Mathematics at Work 10

General Curriculum Outcomes

Students will be expected to

- develop spatial sense through direct and indirect measurement
- develop spatial sense
- develop number sense and critical thinking skills
- develop algebraic reasoning

Specific Curriculum Outcomes

Performance indicators are samples of how students may demonstrate their performance of the goals of a specific curriculum outcome. The range of samples provided is meant to reflect the scope of the SCO. In the SCOs, the word **including** indicates that any ensuing items *must* be addressed to fully achieve the learning outcome. The phrase **such as** indicates that the ensuing items are provided for clarification only and are *not* requirements that must be addressed to fully achieve the learning outcome. The word **and** used in an outcome indicates that both ideas must be addressed to achieve the learning outcome, although not necessarily at the same time or in the same question.

Process Standards Key

[C] Communication	[PS] Problem Solving	[CN] Connections	[ME] Mental Mathematics and Estimation
[T] Technology	[V] Visualization	[R] Reasoning	

Measurement (M)

M01 Students will be expected to demonstrate an understanding of the International System of Units (SI) by
- describing the relationships of the units for length, area, volume, capacity, mass, and temperature
- applying strategies to convert SI units to imperial units [C, CN, ME, V]

Performance Indicators
(It is intended that this outcome be limited to the base units and the prefixes milli-, centi-, deci-, deca-, hector-, and kilo-.)

M01.01 Explain how the SI system was developed, and explain its relationship to base ten.
M01.02 Identify the base units of measurement in the SI system, and determine the relationship among the related units of each type of measurement.
M01.03 Identify contexts that involve the SI system.
M01.04 Match the prefixes used for SI units of measurement with the powers of ten.
M01.05 Explain, using examples, how and why decimals are used in the SI system.
M01.06 Provide an approximate measurement in SI units for a measurement given in imperial units.
M01.07 Write a given linear measurement expressed in one SI unit in another SI unit.
M01.08 Convert a given measurement from SI to imperial units by using proportional reasoning (including formulas).

M02 Students will be expected to demonstrate an understanding of the imperial system by

- describing the relationships of the units for length, area, volume, capacity, mass, and temperature
- comparing the American and British imperial units for capacity
- applying strategies to convert imperial units to SI units [C, CN, ME, V]

Performance Indicators

M02.01 Explain how the imperial system was developed.
M02.02 Identify commonly used units in the imperial system, and determine the relationships among the related units.
M02.03 Identify contexts that involve the imperial system.
M02.04 Explain, using examples, how and why fractions are used in the imperial system.
M02.05 Compare the American and British imperial measurement systems.
M02.06 Provide an approximate measure in imperial units for a measurement given in SI.
M02.07 Write a given linear measurement expressed in one imperial unit in another imperial unit.
M02.08 Convert a given measure from imperial to SI units by using proportional reasoning (including formulas).

M03 Students will be expected to solve and verify problems that involve SI and imperial linear measurements, including decimal and fractional measurements. [CN, ME, PS, V]

Performance Indicators

(It is intended that the four arithmetic operations on decimals and fractions be integrated into the problems.)

M03.01 Identify a referent for a given common SI or imperial unit of linear measurement.
M03.02 Estimate a linear measurement, using a referent.
M03.03 Measure inside diameters, outside diameters, lengths, widths of various given objects, and distances, using various measuring instruments.
M03.04 Estimate the dimensions of a given regular 3-D object or 2-D shape, using a referent (e.g., the height of the desk is about three rulers long, so the desk is approximately three feet high).
M03.05 Solve a linear measurement problem including perimeter, circumference, and length + width + height (used in shipping and air travel).
M03.06 Determine the operation that should be used to solve a linear measurement problem.
M03.07 Provide an example of a situation in which a fractional linear measurement would be divided by a fraction.
M03.08 Determine, using a variety of strategies, the midpoint of a linear measurement such as length, width, height, depth, diagonal, and diameter of a 3-D object, and explain the strategies.
M03.09 Determine if a solution to a problem that involves linear measurement is reasonable.

M04 Students will be expected to solve problems that involve SI and imperial area measurements of regular, composite, and irregular 2-D shapes and 3-D objects, including decimal and fractional measurements, and verify the solutions. [ME, PS, R, V]

Performance Indicators
(It is intended that the four arithmetic operations on decimals and fractions be integrated into the problems.)

M04.01 Identify and compare referents for area measurements in SI and imperial units.
M04.02 Estimate an area measurement, using a referent.
M04.03 Identify a situation where a given SI or imperial area unit would be used.
M04.04 Estimate the area of a given regular, composite, or irregular 2-D shape, using an SI square grid and an imperial square grid.
M04.05 Solve a contextual problem that involves the area of a regular, a composite, or an irregular 2-D shape.
M04.06 Write a given area measurement expressed in one SI unit squared in another SI unit squared.
M04.07 Write a given area measurement expressed in one imperial unit squared in another imperial unit squared.
M04.08 Solve a problem, using formulas for determining the areas of regular, composite, and irregular 2-D shapes, including circles.
M04.09 Solve a problem that involves determining the surface area of 3-D objects, including right cylinders and cones.
M04.10 Explain, using examples, the effect of changing the measurement of one or more dimensions on area and perimeter of rectangles.
M04.11 Determine if a solution to a problem that involves an area measurement is reasonable.

Geometry (G)

G01 Students will be expected to analyze puzzles and games that involve spatial reasoning, using problem-solving strategies. [C, CN, PS, R]

Performance Indicators
(It is intended that this outcome be integrated throughout the course by using sliding, rotation, construction, deconstruction, and similar puzzles and games.)

G01.01 Determine, explain, and verify a strategy to solve a puzzle or to win a game. For example,
- guess and check
- look for a pattern
- make a systematic list
- draw or model
- eliminate possibilities
- simplify the original problem
- work backward
- develop alternative approaches

G01.02 Identify and correct errors in a solution to a puzzle or in a strategy for winning a game.
G01.03 Create a variation on a puzzle or a game, and describe a strategy for solving the puzzle or winning the game.

G02 Students will be expected to demonstrate an understanding of the Pythagorean theorem by identifying situations that involve right triangles, verifying the formula, applying the formula, and solving problems. [C, CN, PS, V]

Performance Indicators

G02.01 Explain, using illustrations, why the Pythagorean theorem applies only to right triangles.
G02.02 Verify the Pythagorean theorem, using examples and counterexamples, including drawings, concrete materials, and technology.
G02.03 Describe historical and contemporary applications of the Pythagorean theorem.
G02.04 Determine if a given triangle is a right triangle, using the Pythagorean theorem.
G02.05 Explain why a triangle with the side length ratio of 3:4:5 is a right triangle.
G02.06 Explain how the ratio of 3:4:5 can be used to determine if a corner of a given 3-D object is square (90°) or if a given parallelogram is a rectangle.
G02.07 Solve a problem using the Pythagorean theorem.

G03 Students will be expected to demonstrate an understanding of similarity of convex polygons, including regular and irregular polygons. [C, CN, PS, V]

Performance Indicators

G03.01 Determine, using angle measurements, if two or more regular or irregular polygons are similar.
G03.02 Determine, using ratios of side lengths, if two or more regular or irregular polygons are similar.
G03.03 Explain why two given polygons are not similar.
G03.04 Explain the relationships between the corresponding sides of two polygons that have corresponding angles of equal measure.
G03.05 Draw a polygon that is similar to a given polygon.
G03.06 Explain why two or more right triangles with a shared acute angle are similar.
G03.07 Solve a contextual problem that involves similarity of polygons.

G04 Students will be expected to demonstrate an understanding of primary trigonometric ratios (sine, cosine, tangent) by applying similarity to right triangles, generalizing patterns from similar right triangles, applying the primary trigonometric ratios, and solving problems. [CN, PS, R, T, V]

Performance Indicators

G04.01 Show, for a specified acute angle in a set of similar right triangles, that the ratios of the length of the side opposite to the length of the side adjacent are equal, and generalize a formula for the tangent ratio.
G04.02 Show, for a specified acute angle in a set of similar right triangles, that the ratios of the length of the side opposite to the length of the hypotenuse are equal, and generalize a formula for the sine ratio.
G04.03 Show, for a specified acute angle in a set of similar right triangles, that the ratios of the length of the side adjacent to the length of the hypotenuse are equal, and generalize a formula for the cosine ratio.
G04.04 Identify situations where the trigonometric ratios are used for indirect measurement of angles and lengths.
G04.05 Solve a contextual problem that involves right triangles, using the primary trigonometric ratios.
G04.06 Determine if a solution to a problem that involves primary trigonometric ratios is reasonable.

G05 Students will be expected to solve problems that involve parallel, perpendicular, and transversal lines, and pairs of angles formed between them. [C, CN, PS, V]

Performance Indicators

G05.01 Sort a set of lines as perpendicular, parallel, or neither, and justify this sorting.
G05.02 Illustrate and describe complementary and supplementary angles.
G05.03 Identify, in a set of angles, adjacent angles that are not complementary or supplementary.
G05.04 Identify and name pairs of angles formed by parallel lines and a transversal, including corresponding angles, vertically opposite angles, alternate interior angles, alternate exterior angles, interior angles on the same side of transversal, and exterior angles on the same side of transversal.
G05.05 Explain and illustrate the relationships of angles formed by parallel lines and a transversal.
G05.06 Explain, using examples, why the angle relationships do not apply when the lines are not parallel.
G05.07 Determine if lines or planes are perpendicular or parallel (e.g., wall perpendicular to floor, and describe the strategy used).
G05.08 Determine the measures of angles involving parallel lines and a transversal, using angle relationships.
G05.09 Solve a contextual problem that involves angles formed by parallel lines and a transversal (including perpendicular transversals).

G06 Students will be expected to demonstrate an understanding of angles, including acute, right, obtuse, straight, and reflex, by drawing, replicating and constructing, bisecting, and solving problems. [C, ME, PS, T, V]

Performance Indicators

G06.01 Draw and describe angles with various measures, including acute, right, straight, obtuse, and reflex angles.
G06.02 Identify referents for angles.
G06.03 Sketch a given angle.
G06.04 Estimate the measure of a given angle, using 22.5°, 30°, 45°, 60°, 90°, and 180° as referent angles.
G06.05 Measure, using a protractor, angles in various orientations.
G06.06 Explain and illustrate how angles can be replicated in a variety of ways (e.g., Mira, protractor, compass and straightedge, carpenter's square, dynamic geometry software).
G06.07 Replicate angles in a variety of ways, with and without technology.
G06.08 Bisect an angle, using a variety of methods.
G06.09 Solve a contextual problem that involves angles.

Number (N)

N01 Students will be expected to solve problems that involve unit pricing and currency exchange, using proportional reasoning. [CN, ME, PS, R]

Performance Indicators

N01.01 Compare the unit price of two or more given items.
N01.02 Solve problems that involve determining the best buy, and explain the choice in terms of the cost as well as other factors, such as quality and quantity.
N01.03 Compare, using examples, different sales promotion techniques.
N01.04 Determine the percent increase or decrease for a given original and new price.

N01.05 Solve, using proportional reasoning, a contextual problem that involves currency exchange.
N01.06 Explain the difference between the selling rate and purchasing rate for currency exchange.
N01.07 Explain how to estimate the cost of items in Canadian currency while in a foreign country, and explain why this may be important.
N01.08 Convert between Canadian currency and foreign currencies, using formulas, charts, or tables.

N02 Students will be expected to demonstrate an understanding of income to calculate gross pay and net pay, including wages, salary, contracts, commissions, and piecework. [C, CN, R, T]

Performance Indicators
N02.01 Describe, using examples, various methods of earning income.
N02.02 Identify and list jobs that commonly use different methods of earning income (e.g., hourly wage, wage and tips, salary, commission, contract, bonus, shift premiums).
N02.03 Determine in decimal form, from a time schedule, the total time worked in hours and minutes, including time and a half and/or double time.
N02.04 Determine gross pay from given or calculated hours worked when given
- the base hourly wage, with and without tips
- the base hourly wage, plus overtime (time and a half, double time)

N02.05 Determine gross pay for earnings acquired by
- base wage, plus commission
- single commission rate

N02.06 Explain why gross pay and net pay are not the same.
N02.07 Determine the Canadian Pension Plan (CPP), Employment Insurance (EI), and income tax deductions for a given gross pay.
N02.08 Determine net pay when given deductions (e.g., health plans, uniforms, union dues, charitable donations, payroll tax).
N02.09 Investigate, with technology, "what if …" questions related to changes in.
N02.10 Identify and correct errors in a solution to a problem that involves gross or net pay.
N02.11 Describe the advantages and disadvantages for a given method of earning income.

Algebra (A)

A01 Students will be expected to solve problems that require the manipulation and application of formulas related to perimeter, area, the Pythagorean theorem, primary trigonometric ratios, and income. [C, CN, ME, PS, R]

Performance Indicators
(It is intended that this outcome be integrated throughout the course.)

A01.01 Solve a contextual problem that involves the application of a formula that does not require manipulation.
A01.02 Solve a contextual problem that involves the application of a formula that requires manipulation.
A01.03 Explain and verify why different forms of the same formula are equivalent.
A01.04 Describe, using examples, how a given formula is used in a trade or an occupation.
A01.05 Create and solve a contextual problem that involves a formula.
A01.06 Identify and correct errors in a solution to a problem that involves a formula.