

# Chapter 36

## SOLVING FOR VARIABLES

Often, we are not given a number to substitute for the variable. This is when we must "solve for the unknown," or "solve for  $x$ ."



Solving an equation is like asking, "Which value makes this equation true?"

In order to do so, we must **ISOLATE THE VARIABLE** on one side of the equal sign.

**EXAMPLE:**  $x + 7 = 13$

In order to isolate the variable ( $x$ ) on one side of the equal sign, we must:

1. Think of an equation as a scale, with the  $=$  sign as the middle. You must keep the scale balanced at all times.



2. Ask yourself, "What is happening to this variable?"  
In this case, 7 is being added to the variable.

3. So, how do we get the variable alone? We use **INVERSE OPERATIONS** on both sides of the equation.  
What is the inverse of adding 7? Subtracting 7.

WHEN YOU SEE THE WORD **INVERSE**,  
THINK ABOUT OPPOSITES!

$$x + 7 = 13$$

$$x + \cancel{7} - \cancel{7} = 13 - 7$$

$$x = 6$$

(We subtract 7 from both sides  
to keep the equation balanced.)

### CHECK YOUR WORK

$$x + 7 = 13$$

$$6 + 7 = 13$$

$$13 = 13 \quad \checkmark$$

Check your work by  
plugging your answer into  
the original equation.

Inverse is just another word for *opposite*. Here's a quick  
rundown of all the operations and their inverse operations:

OPERATION	INVERSE
Addition	Subtraction
Subtraction	Addition
Multiplication	Division
Division	Multiplication
Squaring (exponent of 2)	Square root ( $\sqrt{\quad}$ )
Cubing (exponent of 3)	Cube root ( $\sqrt[3]{\quad}$ )

**EXAMPLE:** Solve for  $m$ :  $m - 9 = -13$ .

$$m - 9 = -13$$

(What is happening to the  $m$ ? The 9 is being subtracted from  $m$ . What is the inverse of subtraction? Addition!)

$$m - \cancel{9} + \cancel{9} = -13 + 9$$

$$m = -4$$

### CHECK YOUR WORK

$$m - 9 = -13$$

$$-4 - 9 = -13$$

$$-13 = -13 \quad \checkmark$$

Plug your answer ( $m = -4$ ) into the original equation.

**EXAMPLE:** Solve for  $f$ :  $-3f = 39$ .

$$-3f = 39$$

(What is the inverse of multiplication? Division.)

$$\frac{-3f}{-3} = \frac{39}{-3}$$

$$f = -13$$

Don't forget that in order to keep the equation balanced, whatever you do to one side, you **MUST** also do to the other side.

### CHECK YOUR WORK

$$-3f = 39$$

$$-3(-13) = 39$$

$$39 = 39 \quad \checkmark$$

**EXAMPLE:** Solve for  $y$ :  $\frac{y}{4} = -19$ .

$$\frac{y}{4} = -19$$

(What is the inverse of division? Multiplication.)

$$\cancel{4} \times \frac{y}{\cancel{4}} = -19 \times 4$$

$$y = -76$$

**CHECK YOUR WORK**

$$\frac{y}{4} = -19$$

$$\frac{-76}{4} = -19$$

$$-19 = -19 \quad \checkmark$$

**EXAMPLE:** Solve for  $g$ :  $g^2 = 121$ .

$$g^2 = 121$$

(What is the inverse of squaring?

$$\sqrt{g^2} = \sqrt{121}$$

Finding the square root.)

$$g = \pm 11$$

**CHECK YOUR WORK**

$$g^2 = 121$$

$$11^2 = 121$$

$$121 = 121 \quad \checkmark$$

and

$$g^2 = 121$$

$$(-11)^2 = 121$$

$$121 = 121 \quad \checkmark$$



# CHECK YOUR KNOWLEDGE

Solve for each variable.

1.  $x + 14 = 22$

2.  $7x = -35$

3.  $y + 19 = 24$

4.  $x - 11 = 8$

5.  $-7 + m = -15$

6.  $-6r = 72$

7.  $-74 = -2w$

8.  $\frac{v}{7} = -6$

9.  $\frac{x}{-12} = -14$

10.  $h^2 = 169$

ANSWERS

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# CHECK YOUR ANSWERS



1.  $x = 8$

2.  $x = -5$

3.  $y = 5$

4.  $x = 19$

5.  $m = -8$

6.  $r = -12$

7.  $w = 37$

8.  $v = -42$

9.  $x = 168$

10.  $h = \pm 13$