General and Specific Learning Outcomes by Strand
Essential Mathematics

Number

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.			
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
8.N.1. Demonstrate an understanding of perfect squares and square roots, concretely, pictorially, and symbolically (limited to whole numbers). [C, CN, R, V] 8.N 2. Determine the approximate square root of numbers that are not perfect squares (limited to whole numbers). [C, CN, ME, R, T] 8.N 3. Demonstrate an understanding of percents greater than or equal to 0%. [CN, PS, R, V] 8.N 4. Demonstrate an understanding of ratio and rate. [C, CN, V] 8.N 5. Solve problems that involve rates, ratios, and proportional reasoning. [C, CN, PS, R]	9.N.1. Demonstrate an understanding of powers with integral bases (excluding base 0) and whole-number exponents by ■ representing repeated multiplication using powers ■ using patterns to show that a power with an exponent of zero is equal to one ■ solving problems involving powers [C, CN, ME, PS, R] 9.N.2. Demonstrate an understanding of operations on powers with integral bases (excluding base 0) and whole-number exponents. [C, CN, ME, PS, R, T]	10E2.C.1. Solve problems that involve unit pricing and currency exchange, using proportional reasoning. [CN, ME, PS, R] 10E1.P.1. Demonstrate an understanding of calculations for gross pay and net pay earned through income sources including ■ wages ■ salary ■ contracts ■ commissions ■ piecework [C, CN, R, T] 10E1.P.2. Solve problems that require the manipulation and application of formulas related to income. [C, CN, ME, PS, R]	11E3.A.1. Analyze puzzles and games that involve numerical reasoning, using problem-solving strategies. [C, CN, PS, R] 11E4.A.1. Analyze puzzles and games that involve numerical reasoning, using problem-solving strategies. [C, CN, PS, R] 11E3.I.1. Demonstrate an understanding of compound interest. [CN, ME, PS, T] 11E3.I.2. Demonstrate an understanding of credit options, including ■ credit cards ■ loans [CN, ME, PS, R]	12E5.A.1. Analyze puzzles and games that involve logical reasoning, using problem-solving strategies. [C, CN, PS, R] 12E6.A.1. Analyze puzzles and games that involve logical reasoning, using problem-solving strategies. [C, CN, PS, R] 12E5.V.1. Solve problems that involve the acquisition, operation, and maintenance of a vehicle when ■ buying ■ leasing ■ leasing to buy [C, CN, PS, R, T] 12E6.B.1. Critique the viability of small business options by considering ■ expenses ■ sales ■ profit or loss [C, CN, R]

Essential Mathematics

Number

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
General Learning Outcome Develop number sense.	General Learning Outcome Develop number sense.			
Specific Learning Outcomes	Specific Learning Outcomes		Specific Learning Outcomes	Specific Learning Outcomes
8.N.6. Demonstrate an understanding of multiplying and dividing positive fractions and mixed numbers, concretely, pictorially, and symbolically. [C, CN, ME, PS] 8.N.7. Demonstrate an understanding of multiplication and division of integers, concretely, pictorially, and symbolically. [C, CN, PS, R, V] 8.N.8. Solve problems involving positive rational numbers. [C, CN, ME, PS, R, T, V]	9.N.3. Demonstrate an understanding of rational numbers by ■ comparing and ordering rational numbers ■ solving problems that involve arithmetic operations on rational numbers [C, CN, ME, PS, R, T, V] 9.N.4. Explain and apply the order of operations, including exponents, with and without technology. [ME, PS, T] 9.N.5. Determine the square root of positive rational numbers that are perfect squares. [C, CN, ME, PS, R, T] 9.N.6. Determine an approximate square root of positive rational numbers that are non-perfect squares. [C, CN, ME, PS, R, T]		11E3.I.3. Solve problems that require the manipulation and application of formulas related to ■ simple interest ■ finance charges [CN, PS, R] 11E4.M.1. Solve problems that involve personal budgets. [CN, PS, R, T] 11E4.M.2. Demonstrate an understanding of financial institution services used to access and manage finances. [C, CN, R, T] 11E4.R 2. Solve problems by applying proportional reasoning and unit analysis. [C, CN, PS, R]	12E6.B.2. Demonstrate an awareness of the government taxation forms and procedures involved in owning a business. [C,CN] 12E6.H.1. Solve problems involving the purchase and maintenance of a house. [C, CN, ME, R, T] 12E5.C.1. Create a plan for the future, including possible career choices and their requirements. [C, CN, PS, R]

Essential Mathematics

Patterns and Relations (Patterns)

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
General Learning Outcome Use patterns to describe the world and solve problems.	General Learning Outcome Use patterns to describe the world and solve problems.			
Specific Learning Outcomes	Specific Learning Outcomes		Specific Learning Outcomes	
8.PR.1. Graph and analyze two-variable linear equations. [C, ME, PS, R, T, V]	9.PR.1. Generalize a pattern arising from a problem-solving context using linear equations, and verify by substitution. [C, CN, PS, R, V] 9.PR.2. Graph linear relations, analyze the graph, and interpolate or extrapolate to solve problems. [C, CN, ME, PS, R, T, V]		11E4.R.5. Demonstrate an understanding of linear relations by ■ recognizing patterns and trends ■ graphing ■ creating tables of values ■ writing equations ■ interpolating and extrapolating ■ solving problems [CN, PS, R, T, V]	

Essential Mathematics

Patterns and Relations (Variables and Equations)

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
General Learning Outcome Represent algebraic expressions in multiple ways.	General Learning Outcome Represent algebraic expressions in multiple ways.			
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	
8.PR.2. Model and solve problems using linear equations of the form ■ $ax = b$ ■ $\frac{x}{a} = b, a \neq 0$ ■ $ax + b = c$ ■ $\frac{x}{a} + b = c, a \neq 0$ ■ $a(x + b) = c$ concretely, pictorially, and symbolically, where a, b, and c are integers. [C, CN, PS, V]	9.PR.3. Model and solve problems using linear equations of the form ■ $ax = b$ ■ $ax + b = c$ ■ $ax = b + cx$ ■ $a(x + b) = c$ ■ $ax + b = cx + d$ ■ $a(bx + c) = d(ex + f)$ ■ $\frac{a}{x} = b, x \neq 0$ where a, b, c, d, e, and f are rational numbers. [C, CN, ME, PS, V] 9.PR.4. Explain and illustrate strategies to solve single variable linear inequalities with rational number coefficients within a problem-solving context. [C, CN, ME, PS, R, V] 9.PR.5. Demonstrate an understanding of polynomials (limited to polynomials of degree less than or equal to 2). [C, CN, R, V]	10E1.P.2. Solve problems that require the manipulation and application of formulas related to income. [C, CN, ME, PS, R] 10E1.M.4. Solve problems that require the manipulation and application of formulas related to converting measurement. [C, CN, ME, PS, R] 10E1.G.2. Solve problems that require the manipulation and application of formulas related to ■ perimeter ■ area [C, CN, ME, PS, R]	11E3.I.3. Solve problems that require the manipulation and application of formulas related to ■ simple interest ■ finance charges [CN, PS, R] 11E3.G.3. Solve problems that require the manipulation and application of formulas related to ■ volume and capacity ■ surface area [CN, PS, R] 11E4.R.3. Solve problems that require the manipulation and application of formulas related to slope and rate of change. [CN, PS, R]	

Patterns and Relations (Variables and Equations) *(continued)*

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
	General Learning Outcome Represent algebraic expressions in multiple ways.			
	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	
	9.PR.6. Model, record, and explain the operations of addition and subtraction of polynomial expressions, concretely, pictorially, and symbolically (limited to polynomials of degree less than or equal to 2). [C, CN, ME, PS, R, V] 9.PR.7. Model, record, and explain the operations of multiplication and division of polynomial expressions (limited to polynomials of degree less than or equal to 2) by monomials, concretely, pictorially, and symbolically. [C, CN, R, V]	10E2.TG.3. Solve problems that require the manipulation and application of formulas related to ■ the Pythagorean theorem ■ primary trigonometric ratios [C, CN, ME, PS, R]	11E4.R.5. Demonstrate an understanding of linear relations by ■ recognizing patterns and trends ■ graphing ■ creating tables of values ■ writing equations ■ interpolating and extrapolating ■ solving problems [CN, PS, R, T, V]	

Essential Mathematics

Patterns and Relations (Relations and Functions)

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
			Specific Learning Outcomes	
			11E4.R 1. Demonstrate an understanding of slope ■ as rise over run ■ as rate of change by solving problems. [C, CN, PS, V]	
			11E4.R 2. Solve problems by applying proportional reasoning and unit analysis. [C, CN, PS, R]	
			11E4.R.3. Solve problems that require the manipulation and application of formulas related to slope and rate of change. [CN, PS, R]	

Essential Mathematics

Shape and Space (Measurement)

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
General Learning Outcome Use direct or indirect measurement to solve problems.	General Learning Outcome Use direct or indirect measurement to solve problems.			
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
8.SS.1. Develop and apply the Pythagorean theorem to solve problems. [CN, PS, R, T, V] 8.SS.2. Draw and construct nets for 3-D objects. [C, CN, PS, V] 8.SS.3. Determine the surface area of ■ right rectangular prisms ■ right triangular prisms ■ right cylinders to solve problems. [C, CN, PS, R, V] 8.SS.4. Develop and apply formulas for determining the volume of right prisms and right cylinders. [C, CN, PS, R, V]	9.SS.1. Solve problems and justify the solution strategy using circle properties, including ■ the perpendicular from the centre of a circle to a chord bisects the chord ■ the measure of the central angle is equal to twice the measure of the inscribed angle subtended by the same arc ■ the inscribed angles subtended by the same arc are congruent ■ a tangent to a circle is perpendicular to the radius at the point of tangency [C, CN, PS, R, T, V]	10E1.M.1. Demonstrate an understanding of the Système International (SI) by describing the relationships of the units for length, area, volume, capacity, and mass. [C, CN, ME, V] 10E1.M.2. Demonstrate an understanding of the imperial system by ■ describing the relationships of the units for length, area, volume, capacity, and mass ■ comparing the American and British imperial units for capacity ■ applying strategies to convert between imperial units and SI units [C, CN, ME, V]	11E3.G.1. Solve problems that involve SI and imperial units in surface area measurements. [C, CN, ME, PS, V] 11E3.G.2. Solve problems that involve SI and imperial units in volume and capacity measurements. [C, CN, ME, PS, V] 11E3.G.3. Solve problems that require the manipulation and application of formulas related to ■ volume and capacity ■ surface area [CN, PS, R]	12E5.P.1. Demonstrate an understanding of the limitations of measuring instruments, including ■ precision ■ accuracy ■ uncertainty ■ tolerance [C, PS, R, T, V] 12E6.G.1. Solve problems by using the sine law and cosine law, excluding the ambiguous case. [CN, PS, V]

Essential Mathematics

Shape and Space (Measurement) *(continued)*

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
		General Learning Outcome Use direct or indirect measurement to solve problems.	General Learning Outcome Use direct or indirect measurement to solve problems.	
		Specific Learning Outcomes	Specific Learning Outcomes	
		10E1.M.3. Solve and verify problems that involve SI and imperial linear measurements, including decimal and fractional measurements. [CN, ME, PS, V] 10E1.M.4. Solve problems that require the manipulation and application of formulas related to converting measurement. [C, CN, ME, PS, R] 10E2.TG.1. Solve problems involving right triangles using the Pythagorean theorem. [C, CN, PS, V]	11E4.TG.1. Solve problems that involve two and three right triangles. [CN, PS, T, V] 11E4.R.4. Solve problems that involve scale. [PS, R, T, V]	

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
		Specific Learning Outcomes		
		10E2.TG.2. Demonstrate an understanding of primary trigonometric ratios (sine, cosine, tangent) by ■ applying similarity to right triangles ■ generalizing patterns from similar right triangles ■ solving problems [CN, PS, R, T, V]		
		10E2.TG.3. Solve problems that require the manipulation and application of formulas related to ■ the Pythagorean theorem ■ primary trigonometric ratios [C, CN, ME, PS, R]		
		10E2.AC.2. Solve problems that involve parallel, perpendicular, and transversal lines, and pairs of angles formed between them. [C, CN, PS, V]		

Essential Mathematics

Shape and Space (3-D Objects and 2-D Shapes)

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
General Learning Outcome Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.	General Learning Outcome Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.			
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes
8.SS.5. Draw and interpret top, front, and side views of 3-D objects composed of right rectangular prisms. [C, CN, R, T, V]	9.SS.2. Determine the surface area of composite 3-D objects to solve problems. [C, CN, ME, PS, R, V] 9.SS.3. Demonstrate an understanding of similarity of polygons. [C, CN, PS, R, T, V]	10E1.G.1. 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. [ME, PS, R, V] 10E1.A.1. Analyze puzzles and games that involve spatial reasoning, using problem-solving strategies. [C, CN, PS, R] 10E2.A.1. Analyze puzzles and games that involve spatial reasoning, using problem-solving strategies. [C, CN, PS, R]	11E4.D.1. Model and draw 3-D objects and their views. [CN, R, V] 11E4.D.2. Draw and describe exploded views, component parts, and scale diagrams of simple 3-D objects. [CN, V]	12E6.G.2. Solve problems that involve ■ triangles ■ quadrilaterals ■ regular polygons [C, CN, PS, V]

Shape and Space (3-D Objects and 2-D Shapes) *(continued)*

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
		Specific Learning Outcomes		
		10E2.AC.1. Demonstrate an understanding of angles, including acute, right, obtuse, straight, and reflex, by ■ drawing ■ replicating and constructing ■ bisecting ■ solving problems [C, ME, PS, T, V]		

Essential Mathematics

Shape and Space (Transformations)

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
General Learning Outcome Describe and analyze position and motion of objects and shapes.	General Learning Outcome Describe and analyze position and motion of objects and shapes.			
Specific Learning Outcomes	Specific Learning Outcomes	Specific Learning Outcomes		
8.SS.6. Demonstrate an understanding of tessellation by ■ explaining the properties of shapes that make tessellating possible ■ creating tessellations ■ identifying tessellations in the environment [C, CN, PS, T, V]	9.SS.4. Draw and interpret scale diagrams of 2-D shapes. [CN, R, T, V] 9.SS.5. Demonstrate an understanding of line and rotation symmetry. [C, CN, PS, V]	10E2.TF.1. Demonstrate an understanding of transformations on a 2-D shape or a 3-D object, including ■ translations ■ rotations ■ reflections ■ dilations [C, CN, R, T, V]		

Essential Mathematics

Statistics and Probability (Data Analysis)

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
General Learning Outcome Collect, display, and analyze data to solve problems.	General Learning Outcome Collect, display, and analyze data to solve problems.			
Specific Learning Outcomes	Specific Learning Outcomes		Specific Learning Outcomes	Specific Learning Outcomes
8.SP.1. Critique ways in which data are presented. [C, R, T, V]	9.SP.1. Describe the effect of ■ bias ■ use of language ■ ethics ■ cost ■ time and timing ■ privacy ■ cultural sensitivity on the collection of data. [C, CN, R, T] 9.SP.2. Select and defend the choice of using either a population or a sample of a population to answer a question. [C, CN, PS, R]		11E3.S.1. Solve problems that involve creating and interpreting graphs, including ■ bar graphs ■ histograms ■ line graphs ■ circle graphs [C, CN, PS, R, T, V]	12E5.S.1. Solve problems that involve measures of central tendency, including ■ mean ■ median ■ mode ■ weighted mean ■ trimmed mean [C, CN, PS, R] 12E5.S.2. Analyze and describe percentiles. [C, CN, PS, R]

Statistics and Probability (Data Analysis) *(continued)*

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
	General Learning Outcome Collect, display, and analyze data to solve problems.			
	Specific Learning Outcomes			
	9.SP. 3. Develop and implement a project plan for the collection, display, and analysis of data by ■ formulating a question for investigation ■ choosing a data collection method that includes social considerations ■ selecting a population or a sample ■ collecting the data ■ displaying the collected data in an appropriate manner ■ drawing conclusions to answer the question [C, PS, R, T, V]			

Essential Mathematics

Statistics and Probability (Chance and Uncertainty)

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

Grade 8	Grade 9	Grade 10	Grade 11	Grade 12
General Learning Outcome Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.	General Learning Outcome Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.			
Specific Learning Outcomes	Specific Learning Outcomes			Specific Learning Outcomes
8.SP.2. Solve problems involving the probability of independent events. [C, CN, PS, T]	9.SP.4. Demonstrate an understanding of the role of probability in society. [C, CN, R, T]			12E6.P.1. Analyze and interpret problems that involve probability. [C, CN, PS, R]