

## Lesson 16: Applying the Properties of Operations to Multiply and Divide Rational Numbers

### Classwork

#### Example 1: Using the Commutative and Associative Properties to Efficiently Multiply Rational Numbers

- a. Evaluate the expression below:

$$-6 \times 2 \times (-2) \times (-5) \times (-3)$$

- b. What types of strategies were used to evaluate the expressions?
- c. Can you identify the benefits of choosing one strategy versus another?
- d. What is the sign of the product and how was the sign determined?

**Exercise 1**

Find an efficient strategy to evaluate the expression and complete the necessary work.

$$-1 \times (-3) \times 10 \times (-2) \times 2$$

**Exercise 2**

Find an efficient strategy to evaluate the expression and complete the necessary work.

$$4 \times \frac{1}{3} \times (-8) \times 9 \times \left(-\frac{1}{2}\right)$$

**Exercise 3**

What terms did you combine first and why?

**Exercise 4**

Refer to the example and exercises. Do you see an easy way to determine the sign of the product first?

**Example 2: Using the Distributive Property to Multiply Rational Numbers**

Rewrite the mixed number as a sum; then, multiply using the distributive property.

$$-6 \times \left(5\frac{1}{3}\right)$$

**Exercise 5**

Multiply the expression using the distributive property.

$$9 \times \left(-3\frac{1}{2}\right)$$

**Example 3: Using the Distributive Property to Multiply Rational Numbers**

Evaluate using the distributive property.

$$16 \times \left(-\frac{3}{8}\right) + 16 \times \frac{1}{4}$$

**Example 4: Using the Multiplicative Inverse to Rewrite Division as Multiplication**

Rewrite the expression as only multiplication and evaluate.

$$1 \div \frac{2}{3} \times (-8) \times 3 \div \left(-\frac{1}{2}\right)$$

**Exercise 6**

$$4.2 \times \left(-\frac{1}{3}\right) \div \frac{1}{6} \times (-10)$$

### Lesson Summary

Multiplying and dividing using strictly order of operations is not always efficient. The properties of multiplication allow us to manipulate expressions by rearranging and regrouping factors that are easier to compute. Where division is involved, we can easily rewrite division as multiplication to allow the use of these properties. The signs of expressions with products and quotients can be easily determined by checking whether the number of negative terms is even or odd.

### Problem Set

- Evaluate the expression:  $-2.2 \times (-2) \div \left(-\frac{1}{4}\right) \times 5$ 
  - Using the order of operations only, the answer is:
  - Using the properties and methods used in Lesson 16, the answer is:
  - If you were asked to evaluate another expression, which method would you use, (a) or (b), and why?
- Evaluate the expressions using the distributive property.
  - $\left(2\frac{1}{4}\right) \times (-8)$
  - $\frac{2}{3}(-7) + \frac{2}{3}(-5)$
- Mia evaluated the expression below but got an incorrect answer. Find Mia's error(s), find the correct value of the expression, and explain how Mia could have avoided her error(s).

$$0.38 \times 3 \div \left(-\frac{1}{20}\right) \times 5 \div (-8)$$

$$0.38 \times 5 \times \left(\frac{1}{20}\right) \times 3 \times (-8)$$

$$0.38 \times \left(\frac{1}{4}\right) \times 3 \times (-8)$$

$$0.38 \times \left(\frac{1}{4}\right) \times (-24)$$

$$0.38 \times (-6)$$

$$-2.28$$