



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

Student Outcomes

- Students use properties of operations to multiply and divide rational numbers without the use of a calculator. They use the commutative and associative properties of multiplication to generate equivalent expressions. They use the distributive property of multiplication over addition to create equivalent expressions, representing the sum of two quantities with a common factor as a product, and vice-versa.
- Students recognize that any problem involving multiplication and division can be written as a problem involving only multiplication.
- Students determine the sign of an expression that contains products and quotients by checking whether the number of negative terms is even or odd.

Lesson Notes

Recall the Properties of Operations from Table 3 of the Common Core State Standards.

Table 3. The Properties of Operations. Here a , b , and c stand for arbitrary numbers.

Associative property of addition	$(a + b) + c = a + (b + c)$
Commutative property of addition	$a + b = b + a$
Additive identity property of 0	$a + 0 = 0 + a = a$
Existence of additive inverses	For every a there exists $-a$ so that $a + (-a) = (-a) + a = 0$
Associative property of multiplication	$(a \cdot b) \cdot c = a \cdot (b \cdot c)$
Commutative property of multiplication	$a \cdot b = b \cdot a$
Multiplicative identity property of 1	$a \cdot 1 = 1 \cdot a = a$
Existence of multiplicative inverses	For every $a \neq 0$ there exists $\frac{1}{a}$ so that $a \cdot \frac{1}{a} = \frac{1}{a} \cdot a = 1$
Distributive property of multiplication over addition	$a \cdot (b + c) = a \cdot b + a \cdot c$

Property Review

Grade 7 Math

Unit 2 Mid-Module Assessment Study Guide (Unit 2, lessons 1-16)

12/1/14
Thursday

Vocabulary:

- Opposite
- Additive Inverse
- Absolute Value

= If I have a score of 7
what do I need to get to 0.

$$7 - 7 = 0$$

the distance between
the number and 0

$$|-15| = 15$$

Know how to:

- Use a number line to model addition and subtraction.
- Write real-world problems for situations involving negative numbers.
- Use absolute value to express difference.
- Find a missing value to make an equation true.
- Understand what happens when you add opposites.
- Add, Subtract, Multiply and Divide Rational Numbers (positive and negative integers, decimals, and fractions.)
- Understand that loss, withdrawals, debt, etc. are represented with negative numbers.

Steps for studying:

- Go through lessons and problems sets done in class to practice problems.
- Go to oldsaybrooks.schools.org/Stamley go to khan academy under websites and practice and/or watch videos under module 2 (Topics A and B only).
- Practice problems from quiz.
- Use khan or another source to practice any skills you have trouble with (long division for example).

Period 3&2 test 12/6 Tuesday

Period 4 test 12/6 Wednesday

12/1/16

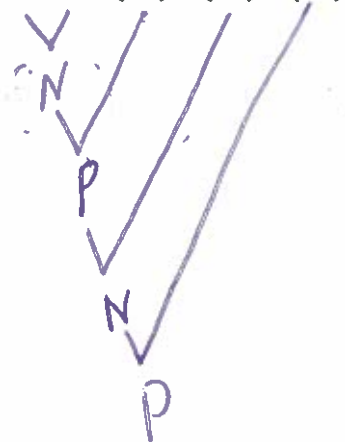
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Classwork

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

- a. Evaluate the expression below.

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



4 Neg x 1 Pos

Pos x Pos

or

Pos

- b. What types of strategies were used to evaluate the expressions?

or

- c. Can you identify the benefits of choosing one strategy versus another?

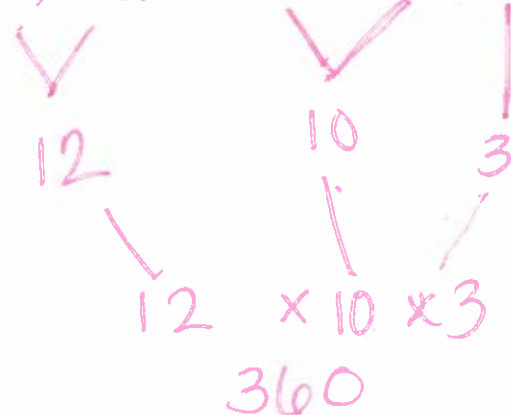
$$-6 \times 2 \times -2 \times -5 \times -3$$

- d. What is the sign of the product, and how was the sign determined?

* If you have a even number of negatives it is a positive answer

* if you have an odd number of negatives your answer is negative

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



Exercise 1

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

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

$$\therefore 3 \cdot 10 \cdot 4$$

$$12 \cdot 10$$

$$-120$$

3 negatives
negative

Exercise 2

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

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

$$4 \times \left[-\frac{1}{2} \times -8\right] \times 9 \times \frac{1}{3}$$

Two negatives
POS. ans

$$4 \times 4 \times 3 \times 9 \times \frac{1}{3}$$

$$4 \times 12$$

$$48$$

Exercise 3

What terms did you combine first and why?

$$-1 \times -2 \times -3 \times -4 \times 5 = \text{ANS POS}$$

$$-1 \times -2 \times -3 \times 4 = \text{ANS NEG}$$

Exercise 4

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

If you have an even number of numbers being mult
your answer is positive

If you have an odd number of numbers being mult
your answer is negative

Example 2: Using the Distributive Property to Multiply Rational Numbers

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

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

$$-2\frac{-6}{1} \times \frac{16}{3}$$

$$\frac{16}{3} \times \frac{16}{2}$$

$$-\frac{32}{1} = -32$$

Exercise 5

Answer Neg

Multiply the expression using the distributive property.

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

$$\frac{9}{1} \times -\frac{7}{2} = -\frac{63}{2} = -3\frac{1}{2}$$

Answer Neg

Example 3: Using the Distributive Property to Multiply Rational Numbers

Evaluate using the distributive property.

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

$$2\cancel{16} \div 3 + 4\cancel{16} \div 4$$

$$-\frac{1}{6} + \frac{1}{4} = -\frac{2}{12} + \frac{3}{12} = \frac{1}{12}$$

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

Rewrite the expression as only multiplication and evaluate.

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

$$1 \times \frac{3}{2} \times -24 \times -\frac{1}{2}$$

$$\frac{3}{2} \times -24 \times -\frac{1}{2}$$

$$-36 \times -2 = +72$$

$$\begin{array}{r} 36 \\ \times 2 \\ \hline 72 \end{array}$$

2 NEGATIVES
ANS POSITIVE

OR

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

$$1 \times (-3) \times (-8) \times 3$$

$$[+3 \times (-3)] \times (-8)$$

$$-9 \times -8 = 72$$

2 NEGATIVES
ANSWER POSITIVE

$$4.2 \times \left(-\frac{1}{3}\right) \times \frac{1}{2} \times (-10)$$

$$4.2 \times -2 \times -10$$

$$4.2 \times 20$$

$$84$$

$$42 = 4.2 \times 10$$

$$4.2 \times \left(-\frac{1}{3}\right) \times \left(-\frac{1}{2}\right) \times -10$$