# Algebra 2 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:

- 2A.1A Apply mathematics to problems arising in everyday life, society, and the workplace
- 2A.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
- 2A.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
- 2A.1D Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate
- 2A.1E Create and use representations to organize, record, and communicate mathematical ideas
- 2A.1F Analyze mathematical relationships to connect and communicate mathematical ideas
- 2A.1G Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication

Grading Period 1

Unit 1: Absolute Value Functions
Estimated Date Range: Aug. 14 – Sept. 9

Unit Overview: In this unit, students will solve, graph, and write absolute value equations from multiple representations for both mathematical and real-world situations. Students will also solve absolute value inequalities and graph their solution sets on a number line. Students will graph absolute value functions and analyze their key features. Students will use absolute value equations, functions and inequalities to model situations including production ranges, margin of error, and motion and use key features to draw conclusions. The concept of absolute value as "distance" should be extended from prior instruction in middle grades. Students should also make connections from the attributes of absolute value functions to the attributes of linear and quadratic functions they studied in Algebra 1.
Big Ideas:
- A solution to an absolute value equation or inequality represents value(s) that make statement(s) true in mathematical and real world situations.
- The process to solve an absolute value equation must maintain equivalence. Equivalence can be maintained using inverse operations, graphing and modeling.
- The graph of an absolute value function provides critical information about the function in order to interpret situations.

Essential Questions
- How do we determine the solution(s) to absolute value equations or inequalities?
- How do we determine if a solution is reasonable in a real-world application?
- How do we maintain equivalence when solving absolute value equations?
- How can key attributes help determine information about a situation?

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<th>Concepts within Unit #1</th>
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<td>Concept #1: Formulating and Solving Absolute Value Equations</td>
<td>2A.6D, 2A.6E, 2A.6F, 2A.71</td>
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<tr>
<td>Concept #2: Graphing, Writing, and Analyzing Absolute Value Functions</td>
<td>2A.2A, 2A.6C, 2A.6D, 2A.6E, 2A.6F, 2A.71</td>
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<tr>
<td>Concept #3: Graph, Write and Solve systems of Absolute Value Equations and Linear Equations</td>
<td>2A.2A, 2A.6D, 2A.6E</td>
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Unit 2: Systems of Equations and Inequalities
Estimated Date Range: Sept. 10 – Oct. 4

Unit Overview: In this unit, students will write, graph, solve, and verify possible solutions for systems of at least two linear inequalities in two variables. Students will build on their prior knowledge from Algebra 1 of graphing linear inequalities and extend what they know to write and solve systems. Students will apply systems to determine solutions for mathematical and real world situations including maximizing problems and geometric applications. Students will also write and solve systems of three linear equations with three variables. Students will analyze systems to select effective tools and techniques to determine solutions both mathematically and in real world context. Students should build on their knowledge of the methods used to solve systems of equations in two variables in Algebra 1. Students will solve these systems both algebraically and with technology. The concepts in this unit are Write and Solve Systems of Inequalities and Write and Solve Systems of Equations in Three Variables.

Big Ideas:
- Analyzing the given information helps to determine an appropriate method for solving systems of equations.
- Solutions to systems of equations and inequalities can represent solutions to real world problems.

Essential Questions
- How do you select a method to solve a system of three linear equations?
- How can you interpret the solution to a system of equations or inequalities?

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<th>Concepts within Unit #2</th>
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<td>Concept #1: Write and Solve Systems of Inequalities</td>
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<tr>
<td>Concept #2: Write and Solve Systems of Equations in Three Variables</td>
<td>2A.3A, 2A.3B</td>
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Unit 3: Quadratic Relations and Functions
Estimated Date Range: Oct. 7 – Oct. 10 and Oct. 15 – Nov. 8

Unit Overview: In this unit, students will explore quadratic relations, functions, and inequalities expanding on their prior knowledge of quadratics from Algebra 1. Students will begin by writing equations of parabolas using given attributes, transformations, and given points. The attributes will include those from conic sections. Students will be introduced to complex numbers so that they will be able to solve quadratic equations with non-real solutions. Students will then solve quadratic equations and inequalities. Emphasis should be placed on selecting efficient methods for solving and making
connections between the various forms of quadratic functions and the attributes of their graphs. Applications in this section should be used to introduce concepts, interpret the attributes of graphs, and relate algebraic solutions to models of real world situations. The unit concludes with solving systems of two equations in which one is quadratic and the other is linear. The Pre-AP Extensions for this unit will be dividing complex numbers and systems of two quadratic equations.

**Big Ideas:**
- An equation that represents a conic relationship can be derived from multiple representations of data.
- The complex number system consists of both real and imaginary numbers and all complex numbers can be written as a + bi, consisting of both a real part and an imaginary part.
- A solution to a quadratic equation or inequality represents value(s) that make statement(s) true in mathematical and real world situations. Solutions can be both real and non-real.
- The process to solve a quadratic equation must preserve equivalence. Equivalence can be preserved using inverse operations, graphing and modeling.
- Analyzing the given information helps to determine an appropriate method for solving systems of equations.
- Solutions to systems of equations can represent solutions to real world problems.

**Essential Questions**
- How do you model a parabola using the attributes defined by a conic section?
- How are real numbers and imaginary numbers related?
- What do the solutions to quadratic equations and inequalities represent?
- What is the relationship between equivalence and solving a quadratic equation?
- How do you select a method to solve a system of equations - one linear, one quadratic?
- How can you interpret the solution to a system of equations?

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<thead>
<tr>
<th>Concepts within Unit #3</th>
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<td>Concept #1: Complex Numbers</td>
<td>2A.4F, 2A.7A</td>
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<tr>
<td>Concept #2: Writing Quadratic Equations</td>
<td>2A.4A, 2A.4B, 2A.4D, 2A.4E, 2A.7I</td>
</tr>
<tr>
<td>Concept #3: Solve Quadratic Equations and Inequalities</td>
<td>2A.4A, 2A.4D, 2A.4E, 2A.4F, 2A.4H</td>
</tr>
<tr>
<td>Concept #4: Solving Linear-Quadratic Systems</td>
<td>2A.3A, 2A.3C, 2A.3D, 2A.4B</td>
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</table>

**Grading Period 2**

**Unit 3: Quadratic Relations and Functions (Continued)**
**Estimated Date Range:** Oct. 7 – Oct. 10 and Oct. 15 – Nov. 8

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.

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<thead>
<tr>
<th>Concepts within Unit #3</th>
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<tbody>
<tr>
<td>Concept #1: Complex Numbers</td>
<td>2A.4F, 2A.7A</td>
</tr>
<tr>
<td>Concept #2: Writing Quadratic Equations</td>
<td>2A.4A, 2A.4B, 2A.4D, 2A.4E, 2A.7I</td>
</tr>
<tr>
<td>Concept #3: Solve Quadratic Equations and Inequalities</td>
<td>2A.4A, 2A.4D, 2A.4E, 2A.4F, 2A.4H</td>
</tr>
<tr>
<td>Concept #4: Solving Linear-Quadratic Systems</td>
<td>2A.3A, 2A.3C, 2A.3D, 2A.4B</td>
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</tbody>
</table>

**Unit 4: Quadratic and Square Root Functions**
**Estimated Date Range:** Nov. 11 – Nov. 22 and Dec. 2 – Dec. 19

Note: Includes 7 days for Semester Exams and review

**Unit Overview:** In this unit, students will develop an understanding of inverse functions by focusing on quadratic and square root functions. They should make connections to vertical and horizontal parabolas from the previous unit. Students will graph square root functions using transformations, analyze key features, and solve square root equations. This unit provides opportunities to explore restricted domain and will connect to complex and real numbers discussed in the previous unit. This unit also provides students the opportunity to dig deeper into transformations as students explore the equations.
of inverse functions. As an extension in Algebra 2 Pre-AP, students will also find inverses of absolute value functions, solve square root inequalities, and solve systems that include square root functions.

**Big Ideas:**
- Inverses and information about a function’s inverse can be found as reflections over the line \( y = x \).
- The graph of the function provides critical information about the function in order to interpret situations.
- The process to solve an equation must preserve equivalence. Equivalence can be preserved using inverse operations, graphing and modeling.

**Essential Questions**
- How can an inverse and its essential information be determined for a function?
- How can key attributes be determined and interpreted from a graph and its inverse?
- What strategy can you use to solve a quadratic or square root equation?

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<tr>
<th>Concepts within Unit #4</th>
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<td>Concept #1: Inverses of Quadratic and Square Root Functions</td>
<td>2A.2B, 2A.2C, 2A.2D, 2A.7I</td>
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<tr>
<td>Concept #2: Solving Square Root Equations</td>
<td>2A.4F, 2A.4G, 2A.7H</td>
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<tr>
<td>Concept #3: Writing and Graphing Square Root Functions</td>
<td>2A.2A, 2A.4C, 2A.4E, 2A.4F, 2A.7I</td>
</tr>
</tbody>
</table>
Unit Overview: In this unit, students will begin with simplifying radical expressions. Students will write roots and powers as rational exponents and solve equations with rational exponents. Students will continue their study of inverse functions with cubic and cube root functions. Prior knowledge of linear and quadratic functions as well as knowledge from the previous unit of inverse functions should be applied in this unit to identify key attributes, including domain and range, and to perform transformations. Students will solve cubic and cube root equations and relate those solutions graphs and models of mathematical and real world situations.

Big Ideas:
- Inverses and information about a function’s inverse can be found as reflections over the line $y = x$.
- The graph of the function provides critical information about the function in order to interpret situations.
- The process to solve an equation must preserve equivalence. Equivalence can be preserved using inverse operations, graphing and modeling.

Essential Questions:
- How can an inverse and its essential information be determined for a function?
- How can key attributes be determined and interpreted from a graph and its inverse?
- What strategy can you use to solve a cubic or cube root equation?

Concepts within Unit #5

<table>
<thead>
<tr>
<th>Concept</th>
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<tr>
<td>1: Radical Expressions and Equations with Rational Exponents</td>
<td>2A.7G, 2A.7H</td>
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<tr>
<td>2: Solving Cubic and Cube Root Equations</td>
<td>2A.6B, 2A.7H</td>
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<tr>
<td>3: Graphing Cubic Functions</td>
<td>2A.2A, 2A.6A, 2A.7I</td>
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<tr>
<td>4: Inverses of Cubic and Cube Root Functions</td>
<td>2A.2B, 2A.2C, 2A.2D, 2A.7I</td>
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<tr>
<td>5: Graphing Cube Root Functions</td>
<td>2A.2A, 2A.6A, 2A.6B, 2A.7I</td>
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Unit Overview: In this unit, students will extend their knowledge of polynomials and rational numbers to operations of polynomials and rational expressions. Students will add, subtract, multiply, divide, and factor polynomials with a focus on polynomials of degree three and four. While the focus is on third and fourth degree polynomials, students should have opportunities to practice quadratic factoring within the higher degree polynomials. Students should be allowed to explore factoring and encouraged to apply the types of factoring they previously learned to make meaning of factoring and division. Avoid presenting solutions procedurally without allowing students to explore and develop their own processes. While graphing and attributes of graphs of polynomials is not included in Algebra 2, students can use what they have learned from quadratic and cubic functions and their roots to help them see solutions graphically. Students will add, subtract, multiply and divide rational expressions. Be aware that the TEK specifically limits quotients of rational expressions to degree one and two.

Extensions for Pre-AP Algebra 2 in this unit include including complex fractions when performing operations of rational expressions and including rational expressions that have numerators and denominators of degree three and four.

Big Ideas:
- Generating equivalent expressions using methods, including factoring, allows us to find specific information about the polynomial.
- Understanding of operations are needed to solve equations. Simplifying rational expressions provides a simplified expression needed for solving rational functions.
### Essential Questions
- How and why should factors of polynomial functions of degree three and four be determined?
- How do we use operations of rational numbers and polynomials in order to simplify rational expressions?

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<td>Concept #1: Add, Subtract, and Multiply Polynomials</td>
<td>2A.7B</td>
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<td>Concept #2: Divide and Factor Polynomials</td>
<td>2A.7C, 2A.7D, 2A.7E</td>
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<tr>
<td>Concept #3: Multiply and Divide Rational Expressions</td>
<td>2A.7F, 2A.7I</td>
</tr>
<tr>
<td>Concept #4: Add and Subtract Rational Expressions</td>
<td>2A.7F, 2A.7I</td>
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</table>
Unit Overview: In this unit, students will extend their knowledge of functions and key attributes of functions to rational functions. Students will begin the unit by solving rational equations. In the previous unit, students performed operations of rational expressions; they will use this knowledge to solve rational equations. Students will also apply knowledge from 8th grade of solving linear equations with variable on both sides with rational coefficients. Students will then graph the rational parent function and use transformations to graph other rational functions. Students will analyze key features of the both the rational parent and the transformed graph. Special attention should be placed on the impact of asymptotes on domain and range and how domain and range can be represented in different ways. Students will finish the unit by solving rational applications including problems that involve inverse variation. Students should be able to contrast the inverse variations with direct variation problems from Algebra 1. Students will continue their study of rational functions, including graphing general rational functions in Pre-Calculus.

Big Ideas:
- The graph of the function provides critical information about the function in order to interpret situations.
- The process to solve an equation must preserve equivalence. Equivalence can be preserved using inverse operations, graphing and modeling.
- An equation that represents inverse variation can be derived from multiple representations of data.

Essential Questions:
- How can key attributes be determined and interpreted from a graph and its inverse?
- What strategy can you use to solve a rational equation?
- How do you model inverse variation?

Concepts within Unit #7

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<th>Concept #1: Solve Rational Equations</th>
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<td>Concept #2: Graph and Transform Rational Functions</td>
<td>2A.2A, 2A.6G, 2A.6K</td>
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<td>Concept #3: Writing and Solving Rational Equations</td>
<td>2A.6H, 2A.6I, 2A.6J, 2A.6K, 2A.6L</td>
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Unit 8: Exponential and Logarithmic Functions

Unit Overview: In this unit, students will extend their knowledge of functions and key attributes of functions to exponential and logarithmic functions. Students will extend their study of exponential functions from Algebra 1 where the focus was on growth and decay functions, graphing from a table and using technology. In Algebra 2, students will graph from base 2, 10, and e and will apply transformations from these bases while analyzing the effect on key attributes. Students will be introduced to the graphs of logarithmic functions of the same bases as they continue their study of inverse functions. Students will write and solve exponential (in the form \( y = ab^x \)) and single logarithmic equations including both mathematical and real world situations. Applications from science, finance, and from our own number system should be used frequently during the unit to give students a context for what they are learning. Students will continue their study of logarithmic and exponential functions in Pre-Calculus, including properties of logarithms, which is not included in Algebra 2.

In Algebra 2 Pre-AP, students will solve systems of two exponential equations and two single log equations algebraically and graphically. Students will continue their study of logarithmic and exponential functions in Pre-Calculus.

Big Ideas:
- The graph of the function provides critical information about the function in order to interpret situations.
- The process to solve an equation must preserve equivalence. Equivalence can be preserved using inverse operations, graphing and modeling.
- Inverses and information about a function’s inverse can be found as reflections over the line \( y = x \).
### Essential Questions

- How can key attributes be determined and interpreted from a graph and its inverse?
- What strategy can you use to solve a rational equation?
- How can an inverse and its essential information be determined for a function?

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<tr>
<td>Concept #1: Graph Exponential Functions</td>
<td>2A.2A, 2A.5A, 2A.7I</td>
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<tr>
<td>Concept #2: Exponential and Logarithmic Functions as Inverses</td>
<td>2A.2B, 2A.2C, 2A.2D, 2A.5C, 2A.7I</td>
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<tr>
<td>Concept #3: Graph Logarithmic Functions</td>
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<td>Concept #4: Write and Solve Exponential and Logarithmic Equations</td>
<td>2A.5B, 2A.5C, 2A.5D, 2A.5E</td>
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### Unit 9: Data Analysis

**Estimated Date Range:** May 4 – May 28

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

**Unit Overview:** In this unit, students will extend their knowledge of regression models. In Algebra 1, students determined regression models for linear, quadratic, and exponential data and used the regression model to make predictions in context of the situation. Students will also extend their knowledge of arithmetic and geometric sequences from Algebra 1 to help determine appropriate models. In Algebra 2, given a set of data, students will determine which model best represents the data, determine the regression model, and then use the model to make predictions. All data should represent real world situations for which models and predictions would be useful. Students will continue to use regression and the study of data in future math courses.

**Big Ideas:**

- A regression model can be used to make predictions from a set of data.

**Essential Questions**

- How do you make predictions using a set of data?

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<td>Concept #1: Analyze Data</td>
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<td>Concept #2: Regression Models</td>
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