



Lesson 4: The Opposite of a Number

Student Outcomes

- Students understand that each nonzero integer, a , has an opposite, denoted $-a$; and that $-a$ and a are opposites if they are on opposite sides of zero and are the same distance from zero on the number line.
- Students recognize the number zero is its own opposite.
- Students understand that since all counting numbers are positive, it is not necessary to indicate such with a plus sign.

Lesson Notes

In this lesson, students practice graphing points on the number line. In particular, students determine the appropriate scale given a set of opposites in real-world situations. Students pay careful attention to the meaning of zero in problem situations and how opposites are related in the context of a given situation. Create a floor model of a number line prior to the lesson.

Classwork

Opening (5 minutes): What Is the Relationship?

Students work in pairs to determine the relationships between sets of words with or without pictures. Display the task to the whole group.

- Find the relationship between the sets of words.

Fast → Slow	Rough → Smooth	Open → Close	Fiction → Nonfiction
Light → Dark	Empty → Full	Accept → Refuse	Shallow → Deep
Dirty → Clean	Apart → Together	Question → Answer	Ancient → Modern
Alike → Different	All → None	Dangerous → Safe	Correct → Incorrect
Defeat → Victory	Easy → Hard	Future → Past	Break → Fix
Inside → Outside	Up → Down	Wet → Dry	Entrance → Exit

- The words are opposites of each other.*
- Once you have determined the relationship, create your own examples, including a math example.
 - Answers will vary (e.g., plus and minus, positive and negative).*

Scaffolding:

- Differentiate levels by providing groups with a set of 8–10 preselected words cut out individually on card stock. Use more challenging vocabulary words for advanced learners, and provide pictures with words for ELL or inclusion students.
- Ask language arts and science teachers for input to provide more variation in vocabulary.

Exercise 1 (10 minutes): Walk the Number Line

Distribute an index card to each student that is labeled with an integer ranging from -10 to 10 . Create enough cards based on the class size. Have students stand or place their index cards on the number line one at a time. When placing their numbers, students should start at zero and move in the direction of their number, counting out loud. Pose discussion questions after the exercise.

Discuss the following:

- What patterns do you see with the numbers on the number line?
 - *For each number to the right of zero, there is a corresponding number the same distance from zero to the left.*
- What does zero represent on the number line?
 - *Zero represents the reference point when locating a point on the number line. It also represents the separation of positive numbers from negative numbers.*
- What is the relationship between any two opposite numbers and zero on the number line?
 - *Opposite numbers are the same distance from zero, but they are on opposite sides of zero.*

Scaffolding:

- Remind students how to locate a negative number on the number line from Lesson 1.
- For advanced learners, provide positive and negative fractions. Pose the last three questions for inquiry only.

Read and display the statement below to the class, and then model Example 1.

Exercise 1: Walk the Number Line

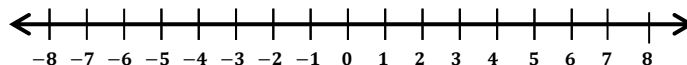
1. Each nonzero integer has an opposite, denoted $-a$; $-a$ and a are opposites if they are on opposite sides of zero and the same distance from zero on the number line.

Example 1 (5 minutes): Every Number has an Opposite

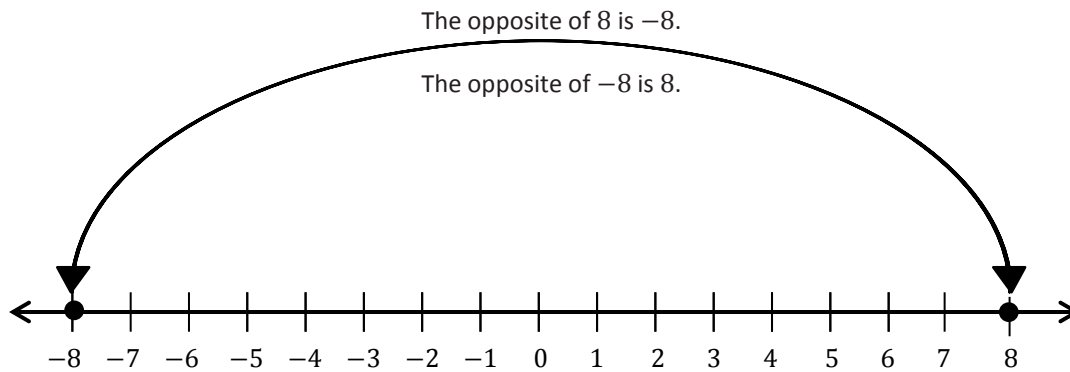
Read the example out loud. Model how to graph both points and explain how they are related.

Example 1: Every Number has an Opposite

Locate the number 8 and its opposite on the number line. Explain how they are related to zero.



- First, start at zero and move 8 units to the right to locate positive 8. So, the opposite of 8 must be 8 units to the left of zero. What number is 8 units to the left of zero?
 - -8
- 8 and -8 are the same distance from zero. Since both numbers are the same distance from zero but on opposite sides of zero on the number line, they are opposites.

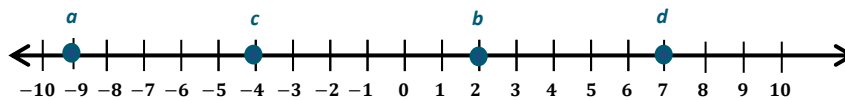
**Exercises 2–3 (5 minutes)**

Students work independently to answer the following questions. Allow 2–3 minutes for review as a whole group.

Exercises 2–3

2. Locate and label the opposites of the numbers on the number line.

- a. 9
- b. -2
- c. 4
- d. -7



3. Write the integer that represents the opposite of each situation. Explain what zero means in each situation.

- a. 100 feet above sea level.
 -100 ; zero represents sea level.
- b. 32°C below zero.
 32 ; zero represents 0 degrees Celsius.
- c. A withdrawal of \$25.
 25 ; zero represents no change, where no withdrawal or deposit is made.

Example 2 (8 minutes): A Real-World Example

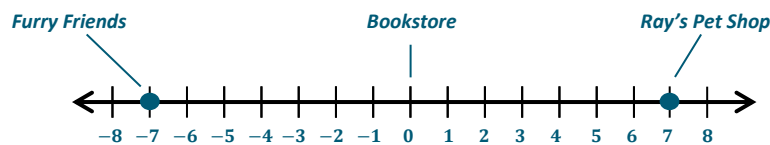
The purpose of this example is to show students how to graph opposite integers given a real-world situation. In pairs, have students read the problem aloud to each other. Instruct students to circle any words that might be important to solve the problem. Guide students as a whole group through the example posing questions to the class as you go.

Example 2: A Real-World Example

Maria decides to take a walk along Central Avenue to purchase a book at the bookstore. On her way, she passes the Furry Friends Pet Shop and goes in to look for a new leash for her dog. Furry Friends Pet Shop is seven blocks west of the bookstore. She leaves Furry Friends Pet Shop and walks toward the bookstore to look at some books. After she leaves the bookstore, she heads east for seven blocks and stops at Ray's Pet Shop to see if she can find a new leash at a better price. Which location, if any, is the furthest from Maria while she is at the bookstore?

Determine an appropriate scale and model the situation on the number line below.

Answers will vary.



Explain your answer. What does zero represent in the situation?

The pet stores are the same distance from Maria, who is at the bookstore. They are each 7 blocks away but in opposite directions. In this example, zero represents the bookstore.

Discuss the following:

- How did you determine an appropriate scale for the situation if all blocks in the city are the same length?
 - *Because both stores are seven blocks in opposite directions, I knew that I could count by ones since the numbers are not that large.*
- Where would the bookstore be located on the number line?
 - *The bookstore would be located at zero.*
- Where would Ray's Pet Shop be located on the number line? Explain.
 - *It would be seven units to the right of zero because it is seven blocks east of the bookstore.*
- What integer represents this situation?
 - *7*
- Where would Furry Friends be located on the number line? Explain.
 - *It would be seven units to the left of zero because it is seven blocks west of the bookstore.*
- What integer represents this situation?
 - *-7*
- What do you notice about the distance between both stores from the bookstore?
 - *Both stores are the same distance from the bookstore but in opposite directions.*

MP.6

Students should practice clarifying any misconceptions about how to represent these situations as integers.

- “Seven blocks to the left” would not be written as “ -7 blocks from the bookstore” or “ -7 units from 0.”
- Positive numbers are counting numbers and do not have a sign.

Exercises 4–6 (5 minutes)

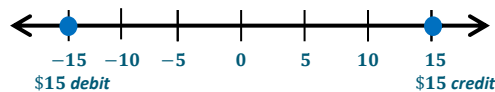
Students work independently to answer the following questions. Allow 2–3 minutes for review as a whole group.

Exercises 4–6

Read each situation carefully and answer the questions.

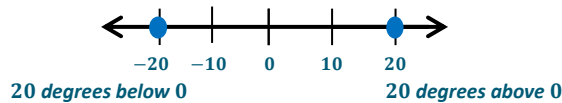
4. On a number line, locate and label a credit of \$15 and a debit for the same amount from a bank account. What does zero represent in this situation?

Zero represents no change in the balance.



5. On a number line, locate and label 20°C below zero and 20°C above zero. What does zero represent in this situation?

Zero represents 0°C .



6. A proton represents a positive charge. Write an integer to represent 5 protons. An electron represents a negative charge. Write an integer to represent 3 electrons.

5 protons: 5

3 electrons: -3

Closing (2 minutes)

- What is the relationship between any number and its opposite when plotted on a number line?
 - *A nonzero number and its opposite are both the same distance away from zero on a number line, but they are on opposite sides of zero.*
- How would you use this relationship to locate the opposite of a given number on the number line?
 - *I would use the given number to find the distance from zero on the opposite side.*
- Will this process work when finding the opposite of zero?
 - *No because zero is its own opposite.*

Exit Ticket (5 minutes)

Name _____

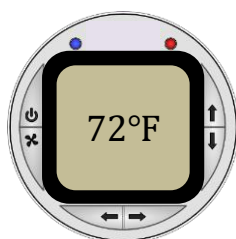
Date _____

Lesson 4: The Opposite of a Number

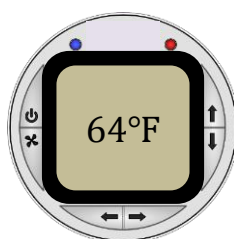
Exit Ticket

In a recent survey, a magazine reported that the preferred room temperature in the summer is 68°F . A wall thermostat, like the ones shown below, tells a room's temperature in degrees Fahrenheit.

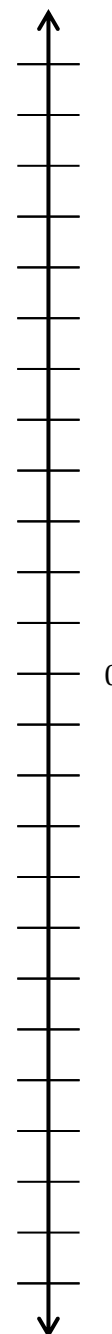
Sarah's Upstairs Bedroom



Downstairs Bedroom



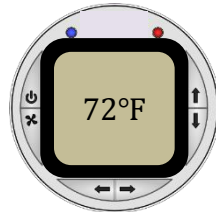
- Which bedroom is warmer than the recommended room temperature?
- Which bedroom is cooler than the recommended room temperature?
- Sarah notices that her room's temperature is 4°F above the recommended temperature and the downstairs bedroom's temperature is 4°F below the recommended temperature. She graphs 72 and 64 on a vertical number line and determines they are opposites. Is Sarah correct? Explain.
- After determining the relationship between the temperatures, Sarah now decides to represent 72°F as 4 and 64°F as -4 and graphs them on a vertical number line. Graph 4 and -4 on the vertical number line on the right. Explain what zero represents in this situation.



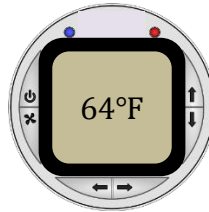
Exit Ticket Sample Solutions

In a recent survey, a magazine reported that the preferred room temperature in the summer is 68°F . A wall thermostat, like the ones shown below, tells a room's temperature in degrees Fahrenheit.

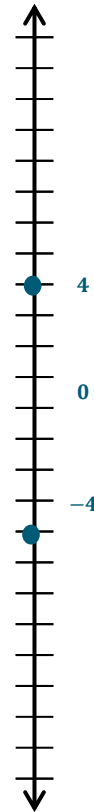
Sarah's Upstairs Bedroom



Downstairs Bedroom



- Which bedroom is warmer than the recommended room temperature?
The upstairs bedroom is warmer than the recommended room temperature.
- Which bedroom is cooler than the recommended room temperature?
The downstairs bedroom is cooler than the recommended room temperature.
- Sarah notices that her room's temperature is 4°F above the recommended temperature and the downstairs bedroom's temperature is 4°F below the recommended temperature. She graphs 72 and 64 on a vertical number line and determines they are opposites. Is Sarah correct? Explain.
No, both temperatures are positive numbers and not the same distance from 0, so they cannot be opposites. Both numbers have to be the same distance from zero, but one has to be above zero and the other has to be below zero in order to be opposites.
- After determining the relationship between the temperatures, Sarah now decides to represent 72°F as 4 and 64°F as -4 and graphs them on a vertical number line. Graph 4 and -4 on the vertical number line on the right. Explain what zero represents in this situation.
Zero represents the recommended room temperature of 68°F . Zero could also represent not being above or below the recommended temperature.



Problem Set Sample Solutions

- Find the opposite of each number and describe its location on the number line.
 - -5
The opposite of -5 is 5, which is 5 units to the right of (or above) 0.
 - 10
The opposite of 10 is -10 , which is 10 units to the left of (or below) 0.
 - -3
The opposite of -3 is 3, which is 3 units to the right of (or above) 0.

d. 15

The opposite of 15 is -15 , which is 15 units to the left of (or below) 0.

2. Write the opposite of each number and label the points on the number line.

a. Point A: The opposite of 9.

-9

b. Point B: The opposite of -4 .

4

c. Point C: The opposite of -7 .

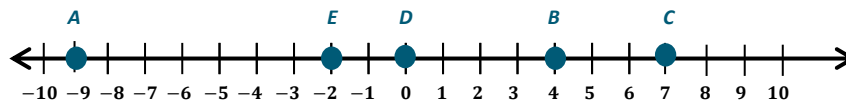
7

d. Point D: The opposite of 0.

0

e. Point E: The opposite of 2.

-2



3. Study the first example. Write the integer that represents the opposite of each real-world situation. In words, write the meaning of the opposite.

a. An atom's positive charge of 7 -7 , an atom's negative charge of 7

b. A deposit of \$25 -25 , a withdrawal of \$25

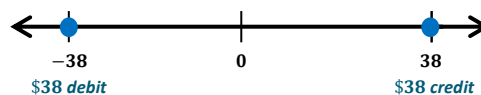
c. 3,500 feet below sea level 3,500, 3,500 feet above sea level

d. A rise of 45°C -45 , a decrease of 45°C

e. A loss of 13 pounds 13, a gain of 13 pounds

4. On a number line, locate and label a credit of \$38 and a debit for the same amount from a bank account. What does zero represent in this situation?

Zero represents no change in the balance.



5. On a number line, locate and label 40°C below zero and 40°C above zero. What does zero represent in this situation?

Zero represents 0°C .

