Key Words

Slope
A number that describes the "steepness" or "slant" of a line. It is the constant rate of change.

System of Linear Equations
A system of linear equations, also referred to as simultaneous linear equations, is the set of at least two linear equations.

Solution to a system of linear equations
If an equation has two variables, then a solution is a pair of numbers from the domain of the variables that, when each number from the pair is substituted into all instances of its corresponding variable, makes the equation a true number sentence.

Linear Equations

In this 31-lesson module, students extend what they already know about unit rates and proportional relationships to linear equations and their graphs. They understand the connections between proportional relationships, lines, and linear equations. They will also transcribe and solve equations in one variable and then in two variables.

Slope

Constant Rate of Change

The slope, m, of the graph of line l below is $m = \frac{3}{7}$.

Ask your child to explain why the slope of this line is $\frac{3}{7}$. Their explanation should include a reference to two points on the line with integer coordinates, (-2, -1) and (5, 2) as well as slope being the number that compares the vertical distance between the two points to the horizontal distance between the two points.

What Came Before this Module:

Students learned about dilation and similarity and applied that knowledge to a proof of the Pythagorean Theorem based on the Angle-Angle criterion for similar triangles. Students learned the definition of a dilation, its properties and how to compose them. They replaced the common idea of "same shape, different sizes" with a definition of similarity that can be applied to shapes that are not polygons, such as ellipses and circles.
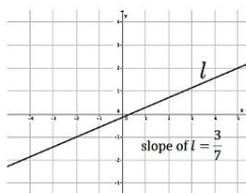
What Comes After this Module:

Students will inspect the rate of change of linear functions and conclude that the rate of change is the slope of the graph of a line. They will learn to interpret the equation $y = mx + b$ as defining a linear function whose graph is a line. Students will also gain some experience with non-linear functions, specifically by compiling and graphing a set of ordered pairs, and then by identifying the graph as something other than a straight line.

How can you help at home?

- ✓ Every day, ask your child what they learned in school and ask them to show you an example.
- ✓ Ask your child to explain the difference between linear and non-linear expressions.

$$\frac{1}{3}x - 5 + 171 = x$$

Solution: x = 249

Key Common Core Standards:

Understand the connections between proportional relationships, lines, and linear equations.

- Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways.

- Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.

Analyze and solve linear equations and pairs of simultaneous linear equations.

- Solve linear equations in one variable.

- Analyze and solve pairs of simultaneous linear equations.

Linear: Yes or No?

Write each of the following statements as a mathematical expression. State whether the expression is linear and explain your answer.

1. The sum of a number and four times the number.

Solution: Let x be a number, then, $x + 4x$ is a linear expression.

2. Half of the product of a number multiplied by itself, three times.

Solution: Let x be a number, then, $\frac{1}{2} \cdot x \cdot x \cdot x$ is not a linear expression. The term $\frac{1}{2} \cdot x \cdot x \cdot x$ is the same as $\frac{1}{2} \cdot x^3$, which is why this expression is not linear.

Spotlight on Terms Frequently Used in this Module:

Linear Expression

&

Linear Equation

Graphing a Linear Relationship

Problem: Graph the equation $y = -3x + 6$.
a. Name the slope and the y-intercept.
Solution: The slope is m= -3 and the y-intercept is (0,6).

b. Graph the known point, and then use the slope to find a second point before drawing a line. *Solution: Graph is shown to the right.*

Write the following statement using symbolic language.

The sum of four consecutive even integers is -28.

Solution:

*Let **x** be the first integer.*

Then, $x + x + 2 + x + 4 + x + 6 = -28$.
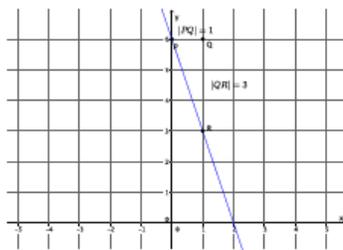
Solving Linear Equations

For the problem below, show your work and check that your solution is correct.

Solve the linear equation: $x + 4 + 3x = 72$. State the property that justifies your first step and why you chose it.

Solution:

I used the commutative and distributive properties on the left side of the equal sign to simplify the expression to fewer terms.

$$x + 4 + 3x = 72$$
$$4x + 4 = 72$$
$$4x + 4 - 4 = 72 - 4$$
$$4x = 68$$
$$\frac{4}{4}x = \frac{68}{4}$$
$$x = 17$$

The left side is equal to $17 + 4 + 3(17) = 21 + 51 = 72$, which is what the right side is. Therefore, $x = 17$ is a solution to the equation $x + 4 + 3x = 72$.