## Pre-Calculus Pre-AP Overview
### 2019-2020

This document is designed to provide parents/guardians/community an overview of the curriculum taught in the FBISD classroom. Included, is an overview of the Mathematics Instructional Model and Pacing, TEKS, Unit Overview, Big Ideas, Essential Questions, and Concepts for each unit.

### Definitions:

**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.

**Process Standards** – The process standards describe ways in which students are expected to engage in the content. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use knowledge learned efficiently and effectively in daily life.

**Unit Overview** – The unit overview provides a brief description of the concepts covered in each unit.

**Big Ideas and Essential Questions** - Big ideas create connections in learning. They anchor all the smaller isolated, facts together in a unit. Essential questions (questions that allow students to go deep in thinking) should answer the big ideas. Students should not be able to answer Essential Questions in one sentence or less. Big ideas should be the underlying concepts, themes, or issues that bring meaning to content.

**Concept** – A subtopic of the main topic of the unit

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

### Parent Supports:

The following resources provide parents with ideas to support students in mathematical understanding

- [Advice for Parents: Helping Children with Math](#)
- [How Math Should be Taught](#)
- [The Most Important Mathematical Habit of Mind](#)
- [Math: Why Doesn’t Yours Look Like Mine?](#)
Instructional Model:

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.

Adopted Resources:

High School: https://www.fortbendisd.com/Page/93927

Supplemental Resource and Tool Designation

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

Mathematical Process Standards:

The student uses mathematical process to acquire and demonstrate mathematical understanding. The student is expected to:

P.1A Apply mathematics to problems arising in everyday life, society, and the workplace
P.1B Use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution
P.1C Select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems
P.1D Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate
P.1E Create and use representations to organize, record, and communicate mathematical ideas
P.1F Analyze mathematical relationships to connect and communicate mathematical ideas
P.1G Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication

Grading Period 1

Unit 1: Polynomial Function Analysis
Estimated Date Range: Aug. 14 – Sept. 5

Unit Overview: In this unit, students will graph and analyze key features of power, piecewise and polynomial functions. Students will connect their knowledge of solutions of power, piecewise, and polynomial functions across multiple representations of one function or across multiple functions in comparison. Students should also be able to explain and interpret their analysis of key features of power, piecewise and polynomial functions through detailed explorations and examinations. In addition, students will apply a variety of techniques (including composition of functions) to solve polynomial equations and inequalities in both mathematical and real-world problems.
Big Ideas:
- Key features of polynomial, power and piecewise functions provide critical information that help to interpret behavior of functions in mathematical and real-world situations.
- Modeling situations with polynomial, power and piecewise functions allows us to interpret and make decisions about the real world situations.

Essential Questions
- How can key features be determined and interpreted from representations of functions?
- How can polynomial, power and piecewise function models be used to solve real-world problems?

<table>
<thead>
<tr>
<th>Concepts within Unit #1</th>
<th>TEKS</th>
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</thead>
<tbody>
<tr>
<td>Concept #1: Graph and Analyze Key Features of Power Functions</td>
<td>P.2D, P.2F, P.2G, P.2I, P.2J, P.2N</td>
</tr>
<tr>
<td>Concept #2: Graph and Analyze Key Features of Piecewise Functions</td>
<td>P.2F, P.2I</td>
</tr>
<tr>
<td>Concept #3: Graph and Analyze Key Features of Polynomial Functions</td>
<td>P.2D, P.2F, P.2G, P.2I, P.2J, P.2N</td>
</tr>
<tr>
<td>Concept #5: Solving Polynomial Inequalities</td>
<td>P.2I, P.2N, P.5K</td>
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</tbody>
</table>

Unit 2: Rational Function Analysis
Estimated Date Range: Sept. 6 – Sept. 26

Unit Overview: In this unit, students will graph and analyze key features of rational functions. Students will connect their knowledge of graphing transformations on the rational parent function to rational functions in any form and across multiple representations of functions in comparison. Students should also be able to interpret and explain their analysis of key features of rational functions through detailed explorations and examinations. Also within this unit, students will apply a variety of techniques (including PNI charts, factoring, synthetic division and long division) to solve rational equations and inequalities in both mathematical and real-world problems. The concepts in this unit include the following: Graph and Analyze Key Features of Rational Functions and Solving Rational Inequalities.

Big Ideas:
- Key features of rational functions provide critical information that help to interpret behavior of functions in mathematical and real-world situations.
- Modeling situations with rational functions allows us to interpret and make decisions about the real world situations.

Essential Questions
- How can key features be determined and interpreted from representations of functions?
- How can rational function models be used to solve real-world problems?

<table>
<thead>
<tr>
<th>Concepts within Unit #2</th>
<th>TEKS</th>
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<tbody>
<tr>
<td>Concept #1: Graph and Analyze Key Features of Rational Functions</td>
<td>P.2D, P.2F, P.2G, P.2I, P.2J, P.2K, P.2N</td>
</tr>
<tr>
<td>Concept #2: Solving Rational Inequalities</td>
<td>P.2I, P.2N, P.5J, P.5K, P.5L</td>
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</tbody>
</table>

Unit 3: Exponential and Logarithmic Function Analysis

Unit Overview: In this unit, students will graph and analyze key features of exponential and logarithmic functions. Students will build on their previous knowledge of inverses and apply to exponential and logarithmic functions. Students should be able to explain and interpret their analysis of key features of exponential and logarithmic functions through detailed explorations and examinations between multiple representations. In addition, students will develop and apply properties of logarithms to solve exponential and logarithmic equations in both mathematical and real-world problems. Concepts in this unit include the following: Exponential and Logarithmic Functions as Inverses, Graph and Analyze Key Features of Exponential and Logarithmic Functions, Properties of Logarithms and Solving Exponential and Logarithmic Equations.
Big Ideas:
- Key features of exponential and logarithmic functions provide critical information that help to interpret behavior of functions in mathematical and real-world situations.
- Modeling situations with exponential and logarithmic functions allows us to interpret and make decisions about the real world situations.

Essential Questions
- How can key features be determined and interpreted from representations of functions?
- How can exponential and logarithmic function models be used to solve real-world problems?

<table>
<thead>
<tr>
<th>Concepts within Unit #3</th>
<th>TEKS</th>
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<tbody>
<tr>
<td>Concept #1: Exponential and Logarithmic Functions as Inverses</td>
<td>P.2B, P.2E, P.2F, P.2I</td>
</tr>
<tr>
<td>Concept #2: Graph and Analyze Key Features of Exponential and Logarithmic Functions</td>
<td>P.2F, P.2G, P.2I, P.2J</td>
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<tr>
<td>Concept #3: Properties of Logarithms</td>
<td>P.2N, P.5G</td>
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Grading Period 2

Unit 3: Exponential and Logarithmic Function Analysis (Continued)

Note: This unit is continued from Grading Period 1. Please refer to Grading Period 1 for the Unit Overview, Big Ideas, and Essential Questions for this unit.

<table>
<thead>
<tr>
<th>Concepts within Unit #3</th>
<th>TEKS</th>
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<tbody>
<tr>
<td>Concept #1: Exponential and Logarithmic Functions as Inverses</td>
<td>P.2B, P.2E, P.2F, P.2I</td>
</tr>
<tr>
<td>Concept #2: Graph and Analyze Key Features of Exponential and Logarithmic Functions</td>
<td>P.2F, P.2G, P.2I, P.2J</td>
</tr>
<tr>
<td>Concept #3: Properties of Logarithms</td>
<td>P.2N, P.5G</td>
</tr>
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Unit 4: Introduction of Periodic Functions
Estimated Date Range: Oct. 25 – Nov. 12

Unit Overview: In this unit, students will develop an understanding of the periodic nature of trigonometric functions. Students will build on their previous knowledge of special right triangles and trigonometry as they develop a conceptual understanding of the relationship between angle positions on a unit circle. Students will work in both radians and degrees to evaluate trigonometric functions at various angles on the unit circle as well as co-terminal values. This understanding will be essential when solving problems involving trigonometric ratios in mathematical and real-world problems. Concepts in this unit include Angle measures and Positions in Degrees and Radians and Unit Circle and Evaluating Trigonometric Functions.

Big Ideas:
- The periodic nature of trigonometric functions can be applied in mathematical and real-world problems.

Essential Questions
- What is the relationship between the values of trigonometric functions at special angles and the unit circle?

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<thead>
<tr>
<th>Concepts within Unit #4</th>
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<tbody>
<tr>
<td>Concept #1: Angle Measures and Positions in Degrees and Radians</td>
<td>P.4B, P.4C, P.4D</td>
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<tr>
<td>Concept #2: Unit Circle and Evaluating Trigonometric Functions</td>
<td>P.2P, P.4A, P.4B, P.4E</td>
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</table>
### Unit 5: Graphing and Applications of Trigonometric Functions

**Estimated Date Range:** Nov. 13 – Nov. 22 and Dec. 2 – Dec. 19  
**Note:** Includes 7 days for semester exams and review

**Unit Overview:** In this unit, students will graph trig functions and inverse trig functions as well as analyze the key features of the graphs of these functions. Students will also write sinusoidal models in order to solve problems.

**Big Ideas:**
- Situations with periodic natures can be modeled using trigonometric functions in order to solve problems.
- Representations of a function provide critical information about the function that help to interpret situations.
- An equation that represents a trigonometric function can be formulated from multiple representations of data.

**Essential Questions:**
- How can trigonometry functions be applied to solve problems.
- How can key features be determined and interpreted from representations of functions?
- How do you model trigonometric equations?

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<tr>
<th>Concepts within Unit #5</th>
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<td>Concept #1: Graphing Sine and Cosine</td>
<td>P.2D, P.2F, P.2G, P.2I, P.4A</td>
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<tr>
<td>Concept #2: Sinusoidal Applications</td>
<td>P.2O, P.5N</td>
</tr>
<tr>
<td>Concept #3: Graphing All Trig Functions</td>
<td>P.2D, P.2F, P.2I, P.2L, P.2M</td>
</tr>
<tr>
<td>Concept #4: Inverse Trig Functions and Their Graphs</td>
<td>P.2D, P.2E, P.2F, P.2H, P.2I, P.2P, P.4A</td>
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</tbody>
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**Grading Period 3**

### Unit 6: Analytical Trigonometry

**Estimated Date Range:** Jan. 7 – Jan. 29

**Unit Overview:** In this unit, students will combine knowledge learned in previous trig units with knowledge of manipulating expressions and equations to simplify trig expressions, verify trig identities, and solve trig equations.

**Big Ideas:**
- An equation that represents a trigonometric function can be formulated from multiple representations of data.
- The process to solve a trigonometric equation must preserve equivalence. Equivalence can be preserved using inverse operations, graphing and modeling.
- The process to verify a trigonometric identity must preserve equivalence. Equivalence can be preserved using identities, graphing and trig properties.

**Essential Questions**
- How can a trig equation be determined?
- What strategy can you use to solve a trigonometric equation?
- What strategy can you use to verify a trigonometric identity?

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<thead>
<tr>
<th>Concepts within Unit #6</th>
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<tr>
<td>Concept #1: Verifying Trig Identities</td>
<td>P.2D, P.5M</td>
</tr>
<tr>
<td>Concept #2: Solving Trig Equations</td>
<td>P.2A, P.2C, P.2E, P.2P, P.5M, P.5N</td>
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</tbody>
</table>
# Unit 7: Vectors with Trigonometry

**Estimated Date Range:** Jan. 30 – Feb. 25

**Unit Overview:** In this unit, students will be introduced to vectors. Students will represent vectors graphically and algebraically. Students will use vectors to represent and solve real world problems that include current and wind speed. Students will also derive and use the Law of Sines and the Law of Cosines.

**Big Ideas:**
- Operations of vectors can be utilized to solve real life problems.
- The characteristics of trigonometric functions and their representations are useful in solving mathematical and real-world problems.

**Essential Questions**
- How can vectors be used to model and analyze real-world situations?
- How can real-world situations be solved through the application of trigonometric functions?

## Concepts within Unit #7

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<tr>
<th>Concept #1: Geometric and Symbolic Representations</th>
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<tr>
<td>Concept #2: Vector Applications</td>
<td>P.4I, P.4J, P.4K</td>
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</table>

# Unit 8: Conic, Parametric, and Polar Function Analysis

**Estimated Date Range:** Feb. 26 – Mar. 6 and Mar. 16 – April 2

**Unit Overview:** In this unit, students will study conics, parametric equations, and polar equations. This will continue students’ study of conics, circles in Geometry and parabolas in Algebra 2. In Pre-Calculus, students will study ellipses and hyperbolas. Students will apply trigonometry to their study of parametric equations and polar equations. Parametric equations allow us to express a set of quantities as explicit functions in terms of a parameter. For polar equations, students will be introduced to the polar coordinate system. For both parametric equations and polar equations, students will convert between the given equations and an equation in rectangular coordinates. Students will graph with and without technology.

**Big Ideas:**
- Equations of conics and the key features of their can be used to solve real world problems.
- Modeling situations with parametric equations allows students to solve real-world problems involving motion.
- The use of polar coordinates can help simplify complicated rectangular equations.

**Essential Questions**
- How can we use conics to represent real-world problems?
- How can we use parametric equations to model paths of real-world objects?
- How can we use conversion of polar coordinates to help us solve problems?

## Concepts within Unit #8

<table>
<thead>
<tr>
<th>Concept #1: Conics</th>
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<tr>
<td>Concept #3: Polar Equations</td>
<td>P.2P, P.3D, P.3E, P.5M</td>
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</table>

## Grading Period 4

**Unit 8: Conic, Parametric, and Polar Function Analysis (Continued)**

**Estimated Date Range:** Feb. 26 – Mar. 6 and Mar. 16 – April 2

Note: This unit is continued from Grading Period 3. Please refer to Grading Period 3 for the Unit Overview, Big Ideas, and Essential Questions for this unit.

## Concepts within Unit #8

<table>
<thead>
<tr>
<th>Concept #1: Conics</th>
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<tbody>
<tr>
<td>Concept #3: Polar Equations</td>
<td>P.2P, P.3D, P.3E, P.5M</td>
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</table>
### Unit 9: Sequences and Series
**Estimated Date Range:** April 3 – April 30

**Unit Overview:** In this unit, students will extend their knowledge of sequences to the study of series. Students were introduced to arithmetic and geometric sequences in Algebra 1. In this unit, students will calculate the $n$th term and $n$th partial sum of arithmetic and geometric sequences for both real world and mathematical situations. Students will represent series using sigma notation. In this unit, students will also apply the Binomial Theorem to expand $(a + b)^n$.

**Big Ideas:**
- Series allows us to efficiently evaluate and interpret data in mathematical and real-life situations.

**Essential Questions**
- How can determining the $n$th term and $n$th partial sum of an arithmetic series help solve situations?
- How can determining the $n$th term and $n$th partial sum of a geometric series and the sum of an infinite geometric series help solve situations?

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<thead>
<tr>
<th>Concepts within Unit #9</th>
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<tr>
<td>Concept #1: Arithmetic and Geometric Sequences</td>
<td>P.5B</td>
</tr>
<tr>
<td>Concept #2: Arithmetic Sequences</td>
<td>P.5A, P.5C, P.5D</td>
</tr>
<tr>
<td>Concept #3: Geometric Sequences</td>
<td>P.5A, P.5D, A.5E</td>
</tr>
<tr>
<td>Concept #4: Binomial Theorem</td>
<td>P.5F</td>
</tr>
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</table>

### Unit 10: Introduction to Limits
**Estimated Date Range:** May 1 – May 28

**Note:** Includes 7 days for semester exams and review

**Unit Overview:** In this unit, students will be introduced to limits. In the Pre-Calculus units on functional analysis (Units 1, 2, and 3) students analyzed the end behavior of functions. In the Rational Function Unit, students analyzed the behavior of rational functions around the asymptotes, determined various types of discontinuities, and described the right and left sided behavior around the discontinuities. These ideas lead to the study of limits. Students will expand and continue their study of limits in Calculus.

**Big Ideas:**
- The concept of a limit can be used to understand the behavior of functions.
- Continuity is a key property of functions that is defined using limits.

**Essential Questions**
- What does the limit tell us about a function?
- How does the continuity of a function relate to limits?

<table>
<thead>
<tr>
<th>Concepts within Unit #10</th>
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<tbody>
<tr>
<td>Concept #1: Introduction to Limits</td>
<td>P.2J, P.2K, P.2L, P.2M</td>
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