Tips for Solving Equations

Solving an equation is a series of steps where you can apply an operation to both sides of an equality until you have a equation that equates a variable with a value. It is the process of taking a equation such as

$$4(x+5) = 48,$$

and from this equation, determining that

$$x = 7.$$

Adding to Both Sides

Example One

The first tool in our toolbox is adding a number to both sides. Consider the equation

$$x + 10 = 15,$$

we can add 5 to both sides,

$$x + 10 + 5 = 15 + 5,$$

since we can simplify $x+10+5$ into $x+15$ and $15+5$ into 20, the equation becomes

$$x + 15 = 20.$$

While this example isn't as interesting there are others where this tool is useful for simplifying an equation.

Example Two

Consider the equation

$$x - 15 = 7,$$

we might try to add 15 to both sides and see what happens,

$$x - 15 + 15 = 7 + 15,$$

in this case we can simplify the $x - 15 + 15$ into just x. This gives us the new equation

$$x = 22,$$

and we have solved it!

Example Three

This can be used in more complex equations when there is a "lonely subtraction" so to speak. For example something a bit crazier such as

$$5\left(\frac{x}{2}-12\right)^2-22=13,$$

can be simplified by adding 22 to both sides.

$$\begin{aligned}5\left(\frac{x}{2}-12\right)^2-22+22&=13+22,\\ 5\left(\frac{x}{2}-12\right)^2&=35.\end{aligned}$$

Example Four

There are times when adding to both sides is not as useful. Consider the equation

$$4(x-8)=12,$$

we might try to add 8 to both sides,

$$4(x-8)+8=12+8,$$

but unfortunately the brackets protect the -8 and $+8$ from being simplified. If you expand the LHS into,

$$4x-32=12,$$

you might notice that we could instead expand then do the addition.