# Algebraic Reasoning 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](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:

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

## Week of Inspirational Maths Fall
Estimated Date Range: Aug. 14 – Aug. 20

## Unit Overview:
This unit is a set of 5 lessons to begin the school year. Lessons focus on growth mindset and how we learn mathematics.

### Themes for the Week

<table>
<thead>
<tr>
<th>The themes for the week promote important mathematical ideas such as:</th>
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<tbody>
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### TEKS Link to Math TEKS

AR.1A, AR.1B, AR.1C, AR.1D, AR.1E, AR.1F, AR.1G

## Unit 1: Patterns and Functions
Estimated Date Range: Aug. 21 – Sept. 13

## Unit Overview:
In this unit, students will analyze patterns in data to determine which type of function the data represents. Students will build on their knowledge of arithmetic and geometric sequences from Algebra 1 to develop an understanding of patterns in data. Students will also relate their knowledge of a common ratio to determine first finite, second finite, and third finite differences in order to classify tables of values as either a linear, quadratic, cubic, or exponential function. Students will apply their understanding of finite differences to determine models for real world data.

### Big Ideas:
- Finite differences and common ratios can be used to construct function models from tables of data.
- Patterns in data can help determine what type of function is being represented by the data.

### Essential Questions
- How can a function models be determined from tables of data?
- How can the type of function data represents be determined?

<table>
<thead>
<tr>
<th>Concepts within Unit #1</th>
<th>TEKS</th>
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<tbody>
<tr>
<td>Concept #1: Sequences</td>
<td>AR.2A</td>
</tr>
<tr>
<td>Concept #2: Patterns and Linear Functions</td>
<td>AR.2A, AR.2B, AR.2C, AR.2D</td>
</tr>
<tr>
<td>Concept #3: Patterns and Exponential Functions</td>
<td>AR.2A, AR.2B, AR.2D</td>
</tr>
<tr>
<td>Concept #4: Patterns and Quadratic Functions</td>
<td>AR.2A, AR.2B, AR.2C, AR.2D</td>
</tr>
<tr>
<td>Concept #5: Patterns and Cubic Functions</td>
<td>AR.2A, AR.2B, AR.2C, AR.2D</td>
</tr>
</tbody>
</table>

## Unit 2: Analyzing Functions
Estimated Date Range: Sept. 16 – Oct. 10
Note: Includes 1 day for PSAT

## Unit Overview:
In this unit, students will continue their study of functions. In Algebra 1, students studied linear, quadratic, and exponential functions, studied the key features of linear, quadratic and exponential graphs, and graphed using transformations linear and quadratic functions. In this unit, students will graph linear, quadratic and exponential graphs using transformations. Students will also be introduced to the square root and absolute value functions. Students will apply their understanding of transformations to graph these functions using transformations. Once students have graphed functions, they will identify and analyze the key features. Students will then compare key features of sets of functions from graphs, tables and symbolic representations. The sets they compare will be linear, quadratic, and exponential or absolute value, quadratic, and square root.
Big Ideas:
- Transformations change graphs in predictable ways in order to examine features and changes in features.
- Multiple representations of functions provide critical information about the function in order to interpret and compare situations.

Essential Questions
- What effects do transformations have on the square root function?
- How can key attributes be determined, interpreted, and compared from the graphs, tables and symbolic representations of a linear, quadratic or exponential functions?
- How can key attributes be determined, interpreted, and compared from the graphs, tables and symbolic representations of an absolute value, quadratic or square root functions?

<table>
<thead>
<tr>
<th>Concepts within Unit #2</th>
<th>TEKS</th>
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<tbody>
<tr>
<td>Concept #1: Transformations of Functions</td>
<td>AR.3A, AR.7A</td>
</tr>
<tr>
<td>Concept #2: Compare Key Features of Sets of Functions</td>
<td>AR.3A, AR.7A</td>
</tr>
</tbody>
</table>

Grading Period 2

Unit 3: Inverses of Functions
Estimated Date Range: Oct. 15 – Nov. 6

Unit Overview: In this unit, students will continue their study of functions by studying inverse functions. Students will determine inverses from graphs, tables and symbolic representations. Students will compare and contrast the key features of a function and its inverse. Students will also verify inverses graphically and tabularly.

Big Ideas:
- Inverses and information about a function’s inverse can be found as reflections over the line y = x.
- Multiple representations of functions provide critical information about the function in order to interpret and compare situations.

Essential Questions
- Inverses and information about a function’s inverse can be found as reflections over the line y = x.
- Multiple representations of functions provide critical information about the function in order to interpret and compare situations.

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<thead>
<tr>
<th>Concepts within Unit #3</th>
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<tbody>
<tr>
<td>Concept #1: Inverses of Linear and Absolute Value Functions</td>
<td>AR.3B, AR.3C, AR.7A, AR.7B</td>
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<tr>
<td>Concept #2: Inverses of Quadratic and Square Root Functions</td>
<td>AR.3B, AR.3C, AR.7A, AR.7B</td>
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<td>Concept #3: Inverses of Rational Functions</td>
<td>AR.3B, AR.3C, AR.7A, AR.7B</td>
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<td>Concept #4: Inverses of Cubic and Cube Root Functions</td>
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<td>Concept #5: Inverses of Exponential and Logarithmic Functions</td>
<td>AR.3B, AR.3C, AR.7A, AR.7B</td>
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Unit 4: Operations of Functions
Estimated Date Range: Nov. 7 – Nov. 22 and Dec. 2 – Dec. 19
Note: Includes 7 days for semester exams and review

Unit Overview: In this unit, students will continue their study of functions. Students will add, subtract, multiply, and divide functions together in order to generate new functions. Students will perform operations symbolically (operations on equations), tabularly, and graphically. Students should make the connection between the representations when performing operations. Students will also explore composition by examining how the output of one function is the input of another function.
Big Ideas:
- Combining functions using operations generates new functions that can be examined to understand situations.

Essential Questions
- Why do we perform operations on functions?

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<tr>
<th>Concepts within Unit #4</th>
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<tbody>
<tr>
<td>Concept #1: Constructing and Deconstructing Functions</td>
<td>AR.3D, AR.3F</td>
</tr>
<tr>
<td>Concept #2: Composing and Decomposing Functions</td>
<td>AR.3E</td>
</tr>
</tbody>
</table>
Grading Period 3

Week of Inspirational Maths Spring
Estimated Date Range: Jan. 7 – Jan. 13

**Unit Overview:** This unit is a set of 5 lessons to begin the second semester. Lessons focus on growth mindset and how we learn mathematics.

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**Unit 5: Polynomial Functions**
Estimated Date Range: Jan. 14 – Feb. 13

**Unit Overview:** In this unit, students will extend their knowledge from operations (add, subtract, multiply, and divide) of polynomials of degree one and degree two to general polynomial functions. Students will:

- use tables, graphs and equations to add, subtract, multiply, and divide polynomial functions in order to solve problems arising from real-world situations
- compare and contrast the sum or product of two linear functions
- factor polynomials using graphs, tables, and algebraic methods
- divide polynomial functions using tables
- determine the linear factors of polynomial functions from tables, graphs, or symbolic representations

**Big Ideas:**
- Understanding of operations are needed to simplify expressions and solve equations related to real-world situations.

**Essential Questions**
- How can a tables, graphs, and equations be used to add or multiply two linear functions?
- How is the sum of two linear functions similar to the product of two linear functions? How are they different?
- What type of function would result if you multiply a cubic function by a linear function? A quadratic function by a cubic function?
- How can you use tables and graphs to identify the linear factors of a polynomial function?

**Concepts within Unit #5**

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Concept #1: Operations of Linear Functions</td>
<td>AR.4B</td>
</tr>
<tr>
<td>Concept #2: Applications of Operations of Polynomial Functions</td>
<td>AR.4A, AR.4B</td>
</tr>
<tr>
<td>Concept #3: Division of polynomial functions</td>
<td>AR.4C</td>
</tr>
<tr>
<td>Concept #4: Factors of Polynomial Functions</td>
<td>AR.4C, AR.4D</td>
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</tbody>
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## Unit 6: Matrices

Estimated Date Range: Feb. 18 – Mar. 6 and Mar. 16– Mar. 25

### Unit Overview:
In this unit, students will perform operations with matrices. Students will represent situations with two and three linear equations and use matrices to solve the systems. The concepts of this unit are:

- Adding and Subtracting Matrices
- Multiplying Matrices
- Systems of Equations

### Big Ideas:
- Matrices can be used to organize and represent a set of data.

### Essential Questions:
- When you add two matrices together, what do you do with the entries in the addend matrices in order to generate the entries for the sum matrix?
- When you subtract two matrices, what do you do with the entries in the subtrahend and minuend matrices in order to generate the entries for the difference matrix?
- When you multiply a matrix by a scale factor, what happens to the values of each entry in the matrix?
- Should you get the same answer to a system of equations regardless of the method of solving?
- How does scalar multiplication relate to the distributive property?

### Concepts within Unit #6

| Concept #1: Adding and Subtracting Matrices | AR.5A |
| Concept #2: Multiplying Matrices | AR.5B, AR.5C |
| Concept #3: Systems of Equations | AR.5B, AR.5C, AR.5D, AR.5E |

## Grading Period 4

### Unit 6: Matrices (Continued)

Estimated Date Range: Feb. 18 – Mar. 6 and Mar. 16– Mar. 25

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 #6

| Concept #1: Adding and Subtracting Matrices | AR.5A |
| Concept #2: Multiplying Matrices | AR.5B, AR.5C |
| Concept #3: Systems of Equations | AR.5B, AR.5C, AR.5D, AR.5E |

## Unit 7: Solutions of Equations

Estimated Date Range: Mar. 26 – April 23

### Unit Overview:
In this unit, students will estimate and determine solutions to equations resulting from functions and real-world applications. Students will work with linear, quadratic, rational, exponential, logarithmic, square root, and cubic functions. The concepts of this unit are:

- Estimating Solutions to Equations
- Solving Linear and Quadratic Equations
- Estimating Solutions to Exponential, Logarithmic, Square Root, and Cubic Functions

### Big Ideas:
- Functions show the relationship between two sets of numbers: the domain of the independent variable and the range of the dependent variable.

### Essential Questions:
- Which numbers would make reasonable input values for a given function with a given output value?
- What does it mean to solve an equation?
• How can you use graphs or tables to estimate solutions?

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<thead>
<tr>
<th>Concepts within Unit #7</th>
<th>TEKS</th>
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<tbody>
<tr>
<td>Concept #1: Estimating Solutions to Equations</td>
<td>AR.6A</td>
</tr>
<tr>
<td>Concept #2: Solving Linear and Quadratic Equations</td>
<td>AR.6A, AR.6B</td>
</tr>
<tr>
<td>Concept #3: Estimating Solutions to Exponential, Logarithmic, Square Root, and Cubic Functions</td>
<td>AR.6A, AR.6B, AR.6C</td>
</tr>
</tbody>
</table>

**Unit 8: Data Modeling**

**Estimated Date Range:** April 24 – 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. In Algebraic Reasoning, 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. The concepts of this unit are:

- Examining Domain and Range of Real World Data
- Determining Function Models from Data
- Predicting using Models

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

**Essential Questions**

- How can you determine domain and range of a function?
- How do you determine reasonableness of domain and range values in real-world situations?
- What limitations are placed on linear functions when they are used to model real-world data?
- What limitations are placed on quadratic functions when they are used to model real-world data?
- What limitations are placed on exponential functions when they are used to model real-world data?
- What limitations are placed on rational functions when they are used to model real-world data?
- How can you determine which function best models a set of data or an interval within a set of data?

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<thead>
<tr>
<th>Concepts within Unit #8</th>
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<tbody>
<tr>
<td>Concept #1: Examining Domain and Range of Real-World Data</td>
<td>AR.7A, AR.7B</td>
</tr>
<tr>
<td>Concept #2: Determining Function Models from Data</td>
<td>AR.7A, AR.7B, AR.7D, AR.7E</td>
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<tr>
<td>Concept #3: Predicting using Models</td>
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