

1-3 Solving Equations

Write an algebraic expression to represent each verbal expression.

1. the product of 12 and the sum of a number and negative 3

SOLUTION:

Let x be the number.

The sum of x and negative 3 is $x + (-3)$.

The product of 12 and the sum of x and negative 3 is $12[x + (-3)]$.

Write a verbal sentence to represent each equation.

3. $5x + 7 = 18$

SOLUTION:

The sum of five times a number and 7 equals 18.

5. $5y - y^3 = 12$

SOLUTION:

The difference between five times a number and the cube of that number is 12.

Name the property illustrated by each statement.

7. $(8x - 3) + 12 = (8x - 3) + 12$

SOLUTION:

Reflexive Property; the Reflexive Property of Equality states that for any real number a , $a = a$.

Solve each equation. Check your solution.

9. $z - 19 = 34$

SOLUTION:

$$z - 19 = 34$$

$$z - 19 + 19 = 34 + 19$$

$$z = 53$$

Substitute $z = 53$ in the equation.

$$53 - 19 = 34$$

$$34 = 34 \quad \checkmark$$

Therefore, the solution is $z = 53$.

11. $-y = 8$

SOLUTION:

$$-y = 8$$

$$y = -8$$

Substitute $y = -8$ in the equation.

$$-(-8) = 8$$

$$8 = 8 \quad \checkmark$$

So, the solution is $y = -8$.

13. $5x - 3 = -33$

SOLUTION:

$$5x - 3 = -33$$

$$5x - 3 + 3 = -33 + 3$$

$$5x = -30$$

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

$$x = -6$$

Substitute $x = -6$ in the equation.

$$5(-6) - 3 = -33$$

$$-30 - 3 = -33$$

$$-33 = -33 \quad \checkmark$$

So, the solution is $x = -6$.

15. $3(2a + 3) - 4(3a - 6) = 15$

SOLUTION:

$$3(2a + 3) - 4(3a - 6) = 15$$

$$6a + 9 - 12a + 24 = 15$$

$$-6a + 33 = 15$$

$$-6a = -18$$

$$a = 3$$

Substitute $a = 3$ in the equation.

$$3(2(3) + 3) - 4(3(3) - 6) = 15$$

$$3(6 + 3) - 4(9 - 6) = 15$$

$$15 = 15 \quad \checkmark$$

So, the solution is $a = 3$.

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17. $-3(-2x + 20) + 8(x + 12) = 92$

SOLUTION:

$$-3(-2x + 20) + 8(x + 12) = 92$$

$$6x - 60 + 8x + 96 = 92$$

$$14x + 36 = 92$$

$$14x = 56$$

$$x = 4$$

Substitute $x = 4$ in the equation.

$$-3(-2(-4) + 20) + 8(4 + 12) \stackrel{?}{=} 92$$

$$-3(12) + 8(16) \stackrel{?}{=} 92$$

$$92 = 92 \quad \checkmark$$

So, the solution is $x = 4$.

Solve each equation or formula for the specified variable.

19. $8r - 5q = 3$, for q

SOLUTION:

$$8r - 5q = 3$$

$$-8r + 8r - 5q = 3 - 8r$$

$$-5q = 3 - 8r$$

$$\frac{-5q}{-5} = \frac{3 - 8r}{-5}$$

$$q = \frac{8r - 3}{5}$$

21. **MULTIPLE CHOICE** If $\frac{y}{5} + 8 = 7$, what is the

value of $\frac{y}{5} - 2$?

A -10

B -3

C 1

D 5

SOLUTION:

$$\frac{y}{5} + 8 = 7$$

$$\frac{y}{5} + 8 - 8 = 7 - 8$$

$$\frac{y}{5} = -1$$

$$\frac{y}{5} - 2 = -1 - 2$$

$$\frac{y}{5} - 2 = -3$$

The correct choice is B.

Write an algebraic expression to represent each verbal expression.

23. the product of the square of a number and 8

SOLUTION:

Let the number be x .

The square of x is x^2 .

The algebraic expression is $8x^2$.

25. five more than the quotient of a number and 4

SOLUTION:

Let the number be x . The quotient of x and 4 is $\frac{x}{4}$.

Five more than $\frac{x}{4}$ is $\frac{x}{4} + 5$.

Write a verbal sentence to represent each equation.

27. $\frac{x+3}{4} = 5$

SOLUTION:

The quotient of the sum of 3 and a number and 4 is 5.

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29. **BASEBALL** During a recent season, Miguel Cabrera and Mike Jacobs of the Florida Marlins hit a combined total of 46 home runs. Cabrera hit 6 more home runs than Jacobs. How many home runs did each player hit? Define a variable, write an equation, and solve the problem.

SOLUTION:

n = number of home runs Jacobs hit.
Cabrera hit 6 more home runs than Jacobs. The keyword 'more than' mean addition.
So, number of home runs Cabrera hit = $n + 6$.
Total number of home runs is 46.
Therefore:

$$\begin{aligned}n + n + 6 &= 46 \\2n + 6 &= 46 \\2n &= 40 \\n &= 20\end{aligned}$$

Jacobs hit 20 home runs and Cabrera hit 26 home runs.

Name the property illustrated by each statement.

31. If $y = -3$, then $7y = 7(-3)$

SOLUTION:

Substitution Property of Equality; the Substitution Property of Equality states that if $a = b$, then a may be replaced by b and b may be replaced by a .

33. If $-y = 13$, then $-(-y) = -13$

SOLUTION:

Multiplication Property of Equality; this states that for any real numbers a , b , and c , $c \neq 0$, if $a = b$, then $a \cdot c = b \cdot c$.

44. **MEDICINE** For Nina's illness her doctor gives her a prescription for 28 pills. The doctor says that she should take 4 pills the first day and then 2 pills each day until her prescription runs out. For how many days does she take 2 pills?

SOLUTION:

Let x be the number of days Nina takes 2 pills.
Total number of pills = 28.

So:

$$\begin{aligned}4 + 2x &= 28 \\-4 + 4 + 2x &= -4 + 28 \\2x &= 24 \\\frac{2x}{2} &= \frac{24}{2} \\x &= 12\end{aligned}$$

Nina takes 2 pills a day for 12 days.

Solve each equation or formula for the specified variable.

45. $E = mc^2$, for m

SOLUTION:

$$\begin{aligned}E &= mc^2 \\\frac{E}{c^2} &= \frac{mc^2}{c^2} \\\frac{E}{c^2} &= m\end{aligned}$$

46. $c(a + b) - d = f$, for a

SOLUTION:

$$\begin{aligned}c(a + b) - d &= f \\ca + cb - d &= f \\ca + cb &= f + d \\ca &= f + d - cb \\a &= \frac{f + d - cb}{c} \\&= \frac{f + d}{c} - b\end{aligned}$$

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47. $z = \pi q^3 h$ for h

SOLUTION:

$$z = \pi q^3 h$$

$$\frac{z}{\pi q^3} = \frac{\pi q^3 h}{\pi q^3}$$

$$\frac{z}{\pi q^3} = h$$

48. $\frac{x+y}{z} - a = b$, for y

SOLUTION:

$$\frac{x+y}{z} - a = b$$

$$\frac{x+y}{z} = a+b$$

$$x+y = z(a+b)$$

$$y = z(a+b) - x$$

62. **ERROR ANALYSIS** Steven and Jade are solving

$A = \frac{1}{2}h(b_1 + b_2)$ for b_2 . Is either of them correct?

Explain your reasoning.

<p>Steven</p> $A = \frac{1}{2}h(b_1 + b_2)$ $\frac{2A}{h} = (b_1 + b_2)$ $\frac{2A - b_1}{h} = b_2$	<p>Jade</p> $A = \frac{1}{2}h(b_1 + b_2)$ $\frac{2A}{h} = (b_1 + b_2)$ $\frac{2A}{h} - b_1 = b_2$
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SOLUTION:

Sample answer: Jade; in the last step, when Steven subtracted b_1 from each side, he mistakenly put the $-$ b_1 in the numerator instead of after the entire fraction. To solve for b_2 , b_1 must be subtracted from each side.