Mathematical Process Expectations

Problem Solving

7m1 • develop, select, apply, and compare a variety of problem-solving strategies as they pose and solve problems and conduct investigations, to help deepen their mathematical understanding;

Reasoning And Proving

7m2 • develop and apply reasoning skills (e.g., recognition of relationships, generalization through inductive reasoning, use of counter-examples) to make mathematical conjectures, assess conjectures and justify conclusions, and plan and construct organized mathematical arguments;

Reflecting

7m3 • demonstrate that they are reflecting on and monitoring their thinking to help clarify their understanding as they complete an investigation or solve a problem (e.g., by assessing the effectiveness of strategies and processes used, by proposing alternative approaches, by judging the reasonableness of results, by verifying solutions);

Selecting Tools and Computational Strategies

7m4 • select and use a variety of concrete, visual, and electronic learning tools and appropriate computational strategies to investigate mathematical ideas and to solve problems;

Connecting

7m5 • make connections among mathematical concepts and procedures, and relate mathematical ideas to situations or phenomena drawn from other contexts (e.g., other curriculum areas, daily life, current events, art and culture, sports);

Representing

7m6 • create a variety of representations of mathematical ideas (e.g., numeric, geometric, algebraic, graphical, pictorial; onscreen dynamic representations), connect and compare them, and select and apply the appropriate representations to solve problems;

Communicating

7m7 • communicate mathematical thinking orally, visually, and in writing, using mathematical vocabulary and a variety of appropriate representations, and observing mathematical conventions.

Number Sense and Numeration

Overall Expectations

7m8 • represent, compare, and order numbers, including integers;

7m9 • demonstrate an understanding of addition and subtraction of fractions and integers, and apply a variety of computational strategies to solve problems involving whole numbers and decimal numbers;

7m10 • demonstrate an understanding of proportional relationships using percent, ratio, and rate.

Quantity Relationships

7m11 – represent, compare, and order decimals to hundredths and fractions, using a variety of tools (e.g., number lines, Cuisenaire rods, base ten materials, calculators);

7m12 – generate multiples and factors, using a variety of tools and strategies (e.g., identify multiples on a hundreds chart; create rectangles on a geoboard) (Sample problem: List all the rectangles that have an area of 36 cm2 and have whole-number dimensions.);

7m13 – identify and compare integers found in real-life contexts (e.g., –10°C is much colder than +5°C);

7m14 – represent and order integers, using a variety of tools (e.g., two-colour counters, virtual manipulatives, number lines);

7m15 – select and justify the most appropriate representation of a quantity (i.e., fraction, decimal, percent) for a given context (e.g., "I would use a decimal for recording the length or mass of an object, and a fraction for part of an hour.");

7m16 – represent perfect squares and square roots, using a variety of tools (e.g., geoboards, connecting cubes, grid paper);

7m17 – explain the relationship between exponential notation and the measurement of area and volume (Sample problem: Explain why area is expressed in square units [units^2] and volume is expressed in cubic units [units^3].).

Operational Sense

7m18 – divide whole numbers by simple fractions and by decimal numbers to hundredths, using concrete materials (e.g., divide 3 by 1/2 using fraction strips; divide 4 by 0.8 using base ten materials and estimation);

7m19 – use a variety of mental strategies to solve problems involving the addition and subtraction of fractions and decimals (e.g., use the commutative property: 3 x 2/5 x 1/3 = 3x 1/3 x 2/5, which gives 1 x 2/5 = 2/5; use the distributive property: 16.8 ÷ 0.2 can be thought of as (16 + 0.8) ÷ 0.2 = 16 ÷ 0.2 + 0.8 ÷ 0.2, which gives 80 + 4 = 84);

7m20 – solve problems involving the multiplication and division of decimal numbers to thousandths by one-digit whole numbers, using a variety of tools (e.g., concrete materials, drawings, calculators) and strategies (e.g., estimation, algorithms);

7m21 – solve multi-step problems arising from real-life contexts and involving whole numbers and decimals, using a variety of tools (e.g., concrete materials, drawings, calculators) and strategies (e.g., estimation, algorithms);

7m22 – use estimation when solving problems involving operations with whole numbers, decimals, and percents, to help judge the reasonableness of a solution (Sample problem: A book costs $18.49. The salesperson tells you that the total price, including taxes, is $22.37. How can you tell if the total price is reasonable without using a calculator?);

7m23 – evaluate expressions that involve whole numbers and decimals, including expressions that contain brackets, using order of operations;

7m24 – add and subtract fractions with simple like and unlike denominators, using a variety of tools (e.g., fraction circles, Cuisenaire rods, drawings, calculators) and algorithms;

7m25 – demonstrate, using concrete materials, the relationship between the repeated addition of fractions and the multiplication of that fraction by a whole number (e.g., 1/2 + 1/2 + 1/2 = 3 x 1/2);

7m26 – add and subtract integers, using a variety of tools (e.g., two-colour counters, virtual manipulatives, number lines).

Proportional Relationships

7m27 – determine, through investigation, the relationships among fractions, decimals, percents, and ratios;

7m28 – solve problems that involve determining whole number percents, using a variety of tools (e.g., base ten materials, paper and pencil, calculators) (Sample problem: If there are 5 blue marbles in a bag of 20 marbles, what percent of the marbles are not blue?);

7m29 – demonstrate an understanding of rate as a comparison, or ratio, of two measurements with different units (e.g., speed is a rate that compares distance to time and that can be expressed as kilometres per hour);

7m30 – solve problems involving the calculation of unit rates (Sample problem:You go shopping and notice that 25 kg of Ryan's Famous Potatoes cost $12.95, and 10 kg of Gillian's Potatoes cost $5.78. Which is the better deal? Justify your answer.).

Measurement

Overall Expectations

7m31 • report on research into real-life applications of area measurements;

7m32 • determine the relationships among units and measurable attributes, including the area of a trapezoid and the volume of a right prism.

Attributes, Units, and Measurement Sense

7m33 – research and report on real-life applications of area measurements (e.g., building a skateboard; painting a room).

Measurement Relationships

7m34 – sketch different polygonal prisms that share the same volume (Sample problem: The Neuman Company is designing a new container for its marbles. The container must have a volume of 200 cm^3. Sketch three possible containers, and explain which one you would recommend.);

7m35 – solve problems that require conversion between metric units of measure (e.g., millimetres and centimetres, grams and kilograms, millilitres and litres) (Sample problem: At Andrew's Deli, cheese is on sale for $11.50 for one kilogram. How much would it cost to purchase 150 g of cheese?);

7m36 – solve problems that require conversion between metric units of area (i.e., square centimetres, square metres) (Sample problem: What is the ratio of the number of square metres to the number of square centimetres for a given area? Use this ratio to convert 6.25 m^2 to square centimetres.);

7m37 – determine, through investigation using a variety of tools (e.g., concrete materials, dynamic geometry software) and strategies, the relationship for calculating the area of a trapezoid, and generalize to develop the formula [i.e., Area = (sum of lengths of parallel sides x height) ÷ 2] (Sample problem: Determine the relationship between the area of a parallelogram and the area of a trapezoid by composing a parallelogram from congruent trapezoids.);

7m38 – solve problems involving the estimation and calculation of the area of a trapezoid;

7m39 – estimate and calculate the area of composite two-dimensional shapes by decomposing into shapes with known area relationships (e.g., rectangle, parallelogram, triangle) (Sample problem: Decompose a pentagon into shapes with known area relationships to find the area of the pentagon.);

7m40 – determine, through investigation using a variety of tools and strategies (e.g., decomposing right prisms; stacking congruent layers of concrete materials to form a right prism), the relationship between the height, the area of the base, and the volume of right prisms with simple polygonal bases (e.g., parallelograms, trapezoids), and generalize to develop the formula (i.e., Volume = area of base x height) (Sample problem: Decompose right prisms with simple polygonal bases into triangular prisms and rectangular prisms. For each prism, record the area of the base, the height, and the volume on a chart. Identify relationships.);

7m41 – determine, through investigation using a variety of tools (e.g., nets, concrete materials, dynamic geometry software, Polydrons), the surface area of right prisms;

7m42 – solve problems that involve the surface area and volume of right prisms and that require conversion between metric measures of capacity and volume (i.e., millilitres and cubic centimetres) (Sample problem: An aquarium has a base in the shape of a trapezoid. The aquarium is 75 cm high. The base is 50 cm long at the front, 75 cm long at the back, and 25 cm wide. Find the capacity of the aquarium.).

Geometry and Spatial Sense

Overall Expectations

7m43 • construct related lines, and classify triangles, quadrilaterals, and prisms;

7m44 • develop an understanding of similarity, and distinguish similarity and congruence;

7m45 • describe location in the four quadrants of a coordinate system, dilatate two-dimensional shapes, and apply transformations to create and analyse designs.

Geometric Properties

7m46 – construct related lines (i.e., parallel; perpendicular; intersecting at 30º, 45º, and 60º), using angle properties and a variety of tools (e.g., compass and straight edge, protractor, dynamic geometry software) and strategies (e.g., paper folding);

7m47 – sort and classify triangles and quadrilaterals by geometric properties related to symmetry, angles, and sides, through investigation using a variety of tools (e.g., geoboard, dynamic geometry software) and strategies (e.g., using charts, using Venn diagrams) (Sample problem: Investigate whether dilatations change the geometric properties of triangles and quadrilaterals.);

7m48 – construct angle bisectors and perpendicular bisectors, using a variety of tools (e.g., Mira, dynamic geometry software, compass) and strategies (e.g., paper folding), and represent equal angles and equal lengths using mathematical notation;

7m49 – investigate, using concrete materials, the angles between the faces of a prism, and identify right prisms (Sample problem: Identify the perpendicular faces in a set of right prisms.).

Geometric Relationships

7m50 – identify, through investigation, the minimum side and angle information (i.e., side-side-side; side-angle-side; angle-sideangle) needed to describe a unique triangle (e.g., "I can draw many triangles if I'm only told the length of one side, but there's only one triangle I can draw if you tell me the lengths of all three sides.");

7m51 – determine, through investigation using a variety of tools (e.g., dynamic geometry software, concrete materials, geoboard), relationships among area, perimeter, corresponding side lengths, and corresponding angles of congruent shapes (Sample problem: Do you agree with the conjecture that triangles with the same area must be congruent? Justify your reasoning.);

7m52 – demonstrate an understanding that enlarging or reducing two-dimensional shapes creates similar shapes;

7m53 – distinguish between and compare similar shapes and congruent shapes, using a variety of tools (e.g., pattern blocks, grid paper, dynamic geometry software) and strategies (e.g., by showing that dilatations create similar shapes and that translations, rotations, and reflections generate congruent shapes) (Sample problem: A larger square can be composed from four congruent square pattern blocks. Identify another pattern block you can use to compose a larger shape that is similar to the shape of the block.).

Location and Movement

7m54 – plot points using all four quadrants of the Cartesian coordinate plane;

7m55 – identify, perform, and describe dilatations (i.e., enlargements and reductions), through investigation using a variety of tools (e.g., dynamic geometry software, geoboard, pattern blocks, grid paper);

7m56 – create and analyse designs involving translations, reflections, dilatations, and/or simple rotations of two-dimensional shapes, using a variety of tools (e.g., concrete materials, Mira, drawings, dynamic geometry software) and strategies (e.g., paper folding) (Sample problem: Identify transformations that may be observed in architecture or in artwork [e.g., in the art of M.C. Escher].);

7m57 – determine, through investigation using a variety of tools (e.g., pattern blocks, Polydrons, grid paper, tiling software, dynamic geometry software, concrete materials), polygons or combinations of polygons that tile a plane, and describe the transformation(s) involved.

Patterning and Algebra

Overall Expectations

7m58 • represent linear growing patterns (where the terms are whole numbers) using concrete materials, graphs, and algebraic expressions;

7m59 • model real-life linear relationships graphically and algebraically, and solve simple algebraic equations using a variety of strategies, including inspection and guess and check.

Patterns and Relationships

7m60 – represent linear growing patterns, using a variety of tools (e.g., concrete materials, paper and pencil, calculators, spreadsheets) and strategies (e.g., make a table of values using the term number and the term; plot the coordinates on a graph; write a pattern rule using words);

7m61 – make predictions about linear growing patterns, through investigation with concrete materials (Sample problem: Investigate the surface area of towers made from a single column of connecting cubes, and predict the surface area of a tower that is 50 cubes high. Explain your reasoning.);

7m62 – develop and represent the general term of a linear growing pattern, using algebraic expressions involving one operation (e.g., the general term for the sequence 4, 5, 6, 7, … can be written algebraically as n + 3, where n represents the term number; the general term for the sequence 5, 10, 15, 20, … can be written algebraically as 5n, where n represents the term number);

7m63 – compare pattern rules that generate a pattern by adding or subtracting a constant, or multiplying or dividing by a constant, to get the next term (e.g., for 1, 3, 5, 7, 9, …, the pattern rule is "start at 1 and add 2 to each term to get the next term") with pattern rules that use the term number to describe the general term (e.g., for 1, 3, 5, 7, 9, …, the pattern rule is "double the term number and subtract 1", which can be written algebraically as 2 x n – 1) (Sample problem: For the pattern 1, 3, 5, 7, 9, …, investigate and compare different ways of finding the 50th term.).

Variables, Expressions, and Equations

7m64 – model real-life relationships involving constant rates where the initial condition starts at 0 (e.g., speed, heart rate, billing rate), through investigation using tables of values and graphs (Sample problem: Create a table of values and graph the relationship between distance and time for a car travelling at a constant speed of 40 km/h. At that speed, how far would the car travel in 3.5 h? How many hours would it take to travel 220 km?);

7m65 – model real-life relationships involving constant rates (e.g., speed, heart rate, billing rate), using algebraic equations with variables to represent the changing quantities in the relationship (e.g., the equation p = 4t represents the relationship between the total number of people that can be seated (p) and the number of tables (t), given that each table can seat 4 people [4 people per table is the constant rate]);

7m66 – translate phrases describing simple mathematical relationships into algebraic expressions (e.g., one more than three times a number can be written algebraically as 1 + 3x or 3x + 1), using concrete materials (e.g., algebra tiles, pattern blocks, counters);

7m67 – evaluate algebraic expressions by substituting natural numbers for the variables;

7m68 – make connections between evaluating algebraic expressions and determining the term in a pattern using the general term (e.g., for 3, 5, 7, 9, …, the general term is the algebraic expression 2n + 1; evaluating this expression when n = 12 tells you that the 12th term is 2(12) + 1, which equals 25);

7m69 – solve linear equations of the form ax = c or c = ax and ax + b = c or variations such as b + ax = c and c = bx + a (where a, b, and c are natural numbers) by modelling with concrete materials, by inspection, or by guess and check, with and without the aid of a calculator (e.g., "I solved x + 7 = 15 by using guess and check. First I tried 6 for x. Since I knew that 6 plus 7 equals 13 and 13, is less than 15, then I knew that x must be greater than 6.").

Data Management and Probability

Overall Expectations

7m70 • collect and organize categorical, discrete, or continuous primary data and secondary data and display the data using charts and graphs, including relative frequency tables and circle graphs;

7m71 • make and evaluate convincing arguments, based on the analysis of data;

7m72 • compare experimental probabilities with the theoretical probability of an outcome involving two independent events.

Collection and Organization of Data

7m73 – collect data by conducting a survey or an experiment to do with themselves, their environment, issues in their school or community, or content from another subject and record observations or measurements;

7m74 – collect and organize categorical, discrete, or continuous primary data and secondary data (e.g., electronic data from websites such as E-Stat or Census At Schools) and display the data in charts, tables, and graphs (including relative frequency tables and circle graphs) that have appropriate titles, labels (e.g., appropriate units marked on the axes), and scales (e.g., with appropriate increments) that suit the range and distribution of the data, using a variety of tools (e.g., graph paper, spreadsheets, dynamic statistical software);

7m75 – select an appropriate type of graph to represent a set of data, graph the data using technology, and justify the choice of graph (i.e., from types of graphs already studied);

7m76 – distinguish between a census and a sample from a population;

7m77 – identify bias in data collection methods (Sample problem: How reliable are your results if you only sample girls to determine the favourite type of book read by students in your grade?).

Data Relationships

7m78 – read, interpret, and draw conclusions from primary data (e.g., survey results, measurements, observations) and from secondary data (e.g., temperature data or community data in the newspaper, data from the Internet about populations) presented in charts, tables, and graphs (including relative frequency tables and circle graphs);

7m79 – identify, through investigation, graphs that present data in misleading ways (e.g., line graphs that exaggerate change by starting the vertical axis at a point greater than zero);

7m80 – determine, through investigation, the effect on a measure of central tendency (i.e., mean, median, and mode) of adding or removing a value or values (e.g., changing the value of an outlier may have a significant effect on the mean but no effect on the median) (Sample problem: Use a set of data whose distribution across its range looks symmetrical, and change some of the values so that the distribution no longer looks symmetrical. Does the change affect the median more than the mean? Explain your thinking.);

7m81 – identify and describe trends, based on the distribution of the data presented in tables and graphs, using informal language;

7m82 – make inferences and convincing arguments that are based on the analysis of charts, tables, and graphs (Sample problem: Use census information to predict whether Canada's population is likely to increase.).

Probability

7m83 – research and report on real-world applications of probabilities expressed in fraction, decimal, and percent form (e.g., lotteries, batting averages, weather forecasts, elections);

7m84 – make predictions about a population when given a probability (Sample problem: The probability that a fish caught in Lake Goodfish is a bass is 29%. Predict how many bass will be caught in a fishing derby there, if 500 fish are caught.);

7m85 – represent in a variety of ways (e.g., tree diagrams, tables, models, systematic lists) all the possible outcomes of a probability experiment involving two independent events (i.e., one event does not affect the other event), and determine the theoretical probability of a specific outcome involving two independent events (Sample problem: What is the probability of rolling a 4 and spinning red, when you roll a number cube and spin a spinner that is equally divided into four different colours?);

7m86 – perform a simple probability experiment involving two independent events, and compare the experimental probability with the theoretical probability of a specific outcome (Sample problem: Place 1 red counter and 1 blue counter in an opaque bag. Draw a counter, replace it, shake the bag, and draw again. Compare the theoretical and experimental probabilities of drawing a red counter 2 times in a row.).