



Solving Equations with variables on both sides

Objectives

The student will be able to:

1. solve equations with variables on both sides.
2. solve equations containing grouping symbols.

1) Solve. $3x + 2 = 4x - 1$

You need to get the variables on one side of the equation. It does not matter which variable you move. Try to move the one that will keep your variable positive.



1) Solve $3x + 2 = 4x - 1$

1. Draw "the river"
2. Subtract $3x$ from both sides
3. Simplify
4. Add 1 to both sides
5. Simplify
6. Check your answer

$$\begin{array}{r|l} -3x & -3x \\ \hline & 2 = x - 1 \\ & + 1 \quad + 1 \\ \hline & 3 = x \end{array}$$

$$3(3) + 2 = 4(3) - 1$$

$$9 + 2 = 12 - 1 \quad \checkmark$$



2) Solve $8y - 9 = -3y + 2$

1. Draw "the river"
2. Add $3y$ to both sides
3. Simplify
4. Add 9 to both sides
5. Simplify
6. Divide both sides by 11
7. Simplify
8. Check your answer

$$\begin{array}{r} + 3y \qquad \qquad + 3y \\ \hline 11y - 9 = 2 \\ \qquad + 9 \qquad \qquad + 9 \\ \hline 11y = 11 \\ \hline 11 \qquad \qquad \qquad 11 \\ \hline y = 1 \end{array}$$

$8(1) - 9 = -3(1) + 2$ ✓



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What is the value of x if $3 - 4x = 18 + x$?

1. -3 ★

2. $\frac{-1}{3}$

3. $\frac{1}{3}$

4. 3

Answer Now



3) Solve $4 = 7x - 3x$

1. Draw “the river”
– Notice the variables are on the same side!
2. Combine like terms
3. Divide both sides by 4
4. Simplify
5. Check your answer

$$\frac{4}{4} = \frac{4x}{4}$$

$$1 = x$$

$$1 = x$$

$$4 = 7(1) - 3(1) \quad \checkmark$$



4) Solve $-7(x - 3) = -7$

1. Draw “the river”
2. Distribute
3. Subtract 21 from both sides
4. Simplify
5. Divide both sides by -7
6. Simplify
7. Check your answer

$$\begin{array}{r} -7x + 21 = -7 \\ -21 \quad -21 \\ \hline \end{array}$$

$$\begin{array}{r} -7x = -28 \\ -7 \quad -7 \end{array}$$

$$x = 4$$

$$-7(4 - 3) = -7$$

$$-7(1) = -7 \quad \checkmark$$



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What is the value of x if

$$3(x + 4) = 2(x - 1)?$$

1. -14 😊
2. -13
3. 13
4. 14

Answer Now



5) Solve

$$\frac{3}{8} - \frac{1}{4}x = \frac{1}{2}x - \frac{3}{4}$$

$$(8)\frac{3}{8} - (8)\frac{1}{4}x = (8)\frac{1}{2}x - (8)\frac{3}{4}$$

$$3 - 2x = 4x - 6$$

$$+ 2x \quad + 2x$$

$$3 = 6x - 6$$

$$+ 6 \qquad \qquad + 6$$

$$\frac{9}{6} = \frac{6x}{6}$$

$$\frac{3}{2} \text{ or } 1.5 = x$$

$$\frac{3}{8} - \frac{1}{4}(1.5) = \frac{1}{2}(1.5) - \frac{3}{4}$$



1. Draw "the river"
2. Clear the fraction – multiply each term by the LCD
3. Simplify
4. Add 2x to both sides
5. Simplify
6. Add 6 to both sides
7. Simplify
8. Divide both sides by 6
9. Simplify
10. Check your answer



Special Case #1

$$6) 2x + 5 = 2x - 3$$

1. Draw “the river”
2. Subtract $2x$ from both sides
3. Simplify

$$\begin{array}{r|l} -2x & -2x \\ \hline & 5 \neq -3 \end{array}$$

This is never true!

No solutions



Special Case #2

$$7) 3(x + 1) - 5 \neq 3x - 2$$

1. Draw “the river”
2. Distribute
3. Combine like terms
4. Subtract $3x$ from both sides
5. Simplify

$$3x + 3 - 5 \neq 3x - 2$$

$$3x - 2 \neq 3x - 2$$

$$\begin{array}{r} -3x \qquad \qquad -3x \\ \hline \end{array}$$

$$-2 \neq -2$$

This is always true!

**Infinite solutions
or identity**



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What is the value of x if
 $-3 + 12x = 12x - 3$?

1. 0
2. 4
3. No solutions
4. Infinite solutions



Answer Now



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Challenge! What is the value of x if
 $-8(x + 1) + 3(x - 2) = -3x + 2$?

- ★ 1. -8
- 2. -2
- 3. 2
- 4. 8

Answer Now