

Explore It!

Rain increases the height of water in a kiddie pool, while evaporation decreases the height. The pool water level is currently 2 inches above the fill line.

Starting Height of Water	Change in Inches of Water	Final Height of Water
2	+ 0	= <input type="text"/>
2	+ <input type="text"/>	= 1
2	+ -2	= 0
2	+ -3	= -1
2	+ -4	= <input type="text"/>

Lesson 1-3

Add Integers

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I can...
add integers.

A. Look for patterns in the equations in the table so you can fill in the missing numbers. Describe any relationships you notice.

B. Will the sum of 2 and (-6) be a positive or negative number? Explain.

Focus on math practices

Look for Relationships Suppose the water level of the pool started at 2 inches below the fill line. Make a table to show the starting height of the water, the change in inches, and the new final height of the water.

Essential Question

How do you use what you know about absolute value to add integers?

Lesson 1-3

Add Two Negative Integers

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EXAMPLE 1

Nita wants to straighten a photo. She uses an app to adjust the tilt. What was the total tilt adjustment?

Reasoning Why is the total tilt adjustment negative?

Set at 0.

Adjust by -4 degrees.

Adjust by another -6 degrees.

Use a number line to represent the total tilt adjustment.

Then move 6 units left to show an adjustment of -6. The total adjustment was -10.

Start at 0. Move 4 units left to show an adjustment of -4.

The sum of -4 and -6 is located 6 units to the left of -4.

The tilt starts at 0 degrees.

Add integers to find the total tilt adjustment.

$-4 + (-6)$

Because you moved 4 units and then 6 units in the same direction on the number line, add the absolute values to find the amount of tilt.

$| -4 | + | -6 |$
 $4 + 6 = 10$

10 represents the amount of tilt.

Because you moved to the left twice, the sum is negative.

$-4 + (-6) = -10$

Both adjustments are negative, so the tilt is negative.

The total tilt adjustment was -10.

Try It!

Dana recorded a temperature drop of 2° and a second temperature drop of 3° . What is the total change in temperature?

+ =

The sign of the sum is . The total change in temperature is .

Convince Me! Would the sum of two positive integers be positive or negative? Explain.

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EXAMPLE 2 Add Integers with Different Signs

Kara entered her chili recipe into the neighborhood cook-off. Nine judges rated each recipe with a thumbs up (+1) or thumbs down (-1). What was the final rating for Kara's recipe?

Reasoning There were more thumbs-down votes, so the final rating is negative.

Use a number line to represent Kara's final rating.

Start at 0. Move 5 units left for -5. Move 4 units right for 4. The final rating is -1.

The sum of -5 and 4 is located 4 units to the right of -5.

Add integers to find Kara's final rating.

$$-5 + 4$$

Because you moved in different directions on the number line, subtract the absolute values.

$$|-5| - |4|$$

$$5 - 4 = 1$$

There is 1 more thumbs down vote than thumbs up.

Because you moved a greater distance to the left than to the right, the sum is negative.

$$-5 + 4 = -1$$

The sum is negative because $|-5|$ is greater than $|4|$.

The final rating for Kara's recipe was -1.

EXAMPLE 3 Identify Additive Inverses and Opposite Integers

Playing golf, Mike got a +2 on the first hole and -2 on the second hole. What is his combined score for the first two holes?

$2 + (-2)$

$|2| = 2$ and $|-2| = 2$

When the signs of the addends are different, subtract the absolute values.

$2 - 2 = 0$

So, $2 + (-2) = 0$.

Mike's combined score for the first two holes is 0.

Two numbers that have a sum of 0 are called **additive inverses**, or opposites.

Try It!

Find the sum for each expression.

a. $-66 + 42$ b. $-57 + 57$ c. $29 + (-28)$

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KEY CONCEPT

When adding integers with the same sign, find the sum of the absolute values.

$(-36) + (-12)$

$$\begin{array}{r} |-36| = 36 \text{ and } |-12| = 12 \\ 36 + 12 = 48 \end{array}$$

So, $(-36) + (-12) = -48$

Use the same sign as the addends.

When adding integers with different signs, find the difference of the absolute values.

$18 + (-14)$

$$\begin{array}{r} |18| = 18 \text{ and } |-14| = 14 \\ 18 - 14 = 4 \end{array}$$

So, $18 + (-14) = 4$

Use the sign of the greater absolute value.

Do You Understand?

- Reasoning** How do you use what you know about absolute value to add integers?
- Reasoning** How can you tell the sign of the sum of a positive and negative integer without doing any calculations?
- Model with Math** How would you use a number line to determine the sum of two negative integers?

Do You Know How?

- Sarah bought a bike that cost \$260. She had a coupon that was worth \$55 off the cost of any bike. Use the expression $260 + (-55)$ to find how much Sarah paid for her bike.
- A shark is swimming 60 feet below the surface of the ocean. There is a fish that is 25 feet deeper in the water. Use the expression $(-60) + (-25)$ to describe the fish's position relative to the surface of the ocean.
- The high temperature one day was 30°F . Then the temperature dropped 23 degrees during the night. Does the expression $30 + (-23)$ represent the temperature at night? Explain.

Handwritten notes and calculations:

$18 + (-14) = 4$

$260 + (-55) = 205$

Sarah paid \$205 for her bike.

$(-60) + (-25) = -85$

The fish is 85 feet below sea level.

Day: 30° } Add
Night: $\downarrow 23$ } $30 + (-23)$

$30 + (-23)$

Name: _____

Practice & Problem Solving

Leveled Practice For 7-9, use a number line to help find the sum.

$5 + (-3)$ is 3 units from 5, in the left or negative direction. $+(-3)$ is 3 units from -1, in the right direction.

Use the number line to find $5 + (-3)$.

9. In City A, the temperature rises 9° from 8 A.M. to 9 A.M. Then the temperature drops 8° from 9 A.M. to 10 A.M. In City B, the temperature drops 5° from 8 A.M. to 9 A.M. Then the temperature drops 4° from 9 A.M. to 10 A.M.

- What expression represents the change in temperature for City A?
- What integer represents the change in temperature for City A?
- What expression represents the change in temperature for City B?
- What integer represents the change in temperature for City B?
- Which city has the greater change in temperature from 8 A.M. to 10 A.M.?

10. An airplane flying at an altitude of 30,000 feet flies up to avoid a storm. Immediately after passing the storm, the airplane returns to its original altitude.

The airplane flies up to 38,000 feet to avoid a storm.

- What integer represents the airplane's change in altitude to avoid the storm?
- What integer represents the airplane's change in altitude immediately after passing the storm?
- Use Appropriate Tools** Draw a number line to represent the airplane's change in altitude.

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- A deep-sea diver dives 81 feet from the surface. He then dives 14 more feet. The diver's depth can be represented by $-81 + (-14)$. What is the diver's present location?
 - Rena's rowboat drifts 23 feet from shore, followed by 9 more feet. The rowboat's current position can be represented by $-23 + (-9)$. What integer represents the rowboat's position?
13. **Critique Reasoning** A submarine traveling 200 meters below the surface of the ocean increases its depth by 45 meters. Adam says that the new location of the submarine is -155 meters. Describe an error Adam could have made that would result in the answer he gave.

- Kim has \$45 to spend for a day at the zoo. She pays \$17 for admission, \$8 for lunch, and \$3 for a snack.
- Higher Order Thinking** Samantha has \$300 for guitar lessons to learn her favorite song. Mrs. Jones charges \$80 per lesson and requires three lessons to teach Samantha the song. Mr. Bellz charges \$62 per lesson and will require four lessons to teach Samantha the song. Use integers to represent what each teacher charges. Which is the better deal for Samantha?

a. **Model with Math** Use integers to write an addition expression that represents the amount of money Kim has left.

$$17 + 8 + 4 = \$29$$

b. Kim goes to the gift shop and finds a T-shirt she likes for \$19. Does she have enough money to buy the T-shirt? Explain.



Kim only has \$16 left, so she doesn't have enough to buy the t-shirt.

Total cost
 $\$ \text{left} = 45 - 29 = \16

Kim has \$16 left.

Assessment Practice

16. Draw lines to match each situation on the left with its addition expression on the right.

A fish swims at 10 ft below sea level, and then swims another 10 ft deeper to avoid a shark.

$10 + (-10)$

Troy takes 10 steps forward, and then takes 10 steps back.

$-10 + (-10)$

The temperature drops 10 degrees, and then rises 10 degrees.

$-10 + (10)$

