Mathematics 8 to 12 IRP: Prescribed Learning Outcomes Using Foundations of Mathematics Pathway

Mathematical Processes (Integrated)

The following mathematical processes have been integrated within the prescribed learning outcomes and achievement indicators for all grades: communication [C], connections [CN], mental mathematics and estimation [ME], problem solving [PS], reasoning [R], technology [T], and visualization [V].

K to 9 Organizers	Grade 8	Grade 9	10 to 12 Organizers	Foundations of Mathematics and Pre-calculus 10	Foundations of Mathematics 11	Foundations of Mathematics 12
Number	**A1** demonstrate an understanding of perfect squares and square roots, concretely, pictorially, and symbolically (limited to whole numbers) [C, CN, R, V] **A2** determine the approximate square root of numbers that are not perfect squares (limited to whole numbers) [C, CN, ME, R, T] **A3** demonstrate an understanding of percents greater than or equal to 0% [CN, PS, R, V] **A4** demonstrate an understanding of ratio and rate [C, CN, V] **A5** solve problems that involve rates, ratios, and proportional reasoning [C, CN, PS, R] **A6** demonstrate an understanding of multiplying and dividing positive fractions and mixed numbers, concretely, pictorially, and symbolically [C, CN, ME, PS] **A7** demonstrate an understanding of multiplication and division of integers, concretely, pictorially, and symbolically [C, CN, PS, R, V]	**A1** 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, PS, R] **A2** demonstrate an understanding of operations on powers with integral bases (excluding base 0) and whole number exponents [C, CN, PS, R, T] **A3** demonstrate an understanding of rational numbers by • comparing and ordering rational numbers • solving problems that involve arithmetic operations on rational numbers [C, CN, PS, R, T, V] **A4** explain and apply the order of operations, including exponents, with and without technology [PS, T] **A5** determine the square root of positive rational numbers that are perfect squares [C, CN, PS, R, T] **A6** determine an approximate square root of positive rational numbers that are non-perfect squares [C, CN, PS, R, T]	**Algebra and Number**	**B1** Demonstrate an understanding of factors of whole numbers by determining the: • prime factors • greatest common factor • least common multiple • square root • cube root. [CN, ME, R] **B2** Demonstrate an understanding of irrational numbers by: • representing, identifying and simplifying irrational numbers • ordering irrational numbers. [CN, ME, R, V] **B3** Demonstrate an understanding of powers with integral and rational exponents. [C, CN, PS, R] **B4** Demonstrate an understanding of the multiplication of polynomial expressions (limited to monomials, binomials and trinomials), concretely, pictorially and symbolically. [CN, R, V] **B5** Demonstrate an understanding of common factors and trinomial factoring, concretely, pictorially and symbolically. [C, CN, R, V]		
			Financial Mathematics			**A1** Solve problems that involve compound interest in financial decision making. [C, CN, PS, T, V] **A2** Analyze costs and benefits of renting, leasing and buying. [CN, PS, R, T] **A3** Analyze an investment portfolio in terms of: • interest rate • rate of return • total return. [ME, PS, R, T]
Patterns and Relations **Patterns**	**B1** graph and analyse two-variable linear relations [C, ME, PS, R, T, V]	**B1** generalize a pattern arising from a problem-solving context using linear equations and verify by substitution [C, CN, PS, R, V] **B2** graph linear relations, analyse the graph, and interpolate or extrapolate to solve problems [C, CN, PS, R, T, V]	**Relations and Functions**	**C1** Interpret and explain the relationships among data, graphs and situations. [C, CN, R, T, V] **C2** Demonstrate an understanding of relations and functions. [C, R, V] **C3** Demonstrate an understanding of slope with respect to: • rise and run • line segments and lines • rate of change • parallel lines • perpendicular lines. [PS, R, V] **C4** Describe and represent linear relations, using: • words • ordered pairs • tables of values • graphs • equations. [C, CN, R, V] **C5** Determine the characteristics of the graphs of linear relations, including the: • intercepts • slope • domain • range. [CN, PS, R, V] **C6** Relate linear relations expressed in: • slope–intercept form ($y = mx + b$) • general form ($Ax + By + C = 0$) • slope–point form ($y - y_1 = m(x - x_1)$) to their graphs. [CN, R, T, V] **C7** Determine the equation of a linear relation, given: • a graph • a point and the slope • two points • a point and the equation of a parallel or perpendicular line to solve problems. [CN, PS, R, V] **C8** Represent a linear function, using function notation. [CN, ME, V] **C9** Solve problems that involve systems of linear equations in two variables, graphically and algebraically. [CN, PS, R, T, V]	**E1** Model and solve problems that involve systems of linear inequalities in two variables [CN, PS, T, V] **E2** Demonstrate an understanding of the characteristics of quadratic functions, including: • vertex • intercepts • domain and range • axis of symmetry. [CN, PS, T, V]	**D1** Represent data, using polynomial functions (of degree ≤ 3), to solve problems. [C, CN, PS, T, V] **D2** Represent data, using exponential and logarithmic functions, to solve problems. [C, CN, PS, T, V] **D3** Represent data, using sinusoidal functions, to solve problems. [C, CN, PS, T, V]
Variables and Equations	**B2** model and solve problems using linear equations of the form: • $ax = b$ • $\frac{x}{a} = b, a \neq 0$ • $ax + b = c$ • $a(x + b) = c$ concretely, pictorially, and symbolically, where a, b, and c are integers [C, CN, PS, V]	**B3** model and solve problems using linear equations of the form • $ax = b$ • $\frac{x}{a} = b, a \leq 0$ • $ax + b = c$ • $\frac{x}{a} + b = c, a \leq 0$ • $ax = b + cx$ • $a(x + b) = c$ • $ax + b = cx + d$ • $a(bx + c) = d(ex + f)$ • $\frac{x}{a} = b, x \leq 0$ where a, b, c, d, e, and f are rational numbers [C, CN, PS, V] **B4** explain and illustrate strategies to solve single variable linear inequalities with rational coefficients within a problem-solving context [C, CN, PS, R, V] **B5** demonstrate an understanding of polynomials (limited to polynomials of degree less than or equal to 2) [C, CN, R, V] **B6** 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, PS, R, V] **B7** 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]				
			Logical Reasoning		**C1** Analyze and prove conjectures, using inductive and deductive reasoning, to solve problems. [C, CN, PS, R] **C2** Analyze puzzles and games that involve spatial reasoning, using problem-solving strategies. [CN, PS, R, V]	**B1** Analyze puzzles and games that involve numerical and logical reasoning, using problem-solving strategies. [CN, ME, PS, R] **B2** Solve problems that involve the application of set theory. [CN, PS, R, V] **B3** Solve problems that involve conditional statements. [C, CN, PS, R]
			Mathematics Research Project		**F1** Research and give a presentation on a historical event or an area of interest that involves mathematics. [C, CN, ME, PS, R, T, V]	**E1** Research and give a presentation on a current event or an area of interest that involves mathematics. [C, CN, ME, PS, R, T, V]

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Shape and Space **Measurement**	**C1** develop and apply the Pythagorean theorem to solve problems [CN, PS, R, V, T] **C2** draw and construct nets for 3-D objects [C, CN, PS, V] **C3** determine the surface area of • right rectangular prisms • right triangular prisms • right cylinders to solve problems [C, CN, PS, R, V] **C4** develop and apply formulas for determining the volume of right prisms and right cylinders [C, CN, PS, R, V]	**C1** 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]	**Measurement**	**A1** Solve problems that involve linear measurement, using: • SI and imperial units of measure • estimation strategies • measurement strategies. [ME, PS, V] **A2** Apply proportional reasoning to problems that involve conversions between SI and imperial units of measure. [C, ME, PS] **A3** Solve problems, using SI and imperial units, that involve the surface area and volume of 3-D objects, including: • right cones • right cylinders • right prisms • right pyramids • spheres. [CN, PS, R, V] **A4** Develop and apply the primary trigonometric ratios (sine, cosine, tangent) to solve problems that involve right triangles. [C, CN, PS, R, T, V]	**A1** Solve problems that involve the application of rates. [CN, PS, R] **A2** Solve problems that involve scale diagrams, using proportional reasoning. [CN, PS, R, V] **A3** Demonstrate an understanding of the relationships among scale factors, areas, surface areas and volumes of similar 2-D shapes and 3-D objects. [C, CN, PS, R, V]	
3-D Objects and 2-D Shapes	**C5** draw and interpret top, front, and side views of 3-D objects composed of right rectangular prisms [C, CN, R, T, V]	**C2** determine the surface area of composite 3-D objects to solve problems [C, CN, PS, R, V] **C3** demonstrate an understanding of similarity of polygons [C, CN, PS, R, V]	**Geometry**		**B1** Derive proofs that involve the properties of angles and triangles. [CN, R, V] **B2** Solve problems that involve the properties of angles and triangles. [CN, PS, V] **B3** Solve problems that involve the cosine law and the sine law, including the ambiguous case. [CN, PS, R]	
Transformations	**C6** 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]	**C4** draw and interpret scale diagrams of 2-D shapes [CN, R, T, V]] **C5** demonstrate an understanding of line and rotation symmetry [C, CN, PS, V]				
Statistics and Probability **Data Analysis**	**D1** critique ways in which data is presented [C, R, T, V]	**D1** 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] **D2** select and defend the choice of using either a population or a sample of a population to answer a question [C, CN, PS, R] **D3** 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]	**Statistics and Probability**		**D1** Demonstrate an understanding of normal distribution, including: • standard deviation • *z*-scores. [CN, PS, T, V] **D2** Interpret statistical data, using: • confidence intervals • confidence levels • margin of error. [C, CN, R]	**C1** Interpret and assess the validity of odds and probability statements. [C, CN, ME] **C2** Solve problems that involve the probability of mutually exclusive and non–mutually exclusive events. [CN, PS, R, V] **C3** Solve problems that involve the probability of two events. [CN, PS, R] **C4** Solve problems that involve the fundamental counting principle. [PS, R, V] **C5** Solve problems that involve permutations. [ME, PS, R, T, V] **C6** Solve problems that involve combinations. [ME, PS, R, T, V]
Chance and Uncertainty	**D2** solve problems involving the probability of independent events [C, CN, PS, T]	**D4** demonstrate an understanding of the role of probability in society [C, CN, R, T]				

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