

Solve Equations with the Distributive Property and Combining Like Terms

Jen Kershaw
Brenda Meery

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AUTHORS

Jen Kershaw

Brenda Meery



Multi-Step Equations

Maintain balance of an equation throughout all steps needed to solve.

Solve Equations with the Distributive Property and Combining Like Terms



[Figure1]

Eight children were given some candy. Then six different children were given the same unknown amount of candy. Next, two children were that same unknown amount of candy plus three additional pieces of candy. The total number of pieces of candy given out was thirty eight. What is the unknown amount of candy?

In this concept, you will learn to solve equations with the distributive property and combining.

Distributive Property and Combining Like Terms

To solve some [multi-step equations](#) you will need to use the distributive property and combine like terms. When this happens, you will see that there is more than one term with the same variable or there is more than one number in the equation. You always want to combine everything that you can before moving on to solving the equation.

Let's apply this to the following situation.

Solve for " m " in the following equation.

$$6(1 + 2m) - 3m = 24$$

First, apply the distributive property to the left side of the equation. Multiply each of the two numbers inside the parentheses by 6 and then add those products.

$$\begin{aligned} 6(1 + 2m) - 3m &= 24 \\ (6 \times 1) + (6 \times 2m) - 3m &= 24 \\ 6 + 12m - 3m &= 24 \end{aligned}$$

Next, combine like terms ($12m$ and $3m$) on the left side of the equation.

$$\begin{aligned} 6 + 12m - 3m &= 24 \\ 6 + (12 - 3m) &= 24 \\ 6 + 9m &= 24 \end{aligned}$$

Then, solve as you would solve any two-step equation. Subtract 6 from both sides of the equation.

$$\begin{aligned} 6 + 9m &= 24 \\ 6 - 6 + 9m &= 24 - 6 \\ 9m &= 18 \end{aligned}$$

Then, divide both sides of the equation by 9 to solve for m .

$$\begin{aligned} 9m &= 18 \\ \frac{9m}{9} &= \frac{18}{9} \\ m &= 2 \end{aligned}$$

The answer is 2.

Here is another example.

Solve for “ b ” in the following equation.

$$-4(2 + 3b) + 5b = 13$$

First, apply the distributive property to the left side of the equation. Multiply each of the two numbers inside the parentheses by -4 and then add those products.

$$\begin{aligned} -4(2 + 3b) + 5b &= 13 \\ (-4 \times 2) + (-4 \times 3b) + 5b &= 13 \\ -8 + (-12b) + 5b &= 13 \end{aligned}$$

Next, add the like terms on the left side of the equation. To add those like terms, $-12b$ and $5b$, you will need to use what you know about adding integers.

$$\begin{aligned} -8 + (-12b) + 5b &= 13 \\ -8 + (-12b + 5b) &= 13 \\ -8 + (-7b) &= 13 \end{aligned}$$

Then, solve as you would solve any two-step equation. Since -8 is added to $(-7b)$, you can subtract -8 from both sides of the equation to solve it.

$$\begin{aligned} -8 + (-7b) &= 13 \\ -8 - (-8) + (-7b) &= 13 - (-8) \\ (-8 + 8) + (-7b) &= 13 + 8 \\ -7b &= 21 \end{aligned}$$

Then, divide both sides of the equation by -7.

$$\begin{aligned} -7b &= 21 \\ \frac{-7b}{-7} &= \frac{21}{-7} \\ b &= -3 \end{aligned}$$

The answer is -3.

Examples

Example 1

Earlier, you were given a problem about eight children who were given some candy. You will let “ c ” represent the unknown amount of candy given.

Six of the eight children were given the same unknown amount of candy ($6c$) and two of the children were that same unknown amount of candy plus three additional pieces of candy ($2(c + 3)$). The total number of pieces of candy given out was thirty eight.

First, write an equation.

$$6c + 2(c + 3) = 38$$

First, apply the distributive property to the left side of the equation.

$$\begin{aligned}6c + 2(c + 3) &= 38 \\6c + (2 \times c) + (2 \times 3) &= 38 \\6c + 2c + 6 &= 38\end{aligned}$$

Next, add the like terms on the left side of the equation.

$$\begin{aligned}6c + 2c + 6 &= 38 \\(6c + 2c) + 6 &= 38 \\8c + 6 &= 38\end{aligned}$$

Then, subtract 6 from both sides.

$$\begin{aligned}8c + 6 &= 38 \\8c + 6 - 6 &= 38 - 6 \\8c &= 32\end{aligned}$$

Then, divide both sides of the equation by 8.

$$\begin{aligned} 8c &= 32 \\ \frac{8c}{8} &= \frac{32}{8} \\ c &= 4 \end{aligned}$$

The answer is 4.

Therefore, the unknown amount of candy is 4 pieces. Six of the children got 4 pieces of candy and two of the children received 7 pieces of candy.

Example 2

Solve for “ x ” in the following equation.

$$-5x + 3(x + 1) - 4x = 45$$

First, apply the distributive property to the left side of the equation.

$$\begin{aligned} -5x + 3(x + 1) - 4x &= 45 \\ -5x + (3 \times x) + (3 \times 1) - 4x &= 45 \\ -5x + 3x + 3 - 4x &= 45 \end{aligned}$$

Next, add the like terms on the left side of the equation.

$$\begin{aligned} -5 + 3x + 3 - 4x &= 45 \\ (-5x + 3x - 4x) + 3 &= 45 \\ 3 - 6x &= 45 \end{aligned}$$

Then, subtract 3 from both sides.

$$\begin{aligned} 3 - 6x &= 45 \\ 3 - 3 - 6x &= 45 - 3 \\ -6x &= 42 \end{aligned}$$

Then, divide both sides of the equation by -6.

$$\begin{aligned} -6x &= 42 \\ \frac{-6x}{-6} &= \frac{42}{-6} \\ x &= -7 \end{aligned}$$

The answer is -7.

Example 3

Solve for “ x ” in the following equation.

$$6(x + 4) + 3x - 2 = 58$$

First, apply the distributive property to the left side of the equation.

$$\begin{aligned} 6(x + 4) + 3x - 2 &= 58 \\ (6 \times x) + (6 \times 4) + 3x - 2 &= 58 \\ 6x + 24 + 3x - 2 &= 58 \end{aligned}$$

Next, add the like terms on the left side of the equation.

$$\begin{aligned} 6x + 24 + 3x - 2 &= 58 \\ (6x + 3x) + (24 - 2) &= 58 \\ 9x + 22 &= 58 \end{aligned}$$

Then, subtract 22 from both sides.

$$\begin{aligned} 9x + 22 &= 58 \\ 9x + 22 - 22 &= 58 - 22 \\ 9x &= 36 \end{aligned}$$

Then, divide both sides of the equation by 9.

$$\begin{aligned}9x &= 36 \\ \frac{9x}{9} &= \frac{36}{9} \\ x &= 4\end{aligned}$$

The answer is 4.

Example 4

Solve for “ y ” in the following equation.

$$6y + 3(y - 4) = 33$$

First, apply the distributive property to the left side of the equation.

$$\begin{aligned}6y + 3(y - 4) &= 33 \\ 6y + (3 \times y) + (3 \times -4) &= 33 \\ 6y + 3y + (-12) &= 33\end{aligned}$$

Next, add the like terms on the left side of the equation.

$$\begin{aligned}6y + 3y + (-12) &= 33 \\ (6y + 3y) + (-12) &= 33 \\ 9y - 12 &= 33\end{aligned}$$

Then, add 12 to both sides.

$$\begin{aligned}9y - 12 &= 33 \\ 9y - 12 + 12 &= 33 + 12 \\ 9y &= 45\end{aligned}$$

Then, divide both sides of the equation by 9.

$$\begin{aligned}9y &= 45 \\ \frac{9y}{9} &= \frac{45}{9} \\ y &= 5\end{aligned}$$

The answer is 5.

Example 5

Solve for “ a ” in the following equation.

$$5(a + 3) + 6(a + 1) + 8a = 40$$

First, apply the distributive property to the left side of the equation.

$$\begin{aligned}5(a + 3) + 6(a + 1) + 8a &= 40 \\ (5 \times a) + (5 \times 3) + (6 \times a) + (6 \times 1) + 8a &= 40 \\ 5a + 15 + 6a + 6 + 8a &= 40\end{aligned}$$

Next, add the like terms on the left side of the equation.

$$\begin{aligned}5a + 15 + 6a + 6 + 8a &= 40 \\ (5a + 6a + 8a) + (15 + 6) &= 40 \\ 19a + 21 &= 40\end{aligned}$$

Then, subtract 21 from both sides.

$$\begin{aligned}19a + 21 &= 40 \\ 19a + 21 - 21 &= 40 - 21 \\ 19a &= 19\end{aligned}$$

Then, divide both sides of the equation by 19.

$$19a = 19$$

$$\frac{19a}{19} = \frac{19}{19}$$

$$a = 1$$

The answer is 1.

Review

Distribute and combine like terms and then solve each equation.

1. $x + 8(x + 2) = 52$

2. $2y + 6(y + 3) = 34$

3. $4y + 2(y - 2) = 8$

4. $9y + 3(y - 6) = 30$

5. $6(x + 2) - 4x = 30$

6. $3(y - 1) + 2(y + 3) = 13$

7. $4(a + 3) - 2(a + 6) = 20$

8. $6(x + 2) - 4x + 6 = 36$

9. $-9(x + 3) + 4x = -2$

10. $-4(y + 3) - 2y = 24$

11. $4(a + 2) - 9 = 11$

12. $-8(y + 2) - 16 = 16$

13. $5(a + 4) - 6a + 1 = 12$

14. $x + 3x + 2x + 3(x + 1) = 30$



15. $2x + 4x + 6x - 2(x + 3) = 34$

Review (Answers)

To see the Review answers, open this [PDF file](#) and look for section 3.7.

Vocabulary

Language: English ▾

Term	Definition
Associative Property	The associative property states that you can change the groupings of numbers being added or multiplied without changing the sum. For example: $(2+3) + 4 = 2 + (3+4)$, and $(2 \times 3) \times 4 = 2 \times (3 \times 4)$.
Commutative Property	The commutative property states that the order in which two numbers are added or multiplied does not affect the sum or product. For example  $a+b=b+a$ and $(a)(b)=(b)(a)$.
distributive property	The distributive property states that the product of an expression and a sum is equal to the sum of the products of the expression and each term in the sum. For example,  $a(b + c) = ab + ac$.
like terms	Terms are considered like terms if they are composed of the same variables with the same exponents on each variable.

1.0 REFERENCES

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