



## UNIT 1

# The Number System

### MODULE 1

#### Adding and Subtracting Integers

**FL**

7.NS.1.1, 7.NS.1.1b,  
7.NS.1.1c, 7.NS.1.1d,  
7.NS.1.3, 7.EE.2.3

### MODULE 2

#### Multiplying and Dividing Integers

**FL**

7.NS.1.2, 7.NS.1.2a,  
7.NS.1.2c, 7.NS.1.2b,  
7.NS.1.3, 7.EE.2.3

### MODULE 3

#### Rational Numbers

**FL**

7.NS.1.1, 7.NS.1.1a,  
7.NS.1.1b, 7.NS.1.1c,  
7.NS.1.1d, 7.NS.1.2,  
7.NS.1.2a,  
7.NS.1.2b, 7.NS.1.2c,  
7.NS.1.2d, 7.NS.1.3,  
7.EE.2.3

## CAREERS IN MATH

**Urban Planner** An urban planner creates plans for urban, suburban, and rural communities and makes recommendations about locations for infrastructure, such as buildings, roads, and sewer and water pipes. Urban planners perform cost-benefit analysis of projects, use measurement and geometry when they design the layout of infrastructure, and use statistics and mathematical models to predict the growth and future needs of a population.

If you are interested in a career as an urban planner, you should study these mathematical subjects:

- Algebra
- Geometry
- Trigonometry
- Statistics

Research other careers that require using measurement, geometry, and mathematical modeling.

### Unit 1 Performance Task

At the end of the unit, check out how **urban planners** use math.

# Vocabulary Preview

Use the puzzle to preview key vocabulary from this unit. Unscramble the circled letters within found words to answer the riddle at the bottom of the page.

1. NIOARLTA  
MURNEB


2. GREITEN

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3. PIRGENAET  
CMSEADIL


4. EADITIVD  
SENEIRV


5. TIIRANGTNEM  
SAELIDMC


- Any number that can be written as a ratio of two integers. (Lesson 1.1)
- A member of the set of whole numbers and their opposites. (Lesson 1.1)
- Decimals in which one or more digits repeat infinitely. (Lesson 1.1)
- The opposite of any number. (Lesson 1.3)
- Decimals that have a finite number of digits. (Lesson 1.1)

**Q:** Why were the two fractions able to settle their differences peacefully?

**A:** They were both \_\_\_\_\_!



# Adding and Subtracting Integers

MODULE



# 1



## ESSENTIAL QUESTION

How can you use addition and subtraction of integers to solve real-world problems?



### LESSON 1.1

#### Adding Integers with the Same Sign



**FL** 7.NS.1.1, 7.NS.1.1b, 7.NS.1.1d

### LESSON 1.2

#### Adding Integers with Different Signs



**FL** 7.NS.1.1, 7.NS.1.1b

### LESSON 1.3

#### Subtracting Integers



**FL** 7.NS.1.1, 7.NS.1.1c

### LESSON 1.4

#### Applying Addition and Subtraction of Integers



**FL** 7.NS.1.1, 7.NS.1.1d, 7.NS.1.3, 7.EE.2.3



### Real-World Video

Death Valley contains the lowest point in North America, elevation  $-282$  feet. The top of Mt. McKinley, elevation  $20,320$  feet, is the highest point in North America. To find the difference between these elevations, you can subtract integers.

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# Are YOU Ready?

Complete these exercises to review skills you will need for this module.



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## Understand Integers

**EXAMPLE** A diver descended 20 meters.

-20

Decide whether the integer is positive or negative:

*descended* → negative

Write the integer.

Write an integer to represent each situation.

1. an elevator ride down 27 stories      2. a \$700 profit      3. 46 degrees below zero      4. a gain of 12 yards

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## Whole Number Operations

**EXAMPLE**  $245 - 28$

$$\begin{array}{r} 3 \ 15 \\ 245 \\ - 28 \\ \hline 217 \end{array}$$

$$245 - 28 = 217$$

Think:

$8 > 5$

Regroup 1 ten as 10 ones.

1 ten + 5 ones = 15 ones

Subtract:  $15 - 8 = 7$

Find the sum or difference.

5. 
$$\begin{array}{r} 183 \\ + 78 \\ \hline \end{array}$$

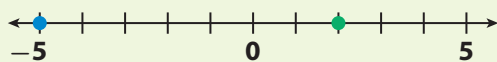
6. 
$$\begin{array}{r} 677 \\ - 288 \\ \hline \end{array}$$

7. 
$$\begin{array}{r} 1,188 \\ + 902 \\ \hline \end{array}$$

8. 
$$\begin{array}{r} 2,647 \\ - 1,885 \\ \hline \end{array}$$

## Locate Points on a Number Line

**EXAMPLE**



Graph +2 by starting at 0 and counting 2 units to the right.

Graph -5 by starting at 0 and counting 5 units to the left.

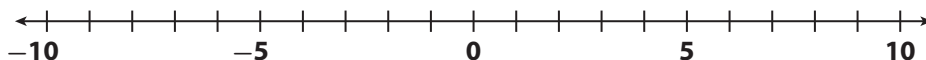
Graph each number on the number line.

9. 7

10. -4

11. -9

12. 4

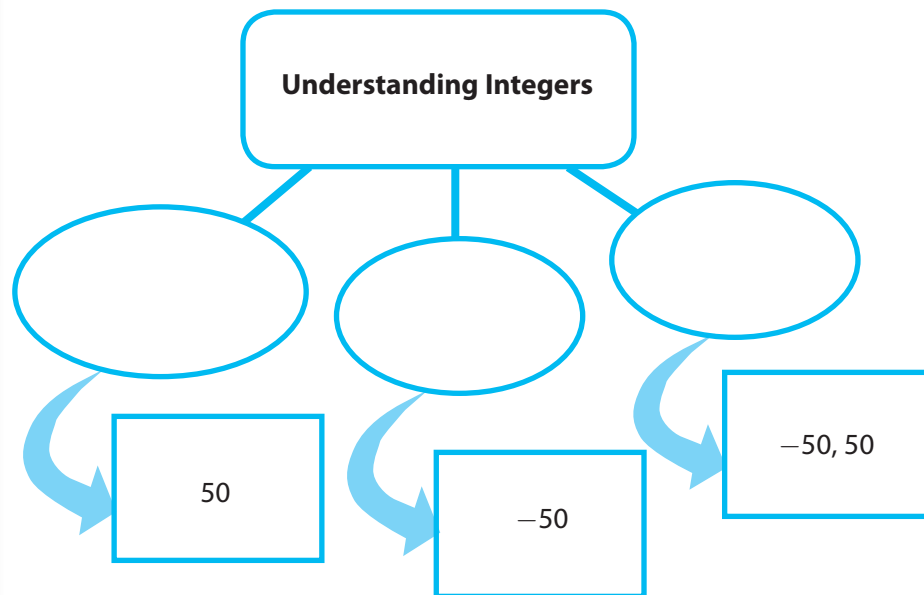




# Reading Start-Up

## Visualize Vocabulary

Use the ✓ words to fill in the ovals on the graphic. You may put more than one word in each oval.



## Vocabulary

### Review Words

- difference (*diferencia*)
- integers (*enteros*)
- ✓ negative number (*número negativo*)
- ✓ opposites (*opuestos*)
- ✓ positive number (*número positivo*)
- sum (*suma*)
- ✓ whole number (*número entero*)

### Preview Words

- absolute value (*valor absoluto*)
- additive inverse (*inverso aditivo*)
- expression (*expresión*)
- model (*modelo*)

## Understand Vocabulary

Complete the sentences using the preview words.

1. The \_\_\_\_\_ of a number gives its distance from zero.
2. The sum of a number and its \_\_\_\_\_ is zero.

## Active Reading

**Booklet** Before beginning the module, create a booklet to help you learn the concepts in this module. Write the main idea of each lesson on each page of the booklet. As you study each lesson, write important details that support the main idea, such as vocabulary and processes. Refer to your finished booklet as you work on assignments and study for tests.





## MODULE 1

# Unpacking the Standards

Understanding the standards and the vocabulary terms in the standards will help you know exactly what you are expected to learn in this module.



### FL 7.NS.1.1

Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

#### Key Vocabulary

**additive inverse** (*inverso* *aditivo*)

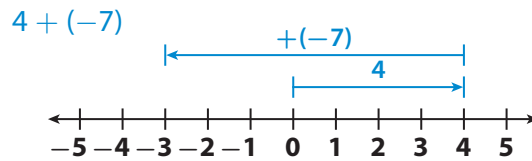
The opposite of a number.

## What It Means to You

You will learn how to use models to add and subtract integers with the same sign and with different signs.

### UNPACKING EXAMPLE 7.NS.1.1

You will learn how to use models to add and subtract integers with the same sign and with different signs.



Start at 0.  
Move right  
4 units.  
Then move  
left 7 units.

$$4 + (-7) = -3$$



### FL 7.NS.1.1c

Understand subtraction of rational numbers as adding the additive inverse,  $p - q = p + (-q)$ . Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.

#### Key Vocabulary

**integer** (*entero*)

A member of the set of whole numbers and their opposites.

## What It Means to You

You will learn that subtracting an integer is the same as adding its additive inverse.

### UNPACKING EXAMPLE 7.NS.1.1c

Find the difference between  $3,000^\circ\text{F}$  and  $-250^\circ\text{F}$ , the temperatures the space shuttle must endure.

$$3,000 - (-250)$$

$$3,000 + 250 = 3,250$$

The difference in temperatures the shuttle must endure is  $3,250^\circ\text{F}$ .



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Apply and extend previous understandings of addition and subtraction to add... rational numbers; represent addition... on a... vertical number line diagram. *Also 7.NS.1.1b, 7.NS.1.1d*



**ESSENTIAL QUESTION**

How do you add integers with the same sign?

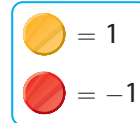
**EXPLORE ACTIVITY 1**



FL 7.NS.1.1

## Modeling Sums of Integers with the Same Sign

You can use colored counters to add positive integers and to add negative integers.



**Model with two-color counters.**

**A**  $3 + 4$



How many counters are there in total? \_\_\_\_\_

What is the sum and how do you find it?

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**B**  $-5 + (-3)$



How many counters are there in total? \_\_\_\_\_

Since the counters are negative integers, what is the sum? \_\_\_\_\_

**Reflect**

- 1. Communicate Mathematical Ideas** When adding two numbers with the same sign, what sign do you use for the sum?

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**Math Talk**

Mathematical Practices



What does the color of each row of counters represent?



# Adding on a Number Line

Just as you can add positive integers on a number line, you can add negative integers.

The temperature was  $2^{\circ}\text{F}$  below zero. The temperature drops by  $5^{\circ}\text{F}$ . What is the temperature now?

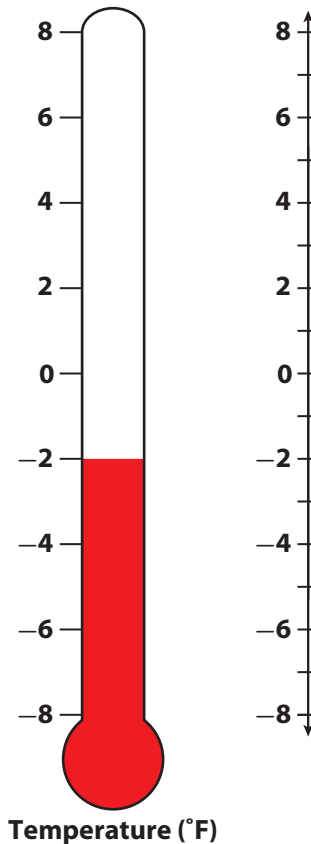
- A** What is the initial temperature written as an integer?  
\_\_\_\_\_
- B** Mark the initial temperature on the number line.
- C** A drop in temperature of  $5^{\circ}$  is like adding  $-5^{\circ}$  to the temperature.

Count on the number line to find the final temperature. Mark the temperature now on the number line.

- D** What is the temperature written as an integer?  
\_\_\_\_\_

The temperature is \_\_\_\_\_

**above / below** zero.



## Reflect

- 2. What If?** Suppose the temperature is  $-1^{\circ}\text{F}$  and drops by  $3^{\circ}\text{F}$ . Explain how to use the number line to find the new temperature.  
\_\_\_\_\_  
\_\_\_\_\_
- 3. Communicate Mathematical Ideas** How would using a number line to find the sum  $2 + 5$  be different from using a number line to find the sum  $-2 + (-5)$ ?  
\_\_\_\_\_  
\_\_\_\_\_
- 4. Analyze Relationships** What are two other negative integers that have the same sum as  $-2$  and  $-5$ ?  
\_\_\_\_\_



# Adding Integers with a Common Sign

To add integers with the same sign, add the absolute values of the integers and use the sign of the integers for the sum.



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## EXAMPLE 1



FL 7.NS.1.1, 7.NS.1.1d

Add  $-7 + (-6)$ .

*The signs of both integers are the same.*

**STEP 1** Find the absolute values.

$$|-7| = 7 \quad |-6| = 6$$

*The absolute value is always positive or zero.*

**STEP 2** Find the sum of the absolute values:  $7 + 6 = 13$

**STEP 3** Use the sign of the integers to write the sum.

$$-7 + (-6) = -13$$

*The sign of each integer is negative.*

## Math Talk

Mathematical Practices

Can you use the same procedure you use to find the sum of two negative integers to find the sum of two positive numbers? Explain.

## Reflect

5. **Communicate Mathematical Ideas** Does the Commutative Property of Addition apply when you add two negative integers? Explain.

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6. **Critical Thinking** Choose any two negative integers. Is the sum of the integers less than or greater than the value of either of the integers? Will this be true no matter which integers you choose? Explain.

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## YOUR TURN

Find each sum.

7.  $-8 + (-1) =$  \_\_\_\_\_

8.  $-3 + (-7) =$  \_\_\_\_\_

9.  $-48 + (-12) =$  \_\_\_\_\_

10.  $-32 + (-38) =$  \_\_\_\_\_

11.  $109 + 191 =$  \_\_\_\_\_

12.  $-40 + (-105) =$  \_\_\_\_\_

13.  $-150 + (-1500) =$  \_\_\_\_\_

14.  $-200 + (-800) =$  \_\_\_\_\_



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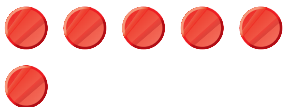
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## Guided Practice

Find each sum. (Explore Activity 1)

1.  $-5 + (-1)$



a. How many counters are there? \_\_\_\_\_

b. Do the counters represent positive or negative numbers? \_\_\_\_\_

c.  $-5 + (-1) =$  \_\_\_\_\_

2.  $-2 + (-7)$



a. How many counters are there? \_\_\_\_\_

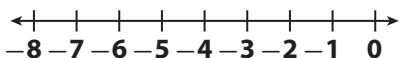
b. Do the counters represent positive or negative numbers? \_\_\_\_\_

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

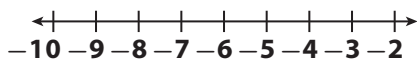
Model each addition problem on the number line to find each sum.

(Explore Activity 2)

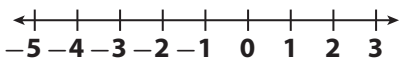
3.  $-5 + (-2) =$  \_\_\_\_\_



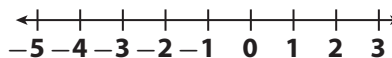
5.  $-3 + (-7) =$  \_\_\_\_\_



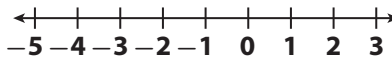
7.  $-2 + (-2) =$  \_\_\_\_\_



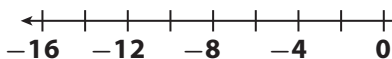
4.  $-1 + (-3) =$  \_\_\_\_\_



6.  $-4 + (-1) =$  \_\_\_\_\_



8.  $-6 + (-8) =$  \_\_\_\_\_



Find each sum. (Example 1)

9.  $-5 + (-4) =$  \_\_\_\_\_

10.  $-1 + (-10) =$  \_\_\_\_\_

11.  $-9 + (-1) =$  \_\_\_\_\_

12.  $-90 + (-20) =$  \_\_\_\_\_

13.  $-52 + (-48) =$  \_\_\_\_\_

14.  $5 + 198 =$  \_\_\_\_\_

15.  $-4 + (-5) + (-6) =$  \_\_\_\_\_

16.  $-50 + (-175) + (-345) =$  \_\_\_\_\_

### ESSENTIAL QUESTION CHECK-IN

17. How do you add integers with the same sign?

\_\_\_\_\_

\_\_\_\_\_



# 1.1 Independent Practice



**FL** 7.NS.1.1, 7.NS.1.1b, 7.NS.1.1d



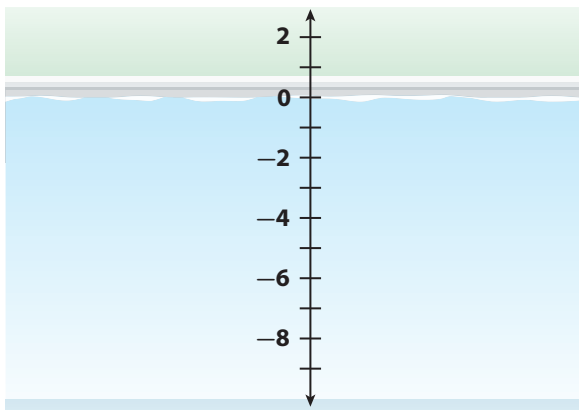
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- 18. Represent Real-World Problems** Jane and Sarah both dive down from the surface of a pool. Jane first dives down 5 feet, and then dives down 3 more feet. Sarah first dives down 3 feet, and then dives down 5 more feet.

- a. Multiple Representations** Use the number line to model the equation  $-5 + (-3) = -3 + (-5)$ .



- b.** Does the order in which you add two integers with the same sign affect the sum? Explain.

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- 19.** A golfer has the following scores for a 4-day tournament.

<b>Day</b>	1	2	3	4
<b>Score</b>	-3	-1	-5	-2

What was the golfer's total score for the tournament?

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- 20.** A football team loses 3 yards on one play and 6 yards on another play. Write a sum of negative integers to represent this situation. Find the sum and explain how it is related to the problem.

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- 21.** When the quarterback is sacked, the team loses yards. In one game, the quarterback was sacked four times. What was the total sack yardage?

<b>Game</b>	1	2	3	4
<b>Sack yardage</b>	-14	-5	-12	-23

- 22. Multistep** The temperature in Jonestown and Cooperville was the same at 1:00. By 2:00, the temperature in Jonestown dropped 10 degrees, and the temperature in Cooperville dropped 6 degrees. By 3:00, the temperature in Jonestown dropped 8 more degrees, and the temperature in Cooperville dropped 2 more degrees.

- a.** Write an equation that models the change to the temperature in Jonestown since 1:00.

---

- b.** Write an equation that models the change to the temperature in Cooperville since 1:00.

---

- c.** Where is it colder at 3:00, Jonestown or Cooperville?

---

23. **Represent Real-World Problems** Julio is playing a trivia game. On his first turn, he lost 100 points. On his second turn, he lost 75 points. On his third turn, he lost 85 points. Write a sum of three negative integers that models the change to Julio's score after his first three turns.
- 



**FOCUS ON HIGHER ORDER THINKING**

Work Area

24. **Multistep** On Monday, Jan made withdrawals of \$25, \$45, and \$75 from her savings account. On the same day, her twin sister Julie made withdrawals of \$35, \$55, and \$65 from *her* savings account.
- a. Write a sum of negative integers to show Jan's withdrawals on Monday. Find the total amount Jan withdrew.
- 
- b. Write a sum of negative integers to show Julie's withdrawals on Monday. Find the total amount Julie withdrew.
- 
- c. Julie and Jan's brother also withdrew money from his savings account on Monday. He made three withdrawals and withdrew \$10 more than Julie did. What are three possible amounts he could have withdrawn?
- 
25. **Communicate Mathematical Ideas** Why might you want to use the Commutative Property to change the order of the integers in the following sum before adding?

$$-80 + (-173) + (-20)$$

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26. **Critique Reasoning** The absolute value of the sum of two different integers with the same sign is 8. Pat says there are three pairs of integers that match this description. Do you agree? Explain.
- 
- 
- 
- 
-





Apply and extend previous understandings of addition and subtraction to add... rational numbers; represent addition... on a horizontal... number line diagram. Also 7.NS.1.1b



## ESSENTIAL QUESTION

How do you add integers with different signs?

### EXPLORE ACTIVITY 1



FL 7.NS.1.1, 7.NS.1.1b

## Adding on a Number Line

To find the sum of integers with the same sign, such as  $3 + 2$ , you can start at 3 and move  $|2| = 2$  units in the positive direction.

To find the sum of integers with different signs, such as  $3 + (-2)$ , you can start at 3 and move  $|-2| = 2$  units in the negative direction.

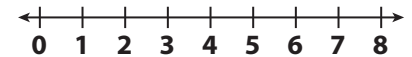


Model each sum on a number line.

- A** Model  $4 + (-3)$ .

Start at 4. Move 3 units to the left, or in the negative direction.

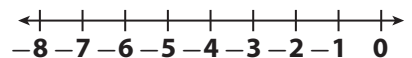
$4 + (-3) =$  \_\_\_\_\_



- B** Model  $-7 + 5$ .

Start at \_\_\_\_\_. Move 5 units to the \_\_\_\_\_, or in the \_\_\_\_\_ direction.

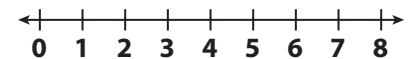
$-7 + 5 =$  \_\_\_\_\_



- C** Model  $6 + (-6)$ .

Start at \_\_\_\_\_. Move \_\_\_\_\_ units to the \_\_\_\_\_, or in the \_\_\_\_\_ direction.

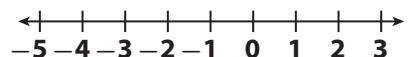
$6 + (-6) =$  \_\_\_\_\_



### Reflect

1. **Make a Prediction** Predict the sum of  $-2 + 2$ . Explain your prediction and check it using the number line.

\_\_\_\_\_



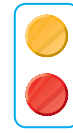
## EXPLORE ACTIVITY 2



FL 7.NS.1.1, 7.NS.1.1b

# Modeling Sums of Integers with Different Signs

You can use colored counters to model adding integers with different signs. When you add a positive integer (yellow counter) and a negative integer (red counter), the result is 0. One red and one yellow counter form a *zero pair*.



$$1 + (-1) = 0$$

**Model and find each sum using counters. Part A is modeled for you. For Part B, follow the steps to model and find the sum using counters.**

**A** Model  $3 + (-2)$ .

Start with 3 positive counters to represent 3.

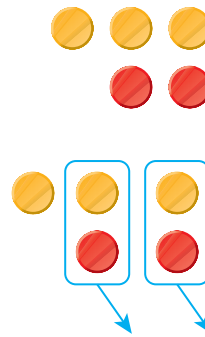
Add 2 negative counters to represent adding  $-2$ .

Form zero pairs.

What is left when you remove the zero pairs?

\_\_\_\_\_ counter

Find the sum:  $3 + (-2) =$  \_\_\_\_\_



The value of a zero pair is 0. Adding or subtracting 0 to any number does not change its value.

**B** Model  $-6 + 3$ .

Start with \_\_\_\_\_ counters to represent \_\_\_\_\_.

Add \_\_\_\_\_ counters to represent adding \_\_\_\_\_.

Form zero pairs.

What is left when you remove the zero pairs?

\_\_\_\_\_ counters

Find the sum:  $-6 + 3 =$  \_\_\_\_\_

## Reflect

2. **Make a Prediction** Kyle models a sum of two integers. He uses more negative (red) counters than positive (yellow) counters. What do you predict about the sign of the sum? Explain.

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## YOUR TURN

Model and find each sum using counters.

3.  $5 + (-1)$  \_\_\_\_\_

4.  $4 + (-6)$  \_\_\_\_\_

5.  $1 + (-7)$  \_\_\_\_\_

6.  $3 + (-4)$  \_\_\_\_\_

## Adding Integers

You have learned how to add integers with the same signs and how to add integers with different signs. The table below summarizes the rules for adding integers.

	Adding Integers	Examples
Same signs	Add the absolute values of the integers. Use the common sign for the sum.	$3 + 5 = 8$ $-2 + (-7) = -9$
Different signs	Subtract the lesser absolute value from the greater absolute value. Use the sign of the integer with the greater absolute value for the sum.	$3 + (-5) = -2$ $-10 + 1 = -9$
A number and its opposite	The sum is 0. The opposite of any number is called its <b>additive inverse</b> .	$4 + (-4) = 0$ $-11 + 11 = 0$

### EXAMPLE 1



FL 7.NS.1.1, 7.NS.1.1b

Find each sum.

**A**  $-11 + 6$

$$|-11| - |6| = 5$$

*Subtract the lesser absolute value from the greater.*

$$-11 + 6 = -5$$

*Use the sign of the number with the greater absolute value.*

**B**  $(-37) + 37$

$$(-37) + 37 = 0$$

*The sum of a number and its opposite is 0.*

### Math Talk

Mathematical Practices

Give an example of two integers with different signs whose sum is a positive number. How did you choose the integers?

## YOUR TURN

Find each sum.

7.  $-51 + 23 =$  \_\_\_\_\_

8.  $10 + (-18) =$  \_\_\_\_\_

9.  $13 + (-13) =$  \_\_\_\_\_

10.  $25 + (-26) =$  \_\_\_\_\_



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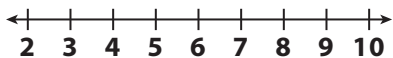
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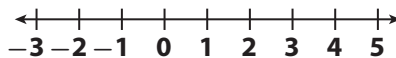
## Guided Practice

Use a number line to find each sum. (Explore Activity 1)

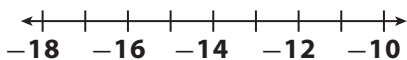
1.  $9 + (-3) =$  \_\_\_\_\_



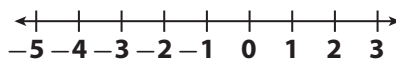
2.  $-2 + 7 =$  \_\_\_\_\_



3.  $-15 + 4 =$  \_\_\_\_\_



4.  $1 + (-4) =$  \_\_\_\_\_



Circle the zero pairs in each model. Find the sum. (Explore Activity 2)

5.  $-4 + 5 =$  \_\_\_\_\_



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



7.  $2 + (-5) =$  \_\_\_\_\_



8.  $-3 + 7 =$  \_\_\_\_\_



Find each sum. (Example 1)

9.  $-8 + 14 =$  \_\_\_\_\_

10.  $7 + (-5) =$  \_\_\_\_\_

11.  $5 + (-21) =$  \_\_\_\_\_

12.  $14 + (-14) =$  \_\_\_\_\_

13.  $0 + (-5) =$  \_\_\_\_\_

14.  $32 + (-8) =$  \_\_\_\_\_



### ESSENTIAL QUESTION CHECK-IN

15. Describe how to find the sums  $-4 + 2$  and  $-4 + (-2)$  on a number line.

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# 1.2 Independent Practice



**FL** 7.NS.1.1, 7.NS.1.1b



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**Find each sum.**

- |  |  |
|--|--|
| <p><b>16.</b> <math>-15 + 71 =</math> _____</p> <p><b>18.</b> <math>-79 + 79 =</math> _____</p> <p><b>20.</b> <math>18 + (-32) =</math> _____</p> <p><b>22.</b> <math>-12 + 8 + 7 =</math> _____</p> <p><b>24.</b> <math>15 + (-15) + 200 =</math> _____</p> | <p><b>17.</b> <math>-53 + 45 =</math> _____</p> <p><b>19.</b> <math>-25 + 50 =</math> _____</p> <p><b>21.</b> <math>5 + (-100) =</math> _____</p> <p><b>23.</b> <math>-8 + (-2) + 3 =</math> _____</p> <p><b>25.</b> <math>-500 + (-600) + 1200 =</math> _____</p> |
|--|--|

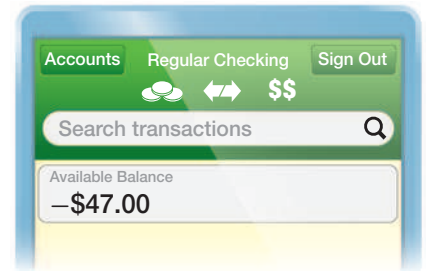
**26.** A football team gained 9 yards on one play and then lost 22 yards on the next. Write a sum of integers to find the overall change in field position. Explain your answer.

\_\_\_\_\_

**27.** A soccer team is having a car wash. The team spent \$55 on supplies. They earned \$275, including tips. The team's profit is the amount the team made after paying for supplies. Write a sum of integers that represents the team's profit.

\_\_\_\_\_

**28.** As shown in the illustration, Alexa had a negative balance in her checking account before depositing a \$47.00 check. What is the new balance of Alexa's checking account?



\_\_\_\_\_

**29.** The sum of two integers with different signs is 8. Give two possible integers that fit this description.

\_\_\_\_\_

**30. Multistep** Bart and Sam played a game in which each player earns or loses points in each turn. A player's total score after two turns is the sum of his points earned or lost. The player with the greater score after two turns wins. Bart earned 123 points and lost 180 points. Sam earned 185 points and lost 255 points. Which person won the game? Explain.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



- 31. Critical Thinking** Explain how you could use a number line to show that  $-4 + 3$  and  $3 + (-4)$  have the same value. Which property of addition states that these sums are equivalent?

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- 32. Represent Real-World Problems** Jim is standing beside a pool. He drops a weight from 4 feet above the surface of the water in the pool. The weight travels a total distance of 12 feet down before landing on the bottom of the pool. Explain how you can write a sum of integers to find the depth of the water.

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- 33. Communicate Mathematical Ideas** Use counters to model two integers with different signs whose sum is positive. Explain how you know the sum is positive.

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- 34. Analyze Relationships** You know that the sum of  $-5$  and another integer is a positive integer. What can you conclude about the sign of the other integer? What can you conclude about the value of the other integer? Explain.

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# 1.3 Subtracting Integers

Understand subtraction of rational numbers as adding the additive inverse,  $p - q = p + (-q)$ . ... Also 7.NS.1



## ESSENTIAL QUESTION

How do you subtract integers?

### EXPLORE ACTIVITY 1

## Modeling Integer Subtraction

You can use counters to find the difference of two integers. In some cases, you may need to add zero pairs.

**Model and find each difference using counters.**

- A** Model  $-4 - (-3)$ .

Start with 4 negative counters to represent  $-4$ .

Take away 3 negative counters to represent subtracting  $-3$ .

What is left? \_\_\_\_\_

Find the difference:  $-4 - (-3) = \underline{\quad}$

- B** Model  $6 - (-3)$ .

Start with 6 positive counters to represent 6.

You need to take away 3 negative counters, so add 3 zero pairs.

Take away 3 negative counters to represent subtracting  $-3$ .

What is left? \_\_\_\_\_

Find the difference:  $6 - (-3) = \underline{\quad}$

- C** Model  $-2 - (-5)$ .

Start with \_\_\_\_\_ counters.

You need to take away \_\_\_\_\_ counters, so add \_\_\_\_\_ zero pairs.

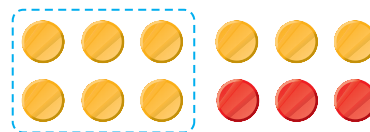
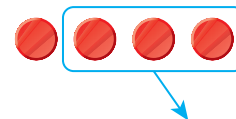
Take away \_\_\_\_\_ counters.

What is left? \_\_\_\_\_

Find the difference:  $-2 - (-5) = \underline{\quad}$



$$1 + (-1) = 0$$





**EXPLORE ACTIVITY 1** (cont'd)**Reflect**

1. **Communicate Mathematical Ideas** Suppose you want to model the difference  $-4 - 7$ . Do you need to add zero pairs? If so, why? How many should you add? What is the difference?

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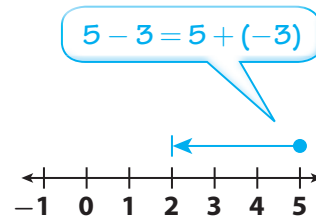
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**EXPLORE ACTIVITY 2**

FL 7.NS.1.1, 7.NS.1.1c

**Subtracting on a Number Line**

To model the difference  $5 - 3$  on a number line, you start at 5 and move 3 units to the left. Notice that you model the sum  $5 + (-3)$  in the same way. Subtracting 3 is the same as adding its opposite,  $-3$ .



You can use the fact that subtracting a number is the same as adding its opposite to find a difference of two integers.

**Find each difference on a number line.**

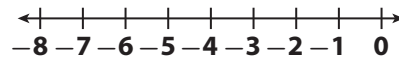
- A** Find  $-1 - 5$  on a number line.

Rewrite subtraction as addition of the opposite.

$$-1 - 5 = -1 + \underline{\hspace{2cm}}$$

Start at  $\underline{\hspace{1cm}}$  and move  $\underline{\hspace{1cm}}$  units to the left.

The difference is  $\underline{\hspace{2cm}}$



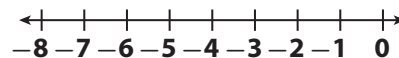
- B** Find  $-7 - (-3)$ .

Rewrite subtraction as addition of the opposite.

$$-7 - (-3) = -7 + \underline{\hspace{2cm}}$$

Start at  $\underline{\hspace{1cm}}$  and move  $\underline{\hspace{1cm}}$  units to the  $\underline{\hspace{1cm}}$ .

The difference is  $\underline{\hspace{2cm}}$



## EXPLORE ACTIVITY 2 (cont'd)

### Reflect

2. **Communicate Mathematical Ideas** Describe how to find  $5 - (-8)$  on a number line. If you found the difference using counters, would you get the same result? Explain.

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## Subtracting Integers by Adding the Opposite

You can use the fact that subtracting an integer is the same as adding its opposite to solve problems.

### EXAMPLE 1



FL 7.NS.1.1c, 7.NS.1.1

The temperature on Monday was  $-5^\circ\text{C}$ . By Tuesday the temperature rose to  $-2^\circ\text{C}$ . Find the change in temperature.

- STEP 1** Write a subtraction expression.

final temperature  $-$  Monday's temperature  $=$  change in temperature

$$-2^\circ\text{C} - (-5^\circ\text{C})$$

- STEP 2** Find the difference.

$$-2 - (-5) = -2 + 5$$

To subtract  $-5$ , add its opposite,  $5$ .

$$-2 + 5 = 3$$

Use the rule for adding integers.

- The temperature increased by  $3^\circ\text{C}$ .

### Reflect

3. **What If?** In Example 1, the temperature rose by  $3^\circ\text{C}$ . Suppose it fell from  $-2^\circ\text{C}$  to  $-10^\circ\text{C}$ . Predict whether the change in temperature would be positive or negative. Then subtract to find the change.

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Animated Math

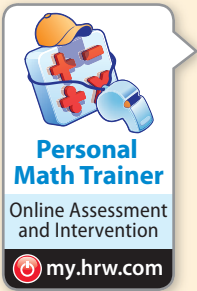
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### Math Talk

Mathematical Practices

Why does it make sense that the change in temperature is a positive number?



## YOUR TURN

Find each difference.

4.  $-7 - 2 =$  \_\_\_\_\_

5.  $-1 - (-3) =$  \_\_\_\_\_

6.  $3 - 5 =$  \_\_\_\_\_

7.  $-8 - (-4) =$  \_\_\_\_\_

## Guided Practice

Explain how to find each difference using counters. (Explore Activity 1)

1.  $5 - 8 =$  \_\_\_\_\_

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2.  $-5 - (-3) =$  \_\_\_\_\_

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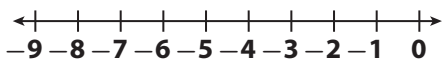
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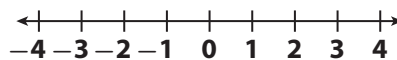
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Use a number line to find each difference. (Explore Activity 2)

3.  $-4 - 5 = -4 +$  \_\_\_\_\_  $=$  \_\_\_\_\_



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



Solve. (Example 1)

5.  $8 - 11 =$  \_\_\_\_\_

6.  $-3 - (-5) =$  \_\_\_\_\_

7.  $15 - 21 =$  \_\_\_\_\_

8.  $-17 - 1 =$  \_\_\_\_\_

9.  $0 - (-5) =$  \_\_\_\_\_

10.  $1 - (-18) =$  \_\_\_\_\_

11.  $15 - 1 =$  \_\_\_\_\_

12.  $-3 - (-45) =$  \_\_\_\_\_

13.  $19 - (-19) =$  \_\_\_\_\_

14.  $-87 - (-87) =$  \_\_\_\_\_



### ESSENTIAL QUESTION CHECK-IN

15. How do you subtract an integer from another integer without using a number line or counters? Give an example.

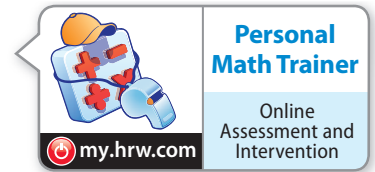
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# 1.3 Independent Practice



FL 7.NS.1.1, 7.NS.1.1c



16. Theo had a balance of  $-\$4$  in his savings account. After making a deposit, he has  $\$25$  in his account. What is the overall change to his account?

\_\_\_\_\_

17. As shown, Suzi starts her hike at an elevation below sea level. When she reaches the end of the hike, she is still below sea level at  $-127$  feet. What was the change in elevation from the beginning of Suzi's hike to the end of the hike?



\_\_\_\_\_

18. The record high January temperature in Austin, Texas, is  $90^\circ\text{F}$ . The record low January temperature is  $-2^\circ\text{F}$ . Find the difference between the high and low temperatures.

\_\_\_\_\_

19. Cheyenne is playing a board game. Her score was  $-275$  at the start of her turn, and at the end of her turn her score was  $-425$ . What was the change in Cheyenne's score from the start of her turn to the end of her turn?

\_\_\_\_\_

20. A scientist conducts three experiments in which she records the temperature of some gases that are being heated. The table shows the initial temperature and the final temperature for each gas.

Gas	Initial Temperature	Final Temperature
A	$-21^\circ\text{C}$	$-8^\circ\text{C}$
B	$-12^\circ\text{C}$	$12^\circ\text{C}$
C	$-19^\circ\text{C}$	$-15^\circ\text{C}$

- a. Write a difference of integers to find the overall temperature change for each gas.

Gas A: \_\_\_\_\_

\_\_\_\_\_

Gas B: \_\_\_\_\_

\_\_\_\_\_

Gas C: \_\_\_\_\_

\_\_\_\_\_

- b. **What If?** Suppose the scientist performs an experiment in which she cools the three gases. Will the changes in temperature be positive or negative for this experiment? Why?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



- 21. Analyze Relationships** For two months, Nell feeds her cat Diet Chow brand cat food. Then for the next two months, she feeds her cat Kitty Diet brand cat food. The table shows the cat's change in weight over 4 months.

	Cat's Weight Change (oz)
Diet Chow, Month 1	-8
Diet Chow, Month 2	-18
Kitty Diet, Month 3	3
Kitty Diet, Month 4	-19

Which brand of cat food resulted in the greatest weight loss for Nell's cat? Explain.

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**FOCUS ON HIGHER ORDER THINKING**

- 22. Represent Real-World Problems** Write and solve a word problem that can be modeled by the difference  $-4 - 10$ .

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- 23. Explain the Error** When Tom found the difference  $-11 - (-4)$ , he got  $-15$ . What might Tom have done wrong?

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- 24. Draw Conclusions** When you subtract one negative integer from another, will your answer be greater than or less than the integer you started with? Explain your reasoning and give an example.

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- 25. Look for a Pattern** Find the next three terms in the pattern 9, 4, -1, -6, -11, ... . Then describe the pattern.

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Work Area

# Applying Addition and Subtraction of Integers



Solve real-world and mathematical problems involving the four operations with rational numbers. Also 7.NS.1.1, 7.NS.1.1d, 7.EE.2.3



## ESSENTIAL QUESTION

How do you solve multistep problems involving addition and subtraction of integers?

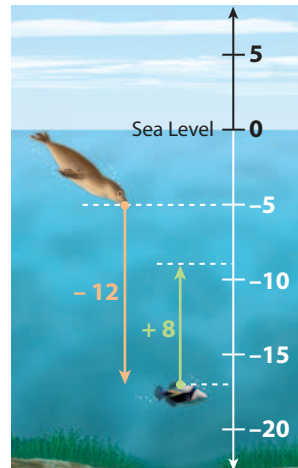
## Solving a Multistep Problem

You can use what you know about adding and subtracting integers to solve a multistep problem.

### EXAMPLE 1



A seal is swimming in the ocean 5 feet below sea level. It dives down 12 feet to catch some fish. Then, the seal swims 8 feet up towards the surface with its catch. What is the seal's final elevation relative to sea level?



**STEP 1** Write an expression.

- The seal starts at 5 feet below the surface, so its initial position is  $-5$  ft.

Starts	–	Dives down	+	Swims up
$-5$	–	$12$	+	$8$

**STEP 2** Add or subtract from left to right to find the value of the expression.

$$-5 - 12 + 8 = -17 + 8$$

$$= -9$$

The seal's final elevation is 9 feet below sea level.

This is reasonable because the seal swam farther down than up.

### YOUR TURN

- Anna is in a cave 40 feet below the cave entrance. She descends 13 feet, then ascends 18 feet. Find her new position relative to the cave entrance.

\_\_\_\_\_



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# Applying Properties to Solve Problems

You can use properties of addition to solve problems involving integers.

## EXAMPLE 2

Problem Solving



FL 7.NS.1.1d, 7.NS.1.3, 7.EE.2.3

Irene has a checking account. On Monday she writes a \$160 check for groceries. Then she deposits \$125. Finally she writes another check for \$40. What was the total change in the amount in Irene's account?



### Analyze Information

When Irene deposits money, she adds that amount to the account. When she writes a check, that money is deducted from the account.



### Formulate a Plan

Use a positive integer for the amount Irene added to the account. Use negative integers for the checks she wrote. Find the sum.

$$-160 + 125 + (-40)$$



### Solve

Add the amounts to find the total change in the account. Use properties of addition to simplify calculations.

$$\begin{aligned}
 -160 + 125 + (-40) &= -160 + (-40) + 125 && \text{Commutative Property} \\
 &= -200 + 125 && \text{Associative Property} \\
 &= -75
 \end{aligned}$$

The amount in the account decreased by \$75.



### Justify and Evaluate

Irene's account has \$75 less than it did before Monday. This is reasonable because she wrote checks for \$200 but only deposited \$125.

## Reflect

- Communicative Mathematical Ideas** Describe a different way to find the change in Irene's account.

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## YOUR TURN

- Alex wrote checks on Tuesday for \$35 and \$45. He also made a deposit in his checking account of \$180. Find the overall change in the amount in his checking account.

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# Comparing Values of Expressions

Sometimes you may want to compare values obtained by adding and subtracting integers.



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## EXAMPLE 3

Problem Solving



FL 7.NS.1.3, 7.EE.2.3

The Tigers, a football team, must gain 10 yards in the next four plays to keep possession of the ball. The Tigers lose 12 yards, gain 5 yards, lose 8 yards, and gain 14 yards. Do the Tigers maintain possession of the ball?



### Analyze Information

When the team gains yards, add that distance.

When the team loses yards, subtract that distance.

If the total change in yards is greater than or equal to 10, the team keeps possession of the ball.



### Formulate a Plan

$$-12 + 5 - 8 + 14$$



### Solve

$$-12 + 5 - 8 + 14$$

$$-12 + 5 + (-8) + 14$$

To subtract, add the opposite.

$$-12 + (-8) + 5 + 14$$

Commutative Property

$$(-12 + (-8)) + (5 + 14)$$

Associative Property

$$-20 + 19 = -1$$

$$-1 < 10$$

Compare to 10 yards

The Tigers gained less than 10 yards, so they do not maintain possession.



### Justify and Evaluate

The football team gained 19 yards and lost 20 yards for a total of  $-1$  yard.

## YOUR TURN

4. Jim and Carla are scuba diving. Jim started out 10 feet below the surface. He descended 18 feet, rose 5 feet, and descended 12 more feet. Then he rested. Carla started out at the surface. She descended 20 feet, rose 5 feet, and descended another 18 feet. Then she rested. Which person rested at a greater depth? Explain.

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## Math Talk

Mathematical Practices

What does it mean that the football team had a total of  $-1$  yard over four plays?



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## Guided Practice

**Write an expression. Then find the value of the expression.**

(Examples 1, 2, 3)

1. Tomas works as an underwater photographer. He starts at a position that is 15 feet below sea level. He rises 9 feet, then descends 12 feet to take a photo of a coral reef. Write and evaluate an expression to find his position relative to sea level when he took the photo.

---

2. The temperature on a winter night was  $-23^{\circ}\text{F}$ . The temperature rose by  $5^{\circ}\text{F}$  when the sun came up. When the sun set again, the temperature dropped by  $7^{\circ}\text{F}$ . Write and evaluate an expression to find the temperature after the sun set.

---

3. Jose earned 50 points in a video game. He lost 40 points, earned 87 points, then lost 30 more points. Write and evaluate an expression to find his final score in the video game.

---

**Find the value of each expression.** (Example 2)

4.  $-6 + 15 + 15 =$  \_\_\_\_\_

5.  $9 - 4 - 17 =$  \_\_\_\_\_

6.  $50 - 42 + 10 =$  \_\_\_\_\_

7.  $6 + 13 + 7 - 5 =$  \_\_\_\_\_

8.  $65 + 43 - 11 =$  \_\_\_\_\_

9.  $-35 - 14 + 45 + 31 =$  \_\_\_\_\_

**Determine which expression has a greater value.** (Example 3)

10.  $-12 + 6 - 4$  or  $-34 - 3 + 39$

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11.  $21 - 3 + 8$  or  $-14 + 31 - 6$

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### ESSENTIAL QUESTION CHECK-IN

12. Explain how you can find the value of the expression  $-5 + 12 + 10 - 7$ .

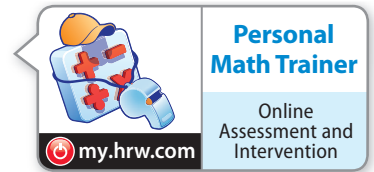
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# 1.4 Independent Practice



**FL** 7.NS.1.1, 7.NS.1.1d, 7.NS.1.3, 7.EE.2.3



- 13. Sports** Cameron is playing 9 holes of golf. He needs to score a total of at most 15 over par on the last four holes to beat his best golf score. On the last four holes, he scores 5 over par, 1 under par, 6 over par, and 1 under par.
- Write and find the value of an expression that gives Cameron's score for 4 holes of golf.  
\_\_\_\_\_
  - Is Cameron's score on the last four holes over or under par?  
\_\_\_\_\_
  - Did Cameron beat his best golf score?  
\_\_\_\_\_
- 14.** Herman is standing on a ladder that is partly in a hole. He starts out on a rung that is 6 feet under ground, climbs up 14 feet, then climbs down 11 feet. What is Herman's final position, relative to ground level?  
\_\_\_\_\_
- 15. Explain the Error** Jerome tries to find the value of the expression  $3 - 6 + 5$  by first applying the Commutative Property. He rewrites the expression as  $3 - 5 + 6$ . Explain what is wrong with Jerome's approach.  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 16.** Lee and Barry play a trivia game in which questions are worth different numbers of points. If a question is answered correctly, a player earns points. If a question is answered incorrectly, the player loses points. Lee currently has  $-350$  points.
- Before the game ends, Lee answers a 275-point question correctly, a 70-point question correctly, and a 50-point question incorrectly. Write and find the value of an expression to find Lee's final score.  
\_\_\_\_\_
  - Barry's final score is 45. Which player had the greater final score?  
\_\_\_\_\_
- 17. Multistep** Rob collects data about how many customers enter and leave a store every hour. He records a positive number for customers entering the store each hour and a negative number for customers leaving the store each hour.

	Entering	Leaving
<b>1:00 to 2:00</b>	30	-12
<b>2:00 to 3:00</b>	14	-8
<b>3:00 to 4:00</b>	18	-30

- During which hour did more customers leave than arrive?  
\_\_\_\_\_
- There were 75 customers in the store at 1:00. The store must be emptied of customers when it closes at 5:00. How many customers must leave the store between 4:00 and 5:00?  
\_\_\_\_\_

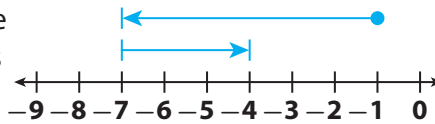
The table shows the changes in the values of two friends' savings accounts since the previous month.

	June	July	August
Carla	-18	22	-53
Leta	-17	-22	18

18. Carla had \$100 in her account in May. How much money does she have in her account in August? \_\_\_\_\_
19. Leta had \$45 in her account in May. How much money does she have in her account in August? \_\_\_\_\_
20. **Analyze Relationships** Whose account had the greatest decrease in value from May to August? \_\_\_\_\_

**H.O.T.** FOCUS ON HIGHER ORDER THINKING

21. **Represent Real-World Problems** Write and solve a word problem that matches the diagram shown.



\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

22. **Critical Thinking** Mary has \$10 in savings. She owes her parents \$50. She does some chores and her parents pay her \$12. She also gets \$25 for her birthday from her grandmother. Does Mary have enough money to pay her parents what she owes them? If not, how much more money does she need? Explain.

\_\_\_\_\_

\_\_\_\_\_

23. **Draw Conclusions** An expression involves subtracting two numbers from a positive number. Under what circumstances will the value of the expression be negative? Give an example.

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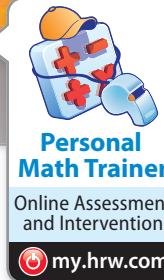
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Work Area

# Ready to Go On?



## 1.1 Adding Integers with the Same Sign

Add.

1.  $-8 + (-6)$  \_\_\_\_\_      2.  $-4 + (-7)$  \_\_\_\_\_      3.  $-9 + (-12)$  \_\_\_\_\_

## 1.2 Adding Integers with Different Signs

Add.

4.  $5 + (-2)$  \_\_\_\_\_      5.  $-8 + 4$  \_\_\_\_\_      6.  $15 + (-8)$  \_\_\_\_\_

## 1.3 Subtracting Integers

Subtract.

7.  $2 - 9$  \_\_\_\_\_      8.  $-3 - (-4)$  \_\_\_\_\_      9.  $11 - (-12)$  \_\_\_\_\_

## 1.4 Applying Addition and Subtraction of Integers

10. A bus makes a stop at 2:30, letting off 15 people and letting on 9. The bus makes another stop ten minutes later to let off 4 more people. How many more or fewer people are on the bus after the second stop compared to the number of people on the bus before the 2:30 stop?

\_\_\_\_\_

11. Cate and Elena were playing a card game. The stack of cards in the middle had 24 cards in it to begin with. Cate added 8 cards to the stack. Elena then took 12 cards from the stack. Finally, Cate took 9 cards from the stack. How many cards were left in the stack?

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### ESSENTIAL QUESTION

12. Write and solve a word problem that can be modeled by addition of two negative integers.

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# Assessment Readiness



## Selected Response

- Which expression has the same value as  $-3 + (-5)$ ?
  - (A)  $-3 - (-5)$
  - (B)  $-3 + 5$
  - (C)  $-5 + (-3)$
  - (D)  $-5 - (-3)$
- A diver's elevation is  $-30$  feet relative to sea level. She dives down 12 feet. What is her elevation after the dive?
  - (A) 12 feet
  - (B) 18 feet
  - (C)  $-30$  feet
  - (D)  $-42$  feet
- Which number line models the expression  $-3 + 5$ ?
  - (A)
  - (B)
  - (C)
  - (D)
- Which number can you add to 5 to get a sum of 0?
  - (A)  $-10$
  - (B)  $-5$
  - (C) 0
  - (D) 5

- The temperature in the morning was  $-3^\circ\text{F}$ . The temperature dropped 11 degrees by night. What was the temperature at night?
  - (A)  $-14^\circ\text{F}$
  - (B)  $-8^\circ\text{F}$
  - (C)  $8^\circ\text{F}$
  - (D)  $14^\circ\text{F}$
- Which of the following expressions has the greatest value?
  - (A)  $3 - 7 + (-10)$
  - (B)  $3 + 7 - (-10)$
  - (C)  $3 - 7 - (-10)$
  - (D)  $3 + 7 + (-10)$

## Mini-Task

- At the end of one day, the value of a share of a certain stock was \$12. Over the next three days, the change in the value of the share was  $-\$1$ , then,  $-\$1$ , and then  $\$3$ .
  - Write an expression that describes the situation.  
\_\_\_\_\_
  - Evaluate the expression. \_\_\_\_\_
  - What does your answer to part **b** mean in the context of the problem?  
\_\_\_\_\_  
\_\_\_\_\_