

FOUNDATIONS OF MATHEMATICS AND PRE-CALCULUS

GRADE 10

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

Measurement	General Outcome: Develop spatial sense and proportional reasoning.
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
A1. Solve problems that involve linear measurement, using: <ul style="list-style-type: none"> • SI and imperial units of measure • estimation strategies • measurement strategies. [ME, PS, V]	1.1 Provide referents for linear measurements, including millimetre, centimetre, metre, kilometre, inch, foot, yard and mile, and explain the choices. 1.2 Compare SI and imperial units, using referents. 1.3 Estimate a linear measure, using a referent, and explain the process used. 1.4 Justify the choice of units used for determining a measurement in a problem-solving context. 1.5 Solve problems that involve linear measure, using instruments such as rulers, calipers or tape measures. 1.6 Describe and explain a personal strategy used to determine a linear measurement; e.g., circumference of a bottle, length of a curve, perimeter of the base of an irregular 3-D object.
A2. Apply proportional reasoning to problems that involve conversions between SI and imperial units of measure. [C, ME, PS]	2.1 Explain how proportional reasoning can be used to convert a measurement within or between SI and imperial systems. 2.2 Solve a problem that involves the conversion of units within or between SI and imperial systems. 2.3 Verify, using unit analysis, a conversion within or between SI and imperial systems, and explain the conversion. 2.4 Justify, using mental mathematics, the reasonableness of a solution to a conversion problem.

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Measurement (continued)	General Outcome: Develop spatial sense and proportional reasoning.
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
A3. Solve problems, using SI and imperial units, that involve the surface area and volume of 3-D objects, including: <ul style="list-style-type: none"> • right cones • right cylinders • right prisms • right pyramids • spheres. [CN, PS, R, V]	3.1 Sketch a diagram to represent a problem that involves surface area or volume. 3.2 Determine the surface area of a right cone, right cylinder, right prism, right pyramid or sphere, using an object or its labelled diagram. 3.3 Determine the volume of a right cone, right cylinder, right prism, right pyramid or sphere, using an object or its labelled diagram. 3.4 Determine an unknown dimension of a right cone, right cylinder, right prism, right pyramid or sphere, given the object's surface area or volume and the remaining dimensions. 3.5 Solve a problem that involves surface area or volume, given a diagram of a composite 3-D object. 3.6 Describe the relationship between the volumes of: <ul style="list-style-type: none"> • right cones and right cylinders with the same base and height • right pyramids and right prisms with the same base and height.
A4. Develop and apply the primary trigonometric ratios (sine, cosine, tangent) to solve problems that involve right triangles. [C, CN, PS, R, T, V]	4.1 Explain the relationships between similar right triangles and the definitions of the primary trigonometric ratios. 4.2 Identify the hypotenuse of a right triangle and the opposite and adjacent sides for a given acute angle in the triangle. 4.3 Solve right triangles, with or without technology. 4.4 Solve a problem that involves one or more right triangles by applying the primary trigonometric ratios or the Pythagorean theorem. 4.5 Solve a problem that involves indirect and direct measurement, using the trigonometric ratios, the Pythagorean theorem and measurement instruments such as a clinometer or metre stick.

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Algebra and Number	General Outcome: Develop algebraic reasoning and number sense.
Specific Outcomes	Achievement Indicators
<i>It is expected that students will:</i>	<i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
B1. Demonstrate an understanding of factors of whole numbers by determining the: <ul style="list-style-type: none"> • prime factors • greatest common factor • least common multiple • square root • cube root. [CN, ME, R]	1.1 Determine the prime factors of a whole number. 1.2 Explain why the numbers 0 and 1 have no prime factors. 1.3 Determine, using a variety of strategies, the greatest common factor or least common multiple of a set of whole numbers, and explain the process. 1.4 Determine, concretely, whether a given whole number is a perfect square, a perfect cube or neither. 1.5 Determine, using a variety of strategies, the square root of a perfect square, and explain the process. 1.6 Determine, using a variety of strategies, the cube root of a perfect cube, and explain the process. 1.7 Solve problems that involve prime factors, greatest common factors, least common multiples, square roots or cube roots.
B2. Demonstrate an understanding of irrational numbers by: <ul style="list-style-type: none"> • representing, identifying and simplifying irrational numbers • ordering irrational numbers. [CN, ME, R, V]	2.1 Sort a set of numbers into rational and irrational numbers. 2.2 Determine an approximate value of a given irrational number. 2.3 Approximate the locations of irrational numbers on a number line, using a variety of strategies, and explain the reasoning. 2.4 Order a set of irrational numbers on a number line. 2.5 Express a radical as a mixed radical in simplest form (limited to numerical radicands). 2.6 Express a mixed radical as an entire radical (limited to numerical radicands). 2.7 Explain, using examples, the meaning of the index of a radical. 2.8 Represent, using a graphic organizer, the relationship among the subsets of the real numbers (natural, whole, integer, rational, irrational).

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Algebra and Number (continued)	General Outcome: Develop algebraic reasoning and number sense.
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
B3. Demonstrate an understanding of powers with integral and rational exponents. [C, CN, PS, R]	<p>3.1 Explain, using patterns, why $a^{-n} = \frac{1}{a^n}$, $a \neq 0$.</p> <p>3.2 Explain, using patterns, why $a^{\frac{1}{n}} = \sqrt[n]{a}$, $n > 0$.</p> <p>3.3 Apply the exponent laws:</p> <ul style="list-style-type: none"> • $(a^m)(a^n) = a^{m+n}$ • $a^m \div a^n = a^{m-n}$, $a \neq 0$ • $(a^m)^n = a^{mn}$ • $(ab)^m = a^m b^m$ • $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$, $b \neq 0$ <p>to expressions with rational and variable bases and integral and rational exponents, and explain the reasoning.</p> <p>3.4 Express powers with rational exponents as radicals and vice versa.</p> <p>3.5 Solve a problem that involves exponent laws or radicals.</p> <p>3.6 Identify and correct errors in a simplification of an expression that involves powers.</p>

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Algebra and Number (continued)	General Outcome: Develop algebraic reasoning and number sense.
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
B4. Demonstrate an understanding of the multiplication of polynomial expressions (limited to monomials, binomials and trinomials), concretely, pictorially and symbolically. [CN, R, V]	<p><i>(It is intended that the emphasis of this outcome be on binomial by binomial multiplication, with extension to polynomial by polynomial to establish a general pattern for multiplication.)</i></p> 4.1 Model the multiplication of two given binomials, concretely or pictorially, and record the process symbolically. 4.2 Relate the multiplication of two binomial expressions to an area model. 4.3 Explain, using examples, the relationship between the multiplication of binomials and the multiplication of two-digit numbers. 4.4 Verify a polynomial product by substituting numbers for the variables. 4.5 Multiply two polynomials symbolically, and combine like terms in the product. 4.6 Generalize and explain a strategy for multiplication of polynomials. 4.7 Identify and explain errors in a solution for a polynomial multiplication.
B5. Demonstrate an understanding of common factors and trinomial factoring, concretely, pictorially and symbolically. [C, CN, R, V]	5.1 Determine the common factors in the terms of a polynomial, and express the polynomial in factored form. 5.2 Model the factoring of a trinomial, concretely or pictorially, and record the process symbolically. 5.3 Factor a polynomial that is a difference of squares, and explain why it is a special case of trinomial factoring where $b=0$. 5.4 Identify and explain errors in a polynomial factorization. 5.5 Factor a polynomial, and verify by multiplying the factors. 5.6 Explain, using examples, the relationship between multiplication and factoring of polynomials. 5.7 Generalize and explain strategies used to factor a trinomial. 5.8 Express a polynomial as a product of its factors.

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Relations and Functions	General Outcome: Develop algebraic and graphical reasoning through the study of relations.
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
C1. Interpret and explain the relationships among data, graphs and situations. [C, CN, R, T, V]	1.1 Graph, with or without technology, a set of data, and determine the restrictions on the domain and range. 1.2 Explain why data points should or should not be connected on the graph for a situation. 1.3 Describe a possible situation for a given graph. 1.4 Sketch a possible graph for a given situation. 1.5 Determine, and express in a variety of ways, the domain and range of a graph, a set of ordered pairs or a table of values.
C2. Demonstrate an understanding of relations and functions. [C, R, V]	2.1 Explain, using examples, why some relations are not functions but all functions are relations. 2.2 Determine if a set of ordered pairs represents a function. 2.3 Sort a set of graphs as functions or non-functions. 2.4 Generalize and explain rules for determining whether graphs and sets of ordered pairs represent functions.
C3. Demonstrate an understanding of slope with respect to: <ul style="list-style-type: none"> • rise and run • line segments and lines • rate of change • parallel lines • perpendicular lines. [PS, R, V]	3.1 Determine the slope of a line segment by measuring or calculating the rise and run. 3.2 Classify lines in a given set as having positive or negative slopes. 3.3 Explain the meaning of the slope of a horizontal or vertical line. 3.4 Explain why the slope of a line can be determined by using any two points on that line. 3.5 Explain, using examples, slope as a rate of change. 3.6 Draw a line, given its slope and a point on the line. 3.7 Determine another point on a line, given the slope and a point on the line. 3.8 Generalize and apply a rule for determining whether two lines are parallel or perpendicular. 3.9 Solve a contextual problem involving slope.

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Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
C4. Describe and represent linear relations, using: <ul style="list-style-type: none"> • words • ordered pairs • tables of values • graphs • equations. [C, CN, R, V]	4.1 Identify independent and dependent variables in a given context. 4.2 Determine whether a situation represents a linear relation, and explain why or why not. 4.3 Determine whether a graph represents a linear relation, and explain why or why not. 4.4 Determine whether a table of values or a set of ordered pairs represents a linear relation, and explain why or why not. 4.5 Draw a graph from a set of ordered pairs within a given situation, and determine whether the relationship between the variables is linear. 4.6 Determine whether an equation represents a linear relation, and explain why or why not. 4.7 Match corresponding representations of linear relations.
C5. Determine the characteristics of the graphs of linear relations, including the: <ul style="list-style-type: none"> • intercepts • slope • domain • range. [CN, PS, R, V]	5.1 Determine the intercepts of the graph of a linear relation, and state the intercepts as values or ordered pairs. 5.2 Determine the slope of the graph of a linear relation. 5.3 Determine the domain and range of the graph of a linear relation. 5.4 Sketch a linear relation that has one intercept, two intercepts or an infinite number of intercepts. 5.5 Identify the graph that corresponds to a given slope and y -intercept. 5.6 Identify the slope and y -intercept that correspond to a given graph. 5.7 Solve a contextual problem that involves intercepts, slope, domain or range of a linear relation.

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Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
<p>C6. Relate linear relations expressed in:</p> <ul style="list-style-type: none"> • slope–intercept form ($y = mx + b$) • general form ($Ax + By + C = 0$) • slope–point form ($y - y_1 = m(x - x_1)$) <p>to their graphs. [CN, R, T, V]</p>	<p>6.1 Express a linear relation in different forms, and compare the graphs.</p> <p>6.2 Rewrite a linear relation in either slope–intercept or general form.</p> <p>6.3 Generalize and explain strategies for graphing a linear relation in slope–intercept, general or slope–point form.</p> <p>6.4 Graph, with and without technology, a linear relation given in slope–intercept, general or slope–point form, and explain the strategy used to create the graph.</p> <p>6.5 Identify equivalent linear relations from a set of linear relations.</p> <p>6.6 Match a set of linear relations to their graphs.</p>
<p>C7. Determine the equation of a linear relation, given:</p> <ul style="list-style-type: none"> • a graph • a point and the slope • two points • a point and the equation of a parallel or perpendicular line <p>to solve problems. [CN, PS, R, V]</p>	<p>7.1 Determine the slope and y-intercept of a given linear relation from its graph, and write the equation in the form $y = mx + b$.</p> <p>7.2 Write the equation of a linear relation, given its slope and the coordinates of a point on the line, and explain the reasoning.</p> <p>7.3 Write the equation of a linear relation, given the coordinates of two points on the line, and explain the reasoning.</p> <p>7.4 Write the equation of a linear relation, given the coordinates of a point on the line and the equation of a parallel or perpendicular line, and explain the reasoning.</p> <p>7.5 Graph linear data generated from a context, and write the equation of the resulting line.</p> <p>7.6 Solve a problem, using the equation of a linear relation.</p>

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Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
C8. Represent a linear function, using function notation. [CN, ME, V]	8.1 Express the equation of a linear function in two variables, using function notation. 8.2 Express an equation given in function notation as a linear function in two variables. 8.3 Determine the related range value, given a domain value for a linear function; e.g., if $f(x) = 3x - 2$, determine $f(-1)$. 8.4 Determine the related domain value, given a range value for a linear function; e.g., if $g(t) = 7 + t$, determine t so that $g(t) = 15$. 8.5 Sketch the graph of a linear function expressed in function notation.
C9. Solve problems that involve systems of linear equations in two variables, graphically and algebraically. [CN, PS, R, T, V]	9.1 Model a situation, using a system of linear equations. 9.2 Relate a system of linear equations to the context of a problem. 9.3 Determine and verify the solution of a system of linear equations graphically, with and without technology. 9.4 Explain the meaning of the point of intersection of a system of linear equations. 9.5 Determine and verify the solution of a system of linear equations algebraically. 9.6 Explain, using examples, why a system of equations may have no solution, one solution or an infinite number of solutions. 9.7 Explain a strategy to solve a system of linear equations. 9.8 Solve a problem that involves a system of linear equations.

