LESSON

1.1 Identifying Integers and Their Opposites

Texas Essential Knowledge and Skills

The student is expected to:

TEKS Number and operations—6.2.B

Identify a number, its opposite, and its absolute value.

Mathematical Processes

TEKS 6.1.D

Communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate.

Engage

ESSENTIAL QUESTION

How do you identify an integer and its opposite? Look for numbers that are the same distance from zero and on opposite sides of zero on the number line; for example, −4 and 4.

Motivate the Lesson

Ask: What is the coldest weather you have ever experienced? Have you ever experienced a temperature that is below zero? How do you write a temperature that is below zero? Begin the Explore Activity to find out.

Explore

EXPLORE ACTIVITY 1

Focus on Modeling Mathematical Processes

Point out to students that the number line is presented horizontally, but for elevation it is useful to think of it vertically. You may want to draw a vertical number line on the board and label the various locations presented in the table on the vertical number line.

Explain

EXPLORE ACTIVITY 2

Connect Vocabulary ELL ELPS c.1.A

To help students understand the concept of **opposite** in math and in other contexts, make a list with students of pairs of opposites, such as hot and cold, black and white, up and down, left and right. Clarify that left and right is used in the math concept of opposite with negative numbers to the left of 0 and positive numbers to the right. Zero is its own opposite.

Questioning Strategies Mathematical Processes

- Does every integer have an opposite? Explain. Yes, zero is its own opposite. For all other integers, the opposite has a different sign.
- How does a number line help you understand what the opposite of an integer is? I can visually see that 4 and −4 are the same distance from zero.

Connect to Daily Life

Explain that bank statements record amounts of money being withdrawn or spent as negative amounts and amounts of money being deposited as positive amounts.

Talk About It

Check for Understanding

Ask: How do you find the opposite of an integer? Look for the integer that is the same distance from 0 but on the other side of zero.

LESSON 1.1

Identifying Integers and Their Opposites

TEKS Number and operations—6.2.B Identify a number, its opposite, and its absolute value.

ESSENTIAL QUESTION How do you identify an integer and its opposite?

EXPLORE ACTIVITY 1

Real World TEKS 6.2.B

Positive and Negative Numbers

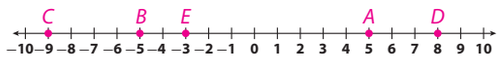
Positive numbers are numbers greater than 0. Positive numbers can be written with or without a plus sign; for example, 3 is the same as +3. **Negative numbers** are numbers less than 0. Negative numbers must always be written with a negative sign.

The number 0 is neither positive nor negative.

The elevation of a location describes its height above or below sea level, which has elevation 0. Elevations below sea level are represented by negative numbers, and elevations above sea level are represented by positive numbers.

A The table shows the elevations of several locations in a state park. Graph the locations on the number line according to their elevations.

Location	Little Butte *A*	Cradle Creek *B*	Dinosaur Valley *C*	Mesa Ridge *D*	Juniper Trail *E*
Elevation (ft)	5	−5	−9	8	−3



B What point on the number line represents sea level? 0

C Which location is closest to sea level? How do you know?

Juniper Trail; its elev. is closest to 0 on the number line.

D Which two locations are the same distance from sea level? Are these locations above or below sea level?

Little Butte (above) and Cradle Creek (below)

E Which location has the least elevation? How do you know?

Dinosaur Valley; its elev. is farthest left on the number line.

EXPLORE ACTIVITY (cont'd)

Reflect

1. **Analyze Relationships** Morning Glory Stream is 7 feet below sea level. What number represents the elevation of Morning Glory Stream?

   −7

2. **Multiple Representations** Explain how to graph the elevation of Morning Glory Stream on a number line.

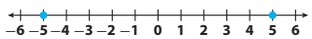
   Graph a point 7 units to the left of 0 on the number line.

EXPLORE ACTIVITY 2

TEKS 6.2.B

Opposites

Two numbers are **opposites** if, on a number line, they are the same distance from 0 but on different sides of 0. For example, 5 and −5 are opposites. 0 is its own opposite.



Integers are the set of all whole numbers and their opposites.

Remember, the set of whole numbers is 0, 1, 2, 3, 4, 5, 6, ...

On graph paper, use a ruler or straightedge to draw a number line. Label the number line with each integer from −10 to 10. Fold your number line in half so that the crease goes through 0. Numbers that line up after folding the number line are opposites.

A Use your number line to find the opposites of 7, −6, 1, and 9. −7; 6; −1; −9

B How does your number line show that 0 is its own opposite?

The crease goes through 0, so 0 lines up with itself.

C What is the opposite of the opposite of 3? 3

Reflect

3. **Justify Reasoning** Explain how your number line shows that 8 and −8 are opposites.

   8 and −8 are the same distance from 0 but on different sides of 0.

4. **Multiple Representations** Explain how to use your number line to find the opposite of the opposite of −6.

   Fold the number line in half at 0. −6 lines up with 6 so 6 is the opposite of −6 and −6 is the opposite of 6. So −6 is the opposite of the opposite of −6.

PROFESSIONAL DEVELOPMENT

Integrate Mathematical Processes

This lesson provides an opportunity to address Mathematical Process **TEKS 6.1.D,** which calls for students to "communicate mathematical ideas … using multiple representations, including symbols, … graphs, and language … as appropriate." In each Explore Activity and Example, students use number lines to represent the integers and opposites that are described with language and/or numbers with or without negative symbols. In this way, students are able to make the connections between and become fluent in using the different representations of integers and their opposites.

Math Background

The opposite of any positive number is negative, and the opposite of any negative number is positive. The sum of a number and its opposite is zero, which is neither positive nor negative.

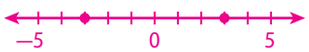
An integer's distance from zero is said to be non-negative instead of positive. When a distance measurement includes a negative symbol, the symbol describes the direction rather than the distance.

ADDITIONAL EXAMPLE 1

The county water department monitors the depth of the reservoir water level each month. The table shows the variation from the optimal depth for four months.

Reservoir Depth Variation from Optimal				
Month	June	July	August	September
Variation (ft)	5	3	−4	−6

A Graph the depth variation for July and its opposite on a number line. What do the numbers represent in this situation?



3 represents positive 3 ft, so in July the water level in the reservoir is 3 ft above the optimal depth. −3 represents 3 ft below the optimal depth.

B The value for October is the opposite of the opposite of the value from August. What was the depth variation in October? −4 ft

Interactive Whiteboard
Interactive example available online

my.hrw.com

EXAMPLE 1

Questioning Strategies — Mathematical Processes

- Is the opposite of a temperature always colder? Explain. No, because if the temperature is negative, say −5°, then the opposite would be 5°, which would be warmer.
- Is the opposite of an opposite always the number you started with? Give an example. Yes. If you start at 3, the opposite is −3, then the opposite of −3 is 3.

Engage with the Whiteboard

Have students take turns graphing an integer and then have another student graph the integer's opposite on the number line.

Focus on Patterns — Mathematical Processes

Elicit from students that when finding the opposite of the opposite of a positive number, the pattern of the signs in the steps is +, −, +. When finding the opposite of the opposite of a negative number, the pattern of the signs in the steps is −, +, −.

YOUR TURN

Avoid Common Errors

If students seem to get lost with the notation "the opposite of the opposite of," suggest that they work backward through the sentence. First they find the opposite of 6, which is −6. Then they find the opposite of −6.

Elaborate

Talk About It

Summarize the Lesson

Ask: How do you find the opposite of an integer? The opposite of an integer is the integer the same distance from zero on the other side of 0. If the integer is 5, then the opposite is −5. If the integer is −3, then the opposite is 3.

GUIDED PRACTICE

Engage with the Whiteboard

For Exercises 1–4, you may want to have students take turns graphing an integer and then have another student graph the integer's opposite on the number lines.

Avoid Common Errors

Exercise 1 Remind students to label the points they graph on the number line carefully, so it is clear which point they intend as the answer.

Exercise 9 Remind students that zero is its own opposite.

Talk About It

Check for Understanding

Ask: I am thinking of a number. The opposite of my number is a distance of 8 units from 0. Do you know what my number is? No, because both 8 and −8 are a distance of 8 units from 0. It could be either 8 or −8.

Integers and Opposites on a Number Line

Positive and negative numbers can be used to represent real-world quantities. For example, 3 can represent a temperature that is 3 °F above 0. −3 can represent a temperature that is 3 °F below 0. Both 3 and −3 are 3 units from 0.

Math On the Spot
my.hrw.com

EXAMPLE 1

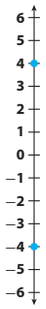
Real World

TEKS 6.2.B

Sandy kept track of the weekly low temperature in her town for several weeks. The table shows the low temperature in °F for each week.

Week	Week 1	Week 2	Week 3	Week 4
Temperature (°F)	−1	3	−4	2

A Graph the temperature from Week 3 and its opposite on a number line. What do the numbers represent?



STEP 1 Graph the value from Week 3 on the number line.

The value from Week 3 is −4.

Graph a point 4 units below 0.

STEP 2 Graph the opposite of −4.

Graph a point 4 units above 0.

The opposite of −4 is 4.

−4 represents a temperature that is 4 °F below 0 and 4 represents a temperature that is 4 °F above 0.

B The value for Week 5 is the opposite of the opposite of the value from Week 1. What was the high temperature in Week 5?

STEP 1 Graph the value from Week 1 on the number line.

The value from Week 1 is −1.

STEP 2 Graph the opposite of −1.

The opposite of −1 is 1.

STEP 3 Graph the opposite of 1.

The opposite of 1 is −1.

The opposite of the opposite of −1 is −1.
The high temperature in Week 5 was −1 °F.

Reflect

5. **Analyze Relationships** Explain how you can find the opposite of the opposite of any number without using a number line.

The opposite of the opposite of a number is the number itself.

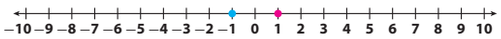
My Notes

Personal Math Trainer
Online Assessment and Intervention
my.hrw.com

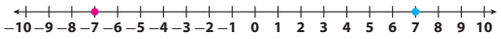
YOUR TURN

Graph the opposite of the number shown on each number line.

6.



7.



Write the opposite of each number.

8. 10 −10 **9.** −5 5 **10.** 0 0

11. What is the opposite of the opposite of 6? 6

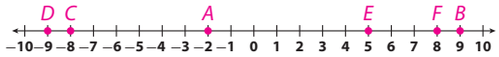
Math Talk
Mathematical Processes
Explain how you could use a number line to find the opposite of 8.

Math Talk anno: First graph a point 8 units to the right of 0. Then grap a point the same distance to the left of 0. That point will be at −8.

Guided Practice

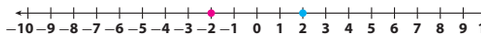
1. Graph and label the following points on the number line. (Explore Activity 1)

a. −2 **b.** 9 **c.** −8 **d.** −9 **e.** 5 **f.** 8

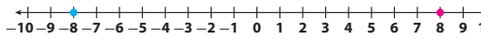


Graph the opposite of the number shown on each number line. (Explore Activity 2 and Example 1)

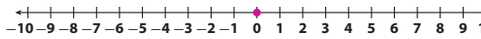
2.



3.



4.



Write the opposite of each number. (Explore Activity 2 and Example 1)

5. 4 −4 **6.** −11 11 **7.** 3 −3

8. −3 3 **9.** 0 0 **10.** 22 −22

ESSENTIAL QUESTION CHECK-IN

11. Given an integer, how do you find its opposite?

Find the integer that is the same distance from 0 but on the other side of 0.

DIFFERENTIATE INSTRUCTION

World History

The concept of negative numbers can be traced to Hindu mathematicians. They used negative numbers to represent debts, as we do today, and formulated rules for the arithmetic of integers. Their ideas were acquired by Arab mathematicians, who passed the ideas on to European scientists over time.

Manipulatives

For Explore Activity 2, some students have difficulty labeling a number line and folding it so the opposite integers line up. It may be helpful to give them printed number lines with a vertical dashed line through zero.

Additional Resources

Differentiated Instruction includes:

- Reading Strategies
- Success for English Learners ELL
- Reteach
- Challenge PRE-AP

Personal Math Trainer

Online Assessment and Intervention

Online homework assignment available

my.hrw.com

1.1 LESSON QUIZ

TEKS 6.2.B

Sara keeps a record of the money that she deposits and withdraws from her account each week.

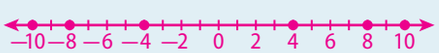
Week	1	2	3
Account entry ($)	$4	$10	−$8

1. Which week(s) does Sara have a negative entry in her account?
2. Graph each value and its opposite on a number line.
3. Which week's entry was the closest to zero?
4. For Week 4, Sara's entry is the opposite of the opposite of her entry on Week 1. What is her Week 4 entry?

Lesson Quiz available online

my.hrw.com

Answers

1. Week 3
2. 

3. Week 1
4. $4

Evaluate

GUIDED AND INDEPENDENT PRACTICE

TEKS 6.2.B

Concepts & Skills	Practice
Explore Activity 1 Positive and Negative Numbers	Exercises 1, 12, 23, 24
Explore Activity 2 Opposites	Exercises 2–10, 12, 13, 15, 18, 19–24
Example 1 Integers and Opposites on a Number Line	Exercises 2–10, 14, 16, 17, 20–23

Exercise	Depth of Knowledge (D.O.K.)	TEKS Mathematical Processes
12	**2** Skills/Concepts	**1.A** Everyday life
13–18	**1** Recall of Information	**1.C** Select tools
19–23	**2** Skills/Concepts	**1.C** Select tools
24	**3** Strategic Thinking H.O.T.	**1.A** Everyday life
25	**3** Strategic Thinking H.O.T.	**1.G** Explain and justify arguments
26	**3** Strategic Thinking H.O.T.	**1.F** Analyze relationships
27	**3** Strategic Thinking H.O.T.	**1.G** Explain and justify arguments
28	**3** Strategic Thinking H.O.T.	**1.C** Select tools

Additional Resources

Differentiated Instruction includes:

- Leveled Practice Worksheets

Name _____ Class _____ Date _____

1.1 Independent Practice

TEKS 6.2.B

Personal Math Trainer — my.hrw.com — Online Assessment and Intervention

12. **Chemistry** Atoms normally have an electrical charge of 0. Certain conditions, such as static, can cause atoms to have a positive or a negative charge. Atoms with a positive or negative charge are called *ions*.

Ion	A	B	C	D	E
Charge	−3	+1	−2	+3	−1

a. Which ions have a negative charge?

A, C, E

b. Which ions have charges that are opposites?

A and D; B and E

c. Which ion's charge is not the opposite of another ion's charge?

C

Name the integer that meets the given description.

13. the opposite of −17 17

14. 4 units left of 0 −4

15. the opposite of the opposite of 2 2

16. 15 units right of 0 15

17. 12 units right of 0 12

18. the opposite of −19 19

19. **Analyze Relationships** Several wrestlers are trying to lose weight for a competition. Their change in weight since last week is shown in the chart.

Wrestler	Tino	Victor	Ramsey	Baxter	Luis
Weight Change (in pounds)	−2	6	2	5	−5

a. Did Victor lose or gain weight since last week? gain

b. Which wrestler's weight change is the opposite of Ramsey's? Tino

c. Which wrestlers have lost weight since last week? Tino and Luis

d. Frankie's weight change since last week was the opposite of Victor's.

What was Frankie's weight change? −6

e. Frankie's goal last week was to gain weight. Did he meet his goal? Explain.

No; −6 pound change means Frankie lost 6 pounds.

Find the distance between the given number and its opposite on a number line.

20. 6 12 units

21. −2 4 units

22. 0 0 units

23. −7 14 units

24. **What If?** Three contestants are competing on a trivia game show. The table shows their scores before the final question.

Contestant	Score Before Final Question
Timothy	−25
Shawna	18
Kaylynn	−14

a. How many points must Shawna earn for her score to be the opposite of Timothy's score before the final question? 7 points

b. Which person's score is closest to 0? Kaylynn

c. Who do you think is winning the game before the final question? Explain.

Shawna; she is the only player with a positive score.

H.O.T. FOCUS ON HIGHER ORDER THINKING

25. **Communicate Mathematical Ideas** Which number is farther from 0 on a number line: −9 or 6? Explain your reasoning.

−9; it is 9 units away from 0 on a number line, and 6 is only 6 units away from 0.

26. **Analyze Relationships** A number is k units to the left of 0 on the number line. Describe the location of its opposite.

Its opposite is k units to the right of 0 on the number line.

27. **Critique Reasoning** Roberto says that the opposite of a certain integer is −5. Cindy concludes that the opposite of an integer is always negative. Explain Cindy's error.

Cindy assumed the original integer is always positive. But if the original integer is negative, its opposite will be positive.

28. **Multiple Representations** Explain how to use a number line to find the opposites of the integers 3 units away from −7.

10, 4; −10 is 3 units to the left of −7 and 10 is the opposite of −10. −4 is 3 units to the right of −7 and 4 is the opposite of −4.

Work Area

EXTEND THE MATH PRE-AP

Activity available online my.hrw.com

Activity The lowest and highest places in the United States are both in California, as shown in the graph. How can you use the graph to find the difference in elevation between the two locations?

If you start at the lowest point, you need to go up 282 ft to sea level and then another 14,495 ft to get to the top of Mt. Whitney. 282 + 14,495 = 14,777.