Solving Two-Step and Multi-Step Equations

Warm Up

Lesson Presentation

Lesson Quiz

Warm Up

Evaluate each expression.

1. $9 - 3(-2)$ 15

2. $3(-5 + 7)$ 6

3. $12\left(\dfrac{3 + (-7)}{12}\right)$ -4

4. $26 - 4(7 - 5)$ 18

Simplify each expression.

5. $10c + c$ $11c$

6. $8.2b + 3.8b - 12b$ 0

7. $5m + 2(2m - 7)$ $9m - 14$

8. $6x - (2x + 5)$ $4x - 5$

Example 1: Solving Two-Step Equations

Solve $18 = 4a + 10$.

$$18 = 4a + 10$$
$$\underline{-10 \qquad -10}$$
$$8 = 4a$$

$$\frac{8}{4} = \frac{4a}{4}$$

$$2 = a$$

First a is multiplied by 4. Then 10 is added. Work backward: Subtract 10 from both sides.

Since a is multiplied by 4, divide both sides by 4 to undo the multiplication.

Example 2: Solving Two-Step Equations

Solve 5t – 2 = –32.

$$5t - 2 = -32$$
$$\underline{+ 2 \quad\quad + 2}$$
$$5t \quad\quad = -30$$

First t is multiplied by 5. Then 2 is subtracted. Work backward: Add 2 to both sides.

$$\frac{5t}{5} = \frac{-30}{5}$$
$$t = -6$$

Since t is multiplied by 5, divide both sides by 5 to undo the multiplication.

Example 3: Solving Two-Step Equations That Contain Fractions

Solve $\dfrac{y}{8} - \dfrac{3}{4} = \dfrac{7}{12}$.

Method 1 Use fraction operations.

$$\dfrac{y}{8} - \dfrac{3}{4} = \dfrac{7}{12}$$

$$+\dfrac{3}{4} \quad +\dfrac{3}{4}$$

$$\dfrac{y}{8} = \dfrac{16}{12}$$

$$8\left(\dfrac{y}{8}\right) = 8\left(\dfrac{16}{12}\right)$$

Since $\dfrac{3}{4}$ is subtracted from $\dfrac{y}{8}$, add $\dfrac{3}{4}$ to both sides to undo the subtraction.

Since y is divided by 8, multiply both sides by 8 to undo the division.

Example 3 Continued

Solve $\dfrac{y}{8} - \dfrac{3}{4} = \dfrac{7}{12}$.

Method 1 Use fraction operations.

$$8\left(\dfrac{y}{8}\right) = 8\left(\dfrac{16}{12}\right)$$

$$y = \dfrac{8 \cdot 16}{12} \qquad \textit{Simplify.}$$

$$y = \dfrac{32}{3}$$

Example 4: Solving Two-Step Equations That Contain Fractions

Solve $\dfrac{2}{3}r + \dfrac{3}{4} = \dfrac{7}{12}$.

Method 1 Use fraction operations.

$$\frac{2}{3}r + \frac{3}{4} = \frac{7}{12}$$

Since $\dfrac{3}{4}$ is added to $\dfrac{2}{3}r$, subtract $\dfrac{3}{4}$ from both sides to undo the addition.

$$\frac{-\frac{3}{4} \quad -\frac{3}{4}}{\frac{2}{3}r = -\frac{1}{6}}$$

$$\left(\frac{3}{2}\right)\frac{2}{3}r = \left(\frac{3}{2}\right)\left(-\frac{1}{6}\right)$$

The reciprocal of $\dfrac{2}{3}$ is $\dfrac{3}{2}$. Since r is multiplied by $\dfrac{2}{3}$, multiply both sides by $\dfrac{3}{2}$.

Example 4 Continued

Solve $\dfrac{2}{3}r + \dfrac{3}{4} = \dfrac{7}{12}$.

Method 1 Use fraction operations.

$$\left(\dfrac{3}{2}\right)\dfrac{2}{3}r = \left(\dfrac{3}{2}\right)\left(-\dfrac{1}{6}\right)$$

$$r = -\dfrac{3 \cdot 1}{2 \cdot 6}$$

$$r = -\dfrac{1}{4}$$

Example 5: Simplifying Before Solving Equations

Solve $8x - 21 + 5x = -15$.

$8x - 21 - 5x = -15$

$8x - 5x - 21 = -15$ *Use the Commutative Property of Addition.*

$3x - 21 = -15$ *Combine like terms.*

$\underline{+ 21 \quad +21}$ *Since 21 is subtracted from 3x, add 21*

$3x = 6$ *to both sides to undo the subtraction.*

$$\frac{3x}{3} = \frac{6}{3}$$ *Since x is multiplied by 3, divide both sides by 3 to undo the multiplication.*

$x = 2$

Example 6

Solve $4(x - 2) + 2x = 40$

$$4(x - 2) + 2x = 40$$

$(4)(x) + (4)(-2) + 2x = 40$	*Distribute 4 on the left side.*
$4x - 8 + 2x = 40$	*Simplify.*
$4x + 2x - 8 = 40$	*Commutative Property of Addition.*
$6x - 8 = 40$	*Combine like terms.*
$\underline{+8 \quad +8}$	*Since 8 is subtracted from 6x, add 8 to both sides to undo the subtraction.*
$6x = 48$	
$\dfrac{6x}{6} = \dfrac{48}{6}$	*Since x is multiplied by 6, divide both sides by 6 to undo the multiplication.*
$x = 8$	