# Math Models with Applications

## 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:

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

**Grading Period 1**

**Unit 1: Modeling with Linear Functions**

**Estimated Date Range:** Aug. 14 – Sept. 6

**Unit Overview:** Students will access their prior knowledge of linear functions and their knowledge of personal finance from middle school to apply linear functions to finance and budget applications. In this unit, students will create, modify, and sustain a personal budget based on earnings using the concepts of rate and linear functions. Students should be able to solve personal finance and budgeting problems and relate their understanding of compensation and deductions as it applies to personal finance.

**Big Ideas:**

- Personal financial and budgeting problems can be solved by using rates and linear functions.
Understanding monetary concepts, such as interest, can aid in making financial decisions.

**Essential Questions:**
- How can rates and linear functions be used to solve real world problems?
- What factors should be considered when choosing the best investment (savings) plan?

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<td>Concept #2: Savings</td>
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### Unit 2: Financial Modeling
Estimated Date Range: Sept. 9 – Oct. 10

#### Unit Overview:
In this unit, students will investigate and compare the features of online banking and checking accounts, solve problems involving personal taxes and use real world data and tax brackets to determine the amount of income taxes owed by an individual based on taxable income, and compare and contrast different types of insurance coverage offered and investment options available.

#### Big Ideas:
- Online banking options could be important factors to consider when making decisions about banking.
- Various taxes we encounter in the real-world affect our net income
- Insurance coverage and investment options are important considerations

#### Essential Questions:
- Online banking options could be important factors to consider when making decisions about banking.
- Various taxes we encounter in the real-world affect our net income
- Insurance coverage and investment options are important considerations

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<td>Concept #3: Financial Planning</td>
<td>M.4A, M.4B</td>
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### Grading Period 2

#### Unit 3: Exponential Models
Estimated Date Range: Oct. 15 — Nov. 8

#### Unit Overview:
In this unit, students will use exponential models to solve and make predictions in both scientific context and financial context. Students will make predictions using exponential models (graphs and equations) to solve problems involving growth, decay, and in particular radioactive decay. Students will use regression to create an exponential model to make predictions regarding growth and decay. Students will create amortization tables using formulas and with technology in order to make informed decisions regarding financial decisions (including buying vs. renting a house and buying vs. leasing a car). Students will use regression to create an exponential model to make predictions about financial decisions.

#### Big Ideas:
- Appropriate formulas can be applied to efficiently generate numerical data in order to make informed decisions.
- Real-world situations that represent an exponential relationship can be modeled by functions.

#### Essential Questions:
- What is the purpose of an amortization table?
- How can you model exponential situations, such as growth and decay?
- How can you use a model to make predictions?
## Unit 4: Quadratic Models and Variation

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 use quadratic functions to model motion. Students have prior experience with modeling motion with quadratics from Algebra 1. There should be an emphasis on multiple representations and using technology to model. Students will also apply variation to physical laws. Students have experience with solving problems using direct variation. They will be introduced to inverse variation and joint variation in this unit.

### Big Ideas:
- Functions can be used to model real world situations.

### Essential Questions:
- How can real life situations be modeled?

### Concepts within Unit #4

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### Concepts within Unit #3

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<td>M.5B, M.9F</td>
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# Grading Period 3

## Unit 5: Similarity and Transformations

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

**Unit Overview:** In this unit, students will extend on their previous knowledge of similarity, transformations, symmetry, scale factor, dimensional changes, surface area and volume. Students will apply these geometric properties to problems related to art, photography, engineering and architecture.

**Big Ideas:**
- Scale drawings and similar figures have corresponding parts that are proportional.
- Real world situations such as architecture and fine arts can be described with mathematical patterns and structure.

**Essential Questions:**
- What can you use to determine the type of dimensional change occurring in 2 and 3 dimensional figures?
- How can math be used to solve problems in art and architecture?

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<td>Concept #2: Dimensional Analysis</td>
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## Unit 6: Right Triangles and Trigonometry

**Estimated Date Range:** Jan. 30 – Feb. 27

**Unit Overview:** In this unit, students will extend on their previous knowledge of right triangles to study how Pythagorean theorem, special right triangles and trigonometric ratios can help solve problems in architecture and the fine arts. Students will also be introduced to the sinusoidal graph and how it models periodic motion in particular sound waves.

**Big Ideas:**
- Real world situations such as architecture and fine arts can be described with mathematical patterns, including trigonometry and periodic motion.

**Essential Questions:**
- How can math be used to solve problems in art and architecture?

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<td>Concept #2: Periodic Models</td>
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## Unit 7: Probability Models

**Estimated Date Range:** Feb. 27 – Mar. 6 and Mar. 16 – Mar. 30

**Unit Overview:** In this unit, students will extend on their previous knowledge of theoretical and experimental probability to determine the reasonableness of geometric and binomial theoretical models. Students will also compare different ways to determine the number of way an event may occur by using combinations, permutations, and the Fundamental Counting Principle.

**Big Ideas:**
- While order (position) matters with permutations, it does not matter with combinations.
- Social Science careers use combinations, permutations, and the Fundamental Counting Principle to determine the number of ways an event may occur.
- The probability of an event occurring can be represented by a number between 0 and 1 which represents the chance that an event will occur.
- The event or the relative frequency of outcomes can be used to determine probability.
The binomial theoretical model is used to calculate the number of success out of the given number of trials where order does not matter in the collection of objects.

The geometric theoretical model does not have affixed number of trials and represents the probability that the first success occurs on the nth trial.

Essential Questions:
- How can combinations and permutations be used to determine the number of ways an event may occur?
- How can it be determined whether to use combinations or permutations?
- How can the Fundamental Counting Principle be used to determine the number of ways an event may occur?
- How can you represent the probability of an event occurring?
- What can be used to determine the probability of an event occurring?
- What is meant by a binomial probability theoretical model?
- How is an experiment designed to determine the reasonableness of a binomial theoretical model for a particular situation?
- What does a geometric area probability model mean?
- How is an experiment designed to determine the reasonableness of a geometric theoretical model for a particular situation?
- What is the comparison and contrast between the binomial and geometric probability models?

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<td>Concept #3: Theoretical Models</td>
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# Grading Period 4

## Unit 7: Probability Models (Continued)

**Estimated Date Range:** Feb. 27 – Mar. 6 and Mar. 16 – Mar. 30

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.

### Concepts within Unit #7

| Concept #1: Theoretical vs. Empirical Probability | M.8B |
| Concept #2: Combinations and Permutations | M.8A |
| Concept #3: Theoretical Models | M.8C |

## Unit 8: Statistical Models

**Estimated Date Range:** Mar. 31 – April 27

**Unit Overview:** In this unit, students will interpret and analyze categorical and numerical data to draw conclusions and will learn how to evaluate the strengths of those conclusions. This unit also addresses the use of measures of central tendency and variability to make inferences with data modeling normal distribution. This is the first time students will learn how to find the standard deviation and understand it as a measure of spread. Students will also be introduced to the normal model and the empirical rule and will learn how and when to apply this model.

### Big Ideas:

- Qualitative and Quantitative data can be organized and displayed in various ways to interpret information, make predictions and draw conclusions.
- Quantitative data is analyzed using different measures to interpret information, make predictions and draw conclusions.
- The normal model can be used to draw various conclusions from data that is normally distributed.
- The central tendency and shape of a data tell a story to inform decision-making.

### Essential Questions:

- What graphical representations can be used to represent data?
- When representing data graphically, how is the best representation determined?
- What are the characteristics of the following types of graphs: line graphs, bar graphs, circle graphs, histograms, scatter plots, dot plots, stem-and-leaf plots, and box and whisker plots?
- What processes are used to construct the following graphs: line graphs, bar graphs, circle graphs, histograms, scatter plots, dot plots, stem-and-leaf plots, and box and whisker plots?
- What aspects of a data distribution can be emphasized with the following types of graphs: line graphs, bar graphs, circle graphs, histograms, scatter plots, dot plots, stem-and-leaf plots, and box and whisker plots?
- What type of conclusions can be drawn from the different representations and how are the conclusions used to make predictions?
- How can the measures of central tendency be used to summarize data?
- How do you determine the most appropriate measure of central tendency that will provide the best information in a problem situation?
- What is the standard deviation (population standard deviation and sample standard deviation), how is it determined, and what does it represent in the data set?
- What conclusions might be drawn from the standard deviation?
Concepts within Unit #8

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<td>Concept #3: Normal Models</td>
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Unit 9: Statistical Studies

Estimated Date Range: April 28 – May 28

Note: Includes 7 days for semester exam and review

Unit Overview: During this unit, students will explore sampling techniques, use statistical parameters to estimate the population mean and proportion, compare and contrast types of research such as surveys, experiments, and observational studies and utilize their data analysis skills to interpret misleading graphs in print and electronic media.

Big Ideas:
- There are different sampling techniques that can be used to draw conclusions about a population.
- The mean of a population is estimated from the sample mean of the population.
- Information from a sample is used to draw conclusions about the entire population.
- Population proportion is estimated the sample proportion of a population that fits a chosen attribute.

Essential Questions:
- What are the advantages and disadvantages of sampling techniques such as simple random sampling (SRS), stratified sampling, cluster sampling, systematic sampling and convenience sampling?
- How are population mean and population proportion determined?
- How can estimations of population mean and population proportion be applied in problem situations?
- What are the differences in surveys, experiments and observational studies?
- How can the appropriate type of research be selected to address a particular question?
- What characteristics and details can be used in analyzing marketing claims for validity?
- What are some ways to make graphs and statistics imply invalid conclusions?
- Why are statistical summaries used?

Concepts within Unit #9

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