Algebra 2 Overview 2018-2019

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
Instructional Model:

The instructional model for mathematics in FBISD consists of two parts. The first part is how students learn math and how math is instructed. Instruction in mathematics should follow 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.

The second part of the instructional model is the lesson cycle. The components of the math lesson cycle for Grades 8-12 include Engage, Learning Experiences, Structured Practice, and Closure. Formative Assessment and Math Discussion occurs throughout the cycle.

Adopted Resources:

High School: [https://www.fortbendisd.com/Page/93927](https://www.fortbendisd.com/Page/93927)

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. 15 – Sept. 10

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 maintain 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?

### Concepts within Unit #1

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<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.7I</td>
</tr>
</tbody>
</table>

### Unit 2: Systems of Equations and Inequalities

**Estimated Date Range:** Sept. 11 – Oct. 8

**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:**
- The solution for a system of inequalities is a set of values that may or may not include the solution to the system of linear equations that comprises its boundaries.
- 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**
- The solution for a system of inequalities is a set of values that may or may not include the solution to the system of linear equations that comprises its boundaries.
- 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.

### Concepts within Unit #2

<table>
<thead>
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<th>Concept #1: Write and Solve Systems of Inequalities</th>
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<td></td>
<td>2A.3E, 2A.3F, 2A.3G</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. 9 – Oct. 18 and Oct. 22 – Nov. 9

**Note:** Includes 1 day for PSAT

**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.

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.
- Equivalent representations of a function highlight different properties or attributes of that function.
- 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 characteristics defined by a conic section?
- What proportional relationships exist in the attributes of parabolas?
- How are real numbers and imaginary numbers related?
- Why are imaginary numbers needed or useful?
- What do the solutions to quadratic equations and inequalities represent?
- How can the solutions to quadratic equations be found graphically and tabularly?
- Which attributes of a quadratic function can be seen in each equivalent representation?
- How does solving a quadratic equation compare to solving an absolute value equation?
- How can you determine the number of solutions to a quadratic equation?
- How do you select a method to solve a system of equation - one linear, one quadratic?
- How can you interpret the solution to a system of equations?

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<tr>
<th>Concepts within Unit #3</th>
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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>
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<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>

Grading Period 2

Unit 3: Quadratic Relations and Functions (Continued)

Estimated Date Range: Oct. 9 – Oct. 18 and Oct. 22 – Nov. 9

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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</table>
**Unit 4: Quadratic and Square Root Functions**
Estimated Date Range: Nov. 12 – Nov. 16 and Nov. 26 – Dec. 21
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.

**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 does the equation of a function and the equation of its inverse relate to each other?
- How can key attributes be determined and interpreted from a graph and its inverse?
- Why does a square root function have a restricted domain?
- What strategy can you use to solve a quadratic or square root equation?
- How are solving square root functions and writing inverses similar?

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<thead>
<tr>
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<td>Concept #1: Inverses of Quadratic and Square Root Functions</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>
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</table>
Grading Period 3
Unit 5: Cubic/Cube Root Functions
Estimated Date Range: Jan. 8 – Feb. 1

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:
- How can an inverse and its essential information be determined for a function?
- How does the equation of a function and the equation of its inverse relate to each other?
- How can key attributes be determined and interpreted from a graph and its inverse?
- Why does a square root function have a restricted domain?
- What strategy can you use to solve a quadratic or square root equation?
- How are solving square root functions and writing inverses similar?

Essential Questions:
- How can an inverse and its essential information be determined for a function?
- How does the equation of a function and the equation of its inverse relate to each other?
- How can key attributes be determined and interpreted from a graph and its inverse?
- Why does a square root function have a restricted domain?
- What strategy can you use to solve a quadratic or square root equation?
- How are solving square root functions and writing inverses similar?

Concepts within Unit #5

<table>
<thead>
<tr>
<th>Concept</th>
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<td>Concept #1: Radical Expressions and Equations with Rational Exponents</td>
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<tr>
<td>Concept #2: Solving Cubic and Cube Root Equations</td>
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<td>Concept #3: Graphing Cubic Functions</td>
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<td>Concept #4: Inverses of Cubic and Cube Root Functions</td>
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<tr>
<td>Concept #5: Graphing Cube Root Functions</td>
<td>2A.2A, 2A.6A, 2A.6B, 2A.7I</td>
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Unit 6: Operations of Polynomial and Rational Functions
Estimated Date Range: Feb. 4 – Mar. 1

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.

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 can the methods of factoring from Algebra 1 and previous Algebra 2 units be used together to make meaning of factoring higher degree polynomials?
- How do we use operations of rational numbers and polynomials in order to simplify rational expressions?
- How can you apply the operations of integers and fractions you learned in elementary middle grades as a basis for operations of polynomial and rational expressions?

### Concepts within Unit #6

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<tr>
<td>Concept #3: Multiply and Divide Rational Expressions</td>
<td>2A.7F, 2A.7I</td>
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<tr>
<td>Concept #4: Add and Subtract Rational Expressions</td>
<td>2A.7F, 2A.7I</td>
</tr>
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</table>

### Unit 7: Rational Functions

**Estimated Date Range:** Mar. 4 – Mar. 8 and Mar. 18 – April 1

**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?
- What symmetries exist in rational functions and what mathematical properties create them?
- Do all rational functions have the same symmetries?
- What strategy can you use to solve a rational equation?
- How does solving rational equations compare to other types of solving you have done in the past?
- How do you model inverse variation?
- How does inverse variation compare to direct 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>
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<tr>
<td>Concept #3: Writing and Solving Rational Equations</td>
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</table>
### Unit 7: Rational Functions (Continued)

**Estimated Date Range:** Mar. 4 – Mar. 8 and Mar. 18 – April 1

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<td>Concept #1: Solve Rational Equations</td>
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<tr>
<td>Concept #2: Graph and Transform Rational Functions</td>
<td>2A.2A, 2A.6G, 2A.6K</td>
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<tr>
<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

**Estimated Date Range:** April 2 – April 29

**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.

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

**Essential Questions**
- How can key attributes be determined and interpreted from a graph and its inverse?
- How does the transformation of a function affect its inverse?
- How can an inverse and its essential information be determined for a function?
- How can you use what you know about exponential and logarithmic functions as inverses to solve equations?
- How are the strategies for solving for an exponent different from the strategies you have used when solving for other functions?

<table>
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<tr>
<th>Concepts within Unit #8</th>
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<td>Concept #1: Graph Exponential Functions</td>
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<td>Concept #2: Exponential and Logarithmic Functions as Inverses</td>
<td>2A.2B, 2A.2C, 2A.2D, 2A.5C, 2A.7I</td>
</tr>
<tr>
<td>Concept #3: Graph Logarithmic Functions</td>
<td>2A.2A, 2A.5A, 2A.7I</td>
</tr>
<tr>
<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:** April 30 – May 24

**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.
- Various methods can be used to determine what model best represents a given set of data, with and without technology.

**Essential Questions**
- How do you make predictions using a set of data?
- How are mathematical models used in real world situations?
- What methods can be used to determine what model best represents a given set of data?
- What does the correlation coefficient tell us about a model's relationship to a data set?

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<td>Concept #1: Analyze Data</td>
<td>2A.8A</td>
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<tr>
<td>Concept #2: Regression Models</td>
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