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Unit 4, Lesson 7: All, Some, or No Solutions

Let's think about how many solutions an equation can have.

7.1: Which One Doesn't Belong: Equations

Which one doesn't belong?

1. $5 + 7 = 7 + 5$

2. $5 \cdot 7 = 7 \cdot 5$

3. $2 = 7 - 5$

4. $5 - 7 = 7 - 5$

7.2: Thinking About Solutions

$$n = n$$

$$2t + 6 = 2(t + 3)$$

$$3(n + 1) = 3n + 1$$

$$\frac{1}{4}(20d + 4) = 5d$$

$$5 - 9 + 3x = -10 + 6 + 3x$$

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

$$y \cdot -6 \cdot -3 = 2 \cdot y \cdot 9$$

$$v + 2 = v - 2$$

- Sort these equations into the two types: true for all values and true for no values.
- Write the other side of this equation so that this equation is true for all values of u .

$$6(u - 2) + 2 =$$

- Write the other side of this equation so that this equation is true for no values of u .

$$6(u - 2) + 2 =$$

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Are you ready for more?

Consecutive numbers follow one right after the other. An example of three consecutive numbers is 17, 18, and 19. Another example is -100, -99, -98.

How many sets of two or more consecutive positive integers can be added to obtain a sum of 100?

7.3: What's the Equation?

1. Complete each equation so that it is true for all values of x .

a. $3x + 6 = 3(x + \underline{\quad})$

b. $x - 2 = -(\underline{\quad} - x)$

c. $\frac{15x-10}{5} = \underline{\quad} - 2$

2. Complete each equation so that it is true for no values of x .

a. $3x + 6 = 3(x + \underline{\quad})$

b. $x - 2 = -(\underline{\quad} - x)$

c. $\frac{15x-10}{5} = \underline{\quad} - 2$

3. Describe how you know whether an equation will be true for all values of x or true for no values of x .

Lesson 7 Summary

An equation is a statement that two expressions have an equal value. The equation

$$2x = 6$$

is a true statement if x is 3:

$$2 \cdot 3 = 6$$

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It is a false statement if x is 4:

$$2 \cdot 4 = 6$$

The equation $2x = 6$ has *one and only one solution*, because there is only one number (3) that you can double to get 6.

Some equations are true no matter what the value of the variable is. For example:

$$2x = x + x$$

is always true, because if you double a number, that will always be the same as adding the number to itself. Equations like $2x = x + x$ have an *infinite number of solutions*. We say it is true for all values of x .

Some equations have *no solutions*. For example:

$$x = x + 1$$

has no solutions, because no matter what the value of x is, it can't equal one more than itself.

When we solve an equation, we are looking for the values of the variable that make the equation true. When we try to solve the equation, we make allowable moves assuming it *has* a solution. Sometimes we make allowable moves and get an equation like this:

$$8 = 7$$

This statement is false, so it must be that the original equation had no solution at all.

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Unit 4, Lesson 7: All, Some, or No Solutions

1. For each equation, decide if it is always true or never true.

a. $x - 13 = x + 1$

b. $x + \frac{1}{2} = x - \frac{1}{2}$

c. $2(x + 3) = 5x + 6 - 3x$

d. $x - 3 = 2x - 3 - x$

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

2. Mai says that the equation $2x + 2 = x + 1$ has no solution because the left hand side is double the right hand side. Do you agree with Mai? Explain your reasoning.

3. a. Write the other side of this equation so it's true for all values of x : $\frac{1}{2}(6x - 10) - x =$

b. Write the other side of this equation so it's true for no values of x : $\frac{1}{2}(6x - 10) - x =$

4. Here is an equation that is true for all values of x : $5(x + 2) = 5x + 10$. Elena saw this equation and says she can tell $20(x + 2) + 31 = 4(5x + 10) + 31$ is also true for any value of x . How can she tell? Explain your reasoning.

5. Elena and Lin are trying to solve $\frac{1}{2}x + 3 = \frac{7}{2}x + 5$. Describe the change they each make to each side of the equation.

a. Elena's first step is to write $3 = \frac{7}{2}x - \frac{1}{2}x + 5$.

b. Lin's first step is to write $x + 6 = 7x + 10$.

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6. Solve each equation and check your solution.

$$3x - 6 = 4(2 - 3x) - 8x$$

$$\frac{1}{2}z + 6 = \frac{3}{2}(z + 6)$$

$$9 - 7w = 8w + 8$$

(from Unit 4, Lesson 6)

7. The point $(-3, 6)$ is on a line with a slope of 4.

- a. Find two more points on the line.
- b. Write an equation for the line.

(from Unit 3, Lesson 12)