	1. Apply data, information and statistics for decision-making and problem-solving. 2. Apply knowledge of probability for decision-making and problem-solving.

Strand 6: Mathematical Skills and Processes

Standard MA6.1: Ability in problem-solving, reasoning, communication and presentation of mathematical concept, linking various bodies of mathematical knowledge, and linking mathematics with other disciplines; and attaining ability for creative thinking

Grade-level Indicators

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6
1. Apply diverse methods for problem-solving. 2. Appropriately apply mathematical knowledge, skills and processes for problem-solving. 3. Suitably provide reasoning for decision-making and appropriately present the conclusions.	1. Apply diverse methods for problem-solving. 2. Appropriately apply mathematical knowledge, skills and processes for problem-solving. 3. Suitably provide reasoning for decision-making and appropriately present the conclusions.	1. Apply diverse methods for problem-solving. 2. Appropriately apply mathematical knowledge, skills and processes for problem-solving. 3. Suitably provide reasoning for decision-making and appropriately present the conclusions.	1. Apply diverse methods for problem-solving. 2. Appropriately apply mathematical and technological knowledge, skills and processes for problem-solving. 3. Suitably provide reasoning for decision-making and appropriately present the conclusions.	1. Apply diverse methods for problem-solving. 2. Appropriately apply mathematical and technological knowledge, skills and processes for problem-solving. 3. Suitably provide reasoning for decision-making and appropriately present the conclusions.	1. Apply diverse methods for problem-solving. 2. Appropriately apply mathematical and technological knowledge, skills and processes for problem-solving. 3. Suitably provide reasoning for decision-making and appropriately present the conclusions.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
1. Apply diverse methods for problem-solving. 2. Appropriately apply mathematical and technological knowledge, skills and processes for problem-solving in various situations. 3. Suitably provide reasoning for decision-making and appropriately present the conclusions. 4. Accurately and succinctly use mathematical language and symbols for communication, communication of concepts and presentation.	1. Apply diverse methods for problem-solving. 2. Appropriately apply mathematical and technological knowledge, skills and processes for problem-solving in various situations. 3. Suitably provide reasoning for decision-making and appropriately present the conclusions. 4. Accurately and succinctly use mathematical language and symbols for communication, communication of concepts and presentation.	1. Apply diverse methods for problem-solving. 2. Appropriately apply mathematical and technological knowledge, skills and processes for problem-solving in various situations. 3. Suitably provide reasoning for decision-making and appropriately present the conclusions. 4. Accurately and succinctly use mathematical language and symbols for communication, communication of concepts and presentation.	1. Apply diverse methods for problem-solving. 2. Appropriately apply mathematical and technological knowledge, skills and processes for problem-solving in various situations. 3. Suitably provide reasoning for decision-making and appropriately present the conclusions. 4. Accurately and succinctly use mathematical language and symbols for communication, communication of concepts and presentation. 5. Link various bodies of mathematical knowledge and link mathematical knowledge, principles and processes with those of other disciplines. 6. Attain ability for creative thinking.

Strand 6: Mathematical Skills and Processes

Standard MA6.1: Ability in problem-solving, reasoning, communication and presentation of mathematical concept, linking various bodies of mathematical knowledge and linking mathematics with other disciplines; and attaining ability for creative thinking

Grade-level Indicators					
Grade 1	**Grade 2**	**Grade 3**	**Grade 4**	**Grade 5**	**Grade 6**
4. Accurately use mathematical language and symbols for communication, communication of concepts and presentation. 5. Link various bodies of mathematical knowledge, and link mathematics with other disciplines. 6. Attain ability for creative thinking.	4. Accurately use mathematical language and symbols for communication, communication of concepts and presentation. 5. Link various bodies of mathematical knowledge, and link mathematics with other disciplines. 6. Attain ability for creative thinking.	4. Accurately use mathematical language and symbols for communication, communication of concepts and presentation. 5. Link various bodies of mathematical knowledge, and link mathematics with other disciplines. 6. Attain ability for creative thinking.	4. Accurately use mathematical language and symbols for communication, communication of concepts and presentation. 5. Link various bodies of mathematical knowledge, and link mathematics with other disciplines. 6. Attain ability for creative thinking.	4. Accurately use mathematical language and symbols for communication, communication of concepts and presentation. 5. Link various bodies of mathematical knowledge, and link mathematics with other disciplines. 6. Attain ability for creative thinking.	4. Accurately use mathematical language and symbols for communication, communication of concepts and presentation. 5. Link various bodies of mathematical knowledge, and link mathematics with other disciplines. 6. Attain ability for creative thinking.

Grade-level Indicators			Interval Indicators
Grade 7	**Grade 8**	**Grade 9**	**Grades 10-12**
5. Link various bodies of mathematical knowledge, and link mathematical knowledge, principles and processes with those of other disciplines. 6. Attain ability for creative thinking.	5. Link various bodies of mathematical knowledge, and link mathematical knowledge, principles and processes with those of other disciplines. 6. Attain ability for creative thinking.	5. Link various bodies of mathematical knowledge, and link mathematical knowledge, principles and processes with those of other disciplines. 6. Attain ability for creative thinking.	