Essential Questions: How do we recognize equations that have no solution? How do we recognize equations that have infinitely many solutions? How do we recognize equations that have the same solution set?

Do Now: Solve each equation.

A) $3(x + 2) = 3x + 6$

B) $3x + 2 - 2x = \frac{1}{2}(2x + 8)$

Not every equation has one solution.
There are equations that exist that have **infinitely many solutions**.
There are equations that exist that have **no solution**.

Example:

$5(2x - 4) = 3(3x - 6) + x - 2$

$10x - 20 = 9x - 18 + x - 2$

$10x - 20 = 10x - 20$ ← *Both sides are the same*

$10x = 10x$

$0 = 0$ *This equation has **infinitely many** solutions.*
x = all real numbers

Example:

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

$2x + 8 + 3 = 2x + 6$

$2x + 11 = 2x + 6$ ← *This doesn't make sense*

$11 \neq 6$

*This equation has **no** solution.*

Decide if each equation below has <u>one</u>, <u>none</u> or <u>infinitely many</u> solutions.

1. $5x - 1 - 4x = 3 + x - 4$
2. $\frac{1}{4}(8x - 16) = 5x - 11$
3. $9(x - 1) = 3x + 5 + 6x$

4. Consider the equation: $4y + 5 - y = 3y - 8 + 12$

A) Determine if the equation has one, none or infinite solutions.

B) How can the equation be changed so that it has an infinite number of solutions?

Equivalent Equations

Equations that have the **same solution set** are **equivalent**.

$2x + 5 = 11$ ***and*** $10x + 25 = 55$ ***are equivalent equations***

$-5 \quad -5 \qquad\qquad -25 \quad -25$

$\frac{2x}{2} = \frac{6}{2} \qquad\qquad \frac{10x}{10} = \frac{30}{10}$

$x = 3 \qquad\qquad x = 3 \leftarrow$ ***same solution set***

Do you notice anything about the equations $2x + 5 = 11$ *and* $10x + 25 = 55$?

How can we determine if two or more equations are equivalent and share the same solution set?

A) $2x + 3 = 13 - 5x$

B) $6 + 4x = -10x + 26$

Using the properties of real numbers, determine which of the following equations have the same solution set. Solve the equations to check your response.

A. $15(2x + 3) + 97 = 110 - 5x$

B. $x - 5 = 3x + 7$

C. $9x + 21 = 3x - 15$

D. $15(2x + 3) = -5x + 13$

TODAY'S TAKE AWAY…

Some equations have _____, _____or _____ many solutions.

Equivalent equations have the same _____.

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Determine if each equation below has <u>one</u>, <u>none</u> or <u>infinite solutions</u>.

1. $3x + 7 = 7$

2. $7 + 3x = 3x - 7$

3. $3x + 15 = 1.5(2x + 10)$

4. $\frac{x-5}{2} = \frac{x-7}{3}$

5. $2x + 1 + x = 3(x - 2) + 7$

6. Consider the equation $2(5x - 4) = \mathbf{a}x + \mathbf{b}$.

   A. Find a value for **a** and **b** so that the equation has no solution.

   B. Find a value for **a** and **b** so that the equation has infinite solutions.

7. Which equations below have the same solution set as **9 – 2x = 3x + 3**?

   A. $2 = 1\frac{2}{3}x$ B. $5(9 - 2x) = 15x + 15$ C. $3 - 2x = x + 1$ D. $-5x = -6$