



## Lesson 2-3

## Subtracting Integers

**ISG** Interactive Study Guide

See pages 33–34 for:

- Getting Started
- Real-World Link
- Notes

**e** Essential Question

What happens when you add, subtract, multiply, and divide integers?

**CCSS** Common Core State Standards

Content Standards

7.NS.1, 7.NS.1c,  
7.NS.1d, 7.NS.3, 7.EE.3

Mathematical Practices

1, 3, 4, 7

**Vocabulary**

inductive reasoning

**What You'll Learn**

- Subtract integers.
- Find distance on the number line.

**Real-World Link**

**Ants** Ants are social insects that live in colonies. Ant colonies can be found both above and below ground. Most colonies build their nest below ground where they can dig to 20 feet below the surface. Other types of ants build their colonies above ground. The nests above ground can sometimes reach more than 6 feet tall!

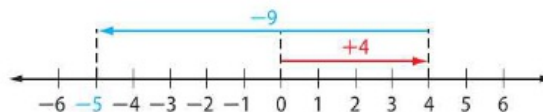
**Key Concept** Subtract Integers

**Words** To subtract an integer, add its additive inverse.

**Examples**  $2 - 7 = 2 + (-7)$

**Symbols**  $a - b = a + (-b)$

The number line below shows  $4 - 9 = -5$ .



When you subtract 9 on the number line, the result is the same as adding  $-9$ .

9 and  $-9$  are  
additive inverses



$$4 - 9 = -5$$

$$4 + (-9) = -5$$



same result

**Example 1**

Find each difference.

a.  $6 - 15$

$$6 - 15 = 6 + (-15)$$

To subtract 15  
add  $-15$ .

$$= -9$$

Simplify.

b.  $-7 - 8$

$$-7 - 8 = -7 + (-8)$$

To subtract 8  
add  $-8$ .

$$= -15$$

Simplify.

**Got It?** Do these problems to find out.

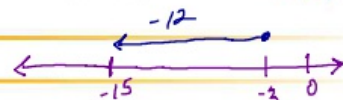
1a.  $4 - 15 = -11$

*SINCE I TOOK  
AWAY MORE  
THAN I HAD*

$$|15| - 4 = 11$$

1b.  $-3 - 12 = -15$

$$-3 + (-12) = -15$$



### Conjecture

A conjecture is the conclusion based on inductive reasoning.

**Inductive reasoning** is the process of reaching a conclusion based on a pattern of examples. In Example 1, you subtracted a positive integer by adding its additive inverse. Use inductive reasoning to see if the method also applies to subtracting a negative integer.

Adding the Additive Inverse			Subtracting an Integer		
Input	Rule: $4 + (-x)$	Output	Input	Rule: $4 - x$	Output
2	$4 + (-2)$	$\rightarrow 2$	2	$4 - 2$	$\rightarrow 2$
1	$4 + (-1)$	$\rightarrow 3$	1	$4 - 1$	3
0	$4 + 0$	4	0	$4 - 0$	4
-1	$4 + 1$	$\rightarrow 5$	-1	$4 - (-1)$	$\rightarrow 5$

Continuing the pattern in the first column,  $4 - (-1) = 5$ . The result is the same as when you add the additive inverse.

### Example 2

Find each difference.

$$4 - 9 = 4 + (-9)$$

a.  $9 - (-2)$

$$9 - (-2) = 9 + 2 \quad \text{To subtract } -2, \text{ add } 2$$
$$= 11$$

b.  $3 - (-5)$

$$3 - (-5) = 3 + 5 \quad \text{To subtract } -5, \text{ add } 5$$
$$= 8$$

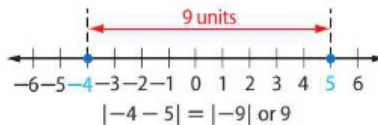
**Got It?** Do these problems to find out.

2a.  $18 - (-2) \rightarrow 18 + 2 = 20$

2b.  $-5 - (-11) \rightarrow -5 + 11 = 6$

### Find Distance on a Number Line

You can find the distance between two integers by using a number line. You can also determine the distance by finding the absolute value of the difference of the numbers. The number line below shows that the distance between  $-4$  and  $5$  is 9 units.



### Example 3

Find the distance between 3 and  $-3$  on a number line.

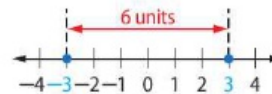
$$| 3 - (-3) | = | 6 |$$
$$= 6$$

Find the absolute value of the difference of 3 and  $-3$ .  
Simplify.

$$3 - (-3) = 3 + 3 = 6$$

The distance between the integers is 6 units.

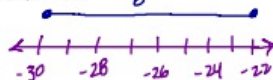
Check using the number line.



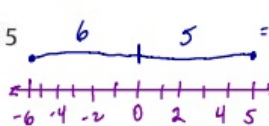
**Got It?** Do these problems to find out.

Find the distance between each pair of integers.

3a.  $-30$  and  $-22$



3b.  $-6$  and  $5$





**Example 4**

The top of an iceberg is 15 feet above sea level. The bottom of the iceberg is 105 feet below sea level. What is the distance from the top to the bottom of the iceberg?

Write an expression to find the distance, and then evaluate.

**Words** 15 feet above sea level minus 105 feet below sea level



**Expression**  $15 - (-105)$

$$\begin{aligned} |15 - (-105)| &= |15 + 105| && \text{Find the absolute value of the difference.} \\ &= |120| && \text{Add.} \\ &= 120 && \text{Simplify.} \end{aligned}$$

So, the distance from the top to the bottom of the iceberg is 120 feet.



**Got It?** Do this problem to find out.

4. A gopher begins digging at 7 inches below ground level and stops digging at 16 inches below ground level. How far did the gopher dig?

**Guided Practice**

Find each difference. (Examples 1 and 2)

1.  $3 - 5$

2.  $-10 - 14$

3.  $17 - (-14)$

4.  $-7 - (-11)$

Find the distance between each pair of integers. (Example 3)

5.  $-1$  and  $-7$

6.  $-8$  and  $8$

7.  $-4$  and  $6$



8. Moira dug a hole 2 feet deep to transplant a shrub. The shrub stands 3 feet above the ground. Write an expression to find the distance from the bottom of the hole to the top of the shrub. What is the distance? (Example 4)

**Independent Practice**

Go online for Step-by-Step Solutions



Find each difference. (Examples 1 and 2)

9.  $6 - 7$

10.  $4 - 8$

11.  $-12 - (-7)$

12.  $-15 - (-6)$

13.  $11 - (-14)$

14.  $9 - (-8)$

15.  $-5 - 2$

16.  $-9 - 3$

17.  $5 - (-10)$

18.  $1 - (-18)$

19.  $-15 - (-14)$

20.  $-12 - (-11)$

21.  $-20 - (-30)$

22.  $-38 - (-40)$

23.  $-32 - 28$

24.  $-47 - 34$

Find the distance between each pair of integers. (Example 3)

25.  $-18$  and  $-12$

26.  $-3$  and  $-11$

27.  $-15$  and  $7$

28.  $-6$  and  $12$

29.  $5$  and  $-15$

30.  $12$  and  $-7$

31. At the end of the first round of a game show, Jillian had a score of 40 points and Marty had a score of  $-50$  points. Find the difference between their two scores. (Example 4)
32. The lowest elevation in Louisiana is 8 feet below sea level. The highest elevation is 535 feet above sea level. What is the difference in elevation between the highest and lowest points? (Example 4)
33. **CCSS Model with Mathematics** A jellyfish is swimming at 4 meters below sea level. It swims to 1 meter below sea level. Draw and label a number line to find the distance the jellyfish swam. How far did the jellyfish swim?

Find each difference.

34.  $125 - (-114)$

35.  $-320 - (-106)$

36.  $-2200 - (-3500)$

37. **Financial Literacy** The daily closing prices for a company's stock are shown.

Date	May 3	May 4	May 5	May 6	May 7
Closing Price	\$33.30	\$30.59	\$31.04	\$31.97	\$30.15
Change	—	■	■	■	■

- a. Find the change in the closing price since the previous day.
- b. What is the difference between the highest and lowest change values?
38. **CCSS Multiple Representations** In this problem, you will apply subtraction of integers to a real-world situation. An underwater video camera is 7 feet below the surface. It will be lowered an additional  $f$  feet.
- a. **Symbols** Write an expression to show how many total feet below the surface the camera will be after it is lowered.
- b. **Table** Make a table to show the depth of the camera if it is lowered 5, 8, 10, or 12 feet.



### H.O.T. Problems Higher Order Thinking

39. **CCSS Identify Structure** Write a subtraction expression with a positive integer and a negative integer whose difference is positive. Then find the difference.
40. **CCSS Find the Error** Rick is finding  $-6 - (-2)$ . Find his mistake and correct it.

$$\begin{aligned} -6 - (-2) &= 6 - 2 \\ &= 4 \end{aligned}$$

41. **CCSS Use a Counterexample** True or false? A subtraction expression with a positive integer and a negative will have a difference of zero. If false, give a counterexample.
42. **e Building on the Essential Question** Write an expression involving the subtraction of a negative integer. Then write an equivalent addition expression. Explain why the result is the same.



### Standardized Test Practice

43. The melting point of mercury is  $-39^{\circ}\text{C}$ . The freezing point of alcohol is  $-114^{\circ}\text{C}$ . How much warmer is the melting point of mercury than the freezing point of alcohol?

A  $-153^{\circ}\text{C}$                       C  $75^{\circ}\text{C}$   
 B  $-75^{\circ}\text{C}$                         D  $153^{\circ}\text{C}$

44. Which expression is modeled below?



F  $5 - 7$                           H  $0 - 2$   
 G  $5 - 2$                         J  $5 + 2$

45. **Short Response** The crest of a mountain is 5740 feet above sea level. The base of the mountain is 25 feet below sea level. What is the difference between the crest and base of the mountain?

46. Which statement about subtracting integers is always true?

A positive  $-$  negative = positive  
 B negative  $-$  positive = positive  
 C negative  $-$  negative = positive  
 D positive  $-$  positive = positive



### Common Core Review

47. A team gained 4 yards on one play. On the next play, they lost 5 yards. Write an addition equation and solve to find the change in yardage. Interpret the sum. **7.NS.1**

Replace each  $\bullet$  with  $<$ ,  $>$ , or  $=$  to make a true sentence. **6.NS.7**

48.  $-18 \bullet -8$                       49.  $0 \bullet -3$                       50.  $9 \bullet -9$

51. **CCSS Multiple Representations** It costs \$6 to buy a student ticket to the movies. **7.EE.4**

- a. **Symbols** Write an expression that can be used to find the cost of any number of student tickets.  
 b. **Table** Make a table to find the cost of 2, 4, 5, and 7 tickets.  
 c. **Graph** Graph the ordered pairs.

Translate each phrase into an algebraic expression. **6.EE.2a**

52. eight more than the amount Kira saved  
 53. five runs fewer than the Pirates scored  
 54. the quotient of a number and four, minus five  
 55. seven increased by the quotient of a number and eight

Simplify each expression. **7.EE.1**

56.  $(n + 4) + 7$                       57.  $24 + (s + 15)$                       58.  $(8 + r) + 12$   
 59.  $(7 \cdot p) \cdot 8$                         60.  $(g \cdot 4) \cdot 9$                         61.  $5(12b)$

Convert each measurement to the given unit. **5.MD.1**

62. 3 meters to centimeters                      63. 8 feet to inches  
 64. 100 grams to kilograms                      65. 12 quarts to gallons



**Interactive Study Guide**

See page 35 for:  
 • Mid-Chapter Check





### Example 4



The top of an iceberg is 15 feet above sea level. The bottom of the iceberg is 105 feet below sea level. What is the distance from the top to the bottom of the iceberg?

Write an expression to find the distance, and then evaluate.

**Words** 15 feet above sea level minus 105 feet below sea level



**Expression**  $15 - (-105)$

$$|15 - (-105)| = |15 + 105| \quad \text{Find the absolute value of the difference.}$$

$$= |120| \quad \text{Add.}$$

$$= 120 \quad \text{Simplify.}$$

So, the distance from the top to the bottom of the iceberg is 120 feet.

**Got It?** Do this problem to find out.

4. A gopher begins digging at 7 inches below ground level and stops digging at 16 inches below ground level. How far did the gopher dig? **9 in.**

### Guided Practice



Find each difference. (Examples 1 and 2)

1.  $3 - 5$  **-2**

2.  $-10 - 14$  **-24**

3.  $17 - (-14)$  **31**

4.  $-7 - (-11)$  **4**

Find the distance between each pair of integers. (Example 3)

5. -1 and -7 **6 units**

6. -8 and 8 **16 units**

7. -4 and 6 **10 units**

8. Moira dug a hole 2 feet deep to transplant a shrub. The shrub stands 3 feet above the ground. Write an expression to find the distance from the bottom of the hole to the top of the shrub. What is the distance? (Example 4)  **$3 - (-2)$ ; 5 ft**

### Independent Practice

Go online for Step-by-Step Solutions



Find each difference. (Examples 1 and 2)

9.  $6 - 7$  **-1**

10.  $4 - 8$  **-4**

11.  $-12 - (-7)$  **-5**

12.  $-15 - (-6)$  **-9**

13.  $11 - (-14)$  **25**

14.  $9 - (-8)$  **17**

15.  $-5 - 2$  **-7**

16.  $-9 - 3$  **-12**

17.  $5 - (-10)$  **15**

18.  $1 - (-18)$  **19**

19.  $-15 - (-14)$  **-1**

20.  $-12 - (-11)$  **-1**

21.  $-20 - (-30)$  **10**

22.  $-38 - (-40)$  **2**

23.  $-32 - 28$  **-60**

24.  $-47 - 34$  **-81**

Find the distance between each pair of integers. (Example 3)

25. -18 and -12 **6 units**

26. -3 and -11 **8 units**

27. -15 and 7 **22 units**

28. -6 and 12 **18 units**

29. 5 and -15 **20 units**

30. 12 and -7 **19 units**

31. At the end of the first round of a game show, Jillian had a score of 40 points and Marty had a score of  $-50$  points. Find the difference between their two scores. (Example 4) **90 points**
32. The lowest elevation in Louisiana is 8 feet below sea level. The highest elevation is 535 feet above sea level. What is the difference in elevation between the highest and lowest points? (Example 4) **543 ft**

- 33. CCSS Model with Mathematics** A jellyfish is swimming at 4 meters below sea level. It swims to 1 meter below sea level. Draw and label a number line to find the distance the jellyfish swam. How far did the jellyfish swim?  
**3 m; See Answer Appendix for number line.**

Find each difference.

34.  $125 - (-114)$  **239**      35.  $-320 - (-106)$  **-214**      36.  $-2200 - (-3500)$  **1300**

- 37. Financial Literacy** The daily closing prices for a company's stock are shown.

Date	May 3	May 4	May 5	May 6	May 7
Closing Price	\$33.30	\$30.59	\$31.04	\$31.97	\$30.15
Change	—	$-\$2.71$	$\$0.45$	$\$0.93$	$-\$1.82$

- a. Find the change in the closing price since the previous day. **See table.**
- b. What is the difference between the highest and lowest change values? **\\$3.64**
- 38. CCSS Multiple Representations** In this problem, you will apply subtraction of integers to a real-world situation. An underwater video camera is 7 feet below the surface. It will be lowered an additional  $f$  feet.
- a. **Symbols** Write an expression to show how many total feet below the surface the camera will be after it is lowered.  **$-7 - f$**
- b. **Table** Make a table to show the depth of the camera if it is lowered 5, 8, 10, or 12 feet. **See Answer Appendix.**

**H.O.T. Problems** Higher Order Thinking  $-7 - (4) = -7 + (-4) = -11$

- 39. CCSS Identify Structure** Write a subtraction expression with a positive integer and a negative integer whose difference is positive. Then find the difference. **Sample answer:  $4 - (-7)$ ; 11**
- 40. CCSS Find the Error** Rick is finding  $-6 - (-2)$ . Find his mistake and correct it.

$$\begin{array}{l} -6 - (-2) = 6 - 2 \\ = 4 \end{array}$$

**Rick incorrectly wrote  $-6$  as  $6$ . The correct solution is  $-6 - (-2) = -6 + 2 = -4$ .**

- 41. CCSS Use a Counterexample** True or false? A subtraction expression with a positive integer and a negative will have a difference of zero. If false, give a counterexample.  
**False;  $2 - (-2) = 4$  and  $(-2) - 2 = -4$**
- 42. Building on the Essential Question** Write an expression involving the subtraction of a negative integer. Then write an equivalent addition expression. Explain why the result is the same. **See Answer Appendix.**

PG 67  
44, 57-61 ODD

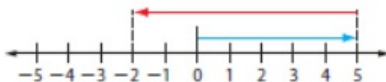


## Standardized Test Practice

43. The melting point of mercury is  $-39^{\circ}\text{C}$ . The freezing point of alcohol is  $-114^{\circ}\text{C}$ . How much warmer is the melting point of mercury than the freezing point of alcohol? **C**

A  $-153^{\circ}\text{C}$       C  $75^{\circ}\text{C}$   
B  $-75^{\circ}\text{C}$       D  $153^{\circ}\text{C}$

44. Which expression is modeled below? **F**



F  $5 - 7$       H  $0 - 2$   
G  $5 - 2$       J  $5 + 2$

45. **Short Response** The crest of a mountain is 5740 feet above sea level. The base of the mountain is 25 feet below sea level. What is the difference between the crest and base of the mountain? **5765 ft**

46. Which statement about subtracting integers is always true? **A**

A positive  $-$  negative = positive  
B negative  $-$  positive = positive  
C negative  $-$  negative = positive  
D positive  $-$  positive = positive



## Common Core Review

47. A team gained 4 yards on one play. On the next play, they lost 5 yards. Write an addition equation and solve to find the change in yardage. Interpret the sum. **7.NS.1**  
 $4 + (-5) = y$ ; **-1 yd; The team lost 1 yard in two plays.**

Replace each  $\bullet$  with  $<$ ,  $>$ , or  $=$  to make a true sentence. **6.NS.7**

48.  $-18 \bullet -8$   **$<$**       49.  $0 \bullet -3$   **$>$**       50.  $9 \bullet -9$   **$>$**

51. **Multiple Representations** It costs \$6 to buy a student ticket to the movies. **7.EE.4**

- a. **Symbols** Write an expression that can be used to find the cost of any number of student tickets.  **$6x$**   
b. **Table** Make a table to find the cost of 2, 4, 5, and 7 tickets. **b-c. See margin.**  
c. **Graph** Graph the ordered pairs.

Translate each phrase into an algebraic expression. **6.EE.2a**

52. eight more than the amount Kira saved  **$s + 8$**   
53. five runs fewer than the Pirates scored  **$r - 5$**   
54. the quotient of a number and four, minus five  **$k \div 4 - 5$**   
55. seven increased by the quotient of a number and eight  **$7 + n \div 8$**

Simplify each expression. **7.EE.1**

56.  $(n + 4) + 7$   **$n + 11$**       57.  $24 + (s + 15)$   **$39 + s$**       58.  $(8 + r) + 12$   **$20 + r$**   
59.  $(7 \cdot p) \cdot 8$   **$56p$**       60.  $(g \cdot 4) \cdot 9$   **$36g$**       61.  $5(12b)$   **$60b$**

Convert each measurement to the given unit. **5.MD.1**

62. 3 meters to centimeters **300 cm**      63. 8 feet to inches **96 in.**  
64. 100 grams to kilograms **0.1 kg**      65. 12 quarts to gallons **3 gal**



See page 35 for:  
• Mid-Chapter Check



$$5 - 12 = -7$$

$$-6 - 11 = -17$$

$$-8 - -20 = -8 + 20 = +12$$

$$4.5 - -16.5 = 4.5 + 16.5 = 21$$

$$-16.5 \quad 16.5$$

$$15 - 12 = 3$$