

SOLVING EQUATIONS WITH MULTIPLICATION OR ABSOLUTE VALUE

3.3.1

To **solve an equation with multiplication**, first use the Distributive Property or a generic rectangle to rewrite the equation without parentheses, then solve in the usual way. For additional information, see the Math Notes box in Lesson 3.3.1. For additional examples and practice, see the Checkpoint 6B materials at the back of the textbook.

To **solve an equation with absolute value**, first break the problem into two cases since the quantity inside the absolute value can be positive or negative. Then solve each part in the usual way.

Example 1

Solve $6(x+2) = 3(5x+1)$

Use the Distributive Property.

$$6x + 12 = 15x + 3$$

Subtract $6x$.

$$12 = 9x + 3$$

Subtract 3.

$$9 = 9x$$

Divide by 9.

$$1 = x$$

Example 2

Solve $x(2x-4) = (2x+1)(x+5)$

Rewrite the equation using the Distributive Property on the left side of the equal sign and a generic rectangle on the right side.

$$2x^2 - 4x = \begin{array}{c} + 5 \\ x \end{array} \begin{array}{|c|c|} \hline 10x & 5 \\ \hline 2x^2 & x \\ \hline \end{array} \\ \begin{array}{c} 2x \\ + 1 \end{array}$$

$$2x^2 - 4x = 2x^2 + 11x + 5$$

Subtract $2x^2$ from both sides.

$$-4x = 11x + 5$$

Subtract $11x$ from both sides.

$$-15x = 5$$

Divide by -15 .

$$x = \frac{5}{-15} = -\frac{1}{3}$$

Example 3

Solve $|2x - 3| = 7$

Separate into two cases.

$2x - 3 = 7$ or $2x - 3 = -7$

Add 3.

$2x = 10$ or $2x = -4$

Divide by 2.

$x = 5$ or $x = -2$

Problems

Solve each equation.

- | | |
|--|---------------------------------------|
| 1. $3(c + 4) = 5c + 14$ | 2. $x - 4 = 5(x + 2)$ |
| 3. $7(x + 7) = 49 - x$ | 4. $8(x - 2) = 2(2 - x)$ |
| 5. $5x - 4(x - 3) = 8$ | 6. $4y - 2(6 - y) = 6$ |
| 7. $2x + 2(2x - 4) = 244$ | 8. $x(2x - 4) = (2x + 1)(x - 2)$ |
| 9. $(x - 1)(x + 7) = (x + 1)(x - 3)$ | 10. $(x + 3)(x + 4) = (x + 1)(x + 2)$ |
| 11. $2x - 5(x + 4) = -2(x + 3)$ | 12. $(x + 2)(x + 3) = x^2 + 5x + 6$ |
| 13. $(x - 3)(x + 5) = x^2 - 7x - 15$ | 14. $(x + 2)(x - 2) = (x + 3)(x - 3)$ |
| 15. $\frac{1}{2}x(x + 2) = \left(\frac{1}{2}x + 2\right)(x - 3)$ | 16. $ 3x + 2 = 11$ |
| 17. $ 5 - x = 9$ | 18. $ 3 - 2x = 7$ |
| 19. $ 2x + 3 = -7$ | 20. $ 4x + 1 = 10$ |

Answers

- | | | |
|--------------------------------|--|---------------------|
| 1. $c = -1$ | 2. $x = -3.5$ | 3. $x = 0$ |
| 4. $x = 2$ | 5. $x = -4$ | 6. $y = 3$ |
| 7. $x = 42$ | 8. $x = 2$ | 9. $x = 0.5$ |
| 10. $x = -2.5$ | 11. $x = -14$ | 12. all numbers |
| 13. $x = 0$ | 14. no solution | 15. $x = -12$ |
| 16. $x = 3$ or $-\frac{13}{3}$ | 17. $x = -4$ or 14 | 18. $x = -2$ or 5 |
| 19. no solution | 20. $x = \frac{9}{4}$ or $-\frac{11}{4}$ | |