

KEY CONCEPT OVERVIEW

In Module 4 Topic A, students begin to make connections between proportional relationships and **linear expressions** and equations. They transcribe the information from word problems into expressions and equations and then evaluate or solve. Students learn that an equation may have one **solution**, no solution, or many solutions.

You can expect to see homework that asks your child to do the following:

- Write statements using symbolic language. For example, twice a number less 4 is transcribed as $2x - 4$, where x represents a number.
- Determine whether an expression or equation is linear or nonlinear.
- Solve linear equations, explain the **properties of equality** used to find the solutions, and check those solutions.
- Write and solve equations to find the measures of angles in triangles.
- Determine whether an equation has a unique (one) solution, no solution, or infinitely many solutions.

SAMPLE PROBLEMS (From Lessons 7 and 9)

1. Solve the linear equation $x - 9 = \frac{3}{5}x$. State the property that justifies each of your steps.

The left side of the equation, $x - 9$, and the right side of the equation, $\frac{3}{5}x$, are transformed as much as possible.

$$x - 9 = \frac{3}{5}x$$

$$x - x - 9 = \frac{3}{5}x - x \quad \text{Subtraction property of equality}$$

$$(1 - 1)x - 9 = \left(\frac{3}{5} - 1\right)x \quad \text{Distributive property}$$

$$-9 = -\frac{2}{5}x$$

$$-\frac{5}{2}(-9) = -\frac{5}{2}\left(-\frac{2}{5}x\right) \quad \text{Multiplicative property of equality}$$

$$\frac{45}{2} = x$$

2. Give a brief explanation as to what kind of solution(s) you expect the following linear equation to have. Transform the equation into a simpler form if necessary.

$$11x - 2x + 15 = 8 + 7 + 9x$$

$$11x - 2x + 15 = 8 + 7 + 9x$$

$$(11 - 2)x + 15 = (8 + 7) + 9x$$

$$9x + 15 = 15 + 9x$$

I notice that the coefficients of the x are the same, specifically 9, and that the constants, 15, are also the same. Therefore, this equation has infinitely many solutions.

Additional sample problems with detailed answer steps are found in the *Eureka Math Homework Helpers* books. Learn more at GreatMinds.org.

HOW YOU CAN HELP AT HOME

You can help at home in many ways. Here are some tips to help you get started.

- Ask your child to transform each side of an equation from class using the **commutative**, **associative**, and/or **distributive** properties. Then have your child solve the *new* equation using the properties of equality.
- Place equations from both Lessons 2 and 3 on index cards. Have your child organize the cards into linear and nonlinear equations.

TERMS

Associative property: The grouping in an addition or multiplication problem may change, but the sum or product will remain the same.

Coefficient: In the term $3y^6$, for example, the 3 represents the coefficient, or the number in front of the base (y). It means that y^6 is being multiplied by 3.

Commutative property: The order of an addition or multiplication problem may change, but the sum or product will remain the same.

Consecutive integers: Consecutive integers are integers that come one after another when counting. For example, $-6, -5, -4$, and -3 are consecutive integers. Likewise, 4, 6, and 8 are consecutive even integers.

Constant of a linear equation/expression: The number that is being added to the variable term. For example, in the linear equation $3x - 4 = 8 + 6x$, -4 and 8 are the constants in the equation.

Distributive property: Allows the numbers in a multiplication problem to be distributed into partial products (i.e., partial answers). The partial products can then be added together to find the product, or the answer to the original multiplication problem (e.g., $3(x + 7) = (3 \cdot x) + (3 \cdot 7) = 3x + 21$).

Exponent: In the term $3y^6$, the 6 is the exponent. The exponent tells you how many times to multiply the base (y) by itself.

Linear expression: The sum/difference of one or more expressions (e.g., $4x - 5$) that consist of either a number, a variable, or the product of a number and a variable, where the variable is raised to the power of 0 or 1. The expression $4x^3 - 5$ is nonlinear because the variable is raised to the third power.

Properties of equality: Each property of equality states that if you add (subtract, multiply, or divide) by a number on one side of an equation, you can add (subtract, multiply, or divide) by that same number on the other side of the equation without changing the value of the variable or the equality of the statement.

Reciprocal: The number obtained by inverting a fraction. For example, 4 (which is $\frac{4}{1}$) and $\frac{1}{4}$ are reciprocals, as are $\frac{3}{4}$ and $\frac{4}{3}$. When you multiply a number by its reciprocal, the product is always 1.

Solutions of a linear equation: There are three possibilities for the solution to a linear equation. If both sides of the equation are transformed using the commutative, associative, and/or distributive properties and you notice that ...

- the coefficients of the variable terms are the same, and the constants are also the same (e.g., $3x + 4 = 4 + 3x$ in both instances), then the equation has infinitely many solutions.
- the coefficients of the variable terms are the same, but the constants are different (e.g., $-8x + 7 = -8x - 6$ in both instances), then the equation has no solution.
- the coefficients of the variable terms are different regardless of the constant (e.g., $6 - \frac{1}{4}x = 7x + 4$ in both instances), then the equation has one unique solution.

Variable term: In a linear equation, the part of the expression containing the coefficient and variable. For example, in the linear equation $3x - 4 = 8 + 6x$, $3x$ and $6x$ are the variable terms.