2 Walk the Line

Adding Integers, Part I

WARM UP

A large hotel has a ground floor (street level) and 26 floors of guest rooms above street level, which can be modeled by positive integers. There are 5 floors of parking below street level, which can be modeled by negative integers. In this hotel, street level is represented by zero.

Write an integer addition problem that models the hotel elevator's motion in each case.

1. The elevator starts at street level, goes up 7 floors, and then goes down 3 floors.
2. The elevator starts at street level, goes up 10 floors, and then goes down 12 floors.
3. The elevator starts at street level, goes down 4 floors, and then goes up 11 floors.
4. The elevator starts at street level, goes down 2 floors, goes up 5 floors, and finally goes down 3 floors.

LEARNING GOALS

- Model the addition of integers on a number line.
- Develop a rule for adding integers.
- Identify $p + q$ as the number located a distance of $|q|$ from p.

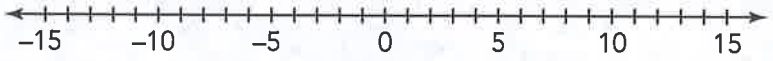
KEY TERM

- absolute value

You have been adding and subtracting positive numbers most of your life. In elementary school, you learned how to add numbers using a number line. How can a number line be a helpful tool in adding positive and negative numbers?

Getting on Line

Use the number line and determine the number described by each. Explain your reasoning.



1. the number that is 7 more than –9

2. the number that is 2 more than –6

3. the number that is 10 more than –8

4. the number that is 10 less than 6

5. the number that is 5 less than –4

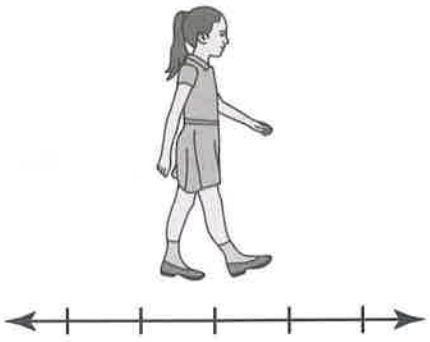
6. the number that is 2 less than –4

ACTIVITY
2.1 Walking the Number Line

Walking a number line can help you to add positive and negative numbers.

Walk the number line for an addition sentence:

- Start at zero and walk to the value of the first term of the expression.
- To indicate addition, turn to face up the number line, towards the greater positive numbers.
- Walk forward if adding a positive number or walk backward if adding a negative number.



Your teacher will select a classmate to walk the line for each of the given problems. Help your classmate by preparing the directions that are needed.

1. Complete the table.

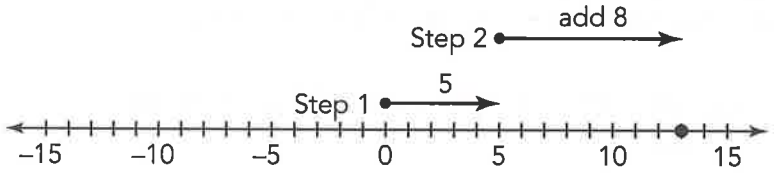
	Where You Start	Direction You Face	Walk Backwards or Forwards	Final Location
1 + 3				
0 + (−4)				
−3 + 5				
−1 + (−4)				

This worked example represents the movement created by walking the number line.

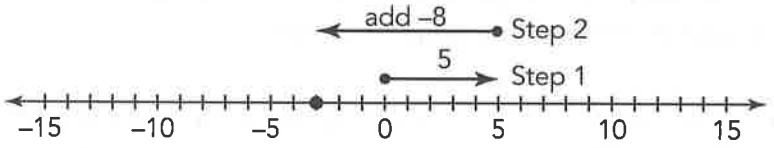
WORKED EXAMPLE

A number line can be used to model integer addition.
When adding a positive integer, move to the right on a number line.
When adding a negative integer, move to the left on a number line.

Example 1: The number line shows how to determine 5 + 8.



Example 2: The number line shows how to determine 5 + (–8).



Compare the first steps in each example.

2. What distance is shown by the first term in each example?

Remember that the **absolute value** of a number is its distance from 0.

3. Describe the graphical representation of the first term. Where does it start and in which direction does it move? How does this movement represent walking the line?

4. What is the absolute value of the first term in each example?

Compare the second steps in each example.

5. What distance is shown by the second term in each example?

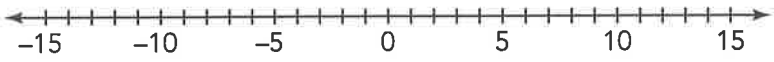
6. Why did the arrows for the second terms both start at the endpoints of the first terms but then continue in opposite directions? Explain your reasoning.

7. What is the absolute value of the second term in each example?

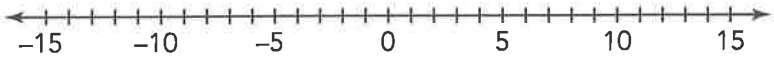
8. Use the number line to determine each sum. Show your work.

Think about walking the line as you model these sums on the number line.

a. $-3 + 7 =$ _____



b. $3 + (-7) =$ _____



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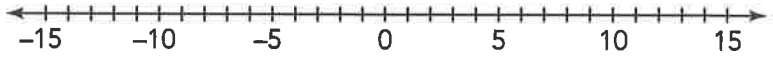
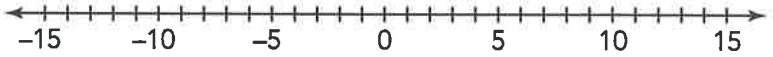
c. $-3 + (-7) =$ _____



d. $3 + 7 =$ _____



Notice that the first term in each expression in parts (a) through (d) was either 3 or (−3).

9. What do you notice about the distances shown by these terms on the number lines?

10. What is the absolute value of each term?

Notice that the second term in each expression was either 7 or (−7).

11. What do you notice about the distances shown by these terms on the number lines?

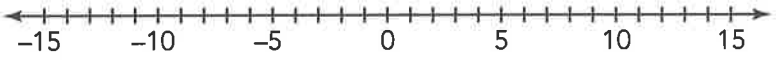
12. What is the absolute value of each term?

ACTIVITY
2.2 Adding on Number Lines

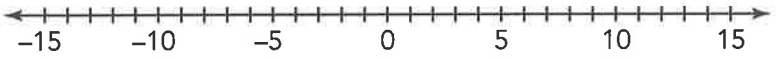
Now that you have the feel for how to move on the number line when adding negative numbers, it is time to practice with more examples.

Use the number line to determine each sum. Show your work.

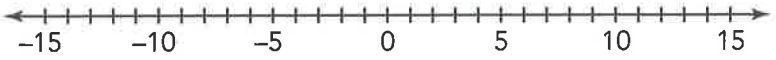
1. $-9 + 5 =$ _____



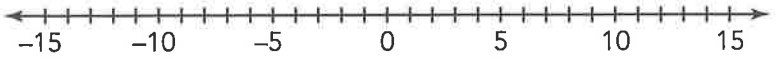
2. $9 + (-5) =$ _____



3. $-9 + (-5) =$ _____



4. $9 + 5 =$ _____



Notice that the first term in each expression in Questions 1 through 4 was either 9 or (−9).

5. What do you notice about the distances shown by these terms on the number lines?

6. What is the absolute value of each term?

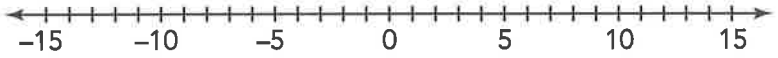
Notice that the second term in each expression was either 5 or (−5).

7. What do you notice about the distances shown by these terms on the number lines?

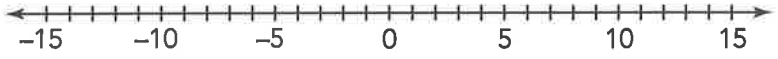
8. What is the absolute value of each term?

Use the number line to determine each sum. Show your work.

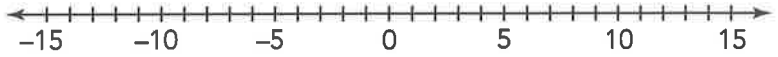
9. $-8 + 2 =$ _____



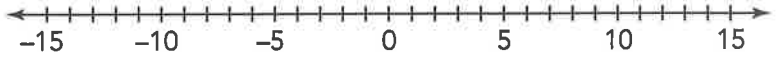
10. $8 + (-2) =$ _____



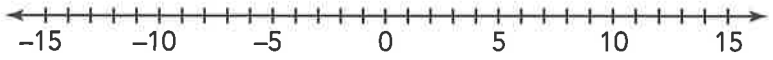
11. $-8 + (-2) =$ _____



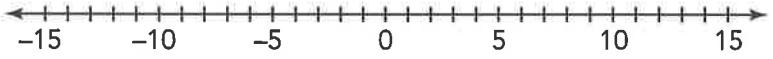
12. $8 + 2 =$ _____

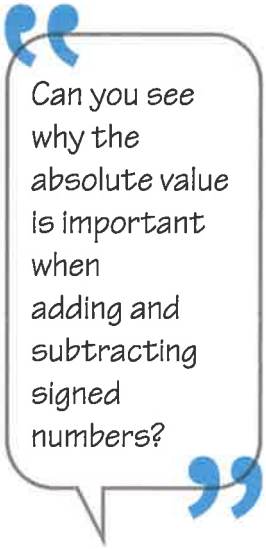


13. $-4 + 11 =$ _____

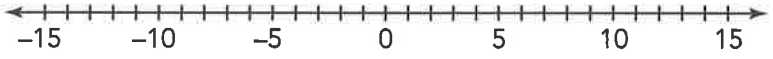


14. $4 + (-11) =$ _____

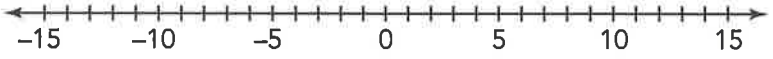




15. $-4 + (-11) =$ _____



16. $4 + 11 =$ _____



NOTES

TALK the TALK

Patterns on the Line

Demonstrate what you have learned about adding two numbers using a number line.

1. Describe the patterns from the *Adding on Number Lines* activity, when you:

   a. add two positive numbers.

   b. add two negative numbers.

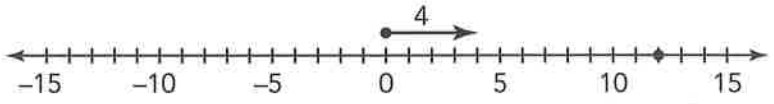
   c. add a negative and a positive number.

2. Do you think these patterns will hold true for all numbers, even fractions and decimals? Explain your reasoning.

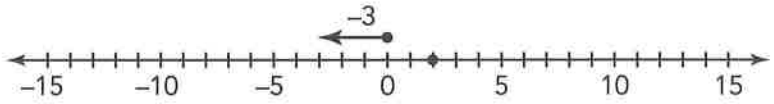
NOTES

3. Complete each number line model and number sentence.

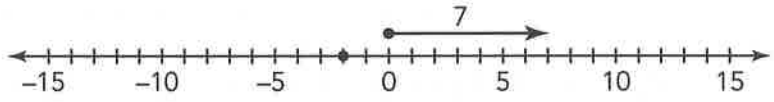
a. $4 + \_\_\_\_\_ = 12$



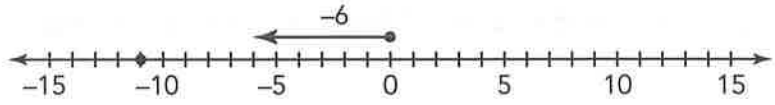
b. $-3 + \_\_\_\_\_ = 2$



c. $7 + \_\_\_\_\_ = -2$



d. $-6 + \_\_\_\_\_ = -11$



Assignment

Write

Explain how walking the line is the same as representing addition and subtraction on the number line.

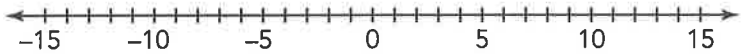
Remember

When adding a positive integer on a number line, move to the right on the number line. When adding a negative integer, move to the left on the number line.

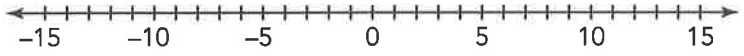
Practice

Use the number line to determine each sum. Show your work.

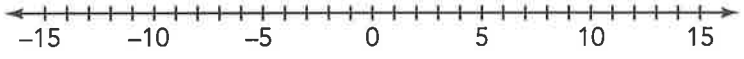
1. $-6 + 4$



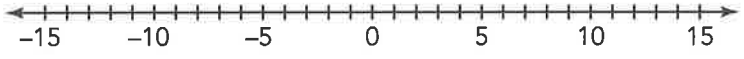
2. $-9 + (-2)$



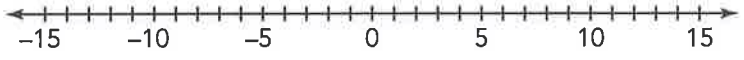
3. $13 + (-12)$



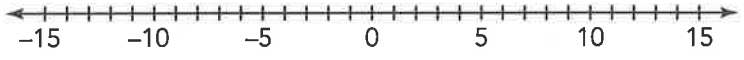
4. $7 + (-14)$



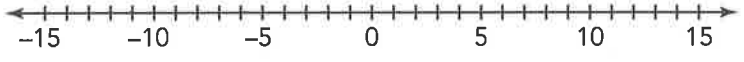
5. $7 + (-1)$



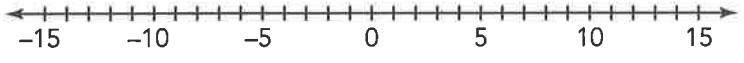
6. $3 + (-13)$



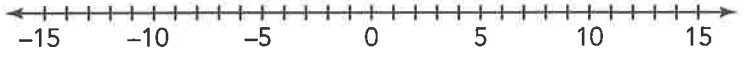
7. $8 + (-8)$



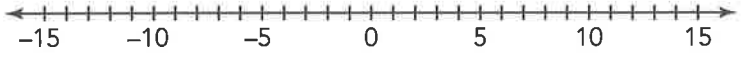
8. $-2 + 8$



9. $-13 + 3$

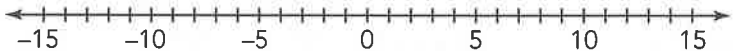


10. $0 + (-12)$

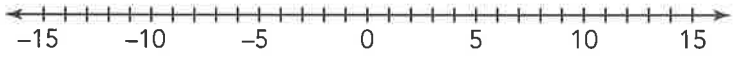


Complete each number line model and number sentence.

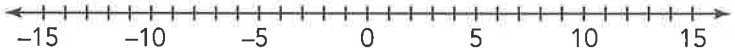
1. $-4 + \_\_\_\_\_ = 0$



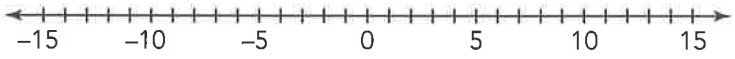
2. $-15 + \_\_\_\_\_ = -9$



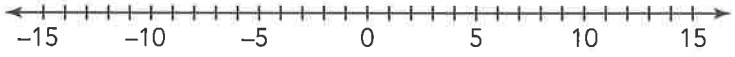
3. $\_\_\_\_\_ + 10 = -2$



4. $\_\_\_\_\_ + (-11) = -4$



5. $-12 + \_\_\_\_\_ = -14$



Stretch

Draw a number line model to determine each sum.

1. $-1.6 + -0.7$
2. $-2.1 + 0.8$
3. $2.2 + -4.1$

Review

Northern Tier Gardens has hired you for a summer job installing water gardens. They have circular water garden pools available in a variety of sizes. The manager has asked you to create a table to show the circumference and area of the company's various water garden pools. Use 3.14 for π and round each answer to the nearest hundredth.

Garden Name	Radius (feet)	Diameter (feet)	Area (square feet)	Circumference (feet)
Atlantic	2.5	5		
Pacifica	6	12		
Mediterranean	1.75	3.5		
Baltica	1	2		
Japanesque	2.25	4.5		
Floridian	3.25	6.5		