**ABOUT EUREKA MATH™**

Created by the organization Great Minds®, *Eureka Math* helps teachers deliver unparalleled math instruction that provides students with a deep understanding and fluency in math. Crafted by teachers and math scholars, the curriculum carefully sequences the mathematical progressions to maximize coherence from Prekindergarten through Precalculus—a principle tested and proven to be essential in students’ mastery of math.

Teachers and students using *Eureka Math* find the trademark “Aha!” moments in *Eureka Math* to be a source of joy and inspiration, lesson after lesson, year after year.

**Eureka Math** is the only curriculum found by EdReports.org to align fully with the Common Core State Standards for Mathematics for all grades, Kindergarten through Grade 8. Great Minds offers detailed analyses which demonstrate how each grade of *Eureka Math* aligns with specific state standards. Access these free alignment studies at greatminds.org/state-studies.

Schools and districts nationwide are experiencing student growth and impressive test scores after using *Eureka Math*. See their stories and data at greatminds.org/data.

As an organization, Great Minds offers the *Eureka Math* curriculum as PDF downloads for free, noncommercial use. Access the free PDFs at greatminds.org/math/curriculum.

The teacher–writers who created the curriculum have also developed essential resources, available only from Great Minds, including the following:

- Printed material in English and Spanish
- Digital resources
- Professional development
- Classroom tools and manipulatives
- Teacher support materials
- Parent resources
The majority of the Algebra I Georgia Standards of Excellence in Mathematics are fully covered by the Algebra I *Eureka Math* curriculum. The areas where the Algebra I Georgia Standards of Excellence in Mathematics and Algebra I *Eureka Math* do not align will require the use of *Eureka Math* content from another course. A detailed analysis of alignment is provided in the table below.

**INDICATORS**

- **Green** indicates the Georgia standard is addressed in *Eureka Math*.
- **Yellow** indicates the Georgia standard may not be completely addressed in *Eureka Math*.
- **Red** indicates the Georgia standard is not addressed in *Eureka Math*.
- **Blue** indicates there is a discrepancy between the grade level at which this standard is addressed in the Georgia standards and in *Eureka Math*. 

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*Georgia Standards of Excellence in Mathematics Correlation to Eureka Math*

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<table>
<thead>
<tr>
<th>Standards for Mathematical Practice</th>
<th>Aligned Components of <em>Eureka Math</em></th>
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</thead>
<tbody>
<tr>
<td><strong>1: Make sense of problems and persevere in solving them.</strong></td>
<td>Lessons in every module engage students in making sense of problems and persevering in solving them as required by this standard. This practice standard is analogous to the CCSSM Standards for Mathematical Practice 1, which is specifically addressed in the following modules:</td>
</tr>
<tr>
<td>High school students start to examine problems by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. By high school, students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. They check their answers to problems using different methods and continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.</td>
<td>Algebra I M1: Relationships Between Quantities and Reasoning with Equations and Their Graphs</td>
</tr>
<tr>
<td></td>
<td>Algebra I M2: Descriptive Statistics</td>
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<tr>
<td></td>
<td>Algebra I M3: Linear and Exponential Functions</td>
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<tr>
<td></td>
<td>Algebra I M4: Polynomial and Quadratic Expressions, Equations, and Functions</td>
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<tr>
<td></td>
<td>Algebra I M5: A Synthesis of Modeling with Equations and Functions</td>
</tr>
<tr>
<td>Standards for Mathematical Practice</td>
<td>Aligned Components of <em>Eureka Math</em></td>
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</tbody>
</table>
| **2: Reason abstractly and quantitatively.** High school students seek to make sense of quantities and their relationships in problem situations. They abstract a given situation and represent it symbolically, manipulate the representing symbols, and pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Students use quantitative reasoning to create coherent representations of the problem at hand; consider the units involved; attend to the meaning of quantities, not just how to compute them; and know and flexibly use different properties of operations and objects. | Lessons in every module engage students in reasoning abstractly and quantitatively as required by this standard. This practice standard is analogous to the CCSSM Standards for Mathematical Practice 2, which is specifically addressed in the following modules:

Algebra I M1: Relationships Between Quantities and Reasoning with Equations and Their Graphs

Algebra I M2: Descriptive Statistics

Algebra I M3: Linear and Exponential Functions

Algebra I M4: Polynomial and Quadratic Expressions, Equations, and Functions

Algebra I M5: A Synthesis of Modeling with Equations and Functions |
### Standards for Mathematical Practice

#### 3: Construct viable arguments and critique the reasoning of others.

High school students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. High school students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. High school students learn to determine domains to which an argument applies, listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

### Aligned Components of *Eureka Math*

Lessons in every module engage students in constructing viable arguments and critiquing the reasoning of others as required by this standard. This practice standard is analogous to the CCSSM Standards for Mathematical Practice 3, which is specifically addressed in the following modules:

- Algebra I M1: Relationships Between Quantities and Reasoning with Equations and Their Graphs
- Algebra I M2: Descriptive Statistics
### Standards for Mathematical Practice

#### 4: Model with mathematics.
High school students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. High school students making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

### Aligned Components of *Eureka Math*

Lessons in every module engage students in modeling with mathematics as required by this standard. This practice standard is analogous to the CCSSM Standards for Mathematical Practice 4, which is specifically addressed in the following modules:

- **Algebra I M1: Relationships Between Quantities and Reasoning with Equations and Their Graphs**
- **Algebra I M2: Descriptive Statistics**
- **Algebra I M3: Linear and Exponential Functions**
- **Algebra I M4: Polynomial and Quadratic Expressions, Equations, and Functions**
- **Algebra I M5: A Synthesis of Modeling with Equations and Functions**
### Standards for Mathematical Practice

**5: Use appropriate tools strategically.**

High school students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. High school students should be sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. They are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

### Aligned Components of *Eureka Math*

Lessons in every module engage students in using appropriate tools strategically as required by this standard. This practice standard is analogous to the CCSSM Standards for Mathematical Practice 5, which is specifically addressed in the following modules:

- Algebra I M2: Descriptive Statistics
- Algebra I M4: Polynomial and Quadratic Expressions, Equations, and Functions
- Algebra I M5: A Synthesis of Modeling with Equations and Functions
### Standards for Mathematical Practice

**6: Attend to precision.**
High school students try to communicate precisely to others by using clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

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<thead>
<tr>
<th>Aligned Components of <em>Eureka Math</em></th>
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<tbody>
<tr>
<td>Lessons in every module engage students in attending to precision as required by this standard. This practice standard is analogous to the CCSSM Standards for Mathematical Practice 6, which is specifically addressed in the following modules:</td>
</tr>
<tr>
<td>Algebra I M1: Relationships Between Quantities and Reasoning with Equations and Their Graphs</td>
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<tr>
<td>Algebra I M2: Descriptive Statistics</td>
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<tr>
<td>Algebra I M4: Polynomial and Quadratic Expressions, Equations, and Functions</td>
</tr>
<tr>
<td>Algebra I M5: A Synthesis of Modeling with Equations and Functions</td>
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</table>

**7: Look for and make use of structure.**
By high school, students look closely to discern a pattern or structure. In the expression $x^2 + 9x + 14$, older students can see the 14 as $2 \times 7$ and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers $x$ and $y$. High school students use these patterns to create equivalent expressions, factor and solve equations, and compose functions, and transform figures.

<table>
<thead>
<tr>
<th>Aligned Components of <em>Eureka Math</em></th>
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<tbody>
<tr>
<td>Lessons in every module engage students in looking for and making use of structure as required by this standard. This practice standard is analogous to the CCSSM Standards for Mathematical Practice 7, which is specifically addressed in the following modules:</td>
</tr>
<tr>
<td>Algebra I M1: Relationships Between Quantities and Reasoning with Equations and Their Graphs</td>
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<tr>
<td>Algebra I M3: Linear and Exponential Functions</td>
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<tr>
<td>Algebra I M4: Polynomial and Quadratic Expressions, Equations, and Functions</td>
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<td>Standards for Mathematical Practice</td>
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<tr>
<td><strong>8: Look for and express regularity in repeated reasoning.</strong></td>
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<tr>
<td>High school students notice if calculations are repeated, and look both for general methods and for shortcuts. Noticing the regularity in the way terms cancel when expanding ((x - 1)(x + 1), (x - 1)(x^2 + x + 1), \text{ and } (x - 1)(x^3 + x^2 + x + 1)) might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, derive formulas or make generalizations, high school students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.</td>
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<tr>
<td>The Real Number System</td>
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<tr>
<td>Use properties of rational and irrational numbers.</td>
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<td>Domain</td>
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<td>Quantities</td>
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<td><strong>MGSE9-12.N.Q.1</strong></td>
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<td>Domain</td>
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<tr>
<td>Seeing Structure in Expressions</td>
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<td><strong>MGSE9-12.A.SSE.1</strong></td>
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<td><strong>MGSE9-12.A.SSE.2</strong></td>
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|        | **MGSE9-12.A.SSE.3**  
Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. | |
|        | a. Factor any quadratic expression to reveal the zeros of the function defined by the expression. | Algebra I M4 Lesson 9: Graphing Quadratic Functions from Factored Form, \( f(x) = a(x - m)(x - n) \)  
Algebra I M4 Lesson 15: Using the Quadratic Formula |
|        | b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function defined by the expression. | Algebra I M4 Lesson 12: Completing the Square  
Algebra I M4 Lesson 17: Graphing Quadratic Functions from the Standard Form, \( f(x) = ax^2 + bx + c \) |
| Arithmetic with Polynomials and Rational Expressions | Perform arithmetic operations on polynomials. | |
|        | **MGSE9-12.A.APR.1**  
Add, subtract, and multiply polynomials; understand that polynomials form a system analogous to the integers in that they are closed under these operations. | Algebra I M1 Topic B: The Structure of Expressions  
Algebra I M4 Lessons 1–2: Multiplying and Factoring Polynomial Expressions  
Algebra I M4 Lessons 3–4: Advanced Factoring Strategies for Quadratic Expressions |
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<th>Aligned Components of <em>Eureka Math</em></th>
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<tr>
<td>Creating Equations</td>
<td>Create equations that describe numbers or relationships.</td>
<td>Algebra I M1 Lesson 18: Equations Involving a Variable Expression in the Denominator</td>
</tr>
<tr>
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<td>Algebra I M1 Topic D: Creating Equations to Solve Problems</td>
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<td>Algebra I M3 Topic A: Linear and Exponential Sequences</td>
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<td>Algebra I M4 Lesson 6: Solving Basic One-Variable Quadratic Equations</td>
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<td>Algebra I M4 Lesson 7: Creating and Solving Quadratic Equations in One Variable</td>
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<td>Algebra I M5 Lesson 6: Modeling a Context from Data</td>
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<td>MGSE9-12.A.CED.1</td>
<td>Algebra I M5 Lesson 9: Modeling a Context from a Verbal Description</td>
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<tr>
<td></td>
<td>Create equations and inequalities in one variable and use them to solve problems.</td>
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<td></td>
<td>Include equations arising from linear, quadratic, and exponential functions (integer inputs only).</td>
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<td>Domain</td>
<td>Standards for Mathematical Content</td>
<td>Aligned Components of <em>Eureka Math</em></td>
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</tbody>
</table>
| MGSE9-12.A.CED.2 | Create linear, quadratic, and exponential equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (The phrase “in two or more variables” refers to formulas like the compound interest formula, in which $A = P(1 + \frac{r}{n})^{nt}$ has multiple variables.) | Algebra I M1 Lesson 5: Two Graphing Stories  
Algebra I M1 Lesson 20: Solution Sets to Equations with Two Variables  
Algebra I M1 Lesson 23: Solution Sets to Simultaneous Equations  
Algebra I M1 Lesson 24: Applications of Systems of Equations and Inequalities  
Algebra I M1 Lesson 28: Federal Income Tax  
Algebra I M4 Lesson 9: Graphing Quadratic Functions from Factored Form, $f(x) = a(x - m)(x - n)$  
Algebra I M4 Lesson 12: Completing the Square  
Algebra I M4 Lesson 16: Graphing Quadratic Equations from the Vertex Form, $y = a(x - h)^2 + k$  
Algebra I M4 Lessons 23–24: Modeling with Quadratic Functions  
Algebra I M5: A Synthesis of Modeling with Equations and Functions |
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<tr>
<th>Domain</th>
<th>Standards for Mathematical Content</th>
<th>Aligned Components of <em>Eureka Math</em></th>
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</thead>
</table>
| MGSE9-12.A.CED.3 | Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as possible (i.e., a solution) or not possible (i.e., a non-solution) under the established constraints. | Algebra I M1 Lesson 15: Solution Sets of Two or More Equations (or Inequalities) Joined by “And” or “Or”  
Algebra I M1 Lesson 20: Solution Sets to Equations with Two Variables  
Algebra I M1 Lesson 24: Applications of Systems of Equations and Inequalities  
Algebra I M1 Lesson 27: Recursive Challenge Problem—The Double and Add 5 Game  
Algebra I M3 Topic B: Functions and Their Graphs  
Algebra I M3 Lesson 24: Piecewise and Step Functions in Context |
<p>| MGSE9-12.A.CED.4 | Rearrange formulas to highlight a quantity of interest using the same reasoning as in solving equations. | Algebra I M1 Lesson 19: Rearranging Formulas |</p>
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<tr>
<th>Domain</th>
<th>Standards for Mathematical Content</th>
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<tr>
<td>Reasoning with Equations and Inequalities</td>
<td>Understand solving equations as a process of reasoning and explain the reasoning.</td>
<td>Algebra I M1 Lesson 12: Solving Equations</td>
</tr>
<tr>
<td></td>
<td><strong>MGSE9-12.A.REI.1</strong></td>
<td>Algebra I M1 Lesson 13: Some Potential Dangers when Solving Equations</td>
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<td>Using algebraic properties and the properties of real numbers, justify the steps of a simple, one-solution equation. Students should justify their own steps, or if given two or more steps of an equation, explain the progression from one step to the next using properties.</td>
<td>Algebra I M1 Lesson 17: Equations Involving Factored Expressions</td>
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<td>Algebra I M1 Lesson 18: Equations Involving a Variable Expression in the Denominator</td>
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<tr>
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<td>Solve equations and inequalities in one variable.</td>
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<td><strong>MGSE9-12.A.REI.3</strong></td>
<td>Algebra I M1: Relationships Between Quantities and Reasoning with Equations and Their Graphs</td>
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<tr>
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<td>Solve linear equations and inequalities in one variable including equations with coefficients represented by letters.</td>
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<td><strong>MGSE9-12.A.REI.4</strong></td>
<td>Algebra I M4 Lesson 13: Solving Quadratic Equations by Completing the Square</td>
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<tr>
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<td>Solve quadratic equations in one variable.</td>
<td>Algebra I M4 Lesson 14: Deriving the Quadratic Formula</td>
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<tr>
<td></td>
<td>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. Derive the quadratic formula from (ax^2 + bx + c = 0).</td>
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<td>Domain</td>
<td>Standards for Mathematical Content</td>
<td>Aligned Components of <em>Eureka Math</em></td>
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</table>
|        | b. Solve quadratic equations by inspection (e.g., for \( x^2 = 49 \)), taking square roots, factoring, completing the square, and the quadratic formula, as appropriate to the initial form of the equation (limit to real number solutions). | Algebra I M4 Lesson 5: The Zero Product Property  
Algebra I M4 Lesson 6: Solving Basic One-Variable Quadratic Equations  
Algebra I M4 Lesson 7: Creating and Solving Quadratic Equations in One Variable  
Algebra I M4 Lesson 13: Solving Quadratic Equations by Completing the Square  
Algebra I M4 Lesson 14: Deriving the Quadratic Formula  
Algebra I M4 Lesson 15: Using the Quadratic Formula |

Solve systems of equations.

**MGSE9-12.A.REI.5**  
Show and explain why the elimination method works to solve a system of two-variable equations.

**MGSE9-12.A.REI.6**  
Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

<table>
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<tr>
<th></th>
<th>Algebra I M1 Lesson 23: Solution Sets to Simultaneous Equations</th>
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</table>
|        | Algebra I M1 Lessons 22–23: Solution Sets to Simultaneous Equations  
Algebra I M1 Lesson 24: Applications of Systems of Equations and Inequalities  
Algebra I M4 Lesson 24: Modeling with Quadratic Functions |
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<tbody>
<tr>
<td></td>
<td>Represent and solve equations and inequalities graphically.</td>
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</table>
|        | **MGSE9-12.A.REI.10**  
Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane. | Algebra I M1 Lesson 20: Solution Sets to Equations with Two Variables |
|        | **MGSE9-12.A.REI.11**  
Using graphs, tables, or successive approximations, show that the solution to the equation \( f(x) = g(x) \) is the \( x \)-value where the \( y \)-values of \( f(x) \) and \( g(x) \) are the same. | Algebra I M3 Lesson 16: Graphs Can Solve Equations Too |
|        | **MGSE9-12.A.REI.12**  
Graph the solution set to a linear inequality in two variables. | Algebra I M1 Lesson 21: Solution Sets to Inequalities with Two Variables  
Algebra I M1 Lesson 22: Solution Sets to Simultaneous Equations  
Algebra I M1 Lesson 24: Applications of Systems of Equations and Inequalities |
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<tr>
<th>Domain</th>
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<th>Aligned Components of Eureka Math</th>
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<tbody>
<tr>
<td>Interpreting Functions</td>
<td>Understand the concept of a function and use function notation.</td>
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<tr>
<td>MGSE9-12.F.IF.1</td>
<td>Understand that a function from one set (the input, called the domain) to another set (the output,</td>
<td>Algebra I M3 Lesson 1: Integer Sequences—Should You Believe in Patterns</td>
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<td>assigned to each element of the domain exactly one element of the range, i.e., each input value</td>
<td>Algebra I M3 Lesson 12: The Graph of the Equation $y = f(x)$</td>
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<td>maps to exactly one output value. If $f$ is a function, $x$ is the input (an element of the domain),</td>
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<td>and $f(x)$ is the output (an element of the range). Graphically, the graph is $y = f(x)$.</td>
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<tr>
<td>MGSE9-12.F.IF.2</td>
<td>Use function notation, evaluate functions for inputs in their domains, and interpret statements</td>
<td>Algebra I M3: Linear and Exponential Functions</td>
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<td>that use function notation in terms of a context.</td>
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<tr>
<td>Domain</td>
<td>Standards for Mathematical Content</td>
<td>Aligned Components of <em>Eureka Math</em></td>
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| MGSE9-12.F.IF.3 | Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. (Generally, the scope of high school math defines this subset as the set of natural numbers 1, 2, 3, 4 ...) By graphing or calculating terms, students should be able to show how the recursive sequence \( a_1 = 7, a_n = a_{n-1} + 2 \); the sequence \( s_n = 2(n - 1) + 7 \); and the function \( f(x) = 2x + 5 \) (when \( x \) is a natural number) all define the same sequence. | Algebra I M3 Lesson 2: Recursive Formulas for Sequences  
Algebra I M3 Lesson 3: Arithmetic and Geometric Sequences  
Algebra I M3 Lesson 4: Why Do Banks Pay YOU to Provide Their Services? |
| Domain | Standards for Mathematical Content | Aligned Components of *Eureka Math*

Interpret functions that arise in applications in terms of the context.

**MGSE9-12.F.IF.4**

Using tables, graphs, and verbal descriptions, interpret the key characteristics of a function which models the relationship between two quantities. Sketch a graph showing key features including: intercepts; interval where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.

- Algebra I M3 Lesson 13: Interpreting the Graph of a Function
- Algebra I M3 Lesson 14: Linear and Exponential Models—Comparing Growth Rate
- Algebra I M3 Topic D: Using Functions and Graphs to Solve Problems
- Algebra I M4 Lesson 8: Exploring the Symmetry in Graphs of Quadratic Functions
- Algebra I M4 Lesson 9: Graphing Quadratic Functions from Factored Form, \( f(x) = a(x - m)(x - n) \)
- Algebra I M4 Lesson 10: Interpreting Quadratic Functions from Graphs and Tables
- Algebra I M4 Lesson 17: Graphing Quadratic Functions from the Standard Form, \( f(x) = ax^2 + bx + c \)
- Algebra I M4 Lesson 22: Comparing Quadratic, Square Root, and Cube Root Functions Represented in Different Ways
- Algebra I M5: A Synthesis of Modeling with Equations and Functions
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<th>Domain</th>
<th>Standards for Mathematical Content</th>
<th>Aligned Components of <em>Eureka Math</em></th>
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</table>
| MGSE9-12.F.IF.5 | Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. | Algebra I M3 Topic B: Functions and Their Graphs  
Algebra I M4 Lesson 9: Graphing Quadratic Functions from Factored Form, \( f(x) = a(x - m)(x - n) \)  
Algebra I M5 Lesson 1: Analyzing a Graph  
Algebra I M5 Lesson 4: Modeling a Context from a Graph |
| MGSE9-12.F.IF.6 | Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. | Algebra I M3 Lesson 6: Exponential Growth—U.S. Population and World Population  
Algebra I M3 Topic D: Using Functions and Graphs to Solve Problems  
Algebra I M4 Lesson 8: Exploring the Symmetry in Graphs of Quadratic Functions  
Algebra I M4 Lesson 10: Interpreting Quadratic Functions from Graphs and Tables  
Algebra I M4 Lesson 17: Graphing Quadratic Functions from the Standard Form, \( f(x) = ax^2 + bx + c \)  
Algebra I M4 Lesson 22: Comparing Quadratic, Square Root, and Cube Root Functions Represented in Different Ways  
Algebra I M5 Lesson 4: Modeling a Context from a Graph |
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<tbody>
<tr>
<td></td>
<td>Analyze functions using different representations.</td>
<td></td>
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</tbody>
</table>
|        | **MGSE9-12.F.IF.7**  
Graph functions expressed algebraically and show key features of the graph both by hand and by using technology. |                                   |
|        | a. Graph linear and quadratic functions and show intercepts, maxima, and minima (as determined by the function or by context). | Algebra I M3 Lesson 11: The Graph of a Function  
Algebra I M3 Lesson 12: The Graph of the Equation $y = f(x)$  
Algebra I M3 Lesson 16: Graphs Can Solve Equations Too  
Algebra I M3 Lesson 19: Four Interesting Transformations of Functions  
Algebra I M4 Lesson 8: Exploring the Symmetry in Graphs of Quadratic Functions  
Algebra I M4 Lesson 9: Graphing Quadratic Functions from Factored Form, $f(x) = a(x - m)(x - n)$  
Algebra I M4 Lesson 16: Graphing Quadratic Equations from the Vertex Form, $y = a(x - h)^2 + k$  
Algebra I M4 Lesson 17: Graphing Quadratic Functions from the Standard Form, $f(x) = ax^2 + bx + c$  
Algebra I M4 Topic C: Function Transformations and Modeling |
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</table>
|        | e. Graph exponential functions, showing intercepts and end behavior. | Algebra I M3 Lesson 14: Linear and Exponential Models—Comparing Growth Rates  
Algebra 1 M3 Topic D: Using Fractions and Graphs to Solve Problems |
|        | **MGSE9-12.F.IF.8**  
Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. | Algebra I M4 Lesson 9: Graphing Quadratic Functions from Factored Form, \( f(x) = a(x - m)(x - n) \)  
Algebra I M4 Topic B: Using Different Forms for Quadratic Functions  
Algebra I M4 Lesson 21: Transformations of the Quadratic Parent Function, \( f(x) = x^2 \)  
Algebra I M4 Lesson 23: Modeling with Quadratic Functions |
|        | a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. | Algebra I M4 Lesson 22: Comparing Quadratic, Square Root, and Cube Root Functions Represented in Different Ways |
|        | **MGSE9-12.F.IF.9**  
Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). | |
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<tbody>
<tr>
<td><strong>Building Functions</strong></td>
<td><strong>Build a function that models a relationship between two quantities.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>MGSE9-12.F.BF.1</strong></td>
<td>Write a function that describes a relationship between two quantities.</td>
<td></td>
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<tr>
<td></td>
<td>a. Determine an explicit expression and the recursive process (steps for calculation) from context.</td>
<td>Algebra I M3: Linear and Exponential Functions</td>
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<td></td>
<td>Algebra I M5: A Synthesis of Modeling with Equations and Functions</td>
</tr>
<tr>
<td><strong>MGSE9-12.F.BF.2</strong></td>
<td>Write arithmetic and geometric sequences recursively and explicitly, use them to model situations, and translate between the two forms. Connect arithmetic sequences to linear functions and geometric sequences to exponential functions.</td>
<td>Algebra I M3 Topic A: Linear and Exponential Sequences</td>
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<td>Algebra II M3 Lesson 25: Geometric Sequences and Exponential Growth and Decay</td>
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<td>Algebra II M3 Lesson 26: Percent Rate of Change</td>
</tr>
<tr>
<td><strong>Build new functions from existing functions.</strong></td>
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<tr>
<td><strong>MGSE9-12.F.BF.3</strong></td>
<td>Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, 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 illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.</td>
<td>Algebra I M3 Topic C: Transformations of Functions</td>
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<tr>
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<td>Algebra I M4 Lesson 19: Translating Graphs of Functions</td>
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<td>Algebra I M4 Lesson 20: Stretching and Shrinking Graphs of Functions</td>
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<td></td>
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<td>Algebra I M4 Lesson 21: Transformations of the Quadratic Parent Function, $f(x) = x^2$</td>
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# Linear, Quadratic, and Exponential Models

## Construct and compare linear, quadratic, and exponential models and solve problems.

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<tr>
<td><strong>MGSE9-12.F.LE.1</strong></td>
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Distinguish between situations that can be modeled with linear functions and with exponential functions.

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<tbody>
<tr>
<td>a. Show that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals. (This can be shown by algebraic proof, with a table showing differences, or by calculating average rates of change over equal intervals.)</td>
</tr>
<tr>
<td>Algebra I M3 Lesson 14: Linear and Exponential Models—Comparing Growth Rates</td>
</tr>
<tr>
<td>b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.</td>
</tr>
<tr>
<td>Algebra I M3 Lesson 5: The Power of Exponential Growth</td>
</tr>
<tr>
<td>Algebra I M3 Lesson 6: Exponential Growth—U.S. Population and World Population</td>
</tr>
<tr>
<td>Algebra I M5: A Synthesis of Modeling with Equations and Functions</td>
</tr>
<tr>
<td>c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.</td>
</tr>
<tr>
<td>Algebra I M3 Lesson 5: The Power of Exponential Growth</td>
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<tr>
<td>Algebra I M3 Lesson 6: Exponential Growth—U.S. Population and World Population</td>
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<tr>
<td>Algebra I M3 Lesson 7: Exponential Decay</td>
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<tr>
<td>Algebra I M5: A Synthesis of Modeling with Equations and Functions</td>
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<td>Domain</td>
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</table>
| MGSE9-12.F.LE.2 | Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).                                                                      | Algebra I M3: Linear and Exponential Functions  
Algebra I M5: A Synthesis of Modeling with Equations and Functions  
Algebra II M3 Lesson 1: Integer Exponents                                                                 |
| MGSE9-12.F.LE.3 | Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.                                                              | Algebra I M3 Lesson 5: The Power of Exponential Growth  
Algebra I M3 Lesson 6: Exponential Growth—U.S. Population and World Population  
Algebra I M3 Lesson 14: Linear and Exponential Models—Comparing Growth Rates  
Algebra I M3 Lesson 21: Comparing Linear and Exponential Models Again                                                                 |
<p>| Interpret expressions for functions in terms of the situation they model.                                                                                                                                   | Algebra I M3 Topic D: Using Functions and Graphs to Solve Problems                                                                                           |
| MGSE9-12.F.LE.5 | Interpret the parameters in a linear ((f(x) = mx + b)) and exponential ((f(x) = a \cdot d^x)) function in terms of context. (In the functions above, “(m)” and “(b)” are the parameters of the linear function, and “(a)” and “(d)” are the parameters of the exponential function.) In context, students should describe what these parameters mean in terms of change and starting value. |                                                                                                        |</p>
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<tbody>
<tr>
<td>Interpreting Categorical and Quantitative Data</td>
<td>Summarize, represent, and interpret data on a single count or measurement variable.</td>
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</tbody>
</table>
|   | **MGSE9-12.S.ID.1**  
Represent data with plots on the real number line (dot plots, histograms, and box plots). | Algebra I M2: Descriptive Statistics |
|   | **MGSE9-12.S.ID.2**  
Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, mean absolute deviation) of two or more different data sets. | Algebra I M2 Lesson 3: Estimating Centers and Interpreting the Mean as a Balance Point  
Algebra I M2 Topic B: Describing Variability and Comparing Distributions |
|   | **MGSE9-12.S.ID.3**  
Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). | Algebra I M2: Descriptive Statistics |
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<tr>
<td></td>
<td>Summarize, represent, and interpret data on two categorical and quantitative variables.</td>
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<tr>
<td><strong>MGSE9-12.S.ID.5</strong></td>
<td>Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.</td>
<td>Algebra I M2 Topic C: Categorical Data on Two Variables</td>
</tr>
<tr>
<td><strong>MGSE9-12.S.ID.6</strong></td>
<td>Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.</td>
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</tbody>
</table>
|                 | a. Decide which type of function is most appropriate by observing graphed data, charted data, or by analysis of context to generate a viable (rough) function of best fit. Use this function to solve problems in context. Emphasize linear, quadratic, and exponential models. | Algebra I M2 Lessons 12–13: Relationships Between Two Numerical Variables  
Algebra I M2 Lesson 19: Interpreting Correlation  
Algebra I M2 Lesson 20: Analyzing Data Collected on Two Variables  
Algebra I M5 Lesson 7: Modeling a Context from Data |
|                 | c. Using given or collected bivariate data, fit a linear function for a scatter plot that suggests a linear association. |                                                                                                      |
|                 |                                                                                                      | Algebra I M2 Lesson 18: Analyzing Residuals  
Algebra I M2 Lesson 19: Interpreting Correlation  
Algebra I M2 Lesson 20: Analyzing Data Collected on Two Variables  
Algebra I M5 Lesson 7: Modeling a Context from Data |
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<tr>
<td></td>
<td>Interpret linear models.</td>
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<td><strong>MGSE9-12.S.ID.7</strong></td>
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<td>Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.</td>
<td>Algebra I M2 Lesson 14: Modeling Relationships with a Line</td>
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<td><strong>MGSE9-12.S.ID.8</strong></td>
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<td>Compute (using technology) and interpret the correlation coefficient “r” of a linear fit. (For instance, by looking at a scatterplot, students should be able to tell if the correlation coefficient is positive or negative and give a reasonable estimate of the “r” value.) After calculating the line of best fit using technology, students should be able to describe how strong the goodness of fit of the regression is, using “r”.</td>
<td>Algebra I M2 Lesson 19: Interpreting Correlation</td>
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<td><strong>MGSE9-12.S.ID.9</strong></td>
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<td>Distinguish between correlation and causation.</td>
<td>Algebra I M2 Lesson 11: Conditional Relative Frequencies and Association</td>
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<td>Algebra I M2 Lesson 19: Interpreting Correlation</td>
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