PreCalculus (Grades 11-12)

Course Description:

The curriculum for this course is developed from the Common Core State Standards for Mathematics and the AP College Board This course is designed to cover a wide variety of Advanced Algebra topics. Many different functions, including polynomial, rational, logarithmic and exponential are explored and used to connect the math classroom to the outside world.The different conic sections are studied in greater detail than in Advanced Algebra. Polar coordinates are introduced and worked with for the first time. Students will then begin to investigate calculus concepts such as limits, and derivatives.

Essential Understandings:

1. Transformations of functions can be represented both algebraically and graphically, and these graphical representations help to provide insight into a function's behavior. (F-IF.4, F-IF.7, F-BF.3, F-BF.4)
2. The logarithmic and exponential functions are inverses of each other and are used to model real life phenomenon such as radioactive decay, population growth, and the magnitude of earthquakes. (F-IF.7, F-IF.8, F-BF.5, F-LE.4)
3. Conic sections (Parabolas, Circles, Ellipses, and Hyperbolas) all have unique characteristics and their equations and graphs model such real life situations as the path of a missile on earth, the orbits of the planets around the sun. (G-GPE.1, G-GRE.2, G-GPE.3)
4. Polar coordinates are an alternative, and often easier way, to specify location in the coordinate plane. (N-CN.4, N-CN.5, N-CN.6)
5. The concepts of limit and continuity are the foundations of calculus and allows for the development of the derivative. (EU 1.1, EU 1.2, EU 2.1, EU 2.2)

Unit	Description of Unit and Learning Targets
Functions and Their Graphs • What does a function represent? • How will this unit be different from previous work involving functions? • Do functions have any characteristics that are similar? How can they differ?	In this unit students will investigate and model a variety of functions. Functions from previous Algebra classes (such as linear, and quadratic) are reviewed. Other functions such as the signum function is introduced. Functions will be visualized using technology and their properties described using notation and terminology that will be used throughout the course. Learning Targets: • I can identify key features of functions from their graphs Key features include: intercepts; intervals where the function is increasing, decreasing, relative maximums and minimums; symmetries; end behavior; and periodicity. • I can graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. • I can identify how a function changes and make the proper transformations to the graph of a function of the form y = a f[b(x+c)] + d for various values of a, b, c, and d. • I can find the inverse of a function when it exists and understand why not all functions have inverses.
Exponential and Logarithmic Functions • Where do logarithmic and exponential	In this unit students will use the logarithmic and exponential functions to model a variety of natural occurring events, such as population growth, radioactive decay and compound interest.

functions occur in nature? ● How were logarithms developed?	Learning Targets: ● I can graph exponential and logarithmic functions and discuss key features of the graph. ● I can rewrite a logarithmic function as an exponential function and vice versa. ● I can discuss relationship between exponential and logarithmic functions and use this relationship to solve problems involving logarithms and/or exponents. ● I can write logarithmic functions using multiple bases.
Conic Sections ● Where do conic sections exist in the real world? ● Do the different conic sections have any similar characteristics? How do they differ?	In this unit we review the circle and the parabola and their equations. These are conic sections that have been studied in previous Algebra classes. Then we explore the remaining conic sections; the ellipse and the hyperbola. Definitions for ellipses and hyperbolas will be given and used to derive equations for both. Examples of where conic sections occur in nature will be discussed. Learning Targets: ● I can write the equation of a circle given its characteristics and graph a circle given its equation. ● I can write the equation of a parabola given its characteristics and graph a parabola given its equation. ● I can write the equation of an ellipse given its characteristics and graph a given its equation. ● I can write the equation of a hyperbola given its characteristics and graph a hyperbola given its equation.
Polar Equations ● How does a polar equation differ from other equations we have studied? ● What can be done with polar coordinates that can't be done with cartesian coordinates?	This short unit will expose students to polar equations. Polar equations provide an alternative way to write the equations of conic sections. Polar coordinates also allow us to graph some interesting functions known as limacons, cartiods, and roses. Learning Targets: ● I can write cartesian equations in polar form and vice versa. ● I can graph polar equations. ● I can use polar coordinates to carry out operations on complex numbers. ● I can use polar coordinates to calculate distance in the complex plane.
Introduction to Calculus ● Why was Calculus developed? ● Where is Calculus used?	In this unit students will be introduced to the key concept of limit and will use the concept of limit to develop the Calculus concept of a derivative. Learning Targets: ● I can determine the limit of a function at a value in the domain and use it to discuss the behavior of the function. ● I can use the concept of a limit to determine continuity of a function. ● I can find the derivative of a function using limits and the difference quotient (i.e. slope formula). ● I can use derivatives to understand the behavior of functions.