GRADE 11 / GRADE 12
COURSE: PRECALCULUS

The understandings, knowledge and skills gained through the algebra and geometry courses continue to apply throughout precalculus and trigonometry. Precalculus and Trigonometry integrates, extends and applies the concepts from algebra and geometry. Probability is also extended in this course through the study of combinatorics.

Note: knowledge and skills bullets that have an asterisk* are expected to be fully achieved by accelerated students only. Standard students may be exposed to these ideas, but are not expected to have achieved mastery.

Understanding **Students will understand that:**	**Questions**	**Knowledge** **Students will know the**:	**Skills** **Students will be able to:**
Relations and functions are used to describe physical relationships in the real world.	• How do we use relations and functions to describe physical relationships in the real world? • How do we interpret relations and functions through their graphic, algebraic and numeric representations? • How do we use technology to examine functions?	• Shape of a graph based upon the equation given • General equation or equations of a relation based upon the shape of its graph • Meaning of domain and range, especially as it is represented using interval notation • Meaning of continuity • Relationship between a function and its inverse	• Find vertical and horizontal asymptotes and removable discontinuities. • Graph *transformation* functions from a *parent function*. • Graph piecewise functions specifying domain and range • Sketch rational functions and their inverses specifying domain and range • Perform algebraic operations on functions • Find zeros and extrema algebraically and graphically • Analyze the graphs of functions and relations

Understanding **Students will understand that:**	**Questions**	**Knowledge** **Students will know the**:	**Skills** **Students will be able to:**
Complex numbers includes all sets of numbers.	• How does the nature of roots broaden with the use of complex numbers? • How are complex number solutions represented graphically?	• Meaning and origin of *i* • Properties of complex numbers • Connection between the graph of a function and any complex solutions of the related equation • Different sets of numbers that make up the complex number system • The connection between logarithmic and exponential function (as inverses)	• Identify each type of number • Write a number in complex form: $a + bi$ • Perform operations with complex numbers • Use complex numbers to factor some polynomials • Solve logarithmic and exponential equations
Polar coordinates introduce a different coordinate system.	• How are polar coordinates related to rectangular coordinates? • When is it appropriate to use the polar coordinate system? • Why is the polar coordinate system useful?	• The methods needed to convert from one system to another. • How to recognize the graphs of polar equations	• Convert between polar coordinates and rectangular coordinates • Convert between polar equations and rectangular equations • Convert between polar and rectangular form of complex numbers • Graph polar equations • Use appropriate operations of complex numbers in polar form (including roots & powers) • Predict or describe the graph of a given polar equation

Understanding **Students will understand that:**	**Questions**	**Knowledge** **Students will know the**:	**Skills** **Students will be able to:**
Trigonometric functions are periodic.	• Why are trigonometric functions periodic? • What are the differences/similarities among the behaviors of the 6 basic trigonometric functions?	• Periodic behavior of trigonometric functions • Relationship between a parent function and its various transformations • Vocabulary related to periodic functions	• Graph the 6 basic trigonometric functions and their inverses • Write the equation of a function from its graph • Graph the function from its equation without a calculator • Calculate frequency, amplitude and phase shift • Perform different types of transformations - translations, dilations, reflections
The trig functions can be used to create models to solve real world problems.	• How does the periodic nature of the trigonometric functions help to solve problems?	• Types of problems that require trigonometric functions (ferris wheel, tuning fork)	• Answer questions about calculations related to sinusoidal behavior • Create equations and graphs that model sinusoidal behavior using data.
Trigonometry is a discipline that is based on the study of triangles (ratios and similar triangles)	• How does the analysis of the unit circle generate right triangle ratios? • How does the study of the 6 basic functions incorporate the study of right triangle trigonometry? • How do the ratios create the asymptotic behavior of some trig functions? • How are the trign. Identities formed?	• Recognize the asymptotic behavior of some trig functions • Six basic trig functions • Equation of a circle • Reciprocal identities, Pythagorean identities and ratio identities • Half-angle formulas, double-angle formulas, laws of sines and cosines	• Calculate the 6 trigonometric functions using right triangles • Write and apply the equation of a circle • Find the angles given the ratios • Use the inverse trigonometric functions to find angles • Describe the asymptotic behavior of some trigonometric functions • Solve trigonometric equations involved in applications • Apply the laws of sines and cosines

Understanding **Students will understand that:**	**Questions**	**Knowledge** **Students will know the**:	**Skills** **Students will be able to:**
Trigonometry is connected to other strands of mathematics, other disciplines & prior learning	• How is trigonometry connected to other strands of mathematics, other disciplines and prior learning?	• Equation of a circle, Pythagorean theorem and distance formula and how they connect to the unit circle • Triangle relationships from geometry • Methods for solving quadratic equations that help to solve trigonometric equations • Sinusoidal models and their connection to science and navigation • Historical reasons for the development of trigonometry	• Create the equation of any circle using the Pythagorean theorem , distance formula, and midpoint formula • Simplify radicals • Solve systems of equations
Limit is a concept that enables us to mathematically describe the tendencies of a function. (introductory concept)	• How do we apply limits to functions? • What do the different results of finding a limit signify about the function?	• Connection between limits and the value of *e* • Connection between limits and growth & decay • Connection between limits and the idea of "approaching".	• Calculate limits as the independent variable approaches +/- infinity or as it approaches a constant from the left or right • Determine location of asymptotes and holes based on limit information • Determine whether a function is continuous or discontinuous • Describe limits by looking at a graph, pattern or chart, or from analytic work done with a function.

Understanding **Students will understand that:**	**Questions**	**Knowledge** **Students will know the**:	**Skills** **Students will be able to:**
There are a variety of ways to represent, model, and analyze data and to predict future events.	• How can we use data to interpret events in the physical world and in our society? • How do we use probability to predict future events? • How do we choose the best model to represent the data? • How reliable is the model that we choose? • How are combinations and permutations used in probability computations? • How do we use sequences and series to represent data?	• Connection between limits and the idea of "approaching". • Vocabulary and symbols related to statistics and probability. • Box & whisker, scatter plots, histograms • Differences between sequences and series • Connection of sequences and series to disciplines such as physics, chemistry, finance, medicine, ecology, and fractal geometry	• Identify and use the different methods of representing data. • Perform linear and quadratic regression with and without a calculator. • Count using combinations and permutations. • Use the binomial theorem • Recognize arithmetic and geometric series and their sums if they exist • Determine the general term of a sequence or series • Make connections between the sequences and their graphs, rules, and domains • Perform proofs by induction • Determine whether an infinite sequence has a limit • Describe the statistics, verbally or in written form, that are evident in any representation of data. • Describe the meaning of any situation involving probability of the occurrence of an event.