Solving Absolute Value Equations

Algebra Worksheet · Grade 8–10

Name: _____ Date: _____

Learning Objectives

- Understand that absolute value represents distance from zero and is always non-negative
- Solve absolute value equations by splitting into two separate equations (positive and negative cases)
- Isolate the absolute value expression before splitting into two equations when coefficients or constants are present

Problems

1. Solve the absolute value equation for x.

$$|x| = 9$$

2. Solve the absolute value equation for x.

$$|x + 3| = 7$$

3. Solve the absolute value equation for x.

$$|x - 6| = 4$$

4. Solve the absolute value equation for x. Check whether a solution exists.

$$|x + 2| = -5$$

5. Solve the absolute value equation for x.

$$3|x| = 18$$

6. Solve the absolute value equation for x.

$$2|x + 3| = 10$$

Scan to watch

7. Solve the absolute value equation for x.

$$4|x-1|-8=12$$

8. Solve the absolute value equation for x.

$$3+5|x-2|=13$$

9. Solve the absolute value equation for x. Then verify both solutions by substituting them back into the original equation.

$$\tfrac{1}{2}|2x+4|-3=5$$

10. Solve the absolute value equation for x. Verify both solutions by substituting them back into the original equation.

$$2|3x-1|+7=19$$

Scan to watch

Solving Absolute Value Equations — Answer Key

Algebra Worksheet · Grade 8–10

Answer Key

1. Answer: x = 9 or x = -9
- Split into two equations: x = 9 and x = -9
- Both values satisfy the original equation since |9| = 9 and |-9| = 9

2. Answer: x = 4 or x = -10
- Split into two equations: x + 3 = 7 and x + 3 = -7
- Solve first: x = 7 - 3 = 4
- Solve second: x = -7 - 3 = -10

3. Answer: x = 10 or x = 2
- Split into two equations: x - 6 = 4 and x - 6 = -4
- Solve first: x = 4 + 6 = 10
- Solve second: x = -4 + 6 = 2

4. Answer: No solution
- Absolute value is always non-negative (it represents distance from zero)
- An absolute value expression can never equal a negative number
- Therefore, there is no solution

5. Answer: x = 6 or x = -6
- Isolate the absolute value by dividing both sides by 3: |x| = 6
- Split into two equations: x = 6 and x = -6

6. Answer: x = 2 or x = -8
- Isolate the absolute value by dividing both sides by 2: |x + 3| = 5
- Split into two equations: x + 3 = 5 and x + 3 = -5
- Solve first: x = 5 - 3 = 2
- Solve second: x = -5 - 3 = -8

7. Answer: x = 6 or x = -4
- Add 8 to both sides: 4|x - 1| = 20
- Divide both sides by 4: |x - 1| = 5
- Split into two equations: x - 1 = 5 and x - 1 = -5
- Solve first: x = 5 + 1 = 6
- Solve second: x = -5 + 1 = -4

8. Answer: x = 4 or x = 0
- Subtract 3 from both sides: 5|x - 2| = 10
- Divide both sides by 5: |x - 2| = 2

Scan to watch

- Split into two equations: x - 2 = 2 and x - 2 = -2
- Solve first: x = 2 + 2 = 4
- Solve second: x = -2 + 2 = 0

---

9. Answer: x = 6 or x = -10

- Add 3 to both sides: \frac{1}{2}|2x + 4| = 8
- Multiply both sides by 2: |2x + 4| = 16
- Split into two equations: 2x + 4 = 16 and 2x + 4 = -16
- Solve first: 2x = 12, so x = 6
- Solve second: 2x = -20, so x = -10
- Verify x = 6: \frac{1}{2}|12 + 4| - 3 = \frac{1}{2}(16) - 3 = 8 - 3 = 5 ✓
- Verify x = -10: \frac{1}{2}|-20 + 4| - 3 = \frac{1}{2}(16) - 3 = 8 - 3 = 5 ✓

---

10. Answer: x = 7/3 or x = -5/3

- Subtract 7 from both sides: 2|3x - 1| = 12
- Divide both sides by 2: |3x - 1| = 6
- Split into two equations: 3x - 1 = 6 and 3x - 1 = -6
- Solve first: 3x = 7, so x = 7/3
- Solve second: 3x = -5, so x = -5/3
- Verify x = 7/3: |3(7/3) - 1| = |7 - 1| = |6| = 6, then 2(6) + 7 = 19 ✓
- Verify x = -5/3: |3(-5/3) - 1| = |-5 - 1| = |-6| = 6, then 2(6) + 7 = 19 ✓

Scan to watch