

SOLVING equations Part I

Recall: An **equation** is a statement that two algebraic expressions are **equal**.
ALL equations have an **equal sign**.

example 1: consider the equation

$$x - 3 = 7$$

To solve for x by inspection, we ask, what number do you subtract 3 from to get 7?

$$\text{Since } 10 - 3 = 7, \quad x = 10$$

We can solve this equation **algebraically**.

Keep in mind that our ultimate goal is to have x by itself on one side of the equal sign.

In the equation $x - 3 = 7$, we need to change the left hand side from $x - 3$ to just x . If we add 3 to $x - 3$, we get $x - 3 + 3 = x + 0 = x$

In order to keep both sides of the equation **equal**, we must also add 3 to the right hand side.

$$x - 3 = 7$$

$$\begin{array}{r} x - 3 = 7 \\ + 3 \quad + 3 \\ \hline \end{array}$$

$$x = 10 \quad [\text{now } x \text{ is alone!}]$$

So $x = 10$ is the solution

example 2: consider the equation

$$x + 3 = 7$$

↳ By inspection, $x = \underline{\quad}$

To solve this equation algebraically, we must subtract 3 from both sides of the equation in order to isolate the variable.

$$x + 3 = 7$$

$$\begin{array}{r} x + 3 = 7 \\ - 3 \quad - 3 \\ \hline \end{array}$$

$$x = 4$$

So $x = 4$ is the solution.

This method of adding 3 to both sides in example 1 and subtracting 3 from both sides in example 2 is called the addition property of equality.

The Addition Property of Equality

states that we can add the same

value to both sides of an equation without changing the solution.

Note: Recall that subtracting a number is the same as adding the opposite of that number. This implies that we can also subtract the same value from both sides of an equation without changing the solution.

example 3: consider the equation

$$4x = 20$$

To solve for x by inspection, we ask, what number do you multiply by 4 to get 20?

↳ By inspection, $x = \underline{\quad}$

We can solve this equation algebraically. Keep in mind that our ultimate goal is to have x by itself on one side of the equal sign.

In the equation $4x = 20$, we need to change the left hand side from $4x$ to just x . If we divide by 4 we

get $\frac{4x}{4} = x$. In order to keep both

sides of the equation equal, we must also divide by 4 on the right hand side,

$$\frac{4x}{4} = \frac{20}{4}$$

$$x = \frac{20}{4} = 5$$

so $x=5$ is the solution.

example 4: consider the equation

$$\frac{x}{3} = 4$$

↳ By inspection, $x = \underline{\quad}$

To solve this equation algebraically, we must multiply both sides by 3 in order to isolate the variable.

$$\frac{3 \cdot x}{3} = 3 \cdot 4$$

↳ $x = \underline{\quad}$

This method of dividing by 4 in example 3 and multiplying by 3 in example 4.

is called the multiplication property of equality.

The Multiplication Property of Equality states that we can multiply both sides of an equation by the same value without changing the solution.

Note: Recall that dividing by a number is the same as **multiplying** by its reciprocal. This implies that we can also **divide** both sides of an equation by the same value without changing the solution.

SOLVING equations part I Practice Problems

Solve each equation algebraically. Check your answers by inspection.

1. $x - 5 = 12$

2. $x - 3 = -4$

3. $x + 5 = 12$

4. $x + 5 = -4$

5. $\frac{x}{7} = 2$

6. $9x = -27$