LCPS FADA Yearly Overview and Scope and Sequence 2021-22

Functions, Algebra, and Data Analysis Yearly Overview 2021-22

Quarter 1	**Linear Functions** Standards of Learning: AFDA.1, AFDA.2, AFDA.3, AFDA.4	**Quadratic Functions** Standards of Learning: AFDA.1, AFDA.2, AFDA.3, AFDA.4

Quarter 2	**Quadratic Functions** *(continued from Quarter 1)*	**Exponential Functions** Standards of Learning: AFDA.1, AFDA.2, AFDA.3, AFDA.4

Quarter 3	**Logarithmic Functions** Standards of Learning: AFDA.1, AFDA.2, AFDA.4	**Linear Programming** Standards of Learning: AFDA.5

Quarter 4	**Data Analysis & Probability** Standards of Learning: AFDA.6, AFDA.7, AFDA.8

VDOE Process Goals
- To build new mathematical knowledge through problem solving and to develop a repertoire of skills and strategies for solving a variety of problem types **(Problem Solving)**
- To communicate mathematical ideas coherently and clearly and to analyze and evaluate the mathematical thinking of others **(Communication)**
- To use logical reasoning in solving mathematical problems and to explain and justify mathematical ideas **(Reasoning)**
- To understand how mathematical ideas interconnect and build on one another and to use those connections to solve problems **(Connections)**
- To create and use a variety of representations in learning, doing, and communicating mathematics **(Representations)**

FADA Scope and Sequence

The Loudoun County Public Schools Mathematics Scope and Sequence provides a broad overview of the content units, the quarter in which each unit is taught, and the sequence of the standards within each unit. Resources to support instruction are located in the [Mathematics Curriculum Schoology Groups](#).

[Curriculum Framework](#)**:** The Curriculum Framework contains the 2016 *Mathematics Standards of Learning*, guidance for Understanding the Standard, and Essential Knowledge and Skills for students. Students are expected to continue to connect and apply knowledge and skills from Standards of Learning presented in previous grades as they deepen their mathematical understanding. Assessment items may not and should not be a verbatim reflection of the information presented in the Curriculum Framework.

Prerequisite Knowledge: These standards are the supporting concepts for the grade level concept. The hyperlinks are to the Just In Time Quick Check documentation which includes teacher notes, instructional plans, formative assessments, and activities to support student learning.

[Just In Time Quick Checks](#): Just in Time Mathematics Quick Checks are formative assessments that align to the 2016 Mathematics Standards of Learning (SOL). They are designed to help teachers identify students with unfinished learning and assist in planning instruction to fill potential gaps "just in time." As new content is introduced throughout the school year, teachers can use these Quick Checks to identify and diagnose unfinished learning at grade level and/or to assess understanding of prerequisite knowledge that may be needed to access grade level content. Student gaps in mathematics understanding exist for a variety of reasons and these resources can be used to help get student mathematical learning back on track.

Essential Skills and Knowledge: This section provides a detailed expansion of the mathematics knowledge and skills that each student should know and be able to demonstrate. This is not meant to be an exhaustive list of student expectations.

Quarter 1

Linear Functions

Curriculum Framework: AFDA.1, AFDA.2, AFDA.3, AFDA.4

Prerequisite Knowledge	Essential Skills and Knowledge
8.16a, **8.16b**, **8.16d** , **8.16e**, **A.6a**, **A.6b**, **A.6c**, **A.7f**	**AFDA.4 Analyze, interprete, and predict using multiple representations of functions** ● Given an equation, graph a linear function. ● Make predictions given a table of values, a graph, or an algebraic formula. ● Describe relationships between data represented in a table, in a scatterplot, and as elements of a function. ● Determine the appropriate representation of data derived from real-world situations. ● Analyze and interpret the data in context of the practical situation. ● Use a graphing utility to graph, analyze, interpret, and make predictions.
8.13a, **8.13b**, **8.13c**, **A.9**	**AFDA.3 Collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems using models of linear functions.** ● Determine an equation for the curve of best fit, given a set of no more than 20 data points in a table, on a graph, or practical situation. ● Make predictions, using data, scatterplots, or the equation of the curve of best fit. ● Solve practical problems involving an equation of the curve of best fit. ● Evaluate the reasonableness of a mathematical model of a practical situation.
A.7a, A.7b, A.7c, A.7d, A.7e, A.7f	**AFDA.1a-h Investigate and analyze the linear function family and its characteristics.** ● Identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically. Domains may be limited by problem context or in graphical representations. (a, d, e) ● Identify intervals on which the function is increasing or decreasing. (b) ● Identify the location and value of the absolute maximum and absolute minimum of a function over the domain of the function graphically or by using a graphing utility. (c) ● For any x value in the domain of f, determine f(x). (f)

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	● Represent relations and functions using verbal descriptions, tables, equations, and graphs. Given one representation, represent the relation in another form. (g) ● Detect patterns in data and represent arithmetic and geometric patterns algebraically. (g) ● Describe the end behavior of a function. (h) ● Investigate and analyze characteristics and multiple representations of functions with a graphing utility. (a, b, c, d, e, f, g, h)
8.7a, 8.7b, 8.16a, 8.16b, 8.16d , 8.16e, A.6a, A.6b, A.6c, A.7f	**AFDA.2 Write an equation, given the graph of a linear function using knowledge of transformations.** ● Write an equation of a line when given the graph of a line. ● Recognize graphs of parent functions for linear functions. ● Write the equation of a linear function in vertex form, given the graph of the parent function and transformation information. ● Describe the transformation from the parent function given the equation written in vertex 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 scatterplot.

Quadratic Functions

(*continued in Quarter 2*)

Curriculum Framework: **AFDA.1, AFDA.2, AFDA.3, AFDA.4**

Prerequisite Knowledge	**Essential Skills and Knowledge**
A.7f	**AFDA.4 Analyze, interprete, and predict using multiple representations of functions** ● Given an equation, graph a quadratic function. ● Make predictions given a table of values, a graph, or an algebraic formula. ● Describe relationships between data represented in a table, in a scatterplot, and as elements of a function. ● Determine the appropriate representation of data derived from real-world situations. ● Analyze and interpret the data in context of the practical situation. ● Use a graphing utility to graph, analyze, interpret, and make predictions.

	AFDA.3 Collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems using models of quadratic functions. ● Determine an equation for the curve of best fit, given a set of no more than 20 data points in a table, on a graph, or practical situation. ● Make predictions, using data, scatterplots, or the equation of the curve of best fit. ● Solve practical problems involving an equation of the curve of best fit. ● Evaluate the reasonableness of a mathematical model of a practical situation.
	AFDA.1a-h Investigate and analyze the quadratic function family and its characteristics. ● Identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically. Domains may be limited by problem context or in graphical representations. (a, d, e) ● Identify intervals on which the function is increasing or decreasing. (b) ● Identify the location and value of the absolute maximum and absolute minimum of a function over the domain of the function graphically or by using a graphing utility. (c) ● For any x value in the domain of f, determine f(x). (f) ● Represent relations and functions using verbal descriptions, tables, equations, and graphs. Given one representation, represent the relation in another form. (g) ● Detect patterns in data and represent arithmetic and geometric patterns algebraically. (g) ● Describe the end behavior of a function. (h) ● Investigate and analyze characteristics and multiple representations of functions with a graphing utility. (a, b, c, d, e, f, g, h)
	AFDA.2 Write an equation, given the graph of a quadratic function using knowledge of transformations. ● Recognize graphs of parent functions for quadratic functions. ● Write the equation of a quadratic function in vertex form, given the graph of the parent function and transformation information. ● Describe the transformation from the parent function given the equation written in vertex form or the graph of the function. ● Given the equation of a function, recognize the parent function and transformation to graph the given function. ● Recognize the vertex of a parabola given a quadratic equation in vertex form or graphed. ● Describe the parent function represented by a scatterplot.

Quarter 2

Quadratic Functions
(*continued from Quarter 1*)

Exponential Functions
Curriculum Framework: AFDA.1, AFDA.2, AFDA.3, AFDA.4

Prerequisite Knowledge	Essential Skills and Knowledge
	AFDA.4 Analyze, interpret, and predict using multiple representations of functions ● Given an equation, graph an exponential function. ● Make predictions given a table of values, a graph, or an algebraic formula. ● Describe relationships between data represented in a table, in a scatterplot, and as elements of a function. ● Determine the appropriate representation of data derived from real-world situations. ● Analyze and interpret the data in context of the practical situation. ● Use a graphing utility to graph, analyze, interpret, and make predictions.
	AFDA.3 Collect and analyze data, determine the equation of the curve of best fit in order to make predictions, and solve practical problems using models of exponential functions. ● Determine an equation for the curve of best fit, given a set of no more than 20 data points in a table, on a graph, or practical situation. ● Make predictions, using data, scatterplots, or the equation of the curve of best fit. ● Solve practical problems involving an equation of the curve of best fit. ● Evaluate the reasonableness of a mathematical model of a practical situation.

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AFDA.1a-i Investigate and analyze the exponential function family and its characteristics.
- Identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically. Domains may be limited by problem context or in graphical representations. (a, d, e)
- Identify intervals on which the function is increasing or decreasing. (b)
- Identify the location and value of the absolute maximum and absolute minimum of a function over the domain of the function graphically or by using a graphing utility. (c)
- For any x value in the domain of f, determine f(x). (f)
- Represent relations and functions using verbal descriptions, tables, equations, and graphs. Given one representation, represent the relation in another form. (g)
- Detect patterns in data and represent arithmetic and geometric patterns algebraically. (g)
- Describe the end behavior of a function. (h)
- Determine the equations of the horizontal asymptote of an exponential function and the vertical asymptote of a logarithmic function. (i)
- Investigate and analyze characteristics and multiple representations of functions with a graphing utility. (a, b, c, d, e, f, g, h, i)

AFDA.2 Write an equation, given the graph of an exponential function using knowledge of transformations.
- Recognize graphs of parent functions for exponential functions.
- Write the equation of an exponential function in vertex form, given the graph of the parent function and transformation information.
- Describe the transformation from the parent function given the equation written in vertex 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 scatterplot.

Quarter 3

Logarithmic Functions

Curriculum Framework: AFDA.1,AFDA.2, AFDA.3, AFDA.4

Prerequisite Knowledge	Essential Skills and Knowledge
	AFDA.4 Analyze, interpret, and predict using multiple representations of functions ● Given an equation, graph a logarithmic function. ● Make predictions given a table of values, a graph, or an algebraic formula. ● Describe relationships between data represented in a table, in a scatterplot, and as elements of a function. ● Determine the appropriate representation of data derived from real-world situations. ● Analyze and interpret the data in context of the practical situation. ● Use a graphing utility to graph, analyze, interpret, and make predictions.
	AFDA.1a-i Investigate and analyze the logarithmic function family and its characteristics. ● Identify the domain, range, zeros, and intercepts of a function presented algebraically or graphically. Domains may be limited by problem context or in graphical representations. (a, d, e) ● Identify intervals on which the function is increasing or decreasing. (b) ● Identify the location and value of the absolute maximum and absolute minimum of a function over the domain of the function graphically or by using a graphing utility. (c) ● For any x value in the domain of f, determine f(x). (f) ● Represent relations and functions using verbal descriptions, tables, equations, and graphs. Given one representation, represent the relation in another form. (g) ● Detect patterns in data and represent arithmetic and geometric patterns algebraically. (g) ● Describe the end behavior of a function. (h) ● Determine the equations of the horizontal asymptote of an exponential function and the vertical asymptote of a logarithmic function. (i)

	● Investigate and analyze characteristics and multiple representations of functions with a graphing utility. (a, b, c, d, e, f, g, h, i)
	AFDA.2 Write an equation, given the graph of a logarithmic function using knowledge of transformations. ● Recognize graphs of parent functions for logarithmic functions. ● Write the equation of a logarithmic function in vertex form, given the graph of the parent function and transformation information. ● Describe the transformation from the parent function given the equation written in vertex 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 scatterplot.

Linear Programming

Curriculum Framework: AFDA.5

Prerequisite Knowledge	Essential Skills and Knowledge
A.5a, A.5b, A.5c, A.5d	**AFDA.5 Determine optimal values in problem situations by identifying constraints and using linear programming techniques** ● Model practical problems with systems of linear inequalities. ● Solve systems of no more than four linear inequalities with pencil and paper and using a graphing utility. ● Solve systems of no more than four equations algebraically and graphically. ● Identify the feasible region of a system of linear inequalities. ● Identify the coordinates of the vertices of a feasible region. ● Determine and describe the maximum or minimum value for the function defined over a feasible region.

Quarter 4

Data Analysis and Probability

Curriculum Framework: AFDA.6, AFDA.7, AFDA.8

Prerequisite Knowledge	Essential Skills and Knowledge (with links to VDOE Just In Time Quick Checks for details on how to support student understanding for each standard)
8.11a, 8.11b	**AFDA.6 Calculate probabilities** ● Analyze, interpret and make predictions based on theoretical probability within practical context. (a, b, c, e) ● Determine conditional probabilities for dependent, independent, and mutually exclusive events. (a, b, c) ● Represent and calculate probabilities using Venn diagrams and probability trees. (a) ● Define and give contextual examples of complementary, dependent, independent, and mutually exclusive events. (b, c) ● Given two or more events in a problem setting, determine whether the events are complementary, dependent, independent, and/or mutually exclusive. (b, c) ● Compare and contrast permutations and combinations, including those occurring in practical situations. (d) ● Calculate the number of permutations of n objects taken r at a time, without repetition. (d) ● Calculate the number of combinations of n objects taken r at a time, without repetition. (d)
	AFDA.7c Apply properties of normal distributions to determine probabilities associated with areas under the standard normal curve ● Represent probability as area under the curve of a standard normal distribution. ● Use a graphing utility or a table of Standard Normal Probabilities to determine probabilities associated with areas under the standard normal curve. ● Use a graphing utility to investigate, represent, and determine relationships between a normally distributed data set and its descriptive statistics.
	AFDA.7a Identify and describe properties of a normal distribution

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- Identify the properties of a normal distribution.
- Describe how the standard deviation and the mean affect the graph of the normal distribution.
- Use a graphing utility to investigate, represent, and determine relationships between a normally distributed data set and its descriptive statistics.

AFDA.7b Interpret and compare z-scores for normally distributed data
- Given standard deviation and mean, calculate and interpret the z-score for a data point.
- Compare two sets of normally distributed data using a standard normal distribution and z-scores, given mean and standard deviation.
- Use a graphing utility to investigate, represent, and determine relationships between a normally distributed data set and its descriptive statistics.

AFDA.8a-e Design and conduct an experiment/survey
- Investigate and describe sampling techniques, such as simple random sampling, stratified sampling, and cluster sampling. (a, b)
- Determine which sampling technique is best, given a particular context. (b)
- Identify biased sampling methods. (c)
- Given a plan for a survey, identify possible sources of bias, and describe ways to reduce bias. (c)
- Plan and conduct an experiment or survey. The experimental design should address control, randomization, and minimization of experimental error. (a, b, c, d)
- Compare and contrast controlled experiments and observational studies and the conclusions one may draw from each. (e)
- Write a report describing the experiment/survey and the resulting data and analysis. (e)