

Mathematics at Work 11

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
- develop statistical reasoning
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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) (20–25 hours)

M01 Students will be expected to solve problems that involve SI and imperial units in surface area measurements and verify the solutions.

Performance Indicators

- M01.01 Explain, using examples, the difference between volume and surface area.
- M01.02 Explain, using examples, including nets, the relationship between area and surface area.
- M01.03 Explain how a referent can be used to estimate surface area.
- M01.04 Estimate the surface area of a 3-D object.
- M01.05 Illustrate, using examples, the effect of dimensional changes on surface area.
- M01.06 Solve a contextual problem that involves the surface area of 3-D objects, including spheres, and that requires the manipulation of formulas.

M02 Students will be expected to solve problems that involve SI and imperial units in volume and capacity measurements.

Performance Indicators

- M02.01 Explain, using examples, the difference between volume and capacity.
- M02.02 Identify and compare referents for volume and capacity measurements in SI and imperial units.
- M02.03 Estimate the volume or capacity of a 3-D object or container, using a referent.
- M02.04 Identify a situation where a given SI or imperial volume unit would be used.

- M02.05 Solve problems that involve the volume of 3-D objects and composite 3-D objects in a variety of contexts.
- M02.06 Solve a problem that involves the capacity of containers.
- M02.07 Write a given volume expressed as another unit in the same measurement system.
- M02.08 Write a given capacity expressed as another unit in the same measurement system.
- M02.09 Determine the volume of prisms, cones, cylinders, pyramids, spheres, and composite 3-D objects using a variety of measuring tools such as rulers, tape measures, calipers, and micrometers.
- M02.10 Determine the capacity of prisms, cones, pyramids, spheres, and cylinders, using a variety of measuring tools and methods, such as graduated cylinders, measuring cups, measuring spoons, and displacement.
- M02.11 Describe the relationship between the volumes of
- cones and cylinders with the same base and height
 - pyramids and prisms with the same base and height
- M02.12 Illustrate, using examples, the effect of dimensional changes on volume.
- M02.13 Solve a contextual problem that involves the volume of a 3-D object, including composite 3-D objects, or the capacity of a container.
- M02.14 Solve a contextual problem that involves the volume of a 3-D object and requires the manipulation of formulas.

Geometry (G) (25–30 hours)

G01 Students will be expected to solve problems that involve two and three right triangles.

Performance Indicators

- G01.01 Identify all of the right triangles in a given illustration for a context.
- G01.02 Determine if a solution to a problem that involves two or three right triangles is reasonable.
- G01.03 Sketch a representation of a given description of a problem in a 2-D or 3-D context.
- G01.04 Solve a contextual problem that involves angles of elevation or angles of depression.
- G01.05 Solve a contextual problem that involves two or three right triangles, using the primary trigonometric ratios.

G02 Students will be expected to solve problems that involve scale.

Performance Indicators

- G02.01 Describe contexts in which a scale representation is used.
- G02.02 Determine, using proportional reasoning, the dimensions of an object from a given scale drawing or model.
- G02.03 Construct a model of a 3-D object, given the scale.
- G02.04 Draw, with and without technology, a scale diagram of a given object.
- G02.05 Solve a contextual problem that involves scale.

G03 Students will be expected to model and draw 3-D objects and their views.

Performance Indicators

- G03.01 Draw a 2-D representation of a given 3-D object.
- G03.02 Draw, using isometric dot paper, a given 3-D object.
- G03.03 Draw to scale top, front, and side views of a given 3-D object.
- G03.04 Construct a model of a 3-D object, given the top, front, and side views.
- G03.05 Draw a 3-D object, given the top, front, and side views.

- G03.06 Determine if given views of a 3-D object represent a given object, and explain the reasoning.
G03.07 Identify the point of perspective of a given one-point perspective drawing of a 3-D object.
G03.08 Draw a one-point perspective view of a given 3-D object.

G04 Students will be expected to draw and describe exploded views, component parts, and scale diagrams of simple 3-D objects.

Performance Indicators

(It is intended that the simple 3-D objects come from contexts such as flat-packed furniture or sewing patterns.)

- G04.01 Draw the components of a given exploded diagram, and explain their relationship to the original 3-D object.
G04.02 Sketch an exploded view of a 3-D object to represent the components.
G04.03 Draw to scale the components of a 3-D object.
G04.04 Sketch a 2-D representation of a 3-D object, given its exploded view.

Number (N) (15–20 hours)

N01 Students will be expected to analyze puzzles and games that involve numerical reasoning, using problem-solving strategies.

Performance Indicators

(It is intended that this outcome be integrated throughout the course by using puzzles and games such as cribbage, magic squares, and Kakuro.)

- N01.01 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
- N01.02 Identify and correct errors in a solution to a puzzle or in a strategy for winning a game.
N01.03 Create a variation on a puzzle or a game, and describe a strategy for solving the puzzle or winning the game.

N02 Students will be expected to solve problems that involve personal budgets.

Performance Indicators

- N02.01 Identify income and expenses that should be included in a personal budget.
N02.02 Explain considerations that must be made when developing a budget (e.g., prioritizing, recurring and unexpected expenses).
N02.03 Create a personal budget based on given income and expense data.
N02.04 Collect income and expense data and create a budget.
N02.05 Modify a budget to achieve a set of personal goals.
N02.06 Investigate and analyze, with or without technology, “what if ...” questions related to personal budgets.

N03 Students will be expected to demonstrate an understanding of compound interest.

Performance Indicators

N03.01 Solve a problem that involves simple interest, given three of the four values in the formula $I = Prt$.

N03.02 Compare simple and compound interest and explain their relationship.

N03.03 Solve, using a formula, a contextual problem that involves compound interest.

N03.04 Explain, using examples, the effect of different compounding periods on calculations of compound interest.

N03.05 Estimate, using the Rule of 72, the time required for a given investment to double in value.

N04 Students will be expected to demonstrate an understanding of financial institution services used to access and manage finances.

Performance Indicators

N04.01 Describe the type of banking services available from various financial institutions, such as online services.

N04.02 Describe the types of accounts available at various financial institutions.

N04.03 Identify the type of account that best meets the needs for a given set of criteria.

N04.04 Identify and explain various automated teller machine (ATM) service charges.

N04.05 Describe the advantages and disadvantages of online banking.

N04.06 Describe the advantages and disadvantages of debit card purchases.

N04.07 Describe ways that ensure the security of personal and financial information (e.g., passwords, encryption, protection of personal identification number [PIN] and other personal identity information).

N05 Students will be expected to demonstrate an understanding of credit options, including credit cards and loans.

Performance Indicators

N05.01 Compare advantages and disadvantages of different types of credit options, including bank and store credit cards, personal loans, lines of credit, and overdraft.

N05.02 Make informed decisions and plans related to the use of credit, such as service charges, interest, payday loans, and sales promotions, and explain the reasoning.

N05.03 Describe strategies to use credit effectively, such as negotiating interest rates, planning payment timelines, reducing accumulated debt, and timing purchases.

N05.04 Compare credit card options from various companies and financial institutions.

N05.05 Solve a contextual problem that involves credit cards or loans.

N05.06 Solve a contextual problem that involves credit linked to sales promotions.

Algebra (A) (15–20 hours)

- A01** Students will be expected to solve problems that require the manipulation and application of formulas related to
- volume and capacity
 - surface area
 - slope and rate of change
 - simple interest
 - finance charges

Performance Indicators

- A01.01 Solve a contextual problem involving the application of a formula that does not require manipulation.
- A01.02 Solve a contextual problem involving 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.

- A02** Students will be expected to demonstrate an understanding of slope

- as rise over run
- as rate of change
- by solving problems

Performance Indicators

- A02.01 Describe contexts that involve slope (e.g., ramps, roofs, road grade, flow rates within a tube skateboard parks, ski hills).
- A02.02 Explain, using diagrams, the difference between two given slopes (e.g., a 3:1 and a 1:3 roof pitch), and describe the implications.
- A02.03 Describe the conditions under which a slope will be either 0 or undefined.
- A02.04 Explain, using examples and illustrations, slope as rise over run.
- A02.05 Verify that the slope of an object, such as a ramp or a roof, is constant.
- A02.06 Explain, using illustrations, the relationship between slope and angle of elevation (e.g., for a ramp with a slope of 7:100, the angle of elevation is approximately 4°).
- A02.07 Explain the implications, such as safety and functionality, of different slopes in a given context.
- A02.08 Explain, using examples and illustrations, slope as rate of change.
- A02.09 Solve a contextual problem that involves slope or rate of change.

- A03** Students will be expected to solve problems by applying proportional reasoning and unit analysis.

Performance Indicators

- A03.01 Explain the process of unit analysis used to solve a problem (e.g., given kmh and time in hours, determine how many kilometres; given revolutions per minute, determine the number of seconds per revolution).
- A03.02 Solve a problem, using unit analysis.

- A03.03 Explain, using an example, how unit analysis and proportional reasoning are related (e.g., to change kmh to km/min., multiply by 1 h/60 min. because hours and minutes are proportional [constant relationship]).
- A03.04 Solve a problem within and between systems using proportions or tables (e.g., km to m or kmh to ft./sec.).

Statistics (S) (10 hours)

- S01** Students will be expected to solve problems that involve creating and interpreting graphs, including bar graphs, histograms, line graphs, and circle graphs.

Performance Indicators

- S01.01 Determine the possible graphs that can be used to represent a given data set and explain the advantages and disadvantages of each.
- S01.02 Create, with and without technology, a graph to represent a given data set.
- S01.03 Describe the trends in the graph of a given data set.
- S01.04 Interpolate and extrapolate values from a given graph.
- S01.05 Explain, using examples, how the same graph can be used to justify more than one conclusion.
- S01.06 Explain, using examples, how different graphic representations of the same data set can be used to emphasize a point of view.
- S01.07 Solve a contextual problem that involves the interpretation of a graph.