Lesson 2-1

Integers and Absolute Value

Interactive Study Guide

See pages 29–30 for:
- Getting Started
- Vocabulary Start-Up
- Notes

Essential Question

What happens when you add, subtract, multiply, and divide integers?

Common Core State Standards

Content Standards
Preparation for 7.NS.1, 7.NS.1a

Mathematical Practices
1, 2, 3, 4, 7

Vocabulary

negative number
positive number
integer
opposites
coordinate
inequality
absolute value

Math Symbols

< is less than
> is greater than

What You'll Learn

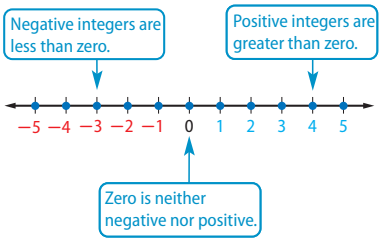
- Compare and order integers.
- Find the absolute value of an expression.

Real-World Link

Geocaching Geocaching is an outdoor treasure hunting game. Some treasures, or geocaches, are located hundreds of feet above sea level. Others are hidden in lakes and can only be reached by snorkeling or scuba diving.

Compare and Order Integers

A **negative number** is a number less than zero. A **positive number** is a number greater than zero. Negative numbers like −3 and positive numbers like +3 are members of the set of integers. An **integer** is any number from the set {…, −3, −2, −1, 0, 1, 2, 3, …}, where … means continues indefinitely.



Integers such as +3 and −3 are called **opposites**, because they are the same distance from zero on the number line.

Example 1

Tutor

Write an integer for each situation. Then identify its opposite and describe what it means.

a. **23°F below zero**

Because it is *below* zero, the integer is −23. Its opposite is +23 or 23, which means 23°F above zero.

b. **11 inches more than normal**

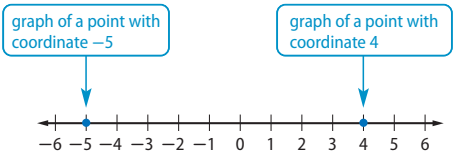
Because it is *more than* normal, the integer is +11 or 11. Its opposite is −11, which means 11 inches less than normal.

Got It? **Do these problems to find out.**

1a. a loss of 8 yards **−8; +8 or 8; a gain of 8 yards**

1b. a deposit of $15 **+15 or 15; −15; a withdrawal of $15**

To graph an integer, locate the point named by the integer on a number line. The **coordinate** is the number that corresponds to the point on a number line.

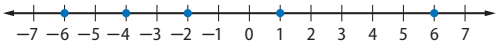


Any mathematical sentence containing < or > is called an inequality. An **inequality** compares numbers or quantities. When two numbers are graphed on a number line, the number to the left is always less than the number to the right.

Example 2

Tools Tutor

Use the integers graphed on the number line below.



Inequalities
The inequality symbol always points to the lesser number.

a. Write two inequalities involving 1 and −2.
Since 1 is to the right of −2, 1 is greater than −2. So, $1 > -2$.
Since −2 is to the left of 1, −2 is less than 1. So, $-2 < 1$.

b. Replace the ● with <, >, or = in −4 ● −6 to make a true sentence.
Since −4 is to the right of −6, −4 is greater. So, $-4 > -6$.

Got It? **Do these problems to find out.**

2a. Write two inequalities involving −7 and −3. **$-3 > -7$; $-7 < -3$**

2b. Replace the ● with <, >, or = in −1 ● 2 to make a true sentence. **<**

Real World Example 3

Tools Tutor

Bethany and her friends played a question-and-answer video game. Their scores at the end of the game were 1, −5, 0, −1, 2, and 4. Order the scores from least to greatest.

Graph each integer on a number line.

Write the numbers as they appear from left to right. The scores −5, −1, 0, 1, 2, and 4 are in order from least to greatest.

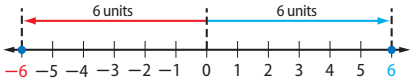
Got It? **Do this problem to find out.**

3. The recorded highs in degrees Celsius at Niagara Falls from February 21 to 28 of a recent year are 4, 2, 3, −6, −5, −1, 0, and 1. Order the temperatures from greatest to least. **4, 3, 2, 1, 0, −1, −5, −6**

Key Concept Absolute Value

Words The absolute value of a number is the distance the number is from zero on the number line. The absolute value of a number is always greater than or equal to zero.

Example $|6|$ and $|-6|$



Symbols $|6| = 6$ The absolute value of 6 is 6.

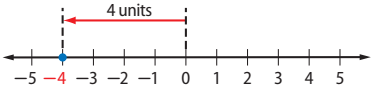
$|-6| = 6$ The absolute value of −6 is 6.

Notice on the number line that −6 and 6 are each 6 units from 0, even though they are on opposite sides of 0. The **absolute value** of a number is the distance the number is from zero on a number line. So, −6 and 6 have the same absolute value.

Example 4

Evaluate each expression.

a. $|-4|$



On the number line, the graph of −4 is 4 units from 0.

$|-4| = 4$

b. $|-8| - |5|$ The absolute value of −8 is 8.

$|-8| - |5| = 8 - 5$ The absolute value of 5 is 5.

$= 3$ Simplify.

expression
When you evaluate an expression, you find the numerical value of the expression.

Got It? Do these problems to find out.

4a. $|-3|$ **3**

4b. $|-4| - |3|$ **1**

You can use absolute value notation with algebraic expressions since variables represent numbers.

Example 5

Evaluate $6 + |x|$ if $x = -2$.

$6 + |x| = 6 + |-2|$ Replace x with −2.

$= 6 + 2$ The absolute value of −2 is 2.

$= 8$ Simplify.

Got It? Do these problems to find out.

5a. Evaluate $|y| + 8$ if $y = -7$. **15**

5b. Evaluate $9 - 5|z|$ if $z = 3$. **−6**

Guided Practice

Check

Write an integer for each situation. Identify its opposite and describe its meaning. (Example 1)

1. a bank withdrawal of \$500
   −500; +500 or 500; a deposit of \$500
2. a gain of 4 pounds **+4 or 4; −4; a loss of 4 pounds**

Write two inequalities using the number pairs. Use the symbols < or >. (Example 2)

3. 2 and −5
   2 > −5; −5 < 2
4. −4 and −8
   −4 > −8; −8 < −4
5. −1 and 1 **1 > −1; −1 < 1**

Replace each ● with <, >, or = to make a true sentence. (Example 2)

6. −9 ● −16 **>**
7. −7 ● 7 **<**
8. −6 ● 0 **<**

9. Order the state temperatures from least to greatest. (Example 3)

State	AL	AK	CA	FL	HI	ME	NJ	OH	TX
Temperature	−27	−80	−45	−2	12	−48	−34	−39	−23

−80, −48, −45, −39, −34, −27, −23, −2, 12

Evaluate each expression. (Example 4)

10. $|-12|$ **12**
11. $|-14|+|3|$ **17**
12. $|18|-|-5|$ **13**

Evaluate each expression if $x = 7$ and $y = -6$. (Example 5)

13. $15-|y|$ **9**
14. $|y|+x$ **13**
15. $3|y|$ **18**