

# Solving Linear Equations

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The strategy for solving linear equations in one variable is to put the variables on one side of the equals sign and the numbers on the other side – by OPPOSITE OPERATION.

Before we get into solving equations, let's look at a gift wrapping analogy. When a present is wrapped, it is placed in a box, the cover put on, the box is wrapped in paper, and finally a ribbon is added to complete the project. To get the present out of the box, everything would be done in reverse order, performing the OPPOSITE OPERATION. That is first we would take off the ribbon, take the paper off, take the cover off, and finally take the present out of the box.

We will learn to solve equations in the  $ax + b = c$  format. That requires that we “undo” an algebraic expression to isolate the variable. To accomplish this, we will use the Order of Operations in reverse, using the opposite operation to isolate the variable.

## Order of Operations

From Left to Right in this order

1. Grouping
2. Exponentials
3. Multiply / Divide
4. Add / Subtract

**EXAMPLE:** Solve for  $x$ ;  $4x - 2 = 10$

Notice the problem is in the  $ax + b = c$  format. To solve the equation, we have to undo the expression  $4x - 2$  by using the Order of Operations in reverse and using the OPPOSITE OPERATION. That means we have to get rid of any addition or subtraction first. How do you get rid of a minus 2?

$$\begin{aligned}4x - 2 &= 10 \\4x - 2 + 2 &= 10 + 2 \\4x &= 12\end{aligned}$$

Now, how do we get rid of a multiplication by 4? That's right, divide by 4. Therefore,

$$x = 3$$

The nice thing about math is I can never make the problems more difficult, I can only make them longer. By making longer problems look like shorter problems we have already solved, math becomes a real blast.

The best strategy to use to solve linear equation is to rewrite equations you don't recognize in the  $ax + b = c$  format. To accomplish that, you identify the physical characteristics that make the problem look different than problems you solved, then using the Properties of real Numbers, you get rid of things.

For instance, if an equation had parentheses, use the Distributive Property to get rid of them, then combine like terms to write the equation in  $ax + b = c$  format. If an equation had fractions, you'd multiply both sides by the common denominator to get rid of the fractions.

As you learn to solve equations in algebra, you always take the equations you don't recognize and change them into the  $ax + b = c$  format – a format you know how to solve by using the Order of Operations in reverse using the opposite operation. You will use the  $ax + b = c$  format when solving systems of equations, equations containing radicals or absolute value, and when you solve quadratic equations using the Zero product Property.

This next example looks a lot longer than our first example, but our goal is to rewrite the equation in the  $Ax + b = c$  format. To do that, we need to get rid of parentheses using the Distributive Property

**EXAMPLE:**  $5(x + 2) - 3 = 27$

Getting rid of the parentheses and combining like terms, we have

$$\begin{aligned} 5x + 10 - 3 &= 27 \\ 5x + 7 &= 27 \end{aligned}$$

Now, the problem is in the  $ax + b = c$  format. Use the Order of Operations in reverse using the opposite operation to undo the expression. Do you have any additions or subtractions? How do you get rid of a +7?

$$\begin{aligned} 5x + 7 - 7 &= 27 - 7 \\ 5x &= 20 \end{aligned}$$

How do you get rid of the multiplication by 5? Divide both sides by 5.

$$x = 4$$