

Section 1.3: Solving Equations with Variables on Both Sides

Solve the equation. Check your solution.

<p>1. $12 - 3x = -6x$</p> $\begin{array}{r} +3x \quad +3x \\ \hline 12 = \frac{-3x}{-3} \end{array}$ $\frac{-3x}{-3} = \frac{-3x}{-3}$ $-4 = x$ <div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block; margin-top: 10px;">$x = -4$</div>	<p>2. $7 - 5z = 17 + 5z$</p> $\begin{array}{r} +5z \quad +5z \\ \hline 7 = 17 + 10z \\ -17 \quad -17 \\ \hline -10 = 10z \\ \frac{-10}{10} = \frac{10z}{10} \\ -1 = z \end{array}$ <div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block; margin-top: 10px;">$z = -1$</div>
<p>3. $3k + 45 = 8k + 25$</p> $\begin{array}{r} -3k \quad -3k \\ \hline 45 = 5k + 25 \\ -25 \quad -25 \\ \hline 20 = 5k \\ \frac{20}{5} = \frac{5k}{5} \\ 4 = k \end{array}$ <div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block; margin-top: 10px;">$k = 4$</div>	<p>4. $\frac{3}{4}(48 - 16x) = 4(4 + 2x)$</p> $\begin{array}{r} 36 - 12x = 16 + 8x \\ +12x \quad +12x \\ \hline 36 = 16 + 20x \\ -16 \quad -16 \\ \hline 20 = 20x \\ \frac{20}{20} = \frac{20x}{20} \\ 1 = x \rightarrow \end{array}$ <div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block; margin-top: 10px;">$x = 1$</div>
<p>5. $5q + 6 = 2q - 2 + q$</p> $\begin{array}{r} 5q + 6 = 3q - 2 \\ -3q \quad -3q \\ \hline 2q + 6 = -2 \\ -6 \quad -6 \\ \hline 2q = -8 \\ \frac{2q}{2} = \frac{-8}{2} \\ q = -4 \end{array}$ <div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block; margin-top: 10px;">$q = -4$</div>	<p>6. $8 + 6x - 10x = 16 - 8x$</p> $\begin{array}{r} 8 - 4x = 16 - 8x \\ +8x \quad +8x \\ \hline 8 + 4x = 16 \\ -8 \quad -8 \\ \hline 4x = 8 \\ \frac{4x}{4} = \frac{8}{4} \\ x = 2 \end{array}$ <div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block; margin-top: 10px;">$x = 2$</div>
<p>7. $6a - 4 = 3a + 5$</p> $\begin{array}{r} -3a \quad -3a \\ \hline 3a - 4 = 5 \\ +4 \quad +4 \\ \hline 3a = 9 \\ \frac{3a}{3} = \frac{9}{3} \\ a = 3 \end{array}$ <div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block; margin-top: 10px;">$a = 3$</div>	<p>8. $2(4b - 6) = 4(3b - 7)$</p> $\begin{array}{r} 8b - 12 = 12b - 28 \\ -8b \quad -8b \\ \hline -12 = 4b - 28 \\ +28 \quad +28 \\ \hline 16 = 4b \\ \frac{16}{4} = \frac{4b}{4} \\ 4 = b \\ b = 4 \end{array}$ <div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block; margin-top: 10px;">$b = 4$</div>

Solve the equation. Determine whether the equation has *one solution*, *no solution*, or *infinitely many solutions*.

<p>9. $2(2x + 5) = 4x + 6$</p> $\begin{array}{r} 4x + 10 = 4x + 6 \\ -4x \quad -4x \\ \hline 10 \neq 6 \end{array}$ <p style="text-align: center; border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">No Solution</p>	<p>10. $16f + 24 = 8(2f + 3)$</p> $\begin{array}{r} 16f + 24 = 16f + 24 \\ -16f \quad -16f \\ \hline 24 = 24 \end{array}$ <p style="text-align: center; border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">Inf. Many Solutions</p>
<p>11. $\frac{1}{2}(10 + 12n) = \frac{1}{3}(15n + 15)$</p> $\begin{array}{r} 5 + 6n = 5n + 5 \\ -5n \quad -5n \\ \hline 5 + n = 5 \\ -5 \quad -5 \\ \hline n = 0 \end{array}$ <p style="text-align: center; border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">(one solution)</p>	<p>12. $\frac{2}{3}(6j + 9) = 3j + 7$</p> $\begin{array}{r} 4j + 6 = 3j + 7 \\ -3j \quad -3j \\ \hline j + 6 = 7 \\ -6 \quad -6 \\ \hline j = 1 \end{array}$ <p style="text-align: center; border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;">(one solution)</p>

13. A gym offers two packages for yearly membership. The first plan costs \$50 to be a member. Then each visit to the gym is \$5. The second plan costs \$200 for a membership fee plus \$2 per visit. Which membership is more economical?

$x = \#$ of visits

$$\begin{array}{r} \text{1st Plan} = \text{2nd Plan} \\ 50 + 5x = 200 + 2x \\ -50 \quad -50 \\ \hline 5x = 150 + 2x \\ -2x \quad -2x \\ \hline \frac{3x}{3} = \frac{150}{3} \\ x = 50 \end{array}$$

50 visits : same price
 < 50 visits: Gym A
 > 50 visits: Gym B