Common Core Standards:
7.NS.1.a, 7.NS.1.b, 7.NS.1.c, 7.NS.1.d, 7.NS.3

Add and Subtract Integers

Getting the Idea

The **absolute value** of a number is its distance from 0. For example, the absolute value of 2, written |2|, is 2 because it is 2 units to the right of 0 on the number line. Likewise, |−2| is also 2 since −2 is 2 units to the left of 0 on a number line.

You can use a number line to add integers. Start at the point that represents the first integer. To add a positive integer, move to the right. To add a negative integer, move to the left.

Recall that the additive inverse of a number is its opposite. For example, the additive inverse of 5 is −5.

Example 1

Find the sum of 3 and its additive inverse.

Strategy **Use a number line.**

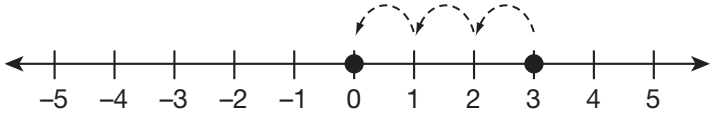
Step 1 Write an addition expression for the sum.

The additive inverse of 3 is −3.

Find 3 + (−3).

Step 2 Use a number line to add.

Start at 3. Since you are adding a negative integer, move 3 units to the left.



The sum is 0.

Solution **The sum of 3 and its additive inverse is 0.**

3 + (−3) = 0 is an example of the existence of the additive inverse property. It states that the sum of a number and its additive inverse is 0.

In Example 1, notice that the sum of 3 + (−3) is at 0, located a distance of 3 units to the left of 3. So, (−3) + 3 will also have the sum of 0 because it is located 3 units to the right of −3.

Let *a* and *b* represent two integers. To find the sum of *a* + *b* on a number line, start at *a* and move a distance of |*b*|. Move to the right of *a* if *b* is positive and to the left of *a* if *b* is negative. The sign of the sum depends upon the direction and the number of units moved from *a*.

Example 2

Find the sum.

$-4 + 3 = \square$

Strategy **Use a number line to add the two integers.**

Start at -4.

Since you are adding a positive integer, move 3 units to the right.

The sum is -1.

Solution $\mathbf{-4 + 3 = -1}$

You can use the following rules to add integers.

Rules for Adding Two Integers

- When integers have the same sign, add the absolute values and use the sign of the addends in the sum.
- When integers have different signs, find the difference of their absolute values. Then use the sign of the addend with the greater absolute value in the sum.

Example 3

Add.

$-11 + (-8) = \square$

Strategy **Apply the rules for adding two integers.**

Step 1 The integers have the same sign, so add the absolute values.

$|-11| = 11$

$|-8| = 8$

$11 + 8 = 19$

Step 2 Use the sign of the addends.

The sign of both addends is negative, so the sum is -19.

Solution $\mathbf{-11 + (-8) = -19}$

You can also use the properties of addition to add integers.

Example 4

Add.

$24 + (-10) = \square$

Strategy **Use the properties of addition.**

Step 1 Rewrite 24 as a sum with an addend of 10.

$24 = (14 + 10)$

Step 2 Rewrite the problem using the new form of 24.

$24 + (-10) = (14 + 10) + (-10)$

Step 3 Use the associative property of addition.

$(14 + 10) + (-10) = 14 + (10 + (-10))$

$= 14 + 0$ ← The sum of a number and its additive inverse is 0.

$= 14$

Solution **$24 + (-10) = 14$**

A number line can also be used to subtract integers. To subtract a positive integer, move to the left. To subtract a negative integer, move to the right.

Example 5

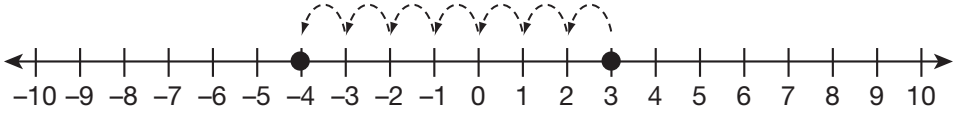
Find the difference.

$3 - 7 = \square$

Strategy **Use a number line to subtract two integers.**

Start at 3.

Since you are subtracting a positive integer, move 7 units to the left.



The difference is -4.

Solution **$3 - 7 = -4$**

Subtracting an integer is the same as adding its additive inverse.

Use these rules to subtract integers.

Rules for Subtracting Two Integers

- Write the additive inverse (opposite) of the number to be subtracted (the subtrahend).
- Change the minus sign to a plus sign.
- Apply the rules for adding two integers.

Example 6

Subtract.

$-5 - 4 = \square$

Strategy **Add the opposite of the subtrahend.**

Step 1 Find the opposite of the number to be subtracted.

The subtrahend is 4.

The opposite of 4 is -4.

Step 2 Add the opposite of the subtrahend to the minuend.

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

Both integers being added have a negative sign.

Step 3 Add the absolute values of the integers.

$|-5| = 5$ and $|-4| = 4$

$5 + 4 = 9$

Step 4 Give the sum the same sign as the addends, a negative sign.

Solution **$-5 - 4 = -9$**

Example 7

Subtract.

$2 - (-8) = \square$

Strategy **Add the opposite of the subtrahend.**

Step 1 Find the opposite of the number to be subtracted.

The subtrahend is -8.

The opposite of -8 is 8.

Step 2 Add the opposite of the subtrahend to the minuend.

$2 - (-8) = 2 + 8$

Both integers being added are positive.

Step 3 Add the integers.

$2 + 8 = 10$

Since both integers are positive, the sum will also be positive.

Solution **$2 - (-8) = 10$**

The properties of addition and subtraction can be used to show that $a - (b + c) = a - b - c$ if a, b, and c are integers.

$a - (b + c) = a + -(b + c)$	Add the opposite.
$= a + (-b) + (-c)$	Rewrite the sum using the distributive property.
$= a - b - c$	Use the properties of subtraction.

You can use the rules for adding and subtracting integers to solve problems.

Example 8

Carly has \$50 in a bank account. She writes a check for \$60 from the account. How much money does Carly have in her account after writing the check?

Strategy **Write a number sentence for the problem. Then solve.**

Step 1 Write a number sentence for the problem.

Let m represent the amount Carly has in her account after writing the check.

$\$50 - \$60 = m$

Step 2 Add the opposite of the number to be subtracted.

$\$50 - \$60 = \$50 + (-\$60)$

The integers being added have different signs.

Step 3 Find the difference of the absolute values of the integers.

$|50| = 50$

$|-60| = 60$

$60 - 50 = 10$

Step 4 Use the sign of the addend with the greater absolute value.

$|-60| > |50|$, so the sum is negative.

$\$50 + (-\$60) = -\$10$

Solution **Carly has −$10 in her account after writing the check.**

Coached Example

The record low temperature for Albany, New York, was −28°F in January 1971. The lowest temperature in U.S. history is 52°F lower than Albany's record low temperature. What is the lowest temperature in U.S. history?

Let *l* represent the lowest temperature in U.S. history.

Write a number sentence to represent the problem. _____

Is the subtrahend positive or negative? _____

Find the opposite of the subtrahend. _____

Add the opposite of the subtrahend to the minuend. _____

Both integers being added have a _____ sign.

Apply the rules for adding two integers.

Find the absolute value of the first addend. _____

Find the absolute value of the second addend. _____

Add the absolute values. _____

Use the sign of the addends in the sum. The sign for the sum is _____.

The lowest temperature in U.S. history is _____°F.

Lesson Practice

Choose the correct answer.

1. Subtract.

$3 - (-6) = \square$

A. -9
B. -3
C. 3
D. 9

2. Add.

$9 + (-16) = \square$

A. 25
B. 7
C. -7
D. -25

3. Subtract.

$-10 - 4 = \square$

A. -14
B. -6
C. 6
D. 14

4. The temperature one morning in Shasta was $-12°$F. By the afternoon, the temperature had risen $8°$F. What was the temperature in the afternoon?

A. $20°$F
B. $4°$F
C. $-4°$F
D. $-20°$F

5. Find the sum.

$-4 + (-2) = \square$

A. -6
B. -2
C. 2
D. 6

6. Find the difference.

$6 - 11 = \square$

A. -17
B. -5
C. 5
D. 17

7. A submarine at −28 feet dives 40 feet. What is the submarine's elevation after the dive?

A. 68 feet

B. 12 feet

C. −12 feet

D. −68 feet

8. The Panthers lost 6 yards on their first play and lost another 8 yards on their next play. What was their net result in yards after these two plays?

A. −14 yards

B. −2 yards

C. 2 yards

D. 14 yards

9. The temperature at the base of a mountain was 14°F. The temperature at the summit was 16°F lower than at the base.

A. Write a subtraction expression to represent the temperature at the summit.

B. What was the temperature at the summit? Show your work.

10. Which word problem has the solution of −4? Circle all that apply.

A. Earl jogged 5 yards forward and then jogged 9 yards backward. What was his final position compared to his starting point?

B. A rainbow trout was swimming at −2 feet. It swam downward 4 more feet. What was the new depth of the trout?

C. Clarissa had $49 in her checking account. She spent $53 on a pair of shoes. What was the new balance of her account?

11. Simplify each expression. Write each expression in the correct box.

$8 + (-2)$	$-6 - 4$	$2 - 4$	$-13 + 3$	$4 - (-2)$

−10	**6**	**−2**

12. A scuba diver is at -4 feet. He dives down 7 more feet to a coral reef. Circle the elevation of the top of the coral reef.

The elevation of the top of the coral reef is

11
3
−3
−11

feet.

13. Select True or False for each equation.

A. $4 - (-6) = 10$ ○ True ○ False

B. $5 + (-11) = -6$ ○ True ○ False

C. $-7 + (-3) = 10$ ○ True ○ False

D. $2 - 9 = -7$ ○ True ○ False

14. Use numbers from the box to complete each equation.

$-21 + 34 =$ _____

_____ $+ (-8) = 26$

$17 - (-38) =$ _____

$64 -$ _____ $= 30$

$-5 - (-18) =$ _____

13
34
55

15. Draw a line from each expression to its equivalent value.

A.	$-3 + (-5)$	8
B.	$14 - 6$	-8
C.	$-5 - 8$	13
D.	$4 - (-9)$	-13

16. The temperature at noon was 72°F. The temperature dropped 16°F by 9:00 P.M. Circle the temperature at 9:00 P.M.

The temperature at 9:00 P.M. was

37
56
88

°F.