

Checkpoint 5



Problem 5-61

Solving Equations

Answers to problem 5-61: a: $x = -2$, b: $x = 1\frac{1}{2}$, c: $x = 3$, d: no solution

Equations may be solved in a variety of ways. Commonly, the first steps are to remove parenthesis using the Distributive Property and then simplify by combining like terms. Next isolate the variable on one side and the constant terms on the other. Finally, divide to find the value of the variable. Note: When the process of solving an equation ends with different numbers on each side of the equal sign (for example, $2 = 4$), there is *no solution* to the problem. When the result is the same expression or number on each side of the equation (for example, $x + 3 = x + 3$) it means that *all real numbers* are solutions.

Example 1: Solve $4x + 4x - 3 = 6x + 9$

$$\begin{array}{ll} \text{Solution: } 4x + 4x - 3 = 6x + 9 & \text{problem} \\ 8x - 3 = 6x + 9 & \text{simplify} \\ 2x = 12 & \text{add 3, subtract } 6x \text{ on each side} \\ x = 6 & \text{divide} \end{array}$$

$$\begin{array}{l} \text{Check: } 4(6) + 4(6) - 3 = 6(6) + 9 \\ 24 + 24 - 3 = 36 + 9 \\ 48 - 3 = 45 \\ 45 = 45 \end{array}$$

Example 2: Solve $-4x + 2 - (-x + 1) = -3 + (-x + 5)$

$$\begin{array}{ll} \text{Solution: } -4x + 2 - (-x + 1) = -3 + (-x + 5) & \text{problem} \\ -4x + 2 + x - 1 = -3 - x + 5 & \text{remove parenthesis (distribute)} \\ -3x + 1 = -x + 2 & \text{simplify} \\ -2x = 1 & \text{add } x, \text{ subtract 1 from each side} \\ x = -\frac{1}{2} & \text{divide} \end{array}$$

Check:

$$\begin{aligned} -4\left(-\frac{1}{2}\right) + 2 - \left(-\left(-\frac{1}{2}\right) + 1\right) &= -3 + \left(-\left(-\frac{1}{2}\right) + 5\right) \\ 2 + 2 - \left(\frac{1}{2} + 1\right) &= -3 + \left(\frac{1}{2} + 5\right) \\ 4 - \left(1\frac{1}{2}\right) &= -3 + \left(5\frac{1}{2}\right) \\ 2\frac{1}{2} &= 2\frac{1}{2} \end{aligned}$$

Now we can go back and solve the original problems.

a. $3x + 7 = -x - 1$

$$4x = -8$$

$$x = -2$$

b. $1 - 2x + 5 = 4x - 3$

$$-2x + 6 = 4x - 3$$

$$9 = 6x$$

$$1\frac{1}{2} = x$$

c. $-2x - 6 = 2 - 4x - (x - 1)$

$$-2x - 6 = 2 - 4x - x + 1$$

$$-2x - 6 = -5x + 3$$

$$3x = 9$$

$$x = 3$$

d. $3x - 4 + 1 = -2x - 5 + 5x$

$$3x - 3 = 3x - 5$$

$$-3 = -5$$

$-3 \neq -5 \Rightarrow$ no solution

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Here are some more to try. Solve each equation.

Show your steps! justify!

1. $2x - 3 = -x + 3$

2. $3x + 2 + x = x + 5$

3. $6 - x - 3 = 4(x - 2)$

4. $4x - 2 - 2x = x - 5$

5. $-(x + 3) = 2x - 6$

6. $-x + 2 = x - 5 - 3x$

7. $1 + 3x - x = x - 4 + 2x$

8. $5x - 3 + 2x = x + 7 + 6x$

9. $4y - 8 - 2y = 4$

10. $-x + 3 = 6$

11. $-2 + 3y = y - 2 - 4y$

12. $2(x - 2) + x = 5$

13. $-x - 3 = 2x - 6$

14. $10 = x + 5 + x$

15. $2x - 1 - 1 = x - 3 - (-5 + x)$

16. $3 + 3x - x + 2 = 3x + 4$

17. $-4 + 3x - 1 = 2x + 1 + 2x$

18. $2x - 7 = -x - 1$

19. $7 = 3x - 4 - (x + 2)$

20. $5y + (-y - 2) = 4 + y$

Answers

1. $x = 2$

2. $x = 1$

3. $x = 2 \frac{1}{5}$

4. $x = -3$

5. $x = 1$

6. $x = -7$

7. $x = 5$

8. no solution

9. $y = 6$

10. $x = -3$

11. $y = 0$

12. $x = 3$

13. $x = 1$

14. $x = 2 \frac{1}{2}$

15. $x = 2$

16. $x = 1$

17. $x = -6$

18. $x = 2$

19. $x = 6 \frac{1}{2}$

20. $y = 2$

