LINEAR FUNCTIONS - UNIT 1 (First Quarter)

AFDA.1
The student will investigate and analyze function (linear, quadratic, exponential, and logarithmic) families and their characteristics. Key concepts include:
a) continuity
c) domain and range
d) zeros
e) intercepts

AFDA.2
The student will use knowledge of transformations to write an equation given the graph of a function

AFDA.3
The student will collect data and generate an equation for the curve (linear, quadratic, exponential, and logarithmic) of best fit to model real-world problems or applications. Students will use the best fit equation to interpolate function values, make decisions, and justify conclusions with algebraic and/or graphical models.

AFDA.4
The student will transfer between and analyze multiple representations of functions including algebraic formulae, graphs, tables, and words. Students will select and use appropriate representations for analysis, interpretation, and prediction.

Key Vocabulary/Topic	Essential Knowledge	Suggested Activities
Domain Range Function	Identify the domain and range for a relation, given a set of ordered pairs, a table, or a graph.	Disappearing Candy Bar Bouncing Balls Paycheck Creating Rectangles String Cuts
	For each x in the domain of f, find $f(x)$. - For each x in the domain of f, x is a member of the input of the function f, $f(x)$ is a member of the output of f, and the ordered pair $[x, f(x)]$ is a member of f.	
Zeros *Initial value* *Intercepts*	Identify the zeros of the function algebraically and confirm them, using the graphing calculator. - A value x in the domain of f is an x-intercept or a zero of a function f if and only if $f(x) = 0$. Identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically.	
Continuous *Discontinuity*	Recognize restricted/discontinuous domains and ranges. Describe continuity of a function on its domain or at a point. - A function is continuous on an interval if the function is defined for every value in the interval and there are no breaks in the graph. A continuous function can be drawn without lifting the pencil.	
Slope *y-intercept* *Slope-intercept form*	Write an equation of a line when given the graph of a line.	
Transformational Form	Write the equation of a linear function in *(h, k)* form given the graph of the parent function and transformation information.	

	Describe the transformation from the parent function given the equation written in *(h, k)* form or the graph of the function.
	- Transformations include:
	  - Translations (horizontal and vertical shifting of a graph)
	  - Reflections
	  - Dilations (stretching and compressing graphs, and)
	  - Rotations	

	-	
	Given the equation of a function, recognize the parent function and transformation to graph the given function.	
	Describe the parent function represented by a scatter plot. Describe relationships between data represented in a table, in a scatter plot, and as elements of a function. Determine the appropriate representation of data derived from real-world situations.	
Residual = Actual – Fitted *Rate of Change* *Correlation* *Correlation Coefficient*	Write an equation for the line of best fit, given a set of data points in a table, on a graph, or from a practical situation. - The regression equation modeling a set of data points can be used to make predictions where appropriate.	Hookes Law Bridge Displacement Investigation String Activity TV and Test Grades TV Preferences DiVinci's Man CSI Investigations
	Make predictions about unknown outcomes, using the equation of a line of best fit. - Data and scatter plots may indicate patterns that can be modeled with a function.	
	Collect and analyze data to make decisions and justify conclusions.	
	Investigate scatter plots to determine if patterns exist, and identify the patterns - Two variables may be strongly associated without a cause-and-effect relationship existing between them. - Each data point may be considered to be comprised of two parts: fit (the part explained by the model) and residual (the result of chance variation or of variables not measured).	
Least Squares Regression	Describe the errors inherent in extrapolation beyond the range of the data. - Least squares regression generates the equation of the line that minimizes the sum of the squared distances between the data points and the line.	
	Estimate the correlation coefficient when given data and/or scatter plots. - A correlation coefficient measures the degree of association between two variables that are related linearly.	

Essential Questions

1. How does one determine if given data represents a linear function?
2. How does a function representing a set of data correlate to the parent linear function?
3. How does one determine the line of best fit for data representing a linear function?
4. Given a real-world situation, how does one determine how best to represent the data (table, graph, equation)?
5. How can predicting and/or extrapolating, given data, be problematic?
6. How can the graphing calculator be best used to gather, illustrate data, and determine the line of best fit?

SYSTEMS OF LINEAR EQUATIONS AND INEQUALITIES
LINEAR PROGRAMMING - UNIT 1 (First Quarter)

AFDA.5

THE STUDENT WILL DETERMINE OPTIMAL VALUES IN PROBLEM SITUATIONS BY IDENTIFYING CONSTRAINTS AND USING LINEAR PROGRAMMING TECHNIQUES

a) Linear programming models an optimization process.

b) A linear programming model consists of a system of constraints and an objective quantity that can be maximized or minimized.

c) Any maximum or minimum value will occur at a corner point of a feasible region.

Key Vocabulary/Topic	Essential Knowledge	Suggested Activities
Independent Dependent Inconsistent Point of Intersection Substitution Elimination	Solve systems of equations algebraically and graphically.	Cell Phone Activity Savings Plan Wacky Water World Catch Me if you can Comparing pay structures Battleships and Mines Meet me
	Model practical problems with systems of linear equations	
Shaded Region	Solve systems of linear inequalities with pencil and paper and using a graphing calculator	
	Model practical problems with systems of linear inequalities	
Minimum Maximum Feasibility Region Vertices	Identify the feasibility region of a system of linear inequalities	Lego Furniture High Step Shoes
	Identify the coordinates of the corner points of a feasibility region	
	Find the maximum or minimum value for the function defined over the feasibility region	
	Describe the meaning of the maximum or minimum value within its context	

Essential Questions:

1. What does the solution of a system of equations look like?
2. How do I know how many solutions a system will have?
3. How do I decide the best method to solve a system?
4. What does the solution of a system mean?

PROBABILITY - UNIT 2 (1st Quarter)

AFDA.6

The student will calculate probabilities. Key concepts include:
a) conditional probability
b) dependent and independent events
c) addition and multiplication rules
d) counting techniques (permutations and combinations)
e) Law of Large Numbers

Key Vocabulary/Topic	Essential Knowledge	Suggested Activities
Experimental Probability *Theoretical Probability* *Sample Space* *Event*	Identify the sample space of a random experiment	Misconceptions of Probability Thinking About Skunk SKUNK gameboard Experimenting With Chance
	Analyze, interpret and make predictions based on theoretical probability within real-world context.	
Law of Large Numbers	Use the *Law of Large Numbers* to show that as a procedure is repeated again and again, the relative frequency probability of an event tends to approach the actual probability.	Spinner, Birthday, Dice Thumb Tacks, Spinner, Dice, Deck of Cards Lottery Multiplcation Principle of Countimg
Fundamental Counting Principle (multiplication principle of counting)	The *Fundamental Counting Principle* states that if one decision can be made *n* ways and another can be made *m* ways, then the two decisions can be made *nm* ways.	
Mutually Exclusive *Dependent* *Independent*	Define and give contextual examples of complementary, dependent, independent, and mutually exclusive events.	Name the event
	Given two or more events in a problem setting, determine if the events are complementary, dependent, independent, and/or mutually exclusive.	
	Represent and calculate probabilities using Venn diagrams and probability trees.	Sets and Events Students w/earrings
Conditional Probability	Find conditional probabilities for dependent, independent, and mutually exclusive events.	Monty-Hall Problem
Permutations *Combinations*	Compare and contrast permutations and combinations.	Analyzing Games
	Calculate the number of permutations of *n* objects taken *r* at a time.	
	Calculate the number of permutations of *n* objects taken *r* at a time.	
	Calculate the number of combinations of *n* objects taken *r* at a time.	

Essential Questions

1. How does probability relate to the likelihood of an event happening?
2. How can we base decisions on chance?
3. What is a random variable and how can they be combined?

QUADRATIC FUNCTIONS – 3 (2nd Quarter)

AFDA.1

The student will investigate and analyze function (linear, quadratic, exponential, and logarithmic) families and their characteristics. Key concepts include:

a) continuity
b) local and absolute maxima and minima
c) domain and range
d) zeros
e) intercepts
f) intervals in which the function is increasing/decreasing
g) end behaviors
h) asymptotes

AFDA.2

The student will use knowledge of transformations to write an equation given the graph of a function (linear, quadratic, exponential, and logarithmic).

AFDA.3

The student will collect data and generate an equation for the curve (linear, quadratic, exponential, and logarithmic) of best fit to model real-world problems or applications. Students will use the best fit equation to interpolate function values, make decisions, and justify conclusions with algebraic and/or graphical models.

AFDA.4

The student will transfer between and analyze multiple representations of functions including algebraic formulae, graphs, tables, and words. Students will select and use appropriate representations for analysis, interpretation, and prediction.

Key Vocabulary/Topic	Essential Knowledge	Suggested Activities
Modeling Activities using Quadratic Equations	Linear vs. Quadratic functions Real-world situations involving quadratic modeling	Linear vs. Non-linear Informal Quadratic Tasks Frogs and Toads game nrich.maths.org :: Mathematics Enrichment :: Frogs
Properties of the Quadratic Equation	Graphs and Parent Function for quadratic equations Understanding parabola as a model for motion	Intro to Quadratic Function Models Exploring Quadratics
Vertex Form and Factors	Finding a Vertex Writing a quadratic equation in vertex form Transformations using the vertex form Finding x-intercepts graphically, understanding the zeros Finding zeros algebraically (factoring, slide and divide) Converting between zeros and factors Writing a quadratic equation in factored form	Finding Vertex WS In-Class Quad App Models Vertex Form WS Vertex Form Quiz QuadTransformations WS Quadratic Motion Activities Ball Bounce Lab Ball Bounce Instructions FactoringWS SlideNDivideWS Quadratic Journal (Lab or test grade)

Assessments:	**Practice Test** **Test** **Pre/Post Assessment**

Essential Questions:

1. **What does a quadratic function look like?**
2. **How many solutions can a quadratic function have?**
3. **How do I graph a quadratic function?**
4. **Where can I find quadratic equations in the real world?**
5. **How do I decide the best method to solve a quadratic equation?**

Statistics - UNIT 4 (Second Quarter)

AFDA.7
The student will analyze the normal distribution. Key concepts include:
a) characteristics of normally distributed data
b) percentiles
c) normalizing data using z-scores
d) area under the standard normal curve and probability

AFDA.8
The student will design and conduct an experiment/survey. Key concepts include:
a) sample size
b) sampling technique
c) controlling sources of bias and experimental error
d) data collection
e) data analysis and reporting

Key Vocabulary/Topic	Essential Knowledge	Suggested Activities
Sampling *Simple Random Sample* *Stratified Sample* *Cluster Sample* *Interval Sample* *Convenience Sample*	Investigate and describe sampling techniques, such as simple random sampling, stratified sampling, and cluster sampling. - The value of a sample statistic may vary from sample to sample, even if the simple random samples are taken repeatedly from the population of interest. - Inherent bias diminishes as sample size increases.	Random Rectangles Raffle Tickets Sampling Activity Gettysburg Address (will be linked after it has been fixed) Identifying Sampling Methods
Bias *Undercoverage bias*	Identify biased sampling methods. - Poor data collection can lead to misleading and meaningless conclusions.	
	Determine which sampling technique is best, given a particular context.	
Experimental Design	Plan and conduct an experiment or survey. The experimental design should address control, randomization, and minimization of experimental error. - Experiments must be carefully designed in order to detect a cause-and-effect relationship between variables.	
	Design a survey instrument.	(Ben Is tweeking) will post soon
	Select a data collection method appropriate for a given context.	
	Compare and contrast controlled experiments and observational studies and the conclusions one may draw from each. - Principles of experimental design include comparison with a control group, randomization, and blindness.	
	Given a plan for a survey, identify possible sources of bias, and describe ways to reduce bias.	
	Write a report describing the experiment/survey and the resulting data and analysis.	

	- The precision, accuracy and reliability of data collection can be analyzed and described.	
Mean *Mode* *Median* *Range* *Interquartile Range* *Variance* *Univariate data set* *Central Tendency*	Interpret mean, median, mode, range, interquartile range, variance, and standard deviation of a univariate data set in terms of the problem's context. - Analysis of the descriptive statistical information generated by a univariate data set includes the relationships between central tendency, dispersion, and position.	Yankee vs. Mets Cross Country Roadtrip Cross Country Roadtrip Student Worksheet Introducing Box and Whisker Stats: Hand Span Activity Histogram Power Point
	Explain the influence of outliers on a univariate data set.	
Normal Curve *Standard Deviation* *z-score* *Normal Density Function* *Mean* *Percentile*	Explain ways in which standard deviation addresses dispersion by examining the formula for standard deviation.	
	Identify the properties of a normal probability distribution - The normal distribution curve is a family of symmetrical curves defined by the mean and the standard deviation.	
	Describe how the standard deviation and the mean affect the graph of the normal distribution - Areas under the curve represent probabilities associated with continuous distributions. - The normal curve is a probability distribution and the total area under the curve is 1. - The mean of the data in a standard normal density function is 0 and the standard deviation is 1. This allows for the comparison of unlike data. - The amount of data that falls within 1, 2, or 3 standard deviations of the mean is constant and the basis of *z*-score data normalization.	NFL quarterback Salaries SOL Score Analysis SAT/ACT Lab Bank Manager Project Creating a Histogram MLB First Basemen and Salary Placement Exam Scores
	Determine the probability of a given event, using the normal distribution.	

Essential Questions

1. How are experiments and surveys designed?
2. How does one eliminate bias when gathering data?
3. What does the results of experiments and surveys mean and the implications to real-life situations?
4. How does one illustrate the results obtained through experimentation?

EXPONENTIAL AND LOGARITHMIC FUNCTIONS – 5 (2nd Quarter)

AFDA.1
The student will investigate and analyze function (linear, quadratic, exponential, and logarithmic) families and their characteristics. Key concepts include:
a) continuity
b) domain and range
c) intercepts
d) intervals in which the function is increasing/decreasing
e) asymptotes

AFDA.2
The student will use knowledge of transformations to write an equation given the graph of a function (linear, quadratic, exponential, and logarithmic).

AFDA.3
The student will collect data and generate an equation for the curve (linear, quadratic, exponential, and logarithmic) of best fit to model real-world problems or applications. Students will use the best fit equation to interpolate function values, make decisions, and justify conclusions with algebraic and/or graphical models.

AFDA.4
The student will transfer between and analyze multiple representations of functions including algebraic formulae, graphs, tables, and words. Students will select and use appropriate representations for analysis, interpretation, and prediction.

Key Vocabulary/Topic	Essential Knowledge	Suggested Activities
Exponential Function Logarithmic Function Exponential Growth Exponential Decay	Investigate scatter plots to determine if patterns exist, and identify the patterns.	M & M Lab Paper Cutting Activity Paper Folding activity
	Find an equation for the curve of best fit for data, using a graphing calculator. Models will include linear, quadratic, exponential, and logarithmic functions.	
	Make predictions, using data, scatter plots, or equation of curve of best fit.	
	Given an equation, graph a linear, quadratic, exponential or logarithmic function with the aid of a graphing calculator.	
	Make predictions given a table of values, a graph, or an algebraic formula.	
	Describe relationships between data represented in a table, in a scatter plot, and as elements of a function.	
	Identify the domain and range for a relation, given a set of ordered pairs, a table, or a graph. - The domain of a function consists of the first coordinates of the ordered pairs that are elements of a function. Each element in the domain is an input into the independent variable of the function. - The range of a function consists of the second coordinates of the ordered pairs that are elements of a function. Each element in the range is an output in the dependent variable of a	The death of Mr. Spud Rhino's and M&M.

	function.	
	Functions describe the relationship between two variables where each input is paired to a unique output. • Identify , *y*-intercepts, , asymptotes, intervals for which the function is increasing or decreasing, points of discontinuity, end behavior, given a graph of a function. • Exponential and logarithmic functions are either strictly increasing or strictly decreasing. Asymptotes can be used to describe local behavior and end behavior of graphs. They are lines or other curves that approximate the graphical behavior of a function.	
	Recognize graphs of parent functions for linear, quadratic, exponential and logarithmic functions. Write the equation of a linear, quadratic, exponential, or logarithmic function in *(h, k)* form given the graph of the parent function and transformation information. Describe the transformation from the parent function given the equation written in *(h, k)* form or the graph of the function. Given the equation of a function, recognize the parent function and transformation to graph the given function. Describe the parent function represented by a scatter plot. Transformations include: • Translations (horizontal and vertical shifting of a graph) • Reflections • Dilations (stretching and compressing graphs, and) • Rotations	Transformation Packet
	Given a set of data, determine the model that would best describe the data.	Newton's Law of Cooling
	Determine the appropriate representation of data derived from real-world situations. Analyze and interpret the data in context of the real-world situation.	

Essential Questions
What are the characteristics and importance of the exponential function?
What are the characteristics and importance of the logarithmic function?
What real-world examples will model an exponential function and a logarithmic function?
How can we model an exponential function or a logarithmic function using the CBR.