



Topic B

Completing the Modeling Cycle

N-Q.A.2, N-Q.A.3, A-CED.A.1, A-CED.A.2, F-IF.B.4, F-IF.B.5, F-IF.B.6, F-BF.A.1a, F-LE.A.1b,
F-LE.A.1c, F-LE.A.2

Focus Standards:	N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.*
	N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.*
	A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.*</i>
	A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*
	F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. <i>Key features include the following: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*</i>
	F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*</i>
	F-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*
	F-BF.A.1	Write a function that describes a relationship between two quantities.* <ol style="list-style-type: none"> Determine an explicit expression, a recursive process, or steps for calculation from a context.

F-LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions.* b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
F-LE.A.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).*
Instructional Days:	6
Lesson 4:	Modeling a Context from a Graph (E) ¹
Lesson 5:	Modeling from a Sequence (P)
Lessons 6–7:	Modeling a Context from Data (P, P)
Lessons 8–9:	Modeling a Context from a Verbal Description (P, P)

Topic B follows a similar progression as Topic A, in that students create models for contexts presented as graphs, data, and verbal descriptions. However, in this topic students complete the entire modeling cycle, from problem posing and formulation to validation and reporting. In Lesson 4, students use the gamut of functions covered in the Algebra I course for modeling purposes. They interpret the functions from their respective graphs: linear, quadratic, exponential, cubic, square root, cube root, absolute value, and other piecewise functions, including a return to some graphs from Topic A. Students build on their work from those lessons to complete the modeling cycle. Additionally, students determine appropriate levels of numerical accuracy when reporting results.

Building on the work done with sequences in Topic A, in Lesson 5 students learn to recognize when a table of values represents an arithmetic sequence (linear), a geometric sequence (exponential), or a quadratic sequence. In this lesson, patterns are presented as a table of values. Sequences that are neither arithmetic (linear) nor geometric (exponential) may also be explored (e.g., the product of two consecutive numbers: $a_n = n(n + 1)$).

In Lessons 6 and 7, students develop models from a given data set. They choose the appropriate function type, interpret key features of the function in context, and make predictions about future results based on their models. Some data sets will be recognized from Lesson 2 and from Module 2. Some will require a regression formula and/or a graphing calculator to compare correlation coefficients to find the best fit of the different function types.

Lessons 8 and 9 are the final lessons of the module and represent the culmination of much of the work students have done in the course. Here, contexts are presented as verbal descriptions from which students decide the type(s) of model to use—graphs, tables, or equations. They interpret the problems and create a function, table of values, and/or a graph to model the contextual situation described verbally, including those involving linear, quadratic, and exponential functions. They use graphs to interpret the function represented by the equation in terms of its context and to answer questions about the model using the appropriate level

¹Lesson Structure Key: **P**-Problem Set Lesson, **M**-Modeling Cycle Lesson, **E**-Exploration Lesson, **S**-Socratic Lesson

of precision in reporting results. They interpret key features of the function and its graph and use both to answer questions related to the context, including calculating and interpreting the rate of change over an interval. When possible, students should articulate the shortcomings of the models they create; they should recognize what a model does and does not take into account.