2-4 Reteaching

Solving Equations With Variables on Both Sides

To solve equations with variables on both sides, you can use the properties of equality and inverse operations to write a series of simpler equivalent equations.

Problem

What is the solution of $2m - 4 + 5m = 13 - 6m - 4$?

$7m - 4 = -6m + 9$	Add the terms with variables together on the left side and the constants on the right side to combine like terms.
$7m - 4 + 6m = -6m + 9 + 6m$	To move the variables to the left side, add $6m$ to each side.
$13m - 4 = 9$	Simplify.
$13m - 4 + 4 = 9 + 4$	To get the variable term alone on the left, add 4 to each side.
$13m = 13$	Simplify.
$\frac{13m}{13} = \frac{13}{13}$	Divide each side by 13 since x is being multiplied by 13 on the left side. This isolates x.
$m = 1$	Simplify.

Problem

What is the solution of $3(5x - 2) = -3(x + 6)$?

$15x - 6 = -3x - 18$	Distribute 3 on the left side and -3 on the right side into the parentheses by multiplying them by each term inside.
$15x - 6 + 6 = -3x - 18 + 6$	To move all of the terms without a variable to the right side, add 6 to each side.
$15x = -3x - 12$	Simplify.
$15x + 3x = -3x - 12 + 3x$	To get the variable terms to the left side, add $3x$ to each side.
$18x = -12$	Simplify.
$\frac{18x}{18} = -\frac{12}{18}$	Divide each side by 18 since x is being multiplied by 18 on the left side. This isolates x.
$x = -\frac{2}{3}$	Simplify and reduce the fraction.

Solve each equation. Check your answer.

1. $-5x + 9 = -3x + 1$

$x = 4$

2. $14 + 7n = 14n + 28$

$n = -2$

3. $22(g - 1) = 2g + 8$

$g = 1.5$

4. $-d + 12 - 3d = 5d - 6$

$d = 2$

5. $4(m - 2) = -2(3m + 3)$

$m = \frac{1}{5}$

6. $-(4y - 8) = 2(y + 4)$

$y = 0$

7. $5a - 2(4a + 5) = 7a$

$a = -1$

8. $11w + 2(3w - 1) = 15w$

$w = 1$

9. $4(3 - 5p) = -5(3p + 3)$

$p = \frac{27}{5}$

An equation that is true for every value of the variable for which the equation is defined is an identity. For example, $x - 5 = x - 5$ is an identity because the equation is true for any value of x. An equation has no solution if there is no value of the variable that makes the equation true. The equation $x + 6 = x + 3$ has no solution.

Problem

What is the solution of each equation?

a) $3(4x - 2) = -2(-6x + 3)$

Distribute 3 on the left side and -2 on the right side into the parentheses by multiplying them by each term inside.

$12x - 6 = 12x - 6$

$12x - 6 - 12x = 12x - 6 - 12x$ To get the variable terms to the left side, subtract $12x$ from each side.

$-6 = -6$ Simplify.

Because $-6 = -6$ is always true, there are infinitely many solutions of the original equation. The equation is an identity.

b) $2n + 4(n - 2) = 8 + 6n$

Distribute 4 into the parentheses by multiplying it by each term inside.

$2n + 4n - 8 = 8 + 6n$

$6n - 8 = 8 + 6n$ Add the variable terms on the left side to combine like terms.

$6n - 8 - 6n = 8 + 6n - 6n$ To get the variable terms to the left side, subtract $6n$ from each side.

$-8 = 8$ Simplify.

Since $-8 \neq 8$, the equation has no solution.

Determine whether each equation is an *identity* or whether it has *no solution*.

10. $-3(2x + 1) = 2(-3x - 1)$ No Solution

11. $4(-3x + 4) = -2(6x - 8)$ identity

12. $3n + 3(-n + 3) = 3$ no Solution

Solve each equation. If the equation is an identity, write *identity*. If it has no solution, write *no solution*.

13. $-(4n + 2) = -2(2n - 1)$ no solution

14. $2(-d + 4) = 2d + 8$ $d = 0$

15. $-k - 18 = -5 - k - 13$ identity

16. Open-Ended Write three equations with variables on both sides of the equal sign with one having no solution, one having exactly one solution, and one being an identity.

Answers vary!

No Solution : $3y + 7 = 3y - 12$

1 solution : $3y + 7 = y - 12$

identity : $2y - 10 + 5y = 7y - 10$

Lesson 2-4

Solve each equation. If the equation is an identity, write *identity*. If it has no solution, write *no solution*.

1. $4h + 5 = 9h$

$h = 1$

2. $2(3x - 6) = 3(2x - 4)$

identity

3. $7t = 80 + 9t$

$t = -40$

4. $m + 3m = 4$

$m = 1$

5. $-b + 4b = 8b - b$

$b = 0$

6. $6p + 1 = 3(2p + 1)$

no solution

7. $10z - 5 + 3z = 8 - z$

$z = \frac{13}{14}$

8. $3(g - 1) + 7 = 3g + 4$

identity

9. $17 - 20q\frac{13}{14} = (-13 - 5q)4$

$5q)4$ No Solution

Answers: 1, all real numbers (identity), -40, 1, 0, no solution, 13/14, all real numbers (identity), no solution