

3 – 5 Solving Equations with variables on both sides

To solve an equation, you are trying to find the value of x . Therefore, you need to get all your x 's on one side. Remember to move a term from one side to the other, you will either use subtraction or addition.

Solve and check.

Ex. 1:

$$\begin{array}{r} 2x + 15 = 3x \\ - 2x \quad - 2x \\ \hline 15 = x \end{array}$$

$$\boxed{\{15\}}$$

On the LHS, there is an x term & a number. On the RHS, the $3x$ is the only term. Since you want all the x terms together, move the $2x$ onto the RHS. To move the $2x$, we will subtract it from both sides. The x terms on the left cancel and 15 is left. The RHS becomes x because $3x - 2x = x$

Therefore, the final solution is 15 .

Ex. 2:

$$\begin{array}{r} 3(2x - 1) + 6 = 4x - 5 \\ 6x - 3 + 6 = 4x - 5 \\ 6x + 3 = 4x - 5 \end{array}$$

$$\begin{array}{r} 6x + 3 = 4x - 5 \\ - 4x \quad - 4x \\ \hline 2x + 3 = -5 \\ - 3 \quad -3 \\ \hline \frac{2x}{2} = \frac{-8}{2} \\ x = -4 \end{array}$$

$$\boxed{\{-4\}}$$

Before solving, you must simplify each side of the equation.

Use the distributive property to get rid of the parentheses.

Combing like terms ($-3 + 6 = 3$) And now that both sides are simplified, we are ready to start solving! Because there are x terms on both sides, we want to get them together. We can put them on either side. Let's get them on the LHS.

To get the x terms on the LHS, subtract $4x$ from both sides.

LHS: $6x - 4x = 2x$ and the $+3$ comes down.

RHS: $4x - 4x =$ zero, and the -5 comes down.

Subtr. 3 from both sides to get LHS to be $2x$. RHS: -5 and $-3 = -8$

Now Divide both sides by 2 .

The final solution is -4 .

To check plug into the ORIGINAL EQUATION and use the ORDER OF OPERATIONS to simplify each side!!!

Check $x = -4$

$$3(2(\quad) - 1) + 6 = 4(\quad) - 5$$

$$3(2(-4) - 1) + 6 = 4(-4) - 5$$

$$3(-8 - 1) + 6 = -16 - 5$$

$$3(-9) + 6 = -21$$

$$-27 + 6 = -21$$

$$-21 = -21$$

(One simplification per side)

Do NOT use the distributive property! Simplify inside the parentheses. Remember $-16 - 5 = -16 + -5$

Sometimes when you are solving an equation, the variables cancel.

Ex. 3:

$$\begin{array}{r} 3x + 7 = 3x \\ -3x \quad -3x \\ \hline 7 = 0 \end{array}$$

If you subtract $3x$ from both sides, look what happens.

The x 's cancel (because of the Additive Inverse Property) and you no longer have a variable in your equation. Therefore, you can't say $x =$ a specific number.

Look at the result, it is $7 = 0$. Is this true? NO, $7 \neq 0$ Since the result is false, the final answer is NO SOLUTION. That means there is no number that can replace the variable to make this statement true.

Ex. 4:

$$\begin{array}{r} 8x + 11 = 2(4x - 7) + 25 \\ 8x + 11 = 8x - 14 + 25 \\ 8x + 11 = 8x + 11 \\ -8x \quad -8x \\ \hline 11 = 11 \end{array}$$

Simplify the RHS by distributive property

Combine like terms

Get x terms on one side

x terms cancel leaving you with a TRUE statement.

The final answer is IDENTITY.