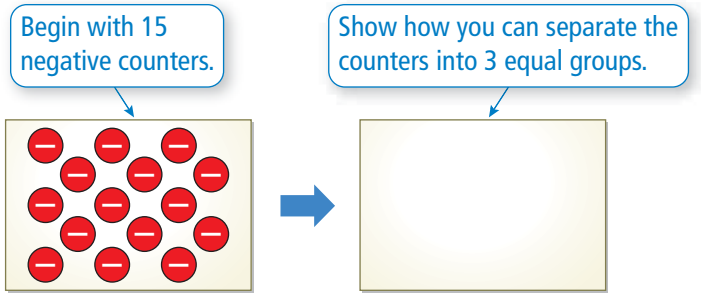
1.5 Dividing Integers

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

1 ACTIVITY: Dividing Integers with Different Signs

Work with a partner. Use integer counters to find $-15 \div 3$.



Because there are ____ negative counters in each group, $-15 \div 3 =$ ____.

2 ACTIVITY: Rewriting a Product as a Quotient

Work with a partner. Rewrite the product $3 \cdot 4 = 12$ as a quotient in two different ways.

First Way

12 is equal to 3 groups of ____.

So, $12 \div 3 =$ ____.

Second Way

12 is equal to 4 groups of ____.

So, $12 \div 4 =$ ____.

3 ACTIVITY: Dividing Integers with Different Signs

Integers

In this lesson, you will

- divide integers.
- solve real-life problems.

Work with a partner. Rewrite the product $-3 \cdot (-4) = 12$ as a quotient in two different ways. What can you conclude?

First Way

$12 \div (\quad) =$ ____

Second Way

$12 \div (\quad) =$ ____

In each case, when you divide a ____ integer by a ____ integer, you get a ____ integer.

4 ACTIVITY: Dividing Negative Integers

Math Practice

Maintain Oversight

How do you know what the sign will be when you divide two integers?

Work with a partner. Rewrite the product $3 \cdot (-4) = -12$ as a quotient in two different ways. What can you conclude?

First Way

$-12 \div (\quad) = \quad$

Second Way

$-12 \div (\quad) = \quad$

When you divide a _____ integer by a _____ integer, you get a _____ integer. When you divide a _____ integer by a _____ integer, you get a _____ integer.

Inductive Reasoning

Work with a partner. Complete the table.

	Exercise	Type of Quotient	Quotient	Quotient: Positive, Negative, or Zero
1	**5.** $-15 \div 3$	Integers with different signs		
2	**6.** $12 \div 4$			
3	**7.** $12 \div (-3)$			
4	**8.** $-12 \div (-4)$			
	9. $-6 \div 2$			
	10. $-21 \div (-7)$			
	11. $10 \div (-2)$			
	12. $12 \div (-6)$			
	13. $0 \div (-15)$			
	14. $0 \div 4$			

What Is Your Answer?

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

16. STRUCTURE Write general rules for dividing (a) two integers with the same sign and (b) two integers with different signs.

Practice Use what you learned about dividing integers to complete Exercises 8–15 on page 32.

1.5 Lesson

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Key Ideas

Remember
Division by 0 is undefined.

Dividing Integers with the Same Sign

Words The quotient of two integers with the same sign is positive.

Numbers $8 \div 2 = 4$ $\quad -8 \div (-2) = 4$

Dividing Integers with Different Signs

Words The quotient of two integers with different signs is negative.

Numbers $8 \div (-2) = -4$ $\quad -8 \div 2 = -4$

EXAMPLE 1 Dividing Integers with the Same Sign

Find $-18 \div (-6)$.

The integers have the same sign.

$-18 \div (-6) = 3$

The quotient is positive.

∴ The quotient is 3.

EXAMPLE 2 Dividing Integers with Different Signs

Divide.

a. $75 \div (-25)$ **b.** $\frac{-54}{6}$

The integers have different signs.

$75 \div (-25) = -3$ $\quad \frac{-54}{6} = -9$

The quotient is negative.

∴ The quotient is -3. ∴ The quotient is -9.

On Your Own

Now You're Ready
Exercises 8–23

Divide.

1. $14 \div 2$
2. $-32 \div (-4)$
3. $-40 \div (-8)$
4. $0 \div (-6)$
5. $\frac{-49}{7}$
6. $\frac{21}{-3}$

EXAMPLE 3 Evaluating an Expression

Evaluate $10 - x^2 \div y$ when $x = 8$ and $y = -4$.

Remember

Use order of operations when evaluating an expression.

$$\begin{aligned} 10 - x^2 \div y &= 10 - 8^2 \div (-4) && \text{Substitute 8 for } x \text{ and } -4 \text{ for } y. \\ &= 10 - 8 \cdot 8 \div (-4) && \text{Write } 8^2 \text{ as repeated multiplication.} \\ &= 10 - 64 \div (-4) && \text{Multiply 8 and 8.} \\ &= 10 - (-16) && \text{Divide 64 by } -4. \\ &= 26 && \text{Subtract.} \end{aligned}$$

On Your Own

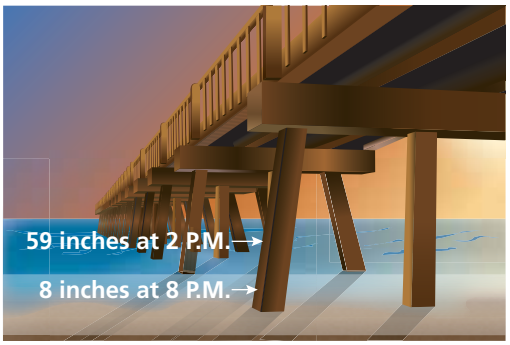
Now You're Ready
Exercises 28–31

Evaluate the expression when $a = -18$ and $b = -6$.

7. $a \div b$ **8.** $\dfrac{a + 6}{3}$ **9.** $\dfrac{b^2}{a} + 4$

EXAMPLE 4 Real-Life Application

You measure the height of the tide using the support beams of a pier. Your measurements are shown in the picture. What is the mean hourly change in the height?



Use a model to solve the problem.

$$\text{mean hourly change} = \frac{\text{final height} - \text{initial height}}{\text{elapsed time}}$$

$$\begin{aligned} &= \frac{8 - 59}{6} && \text{Substitute. The elapsed time from 2 P.M. to 8 P.M. is 6 hours.} \\ &= \frac{-51}{6} && \text{Subtract.} \\ &= -8.5 && \text{Divide.} \end{aligned}$$

∴ The mean change in the height of the tide is -8.5 inches per hour.

On Your Own

10. The height of the tide at the Bay of Fundy in New Brunswick decreases 36 feet in 6 hours. What is the mean hourly change in the height?

1.5 Exercises

Check It Out
Help with Homework
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Vocabulary and Concept Check

1. **WRITING** What can you tell about two integers when their quotient is positive? negative? zero?
2. **VOCABULARY** A quotient is undefined. What does this mean?
3. **OPEN-ENDED** Write two integers whose quotient is negative.
4. **WHICH ONE DOESN'T BELONG?** Which expression does *not* belong with the other three? Explain your reasoning.

$\frac{10}{-5}$ $\frac{-10}{5}$ $\frac{-10}{-5}$ $-\left(\frac{10}{5}\right)$

Tell whether the quotient is *positive* or *negative* without dividing.

5. $-12 \div 4$
6. $\frac{-6}{-2}$
7. $15 \div (-3)$

Practice and Problem Solving

Divide, if possible.

1 2 8. $4 \div (-2)$
9. $21 \div (-7)$
10. $-20 \div 4$
11. $-18 \div (-3)$
12. $\frac{-14}{7}$
13. $\frac{0}{6}$
14. $\frac{-15}{-5}$
15. $\frac{54}{-9}$
16. $-33 \div 11$
17. $-49 \div (-7)$
18. $0 \div (-2)$
19. $60 \div (-6)$
20. $\frac{-56}{14}$
21. $\frac{18}{0}$
22. $\frac{65}{-5}$
23. $\frac{-84}{-7}$

ERROR ANALYSIS **Describe and correct the error in finding the quotient.**

24. ✗ $\frac{-63}{-9} = -7$

25. ✗ $0 \div (-5) = -5$

26. **ALLIGATORS** An alligator population in a nature preserve in the Everglades decreases by 60 alligators over 5 years. What is the mean yearly change in the alligator population?
27. **READING** You read 105 pages of a novel over 7 days. What is the mean number of pages you read each day?

ALGEBRA **Evaluate the expression when $x = 10$, $y = -2$, and $z = -5$.**

3 28. $x \div y$
29. $\frac{10y^2}{z}$
30. $\left|\frac{xz}{-y}\right|$
31. $\frac{-x^2 + 6z}{y}$

Find the mean of the integers.

32. $3, -10, -2, 13, 11$

33. $-26, 39, -10, -16, 12, 31$

Evaluate the expression.

34. $-8 - 14 \div 2 + 5$

35. $24 \div (-4) + (-2) \bullet (-5)$

36. PATTERN Find the next two numbers in the pattern $-128, 64, -32, 16, \ldots$. Explain your reasoning.

37. SNOWBOARDING A snowboarder descends a 1200-foot hill in 3 minutes. What is the mean change in elevation per minute?

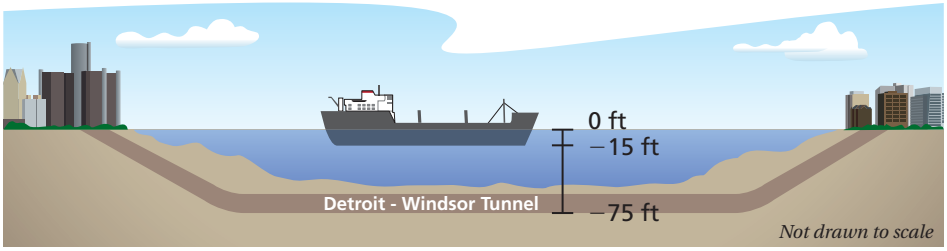
38. GOLF The table shows a golfer's score for each round of a tournament.

Scorecard	
Round 1	-2
Round 2	-6
Round 3	-7
Round 4	-3

a. What was the golfer's total score?

b. What was the golfer's mean score per round?

39. TUNNEL The Detroit-Windsor Tunnel is an underwater highway that connects the cities of Detroit, Michigan, and Windsor, Ontario. How many times deeper is the roadway than the bottom of the ship?



40. AMUSEMENT PARK The regular admission price for an amusement park is \$72. For a group of 15 or more, the admission price is reduced by \$25. How many people need to be in a group to save \$500?

41. Number Sense Write five different integers that have a mean of -10. Explain how you found your answer.

Fair Game Review What you learned in previous grades & lessons

Graph the values on a number line. Then order the values from least to greatest. *(Section 1.1)*

42. $-6, 4, |2|, -1, |-10|$

43. $3, |0|, |-4|, -3, -8$

44. $|5|, -2, -5, |-2|, -7$

45. MULTIPLE CHOICE What is the value of $4 \bullet 3 + (12 \div 2)^2$? *(Skills Review Handbook)*

Ⓐ 15 Ⓑ 48 Ⓒ 156 Ⓓ 324