

2-8 Solving Equations: Undoing

Warm-up

Solve

1. $4a + 13 = 25$

Solution

$$4a + 13 = 25$$

$$\begin{array}{r} -13 \quad -13 \\ \hline 4a = 12 \end{array} \quad \text{Subtract 13 from each side}$$

$$\frac{4a}{4} = \frac{12}{4}$$

$$\frac{4}{4} \quad \frac{12}{4} \quad \text{Divide both sides by 4}$$

$$a = 3$$

Check your answer

$$4(3) + 13 = 25 \quad \text{Substitute (3) in for } a \text{ into the original equation}$$

$$12 + 13 = 25$$

$$25 = 25 \quad \text{Yes, } a = 3$$

2. $m + m + 7 = 15$

Solution

$$m + m + 7 = 15$$

$$2m + 7 = 15 \quad \text{Combine like terms}$$

$$\begin{array}{r} -7 \quad -7 \\ \hline 2m = 8 \end{array} \quad \text{Subtract 7 from each side}$$

$$\frac{2m}{2} = \frac{8}{2}$$

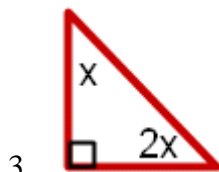
$$\frac{2}{2} \quad \frac{8}{2} \quad \text{Divide both sides by 2}$$

$$m = 4$$

Check your answer

$$4 + 4 + 7 = 15 \quad \text{Substitute 4 in for } m \text{ into the original equation}$$

$$15 = 15 \quad \text{Yes, } m = 4$$



Solution

Triangle angles add to 180°

$$90 + x + 2x = 180$$

$$90 + 3x = 180 \quad \text{Combine like terms}$$

$$\begin{array}{r} -90 \quad -90 \\ \hline 3x = 90 \end{array} \quad \text{Subtract 90 from both sides}$$

$$\frac{3x}{3} = \frac{90}{3}$$

$$\frac{3}{3} \quad \frac{90}{3} \quad \text{Divide both sides by 3}$$

$$x = 30$$

$$x = 30 \text{ and } 2x = 60$$

More practice writing and solving equations today!

If you divide a number by 3 and subtract 64, you get 76. What is the number?

Solution

Start with 76 Working backwards

Add 64 undo subtracting 64 by adding 64

$$76 + 64 = 140$$

$140 \cdot 3 = 420$ Multiply by 3 (undo dividing by 3 by multiplying by 3)

Check your answer

$$\frac{420}{3} - 64 = 76 \quad \checkmark$$

This method of solving is called solving by undoing or solving by inverse operations.

- Subtraction is the inverse operation for addition.
- Division is the inverse operation for multiplication.

Examples – Solve the equations

1. $\frac{a}{5} = 75$

Solution

$$\frac{a}{5} = 75$$

$5 \cdot \frac{a}{5} = 75 \cdot 5$ undo division by 5 by multiplying by 5

$$a = 375$$

Check your answer

$$\frac{375}{5} = 75$$

$75 = 75$ Yes, $a = 375$

2. $\frac{x}{2} - 3 = 9$

Solution

$$\frac{x}{2} - 3 = 9$$

$\frac{x}{2} \quad +3 \quad +3$ Add 3 to each side. Undo subtraction by addition.

$$\frac{x}{2} = 12$$

$2 \cdot \frac{x}{2} = 12 \cdot 2$ Multiply each side by 2. Undo division by multiplication.

$$x = 24$$

Check your answer

$$\frac{24}{2} - 3 = 9$$

$$12 - 3 = 9$$

$$9 = 9$$

3. $4x - 7 = 45$ Solution: $x = 13$

4. $-2y + 6 = 0$ Solution: $y = 3$

5. $4n + 6n = 80$ Solution: $n = 8$

Plug 24 into x in the original equation. Yes, $x = 24$ is correct.

Writing and solving equations

6. The total cost for 3 lb. of grapes and a 98¢ melon is \$2.75. How much do the grapes cost per pound?

Solution

Write and solve an equation.

Let g = cost per pound for grapes.

cost of grapes + cost of melon = total cost

$$3g + 0.98 = 2.75$$

$$\begin{array}{r} 3g + 0.98 = 2.75 \\ -0.98 \quad -0.98 \\ \hline 3g = 1.77 \end{array}$$

undo the addition of 0.98 by subtracting 0.98 from each side

$$3g = 1.77$$

$$3 = 3$$

$$g = 0.59$$

undo multiplication by 3 by dividing each side by 3

The grapes cost 59¢ per pound.

7. Taylor's lunch cost her \$4.80. This amount included the price of the lunch and 5% sales tax and a tip of 15% of the price of the lunch. What was the price of her lunch?

Solution

Write and solve an equation.

Let p = price of her lunch.

price of lunch + tax + tip = total cost

$$p + 0.05p + 0.15p = 4.80$$

$$1.20p = 4.80$$

$$1.20 = 1.20$$

$$p = 4.00$$

Combine like terms.

undo multiplication by 1.20 by dividing each side by 1.20

Taylor's lunch was \$4.00 before tax and tip.

8. Jessie and 2 friends want to rent an apartment. They will split the rent evenly. Jessie figures that food will cost her \$225 per month. She only has \$400 a month to spend on food and rent. How much will rent have to be for it to fit into Jessie's budget?

Solution

Write and solve an equation.

Let R = rent

Rent + food = total cost

$$\begin{array}{r} R + 225 = 400 \\ \hline \end{array} \quad \text{Divide Rent by 3 because there are 3 renters.}$$

$$\begin{array}{r} -225 \quad -225 \\ \hline \end{array} \quad \text{Subtract 225 from each side}$$

$$3 \cdot \frac{R}{3} = 175 \cdot 3 \quad \text{Multiply each side by 3}$$

$$R = 525$$

Rent will have to be \$525.

9. Rosalie spent \$4.72 to buy and mail eight postcards. The total cost of the stamps was \$1.52. How much did she pay for each postcard?

Solution

Write and solve an equation.

Let p = the cost for a postcard

$$8p + 1.52 = 4.72$$

$$8p + 1.52 = 4.72 \quad \text{Subtract 1.52 from each side.}$$

$$\begin{array}{r} -1.52 \quad -1.52 \\ \hline \end{array}$$

$$\frac{8p}{8} = \frac{3.2}{8} \quad \text{Divide each side by 8}$$

$$p = 0.40$$

The postcards cost 40¢ each.

Check your answer

$$8(.40) + 1.52 = 4.72 \quad \checkmark \text{ Plug .40 into the original equation.}$$

10. Zach took 3.5 hours to mow the Smith's lawn and 1.5 hours to mow the Jone's lawn. He charged the same amount per hour for each job. In all, he earned \$39. What did he charge per hour for this work?

Solution

Write and solve an equation.

Let c = cost per hour

$$3.5c + 1.5c = 39$$

$$\frac{5c}{5} = \frac{39}{5}$$

Combine like terms

$$\frac{5c}{5} = \frac{39}{5}$$

Divide each side by 5

$$c = 7.80$$

Zach charged \$7.80 per hour.

Check your answer

$$3.5(7.8) + 1.5(7.8) = \checkmark$$

11. Some generous person likes to pick apples but doesn't much enjoy eating them. So she picks a sack full of apples and then proceeds to give most of them away. Each person who receives apples gets a whole number of apples; no apples are cut. She does this in the following way: The first person she meets gets half the apples in the sack. The second person gets half the remaining apples. The third person gets half the remaining apples. The fourth person gets half the remaining apples. The generous person has one apple left. How many apples were in the sack?
- o This puzzle can be solved by working backward, undoing the process of giving away the apples.

Solve in notes

1. $4x - 6 = 36$
2. $-2y + 6 = 0$
3. $4n + 6n = 80$
4. $\frac{m}{3} - 10 = 1$

Homework

- Read pg. 105-108
- Pg. 108 #15-22
- Practice 16 #1-31