

# Algebra, Functions, and Data Analysis

## Algebra and Functions

**AF.1** The student will investigate, analyze, and compare linear, quadratic, and exponential function families, algebraically and graphically, using transformations. [AFDA.AF.1](#)

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**AF.2** The student will investigate and analyze characteristics of the graphs of linear, quadratic, exponential, and piecewise-defined functions. [AFDA.AF.2](#)

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**AF.3** The student will represent and interpret contextual situations with constraints that require optimization using linear programming techniques, including systems of linear equations or inequalities, solving graphically and when appropriate, algebraically. [AFDA.AF.3](#)

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Identify graphs and equations of parent functions for linear, quadratic, and exponential function families. [AFDA.AF.1.A](#)

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**a** Identify graphs and equations of parent functions for linear, quadratic, and exponential function families. [AFDA.AF.1.A](#)

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Describe the transformation from the parent function given the equation or the graph of the function. [AFDA.AF.1.B](#)

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**b** Describe the transformation from the parent function given the equation or the graph of the function. [AFDA.AF.1.B](#)

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Determine and analyze whether a linear, quadratic, or exponential function best models a given representation, including those in context. [AFDA.AF.1.C](#)

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**c** Determine and analyze whether a linear, quadratic, or exponential function best models a given representation, including those in context. [AFDA.AF.1.C](#)

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Write the equation of a linear, quadratic, or exponential function,

**d** Write the equation of a linear, quadratic, or exponential function, given a graph, using transformations of the parent function. [AFDA.AF.1.D](#)

given a graph, using transformations of the parent function. AFDA.AF.1.D

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Use a graphical or algebraic representation of a function to solve problems within a context, graphically and algebraically, when appropriate. AFDA.AF.1.E

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**e** Use a graphical or algebraic representation of a function to solve problems within a context, graphically and algebraically, when appropriate. AFDA.AF.1.E

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Graph a function given the equation of a function, using transformations of the parent function. Use technology to verify transformations of functions. AFDA.AF.1.F

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**f** Graph a function given the equation of a function, using transformations of the parent function. Use technology to verify transformations of functions. AFDA.AF.1.F

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Compare and contrast linear, quadratic, and exponential functions using multiple representations (e.g., graphs, tables, equations, verbal descriptions). AFDA.AF.1.G

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**g** Compare and contrast linear, quadratic, and exponential functions using multiple representations (e.g., graphs, tables, equations, verbal descriptions). AFDA.AF.1.G

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Determine the domain and range of a function given a graphical representation, including those limited by contexts. AFDA.AF.2.A

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**a** Determine the domain and range of a function given a graphical representation, including those limited by contexts. AFDA.AF.2.A

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Identify intervals on a graph for which a function is increasing, decreasing, or constant. AFDA.AF.2.B

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**b** Identify intervals on a graph for which a function is increasing, decreasing, or constant. AFDA.AF.2.B

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Given a graph, identify the location and value of the absolute maximum and absolute minimum

**c** Given a graph, identify the location and value of the absolute maximum and absolute minimum of a function over the domain of a function. AFDA.AF.2.C

of a function over the domain of a function. AFDA.AF.2.C

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Given a graph, determine the zeros and intercepts of a function. AFDA.AF.2.D

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**d** Given a graph, determine the zeros and intercepts of a function. AFDA.AF.2.D

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Describe and recognize the connection between points on the graph and the value of a function. AFDA.AF.2.E

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**e** Describe and recognize the connection between points on the graph and the value of a function. AFDA.AF.2.E

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Describe the end behavior of a function given its graph. AFDA.AF.2.F

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**f** Describe the end behavior of a function given its graph. AFDA.AF.2.F

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Identify horizontal and/or vertical asymptotes from the graph of a function, if they exist. AFDA.AF.2.G

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**g** Identify horizontal and/or vertical asymptotes from the graph of a function, if they exist. AFDA.AF.2.G

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Describe and relate the characteristics of the graphs of linear, quadratic, exponential, and piecewise-defined functions, including those in contextual situations. AFDA.AF.2.H

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**h** Describe and relate the characteristics of the graphs of linear, quadratic, exponential, and piecewise-defined functions, including those in contextual situations. AFDA.AF.2.H

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Represent and interpret contextual problems requiring optimization with systems of linear equations or inequalities. AFDA.AF.3.A

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**a** Represent and interpret contextual problems requiring optimization with systems of linear equations or inequalities. AFDA.AF.3.A

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Solve systems of no more than four equations or inequalities graphically and when appropriate, algebraically. AFDA.AF.3.B

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**b** Solve systems of no more than four equations or inequalities graphically and when appropriate, algebraically. AFDA.AF.3.B

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Identify the feasible region of a system of linear inequalities. AFDA.AF.3.C

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**c** Identify the feasible region of a system of linear inequalities. AFDA.AF.3.C

Identify the coordinates of the vertices of a feasible region. AFDA.AF.3.D

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**d** Identify the coordinates of the vertices of a feasible region. AFDA.AF.3.D

Determine and describe the maximum or minimum value for the function defined over a feasible region. AFDA.AF.3.E

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**e** Determine and describe the maximum or minimum value for the function defined over a feasible region. AFDA.AF.3.E

Interpret the validity of possible solution(s) algebraically, graphically, using technology, and in context and justify the reasonableness of the answer(s) or the solution method in context. AFDA.AF.3.F

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**f** Interpret the validity of possible solution(s) algebraically, graphically, using technology, and in context and justify the reasonableness of the answer(s) or the solution method in context. AFDA.AF.3.F

Data Analysis

**DA.1** The student will apply the data cycle (formulate questions; collect or acquire data; organize and represent data; and analyze data and communicate results) with a focus on representing bivariate data in scatterplots and determining the curve of best fit using linear, quadratic, and exponential functions. AFDA.DA.1

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**DA.2** The student will apply the data cycle (formulate questions; collect or acquire data; organize and represent data; and analyze data and communicate results) with a focus on the design and implementation of an experiment and/or observational study. AFDA.DA.2

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**DA.3** The student will calculate and interpret probabilities, including those in contextual situations. AFDA.DA.3

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**DA.4** The student will describe and apply the properties of normal distribution, including those in contextual situations. AFDA.DA.4

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Formulate investigative questions that require the collection or acquisition of bivariate

**a** Formulate investigative questions that require the collection or acquisition of bivariate data, where exactly two of the variables are quantitative. AFDA.DA.1.A

data, where exactly two of the variables are quantitative. [AFDA.DA.1.A](#)

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Collect or acquire bivariate data from a representative sample to answer an investigative question. [AFDA.DA.1.B](#)

**b** Collect or acquire bivariate data from a representative sample to answer an investigative question. [AFDA.DA.1.B](#)

Represent bivariate data with a scatterplot using technology and describe how the variables are related in terms of the given context. [AFDA.DA.1.C](#)

**c** Represent bivariate data with a scatterplot using technology and describe how the variables are related in terms of the given context. [AFDA.DA.1.C](#)

Make predictions, decisions, and critical judgments using data, scatterplots, or the equation(s) of the mathematical model. [AFDA.DA.1.D](#)

**d** Make predictions, decisions, and critical judgments using data, scatterplots, or the equation(s) of the mathematical model. [AFDA.DA.1.D](#)

Formulate questions that can be addressed with data and assess the type of data relevant to the question (e.g., quantitative versus categorical). [AFDA.DA.2.A](#)

**a** Formulate questions that can be addressed with data and assess the type of data relevant to the question (e.g., quantitative versus categorical). [AFDA.DA.2.A](#)

Investigate, describe, and determine best sampling techniques, such as simple random sampling, stratified sampling, and cluster sampling. [AFDA.DA.2.B](#)

**b** Investigate, describe, and determine best sampling techniques, such as simple random sampling, stratified sampling, and cluster sampling. [AFDA.DA.2.B](#)

Plan and conduct an experiment and/or observational study. The experimental design should address control, randomization, and

**c** Plan and conduct an experiment and/or observational study. The experimental design should address control, randomization, and minimization of experimental error. [AFDA.DA.2.C](#)

**minimization of experimental error.**

AFDA.DA.2.C

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**Collect or acquire data to answer a statistical question.**

AFDA.DA.2.D

**d Collect or acquire data to answer a statistical question.** AFDA.DA.2.D

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**Recognize that data may contain errors, have missing values, or may be biased, and make decisions about how to account for these issues.**

AFDA.DA.2.E

**e Recognize that data may contain errors, have missing values, or may be biased, and make decisions about how to account for these issues.** AFDA.DA.2.E

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**Identify biased sampling methods.**

AFDA.DA.2.F

**f Identify biased sampling methods.** AFDA.DA.2.F

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**Given a plan for an observational study, identify possible sources of bias, and describe ways to reduce bias.**

AFDA.DA.2.G

**g Given a plan for an observational study, identify possible sources of bias, and describe ways to reduce bias.** AFDA.DA.2.G

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**Select, create, and use appropriate visual representations of data to brainstorm solutions.**

AFDA.DA.2.H

**h Select, create, and use appropriate visual representations of data to brainstorm solutions.** AFDA.DA.2.H

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**Use appropriate statistical methods to analyze data.**

AFDA.DA.2.I

**i Use appropriate statistical methods to analyze data.** AFDA.DA.2.I

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**Communicate the description of an experiment and/or observational study, the resulting data, analysis, and the validity of the conclusions.**

AFDA.DA.2.J

**j Communicate the description of an experiment and/or observational study, the resulting data, analysis, and the validity of the conclusions.** AFDA.DA.2.J

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**Analyze, interpret, and make predictions based**

**a Analyze, interpret, and make predictions based on theoretical probability.** AFDA.DA.3.A

on theoretical probability. [AFDA.DA.3.A](#)

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Calculate conditional probabilities for dependent, independent, and mutually exclusive events. [AFDA.DA.3.B](#)

**b** Calculate conditional probabilities for dependent, independent, and mutually exclusive events. [AFDA.DA.3.B](#)

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Represent and calculate probabilities using Venn diagrams, probability trees, organized lists, two-way tables, simulations, or other probability models. [AFDA.DA.3.C](#)

**c** Represent and calculate probabilities using Venn diagrams, probability trees, organized lists, two-way tables, simulations, or other probability models. [AFDA.DA.3.C](#)

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Interpret probabilities from simulations or experiments to make informed decisions and justify the rationale. [AFDA.DA.3.D](#)

**d** Interpret probabilities from simulations or experiments to make informed decisions and justify the rationale. [AFDA.DA.3.D](#)

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Define and give contextual examples of complementary, dependent, independent, and mutually exclusive events. [AFDA.DA.3.E](#)

**e** Define and give contextual examples of complementary, dependent, independent, and mutually exclusive events. [AFDA.DA.3.E](#)

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Given two or more events in a problem setting, determine whether the events are complementary, dependent, independent, and/or mutually exclusive. [AFDA.DA.3.F](#)

**f** Given two or more events in a problem setting, determine whether the events are complementary, dependent, independent, and/or mutually exclusive. [AFDA.DA.3.F](#)

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Compare and contrast permutations and combinations, including those in contextual situations. [AFDA.DA.3.G](#)

**g** Compare and contrast permutations and combinations, including those in contextual situations. [AFDA.DA.3.G](#)

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Calculate the number of permutations of  $n$  objects taken  $r$  at a time, without repetition. AFDA.DA.3.H

**h** Calculate the number of permutations of  $n$  objects taken  $r$  at a time, without repetition. AFDA.DA.3.H

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Calculate the number of combinations of  $n$  objects taken  $r$  at a time, without repetition. AFDA.DA.3.I

**i** Calculate the number of combinations of  $n$  objects taken  $r$  at a time, without repetition. AFDA.DA.3.I

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Identify and describe the properties of a normal distribution. AFDA.DA.4.A

**a** Identify and describe the properties of a normal distribution. AFDA.DA.4.A

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Determine when the normal distribution is a reasonable representation of the data. AFDA.DA.4.B

**b** Determine when the normal distribution is a reasonable representation of the data. AFDA.DA.4.B

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Describe how the mean and the standard deviation affect the graph of the normal distribution. AFDA.DA.4.C

**c** Describe how the mean and the standard deviation affect the graph of the normal distribution. AFDA.DA.4.C

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Calculate and interpret the z-score for a data point, given the mean and the standard deviation. AFDA.DA.4.D

**d** Calculate and interpret the z-score for a data point, given the mean and the standard deviation. AFDA.DA.4.D

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Compare two sets of normally distributed data using a standard normal distribution and z-scores, given the mean and the standard deviation. AFDA.DA.4.E

**e** Compare two sets of normally distributed data using a standard normal distribution and z-scores, given the mean and the standard deviation. AFDA.DA.4.E

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Represent probability as the area under the curve of a standard normal distribution. AFDA.DA.4.F

**f** Represent probability as the area under the curve of a standard normal distribution. AFDA.DA.4.F

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**Determine probabilities associated with areas under the standard normal curve, using technology or a table of Standard Normal Probabilities.** AFDA . DA . 4 . G

**g Determine probabilities associated with areas under the standard normal curve, using technology or a table of Standard Normal Probabilities.** AFDA . DA . 4 . G

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**Investigate, represent, and determine relationships between a normally distributed data set and its descriptive statistics.** AFDA . DA . 4 . H

**h Investigate, represent, and determine relationships between a normally distributed data set and its descriptive statistics.** AFDA . DA . 4 . H