KISS My MATH

Solution Guide for Chapter 12

Here are the solutions for the “Doing the Math” exercises in *Kiss My Math*!

DTM from p. 170-1

2. Start with *x*. Add 3, then multiply by 4.

So, starting with *x*, when we add 3, we’ll get: $x + 3$. Then we multiply the whole thing by 4, so that’s: $4(x + 3)$. To unwrap this, then first we’d have to divide by 4, and then subtract 3. That would give us x all by itself again!

Answer: **$4(x + 3)$, and to unwrap it, divide by 4, then subtract 3.**

3. Start with *y*. Multiply by 4, then add 3.

Starting with y, multiplying by 4 would give us 4y. Then adding 3, we’d get 4y + 3. Then to unwrap it, we’d have to subtract 3, then divide by 4.

Answer: **4y + 3, and to unwrap it, subtract 3, then divide by 4.**

4. Start with *z*. Add 3, then divide by 4.

Starting with z, when we add 3, we'd get: z + 3. Then, dividing "z + 3" by 4, we'd get:

$\frac{z+3}{4}$. To unwrap this, first we'd have to multiply by 4, and then subtract 3.

Answer: $\mathbf{\frac{z+3}{4}}$**, and to unwrap this, first we'd have to multiply by 4, and then subtract 3.**

5. Start with *w*. Divide by 2, then subtract 1, then multiply by 5.

Starting with w, when we first divide by 2, we'll get: $\frac{w}{2}$. Then if we subtract 1, we'll get:

"$\frac{w}{2} - 1$". Then if we multiply this expression by 5, we'll get: $5(\frac{w}{2} - 1)$.

To unwrap this, doing the inverse of the steps, we'd first divide by 5, then add 1, and finally we'd multiply by 2 in order to get back to plain 'ol *w*!

Answer: $\mathbf{5(\frac{w}{2} - 1)}$**, and to unwrap this, divide by 5, then add 1, then multiply by 2.**

6. Start with *n*. Multiply by 6, then subtract 5, then divide by 7.

Starting with *n*, when we first multiply by 6, we'd get 6*n*. Then subtracting 5, we'd get 6*n* – 5, right? Then dividing the whole thing by 7, we'd get: $\frac{6n-5}{7}$. And doing the inverse, to unwrap it, we'd first multiply by 7, then add 5, and finally divide by 6.

Answer: $\mathbf{\frac{6n - 5}{7}}$ To unwrap it, we'd first multiply by 7, then add 5, and then divide by 6.

DTM on p.179

2. $2(x - 6) = -18$

To isolate x, let's first divide both sides by 2, so that we can get x out of the parentheses:

$$2(x - 6) = -18$$

$$\rightarrow \frac{2(x-6)}{\mathbf{2}} = \frac{-18}{\mathbf{2}}$$

$$\rightarrow (x - 6) = -9$$

$$\rightarrow x - 6 = -9$$

And now, we just need to add 6 to both sides:

$$\rightarrow x - 6 + \mathbf{6} = -9 + \mathbf{6}$$

$$\rightarrow \underline{x = -3}$$

Now, let's check our answer by sticking in the value x = –3 into our original equation:

$2(x - 6) = -18$

$\rightarrow 2(-\mathbf{3} - 6) = -18$?

$\rightarrow 3(-9) = -18$?

$\rightarrow -18 = -18$

yep! We got a true statement, which means that we found the value of x that *makes* the original equation true statement.

Answer: ***x* = –3**

3. $\frac{(x-4)}{2} = 1$

To isolate *x*, let's start by multiplying both sides by 2:

$$\frac{(x-4)}{2} = 1$$

$\rightarrow \dfrac{\mathbf{2}(x-4)}{2} = (\mathbf{2})1$

Notice that the 2's cancel on the fraction, just like we intended them to!

$\rightarrow (x - 4) = 2$

$\rightarrow x - 4 = 2$

and now we just need to add 4 to both sides:

$\rightarrow x - 4 + \mathbf{4} = 2 + \mathbf{4}$

$\rightarrow \underline{x = 6}$

Now, let's check out answer by plugging in the value $x = 6$ into the original equation:

$\dfrac{(x-4)}{2} = 1$

$\rightarrow \dfrac{(\mathbf{6}-4)}{2} = 1$?

$\rightarrow \dfrac{2}{2} = 1$?

$\rightarrow$ 1 = 1 , yep! We found the right value of x to make the equation true!

Answer: $\boldsymbol{x = 6}$

4. $3(x - 5) - 2 = 7$

To unwrap x, remembering reverse PEMDAS, we should add 2 to both sides, so we get:

$3(x - 5) - 2 = 7$

$\rightarrow 3(x - 5) - 2 + \mathbf{2} = \mathbf{7 + 2}$

$\rightarrow 3(x - 5) = 9$

Now, let's divide both sides by 3:

$$\rightarrow \frac{3(x-5)}{\mathbf{3}} = \frac{9}{\mathbf{3}}$$

notice that the 3's cancel on the fraction, and 9 divided by 3 equals 3, so:

$$\rightarrow (x-5) = 3$$

$$\rightarrow x - 5 = 3$$

and now we can just add 5 to both sides:

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

$$\rightarrow \underline{x = 8}$$

Let's check our answer by plugging in x = 8 into our original equation:

$3(x - 5) - 2 = 7$

$\rightarrow 3(\mathbf{8} - 5) - 2 = 7$?

$\rightarrow 3(3) - 2 = 7$?

$\rightarrow 9 - 2 = 7$?

$\rightarrow$ 7 = 7, yep, we must have found the right value of *x* for this equation.

Answer: ***x* = 8**

5. $\frac{(x+1)}{3} + 2 = 3$

Again, undoing PEMDAS, we should subtract 2 from both sides to begin isolating x:

$$\frac{(x+1)}{3} + 2 = 3$$

$$\rightarrow \frac{(x+1)}{3} + 2 - \mathbf{2} = 3 - \mathbf{2}$$

$$\rightarrow \frac{(x+1)}{3} = 1$$

Now we should multiply both sides by 3, so that the 3 will cancel from the bottom of the fraction:

$$\rightarrow \frac{\mathbf{3}(x+1)}{3} = \mathbf{3}\times 1$$

$$\rightarrow (x + 1) = 3$$

$$\rightarrow x + 1 = 3$$

finally, we can just subtract 1 from both sides:

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

$$\rightarrow \underline{x = 2}$$

Now let's check our answer by plugging in $x = 2$ into the original equation:

$$\frac{(x+1)}{3} + 2 = 3$$

$$\rightarrow \frac{(\mathbf{2}+1)}{3} + 2 = 3$$

$$\rightarrow \frac{3}{3} + 2 = 3$$

$\rightarrow$ 1 + 2 = 3

$\rightarrow$ 3 = 3, yep, we found the right value of *x*!

Answer: ***x* = 2**

DTM from p.188

2. $6x + 10 = 4(x + 3)$

Okay, in order to collect all the "*x*" stuff to one side, and the numbers to the other, we'll have to first distribute that 4:

$$6x + 10 = 4(x + 3)$$

$$\rightarrow 6x + 10 = 4x + 12$$

Now, let's subtract 10 from both sides, so that only constants are on the right side:

$$\rightarrow 6x + 10 \mathbf{- 10} = 4x + 12 \mathbf{- 10}$$

$$\rightarrow 6x = 4x + 2$$

now let's subtract 4*x* from both sides:

$$\rightarrow 6x - \boldsymbol{4x} = 4x - \boldsymbol{4x} + 2$$

$$\rightarrow 2x = 2$$

Finally, we just divide both sides by 2:

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

$$\rightarrow \underline{x = 1}$$

Let's check our answer by plugging $x = 1$ into the original equation:

$6x + 10 = 4(x + 3)$

$\rightarrow 6(\mathbf{1}) + 10 = 4(\mathbf{1} + 3)$?

$\rightarrow 6 + 10 = 4(4)$?

$\rightarrow 16 = 16$ yep! We found the right value of *x*.

Answer: $\boldsymbol{x = 1}$

3. $-2x - 5 = -x + 1$

Hm, lots of negative signs on this one. Let's multiply both sides by –1 to get rid of them, just to make thing nicer to deal with:

$$-2x - 5 = -x + 1$$

$$\rightarrow \mathbf{(-1)}(-2x - 5) = \mathbf{(-1)}(-x + 1)$$

→ $2x + 5 = x - 1$

That's better. Okay, moving forward, let's subtract x from both sides:

→ $2x \mathbf{-\, x} + 5 = x \mathbf{-\, x} - 1$

→ $x + 5 = -1$

and now let's subtract 5 from both sides:

→ $x + 5 \mathbf{-\, 5} = -1 \mathbf{-\, 5}$

On the left, the 5's disappear, and you can rewrite that subtraction as "adding a negative

on the right, if it helps:

→ $x = -1 + (-5)$

→ $\underline{x = -6}$

Let's check our answer by plugging the value "$x = -6$" back into the original equation:

$-2x - 5 = -x + 1$

→ $-2(-6) - 5 = -(-6) + 1$?

Remembering how to multiply negatives, we see that the negative signs cancel twice here!

→ $2(6) - 5 = 6 + 1$?

→ $12 - 5 = 7$?

→ $7 = 7$, yep!

Answer: $\boldsymbol{x = -6}$

4. $3x + 2 - x = -6 + 2x + 8$

Let's first rewrite the subtraction as "adding a negative":

$3x + 2 + (-x) = -6 + 2x + 8$

Before we do things to both sides, notice that we can combine some like terms! on the left, the $3x$ and $(–x)$ will combine to give us $2x$, and on the right, the –6 and the 8 will combine to make 2:

$$3x + 2 + (-x) = -6 + 2x + 8$$

$$\rightarrow 2x + 2 = 2x + 2$$

Hey, wait a minute – we have the same thing on both sides! We could subtract 2x from both sides, and get:

$$\rightarrow 2 = 2$$

So, now that we have gotten a true statement without x in it, we know that this is true for all values of x. Try plugging in $x = 0$, $x = 1$, or x = anything else, and you'll see that you get true statements each time!

Answer: **This equation is true for all values of *x*.**

5. $\frac{2x}{3} + 1 = x$ (Hint: multiply both *entire* sides by 3.)

Let's take the hint, and see what happens when we multiply both sides by 3. See, our goal is to get x off of that fraction:

$$\frac{2x}{3} + 1 = x$$

$$\rightarrow \mathbf{3}\left(\frac{2x}{3} + 1\right) = \mathbf{3}x$$

Distributing the 3 inside the parentheses, and writing 3 as $\frac{3}{1}$ to multiply it times the fraction, we get:

→ $\frac{3}{1}(\frac{2x}{3}) + 3(1) = 3x$

→ $\frac{6x}{3} + 3 = 3x$

We can cancel a factor of "3" from the top and bottom of the fraction, and get:

→ 2x + 3 = 3x

Phew! The *x* is finally off that fraction.

Okay, in order to get all the "stuff with x" on one side, let's subtract 2x from both sides:

2x – 2x + 3 = 3x – 2x

→ 3 = 1*x*

→ 3 = x

→ <u>x = 3</u>

To check our answer, let's plug the value x = 3 wherever we see x in the original

equation:

$\frac{2x}{3} + 1 = x$

→ $\frac{2(\mathbf{3})}{3} + 1 = \mathbf{3}$?

→ $\frac{6}{3}$ + 1 = 3 ?

→ 2 + 1 = 3 ?

→ 3 = 3, yep! We found the right value for x.

Answer: ***x* = 3**

6. $x + 2xy + 1 – xy = 2x – 7 + xy$ (Hint: notice what happens to the "*xy*" term when you collect variables together and combine like terms correctly!)

Well, this looks like a big mess. Let's deal with it a step at a time. First, let's rewrite the subtraction as "adding negatives" and go ahead and write in the "1" coefficients, just to make this problem easier to look at:

$$1x + 2xy + 1 + (–1xy) = 2x + (–7) + 1xy$$

We have x terms, xy terms, and constants. The hint says we should pay attention to the xy terms – so let's do that. On the left side of the equation, we have $2xy$ and also $(–1xy)$, so they will combine to give us $1xy$. Let's rewrite the problem:

$$1x + 1xy + 1 = 2x + (–7) + 1xy$$

Notice that we can subtract $1xy$ from both sides, and the terms disappear completely!

$$\rightarrow 1x + 1xy \mathbf{–1xy} + 1 = 2x + (–7) + 1xy \mathbf{–1xy}$$

$$\rightarrow 1x + 1 = 2x + (–7)$$

Ah, much nicer. Now let's subtract $1x$ from both sides:

$$\rightarrow 1x \mathbf{– 1x} + 1 = 2x \mathbf{– 1x} + (–7)$$

$$\rightarrow 1 = x + (–7)$$

Now let's add 7 to both sides, and we'll get:

$$\rightarrow 1 \mathbf{+ 7} = x + (–7) \mathbf{+ 7}$$

$$\rightarrow 8 = x$$

$$\rightarrow \underline{x = 8}$$

Let's check our answer by plugging the value x = 8 into the original equation, remembering that the xy terms will all disappear completely:

$\mathbf{8} + 2(\mathbf{8})y + 1 - \mathbf{8}y = 2(\mathbf{8}) - 7 + (\mathbf{8})y$?

→ $8 + 16y + 1 - 8y = 16 - 7 + 8y$?

at this point, we can combine the "*y*" terms and see that they disappear completely, just like we knew they would (these used to be the *xy* terms)

→ $8 + 1 + \underline{8y} = 16 - 7 + \underline{8y}$?

(subtract 8*y* from both sides, and get)

→ $8 + 1 = 16 - 7$?

→ $9 = 9$ yep! We got the right value of x.

Answer: ***x* = 8**