

Algebra I

Lesson 2.4 – Solving Equations with Variables on Both Sides

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Using the techniques learned in the previous sections, we can now solve equations where a variable is on both sides of the equation. This skill is important as allows us to compare, for example, rental rates for cars, or billing rates of two different phone companies.

In this type of equation you will find a variable on each side of the equation. The first thing we need to do is to gather all the like terms together. That is get the numbers together on one side and the variables together on the other side:

$$7k = 4k + 15$$

$$7k - 4k = 4k + 15 - 4k$$

$$3k = 15$$

$$\left(\frac{1}{3}\right)3k = \left(\frac{1}{3}\right)15$$

$$k = 5$$

1. To solve for k get all the k terms on the left side of the equation

HOW??? Subtract $4k$ from each side

2. Now use the reciprocal to get rid of the coefficient.

$4b + 2 = 3b$	$0.5 + 0.3y = 0.7y - 0.3$
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Sometimes you will need to simplify one or both sides of the equation before solving:

$$2(y + 6) = 3y$$

$$2y + 12 = 3y$$

$$2y + 12 - 2y = 3y - 2y$$

$$12 = y$$

1. Use the distribution property to simplify the left side of the equation.

2. With the integer on the left, combine variables on the right side.

HOW??? Subtract $2y$ from each side.

$3 - 5b + 2b = -2 - 2(1 - b)$ $3 - 3b = -2 - 2 + 2b$ $3 - 3b = -4 + 2b$ $3 - 3b + 3b = -4 + 2b + 3b$ $3 + 4 = -4 + 5b + 4$ $7 = 5b$ $\left(\frac{1}{5}\right)7 = \left(\frac{1}{5}\right)5b$ $\frac{7}{5} = b$	<p>-----</p> <p>Lots of stuff!!</p> <p>1. Left side combine the like terms. Right side do distribution</p> <p>2. Combine like terms on the right side.</p> <p>STRATEGY: <i>We are solving for the variable, so move the side that will get rid of the variable's negative sign.</i></p> <p>3. Using the reciprocal solve for the variable.</p> <p>UNLESS DIRECTED, LEAVE THE ANSWER AS A FRACTION. FRACTIONS ARE ALWAYS EXACT ANSWERS.</p>
$\frac{1}{2}(b + 6) = \frac{3}{2}b - 1$	$3x + 15 - 9 = 2(x + 2)$

$$4y + 7 - y = 10 + 3y$$

$$2c + 7 + c = -14 + 3c + 21$$



What are our answers? Are they true or false statements? Where did the variables go?

Vocabulary

Contradiction – an equation that has no solution, that is, there is no value for the variable that will make a true statement then we have a **contradiction**. When we try to solve for the variable, the variable will cancel out and we will be left with a false statement: $7 = 10$. I don't think so!!! This is a false statement \therefore the correct answer is **NO SOLUTION**.

Identity – an equation that is true for any value of the variable; it has infinitely many solutions, the equation is an **identity**. When we try to solve the equation for the variable, the variable cancels out, and we are left with a true statement: $7 = 7$ the correct answer is **ALL REAL NUMBERS**.

The long distance rates of 2 phone companies are shown in the table. How long is a call that costs the same no matter which company is used? What is the cost of that call?

Phone Company	Charges
Company A	36 ¢ plus 3 ¢ cents per minute
Company B	6 ¢ per minute

HOW DO WE KNOW IF OUR ANSWERS ARE CORRECT?????

ALWAYS CHECK YOUR ANSWERS!!! THERE IS NO EXCUSE FOR GETTING THE WRONG ANSWER, IF YOU CHECK YOUR WORK!