High School Math Solution Algebra 1 MATHia® Table of Contents

2020-2021 School Year

CARNEGIE LEARNING

1 Searching for Patterns

MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Strategies: Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Topic 1 Quantities and Relationships															
Understanding Quantities and Their Relationships	Identifying Quantities	Students answer questions related to two animations--one discussing dependent and independent quantities and slope in a real-world context, and the other investigating the shapes of graphs of functions which show the linear and non-linear relationships between different quantities in real-world contexts. Students study numberless graphs of functions and match the graphs to various situations.	N.Q.2	✓			•	•						•	•
Recognizing Functions and Function Families	Evaluating Linear Functions	Given a function in function notation, students determine input and output values.	F.IF.2		✓						•				
	Identifying Domain and Range	Students are introduced to domain and range. They analyze the domain and range of functions in multiple representations. Students identify the domain and range of graphed functions. They identify the mathematical and contextual domain and range of functions represented by scenarios and by graphs.	F.IF.5	✓				•						•	•
	Identifying Key Characteristics of Graphs of Functions	Students will identify key characteristics from the graph of a function, such as the intercepts, minimum and maximum x-values, minimum and maximum y-values, domain, and range.	F.IF.1		✓				•						
	Introduction to Function Families	Students answer questions related to an animation describing different function families (linear, quadratic, exponential, absolute value), their graphs, equations, and general characteristics. Students then investigate the graphs and characteristics of linear, exponential, quadratic, and linear absolute functions in more detail.	F.IF.1	✓			•	•			•				•

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Topic 2 Sequences

MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Strategies									
						Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Recognizing Patterns and Sequences	Describing Patterns in Sequences	Students determine the patterns in sequences and determine the next terms in sequences.	F.IF.3		✓										
	Graphs of Sequences	Students sort numeric sequences by whether they are arithmetic, geometric, or neither. They analyze the characteristics of graphs of arithmetic and geometric sequences. Students match graphs of sequences to their numeric representations.	F.IF.3	✓				•							
Determinig Recursive and Explicit Expressions	Writing Recursive Formulas	Students determine if sequences are arithmetic or geometric and determine recursive formulas for the sequences.	F.IF.3 F.BF.1a		✓										
	Writing Explicit Formulas	Students determine if sequences are artihmetic or geometric and develop the explicit formulas for the sequences.	F.BF.1a		✓										

Topic 3 Linear Regressions

MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Least Squares Regression	Exploring Linear Regression	Students use an interactive Explore Tool to investigate linear regression functions. Students enter data related to various real-world contexts and use the Explore Tool to analyze the linear trend present in the data set, as given by the regression function. Students investigate how moving the points of the data set affects the slope of the regression line, and they analyze the effect of outliers on the regression function. Students also explore Anscombe's Quartet--a group of 4 data sets which are used to show that data sets which have strikingly different graphical shapes can be described by the same linear regression function.	S.ID.6a S.ID.6c S.ID.7	✓		•								•	

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						Strategies									
MATHia Unit	**MATHia Workspace**	**Overview**	**CCSS**	**Concept Builder**	**Mastery**	Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Least Squares Regression (continued)	Using Linear Regression	Students are given a table of data and a linear regression equation that represents the line of best fit. They calculate values of the dependent variable using the linear regression equation. Students compare the values of the dependent variable from both representations, stating whether the question called for interpolation or extrapolation, and whether the linear regression answer was reasonable or not based upon the table of data. The worked example and practice problems are provided in a context.	S.ID.6a	✓							•			•	•
Correlation	Interpreting Lines of Best Fit	Students are introduced to the terms correlation coefficient, positive association, and negative association through examples of scatter plots. They select the possible correlation coefficients for given scatter plots from a range of choices using their conceptual understanding. They complete problems in context, giving rough estimates of the value of r, stating how the estimate is reflected in the table of values, and determining whether the linear regression equation is appropriate for the data set.	S.ID.7 S.ID.8	✓											•
	Correlation and Causation	In different scenarios, students use necessary and sufficient conditions to distinguish between quantities that are correlated and not correlated, and between those that are only correlated versus those that are both correlated and causally related.	S.ID.9	✓										•	

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Creating Residual Plots	Analyzing Residuals of Lines of Best Fit	Students view an animation demonstrating the least squares regression method. Given a scatter plot and possible lines of best fit, they must complete the least squares regression method for each line to determine which is the line of best fit. The term residual is defined and a formula provided. Students analyze a scatter plot and line of best fit, a table comparing the data with the residuals, and a residual plot. They practice making residual tables and analyzing residual plots to decide whether a line of best fit is a good fit.	S.ID.6b	✓			●				●				●

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Topic 1 Linear Functions

MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Strategies: Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Connecting Arithmetic Sequences and Linear Functions	Writing Sequences as Linear Functions	Students classify sequences as arithmetic, geometric, or neither based on their graphs. Students then determine the function family for the sequence, write an explicit formula for the sequence, and finally rewrite it in linear form.	F.IF.1 F.IF.6		✓										
	Understanding Linear Functions	Students use an interactive Explore tool to investigate linear functions in the context of a plane's ascent and descent. Students analyze the different functions' x-intercepts, y-intercepts, domains, ranges, and slopes. Students then solve problems in context by using the Explore tool and solving for the slope (rate of change of descent/ascent) and the initial height (y-intercept).	F.IF.1 F.IF.6	✓		●			●					●	
	Equal Differences Over Equal Intervals	Students watch an animation showing how steps and straight lines described by linear functions are connected. Students demonstrate that straight lines increase or decrease equal amounts over equal intervals, and they show that the average rate of change between any two points on a straight line is the same. Finally, students connect linear functions with arithmetic sequences and show that arithmetic sequences change equal amounts over equal intervals. Students learn that the common difference of an arithmetic sequence is the same as the slope of the line that is matched to the sequence.	F.LE.1a	✓			●				●				
Multiple Representations of Linear Functions	Multiple Representations of Linear Functions	Students represent scenarios with linear expressions. They compare multiple representations of linear functions and determine whether a table, graph, or equation match a given scenario. Students match graphed lines and equations to given scenarios.	N.Q.2	✓				●						●	

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Multiple Representations of Linear Functions (continued)	Modeling Linear Relationships Using Multiple Representations	Students model problems using expressions, tables, and graphs. Students use number properties to evaluate and solve one-step and two-step equations.	A.CED.1		✓				•		•		•	•	
Transforming Linear Functions	Exploring Graphs of Linear Functions	Students use an interactive function machine and a graph to identify transformations of functions, including vertical translations and vertical dilations, and analyze function equations and graphs. Students identify intercepts of the graphs.	A.REI.10 F.IF.1 F.BF.3	✓		•									
	Vertically Translating Linear Functions	Students vertically shift graphs of linear functions. They use verbal descriptions, graphs, and algebraic representations.	F.BF.3		✓										
	Vertically Dilating Linear Functions	Students vertically dilate graphs of linear functions. They use verbal descriptions, graphs, and algebraic representations.	F.BF.3		✓										
	Multiple Transformations of Linear Functions	Given a representation of a transformed function, students determine how the basic linear function was transformed to create the new function.	F.BF.3		✓										
Comparing Linear Functions in Different Forms	Comparing Linear Functions in Different Forms	Given two linear functions in different representations -- equation, graph, table, or description -- with a contextual or noncontextual scenario, students compare the functions' slopes or y-intercepts.	F.IF.C.9		✓									•	

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2 Exploring Constant Change

Topic 2 Solving Linear Equations and Inequalities

MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Solving Linear and Literal Equations	Reasoning About Solving Equations	Students review the four Properties of Equality and then use these properties to justify steps in solving linear equations with integer and rational coefficients and variables on both sides. Students are then shown one way to solve equations, and they use given Properties of Equality to complete steps in solving the equations in a different way.	A.REI.1	✓							•				•
	Solving Linear Equations in a Variety of Forms	Solve linear equations in all forms.	A.REI.1 A.REI.3		✓								•		
Solving Linear and Literal Equations (continued)	Extending Equations to Literal Equations	Students use their knowledge of solving multi-step linear equations to solve a literal equation of the same form.	A.CED.4		✓								•		
	Solving Literal Equations	Students solved literal equations with the aid of a parallel linear equation. In this workspace, the scaffolding is removed and students are responsible for solving a single literal equation.	A.CED.4		✓								•		
Modeling Linear Inequalities	Graphing Inequalities with Rational Numbers	Students graph simple inequalities involving rational numbers on a number line.	A.REI.3		✓				•						
	Solving Two-Step Linear Inequalities	Students solve linear inequalities.	A.REI.3		✓				•				•		
	Representing Compound Inequalities	Students make a distinction between two types of compound inequalities, conjunctions and disjunctions. They interpret the meaning of compound inequality statements written in inequality notation. Students write compound inequalities to represent problems in context. Students interpret graphs by selecting the compound inequality that represents a given graph.	A.REI.3	✓				•							•

2 Exploring Constant Change

Topic 3 Systems of Equations and Inequalities

MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Strategies									
						Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Introduction to Systems of Linear Equations	Representing Systems of Linear Functions	Students reason with linear functions and their graphs to solve systems of two linear functions in real-world contexts. Students use graphs, situations, and equations to solve for both the independent and dependent variables in problems.	A.REI.C.6 A.REI.11	✓							•			•	
	Modeling Linear Systems Using Integers		A.REI.6		✓				•		•		•	•	
	Solving Linear Systems Using Substitution		A.REI.6		✓				•					•	
Using Linear Combinations to Solve a System of Linear Equations	Solving Linear Systems Using Linear Combinations	Students solve systems of linear equations using linear combinations and compare the algebraic and graphical solutions.	A.REI.C.5		✓				•				•		
	Solving Linear Systems Using Any Method	Students choose to solve systems of linear equations using substitution or linear combinations.	A.REI.C.6		✓										
Graphing Linear Inequalities in Two Variables	Exploring Linear Inequalities	Students model solution sets of inequalities in two variables as half-planes on the coordinate plane. They are introduced to cases where a point is included and excluded from the solution set of an inequality. Students connect graphical solutions with algebraic solutions.	A.REI.12	✓									•		
	Graphing Linear Inequalities in Two Variables	Students graph and solve linear inequalities in two variables graphically by determining the correct half-planes for the solution sets.	A.REI.12		✓										
Graphing a System of Linear Inequalities	Systems of Linear Inequalities	Students determine the intersections between two inequalities, graph the inequalities, and shade the regions representing the solutions and their intersections.	A.REI.12		✓				•						
	Interpreting Solutions to Systems of Inequalities	Students will learn how to interpret solutions to systems of inequalities.	A.CED.3	✓					•					•	

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2 Exploring Constant Change

Topic 4 Functions Derived from Linear Relationships

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Defining Absolute Value Functions and Transformations	Building Absolute Value Functions	Students watch an animation showing how taking the absolute value of a number reflects that number across 0, or across the x-axis. Students use reflections to create the basic absolute value function from the functions f(x) = x and f(x) = -x. They show that the two functions f(x) = |x| and f(x) = |-x| are equivalent.	F.IF.7b	✓			•				•				
	Vertically Dilating Absolute Value Functions		F.BF.3		✓										
	Vertically Translating Absolute Value Functions		F.BF.3		✓										
Defining Absolute Value Functions and Transformations (continued)	Horizontally Translating Absolute Value Functions		F.BF.3		✓										
	Multiple Transformations of Absolute Value Functions		F.BF.3		✓										

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Absolute Value Equations and Inequalities	Reasoning About Absolute Value Functions	Students determine the solutions to absolute value equations by graphing each side of the equation as a separate function and looking for the points of intersection. They determine if an absolute value equation has 0, 1, or 2 solutions. They use a graph to solve a real-world problem modeled by an absolute value function.	A.REI.11	✓										•	•
	Graphing Simple Absolute Value Equations Using Number Lines	Students write a simple absolute value equation from a verbal statement, determine the number of solutions, and then represent the solution on a number line.	A.CED.3		✓				•						
	Introduction to Absolute Value Equations	Students practice rewriting absolute value equations as two linear equations. They solve absolute value equations algebraically using properties of equality. Students sort absolute value equations by their number of solutions. They use absolute value equations to solve a contextual problem and consider the reasonableness of the solutions.	A.CED.3 A.REI.3	✓				•						•	•
	Solving Absolute Value Equations	Students solve multi-step absolute value equations, determine the number of solutions, and then represent the solution on a number line	A.CED.3		✓				•				•		
	Reasoning About Absolute Value Inequalities	Students use graphical representations to solve absolute value inequalities. They learn to write equivalent compound inequalities for absolute value inequalities.	A.CED.3	✓				•							•

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Linear Piecewise Functions	Introduction to Piecewise Functions	Students are introduced to a linear piecewise function through a real-world scenario and giving the definition of a piecewise function. They then sort sketches of graphs of linear piecewise functions to given scenarios. Finally, students identify the graph of a linear piecewise function after being given the function's equation.	F.IF.C.7b	✓				•						•	•
	Graphing Linear Piecewise Functions	Given a linear piecewise function definition, students represent its piece domain boundaries on a number line and then graph the function.	F.IF.C.7b		✓				•					•	
	Interpreting Piecewise Functions	Students identify the domain in both non-continuous and continuous piecewise functions given an equation and the graph of the function. They are then given a domain and a graph of a piecewise function and are asked to determine the equation the graph with that domain represents.	F.IF.C.7b	✓					•						•
	Using Linear Piecewise Functions	Students use graphs of linear piecewise functions to answer questions about scenarios in context.	F.IF.C.7b		✓				•					•	
Step Functions	Analyzing Step Functions	Students are introduced to step functions in the first problem. They then identify the domain of a given equation of a step function using a problem situation and graph. Next students are asked to idententfiy the step function that represents a given problem situation and graph.	F.IF.C.7b	✓											•

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3 Investigating Growth and Decay

						Strategies									
MATHia Unit	**MATHia Workspace**	**Overview**	**CCSS**	**Concept Builder**	**Mastery**	Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Topic 1 Introduction to Exponential Functions															
Geometric Sequences and Exponential Functions	Writing Sequences as Exponential Functions	Students classify sequences as arithmetic, geometric, or neither based on their graphs. Students then determine the function family for the sequence, write an explicit formula for the sequence, and finally rewrite it in exponential form	F.IF.3		✓										
Rational Exponents	Using the Properties of Exponents	Students review the properties of powers and identify simplified versions of expressions with numeric powers. They deal with more complex exponential expressions with variables, sorting them into groups that are equivalent expressions.	8.EE.1	✓				•							
	Properties of Rational Exponents	Students learn the names of the components of radical notation (radical, radicand, index and nth root). They use the properties of powers to make sense of the fact that x to the one-half power and the square root of x are equivalent. Students practice rewrite expressions with radical notation using rational exponents, and then reverse the process and rewrite expressions with rational exponents using radical notation. In these problems, all rational exponents are positive fractions with one as a numerator.	N.RN.1	✓											•
	Rewriting Expressions with Radical and Rational Exponents	Students expand their understanding of rational exponents to include making sense of fractional exponents with a numerator other than one and negative exponents. Given various expressions with exponents with fractions, exponents with negative values and powers raised to a power, they select a equivalent radical expressions. The process is then reversed, and students convert radical expressions to expressions with positive or negative fractional exponents.	N.RN.2	✓				•							•

3 Investigating Growth and Decay

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Rational Exponents (continued)	Solving Contextual Exponential Relations Using Common Bases	Students model contextual scenarios by creating equations or inequalities involving an exponential expression with a single variable and a constant expression. Student solve for the variable by rewriting the expressions as exponential expressions with a common base, rewriting the equation or inequality with just the exponents, and then simplifying if necessary to isolate the variable. Finally, students interpret their symbolic solution in terms of the contexts.	A.CED.1		✓								•		
Transformations of Exponential Functions	Introduction to Transforming Exponential Functions	Students use four animations, demonstrating the different ways of transforming an exponential function, to investigate how changing the equation for an exponential function changes the graph of the function. Students answer questions related to horizontal and vertical translations and dilations of exponential functions.	F.BF.3	✓			•								
	Vertically Translating Exponential Functions	Students vertically shift graphs of linear and exponential functions. Students use verbal descriptions, graphs, and algebraic representations.	F.BF.3		✓				•						
	Horizontaly Translating Exponential Functions	Students horizontally shift graphs of linear and exponential functions. Students use verbal descriptions, graphs, and algebraic representations.	F.BF.3		✓				•						
	Reflecting and Dilating Exponential Functions Using Graphs	Students reflect and dilate graphs of linear and exponential functions. Students use verbal descriptions, graphs, and algebraic representations.	F.BF.3		✓				•						
	Transforming Exponential Functions Using Tables of Values	Given a table of values and a table of transformed values, students determine how the basic linear and exponential functions were transformed to create the new functions.	F.BF.3		✓				•						
	Multiple Transformations of Exponential Functions	Given a representation of a transformed function, students determine how the basic linear and exponential functions were transformed to create the new functions.	F.BF.3		✓				•						

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3 Investigating Growth and Decay

Topic 2 Using Exponential Equations

MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Exponential Equations for Growth and Decay	Recognizing Linear and Exponential Models	Students compare linear and exponential functions and their graphs in the context of simple interest (linear) and compound interest (exponential). Students solve problems related to the independent and dependent variables of both linear and exponential functions using the graphs and equations.	F.LE.1b F.LE.1c	✓					•					•	•
	Calculating and Interpreting Average Rate of Change	A formula is provided to calculate the average rate of change for a specified interval of an exponential function, and the reason it is considered an average is explained. Students are provided contexts along with either a graph or table. They must calculate the average rate of change for specified intervals of the function, and make an estimation for another interval based upon their results.	F.IF.6	✓							•				•
	Recognizing Growth and Decay	Students watch two different animations: one shows a model of exponential growth and one shows a model of exponential decay. They analyze how to recognize the difference between the two exponential models before interpreting exponential functions using scenarios of population increase and decrease.	F.LE.1c	✓			•							•	
	Comparing Exponential Functions in Different Forms	Given two exponential functions in different representations -- equation, graph, table, or description -- with a contextual or noncontextual scenario, students compare the functions' y-intercepts, x-intercepts, or average rates of change over a specific interval.	F.IF.C.9		✓									•	
Solving Exponential Equations	Modeling Equations with a Starting Point of 1.	Students use exponential equations with a y-intercept of 1 to model scenarios. They answer questions by completing a table of values and graphing corresponding points of the exponential function.	A.CED.2 A.REI.10		✓				•		•			•	

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MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Strategies: Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Solving Exponential Equations (continued)	Modeling Equations with a Starting Point Other Than 1	Students use exponential equations with a y-intercept other than 1 to model scenarios. They answer questions by completing a table of values and graphing corresponding points of the exponential function.	A.CED.2 A.REI.10		✓				•		•			•	
	Solving Exponential Equations Using a Graph	Students write the equation for an exponential function (with a dilation, vertical shift, or horizontal shift) from a contextual scenario. Students then use a graph to determine the solution to the equation for a given dependent value, and interpret the solution in context.	A.REI.11		✓				•					•	
Modeling Using Exponential Functions	Relating the Domain to Exponential Functions	Students determine the domain of exponential functions. Scenarios are provided, and in light of the context, two factors must be considered: the lowest and highest values for the independent variable and the types of numbers that make sense for the independent variable. Several examples are provided to model the process of selecting an appropriate domain prior to students completing problems independently.	F.IF.5	✓							•				•
	Exploring Exponential Regressions	Students use an interactive Explore Tool to investigate exponential regression functions. They enter data related to various real-world contexts and use the Explore Tool to determine the exponential regression equation. Students interpret the parameters of the regression equation in the context of the data and investigate how moving the points of the data set affects those parameters. They use a regression equation to make predictions based on interpolation and extrapolation, determining which prediction is more accurate and why.	S.ID.6a	✓		•								•	

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4 Describing Distributions

						Strategies									
MATHia Unit	**MATHia Workspace**	**Overview**	**CCSS**	**Concept Builder**	**Mastery**	Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Topic 1 One-Variable Statistics															
Graphically Representing Data	Creating Frequency Plots	Given a data set in context, students construct either a dot plot or histogram. In both cases, they must select a title based on the description of the data. For dot plots, students must identify the least and greatest data values, then the bounds on the number line are provided. Students then use a tool to plot each data value to create the dot plot. For histograms, students must label the axes and create a scale for the horizontal axis, while the scale for the vertical axis is provided. They then use a tool to graph each bin; as students select the data that belongs in each bin, the tool graphs each bin to the appropriate height. Data values include rational numbers.	S.ID.1		✓				•					•	
	Describing Data Sets	Students watch an animation to review shape, center, and spread of a data set. They describe a data set by its shape, reviewing skewness and the terms cluster, gap, peak, and outlier. Students review mean and median and describe a data set using each center. They review range and interquartile range before being introduced to standard deviation and use these measures of spread to describe a data set.	S.ID.3	✓			•							•	•
Comparing Measures of Center and Spread	Determining Appropriate Measures of Center	Students use their understanding of mean, median, and mode to determine which was used as the measure of central tendency.	S.ID.2		✓										
	Measuring the Effects of Changing Data Sets	Students calculate mean and median, with and without an additional data value, and compare the original and adjusted measures.	S.ID.3		✓										

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4 Describing Distributions

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Comparing Measures of Center and Spread (continued)	Creating Box Plots and Identifying Outliers	Given a scenario and a corresponding data set, students determine the five-number summary. They also calculate the IQR, lower fence, and upper fence in order to identify any outliers. As students place their responses in a framework which visually supports the order of the values on a number line, a box plot is constructed for them using their responses. They then select an appropriate title for their box plot. Additionally, a tool is provided to help students determine the median, Q1, and Q3 in an efficient manner.	S.ID.1		✓	•			•					•	
	Calculating Standard Deviation	Students compute the mean, variance, and standard deviation of data sets.	S.ID.2		✓						•			•	
Comparing Data Sets	Comparing and Interpreting Measures of Center	Students calculate the mean and median of a data set and determine which is the better measure of center based on the distribution of the data. They also examine when a mean or median cannot be determined from a given display as well as the effect that outliers have on the mean. Finally, students compare two data sets according to each set's better measure of center.	S.ID.2 S.ID.3	✓							•				•
	Comparing Data Sets Using Center and Spread		S.ID.2 S.ID.3		✓										

Topic 2 Two-Variable Categorical Data

MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Two-Variable Categorical Data	Creating Marginal Frequency Distributions	Students construct a Marginal Frequency Distribution from an input Data Table for a contextual scenario.	S.ID.5		✓						•			•	
	Using Marginal Frequency Distributions	Students analyze a Marginal Frequency Distribution to answer questions about frequencies for interior and total cells, categories with minimum or maximum frequencies for interior and/or total cells, and comparing frequencies in different rows or columns	S.ID.5		✓										

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4 Describing Distributions

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						Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Two-Variable Categorical Data (continued)	Creating Marginal Relative Frequency Distributions	Students construct a Marginal Relative Frequency Distribution from an input Marginal Frequency Distribution for a contextual scenario.	S.ID.5		✔						•			•	
	Using Marginal Relative Frequency Distributions	Students analyze a Marginal Relative Frequency Distribution to answer questions about relative frequencies for interior and total cells, categories with minimum or maximum relative frequencies for interior and/or total cells, and comparing relative frequencies in different rows or columns.	S.ID.5		✔										
	Creating Conditional Relative Frequency Distributions	Students construct a Conditional Relative Frequency Distribution from an input Marginal Frequency Distribution for a contextual scenario.	S.ID.5		✔						•			•	
	Using Conditional Relative Frequency Distributions	Students analyze a Conditional Relative Frequency Distribution to answer questions about conditional frequencies for interior cells, categories with minimum or maximum conditional frequencies for interior cells, comparing conditional frequencies in different rows or columns, and whether there appears to be an association between the categorical variables.	S.ID.5		✔										

5 Maximizing and Minimizing

MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Strategies: Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Topic 1 Introduction to Quadratic Functions															
Exploring Quadratic Functions	Introduction to a Quadratic Function	Students watch an animation introducing them to a quadratic function. They sort functions modeled by an equation or by a graph as quadratic or not. Students use a table of values to graph a basic quadratic function. They sort graphs of quadratic functions by their number of x-intercepts. Students determine the range of quadratic functions given their graphs.	F.IF.7a	✔			•	•			•				
	Modeling Area as Product of Monomial and Binomial	Students complete a table of values and graph from a scenario represented by a quadratic model. Students construct the quadratic function for the scenario as a product of a monomial and a binomial.	A.CED.1		✔				•		•		•	•	
	Modeling Area as Product of Two Binomials	Students complete a table of values and graph from a scenario represented by a quadratic model. Students construct the quadratic function for the scenario as the product of two binomials.	A.CED.1		✔				•		•		•	•	
	Modeling Projectile Motion	Students use quadratic functions to model projectile motion, and use the solver and the graphs to answer questions.	F.IF.4		✔				•		•		•	•	
	Recognizing Key Features of Vertical Motion Graphs	Students use an interactive Explore Tool to investigate how a vertical motion graph changes when the different values in the vertex, factored, and general form of the quadratic function change. They then use vertical motion graphs to identify the maximum, x-intercepts, y-intercept, domain, and range of a quadratic function. Finally, students use a vertical motion graph to determine the axis of symmetry and vertex of a quadratic function.	F.IF.4	✔		•								•	•
	Interpreting Maximums of Quadratic Models	Students analyze the graphs of functions modeling scenarios of area and vertical motion to identify the maximum and interpret what it means in terms of the problem.	A.CED.1	✔											•

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5 Maximizing and Minimizing

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Key Characteristics of Quadratic Functions	Recognizing Quadratic Functions from Tables	Students recall first differences and are introduced to second differences. They calculate and analyze the first and second differences of linear and quadratic functions, comparing the values to the equations and graphs of the functions. Students then determine first and second differences in a table of values and identify the function represented by the table.	F.IF.6	✓							•				
	Identifying Properties of Quadratic Functions	Students differentiate among general form, factored form, and vertex form of a quadratic function. They learn the characteristics of the graph that are visible from each form: y-intercept from general form, x-intercepts from factored form, and vertex from vertex form, and practice identifying these characteristics from the algebraic representations. The axis of symmetry is introduced as an aid in graphing, and students determine the vertex and axis of symmetry from the vertex form and factored form of a quadratic function. They use the concept of symmetry to determine an additional point that lies on a parabola. Lastly, students identify whether a parabola is concave up or down based upon the sign of the x-squared term when the function is written in any form.	F.IF.C.8a	✓				•			•				•
Transformations of Quadratic Functions	Vertically Translating Quadratic Functions	Students vertically shift graphs of linear and quadratic functions. Students use verbal descriptions, graphs, and algebraic representations.	F.BF.3		✓				•						
	Horizontally Translating Quadratic Functions	Students horizontally shift graphs of linear and quadratic functions. Students use verbal descriptions, graphs, and algebraic representations.	F.BF.3		✓				•						
	Reflecting and Dilating Quadratic Functions using Graphs	Students reflect and dilate graphs of linear and quadratic functions. Students use verbal descriptions, graphs, and algebraic representations.	F.BF.3		✓				•						

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Transformations of Quadratic Functions (continued)	Transforming Quadratic Functions Using Tables	Given a table of values and a table of transformed values, students determine how the basic linear and quadratic functions were transformed to create the new functions.	F.BF.3		✔				•						
	Multiple Transformations of Quadratic Functions	Given a representation of a transformed function, students determine how the basic linear and quadratic functions were transformed to create the new functions.	F.BF.3		✔				•						
Sketching and Comparing Quadratic Functions	Comparing Increasing Linear, Exponential, and Quadratic Functions	Students use graphs and tables to observe that an increasing exponential function will eventually exceed an increasing linear or quadratic function. They determine the average rate of change for a linear, quadratic, and exponential function over different intervals. Students compare an increasing linear, quadratic, and exponential model in context to determine that the exponential model has the best output over time.	F.LE.3	✔							•			•	
	Sketching Quadratic Functions	Sketch a quadratic function given factored, standard or vertex form	F.IF.C.7.a		✔				•						
	Comparing Quadratic Functions in Different Forms	Given two quadratic functions in different representations -- equation, graph, table, or description -- with a contextual or noncontextual scenario, students compare the functions' y-intercepts, zeros, absolute maximums/minimums, or rates of change over a specific interval.	F.IF.C.9		✔									•	

Topic 2 Solving Quadratic Equations

MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Adding, Subtracting, and Multiplying Polynomials	Introduction to Polynomial Arithmetic	Students are introduced to polynomials and identify the difference between different types of polynomials as well as non-polynomials. They then use an Explore Tool to investigate combining like terms when adding polynomial expressions. Finally, students examine the steps to simplifying polynomial expressions that are either added or subtracted before simplifying on their own.	A.APR.1	✔		•		•			•				•

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5 Maximizing and Minimizing

MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Strategies: Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Adding, Subtracting, and Multiplying Polynomials (continued)	Identifying Parts of Complex Algebraic Expressions	Students identify the parts of complex algebraic expressions, including terms, coefficients, sums, factors, products, differences, and quotients.	A.SSE.1a	✓				•							•
	Operating with Functions on the Coordinate Plane	Students watch an animation about operating with functions on the coordinate plane before examining adding and subtracting constant functions, linear functions, and a linear and a quadratic function.	F.BF.3	✓			•				•				
	Adding Polynomials	Students add quadratic expressions.	A.APR.1		✓								•		
	Subtracting Polynomials	Students subtract polynomials.	A.APR.1		✓								•		
	Using a Factor Table to Multiply Binomials	Students use factor tables to multiply linear expressions. Students combine like terms.	A.APR.1		✓						•				
	Multiplying Binomials	Students determine which factor table is appropriate for a given problem, set up the table, and then use the table to multiply linear expressions.	A.APR.1		✓						•				
Representing Solutions to Quadratic Equations	Making Sense of Roots and Zeros	Students experiment with patterns relating two lines and the parabola that is generated by the product of their two linear functions. The first pattern solidifies the fact that the two expressions are factors of the quadratic function. The second pattern guides students to the Zero Product Property, an underpinning for determining the zeros of a quadratic function written in factored form.	A.REI.11	✓											
	Factoring using Difference of Squares	Students factor quadratic expressions using difference to two squares.	A.SSE.2		✓								•		
Solutions to Quadratic Equations in Vertex Form	Using Properties of Equality to Solve Quadratic Equations	Students use the Properties of Equality to solve quadratic equations in the form $y = ax^2$, $y = ax^2 + d$, $y = a(x - c)^2$, and $y = a(x - c)^2 + d$ where a, c, and d are constants.	A.REI.4b		✓								•		

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5 Maximizing and Minimizing

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Factoring and Completing the Square	Introduction to Factoring	Students are introduced to factoring trinomials first using factor tables. They analyze patterns in the operations of binomial factors. Students factor the GCF from quadratic expressions. They practice factoring quadratic trinomials with and without first factoring out a GCF. Students then use factoring as a method to solve a quadratic equation.	A.SEE.3a	✓							•				•
	Factoring Trinomials with Coefficients of One	Students factor quadratic trinomials with a coefficient of one.	A.SSE.3a		✓								•		
	Factoring Trinomials with Coefficients Other than One	Students factor quadratic trinomials with a coefficient other than one.	A.SSE.3a		✓								•		
	Factoring Quadratic Expressions	Students factor quadratic expressions using all known factoring methods.	A.SSE.3a		✓								•		
	Solving Quadratic Equations by Factoring	Students solve quadratic equations by factoring and applying the zero-product property.	A.REI.4b		✓								•		
	Problem Solving Using Factoring	Students create quadratic equations to represent mathematical and real-world situations. They then factor these equations and determine zeros to reveal different structures and quantities that can help them relate quantities and solve problems.	A.SSE.3a	✓											•
	Completing the Square	Students analyze a worked example of a quadratic function in general form being written in vertex form through the process of completing the square. They then practice completing the square using polynomials and area models before filling in unknown values in trinomials that create perfect square trinomials. Finally, students are shown the algebraic method of changing a quadratic function in general form to vertex form by completing the square. They use the algebra shown to determine the axis of symmetry and vertex of quadratic functions in general form.	A.REI.4a F.IF.C.8a	✓											•

5 Maximizing and Minimizing

MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
						Strategies									
Factoring and Completing the Square (continued)	Problem Solving Using Completing the Square	Students use the method of Completing the Square to convert quadratic equations to vertex form in order to solve real-world problems in different situations by revealing maxima of quadratic functions.	A.SSE.3b	✓											•
The Quadratic Formula	Deriving the Quadratic Formula	Students use the completing the square method to determine the roots of a given quadratic equation. They then analyze the method of completing the square for any quadratic equation in general form from which the Quadratic Formula is derived. They practice using the Quadratic Formula to calculate the roots of quadratic equations in general form.	A.REI.4a A.REI.4b	✓											
	Solving Quadratic Equations	Students solve quadratic equations by using factoring or the quadratic formula.	A.REI.4b		✓								•		

Topic 3 Applications of Quadratics

MATHia Unit	MATHia Workspace	Overview	CCSS	Concept Builder	Mastery	Animations	Classifications	Explore Tools	Graphing Tools	Interactive Diagrams	Interactive Worksheets	Proof	Real-World Scenarios	Solvers	Worked Example
Using Quadratic Functions to Model Data	Using Regression Models	Students use equations of quadratic regression models, the solver, and graphs to answer questions.	S.ID.6a		✓				•		•		•	•	
	Introduction to Inverses	Students watch an animation that shows the graph of the inverse of a function is a reflection of the function across the line y = x. They determine whether a function is a one-to-one function given its graph and the graph of its inverse. Students identify the graph of the inverse of a function by considering its reflection across y = x. They complete a table of values for the inverse of a function and determine its graph.	F.BF.4	✓			•	•							
	Recognizing Graphs of Inverses	Given the graphs of two relations, students decide if the relations are inverses.	F.BF.4		✓										