Mathematics 8 to 12 IRP: Prescribed Learning Outcomes Using Apprenticeship & Workplace 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	Apprenticeship and Workplace 10	Apprenticeship and Workplace 11	Apprenticeship and Workplace 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]	**Number**	C1 Solve problems that involve unit pricing and currency exchange, using proportional reasoning. [CN, ME, PS, R] C2 Demonstrate an understanding of income, including: • wages • salary • contracts • commissions • piecework to calculate gross pay and net pay. [C, CN, R, T]	C1 Analyze puzzles and games that involve numerical reasoning, using problem-solving strategies. [C, CN, PS, R] C2 Solve problems that involve personal budgets. [CN, PS, R, T] C3 Demonstrate an understanding of compound interest. [CN, ME, PS, T] C4 Demonstrate an understanding of financial institution services used to access and manage finances. [C, CN, R, T] C5 Demonstrate an understanding of credit options, including: • credit cards • loans. [CN, ME, PS, R]	C1 Analyze puzzles and games that involve logical reasoning, using problem-solving strategies. [C, CN, PS, R] C2 Solve problems that involve the acquisition of a vehicle by: • buying • leasing • leasing to buy [C, CN, PS, R, T] C3 Critique the viability of small business options by considering: • expenses • sales • profit or loss [C, CN, R]
Patterns and Relations **Patterns** **Variables and Equations**	B1 graph and analyse two-variable linear relations [C, ME, PS, R, T, V] 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]	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] 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]	**Algebra**	D1 Solve problems that require the manipulation and application of formulas related to: • perimeter • area • the Pythagorean theorem • primary trigonometric ratios • income [C, CN, ME, PS, R]	D1 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. [CN, PS, R] D2 Demonstrate an understanding of slope: • as rise over run • as rate of change • by solving problems. [C, CN, PS, V] D3 Solve problems by applying proportional reasoning and unit analysis. [C, CN, PS, R]	D1 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]

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K to 9 Organizers	Grade 8	Grade 9	10 to 12 Organizers	Apprenticeship and Workplace 10	Apprenticeship and Workplace 11	Apprenticeship and Workplace 12
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 Demonstrate an understanding of the Système International (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] A2 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] A3 Solve and verify problems that involve SI and imperial linear measurements, including decimal and fractional measurements. [CN, ME, PS, V] A4 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]	A1 Solve problems that involve SI and imperial units in surface area measurements and verify the solutions. [C, CN, ME, PS, V] A2 Solve problems that involve SI and imperial units in volume and capacity measurements. [C, CN, ME, PS, V]	A1 Demonstrate an understanding of the limitations of measuring instruments, including: • precision • accuracy • uncertainty • tolerance and solve problems. [C, PS, R, T, 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 Analyze puzzles and games that involve spatial reasoning, using problem-solving strategies. [C, CN, PS, R] B2 Demonstrate an understanding of the Pythagorean theorem by: • identifying situations that involve right triangles • verifying the formula • applying the formula • solving problems. [C, CN, PS, V] B3 Demonstrate an understanding of similarity of convex polygons, including regular and irregular polygons. [C, CN, PS, V] B4 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 • solving problems. [CN, PS, R, T, V] B5 Solve problems that involve parallel, perpendicular and transversal lines, and pairs of angles formed between them. [C, CN, PS, V] B6 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]	B1 Solve problems that involve two and three right triangles. [CN, PS, T, V] B2 Solve problems that involve scale. [PS, R, T, V] B3 Model and draw 3-D objects and their views. [CN, R, V] B4 Draw and describe exploded views, component parts and scale diagrams of simple 3-D objects. [CN, V]	B1 Solve problems by using the sine law and cosine law, excluding the ambiguous case. [CN, PS, V] B2. Solve problems that involve: • triangles • quadrilaterals • regular polygons. [C, CN, PS, V] B3 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]
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**		E1 Solve problems that involve creating and interpreting graphs, including: • bar graphs • histograms • line graphs • circle graphs. [C, CN, PS, R, T, V]	E1 Solve problems that involve measures of central tendency, including: • mean • median • mode • weighted mean • trimmed mean. [C, CN, PS, R] E2 Analyze and describe percentiles. [C, CN, PS, R]
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]	**Probability**			F1 Analyze and interpret problems that involve probability. [C, CN, PS, R]

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