

Chapter 35

EQUATIONS

An **EQUATION** is a mathematical sentence with an equal sign. To solve an equation, we find the missing number, or variable, that makes the sentence true. This number is called the **SOLUTION**.

EXAMPLE: Is $x = 8$ the solution for $x + 12 = 20$?

$$8 + 12 = 20 \quad (\text{Rewrite the equation and substitute } 8 \text{ for } x.)$$

$$20 = 20$$

Both sides are the same, so the solution ($x = 8$) makes the sentence true.

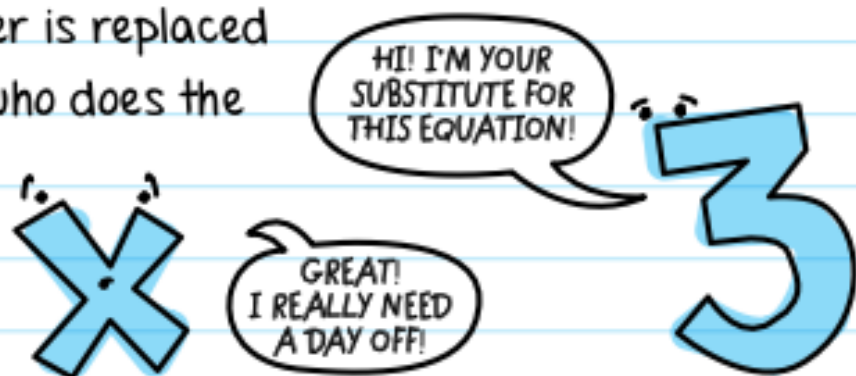
EXAMPLE: Is -6 the solution to $3x = 18$?

$$3(-6) = 18$$

$$-18 \neq 18$$

Both sides are NOT the same, so -6 is NOT the solution!

EVALUATION is the process of simplifying a mathematical expression by first **SUBSTITUTING** (replacing) a variable with a number, and then solving the expression using order of operations—kind of like when you have a substitute teacher. Your teacher is replaced by somebody else who does the same function.



EXAMPLE: Evaluate $x+1$ when $x=3$.

$$3+1=4$$

(Because we know $x=3$, we can take the x out and replace it with 3.)

EXAMPLE: Evaluate $3y-6$ when $y=8$.

$3 \cdot 8 - 6$ (Because we know $y=8$, we substitute y with 8. Then, we follow order of operations: In this case, we multiply first.)

$$= 24 - 6$$

$$= 18$$

If there are two or more variables, we follow the same steps: substitute and solve!

EXAMPLE: Evaluate $4x - 7m$ when $x = 6$ and $m = 4$

$$\begin{aligned} &4 \cdot 6 - 7 \cdot 4 \\ &= 24 - 28 \\ &= -4 \end{aligned}$$

EXAMPLE: Evaluate $\frac{8y+z}{6-x}$ when $y = 3$; $z = -2$; $x = -5$.

$$\begin{aligned} &\frac{8 \cdot 3 + (-2)}{6 - (-5)} \\ &= \frac{24 + (-2)}{6 - (-5)} \\ &= \frac{22}{11} \\ &= 2 \end{aligned}$$

HINT: When variables are in a numerator or denominator, first simplify the entire top, then simplify the entire bottom, then you can divide the numerator by the denominator. Think about the fraction bar like a grouping symbol.

Independent and Dependent Variables

There are different types of variables that can appear in an equation:

The variable you are substituting for is called the **INDEPENDENT VARIABLE**.

The other variable (that you solve for) is called the **DEPENDENT VARIABLE**.

Just remember: The dependent variable depends on the independent variable!

EXAMPLE: Solve for y in the expression $y = 5x + 3$ when $x = 4$.

$y = 5 \cdot 4 + 3$ (The variable x is the independent variable, and y is the dependent variable.)

$$y = 20 + 3$$

$$y = 23$$

CHECK YOUR WORK

$$y = 5x + 3$$

$$23 = 5(4) + 3$$

$$23 = 20 + 3$$

$$23 = 23 \quad \checkmark$$

The answer is correct!

If you're unsure of your answer, go back to the original equation and insert both values for the variables, making sure both sides are equal.



CHECK YOUR KNOWLEDGE

1. Evaluate $x+6$ when $x=7$.
2. Evaluate $3m-5$ when $m=9$.
3. Evaluate $7b-b$ when $b=4$.
4. Evaluate $9x-y$ when $x=6$ and $y=3$.
5. Evaluate $-5m-2n$ when $m=6$ and $n=-2$.

For 6 through 10, solve for y in each expression.

6. $y=7-x$ when $x=-1$
7. $y=19x$ when $x=2$
8. $y=-22t^2$ when $t=5$
9. $y=\frac{175}{x+2}$ when $x=17$ and $z=8$
10. $y=j(11+k)^2$ when $j=-4$ and $k=1$

ANSWERS

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CHECK YOUR ANSWERS



1. 13

2. 22

3. 24

4. 51

5. -26

6. $y = 8$

7. $y = 38$

8. $y = -550$

9. $y = 7$

10. $y = -576$