Grade 7 FIELD TESTING Curriculum

Grade — Learning Outcome — 7N1.2 — Organizing Idea — Understanding row

Number = N
Measurement = M
Algebra = A
Functions = F
Geometry = G
Statistics = ST
Probability = P

Number (N)

Numbers are organized into systems with unique notation to communicate quantities and to facilitate calculations.

Guiding Question: How can the symmetry of the number line contribute to a sense of number?

LEARNING OUTCOME
7N1 Students analyze positive and negative numbers.

7N1.1 UNDERSTANDING
Every fraction and decimal number has an additive inverse with the same absolute value and opposite sign.

KNOWLEDGE	SKILLS & PROCEDURES
Absolute value represents the magnitude of any number from zero. A negative fraction can be expressed equivalently as $-\frac{a}{b}$, $\frac{-a}{b}$, or $\frac{a}{-b}$, for any two positive numbers a and b. Negative decimal numbers can be found in real-world situations, such as • debt • change in stock prices • sea levels • temperature	Relate the absolute value of positive and negative numbers, including decimal numbers and fractions, to their positions on the number line. Convert between fractions and decimal numbers, including negative numbers. Compare and order positive and negative numbers, including decimal numbers and fractions. Discuss real-world situations involving negative decimal numbers.

Number (N)

Numbers are organized into systems with unique notation to communicate quantities and to facilitate calculations.

Guiding Question: How can operations on positive and negative numbers be understood?

LEARNING OUTCOME

7N2 Students apply operations to positive and negative numbers.

7N2.1 UNDERSTANDING

Addition and subtraction of integers can be represented as numerical expressions.

KNOWLEDGE	SKILLS & PROCEDURES
The symbol, −, can indicate a negative number or the subtraction operation. Addition does not always result in a greater number, and subtraction does not always result in a smaller number. Subtraction can be expressed as addition, i.e., $a - b = a + (-b)$. Addition and subtraction of positive and negative numbers can be supported by various processes for adding and subtracting decimal numbers and fractions, such as • employing standard algorithms • determining common denominator • expressing subtraction as related addition	Distinguish the meaning of the symbol, −, represented in a numerical expression. Add and subtract any two integers. Assess the reasonableness of a sum or difference of two integers. Solve problems involving addition and subtraction of integers.

7N2.2 UNDERSTANDING

Products and quotients can be represented as numerical expressions in infinitely many ways.

KNOWLEDGE	SKILLS & PROCEDURES
The product or quotient of • two positive numbers is positive • two negative numbers is positive • a negative number and a positive number is negative Multiplication can be represented symbolically in various ways, i.e., $a \times b$, $a \cdot b$, $a(b)$, and $(a)(b)$. Any negative number can be expressed as the product of its inverse and −1, i.e., $-a = -1(a)$.	Multiply and divide any two integers. Investigate whether a product or quotient of three or more integers will be positive or negative. Create various expressions of the same product, using positive and negative factors. Assess the reasonableness of a product or quotient of integers. Solve problems involving multiplication and division of integers.

Number (N)

Numbers are organized into systems with unique notation to communicate quantities and to facilitate calculations.

Guiding Question: How can different representations provide new perspectives of squares and cubes?

LEARNING OUTCOME

7N3 Students interpret perfect squares and perfect cubes.

7N3.1 UNDERSTANDING

A square can be interpreted as a number and as a shape.

KNOWLEDGE	SKILLS & PROCEDURES
The product of two identical factors is a perfect square. A perfect square can be represented as a power with the exponent two, i.e., a^2. The square root of a perfect square is one of the two identical factors and can be expressed symbolically by using a radical sign, $\sqrt{\square}$. A perfect square can be represented by the area of a square, while the side length can be expressed as a square root.	Identify the base and exponent in a perfect square. Express a perfect square as repeated multiplication and a power. Recall perfect squares within 144 and their square roots, limited to natural numbers. Solve problems involving perimeter and area of squares, limited to side lengths that are natural numbers.

7N3.2 UNDERSTANDING

A cube can be interpreted as a number and as a shape.

KNOWLEDGE	SKILLS & PROCEDURES
The product of three identical positive factors is a perfect cube. A perfect cube can be represented as a power with the exponent three, i.e., a^3. The cube root of a perfect cube is one of the three identical natural number factors and can be expressed symbolically by using a radical sign, $\sqrt[3]{\square}$. The volume of a cube can be represented by a perfect cube, while the length of an edge can be expressed as a cube root.	Identify the base and exponent in a perfect cube. Express a perfect cube as repeated multiplication and a power. Recall perfect cubes within 125 and their cube roots, limited to natural numbers. Solve problems involving volume of cubes, limited to edge lengths that are natural numbers.

Number (N)

Numbers are organized into systems with unique notation to communicate quantities and to facilitate calculations.

Guiding Question: How can multiplication and division be generalized?

LEARNING OUTCOME

7N4 Students interpret multiplication and division of positive fractions and of positive decimal numbers.

7N4.1 UNDERSTANDING

The product of two fractions can be interpreted as part of a part.

KNOWLEDGE	SKILLS & PROCEDURES
The product of two fractions is the fraction resulting from multiplication of the numerators and multiplication of the denominators, i.e., $\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$ and can be applied to real-world situations such as adjusting recipes. Multiplication of two fractions can be represented by a model, e.g., an area model. The product of two proper fractions is less than its factors. A proper fraction is a fraction in which the numerator is less than the denominator. The product of two fractions is equivalent to the product of any equivalent forms of those fractions.	Model multiplication of fractions. Relate the product of a fraction by a fraction to part of a part. Multiply two fractions. Compare products of fractions in various equivalent forms, including simplest form. Solve problems involving multiplication of two fractions.

7N4.2 UNDERSTANDING

The quotient of any quantity and a fraction can be interpreted as the number of fraction-sized groups that compose the quantity.

KNOWLEDGE	SKILLS & PROCEDURES
Division by a fraction is equivalent to multiplication by its reciprocal, i.e., $\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$ and $a \div \frac{b}{c} = a \times \frac{c}{b} = \frac{ac}{b}$ and can be applied to real-world situations such as sharing food and cutting materials. A reciprocal is the multiplicative inverse of a fraction. The product of a fraction and its reciprocal is 1. The quotient of a number and a proper fraction is greater than the number. Division of two fractions can be facilitated by representing the fractions with common denominators. The quotient of two fractions with common denominators is the quotient of the two numerators, i.e., $\frac{a}{b} \div \frac{c}{b} = \frac{a}{c}$	Relate a number to its reciprocal. Prove that multiplication of a fraction and its reciprocal is 1. Divide a natural number by a fraction and vice versa. Divide a fraction by a fraction. Investigate the composition of a quantity by fraction-sized groups. Solve problems involving division of two fractions.

7N4.3 UNDERSTANDING Equivalent expressions can facilitate multiplication and division of decimal numbers.	
KNOWLEDGE Multiplication and division of a decimal number by a decimal number can be supported by processes, such as • expressing decimal numbers as fractions • using standard algorithms • using area models Equivalent division expressions can be created when dividing decimal numbers by multiplying the divisor and dividend by the same factor.	**SKILLS & PROCEDURES** Multiply and divide decimal numbers, including dividing a natural number by a decimal number. Solve problems involving decimal numbers, including in real-world situations.
7N4.4 UNDERSTANDING Equivalent forms of mathematical expressions can facilitate evaluation.	
KNOWLEDGE The conventional order of operations applies to integers, fractions, and decimal numbers.	**SKILLS & PROCEDURES** Evaluate numerical expressions according to the order of operations.

Number (N)

Numbers are organized into systems with unique notation to communicate quantities and to facilitate calculations.

Guiding Question: In what ways can proportional relationships be characterized?

LEARNING OUTCOME **7N5 Students analyze multiplicative relationships between equivalent ratios.**	
7N5.1 UNDERSTANDING Multiplicative relationships are foundational to proportional reasoning.	
KNOWLEDGE The terms of a ratio can be any numbers, including integers, decimal numbers, or fractions. The first term of a ratio can be less than or greater than the second term. A ratio can be iterated by multiplying both terms by the same factor, e.g., $\frac{a}{b} = \frac{5a}{5b}$ A ratio can be partitioned by dividing both terms by the same factor, e.g., a:b = $\frac{a}{4}$: $\frac{b}{4}$ Equivalent ratios are related by a factor. The factor relating equivalent ratios can be a natural number, decimal number, or fraction. A proportional relationship expressed $\frac{a}{b} = \frac{c}{d}$ is equivalent to ad = bc. The first terms and the second terms of two equivalent ratios can be added or subtracted, respectively, to generate another equivalent ratio.	**SKILLS & PROCEDURES** Generate equivalent ratios by iterating or partitioning a ratio. Determine the factor that relates equivalent ratios. Determine an unknown value related to a given equivalent ratio. Generate an equivalent ratio, using two existing equivalent ratios. Compare two ratios that have common first or second terms. Determine a percentage of a natural number by iterating or partitioning benchmark percentages. Determine percentages of natural numbers less than 1% and greater than 100%. Solve problems involving proportional reasoning in real-world situations.

Equal first terms or equal second terms can facilitate the comparison of ratios. A percentage can be represented as a ratio, i.e., $\frac{a}{b} = \frac{x}{100}$ A ratio can be converted into a percentage by multiplying by 100. A percentage can be interpreted as a sum of benchmark percentages, including 1%, 5%, 10%, 25%, 50%. A percentage can be less than 1% or greater than 100%. Proportional reasoning can be applied in real-world situations, including ● discounts ● percent increase/decrease ● taxes ● scaling recipes ● unit rates ● converting between units	

Algebra (A)

Generalizing arithmetic with expressions, equations, and inequalities supports problem solving in real-world situations.

Guiding Question: How can equivalence provide new perspectives of equations?

LEARNING OUTCOME
7A1 Students apply equivalence to solving linear equations.

7A1.1 UNDERSTANDING
Equations can be expressed in infinitely many equivalent ways.

KNOWLEDGE	**SKILLS & PROCEDURES**
Simplifying algebraic expressions on one or both sides of an equation results in an equivalent equation.	Simplify algebraic expressions on one or both sides of an equation, using algebraic properties, including the distributive property.
Algebraic expressions can be simplified by applying algebraic properties and by combining like terms.	Solve linear equations with algebraic terms on both sides of the equation.
Adding or subtracting the same algebraic or constant term on both sides of an equation results in an equivalent equation.	Verify the solution to a linear equation by substituting the solution into any equivalent equation.
A solution is a value that, when substituted into the equation, satisfies the equation.	Solve problems involving real-world situations, using linear equations.

Geometry (G)

The properties of geometric objects are explained through justification and proof.

Guiding Question: In what ways can geometric objects be interpreted?

LEARNING OUTCOME
7G1 Students analyze the structure and relationships of geometric objects.

7G1.1 UNDERSTANDING
Symbols and symbolic notation can be used to represent relationships between geometric objects.

KNOWLEDGE
Geometric objects are abstract mathematical concepts and include

- straight lines
- rays
- line segments
- angles
- polygons

A straight line can be interpreted as a series of adjacent points that extends infinitely in two opposite directions.

A ray is the portion of a straight line that extends infinitely in one direction from a given point on the line.

A line segment is the portion of a straight line between two given points.

An angle is formed by two straight lines, line segments, or rays that share a vertex.

A polygon is a closed figure made of three or more line segments that only intersect at the vertices.

Symbolic notation can be used to communicate geometric objects, including

- straight lines, e.g., $\overleftrightarrow{CD}$ or a single lower case letter
- rays, e.g., $\overrightarrow{AC}$
- line segments, e.g., $\overline{AB}$ or AB
- angles, e.g., ∠CAB or ∠A
- triangles, e.g., △ABC

Relationships between geometric objects can be communicated by using

- a small square symbol at the intersection of perpendicular lines
- the same number of arrow head symbols on two or more parallel lines
- the symbolic notation of perpendicular lines, e.g., $\overleftrightarrow{AB} \perp \overleftrightarrow{EF}$
- the symbolic notation of parallel lines, e.g., $\overleftrightarrow{CD} \parallel \overleftrightarrow{JK}$

SKILLS & PROCEDURES
Differentiate between straight lines, rays, line segments, angles, and polygons.

Model geometric objects, using hands-on materials or a digital geometry environment.

Identify straight lines, rays, line segments, angles, and triangles, using symbols and symbolic notation.

Represent relationships between geometric objects, using symbols and symbolic notation.

7G1.2 UNDERSTANDING Relationships between geometric objects can be found at intersections.	
KNOWLEDGE A point common to two or more geometric objects is called an intersection. Angle relationships at the intersection of straight lines, line segments, or rays include • opposite angles, which are congruent • adjacent angles, which are supplementary A transversal is a straight line, line segment, or ray that intersects two or more parallel lines. Angle relationships at the intersections of a transversal and two or more parallel lines include congruent corresponding angles, which are in the same relative position at each point of intersection.	**SKILLS & PROCEDURES** Investigate angle relationships at the intersection of two straight lines. Identify corresponding angles at intersections of parallel lines and a transversal. Verify that two lines are parallel, using angles at intersections of a transversal. Model angle relationships, using hands-on materials or a digital geometry environment. Solve problems involving angle relationships at intersections.
7G1.3 UNDERSTANDING Congruence of geometric objects can be verified through symbols and symbolic notation.	
KNOWLEDGE In congruent polygons, corresponding • vertices, sides, and angles are in the same relative position • side measures are equal • angle measures are equal Congruence of geometric objects can be represented with symbols, including • the same number of arcs on congruent angles • the same number of hash marks on congruent line segments Symbolic notation can be used to communicate congruence of geometric objects, including • congruent angles, e.g., $\angle ABC \cong \angle RST$ • congruent sides, e.g., $\overline{AB} \cong \overline{RS}$ • congruent rectangles, e.g., ABCD ≅RSTU • congruent triangles, e.g., $\triangle ABC \cong \triangle RST$	**SKILLS & PROCEDURES** Identify corresponding sides and corresponding angles of congruent polygons. Identify congruent angles and congruent line segments indicated with symbols in congruent polygons. Verify that geometric objects are congruent, using symbolic notation. Solve problems involving congruent polygons.

Measurement (M)

Attributes such as length, area, volume, and angle are quantified by measurement.

Guiding Question: In what ways can measurable attributes of circles influence perspectives of size?

LEARNING OUTCOME
7M1 Students interpret and explain area and circumference of circles.

7M1.1 UNDERSTANDING
The size of a circle is determined by its radius.

KNOWLEDGE	SKILLS & PROCEDURES
A circle is a 2-D shape structured by a set of points that are all the same distance from one point, known as the centre. The perimeter of a circle is called circumference. The radius of a circle is the distance from the centre to any point on the circle. The diameter is the distance across a circle, through the centre, and is twice the length of the radius. Area and circumference are different interpretations of the size of a circle. There is a constant ratio π (pi) that relates the circumference of any circle and its diameter. The circumference of a circle can be expressed as the product of its diameter and π, represented symbolically as $C = \pi D$ The area of a circle can be divided into equal sized pie-shaped slices (sectors) and rearranged to form an approximation of a parallelogram. The area of a circle can be expressed as the product of the square of its radius and π, represented symbolically as $A=\pi r^2$	Create circles, given the radius, using a compass or a digital geometry environment. Investigate the relationship between the circumference of a circle and its diameter. Determine the diameter of a circle, given its circumference and using 3.14 as an approximation for π. Derive the symbolic notation to calculate the area of a circle from the area of a parallelogram. Calculate the area and circumference of a circle, given its radius or diameter and using 3.14 as an approximation for π. Solve problems involving circumference and area of circles.

Measurement (M)

Attributes such as length, area, volume, and angle are quantified by measurement.

Guiding Question: In what ways can area provide perspectives of volume?

LEARNING OUTCOME
7M2 Students analyze volume of right prisms and right cylinders.

7M2.1 UNDERSTANDING
The volume of a prism or cylinder can be explained as a product of dimensions.

KNOWLEDGE	SKILLS & PROCEDURES
A prism is a solid 3-D shape with rectangular lateral faces and two parallel congruent polygonal bases. The base of a prism can be any polygon, including rectangles and triangles. A prism is named according to the shape of its base. Any face of a rectangular prism can be interpreted as the base. A cylinder is a solid 3-D shape with one curved lateral surface and parallel congruent circular bases. Dimensions of a rectangular prism are its length, width, and height. Dimensions of a cylinder are its radius and height. Dimensions can be used for calculating the volume of a 3-D shape. The dimensions of a 3-D shape must be measured in the same units to calculate volume. The volume of a prism can be represented as the volume of a single layer of 1 × 1 × 1 cubes multiplied by the total number of layers. The volume of any prism or cylinder can be generalized as the product of the area of the base and the perpendicular height of the prism or cylinder, represented symbolically as $V = Bh$	Relate the name of a prism to the shape of its base. Differentiate the lateral faces and lateral surfaces from the bases of prisms and cylinders oriented in various ways. Model volume of rectangular prisms by iterating the volume of a single layer, using hands-on materials or a digital geometry environment. Calculate the volume of rectangular prisms, triangular prisms, and cylinders. Determine the area of the base of rectangular prisms, triangular prisms, and cylinders, given volume and height. Determine the height of rectangular prisms, triangular prisms, and cylinders, given volume and area of the base. Solve problems involving volume of prisms and cylinders.

Functions (F)

Functions model relationships between changing quantities in real-world situations.

Guiding Question: In what ways can functions be characterized?

LEARNING OUTCOME

7F1 Students interpret functions through domain and range.

7F1.1 UNDERSTANDING

Domain and range are attributes of a function.

KNOWLEDGE	SKILLS & PROCEDURES
The independent and dependent variables, respectively, represent the input and output values of a function. A relation is any correspondence between two changing quantities represented by input values and output values. A function is a relation where each input value corresponds to exactly one output value. The domain of a function is the set of all possible input values and can be communicated in words. The range of a function is the set of all possible output values and can be communicated in words. A function can be discrete or continuous. Domain and range can be discrete or continuous, and the maximum and minimum values can be restricted to model a real-world situation. Domain and range can be interpreted from various representations of a function, including • ordered pairs • a table of values • a graph • a real-world situation The graph of a discrete function is the set of points described by ordered pairs. The graph of a continuous function is a line that connects all points described by ordered pairs. The graph of a function will be intersected at no more than one point by a vertical line drawn on the Cartesian plane, known as the vertical line test.	Distinguish between discrete and continuous functions. Describe the domain and range of a function. Describe restrictions on the domain and range of a function that models a real-world situation. Graph a function that models a real-world situation, given a table of values. Determine whether a relation is a function.

Statistics (ST) **The science of collecting, analyzing, visualizing, and interpreting data can inform understanding and decision making.** ***Guiding Question: How can statistics support generalizations?***	
LEARNING OUTCOME **7ST1 Students interpret sample data.**	
7ST1.1 UNDERSTANDING Samples can represent populations.	
KNOWLEDGE A population is a complete set of elements, such as people, animals, objects, or events, that are the focus of a statistical question. A population is defined by one or more shared characteristics, such as age, location, time, or type. A census is the collection of data from an entire population. A sample is a subset of a population. A sample can be used in place of a population when a census would be ● too costly ● too time-consuming ● too difficult A representative sample has the same defining characteristics as the population. A representative sample can be obtained by using random sampling methods, including ● simple random sampling ● systematic random sampling	**SKILLS & PROCEDURES** Identify the population for a statistical question. Justify the use of data from a sample or a census in various situations. Describe a representative sample for a population in relation to a statistical question. Explain the process for obtaining a representative sample by using a chosen random sampling method.
7ST1.2 UNDERSTANDING Data collected from a sample can be summarized by using statistics.	
KNOWLEDGE Quantitative data are numerical data that can be discrete or continuous. Discrete data are countable, specific values within a range, between which other values cannot exist. Continuous data are measurable values within a range, between which infinitely many other values can exist. Numbers used to describe a sample are called statistics, including ● mean ● median ● mode ● range The mean describes the centre of a data set by using the sum of the data values divided by the number of data values, e.g.,	**SKILLS & PROCEDURES** Determine mean, median, mode, and range for a set of quantitative data collected from a representative sample. Compare statistics from two different samples of the same population. Draw conclusions about a population, using statistics from a representative sample.

$\bar{x} = \frac{x_1 + x_2 + \ldots x_n}{n}$ The median is the middle value, or the mean of the two middle values, in a set of data ordered numerically. The range is the difference between the maximum and minimum values of a data set.	

Probability (P)

Modelling randomness and quantifying the likelihood of events can inform decision making where uncertainty exists.

Guiding Question: In what ways can likelihood be explained?

LEARNING OUTCOME
7P1 Students interpret theoretical and experimental probability.

7P1.1 UNDERSTANDING
Probability quantifies the likelihood that an event occurs.

KNOWLEDGE	SKILLS & PROCEDURES
A set is a collection of objects of any nature. An outcome is any possible result of an experiment. An event is a set of outcomes, and any outcome that matches the event is called a favourable outcome. A simple event is when only one event can occur. The probability of an event numerically represents its likelihood. Events that are certain have a probability of 1. Events that are impossible have a probability of 0. Equally likely outcomes have the same probability. Not all events have an equal likelihood, e.g., a biased coin.	Describe favourable outcomes for a given event. Describe one outcome as more or less likely than another outcome. Describe situations where not all events are equally likely. Explain certain and impossible events.

7P1.2 UNDERSTANDING
Over a large number of trials, experimental probability models theoretical probability.

KNOWLEDGE	SKILLS & PROCEDURES
Theoretical probability is the likelihood of an event occurring under ideal conditions. If all outcomes are equally likely, the theoretical probability is the ratio of the number of favourable outcomes to the total number of outcomes. Experimental probability is determined by using data collected from repeated trials of an experiment. Experimental probability compares the number of favourable outcomes to the total number of trials of an experiment. Sample space is the list of all possible outcomes for a situation or an experiment and does not include the frequency of each outcome.	Express, in various ways, the theoretical probability for each of the possible outcomes in a situation. Predict the experimental probability of an event, using theoretical probability. Collect data from multiple trials of an experiment with equally likely outcomes. Simulate situations by generating a sample space. Determine the experimental probability of an event. Compare the experimental probability to the theoretical probability for a given event.

The sum of the probabilities within a sample space is 1. A situation can be simulated if it has the same number of possible outcomes and each outcome occurs with the same probability, e.g., within a sample space, a coin has two equally likely outcomes and a die has six. Probability can be expressed in various ways, including ● ratio ● fraction ● decimal ● percentage In an experiment, the outcome of any trial is unknown before it occurs, except for certain and impossible events. Repeated trials of an experiment have no influence on each other. Probability can inform decision making in various situations, such as games and weather forecasts.	Relate probability to decision making in various situations.