

Appendix:

Outcomes with Achievement Indicators Organized by Strand (With Curriculum Guide Page References)

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

Strand: Number	General Outcome: Develop number sense.	
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following sets of indicators help determine whether students have met the corresponding specific outcome.</i>	Page Reference
9N1 Demonstrate an understanding of powers with integral bases (excluding base 0) and whole number exponents by: <ul style="list-style-type: none"> 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]	9N1.1 Demonstrate the difference between the exponent and the base by building models of a given power, such as 2^3 and 3^2 .	p. 50
	9N1.2 Explain, using repeated multiplication, the difference between two given powers in which the exponent and base are interchanged, e.g., 10^3 and 3^{10} .	p. 50
	9N1.3 Express a given power as a repeated multiplication.	p. 50
	9N1.4 Express a given repeated multiplication as a power.	p. 50
	9N1.5 Explain the role of parentheses in powers by evaluating a given set of powers, e.g., $(-2)^4$, (-2^4) and -2^4 .	p. 52
	9N1.6 Demonstrate, using patterns, that a^0 is equal to 1 for a given value of a ($a \neq 0$).	p. 52
	9N1.7 Evaluate powers with integral bases (excluding base 0) and whole number exponents.	p. 52

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Strand: Number	General Outcome: Develop number sense.	
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following sets of indicators help determine whether students have met the corresponding specific outcome.</i>	Page Reference
9N2 Demonstrate an understanding of operations on powers with integral bases (excluding base 0) and whole number exponents: <ul style="list-style-type: none"> • $(a^m)(a^n) = a^{m+n}$ • $a^m \div a^n = a^{m-n}, m > n$ • $(a^m)^n = a^{mn}$ • $(ab)^m = a^m b^m$ • $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}, b \neq 0.$ [C, CN, PS, R, T]	9N2.1 Explain, using examples, the exponent laws of powers with integral bases (excluding base 0) and whole number exponents: <ul style="list-style-type: none"> • $(a^m)(a^n) = a^{m+n}$ • $a^m \div a^n = a^{m-n}, m > n$ • $(a^m)^n = a^{mn}$ • $(ab)^m = a^m b^m$ • $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}, b \neq 0.$ 	pp. 54, 56
	9N2.2 Evaluate a given expression by applying the exponent laws.	p. 56
	9N2.3 Determine the sum of two given powers, e.g., $5^2 + 5^3$, and record the process.	p. 58
	9N2.4 Determine the difference of two given powers, e.g., $4^3 - 4^2$, and record the process.	p. 58
	9N2.5 Identify the error(s) in a given simplification of an expression involving powers.	p. 58
9N3 Demonstrate an understanding of rational numbers by: <ul style="list-style-type: none"> • comparing and ordering rational numbers • solving problems that involve arithmetic operations on rational numbers. [C, CN, PS, R, T, V]	9N3.1 Order a given set of rational numbers, in fraction and decimal form, by placing them on a number line, e.g., $\frac{3}{5}, -0.666\dots, 0.5, -\frac{5}{8}$.	p. 64
	9N3.2 Identify a rational number that is between two given rational numbers.	p. 66
	9N3.3 Solve a given problem involving operations on rational numbers in fraction form and decimal form.	p. 68

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Strand: Number		General Outcome: Develop number sense.		
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9N4	Explain and apply the order of operations, including exponents, with and without technology. [PS, T]	9N4.1	Solve a given problem by applying the order of operations without the use of technology.	p. 70
		9N4.2	Solve a given problem by applying the order of operations with the use of technology.	p. 70
		9N4.3	Identify the error in applying the order of operations in a given incorrect solution.	p. 70
9N5	Determine the square root of positive rational numbers that are perfect squares. [C, CN, PS, R, T]	9N5.1	Determine whether or not a given rational number is a square number and explain the reasoning.	p. 32
		9N5.2	Determine the square root of a given positive rational number that is a perfect square.	pp. 34, 36
		9N5.3	Identify the error made in a given calculation of a square root, e.g., Is 3.2 the square root of 6.4?	p. 36
		9N5.4	Determine a positive rational number given the square root of that positive rational number.	p. 36
9N6	Determine an approximate square root of positive rational numbers that are non-perfect squares. [C, CN, PS, R, T]	9N6.1	Estimate the square root of a given rational number that is not a perfect square using the roots of perfect squares as benchmarks.	p. 38
		9N6.2	Determine an approximate square root of a given rational number that is not a perfect square using technology, e.g., calculator, computer.	pp. 38, 40
		9N6.3	Explain why the square root of a given rational number as shown on a calculator may be an approximation.	pp. 38, 40
		9N6.4	Identify a number with a square root that is between two given numbers.	p. 40

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Strand: Patterns and Relations (Patterns)	General Outcome: Use patterns to describe the world and to solve problems.	
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following sets of indicators help determine whether students have met the corresponding specific outcome.</i>	Page Reference
9PR1 Generalize a pattern arising from a problem-solving context, using a linear equation, and verify by substitution. [C, CN, PS, R, V]	9PR1.1 Write an expression representing a given pictorial, oral or written pattern.	p. 76
	9PR1.2 Write a linear equation to represent a given context.	p. 76
	9PR1.3 Write a linear equation representing the pattern in a given table of values and verify the equation by substituting values from the table.	pp. 76, 78
	9PR1.4 Solve, using a linear equation, a given problem that involves pictorial, oral and written linear patterns.	p. 78
	9PR1.5 Describe a context for a given linear equation.	p. 78
9PR2 Graph a linear relation, analyze the graph, and interpolate or extrapolate to solve problems. [C, CN, PS, R, T, V]	9PR2.1 Describe the pattern found in a given graph.	p. 80
	9PR2.2 Graph a given linear relation, including horizontal and vertical lines.	p. 80
	9PR2.3 Match given equations of linear relations with their corresponding graphs.	p. 82
	9PR2.4 Interpolate the approximate value of one variable on a given graph given the value of the other variable.	p. 82
	9PR2.5 Extrapolate the approximate value of one variable from a given graph given the value of the other variable.	p. 82
	9PR2.6 Solve a given problem by graphing a linear relation and analyzing the graph.	p. 82

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Strand: Patterns and Relations (Variables and Equations)	General Outcome: Represent algebraic expressions in multiple ways.	
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following sets of indicators help determine whether students have met the corresponding specific outcome.</i>	Page Reference
<p>9PR3 Model and solve problems using linear equations of the form:</p> <ul style="list-style-type: none"> • $ax = b$ • $\frac{x}{a} = b, a \neq 0$ • $ax + b = c$ • $\frac{x}{a} + b = c, a \neq 0$ • $ax = b + cx$ • $a(x + b) = c$ • $ax + b = cx + d$ • $a(bx + c) = d(ex + f)$ • $\frac{a}{x} = b, x \neq 0$ <p>where a, b, c, d, e and f are rational numbers. [C, CN, PS, V]</p>	<p>9PR3.1 Model the solution of a given linear equation using concrete or pictorial representations, and record the process.</p> <p>9PR3.2 Determine, by substitution, whether a given rational number is a solution to a given linear equation.</p> <p>9PR3.3 Solve a given linear equation symbolically.</p> <p>9PR3.4 Identify and correct an error in a given incorrect solution of a linear equation.</p> <p>9PR3.5 Represent a given problem using a linear equation.</p> <p>9PR3.6 Solve a given problem using a linear equation and record the process.</p>	<p>p. 106</p> <p>p. 106</p> <p>p. 106</p> <p>p. 108</p> <p>p. 108</p> <p>p. 108</p>

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Strand: Patterns and Relations (Variables and Equations)	General Outcome: Represent algebraic expressions in multiple ways.	
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following sets of indicators help determine whether students have met the corresponding specific outcome.</i>	Page Reference
9PR4 Explain and illustrate strategies to solve single variable linear inequalities with rational coefficients within a problem-solving context. [C, CN, PS, R, V]	9PR4.1 Translate a given problem into a single variable linear inequality using the symbols \geq , $>$, $<$ or \leq . 9PR4.2 Determine if a given rational number is a possible solution of a given linear inequality. 9PR4.3 Graph the solution of a given linear inequality on a number line. 9PR4.4 Generalize and apply a rule for adding or subtracting a positive or negative number to determine the solution of a given inequality. 9PR4.5 Generalize a rule for multiplying or dividing by a positive or negative number to determine the solution of a given inequality. 9PR4.6 Solve a given linear inequality algebraically and explain the process orally or in written form. 9PR4.7 Compare and explain the process for solving a given linear equation to the process for solving a given linear inequality. 9PR4.8 Compare and explain the solution of a given linear equation to the solution of a given linear inequality. 9PR4.9 Verify the solution of a given linear inequality using substitution for multiple elements in the solution. 9PR4.10 Solve a given problem involving a single variable linear inequality and graph the solution.	p. 110 p. 110 p. 110 p. 112 p. 112 p. 112 p. 112 p. 114 p. 114
9PR5 Demonstrate an understanding of polynomials (limited to polynomials of degree less than or equal to 2). [C, CN, R, V]	9PR5.1 Identify the variables, degree, number of terms and coefficients, including the constant term, of a given simplified polynomial expression. 9PR5.2 Create a concrete model or a pictorial representation for a given polynomial expression. 9PR5.3 Write the expression for a given model of a polynomial. 9PR5.4 Match equivalent polynomial expressions given in simplified form.	p. 88 p. 88 p. 88 p. 90

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Strand: Patterns and Relations (Variables and Equations) (continued)	General Outcome: Represent algebraic expressions in multiple ways.	
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following sets of indicators help determine whether students have met the corresponding specific outcome.</i>	Page Reference
9PR6 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]	9PR6.1 Identify equivalent polynomial expressions from a given set of polynomial expressions, including pictorial and symbolic representations. 9PR6.2 Model addition of two given polynomial expressions concretely or pictorially and record the process symbolically. 9PR6.3 Model subtraction of two given polynomial expressions concretely or pictorially and record the process symbolically. 9PR6.4 Apply a personal strategy for addition and subtraction of given polynomial expressions, and record the process symbolically. 9PR6.5 Identify the error(s) in a given simplification of a given polynomial expression.	p. 90 p. 92 p. 92 p. 94 p. 94
9PR7 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]	9PR7.1 Model multiplication of a given polynomial expression by a given monomial concretely or pictorially and record the process symbolically. 9PR7.2 Model division of a given polynomial expression by a given monomial concretely or pictorially and record the process symbolically. 9PR7.3 Apply a personal strategy for multiplication and division of a given polynomial expression by a given monomial. 9PR7.4 Provide examples of equivalent polynomial expressions. 9PR7.5 Identify the error(s) in a given simplification of a given polynomial expression.	p. 96 p. 98 p. 100 p. 100 p. 100

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Strand: Shape and Space (Measurement)		General Outcome: Use direct and indirect measurement to solve problems.		
Specific Outcomes <i>It is expected that students will:</i>		Achievement Indicators <i>The following sets of indicators help determine whether students have met the corresponding specific outcome.</i>		Page Reference
9SS1 Solve problems and justify the solution strategy, using the following circle properties: <ul style="list-style-type: none"> 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]	9SS1.1	Explain the relationship between the tangent of a circle and the radius at the point of tangency.	p. 136	
	9SS1.2	Explain the relationship between the perpendicular from the centre of the circle and a chord.	p. 136	
	9SS1.3	Explain the relationship between the measure of the central angle and the inscribed angle subtended by the same arc.	p. 138	
	9SS1.4	Determine the measure of a given angle inscribed in a semicircle using the circle properties.	pp. 138, 140	
	9SS1.5	Explain the relationship between inscribed angles subtended by the same arc.	p. 140	
	9SS1.6	Solve a given problem involving application of one or more of the circle properties.	pp. 136, 138, 140	

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Strand: Shape and Space (3-D Objects and 2-D Shapes)	General Outcome: Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.	
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following sets of indicators help determine whether students have met the corresponding specific outcome.</i>	Page Reference
9SS2 Determine the surface area of composite 3-D objects to solve problems. [C, CN, PS, R, V]	9SS2.1 Determine the overlap in a given concrete composite 3-D object, and explain its effect on determining the surface area (limited to right cylinders, right rectangular prisms and right triangular prisms).	pp. 42, 44
	9SS2.2 Determine the surface area of a given concrete composite 3-D object (limited to right cylinders, right rectangular prisms and right triangular prisms).	pp. 42, 44
	9SS2.3 Solve a given problem involving surface area.	pp. 42, 44
9SS3 Demonstrate an understanding of similarity of polygons. [C, CN, PS, R, V]	9SS3.1 Determine if the polygons in a given set are similar and explain the reasoning.	p. 122
	9SS3.2 Draw a polygon similar to a given polygon and explain why the two are similar.	p. 122
	9SS3.3 Solve a given problem using the properties of similar polygons.	p. 122

Strand: Shape and Space (Transformations)	General Outcome: Describe and analyze position and motion of objects and shapes.	
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following sets of indicators help determine whether students have met the corresponding specific outcome.</i>	Page Reference
9SS4 Draw and interpret scale diagrams of 2-D shapes. [CN, R, T, V]	9SS4.1 Identify an example in print and electronic media, e.g., newspapers, the Internet, of a scale diagram and interpret the scale factor.	p. 120
	9SS4.2 Draw a diagram to scale that represents an enlargement or reduction of a given 2-D shape.	p. 120
	9SS4.3 Determine the scale factor for a given diagram drawn to scale.	p. 120
	9SS4.4 Determine if a given diagram is proportional to the original 2-D shape and, if it is, state the scale factor.	p. 120
	9SS4.5 Solve a given problem that involves a scale diagram by applying the properties of similar triangles.	p. 122

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Strand: Shape and Space (Transformations)	General Outcome: Describe and analyze position and motion of objects and shapes.	
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following sets of indicators help determine whether students have met the corresponding specific outcome.</i>	Page Reference
9SS5 Demonstrate an understanding of line and rotation symmetry. [C, CN, PS, V]	9SS5.1 Classify a given set of 2-D shapes or designs according to the number of lines of symmetry. 9SS5.2 Complete a 2-D shape or design given one half of the shape or design and a line of symmetry. 9SS5.3 Determine if a given 2-D shape or design has rotation symmetry about the point at the centre of the shape or design and, if it does, state the order and angle of rotation. 9SS5.4 Rotate a given 2-D shape about a vertex and draw the resulting image. 9SS5.5 Identify a line of symmetry or the order and angle of rotation symmetry in a given tessellation. 9SS5.6 Identify and describe the types of symmetry created in a given piece of artwork. 9SS5.7 Create or provide a piece of artwork that demonstrates line and rotation symmetry, and identify the line(s) of symmetry and the order and angle of rotation. 9SS5.8 Determine whether or not two given 2-D shapes on the Cartesian plane are related by either rotation or line symmetry. 9SS5.9 Identify the type of symmetry that arises from a given transformation on the Cartesian plane. 9SS5.10 Complete, concretely or pictorially, a given transformation of a 2-D shape on a Cartesian plane, record the coordinates and describe the type of symmetry that results. 9SS5.11 Draw, on a Cartesian plane, the translation image of a given shape using a given translation rule, such as R_2 , U_3 or $\rightarrow\rightarrow$, $\uparrow\uparrow\uparrow$, label each vertex and its corresponding ordered pair and determine why the translation may or may not result in line or rotation symmetry.	p. 124 p. 124 p. 126 p. 126 p. 128 p. 128 p. 128 p. 130 p. 130 p. 130 p. 130

[C] Communication	[PS] Problem Solving
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Strand: Statistics and Probability (Data Analysis)	General Outcome: Collect, display and analyze data to solve problems.	
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following sets of indicators help determine whether students have met the corresponding specific outcome.</i>	Page Reference
9SP1 Describe the effect of: <ul style="list-style-type: none"> • bias • use of language • ethics • cost • time and timing • privacy • cultural sensitivity on the collection of data. [C, CN, R, T]	9SP1.1 Analyze a given case study of data collection, and identify potential problems related to bias, use of language, ethics, cost, time and timing, privacy or cultural sensitivity.	p. 152
	9SP1.2 Provide examples to illustrate how bias, use of language, ethics, cost, time and timing, privacy or cultural sensitivity may influence the data.	p. 152
9SP2 Select and defend the choice of using either a population or a sample of a population to answer a question. [C, CN, PS, R]	9SP2.1 Identify whether a given situation represents the use of a sample or a population.	p. 154
	9SP2.2 Provide an example of a situation in which a population may be used to answer a question and justify the choice.	p. 154
	9SP2.3 Provide an example of a question where a limitation precludes the use of a population and describe the limitation, e.g., too costly, not enough time, limited resources.	p. 154
	9SP2.4 Identify and critique a given example in which a generalization from a sample of a population may or may not be valid for the population.	p. 154

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Strand: Statistics and Probability (Data Analysis)	General Outcome: Collect, display and analyze data to solve problems.	
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following sets of indicators help determine whether students have met the corresponding specific outcome.</i>	Page Reference
9SP3 Develop and implement a project plan for the collection, display and analysis of data by: <ul style="list-style-type: none"> • 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]	9SP3.1 Create a rubric to assess a project that includes the assessment of: <ul style="list-style-type: none"> • a question for investigation • the choice of a data collection method that includes social considerations • the selection of a population or a sample and justifying the choice • the display of the collected data • the conclusions to answer the question. 	pp. 156, 158
	9SP3.2 Develop a project plan that describes: <ul style="list-style-type: none"> • a question for investigation • the method of data collection that includes social considerations • the method for selecting a population or a sample • the method to be used for collection of the data • the methods for analysis and display of the data 	p. 160
	9SP3.3 Complete the project according to the plan, draw conclusions and communicate findings to an audience.	p. 160
	9SP3.4 Self-assess the completed project by applying the rubric.	p. 160

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Strand: Statistics and Probability (Chance and Uncertainty)	General Outcome: Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.	
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following sets of indicators help determine whether students have met the corresponding specific outcome.</i>	Page Reference
9SP4 Demonstrate an understanding of the role of probability in society. [C, CN, R, T]	9SP4.1 Provide an example from print and electronic media, e.g., newspapers, the Internet, where probability is used.	p. 146
	9SP4.2 Identify the assumptions associated with a given probability and explain the limitations of each assumption.	p. 148
	9SP4.3 Explain how a single probability can be used to support opposing positions.	p. 148
	9SP4.4 Explain, using examples, how decisions based on probability may be a combination of theoretical probability, experimental probability and subjective judgment.	p. 150