MATH DOESN'T SUCK

Solution Guide – Chapter 20

Introduction to "Solving for *x*"

Doing the Math from p. 243

2) If the nickname for number of pearls in the bag is *x*, then if we add 3 pearls to it, the total number of pearls would have the nickname: $x + 3$.
Answer: Now I have $\boldsymbol{x + 3}$ beads.

3) The nickname for the current number of mints is *m*. Then if your sister take 2 mints away, you'd be left with "$m - 2$" mints. Then, if you ate 5 more of them, you'd be taking 5 *more* mints out of the box, which is a total of 7 being taken away. How many mints are left over now? That would be $m - 7$.
Answer: You now have $\boldsymbol{m - 7}$ mints in the box.

4) The number of chocolates in a full, unopened box is *c*. If you eat 3 of them, then you'd be left with only "$c - 3$" chocolates in the box. But then if your mom gave you a second whole box, you'd have "$c - 3 + \boldsymbol{c}$" chocolates, right? That second "*c*" stands for the number of chocolates in the second, full box.
But we can now simplify that expression by combining the two *c*'s. Essentially, we are rewriting the expression as 2 full boxes of chocolates that we have (that would be "2*c*"), *minus* 3 individual chocolates, so: $2c - 3$.
Answer: You now have $\boldsymbol{2c - 3}$ total chocolates left.

Doing the Math from p. 254

2) $x - 7 = 11$

We want to get x by itself, but we have to keep the scales balanced, so let's add 7 to both sides:

$$x - 7 + \mathbf{7} = 11 + \mathbf{7}$$

On the left, the two 7's cancel each other out, and on the right, 11 + 7 = 18, so the equation becomes:

$$\rightarrow x = 18$$

Let's plug in **18** for x in the original equation, and check our work – make sure we found the right value for "x" to make the original equation a true equality:

$\boldsymbol{x} - 7 = 11$

and substitute 18 for x:

$\mathbf{18} - 7 = 11$

$\rightarrow 11 = 11$

We got a true statement - yep, we got the right value for x!

Answer: $\boldsymbol{x} = 18$

3) $2x + 6 = 10$

The first good step to getting x all by itself is to get rid of the 6, but we have to keep both sides of the equation equal, so let's subtract 6 from *both* sides:

$$2x + 6 - \mathbf{6} = 10 - \mathbf{6}$$

$$\rightarrow 2x = 4$$

And now it's pretty clear that $x = 2$, right? But if you wanted, you could proceed with the method (it's really good practice):

To get *x* by itself, we should divide both sides by 2, and we'll do it fraction-style

$$\frac{2x}{\mathbf{2}} = \frac{4}{\mathbf{2}}$$

Now we can cancel a 2 from the top and bottom:

$$\frac{\cancel{2}x}{\cancel{2}} = \frac{^{2}\cancel{4}}{\cancel{2}}$$

→ $\boldsymbol{x = 2}$

Now plug in 2 for *x* in the original equation, to check our answer.

$2\boldsymbol{x} + 6 = 10$

substituting 2 for *x*:

→ $2 \times \mathbf{2} + 6 = 10$ (remember order of operations!)

→ $4 + 6 = 10$

→ $10=10$

Yep, we did it right! **Answer: x = 2**

4) $\frac{x}{5} + 1 = 3$

To get x by itself on one side of the equation, let's first get rid of the 1. But since both sides of the equation always have to balanced, let's subtract 1 from *both* sides:

$$\frac{x}{5} + 1 - \mathbf{1} = 3 - \mathbf{1}$$

On the left side, the 1's cancel each other out, and on the right side, 3 – 1 = 2, and we're left with:

$$\frac{x}{5} = 2$$

But how do we get rid of the 5, so we have only *x* by itself on that side of the equation? Let's multiply both sides by **5**:

$$\frac{\mathbf{5}}{\mathbf{1}} \times \frac{x}{5} = \mathbf{5} \times 2$$ (remember that $\frac{5}{1}$ is the same as 5)

$$\rightarrow \frac{5x}{5} = 10$$

Now cancel the 5's on the left:

$$\frac{\cancel{5}x}{\cancel{5}} = 10$$

$$\rightarrow \boldsymbol{x = 10}$$

Let's check this value for *x* in the original equation, and make sure we get a true statement!

$$\frac{\boldsymbol{x}}{5} + 1 = 3$$

now substituting 10 for *x*:

$$\rightarrow \frac{\mathbf{10}}{5} + 1 = 3$$

$$\rightarrow 2 + 1 = 3$$

$$\rightarrow 3 = 3$$

Yep! We got a true statement, which means we found the right value of x to make the original equation a true equality!

Answer: *x* = 10

5) $8x = 7x + 5$

Let's write this one with boxes, just for the heck of it. It'll be a little easier to follow.

$$8\square = 7\square + 5$$

First, let's get all the stuff with the boxes on one side of the equation. The best way to do that is to *subtract* 7 boxes from both sides:

$$8\square - \mathbf{7}\square = 7\square - \mathbf{7}\square + 5$$

On the left side, if you subtract 7 boxes from 8 boxes, you end up with 1 box, right? And on the right side, the 7 boxes are being subtracted away completely, leaving just the 5:

$$\mathbf{1}\square = \mathbf{5}$$

Which means that $1x = 5$, and we know that 1x is the same as x, so we have:

$$x = 5$$

Lookie there, we have an answer! But just to make sure that one box is really equal to 5. Let's plug **5** in our original equation, wherever there used to be a box:

$8\square = 7\square + 5$

substituting 5 for $\square$

→ $8 \times \mathbf{5} = 7 \times \mathbf{5} + 5$ (remember order of operations)

→ $40 = 35 + 5$

→ $40 = 40$

Yep! We got a true statement when we plugged our answer back in, so that means we did find the correct value for $\square$! (in other words, x)

Answer: $x = 5$

6) $6x + 1 = 2x + 5$

Again, since this is a bit more complicated to solve, let's rewrite it in terms of boxes:

$$6\square + 1 = 2\square + 5$$

We'd like to get all of the boxes on one side, and all of the plain numbers on the other side. Let's subtract two boxes from both sides:

$$6\square \mathbf{- 2}\square + 1 = 2\square \mathbf{- 2}\square + 5$$

Taking away 2 boxes from 6 boxes will leave us with only 4 boxes on the left, and we'll end up with no boxes on the right:

$$4\square + 1 = 5$$

Ah, things are already looking nicer. Now let's subtract 1 from both sides, to keep isolating x:

$$4\square + 1 \mathbf{- 1} = 5 \mathbf{- 1}$$

$$4\square = 4$$

Divide both sides by 4, by creating fractions with 4 as the denominators on both sides:

$$\frac{4\square}{\mathbf{4}} = \frac{4}{\mathbf{4}}$$

Then we can cancel the 4's:

$$\frac{\cancel{4}\square}{\cancel{4}} = \frac{\cancel{4}}{\cancel{4}}$$

And we're left with:

$$\square = \mathbf{1}$$

Let's check that value in the equation, by plugging in **1** wherever we see a box:

$6\square + 1 = 2\square + 5$

(substituting "1" for $\square$)

→ $6 \times \mathbf{1} + 1 = 2 \times \mathbf{1} + 5$ (remember order of operations!)

→ $6 + 1 = 2 + 5$

→ $7 = 7$

Yep! Getting a true statement means that we got the right value for $\square$, and since "$\square$" was just another placeholder (nickname) for *x*, we know:

Answer: $x = 1$