

## Advanced Functions and Modeling

Advanced Functions and Modeling provides students an in-depth study of modeling and applying functions. Home, work, recreation, consumer issues, public policy, and scientific investigations are just a few of the areas from which applications should originate. Appropriate technology, from manipulatives to calculators and application software, should be used regularly for instruction and assessment.

### Prerequisites

- Describe phenomena as functions graphically, algebraically and verbally; identify independent and dependent quantities, domain, and range, and input/output.
- Translate among graphic, algebraic, numeric, tabular, and verbal representations of relations.
- Define and use linear, quadratic, cubic, and exponential functions to model and solve problems.
- Use systems of two or more equations or inequalities to solve problems.
- Use the trigonometric ratios to model and solve problems.
- Use logic and deductive reasoning to draw conclusions and solve problems.

**Strands:** Data Analysis and Probability, Algebra

**COMPETENCY GOAL 1: The learner will analyze data and apply probability concepts to solve problems.**

### Objectives

- 1.01 Create and use calculator-generated models of linear, polynomial, exponential, trigonometric, power, and logarithmic functions of bivariate data to solve problems.
  - a) Interpret the constants, coefficients, and bases in the context of the data.
  - b) Check models for goodness-of-fit; use the most appropriate model to draw conclusions and make predictions.
- 1.02 Summarize and analyze univariate data to solve problems.
  - a) Apply and compare methods of data collection.
  - b) Apply statistical principles and methods in sample surveys.

- c) Determine measures of central tendency and spread.
  - d) Recognize, define, and use the normal distribution curve.
  - e) Interpret graphical displays of univariate data.
  - f) Compare distributions of univariate data.
- 1.03 Use theoretical and experimental probability to model and solve problems.
- a) Use addition and multiplication principles.
  - b) Calculate and apply permutations and combinations.
  - c) Create and use simulations for probability models.
  - d) Find expected values and determine fairness.
  - e) Identify and use discrete random variables to solve problems.
  - f) Apply the Binomial Theorem.

**COMPETENCY GOAL 2: The learner will use functions to solve problems.**

**Objectives**

- 2.01 Use logarithmic (common, natural) functions to model and solve problems; justify results.
- a) Solve using tables, graphs, and algebraic properties.
  - b) Interpret the constants, coefficients, and bases in the context of the problem.
- 2.02 Use piecewise-defined functions to model and solve problems; justify results.
- a) Solve using tables, graphs, and algebraic properties.
  - b) Interpret the constants, coefficients, and bases in the context of the problem.
- 2.03 Use power functions to model and solve problems; justify results.
- a) Solve using tables, graphs, and algebraic properties.
  - b) Interpret the constants, coefficients, and bases in the context of the problem.
- 2.04 Use trigonometric (sine, cosine) functions to model and solve problems; justify results.
- a) Solve using tables, graphs, and algebraic properties.
  - b) Create and identify transformations with respect to period, amplitude, and vertical and horizontal shifts.
  - c) Develop and use the law of sines and the law of cosines.
- 2.05 Use recursively-defined functions to model and solve problems.
- a) Find the sum of a finite sequence.
  - b) Find the sum of an infinite sequence.
  - c) Determine whether a given series converges or diverges.
  - d) Translate between recursive and explicit representations.