3.2 Multiplication of Rational Numbers

You have already examined patterns in multiplication of rational numbers that are integers. Now you will use patterns to develop algorithms for multiplication of rational numbers that include fractions and decimals.

Which of the following products will have the same value?

$4 \cdot 5$ $\quad 4 \cdot (-5)$ $\quad -4 \cdot 5$ $\quad -4 \cdot (-5)$

Problem 3.2

A **1.** What do the examples in each group below have in common?

Group 1	Group 2	Group 3
$4 \cdot 3$	$4 \cdot (-3)$	$-4 \cdot (-3)$
$5.1 \cdot 1$	$-5.1 \cdot 1$	$-5.1 \cdot (-1)$
$3 \cdot 4\frac{1}{2}$	$3 \cdot \left(-4\frac{1}{2}\right)$	$-3 \cdot \left(-4\frac{1}{2}\right)$

2. Find the products in each group above.

3. Write and solve two additional problems for each group.

B Find the products in each group below. Is multiplication commutative?

2×3 and 3×2

$-2 \times (-3)$ and $-3 \times (-2)$

-2×3 and $3 \times (-2)$

Problem 3.2 continued

C

1. Describe an algorithm for multiplying two positive rational numbers.
2. Describe an algorithm for multiplying a positive rational number and a negative rational number.
3. Describe an algorithm for multiplying a negative rational number and a negative rational number.

D

1. For each product, predict the sign. Then find the product.
   a. $7 \cdot (-8) \cdot (-3)$
   b. $-12 \cdot (-5) \cdot (-4)$
   c. $\frac{1}{2} \cdot \left(-\frac{2}{3}\right) \cdot 3$
2. Explain how you used what you know about multiplying two rational numbers to multiply three rational numbers.

E

1. Predict whether the sign of each product is positive or negative. Explain your reasoning.
   a. $2 \cdot 3 \cdot 4 \cdot 5$
   b. $2 \cdot (-3) \cdot 4 \cdot 5$
   c. $2 \cdot (-3) \cdot 4 \cdot (-5)$
   d. $-2 \cdot (-3) \cdot 4 \cdot (-5)$
   e. $-2 \cdot (-3) \cdot (-4) \cdot (-5)$
2. Find each product in part (1). Check whether your predictions are correct.
3. Explain how to determine whether a product will be positive or negative.

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