MIDLAND ISD
ADVANCED PLACEMENT CURRICULUM STANDARDS

	PRECALCULUS	
TEKS	**COLLEGE BOARD**	**COLLEGE AND CAREER READINESS STDS**
(1) The student defines functions, describes characteristics of functions, and translates among verbal, numerical, graphical, and symbolic representations of functions, including polynomial, rational, power (including radical), exponential, logarithmic, trigonometric, and piecewise-defined functions. The student is expected to: **(A)** describe parent functions symbolically and graphically, including $f(x) = x^n$, $f(x) = \ln x$, $f(x) = \log_a x$, $f(x) = 1/x$, $f(x) = e^x$, $f(x) = \|x\|$, $f(x) = a^x$, $f(x) = \sin x$, $f(x) = \arcsin x$, etc.; **(B)** determine the domain and range of functions using graphs, tables, and symbols; **(C)** describe symmetry of graphs of even and odd functions; **(D)** recognize and use connections among significant values of a function (zeros, maximum values, minimum values, etc.), points on the graph of a function, and the symbolic representation of a function; and **(E)** investigate the concepts of continuity, end behavior, asymptotes, and limits and connect these characteristics to functions represented graphically and numerically.	**Standard PC.1: Properties of Families of Functions** **PC.1.1** Student investigates behavior of functions and their related equations, and student compares and contrasts properties of families of functions and their related equations. **PC.1.2** Student examines and applies basic transformations of functions and investigates the composition of two functions in mathematical and real-world situations. **Standard PC.2: Trigonometric Functions** **PC.2.1** Student solves problems involving measures in triangles by applying trigonometric functions of the degree or radian measure of a general angle and shifts from primarily viewing trigonometric functions as based on degree measure to viewing them as functions based on radian measure, and ultimately to viewing them as general periodic functions of real numbers. Student investigates the properties of trigonometric functions, their inverse functions, and their graphical representations. **PC.2.2** Student uses transformations of trigonometric functions, their properties, and their graphs to model and solve trigonometric equations and a variety of	**I. Numeric Reasoning** **A. Number representation** **1.** Compare real numbers. **2.** Define and give examples of complex numbers. **B. Number operations** **1.** Perform computations with real and complex numbers. **C. Number sense and number concepts** **1.** Use estimation to check for errors and reasonableness of solutions. **II. Algebraic Reasoning** **A. Expressions and equations** **1.** Explain and differentiate between expressions and equations using words such as "solve," "evaluate," and "simplify." **B. Manipulating expressions** **1.** Recognize and use algebraic (field) properties concepts, procedures, and algorithms to combine, transform, and evaluate expressions (e.g., polynomials, radicals, rational expressions). **C. Solving equations, inequalities, and systems of equations** **1.** Recognize and use algebraic (field) properties concepts, procedures, and algorithms to solve equations, inequalities, and systems of linear equations. **2.** Explain the difference between the solution

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(2) The student interprets the meaning of the symbolic representations of functions and operations on functions to solve meaningful problems. The student is expected to: **(A)** apply basic transformations, including a • f(x), f(x) + d, f(x - c), f(b • x), and compositions with absolute value functions, including |f(x)|, and f(|x|), to the parent functions; **(B)** perform operations including composition on functions, find inverses, and describe these procedures and results verbally, numerically, symbolically, and graphically; and **(C)** investigate identities graphically and verify them symbolically, including logarithmic properties, trigonometric identities, and exponential properties. **(3) The student uses functions and their properties, tools and technology, to model and solve meaningful problems. The student is expected to:** **(A)** investigate properties of trigonometric and polynomial functions; **(B)** use functions such as logarithmic, exponential, trigonometric, polynomial, etc. to model real-life data; **(C)** use regression to determine the appropriateness of a linear function to model real-life data (including using technology to determine the correlation coefficient);	problems. **Standard PC.3: Conic Sections and Polar Equations** **PC.3.1** Student develops and represents conic sections from their locus descriptions, illustrating the major features and graphs. Student uses conic sections and their properties to model mathematical and real-world problem situations. **PC.3.2** Student represents points and curves in rectangular and polar forms and finds equivalent polar and rectangular representations for points and curves. **Standard PC.4: Structure of Sequences and Recursion** **PC.4.1** Student categorizes sequences as arithmetic, geometric, or neither and develops formulas for the general terms and sums related to arithmetic and geometric sequences. **PC.4.2** Student develops recursive relationships for modeling and investigating patterns in the long-term behavior of their associated sequences. **Standard PC.5: Vectors and Parametric Equations** **PC.5.1** Student applies vector concepts in	set of an equation and the solution set of an inequality. **D. Representations** **1.** Interpret multiple representations of equations and relationships. **2.** Translate among multiple representations of equations and relationships. **III. Geometric Reasoning** **A. Figures and their properties** **1.** Identify and represent the features of plane and space figures. **2.** Make, test, and use conjectures about one-,two-,and three-dimensional figures and their properties. **3.** Recognize and apply right triangle relationships including basic trigonometry. **B. Transformations and symmetry** **1**. Identify and apply transformations to figures. **2.** Identify the symmetries of a plane figure. **3**. Use congruence transformations and dilations to investigate congruence, similarity, and symmetries of plane figures. **C. Connections between geometry and other mathematical content strands** **1.** Make connections between geometry and algebra. **2.** Make connections between geometry, statistics, and probability.

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(D) use properties of functions to analyze and solve problems and make predictions; and **(E)** solve problems from physical situations using trigonometry, including the use of Law of Sines, Law of Cosines, and area formulas and incorporate radian measure where needed. **(4) The student uses sequences and series as well as tools and technology to represent, analyze, and solve real-life problems. The student is expected to:** **(A)** represent patterns using arithmetic and geometric sequences and series; **(B)** use arithmetic, geometric, and other sequences and series to solve real-life problems; **(C)** describe limits of sequences and apply their properties to investigate convergent and divergent series; and **(D)** apply sequences and series to solve problems including sums and binomial expansion. **(5) The student uses conic sections, their properties, and parametric representations, as well as tools and technology, to model physical situations. The student is expected to:** **(A)** use conic sections to model motion, such as the graph of velocity vs. position of a pendulum and motions of planets;	two dimensions to represent, interpret, and solve problems. **PC.5.2** Student applies parametric methods to represent and interpret motion of objects in the plane. **Standard PC.6: Bivariate Data and Trend-Line Models** **PC.6.1** Student assesses association in tables and scatterplots of bivariate numerical data and uses the correlation coefficient to measure linear association. Student develops models for trends in bivariate data using both median-fit lines and least-squares regression lines. **PC.6.2** Student examines the influence of outliers on the correlation and on models for trend. **PC.6.3** Student examines the effects of transformations on measures of center, spread, association, and trend and develops basic techniques for modeling and more-advanced data analytic techniques.	**3.** Make connections between geometry and measurement. **D. Logic and reasoning in geometry** **1.** Make and validate geometric conjectures. **2.** Understand that Euclidean geometry is an axiomatic system. **IV. Measurement Reasoning** **A. Measurement involving physical and natural attributes** **1.** Select or use the appropriate type of unit for the attribute being measured. **B. Systems of measurement** **1.** Convert from one measurement system to another. **2.** Convert within a single measurement system. **C. Measurement involving geometry and algebra** **1.** Find the perimeter and area of two-dimensional figures. **2.** Determine the surface area and volume of three-dimensional figures. **3.** Determine indirect measurements of figures using scale drawings, similar figures, the Pythagorean Theorem, and basic trigonometry. **D. Measurement involving statistics and probability** **1.** Compute and use measures of center and spread to describe data. **2.** Apply probabilistic measures to practical

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(B) use properties of conic sections to describe physical phenomena such as the reflective properties of light and sound; (**C**) convert between parametric and rectangular forms of functions and equations to graph them; and **(D)** use parametric functions to simulate problems involving motion. **(6) The student uses vectors to model physical situations. The student is expected to:** **(A)** use the concept of vectors to model situations defined by magnitude and direction; and **(B)** analyze and solve vector problems generated by real-life situations.		situations to make an informed decision. **V. Probabilistic Reasoning** **A. Counting principles** **1.** Determine the nature and the number of elements in a finite sample space. **B. Computation and interpretation of probabilities** **1.** Compute and interpret the probability of an event and its complement. **2.** Compute and interpret the probability of conditional and compound events. **VI. Statistical Reasoning** **A. Data collection** **1**. Plan a study. **B. Describe data** **1**. Determine types of data. **2.** Select and apply appropriate visual representations of data. **3.** Compute and describe summary statistics of data. **4.** Describe patterns and departure from patterns in a set of data. **C. Read, analyze, interpret, and draw conclusions from data** **1.** Make predictions and draw inferences using summary statistics. **2.** Analyze data sets using graphs and summary statistics.

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		3. Analyze relationships between paired data using spreadsheets, graphing calculators, or statistical software.
		4. Recognize reliability of statistical results.
		VII. Functions
		A. Recognition and representation of functions
		1. Recognize whether a relation is a function.
		2. Recognize and distinguish between different types of functions.
		B. Analysis of functions
		1. Understand and analyze features of a function.
		2. Algebraically construct and analyze new functions.
		C. Model real world situations with functions
		1. Apply known function models.
		2. Develop a function to model a situation.
		VIII. Problem Solving and Reasoning
		A. Mathematical problem solving
		1. Analyze given information.
		2. Formulate a plan or strategy.
		3. Determine a solution.
		4. Justify the solution.
		5. Evaluate the problem-solving process.
		B. Logical reasoning
		1. Develop and evaluate convincing arguments.
		2. Use various types of reasoning.

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		C. Real world problem solving **1.** Formulate a solution to a real world situation based on the solution to a mathematical problem. **2.** Use a function to model a real world situation. **3.** Evaluate the problem-solving process. **IX. Communication and Representation** **A. Language, terms, and symbols of mathematics** **1.** Use mathematical symbols, terminology, and notation to represent given and unknown information in a problem. **2.** Use mathematical language to represent and communicate the mathematical concepts in a problem. **3**. Use mathematics as a language for reasoning, problem solving, making connections, and generalizing. **B. Interpretation of mathematical work** **1.** Model and interpret mathematical ideas and concepts using multiple representations. **2.** Summarize and interpret mathematical information provided orally, visually, or in written form within the given context. **C. Presentation and representation of mathematical work** **1.** Communicate mathematical ideas, reasoning, and their implications using symbols, diagrams,

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		graphs, and words. **2.** Create and use representations to organize, record, and communicate mathematical ideas. **3.** Explain, display or justify mathematical ideas and arguments using precise mathematical language in written or oral communication. **X. Connections** **A. Connections among the strands of mathematics** **1.** Connect and use multiple strands of mathematics in situations and problems. **2.** Connect mathematics to the study of other disciplines. **B. Connections of mathematics to nature, real world situations, and everyday life** **1.** Use multiple representations to demonstrate links between mathematical and real world situations. **2.** Understand and use appropriate mathematical models in the natural, physical, and social sciences. **3.** Know and understand the use of mathematics in a variety of careers and professions.