LEARNING TARGETS

- I can give a detailed step-by-step description of how I solve algebraic equations.

You've literally solved a billion (I rounded up.) equations that look like this; $3x – 4 = 2x + 1$

The focus of this section is for you to give a **step-by-step description of how you solve an equation** like the one above. If you were to explain how to solve the problem to a friend, you might say something like this;
{Note: I underlined the key parts of each description}

3x – 4 = 2x + 1	*This is the original equation which was <u>given</u>.*
3x = 2x + 5	*For this step, I <u>added 4</u> to each side of the equation.*
x = 5	*I then <u>subtracted 2x</u> from each side to get my final answer.*

That is a very good explanation of how to solve the problem but it is a little over the top to have to do that for every problem you solve. There is a more efficient way to explain how you arrived at your solution by using a two column chart. One column will be for your <u>statements</u> and the other column will be for your <u>reasons</u>.

For the <u>reasons</u> column, we can use all of the algebraic strategies/properties we have learned before. You may not remember the official names but here are some of the properties that you would have seen already:

• ***Addition Property***	• ***Division Property***	• ***Combine Like Terms***
• ***Subtraction Property***	• ***Substitution Property***	• ***Simplification***
• ***Multiplication Property***	• ***Distributive Property***	• ***Transitive Property***
• ***Definition of Midpoint***	• ***Segment Addition Postulate***	

Let's try the same problem but this time we will put our <u>statements</u> and <u>reasons</u> into the two-column chart.

STATEMENTS	REASONS
1. 3x – 4 = 2x + 1	1. Given
2. 3x = 2x + 5	2. Addition Property
3. x = 5	3. Subtraction Property

See how much more streamlined the explanation looks? Notice that all our reasons match exactly how we described it originally. The key words gave away what 'property' was being used. As long as every statement you make has a reason to go along with it, your explanation will be correct.

Now some of you are probably wondering, "What if I subtracted 2x from both sides first? Would I lose points?". Absolutely not! There is nothing wrong with saying;

STATEMENTS	REASONS
1. 3x – 4 = 2x + 1	1. Given
2. x – 4 = 1	2. Subtraction Property
3. x = 5	3. Addition Property

Notice reasons 2 & 3 switched from before because we chose to explain this one in a different order.

Remember, every step you take will require some kind of logical explanation of how you got there.

Let's look at another example: $8x + 2 - 3x = 9x + 6$

STATEMENTS	REASONS
1. $8x + 2 - 3x = 9x + 6$	1. Given
2. $5x + 2 = 9x + 6$	2. Combine Like Terms
3. $5x = 9x + 4$	3. Subtraction Property
4. $-4x = 4$	4. Subtraction Property
5. $x = -1$	5. Division Property

This one had a few different ways you could have gone. As long as your statement has an appropriate reason, you will get full credit.

You are basically solving problems the same way you always have but you are actually writing down 'how' you got from one step to the next. The 'how' is really important and this section will help you focus on that part of the solving process.

Let's try one more; $4(x - 3) = x + 3$

STATEMENTS	REASONS
1. $4(x - 3) = x + 3$	1. Given
2. $4x - 12 = x + 3$	2. Distributive Property
3. $3x - 12 = 3$	3. Subtraction Property
4. $3x = 15$	4. Addition Property
5. $x = 5$	5. Division Property

If you're not sure what property to put in your reason box, just ask yourself this question, "What did you do to get from the previous step to the step you're on?". If you answered, "I added something to both sides.", well then you used the 'addition property'. Whatever algebraic process you used to get to your step, <u>IS</u> the actual <u>reason</u> you want!

Try some of the practice problems and let me know if you need any help. Good luck and have a great weekend!!!

Complete each problem by naming the property that justifies each statement. I've given you the amount of steps these problems 'should' take.

1. Given: $3x - 2 = x - 8$

Statements	Reasons
1.	1. Given
2.	2.
3.	3.
4. x = -3	4.

2. Given: $7(2x - 3) - 4(x + 5) = 8(x - 1) + 3$

Statements	Reasons
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6. x = 18	6.

In your notebooks, please copy the given problem and create a two-column chart to solve for x. Make sure to give a reason for each step as you go.

1. $\frac{x}{8} = 2$

2. $6 = \frac{x}{4} + 2$

3. $2(x + 5) = -2$

4. $1 - 2x + 5 = 6$

5. $6x - 1 + 6x = 11$

6. $5x - 14 = 8x + 4$

7. $-(x + 4) = -8$

8. $x - 1 = 5x + 3x - 8$

9. $12 = -4(-6x - 3)$

10. $-13 = 5(1 + 4x) - 2x$

11. $18 - 6x = 6(1 + 3x)$

12. $-3(4x + 3) + 4(6x + 1) = 43$

Translate the following sentences into number equations and solve using a two column chart. Write a justification for each step.

13. Six more than three times a number is negative thirty-six.

14. The quotient of a number and five increased by four is sixteen.

Geometric Problems!

15. Using the diagram to the right, prove x = 3.

$$\overset{\displaystyle \underset{}{\overline{ 7x - 3 }}}{\underset{\underset{H}{\bullet} \quad \underset{2x+6}{} \quad \underset{I \ \ 3x-3 \ \ J}{\bullet}}{}}$$
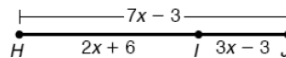
16. Given that C is the midpoint of $\overline{AD}$, $\overline{AC}$ = 4x and $\overline{CD}$ = 2x + 12, prove x = 6.

17. Given that B is the midpoint of $\overline{AC}$, $\overline{AB} = \frac{1}{4}x + 3$ and $\overline{BC} = \frac{2}{5}x$, prove x = 20.

Part A: Answers

1)

Statements	Reasons
1. 3x − 2 = x − 8	1. Given
2. 2x − 2 = -8	2. Subtraction Property
3. 2x = -6	3. Addition Property
4. x = -3	4. Division Property

2)

Statements	Reasons
1. 7(2x-3) − 4(x+5) = 8(x-1) +3	1. Given
2. 14x − 21 − 4x − 20 = 8x − 8 +3	2. Distributive Property
3. 10x − 41 = 8x − 5	3. Combine Like Terms
4. 2x − 41 = -5	4. Subtraction Property
5. 2x = 36	5. Addition Property
6. x = 18	6. Division Property

Part B: Answers

Note: These are just the answers for the x-values. The step-by-step description should be completed by you. I just wanted to give you the x-values so you can at least see if you got the answer correct. Please let me know if you have any questions.

1) 16
2) 16
3) -6
4) 0
5) 1
6) -6
7) 4
8) 1
9) 0
10) -1
11) -½
12) 4

13)

Statements	Reasons
1. 6 + 3x = -36	1. Given
2. 3x = -42	2. Subtraction Property
3. x = -14	3. Division Property

Statements	Reasons

14)

1. $\dfrac{x}{5}+4=16$	1. Given
2. $\dfrac{x}{5}=12$	2. Subtraction Property
3. x = 60	3. Multiplication Property

15)

Statements	Reasons
1. 2x+6 + 3x − 3 =7x -3	1. Segment Addition Postulate
2. 5x +3 = 7x − 3	2. Combine Like Terms
3. 3 = 2x − 3	3. Subtraction Property
4. 6 = 2x	4. Addition Property
5. x = 3	5. Division Property

16)

Statements	Reasons
1. 4x = 2x + 12	1. Definition of Midpoint
2. 2x = 6	2. Subtraction Property
3. x = 3	3. Division Property

17)

Statements	Reasons
1. $\dfrac{1}{4}x+3=\dfrac{2}{5}x$	1. Definition of Midpoint
2. $3=\dfrac{2}{5}x-\dfrac{1}{4}x$	2. Subtraction Property
3. $3=\dfrac{3}{20}x$	3. Combine Like Terms
4. $x=20$	4. Multiplication Property