1.2 Adding Integers

Essential Question: Is the sum of two integers positive, negative, or zero? How can you tell?

1 **ACTIVITY: Adding Integers with the Same Sign**

Work with a partner. Use integer counters to find \(-4 + (-3)\).

Combine 4 negative counters and 3 negative counters. What is the total number of counters?

\[
\begin{align*}
-4 & \quad + \quad -3 \\
\text{Combine 4 negative counters and 3 negative counters.} \\
\text{What is the total number of counters?}
\end{align*}
\]

\[
\begin{array}{c}
\text{So, } -4 + (-3) = \boxed{7}.
\end{array}
\]

2 **ACTIVITY: Adding Integers with Different Signs**

Work with a partner. Use integer counters to find \(-3 + 2\).

Combine 3 negative counters and 2 positive counters. Remove zero pairs. What is the total number of counters?

\[
\begin{align*}
-3 & \quad + \quad 2 \\
\text{Combine 3 negative counters and 2 positive counters.} \\
\text{Remove zero pairs.} \\
\text{What is the total number of counters?}
\end{align*}
\]

\[
\begin{array}{c}
\text{So, } -3 + 2 = \boxed{1}.
\end{array}
\]

3 **ACTIVITY: Adding Integers with Different Signs**

Work with a partner. Use a number line to find \(5 + (-3)\).

Start at 0. Move 5 units to the right. Add \(-3\). Then move 3 units left to end at .

\[
\begin{align*}
5 & \quad + \quad (-3) \\
\text{Start at 0. Move 5 units to the right.} \\
\text{Add } -3. \\
\text{Then move 3 units left to end at .}
\end{align*}
\]

\[
\begin{array}{c}
\text{So, } 5 + (-3) = \boxed{-2}.
\end{array}
\]
**Math Practice**

Make Conjectures

How can the relationship between the integers help you write a rule?

**4 ACTIVITY: Adding Integers with Different Signs**

Work with a partner. Write the addition expression shown. Then find the sum. How are the integers in the expression related to 0 on a number line?

- Start at 0. Move 7 units to the right.
- Add -7.
- Then move 7 units left to end at _ 

**Inductive Reasoning**

Work with a partner. Use integer counters or a number line to complete the table.

<table>
<thead>
<tr>
<th>Exercise</th>
<th>Type of Sum</th>
<th>Sum</th>
<th>Sum: Positive, Negative, or Zero</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.</td>
<td>Integers with the same sign</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>-3 + 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>5 + (-3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>7 + (-7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>2 + 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>-6 + (-2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>-5 + 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>15 + (-9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>-10 + 10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>-6 + (-6)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>13 + (-13)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**What Is Your Answer?**

16. **IN YOUR OWN WORDS**  Is the sum of two integers positive, negative, or zero? How can you tell?

17. **STRUCTURE**  Write general rules for adding (a) two integers with the same sign, (b) two integers with different signs, and (c) two integers that vary only in sign.

**Practice**

Use what you learned about adding integers to complete Exercises 8–15 on page 12.
Key Idea

Adding Integers with the Same Sign

Words: Add the absolute values of the integers. Then use the common sign.

Numbers:

\[2 + 5 = 7\]

\[-2 + (-5) = -7\]

**EXAMPLE 1**

Adding Integers with the Same Sign

Find \(-2 + (-4)\). Use a number line to check your answer.

\[-2 + (-4) = -6\]  \[\text{Add } |-2| \text{ and } |-4|.\]

\[\text{Use the common sign.}\]

\[\therefore \text{ The sum is } -6.\]

Check

\[\begin{array}{ccccccc}
-7 & -6 & -5 & -4 & -3 & -2 & -1 & 0 & 1 \\
\hline
& & & & & & & & \\
\end{array}\]

**The Meaning of a Word**

**Opposite**

When you walk across a street, you are moving to the opposite side of the street.

**On Your Own**

Add.

1. \(7 + 13\)
2. \(-8 + (-5)\)
3. \(-20 + (-15)\)

Two numbers that are the same distance from 0, but on opposite sides of 0, are called **opposites**. For example, \(-3\) and 3 are opposites.

Key Ideas

Adding Integers with Different Signs

Words: Subtract the lesser absolute value from the greater absolute value. Then use the sign of the integer with the greater absolute value.

Numbers:

\[8 + (-10) = -2\]

\[-13 + 17 = 4\]

Additive Inverse Property

Words: The sum of an integer and its additive inverse, or opposite, is 0.

Numbers:

\[6 + (-6) = 0\]

\[-25 + 25 = 0\]

Algebra:

\[a + (-a) = 0\]
**EXAMPLE 2 Adding Integers with Different Signs**

a. Find $5 + (-10)$.

\[
5 + (-10) = -5 \quad \text{Use the sign of } -10.
\]

The sum is $-5$.

b. Find $-3 + 7$.

\[
-3 + 7 = 4 \quad \text{Use the sign of 7.}
\]

The sum is $4$.

c. Find $-12 + 12$.

\[
-12 + 12 = 0 \quad \text{The sum is 0 by the Additive Inverse Property.}
\]

The sum is $0$.

**EXAMPLE 3 Adding More Than Two Integers**

The list shows four bank account transactions in July. Find the change $C$ in the account balance.

<table>
<thead>
<tr>
<th>JULY TRANSACTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Withdrawal</td>
</tr>
<tr>
<td>Deposit</td>
</tr>
<tr>
<td>Deposit</td>
</tr>
<tr>
<td>Withdrawal</td>
</tr>
</tbody>
</table>

Find the sum of the four transactions.

\[
C = -40 + 50 + 75 + (-50) \quad \text{Write the sum.}
\]

\[
= -40 + 75 + 50 + (-50) \quad \text{Commutative Property of Addition}
\]

\[
= -40 + 75 + [50 + (-50)] \quad \text{Associative Property of Addition}
\]

\[
= -40 + 75 + 0 \quad \text{Additive Inverse Property}
\]

\[
= 35 + 0 \quad \text{Add } -40 \text{ and 75.}
\]

\[
= 35 \quad \text{Addition Property of Zero}
\]

Because $C = 35$, the account balance increased $35 in July.

**On Your Own**

Add.

4. $-2 + 11$

5. $9 + (-10)$

6. $-31 + 31$

7. **WHAT IF?** In Example 3, the deposit amounts are $30 and $40. Find the change $C$ in the account balance.

Section 1.2 Adding Integers
1.2 Exercises

Vocabulary and Concept Check

1. WRITING How do you find the additive inverse of an integer?
2. NUMBER SENSE Is 3 + (−4) the same as −4 + 3? Explain.

Tell whether the sum is positive, negative, or zero without adding. Explain your reasoning.
3. −8 + 20
4. 30 + (−30)
5. −10 + (−18)

Tell whether the statement is true or false. Explain your reasoning.
6. The sum of two negative integers is always negative.
7. An integer and its absolute value are always opposites.

Practice and Problem Solving

Add.

8. 6 + 4
9. −4 + (−6)
10. −2 + (−3)
11. −5 + 12
12. 5 + (−7)
13. 8 + (−8)
14. 9 + (−11)
15. −3 + 13
16. −4 + (−16)
17. −3 + (−1)
18. 14 + (−5)
19. 0 + (−11)
20. −10 + (−15)
21. −13 + 9
22. 18 + (−18)
23. −25 + (−9)

ERROR ANALYSIS Describe and correct the error in finding the sum.
24. 9 + (−6) = −3
25. −10 + (−10) = 0

26. TEMPERATURE The temperature is −3°F at 7:00 a.m. During the next 4 hours, the temperature increases 21°F. What is the temperature at 11:00 a.m.?

27. BANKING Your bank account has a balance of −$12. You deposit $60. What is your new balance?

Tell how the Commutative and Associative Properties of Addition can help you find the sum mentally. Then find the sum.

28. 9 + 6 + (−6)
29. −8 + 13 + (−13)
30. 9 + (−17) + (−9)
31. 7 + (−12) + (−7)
32. −12 + 25 + (−15)
33. 6 + (−9) + 14

Add.

34. 13 + (−21) + 16
35. 22 + (−14) + (−35)
36. −13 + 27 + (−18)
37. −19 + 26 + 14
38. −32 + (−17) + 42
39. −41 + (−15) + (−29)
40. **SCIENCE** A lithium atom has positively charged protons and negatively charged electrons. The sum of the charges represents the charge of the lithium atom. Find the charge of the atom.

41. **OPEN-ENDED** Write two integers with different signs that have a sum of $-25$. Write two integers with the same sign that have a sum of $-25$.

**ALGEBRA** Evaluate the expression when $a = 4$, $b = -5$, and $c = -8$.

42. $a + b$
43. $-b + c$
44. $|a + b + c|$

**MENTAL MATH** Use mental math to solve the equation.

45. $d + 12 = 2$
46. $b + (-2) = 0$
47. $-8 + m = -15$

48. **PROBLEM SOLVING** Starting at point $A$, the path of a dolphin jumping out of the water is shown.

a. Is the dolphin deeper at point $C$ or point $E$? Explain your reasoning.
b. Is the dolphin higher at point $B$ or point $D$? Explain your reasoning.

49. **Puzzle** According to a legend, the Chinese Emperor Yu-Huang saw a magic square on the back of a turtle. In a magic square, the numbers in each row and in each column have the same sum. This sum is called the magic sum.

Copy and complete the magic square so that each row and each column has a magic sum of 0. Use each integer from $-4$ to 4 exactly once.

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**Fair Game Review** What you learned in previous grades & lessons

**Subtract.** *(Skills Review Handbook)*

50. $69 - 38$
51. $82 - 74$
52. $177 - 63$
53. $451 - 268$

54. **MULTIPLE CHOICE** What is the range of the numbers below? *(Skills Review Handbook)*

12, 8, 17, 12, 15, 18, 30

A 12
B 15
C 18
D 22