PRE-CALCULUS 12

COURSE OUTLINE

Mathematics is a very important part of our technological society. Students require the ability to reason and communicate mathematically, to solve problems, and to understand and use mathematics. Skill in these areas create a mathematically literate citizen. Pre-calculus 12 is designed for students who have a particular interest in mathematics, or who have career aspirations in the fields of engineering, pure and applied science, economics, some business programs, or other areas requiring a higher level of mathematics.

BIG IDEAS :

1. Understanding the characteristics of families of **functions** allows us to model and understand relationships and to build connections between classes of functions.
2. Using **inverses** is the foundation of solving equations and can be extended to relationships between functions.
3. **Transformations** of shapes extend to functions and relations in all of their representations.

The following topics will be covered. The actual order of topics may not be exactly as shown.

TOPICS

1. Polynomial Expressions and Functions
2. Radical and Rational Functions
3. Transforming Graphs of Functions
4. Combining Functions
5. Exponential and Logarithmic Functions
6. Trigonometry
7. Trigonometric Equations and Identities
8. Permutations and Combinations

EVALUATION

Tests and Quizzes	35%
Midterm Exam	20%
Homework, in-class assignments	10%
Final Exam	25%
Attendance, class participation	10%
	100%

PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLANS
September 2019

UNITS :

1. Relations and Functions
2. Trigonometry
3. Exponents and Logarithms
4. Radicals and Rational Functions
5. Polynomials
6. Permutations, Combinations, and Binomial Theorem

COURSE : PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLAN

UNIT TITLE : **Relations and Functions**

BIG IDEAS :

Analyzing the characteristics of functions allows us to solve trigonometric equations, and model and understand relationships..
Transformations of shapes extend to many mathematical functions to make changes in shape, reflections, and displacements.

Curricular Competencies

Students are expected to **DO** the following :

Reasoning and modeling

1. Develop thinking strategies to solve problems.
2. Explore, analyze, and apply mathematical ideas using reason, technology, and other tools
3. Model with mathematics in situational contexts.
4. Think creatively and with curiosity and wonder when exploring problems.
5. Visualize to explore and illustrate mathematical concepts and relationships.

Understanding and solving

6. Apply flexible and strategic approaches to solve problems.
7. Engage in problem-solving experiences connected with place, story, cultural practices, and perspectives relevant to local First Peoples communities, the local community, and other cultures.

Communicating and representing

8. Explain and justify mathematical ideas and decisions in many ways.
9. Represent mathematical ideas in concrete, pictorial, and symbolic forms
10. Use mathematical vocabulary and language to contribute to discussions in the classroom.

Connecting and Reflecting

11. Reflect on mathematical thinking.
12. Connect mathematical concepts with each other, with other areas, and with personal interests
13. Use mistakes as opportunities to advance learning.
14. Incorporate First Peoples world views, perspectives, knowledge, and practices to make connections with mathematical concepts.

Curricular Competencies / Big Ideas

Students are expected to **DO** the following :

1. Demonstrate an understanding of operations on, and compositions of, functions.
2. Demonstrate of the effects of horizontal and vertical translations on the graphs of functions, and their related equations.
3. Demonstrate an understanding of the effects of horizontal and vertical stretches on the graphs of functions and their related equations.
4. Demonstrate an understanding of the effects of reflections on the graphs of functions and their related equations, including reflections through the and y-axis, x-axis, and the line y = x.
5. Demonstrate an understanding of inverses of relations.

Concepts and Content :

What students will **KNOW** :

1. Sketch the graph of a function that is the sum, difference, product or quotient of two give their graphs.
2. Write the equation of a function that is the sum, difference, product or quotient of two or more functions, given their equations.
3. Determine the domain and range of a function that is the sum, difference, product or quotient of two functions.
4. Write a function h(x) as the sum, difference, product or quotient of two or more functions.
5. Determine the value of the composition of functions when evaluated at a point, including : f [f(a)], f[g(a)], and g[f(a)].

6, Determine, given the equations of two functions f (x) and g (x), the equation of the composite functions : f [f(x)], f[g(x)], and g[f(x)].

7. Sketch, given the equations of two functions f (x) and g (x), the graph of the composite functions : : f [f(x)], f[g(x)], and g[f(x)].
8. Write a function h(x) as the composition of two or more functions.
9. Write a function h(x) by combining two or more functions through operations on, and compositions of functions.
10. Compare the graphs of a set of functions of the form y-k = f(x) to the graph of y=f(x) and generalize , using inductive reasoning, a rule about the effect of k.
11. Compare the graphs of a set of functions of the form y = f(x-h) to the graph of y=f(x) and generalize , using inductive reasoning, a rule about the effect of h.
12. Compare the graphs of a set of functions of the form y-k = f(x-h) to the graph of y=f(x) and generalize , using inductive reasoning, a rule about the effects of h and k.
13. Sketch the graphs of y-k = f(x) , y = f(x-h) , or y-k = f(x-h) for given values of h and k, given a sketch of the function y = f(x), where the equation of y = f(x) is not given.
14. Write the equation of a function whose graph is a vertical and/or horizontal translation of the graph of y = f(x).
15. Compare the graphs of a set of functions of the form y = a f(x) to the graph of y = f(x), and generalize, using inductive reasoning, a rule about the effect of a.

16. Compare the graphs of a set of functions of the form $y = f(bx)$ to the graph of $y = f(x)$, and generalize, using inductive reasoning, a rule about the effect of b.

17. Compare the graphs of a set of functions of the form $y = a\,f(bx)$ to the graph of $y = f(x)$, and generalize, using inductive reasoning, a rule about the effects of a and b.

18. Sketch the graphs of $y = a\,f(x)$, $y = f(bx)$ or $y = a\,f(bx)$ for given values of a and b, given a sketch of the function $y = f(x)$, where the equation of $y = f(x)$ is not given.

19. Write the equation of a function, given its graph which is a vertical and/or horizontal stretch of the graph of the function $y = f(x)$.

20. Sketch the graph of the function $y-k = a\,f[\,b(x-h)]$ for given values of a, b, h and k, given the graph of the function of $y = f(x)$, where the equation of $y = f(x)$ is not given.

21. Write the equation of a function, given its graph which is a translation and/or stretch of the graph of the function $y = f(x)$.

22. Sketch the graphs of the functions $y = -f(x)$, $y = f(-x)$, and $y = -f(-x)$, given the graph of $y = f(x)$, where the equation of $y = f(x)$ is not given.

23. Write the equation of a function, given its graph which is a reflection of the the graph of the function $y = f(x)$ through the x-axis, the y-axis or the line $y = x$.

24. Explain how the graph of the line $y = x$ can be used to sketch the inverse of a relation.

25. Explain how the transformation $(x, y) \rightarrow (y, x)$ can be used to sketch the inverse of a relation.

26. Determine if a relation and its inverse are functions.

27. Determine restrictions on the domain of a function in order in order for its inverse to be a function.

28. Determine the equation and sketch the graph of the inverse relation, given the equation of a linear or quadratic relation.

29. Explain the relationship between the domains and ranges of a relation and its inverse.

30. Determine, algebraically or graphically, if two functions are inverses of each other.

Learning Targets	Formative Assessment
1. Write the equation of a function that is the sum, difference, product or quotient of two or more functions, given their equations.	A new function can be created by adding, subtracting, multiplying, or dividing other functions on appropriate domain.
2. Given the equations of two functions f(x) and g(x) , the equation of the composite functions : : f [f(x)], f[g(x)], and g[f(x)]	A composite function is the result of applying two functions in succession.
3. Determine the domain of a function that is created by the composition of two functions f(x) and g(x).	The domain of a composite function f[g(x)] is the set of values of x for which g is defined and for which g(x) is in the domain of f.
4. Write a function h(x) by combining two or more functions through operations on, and compositions of, functions.	Demonstrate an understanding of operations on, and compositions of functions.
5. Find the implied domain of a composition function.	The domain of a function is limited when division is involved in that the denominator zero is non-permissible.
6. Sketch the graph of the function $y-k = a\,f[\,b(x-h)]$ for given values of a, b, h and k, given the graph of the function of $y = f(x)$.	Emphasize the graphs of functions can be translated, reflected, stretched or compressed .
7. Write the equation of a function, given its graph which is a translation and/or stretch of the graph of the function $y = f(x)$.	When a function is written in the form $y-k = a\,f[\,b(x-h)]$, its graph is a transformation image of the graph $y = f(x)$.
8. Sketch the graph of the inverse of the inverse relation , given the graph of a relation.	The graphs of a relation and its inverse are reflections of each other in the line $y = x$.
9. Sketch the reflection of the graph of a function of a function $y = f(x)$ through the x-axis, the y-axis, or the line $y = x$, given the graph of $y = f(x)$ where the equation of $y = f(x)$ is not given.	Considerable time will be spent on sketching the various mathematical functions after they have been reflected in 3 different ways.
10. Generalize, using inductive reasoning, and explain rules for the reflection of the graph of the function $y = f(x)$ through the x-axis, y-axis or the line $y = x$.	Demonstrate that reflections are done linearly including across both the x and y axes and the line $y = x$.

11. Write the equation of a function, given its graph which is a reflection of the graph of the function $y = f(x)$ through the x-axis, the y-axis or the line $y = x$	Students will learn to give the resulting equations of reflected functions.
12. Sketch the graphs of the functions $y = -f(x)$, $y = f(-x)$, and $y = -f(-x)$, given the graph of $y = f(x)$, where the equation of $y = f(x)$ is not given.	Demonstrate that reflections are done linearly including across both the x and y axes and the line $y = x$.

Core Competencies in Action

1. Demonstrate an understanding of operations on, and compositions of, functions.

2. Demonstrate an understanding of the effects of horizontal and vertical translations on the graphs of functions and their related equations.

3. Demonstrate an understanding of the effects of horizontal and vertical stretches on the graphs of functions and their related equations.

4. Demonstrate an understanding of the effects of reflections on the graphs of functions and their related equations, including the reflections through the x-axis, y-axis, and the line $y = x$.

5. Demonstrate an understanding of inverses of relations.

FORMATIVE ASSESSMENT : Students will regularly check each other's work. As well, there will be some tests and quizzes.

SUMMATIVE ASSESSMENT: There will be math labs where graphing using technology is the primary focus to help students demonstrate and check their understanding of transformation of various important relations and functions such as reflections, expansions, compressions, both vertical and horizontal.

TRANSFER/EXTENSION : The students will see applications of translated functions in university and college enrollment statistics and kinematics in physics. Composite combinations of functions can be seen to be an important part of differential calculus.

COURSE : PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLAN

UNIT TITLE : **Trigonometry**

BIG IDEAS :

Many functions are related through inverse operations eg. $f(x) = \sin x$ and $f^{-1}(x) = \sin^{-1} x$.
Analyzing the characteristics of functions allows us to solve trigonometric equations, and model and understand relationships..
Transformations of shapes extend to trigonometric functions to make changes in amplitude, period, and displacements.

Curricular Competencies

Students are expected to **DO** the following :

1. Demonstrate an understanding of angles in standard position, expressed in degrees or radians.
2. Develop and apply the equation of the unit circle.
3. Solve problems using the six trigonometric ratios for angles (in degrees and radians).
4. Graph and analyze the trigonometric functions sine, cosine, and tangent to solve problems.
5. Solve, algebraically and graphically, first and second degree trigonometric equations with the domain expressed in degrees and radians.
6. Prove trigonometric identities, using reciprocal identities, quotient identities, Pythagorean identities, sum or difference identities of sine and cosine, double angle identities of sine and cosine and tangent.

Concepts and Content :

What students will **KNOW** :

1. Sketch, in standard position (S.P.) an angle (positive or negative) when the measure in degrees or radians.
2. Be able to convert angle measure in degrees to radians and vice versa .

3. Determine the general form of the measures, in degrees or radians, of all angles that are co-terminal with a given S.P. angles.
4. Explain the relationship between the radian measure of an S.P. angle and the length of the arc cut on a circle of radius r, and solve problems based upon that relationship.

5. Sketch the graph of the function $y - d = a \cos b(x-c)$ or $y - d = a \sin b(x-c)$ and give the properties such as domain and range , amplitude, period, phase shift and vertical displacement.

6. Graph, with or without technology, a trigonometric equation and using it solve the equation. function.

Learning Targets	Formative Assessment
1. Angles in standard position.	Demonstrate understanding of S.P. angles in radians or degrees.
2. Solve problems using the primary and reciprocal ratios/functions.	A sine or cosine can be used to model periodic behaviour.
3. Angles measure can be in degrees or radians.	The radian measure is a real number which is a unit of length.
4. Determine using a unit circle or reference triangle, the exact value of a trig. ratio for any S.P. angle that has a special angle as a reference angle.	Demonstrate an understanding of S.P. angles expressed in degrees or radians.
5. Determine the measure of angles in a specified domain in degrees or radians, given the terminal arm of an angle in standard position.	Demonstrate an understanding of S.P. angles expressed in degrees or radians.
6. Sketch a diagram to represent a problem that involves trigonometric ratios.	Graph and analyze the trig. functions sine, cosine, and tangent to solve problems.
7. Determine the characteristics (amplitude, asymptotes, domain, period, range and zeroes) of the graphs of $y = \sin x$, $y = \cos x$ and $y = \tan x$.	Recognize the periodic nature of trig. functions and their properties.
8. Determine the effects of a, b, c, and d for transformed sine or cosine function eg. $y - d = a \cos b(x-c)$	Understand that the graphing of a transformed trig. function is no different than graphing transformed basic math functions such as linear, quadratic, abs. value, polynomials, radicals, and others.
9. Solve a problem by analyzing the graph of a trigonometric function.	Classroom time will be devoted to sketching graphs manually on graph paper and verification will be done using the TI-83 or equivalent graphing calculator.

10. Solve algebraically first and second degree trigonometric equations with the domain expressed in degrees or radians.	Relate the general solution of a trig. equation to the zeroes of the corresponding trig. function (restricted to sine and cosine functions).
11. Evaluation of other students solving of trigonometric equations.	Identify and correct errors in a solution for a given trigonometric equation.
12. Prove trigonometric identities using: reciprocal, quotient, Pythagorean, sum or difference, and double-angle identities.	-Verify a trig. identity numerically for a given value in either degrees or radians. -Determine graphically the validity of a trig. identity using technology -Determine the non-permissible values. -Prove algebraically the validity.
13. Determine the exact value of a trigonometric ratio.	Use a sum, difference, or double angle identity.
4. Graph and analyze rational functions.	For the graph of a rational function, $y = f(x)/g(x)$, the non-permissible values of x correspond to vertical asymptotes or holes.
5. Know the rules for graphing rational functions including the use of x and y-intercepts.	Sketching graphs of rational functions using non-permissible values, vertical, horizontal and oblique asymptotes.
6. Match a set of rational functions to their graphs and explain the reasoning.	With appropriate theoretical knowledge of rational functions, the graph images can be correlated to the appropriate equations
7. Determine, graphically, an approximate solution of a rational function.	The roots of a rational function are the x-intercepts of the graph of a corresponding function.

Core Competencies in Action

1. Demonstrate an understanding of angles in standard position, expressed in degrees or radians.
2. Solve problems, using the six trigonometric ratios for angles, expressed in degrees or radians.
3. Use the trig. functions sine, cosine, and tangent to solve problems.
4. Take graphed sinusoidal trig. functions and give either a sine or cosine equation.

5. Sketch the graph of a transformed trigonometric function and verify using technology.

6. Trigonometric equations can be solved graphically or algebraically.

7. Recognize that there may be restrictions on the domain of a trigonometric equation.

8. A trigonometric identity is a trigonometric equation that is true for all permissible values of the variable.

9. The graph of a rational function can be sketched entirely without a data table using the properties and domain and range of the particular function.

10. Rational functions take on various shapes due to the degrees of the numerator and denominator.

11. Complex rational functions can be solved approximately using a data table and locating the x-intercepts on the graph.

FORMATIVE ASSESSMENT : Students will regularly check each other's work. As well, there will be some tests and quizzes.

SUMMATIVE ASSESSMENT: There will be math labs where graphing using technology is the primary focus to help students demonstrate their understanding of trigonometric functions such as their periodic nature. In solving trig. equations, the student is expected to relate the general solution to the zeroes of the function.

TRANSFER/EXTENSION : The students will see applications of trigonometric functions eg. , scientific, geographical, and business applications.

COURSE : PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLAN

UNIT TITLE : **Exponents and Logarithms**

BIG IDEAS :

Many functions are related through inverse operations.
Understand the characteristics of families of functions to allow us to model and understand relationships and to build connections between classes of functions.
Transformations of shapes extend to functions and relations in all of their representations.

Curricular Competencies

Students are expected to **DO** the following :

1. Graph and analyze exponential and logarithmic functions.
2. Solve problems that involve exponential and logarithmic equations.
3. Demonstrate an understanding of logarithms.
4. Demonstrate an understanding of the product, quotient and power laws of logarithms.

Concepts and Content :

What students will **KNOW** :

1. Sketch the graph of an exponential function $y = a^x$ and identify the characteristics of the graph including the domain, range, horizontal asymptote and intercepts.
2. Sketch the graph of an exponential function by applying a set of transformations to $y = a^x$, and state the characteristics of the graph.
3. Sketch the graph of a logarithmic function $y = \log_a x$ and identify the characteristics of the graph including the domain, range, vertical asymptote and intercepts.
4. Sketch the graph of a logarithmic function by applying a set of transformations to $y = \log_a x$, and state the characteristics of the graph.
5. Demonstrate graphically that a logarithmic function and an exponential function with thesame base are inverses of each other.
6. Determine the solution of an exponential equation in which the bases are powers of one another and also if the bases are not powers of one another.
7. Determine the solution of a logarithmic equation, and verify the solution.
8. Solve a problem that involves exponential growth or decay.
9. Solve a problem that involves logarithmic scales, such as the Richter scale and the pH scale.
10. Explain the relationships between logarithms and exponents.
11. Express a logarithmic equation as an exponential expression and vice versa.
12. Develop and generalize the laws for exponents, using numeric examples and exponent laws.

Concepts and Content (cont'd)

13. Determine, using the laws of logarithms , an equivalent expression for a logarithmic expression.

Learning Targets	Formative Assessment
1. Sketch the graphs of $y = a^x$ and graphs of of it after applying a set of transformations.	Graph and analyze exponential functions and state the characteristics of the graphs.
2. Sketch the graphs of $y = \log_a x$ and graphs of of it after applying a set of transformations.	Graph and analyze logarithmic functions and state the characteristics of the graphs.
3. Compare graphically the graphs of a logarithmic function and an exponential function with the same base to see that they are mathematic inverses.	Demonstrate an understanding of how logarithms and exponents are related.
4. Solve problems that involve exponential equations.	Applications of exponential equations include loans, investments, growth and decay.
5. Solve problems that involve logarithmic equations.	Applications involve Richter scale and the pH scale.
6. Solve a problem by modelling a situation with an exponential or a logarithmic equation.	Demonstrate how logarithms and exponents are related and one can be used to solve the other.
7. Express a logarithmic expression as an exponential and vice versa.	An exponential function is the inverse of of an logarithmic function.
8. Determine, using the laws of logarithms an equivalent expression for a logarithmic expression .	Have an understanding of the product, quotient and power laws of logarithms.

Core Competencies in Action

1. Graph and analyse exponential and logarithmic functions.

2. Solve problems that involve exponential and logarithmic equations.

3. Understand both algebraically and graphically that a logarithmic function and an exponential function with the same base are inverses of each other.

4. Exponential and logarithmic functions have extensive applications in the modeling of financial, physical and scientific situations.

5. Demonstrate an understanding of logarithms and how they are related to exponents.

6. Demonstrate an understanding of the product, quotient, and power laws of logarithms.

7. The logarithms of bases other than 10 or e can be determined using the change of base rule.

FORMATIVE ASSESSMENT : Mostly tests and quizzes.

SUMMATIVE ASSESSMENT: There will be math labs where graphing is the primary focus to help students demonstrate their understanding of the shapes of the graphs of exponential and logarithmic functions

TRANSFER/EXTENSION : The students will see applications of exponential and logarithmic functions when they are used in actual banking situations and in important events in our daily lives such as the Richter scale that is used to measure the intensity of an earthquake or the pH to determine alkalinity or acidity of a solution.

COURSE : PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLAN

UNIT TITLE : **Radicals and Rational Functions**

BIG IDEAS :

Many functions are related through inverse operations

Analyzing the characteristics of functions allows us to solve equations, and model and understand relationships..

Transformations of shapes extend to functions and relations in all of their representations.

Curricular Competencies

Students are expected to **DO** the following :

1. Graph and analyze radical functions.
2. Graph and analyze rational functions .

Concepts and Content :

What students will **KNOW** :

1. Sketch the graph of the function $y - k = a\sqrt{(b(x-h)}$ and give the domain and range .
2. Sketch the graph of the function $y = \sqrt{f(x)}$ and give the domain and range .
3. Determine graphically an approximate solution of a radical equation.
4. Graph, with or without technology, a rational function.
5. Analyze the graphs of a various rational functions to identify common characteristics.

Learning Targets	**Formative Assessment**
1. Sketch the graph of the function $y - k = a\sqrt{(b(x-h)}$.	The graph of $y - k = a\sqrt{(b(x-h)}$ is produced by applying regular transformations to $y = \sqrt{x}$.
2. Sketch the graph of the function $y = \sqrt{f(x)}$ using a data table that includes y=f(x) data.	The graph of a function y=f(x) can be used graph the corresponding radical function $y = \sqrt{f(x)}$
3. Compare the domain and range of $y = \sqrt{f(x)}$ to that of y=f(x).	The domain and range of the radical function has restrictions as compared to the original function

4. Graph and analyze rational functions.	For the graph of a rational function, $y = f(x)/g(x)$, the non-permissible values of x correspond to vertical asymptotes or holes.
5. Know the rules for graphing rational functions including the use of x and y-intercepts.	Sketching graphs of rational functions using non-permissible values, vertical, horizontal and oblique asymptotes.
6. Match a set of rational functions to their graphs and explain the reasoning.	With appropriate theoretical knowledge of rational functions, the graph images can be correlated to the appropriate equations
7. Determine, graphically, an approximate solution of a rational function.	The roots of a rational function are the x-intercepts of the graph of a corresponding function.

Core Competencies in Action

1. Sketch the graph of a transformed radical function and verify using technology.

2. Sketch the graph of y=f(x) and manually sketch, using a data table, $y = \sqrt{f(x)}$.

3. Recognize that the domain and range of a radical function is related to that of the corresponding non radical function using domain restrictions.

4. Rational functions involve division and because division is not allowed , the graph will have holes and/or vertical asymptotes, and either a horizontal or oblique asymptote.

5. The graph of a rational function can be sketched entirely without a data table using the properties and domain and range of the particular function.

6. Rational functions take on various shapes due to the degrees of the numerator and denominator.

7. Complex rational functions can be solved approximately using a data table and locating the x-intercepts on the graph.

FORMATIVE ASSESSMENT : Mostly tests and quizzes.

SUMMATIVE ASSESSMENT: There will be math labs where graphing is the primary focus to help students demonstrate their understanding of the shapes of the graphs of rational functions .

TRANSFER/EXTENSION : The students will see applications of rational functions when , for example, with physics applications involving time and velocity.

COURSE : PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLAN

UNIT TITLE : **Polynomials**

BIG IDEAS :

Understand the characteristics of families of functions to allow us to model and understand relationships and to build connections between classes of functions.

Transformations of shapes extend to functions and relations in all of their representations.

Curricular Competencies

Students are expected to **DO** the following :

1. Demonstrate an understanding of factoring polynomials of degree 3 to 5.
2. Graph and analyze polynomial functions of degree 3 to 5 .

Concepts and Content :

What students will **KNOW** :

1. Use long division or synthetic division to divide a polynomial expression by a binomial of the form (x-a) .
2. Use the factor and remainder theorems.
3. Generalize the rules for graphing polynomial functions of odd or even degree.
4. Explain the relationship between the zeroes of a polynomial function, the roots of the corresponding polynomial equation, and the x-intercepts of the graph of the polynomial function
5. Sketch the graph of a polynomial function

Learning Targets	**Formative Assessment**
1. Divide a polynomial expression by a binomial expression of the form x - a	Some polynomials can be factored by using long and/or synthetic division.
2. Know the relationship between the linear factors of a polynomial and the zeroes of the corresponding polynomial function.	The zeroes of a polynomial function or the x-intercepts of its graph can be determined solving the corresponding poly. equation.
3. Explain the role of the constant term and the leading coefficient in the equation of a polynomial function with respect to the	The shape of the graph depends on the size and sign of the leading coefficient.

3. (cont'd)
graph of the function.

4. Explain the relationship between the remainder when a polynomial expression is divided by and the value of the poly. expression at $x = a$.	The Remainder Theorem and the Factor Theorem.
5. Know the rules for graphing polynomial functions of odd or even degree	The end behaviour of graphs of polynomial depends on the degree of the polynomial
6. Explain how the multiplicity of a zero of a polynomial affects the graph.	Multiple roots at a single x-value affects the the shape of the graph of a polynomial.
7. Sketch the graphs of polynomial functions.	Apply the rules of end behaviour, the constant term, and multiplicity in sketching the graphs of polynomial functions.

Core Competencies in Action

1. Write an appropriate division statement

2. The zeroes, roots, and x-intercepts of the graph of polynomial functions are related.

3. The constant term is the y-intercept of the polynomial function and the leading coefficient affects end behaviour.

4. When dividing a polynomial by a binomial x-a , the remainder can be calculated using the Remainder Theorem.

5. The degree and sign of the leading coefficient are important factors in determining the shape of the polynomial

6. Multiplicity of roots and being even or odd affects the shape of the polynomial along the x-axis.

7. Curve sketching using the properties of polynomials provides a reasonable sketch of the graph without having to use a data table.

FORMATIVE ASSESSMENT : Mostly tests and quizzes.

SUMMATIVE ASSESSMENT: There will be math labs where graphing is the primary focus to help students demonstrate their understanding of the shapes of the graphs of polynomial functions

TRANSFER/EXTENSION : The students will see applications of polynomial functions when they use a cubic polynomial to assist in maximizing the volume of a rectangular container.

COURSE : PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLAN

UNIT TITLE : **Permutations, Combinations, and Binomial Theorem**

BIG IDEAS :

Analyzing the characteristics of functions allows us to solve equations, and model and understand relationships..

The ability to count all possibilities is the basis for probability and statistics

Curricular Competencies

Students are expected to **DO** the following :

1. Apply the fundamental counting principle to solve problems.
2. Determine the number of permutations of n elements taken r at a time to solve problems.
3. Determine the number of combinations of n different elements taken r at a time to solve problems.
4. Explan powers of a binomial in a variety of ways, including using the binomial theorem.

Concepts and Content :

What students will **KNOW** :

1. Explain why the total number of possible choices is found by multiplying rather adding the number of ways the individual choices can be made.
2. Determine, in factorial notation, the number of permutations of n different elements taken n at a time to solve a problem.
3. Determine, in factorial notation, the number of permutations of n different elements taken r at a time to solve a problem
4. Determine the number of ways that a subset of k elements can be selected from a set of n different elements.
5. Solve an equation that involves n P r.

Learning Targets	**Formative Assessment**
1. Count the total number of possible choices That can be made, using graphic organizers such as lists and tree diagrams.	Counting strategies can be used to determine the number of ways to choose objects from a set or to arrange a set of objects.
2. Solve problems by applying the fundamental	The fundamental counting principle is also

2. (cont'd) counting principle.	known as the multiplication principle.
3. Determine, in factorial notation, the number of permutations of n different different objects taken n at a time	Counting strategies can be used to determine the number of ways to choose objects from a set of objects.
4. Determine, using a variety of strategies, the number of permutations of n different objects taken r at a time to solve a problem	Use the n P r formula.
5. Solve an equation involving $n P r = k$.	A permutation is an arrangement of a set of objects where order is important.
6. Explain, using examples, the difference between a permutation and a combination.	A combination is a selection from a set of objects where order is not important.
7. Determine the number of combinations of n different elements taken r at a time to solve a problem.	Apply the n C r formula.
8. Solve equations and problems that involve $n C r$.	Apply the n C r formula.
9. Expand the powers of a binomial in a variety of ways, including using the Binomial Theorem.	The coefficients of a the binomial expansion are the result of combinations.
10. Expand, using the binomial theorem $(x + y)^n$.	Binomial expansion is done using a formula for the variables and Pascal's Triangle for the coefficients of the binomial expansion.

Core Competencies in Action

1. Apply the fundamental counting principle, also known as the multiplication principle.

2. Determine the number of permutations of n elements taken both n or r at time.

3. Determine the number of combinations of n different elements taken r at time to solve problems.

4. Expand powers of binomials in a variety of ways, including using the binomial theorem.

5. Pascal's triangle is constructed using combinations. The coefficients of a binomial expansion can be found on the triangle.

FORMATIVE ASSESSMENT : Mostly tests and quizzes.

SUMMATIVE ASSESSMENT: There will be math labs where Pascal's Triangle is put together using combinations, card games like poker to investigate combinations and the fundamental counting principle to help the student connect the concepts of combinations and fundamental counting together.

TRANSFER/EXTENSION : The students will see applications of permutations and combinations in games of chance like cards and dice .

SPRING 2020 PRE-CALCULUS 12

COURSE OUTLINE

MR. E. WONG

Class Days : Monday to Friday **Time** : 12:50 to 2:25 pm **Room** : 100

Mathematics is a very important part of our technological society. Students require the ability to reason and communicate mathematically, to solve problems, and to understand and use mathematics. Skill in these areas create a mathematically literate citizen. Pre-calculus 12 is designed for students who have a particular interest in mathematics, or who have career aspirations in the fields of engineering, pure and applied science, economics, some business programs, or other areas requiring a higher level of mathematics.

BIG IDEAS

1. Understanding the characteristics of families of **functions** allows us to model and understand relationships and to build connections between classes of functions.
2. Using **inverses** is the foundation of solving equations and can be extended to relationships between functions.
3. **Transformations** of shapes extend to functions and relations in all of their representations.
4. Geometrical thinking and visualization can be used to explore conics and functions.

CORE COMPETENCIES

By the end of this course students will be expected to

- **Communication** : Acquire and **communicate** mathematical ideas using appropriate language, equations, graphs and graphing technology, oral presentations.
- **Creative thinking** :Collaboratively develop, **analyze**, and carry out problem solving and research based mathematical activities.
- Reflect on experiences and accomplishments to demonstrate one's own progress in learning
- **Positive Personal Awareness and Responsibility** : demonstrate self-determination and self-regulation.
- **Critical thinking**: visualize to explore, investigate and illustrate mathematical concepts and relationships.
- **First Peoples Principles of Learning** (FPPL) : Engage in problem-solving experiences that are connected to local **First Peoples** communities, the local community, and other cultures.
-Explain and justify mathematical ideas
- Connect mathematical concepts to each other and to other areas and personal interests.
- Incorporate **First Peoples** world views and perspectives to make connections to mathematical concepts.

CURRICULAR COMPETENCIES – Elaborations

- Reasoning and logic : inductive and deductive reasoning ; predicting, generalizing, drawing conclusions through experiences including puzzles, games, and coding
- Fluent and flexible thinking: includes using known facts and benchmark, applying whole number strategies to rational numbers and algebraic expressions
- Model : using concrete materials and dynamic interactive technology; representing a situation graphically or symbolically
- conceptual understanding developed playing with ideas, inquiry, and problem solving
- Flexible strategies : from a repertoire of strategies, choosing an appropriate strategy to solve problems
- Experiences : includes context, strategies, approaches, language across cultures
- Discussions : developing a mathematical community in the classroom through discourse – partner talks, small-group discussions, teacher-student conferences
- Represent : concretely, pictorially, symbolically, including using models, tables, graphs, words, numbers, symbols
- Reflect: sharing mathematical thinking of self and others, including evaluating strategies and solutions, extending, posing new problems and questions
- Other areas and personal interest: to develop a sense of how mathematics helps us understand ourselves and the world around us
- Incorporate : collaborate with local **First Peoples Elders** and knowledge keepers.

CONTENT – Elaborations

1. Exponential : graphing including transformations, solving, and base *e*
2. Series such as geometric, sigma notation, infinite
3. Logarithms : laws of logarithms, evaluating with different bases
4. Polynomial : solving, factoring, graphing, characteristics of graphs, function notation
5. Transformations : singular vertical and horizontal expansions, compressions, reflections and translations, inverses, composed functions.
6. Conics : transformations and/or locus derivations
7. Rational : characteristics of graphs, including asymptotes, intercepts, point discontinuities
8. Functions : radian measure, primary trigonometric ratios, including transformations, characteristics, solving
9. Identities : using Pythagorean, double angle, reciprocal, sum and difference identities to reduce complexity in expressions.

FIRST PEOPLES PRINCIPLES OF LEARNING (FPPL)

Over the course of the semester, students will incorporate from FPPL :

- Learning is holistic, reflexive, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).

- Learning involves recognizing the consequences of one's actions e.g. doing your homework regularly and diligently.
- Learning is embedded in memory, history and story eg. mathematical principles build on each other and what you learn in the past will facilitate learning in the future
- Learning involves patience and time.
- Learning involves exploration of one's identity e.g. how has mathematics influenced you in the past present, and how will it impact you in the future.

EVALUATION

Summative assessment :

Tests and Quizzes (of **Curricular Competencies**)	20 %
Midterm Exam	20 %
Homework, in-class assignments	5 %
Project/Presentation	10 %
Final Exam	25 %
Attendance, class participation	5 %
	80%

Formative assessment :

Self-assessment	5 %
Core competencies	15 %
	20 %

Final Grade = Summative + Formative = 80% + 20% = 100 %

Textbook and Supplies

Textbook: PRE-CALCULUS 12
myWORKTEXT
Pearson Canada Inc.
Davis et al
2012 Pearson Canada Inc. Publishers

Supplies Needed (to be supplied by student) :

a) Pen, pencil, loose leaf paper, binder
a) Scientific calculator (Optional : TI-83 Graphing calculator)
b) Geometry Set (compass, protractor, set squares)

PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLANS
September 2019

UNITS :

1. Relations and Functions
2. Trigonometry
3. Exponents and Logarithms
4. Radicals and Rational Functions
5. Polynomials
6. Permutations, Combinations, and Binomial Theorem

COURSE : PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLAN

UNIT TITLE : **Relations and Functions** Time Length : 2 weeks

BIG IDEAS :

Transformations of shapes extend to many mathematical functions to make changes in shape, reflections, and displacements.

Curricular Competencies

Students are expected to **DO** the following :

Reasoning and modeling

1. Develop thinking strategies to solve problems.
2. Explore, analyze, and apply mathematical ideas using reason, technology, and other tools
3. Model with mathematics in situational contexts.
4. Think creatively and with curiosity and wonder when exploring problems.
5. Visualize to explore and illustrate mathematical concepts and relationships.

Understanding and solving

6. Apply flexible and strategic approaches to solve problems.
7. Engage in problem-solving experiences connected with place, story, cultural practices, and perspectives relevant to local First Peoples communities, the local community, and other cultures.

Communicating and representing

8. Explain and justify mathematical ideas and decisions in many ways.
9. Represent mathematical ideas in concrete, pictorial, and symbolic forms
10. Use mathematical vocabulary and language to contribute to discussions in the classroom.

Connecting and Reflecting

11. Reflect on mathematical thinking.
12. Connect mathematical concepts with each other, with other areas, and with personal interests
13. Use mistakes as opportunities to advance learning.
14. Incorporate First Peoples world views, perspectives, knowledge, and practices to make connections with mathematical concepts.

Curricular Competencies / Big Ideas

Students are expected to **DO** the following :

1. Demonstrate an understanding of operations on, and compositions of, functions.
2. Demonstrate of the effects of horizontal and vertical translations on the graphs of functions, and their related equations.
3. Demonstrate an understanding of the effects of horizontal and vertical stretches on the graphs of functions and their related equations.
4. Demonstrate an understanding of the effects of reflections on the graphs of functions and their related equations, including reflections through the and y-axis, x-axis, and the line y = x.
5. Demonstrate an understanding of inverses of relations.

Concepts and Content :

What students will **KNOW** :

1. Sketch the graph of a function that is the sum, difference, product or quotient of two give their graphs.
2. Write the equation of a function that is the sum, difference, product or quotient of two or more functions, given their equations.
3. Determine the domain and range of a function that is the sum, difference, product or quotient of two functions.
4. Write a function h(x) as the sum, difference, product or quotient of two or more functions.
5. Determine the value of the composition of functions when evaluated at a point, including : f [f(a)], f[g(a)], and g[f(a)].

6, Determine, given the equations of two functions f (x) and g (x), the equation of the composite functions : f [f(x)], f[g(x)], and g[f(x)].

7. Sketch, given the equations of two functions f (x) and g (x), the graph of the composite functions : : f [f(x)], f[g(x)], and g[f(x)].
8. Write a function h(x) as the composition of two or more functions.
9. Write a function h(x) by combining two or more functions through operations on, and compositions of functions.
10. Compare the graphs of a set of functions of the form y-k = f(x) to the graph of y=f(x) and generalize , using inductive reasoning, a rule about the effect of k.
11. Compare the graphs of a set of functions of the form y = f(x-h) to the graph of y=f(x) and generalize , using inductive reasoning, a rule about the effect of h.
12. Compare the graphs of a set of functions of the form y-k = f(x-h) to the graph of y=f(x) and generalize , using inductive reasoning, a rule about the effects of h and k.
13. Sketch the graphs of y-k = f(x) , y = f(x-h) , or y-k = f(x-h) for given values of h and k, given a sketch of the function y = f(x), where the equation of y = f(x) is not given.
14. Write the equation of a function whose graph is a vertical and/or horizontal translation of the graph of y = f(x).

15. Compare the graphs of a set of functions of the form $y = a\,f(x)$ to the graph of $y = f(x)$, and generalize, using inductive reasoning, a rule about the effect of a.

16. Compare the graphs of a set of functions of the form $y = f(bx)$ to the graph of $y = f(x)$, and generalize, using inductive reasoning, a rule about the effect of b.

17. Compare the graphs of a set of functions of the form $y = a\,f(bx)$ to the graph of $y = f(x)$, and generalize, using inductive reasoning, a rule about the effects of a and b.

18. Sketch the graphs of $y = a\,f(x)$, $y = f(bx)$ or $y = a\,f(bx)$ for given values of a and b, given a sketch of the function $y = f(x)$, where the equation of $y = f(x)$ is not given.

19. Write the equation of a function, given its graph which is a vertical and/or horizontal stretch of the graph of the function $y = f(x)$.

20. Sketch the graph of the function $y-k = a\,f[\,b(x-h)]$ for given values of a, b, h and k, given the graph of the function of $y = f(x)$, where the equation of $y = f(x)$ is not given.

21. Write the equation of a function, given its graph which is a translation and/or stretch of the graph of the function $y = f(x)$.

22. Sketch the graphs of the functions $y = -f(x)$, $y = f(-x)$, and $y = -f(-x)$, given the graph of $y = f(x)$, where the equation of $y = f(x)$ is not given.

23. Write the equation of a function, given its graph which is a reflection of the the graph of the function $y = f(x)$ through the x-axis, the y-axis or the line $y = x$.

24. Explain how the graph of the line $y = x$ can be used to sketch the inverse of a relation.

25. Explain how the transformation $(x, y) \rightarrow (y, x)$ can be used to sketch the inverse of a relation.

26. Determine if a relation and its inverse are functions.

27. Determine restrictions on the domain of a function in order in order for its inverse to be a function.

28. Determine the equation and sketch the graph of the inverse relation, given the equation of a linear or quadratic relation.

29. Explain the relationship between the domains and ranges of a relation and its inverse.

30. Determine, algebraically or graphically, if two functions are inverses of each other.

Learning Targets	Summative Assessment
1. Write the equation of a function that is the sum, difference, product or quotient of two or more functions, given their equations.	A new function can be created by adding, subtracting, multiplying, or dividing other functions on appropriate domain.
2. Given the equations of two functions f(x) and g(x) , the equation of the composite functions : : f [f(x)], f[g(x)], and g[f(x)]	A composite function is the result of applying two functions in succession.
3. Determine the domain of a function that is created by the composition of two functions f(x) and g(x).	The domain of a composite function f[g(x)] is the set of values of x for which g is defined and for which g(x) is in the domain of f.
4. Write a function h(x) by combining two or more functions through operations on, and compositions of, functions.	Demonstrate an understanding of operations on, and compositions of functions.
5. Find the implied domain of a composition function.	The domain of a function is limited when division is involved in that the denominator zero is non-permissible.
6. Sketch the graph of the function $y-k = a\, f[\, b(x-h)]$ for given values of a, b, h and k, given the graph of the function of $y = f(x)$.	Emphasize the graphs of functions can be translated, reflected, stretched or comprssed .
7. Write the equation of a function, given its graph which is a translation and/or stretch of the graph of the function $y = f(x)$.	When a function is written in the form $y-k = a\, f[\, b(x-h)]$, its graph is a transformation image of the graph $y = f(x)$.
8. Sketch the graph of the inverse of the inverse relation , given the graph of a relation.	The graphs of a relation and its inverse are reflections of each other in the line $y = x$.
9. Sketch the reflection of the graph of a function of a function $y = f(x)$ through the x-axis, the y-axis, or the line $y = x$, given the graph of $y = f(x)$ where the equation of $y = f(x)$ is not given.	Considerable time will be spent on sketching the various mathematical functions after they have been reflected in 3 different ways.
10. Generalize, using inductive reasoning, and explain rules for the reflection of the graph of the function $y = f(x)$ through the x-axis, y-axis or the line $y = x$.	Demonstrate that reflections are done linearly including across both the x and y axes and the line $y = x$.

11. Write the equation of a function, given its graph which is a reflection of the graph of the function $y = f(x)$ through the x-axis, the y-axis or the line $y = x$	Students will learn to give the resulting equations of reflected functions.
12. Sketch the graphs of the functions $y = -f(x)$, $y = f(-x)$, and $y = -f(-x)$, given the graph of $y = f(x)$, where the equation of $y = f(x)$ is not given.	Demonstrate that reflections are done linearly including across both the x and y axes and the line $y = x$.

Curricular Competencies in Action

1. Demonstrate an understanding of operations on, and compositions of, functions.

2. Demonstrate an understanding of the effects of horizontal and vertical translations on the graphs of functions and their related equations.

3. Demonstrate an understanding of the effects of horizontal and vertical stretches on the graphs of functions and their related equations.

4. Demonstrate an understanding of the effects of reflections on the graphs of functions and their related equations, including the reflections through the x-axis, y-axis, and the line $y = x$.

5. Demonstrate an understanding of inverses of relations.

CORE COMPETENCIES IN ACTION

Students will focus on the following core competencies in this unit :

- **Communication** : Acquire and **communicate** mathematical ideas using appropriate language, equations, graphs and graphing technology, oral presentations.
- **Creative thinking** :Collaboratively develop, **analyze**, and carry out problem solving and research based mathematical activities.
- Reflect on experiences and accomplishments to demonstrate one's own progress in learning
- **Positive Personal Awareness and Responsibility** : demonstrate self-determination and self-regulation.
- **Critical thinking**: visualize to explore, investigate and illustrate mathematical concepts and relationships.
- **First Peoples Principles of Learning** (FPPL) :- Connect mathematical concepts to each other and to other areas and personal interests.

FIRST PEOPLES PRINCIPLES OF LEARNING (FPPL)

Over the course of the semester, students will incorporate from FPPL :

- Learning is holistic, reflexive, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).
- Learning involves recognizing the consequences of one's actions eg. doing your homework regularly and diligently.
- Learning is embedded in memory, history and story eg. mathematical principles build on each other and what you learn in the past will facilitate learning in the future
- Learning involves patience and time.
- Learning involves exploration of one's identity eg. how has mathematics influenced you in the past present, and how will it impact you in the future.
- Engage in problem-solving experiences that are connected to local **First Peoples** communities, the local community, and other cultures.
- Incorporate **First Peoples** world views and perspectives to make connections to mathematical concepts.

TRANSFER/EXTENSION : The students will see applications of translated functions in university and college enrollment statistics and kinematics in physics. Composite combinations of functions can be seen to be an important part of differential calculus.

EVALUATION

FORMATIVE ASSESSMENT : Students will regularly check each other's work. The student will self assess themselves regularly in each of the units of study. Teacher and student will have two or three meetings to discuss grades, work habits, core competencies e.g. assignment accountability (positive, personal, & cultural identity) and recognition of FPPL.

SUMMATIVE ASSESSMENT: There will be math labs where graphing using technology is the primary focus to help students demonstrate and check their understanding of transformation of various important relations and functions such as reflections, expansions, compressions, both vertical and horizontal. Tests, quizzes, midterm and final exams will form the bulk of the summative assessment.

ASSESSMENT

Summative Assessment	= 80%
Formative Assessment	= 15 %
Grade Reporting (Teacher-student meeting)	= **5** %
	100 %

COURSE : PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLAN

UNIT TITLE : **Trigonometry** Time Length = 3 - 4 weeks

BIG IDEAS :

Understand the characteristics of functions allows us to solve trigonometric equations, modeling trigonometric functions and understand relationships..
Transformations of shapes extend to trigonometric functions to make changes in amplitude, period, and displacements.

Curricular Competencies

Students are expected to **DO** the following :

1. Demonstrate an understanding of angles in standard position, expressed in degrees or radians.
2. Develop and apply the equation of the unit circle.
3. Solve problems using the six trigonometric ratios for angles (in degrees and radians).
4. Graph and analyze the trigonometric functions sine, cosine, and tangent to solve problems.
5. Solve, algebraically and graphically, first and second degree trigonometric equations with the domain expressed in degrees and radians.
6. Prove trigonometric identities, using reciprocal identities, quotient identities, Pythagorean identities, sum or difference identities of sine and cosine, double angle identities of sine and cosine and tangent.

Concepts and Content :

What students will **KNOW** :

1. Sketch, in standard position (S.P.) an angle (positive or negative) when the measure in degrees or radians.
2. Be able to convert angle measure in degrees to radians and vice versa .

3. Determine the general form of the measures, in degrees or radians, of all angles that are co-terminal with a given S.P. angles.
4. Explain the relationship between the radian measure of an S.P. angle and the length of the arc cut on a circle of radius r, and solve problems based upon that relationship.

5. Sketch the graph of the function $y - d = a \cos b(x-c)$ or $y - d = a \sin b(x-c)$ and give the properties such as domain and range , amplitude, period, phase shift and vertical displacement.

6. Graph, with or without technology, a trigonometric equation and using it solve the equation. function.

Learning Targets	**Summative Assessment**
1. Angles in standard position.	Demonstrate understanding of S.P. angles in radians or degrees.
2. Solve problems using the primary and reciprocal ratios/functions.	A sine or cosine can be used to model periodic behaviour.
3. Angles measure can be in degrees or radians.	The radian measure is a real number which is a unit of length.
4. Determine using a unit circle or reference triangle, the exact value of a trig. ratio for any S.P. angle that has a special angle as a reference angle.	Demonstrate an understanding of S.P. angles expressed in degrees or radians.
5. Determine the measure of angles in a specified domain in degrees or radians, given the terminal arm of an angle in standard position.	Demonstrate an understanding of S.P. angles expressed in degrees or radians.
6. Sketch a diagram to represent a problem that involves trigonometric ratios.	Graph and analyze the trig. functions sine, cosine, and tangent to solve problems.
7. Determine the characteristics (amplitude, asymptotes, domain, period, range and zeroes) of the graphs of $y = \sin x$, $y = \cos x$ and $y = \tan x$.	Recognize the periodic nature of trig. functions and their properties.
8. Determine the effects of a, b, c, and d for transformed sine or cosine function eg. $y - d = a \cos b(x-c)$	Understand that the graphing of a transformed trig. function is no different than graphing transformed basic math functions such as linear, quadratic, abs. value, polynomials, radicals, and others.
9. Solve a problem by analyzing the graph of a trigonometric function.	Classroom time will be devoted to sketching graphs manually on graph paper and verification will be done using the TI-83 or equivalent graphing calculator.

10. Solve algebraically first and second degree trigonometric equations with the domain expressed in degrees or radians.	Relate the general solution of a trig. equation to the zeroes of the corresponding trig. function (restricted to sine and cosine functions).
11. Evaluation of other students solving of trigonometric equations.	Identify and correct errors in a solution for a given trigonometric equation.
12. Prove trigonometric identities using: reciprocal, quotient, Pythagorean, sum or difference, and double-angle identities.	-Verify a trig. identity numerically for a given value in either degrees or radians. -Determine graphically the validity of a trig. identity using technology -Determine the non-permissible values. -Prove algebraically the validity.
13. Determine the exact value of a trigonometric ratio.	Use a sum, difference, or double angle identity.
4. Graph and analyze rational functions.	For the graph of a rational function, $y = f(x)/g(x)$, the non-permissible values of x correspond to vertical asymptotes or holes.
5. Know the rules for graphing rational functions including the use of x and y-intercepts.	Sketching graphs of rational functions using non-permissible values, vertical, horizontal and oblique asymptotes.
6. Match a set of rational functions to their graphs and explain the reasoning.	With appropriate theoretical knowledge of rational functions, the graph images can be correlated to the appropriate equations
7. Determine, graphically, an approximate solution of a rational function.	The roots of a rational function are the x-intercepts of the graph of a corresponding function.

Curricular Competencies in Action

1. Demonstrate an understanding of angles in standard position, expressed in degrees or radians.
2. Solve problems, using the six trigonometric ratios for angles, expressed in degrees or radians.
3. Use the trig. functions sine, cosine, and tangent to solve problems.
4. Take graphed sinusoidal trig. functions and give either a sine or cosine equation.

5. Sketch the graph of a transformed trigonometric function and verify using technology.

6. Trigonometric equations can be solved graphically or algebraically.

7. Recognize that there may be restrictions on the domain of a trigonometric equation.

8. A trigonometric identity is a trigonometric equation that is true for all permissible values of the variable.

9. The graph of a rational function can be sketched entirely without a data table using the properties and domain and range of the particular function.

10. Rational functions take on various shapes due to the degrees of the numerator and denominator.

11. Complex rational functions can be solved approximately using a data table and locating the x-intercepts on the graph.

CORE COMPETENCIES IN ACTION

Students will focus on the following core competencies in this unit :

- **Communication** : Acquire and **communicate** mathematical ideas using appropriate language, equations, graphs and graphing technology, oral presentations.
- **Creative thinking** :Collaboratively develop, **analyze**, and carry out problem solving and research based mathematical activities.
- Reflect on experiences and accomplishments to demonstrate one's own progress in learning
- **Positive Personal Awareness and Responsibility** : demonstrate self-determination and self-regulation.
- **Critical thinking**: visualize to explore, investigate and illustrate mathematical concepts and relationships.
- **First Peoples Principles of Learning** (FPPL) :- Connect mathematical concepts to each other and to other areas and personal interests.

FIRST PEOPLES PRINCIPLES OF LEARNING (FPPL)

Over the course of the semester, students will incorporate from FPPL :

- Learning is holistic, reflexive, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).
- Learning involves recognizing the consequences of one's actions eg. doing your homework regularly and diligently.

- Learning is embedded in memory, history and story eg. mathematical principles build on each other and what you learn in the past will facilitate learning in the future
- Learning involves patience and time.
- Learning involves exploration of one's identity eg. how has mathematics influenced you in the past present, and how will it impact you in the future.
- Engage in problem-solving experiences that are connected to local **First Peoples** communities, the local community, and other cultures.
- Incorporate **First Peoples** world views and perspectives to make connections to mathematical concepts.

TRANSFER/EXTENSION : The students will see applications of trigonometric functions e.g. scientific, geographical, and business applications.

EVALUATION

FORMATIVE ASSESSMENT : Students will regularly check each other's work. The student will self assess themselves regularly in each of the units of study. Teacher and student will have two or three meetings to discuss grades, work habits, core competencies, e.g. assignment accountability (positive, personal, & cultural identity) and acknowledgment of FPPL

SUMMATIVE ASSESSMENT: There will be math labs where graphing using technology is the primary focus to help students demonstrate and check their understanding of trigonometric functions such as their periodic nature. In solving trig. equations the student is expected to relate the general solution to the zeros of the functions. Tests, quizzes, midterm and final exams will form the bulk of the summative assessment.

FINAL ASSESSMENT :

Summative Assessment	= 80 %
Formative Assessment	= 15 %
Grade Reporting (Teacher-student meeting)	= **5 %**
	100 %

COURSE : PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLAN

UNIT TITLE : **Exponents and Logarithms** Time Length : 2 weeks

BIG IDEAS :

Many functions are related through inverse operations.
Understand the characteristics of families of functions to allow us to model and understand relationships and to build connections between classes of functions.
Transformations of shapes extend to functions and relations in all of their representations.

Curricular Competencies

Students are expected to **DO** the following :

1. Graph and analyze exponential and logarithmic functions.
2. Solve problems that involve exponential and logarithmic equations.
3. Demonstrate an understanding of logarithms.
4. Demonstrate an understanding of the product, quotient and power laws of logarithms.

Concepts and Content :

What students will **KNOW** :

1. Sketch the graph of an exponential function $y = a^x$ and identify the characteristics of the graph including the domain, range, horizontal asymptote and intercepts.
2. Sketch the graph of an exponential function by applying a set of transformations to $y = a^x$, and state the characteristics of the graph.
3. Sketch the graph of a logarithmic function $y = \log_a x$ and identify the characteristics of the graph including the domain, range, vertical asymptote and intercepts.
4. Sketch the graph of a logarithmic function by applying a set of transformations to $y = \log_a x$, and state the characteristics of the graph.
5. Demonstrate graphically that a logarithmic function and an exponential function with thesame base are inverses of each other.
6. Determine the solution of an exponential equation in which the bases are powers of one another and also if the bases are not powers of one another.
7. Determine the solution of a logarithmic equation, and verify the solution.
8. Solve a problem that involves exponential growth or decay.
9. Solve a problem that involves logarithmic scales, such as the Richter scale and the pH scale.
10. Explain the relationships between logarithms and exponents.
11. Express a logarithmic equation as an exponential expression and vice versa.
12. Develop and generalize the laws for exponents, using numeric examples and exponent laws.

Concepts and Content (cont'd)

13. Determine, using the laws of logarithms , an equivalent expression for a logarithmic expression.

Learning Targets	**Formative Assessment**
1. Sketch the graphs of $y = a^x$ and graphs of of it after applying a set of transformations.	Graph and analyze exponential functions and state the characteristics of the graphs.
2. Sketch the graphs of $y = \log_a x$ and graphs of of it after applying a set of transformations.	Graph and analyze logarithmic functions and state the characteristics of the graphs.
3. Compare graphically the graphs of a logarithmic function and an exponential function with the same base to see that they are mathematic inverses.	Demonstrate an understanding of how logarithms and exponents are related.
4. Solve problems that involve exponential equations.	Applications of exponential equations include loans, investments, growth and decay.
5. Solve problems that involve logarithmic equations.	Applications involve Richter scale and the pH scale.
6. Solve a problem by modelling a situation with an exponential or a logarithmic equation.	Demonstrate how logarithms and exponents are related and one can be used to solve the other.
7. Express a logarithmic expression as an exponential and vice versa.	An exponential function is the inverse of of an logarithmic function.
8. Determine, using the laws of logarithms an equivalent expression for a logarithmic expression .	Have an understanding of the product, quotient and power laws of logarithms.

Curricular Competencies in Action

Students will focus on the following skills/curricular competencies :

1. Graph and analyse exponential and logarithmic functions.

2. Solve problems that involve exponential and logarithmic equations.

3. Understand both algebraically and graphically that a logarithmic function and an exponential

function with the same base are inverses of each other.

4. Exponential and logarithmic functions have extensive applications in the modeling of financial, physical and scientific situations.

5. Demonstrate an understanding of logarithms and how they are related to exponents.

6. Demonstrate an understanding of the product, quotient, and power laws of logarithms.

7. The logarithms of bases other than 10 or e can be determined using the change of base rule.

CORE COMPETENCIES IN ACTION

Students will focus on the following core competencies in this unit :

- **Communication** : Acquire and **communicate** mathematical ideas using appropriate language, equations, graphs and graphing technology, oral presentations.
- **Creative thinking** :Collaboratively develop, **analyze**, and carry out problem solving and research based mathematical activities.
- Reflect on experiences and accomplishments to demonstrate one's own progress in learning
- **Positive Personal Awareness and Responsibility** : demonstrate self-determination and self-regulation.
- **Critical thinking**: visualize to explore, investigate and illustrate mathematical concepts and relationships.
- **First Peoples Principles of Learning** (FPPL) :- Connect mathematical concepts to each other and to other areas and personal interests.

FIRST PEOPLES PRINCIPLES OF LEARNING (FPPL)

Over the course of the semester, students will incorporate from FPPL :

- Learning is holistic, reflexive, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).
- Learning involves recognizing the consequences of one's actions eg. doing your homework regularly and diligently.
- Learning is embedded in memory, history and story eg. mathematical principles build on each other and what you learn in the past will facilitate learning in the future
- Learning involves patience and time.
- Learning involves exploration of one's identity eg. how has mathematics influenced you in the past present, and how will it impact you in the future.
- Engage in problem-solving experiences that are connected to local **First Peoples** communities, the local community, and other cultures.
- Incorporate **First Peoples** world views and perspectives to make connections to mathematical concepts.

TRANSFER/EXTENSION : The students will see applications of exponential and logarithmic functions when they are used in actual banking situations and in important events in our daily lives such as the Richter scale that is used to measure the intensity of an earthquake or the pH to determine alkalinity or acidity of a solution.

FORMATIVE ASSESSMENT : Students will regularly check each other's work. The student will self assess themselves regularly in each of the units of study. Teacher and student will have two or three meetings to discuss grades, work habits, core competencies e.g. assignment accountability (positive, personal, & cultural identity) and recognition of FPPL.

SUMMATIVE ASSESSMENT: There will be math labs where graphing is the primary focus to help students demonstrate their understanding of the shapes of the graphs of exponential and logarithmic functions. The bulk of the summative assessment will be in the traditional sense using testing and quizzes to evaluate their curricular competencies in simplifying and solving exponential and logarithmic equations and using them in actual applications.

FINAL ASSESSMENT

Summative Assessment	= 80%
Formative Assessment	= 15 %
Grade Reporting (Teacher-student meeting)	= **5 %**
	100 %

COURSE : PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLAN

UNIT TITLE : **Radicals and Rational Functions** Time Length : 1½ weeks

BIG IDEAS :

Many functions are related through inverse operations
Analyzing the characteristics of functions allows us to solve equations, and model and understand relationships..
Transformations of shapes extend to functions and relations in all of their representations.

Curricular Competencies

Students are expected to **DO** the following :

1. Graph and analyze radical functions.
2. Graph and analyze rational functions .

Concepts and Content :

What students will **KNOW** :

1. Sketch the graph of the function $y - k = a\sqrt{(b(x-h)}$ and give the domain and range .
2. Sketch the graph of the function $y = \sqrt{f(x)}$ and give the domain and range .
3. Determine graphically an approximate solution of a radical equation.
4. Graph, with or without technology, a rational function.
5. Analyze the graphs of a various rational functions to identify common characteristics.

Learning Targets	**Summative Assessment**
1. Sketch the graph of the function $y - k = a\sqrt{(b(x-h)}$.	The graph of $y - k = a\sqrt{(b(x-h)}$ is produced by applying regular transformations to $y = \sqrt{x}$.
2. Sketch the graph of the function $y = \sqrt{f(x)}$ using a data table that includes y=f(x) data.	The graph of a function y=f(x) can be used graph the corresponding radical function $y = \sqrt{f(x)}$
3. Compare the domain and range of $y = \sqrt{f(x)}$ to that of y=f(x).	The domain and range of the radical function has restrictions as compared to the original function

4. Graph and analyze rational functions.	For the graph of a rational function, $y = f(x)/g(x)$, the non-permissible values of x correspond to vertical asymptotes or holes.
5. Know the rules for graphing rational functions including the use of x and y-intercepts.	Sketching graphs of rational functions using non-permissible values, vertical, horizontal and oblique asymptotes.
6. Match a set of rational functions to their graphs and explain the reasoning.	With appropriate theoretical knowledge of rational functions, the graph images can be correlated to the appropriate equations
7. Determine, graphically, an approximate solution of a rational function.	The roots of a rational function are the x-intercepts of the graph of a corresponding function.

Curricular Competencies in Action

1. Sketch the graph of a transformed radical function and verify using technology.

2. Sketch the graph of $y=f(x)$ and manually sketch, using a data table, $y = \sqrt{f(x)}$.

3. Recognize that the domain and range of a radical function is related to that of the corresponding non radical function using domain restrictions.

4. Rational functions involve division and because division is not allowed , the graph will have holes and/or vertical asymptotes, and either a horizontal or oblique asymptote.

5. The graph of a rational function can be sketched entirely without a data table using the properties and domain and range of the particular function.

6. Rational functions take on various shapes due to the degrees of the numerator and denominator.

7. Complex rational functions can be solved approximately using a data table and locating the x-intercepts on the graph.

CORE COMPETENCIES IN ACTION

Students will focus on the following core competencies in this unit :

- **Communication** : Acquire and **communicate** mathematical ideas using appropriate language, equations, graphs and graphing technology, oral presentations.
- **Creative thinking** :Collaboratively develop, **analyze**, and carry out problem solving and research based mathematical activities.
- Reflect on experiences and accomplishments to demonstrate one's own progress in learning
- **Positive Personal Awareness and Responsibility** : demonstrate self-determination and self-regulation.
- **Critical thinking**: visualize to explore, investigate and illustrate mathematical concepts and relationships.
- **First Peoples Principles of Learning** (FPPL) :- Connect mathematical concepts to each other and to other areas and personal interests.

FIRST PEOPLES PRINCIPLES OF LEARNING (FPPL)

Over the course of the semester, students will incorporate from FPPL :

- Learning is holistic, reflexive, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).
- Learning involves recognizing the consequences of one's actions eg. doing your homework regularly and diligently.
- Learning is embedded in memory, history and story eg. mathematical principles build on each other and what you learn in the past will facilitate learning in the future
- Learning involves patience and time.
- Learning involves exploration of one's identity eg. how has mathematics influenced you in the past present, and how will it impact you in the future.
- Engage in problem-solving experiences that are connected to local **First Peoples** communities, the local community, and other cultures.
- Incorporate **First Peoples** world views and perspectives to make connections to mathematical concepts.

TRANSFER/EXTENSION : The students will see applications of rational functions when , for example, with physics applications involving time and velocity.

FORMATIVE ASSESSMENT : Students will regularly check each other's work. The student will self assess themselves regularly in each of the units of study. Teacher and student will have two or three meetings to discuss grades, work habits, core competencies e.g. assignment accountability (positive, personal, & cultural identity) and recognition of FPPL.

SUMMATIVE ASSESSMENT: There will be math labs where graphing is the primary focus to help students demonstrate their understanding of the shapes of the graphs of radical and rational functions . The bulk of the summative assessment will be through traditional testing and quizzing.

ASSESSMENT

Summative Assessment	= 80%
Formative Assessment	= 15 %
Grade Reporting (Teacher-student meeting)	= **5 %**
	100 %

COURSE : PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLAN

UNIT TITLE : **Polynomials** Time Length : 2 weeks

BIG IDEAS :

Understand the characteristics of families of functions to allow us to model and understand relationships and to build connections between classes of functions.

Transformations of shapes extend to functions and relations in all of their representations.

Curricular Competencies

Students are expected to **DO** the following :

1. Demonstrate an understanding of factoring polynomials of degree 3 to 5.
2. Graph and analyze polynomial functions of degree 3 to 5 .

Concepts and Content :

What students will **KNOW** :

1. Use long division or synthetic division to divide a polynomial expression by a binomial of the form (x-a) .
2. Use the factor and remainder theorems.
3. Generalize the rules for graphing polynomial functions of odd or even degree.
4. Explain the relationship between the zeroes of a polynomial function, the roots of the corresponding polynomial equation, and the x-intercepts of the graph of the polynomial function
5. Sketch the graph of a polynomial function

Learning Targets	**Formative Assessment**
1. Divide a polynomial expression by a binomial expression of the form x - a	Some polynomials can be factored by using long and/or synthetic division.
2. Know the relationship between the linear factors of a polynomial and the zeroes of the corresponding polynomial function.	The zeroes of a polynomial function or the x-intercepts of its graph can be determined solving the corresponding poly. equation.
3. Explain the role of the constant term and the leading coefficient in the equation of a polynomial function with respect to the	The shape of the graph depends on the size and sign of the leading coefficient.

3. (cont'd) graph of the function.	
4. Explain the relationship between the remainder when a polynomial expression is divided by and the value of the poly. expression at $x = a$.	The Remainder Theorem and the Factor Theorem.
5. Know the rules for graphing polynomial functions of odd or even degree	The end behaviour of graphs of polynomial depends on the degree of the polynomial
6. Explain how the multiplicity of a zero of a polynomial affects the graph.	Multiple roots at a single x-value affects the the shape of the graph of a polynomial.
7. Sketch the graphs of polynomial functions.	Apply the rules of end behaviour, the constant term, and multiplicity in sketching the graphs of polynomial functions.

Curricular Competencies in Action

1. Write an appropriate division statement

2. The zeroes, roots, and x-intercepts of the graph of polynomial functions are related.

3. The constant term is the y-intercept of the polynomial function and the leading coefficient affects end behaviour.

4. When dividing a polynomial by a binomial x-a , the remainder can be calculated using the Remainder Theorem.

5. The degree and sign of the leading coefficient are important factors in determining the shape of the polynomial

6. Multiplicity of roots and being even or odd affects the shape of the polynomial along the x-axis.

7. Curve sketching using the properties of polynomials provides a reasonable sketch of the graph without having to use a data table.

CORE COMPETENCIES IN ACTION

Students will focus on the following core competencies in this unit :

- **Communication** : Acquire and **communicate** mathematical ideas using appropriate language, equations, graphs and graphing technology, oral presentations.
- **Creative thinking** :Collaboratively develop, **analyze**, and carry out problem solving and research based mathematical activities.
- Reflect on experiences and accomplishments to demonstrate one's own progress in learning
- **Positive Personal Awareness and Responsibility** : demonstrate self-determination and self-regulation.
- **Critical thinking**: visualize to explore, investigate and illustrate mathematical concepts and relationships.
- **First Peoples Principles of Learning** (FPPL) :- Connect mathematical concepts to each other and to other areas and personal interests.

FIRST PEOPLES PRINCIPLES OF LEARNING (FPPL)

Over the course of the semester, students will incorporate from FPPL :

- Learning is holistic, reflexive, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).
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- Learning involves patience and time.
- Learning involves exploration of one's identity eg. how has mathematics influenced you in the past present, and how will it impact you in the future.
- Engage in problem-solving experiences that are connected to local **First Peoples** communities, the local community, and other cultures.
- Incorporate **First Peoples** world views and perspectives to make connections to mathematical concepts.

TRANSFER/EXTENSION : The students will see applications of polynomial functions when they use a cubic polynomial to assist in maximizing the volume of a rectangular container.

SUMMATIVE ASSESSMENT: There will be math labs where graphing is the primary focus to help students demonstrate their understanding of the shapes of the graphs of polynomial functions The traditional forms of evaluation including tests and quizzes will form the bulk of the summative assessment.

FORMATIVE ASSESSMENT : Students will regularly check each other's work. The student will self assess themselves regularly in each of the units of study. Teacher and student will have two or three meetings to discuss grades, work habits, core competencies e.g. assignment accountability (positive, personal, & cultural identity) and recognition of FPPL.

FINAL ASSESSMENT

Summative Assessment	= 80%
Formative Assessment	= 15 %
Grade Reporting (Teacher-student meeting)	= **5 %**
	100 %

COURSE : PRE-CALCULUS 12

UNIT INSTRUCTIONAL PLAN

UNIT TITLE : **Permutations, Combinations, and Binomial Theorem** Time Length : 1 week

BIG IDEAS :

Analyzing the characteristics of functions allows us to solve equations, and model and understand relationships..

The ability to count all possibilities is the basis for probability and statistics

Curricular Competencies

Students are expected to **DO** the following :

1. Apply the fundamental counting principle to solve problems.
2. Determine the number of permutations of n elements taken r at a time to solve problems.
3. Determine the number of combinations of n different elements taken r at a time to solve problems.
4. Explain powers of a binomial in a variety of ways, including using the binomial theorem.

Concepts and Content :

What students will **KNOW** :

1. Explain why the total number of possible choices is found by multiplying rather adding the number of ways the individual choices can be made.
2. Determine, in factorial notation, the number of permutations of n different elements taken n at a time to solve a problem.
3. Determine, in factorial notation, the number of permutations of n different elements taken r at a time to solve a problem
4. Determine the number of ways that a subset of k elements can be selected from a set of n different elements.
5. Solve an equation that involves n P r.

Learning Targets

1. Count the total number of possible choices That can be made, using graphic organizers such as lists and tree diagrams.

Summative Assessment

Counting strategies can be used to determine the number of ways to choose objects from a set or to arrange a set of objects.

2. Solve problems by applying the fundamental	The fundamental counting principle is also
2. (cont'd) counting principle.	known as the multiplication principle.
3. Determine, in factorial notation, the number of permutations of n different different objects taken n at a time	Counting strategies can be used to determine the number of ways to choose objects from a set of objects.
4. Determine, using a variety of strategies, the number of permutations of n different objects taken r at a time to solve a problem	Use the n P r formula.
5. Solve an equation involving $n P r = k$.	A permutation is an arrangement of a set of objects where order is important.
6. Explain, using examples, the difference between a permutation and a combination.	A combination is a selection from a set of objects where order is not important.
7. Determine the number of combinations of n different elements taken r at a time to solve a problem.	Apply the n C r formula.
8. Solve equations and problems that involve n C r.	Apply the n C r formula.
9. Expand the powers of a binomial in a variety of ways, including using the Binomial Theorem.	The coefficients of a the binomial expansion are the result of combinations.
10. Expand, using the binomial theorem $(x + y)^n$.	Binomial expansion is done using a formula for the variables and Pascal's Triangle for the coefficients of the binomial expansion.

Curricular Competencies in Action

1. Apply the fundamental counting principle, also known as the multiplication principle.

2. Determine the number of permutations of n elements taken both n or r at time.

3. Determine the number of combinations of n different elements taken r at time to solve problems.

4. Expand powers of binomials in a variety of ways, including using the binomial theorem.

5. Pascal's triangle is constructed using combinations. The coefficients of a binomial expansion

can be found on the triangle.

CORE COMPETENCIES IN ACTION

Students will focus on the following core competencies in this unit :

- **Communication** : Acquire and **communicate** mathematical ideas using appropriate language, equations, graphs and graphing technology, oral presentations.
- **Creative thinking** :Collaboratively develop, **analyze**, and carry out problem solving and research based mathematical activities.
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- **Critical thinking**: visualize to explore, investigate and illustrate mathematical concepts and relationships.
- **First Peoples Principles of Learning** (FPPL) : Connect mathematical concepts to each other and to other areas and personal interests.

FIRST PEOPLES PRINCIPLES OF LEARNING (FPPL)

Over the course of the semester, students will incorporate from FPPL :

- Learning is holistic, reflexive, experiential, and relational (focused on connectedness, on reciprocal relationships, and a sense of place).
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- Learning involves patience and time.
- Learning involves exploration of one's identity eg. how has mathematics influenced you in the past present, and how will it impact you in the future.
- Engage in problem-solving experiences that are connected to local **First Peoples** communities, the local community, and other cultures.
- Incorporate **First Peoples** world views and perspectives to make connections to mathematical concepts.

TRANSFER/EXTENSION : The students will see applications of permutations and combinations in games of chance like cards and dice .

FORMATIVE ASSESSMENT : Students will regularly check each other's work. The student will self assess themselves regularly in each of the units of study. Teacher and student will have two or three meetings to discuss grades, work habits, core competencies e.g. assignment accountability (positive, personal, & cultural identity) and recognition of FPPL.

SUMMATIVE ASSESSMENT: There will be math labs where Pascal's Triangle is put together using combinations, card games like poker to investigate combinations and the fundamental counting principle to help the student connect the concepts of combinations and fundamental counting together. The traditional forms of evaluation including tests and quizzes will form the bulk of the summative assessment.

FINAL ASSESSMENT

Summative Assessment	= 80%
Formative Assessment	= 15 %
Grade Reporting (Teacher-student meeting)	= **5 %**
	100 %