The Algebra I course is the first high school level course in mathematics. Many Brooklyn Tech students complete this course in middle school as well as the corresponding end of year New York State Regents Examination. Students who take the accelerated course in middle school and successfully pass the New York State Regents Examination in Algebra will receive two mathematics credits toward meeting their graduation requirements. It is the responsibility of the student and parent to confirm that the middle school properly documents both the course and test grade on their official transcript prior to the start of the school year. Students lacking the documentation will automatically be programmed for Algebra I.

Students must have access to a graphic calculator for this class. Brooklyn Tech recommends the Texas Instruments 84+, 84+ Silver Edition, or the TI-Inspire (without the CAS system). Any graphing calculator will suffice but teachers are most familiar with the recommended models.

Algebra I Module I: Relationships Between Quantities and Reasoning with Equations and Their Graphs

Topic A: Introduction to Functions Studied this Year—Graphing Stories (N-Q.1, N-Q.2, N-Q.3, A-CED.2)

Students explore the main functions that they will work with in Grade 9: linear, quadratic, and exponential. The goal is to introduce students to these functions by having them make graphs of a situation (usually based upon time) in which these functions naturally arise. As they graph, they reason quantitatively and use units to solve problems related to the graphs they create.

- Lesson 1: Graphs of Piecewise Linear Functions
- Lesson 2: Graphs of Quadratic Functions
- Lesson 3: Graphs of Exponential Functions
- Lesson 4: Analyzing Graphs—Water Usage During a Typical Day at School
- Lesson 5: Two Graphing Stories

Topic B: The Structure of Expressions (A-SSE.1, A-SSE.2)

In Lessons 6 and 7 of this topic, students develop a precise understanding of what it means for expressions to be algebraically equivalent. By exploring geometric representations of the distributive, associative, and commutative properties for positive whole numbers and variable expressions assumed to represent positive whole numbers, students confirm their understanding of these properties and expand them to apply to all real numbers. Students use the properties to generate equivalent expressions and formalize that two algebraic expressions are equivalent if we can convert one expression into the other by repeatedly applying the commutative, associative and distributive properties, and the properties of rational exponents to components of the first expression. A goal of this topic is to address a fundamental, underlying question: Why are the commutative, associative, and distributive properties so important in mathematics? The answer to the question is, of course, because these three properties help to generate all equivalent algebraic expressions discussed in Algebra I.

Lessons 6 and 7 also engage students in their first experience using a recursive definition for building algebraic expressions. Recursive definitions are sometimes confused with being circular in nature because the definition of the term uses the very term one is defining. However, a recursive definition or process is not circular because it has what is referred to as a base case. For example, a definition for algebraic expression is presented as follows: An algebraic expression is either:

A numerical symbol or a variable symbol or the result of placing previously generated algebraic expressions into the two blanks of one of the four operators ((_)+(_), (_)-(_), (_)×(_), (_)/(_)) or into the base blank of an exponentiation with exponent that is a rational number. Part (1) of this definition serves as a base case, stating that any numerical or variable symbol is in itself an algebraic expression. The recursive portion of the definition is in part (2) where one can use any previously generated algebraic expression to form new ones using the given operands. Recursive definitions are an important part of the study of sequences in Module 3. Giving students this early experience lays a nice foundation for the work to come. Having a clear understanding of how algebraic expressions are built and what makes them equivalent provides a foundation for the study of polynomials and polynomial expressions.

In Lessons 8 and 9, students learn to relate polynomials to integers written in base x, rather than our traditional base of 10. The analogies between the system of integers and the system of polynomials continue as they learn to add, subtract, and multiply polynomials and to find that the polynomials for a system that is closed under those operations (e.g., a polynomial added to, subtracted from, or multiplied by another polynomial) always produces another polynomial.

We use the terms polynomial and polynomial expression in much the same way as we use the terms number and numerical expression. Where we would not call 27(3+8) a number, we would call it a numerical expression. Similarly, we reserve the word polynomial for polynomial expressions that are written as a sum of monomials.
An equation with variables can be viewed as a question asking for which values of the variables (the solution set) will result in true number sentences when those values are substituted into the equation. Equations are manifestly about numbers and understanding true and false number sentences. In Grade 9, the application of this idea expands to include solutions to compound statements such as equations or inequalities joined by “And” or “Or,” including simultaneous systems of equations and/or inequalities.

The Common Core Learning Standards rightfully downplay the notion of equivalent equations and instead place a heavy emphasis on students studying the solution sets to equations. In Lessons 12-14 of this topic, students formalize descriptions of what they learned before (true/false equations, solution sets, identities, properties of equality, etc.) and learn how to explain the steps of solving equations to construct viable arguments to justify their solution methods. They then learn methods for solving inequalities, again by focusing on ways to preserve the (now infinite) solution sets. With these methods now on firm footing, students investigate in Lessons 15-18 solution sets of equations joined by “and” or “or” and investigate ways to change an equation such as squaring both sides, which changes the solution set in a controlled (and often useful) way. In Lesson 19, students learn to use these same skills as they rearrange formulas to define one quantity in terms of another. Finally, in Lessons 20-24, students apply all of these new skills and understandings as they work through solving equations and inequalities with two variables including systems of such equations and inequalities.

Topic D: Creating Equations to Solve Problems (N-Q.1, A-SSE.1, A-CED.1, A-CED.2, A-REL3)  
In this topic, students are introduced to the modeling cycle through problems that can be solved using equations and inequalities in one variable, systems of equations, and graphing. Modeling links classroom mathematics and statistics to everyday life, work, and decision-making. The basic modeling cycle is summarized in the diagram. It involves (1) identifying variables in the situation and selecting those that represent essential features; (2) formulating a model by creating and selecting geometric, graphical, tabular, algebraic, or statistical representations that describe relationships between the variables; (3) analyzing and performing operations on these relationships to draw conclusions; (4) interpreting the results of the mathematics in terms of the original situation; (5) validating the conclusions by comparing them with the situation and then either improving the model; (6) or if it is acceptable, reporting on the conclusions and the reasoning behind them. Choices, assumptions, and approximations are present throughout this cycle. 

The first lesson introduces parts of the modeling cycle using problems and situations that students have encountered before: creating linear equations, tape diagrams, rates, systems of linear equations, graphs of systems, etc.

The next lesson, The Double and Add 5 Game, employs the modeling cycle in a mathematical context. In this 2-day lesson, students formulate a model and build an equation to represent the model (in this case, converting a sequence defined recursively to an explicit formula). After they play the game in a specific case, “double and add 5,” they have to interpret the
results of the mathematics in terms of the original model and validate whether their model is acceptable. Then they use the model to analyze and report on a problem that is too difficult to do “by hand” without the model.

Finally, Lesson 28 serves as a signature lesson on modeling as students take on the very real-life example of understanding federal marginal income tax rates (i.e., the progressive income tax brackets). Students are provided the current standard deduction tables per dependent or marital status and the marginal income tax table per marital filing status. For a specific household situation (e.g., married filing jointly with 2 dependents), students determine equations for the total Federal Income Tax for different income intervals, graph the piecewise-defined equations, and answer specific questions about the total effective rate for different income levels. All elements of the modeling cycle occur as students analyze the information to find for example: roughly how much did <their favorite famous performer> pay in federal taxes last year?

Lesson 25: Solving Problems in Two Ways—Rates and Algebra
Lessons 26-27: Recursive Challenge Problem—The Double and Add 5 Game
Lesson 28: Federal Income Tax

Algebra I Module II: Descriptive Statistics

**Topic A: Shapes and Centers of Distributions (S-ID.1, S-ID.2, S-ID.3)**
In Topic A, students observe and describe data distributions. They reconnect with their earlier study of distributions in Grade 6 by calculating measures of center and describing overall patterns or shapes. Students deepen their understanding of data distributions recognizing that the value of the mean and median are different for skewed distributions and similar for symmetrical distributions. Students select a measure of center based on the distribution shape to appropriately describe a typical value for the data distribution. Topic A moves from the general descriptions used in Grade 6 to more specific descriptions of the shape and the center of a data distribution.

Lesson 1: Distributions and Their Shapes
Lesson 2: Describing the Center of a Distribution
Lesson 3: Estimating Centers and Interpreting the Mean as a Balance Point

**Topic B: Describing Variability and Comparing Distributions (S-ID.1, S-ID.2, S-ID.3)**
In Topic B, students reconnect with methods for describing variability first seen in Grade 6. Topic B deepens students’ understanding of measures of variability by connecting a measure of the center of a data distribution to an appropriate measure of variability. The mean is used as a measure of center when the distribution is more symmetrical. Students calculate and interpret the mean absolute deviation and the standard deviation to describe variability for data distributions that are approximately symmetric. The median is used as a measure of center for distributions that are more skewed, and students interpret the interquartile range as a measure of variability for data distributions that are not symmetric. Students match histograms to box plots for various distributions based on an understanding of center and variability. Students describe data distributions in terms of shape, a measure of center, and a measure of variability from the center.

Lesson 4: Summarizing Deviations from the Mean
Lesson 5: Measuring Variability for Symmetrical Distributions
Lesson 6: Interpreting the Standard Deviation
Lesson 7: Measuring Variability for Skewed Distributions (Interquartile Range)
Lesson 8: Comparing Distributions

**Topic C: Categorical Data on Two Variables (S-ID.5, S-ID.9)**
In Topic C, students reconnect with previous work in Grade 8 involving categorical data. Students use a two-way frequency table to organize data on two categorical variables. Students calculate the conditional relative frequencies from the frequency table. They explore a possible association between two categorical variables using differences in conditional, relative frequencies. Students also come to understand the distinction between association between two categorical variables and a causal relationship between two variables. This provides a foundation for work on sampling and inference in later grades.

Lesson 9: Summarizing Bivariate Categorical Data
Lesson 10: Summarizing Bivariate Categorical Data with Relative Frequencies
Lesson 11: Conditional Relative Frequencies and Association

**Topic D: Numerical Data on Two Variables (S-ID.6, S-ID.7, S-ID.8, S-ID.9)**
In Topic D, students analyze relationships between two quantitative variables using scatterplots and by summarizing linear relationships using the least squares regression line. Models are proposed based on an understanding of the equations representing the models and the observed pattern in the scatter plot. Students calculate and analyze residuals based on an interpretation of residuals as prediction errors.
Lessons 12–13: Relationships between Two Numerical Variables
Lesson 14: Modeling Relationships with a Line
Lesson 15: Interpreting Residuals from a Line
Lesson 16: More on Modeling Relationships with a Line
Lessons 17–18: Analyzing Residuals
Lesson 19: Interpreting Correlation
Lesson 20: Analyzing Data Collected on Two Variables

Algebra I Module III: Linear & Exponential Functions

**Topic A: Linear and Exponential Sequences** (F-IF.A.1, F-IF.A.2, F-IF.A.3, F-IF.B.6, F-BF.A.1a, F-LE.A.1, F-LE.A.2, F-LE.A.3)

In Lesson 1 of Topic A, students challenge the idea that patterns can be defined by merely seeing the first few numbers of the pattern. They learn that a sequence is an ordered list of elements, and that it is sometimes intuitive to number the elements in a sequence beginning with 0 rather than 1. In Lessons 2 and 3, students learn to define sequences explicitly and recursively and begin their study of arithmetic and geometric sequences that continues through Lessons 4–7 as students explore applications of geometric sequences. In the final lesson, students compare arithmetic and geometric sequences as they compare growth rates. Throughout this topic, students use the notation of functions without naming it as such—they come to understand f(n) as a “formula for the nth term of a sequence,” expanding to use other letters such as A(n) for Aliki’s sequence and B(n) for Ben’s sequence. Their use of this same notation for functions will be developed in Topic B.

Lesson 1: Integer Sequences—Should You Believe in Patterns?
Lesson 2: Recursive Formulas for Sequences
Lesson 3: Arithmetic and Geometric Sequences
Lesson 4: Why Do Banks Pay YOU to Provide Their Services?
Lesson 5: The Power of Exponential Growth
Lesson 6: Exponential Growth—U.S. Population and World Population
Lesson 7: Exponential Decay

**Topic B: Functions and Their Graphs** (F-IF.A.1, F-IF.A.2, F-IF.B.4, F-IF.B.5, F-IF.C.7a)

In Lesson 8, students consider that the notation they have been using to write explicit formulas for sequences can be applied to situations where the inputs are not whole numbers. In Lessons 9 and 10, they revisit the notion of function that was introduced in Grade 8. They are now prepared to use function notation as they write functions, interpret statements about functions and evaluate functions for inputs in their domains. They formalize their understanding of a function as a correspondence between two sets, X and Y, in which each element of X is matched (or assigned) to one and only one element of Y, and add the understanding that the set X is called the domain, and the set Y is called the range.

Students study the graphs of functions in Lessons 11-14 of this topic. In Lesson 11, students learn the meaning of the graph of a function, f, as the set of all points (x,f(x)) in the plane, such that x is in the domain of f and f(x) is the value assigned to x by the correspondence of the function. Students use plain English language to write the instructions needed to plot the graph of a function. The instructions are written in a way similar to writing computer “pseudo code”—before actually writing the computer programs. In Lesson 12, students learn that the graph of y = f(x) is the set of all points (x,y) in the plane that satisfy the equation y = f(x) and conclude that it is the same as the graph of the function explored in Lesson 11.

In Lesson 13, students use a graphic of the planned landing sequence Mars Curiosity Rover to create graphs of specific aspects of the landing sequence—altitude over time, and velocity over time—and use the graphs to examine the meaning of increasing and decreasing functions. Finally, Lesson 14 capitalizes on students’ new knowledge of functions and their graphs to contrast linear and exponential functions and the growth rates which they model.

Lesson 8: Why Stay with Whole Numbers?
Lessons 9–10: Representing, Naming, and Evaluating Functions
Lesson 11: The Graph of a Function
Lesson 12: The Graph of the Equation y = (x)
Lesson 13: Interpreting the Graph of a Function
Lesson 14: Linear and Exponential Models—Comparing Growth Rates

**Topic C: Transformations of Functions** (A-RELD.11, F-IF.C.7a, F-BF.B.3)

Lesson 15 of this Topic formalizes the study of piecewise functions that began in Module 1. The study of piecewise functions in this lesson includes step functions and the absolute value function. Piecewise functions work nicely in the remaining lessons of this topic beginning with Lesson 16, where students learn that an equation f(x)=g(x), such as |x – 3|+1=|2x – 4|, can be solved by finding the intersection points of the graphs of y=f(x) and y=g(x). Students use technology in this lesson to create the graphs and observe their intersection points. Next, in Lessons 17-20 students use piecewise functions as they explore four transformations of functions: f(x)+k, f(x+k), k/f(x), and f(kx).
Lesson 15: Piecewise Functions
Lesson 16: Graphs Can Solve Equations Too
Lessons 17–20: Four Interesting Transformations of Functions


In Topic D, students explore application of functions in real world context and use exponential, linear and/or piecewise functions and their associated graphs to model the situations. The contexts include the population of an invasive species, applications of Newton’s Law of Cooling, and long-term parking rates at the Albany International Airport. Students are given tabular data and/or verbal descriptions of a situation and create equations and/or scatterplots of the data. They use continuous curves fit to population data to estimate average rate of change and make predictions about future population sizes. They write functions to model temperature over time, graph the functions they have written, and use the graphs to answer questions within the context of the problem. They recognize when one function is a transformation of another within a context involving cooling substances.

Lesson 21: Comparing Linear and Exponential Models Again
Lesson 22: Modeling an Invasive Species Population
Lesson 23: Newton’s Law of Cooling
Lesson 24: Piecewise and Step Functions in Context

**Algebra I Module IV: Polynomial and Quadratic Expressions, Equations, and Functions**


Deep conceptual understanding of operations with polynomials is the focus of this topic. The emphasis is on using the properties of operations for multiplying and factoring quadratic trinomials, including the connections to numerical operations and rectangular geometry, rather than using common procedural gimmicks like FOIL. In Topic A, students begin by using the distributive property to multiply monomials by polynomials. They relate binomial expressions to the side lengths of rectangles, and find area by multiplying binomials, including those whose expanded form is the difference of squares and perfect squares. They analyze, interpret, and use the structure of polynomial expressions to factor, with the understanding that factoring is the reverse process of multiplication. There are two exploration lessons in Topic A. The first is Lesson 6, in which students will explore all aspects of solving quadratic equations, including using the zero-product property. The second is Lesson 8, where students explore the unique symmetric qualities of quadratic graphs. Both explorations will be revisited and extended throughout this topic and the module.

In Lesson 3, students encounter quadratic expressions for which extracting the GCF is impossible (the leading coefficient, a, is not 1 and is not a common factor of the terms). They discover the importance of the product of the leading coefficient and the constant (ac), and become aware of its use when factoring expressions like $6x^2+5x-6$. In Lesson 4, students explore other factoring strategies strongly associated with the area model, such as using the area method or a table to determine the product-sum combinations. Lesson 5, students discover the zero-product property, and solve for one variable by setting factored expressions equal to zero. In Lesson 6, they decontextualize word problems to create equations and inequalities that model authentic scenarios addressing area and perimeter.

Finally, students build on their prior experiences with linear and exponential functions and their graphs to include interpretation of quadratic functions and their graphs. Students explore and identify key features of quadratic functions and calculate and interpret the average rate of change from the graph of a function. Key features include x- and y-intercepts (zeros of the function), the vertex (minimum maximum values of the function), end behavior, and intervals where the function is increasing or decreasing. It is important for students to use these features to understand how functions behave and to interpret a function in terms of its context.

A focus of this topic is to develop a deep understanding of symmetric nature of a quadratic function. Students use factoring to reveal its zeros and then use these values and their understanding of quadratic function symmetry to determine the axis of symmetry and the coordinates of the vertex. Often students are asked to use $x = -b/2a$ as an efficient way of finding the axis of symmetry and/or the vertex. (Note: Students learn to use this formula without understanding that this is a generalization for the average of the domain values for the x-intercepts.) Only after students develop an understanding of symmetry will $x = -b/2a$ be explored as a general means of finding the axis of symmetry.

Lessons 1–2: Multiplying and Factoring Polynomial Expressions
Lessons 3–4: Advanced Factoring Strategies for Quadratic Expressions
Lesson 5: The Zero Product Property
Lesson 6: Solving Basic One-Variable Quadratic Equations
Lesson 7: Creating and Solving Quadratic Equations in One Variable
Lesson 8: Exploring the Symmetry in Graphs of Quadratic Functions
Lesson 9: Graphing Quadratic Functions from Factored Form, \( (x) = a(x - m)(x - n) \)

Lesson 10: Interpreting Quadratic Functions from Graphs and Tables


In Topic A, students expand their fluency with manipulating polynomials and deepen their understanding of the nature of quadratic functions. They rewrite polynomial expressions by factoring, and use these factors to solve quadratic equations in one variable, using rectangular area as a context. They also sketch quadratic functions and learn about the key features of their graphs, with particular emphasis on relating the factors of a quadratic expression to the zeros of the function it defines.

In Lessons 11 and 12 of Topic B, students learn to manipulate quadratic expressions by completing the square. They use this knowledge to solve quadratic equations in one variable in Lesson 13 in situations where factoring is either impossible or inefficient. There is particular emphasis on quadratic functions with irrational solutions in this topic, and students use these solutions as an opportunity to explore the property of closure for rational and irrational numbers. From there, students derive the quadratic formula by completing the square for the standard form of a quadratic equation, \( y=ax^2+bx+c \).

In Lesson 14 and use it to solve quadratic equations that cannot be easily factored. They discover that some quadratic equations do not have real solutions, and use the discriminant in Lesson 15, to determine whether a quadratic equation has one, two, or no real solutions. Students learn in Lesson 16 that the \( f(x)=a(x-h)^2+k \) form of a function reveals the vertex of its graph. They sketch the graph of a quadratic from its equation in vertex form, and construct a quadratic equation in vertex form from its graph.

As students begin to work in two variables, they are introduced to business applications, which can be modeled with quadratic functions, including profit, loss, revenue, cost, etc. Then, students use all of the tools at their disposal in Lesson 17 to interpret functions and their graphs when prepared in the standard form, \( f(x)=ax^2+bx+c \). They explore the relationship between the coefficients/constants, in the standard/vertex forms of the quadratic functions and the key features of their graphs.

Lessons 11–12: Completing the Square
Lesson 13: Solving Quadratic Equations by Completing the Square
Lesson 14: Deriving the Quadratic Formula
Lesson 15: Using the Quadratic Formula
Lesson 16: Graphing Quadratic Functions from the Vertex Form, \( (x) = a(x - h)^2 + k \)
Lesson 17: Graphing Quadratic Functions from the Standard Form, \( (x) = ax^2 + bx + c \)

**Topic C: Function Transformations and Modeling** (A-CED.A.2, F-IF.6, F-IF.C.7b, F-IF.C.9, F-BF.B.3)

In Lesson 18 of this topic, students build an understanding of the transformational relationship between basic quadratic/cubic functions and square/cube root functions in Lesson 18. (Note: Square and cube roots will not be treated as inverse functions in this course but rather as rotations and reflections of quadratic and cubic functions.) The topic builds on the student’s prior experience of transforming linear, exponential, and absolute value functions in Module 3 to include transforming quadratic, square root, and cube root functions in Lessons 19 and 20. Students create graphs of quadratic, square root, and cube root functions by recognizing in the given functions as the “parent” functions and the transformations to be performed. Students also write the function of the given graph by recognizing the parent function and different transformations being performed. It is crucial that students understand that complex functions can be built from basic parent functions and that this recognition can simplify both graphing functions and also creating function equations from graphs. They recognize the application of transformations in the vertex form for the quadratic function and use it to expand their ability to efficiently sketch graphs of square root and cube root functions.

In Lesson 21, students use what they know about transformations of functions to build both graphs and new, related functions from the quadratic parent function. Then, in Lesson 22, they compare key features of two functions (quadratic, square root, or cube root), each represented in a different way, including graphically, algebraically, numerically in tables, or by verbal description.

In the final two lessons, students create quadratic functions from contextual situations described verbally and from data sets, create a graph of their function, interpret key features of both the function and the graph in terms of the contexts, and answer questions related to the function and its graph. They justify their solutions, as well as choosing and explaining the level of precision they used in reporting their results.

Lesson 18: Graphing Cubic, Square Root, and Cube Root Functions
Lesson 19: Translating Functions
Lesson 20: Stretching and Shrinking Functions
Lesson 21: Transformations of the Quadratic Parent Function, \( (x) = x^2 \)
Lesson 22: Comparing Quadratic, Square Root, and Cube Root Functions Represented in Different Ways
Lessons 23–24: Modeling with Quadratic Functions
Topic A: Elements of Modeling (N-Q.A.2, A-CED.A.2, F-IF.B.4, F-IF.B.5, F-BF.A.1a, F-LE.A.1b, F-LE.A.1c, F-LE.A.2)
Topic A deals with some foundational skills in the modeling process. With each lesson, students build a “toolkit” for modeling. They develop fluency in analyzing graphs, data sets, and verbal descriptions of situations for the purpose of modeling; recognizing different function types (e.g., linear, quadratic, exponential, square root, cube root, and absolute value); and identifying the limitations of the model. From each graph, data set, or verbal description, students will recognize the function type and formulate a model, but stop short of solving problems, making predictions, or interpreting key features of functions or solutions. This topic focuses on the skill building required for the lessons in Topic B, where students will take a problem through the complete modeling cycle. This module will deal with both "descriptive models" (such as graphs) and "analytic models" (such as algebraic equations).

In Lesson 1, students recognize the function type represented by a graph. They recognize the key features of linear, quadratic, exponential, cubic, absolute value, piecewise, square root, and cube root functions. These key features include, but are not limited to, the x- and y-intercepts, vertex, axis of symmetry, and domain and range, as well as domain restrictions dependent on context. They then use the key features and/or data pairs from the graph to create or match to an equation that can be used as another representation of the function; some examples will be in real-world contexts.

Lesson 2 follows the same blueprint. Instead of a graph, students are given a data set presented as a table and asked to identify the function type based on their analysis of the given data. In particular, students look for patterns in the data set at fixed intervals to help them determine the function type, e.g., while linear functions have constant first differences (rate of change), quadratic functions have constant second differences (rate of the rate of change), and exponential functions have a common ratio (constant percent change).

Lesson 3 asks students to make sense of a contextual situation presented as a word problem or as a situation described verbally. They start by making sense of the problem by looking for entry points, analyzing the givens and constraints, and defining the quantities and the relationships described in the context. They recognize specific situations where linear, quadratic, or exponential models are typically used.

Lesson 1: Analyzing a Graph
Lesson 2: Analyzing a Data Set
Lesson 3: Analyzing a Verbal Description

Topic B follows a similar progression as Topic A, in that students create models for contexts presented as graphs, data, and as a verbal description. 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 will 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 (linear), geometric sequence (exponential), or 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 answer questions about the model using the appropriate level 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.

Lesson 4: Modeling a Context from a Graph
Lesson 5: Modeling from a Sequence
Lessons 6–7: Modeling a Context from Data
Lessons 8–9: Modeling a Context from a Verbal Description