

Lesson 3: Linear Equations in x

Classwork

Exercises

1. Is the equation a true statement when $x = -3$; in other words, is -3 a solution to the equation $6x + 5 = 5x + 8 + 2x$? Explain.

$$\begin{aligned} 6(-3) + 5 &\stackrel{?}{=} 5(-3) + 8 + 2(-3) \\ -18 + 5 &\stackrel{?}{=} -15 + 8 + (-6) \\ -13 &\stackrel{?}{=} -13 \end{aligned}$$

2. Does $x = 12$ satisfy the equation $16 - \frac{1}{2}x = \frac{3}{4}x + 1$? Explain.

$$\begin{aligned} 16 - \frac{1}{2}(12) &\stackrel{?}{=} \frac{3}{4}(12) + 1 \\ 16 - 6 &\stackrel{?}{=} 9 + 1 \\ 10 &= 10 \end{aligned}$$

3. Chad solved the equation $24x + 4 + 2x = 3(10x - 1)$ and is claiming that $x = 2$ makes the equation true. Is Chad correct? Explain.

$$\begin{aligned} 24(2) + 4 + 2(2) &\stackrel{?}{=} 3(10(2) - 1) \\ 48 + 4 + 4 &\stackrel{?}{=} 3(20 - 1) \\ 52 + 4 &\stackrel{?}{=} 3(19) \\ 56 &\neq 57 \end{aligned}$$

The solution to an equation is the value that makes the equation true (the left side equals the right side).

4. Lisa solved the equation $x + 6 = 8 + 7x$ and claimed that the solution is $x = -\frac{1}{3}$. Is she correct? Explain.
5. Angel transformed the following equation from $6x + 4 - x = 2(x + 1)$ to $10 = 2(x + 1)$. He then stated that the solution to the equation is $x = 4$. Is he correct? Explain.
6. Claire was able to verify that $x = 3$ was a solution to her teacher's linear equation, but the equation got erased from the board. What might the equation have been? Identify as many equations as you can with a solution of $x = 3$.
7. Does an equation always have a solution? Could you come up with an equation that does not have a solution?

Lesson Summary

Equations are statements about equality. If the expression on the left side of the equal sign has the same value as the expression on the right side of the equal sign, then you have a true equation.

A solution of a linear equation in x is a number, such that when all instances of x are replaced with the number, the left side will equal the right side. For example, 2 is a solution to $3x + 4 = x + 8$ because when $x = 2$, the left side of the equation is

$$\begin{aligned} 3x + 4 &= 3(2) + 4 \\ &= 6 + 4 \\ &= 10, \end{aligned}$$

and the right side of the equation is

$$\begin{aligned} x + 8 &= 2 + 8 \\ &= 10. \end{aligned}$$

Since $10 = 10$, then $x = 2$ is a solution to the linear equation $3x + 4 = x + 8$.

Problem Set

- Given that $2x + 7 = 27$ and $3x + 1 = 28$, does $2x + 7 = 3x + 1$? Explain.
- Is -5 a solution to the equation $6x + 5 = 5x + 8 + 2x$? Explain.
- Does $x = 1.6$ satisfy the equation $6 - 4x = -\frac{x}{4}$? Explain.
- Use the linear equation $3(x + 1) = 3x + 3$ to answer parts (a)–(d).
 - Does $x = 5$ satisfy the equation above? Explain.
 - Is $x = -8$ a solution of the equation above? Explain.
 - Is $x = \frac{1}{2}$ a solution of the equation above? Explain.
 - What interesting fact about the equation $3(x + 1) = 3x + 3$ is illuminated by the answers to parts (a), (b), and (c)? Why do you think this is true?