Mathematical Process Expectations

Problem Solving

6m1 • develop, select, and apply problem-solving strategies as they pose and solve problems and conduct investigations, to help deepen their mathematical understanding;

Reasoning And Proving

6m2 • develop and apply reasoning skills (e.g., classification, recognition of relationships, use of counter-examples) to make and investigate conjectures and construct and defend arguments;

Reflecting

6m3 • 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 comparing and adjusting strategies used, by explaining why they think their results are reasonable, by recording their thinking in a math journal);

Selecting Tools and Computational Strategies

6m4 • 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

6m5 • 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, sports);

Representing

6m6 • create a variety of representations of mathematical ideas (e.g., by using physical models, pictures, numbers, variables, diagrams, graphs, onscreen dynamic representations), make connections among them, and apply them to solve problems;

Communicating

6m7 • communicate mathematical thinking orally, visually, and in writing, using everyday language, a basic mathematical vocabulary, and a variety of representations, and observing basic mathematical conventions.

Number Sense and Numeration

Overall Expectations

6m8 • read, represent, compare, and order whole numbers to 1 000 000, decimal numbers to thousandths, proper and improper fractions, and mixed numbers;

6m9 • solve problems involving the multiplication and division of whole numbers, and the addition and subtraction of decimal numbers to thousandths, using a variety of strategies;

6m10 • demonstrate an understanding of relationships involving percent, ratio, and unit rate.

Quantity Relationships

6m11 – represent, compare, and order whole numbers and decimal numbers from 0.001 to 1 000 000, using a variety of tools (e.g., number lines with appropriate increments, base ten materials for decimals);

6m12 – demonstrate an understanding of place value in whole numbers and decimal numbers from 0.001 to 1 000 000, using a variety of tools and strategies (e.g. use base ten materials to represent the relationship between 1, 0.1, 0.01, and 0.001) (Sample problem: How many thousands cubes would be needed to make a base ten block for 1 000 000?);

6m13 – read and print in words whole numbers to one hundred thousand, using meaningful contexts (e.g., the Internet, reference books);

6m14   – represent, compare, and order fractional amounts with unlike denominators, including proper and improper fractions and mixed numbers, using a variety of tools (e.g., fraction circles, Cuisenaire rods, drawings, number lines, calculators) and using standard fractional notation (Sample problem: Use fraction strips to show that 1 1/2 is greater than 5/4.);

6m15   – estimate quantities using benchmarks of 10%, 25%, 50%, 75%, and 100% (e.g., the container is about 75% full; approximately 50% of our students walk to school);

6m16   – solve problems that arise from real-life situations and that relate to the magnitude of whole numbers up to 1 000 000 (Sample problem: How would you determine if a person could live to be 1 000 000 hours old? Show your work.);

6m17   – identify composite numbers and prime numbers, and explain the relationship between them (i.e., any composite number can be factored into prime factors) (e.g., 42 = 2 x 3 x 7).

Operational Sense

6m18   – use a variety of mental strategies to solve addition, subtraction, multiplication, and division problems involving whole numbers (e.g., use the commutative property: 4 x 16 x 5 = 4 x 5 x 16, which gives 20 x 16 = 320; use the distributive property: (500 + 15) ÷ 5 = 500 ÷ 5 + 15 ÷ 5, which gives 100 + 3 = 103);

6m19   – solve problems involving the multiplication and division of whole numbers (four-digit by two-digit), using a variety of tools (e.g., concrete materials, drawings, calculators) and strategies (e.g., estimation, algorithms);

6m20   – add and subtract decimal numbers to thousandths, using concrete materials, estimation, algorithms, and calculators;

6m21   – multiply and divide decimal numbers to tenths by whole numbers, using concrete materials, estimation, algorithms, and calculators (e.g., calculate 4 x 1.4 using base ten materials; calculate 5.6 ÷ 4 using base ten materials);

6m22   – multiply whole numbers by 0.1, 0.01, and 0.001 using mental strategies (e.g., use a calculator to look for patterns and generalize to develop a rule);

6m23   – multiply and divide decimal numbers by 10, 100, 1000, and 10 000 using mental strategies (e.g., "To convert 0.6 m2 to square centimetres, I calculated in my head 0.6 x 10 000 and got 6000 cm2.") (Sample problem: Use a calculator to help you generalize a rule for multiplying numbers by 10 000.);

6m24   – use estimation when solving problems involving the addition and subtraction of whole numbers and decimals, to help judge the reasonableness of a solution;

6m25   – explain the need for a standard order for performing operations, by investigating the impact that changing the order has when performing a series of operations (Sample problem: Calculate and compare the answers to 3 + 2 x 5 using a basic four-function calculator and using a scientific calculator.).

Proportional Relationships

6m26   – represent ratios found in real-life contexts, using concrete materials, drawings, and standard fractional notation (Sample problem: In a classroom of 28 students, 12 are female. What is the ratio of male students to female students?);

6m27   – determine and explain, through investigation using concrete materials, drawings, and calculators, the relationships among fractions (i.e., with denominators of 2, 4, 5, 10, 20, 25, 50, and 100), decimal numbers, and percents (e.g., use a 10 x 10 grid to show that 1/4 = 0.25 or 25%);

6m28   – represent relationships using unit rates (Sample problem: If 5 batteries cost $4.75, what is the cost of 1 battery?).

Measurement

Overall Expectations

6m29   • estimate, measure, and record quantities, using the metric measurement system;

6m30 • determine the relationships among units and measurable attributes, including the area of a parallelogram, the area of a triangle, and the volume of a triangular prism.

Attributes, Units, and Measurement Sense

6m31 – demonstrate an understanding of the relationship between estimated and precise measurements, and determine and justify when each kind is appropriate (Sample problem:You are asked how long it takes you to travel a given distance. How is the method you use to determine the time related to the precision of the measurement?);

6m32 – estimate, measure, and record length, area, mass, capacity, and volume, using the metric measurement system.

Measurement Relationships

6m33 – select and justify the appropriate metric unit (i.e., millimetre, centimetre, decimetre, metre, decametre, kilometre) to measure length or distance in a given real-life situation (Sample problem: Select and justify the unit that should be used to measure the perimeter of the school.);

6m34 – solve problems requiring conversion from larger to smaller metric units (e.g., metres to centimetres, kilograms to grams, litres to millilitres) (Sample problem: How many grams are in one serving if 1.5 kg will serve six people?);

6m35 – construct a rectangle, a square, a triangle, and a parallelogram, using a variety of tools (e.g., concrete materials, geoboard, dynamic geometry software, grid paper), given the area and/or perimeter (Sample problem: Create two different triangles with an area of 12 square units, using a geoboard.);

6m36 – determine, through investigation using a variety of tools (e.g., pattern blocks, Power Polygons, dynamic geometry software, grid) and strategies (e.g., paper folding, cutting, and rearranging), the relationship between the area of a rectangle and the areas of parallelograms and triangles, by decomposing (e.g., cutting up a parallelogram into a rectangle and two congruent triangles) and composing (e.g., combining two congruent triangles to form a parallelogram) (Sample problem: Decompose a rectangle and rearrange the parts to compose a parallelogram with the same area. Decompose a parallelogram into two congruent triangles, and compare the area of one of the triangles with the area of the parallelogram.);

6m37 – develop the formulas for the area of a parallelogram (i.e., Area of parallelogram = base x height) and the area of a triangle [i.e., Area of triangle = (base x height) ÷ 2], using the area relationships among rectangles, parallelograms, and triangles (Sample problem: Use dynamic geometry software to show that parallelograms with the same height and the same base all have the same area.);

6m38 – solve problems involving the estimation and calculation of the areas of triangles and the areas of parallelograms (Sample problem: Calculate the areas of parallelograms that share the same base and the same height, including the special case where the parallelogram is a rectangle.);

6m39 – determine, using concrete materials, the relationship between units used to measure area (i.e., square centimetre, square metre), and apply the relationship to solve problems that involve conversions from square metres to square centimetres (Sample problem: Describe the multiplicative relationship between the number of square centimetres and the number of square metres that represent an area. Use this relationship to determine how many square centimetres fit into half a square metre.);

6m40 – determine, through investigation using a variety of tools and strategies (e.g., decomposing rectangular prisms into triangular prisms; stacking congruent triangular layers of concrete materials to form a triangular prism), the relationship between the height, the area of the base, and the volume of a triangular prism, and generalize to develop the formula (i.e., Volume = area of base x height) (Sample problem: Create triangular prisms by splitting rectangular prisms in half. For each prism, record the area of the base, the height, and the volume on a chart. Identify relationships.);

6m41   – determine, through investigation using a variety of tools (e.g., nets, concrete materials, dynamic geometry software, Polydrons) and strategies, the surface area of rectangular and triangular prisms;

6m42   – solve problems involving the estimation and calculation of the surface area and volume of triangular and rectangular prisms (Sample problem: How many square centimetres of wrapping paper are required to wrap a box that is 10 cm long, 8 cm wide, and 12 cm high?).

Geometry and Spatial Sense

Overall Expectations

6m43   • classify and construct polygons and angles;

6m44   • sketch three-dimensional figures, and construct three-dimensional figures from drawings;

6m45   • describe location in the first quadrant of a coordinate system, and rotate two-dimensional shapes.

Geometric Properties

6m46   – sort and classify 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);

6m47   – sort polygons according to the number of lines of symmetry and the order of rotational symmetry, through investigation using a variety of tools (e.g., tracing paper, dynamic geometry software, Mira);

6m48   – measure and construct angles up to 180° using a protractor, and classify them as acute, right, obtuse, or straight angles;

6m49   – construct polygons using a variety of tools, given angle and side measurements (Sample problem: Use dynamic geometry software to construct trapezoids with a 45° angle and a side measuring 11 cm.).

Geometric Relationships

6m50   – build three-dimensional models using connecting cubes, given isometric sketches or different views (i.e., top, side, front) of the structure (Sample problem: Given the top, side, and front views of a structure, build it using the smallest number of cubes possible.);

6m51   – sketch, using a variety of tools (e.g., isometric dot paper, dynamic geometry software), isometric perspectives and different views (i.e., top, side, front) of three-dimensional figures built with interlocking cubes.

Location and Movement

6m52   – explain how a coordinate system represents location, and plot points in the first quadrant of a Cartesian coordinate plane;

6m53   – identify, perform, and describe, through investigation using a variety of tools (e.g., grid paper, tissue paper, protractor, computer technology), rotations of 180º and clockwise and counterclockwise rotations of 90°, with the centre of rotation inside or outside the shape;

6m54   – create and analyse designs made by reflecting, translating, and/or rotating a shape, or shapes, by 90º or 180º (Sample problem: Identify rotations of 90° or 180° that map congruent shapes, in a given design, onto each other.).

Patterning and Algebra

Overall Expectations

6m55   • describe and represent relationships in growing and shrinking patterns (where the terms are whole numbers), and investigate repeating patterns involving rotations;

6m56   • use variables in simple algebraic expressions and equations to describe relationships.

Patterns and Relationships

6m57   – identify geometric patterns, through investigation using concrete materials or drawings, and represent them numerically;

6m58 – make tables of values, for growing patterns given pattern rules, in words (e.g., start with 3, then double each term and add 1 to get the next term), then list the ordered pairs (with the first coordinate representing the term number and the second coordinate representing the term) and plot the points in the first quadrant, using a variety of tools (e.g., graph paper, calculators, dynamic statistical software);

6m59 – determine the term number of a given term in a growing pattern that is represented by a pattern rule in words, a table of values, or a graph (Sample problem: For the pattern rule "start with 1 and add 3 to each term to get the next term", use graphing to find the term number when the term is 19.);

6m60 – describe pattern rules (in words) that generate patterns 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 with 1 and add 2 to each term to get the next term"), then distinguish such pattern rules from pattern rules, given in words, that describe the general term by referring to the term number (e.g., for 2, 4, 6, 8, …, the pattern rule for the general term is "double the term number");

6m61 – determine a term, given its term number, by extending growing and shrinking patterns that are generated by adding or subtracting a constant, or multiplying or dividing by a constant, to get the next term (Sample problem: For the pattern 5000, 4750, 4500, 4250, 4000, 3750, …, find the 15th term. Explain your reasoning.);

6m62 – extend and create repeating patterns that result from rotations, through investigation using a variety of tools (e.g., pattern blocks, dynamic geometry software, geoboards, dot paper).

Variables, Expressions, and Equations

6m63 – demonstrate an understanding of different ways in which variables are used (e.g., variable as an unknown quantity; variable as a changing quantity);

6m64 – identify, through investigation, the quantities in an equation that vary and those that remain constant (e.g., in the formula for the area of a triangle, $A = (b \times h)/2$, the number 2 is a constant, whereas b and h can vary and may change the value of A);

6m65 – solve problems that use two or three symbols or letters as variables to represent different unknown quantities (Sample problem: If $n + l = 15$ and $n + l + s = 19$, what value does the s represent?);

6m66 – determine the solution to a simple equation with one variable, through investigation using a variety of tools and strategies (e.g., modelling with concrete materials, using guess and check with and without the aid of a calculator) (Sample problem: Use the method of your choice to determine the value of the variable in the equation $2 \times n + 3 = 11$. Is there more than one possible solution? Explain your reasoning.).

Data Management and Probability

Overall Expectations

6m67 • collect and organize discrete or continuous primary data and secondary data and display the data using charts and graphs, including continuous line graphs;

6m68 • read, describe, and interpret data, and explain relationships between sets of data;

6m69 • determine the theoretical probability of an outcome in a probability experiment, and use it to predict the frequency of the outcome.

Collection and Organization of Data

6m70 – collect data by conducting a survey (e.g., use an Internet survey tool) 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;

6m71 – collect and organize 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 continuous line 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);

6m72 – 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, such as pictographs, horizontal or vertical bar graphs, stem-and-leaf plots, double bar graphs, broken-line graphs, and continuous line graphs);

6m73 – determine, through investigation, how well a set of data represents a population, on the basis of the method that was used to collect the data (Sample problem:Would the results of a survey of primary students about their favourite television shows represent the favourite shows of students in the entire school? Why or why not?).

Data Relationships

6m74 – read, interpret, and draw conclusions from primary data (e.g., survey results, measurements, observations) and from secondary data (e.g., sports data in the newspaper, data from the Internet about movies), presented in charts, tables, and graphs (including continuous line graphs);

6m75 – compare, through investigation, different graphical representations of the same data (Sample problem: Use technology to help you compare the different types of graphs that can be created to represent a set of data about the number of runs or goals scored against each team in a tournament. Describe the similarities and differences that you observe.);

6m76 – explain how different scales used on graphs can influence conclusions drawn from the data;

6m77 – demonstrate an understanding of mean (e.g., mean differs from median and mode because it is a value that "balances" a set of data – like the centre point or fulcrum in a lever), and use the mean to compare two sets of related data, with and without the use of technology (Sample problem: Use the mean to compare the masses of backpacks of students from two or more Grade 6 classes.);

6m78 – demonstrate, through investigation, an understanding of how data from charts, tables, and graphs can be used to make inferences and convincing arguments (e.g., describe examples found in newspapers and magazines).

Probability

6m79 – express theoretical probability as a ratio of the number of favourable outcomes to the total number of possible outcomes, where all outcomes are equally likely (e.g., the theoretical probability of rolling an odd number on a six-sided number cube is 3/6 because, of six equally likely outcomes, only three are favourable – that is, the odd numbers 1, 3, 5);

6m80 – represent the probability of an event (i.e., the likelihood that the event will occur), using a value from the range of 0 (never happens or impossible) to 1 (always happens or certain);

6m81 – predict the frequency of an outcome of a simple probability experiment or game, by calculating and using the theoretical probability of that outcome (e.g., "The theoretical probability of spinning red is 1/4 since there are four different-coloured areas that are equal. If I spin my spinner 100 times, I predict that red should come up about 25 times."). (Sample problem: Create a spinner that has rotational symmetry. Predict how often the spinner will land on the same sector after 25 spins. Perform the experiment and compare the prediction to the results.).