AP Pre-Calculus
Overview
2024-2025

This document is designed provide parents/guardians/community an overview of the curriculum taught in the FBISD classroom. This document supports families in understanding the learning goals for the course, and how students will demonstrate what they know and are able to do. The overview offers suggestions or possibilities to reinforce learning at home.

Included at the end of this document, you will find:

- A glossary of curriculum components
- The content area instructional model
- Parent resources for this content area

To advance to a particular grading period, click on a link below.

At Home Connections

The following are suggestions for reinforcing number sense and mathematical reasoning at home. These ideas can be used throughout the school year. You will find additional ideas to reinforce learning at home within each unit below.

- Ask questions that require students to describe and elaborate on their thinking and reasoning. Topics can be about everyday things as well as mathematics.
- Engage students in situations that challenge them to inquire and persevere through questioning.
- Play card games with students
- Play games with students such as Mancala, Yahtzee, Blokus, Rack-O, Mastemind, etc.
- Work number puzzles such as Sudoku, KenKen, Kakuro, or Numbrix.

Grading Period 1

Unit 1: Polynomial and Rational Functions

Estimated Date Range: Aug. 8 – Sept. 26
Estimated Time Frame: 35 days

Unit Overview: This unit will include the study of polynomial and rational functions.
For a complete overview of this unit please refer *Developing Understanding* on page 27 of the AP Pre-Calculus Course and Exam Description.

At home connections:

- Discuss and research real-world applications of polynomial functions.
- Discuss similarities and differences between the different types of functions – power, piecewise and polynomial.

Concepts within the Unit	AP Learning Objectives
Concept #1: Functions and Rate of Change (Topics 1.1, 1.2, 1.3)	1.1A Describe how the input and output values of a function vary together by comparing function values. 1.1B Construct a graph representing two quantities that vary with respect to each other in a contextual scenario

	1.2A Compare the rates of change at two points using average rates of change near the points 1.2B Describe how two quantities vary together at different points and over different intervals of a function 1.3A Determine the average rates of change for sequences and functions, including linear, quadratic, and other function types. 1.3B Determine the change in the average rates of change for linear, quadratic, and other function types.
Concept #2: Polynomial Functions (Topics 1.4, 1.5, 1.6)	1.4A Identify key characteristics of polynomial functions related to rates of change. 1.5A Identify key characteristics of a polynomial function related to its zeros when suitable factorizations are available or with technology. 1.5B Determine if a polynomial function is even or odd 1.6A Describe end behaviors of polynomial functions
Concept #3: Rational Functions (Topics 1.7, 1.8, 1.9, 1.10)	1.7A Describe end behaviors of rational functions 1.8A Determine the zeros of rational functions 1.9A Determine vertical asymptotes of graphs of rational functions 1.10A Determine holes in graphs of rational functions
Concept #4: Applications and Modeling of Functions (Topics 1.11, 1.12, 1.13, 1.14)	1.11A Rewrite polynomial and rational expressions in equivalent forms 1.11B Determine the quotient of two polynomial function using long division 1.11C Rewrite the repeated product of binomials using the binomial theorem 1.12A Construct a function that is an additive and/or multiplicative transformation of another function. 1.13A Identify an appropriate function type to construct a function model for a given scenario. 1.13B Describe assumptions and restrictions related to building a function model. 1.14A Construct a linear, quadratic, cubic, quartic, polynomial of degree *n*, or related piecewise-defined function model. 1.14B Construct a rational function model based on a context. 1.14C Apply a function model to answer questions about a data set or contextual scenario.
Unit 2: Exponential and Logarithmic Functions (Continues in Grading Period 2) Estimated Date Range: Sept. 30 – Dec. 20 Estimated Time Frame: 48 Days *See Grading Period 2 for details*	

Grading Period 2

Unit 2: Exponential and Logarithmic Functions (continued)

Estimated Date Range: Sept. 30 – Dec. 20

Estimated Time Frame: 48 Days

Unit Overview: This unit will include the study of *Exponential and Logarithmic Functions*.

For a complete overview of this unit please refer *Developing Understanding* on page 53 of the AP Pre-Calculus Course and Exam Description.

At home connections:

- Discuss and research real-world applications of polynomial functions.
- Discuss similarities and differences between exponential and logarithmic functions.
- Discuss what the word inverse means (not just mathematically) and how to verify that exponential functions and logarithmic functions are inverses.

Concepts within the Unit	AP Learning Objectives
Concept #1: Exponential Functions (Topics 2.1, 2.2, 2.3, 2.4, 2.5, 2.6)	2.1A Express arithmetic sequences found in mathematical and contextual scenarios as functions of the whole numbers. 2.1B Express geometric sequences found in mathematical and contextual scenarios as functions of the whole numbers. 2.2A Construct functions of the real numbers that are comparable to arithmetic and geometric sequences. 2.2B Describe similarities and differences between linear and exponential functions. 2.3A Identify key characteristics of exponential functions 2.4A Rewrite exponential expression in equivalent forms 2.5A Construct a model for situations involving proportional output values over equal-length input-value intervals. 2.5B Apply exponential models to answer questions about a data set or contextual scenario. 2.6A Construct linear, quadratic, and exponential models based on a data set. 2.6B Validate a model constructed from a data set.
Concept #2: Logarithmic Functions (Topics 2.7. 2.8, 2.9, 2.10, 2.11)	2.7A Evaluate the composition of two or more functions for given values. 2.7B Construct a representation of the composition of two or more functions. 2.7C Rewrite a given function as a composition of two or more functions. 2.8A Determine the input-output pairs of the inverse of a function. 2.8B Determine the inverse of a function on an invertible domain. 2.9A Evaluate logarithmic expressions 2.10A Construct representations of the inverse of an exponential function with an initial value of 1. 2.11A Identify key characteristics of logarithmic functions.
Concept #3: Exponential and Log Equations and Inequalities (Topics 2.12, 2.13)	2.12A Rewrite logarithmic expression in equivalent forms. 2.13A Solve exponential and logarithmic equations and inequalities. 2.13B Construct the inverse function for exponential and logarithmic functions

Concept #4: Modeling with Exponential and Log Functions (Topics 2.14, 2.15)	2.14A Construct a logarithmic function model. 2.15A Determine if an exponential model is appropriate by examining a semi-log plot of a data set. 2.15B Construct the linearization of exponential data.

Grading Period 3

Unit 3: Trigonometric and Polar Functions (Continues in Grading Period 4)

Estimated Date Range: Jan. 9 – Apr. 4

Estimated Time Frame: 52 days

Unit Overview: This unit will include the study of *Trigonometric and Polar Functions*.
For a complete overview of this unit please refer *Developing Understanding* on page 79 of the AP Pre-Calculus Course and Exam Description.

At home connections:

- Discuss how verifying trig identities relates to proofs.
- Discuss how simplifying trig expressions and solving trig equations relates to previous math courses.
- Explain how the process of verifying trig identities can be applied to something in the real-world.

Concepts within the Unit	AP Learning Objectives
Concept #1: Periodic Functions (Topics 3.1, 3.2, 3.3)	3.1A Construct graphs of periodic relationships based on verbal representations. 3.1B Describe key characteristics of a periodic function based on a verbal representation. 3.2A Determine the sine, cosine, and tangent of an angle using the unit circle. 3.3A Determine coordinates of points on a circle centered at the origin.
Concept #2: Sinusoidal Functions (Topics 3.4, 3.5, 3.6, 3.7)	3.4A Construct representation of the sine and cosine functions using the unit circle. 3.5A Identify key characteristics of the sine and cosine functions. 3.6A Identify the amplitude, vertical shift, period, and phase shift of a sinusoidal function. 3.7A Construct sinusoidal function models of periodic phenomena.
Concept #3: Other Trigonometric Functions (Topics 3.8, 3.9, 3.10, 3.11)	3.8A Construct representations of the tangent function using the unit circle. 3.8B Describe key characteristics of the tangent function. 3.8C Describe additive and multiplicative transformations involving the tangent function. 3.9A Construct analytical and graphical representations of the inverse of the sine, cosine, and tangent functions over a restricted domain. 3.10A Solve equations and inequalities involving trigonometric functions. 3.11A Identify key characteristics of functions that involve quotients of the sine and cosine functions.

Concept #4: Equivalent Representations of Trig Functions (Topic 3.12)	3.12A Rewrite trigonometric expressions in equivalent forms with the Pythagorean identity. 3.12B Rewrite trigonometric expressions in equivalent forms with sine and cosine sum identities. 3.12C Solve equations using equivalent analytic representations of trigonometric functions.
Concept #5: Polar Functions (Topics 3.13, 3.14, 3.15)	3.13A Determine the location of a point in the plane using both rectangular and polar coordinates. 3.14A Construct graphs of polar functions 3.15A Describe characteristics of the graph of a polar function.

Grading Period 4

Unit 3: Trigonometric and Polar Functions (continued)

Estimated Date Range: Jan. 9 – Apr. 4
Estimated Time Frame: 52 days
See Grading Period 3 for details

Unit 4: Parametric Functions Part 1

Estimated Date Range: Jan. April 7 – April 17
Estimated Time Frame: 9 days

Unit Overview: This unit will include the study of *Parametric Functions*.
For a complete overview of this unit please refer *Developing Understanding* on page 105 of the AP Pre-Calculus Course and Exam Description.

At home connections:

- Discuss and research real-world applications of conic, parametric and polar functions.
- Discuss similarities and differences between conic, parametric and polar functions.

Concepts within the Unit Link to TEKS	AP Learning Objectives
Concept #1: Parametric Functions (Topics 4.1, 4.2, 4.3, and 4.4)	4.1A Construct a graph or table of values for a parametric function represented analytically. 4.2A Identify key characteristics of a parametric planar motion function that are related to position. 4.3A Identify key characteristics of a parametric planar motion function that are related to direction and rate of change. 4.4A Express motion around a circle or along a line segment parametrically.

Unit 5: AP Review

Estimated Date Range: April 22 – May 13
Estimated Time Frame: 16 days

Unit Overview:

At home connections:

- Have your student research sequences that occur in the real-world.
- Have your students explain the difference between different arithmetic and geometric sequences.

Concepts within the Unit	AP Learning Objectives
Concept #1: Polynomial and Rational Functions	1.1A Describe how the input and output values of a function vary together by comparing function values. 1.1B Construct a graph representing two quantities that vary with respect to each other in a contextual scenario 1.2A Compare the rates of change at two points using average rates of change near the points 1.2B Describe how two quantities vary together at different points and over different intervals of a function 1.3A Determine the average rates of change for sequences and functions, including linear, quadratic, and other function types.

	1.3B Determine the change in the average rates of change for linear, quadratic, and other function types. 1.4A Identify key characteristics of polynomial functions related to rates of change. 1.5A Identify key characteristics of a polynomial function related to its zeros when suitable factorizations are available or with technology. 1.5B Determine if a polynomial function is even or odd 1.6A Describe end behaviors of polynomial functions 1.7A Describe end behaviors of rational functions 1.8A Determine the zeros of rational functions 1.9A Determine vertical asymptotes of graphs of rational functions 1.10A Determine holes in graphs of rational functions 1.11A Rewrite polynomial and rational expressions in equivalent forms 1.11B Determine the quotient of two polynomial function using long division 1.11C Rewrite the repeated product of binomials using the binomial theorem 1.12A Construct a function that is an additive and/or multiplicative transformation of another function. 1.13A Identify an appropriate function type to construct a function model for a given scenario. 1.13B Describe assumptions and restrictions related to building a function model. 1.14A Construct a linear, quadratic, cubic, quartic, polynomial of degree *n*, or related piecewise-defined function model. 1.14B Construct a rational function model based on a context. 1.14C Apply a function model to answer questions about a data set or contextual scenario.
Concept #2: Exponential and Logarithmic Functions	2.1A Express arithmetic sequences found in mathematical and contextual scenarios as functions of the whole numbers. 2.1B Express geometric sequences found in mathematical and contextual scenarios as functions of the whole numbers. 2.2A Construct functions of the real numbers that are comparable to arithmetic and geometric sequences. 2.2B Describe similarities and differences between linear and exponential functions. 2.3A Identify key characteristics of exponential functions 2.4A Rewrite exponential expression is equivalent forms 2.5A Construct a model for situations involving proportional output values over equal-length input-value intervals. 2.5B Apply exponential models to answer questions about a data set or contextual scenario. 2.6A Construct linear, quadratic, and exponential models based on a data set. 2.6B Validate a model constructed from a data set. 2.7A Evaluate the composition of two or more functions for given values.

	2.7B Construct a representation of the composition of two or more functions. 2.7C Rewrite a given function as a composition of two or more functions. 2.8A Determine the input-output pairs of the inverse of a function. 2.8B Determine the inverse of a function on an invertible domain. 2.9A Evaluate logarithmic expressions 2.10A Construct representations of the inverse of an exponential function with an initial value of 1. 2.11A Identify key characteristics of logarithmic functions. 2.12A Rewrite logarithmic expression in equivalent forms. 2.13A Solve exponential and logarithmic equations and inequalities. 2.13B Construct the inverse function for exponential and logarithmic functions 2.14A Construct a logarithmic function model. 2.15A Determine if an exponential model is appropriate by examining a semi-log plot of a data set. 2.15B Construct the linearization of exponential data.
Concept #3: Trigonometric and Polar Functions	3.1A Construct graphs of periodic relationships based on verbal representations. 3.1B Describe key characteristics of a periodic function based on a verbal representation. 3.2A Determine the sine, cosine, and tangent of an angle using the unit circle. 3.3A Determine coordinates of points on a circle centered at the origin. 3.4A Construct representation of the sine and cosine functions using the unit circle. 3.5A Identify key characteristics of the sine and cosine functions. 3.6A Identify the amplitude, vertical shift, period, and phase shift of a sinusoidal function. 3.7A Construct sinusoidal function models of periodic phenomena. 3.8A Construct representations of the tangent function using the unit circle. 3.8B Describe key characteristics of the tangent function. 3.8C Describe additive and multiplicative transformations involving the tangent function. 3.9A Construct analytical and graphical representations of the inverse of the sine, cosine, and tangent functions over a restricted domain. 3.10A Solve equations and inequalities involving trigonometric functions. 3.11A Identify key characteristics of functions that involve quotients of the sine and cosine functions. 3.12A Rewrite trigonometric expressions in equivalent forms with the Pythagorean identity. 3.12B Rewrite trigonometric expressions in equivalent forms with sine and cosine sum identities. 3.12C Solve equations using equivalent analytic representations of trigonometric functions.

	3.13A Determine the location of a point in the plane using both rectangular and polar coordinates. 3.14A Construct graphs of polar functions 3.15A Describe characteristics of the graph of a polar function.
Unit 6: Parametric Functions Part 2 Estimated Date Range: May 14 – May 29 Estimated Time Frame: 11 days	
Unit Overview: This unit will include the study of *Parametric Functions*. For a complete overview of this unit please refer *Developing Understanding* on page 105 of the AP Pre-Calculus Course and Exam Description. **At home connections:** • Discuss how limits relates to the behavior of rational functions.	
Concepts within the Unit	**AP Learning Objectives**
Concept #1: Implicitly Defined Functions (Topics 4.5, 4.6, 4.7)	4.5A Construct a graph of an equation involving two variables. 4.5B Determine how the two quantities related in an implicitly defined function vary together. 4.6A Represent conic sections with horizontal or vertical symmetry analytically. 4.7A Represent a curve in the plane parametrically. 4.7B Represent conic sections parametrically.

Glossary of Curriculum Components

Overview– The content in this document provides an overview of the pacing and concepts covered in a subject for the year.
TEKS – Texas Essential Knowledge and Skills (TEKS) are the state standards for what students should know and be able to do.
Unit Overview – The unit overview provides a brief description of the concepts covered in each unit.
Concept – A subtopic of the main topic of the unit.
Success Criteria—a description of what it looks like to be successful in this concept.

Parent Resources
The following resources provide parents with ideas to support students' understanding. For sites that are password protected, your child will receive log-in information through their campus.

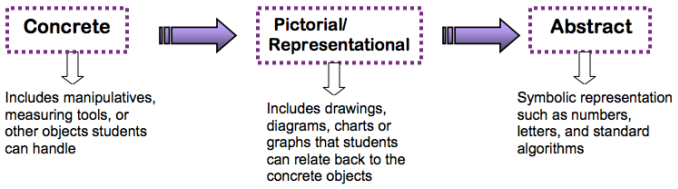
Resource	How it supports parent and students
Pearson – PreCalculus – Graphical Numerical, Algebraic Texas Ed.	This is the state adopted textbook for Pre-Calculus. Students will receive login information from their teacher.
Didax Virtual Manipulatives Math Learning Center Math Apps Polypad: Mathigon – Virtual Manipulatives	These online resources provide access to virtual manipulatives.
Parent Resources from youcubed.org	This resource from youcubed.org includes articles for parents on ways to support their students in learning and understanding mathematics.
Student Resources from youcubed.org	This resource from youcubed.org includes videos concerning growth mindset in mathematics.
Math: Why Doesn't Yours Look Like Mine?	This resource provides an explanation of why math looks different now as opposed to how parents learned mathematics and how to support students in learning mathematics.

Supplemental Resource and Tool Designation:

- The TI Nspire CX calculator is a standardized technology integration tool used for Mathematics and Science in FBISD.

Instructional Model

The structures, guidelines or model in which students engage in a particular content that ensures understanding of that content.



The instructional model for mathematics is the Concrete-Representational-Abstract Model (CRA).

The CRA model allows students to access mathematics content first through a concrete approach ("doing" stage) then representational ("seeing" stage) and then finally abstract ("symbolic" stage). The CRA model allows students to conceptually develop concepts, so they have a deeper understanding of the mathematics and are able to apply and transfer their understanding across concepts and contents. The CRA model is implemented in grades K-12 in FBISD.