A Correlation of

Connected Mathematics Project 3 (CMP3) ©2018

to the

Alabama Course of Study Mathematics 2019

Grade 8 Accelerated

Alabama Course of Study Mathematics 2019 Grade 8 Accelerated	Connected Mathematics Project 3 Algebra 1 Investigations
Student Mathematical Practices	
1. Make sense of problems and persevere in solving them.	The Standards for Mathematical Practice can be met throughout the CMP3 program. For specific examples, please see: **Looking for Pythagoras:** Inv. 1, Inv. 2, Inv. 3 **Growing, Growing, Growing:** Inv. 1, Inv. 4 **Butterflies, Pinwheels, and Wallpaper:** Inv. 1, Inv. 3, Inv. 4 **Say It with Symbols:** Inv. 3, Inv. 4, Inv. 5 **It's In the System:** Inv. 1, Inv. 4
2. Reason abstractly and quantitatively.	The Standards for Mathematical Practice can be met throughout the CMP3 program. For specific examples, please see: **Thinking with Mathematical Models:** Inv. 1 **Looking for Pythagoras:** Inv. 5 **Growing, Growing, Growing:** Inv. 3 **Butterflies, Pinwheels, and Wallpaper:** Inv. 4 **Say It With Symbols:** Inv. 3 **It's In the System:** Inv. 2
3. Construct viable arguments and critique the reasoning of others.	The Standards for Mathematical Practice can be met throughout the CMP3 program. For specific examples, please see: **Thinking with Mathematical Models:** Inv. 4 **Growing, Growing, Growing:** Inv. 1, Inv. 4 **Butterflies, Pinwheels, and Wallpaper:** Inv. 1, Inv. 3, Inv. 4 **Say It With Symbols:** Inv. 1, Inv. 5 **It's In the System:** Inv. 1

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4. Model with mathematics.	The Standards for Mathematical Practice can be met throughout the CMP3 program. For specific examples, please see: **Thinking with Mathematical Models:** Inv. 4, Inv. 5 **Looking for Pythagoras:** Inv. 3, Inv. 5 **Growing, Growing, Growing:** Inv. 3 **Butterflies, Pinwheels, and Wallpaper:** Inv. 4 **Say It With Symbols:** Inv. 2
5. Use appropriate tools strategically.	The Standards for Mathematical Practice can be met throughout the CMP3 program. For specific examples, please see: **Thinking with Mathematical Models:** Inv. 2 **Looking for Pythagoras:** Inv. 1, Inv. 3, Inv. 5 **Growing, Growing, Growing:** Inv. 1, Inv. 3, Inv. 5 **Butterflies, Pinwheels, and Wallpaper:** Inv. 4 **It's In the System:** Inv. 3
6. Attend to precision.	The Standards for Mathematical Practice can be met throughout the CMP3 program. For specific examples, please see: **Thinking with Mathematical Models:** Inv. 2, Inv. 5 **Looking for Pythagoras:** Inv. 4 **Growing, Growing, Growing:** Inv. 1 **Say It With Symbols:** Inv. 4 **It's In the System:** Inv. 4

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7. Look for and make use of structure.	The Standards for Mathematical Practice can be met throughout the CMP3 program. For specific examples, please see: **Thinking with Mathematical Models:** Inv. 1, Inv. 3 **Looking for Pythagoras:** Inv. 4 **Growing, Growing, Growing:** Inv. 1, Inv. 2, Inv. 4, Inv. 5 **Butterflies, Pinwheels, and Wallpaper:** Inv. 3
8. Look for and express regularity in repeated reasoning.	The Standards for Mathematical Practice can be met throughout the CMP3 program. For specific examples, please see: **Thinking with Mathematical Models:** Inv. 3 **Looking for Pythagoras:** Inv. 2 **Growing, Growing, Growing:** Inv. 2 **Butterflies, Pinwheels, and Wallpaper:** Inv. 2, Inv. 3 **Say It With Symbols:** Inv. 2 **It's In the System:** Inv. 2
Number Systems and Operations	
Together, irrational numbers and rational numbers complete the real number system, representing all points on the number line, while there exist numbers beyond the real numbers called complex numbers.	
1. Explain how the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for an additional notation for radicals in terms of rational exponents. [*Algebra I with Probability, 1*]	**Growing, Growing, Growing:** Inv. 5, ACE, MR
2. Rewrite expressions involving radicals and rational exponents using the properties of exponents. [*Algebra I with Probability, 2*]	**Growing, Growing, Growing:** Inv. 5, ACE
3. Define the imaginary number i such that $i^2 = -1$. [*Algebra I with Probability, 3*]	**Function Junction:** Inv. 4, ACE, MR

ACE = Applications Connections – Extensions
Inv. = Investigations
MR = Mathematical Reflections

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Algebra and Functions	
Expressions can be rewritten in equivalent forms by using algebraic properties, including properties of addition, multiplication, and exponentiation, to make different characteristics or features visible.	
4. Interpret linear, quadratic, and exponential expressions in terms of a context by viewing one or more of their parts as a single entity. [*Algebra I with Probability, 4*] *Example: Interpret the accrued amount of investment* $P(1 + r)^t$, *where* P *is the principal and r is the interest rate, as the product of* P *and a factor depending on time* t.	**Thinking with Mathematical Models:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR **Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR **Say It With Symbols:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR, Inv. 5, ACE, MR **Frogs, Fleas, and Painted Cubes:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR
5. Use the structure of an expression to identify ways to rewrite it. [*Algebra I with Probability, 5*] *Example: See* $x^4 - y^4$ *as* $(x^2)^2 - (y^2)^2$, *thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$.	**Say It with Symbols:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR **Frogs, Fleas, and Painted Cubes:** Inv. 2, ACE, MR
6. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	**Say It with Symbols:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR **Frogs, Fleas, and Painted Cubes:** Inv. 2, ACE, MR
a. Factor quadratic expressions with leading coefficients of one, and use the factored form to reveal the zeros of the function it defines.	**Say It with Symbols:** Inv. 3, ACE, MR, Inv. 4 **Frogs, Fleas, and Painted Cubes:** Inv. 2, ACE, MR
b. Use the vertex form of a quadratic expression to reveal the maximum or minimum value and the axis of symmetry of the function it defines; complete the square to find the vertex form of quadratics with a leading coefficient of one.	**Function Junction:** Inv. 4, ACE, MR
c. Use the properties of exponents to transform expressions for exponential functions. [*Algebra I with Probability, 6*] *Example: Identify percent rate of change in functions such as* $y = (1.02)^t$, $y = (0.97)^t$, $y = (1.01)^{12t}$, *or* $y = (1.2)^{t/10}$, *and classify them as representing exponential growth or decay.*	**Growing, Growing, Growing:** Inv. 5, ACE, MR

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7. Add, subtract, and multiply polynomials, showing that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication. [*Algebra I with Probability, 7*]	**Say It with Symbols:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR **Frogs, Fleas, and Painted Cubes:** Inv. 2, ACE, MR **Function Junction:** Inv. 5, ACE, MR
8. Analyze the relationship (increasing or decreasing, linear or non-linear) between two quantities represented in a graph. [*Grade 8*, *17*]	**Thinking with Mathematical Models:** Inv. 1, ACE, MR, Inv. 3, ACE, MR **Growing, Growing, Growing:** Inv. 4, ACE, MR
Analyze and solve linear equations and systems of two linear equations.	
9. Solve systems of two linear equations in two variables by graphing and substitution.	**Thinking with Mathematical Models:** Inv. 2, ACE **It's in the System:** Inv. 1, ACE, MR, Inv. 2, ACE, MR
a. Explain that the solution(s) of systems of two linear equations in two variables corresponds to points of intersection on their graphs because points of intersection satisfy both equations simultaneously.	**Thinking with Mathematical Models:** Inv. 2, ACE **It's in the System:** Inv. 2, ACE, MR
b. Interpret and justify the results of systems of two linear equations in two variables (one solution, no solution, or infinitely many solutions) when applied to real-world and mathematical problems. [*Grade 8, 12*]	**Thinking with Mathematical Models:** Inv. 2, ACE **It's in the System:** Inv. 2, ACE, MR

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Finding solutions to an equation, inequality, or system of equations or inequalities requires the checking of candidate solutions, whether generated analytically or graphically, to ensure that solutions are found and that those found are not extraneous.	
10. Explain why extraneous solutions to an equation involving absolute values may arise and how to check to be sure that a candidate solution satisfies an equation. [*Algebra I with Probability, 8*]	While the technical vocabulary surrounding the concept of "extraneous solutions" is not introduced here, students are encouraged to check their solutions for reasonableness and accuracy, and they do encounter situations where an answer arrived at through algebra does not necessarily make sense in context. Also, students gain experience with equations that have no real solution or infinitely many solutions. **Looking for Pythagoras:** Inv. 1, ACE, MR **Say It With Symbols:** Inv. 3, ACE, MR **It's in the System:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR
The structure of an equation or inequality (including, but not limited to, one-variable linear and quadratic equations, inequalities, and systems of linear equations in two variables) can be purposefully analyzed (with and without technology) to determine an efficient strategy to find a solution, if one exists, and then to justify the solution.	
11. Select an appropriate method to solve a quadratic equation in one variable.	**Say It with Symbols:** Inv. 3, ACE, MR **Function Junction:** Inv. 4, ACE, MR
a. Use the method of completing the square to transform any quadratic equation in *x* into an equation of the form $(x - p)^2 = q$ that has the same solutions. Explain how the quadratic formula is derived from this form.	**Function Junction:** Inv. 4, ACE, MR
b. Solve quadratic equations by inspection (such as $x^2 = 49$), taking square roots, completing the square, the quadratic formula, and factoring, as appropriate to the initial form of the equation, and recognize that some solutions may not be real. [*Algebra I with Probability, 9*]	**Say It with Symbols:** Inv. 3, ACE, MR **Function Junction:** Inv. 4, ACE, MR
12. Select an appropriate method to solve a system of two linear equations in two variables.	**Thinking with Mathematical Models:** Inv. 2, ACE **Say It With Symbols:** Inv. 3, ACE **It's In the System:** Inv. 1, ACE, MR, Inv. 2, ACE, MR

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a. Solve a system of two equations in two variables by using linear combinations; contrast situations in which use of linear combinations is more efficient with those in which substitution is more efficient.	**It's in the System:** Inv. 2, ACE, MR
b. Contrast solutions to a system of two linear equations in two variables produced by algebraic methods with graphical and tabular methods. [*Algebra I with Probability, 10*]	**Thinking with Mathematical Models:** Inv. 2, ACE **Say It with Symbols:** Inv. 3, ACE **It's in the System:** Inv. 1, ACE, MR, Inv. 2, ACE, MR
Expressions, equations, and inequalities can be used to analyze and make predictions, both within mathematics and as mathematics is applied in different contexts – in particular, contexts that arise in relation to linear, quadratic, and exponential situations.	
13. Create equations and inequalities in one variable and use them to solve problems in context, either exactly or approximately. **Extend from contexts arising from linear functions to those involving quadratic, exponential, and absolute value functions. [***Algebra I with Probability, 11*]	**Thinking with Mathematical Models:** Inv. 2, ACE **Looking for Pythagoras:** Inv. 2, ACE, MR, Inv. 5, ACE, MR **Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR, Inv. 5, ACE **Say It with Symbols:** Inv. 3, ACE, MR
14. Create equations in two or more variables to represent relationships between quantities in context; graph equations on coordinate axes with labels and scales and use them to make predictions. **Limit to contexts arising from linear, quadratic, exponential, absolute value, and linear piecewise functions. [***Algebra I with Probability, 12*]	**Thinking with Mathematical Models:** Inv. 2, ACE **Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR, Inv. 5, ACE **It's in the System:** Inv. 1, ACE, MR **Frogs, Fleas, and Painted Cubes:** Inv. 2, ACE
15. Represent constraints by equations and/or inequalities, and solve systems of equations and/or inequalities, interpreting solutions as viable or nonviable options in a modeling context. **Limit to contexts arising from linear, quadratic, exponential, absolute value, and linear piecewise functions. [***Algebra I with Probability, 13*]	**Thinking with Mathematical Models:** Inv. 2, ACE **Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR, Inv. 5, ACE **It's in the System:** Inv. 1, ACE, MR, Inv. 2, Inv. 3, ACE, Inv. 4 **Frogs, Fleas, and Painted Cubes:** Inv. 4, ACE

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Functions shift the emphasis from a point-by-point relationship between two variables (input/output) to considering an entire set of ordered pairs (where each first element is paired with exactly one second element) as an entity with its own features and characteristics.	
16. Define a function as a mapping from one set (called the domain) to another set (called the range) that assigns to each element of the domain exactly one element of the range. [*Grade 8, 13, edited for added content*]	**Thinking with Mathematical Models:** Inv. 2, ACE, MR, Inv. 3, ACE **Growing, Growing, Growing:** Inv. 2, ACE, Inv. 5, ACE, MR **Say It with Symbols:** Inv. 3, ACE, Inv. 4, ACE, MR **Frogs, Fleas, and Painted Cubes:** Inv. 1, ACE, MR, Inv. 4, ACE, MR **Function Junction:** Inv. 1, ACE, MR, Inv. 5, ACE, MR
a. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. *[Grade 8, 14, edited for added content*] *Note: If* f *is a function and* x *is an element of its domain, then* f*(*x*) denotes the output of* f *corresponding to the input* x*.*	**Function Junction:** Inv. 1, ACE, MR, Inv. 5, ACE, MR
b. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. **Limit to linear, quadratic, exponential, and absolute value functions. [***Algebra I with Probability, 15*]	**Frogs, Fleas, and Painted Cubes:** Inv. 4, ACE, MR **Function Junction:** Inv. 1, ACE, MR, Inv. 5, ACE, MR
17. Given a relation defined by an equation in two variables, identify the graph of the relation as the set of all its solutions plotted in the coordinate plane. *[Algebra I with Probability, 14]* *Note: The graph of a relation often forms a curve (which could be a line).*	**Thinking with Mathematical Models:** Inv. 2, ACE, MR **Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR, Inv. 5, ACE **It's in the System:** Inv. 1, ACE, MR **Frogs, Fleas, and Painted Cubes:** Inv. 2, ACE
18. Compare and contrast relations and functions represented by equations, graphs, or tables that show related values; determine whether a relation is a function. Identify that a function f is a special kind of relation defined by the equation $y = f(x)$. [*Algebra I with Probability, 16*]	**Thinking with Mathematical Models:** Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR **Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR **Say It With Symbols:** Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR, Inv. 5, ACE, MR

<table>
<tr><th>Alabama Course of Study Mathematics 2019
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<tr><td>19. Combine different types of standard functions to write, evaluate, and interpret functions in context. Limit to linear, quadratic, exponential, and absolute value functions.</td><td>Students perform operations on polynomial functions.
Function Junction:
Inv. 5, ACE, MR</td></tr>
<tr><td>a. Use arithmetic operations to combine different types of standard functions to write and evaluate functions. Example: Given two functions, one representing flow rate of water and the other representing evaporation of that water, combine the two functions to determine the amount of water in the container at a given time.</td><td>Students perform operations on polynomial functions.
Function Junction:
Inv. 5, ACE, MR</td></tr>
<tr><td>b. Use function composition to combine different types of standard functions to write and evaluate functions. [Algebra I with Probability, 17]
Example: Given the following relationships, determine what the expression S(T(t)) represents.
<table>
<tr><td>Function</td><td>Input</td><td>Output</td></tr>
<tr><td>G</td><td>Amount of studying: s</td><td>Grade in course: G(s)</td></tr>
<tr><td>S</td><td>Grade in course: g</td><td>Amount of screen time: S(g)</td></tr>
<tr><td>T</td><td>Amount of screen time: t</td><td>Number of followers: T(t)</td></tr>
</table></td><td>Students perform operations on polynomial functions.
Function Junction:
Inv. 5, ACE, MR</td></tr>
<tr><td colspan="2">Graphs can be used to obtain exact or approximate solutions of equations, inequalities, and systems of equations and inequalities – including systems of linear equations in two variables and systems of linear and quadratic equations (given or obtained by using technology).</td></tr>
<tr><td>20. Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x).</td><td>It's in the System:
Inv. 1, ACE, MR</td></tr>
<tr><td>a. Find the approximate solutions of an equation graphically, using tables of values, or finding successive approximations, using technology where appropriate. [Algebra I with Probability, 19] Note: Include cases where f(x) is linear, quadratic, exponential, or absolute value functions and g(x) is constant or linear.</td><td>Thinking with Mathematical Models:
Inv. 2, ACE, MR</td></tr>
</table>

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21. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes, using technology where appropriate. [*Algebra I with Probability, 20*]	**It's in the System:** Inv. 4, ACE, MR
22. Solve systems consisting of linear and/or quadratic equations in two variables graphically, using technology where appropriate. [*Algebra I with Probability, 18*]	**It's in the System:** Inv. 1, ACE, MR
Functions can be described by using a variety of representations: mapping diagrams, function notation (e.g., $f(x) = x^2$), recursive definitions, tables, and graphs.	
23. Compare properties of two functions, each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). **Linear, quadratic, exponential, absolute value, and linear piecewise. [***Algebra I with Probability, 21, edited*]	**Thinking with Mathematical Models:** Inv. 2, ACE, MR **Growing, Growing, Growing:** Inv. 3, ACE, MR, Inv. 4, ACE, MR **Frogs, Fleas & Painted Cubes:** Inv. 1, ACE, MR, Inv. 2, ACE, Inv. 3, ACE **Say It with Symbols:** Inv. 2, ACE, MR, Inv. 4, ACE, MR **Function Junction:** Inv. 3, ACE, MR, Inv. 5, ACE, MR
a. Distinguish between linear and non-linear functions. [*Grade 8, 15a*]	**Thinking with Mathematical Models:** Inv. 2, ACE, MR
24. Define sequences as functions, including recursive definitions, whose domain is a subset of the integers.	**Function Junction:** Inv. 2, ACE, MR
a. Write explicit and recursive formulas for arithmetic and geometric sequences and connect them to linear and exponential functions. [*Algebra I with Probability, 22*]	**Function Junction:** Inv. 2, ACE, MR

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Functions that are members of the same family have distinguishing attributes (structure) common to all functions within that family.	
25. Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k \cdot f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and explain the effects on the graph, using technology as appropriate. **Extend from linear to quadratic, exponential, absolute value, and linear piecewise functions.** [*Algebra I with Probability, 23, edited*]	**Function Junction:** Inv. 3, ACE, MR
26. Distinguish between situations that can be modeled with linear functions and those that can be modeled with exponential functions.	**Thinking with Mathematical Models:** Inv. 2, ACE, MR **Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR **Say It with Symbols:** Inv. 4, ACE, MR
a. Show that linear functions grow by equal differences over equal intervals, while exponential functions grow by equal factors over equal intervals.	**Thinking with Mathematical Models:** Inv. 2, ACE, MR **Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR **Say It with Symbols:** Inv. 4, ACE, MR
b. Define linear functions to represent situations in which one quantity changes at a constant rate per unit interval relative to another.	**Thinking with Mathematical Models:** Inv. 2, ACE, MR
c. Define exponential functions to represent situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. [*Algebra I with Probability, 24*]	**Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR
27. 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). [*Algebra I with Probability*, 25]	**Thinking with Mathematical Models:** Inv. 2, ACE, MR **Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR **Function Junction:** Inv. 2, ACE, MR

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28. Use graphs and tables to show that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically. [*Algebra I with Probability, 26*]	**Say It with Symbols:** Inv. 4, ACE, MR **Frogs, Fleas, and Painted Cubes:** Inv. 3, ACE, MR **Growing, Growing, Growing**, Inv. 1
29. Interpret the parameters of functions in terms of a context. **Extend from linear functions, written in the form *mx + b*, to exponential functions, written in the form ab^x.** [*Algebra I with Probability, 27*] *Example: If the function* $V(t) = 19885(0.75)^t$ *describes the value of a car after it has been owned for* t *years, 19885 represents the purchase price of the car when t = 0, and 0.75 represents the annual rate at which its value decreases.*	**Thinking with Mathematical Models:** Inv. 2, ACE, MR **Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR
Functions can be represented graphically and key features of the graphs, including zeros, intercepts, and, when relevant, rate of change and maximum/minimum values, can be associated with and interpreted in terms of the equivalent symbolic representation.	
30. 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. *Note: Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; maximums and minimums; symmetries; and end behavior.* **Extend from relationships that can be represented by linear functions to quadratic, exponential, absolute value, and general piecewise functions.** [*Algebra I with Probability, 28*]	**Thinking with Mathematical Models:** Inv. 2, ACE, MR **Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR **Frogs, Fleas & Painted Cubes:** Inv. 1, ACE, MR, Inv. 2, ACE, Inv. 3, ACE, Inv. 4, ACE, MR **Say It with Symbols:** Inv. 4, ACE, MR **Function Junction:** Inv. 1, ACE, MR
31. 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**. Limit to linear, quadratic, exponential, and absolute value functions.** **[***Algebra I with Probability, 29*] F-IF.B.6	**Thinking With Mathematical Models:** Inv. 2, ACE, MR **Growing, Growing, Growing:** Inv. 1, ACE, MR **Say It With Symbols:** Inv. 4, ACE, MR

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32. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.	**Thinking with Mathematical Models:** Inv. 2, ACE, MR **Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR **Frogs, Fleas & Painted Cubes:** Inv. 1, ACE, MR, Inv. 2, ACE, Inv. 3, ACE, Inv. 4, ACE, MR **Say It with Symbols:** Inv. 4, ACE, MR **Function Junction:** Inv. 1, ACE, MR
a. Graph linear and quadratic functions and show intercepts, maxima, and minima.	**Thinking with Mathematical Models:** Inv. 2, ACE, MR **Frogs, Fleas & Painted Cubes:** Inv. 1, ACE, MR, Inv. 2, ACE, Inv. 3, ACE, Inv. 4, ACE, MR **Say It with Symbols:** Inv. 4, ACE, MR
b. Graph piecewise-defined functions, including step functions and absolute value functions.	**Function Junction:** Inv. 1, ACE, MR
c. Graph exponential functions, showing intercepts and end behavior. [*Algebra I with Probability*, *30*]	**Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR
Functions model a wide variety of real situations and can help students understand the processes of making and changing assumptions, assigning variables, and finding solutions to contextual problems.	
33. Use the mathematical modeling cycle to solve real world problems involving linear, quadratic, exponential, absolute value, and linear piecewise functions. [*Algebra I with Probability*, *31*]	**Thinking with Mathematical Models:** Inv. 2, ACE, MR **Growing, Growing, Growing:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR **Frogs, Fleas & Painted Cubes:** Inv. 1, ACE, MR, Inv. 2, ACE, Inv. 3, ACE, Inv. 4, ACE, MR **Say It with Symbols:** Inv. 4, ACE, MR **Function Junction:** Inv. 1, ACE, MR

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Data Analysis, Statistics and Probability	
Investigate patterns of association in bivariate data.	
34. Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities, describing patterns in terms of positive, negative, or no association, linear and non-linear association, clustering, and outliers. [*Grade 8,18*]	**Thinking with Mathematical Models:** Inv. 1, ACE, MR, Inv. 2, ACE, MR, Inv. 3, ACE, MR, Inv. 4, ACE, MR
35. Given a scatter plot that suggests a linear association, informally draw a line to fit the data, and assess the model fit by judging the closeness of the data points to the line. [*Grade 8, 19*]	**Thinking with Mathematical Models:** Inv. 2, ACE, MR, Inv. 4, ACE, MR
36. Use a linear model of a real-world situation to solve problems and make predictions.	**Thinking with Mathematical Models:** Inv. 2, ACE, MR, Inv. 4, ACE, MR
a. Describe the rate of change and *y*-intercept in the context of a problem using a linear model of a real-world situation. [*Grade 8, 20*]	**Thinking with Mathematical Models:** Inv. 2, ACE, MR **Say It With Symbols:** Inv. 4, ACE, MR, Inv. 5, ACE, MR
37. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects, using relative frequencies calculated for rows or columns to describe possible associations between the two variables. [*Grade 8, 21*]	**Thinking with Mathematical Models:** Inv. 5, ACE, MR
Data arise from a context and come in two types: quantitative (continuous or discrete) and categorical. Technology can be used to "clean" and organize data, including very large data sets, into a useful and manageable structure – a first step in any analysis of data.	
38. Distinguish between quantitative and categorical data and between the techniques that may be used for analyzing data of these two types. [*Algebra I with Probability*, *34*] *Example: The color of cars is categorical and so is summarized by frequency and proportion for each color category, while the mileage on each car's odometer is quantitative and can be summarized by the mean.*	**Thinking with Mathematical Models:** Inv. 4, ACE, MR, Inv. 5, ACE, MR

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The association between two categorical variables is typically represented by using two-way tables and segmented bar graphs.	
39. Analyze the possible association between two categorical variables.	**Thinking with Mathematical Models:** Inv. 5, ACE, MR
a. Summarize categorical data for two categories in two-way frequency tables and represent using segmented bar graphs.	**Thinking with Mathematical Models:** Inv. 5, ACE, MR
b. Interpret relative frequencies in the context of categorical data (including joint, marginal, and conditional relative frequencies).	**Thinking with Mathematical Models:** Inv. 5, ACE, MR
c. Identify possible associations and trends in categorical data. [*Algebra I with Probability*, *35*]	**Thinking with Mathematical Models:** Inv. 5, ACE, MR
Data analysis techniques can be used to develop models of contextual situations and to generate and evaluate possible solutions to real problems involving those contexts.	
40. Generate a two-way categorical table in order to find and evaluate solutions to real-world problems.	**Thinking with Mathematical Models:** Inv. 5, ACE, MR
a. Aggregate data from several groups to find an overall association between two categorical variables.	**Thinking With Mathematical Models:** Inv. 5, ACE, MR
b. Recognize and explore situations where the association between two categorical variables is reversed when a third variable is considered (Simpson's Paradox). [*Algebra I with Probability*, *36*] *Example: In a certain city, Hospital 1 has a higher fatality rate than Hospital 2. But when considering mildly-injured patients and severely-injured patients as separate groups, Hospital 1 has a lower fatality rate among both groups than Hospital 2, since Hospital 1 is a Level 1 Trauma Center. Thus, Hospital 1 receives most of the severely injured patients who are less likely to survive overall but have a better chance of surviving in Hospital 1 than they would in Hospital 2.*	**Thinking with Mathematical Models:** Inv. 5, ACE, MR

<table>
<tr><th>Alabama Course of Study Mathematics 2019
Grade 8 Accelerated</th><th>Connected Mathematics Project 3
Algebra 1 Investigations</th></tr>
<tr><td colspan="2">Mathematical and statistical reasoning about data can be used to evaluate conclusions and assess risks.</td></tr>
<tr><td>41. Use mathematical and statistical reasoning with bivariate categorical data in order to draw conclusions and assess risk. [Algebra I with Probability, 32]
Example: In a clinical trial comparing the effectiveness of flu shots A and B, 21 subjects in treatment group A avoided getting the flu while 29 contracted it. In group B, 12 avoided the flu while 13 contracted it. Discuss which flu shot appears to be more effective in reducing the chances of contracting the flu.
Possible answer: Even though more people in group A avoided the flu than in group B, the proportion of people avoiding the flu in group B is greater than the proportion in group A, which suggests that treatment B may be more effective in lowering the risk of getting the flu.
<table>
<tr><th></th><th>Contracted Flu</th><th>Did Not Contract Flu</th></tr>
<tr><td>Flu Shot A</td><td>29</td><td>21</td></tr>
<tr><td>Flu Shot B</td><td>13</td><td>12</td></tr>
<tr><td>Total</td><td>42</td><td>33</td></tr>
</table></td><td>Thinking with Mathematical Models:
Inv. 5, ACE, MR</td></tr>
<tr><td colspan="2">Making and defending informed, data-based decisions is a characteristic of a quantitatively literate person.</td></tr>
<tr><td>42. Design and carry out an investigation to determine whether there appears to be an association between two categorical variables, and write a persuasive argument based on the results of the investigation. [Algebra I with Probability, 33]
Example: Investigate whether there appears to be an association between successfully completing a task in a given length of time and listening to music while attempting to complete the task. Randomly assign some students to listen to music while attempting to complete the task and others to complete the task without listening to music. Discuss whether students should listen to music while studying, based on that analysis.</td><td>Students analyze given categorical data to determine whether there appears to be an association between the variables.

Thinking with Mathematical Models:
Inv. 5, ACE, MR</td></tr>
<tr><td colspan="2">Two events are independent if the occurrence of one event does not affect the probability of the other event. Determining whether two events are independent can be used for finding and understanding probabilities.</td></tr>
<tr><td>43. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").
[Algebra I with Probability, 37]</td><td>The 7th Grade unit, What Do You Expect? informally introduces the concept of event complements but focuses mostly on theoretical and experimental probabilities, probability and decision making, compound events, and binomial probability.
What Do You Expect?:
Inv. 1, Inv. 2, Inv. 3, Inv. 4</td></tr>
</table>

Alabama Course of Study Mathematics 2019 **Grade 8 Accelerated**	**Connected Mathematics Project 3** **Algebra 1 Investigations**
44. Explain whether two events, A and B, are independent, using two-way tables or tree diagrams. [*Algebra I with Probability*, *38*]	Students use two-way tables to analyze relationships between categorical variables. **Thinking with Mathematical Models:** Inv. 5, ACE, MR
Conditional probabilities – that is, those probabilities that are "conditioned" by some known information – can be computed from data organized in contingency tables. Conditions or assumptions may affect the computation of a probability.	
45. Compute the conditional probability of event A given event B, using two-way tables or tree diagrams. [*Algebra I with Probability*, *39*]	In 8th grade, students use two-way tables to analyze relationships between categorical variables. In 7th grade, students use tree diagrams to construct sample spaces for compound events. **Thinking with Mathematical Models:** Inv. 5, ACE, MR **Grade 7** **What Do You Expect?** Inv. 2, ACE, MR, Inv. 4, ACE, Inv. 5
46. Recognize and describe the concepts of conditional probability and independence in everyday situations and explain them using everyday language. *Example: Contrast the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* [*Algebra I with Probability*, *40*]	The 7th Grade unit, What Do You Expect? focuses on theoretical and experimental probabilities, probability and decision making, compound events, and binomial probability. **What Do You Expect?:** Inv. 1, Inv. 2, Inv. 3, Inv. 4
47. Explain why the conditional probability of A given B is the fraction of B's outcomes that also belong to A, and interpret the answer in context. [*Algebra I with Probability*, *41*] *Example: the probability of drawing a king from a deck of cards, given that it is a face card, is* 4/5212/52*, which is* 13*.*	The 7th Grade unit, What Do You Expect? focuses on theoretical and experimental probabilities, probability and decision making, compound events, and binomial probability. **What Do You Expect?:** Inv. 1, Inv. 2, Inv. 3, Inv. 4

Alabama Course of Study Mathematics 2019 Grade 8 Accelerated	**Connected Mathematics Project 3 Algebra 1 Investigations**
Geometry and Measurement	
Understand and apply the Pythagorean Theorem.	
48. Informally justify the Pythagorean Theorem and its converse. [*Grade 8, 26*]	**Looking for Pythagoras:** Inv. 3, ACE, MR
49. Apply the Pythagorean Theorem to find the distance between two points in a coordinate plane. [*Grade 8, 27*]	**Looking for Pythagoras:** Inv. 3, ACE, MR, Inv. 4, ACE, MR, Inv. 5, ACE, MR
50. Apply the Pythagorean Theorem to determine unknown side lengths of right triangles, including real-world applications. [*Grade 8, 28]*	**Looking for Pythagoras:** Inv. 1, ACE, MR, Inv. 3, ACE, MR, Inv. 5, ACE, MR