2023/24 PEI Math 521B DRAFT Curriculum Document

The following document streamlines the Math 521B curriculum, by narrowing the instructional focus to key content while maintaining its cognitive integrity. This document represents a research-supported, collaborative initiative between Department of Education and Early Years personnel and mathematics teachers across the province.

This document is intended to supplement (not replace) the current curriculum guide, to aid in an efficient delivery of the curriculum. Teachers should continue to consult the curriculum guide and other resources located on the Learn site.

There are three main parts to the following document:

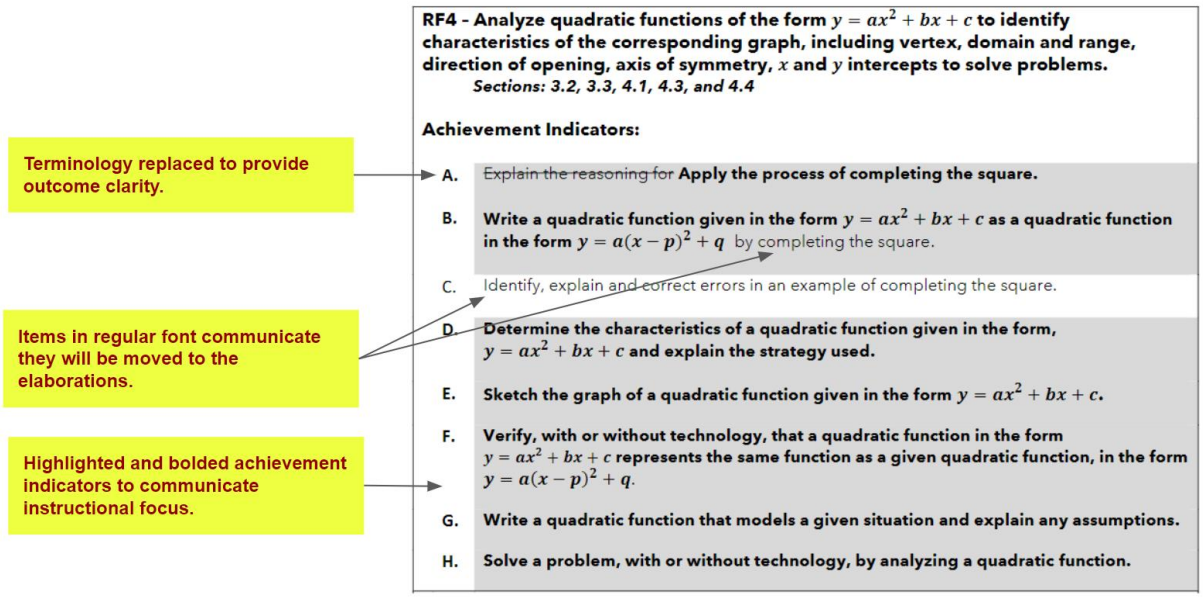
I. Outcomes

Highlighting and bolding have been added to identify key content.

Any text without bolding indicates content that does not need to be directly instructed or summatively assessed. The items not bolded can be used to provide additional instruction or extension opportunities and will be added to the elaborations section of the curriculum guide.

Some wording has been struck through and replaced with terminology to provide clarity.

Note the example provided below:



II. Suggested Sequencing and Timeline

A table providing a recommended sequencing of topics, the outcomes related to that topic, and the suggested instructional time is included. The first two units and the last unit (highlighted in the table) will retain mandatory sequencing.

III. PowerSchool Reporting Structure

A table of the relative and absolute weights in PowerSchool is included.

Text	Indicators to be retained
~~Text~~	Replaced text to improve clarity
Text	Indicators to be relocated to instructional elaboration

I. Math 521B Outcomes

AN1 - Demonstrate an understanding of the absolute value of real numbers.
Section: 7.1

Achievement Indicators:

A. **Determine the distance of two real numbers of the form $\pm a, a \in R$, from 0 on a number line, and relate this to the absolute value of a, $(|a|)$.**

B. **Determine the absolute value or a real number.**

C. Explain, using examples, how the distance between two points on a number line is expressed in terms of absolute value.

D. **Determine the absolute value of a numerical expression.**

E. **Compare and order the absolute values of real numbers in a given set.**

AN2 - Solve problems that involve operations on radicals and radical expressions with numerical and variable radicands.
Sections: 5.1 and 5.2

Achievement Indicators:

A. Compare and order radical expressions with numerical radicands in a given set.

B. **Express an entire radical with a numerical radicand as a mixed radical.**

C. **Express a mixed radical with a numerical radicand as an entire radical.**

D. **Perform one or more operations to simplify radical expressions with numerical or variable radicands.**

E. **Rationalize the denominator of a rational expression with monomial or binomial denominators.**

F. ~~Describe~~ ***Recognize*** **the relationship between rationalizing a binomial denominator of a rational expression and the product of the factors of a difference of square expression.**

G. **Explain, using examples that $(-x)^2 = x^2$, $\sqrt{x^2} = |x|$ and $\sqrt{x^2} \neq \pm x$, $e.g.\ \sqrt{9} \neq \pm 3$.**

H. **Identify the values of the variable for which a given radical expression is defined.**

I. **Solve a problem that involves radical expressions.**

AN3 - Solve problems that involve radical equations (limited to square roots).
Section: 5.3

Achievement Indicators:

- **A. Determine any restrictions on the values for the variable in a radical equation.**
- **B. Determine the roots of a radical equation algebraically, and explain the process used to solve the equation.**
- **C. Verify by substitution, that the values determined in solving a radical equation algebraically are roots of the equation.**
- D. Explain why some roots determined in solving a radical equation algebraically are extraneous.
- E. Solve problems by modeling a situation using a radical equation.

AN4 - Determine equivalent forms of rational expressions (limited to numerators and denominators that are monomials, binomials, or trinomials).
Section: 6.1

Achievement Indicators:

- **A. Compare the strategies for writing equivalent forms of rational expressions to the strategies for writing equivalent forms of rational numbers.**
- **B. Explain why a given value is non-permissible for a given rational expression.**
- **C. Determine the non-permissible values for a rational expression.**
- **D. 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.**
- **E. Simplify a rational expression.**
- F. Explain why the non-permissible values of a given rational expression and of its simplified form are the same.
- **G. Identify and correct errors in a simplification of a rational expression and explain the reasoning.**

AN5 - Perform operations on rational expressions (limited to numerators and denominators that are monomials, binomials, or trinomials).

Sections: 6.2 and 6.3

Achievement Indicators:

A. **Compare the strategies for performing a given operation on rational expressions to the strategies for performing the same operation on rational numbers.**

B. **Determine the non-permissible values when performing operations on rational expressions.**

C. **Determine, in simplified form, the sum or difference of rational expressions with the same denominator.**

D. **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.**

E. **Determine, in simplified form, the product or quotient of rational expressions.**

F. **Simplify an expression that involves two or more operations on rational expressions.**

AN6 - Solve problems that involve rational equations (limited to numerators and denominators that are monomials, binomials or trinomials).

Section: 6.4

Achievement Indicators:

A. **Determine the non-permissible values for the variable in a rational equation.**

B. **Determine the solution to a rational equation algebraically, and explain the process used to solve the equation.**

C. **Explain why a value obtained in solving a rational equation may not be a solution of the equation.**

D. **Solve problems by modeling a situation using a rational equation.**

T1 - Demonstrate an understanding of angles in standard position.
Section: 2.1

Achievement Indicators:

- **A.** **Sketch an angle in standard position, given the measure of the angle.**
- **B.** **Determine the reference angle for an angle in standard position.**
- **C.** **Explain, using examples, how to determine the angles from $0°$ to $360°$ that have the same reference angle as a given angle.**
- D. 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.
- **E.** **Determine the quadrant in which a given angle in standard position terminates.**
- **F.** **Draw an angle in standard position given any point $P(x, y)$ on the terminal arm of the angle.**
- G. 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.

T2 - Solve problems, using the three primary trigonometric ratios for angles from $0°$ to $360°$ in standard position.
Sections: 2.1 and 2.2

Achievement Indicators:

- **A.** **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.**
- **B.** **Determine the value of $sin\ \theta, cos\ \theta,$ or $tan\ \theta$, given any point $P(x, y)$ on the terminal arm of angle θ.**
- **C.** **Determine, without the use of technology, the value of $sin\ \theta, cos\ \theta,$ or $tan\ \theta$, given any point $P(x, y)$ on the terminal arm of angle θ where $\theta = 0°, 90°, 180°, 270°,$ or $360°$.**
- **D.** **Determine the sign of a given trigonometric ratio for a given angle, without the use of technology, and explain.**
- **E.** **Solve, for all values of θ, equations of the form $sin\ \theta = a, cos\ \theta = a$, where $-1 \leq a \leq 1$, and an equation of the form $tan\ \theta = a$, where a is a real number.**
- **F.** **Determine the exact value of the sine, cosine, or tangent of a given angle with a reference angle of $30°, 45°,$ or $60°$.**
- G. Describe the patterns in and among the values of the sine, cosine, and tangent ratios for angles from $0°$ to $360°$.
- **H.** **Sketch a diagram to represent a problem.**
- **I.** **Solve a contextual problem, using trigonometric ratios.**

T3 - Solve problems, using the cosine law and sine law, including the ambiguous case.

Sections: 2.3 and 2.4

Achievement Indicators:

A. **Sketch a diagram to represent a problem that involves a triangle without a right angle.**

B. Solve, using primary trigonometric ratios, a triangle that is not a right triangle.

C. Explain the steps in a given proof of the sine law or cosine law.

D. **Sketch a diagram and solve a problem, using the cosine law.**

E. **Sketch a diagram and solve a problem, using the sine law.**

F. **Describe and explain situations in which a problem may have no solution, one solution or two solutions.**

RF1 - Factor polynomials of the following forms (where $a, b,$ and c are rational numbers):

$$\boldsymbol{ax^2 + bx + c, \quad a \neq 0}$$
$$\boldsymbol{a^2x^2 - b^2y^2, \quad a \neq 0,\ b \neq 0}$$

$$a[f(x)]^2 + b[f(x)] = c, \quad a \neq 0$$
$$a^2[f(x)]^2 - b^2[g(y)]^2, \quad a \neq 0,\ b \neq 0$$

Sections: 4.2 and 4.4

Achievement Indicators:

A. **Factor a given polynomial expression that requires the identification of common factors.**

B. Determine whether a given binomial is a factor for a given polynomial expression and explain why or why not.

C. **Factor a given polynomial expression of the form:**

$$\boldsymbol{ax^2 + bx + c, \quad a \neq 0}$$
$$\boldsymbol{a^2x^2 - b^2y^2, \quad a \neq 0,\ b \neq 0}$$

D. Factor a given polynomial expression that has a quadratic pattern, including:

$$a[f(x)]^2 + b[f(x)] = c, \quad a \neq 0$$
$$a^2[f(x)]^2 - b^2[g(y)]^2, \quad a \neq 0,\ b \neq 0$$

RF2 - Graph and analyze absolute value functions (limited to linear and quadratic functions) to solve problems

Sections: 7.2 and 7.3

Achievement Indicators:

- **A.** **Create a table of values for $y = |f(x)|$, given a table of values for $y = f(x)$.**
- **B.** ~~Generalize a rule for writing~~ **Write absolute value functions in piecewise notation.**
- **C.** **Sketch the graph of $y = |f(x)|$, then state the intercepts, domain and range, and explain the strategy used.**
- **D.** **Solve an absolute value equation graphically, with or without technology.**
- **E.** **Solve, algebraically, an equation with a single absolute value, and verify the solution.**
- **F.** **Explain why the absolute value inequality $|f(x)| < 0$ has no solution.**
- **G.** **Determine and correct errors in a solution to an absolute value equation.**
- H. Solve a problem that involves an absolute value function.

RF3 – 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, and x and y intercepts.

Section: 3.1

Achievement Indicators:

- **A.** **Explain why a function given in the form $y = a(x - p)^2 + q$ is a quadratic function.**
- **B.** **Compare the graphs of a set of functions of the form $y = ax^2$ to the graph of $y = x^2$ and generalize, using inductive reasoning a rule about the effect of a.**
- **C.** **Compare the graphs of a set of functions of the form $y = x^2 + q$ to the graph of $y = x^2$ and generalize, using inductive reasoning a rule about the effect of q.**
- **D.** **Compare the graphs of a set of functions of the form $y = (x - p)^2$ to the graph of $y = x^2$ and generalize, using inductive reasoning a rule about the effect of p.**
- **E.** **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.**
- **F.** **Generalize, using inductive reasoning, a rule for determining the coordinates of the vertex for quadratic functions of the form $y = a(x - p)^2 + q$.**
- **G.** **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.**
- **H.** **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.**
- **I.** **Write a quadratic function of the form $y = a(x - p)^2 + q$ for a given graph or set of characteristics of a graph.**

RF4 – 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 to solve problems.
Sections: 3.2, 3.3, 4.1, 4.3, and 4.4

Achievement Indicators:

A. ~~Explain the reasoning for~~ **Apply the process of completing the square.**

B. **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.

C. Identify, explain and correct errors in an example of completing the square.

D. **Determine the characteristics of a quadratic function given in the form, $y = ax^2 + bx + c$ and explain the strategy used.**

E. **Sketch the graph of a quadratic function given in the form $y = ax^2 + bx + c$.**

F. **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 $y = a(x - p)^2 + q$.**

G. **Write a quadratic function that models a given situation and explain any assumptions.**

H. **Solve a problem, with or without technology, by analyzing a quadratic function.**

RF5 - Solve problems that involve quadratic equations.
Sections: 4.1, 4.2, 4.3, and 4.4

Achievement Indicators:

A. **Explain, using examples, the relationships among the roots of a quadratic equation, the zeros of its corresponding quadratic function and the x-intercepts of the graph of the quadratic function.**

B. Derive the quadratic formula of the quadratic formula, using deductive reasoning.

C. **Solve a quadratic equation of the form $y = ax^2 + bx + c$ by using strategies such as: determining square roots, factoring,** completing the square, **applying the quadratic formula, and graphing its corresponding function.**

D. **Select a method for solving a quadratic equation, justify the choice, and verify.**

E. 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.

F. **Identify and correct errors in a solution to a quadratic equation.**

G. **Solve a problem by: analyzing a quadratic equation; determining and analyzing a quadratic equation.**

RF6 - Solve, algebraically and graphically, problems that involve systems of linear-quadratic and quadratic-quadratic equations in two variables.
Sections: 8.1 and 8.2

Achievement Indicators:

A. Model a situation, using a system of linear-quadratic or quadratic-quadratic equations.

B. Relate a system of linear-quadratic or quadratic-quadratic equations to the context of a given problem.

C. Determine and verify the solution of a system of linear-quadratic or quadratic-quadratic equations graphically, with technology.

D. Determine and verify the solution of a system of linear-quadratic or quadratic-quadratic equations algebraically.

E. Explain the meaning of the points of intersection of a system of linear-quadratic or quadratic-quadratic equations.

F. Explain, using examples, why a system of linear-quadratic or quadratic-quadratic equations may have zero, one, two, or an infinite number of solutions.

G. Solve a problem that involves a system of linear-quadratic or quadratic-quadratic equations, and explain the strategy used.

RF7 - Solve problems that involve linear and quadratic inequalities in two variables.
Sections: 9.1 and 9.3

Achievement Indicators:

A. Explain, using examples, how test points can be used to determine the solution region that satisfies an inequality.

B. Explain, using examples, when a solid or broken line should be used in the solution for an inequality.

C. Sketch with or without technology, the graph of a linear or quadratic inequality.

D. Solve a problem that involves a linear or quadratic inequality.

RF8 - Solve problems that involve quadratic inequalities in one variable.
Section: 9.2

Achievement Indicators:

A. **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.

B. **Represent and solve a problem that involves a quadratic inequality in one variable.**

C. **Interpret the solution to a problem that involves a quadratic inequality in one variable.**

RF9 - Analyse arithmetic sequences and series to solve problems.
Sections: 1.1 and 1.2

Achievement Indicators:

A. **Identify the assumption(s) made when defining an arithmetic sequence or series.**

B. **Provide and justify an example of an arithmetic sequence.**

C. ~~Derive a~~ **Apply a rule for determining the general term of an arithmetic sequence.**

D. Describe a rule for determining the general term of an arithmetic sequence.

E. **Describe the relationship between arithmetic sequences and linear functions.**

F. **Determine $t_1, d, n,$ or t_n in a problem that involves an arithmetic sequence.**

G. ~~Derive a~~ **Apply a rule for determining the sum of n terms of an arithmetic series.**

H. **Determine $t_1, d, n,$ or S_n in a problem that involves an arithmetic series.**

RF10 - Analyse geometric sequences and series to solve problems.
Sections: 1.3, 1.4, and 1.5

Achievement Indicators:

A.	**Identify the assumption(s) made when defining a geometric sequence or series.**
B.	**Provide and justify an example of a geometric sequence.**
C.	~~Derive a~~ **Apply a rule for determining the general term of a geometric sequence.**
D.	**Determine t_1, r, n, or t_n in a problem that involves a geometric sequence.**
E.	~~Derive a~~ **Apply a rule for determining the sum of n terms of a geometric series.**
F.	**Determine t_1, r, n, or S_n in a problem that involves a geometric series.**
G.	Generalize, using inductive reasoning, a rule for determining the sum of an infinite geometric series.
H.	**Explain why a geometric series is convergent or divergent.**
I.	**Solve a problem that involves a geometric sequence or series.**

RF 11 - Graph and analyse reciprocal functions (limited to the reciprocal of linear and quadratic **functions).**
Section: 7.4

Achievement Indicators:

A.	**Compare the graph $y = \frac{1}{f(x)}$ to the graph of $y = f(x)$.**
B.	**Identify, given a function $y = f(x)$, 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.**
C.	**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.**
D.	**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.**

II. Suggested Sequencing and Timeline

The following table contains a suggested topic sequencing as well as an approximate time frame to cover each of the topics. The first two units and the last unit (highlighted in the table) will retain mandatory sequencing. The time frame is based on a total of 80 classes, each with an average length of 75 minutes:

Topic	Outcomes	Suggested Time
Trigonometry	**T1, T2, T3**	10 classes
Quadratic Functions	**RF3, RF4**	11 classes
Quadratic Equations	**RF1, RF5**	10 classes
Radical Expressions and Equations	**AN2, AN3**	6 classes
Rational Expressions and Equations	**AN4, AN5, AN6**	10 classes
Absolute Value and Reciprocal Functions	**AN1, RF2, RF11**	8 classes
Systems of Equations	**RF6**	7 classes
Linear and Quadratic Inequalities	**RF7, RF8**	7 classes
Sequences and Series	**RF9, RF10**	11 classes
	Total	80 classes

III. PowerSchool Reporting Structure

Topic	Relative (%)	Absolute (%)
Trigonometry	13.3	10
Quadratics	29.3	22
Radical and Rational Expressions and Equations	24	18
Absolute Value and Reciprocal Functions	10.7	8
Systems of Equations and Inequalities	16	12
Sequences and Series	6.7	5
Major Assessment		25