Pre-Calculus (#9400)

Description This course is a foundation course for college-level mathematics classes. The topics covered include functions and their graphs; the circular functions (sin, cos, tan, sec, csc, and cot); inverse trigonometric functions, and other periodic functions; polar and parametric equations; conic sections; sequences and series; and vectors and their applications. Calculators are an integral part of the course.

Credits 1

Prerequisites Algebra 2 for Pre-Calculus

Textbooks/Resources Carter, Guevas, Day, Malloy, *Precalculus*. McGraw-Hill Education, 2014. (ISBN 9780076641833)

Required Assessments District-wide, standards-based assessments

Board Approved November 2009

Revised August 2016

AASD Mathematics Goals for K-12 Students

- *Become mathematical problem solvers.*
- *Learn to reason mathematically.*
- *Learn to communicate mathematically.*
- *Make mathematical connections.*
- *Develop conceptual understanding of mathematics.*
- *Develop procedural fluency.*
- *Learn to use technology appropriately.*

AASD Mathematics Standards for Students in Pre-Calculus

Mathematical Practice Standards

1. Make Sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Mathematics Content Standards			
Domain		***Cluster***	
I.	Mathematical Processes	A.	Use of mathematical knowledge, skills and strategies to solve mathematical, real-world and non-routine problems: reasoning
		B.	Use of mathematical knowledge, skills and strategies to solve mathematical, real-world and non-routine problems: oral and written communication
		C.	Use of mathematical knowledge, skills and strategies to solve mathematical, real-world and non-routine problems: use of appropriate technology
II.	Number Operations & Relationships	A.	Use numbers effectively for counting
		B.	Use numbers effectively for measuring
		C.	Use numbers effectively for estimating
		D.	Use numbers effectively for problem solving
III.	Geometry	A.	Use geometric concepts to interpret, represent and solve problems
		B.	Use geometric relationships to interpret, represent and solve problems
		C.	Use geometric procedures to interpret, represent and solve problems
IV.	Measurement	A.	Select and use appropriate tools and techniques to measure to a specified degree of accuracy
		B.	Use measurements in problem-solving situations
V.	Statistics & Probability	A.	Use data collection and analysis
		B.	Use statistics in problem-solving situations
		C.	Use probability in problem-solving situations
VI.	Algebraic Relationships	A.	Discover, describe and generalize simple and complex patterns and relationships
		B.	Use algebraic techniques to define and describe real-world problems to determine and justify appropriate solutions

Essential Learning Objectives	Performance Indicators	Classroom Assessment
1. Develop deep conceptual understanding of mathematics by engaging in age-appropriate mathematical habits.	**Performance will be satisfactory when the student:** a. makes sense of problems and perseveres in solving them. b. reasons abstractly and quantitatively. c. constructs viable arguments and critiques the reasoning of others. d. models with mathematics. e. uses appropriate tools strategically. f. attends to precision. g. looks for and makes use of structure. h. looks for and expresses regularity in repeated reasoning.	• Unit Assessment
Objectives are linked to the Mathematical Practice Standards.		
2. Review Logarithms and Exponential Equations.	**Performance will be satisfactory when the student:** a. converts between logarithmic and exponential form. b. simplifies log and exp expressions using properties of logs. c. solves log and exponential equations including growth and decay and other real world problems involving exponentials. d. graphs simple exponential and log functions.	• Unit assessment
Objectives are linked to the following AASD Mathematics Domains: I. Mathematical Processes; II. Number Operations and Relationships; VI. Algebraic Relationships		
3. Interpret, graph, and analyze various functions	**Performance will be satisfactory when the student:** a. graphs radical, polynomial, absolute value, rational, exponential, and logarithmic functions with appropriate transformations; and utilizes various techniques for curve sketching including plotting points, and recognizing patterns and relationships. b. evaluates and interprets the composition of functions. c. determines the inverse of a function. d. solves equations and inequalities involving all types of functions listed in part a. e. determines characteristics of functions such as domain, range, maxima, minima, intercepts, increasing and decreasing intervals, asymptotes, and end behavior. f. use long division to factor or divide polynomial functions.	• Unit assessment
Objectives are linked to the following AASD Mathematics Domains: I. Mathematical Processes; II. Number Operations and Relationships; IV. Measurement; VI. Algebraic Relationships		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
4. Define and apply the concepts of trigonometric functions.	**Performance will be satisfactory when the student:** a. explores various periodic functions and the concepts of fundamental period. b. uses the definitions of sine and cosine to define the tangent, cotangent, secant, and cosecant. c. finds the exact values of cos x and sin x for special values of x. d. shows the locations of the values of cos x and sin x on the unit circle. e. determines values of the four other circular functions by using known values for sine and cosine. f. applies the properties of the functions and the values obtained to graph the six circular functions over specified intervals of values for x, using appropriate terminology. g. graphs inverse circular functions (arcsin, arccos, arctan) including limitations on the domains and ranges. h. derives the properties and identities of the circular functions (e.g., Pythagorean identity, odd/even). i. uses appropriate algebraic and geometric methods to solve equations that include circular functions. j. utilizes technology to facilitate computation and graphing of circular functions and their inverses. k. models periodic real-world phenomena using circular functions. l. applies the trigonometric functions to solving right triangle problems. m. applies the Law of Sines and Law of Cosines to situations involving general triangles	• Unit assessment
Objectives are linked to the following AASD Mathematics Domains: I. Mathematical Processes; III. Geometry; IV. Measurement; VI. Algebraic Relationships		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
5. Use various graphing techniques.	**Performance will be satisfactory when the student:** a. explores the concepts related to trigonometric functions including amplitude, period, vertical shift, and phase shift. b. sketches manually the graph of a function by applying at least two transformations to a graph of the type y=cos x. c. analyzes various types of trigonometric graphs to determine domain, range, asymptotes, relative maximums or minimums, intercepts, and asymptotes. d. utilizes technology to assist in the process of graphical analysis. e. graphs using equations in parametric form and converting from parametric to standard form of an equation.	• Unit assessment
Objectives are linked to the following AASD Mathematics Domains: I. Mathematical Processes; III. Geometry; IV. Measurement; VI. Algebraic Relationships		
6. Apply the theory of vectors.	**Performance will be satisfactory when the student:** a. uses the basic vector definitions and properties including vector addition and subtraction, scalar multiplication, norm and direction angle, dot product, and angle between vectors. b. shows the relationship of the magnitude and directional angle to the components of a vector. c. uses the magnitude and directional angle of a vector. d. determines relationships between algebraic and geometric representations of vectors. e. utilizes vectors to analyze and solve real-world situations (e.g., navigation, forces, energy and work).	• Unit assessment
Objectives are linked to the following AASD Mathematics Domains: I. Mathematical Processes; III. Geometry; IV. Measurement; VI. Algebraic Relationships		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
7. Develop and analyze the conic sections	**Performance will be satisfactory when the student:** a. develops the equation in various forms for each conic section: circle, parabola, ellipse, and hyperbola. b. identifies the appropriate conic section given information about the curve such as focus, directrix, vertex, axis, center, or asymptotes. c. sketches the graph of a conic section given the equation or information concerning the conic. d. changes the form of the equation from general to standard form and vice versa. e. utilizes technology to assist in the analysis of the various conics. f. applies the properties and equations of conic sections to real-world situations (ie science, engineering, astronomy, physics, and related fields). g. identifies degenerate conic sections and their classifications.	• Unit assessment
Objectives are linked to the following AASD Mathematics Domains: I. Mathematical Processes; II. Number Operations and Relationships; III. Geometry; IV. Measurement: VI. Algebraic Relationships		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
8. Use the concepts of polar coordinates and complex numbers.	**Performance will be satisfactory when the student:** a. uses basic properties and definitions including pole, polar axis, and direction to describe polar coordinates. b. transforms polar coordinate and equations to Cartesian coordinates and equations and vice-versa. c. utilizes definitions and properties including symmetry and trigonometry to graph polar equations. d. utilizes technology to assist in the analysis of polar equations. e. expresses complex numbers in polar form. f. explores the connection among vectors, polar coordinates, and trigonometric representations of complex numbers.	• Unit assessment
Objectives are linked to the following AASD Mathematics Domains: I. Mathematical Processes; II. Number Operations and Relationships; III. Geometry; IV. Measurement; VI. Algebraic Relationships		
9. Introduce Sequences and Series.	**Performance will be satisfactory when the student:** a. identifies sequences and series as arithmetic or geometric. b. finds terms from recursive and explicit definitions of arithmetic and geometric sequences. c. finds sums of finite arithmetic and geometric series. d. finds sums of infinite geometric series. e. uses summation notation to find or indicate the sum of a given series.	• Unit assessment
Objectives are linked to the following AASD Mathematics Domains: I. Mathematical Processes; II. Number Operations and Relationships; VI. Algebraic Relationships		