

# Key Concepts

Lesson  
8-4

## Multiplying Integers

**Objective** Teach students to multiply both positive and negative integers.

**Note to the Teacher** *In this lesson, your students will continue their study of doing arithmetic with integers. We will be studying multiplication in this lesson. Multiplication may be the most confusing and nonintuitive of the operations when applied to negative integers. In order to address this concern, have a classroom discussion in which you begin by discussing the idea behind multiplication of integers, and then discuss with your class why this idea is true. Finally demonstrate how the idea is applied to examples.*

## Multiplying with Negative Integers

Discuss the following rules for multiplying negative integers with your students. Remind them of the definition of *opposites*.

<b>Key Idea</b>	<ol style="list-style-type: none"><li>1. When we multiply a positive integer and a negative integer together, the result is the opposite of the number we would get if both integers had been positive. For example, <math>2 \times (-3) = -(2 \times 3) = -6</math> and <math>-5 \times 4 = -(5 \times 4) = -20</math>.</li><li>2. When we multiply two negative integers, the result is the positive integer we would get if both integers had been positive. For example, <math>-3 \times (-4) = 3 \times 4 = 12</math>.</li></ol>
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In summary,

- (1) multiplying a positive integer times a negative integer gives a negative integer, and
- (2) multiplying two negative integers gives a positive integer.

Make sure your students know these rules by asking them questions like these:

- Will  $-3 \times (-7)$  be positive or negative? **positive**
- Will  $457 \times (-325)$  be positive or negative? **negative**

Point out that the rules for multiplying two integers can also be remembered using the phrase *same signs, positive product; different signs, negative product*.

## Why Are These Rules True?

Point out to your students that multiplying any integer (positive or negative) by a positive integer is the same as adding “copies” of that integer, where the number of copies is equal to the positive integer.

Remind students that multiplication by a positive integer can be viewed as repeated addition. That is,  $5 \times 2$  is the same as  $2 + 2 + 2 + 2 + 2$ . Point out that  $5 \times (-2)$  is then equal to  $(-2) + (-2) + (-2) + (-2) + (-2)$ . The following example uses this thinking.

### **Example** What is $5 \times (-3)$ ?

**Solution** The product  $5 \times (-3)$  can be found by adding 5 copies of the integer  $-3$ . So,

$$5 \times (-3) = (-3) + (-3) + (-3) + (-3) + (-3) = -15.$$

The same answer can be obtained by applying the first rule in the Key Idea box shown earlier.

$$5 \times (-3) = -(5 \times 3) = -15$$

The idea that the product of two negative integers is positive is harder for students to understand. Pose the following question. “Why is  $-5 \times (-3) = 15$ ?”

Your students do not need a formal proof of this fact. Simply point out that the Example just showed that  $5 \times (-3) = -15$ . Suggest that it is reasonable for the products  $-5 \times (-3)$  and  $5 \times (-3)$  to be opposite of each other since they cannot be the same. So  $-5 \times (-3)$  should be the opposite of  $-15$  or  $15$ .

Now ask your students to give reasons for why the following fact is true. Given any number  $x$ ,  $-1 \cdot x$  is the opposite of  $x$ .

By the rules for multiplying negative integers, if  $x$  is positive, then  $-1 \cdot x$  is negative and its value is the opposite of the value of  $1 \cdot x = x$ . Similarly, if  $x$  is negative, then  $-1 \cdot x$  is positive and its value is the opposite of the value of  $1 \cdot x$ .

End the lesson by giving your students several problems involving the multiplication of negative integers. The only way students will fully understand the concept of multiplication of negative integers is if they become skilled at the calculations. Here are some good examples.

## Exercises

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**Find each product.**

**1.**  $-9 \times 4$       **-36**

**2.**  $-9 \times (-4)$       **36**

**3.**  $12 \times (-4)$       **-48**

**4.**  $-11 \times (-6)$       **66**

