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.

**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.

**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.

**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: $x = 249$
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.

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:

\[
\begin{align*}
  x + 4 + 3x &= 72 \\
  4x + 4 &= 72 \\
  4x + 4 - 4 &= 72 - 4 \\
  4x &= 68 \\
  \frac{4x}{4} &= \frac{68}{4} \\
  x &= 17
\end{align*}
\]

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 \( x + 4 + 3x = 72 \).