Solve One-Step Equations Using Inverse Properties of Subtraction and Division

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[Figure 1]

Jessica and Casey worked at a bakery during school vacation. One day Casey was asked to divide up many pounds of flour in order to prepare for their day of baking. She divided the amount she was given by three. Then she added four more pounds to one of these portions. Jessica was given the largest portion. If Jessica received 8 pounds of flour, how many pounds of flour did Casey begin with?

In this concept, you will solve equations involving the inverse properties of addition and division.

Inverse Properties of Adding and Dividing

To solve a two-step equation, you will need to use more than one inverse operation. When you perform inverse operations to find the value of a variable, you work to get the variable

alone on one side of the equals. This is called isolating the variable. It is one strategy for solving equations.

Let's look at an example.

Solve for c: $5 + \frac{c}{4} = 15$

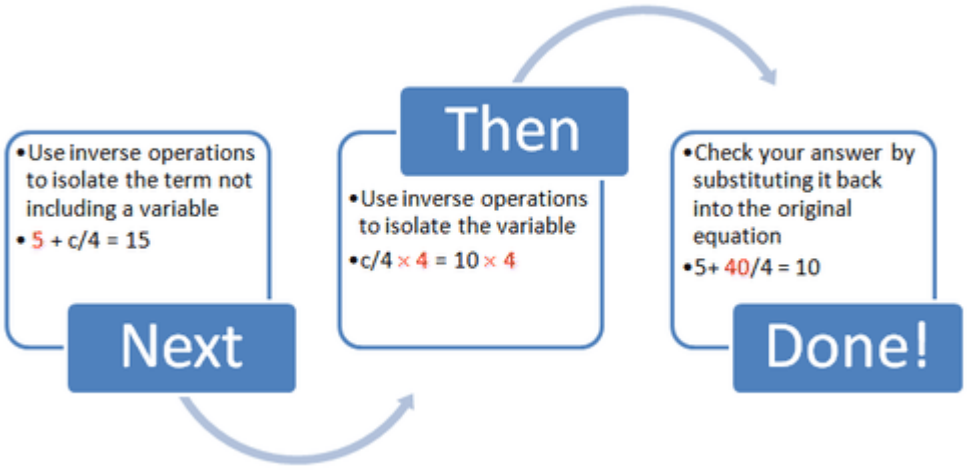
First, use the inverse operations to get the variable, $\frac{c}{4}$, by itself on the left side. Since 5 is being added to the variable, the inverse operation is subtraction.

$$\begin{aligned} 5 + \tfrac{c}{4} &= 15 \\ 5 - 5 + \tfrac{c}{4} &= 15 - 5 \\ \tfrac{c}{4} &= 10 \end{aligned}$$

Next, use inverse operations to isolate c. Since c is divided by 4, the inverse operation would be multiplication. The number 4 is $\frac{4}{1}$ which is the **multiplicative inverse** or the **reciprocal** of $\frac{1}{4}$. So the reciprocal of $\frac{1}{4}$ is $\frac{4}{1}$. When a number if multiplied by its reciprocal, the product is 1.

$$\begin{aligned} \tfrac{4}{1} \times \tfrac{1}{4}c &= \tfrac{10}{1} \times \tfrac{4}{1} \\ c &= 40 \end{aligned}$$

The answer is $c = 40$.



[Figure 2]

Examples

Example 1

Earlier, you were given a problem about Casey and her baking problem.

Casey divided the pounds of flour by three, but you don't know how many pounds she started with, so this is the variable.

First, let "x" be the number of pounds she started with such that the variable is $\frac{x}{3}$.

You know that Casey added four pounds to one of the portions, so $\frac{x}{3}+4$.

You also know that Jessica ended up with 8 pounds, so $\frac{x}{3}+4=8$.

Next, you can begin solving the equation. Start by subtracting four from both sides of the equation.

$$\frac{x}{3}+4-4 = 8-4$$

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

Then, use the inverse of division, multiplication, and multiply three times four.

$$\begin{aligned} \frac{3}{1} \times \frac{x}{3} &= \frac{4}{1} \times \frac{3}{1} \\ x &= 12 \end{aligned}$$

The answer is 12.

Casey started with 12 pounds of flour.

Example 2

$$\frac{y}{19} + 6 = 10$$

First, use the inverse operations to get the variable, $\frac{y}{19}$, by itself on the left side.

$$\begin{aligned} \frac{y}{19} + 6 &= 10 \\ \frac{y}{19} + 6 - 6 &= 10 - 6 \\ \frac{y}{19} &= 4 \end{aligned}$$

Next, use inverse operations to isolate y.

$$\begin{aligned} \frac{19}{1} \times \frac{1}{19} y &= \frac{4}{1} \times \frac{19}{1} \\ y &= 76 \end{aligned}$$

The answer is $y = 76$.

Example 3

$$\frac{y}{5} + 6 = 10$$

First, use the inverse operations to get the variable, $\frac{y}{5}$, by itself on the left side.

$$\begin{aligned} \frac{y}{5}+6 &= 10 \\ \frac{y}{5}+6-6 &= 10-6 \\ \frac{y}{5} &= 4 \end{aligned}$$

Next, use inverse operations to isolate "y".

$$\begin{aligned} \frac{5}{1} \times \frac{1}{5}y &= \frac{4}{1} \times \frac{5}{1} \\ y &= 20 \end{aligned}$$

The answer is $y = 20$.

Example 4

$\frac{a}{9}+12=28$

First, use the inverse operations to get the variable, $\frac{a}{9}$, by itself on the left side.

$$\begin{aligned} \frac{a}{9}+12 &= 28 \\ \frac{a}{9}+12-12 &= 28-12 \\ \frac{a}{9} &= 16 \end{aligned}$$

Next, use inverse operations to isolate "a".

$$\begin{aligned} \frac{9}{1} \times \frac{1}{9}a &= \frac{16}{1} \times \frac{9}{1} \\ a &= 144 \end{aligned}$$

The answer is $a = 144$.

Example 5

$$\frac{x}{11} + 12 = 18$$

First, use the inverse operations to get the variable, $\frac{x}{11}$, by itself on the left side.

$$\begin{aligned} \tfrac{x}{11} + 12 &= 18 \\ \tfrac{x}{11} + 12 - 12 &= 18 - 12 \\ \tfrac{x}{11} &= 6 \end{aligned}$$

Next, use inverse operations to isolate "x".

$$\begin{aligned} \tfrac{11}{1} \times \tfrac{1}{11} x &= \tfrac{6}{1} \times \tfrac{11}{1} \\ x &= 66 \end{aligned}$$

The answer is $x = 66$.

Review

Solve the following two-step equations that have addition and division in them.

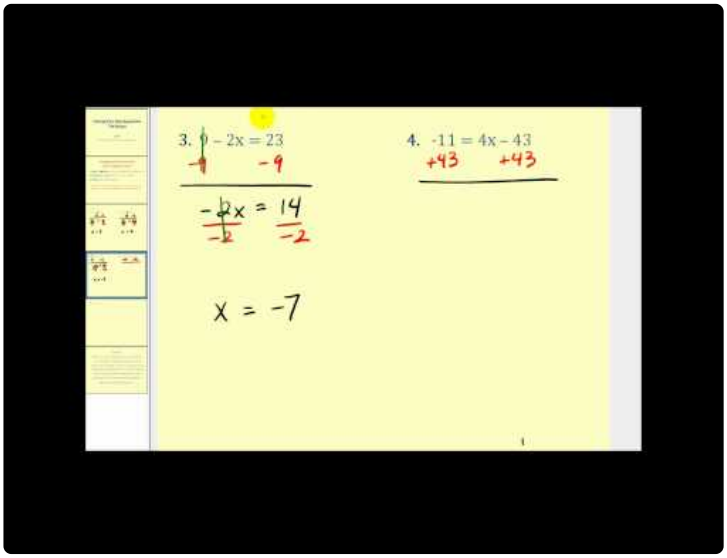
1. $\frac{x}{3} + 4 = 8$
2. $\frac{x}{5} + 8 = 10$
3. $\frac{a}{6} + 7 = 13$
4. $\frac{a}{9} + 4 = 30$
5. $\frac{b}{8} + 6 = 15$
6. $\frac{c}{12} + 9 = 18$

7. $\frac{x}{7} + 7 = 21$
8. $\frac{x}{11} + 5 = 12$
9. $\frac{x}{12} + 9 = 16$
10. $\frac{a}{14} + 6 = 8$
11. $\frac{x}{22} + 9 = 12$
12. $\frac{y}{2} + 14 = 18$
13. $\frac{x}{7} + 24 = 38$
14. $\frac{x}{8} + 15 = 30$
15. $\frac{x}{9} + 11 = 28$

Review (Answers)

To see the review answers, return to the Table of Contents and select 'Other Versions' or 'Resources'.

Resources



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