The National School Curriculum: Mathematics

1. Character

Mathematics is a subject dealing with mathematical concepts, principles and rules, developing logical thinking, cultivating the ability to observe and interpret various phenomena, and understanding how to use various methods to solve problems.

The intense understanding and application of mathematical concepts, including practical problem solving ability, are essential in successfully learning diverse subjects and are also necessary to increase one's professional skills and one's ability to solve problems as a democratic citizen. Moreover, mathematical knowledge and thinking methods have acted as an intellectual driving force in the development of human civilization, and will be necessary in the future society of information.

The elementary school math curriculum is comprised of five strands: numbers and operations, figure, measurement, probability and statistics, and patterns and problem solving. In the 'numbers and operations' strand, the concepts of natural numbers, fractions, decimals, and the four fundamental rules of arithmetic are covered; in the 'figure' strand, the concepts and nature of plane and solid figures are presented; in 'measurement', the concepts and application of length, time, mass capacity, weight, angles, area, and volume are demonstrated; in the 'probability and statistics' strand, the organization and interpretation of data, number of cases, and the meaning of probability are explained; and in the 'patterns and problem solving' strand, the ideas of discovering patterns, ratio and proportion, use of variables, simple equations, and direct and inverse proportions, etc are treated.

In middle and high school, the math subject is also divided into five strands:

numbers and operations, variables and expressions, functions, probability and statistics, and geometry.

At the middle school level, in the ‘numbers and operations’ strand, the concepts of sets, integer, rational number, real number and the four fundamental rules of arithmetic, and approximate values are covered; in the ‘variables and expressions’ strand, the concepts of polynomials and the interpretation and application of the four fundamental rules of arithmetic, linear equations and linear inequalities, simultaneous linear equations and simultaneous linear inequalities, and quadratic equations are dealt with; in the ‘functions’ strand, the concept and application of functions and quadratic functions are discussed; in the ‘probability and statistics’ strand, the understanding and application of frequency distribution, the basic nature of probability, and representative values and measure of dispersion are presented; and in the ‘geometry’ strand, the understanding and proving of the nature of basic figures, the understanding and application of Pythagoras' theorem, and trigonometric ratios are treated.

At the high school level, in the ‘numbers and operations’ strand, the rules for set operations, the understanding and application of propositions, the nature of real number, the concept of complex number, and the four fundamental rules of arithmetic are presented; in the ‘variables and expressions’ strand, the operation and application of polynomials, the calculation of rational and irrational expressions, the application of quadratic equations, equations of higher degree, simultaneous equations, quadratic inequalities, simultaneous inequalities, and absolute inequalities are covered; in the ‘geometry’ strand, the understanding and application of coordinate plane, linear equations, circular equations, figure transfers, and the domain of inequalities are discussed; in the ‘functions’ strand, the application of quadratic functions, the concept and application of rational functions, irrational functions, and trigonometric functions are covered; and in the ‘probability and statistics’ strand, the understanding of permutation and combination is treated.

The teaching and learning in mathematics should enable students to interpret many phenomena in a mathematical way, and based on concrete experiences, they

should be able to go from concrete facts to abstract concepts. It will enable them to discover relations or forms, and understand mathematical concepts, principles, rules, etc. by mathematical experiences based on intuition or concrete manipulation activities. They will also, in the process of solving problems, cultivate the ability to clearly understand problems and implement practical plans, revise the course of solution, and make applications in various ways. By applying mathematical knowledge and functions to many real-life activities, students will understand the utility and necessity of mathematics. And by enabling them to experience the joy of successfully using mathematics, this curriculum will encourage a positive attitude towards it.

2. Objective

Obtain mathematical knowledge and understand functions, and cultivate the ability to think and communicate mathematically in order to investigate diverse phenomena and problems mathematically to make practical solutions, and build a positive attitude towards mathematics.

2-1. Elementary School

Acquire basic mathematical knowledge and understanding of functions, and cultivate the ability to think and communicate in a mathematical way to have the ability to contrive practical solutions to phenomena and problems in daily life, and promote a positive attitude towards mathematics.

a) By mathematically observing and manipulating phenomena in daily life, cultivate the ability to understand basic concepts, principles, and rules of mathematics.
b) Cultivate the ability to think and communicate mathematically to solve problems in daily life in a practical way.

c) Have interest in mathematics and understand its value to cultivate a positive attitude towards it.

2-2. Middle School

Acquire the basic knowledge and understanding of the functions of mathematics, and cultivate the ability to mathematically think and communicate to make practical solutions to social and natural phenomena and problems, and cultivate a positive attitude towards mathematics.

a) By the experience of observing, analyzing, and dealing with social and natural phenomena in a mathematical way, cultivate the ability to understand the basic concepts, principles, and rules of mathematics and their relationships.
b) Cultivate the ability to think and communicate in mathematics, to make practical solutions to social and natural phenomena.
c) Continue having interest in mathematics and understand its value to cultivate a positive attitude towards it.

2-3. High School

Acquire developed knowledge and understanding of the functions of mathematics, and cultivate the ability to mathematically think and communicate to make practical solutions to various phenomena and problems, and cultivate a positive attitude towards mathematics.

a) By the experience of observing, analyzing, and dealing with various phenomena in a mathematical way, cultivate the ability to understand the basic concepts, principles, and rules of mathematics and their relationships.
b) Cultivate the ability to think and communicate in mathematics, to make practical solutions to various phenomena.

c) Continue having interest in mathematics and understand its value to cultivate a positive attitude towards it.

3. Contents

3-1. Content Organization

School / Grade / Strand	Elementary School		
	First Grade	Second Grade	Third Grade
Numbers and Operations	·Numbers up to 100 ·Addition and subtraction of simple numbers ·Addition and subtraction of two-digit numbers	·Numbers up to 1000 ·Addition and subtraction of two-digit numbers ·Addition and subtraction of three-digit numbers ·Multiplication ·Understanding of fractions	·Numbers up to 10000 ·Addition and subtraction of four-digit numbers ·Multiplication ·Division ·Fractions ·Understanding of decimals
Figures	·Shapes of solid figures ·Shapes of plane figures	·Basic plane figures ·Components of solid figures	·Angles and plane figures ·Transfer of a plane figure ·Components of a circle
Measurement	·Comparisons of quantities ·Reading the time	·Time and hours ·Length ·Expressing measured value	·Time ·Length ·Capacity ·Weight
Probability and Statistics	·Classifying objects into groups	·Making charts and graphs	·Organizing data, Properties of data (bar graphs, simple pictographs)
Patterns and Problem Solving	·Finding patterns in a systematic array ·Arraying according to one's own rules ·Finding and speaking the rules in the tables of numbers up to 100 ·Expressions using □ ·Solving problems by trying out, drawing, making equations, etc	·Finding patterns in diverse changes ·Finding patterns in number arrays and arraying the numbers in order ·Finding various patterns in the multiplication table ·Finding the unknowns ·Constructing expressions ·Solving problems by finding patterns, working backward, etc.	·Designing various patterns according to rules ·Solving problems by making charts, guess and check etc.

School / Grade / Strand	Elementary School		
	Fourth Grade	Fifth Grade	Sixth Grade
Numbers and Operations	·Numbers over five ciphers ·The four fundamental rules of the arithmetic of natural numbers ·Various fractions ·Addition and subtraction of fractions with the common denominator ·Decimals ·Addition and subtraction of decimals	·Divisors and multiples ·Reduction and reduction to common denominators ·Decimals and fractions ·Addition and subtraction of fractions with uncommon denominators ·Multiplication and division of fractions ·Multiplication and division of decimals	·Division of fractions ·Division of decimals ·Mixing calculations of fraction and decimal
Figures	·Angles and various triangles ·Understanding of polygons	·Properties of a rectangular parallelepipeds and cubes ·Congruence ·Symmetry	·Properties of prisms and pyramids ·Properties of cylinders and cones ·Various solid figures
Measurement	·Angles ·Perimeter of plane figures ·Area of rectangles and squares ·Approximation, rounding off, rounding up, rounding down ·Range of numbers (greater than or equal to, less than or equal to, greater/less than)	·Area of plane figures ·Various units of weight and area	·Number π and area of circles ·Surface area and volume ·Surface area and volume of cylinders
Probability and Statistics	·Graph of broken lines ·Expressing data in appropriate graphs	·Stem-and-leaf diagram, pictographs ·Mean	·Ratio Graphs (band graphs, circle graph) ·Numbers of cases and probability
Patterns and Problem Solving	·Expressing and explaining diverse change patterns in numbers ·Guessing patterns and expressing in words or letters ·Making systematic designs ·Patterns and correspondence ·Solving problems by simplifying, logical inference, etc. ·Explaining the process of problem solving	·Ratio and Rate ·Solving a problem in various ways ·Understanding the unnecessary or deficient information in a given problem ·Evaluating the propriety of problem solving	·Equations ·Proportional expressions ·Continued ratios and proportional distribution ·Direct and inverse proportions ·Comparing the methods of problem solving ·Constructing new problems by changing the conditions of the problem ·Evaluating the propriety of the process of problem solving

School / Grade / Strand	Middle School			High School
	First Grade	Second Grade	Third Grade	First Grade
Numbers and Operations	·Sets ·Prime factorization ·Greatest common divisors, Least common multiples ·Decimal systems and binary systems ·Concept of integer and their order relation, the four fundamental rules of arithmetic ·The concept and order relation of rational numbers, the four fundamental rules of arithmetic	·Definition of recurring decimals ·Relationship between rational numbers and recurring decimals ·Approximate value and error, truth value	·The concept and properties of square roots ·Concept of irrational number ·The order relation of real numbers in a number line ·The four fundamental rules of arithmetic including rational numbers	·Operation of sets ·Propositions and conditions ·Converse, inverse, and contrapositive of propositions ·Necessary conditions and sufficient conditions ·The properties of operations of real numbers, and their order relation ·The concept and properties of complex number ·Four fundamental rules of the arithmetic of complex number
Variables and Expressions	·Use of variables ·Values of expressions ·Addition and subtraction of linear expressions ·Linear equations ·Properties of equalities	·Addition and subtraction of quadratic expressions ·Laws of exponents ·Multiplication and product formulas of polynomials ·Division of polynomials ·Deformation of equalities ·Linear equations with two unknowns ·Simultaneous linear equations ·Solutions and basic properties of inequalities ·Linear inequalities ·Simultaneous linear inequalities	·Factorization of simple polynomials ·Quadratic equations and solutions ·Application of quadratic equations	·Operations of polynomials ·Identities ·Remainder theorem ·Factorization of polynomials, Divisors and multiples ·Calculation of rational expressions and irrational expressions ·Discriminant of quadratic equations, Relationships between solutions and coefficients ·Simple cubic equations and quartic equations ·System of equations ·Properties and applications of inequalities ·Linear inequalities with absolute values ·Quadratic inequalities and simultaneous quadratic inequalities ·Absolute inequalities
Functions	·Concept of functions ·Ordered pairs and coordinates ·Expressing functions in tables, expressions ·Application of functions	·The graph of a linear function ·The relation between a linear function and a linear equation with two unknowns ·Application of linear function	·The quadratic function ·The properties of the graph of a quadratic function	·The graph of a function ·Composite functions and inverse functions ·Applications of quadratic functions ·Rational functions and irrational functions ·General angle and circular measure ·The properties of the graph of a trigonometric function

School / Grade / Strand	Middle School			High School
	First Grade	Second Grade	Third Grade	First Grade
Functions				·The properties of a trigonometric function ·Trigonometric equations and trigonometric inequalities ·The sine rule and cosine rule ·The area of a triangle applying trigonometric functions
Probability and Statistics	·Frequency tables, histograms, frequency distribution polygons ·Mean in the frequency table ·The distribution of relative frequencies and cumulative frequencies	·Numbers of cases ·The concept and basic properties of probabilities ·Calculation of simple probabilities	·Median, mode, mean ·Variance, standard deviation	·Rule of sum, rule of product ·Permutation ·Combination
Geometry	·Points, lines, planes, angles ·Positional relation of points, straight lines and planes ·The properties of parallel lines ·Simple construction ·The determination conditions and congruence conditions of a triangle ·The properties of polygons, interior angles and exterior angles ·Relation between the central angle and the arc ·The area of a sector and the length of an arc ·The positional relation between a circle and a straight line, and two circles ·The properties of a polyhedron, a solid of revolution ·The surface area and volume of a solid figure	·The definition of proposition and the meaning of proof ·The proof of the properties of triangles and rectangles ·The similarities of figures ·The properties of similar figures ·The conditions of similarities of triangles ·The ratio of the lengths between parallel lines ·Theorem of midpoint connection of a triangle ·The area and volume of similar figures	·Pythagorean theorem ·Trigonometric ratios ·The proprieties of the chord and tangent in circle ·The properties of an inscribed angle ·The properties of inscribed rectangles in a circle ·The properties of circles and proportion	·The distance between two points ·The internal division and external division of a segment ·The equations of straight lines ·The parallel conditions and perpendicular conditions of two lines ·The distance between a point and a straight line ·The equations of circles ·The positional relation of a circle and a straight line in a coordinate plane ·Translation and symmetric transposition ·The region of an inequality

3-2. Contents of Each Grade

3-2-1. Elementary School

<First Grade>

(A) Numbers and Operations

1 Numbers up to 100

① Understand the concept and write/read numbers from zero to 100.

② Understand the number system within 100, and compare size.

③ Understand the basic concept of positional numeration system up to 100.

④ Break down a number below 10 into two numbers and add the two.

⑤ When counting numbers is required, be able to count in groups.

2 Simple addition and subtraction

① Understand the situations for, and the meaning of, addition and subtraction.

② Add and subtract one-digit numbers.

③ In addition expressions where the sum is 10, and the subtraction expression '10-(one-digit number)', be able to find the numbers that add up to 10.

④ Calculate '(two-digit number)-(one-digit number).'

⑤ Understand the relation between addition and subtraction.

⑥ Add and subtract three one-digit numbers.

3 Addition and Subtraction of Two-digit Numbers

① Add numbers with two digits without regrouping.

② Subtract numbers with two digits without regrouping.

③ Applying addition and subtraction, solve problems in real life.

<Terms and Symbols> addition, subtraction, greater than~, less than~, +, -, =, >, <

<Attend to the following when teaching/learning>

① Using common words such as ‘add’, ‘subtract’, ‘greater than ~ large number’, ‘remove’, ‘difference’, ‘~ less than ~ small number’, etc. become familiar with addition and subtraction.

② Understand various methods to add or subtract two-digit numbers without rounding, and be able to do mental arithmetic.

(B) Figures

1 Shapes of Solid Figures

① By observing various objects, find the shape of a rectangular parallelepiped, cylinder, or sphere.

② Through activities involving making various shapes, become acquainted with such shapes.

2 Shapes of Plane Figures

① By observing various objects, find the shapes of quadrangles, triangles, and circles.

② By using concrete objects, make basic plane figures and design many different shapes.

<Attend to the following when teaching/learning>

① Using common terms such as ‘shape of a box’, ‘shape of a cylinder, ‘shape of a ball’, etc, become familiar with basic solid figures.

② By using common terms such as ‘square’, ‘triangle’, ‘circle’, etc. become familiar with basic plane figures.

(C) Measurement

1 Comparison of Quantities

① Comparing concrete objects' length, capacity, weight and area, be able to express 'long/short', 'numerous/scarce', 'heavy/light', 'wide/narrow', etc. and distinguish them.

2 Reading the Time

① Read the time, 'hour and minute', by looking at a clock.

<Terms and Symbols> hour, minute

<Attend to the following when teaching/learning>

① By intuitional comparison in daily life, understand the sense of quantities.

② Student's experiences should be used as examples when reading the time.

(D) Probability and Statistics

1 Classification

① Classify objects or people by a predetermined standard, and count the numbers in each category.

<Attend to the following when teaching/learning>

① The classification's standard should be clear and simple.

(E) Patterns and Problem Solving

1 Finding Patterns

① Find the rules of various objects, different patterns, arrays of numbers, and

arrange them.

② By the rules decided, arrange objects, patterns, numbers, etc.

③ Find and speak the patterns of numbers from the number array table up to 100.

2 Expressions using □

① In an addition or subtraction expression using □, understand the meaning of □.

3 Problem Solving Methods

① Solve problems by using various methods such as trying out, drawing, making equations, etc.

<Terms and Symbols> expressions

<Attend to the following when teaching/learning>

① In finding patterns, use simple materials such as size, position, directions, color, etc.

② Instead of □, be able to use different symbols such as △, ○, ( ), etc.

③ Since it is the basic experience level of problem solving, encourage confidence and interest.

<Second Grade>

(A) Numbers and Operations

1 Numbers up to 1000

① Understand the place values of ones, tens, hundreds, and the positional numeration system, and be able to write and read up to 1000.

② Understand the system of three-digit numbers and compare sizes.

2 Addition and Subtraction of Two-digit Numbers

① Add by and subtract with regrouping within two-digit numbers.

② Add and subtract three within two-digit numbers.

③ Understand the relation between addition and subtraction.

3 Addition and Subtraction of Three-digit Numbers

① Add and subtract two numbers within three-digits.

② Add and subtract three numbers within three-digits.

③ By applying addition and subtraction, solve problems in daily life.

4 Multiplication

① Understand the situations for, and meaning of, multiplication.

② Understand the multiplication table and multiply one-digit numbers.

5 Understanding Fractions

① By the division into equal parts of continuous quantity, understand fractions, and know how to read and write them.

<Terms and Symbols> product, multiplication, multiplication table, fraction, ×

<Attend to the following when teaching/learning>

① Addition of three-digit numbers should be limited to those in which the sum is below 1000.

② Before adding and subtracting, try making estimations.

③ Treat the meaning of multiplication as adding the same number or with the concept of multiples, and relate it to daily life.

④ In the division into equal parts of continuous quantity only deal with figures which can be divided into equal shapes and sizes.

(B) Figures

1 Basic Plane Figures

① Understand segments, straight lines, triangles, quadrangles, and circles, and know how to make or draw these shapes.

② Understand basic plane figures' components and find them.

2 The Components of Solid Figures

① By looking at solid figures made by building blocks, know how to make the same shapes.

② Using given building blocks, know how to make various solid figures.

<Terms and Symbols> segment, straight line, triangle, quadrangle, circle, vertex, side

<Attend to the following when teaching/learning>

① Draw various triangles and quadrangles, and discover the similarities by counting the number of vertices and sides.

② Give simple solid figures.

③ Five or six building blocks should be used when making solid figures.

(C) Measurement

1 Hour and Time

① Know how to read the hour and minute.

② Understand that one hour is 60 minutes and be able to express the time in 'hours' and 'minutes'.

③ Understand the relation between one hour, one day, one week, one month and one year.

2 Length

① Understand the units of length such as 1cm and 1m, and know how to measure the length.

② Understand the relation between 1m and 100cm, and know how to say the length in single-unit numbers and plural-unit numbers.

③ Make approximations of various objects' lengths to obtain a sense of quantity.

④ Know how to add and subtract lengths.

3 Express Measured Value

① When the length does not correspond to the scale of a ruler, judge it as a 'little more than' or a 'little less than', and express the approximation of the length.

<Terms and Symbols> time, day, week, month, year, approximate, cm, m

<Attend to the following when teaching/learning>

① By using examples from daily life, know how to differentiate between time and hour.

② By making measurements of concrete objects in various units, acknowledge the necessity of a standardized unit.

③ The addition and subtraction of measured values represented by plural units should be taught by using examples from daily life.

(D) Probability and Statistics

1 Making Tables

① Investigate data in daily life and make them into a table.

② By using simple pictures, express investigated data in graphs and compare the size of data.

<Terms and Symbols> table, graph

<Attend to the following when teaching/learning>

① Use materials that are related to students' daily lives.
② Understand that tables or graphs are useful when comparing the size of data.

(E) Patterns and Problem Solving

1 Finding Patterns
① Find and explain various variation patterns of objects or pictures.
② Find patterns in number arrays or number array tables, and know how to array the numbers according to that pattern.
③ Find and explain diverse patterns in a multiplication table.

2 Finding the Unknowns
① Express some number as □, and by using simple addition, subtraction, and multiplication equalities, find the unknown value.

3 Making Expressions
① Make an expression of a written sentence.
② Make appropriate questions of expressions.

4 Problem Solving Methods
① By various methods such as finding patterns, working backward, etc. solve problems.

<Attend to the following when teaching/learning>

① Allow the various activities of finding patterns in a number array table become the basis for multiplication table activities.
② Instead of □, be able to use symbols such as △, ○, ( ), etc.
③ Find the unknown by using various methods.

<Third Grade>

(A) Numbers and Operations

1 Numbers up to 10000

① Understand the place values of ones, tens, hundreds and thousands, positional numeration system and know how to read and write numbers up to 10000.

② Understand the system of four-digit numbers and know how to compare the size of it.

2 Addition and Subtraction of Four-digit Numbers

① Know how to add and subtract three-digit numbers.

② Know how to add and subtract two numbers within four-digit numbers.

③ Within the limit of four-digit numbers, add and subtract three numbers.

④ By applying addition and subtraction, solve daily life problems.

3 Multiplication

① Calculate '(two-digit number)×(one-digit number)', '(three-digit number)×(one-digit number)', and '(two-cipher number)×(two-cipher number)'.

② By applying multiplication, solve daily life problems.

4 Division

① Understand the situations in which division is carried out, and know the meaning of division.

② Understand the relation between multiplication and division.

③ Calculate '(two-digit number)÷(one-digit number)', and understand the meaning of quotient and remainder.

④ By applying division, solve daily life problems.

5 Fractions

① Understand fractions by the division into equal parts of discrete quantity.

② Understand the meaning of unit fractions and proper fractions, and their relation.

③ Know how to compare the size of proper fractions with common denominators and simple unit fractions.

6 Understanding of Decimals

① By proper fractions whose denominator is 10, understand the concept of decimals.

② Read and write decimals and compare their size.

<Terms and Symbols> division, quotient, remainder, divisible, decimal, ÷, decimal point (.)

<Attend to the following when teaching/learning>

① Find cases in daily life where fractions or decimals are used.

② Before adding, subtracting, multiplying, or dividing, make estimations.

③ Acknowledge the utility of fractions and decimals in problem situations.

(B) Figures

1 Angles and Plane Figures

① Understand angles and right angle.

② Understand right triangles, rectangles, and squares.

2 Movement of Plane Figures

① By the sliding, flipping and rotating of simple plane figures, understand the respective changes.

3 The Components of a Circle

① Understand the circle's center, radius, diameter, and their relation.

② By using a compass, draw various shapes.

<Terms and Symbols> angle, vertex of an angle, side of an angle, right angle, right triangle, rectangle, square, center, radius, diameter

<Attend to the following when teaching/learning>

① The sliding, flipping, and rotating of concrete objects, pictures, or plane figures drawn on graph paper are treated at a simple level.

(C) Measurement

1 Time

① Understand the meaning of time and hour.

② Understand that one minute is 60 seconds, and read the time down to seconds.

③ Add and subtract time down to seconds.

2 Length

① Understand the units of length such as 1mm and 1km.

② Understand the relation between 1cm and 1mm, 1m and 1km and know how to express the length in single-unit numbers and plural-unit numbers.

③ Add and subtract lengths.

3 Capacity

① Understand the units of 1L and 1mL and their relation.

② By measuring capacity know how to express it in L and mL.

③ Add and subtract capacities.

④ Estimate capacities of various containers and build a sense of quantity.

4 Weight

① Understand the unit and relation of 1g and 1kg.

② By measuring the weights of various objects, express it in g and kg.
③ Add and subtract weights.
④ Estimate weights of various objects, and build a sense of quantity.

<Terms and Symbols> hour, second, mm, km, L, mL, g, kg

<Attend to the following when teaching/learning>

① Using examples from daily life, know the necessity and utility of units.
② Treat weight and capacity through actual measurement activities.
③ The calculation of hour, length, capacity and weight should be limited to simple examples.

(D) Probability and Statistics

1 Organizing Data
① By collecting, sorting, and organizing various data, express them in tables, bar graphs, and simple pictographs.
② Find and explain the properties of data in tables or graphs.

<Terms and Symbols> bar graph, pictograph

(E) Patterns and Problem Solving

1 Finding Patterns
① By a set of rules, design various patterns using a single figure.

2 Problem Solving Methods
① Solve problems by using various methods such as making tables, guess and check, etc.

<Attend to the following when teaching/learning>

① Figures used in pattern designing can make various patterns by the method of arraying.

<Fourth Grade>

(A) Numbers and Operations

1 Numbers above Five-digits

① Understand the place value and positional numeration system of numbers above 10000, and read and write such numbers.

② Understand the system of numbers, and be able to compare their sizes.

2 Natural Numbers and the Four Fundamental Rules of Arithmetic

① Know how to multiply two-digit numbers.

② Know how to divide two-digit numbers.

③ Calculate problems containing a mixture of addition, subtraction, multiplication, and division.

3 Various Fractions

① Understand the concept of proper fraction, improper fraction, and mixed fraction, and their relation.

② Compare the size of fractions with common denominators.

4 Addition and Subtraction of Fractions with Common Denominators

① Add and subtract fractions with common denominators.

5 Decimals

① Based on the principle of place value, understand the numbers of two and three decimal places.

② Read and write, decimals and compare their sizes.

6 Addition and Subtraction of Decimals

① Know how to add and subtract decimals.

<Terms and Symbols> proper fraction, improper fraction, natural number, mixed fraction

<Attend to the following when teaching/learning>

① The four fundamental rules of arithmetic of natural numbers should be generalized in order to be completed by the fourth grade.

② Complicated mixing calculations of natural numbers are not dealt with.

③ Before the calculation of natural numbers, fractions, and decimals, estimate the answer.

④ Using a calculator or actual calculation, confirm the estimation.

⑤ Relate decimals to fractions.

(B) Figures

1 Angles and Various Triangles

① Understand isosceles triangle and regular triangle.

② Understand the definition of acute angle, obtuse angle, acute triangle, and obtuse triangle.

2 Understanding of Polygons

① Understand the relation between perpendicularity and parallel.

② Understand the concepts of trapezoid, parallelogram, rhombus, rectangle, square, and their properties.

③ Understand simple polygons and regular polygons.

④ With a given figure, make various shapes.

⑤ Know how to cover a given figure with various shapes.

<Terms and Symbols> isosceles triangle, regular triangle, acute angle, obtuse angle, acute triangle, obtuse triangle perpendicularity, perpendicular line, parallel, parallel line, trapezoid, parallelogram, rhombus, diagonal line, polygon, regular polygon

<Attend to the following when teaching/learning>

① By concrete manipulation, understand the properties of figures.
② Understand the relation between various quadrangles.

(C) Measurement

1 Angles
① Understand the unit of angles – one degree(°), and using a protractor, measure the size of angles.
② Know how to draw the same angle of a given size.
③ Calculate the sum of the internal angles of a triangle or a quadrangle.

2 Perimeter of a Plane Figure
① Calculate the perimeter of a simple plane figure.

3 Area of a Rectangle and a Square
① Understand area and its unit $1cm^2$.
② Understand the method of calculating the area of a rectangle or a square, and calculate it.

4 Estimation
① Understand the meaning of ‘greater than or equal to’, ‘less than or equal to’, ‘greater than’, and ‘less than’, and know how to express the range of numbers.
② Understand the meaning of rounding off, rounding up, and rounding down and apply these to daily life.

<Terms and Symbols> greater than or equal to, less than or equal to, greater than, less than, rounding off, rounding up, rounding down, degree (°), cm^2

<Attend to the following when teaching/learning>

① By using examples of rounding off, rounding up, and rounding down in daily life, understand their necessity.

(D) Probability and Statistics

1 Graph of Broken Lines

① Collect data of continuous variates and express them in a graph of broken lines.

② By comparing the bar graph and the graph of broken lines, understand the properties and uses of each graph.

③ Know how to make appropriate graphs with data found in daily life.

<Terms and Symbols> graph of broken lines

<Attend to the following when teaching/learning>

① Know how to choose the appropriate graph considering the properties of data.

(E) Patterns and Problem Solving

1 Finding Patterns

① Express in numbers and explain various variation patterns.

② By finding pattern games, guess the patterns and express them in words or letters.

2 Make Regular Patterns

① By sliding, flipping and rotating, make new patterns from a given pattern.

3 Patterns and Correspondence

① Find the patterns from a table expressing the relation of the correspondence of two quantities, and represent them in an expression using □, △.

4 Problem Solving Methods

① Solve problems by using various methods such as simplifying, logical inference, etc.

② Explain the process of problem solving.

<Attend to the following when teaching/learning>

① Games finding patterns should use simple calculations.

② The relation of correspondence between two quantities should be dealt with using examples in which one changes depending on the other.

<Fifth Grade>

(A) Numbers and Operations

1 Divisors and Multiples

① Understand the meaning of divisor, common divisor, greatest common divisor, and know how to solve for them.

② Understand the meaning of multiple, common multiple, least common multiple, and know how to solve for them.

③ Understand the relation between divisors and multiples, and know how to apply these.

2 Reduction of Fraction and Reduction to Common Denominator

① Make equivalent fractions by using the properties of fractions.
② Know how to abbreviate and reduce fractions.
③ Compare fractions of uncommon denominators.

3 Decimals and Fractions
① Understand the relation between decimals and fractions, and know how to express fractions in decimals, and decimals in fractions.
② Compare the sizes of decimals and fractions.

4 Addition and Subtraction of Fractions with uncommon Denominators
① Know how to add and subtract fractions with uncommon denominators.

5 Multiplication and Division of Fractions
① Understand the meaning and calculation principle of multiplication between natural numbers and fractions, and between fractions.
② Know how to express '(natural number)÷(natural number)' in fractions.
③ Understand the calculation principle of '(fraction)÷(natural number)' and calculate it.

6 Multiplication and Division of Decimals
① Know how to multiply decimals by natural numbers, and how to multiply decimals.
② Understand the principle of division of decimals, and calculate '(natural number)÷(natural number)', and '(decimal)÷(natural number)'.

<Terms and Symbols> multiple, even number, odd number, divisor, common divisor, greatest common divisor, common multiple, least common multiple, reduction of fraction, reduction to common denominator, irreducible fraction

<Attend to the following when teaching/learning>

① The divisor and the multiple should be limited to natural numbers.
② Solve for the greatest common divisor and the least common multiple only among two numbers.
③ The calculation of decimals should be at a level where the principle of calculation is easily understood.

(B) Figures

1 The Properties of a Rectangular Parallelepiped and a Cube
① Understand the components of a rectangular parallelepiped and a cube, and discover their various properties.
② Draw the development figure and sketch of a rectangular parallelepiped and a cube.

2 Congruence
① Understand the meaning of congruence of figures, and discern congruent figures.
② Using a ruler, compass, and protractor, draw a triangle appropriate to the conditions.

3 Symmetry
① Understand the meaning of, and know how to draw, a symmetric figure for a line and a symmetric figure for a point.
② Draw figures that are line symmetry and point symmetry.

<Terms and Symbols> rectangular parallelepiped, face, edge, base plane, lateral face, cube, sketch, development figure, congruence, corresponding point, corresponding side, corresponding angle, symmetry, symmetric figure for a line, symmetric figure for a point, axis of symmetry, center of symmetry

<Attend to the following when teaching/learning>

① Draw various development figures of a rectangular parallelepiped.
② By concrete manipulation, understand the meaning of a symmetric figure for a line and a point.
③ When explaining a symmetric figure for a line, use a mirror.

(C) Measurement

1 Area of a Plane Figure
① Understand the method of finding the area of a parallelogram, triangle, trapezoid, and rhombus.

2 Various Units
① Understand the new units of weight, and understand the relation between different units of weight.
② Understand the new units of area and the relation between them.

<Terms and Symbols> base, height, t, m^2, km^2, a, ha

<Attend to the following when teaching/learning>

① The area of a triangle should be taught for when the height is interior or exterior.
② Understand the relation between $1cm^2$ and $1m^2$ through activities.
③ Understand the need of new units in daily life.
④ Do not deal with the conversion of complicated units.

(D) Probability and Statistics

1 The Expression and Interpretation of Data
① To organize data, express them in Stem-and-leaf diagram, or pictographs, and

grasp the properties of the data.

② Understand the meaning of mean, and find the mean of given data.

③ Collect appropriate data, organize and express them in graphs, and be able to explain their properties.

<Terms and Symbols> Stem-and-leaf diagram, mean

<Attend to the following when teaching/learning>

① Understand the importance of appropriately collecting and organizing data.

(E) Patterns and Problem Solving

1 Ratio and Rate

① Compare the sizes of two quantities, and express them in a fraction.

② Understand the meaning of ratio and rate between two quantities.

③ Express rate in various ways.

2 Methods of Problem Solving

① Solve a problem using various methods, and compare them.

② Know how to identify unnecessary or insufficient information in solving problems.

③ Examine the propriety of the process of problem solving.

<Terms and Symbols> ratio, basic quantity, quantity to be compared, rate, percentage, %

<Attend to the following when teaching/learning>

① When comparing two quantities, discuss the relation between a part and a whole, and a part and a part in various ways.

② Find examples in different subjects from daily life in which rate in used,

such as velocity and population density, and solve related problems.

<Sixth Grade>

(A) Numbers and Operations

1 Division of Fractions

① Understand the meaning and calculation principle in which the divisor is a fraction, and know how to calculate it.

2 Division of Decimals

① Understand the meaning and calculation principle in which the divisor is a decimal, and know how to calculate it.

3 Mixing Calculations of Fractions and Decimals

① Know how to solve simple calculations with both fractions and decimals.

(B) Figures

1 The Properties of Prisms and Pyramids

① Understand the concepts of prisms and pyramids, and their components and properties.

② Draw the development figure of a prism.

2 The Properties of Cylinders and Cones

① Understand the concepts of cylinders and cones, and their components and properties.

② Draw the development figure of a cylinder.

③ Understand the concept of a solid of revolution.

3 Various Solid Figures

① Looking at a solid figure made by building blocks, count the number of

blocks used.

② Make various shapes using building blocks, and find the patterns.

③ Express the shape of a solid figure made by building blocks from the top, front, and side.

④ Express the shapes from the top, front, and side of various objects.

<Terms and Symbols> prism, pyramid, cylinder, cone, generator, solid of revolution, axis of rotation, sphere, section

<Attend to the following when teaching/learning>

① The development figure of a prism should be treated at a simple level.

② When dealing with various objects, use materials closely related to daily life.

(C) Measurement

1 Number π and Area of a Circle

① Understand the concept of number π.

② Understand the method of calculating the circumference and the area of a circle, and calculate them.

2 Surface Area and Volume

① Understand how to calculate the area of a rectangular parallelepiped and a cube.

② Understand the concept of volume, and know its units ($1cm^3$, $1m^3$) and their relation.

③ Understand how to calculate the volume of a rectangular parallelepiped and a cube.

④ Understand the relation between volume and capacity.

3 The Surface Area and Volume of a Cylinder

① Understand how to calculate the surface area and volume of a cylinder.

<Terms and Symbols> surface area, volume, circumference, number π, cm^3, m^3

<Attend to the following when teaching/learning>

① Understand number π through activities measuring the diameter and the circumference.
② Calculate the area of a circle in various ways through concrete manipulations.

(D) Probability and Statistics

1 Ratio Graphs
① Understand the meanings of band graphs and circle graphs, and know how to apply them.
② Find the characteristics of data from a ratio graph, and know how to explain them.

2 Number of Cases and Probability
① Understand the meaning of number of cases and find it.
② Based on the number of cases, understand the meaning of probability.

<Terms and Symbols> band graph, circle graphs, number of cases, probability

<Attend to the following when teaching/learning>

① When teaching circle graphs, use circles with scales.
② When teaching ratio graphs, use materials from television, newspapers, internet, etc.
③ The number of cases should be treated at a simple level.

④ Using examples from daily life, teach the meaning of probability.

(E) Patterns and Problem Solving

1 Equations

① Express the unknown as 'x'.

② Understand the properties of an equality, and by using them, solve simple equations.

2 Proportional Expressions

① Understand proportional expressions, and know how to apply them.

② By using the properties of proportional expressions, solve simple proportional expressions.

3 Continued Ratios and Proportional Distribution

① Understand the meaning of continued ratios, and know how to express a ratio between three quantities.

② Understand the meaning of proportional distribution, and know how to proportionally distribute given quantities.

4 Direct Proportion and Inverse Proportion

① Express the correspondence of two numbers using x and y.

② Understand the relation between direct proportion and inverse proportion, and express this relation in a table or graph.

③ By applying the relationship between direct proportion and inverse proportion, solve problems in daily life.

5 Methods of Problem Solving

① Compare various methods of problem solving, and choose the appropriate method depending on the question.

② By changing the conditions of a given problem, construct a new problem

and solve it.

③ Explain the propriety of the process of problem solving.

<Terms and Symbols> equality, equation, proportional expression, continued ratio, proportional distribution, direct proportion, inverse proportion, expression of relation, proportional constant, x

<Attend to the following when teaching/learning>

① Use symbols in addition to x for the unknown.

② The property of equality is taught using concrete objects.

③ Proportional expressions, continued ratios, and proportional distribution are dealt with at a simple level.

④ Correspondence, direct proportion, and inverse proportion are taught using examples from daily life.

⑤ When introducing the relation of the correspondence between two numbers, only treat cases in which $y = x + a$ or $y = a \times x$.

3-2-2. Middle School

<First Grade>

(A) Numbers and Operations

1 Sets

① Understand the concept of a set, and know how to express it.

② Understand the inclusion relation between two sets.

③ Know how to operate sets.

2 The Properties of Natural Number

① Understand the meaning of power.

② Understand the meaning of prime factorization, and know how to factorize natural numbers.

③ Understand the properties of the greatest common divisor and the least common multiple, and know how to find them.

④ Using the greatest common divisor and the least common multiple, solve various problems.

⑤ Understand the principle of the decimal system and the binary system, and know how to express a natural number in the expression of decimal system and binary system.

⑥ Understand the relation between the decimal system and the binary system.

3 Integer

① Understand the concept of integer.

② Understand the order relation of integers.

③ Understand the four fundamental rules of arithmetic with integers.

4 Rational Number

① Understand the concept of rational number.

② Understand the order relation of rational numbers.
③ Understand the four fundamental rules of arithmetic with rational numbers.

<Terms and symbols> set, element, tabular form, set-builder form, finite set, infinite set, empty set, subset, proper subset, be equal to each other, Venn diagram, union, intersection, universal set, complement, difference set, prime number, composite number, power, exponent, base, prime factor, prime factorization, relatively prime, decimal system, binary system, expansion of numeral representation, positive number, negative number, positive integer, negative integer, integer, number line, positive rational number, negative rational number, rational number, absolute value, commutative law, associative law, distributive law, inverse number, $a \in A$, $b \notin B$, $\varnothing$, $A \subset B$, $A \not\subset B$, $A \neq B$, $A \cup B$, $A \cap B$, $\cup$, A^c, *A-B*, *n(A)*, $1011_{(2)}$, +, −, $|\ |$ (absolute value), $\leq$, $\geq$

<Attend to the following when teaching/learning>

① In the operation of sets, mostly deal with the operation of two sets.
② The divisors and multiples are only treated within the range of natural numbers.

(B) Variables and Expressions

1 Use of Variables and Calculation of Expressions
① Using variables, make simple expressions.
② Find the value of expressions.
③ Understand the addition and subtraction principle of linear expressions, and know how to calculate them.

2 Linear Equations
① Understand the meaning of a linear equation and its solution.

② Understand the property of equality, and know how to apply it.
③ Solve linear equations.

3 Application of Linear Equations
① Solve various problems by applying linear equations.

<Terms and Symbols> substitution, numerical value of expression, polynomial, term, monomial, constant term, coefficient, degree, linear expression, similar term, left side, right side, both sides, unknown, solution, root, identity, transposition, linear equation

<Attend to the following when teaching/learning>

① When solving linear expressions, only deal with those with one variable.

(C) Functions

1 Functions and Graphs
① Understand the concept of functions.
② Understand ordered pairs and coordinates.
③ Express a function in tables, expressions, and graphs.

2 Application of Functions
① By applying functions, solve problems in daily life.

<Terms and Symbols> variable, function, domain, co-domain, value of function, range, coordinates, ordered pair, x-coordinate, y-coordinate, origin, coordinate axis, x-axis, y-axis, coordinate plane, first quadrant, second quadrant, third quadrant, forth quadrant, graph of function, $f(x)$, $y=f(x)$

<Attend to the following when teaching/learning>

① Demonstrate in daily life how one quantity changes as another quantity changes.
② When teaching the concept of functions, deal at an intuitional level.

(D) Probability and Statistics

1 Frequency Distribution and Graph
① Understand the frequency table, histograms, and frequency distribution polygons.
② Know how to make the graph or the table of given data, and interpret them.
③ Understand the meaning of mean in a frequency table, and know how to find it.

2 Distribution of Relative Frequency and Cumulative Frequency
① Understand the distribution of relative frequency and cumulative frequency, and know how to make a graph of it.

<Terms and Symbols> variant, class, class interval, frequency, frequency table, class mark, histogram, frequency distribution polygon, relative frequency, cumulative frequency

<Attend to the following when teaching/learning>

① Collect data from daily life, and express them in tables and graphs.
② Do not show how to find the mean using the temporary mean.

(E) Geometry

1 Basic Figures
① Understand the properties of points, lines, planes, and angles.
② Understand the positional relation between points, lines, and planes.

③ Understand the properties of parallel lines.

2 Construction and Congruence

① Know how to construct simple figures.

② Understand the properties of congruent figures.

③ Understand the determination condition and congruence condition of a triangle.

3 The Properties of a Plane Figure

① Understand the properties of a polygon.

② Find the size of a polygon's internal angles and external angles.

③ Understand the relation of a sector's central angle and arc.

④ Find the area of a sector and the length of an arc.

⑤ Understand the positional relation between a circle and a straight line.

⑥ Understand the positional relation between two circles.

4 The Property of a Solid Figure

① Understand the meaning of a polyhedron and its properties.

② Understand the meaning of a solid of revolution and its properties.

③ Know how to find the surface area and volume of a solid figure.

<Terms and Symbols> intersection point, line of intersection, ray, distance between two points, midpoint, perpendicular bisector, skew position, intersection angle, opposite vertical angles, alternate angle, corresponding angle, straight angle, orthogonal, foot of perpendicular, construction, opposite side, opposite angle, triangle's determination condition, correspondence of figures, triangle's congruence condition, internal angle, external angle, sector, central angle, arc, chord, segment of a circle, secant line, tangent line, tangent point, contact, common chord, central line, distance between centers, common tangent, polyhedron, truncated pyramid, regular polyhedron, truncated circular cone, $\overleftrightarrow{AB}$, $\overrightarrow{AB}$, $\overline{AB}$, $l//m$,

$\angle ABC$, $\overleftrightarrow{AB} \perp \overleftrightarrow{CD}$, $\triangle ABC$, $\equiv$, $\overset{\frown}{AB}$, π

<Attend to the following when teaching/learning>

① Investigate intuitionally the characters of points, lines, planes, angles and circles.

② If a specific numerical value is not given for the ratio of the circumference of a circle to its diameter, then express it as π.

<Second Grade>

(A) Numbers and Operations

1 Rational Number and Recurring Decimal

① Understand the meaning of recurring decimal.

② Understand the relation between rational number and recurring decimal.

2 Approximate Value

① Understand the meaning of approximate value and error, and find the range of the truth value.

② Understand how to express the approximate value.

<Terms and Symbols> finite decimal, infinite decimal, recurring decimal, repetend, truth value, measured value, approximate value, error, limit of error, significant digit, $2.\dot{4}1\dot{5}$, $a \times 10^n (1 \le a < 10,\ n)$, $a \times \frac{1}{10^n} (1 \le a < 10,\ n)$

<Attend to the following when teaching/learning>

① Do not emphasize expressing finite decimals as recurring decimals.

② When changing a recurring decimal into a fraction, do not emphasize the formulation of it.

② When dealing with approximate value, incorporate situations related to science or daily life.

(B) Variables and Expressions

1 Calculation of expressions

① Understand the principle of the addition and subtraction of a quadratic expression, and be able to calculate it.

② Understand the law of exponent.

③ Understand the multiplication principle of polynomials and derive the multiplication fomula.

$(a+b)(c+d)=ac+ad+bc+bd$

$(a+b)^2=a^2+2ab+b^2$

$(a-b)^2=a^2-2ab+b^2$

$(a+b)(a-b)=a^2-b^2$

$(x+a)(x+b)=x^2+(a+b)x+ab$

$(ax+b)(cx+d)=acx^2+(ad+bc)x+bd$

④ Understand the division principle of polynomials, and be able to calculate it.

⑤ Transform simple equalities.

2 Simultaneous Linear Equations with Two unknowns

① Understand the meaning of linear equations with two unknowns.

② Understand the meaning of a simultaneous linear equations with two unknowns and their solutions.

③ Solve a simultaneous linear equations with two unknowns.

3 Application of Simultaneous Linear Equations

① Solve various problems by using the simultaneous linear equations with two unknowns.

4 Linear Inequalities and Simultaneous Linear Inequalities

① Understand inequalities and their solutions.
② Understand the basic principle of inequalities.
③ Understand linear inequalities and their solutions, and solve them.
④ Understand simultaneous linear inequalities and their solutions, and solve simultaneous linear inequalities.

5 Application of Linear Inequalities and Simultaneous Linear Inequalities
① By applying linear inequalities or simultaneous linear inequalities, solve various problems.

<Terms and Symbols> quadratic expression, expansion, expanded expression, simultaneous equations, simultaneous linear equations, elimination, addition or subtraction method, method of substitution, inequality, linear inequality, simultaneous inequalities, simultaneous linear inequalities

<Attend to the following when teaching/learning>

① When discussing the law of exponents, exponents should be limited to natural numbers.
② When dividing a polynomial, it should be divided by a monomial, and the quotient should be a polynomial.
③ When carrying out the four fundamental rules of arithmetic of a polynomial, do not include very complicated calculations.

(C) Functions

1 Linear Functions and Their Graphs
① Understand the meaning of linear functions, and know how to draw a graph of them.
② Understand the properties of a graph of a linear function.

2 Applications of a Linear Function

① Understand the relation between a linear function and a linear equation with two unknowns.

② By using two graphs of linear functions, understand the solution of a simultaneous linear equations.

③ By applying a linear function, solve various problems.

<Terms and Symbols> linear function, slope, x-intercept, y-intercept, translation, equation of a straight line

<Attend to the following when teaching/learning>

① The solution of a simultaneous linear equations by using graphs of two linear functions should be taught at a level that shows that the intersection point of the two lines is their solution.

(D) Probability and Statistics

1 Probability and Basic Properties

① Know how to find the number of cases.

② Understand the meaning of probability and its basic properties.

③ Calculate simple probabilities.

<Terms and Symbols> event

<Attend to the following when teaching/learning>

① When finding the number of cases, do not deal with very complicated cases.

② When introducing and calculating probability, use the situation related to a simple number of cases or a relative frequency

(E) Geometry

1 The Properties of a Triangle and a Quadrangle

① Understand the meaning of proposition and proof.

② Using the triangle's congruence conditions, prove the properties of a triangle and a quadrangle.

2 Similarities of Figures

① Understand the meaning of similarities of figures.

② Understand the properties of similar figures.

③ Understand the conditions of triangle's similarity.

3 Application of Similarities

① Understand and apply the property of the length ratio of a segment between parallel lines.

② Understand and apply the theorem of midpoint connection of a triangle.

③ Using ratios of similarities, find the area or volume of figures.

<Terms and Symbols> proposition, hypothesis, conclusion, converse, definition, theorem, proof, circumcenter, circumscription, circumscribed circle, incenter, inscription, inscribed circle, similarity, ratio of similarity, center of similarity, position of similarity, conditions of similarities of a triangle, median line, barycenter, $p \rightarrow q$, $\square ABCD$, $\backsim$

<Attend to the following when teaching/learning>

① $p \rightarrow q$ are used as symbols expressing propositions.

② By comparing a triangle's similarity conditions and congruence conditions, understand their differences.

③ For a difficult proof, before carrying out the task, use technology or manipulatives to acquire an intuitional understanding of it.

<Third Grade>

(A) Numbers and Operations

1 Square Roots and Real Number

① Understand the meaning and properties of a square root.

② Understand the concept of irrational number.

③ Understand the order relation of real numbers in a number line.

2 Calculation of expressions including radical signs

① Carry out the four fundamental rules of arithmetic with expressions including radical signs.

<Terms and Symbols> square root, radical sign, irrational number, real number, rationalization of denominator, $\sqrt{\ }$

<Attend to the following when teaching/learning>

① Use a square root table or calculator when the approximate value of a square root is necessary and the solution method of the square root is not included.

(B) Variables and Expressions

1 Factorization of Polynomials

① Understand the meaning of factorization, and be able to factorize.

ma+mb=m(a+b)

$a^2+2ab+b^2=(a+b)^2$

$a^2-2ab+b^2=(a-b)^2$

$a^2-b^2=(a+b)(a-b)$

$x^2 + (a+b)x + ab = (x+a)(x+b)$

$acx^2 + (ad+bc)x + bd = (ax+b)(cx+d)$

2 Quadratic Equations

① Understand the meaning of a quadratic equation and its solution, and solve them.

3 Application of Quadratic Equations

① By applying quadratic equations, solve various problems.

<Terms and Symbols> factor, factorization, perfect square expression, quadratic equation, multiple root, quadratic formula

<Attend to the following when teaching/learning>

① Simple forms of factorization where multiplication formula can be used should be discussed.

② Only quadratic equations which have real number solutions are treated.

(C) Functions

1 Quadratic Functions and Their Graphs

① Understand the meaning of a quadratic function and draw its graph.

② Understand the properties of the graph of a quadratic function.

<Terms and Symbols> quadratic function, parabola, axis, vertex, maximum, minimum

<Attend to the following when teaching/learning>

① The relation between the solution of a quadratic equation and the graph of a quadratic function are not included.

② In a quadratic function, the maximum and minimum are only dealt with when the domain is the whole of a real number.

(D) Probability and Statistics

1 Representative Values and Measures of Dispersion

① Understand the meaning of median, mode, mean, and find them.

② Understand the meaning of variance and standard deviation, and find them.

<Terms and Symbols> median, mode, representative value, measure of dispersion, deviation, variance, standard deviation

<Attend to the following when teaching/learning>

① By using various situations from daily life, introduce the representative value and the measure of dispersion, and acknowledge their necessity.

(E) Geometry

1 Pythagorean Theorem

① Understand and prove Pythagorean theorem.

② Apply Pythagorean theorem to simple figures.

2 Trigonometric Ratios

① Understand the meaning of trigonometric ratios, and calculate simple trigonometric ratio.

② By applying trigonometric ratios, solve problems in daily life.

3 Circles and Straight Lines

① Understand the properties of a chord in a circle.

② Understand the properties of a circle's tangent line.

4 Inscribed Angles

① Understand and apply the characters of an inscribed angle.

② Understand the properties of a quadrangle inscribed in a circle.

③ Understand the properties of proportion circles.

<Terms and Symbols> trigonometric ratio, sine, cosine, tangent, length of tangent line, inscribed angle, inner opposite angle, sin$A$, cos$A$, tan$A$

<Attend to the following when teaching/learning>

① The converse of Pythagorean) theorem is treated simply without proof.

② The relation among trigonometric ratios is not treated.

③ The value of trigonometric ratios from 0° to 90° is treated, and graphs of trigonometric ratios are not.

④ The application of trigonometric ratios is done by choosing simple situations.

3-2-3. High School

<First Grade>

(A) Numbers and Operations

1 Operations of Sets

① Understand the operations of sets.

2 Propositions

① Understand the meaning of propositions and conditions.

② Understand the converse, inverse, and contrapositive of propositions.

③ Understand the necessary condition and sufficient condition.

3 Real Number

① Understand the properties of operations of real numbers.
② Understand the order relation of real numbers.

4 Complex Number
① Understand the meaning of complex numbers and their basic properties.
② Understand the properties of operations of complex numbers, and use this for the four fundamental rules of arithmetic.

<Terms and Symbols> relatively prime of sets, commutative law of sets, associative law of sets, distributive law of sets, De Morgan's law, condition, truth set, negation, inverse, contrapositive, necessary condition, sufficient condition, necessary and sufficient condition, all, some, closed, identity, inverse element, imaginary unit, complex number, real part, imaginary part, imaginary number, conjugate complex number, $\sim p$, $p \Rightarrow q$, $p \Leftrightarrow q$, i, $a+bi$, $\overline{a+bi}$

<Attend to the following when teaching/learning>

① The operations of a set should be dealt with by simply referring to a Venn diagram.
② The meaning of propositions of condition should be taught at the level of understanding a mathematical sentence.

(B) Variables and Expressions

1 Polynomials and Their Operations
① Add and subtract Polynomials.
② Multiply and divide Polynomials.

2 Remainder Theorem
① Understand identity.

② Understand the meaning of the remainder theorem, and apply this to problem solving.

3 Factorization

① Factorize Polynomials.

4 Divisors and Multiples

① Understand the meaning of divisors and multiples of a polynomial and find them.

② Understand the greatest common divisor and least common multiple of polynomials and find them.

5 Rational Expressions and Irrational Expressions

① Understand the meaning of rational expressions, and solve them.

② Understand the meaning of irrational expressions, and solve them.

6 Quadratic Equations

① Understand the meanings of real root and imaginary root of a quadratic equation.

② Understand the discriminant of a quadratic equation.

③ Understand the relation between the root and coefficient of a quadratic equation.

7 Equations of and Simultaneous Equations

① Solve simple cubic equations and quartic equations.

② Solve simultaneous linear equations with three unknowns and simultaneous quadratic equations with two unknowns.

8 Quadratic Inequalities and Absolute Inequalities

① Understand the properties of an inequality and apply them.

② Solve linear inequalities including absolute values.

③ Solve quadratic inequalities and simultaneous of quadratic inequalities.
④ Understand the meaning of an absolute inequality, and be able to prove a simple absolute inequality.

<Terms and Symbols> method of undetermined coefficients, remainder theorem, factor theorem, synthetic division, rational expression, fractional expression, irrational expression, double radical sign, discriminant, real root, imaginary root, cubic equation, quartic equation, simultaneous quadratic equations, quadratic inequality, simultaneous quadratic inequalities, absolute inequality, $\sqrt{a+b\sqrt{c}}$

<Attend to the following when teaching/learning>

① Treat synthetic division in a simple way by using examples.
② When treating irrational expressions, only deal with those that have a linear or a quadratic expression in the root.
③ Only deal with equations which have real number coefficients.

(C) Geometry

1 Coordinate Plane
① Find the distance between two points.
② Understand the internal division and external division of a segment, and find the internally dividing point and externally dividing point.

2 Equations of Straight Lines
① Find the various equations of straight lines.
② Understand the parallel conditions and perpendicular conditions of two straight lines.
③ Find the distance between the point and the line.

3 Equation of a Circle

① Find the equation of a circle.

② Understand the positional relation of a circle and a line on the coordinate plane.

4 Transfer of a Figure

① Understand the meaning of translation.

② Understand the meaning of symmetric transposition to the origin, x-axis, y-axis, and $y=x$

5 Region of Inequalities

① Understand the meaning of the region of inequalities.

② Apply the region of inequalities to solve for the maximum and minimum.

<Terms and Symbols> internal division, external division, internally dividing point, externally dividing point, equation of a circle, symmetric transposition, $f(x, y)=0$

<Attend to the following when teaching/learning>

① Do not deal with translation of a coordinate axis.

② When applying the region of inequalities), choose simple situations.

(D) Functions

1 Functions

① Understand the definition of a function and its graph.

② Understand the composition of functions, and find the composite function.

③ Understand the definition of inverse function, and find the inverse function of a given function.

2 Applications of quadratic functions

① Understand the maximum and minimum of a quadratic function.

② Understand the positional relation between the graph of a quadratic function and the straight line.

③ Understand the relation between quadratic functions, quadratic equations, and quadratic inequalities.

3 Rational Functions and Irrational functions

① Understand the definition of rational function and irrational function.

② Draw the graph of a function $y=\frac{ax+b}{cx+d}$, and understand the properties of this graph.

③ Draw the graph of a function $y=\sqrt{ax+b}+c$, and understand the properties of this graph.

4 Trigonometric functions

① Understand the definition of general angles and circular measure.

② Understand the definition of trigonometric functions.

③ Draw the graphs of sine, cosine, and tangent functions, and understand their properties.

④ Understand the properties of trigonometric functions.

⑤ Solve simple trigonometric equations and trigonometric inequalities.

5 Applications to Triangles

① Understand the sine rules and cosine rules.

② By applying trigonometric functions, find the area of a triangle.

<Terms and Symbols> correspondence, one to one correspondence, identity function, constant function, one to one function, composite function, inverse function, polynomial function, rational function, fractional function, asymptotic line, irrational function, initial line, radius, general angle, circular

measure, radian, sine function, cosine function, tangent function, trigonometric function, period, periodic function, trigonometric equation, trigonometric inequality, sine rule, cosine rule.
$f : X \rightarrow Y$, $g \circ f$, $(g \circ f)(x)$, $y = g(f(x))$, f^{-1}, $y = f^{-1}(x)$, $\sin x$ $\cos x$ $\tan x$

<Attend to the following when teaching/learning>

① Understand composite functions and inverse functions, based on polynomial functions, rational functions and irrational functions with the degree lower than three.
② The general solution of trigonometric equations and triangle inequalities are not dealt with.

(E) Probability and Statistics

1 Number of cases
① Understand the rules of sum and rules of product and use these to find the number of cases.

2 Permutation and Combination
① Understand the meaning of permutation, and find the number of permutations.
② Understand the meaning of combination, and fine the number of combinations.

<Terms and Symbols> permutation, factorial, combination, ${}_nP_r$, $n!$, ${}_nC_r$

<Attend to the following when teaching/learning>

① By using the number of cases, permutation, and combination, solve problems related to daily life to acknowledge their utility.
② Complicated permutation and combination are not dealt with.

4. Teaching/Learning Methods

A) The contents of the curriculum are accomplishment standards that students must achieve, so appropriately guide students with careful consideration of their character, connection among different grades, regional factors, and practicality.

B) The array's order of each grade does not necessarily dictate the order of teaching/learning, so when planning teaching/learning or developing teaching materials, consider the contents' characteristics and degree of difficulty, and reconstruct them accordingly.

C) After guiding students by the contents indicated in the curriculum, for students who have deficiencies, operate supplemental classes. And for those who excel, provide opportunities for learning enriched contents.

D) In a mathematics class, by considering the students' abilities, carry out various teaching/learning methods such as discovery learning, exploratory learning, cooperative learning, individual learning, and explanation-type learning etc.

E) Consider the following to allow significant questions to be formed by a mathematics class:
(1) The questions should be chosen based on the student's level of intellect and experience. Attend to the reactions in a meaningful way.
(2) If possible ask open questions to encourage creative responses.

F) For the teaching/learning of mathematical principles and rules, attend to the following:
(1) Using various teaching materials such as social phenomena, natural

phenomena, etc., introduce the mathematical concepts, principles, and rules.

(2) Through concrete manipulation and investigation activities, allow students to discover the concepts, principles and rules by themselves.

G) In order to enhance mathematical thinking and inference ability, attend to the following:

(1) By induction, analogy, etc., allow the students to infer mathematical facts by themselves, and justify or prove them.

(2) Analyze mathematical facts or propositions, form and consolidate mathematical relations, and enable students to reflect their own thinking process.

H) Attend to the following when teaching/learning in order to increase mathematical communication ability:

(1) Understand mathematical expressions like terms, symbols, tables, graphs, etc., and use correctly.

(2) Explain mathematical ideas in words and letters, and visualize them to communicate effectively.

(3) By expressing and discussing mathematics, clarify and reflect on one's thoughts to understand the importance of communication in mathematical studies.

I) Attend to the following when teaching/learning in order to increase mathematical problem solving ability:

(1) Problem solving should be continuously treated in all strands.

(2) Students should investigate circumstances, and with mathematical knowledge and thinking methods, use appropriate methods to solve problems.

(3) Based on a student's experience and motivation, solve problems in creative ways.

(4) Not only the results, but the method and process of problem solving and problem posing, should be emphasized.

(5) By solving problems in daily life, natural and social phenomena, investigate mathematical concepts, principles, and rules, and generalize them.

J) Attend to the following when teaching/learning to enhance a positive attitude towards mathematics:

(1) By dealing with various phenomena using mathematics, acknowledge the value and necessity of mathematics.

(2) To acquire interest and confidence in mathematics, induce learning motivation and intentions.

K) Attend to the following in teaching/learning when applying tools:

(1) By the whole course of teaching/learning, apply appropriate and various education tools to enhance the effect of mathematical education.

(2) If cultivation of calculation ability is not the objective, use calculators, computers, educational software, and other tools when dealing with complicated calculations understanding mathematical concepts, principles, and rules, and increasing problem solving ability, etc.

L) Each school may operate differentiated classes considering the level and ability of each student. When operating differentiated classes, the following should be considered:

(1) Differentiated classes may be operated by forming and organizing leveled groups appropriate to each school.

(2) In differentiated classes, rather than differentiating the content, focus on differentiating the method of approach and the depth of the content.

5. Evaluation

A) Evaluation of mathematics should provide useful cognitive and definitive advice, which induces an individual student's education and development of well-roundedness, and may be helpful in improving teaching methods.

B) When evaluating mathematics learning, consider the level of knowledge of the students, and abide by the contents and level of the curriculum.

C) Mathematics evaluation should be carried out in the form of diagnosis, formative, and summative evaluations, according to the progress of the classes.

D) Uniform evaluation should be avoided, and by various evaluation methods such as written exams, observation, interviews, and self-evaluation, enhance the teaching and learning of mathematics.

E) Evaluation of the cognitive domain should focus not only on the results, but also on the process, while emphasizing the following requirements throughout the teaching/learning of mathematics:

(1) Ability to understand and apply the basic principles, concepts, and rules of mathematics
(2) Ability to understand the mathematical representations and apply them correctly.
(3) Ability to apply mathematical knowledge and function to make sound inferences.
(4) Ability to solve various problems in diverse situations by mathematical thinking
(5) Ability to mathematically observe, analyze, and organize various phenomena in daily life, social and natural.

(6) Ability to reasonably communicate the process and results of mathematical thinking.

F) Evaluation of the affective domain should be at the level of understanding the students' sound perspective, interest, and confidence in mathematics, in order to enhance a positive attitude towards mathematics.

G) According to the evaluation, allow students an opportunity to use calculators, computers, and other technological and educational tools.