

# Algebra: Concepts & Connections (Semester 1)

## Modeling Linear Functions

**2. Construct and interpret arithmetic sequences as functions, algebraically and graphically, to model and explain real-life phenomena. Use formal notation to represent linear functions and the key characteristics of graphs of linear functions, and informally compare linear and nonlinear functions using parent graphs.** [A.FRR.2](#)

- 1 Use mathematically applicable situations algebraically and graphically to build and interpret arithmetic sequences as functions whose domain is a subset of the integers. [A.FGR.2.1](#)
- 2 Construct and interpret the graph of a linear function that models real-life phenomena and represents key characteristics of the graph using formal notation. [A.FGR.2.2](#)
- 3 Relate the domain and range of a linear function to its graph and, where applicable, to the quantitative relationship it describes. Use formal notation and set notation to describe the domain and range of linear functions. [A.FGR.2.3](#)
- 4 Use function notation to build and evaluate linear functions for inputs in their domains and interpret statements that use function notation in terms of a mathematical framework. [A.FGR.2.4](#)
- 5 Analyze the difference between linear functions and nonlinear functions by informally analyzing the graphs of various parent functions (linear, quadratic, exponential, absolute value, square root, and cube root parent curves). [A.FGR.2.5](#)

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## Analyzing Linear Inequalities

**4. Create, analyze, and solve linear inequalities in two variables and systems of linear inequalities to model real-life phenomena.** [A.PAR.4](#)

- 1 Create and solve linear inequalities in two variables to represent relationships between quantities including mathematically applicable situations; graph inequalities on coordinate axes with labels and scales. [A.PAR.4.1](#)
  - 2 Represent constraints of linear inequalities and interpret data points as possible or not possible. [A.PAR.4.2](#)
  - 3 Solve systems of linear inequalities by graphing, including systems representing a mathematically applicable situation. [A.PAR.4.3](#)
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## Investigating Rational and Irrational Numbers

### 5. Investigate rational and irrational numbers and rewrite expressions involving square roots and cube roots. [A.NR.5](#)

- 1 Rewrite algebraic and numeric expressions involving radicals. [A.NR.5.1](#)
- 2 Using numerical reasoning, show and explain that the sum or product of rational numbers is rational, the sum of a rational number and an irrational number is irrational, and the product of a nonzero rational number and an irrational number is irrational. [A.NR.5.2](#)

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## Modeling and Analyzing Quadratic Functions

### 7. Construct and interpret quadratic functions from data points to model and explain real-life phenomena; describe key characteristics of the graph of a quadratic function to explain a contextual situation for which the graph serves as a model. [A.FGR.7](#)

- 1 Use function notation to build and evaluate quadratic functions for inputs in their domains and interpret statements that use function notation in terms of a given framework. (See the Mathematical Modeling Framework and Statistical Reasoning Framework for contextual connections.) [A.FGR.7.1](#)
- 2 Identify the effect on the graph generated by a quadratic function when replacing  $f(x)$  with  $f(x) + k$ ,  $kf(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. [A.FGR.7.2](#)
- 3 Graph and analyze the key characteristics of quadratic functions including contextual situations. [A.FGR.7.3](#)
- 4 Relate the domain and range of a quadratic function to its graph and, where applicable, to the quantitative relationship it describes. [A.FGR.7.4](#)
- 5 Rewrite a quadratic function representing a mathematically applicable situation to reveal the maximum or minimum value of the function it defines. Explain what the value describes in context. [A.FGR.7.5](#)
- 6 Create quadratic functions in two variables to represent relationships between quantities; graph quadratic functions on the coordinate axes with labels and scales. [A.FGR.7.6](#)
- 7 Estimate, calculate, and interpret the average rate of change of a quadratic function and make comparisons to the average rate of change of linear functions. [A.FGR.7.7](#)
- 8 Write a function defined by a quadratic expression in different but equivalent forms to reveal and explain different properties of the function. [A.FGR.7.8](#)
- 9 Compare characteristics of two functions each represented in a different way. [A.FGR.7.9](#)

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**8. Create and analyze exponential expressions and equations to represent and model real-life phenomena; solve exponential equations in mathematically applicable situations.** A.PAR.8

- 1 Interpret exponential expressions and parts of an exponential expression that represent a quantity in terms of its framework. (See the Mathematical Modeling Framework and Statistical Reasoning Framework for contextual connections.) A.PAR.8.1
- 2 Create exponential equations in one variable and use them to solve problems, including mathematically applicable situations. A.PAR.8.2
- 3 Create exponential equations in two variables to represent relationships between quantities, including in mathematically applicable situations; graph equations on coordinate axes with labels and scales. A.PAR.8.3
- 4 Represent constraints by exponential equations and interpret data points as possible or not possible in a modeling environment. A.PAR.8.4