Math Models with Applications
Overview
2022-2023

This document is designed provide parents/guardians/community an overview of the curriculum taught in the FBISD classroom. This document supports families in understanding the learning goals for the course, and how students will demonstrate what they know and are able to do. The overview offers suggestions or possibilities to reinforce learning at home.

Included at the end of this document, you will find:

- A glossary of curriculum components
- The content area instructional model
- Parent resources for this content area

To advance to a particular grading period, click on a link below.

At Home Connections

The following are suggestions for reinforcing number sense and mathematical reasoning at home. These ideas can be used throughout the school year. You will find additional ideas to reinforce learning at home within each unit below.

- Ask questions that require students to describe and elaborate on their thinking and reasoning. Topics can be about everyday things as well as mathematics.
- Engage students in situations that challenge them to inquire and persevere through questioning.
- Play card games with students
- Play games with students such as Mancala, Yahtzee, Blokus, Rack-O, Mastemind, etc.
- Work number puzzles such as Sudoku, KenKen, Kakuro, or Numbrix.

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.

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. 10 – Sept. 8
Estimated Time Frame: 21 days

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.

At home connections:

- Discuss the importance of budgeting and savings.
- Research saving options at various banking institutions. Consider opening a savings account for the student.
- Have student create a budget worksheet based on current or future earnings.

Concepts within Unit #1 **Link to TEKS**	**Success Criteria for this concept**
Learning Math Online TEKS: M.1A, M.1B, M.1C, M.1D, M.1E, M1F, M.1G	• Demonstrate active listening skills while sharing in the community circle. • Make positive and supportive connections with my peers. • Engage in circle dialogues using the circle guidelines. • Share my math ideas and strategies when given a problem during the number sense routine. • Explain what a Respect Agreement is and why it is created. • Work in a group to solve a mathematical problem. • Describe strategies that I can use to solve math problems. • Provide feedback to by peers using guidelines and a protocol.
Concept #1: Budgeting TEKS: M.2A, M.9F	• create, modify as needed, and sustain a personal budget based on earnings using the concepts of rate and linear functions. • solve personal finance and budgeting problems using rates and linear functions.
Concept #2: Savings TEKS: M.2A, M.4C, M.9F	• Generate linear function to model a simple interest problem. • Use linear functions to analyze types of savings options involving simple interest • Graph linear functions to model a simple interest problem. • Use linear regression to model linear functions involving simple interest • Determine a line of best fit for a set of data in a simple interest problem. • Compare types of savings options involving simple and compound interest. • Make predictions as it relates to personal finance (i.e., commissions, income, wages, etc.).

Unit 2: Financial Modeling

Estimated Date Range: Sept. 9– Oct. 7
Estimated Time Frame: 20 days

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.

At home connections:

- Discuss banking options and features of online banking.
- Consider opening a student checking account for the student to build financial ownership.

- Share with student the purpose of insurance and the different insurance policies (life, auto, renter's, home, medical, etc.) an adult may encounter.
- Have student investigate the IRS 1040 tax tables to learn more about taxable income.
- Ask student to share at what age he/she would like to retire and the plan for accumulating enough money to sustain retirement.

Concepts within Unit # 2 Link to TEKS	**Success Criteria for this concept**
Concept #1: Banking TEKS: M.2C	• Investigate the features of checking accounts • Compare the features of checking accounts from more than one banking institutions • Analyze data to make decisions about banking • Investigate the features of online banking
Concept #2: Taxes TEKS: M.2B	• Determine the amount of income taxes owed by an individual based on taxable income • Determine the difference between gross and net income in relation to income taxes • Determine the tax bracket based on net income • Analyze the effects of deductions on personal income tax

Concept #3: Financial Planning
TEKS: M.4A, M.4B
	• Discuss the types of insurance that are required by citizens of the United States and as residents of Texas.
	  ○ Medical
	  ○ Auto (Liability only)
	  ○ Homeowner's (with mortgage)
	• Explore optional insurance options.
	  ○ Medical (vision, dental)
	  ○ Auto (Comprehensive/Collision)
	  ○ Life
	  ○ Renter's
	• Calculate insurance premiums
	  ○ Medical
	  ○ Auto
	  ○ Life
	  ○ Renter's
	• Compare and contrast different types of insurance coverage offered.
	  ○ Auto
	  ○ Medical
	• Compare and contrast different investment options
	  ○ Stocks
	  ○ Bonds
	  ○ Annuities
	  ○ Certificates of deposit
	  ○ Retirement plans

Grading Period 2

Unit 3: Exponential Models

Estimated Date Range: Oct. 11 – Nov. 4
Estimated Time Frame: 18 days

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 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.

At home connections:

- Have student research amortization tables for buying a home or vehicle at a given sales price.
- Ask student to share the importance and components of the amortization table.

Concepts within Unit # 3 Link to TEKS	Success Criteria for this concept
Concept #1: Scientific Models TEKS: M.5B, M.9F	• Use technology to graph an exponential growth or decay problem. • Use a graph of an exponential model to solve problems. • Determine a model for an exponential growth or decay problem using exponential regression. • Use an exponential model to solve problems. • Model and solve problems involving radioactive decay.

Concept #2: Financial Models
TEKS: M.3A, M.3B, M.3C, M.3D, M.4C, M.9F
	• Use formulas to create amortization tables for
	  ○ Buying or renting a home
	  ○ Buying or leasing a vehicle
	  ○ Retail credit options
	  ○ Savings options
	• Use technology to create amortization tables for
	  ○ Buying or renting a home
	  ○ Buying or leasing a vehicle
	  ○ Retail credit options
	  ○ Savings options
	• Compare options from amortization tables to make informed decisions regarding
	  ○ Buying or renting a home
	  ○ Buying or leasing a vehicle
	  ○ Retail credit options
	  ○ Savings options
	• Determine a model for financial application problems using exponential regression.
	• Make predictions using a regression model regarding financial decisions

Unit 4: Quadratic Models and Variation

Estimated Date Range: Nov.7 – Nov. 18 and Nov. 28 – Dec. 16
Estimated Time Frame: 25 days
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.

At home connections:

- Ask student to share real-world examples of a quadratic function.
- Ask student to create an instructional tool such as a video or short story explaining Hooke's and Boyle's Law.

Concepts within Unit # 4 **Link to TEKS**	**Success Criteria for this concept**
Concept #1: Motion TEKS: M.5A, M.5C	• Solve distance rate problems using direct variation. • Model a quadratic graph that represent a motion problem. • Identify the key features of the quadratic model and explain their meaning in the context of the situation. • Write an equation of a quadratic function to solve a motion problem.
Concept #2: Physical Laws TEKS: M.5A	• Model inverse variation • Solve physical problems using inverse variation.. • Model and solve problems using proportional relationships that involve physical laws.

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Grading Period 3

Unit 5: Similarity and Transformations

Estimated Date Range: Jan. 5 - Jan. 27
Estimated Time Frame: 16 days

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.

At home connections:

- Ask student to choose an object and model the different types of transformations.
- Ask student to identify transformations, similarity, and symmetry in art, photograph, engineering, and/or architecture.
- Have student create a scale drawing of his/her dream home.

Concepts within Unit # 5 Link to TEKS	Success Criteria for this concept
Concept #1: Patterns and Structures TEKS: M.6A, M.7B	• Use geometry formulas to solve problems. • Use scale drawings in the problem-solving process. • Identify a tessellation • Preform a transformation on a given figure • Translate a given figure • Rotate a given figure • Perform a glide reflection on a given figure • Identify reflective and translational symmetry • Recognize a golden rectangle finding the golden ratio • Recognize Fibonacci numbers and the ratios of successive terms • Understand one- and two- point perspective
Concept #2: Dimensional Analysis TEKS: M.6B, M.7D	• Recognize perimeter as a geometric property of plane figures. • Write formulas for quadrilaterals, triangles and other polygons. • Use unit analyses to solve problems involving perimeter • Write and use formulas for the circumference of a circle • Calculate perimeter of many-sided figures using formulas and combinations of formulas • Use unit analysis to solve problems involving perimeters • Explain how changes in dimensions affect the perimeter of plane figures • Write area formulas for polygons. • Calculate the area of polygons • Explain how changes in dimensions affect the perimeter of plane figures • Solve problems in context using geometric models • Distinguish between problems requiring area and perimeter • Recognize geometric properties in three-dimensional figures • Write formulas for surface area of 3-d figures • Solve for the surface area for 3-d figures

	• Write formulas for volume of 3-d figures • Solve for the volume for 3-d figures • Solve dimensional analysis problems in which all the dimensions change equally. • Solve dimensional analysis problems in which not all the dimensions change or do not change equally.

Unit 6: Right Triangles and Trigonometry

Estimated Date Range: Jan. 30 – Feb. 24
Estimated Time Frame: 18 days

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 and in particular sound waves.

At home connections:

- Have student share real-world examples/ pictures of sinusoidal functions.
- Have student create a game involving the Pythagorean Theorem, Right Triangles, and Trig Ratios.

Concepts within Unit # 6 Link to TEKS	Success Criteria for this concept
Concept #1: Applications of Distance TEKS: M.6C, M.6D	• Verify and use the Pythagorean theorem for right triangles. • Use the Pythagorean theorem to solve problems finding distances • Identify the sides of corresponding angles of a right tringle. • Determine the length of the sides of right triangles using proportions • Determine the sine, cosine and tangent of a right triangle • Use trig ratios to find a missing distance. • Use trig ratios to find a missing angle. • Determine the inverse sine and inverse cosine of a number using technology.
Concept #2: Periodic Models TEKS: M.7A, M.7C	• Determine the equation of the sine function that best fits given data • Explain the relationship between wavelength and frequency • Determine the sine model for a given frequency.

Unit 7: Probability Models

Estimated Date Range: Feb. 27 – Mar. 10 and Mar. 20 – Mar. 29
Estimated Time Frame: 18 days (Continued in grading period 4)

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 ways an event may occur by using combinations, permutations, and the Fundamental Counting Principle.

At home connections:

- Have student share the difference between permutations and combinations
- Ask student to identify real-world examples of permutations and combinations.

Concepts within Unit # 7 **Link to TEKS**	**Success Criteria for this concept**
Concept #1: Theoretical vs Empirical Probability TEKS: M.8B	nces and similarities of theoretical and empirical probability w of large numbers applies to theoretical and empirical
Concept #2: Combinations and Permutations TEKS: M.8A	• Define Combinatorics • Explain the Fundamental Counting Principle, combinations, and permutations • Identify which counting principle applies to a word problem and solve the problem • Express binomial coefficient in two ways • Solve combination and permutation word problems by utilizing the formula
Concept #3: Theoretical Models TEKS: M.8C	• Use a graphic organizer to list the components of a binomial and geometric experiment • Identify the number of trials • Determine the success and failure in the problem • Determine the probability of the success and failure and the number of times they occur • Use the combination formula to determine the number of arrangements • Multiply the number of arrangements by the number of times success and failure can happen • Use the binomial probability formula to check my answer • Identify the number of times until success happens. • Multiply the frequency of the probability of failures and successes • Use the geometric probability formula to check my answer • Find the binomial or geometric probability of an event happening and justify the answer • Use the binomial/geometric models or formula and graphing calculator to evaluate the answer from the experiment

Grading Period 4

Unit 7: Probability Models (Continued)

Estimated Date Range: Feb. 27 – Mar. 10 and Mar. 20 – Mar. 29
Estimated Time Frame: 18 days (Continued from Grading Period 3)
See Grading Period 3 for details

Unit 8: Statistical Models

Estimated Date Range: Mar. 30 – April 26
Estimated Time Frame: 18 days

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.

At home connections:

- Have student gather various graphs from print and media and interpret the graphs.
- Have student survey the ages of immediate or extended family and determine the range, interquartile range, and/or standard deviation.

Concepts within Unit # 8 **Link to TEKS**	**Success Criteria for this concept**
Concept #1: Representing and Interpreting Data TEKS: M.9A	• Analyze and explain information from various graphs
Concept #2: Numerical Data TEKS: M.9A, M.9B	• Determine measures of central tendency, including the mean, median and mode) • Recognize the shape of a distribution (symmetric, skewed left, skewed right) • Determine measures of variability including range, interquartile range, and standard deviation • Distinguish between the standard deviation formula for a population and sample
Concept #2: Normal Models TEKS: M.9B	• Identify a normal distribution • List the properties of a normal curve • Determine the z-score of a given numerical data value in a normal distribution • Identify the properties of a standard normal curve, including the empirical rule • Solve problems using the z-score of standardized normal curve

Unit 9: Statistical Studies

Estimated Date Range: April 27 – May 25
Estimated Time Frame: 21 days

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.

At home connections:

- Ask student to share a misleading graph in print or media and why the graph is misleading
- Create with student a valid survey to share with family and friends.

Concepts within Unit # 9 **Link to TEKS**	**Success Criteria for this concept**

Concept #1: Sampling Populations
TEKS: M.9D
	• Explain the advantages and disadvantages of the following sampling techniques:
	  ○ Simple Random Sampling (SRS)
	  ○ Stratified Sampling
	  ○ Convenience Sampling
	  ○ Voluntary Sampling
	  ○ Cluster Sampling
	  ○ Systematic Sampling
	• Calculate the sample mean and proportion to estimate the population mean and proportion
	• Identify how the size of a sample affects the results
	• Explain what bias in a sample means

Concept #2: Types of Research TEKS: M.9C, M.10A, M.10B	• List and explain the features of a valid survey, an experiment and an observations study
Concept #3: Analyzing Statistical Stud TEKS: M.9E	• Recognize how scaling of the axes of a graph can misrepresent data • List the common actions that can make a graph misleading • Determine if a stated or implied conclusion is true.

Glossary of Curriculum Components

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.
Unit Overview – The unit overview provides a brief description of the concepts covered in each unit.
Concept – A subtopic of the main topic of the unit.
Success Criteria—a description of what it looks like to be successful in this concept.

Parent Resources

The following resources provide parents with ideas to support students' understanding. For sites that are password protected, your child will receive log-in information through their campus.

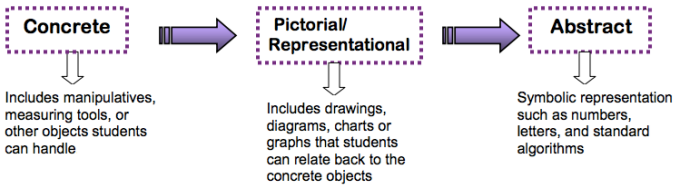
Resource	How it supports parent and students
Pearson-Math Models with Applications	This is the state adopted textbook for high school math. Students will receive login information from their teacher.
Didax Virtual Manipulatives Math Learning Center Math Apps Polypad: Mathigon – Virtual Manipulatives	These online resources provide access to virtual manipulatives.
Parent Resources from youcubed.org	This resource from youcubed.org includes articles for parents on ways to support their students in learning and understanding mathematics.
Student Resources from youcubed.org	This resource from youcubed.org includes videos concerning growth mindset in mathematics.
Math: Why Doesn't Yours Look Like Mine?	This resource provides an explanation of why math looks different now as opposed to how parents learned mathematics and how to support students in learning mathematics.

Supplemental Resource and Tool Designation:

- The TI Nspire CX calculator is a standardized technology integration tool used for Mathematics and Science in FBISD.

Instructional Model

The structures, guidelines or model in which students engage in a particular content that ensures understanding of that content.



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.