3-7 Absolute Value Equations and Inequalities

Vocabulary

Review

Write T for *true* or F for *false*.

_____ **1.** To indicate the *absolute value* of -8, you write $|-8|$.

_____ **2.** The *absolute value* of -8 is -8, since -8 is 8 units to the left of 0 on the number line.

_____ **3.** The *absolute value* of -8 is 8, since -8 is 8 units away from 0 on the number line.

_____ **4.** According to the definition of absolute value, if $|r| = 3$, then $r = 3$ or $r = -3$.

Vocabulary Builder

numerical expression
$18 \div (6 + 3)$

algebraic expression
$4k - 7$

expression (noun) **ek SPRESH un**

Related Words: express (verb), phrase (noun)

Main Idea: An **expression** is a word or phrase that communicates an idea. A mathematical **expression** is a mathematical phrase. A mathematical **expression** may be *numerical* or *algebraic*.

Use Your Vocabulary

Write an *expression* for each word phrase.

5. m increased by 8

m ____ ____

6. y divided by 9

y ____ ____

7. u more than 7

____ ____ u

8. Cross out the *expression* that is NOT algebraic.

$3y - 12$ $\quad$ $4 + 18 - 3$ $\quad$ $12 + x$

9. Cross out the *expression* that is NOT numeric.

$3 - 12$ $\quad$ $4 + 18q - 3$ $\quad$ $12 + 5$

Problem 1 Solving an Absolute Value Equation

Got It? What are the solutions of $|n| - 5 = -2$? Graph and check the solutions.

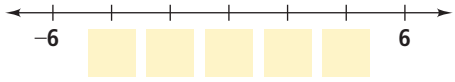
10. Complete the equation to solve for n.

$|n| - 5 + \square = -2 + \square$

$|n| = \square$

$n = \square$ or $n = \square$

11. Graph the solutions.



12. Check the solutions of the equation.

take note

Key Concept Solving Absolute Value Equations

To solve an equation in the form $|A| = b$, where A represents a variable expression and $b > 0$, solve $A = b$ and $A = -b$.

Complete.

13. To solve $|b| = 3$, solve $b = \square$ and $b = \square$.

14. To solve $|x - 5| = 6$, solve $x - 5 = \square$ and $x - 5 = \square$.

15. To solve $|h + 7| = 2h$, solve $h + 7 = \square$ and $h + 7 = \square$.

Problem 2 Solving an Absolute Value Equation

Got It? You are skating with a friend, The friend's distance d from you (in feet) after t seconds is given by $d = |80 - 5t|$.

16. a. Circle what the 80 in the equation represents.

The distance she travels. | How long she travels.

How fast she travels. | How far away she starts from you.

b. Circle what the 5 in the equation represents.

The distance she travels. | How long she travels.

How fast she travels. | How far away she is from you.

c. Why is the $5t$ subtracted from the 80?

_____

17. At what times is she 60 ft from you?

a. The 60 is a measure of distance / time and replaces the variable d / t.

b. To find the times she is 60 ft from you, solve the equation $\square = |80 - 5\square|$

Problem 3 Solving an Absolute Value Equation With No Solution

Got It? **What are the solutions of $|3x - 6| - 5 = -7$?**

19. To isolate the absolute value expression, you add 5 to each side of the equation. Circle the simplified value of the right side.

-12 -7 -6 -5 -3 -2

20. Underline the correct word to complete the sentence.

The absolute value of an expression cannot be negative / positive, so the inequality has no solution.

take note

Key Concept Solving Absolute Value Inequalities

Let A represent a variable expression and let $b > 0$.

To Solve an Inequality in the Form	Solve	
$\|A\| < b$	$-b < A < b$	(For $\|A\| \leq b$, solve $-b \leq A \leq b$.)
$\|A\| > b$	$A < -b$ or $A > b$	(For $\|A\| \geq b$, solve $A \leq -b$ or $A \geq b$.)

21. Circle the compound inequality you would use to solve $|5x| > 3$.

$-3 < 5x < 3$ $-3 \leq 5x \leq 3$ $5x < -3$ or $5x > 3$ $5x \leq -3$ or $5x \geq 3$

22. Circle the compound inequality you would use to solve $|3x| < 5$.

$-5 < 3x < 5$ $-5 \leq 3x \leq 5$ $3x < -5$ or $3x > 5$ $3x \leq -5$ or $3x \geq 5$

Problem 4 Solving an Absolute Value Inequality Involving ≥

Got It? **What are the solutions of $|2x + 4| \geq 5$? Graph the solutions.**

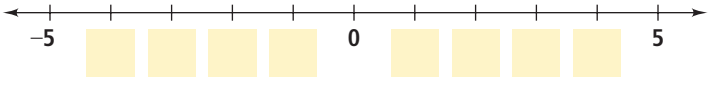
23. Write a compound inequality to solve the absolute value inequality.

$2x + 4$ ____ -5 or $2x + 4$ ____ 5

24. Solve the inequalities.

____ or ____

25. Graph your solutions on the number line below.



Problem 5 Solving an Absolute Value Inequality Involving ≤

Got It? **A food manufacturer makes 32-oz boxes of pasta. Not every box weighs exactly 32 oz. The allowable difference from the ideal weight is at most 0.05 oz. Write and solve an absolute value inequality to find the range of allowable weights.**

24. Complete the model.

Relate	difference between ideal and actual weights	is at most	0.05 oz
Define	Let w = the actual weight.		
Write	$\lvert w - \square \rvert$	$\square$	0.05

25. Write the absolute value inequality as a compound inequality.

-0.05 $\square$ $w -$ $\square$ $\square$ $\square$

26. Solve the compound inequality.

27. A box of pasta must weigh between $\square$ oz and $\square$ oz, inclusive.

Lesson Check • Do you UNDERSTAND?

Reasoning **How many solutions do you expect to get when you solve an absolute value equation? Explain.**

28. Write how many solutions each absolute value equation has.

$|x| = 9$ $\square$ solution(s)

$|x| = 0$ $\square$ solution(s)

$|x| = -9$ $\square$ solution(s)

29. Explain how many solutions are possible for any absolute value equation.

_____

Math Success

Check off the vocabulary words that you understand.

☐ absolute value ☐ equation ☐ inequality

Rate how well you can *solve absolute value equations and inequalities.*

Need to review 0 2 4 6 8 10 Now I get it!