English Spanish

1.3b Solutions of Linear Equations

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Linear equations do not always have one solution. Linear equations can also have no solution or infinitely many solutions.

When solving a linear equation that has no solution, you will obtain an equivalent equation that is not true for any value of x, such as $0 = 2$.

EXAMPLE 1 Solving Equations with No Solution

a. Solve $3 - 4x = -7 - 4x$.

$3 - 4x = -7 - 4x$ — Write the equation.

Undo the subtraction. → $+\,4x \qquad +\,4x$ — Add $4x$ to each side.

$3 = -7$ ✗ — Simplify.

The equation $3 = -7$ is never true. So, the equation has no solution.

b. Solve $\frac{1}{2}(10x + 7) = 5x$.

$\frac{1}{2}(10x + 7) = 5x$ — Write the equation.

$5x + \frac{7}{2} = 5x$ — Distributive Property

Undo the addition. → $-\,5x \qquad -\,5x$ — Subtract $5x$ from each side.

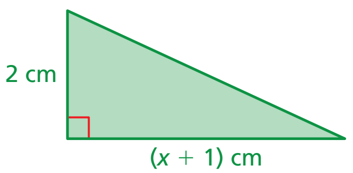
$\frac{7}{2} = 0$ ✗ — Simplify.

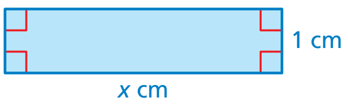
The equation $\frac{7}{2} = 0$ is never true. So, the equation has no solution.

Practice

Solve the equation.

1. $x + 6 = x$
2. $2x + 1 = 2x - 1$
3. $3x - 1 = 1 - 3x$
4. $4x - 9 = 3.5x - 9$
5. $\frac{1}{3}(2x + 9) = \frac{2}{3}x$
6. $6(5 - 2x) = -4(3x + 1)$
7. **GEOMETRY** Are there any values of x for which the areas of the figures are the same? Explain.





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When solving a linear equation that has infinitely many solutions, you will obtain an equivalent equation that is true for all values of x, such as $-5 = -5$.

EXAMPLE 2 Solving Equations with Infinitely Many Solutions

a. Solve $3(4x - 1) = 12x - 3$.

$3(4x - 1) = 12x - 3$		Write the equation.
$12x - 3 = 12x - 3$		Distributive Property
$\underline{-12x} \qquad \underline{-12x}$	Undo the addition.	Subtract $12x$ from each side.
$-3 = -3$		Simplify.

The equation $-3 = -3$ is always true. So, the equation has infinitely many solutions.

b. Solve $2(2 - 3x) = 4\left(1 - \frac{3}{2}x\right)$.

$2(2 - 3x) = 4\left(1 - \frac{3}{2}x\right)$		Write the equation.
$4 - 6x = 4 - 6x$		Distributive Property
$\underline{+6x} \qquad \underline{+6x}$	Undo the subtraction.	Add $6x$ to each side.
$4 = 4$		Simplify.

The equation $4 = 4$ is always true. So, the equation has infinitely many solutions.

Practice

Solve the equation.

8. $x + 8 - x = 9$

9. $\frac{1}{2}x + \frac{1}{2}x = x + 1$

10. $3x + 15 = 3(x + 5)$

11. $\frac{1}{2}(6x - 4) = 3x - 2$

12. $5x - 7 = 4x - 1$

13. $2x + 4 = -(-7x + 6)$

14. $5.5 - x = -4.5 - x$

15. $10x - \frac{8}{3} - 4x = 6x$

16. $-3(2x - 3) = -6x + 9$

17. $6(7x + 7) = 7(6x + 6)$

18. $\frac{3}{4}(4x - 8) = -10$

19. $-\frac{1}{8} = 2(x - 1)$