South Slave Divisional Education Council

Math 20-1

Curriculum Package

February 2012

2012

Strand: Algebra and Number
General Outcome: Develop algebraic reasoning and number sense

Specific Outcomes	Achievement Indicators – Measurable outcomes
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
Demonstrate an understanding of the absolute value of real numbers. [R, V]	• Determine the distance of two real numbers of the form ±a, a ∈ R, from 0 on a number line, and relate this to the absolute value of a (|a|). • Determine the absolute value of a positive or negative real number. • Explain, using examples, how distance between two points on a number line can be expressed in terms of absolute value. • Determine the absolute value of a numerical expression. • Compare and order the absolute values of real numbers in a given set.
Solve problems that involve operations on radicals and radical expressions with numerical and variable radicands. [CN, ME, PS, R]	• Compare and order radical expressions with numerical radicands in a given set. • Express an entire radical with a numerical radicand as a mixed radical. • Express a mixed radical with a numerical radicand as an entire radical. • Perform one or more operations to simplify radical expressions with numerical or variable radicands. • Rationalize the denominator of a rational expression with monomial or binomial denominators. • Describe the relationship between rationalizing a binomial denominator of a rational expression and the product of the factors of a difference of squares expression. • Explain, using examples, that $(-x)^2 = x^2$, $\sqrt{x^2} = \|x\|$ and $\sqrt{x^2} \neq \pm x$ e.g., $\sqrt{9} \neq \pm 3$. • Identify the values of the variable for which a given radical expression is defined. • Solve a problem that involves radical expressions.
Solve problems that involve radical equations (limited to square roots). [C, PS, R]	• Determine any restrictions on values for the variable in a radical equation. • Determine the roots of a radical equation algebraically, and explain the process used to solve the equation. • Verify, by substitution, that the values determined in solving a radical equation algebraically are roots of the equation. • Explain why some roots determined in solving a radical equation algebraically are extraneous. • Solve problems by modelling a situation using a radical equation.

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General Outcome: Develop algebraic reasoning and number sense

Specific Outcomes	Achievement Indicators – Measurable outcomes
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
Determine equivalent forms of rational expressions (limited to numerators and denominators that are monomials, binomials or trinomials). [C, ME, R]	• Compare the strategies for writing equivalent forms of rational expressions to the strategies for writing equivalent forms of rational numbers. • Explain why a given value is non-permissible for a given rational expression. • Determine the non-permissible values for a rational expression. • Determine a rational expression that is equivalent to a given rational expression by multiplying the numerator and denominator by the same factor (limited to a monomial or a binomial), and state the non-permissible values of the equivalent rational expression. • Simplify a rational expression. • Explain why the non-permissible values of a given rational expression and its simplified form are the same. • Identify and correct errors in a simplification of a rational expression, and explain the reasoning.
Perform operations on rational expressions (limited to numerators and denominators that are monomials, binomials or trinomials). [CN, ME, R]	• Compare the strategies for performing a given operation on rational expressions to the strategies for performing the same operation on rational numbers. • Determine the non-permissible values when performing operations on rational expressions. • Determine, in simplified form, the sum or difference of rational expressions with the same denominator. • Determine, in simplified form, the sum or difference of rational expressions in which the denominators are not the same and which may or may not contain common factors. • Determine, in simplified form, the product or quotient of rational expressions. • Simplify an expression that involves two or more operations on rational expressions.
Solve problems that involve rational equations (limited to numerators and denominators that are monomials, binomials or trinomials). [C, PS, R]	• Determine the non-permissible values for the variable in a rational equation. • Determine the solution to a rational equation algebraically, and explain the process used to solve the equation. • Explain why a value obtained in solving a rational equation may not be a solution of the equation. • Solve problems by modelling a situation using a rational equation.

Strand: Trigonometry
General Outcome: Develop trigonometric reasoning.

Specific Outcomes	Achievement Indicators – Measurable outcomes
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
Demonstrate an understanding of angles in standard position [0° to 360°]. [R, V]	• Sketch an angle in standard position, given the measure of the angle. • Determine the reference angle for an angle in standard position. • Explain, using examples, how to determine the angles from 0° to 360° that have the same reference angle as a given angle. • Illustrate, using examples, that any angle from 90° to 360° is the reflection in the x-axis and/or the y-axis of its reference angle. • Determine the quadrant in which a given angle in standard position terminates. • Draw an angle in standard position given any point P(x, y) on the terminal arm of the angle. • Illustrate, using examples, that the points P(x, y) , P(−x, y) , P(−x,− y) and P(x,− y) are points on the terminal sides of angles in standard position that have the same reference angle.
Solve problems, using the three primary trigonometric ratios for angles from 0° to 360° in standard position. [C, ME, PS, R, T, V] [ICT: C6–4.1]	• Determine, using the Pythagorean theorem or the distance formula, the distance from the origin to a point P(x, y) on the terminal arm of an angle. • Determine the value of sinθ , cosθ or tanθ, given any point P(x, y) on the terminal arm of angle θ. • Determine, without the use of technology, the value of sinθ, cosθ or tanθ, given any point P(x, y) on the terminal arm of angle θ, where θ = 0º, 90º, 180º, 270º or 360º. • Determine the sign of a given trigonometric ratio for a given angle, without the use of technology, and explain. • Solve, for all values of θ, an equation of the form sin θ = a or cosθ θ = a, where −1 ≤ a ≤ 1, and an equation of the form tan θ = a, where a is a real number. • Determine the exact value of the sine, cosine or tangent of a given angle with a reference angle of 30º, 45º or 60º. • Describe patterns in and among the values of the sine, cosine and tangent ratios for angles from 0° to 360°. • Sketch a diagram to represent a problem. • Solve a contextual problem, using trigonometric ratios.
Solve problems, using the cosine law and sine law, including the ambiguous case. [C, CN, PS, R, T] [ICT: C6–4.1]	• Sketch a diagram to represent a problem that involves a triangle without a right angle. • Solve, using primary trigonometric ratios, a triangle that is not a right triangle. • Explain the steps in a given proof of the sine law or cosine law. • Sketch a diagram and solve a problem, using the cosine law. • Sketch a diagram and solve a problem, using the sine law. • Describe and explain situations in which a problem may have no solution, one solution or two solutions.

Strand: Relations and Functions

General Outcome: Develop algebraic and graphical reasoning through the study of relations**.**

Specific Outcomes	Achievement Indicators – Measurable outcomes
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
Factor polynomial expressions of the form $ax^2 + bx + c, a \neq 0$ $a^2x^2 - b^2y^2, a \neq 0, b \neq 0$ $a(f(x))^2 + b\big(f(x)\big) + \ c, a \neq 0$ $a^2(f(x))^2 - b^2\big(g(y)\big)^2, \ \ a \neq 0, b \neq 0$ where *a*, *b* and *c* are rational numbers. [CN, ME, R]	• Factor a given polynomial expression that requires the identification of common factors. • Determine whether a given binomial is a factor for a given polynomial expression, and explain why or why not. • Factor a given polynomial expression of the form: o ax2 + bx + c, a ≠ 0 o a2x2 − b2y2, a ≠ 0, b ≠ 0 • Factor a given polynomial expression that has a quadratic pattern, including: o a(f(x))2 + b(f(x)) + c, a ≠ 0 o a2(f(x))2 − b2(g(y))2, a ≠ 0, b ≠ 0
Graph and analyze absolute value functions (limited to linear and quadratic functions) to solve problems. [C, PS, R, T, V] [ICT: C6–4.1, C6–4.3]	• Create a table of values for y = |f (x)| , given a table of values for y = f (x). • Generalize a rule for writing absolute value functions in piecewise notation. • Sketch the graph of y = |f (x)| ; state the intercepts, domain and range; and explain the strategy used. • Solve an absolute value equation graphically, with or without technology. • Solve, algebraically, an equation with a single absolute value, and verify the solution. • Explain why the absolute value equation |f (x)| < 0 has no solution. • Determine and correct errors in a solution to an absolute value equation. • Solve a problem that involves an absolute value function.
Analyze quadratic functions of the form $y = a(x - p)^2 + q$ and determine the: vertex, domain and range, direction of opening, axis of symmetry, *x*- and *y*-intercepts. [CN, R, T, V] [ICT: C6–4.3, C7–4.2]	• Explain why a function given in the form y = a(x - p)2 + q is a quadratic function. • Compare the graphs of a set of functions of the form y = ax2 to the graph of y = x2, and generalize, using inductive reasoning, a rule about the effect of a. • Compare the graphs of a set of functions of the form y = x2+ q to the graph of y = x2 , and generalize, using inductive reasoning, a rule about the effect of q. • Compare the graphs of a set of functions of the form y = (x - p)2 to the graph of y = x2, and generalize, using inductive reasoning, a rule about the effect of p. • Determine the coordinates of the vertex for a quadratic function of the form y = a(x - p)2 + q, and verify with or without technology. • Generalize, using inductive reasoning, a rule for determining the coordinates of the vertex for quadratic functions of the form y = a(x - p)2 + q. • Sketch the graph of y = a(x - p)2 + q, using transformations, and identify the vertex, domain and range, direction of opening, axis of symmetry and x- and y-intercepts. • Explain, using examples, how the values of a and q may be used to determine whether a quadratic function has zero, one or two x-intercepts. • Write a quadratic function in the form y = a(x - p)2 + q for a given graph or a set of characteristics of a graph.

Strand: Relations and Functions
General Outcome: Develop algebraic and graphical reasoning through the study of relations**.**

Specific Outcomes	Achievement Indicators – Measurable outcomes
It is expected that students will:	*The following set of indicators may be used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
Analyze quadratic functions of the form $y = ax^2 + bx + c$ to identify characteristics of the corresponding graph, including: vertex, domain and range, direction of opening, axis of symmetry, *x*- and *y*-intercepts and to solve problems. [CN, PS, R, T, V] [ICT: C6–4.1, C6–4.3]	Explain the reasoning for the process of completing the square as shown in a given example. Write a quadratic function given in the form $y = ax^2 + bx + c$ as a quadratic function in the form $y = a(x - p)^2 + q$ by completing the square. Identify, explain and correct errors in an example of completing the square. Determine the characteristics of a quadratic function given in the form $y = ax^2 + bx + c$, and explain the strategy used. Sketch the graph of a quadratic function given in the form $y = ax^2 + bx + c$. Verify, with or without technology, that a quadratic function in the form $y = ax^2 + bx + c$ represents the same function as a given quadratic function in the form $y = a(x - p)^2 + q$. Write a quadratic function that models a given situation, and explain any assumptions made. Solve a problem, with or without technology, by analyzing a quadratic function.
Solve problems that involve quadratic equations. [C, CN, PS, R, T, V] [ICT: C6–4.1]	• Explain, using examples, the relationship among the roots of a quadratic equation, the zeros of the corresponding quadratic function and the x-intercepts of the graph of the quadratic function. • Derive the quadratic formula, using deductive reasoning. • Solve a quadratic equation of the form ax2+ bx + c = 0 by using strategies such as: o determining square roots o factoring o completing the square o applying the quadratic formula o graphing its corresponding function. • Select a method for solving a quadratic equation, justify the choice, and verify the solution. • Explain, using examples, how the discriminant may be used to determine whether a quadratic equation has two, one or no real roots; and relate the number of zeros to the graph of the corresponding quadratic function. • Identify and correct errors in a solution to a quadratic equation. • Solve a problem by: o analyzing a quadratic equation o determining and analyzing a quadratic equation.

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It is expected that students will:	*The following set of indicators may be used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
Solve, algebraically and graphically, problems that involve systems of linear-quadratic and quadratic-quadratic equations in two variables. [CN, PS, R, T, V] [ICT: C6–4.1, C6–4.4]	• Model a situation, using a system of linear-quadratic or quadratic-quadratic equations. • Relate a system of linear-quadratic or quadratic-quadratic equations to the context of a given problem. • Determine and verify the solution of a system of linear-quadratic or quadratic-quadratic equations graphically, with technology. • Determine and verify the solution of a system of linear-quadratic or quadratic-quadratic equations algebraically. • Explain the meaning of the points of intersection of a system of linear-quadratic or quadratic-quadratic equations. • Explain, using examples, why a system of linear-quadratic or quadratic-quadratic equations may have zero, one, two or an infinite number of solutions. • Solve a problem that involves a system of linear-quadratic or quadratic-quadratic equations, and explain the strategy used.
Solve problems that involve linear and quadratic inequalities in two variables. [C, PS, T, V] [ICT: C6–4.1, C6–4.3]	• Explain, using examples, how test points can be used to determine the solution region that satisfies an inequality. • Explain, using examples, when a solid or broken line should be used in the solution for an inequality. • Sketch, with or without technology, the graph of a linear or quadratic inequality. • Solve a problem that involves a linear or quadratic inequality.
Solve problems that involve quadratic inequalities in one variable. [CN, PS, V]	• Determine the solution of a quadratic inequality in one variable, using strategies such as case analysis, graphing, roots and test points, or sign analysis; and explain the strategy used. • Represent and solve a problem that involves a quadratic inequality in one variable. • Interpret the solution to a problem that involves a quadratic inequality in one variable.
Analyze arithmetic sequences and series to solve problems. [CN, PS, R]	• Identify the assumption(s) made when defining an arithmetic sequence or series. • Provide and justify an example of an arithmetic sequence. • Derive a rule for determining the general term of an arithmetic sequence. • Describe the relationship between arithmetic sequences and linear functions. • Determine t1, d, n or tn in a problem that involves an arithmetic sequence. • Derive a rule for determining the sum of n terms of an arithmetic series. • Determine t1, d, n or Sn in a problem that involves an arithmetic series. • Solve a problem that involves an arithmetic sequence or series.
Analyze geometric sequences and series to solve problems. [PS, R]	• Identify assumptions made when identifying a geometric sequence or series. • Provide and justify an example of a geometric sequence. • Derive a rule for determining the general term of a geometric sequence. • Determine t1, r, n or tn in a problem that involves a geometric sequence. • Derive a rule for determining the sum of n terms of a geometric series. • Determine t1, r, n or Sn in a problem that involves a geometric series. • Generalize, using inductive reasoning, a rule for determining the sum of an infinite geometric series. • Explain why a geometric series is convergent or divergent. • Solve a problem that involves a geometric sequence or series.

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It is expected that students will:	*The following set of indicators may be used to assess student achievement for each related specific learning outcome. Students who have fully met the specific learning outcomes are able to:*
Graph and analyze reciprocal functions (limited to the reciprocal of linear and quadratic functions). [CN, R, T, V] [ICT: C6–4.1, C6–4.3]	• Compare the graph of $y = \frac{1}{f(x)}$ to the graph of y = f(x). • Identify, given a function f(x), values of x for which $y = \frac{1}{f(x)}$ will have vertical asymptotes; and describe their relationship to the non-permissible values of the related rational expression. • Graph, with or without technology, $y = \frac{1}{f(x)}$, given y = f(x) as a function or a graph, and explain the strategies used. • Graph, with or without technology, y = f(x), given $y = \frac{1}{f(x)}$ as a function or a graph, and explain the strategies used.