

1-11 Solving Equations by Multiplying and Dividing

Learn to solve one-step equations by using multiplication or division.

Vocabulary

Multiplication Property of Equality
Division Property of Equality

Like addition and subtraction, multiplication and division are inverse operations. They “undo” each other.

$$2 \cdot 5 = 10$$

$$10 \div 5 = 2$$

MULTIPLICATION PROPERTY OF EQUALITY		
Words	Numbers	Algebra
You can multiply both sides of an equation by the same number, and the statement will still be true.	$3 \cdot 4 = 12$ $2 \cdot 3 \cdot 4 = 2 \cdot 12$ $6 \cdot 4 = 24$	$x = y$ $zx = zy$

If a variable is divided by a number, you can often use multiplication to isolate the variable. Multiply both sides of the equation by the number.

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Solving Equations by Multiplying and Dividing

Additional Example 1: Using the Division Property of Equality

Solve the equation $\frac{h}{2} = 13$. Check your answer.

$$\frac{h}{2} = 13$$

$$(2)\frac{h}{2} = 13(2)$$

$$h = 26$$

*Think: h is **divided** by 2, so **multiply** both sides by 2 to isolate h .*

Check

$$\frac{h}{2} = 13$$

$$\frac{26}{2} \stackrel{?}{=} 13$$

$$13 \stackrel{?}{=} 13 \checkmark$$

Substitute 26 for h .

26 is a solution.

Check It Out: Example 1

Solve the equation $\frac{x}{5} = 30$. Check your answer.

$$\frac{x}{5} = 30$$

$$(5)\frac{x}{5} = 30(5)$$

$$x = 150$$

*Think: x is **divided** by 5, so **multiply** both sides by 5 to isolate x .*

Check

$$\frac{x}{5} = 30$$

$$\frac{150}{5} \stackrel{?}{=} 30$$

$$30 \stackrel{?}{=} 30 \checkmark$$

Substitute 150 for x .

150 is a solution.

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Solving Equations by Multiplying and Dividing

DIVISION PROPERTY OF EQUALITY

Words	Numbers	Algebra
You can divide both sides of an equation by the same nonzero number, and the statement will still be true.	$5 \cdot 6 = 30$ $\frac{5 \cdot 6}{3} = \frac{30}{3}$ $5 \cdot \frac{6}{3} = 10$ $5 \cdot 2 = 10$	$x = y$ $\frac{x}{z} = \frac{y}{z}$ $z \neq 0$

If a variable is multiplied by a number, you can often use division to isolate the variable. Divide both sides of the equation by the number.

Additional Example 2: Solving an Equation by Division

Solve the equation $51 = 17x$. Check your answer.

$$51 = 17x$$

$$\frac{51}{17} = \frac{17x}{17}$$

$$3 = x$$

*Think: x is **multiplied** by 17, so **divide** both sides by 17 to isolate x .*

Check

$$51 = 17x$$

$$51 \stackrel{?}{=} 17(3)$$

$$51 \stackrel{?}{=} 51 \checkmark$$

Substitute 3 for x .

3 is a solution.

Check It Out: Example 2

Solve the equation $76 = 19y$. Check your answer.

$$76 = 19y$$

$$\frac{76}{19} = \frac{19y}{19}$$

$$4 = y$$

Think: y is **multiplied** by 19, so **divide** both sides by 19 to isolate y .

Check

$$76 = 19y$$

$$76 \stackrel{?}{=} 19(4)$$

$$76 \stackrel{?}{=} 76 \checkmark$$

Substitute 4 for y .
4 is a solution.

Additional Example 3: *Health Application*

Trevor's heart rate is 78 beats per minute. How many times does his heart beat in 10 seconds?

Use the given information to write an equation, where b is the number of heart beats in 10 seconds.

If you count your heart beats for 10 seconds and then multiply that by 6, you can find your heart rate in beats per minute.

Additional Example 3 Continued

Beats in 10s **times 6** = **beats per minutes**

$$b \quad \cdot \quad 6 \quad = \quad 78$$

$$6b = 78$$

$$\frac{6b}{6} = \frac{78}{6}$$

$$b = 13$$

*Think: b is **multiplied** by 6, so **divide** both sides by 6 to isolate b .*

Trevor's heart beats 13 times 10 seconds.

Check It Out: Example 3

During a stock car race, one driver is able to complete 68 laps in 1 hour. How many laps would he finish in 15 minutes?

Use the given information to write an equation, where n is the number of laps completed in 15 minutes.

If you count the number of laps in 15 minutes and multiply by 4, you can find the number of laps completed in 1 hour.

Check It Out: Example 3 Continued

Laps in 15 min *times 4* = *Laps in 1 hour*

$$n \qquad \cdot \qquad 4 \qquad = \qquad 68$$

$$4n = 68$$

$$\frac{4n}{4} = \frac{68}{4}$$

$$n = 17$$

*Think: L is **multiplied** by 4, so **divide** both sides by 4 to isolate n.*

The driver would complete 17 laps in 15 minutes.