

3.4

Solve Equations with Variables on Both Sides

Goal • Solve equations with variables on both sides.

Your Notes

VOCABULARY

Identity

Collect variables on one side of the equation and constant terms on the other to solve equations with variables on both sides.

Example 1 Solve an equation with variables on both sides

Solve $15 + 4a = 9a - 5$.

Solution

$$15 + 4a = 9a - 5$$

Write original equation.

$$15 + 4a - \underline{\quad} = 9a - \underline{\quad} - 5$$

Subtract $\underline{\quad}$ from each side.

$$15 = \underline{\quad} - 5$$

Simplify.

$$15 + \underline{\quad} = \underline{\quad} - 5 + \underline{\quad}$$

Add $\underline{\quad}$ to each side.

$$\underline{\quad} = \underline{\quad}$$

Simplify.

$$\frac{\boxed{\quad}}{\boxed{\quad}} = \frac{\boxed{\quad}}{\boxed{\quad}}$$

Divide each side by $\underline{\quad}$.

$$\underline{\quad} = a$$

Simplify.

The solution is $\underline{\quad}$.

CHECK

$$15 + 4a = 9a - 5$$

Write original equation.

$$15 + 4(\underline{\quad}) \stackrel{?}{=} 9(\underline{\quad}) - 5$$

Substitute $\underline{\quad}$ for a .

$$15 + \underline{\quad} \stackrel{?}{=} \underline{\quad} - 5$$

Multiply.

$$\underline{\quad} = \underline{\quad} \checkmark$$

Solution checks.

Your Notes

Example 2 Solve an equation with grouping symbols

Solve $4t - 12 = 6(t + 3)$.

Solution

$$4t - 12 = 6(t + 3)$$

Write original equation.

$$4t - 12 = \underline{\hspace{1cm}} + \underline{\hspace{1cm}}$$

Distributive property

$$-12 = \underline{\hspace{1cm}} + \underline{\hspace{1cm}}$$

Subtract $\underline{\hspace{1cm}}$ from each side.

$$\underline{\hspace{1cm}} = \underline{\hspace{1cm}}$$

Subtract $\underline{\hspace{1cm}}$ from each side.

$$\underline{\hspace{1cm}} = t$$

Divide each side by $\underline{\hspace{1cm}}$.

 **Checkpoint** Solve the equation. Check your solution.

1. $3b + 7 = 8b + 2$

2. $6d - 6 = \frac{3}{4}(4d + 8)$

Example 3 Identify the number of solutions of an equation

Solve the equation, if possible.

a. $4x + 5 = 4(x + 5)$

b. $6x - 3 = 3(2x - 1)$

Solution

a. $4x + 5 = 4(x + 5)$

Original equation

$$4x + 5 = \underline{\hspace{1cm}}$$

Distributive property

The equation $4x + 5 = \underline{\hspace{1cm}}$ is $\underline{\hspace{1cm}}$ because the number $4x$ $\underline{\hspace{1cm}}$ equal to 5 more than itself and $\underline{\hspace{1cm}}$ more than itself. So, the equation has $\underline{\hspace{1cm}}$ solution.

b. $6x - 3 = 3(2x - 1)$

Original equation

$$6x - 3 = \underline{\hspace{1cm}}$$

Distributive property

The statement $6x - 3 = \underline{\hspace{1cm}}$ is $\underline{\hspace{1cm}}$ for all values of x . So, the equation is an $\underline{\hspace{1cm}}$.

Your Notes

✔ **Checkpoint** Solve the equation, if possible.

$$3. \frac{1}{2}(4t - 6) = 2t$$

$$4. 10m - 4 = -2(2 - 5m)$$

Homework

STEPS FOR SOLVING LINEAR EQUATIONS

Step 1 Use the _____ to remove any grouping symbols.

Step 2 _____ the expression on each side of the equation.

Step 3 Use the properties of equality to collect the _____ terms on one side of the equation and the _____ terms on the other side of the equation.

Step 4 Use the properties of equality to solve for the _____.

Step 5 Check your _____ in the original equation.