## Advanced Quantitative Reasoning

### 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 occur throughout the cycle.

Adopted Resources:

High School: 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:

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

Grading Period 1

Unit 1: Numerical Reasoning
Estimated Date Range: Aug. 15 – Sept. 14

Unit Overview: In this unit, students will focus on proportional reasoning and basic numerical calculations such as ratios, rates, and percents, by applying them to settings in business, media, consumer, and other areas. Working with familiar mathematical tools and learning some new ones, students improve their ability to solve problems by applying appropriate strategies.
Big Ideas:
• Informed decisions based on data can be determined through calculations and interpretations of numerical summaries, such as weighted averages and sums, indices, and ratings, decisions, predictions, and critical judgments are conveyed.
• Techniques such as Fermi questions, counting principal, and the use of two-dimensional and three-dimensional models can be used to solve problems involving large quantities.

Essential Questions
• How can informed decisions be determined based on data?
• What numerical methods can be used to solve problems involving large quantities?

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<th>Concepts within Unit #1</th>
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<td>Concept #1: Measurement and Indirect Measurement</td>
<td>AQ.2A, AQ.2C, AQ.2D</td>
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<td>Concept #2: Ratios and Proportionality</td>
<td>AQ.2A, AQ.2C, AQ.2D</td>
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<tr>
<td>Concept #3: Ratings, Weighted Averages, Indices</td>
<td>AQ.2B, AQ.2H</td>
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Unit 2: Probability
Estimated Date Range: Sept. 17 – Oct. 18

Unit Overview: In this unit, students will focus on the analysis of information using probability to make decisions about everyday situations. After determining the probability of various events, students expand their knowledge toward making decisions about the risks and mathematical fairness of these events.

Big Ideas:
• The probability of an event occurring is modeled through the use data and sample spaces.
• Representations such as: a number between 0 and 1 regarding the chance that an event will occur, Venn diagrams, tree diagrams, lists, and area models can be analyzed to interpret probability.

Essential Questions
• How can you interpret probabilities in order to make decisions regarding an event occurring?
• What can be used to interpret the probability of an event occurring?

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<td>Concept #1: Calculate and Represent Probabilities</td>
<td>AQ.4A, AQ.4B, AQ.4C, AQ.4D</td>
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<td>Concept #2: Probability Applications</td>
<td>AQ.4A, AQ.4C, AQ.4D, AQ.4E, AQ.4F, AQ.4G</td>
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<td>Concept #3: Combinatorics</td>
<td>AQ.2E</td>
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Grading Period 2

Unit 3: Algebraic Reasoning with Mathematical Models
Estimated Date Range: Oct. 22 – Nov. 16 and Nov. 26 – Nov. 30

Unit Overview: In this unit, students will focus on analyzing data and finding rules to model the data. By looking at recursive models for bivariate data and relationships, students expand their set of tools for data analysis.

Big Ideas:
• Bivariate data has a shape and distribution, which help us understand relationships.
• Understanding mathematical models can aid in making informed financial decisions in everyday situations.
• The graph of a function provides critical information about the function in order to interpret situations.

Essential Questions
• What features of the graphical representation of data (scatterplot) are useful in interpreting results?
• How can selecting the appropriate function contribute to making accurate predictions?
• How can you determine the appropriate growth or decay model from given data?
### Unit 4: Data and Statistics

**Estimated Date Range:** Dec. 3 – Dec. 21 and Jan. 8 – Feb. 14  
**Note:** Includes 7 days for Semester Exams and review

**Unit Overview:** In this unit, students will focus on the statistical problem solving process that includes designing a study, collecting data, representing data and analyzing the data. Students will examine strengths and weakness of studies in order to make appropriate decisions and understand relationships.

**Big Ideas:**
- Strengths and weaknesses of studies assist with making appropriate predictions and decisions based on the accuracy of the study to reveal patterns that help us to understand relationships.

**Essential Questions**
- Why is it necessary to describe strengths and weaknesses of results for a statistical study?

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<td>Concept #1: Linear Models</td>
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<td>Concept #2: Exponential Models</td>
<td>AQ.3A, AQ.3B, AQ.3C</td>
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<td>Concept #3: Logistic Models</td>
<td>AQ.3A, AQ.3C</td>
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<td>Concept #4: Piecewise Functions</td>
<td>AQ.3A, AQ.3E</td>
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<td>Concept #5: Cyclical Functions</td>
<td>AQ.3A, AQ.3D</td>
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<th>Concepts within Unit #4</th>
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<td>Concept #1: Questions and Study Design</td>
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<tr>
<td>Concept #2: Collection of Data</td>
<td>AQ.2G, AQ.4K, AQ.4M, AQ.4O</td>
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<tr>
<td>Concept #3: Representations of Data</td>
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<td>Concept #4: Analysis of Data</td>
<td>AQ.4H, AQ.4I, AQ.4J, AQ.4K, AQ.4L, AQ.4O, AQ.4Q, AQ.4R, AQ.4T</td>
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## Grading Period 3

**Unit 4: Data and Statistics (Continued)**

Estimated Date Range: Dec. 3 – Dec. 21 and Jan. 8 – Feb. 14  
Note: Includes 7 days for Semester Exams and review

Note: This unit is continued from Grading Period 2. Please refer to Grading Period 2 for the Unit Overview, Big Ideas, and Essential Questions for this unit.

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<tr>
<td>Concept #1: Questions and Study Design</td>
<td>AQ.4H, AQ.4J, AQ.4L, AQ.4N, AQ.4O, AQ.4S</td>
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<tr>
<td>Concept #2: Collection of Data</td>
<td>AQ.2G, AQ.4K, AQ.4M, AQ.4O</td>
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**Unit 5: Large Collections of Data**

Estimated Date Range: Feb. 18 – Mar. 8

Unit Overview: In this unit, students will apply arrays and matrices in order to solve problems including product distribution and sales, geometric transformations, and code encryption.

Big Ideas:  
- Arrays and matrices allow for the efficient management of large collections of data in order to solve problem.

Essential Questions:  
- How do solve problems that involve large collections of data?

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<th>Concepts within Unit #5</th>
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<tr>
<td>Concept #1: Arrays and Matrices</td>
<td>AQ.2F</td>
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Unit Overview: The Mathematical Models in Finance unit focuses on the financial decisions that surround borrowing, loaning, and investing money and how the time value of money affects such decisions. While some of these topics may be familiar to teachers and students, the mathematics behind them can be challenging. Thus, these contexts provide rich opportunities for critical thinking and problem solving. This unit goes well beyond typical “consumer math” skills that might be addressed in middle school or high school. It asks students to use sophisticated mathematical models to deal with problems in these familiar situations. In earlier units, students studied the mathematical structure involved in such decision-making: \( f(t) = ab^t \), the general exponential function. They use this function as the basis for more complex functions that model change in a variety of financial situations. The overall goal of this unit is to provide future citizens with mathematical and financial tools they can use to plan wisely and use credit knowledgeably.

Big Ideas:
- Appropriate formulas can be applied to efficiently generate numerical data to make financial predictions.
- Understanding monetary (mathematical) models can aid in making informed financial decisions in everyday situations.

Essential Questions
- How can mathematical connections within financial models affect predictions?
- How can appropriate representations contribute to selecting the best financial options in everyday situations?

Concepts within Unit #6
| Concept #1: Income | AQ.3F |
| Concept #2: Expenditures | AQ.3G |
| Concept #3: Loans and Investments | AQ.3H |

Unit Overview: The Paths and Circuits unit focuses on the creation of models that represent real-world contexts involving networks and graphs and the use of these networks and graphs to investigate real-world scheduling problems. In this unit, students extend their ability to solve abstract and concrete problems. Although networks and graphs have geometrical connections (in that they are drawn in two dimensions with points, lines, and curves), the mathematical reasoning required to create, understand, and use them is new to most students.

Big Ideas:
- Appropriate algorithms can be applied to efficiently gather, organize, and interpret numerical data
- Explaining how selected tools can be applied, through written or oral communication, will assist in making connections between the mathematics and real-world situations.

Essential Questions
- How would you apply mathematical skills in real-world situations to manipulate numerical data?
- How can you justify the mathematics used to solve problems in real-world situations?

Concepts within Unit #7
| Concept #1: Paths and Circuits | AQ.2H |
| Concept #2: Minimal Spanning Trees | AQ.2H |
| Concept #3: Graph Coloring | AQ.2H |
| Concept #4: PERT Charts | AQ.2H |