Why

One- and Two-Variable Equations

How does this module integrate the learning of grades 7 and 8 of *Eureka Math²*?

This module connects the learning from grade 7 about solving linear equations in one variable of the forms $px + q = r$ and $p(x + q) = r$ with the learning from grade 8 about the number of solutions to linear equations in one variable. Then the module returns to grade 7 learning and introduces students to proportional relationships. The module ends with students writing equations in two variables as well as writing and solving equations in one variable to model proportional relationships and percent situations.

This sequence is intentionally designed to build and reinforce students' understanding of equality. Throughout the module, students recognize that when they apply if–then moves or the properties of equality when solving an equation, the equation in each line of work has the same solution as any equation in the lines before it. In topics C and D, as students write equations to represent proportional relationships or percent situations and use those equations to solve problems, students repeatedly recognize how the properties of equality are demonstrated in their work.

If–Then Moves for Equations

Assume a, b, and c are numbers.

If $a = b$, then $a + c = b + c$.

If $a = b$, then $a - c = b - c$.

If $a = b$, then $a \cdot c = b \cdot c$.

If $a = b$ and $c \neq 0$, then $a \div c = b \div c$.

If–Then Moves for Inequalities

Assume a, b, and c are numbers.

If $a < b$, then $a + c < b + c$.

If $a < b$, then $a - c < b - c$.

If $a < b$ and c is a positive number, then $a \cdot c < b \cdot c$.

If $a < b$ and c is a negative number, then $a \cdot c > b \cdot c$.

If $a < b$ and c is a positive number, then $a \div c < b \div c$.

If $a < b$ and c is a negative number, then $a \div c > b \div c$.

Why does this module include if–then moves in topic A and the properties of equality in topic B?

The module is intentionally scaffolded to build students' understanding of equality in a coherent and logical progression. Topic A begins with students concretely experiencing if–then moves by observing the conditions under which two equal angle measures remain equal and then progresses to students applying if–then moves to solve different forms of linear equations in one variable. As students progress to work with inequalities, they systematically test each if–then move. Students use their observations to build an understanding of inequality and develop if–then moves for inequalities.

Properties of Equality

Property	Addition property of equality	Multiplication property of equality
Symbols	Assume a, b, and c are real numbers. If $a = b$, then $a + c = b + c$.	Assume a, b, and c are real numbers. If $a = b$, then $a \cdot c = b \cdot c$.

After their experience with if–then moves, students are ready to formalize this understanding as the properties of equality at the beginning of topic B when they begin working with equations involving a variable on both sides of the equal sign. Students build on their prior knowledge of expressing subtraction as an equivalent addition expression and expressing division as an equivalent multiplication expression to recognize that there are only two properties of equality: the addition property of equality and the multiplication property of equality. Students will continue to apply the properties of equality throughout their future mathematics courses.

Why does this module include an optional lesson?

Lesson 12, An Experiment with Ratios and Rates, is an optional lesson at the beginning of topic C. This lesson gives students an opportunity to recall and apply prior knowledge, terminology, and models from grade 6 involving ratios and rates. The lesson activity also fosters student thinking about real-world situations with a constant rate, which prepares them to identify proportional relationships throughout the rest of topic C.

How can you find the number of coins sorted when the time is only 1 second?

Machine C

Number of Seconds	Number of Coins Sorted
8	36
2	9
16	72
6	27
14	63
1	

Machine D

Number of Seconds	Number of Coins Sorted
1.5	9
12	72
3	18
16.5	99
10	60
1	

Because of the learning sequence of this course, students encounter several application problems involving rates and ratio relationships in their work in module 1 and in module 2 topics A and B. So the content in this optional lesson may not be necessary for students to be successful with the remaining lessons in topic C. Teachers should use evidence of their students' conceptual understanding of ratios and rates to determine whether to include this optional lesson.

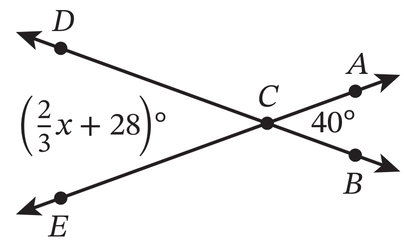
I notice that this module includes standards for geometry. Why are these standards addressed in this module?

To determine unknown angle measures, students must be able to identify and apply angle relationships. These relationships necessitate equivalence. To determine whether angles are complementary, students understand that the two angle measures must sum to $90°$. To determine whether angles are supplementary, students understand that the two angle measures must sum to $180°$. A natural approach to determine unknown angle measures in these and other cases is to solve for the unknown by using an equation. Determining unknown angle measures drives the need to solve equations. Students use equations to show why angles are equal in measure.

Why is the word *simplified* not used in this module?

The word *simplified* has multiple meanings depending on the different situations in which it is used. For example, when asked to simplify a fraction, students perform a different task than they would when they simplify an expression. When a student is directed to simplify in any situation, a specific description of the term should be provided that is appropriate for that situation.

$\overleftrightarrow{DB}$ and $\overleftrightarrow{AE}$ intersect at point C



$$\frac{2}{3}x + 28 = 40$$

$$\frac{2}{3}x + 28 - 28 = 40 - 28$$

$$\frac{2}{3}x = 12$$

$$\frac{2}{3}x \div \frac{2}{3} = 12 \div \frac{2}{3}$$

$$x = 12 \cdot \frac{3}{2}$$

$$x = 18$$