Lesson 4 Introduction

Multiply and Divide Positive and Negative Integers

7.NS.A.2a
7.NS.A.2b
7.NS.A.2c

Use What You Know

In Lessons 1–3, you learned that adding integers is a lot like adding and subtracting whole numbers. Take a look at this problem.

What numbers complete Table 1? What numbers complete Table 2?

Table 1

Multiplication	Product
3 • 3	9
3 • 2	6
3 • 1	3
3 • 0	0
3 • (−1)	
3 • (−2)	
3 • (−3)	

Table 2

Multiplication	Product
−3 • 3	
−3 • 2	−6
−3 • 1	−3
−3 • 0	
−3 • (−1)	
−3 • (−2)	
−3 • (−3)	

Use the math you already know to solve the problem.

a. Look for a pattern in the products in Table 1. Each product decreases by _____.

b. I can fill Table 1 by adding _____ to each product. Then fill Table 1.

c. Why can you use your entry in Table 1 for 3 • (−3) to find the product for −3 • 3 in Table 2?

_____

d. Look for a pattern in the products in Table 2. Each product increases by _____.

e. I can fill Table 2 by adding _____ to each product. Then fill Table 2.

f. What do you notice about the factors that result in a negative product?

_____

g. What do you notice about the product when both factors are negative?

_____

Find Out More

Multiplying integers is a lot like multiplying whole numbers. You can use what you know about the properties of operations and repeated addition to multiply integers.

Think about these problems:

$-3 \cdot 1 = ?$	Use the identity property.	$-3 \cdot 1 = -3$
$-3 \cdot 0 = ?$	Use the zero product property.	$-3 \cdot 0 = 0$
$-3 \cdot 3 = ?$	Use the commutative property. Multiplying 3 groups of (-3) is the same as adding 3 groups of -3.	$-3 \cdot 3 = 3 \cdot (-3)$ $3 \cdot (-3) = (-3) + (-3) + (-3) = -9$

You can use the distributive property to show why you get a positive product when you multiply two negative numbers. You know $-3 \cdot 3 = -9$.
One way you can write $-3 \cdot 3$ is to think of it as $-3 \cdot [5 + (-2)]$.

	Write 3 as $[5 + (-2)]$.	$-3 \cdot 3 = -3 \cdot [5 + (-2)]$
	Use the distributive property.	$-9 = (-3)(5) + (-3)(-2)$.
Think:	$(-3)(5)$ is the same as $5(-3)$ or $(-3) + (-3) + (-3) + (-3) + (-3) = -15$	$-9 = -15 + (-3)(-2)$

Since $-9 = -15 + 6$, we know that $(-3)(-2) = 6$.
So when you multiply two negative numbers, the product is a positive number.

You can use these facts to find products when there are more than two negative numbers.

$(-3) \cdot (-3) \cdot (-3) =$

$9 \cdot (-3) = -27$

$(-3) \cdot (-3) \cdot (-3) \cdot (-3) =$

$9 \cdot 9 = 81$

Reflect

1 For each statement, tell whether the product is *positive* or *negative*:

When you multiply a positive integer by a negative integer or a negative integer by a positive integer, the product is _____.

When you multiply a negative integer by a negative integer, the product is _____.

When you multiply an even number of negative integers, the product is _____.

When you multiply an odd number of negative integers, the product is _____.

Learn About Multiplying Integers

Read the problem below. Then explore different ways to understand multiplying integers.

Lisa owes $2 to each of 6 friends. What integer represents Lisa's debt?

Model It You can use groups to help understand the problem.

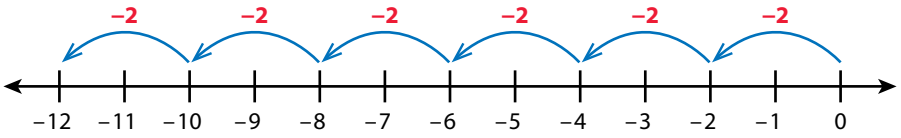
Lisa owes **$2** to each of **6** friends. You can write that as **6 groups** of **(−2)**.

6 groups of **(−2)** = **(−2)** + **(−2)** + **(−2)** + **(−2)** + **(−2)** + **(−2)** = −12

Model It You can also use models to understand the problem.

The following number line shows the amount Lisa owes her friends.

Start at 0 and make **6** jumps of **−2**.



Connect It **Now you will solve the problem from the previous page using equations.**

2 What number represents the amount Lisa owes each friend? _____

3 Is the amount positive or negative? Why?

_____

_____

4 How many friends does Lisa owe? _____

5 Complete the phrase to show how much Lisa owes.

_____ groups of _____

6 Rewrite the addition of groups as multiplication of groups.

$(-2) + (-2) + (-2) + (-2) + (-2) + (-2) =$ _____ $\cdot (-2)$

7 Adding 6 groups of (-2) is the same as _____ 6 and (-2).

8 Complete the multiplication to find the integer that represents Lisa's total debt.

$6 \cdot (-2) =$ _____

9 Explain how you can use the rules of multiplying a positive number by a negative number to check that your answer has the correct sign.

_____

_____

Try It **Use what you just learned to solve these problems. Show your work on a separate sheet of paper.**

10 $-8 \cdot 12 =$ _____

11 A crack in a water tank leaks 7 gallons of water each hour. After 9 hours, what is the change in the volume of water in the tank due to the leak?

_____

Learn About Dividing Integers

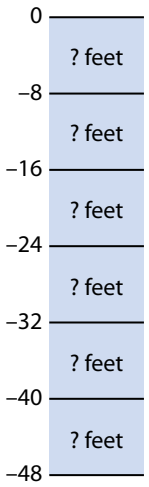
Read the problem below. Then explore different ways to understand dividing integers.

Rosa is at the top of a climbing wall. She descends 48 feet of the wall in 6 equal stages. What number represents the change in Rosa's position at each stage?

Picture It **You can use a diagram to help you understand the problem.**

The following diagram shows the change in Rosa's position at each stage. The top of the wall is the starting or 0 position.

Rosa's Change in Position



Model It **You can also use division to help you understand the problem.**

Total change (in feet)	÷	Number of stages	=	Change in each stage (in feet)
−48	÷	6	=	?

Connect It **Now you will solve the problem from the previous page by reasoning about division.**

12 Rewrite Rosa's division problem from the previous page as a multiplication problem.

$-48 \div 6 = ?$ → $6 \cdot ? =$ _____

13 Think about what you know about multiplying positive and negative integers. Will the missing number in the multiplication problem be positive or negative? Why?

_____

_____

14 Solve to find the change in Rosa's position at each stage.

$6 \cdot$ _____ $= -48$

The change in position at each stage is _____ feet.

15 Now look at these division problems. Rewrite each as multiplication. Then use multiplication rules to decide whether the missing number is positive or negative.

$-15 \div 3 = ?$ _____ $\cdot ? =$ _____ The missing number is _____.

$-15 \div (-3) = ?$ _____ $\cdot ? =$ _____ The missing number is _____.

$15 \div (-3) = ?$ _____ $\cdot ? =$ _____ The missing number is _____.

16 Use the multiplication rules to complete these statements about division with integers.

When you divide a negative integer by a positive integer, the quotient is _____.

When you divide a negative integer by a negative integer, the quotient is _____.

When you divide a positive integer by a negative integer, the quotient is _____.

Try It **Use what you just learned to solve these problems. Show your work on a separate sheet of paper.**

17 $54 \div (-9) =$ _____

18 A glider descends 240 meters in 12 seconds. What is the average change in elevation per second?

_____

Practice Multiplying and Dividing Integers

Study the example below. Then solve problems 19–21.

The student used multiplication rules to check the sign for each solution.

Example

Paul, Hayden, and Alex each have a card with a multiplication sentence written on it. Paul thinks each card has a different solution. Hayden thinks each card has the same solution. Alex thinks only two cards have the same solution. Who is correct?

$-4 \cdot 3 = ?$

$4 \cdot (-3) = ?$

$-4 \cdot (-3) = ?$

Look at how you could show your work using multiplication rules.

Equation	Rule	Solution
$-4 \cdot 3 = ?$	negative · positive = negative	-12
$4 \cdot (-3) = ?$	positive · negative = negative	-12
$-4 \cdot (-3) = ?$	negative · negative = positive	$+12$

Solution Alex is correct. Only two cards have the same solution, -12.

Pair/Share
How could you use addition of groups to show that $4 \cdot (-3) = -12$?

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19 A movie rental company deducts $7 from Serena's account every month for a year. After 1 year, how much do movie rental fees change Serena's account?

Show your work.

Will your answer be positive or negative?

Pair/Share
How can you check that your answer is reasonable?

Solution _____

20 The table shows the low temperatures in Alto for 5 days. What is the average low temperature?

Daily Low Temperature in Alto	
Day	**Low Temperature**
1	−4°F
2	−7°F
3	−13°F
4	−5°F
5	−5°F

To find the average of a set of numbers, do you multiply or divide?

Show your work.

Solution _____

Pair/Share
How did you and your partner decide what step to do first?

21 Which equation has a negative solution?

A $-6 \div (-2) = \square$

B $-6 + (-2) = \square$

C $-2 \cdot (-6) = \square$

D $-2 - (-6) = \square$

How can you use the multiplication rules to help you solve this problem?

Seth chose **C** as the correct answer. How did he get that answer?

_____

_____

_____

_____

Pair/Share
How did you and your partner choose your answer?

Practice Multiplying and Dividing Integers

Solve the problems.

1 Which multiplication equation is ***false***?

A $(-a) \cdot (-1) = (-a)$

B $(-a) \cdot 0 = 0$

C $(-a) \cdot 1 = (-a)$

D $(-a) \cdot b = b \cdot (-a)$

2 The lowest elevation in Long Beach, California, is 7 feet below sea level. The elevation of Death Valley is about 40 times lower than the elevation of Long Beach. What is the approximate elevation of Death Valley?

A −280 feet

B −47 feet

C −33 feet

D −6 feet

3 Draw a line from each expression to the word problem it could represent.

-12×4	A football team loses a total of 12 yards in 4 plays. On average, how many yards did the team move per play?
12×4	The temperature of the ocean water dropped 4 degrees every hour. After 12 hours, what was the change in the water temperature?
$12 \times (-4)$	A garden consists of 12 rose bushes in each of 4 rows. How many rose bushes does the garden have altogether?
$-3 \times (-4)$	Every second, a snail crawls 12 millimeters down a hole. What is the snail's change in position after 4 seconds?
$-12 \div 4$	During a drought, a pond's fish population decreased by 3 for every meter drop in the pond's water level. At that rate, how many fish died once the water level dropped 4 meters?

4 Write each expression under the category that correctly describes the number to which the expression simplifies.

$-(8 \div 2)$
$-5 \times (-4 + 3)$
$6 \div (-3)$
$-10 \div (-10)$
$-25 \times (-4)$
$-21 \div 7$

A negative number	A positive number

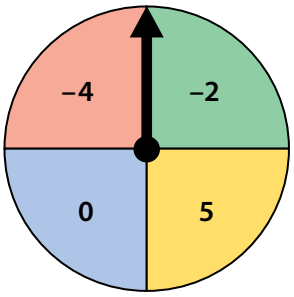
5 Marc's elevation decreases by 350 meters as he rides his bike down to the bottom of a hill. He did the ride in 5 equal stages. How much did Marc's elevation change during each stage?

Show your work.

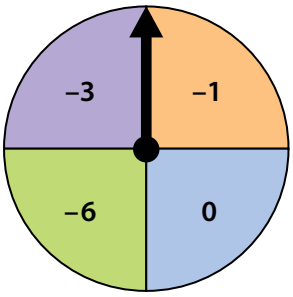
Answer _____

6 Hugh is playing a game. He spins each spinner and then multiplies the numbers to find the product.

Spinner A



Spinner B



Part A Give an example of two numbers Hugh could spin to get a positive product.

Answer _____

_____

Part B Give an example of two numbers Hugh could spin to get a negative product.

Answer _____

_____

Self Check **Go back and see what you can check off on the Self Check on page 1.**