NAME

Module 6   Solving Absolute Value Equations and Inequalities

Lesson 2   Solving Advanced Absolute Value Equations

independent practice

Solve the following absolute value equations.

1. $|x| = 4$ **x = 4 or –4**

2. $|x| = 5$ **x = 5 or –5**

3. $3|x| = 27$ **x = 9 or –9**

4. $3|x| = –3$ **∅**

5. $–9|x| = –18$ **x = 2 or –2**

6. $5|x| + 2 = 7$ **x = 1 or –1**

7. $6|x| – 2 = 10$ **x = 2 or –2**

8. $7|x| + 1 = 50$ **x = 7 or –7**

9. $3|x – 8| = 9$ **x = 5 or 11**

10. $|x – 6| = 4$ **x = 2 or 10**

11. $|x – 1| + 2 = 12$ **x = 11 or –9**

12. $4|x| – 9 = 7$ **x = 4 or –4**

13. $5 = |x + 2| – 5$ **x = 8 or –12**

14. $|x – 3| – 4 = 7$ **x = 14 or –8**

15. $|x + 7| = 14$ **x = 7 or –21**

16. $|x + 3| = 8$ **x = 5 or –11**

17. $|2x – 4| = 16$ **x = 10 or –6**

18. $|2x – 1| = 9$ **x = 5 or –4**

19. $3|x + 5| = 9$ **x = –2 or –8**

20. $|3x + 6| = 9$ **x = 1 or –5**

Journal

1. What precedence does absolute value have in the order of operations?

2. Frank says that the solution to the inequality $|3(t + 1)| = 9$ is $t = 2$ or –4. Zoe says that the solution is $t = 2\frac{2}{3}$ or $–3\frac{1}{3}$. Who is correct and why?

3. Explain how to solve $|2x + 3| = 7$.

4. Explain how you would solve an equation like this: $|x + 2| = |2x + 3|$.

5. Why does the equation $|x + 2| = |2x + 6|$ have two solutions and not four?

Possible Journal Answers

1. They are the same as parentheses in order.

2. Frank is correct. He remembered the parentheses in the order of operations.

3. Put the equation into two equations by removing the absolute value: 2x + 3 = 7, 2x + 3 = –7. Then solve each equation: 2x + 3 = 7, subtract 3 from both sides to get 2x = 4. Now, divide both sides by 2, to get x = 2. From 2x + 3 = –7, subtract 3 from both sides to get 2x = –10. Now, divide both sides by 2, to get x = –5.

4. Start by dividing it into two equations (either equation can be made negative):
   A: x + 2 = –(2x + 3)
   B: x + 2 = 2x + 3.

Cumulative Review

Write an equation to represent each sentence or situation.
Any variable may be used in question numbers 1, 2, 5, and 6.

1. The product of a number and seven, decreased by five, is twenty–seven.

$7n - 5 = 27$

2. Negative seventeen times the sum of a number and twelve is sixteen.

$-17(x + 12) = 16$

3. The cost of n tires is $1,408. The cost of one tire is $88.

$88n = 1,408$ or $\frac{1,408}{n} = 88$

4. Carmel is y years old. Her mother is 23 years older. The sum of their ages is 72.

$y + (y + 23) = 72$

5. Tiffany has five times as many red shirts as Amy. Together, they have 30 game red shirts.

$s + 5s = 30$

6. Six less than twice a number is the same as two more than three times the number.

$2x - 6 = 3x + 2$

Solve.

7. The perimeter of a triangle can be no more than 705 cm. Two sides of the garden are 103 cm long. What is the longest possible length for the third side?

$s \leq 499$ The longest possible length for the third side is 499 cm.

8. A glass holds 12 oz of a beverage that contains 10% orange juice. What is the minimum amount of pure orange juice that must be added to the beverage so that it contains at least 20% orange juice?

You should add at least 1.5 oz. of pure orange juice.

9. The measure of angle A is equal to $d + 30$ degrees while the measure of angle B is equal to $d - 30$ degrees. If the sum of the measures of the two angles is more than 180 degrees, what are the possible measures of angle B?

The measure of angle B is greater than 60 degrees.

10. A wagon can hold 50 pounds of dirt. How many wagon-fulls will you need to carry if you need to move at least 625 pounds of dirt?

$x > 12.5$. You will need at least 13 wagon-fulls of dirt.

Possible Journal Answers *(continued)*
Then solve each equation.
For equation A:
$x + 2 = -(2x + 3)$
$x + 2 = -2x - 3$ **distribute the negative sign**
$3x + 2 = -3$ **add $2x$ to both sides**
$3x = -5$ **subtract 2 from both sides**
$x = -\frac{5}{3}$ **divide both sides by 3**

For equation B:
$x + 2 = 2x + 3$
$2 = x + 3$ **subtract x from both sides**
$-1 = x$ **subtract 3 from both sides**

5. The four possibilities are: $x + 2 = 2x + 6$; $-(x + 2) = 2x + 6$; $x + 2 = -(2x + 6)$; $-(x + 2) = -(2x + 6)$. Lines 1 and 4 are equivalent and lines 2 and 3 are equivalent. Solving the solution set is $x = -4$ and $x = -\frac{8}{3}$.