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Multi-Step Equations

Properties of
Equality
Foldable

$$\begin{array}{r} \textcircled{1} \quad 5x + 2 = 27 \\ \quad \quad \underline{-2 \quad -2} \\ \quad \quad 5x = 25 \\ \quad \quad \underline{5 \quad 5} \\ \quad \quad \boxed{x = 5} \end{array}$$

$$\begin{array}{r} \textcircled{2} \quad 4 \cdot 16 = \frac{d - 12}{14} \cdot 14 \\ 224 = d - 12 \\ \underline{+12 \quad +12} \\ \boxed{236 = d} \end{array}$$

$$\textcircled{3} \quad 8 \cdot -4 = \frac{7x - (-1)}{-8} \cdot 8$$

$$\begin{array}{r} 32 = 7x \cdot (-1) \\ 32 = 7x + x \\ \underline{-1 \quad -1} \\ \frac{31}{7} = \frac{7x}{7} \end{array} \quad \boxed{x = \frac{31}{7}}$$

Multi-Step Equations: Steps

- 1) Distribute, if necessary.
- 2) Combine Like terms on same side, if necessary.
- 3) Move your variables to the left using inverse operations.
- 4) Move your constants to the right
- 5) Solve for your variable!!!

What is the solution of $5 = 5m - 23 + 2m$?

$$\begin{array}{r}
 5 = 5m - 23 \\
 +23 \quad \quad +23 \\
 \hline
 28 = 7m \\
 \frac{7}{7} \quad \frac{7}{7} \\
 \boxed{4 = m}
 \end{array}$$

Solving an Equation That Contains Fractions

④

$$\frac{3x}{4} - \frac{x}{3} = 10$$

$$12 \left(\frac{3x}{4} - \frac{x}{3} \right) = (10)12$$

$$9x - 4x = 120$$

$$\frac{5x}{5} = \frac{120}{5}$$

$$\boxed{x = 24}$$

* Multiply both sides of the equation by least common denominator.

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$$\begin{aligned}
 (5) \quad & 4(2r-8) = \frac{1}{4}(49r+70) \\
 & 8r-32 = 7r+10 \\
 & \begin{array}{r} -7r \\ \hline r-32 = 10 \\ \quad +32 \quad +32 \\ \hline \boxed{r = 42} \end{array}
 \end{aligned}$$

$$\begin{aligned}
 (6) \quad & \frac{1}{3}(18+12g) = 6(2g-7) \\
 & 6+4g = 12g-42 \\
 & \begin{array}{r|l} \downarrow -12g & -12g \downarrow \\ \hline 6-8g & -42 \\ \downarrow & -6 \\ \hline -8g & -48 \\ -8 & -8 \\ \hline & g = 6 \end{array}
 \end{aligned}$$

There are 3 types of Solutions:

Infinitely many, no Solution, and one Solution

One Solution: An equation that has only one possible value for the variable.
Ex. $x=2$

Infinitely Many Solutions (Identity Equation): The two sides of the equal sign must be the same. An equation that is true for every possible value of the variable.
Ex. $3=3$

No Solution: The two sides of the equal sign are not the same. There is no value of the variable that makes the equation true.

Ex. $4 \neq 5$

$$\begin{array}{l} \text{Ex. 1) } 4(t+20) = \frac{1}{5}(20t+400) \\ 4t+80 = 4t+80 \leftarrow \text{Identity Equation} \\ \hline 80 = 80 \checkmark \end{array}$$

Infinitely many solutions

$$\begin{array}{l} \text{Ex. 2) } 2m+5 = 5(m-7) - 3m \\ 2m+5 = 5m-35-3m \\ 2m+5 = 2m-35 \\ \hline 5 \neq -35 \end{array}$$

No solution