Essential Question How can you use a number line to represent real-life events?

1 ACTIVITY: Seconds to Liftoff

Work with a partner. You are listening to the NASA Command Center before the liftoff of a space shuttle.

You hear the following:

> "T minus 10 seconds . . . go for main engine start . . . T minus 9 . . . 8 . . . 7 . . . 6 . . . 5 . . . 4 . . . 3 . . . 2 . . . 1 . . . we have liftoff."

Draw a number line. Then locate the following events at appropriate points on the number line.

Terminal launch sequence	Main engine start	Three main engines are ignited
31 seconds before liftoff	10 seconds before liftoff	7 seconds before liftoff

Solid rocket booster ignition sequence starts	Solid rocket boosters ignite	Shuttle clears launch pad tower
3 seconds before liftoff	Liftoff	7 seconds after liftoff

## 2 ACTIVITY: Being Careful with Terminology

Work with a partner.

a. Use a number line to show that the phrase "3 seconds away from liftoff" can have two meanings.

b. Reword the phrase "3 seconds away from liftoff" in two ways so that each meaning is absolutely clear.

c. Explain why you must be very careful with terminology if you are working in the NASA Command Center for a space shuttle launch.

3 ACTIVITY: A Day in the Life of an Astronaut

Make a time line that shows a day in the life of an astronaut. Use the Internet or another reference source to gather information.

- Use a number line with units representing hours. Start at 12 hours before liftoff and end at 12 hours after liftoff.
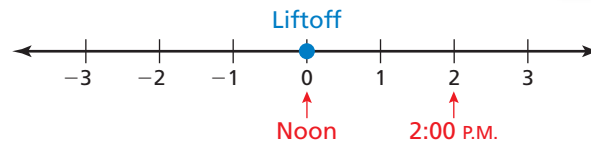
- Illustrate your time line with drawings or photographs.

- Include at least five events before liftoff, such as when the astronauts suit up.

- Include at least five events after liftoff, such as when the space shuttle enters Earth's orbit.

What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you use a number line to represent real-life events?

5. Describe how you can use a number line to create a time line.

Practice Use what you learned about the number line to complete Exercises 4–6 on page A14.

Key Vocabulary
absolute value,
  p. A13

The following numbers are *integers. Negative integers* are less than 0.
Positive integers are greater than 0.

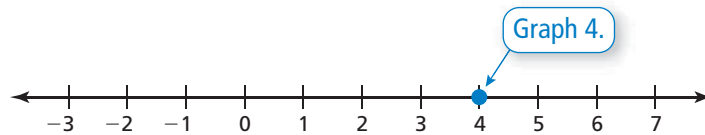negative integers   positive integers

. . ., $-3, -2, -1$, 0, $1, 2, 3$, . . .

Zero is neither negative nor positive.

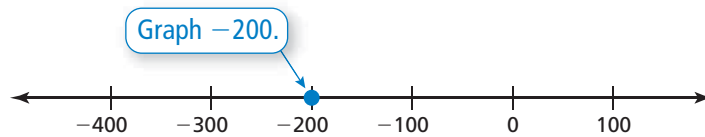You can use a number line to graph and compare integers.

EXAMPLE 1   **Writing and Graphing Integers**

Write and graph the integer that represents the situation.

a. The temperature outside is 4 degrees above zero.

Graph 4.

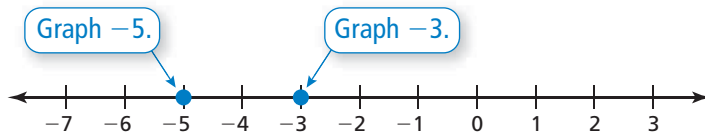**b.** A contestant on a game show loses 200 points.

Graph -200.

EXAMPLE 2   **Comparing Integers**

Which is greater, -3 or -5?

Graph -5.   Graph -3.

-3 is to the right of -5. So, -3 is greater.

Remember

On a number line, numbers to the left are less than numbers to the right. Numbers to the right are greater than numbers to the left.

On Your Own

Now You're Ready
Exercises 4–17

Write and graph the integer that represents the situation.

  1. You climb 76 feet to the top of a water slide.

  2. You dig a hole at the beach that is 2 feet deep.

  3. Which is greater, 0 or -4?   **4.** Which is greater, -7 or -2?
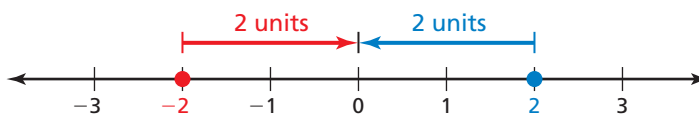
Multi-Language Glossary at BigIdeasMath.com.

🔑 Key Idea

Absolute Value

Words The **absolute value** of a number is the distance between the number and 0 on a number line. The absolute value of a number a is written as $|a|$.
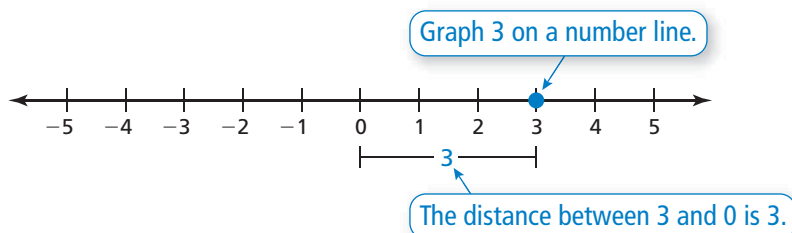
Numbers $|-2| = 2$ $\quad$ $|2| = 2$

2 units $\qquad$ 2 units

$$\begin{array}{ccccccc} & & & & & & \\ -3 & -2 & -1 & 0 & 1 & 2 & 3 \end{array}$$

EXAMPLE ③ Finding Absolute Value

Find the absolute value of 3.

Graph 3 on a number line.

$$\begin{array}{cccccccccccc} -5 & -4 & -3 & -2 & -1 & 0 & 1 & 2 & 3 & 4 & 5 \end{array}$$

3

The distance between 3 and 0 is 3.

∴ So, $|3| = 3$.

EXAMPLE ④ Finding Absolute Value

Find the absolute value of -4.

Graph -4 on a number line.

$$\begin{array}{cccccccccccc} -5 & -4 & -3 & -2 & -1 & 0 & 1 & 2 & 3 & 4 & 5 \end{array}$$

4

The distance between -4 and 0 is 4.
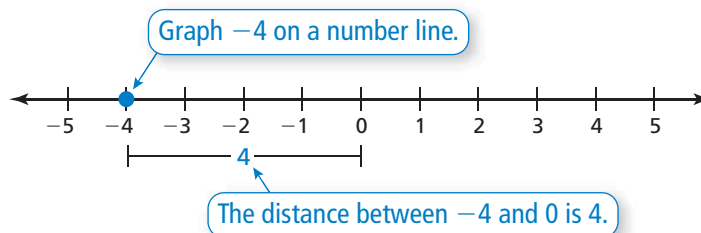
∴ So, $|-4| = 4$.

🔴 On Your Own

Find the absolute value of the integer.

5. 5 $\qquad$ **6.** -1 $\qquad$ **7.** -6 $\qquad$ **8.** 73

9. Write two integers that have an absolute value of 7.

✓ Vocabulary and Concept Check

1. **VOCABULARY** Which of the following numbers are integers?
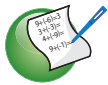
$$8, -4.1, -9, \frac{1}{6}, 1.75, 22$$

2. **VOCABULARY** Explain how to find the absolute value of an integer.

3. **WHICH ONE DOESN'T BELONG?** Which expression does *not* belong with the other three? Explain your reasoning.

| 2 | $|2|$ | -2 | $|-2|$ |

📝 Practice and Problem Solving

Write and graph the integer that represents the situation.

① 4. You gain 10 bonus points on a quiz.   5. The temperature is 6 degrees below zero.

6. A football team loses 3 yards.   7. You swim down to 6 feet below sea level.

8. A person climbs 600 feet up a mountain.   9. A company earns a profit of $800.

Tell which integer is greater.

② 10. $-1, -4$ 11. $-3, 6$ 12. $-7, 2$ 13. $-5, 5$

14. $9, -11$ 15. $13, 20$ 16. $-15, -10$ 17. $8, -12$

Find the absolute value of the integer.

③ ④ 18. -2 19. 3 20. 23 21. -17

22. -56 23. -110 24. 49 25. 11

26. **ERROR ANALYSIS** Describe and correct the error in finding the absolute value.

❌ $-|-15| = 15$

27. **OCEAN** A diver is 15 feet below sea level. A scientist on a boat is 12 feet above sea level.

   a. Write an integer for the position of each person relative to sea level.
   b. Find the absolute value of each integer.
   c. Who is farther from sea level?

Find the median of the data.

28. $-7, 3, -2, 0, 1, -5, 9$ 29. $-12, -8, -15, 1, 3, -4, 10, 2, 6$

Copy and complete the statement using <, >, or =.

30. $6 \boxed{} |-8|$

31. $|-10| \boxed{} |-9|$

32. $|-2| \boxed{} |4|$

Order the values from least to greatest.

33. $5,\ 0,\ |-1|,\ |4|,\ -2$

34. $|-3|,\ |5|,\ -3,\ -4,\ |-4|$

35. $10,\ |-6|,\ 9,\ |3|,\ -11,\ 0$

36. $-18,\ |30|,\ -19,\ |-22|,\ -20,\ |-18|$

Simplify the expression.

37. $|0|$

38. $-|6|$

39. $-|-1|$

Tell whether the statement is *always*, *sometimes*, or *never* true. Explain.

40. Zero is a positive integer.

41. The absolute value of a number is greater than the number.

42. The absolute value of a negative number is positive.

43. **ELEVATION** The table shows the highest and lowest elevations for five states.

   a. Order the states by their highest elevations, from least to greatest.

   b. Order the states by their lowest elevations, from least to greatest.

State	Highest Elevation (ft)	Lowest Elevation (ft)
Arkansas	2753	55
California	14,494	−282
Florida	345	0
Louisiana	535	−8
Tennessee	6643	178

44. **NUMBER LINE** Point A is on a number line halfway between -17 and 5. Point B is halfway between point A and 0. What integer is represented by point B?

45. **Critical Thinking** The absolute value of x is less than the absolute value of y. Describe all possible relationships between x and y.

Fair Game Review What you learned in previous grades & lessons

Use a number line to find the sum.

46. $2 + 5$

47. $3 + 8$

48. $4 + 4$

49. $12 + 9$

50. **MULTIPLE CHOICE** What is the area of the circle? Use 3.14 for π.

   (A) 53.38 m^2

   (B) 106.76 m^2

   (C) 226.87 m^2

   (D) 907.46 m^2

17 m