

## WORDS TO KNOW

opposites

additive inverse

# Lesson 6

## UNDERSTAND RATIONAL NUMBERS

NY-7.NS.1, NY-7.NS.1a, NY-7.NS.1b

## INTRODUCTION

### Real-World Connection

Zhen earned money doing landscape work for his neighbors. Last week, he earned \$45 working for the Ramirez family, but he spent \$25 on his equipment and supplies. He also earned \$35 working for the King family. Use rational numbers to show Zhen's earnings and expenses. How much money did Zhen take home last week? Let's practice the skills in the **Guided Instruction** and **Independent Practice** and, at the end of the lesson, see how much Zhen earned!

### What I Am Going to Learn

- How to add rational numbers
- How to identify opposite quantities that combine to make 0

### What I May Already Know

- I know how to represent integers on a number line.
- I know that opposite numbers are the same distance from 0 on a number line.
- I know how to compare integers.

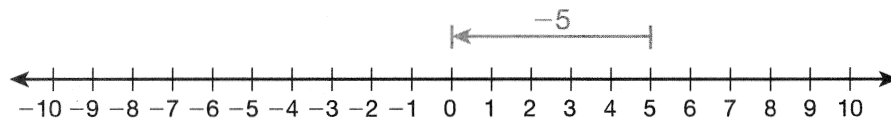
### Vocabulary in Action

Two rational numbers are **opposites** if they are the same distance from 0 on a number line.

- Opposites are on opposite sides of 0:  $-8$  and  $8$  are opposites.
- The opposite of a number is its **additive inverse**.
- The sum of a number and its additive inverse is 0:  $-8 + 8 = 0$ .
- Addition is shown on a number line by moving to the right when adding a positive number, and moving to the left when adding a negative number.

**EXAMPLE**

Find the sum of 5 and  $-5$ .



Start at 5, and move to the left 5.

$$5 + (-5) = 0$$

**TURN AND TALK**

Think of numbers in real-world situations that are opposites.

Rational numbers can be used to model real-world situations. For example, money earned is a positive number, while money spent is described with a negative number.

**EXAMPLE**

Trey is the quarterback of his football team. On the first play of the game, his team gained 8 yards. On the second play, the team lost 8 yards. In other words, on the first play the team moved 8 yards and on the second play the team moved  $-8$  yards. What was the total gain after the two plays?

The total gain on the two plays was  $8 + (-8) = 0$ .

After the second play, the team had returned to its initial position.

**SKETCH IT**

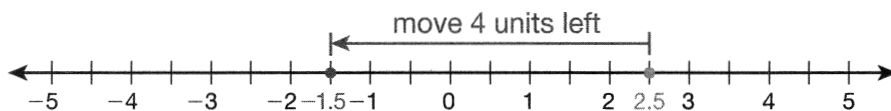
Where would the team be if they had gained 10 yards on the first play, but lost 8 yards on the second play?

To add two integers using a number line, start by locating the first number on the number line. The second number tells how many units to move. If that number is positive, move to the right. If that number is negative, move to the left.

**EXAMPLE**

Find the sum:  $2.5 + (-4)$ .

Start at 2.5 and move 4 units to the left on the number line.



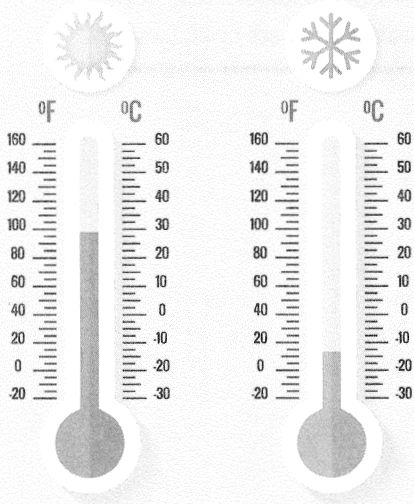
$$2.5 + (-4) = -1.5$$

**THINK ABOUT IT**

To find where you will end up, you can move the distance to 0 (2.5), then move 1.5 units more for a total move of 4 units left.

# GUIDED INSTRUCTION

A thermometer is a vertical number line. The mercury in it rises when the temperature increases, and drops when the temperature decreases.



## SHARE IT

Have you or members of your family ever lived where the temperatures got higher or lower than they do here in the local area?

## THINK ABOUT IT

Notice that  $3.2 - 1.8 = 1.4$ . How does this help with adding rational numbers?

## TIPS AND HINTS

The order in which you add two numbers does not change the sum. You can check your work by adding the numbers in the reverse order.

- The temperature was  $-10^{\circ}\text{F}$ . Find the additive inverse of  $-10$  and write a real-world problem with these numbers, describing their sum.

**Step One** Find the additive inverse of  $-10$ .

The additive inverse of  $-10$  is  $10$ .

**Step Two** Write a real-world problem.

This morning it was  $-10^{\circ}\text{F}$ . During the day, the temperature rose  $10^{\circ}\text{F}$ .

What is the temperature now?

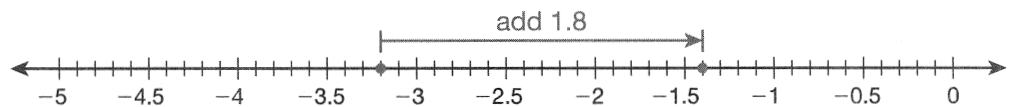
**Step Three** Describe the sum.

$$-10 + 10 = \boxed{\phantom{00}}$$

The temperature is  $\boxed{\phantom{00}}$  now.

- Use a number line to find the sum of  $-3.2 + 1.8$ .

**Step One** Start at  $-3.2$ . Move to the right 1.8 units.



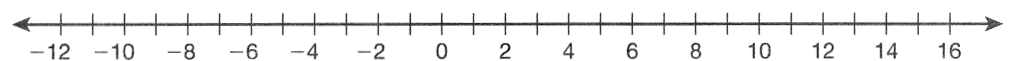
**Step Two** Find the ending point.

After moving to the right 1.8 units, the ending point is  $\boxed{\phantom{00}}$ .

**Step Three** Find the sum.

$$-3.2 + 1.8 = \boxed{\phantom{00}}$$

- Which of the following pairs of numbers has a sum of  $-4$ ? Use the number line to help you add.



- (A) 2 and  $-8$                       (C)  $-1.2$  and  $5.2$   
 (B)  $-\frac{4}{3}$  and  $-\frac{8}{3}$                     (D) 9 and 5



# INDEPENDENT PRACTICE 1

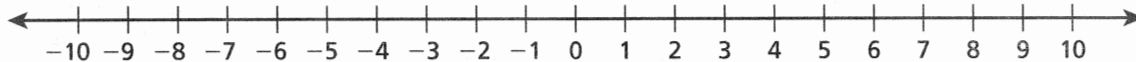
1 Which of the following is the additive inverse of  $-9$ ?

- A  $-9$
- B  $81$
- C  $9$
- D  $-81$

## TIPS AND HINTS

Opposite values are the same distance from 0 on the number line. They just lie on opposite sides of 0.

2 A blank number line is included below.



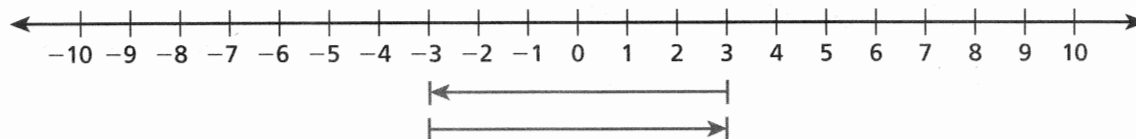
As needed, use the number line to find the sum of  $-5 + (-2) + (-4) + 7$ .

- A  $0$
- B  $-4$
- C  $17$
- D  $-11$

## SKETCH IT

Even if you think you can find the sum without using the number line, mark up the number line to check your answer.

3 An expression is modeled on the number line below.



What additive inverse does the model show?

- A  $6 + 6 = 12$
- B  $-6 + 6 = 0$
- C  $-6 + (-6) = -12$
- D  $6 - 0 = 6$

## THINK ABOUT IT

Can you think of a situation where the additive inverse would not be at 0 on the number line?

4 Find the sum:  $-3 + (-4)$

**Answer** \_\_\_\_\_

How can you use a number line to find  $-3 + (-4)$ ?

**Explain your answer.**

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### ◀ TIPS AND HINTS

The first addend is negative and the second addend is also negative. First decide whether the sum will be positive or negative.



# INDEPENDENT PRACTICE 2

1 Which pair of numbers is an additive inverse?

- A  $-8.3$  and  $8.3$
- B  $\frac{1}{2}$  and  $0$
- C  $3$  and  $-2$
- D  $-1$  and  $2$

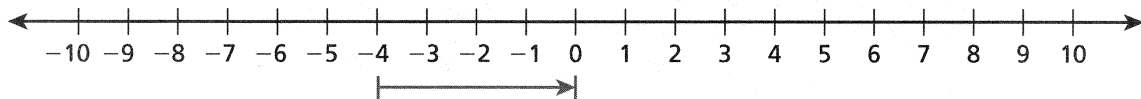
2 What is  $12 + (-12)$ ?

- A  $-12$
- B  $0$
- C  $24$
- D  $144$

3 Which shows the sum of  $-6 + 2$ ?

- A  $-8$
- B  $-4$
- C  $4$
- D  $8$

4 An expression is modeled on the number line below.



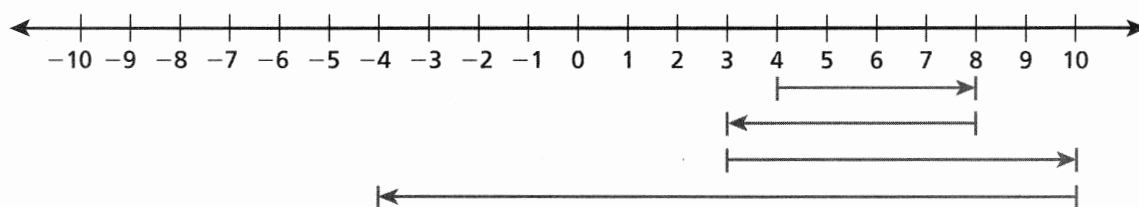
What expression does the model represent?

- A  $0 + (-4)$
- B  $0 + 4$
- C  $-4 + 4$
- D  $-4 + 0$

5 Which situation can be modeled with an additive inverse?

- A E.J. walks 1 mile to the store. Then he walks 1 mile farther to his friend's house.
- B A bird is flying 8 feet above the surface of the lake. Then it dives 10 feet to catch a fish.
- C Sofia earns \$15 babysitting. Then she pays \$15 for a new T-shirt.
- D A commuter train travels 3 miles north from the center of town. Then it travels 3 miles west.

6 The number line below shows addition and subtraction.



Which of these situations aligns with the model?

- A It was 4 degrees at 5:00 a.m. It warmed up 4 degrees by 7:00 a.m and stayed there until the wind started blowing a storm in at 11:00 and it dropped 5 degrees. The storm ended, the sun came out at 3:00, and it warmed up 7 degrees. Then the sun went down and, by midnight, it has dropped 14 degrees.
- B Sergio started going to school at age 4. He changed schools at age 8 and then again after both 3rd and 10 grades. He graduated from his 10th grade school.
- C The tree in our yard had only 4 branches when we planted it. After two years, it had 8 branches, but then it lost 5 branches in a storm. Luckily, it grew 7 branches back and was doing well until the drought hit and it died.
- D A roadrunner went 4 feet in one direction, turned around and went 5 feet in the other direction, stopped and looked around and then continued 7 feet in that same direction, and then turned around and went 14 feet in the other direction.



7

When working with two like numbers, such as two 3s, which will equal zero?

- A adding two negative like numbers
- B subtracting a negative number from a positive number
- C adding one negative and one positive number
- D subtracting a positive number from a negative number

8

Find the sum of each of the following.

$$-5 + 6$$

**Answer** \_\_\_\_\_

$$5 + 6$$

**Answer** \_\_\_\_\_

$$5 + (-6)$$

**Answer** \_\_\_\_\_

$$-5 + (-6)$$

**Answer** \_\_\_\_\_

Write each of the four problems in another form that results in the same answer.

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## EXIT TICKET

NY-7.NS.1, NY-7.NS.1a, NY-7.NS.1b

Now that you have mastered adding rational numbers, let's solve the problem in the Real-World Connection.

Zhen earned money doing landscape work for his neighbors. Last week, he earned \$45 working for the Ramirez family, but he spent \$25 on his equipment and supplies. He also earned \$35 working for the King family. Use rational numbers to show Zhen's earnings and expenses. How much money did Zhen take home last week?



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