Lesson 11: Develop Rules for Multiplying Signed Numbers

Classwork

Example 1: Extending Whole Number Multiplication to the Integers

Part A: Complete quadrants I and IV of the table below to show how sets of matching integer cards will affect a player's score in the Integer Game. For example, three 2s would increase a player's score by $0 + 2 + 2 + 2 = 6$ points.

Quadrant II

Quadrant I

What does this quadrant represent?

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What does this quadrant represent?

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					5					
					4					
					3					
					2			6		
					1					
						1	2	3	4	5
					−1					
					−2					
					−3					
					−4					
					−5					

← Number of matching cards

What does this quadrant represent?

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____

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What does this quadrant represent?

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Quadrant III

Quadrant IV

↑

Integer card values

a. What patterns do you see in the right half of the table?

b. Enter the missing integers in the left side of the middle row, and describe what they represent.

Part B: Complete quadrant II of the table.

c. What relationships or patterns do you notice between the products (values) in quadrant II and the products (values) in quadrant I?

d. What relationships or patterns do you notice between the products (values) in quadrant II and the products (values) in quadrant IV?

e. Use what you know about the products (values) in quadrants I, II, and IV to describe what quadrant III will look like when its products (values) are entered.

Part C: Complete quadrant III of the table.

Refer to the completed table to help you answer the following questions:

f. Is it possible to know the sign of a product of two integers just by knowing in which quadrant each integer is located? Explain.

g. Which quadrants contain which values? Describe an Integer Game scenario represented in each quadrant.

Example 2: Using Properties of Arithmetic to Explain Multiplication of Negative Numbers

Exercise 1: Multiplication of Integers in the Real World

Generate real-world situations that can be modeled by each of the following multiplication problems. Use the Integer Game as a resource.

a. -3×5

b. $-6 \times (-3)$

c. $4 \times (-7)$

Lesson Summary

To multiply signed numbers, multiply the absolute values to get the absolute value of the product. The sign of the product is positive if the factors have the same sign and negative if they have opposite signs.

Problem Set

1. Complete the problems below. Then, answer the question that follows.

$3 \times 3 =$	$3 \times 2 =$	$3 \times 1 =$	$3 \times 0 =$	$3 \times (-1) =$	$3 \times (-2) =$
$2 \times 3 =$	$2 \times 2 =$	$2 \times 1 =$	$2 \times 0 =$	$2 \times (-1) =$	$2 \times (-2) =$
$1 \times 3 =$	$1 \times 2 =$	$1 \times 1 =$	$1 \times 0 =$	$1 \times (-1) =$	$1 \times (-2) =$
$0 \times 3 =$	$0 \times 2 =$	$0 \times 1 =$	$0 \times 0 =$	$0 \times (-1) =$	$0 \times (-2) =$
$-1 \times 3 =$	$-1 \times 2 =$	$-1 \times 1 =$	$-1 \times 0 =$	$-1 \times (-1) =$	$-1 \times (-2) =$
$-2 \times 3 =$	$-2 \times 2 =$	$-2 \times 1 =$	$-2 \times 0 =$	$-2 \times (-1) =$	$-2 \times (-2) =$
$-3 \times 3 =$	$-3 \times 2 =$	$-3 \times 1 =$	$-3 \times 0 =$	$-3 \times (-1) =$	$-3 \times (-2) =$

Which row shows the same pattern as the outlined column? Are the problems similar or different? Explain.

2. Explain why $(-4) \times (-5) = 20$. Use patterns, an example from the Integer Game, or the properties of operations to support your reasoning.

3. Each time that Samantha rides the commuter train, she spends $\$4$ for her fare. Write an integer that represents the change in Samantha's money from riding the commuter train to and from work for 13 days. Explain your reasoning.

4. Write a real-world problem that can be modeled by $4 \times (-7)$.

Challenge:

5. Use properties to explain why for each integer a, $-a = -1 \times a$. (Hint: What does $\left(1 + (-1)\right) \times a$ equal? What is the additive inverse of a?)