Lesson 1-7
Multiply Rational Numbers

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I can...
multiply rational numbers.

Solve & Discuss It!

Stella is making the United States flag. She has blue fabric, red fabric, and white fabric. Choose a length for the flag. What length of blue fabric would Stella need to make this flag? Explain your thinking.

Focus on math practices

Be Precise The blue region of the flag is $\frac{7}{13}$ the width and $\frac{2}{5}$ the length of the flag. What part of the total area is the blue region of the flag?

45

Essential Question How is multiplying rational numbers like multiplying integers?

EXAMPLE 1 Multiply a Negative Number by a Positive Rational Number

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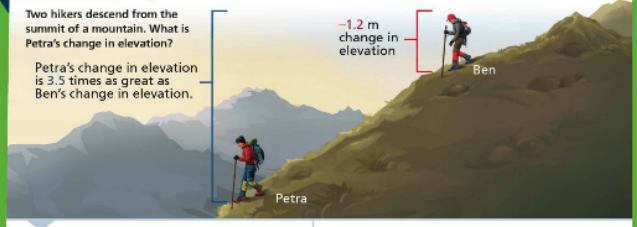
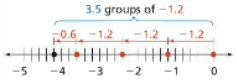
Two hikers descend from the summit of a mountain. What is Petra's change in elevation?

Petra's change in elevation is 3.5 times as great as Ben's change in elevation.



Use a number line to represent Petra's change in elevation.

3.5 groups of −1.2



Petra's change in elevation is −4.2 meters.

Use the rules for multiplying to find Petra's change in elevation.

$3.5 \cdot (-1.2)$ Write an expression to represent the situation.

$= -4.2$

Petra's change in elevation is −4.2 meters.

Generalize The rules for multiplying integers apply to all rational numbers.

positive • negative = negative

Try It!

Meghan's bank account is charged $9.95 per month for an online newspaper subscription. How could you represent the change in her account balance after three months of charges?

[ ] groups of [ ]

[ ] • −9.95 = [ ]

After three months, the change in her account balance is $[ ].

Convince Me! Meghan's bank account is charged 3 times. Without calculating, how can you determine whether this is a negative or positive change to her account? Explain.

EXAMPLE 2 Multiply a Positive Number by a Negative Rational Number

Find the product of $-\frac{5}{6}$ and $\frac{2}{5}$.

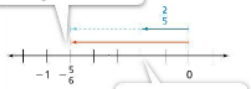
$-\frac{5}{6} \cdot \frac{2}{5}$

$= \frac{-5 \cdot 2}{6 \cdot 5}$

$= \frac{-10}{30} = -\frac{1}{3}$ Multiply the numerators and the denominators and then simplify.

So, $-\frac{5}{6} \cdot \frac{2}{5} = -\frac{1}{3}$.

Plot the negative value and then find $\frac{2}{5}$ of that length.



$-\frac{5}{6} \cdot \frac{2}{5} = -\frac{2}{6} = -\frac{1}{3}$

EXAMPLE 3 Multiply a Negative Number by a Negative Rational Number

Find the product of -0.3 and $-\frac{11}{30}$.

$-0.30 \cdot \left(-\frac{11}{30}\right)$

$= \frac{-3}{10} \cdot \left(-\frac{11}{30}\right)$ Convert one of the rational numbers so that they are both fractions or both decimals.

$= \frac{-3 \cdot (-11)}{10 \cdot 30}$

$= \frac{33}{300}$ or 0.11

So, $-0.3 \cdot \left(-\frac{11}{30}\right) = 0.11$ or $\frac{11}{100}$.

Generalize The rules for multiplying integers apply to all rational numbers.

negative • negative = positive

Try It!

Find each product.

a. $-5.3 \cdot (-2.6)$

b. $-\frac{3}{5} \cdot 4\frac{1}{6}$

c. $0.2 \cdot (-1.78)$

d. $-2.5 \cdot \left(-\frac{7}{10}\right)$

KEY CONCEPT

The same rules for multiplying integers apply to multiplying all rational numbers.

When multiplying two rational numbers:

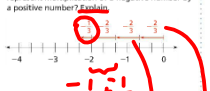
- If the signs of the factors are the same, the product is positive. +
- If the signs of the factors are different, the product is negative.

Do You Understand?

1. Essential Question How is multiplying rational numbers like multiplying integers?

2. How do you multiply a decimal greater than 0 and a fraction less than 0?

3. Model with Math How does this number line represent multiplication of a negative number by a positive number? Explain.



$-\frac{1}{3} + \frac{-1}{3}$

$7 \cdot \left(-\frac{1}{3}\right)$

$-\frac{1}{3} + \frac{-1}{3}$

Do You Know How?

4. Use the number line to find the product $3 \cdot \left(-1\frac{1}{2}\right)$.

5. Which of these products is positive? Select all that apply.

- ☐ $-0.2 \cdot (12.5)$ −
- ☑ $-\frac{1}{12} \cdot \left(-6\frac{1}{2}\right)$ +
- ☐ $3.2 \cdot \left(-\frac{1}{800}\right)$ −
- ☐ $-3\frac{1}{2} \cdot 0$ → 0
- ☑ $-4.7 \cdot (-1)$ +

6. Find the product.

a. $-3.1 \cdot (-2.9)$

b. $1\frac{1}{2} \cdot \left(-\frac{5}{3}\right)$

c. $-3\frac{1}{2} \cdot 0.5$

d. $-\frac{4}{5} \cdot -\frac{1}{8}$

Each of the $\frac{-2}{3}$ is made up of $\frac{-1}{3} + \frac{-1}{3}$ for a total of 6 plus the extra $\frac{-1}{3}$ at the end, so $7 \cdot \left(-\frac{1}{3}\right)$

Name: _____

Practice & Problem Solving

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In 7–14, multiply.

7. $(-2.655) \cdot (18.44)$

8. $-1\frac{5}{6} \cdot 6\frac{1}{2}$

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

10. $-3\frac{7}{8} \cdot \left(-5\frac{3}{4}\right)$

11. $-7.5 \cdot -2\frac{3}{4}$

12. $-0.6 \cdot (-0.62)$

13. $-0.2 \cdot -\frac{5}{6}$

14. $-\frac{5}{6} \cdot \frac{1}{8}$

15. At the beginning of the season, Jamie pays full price for a ticket to see the Panthers, her favorite baseball team.

The Panthers currently have 33 wins and 31 losses.

a. Represent the total change in the cost of a ticket given their losses.

b. What is the cost of a ticket for the next game they play?

7) $-2.655 \cdot 18.44$

$$
\begin{array}{r}
2655 \\
\times\ 1844 \\
\hline
10620 \\
106200 \\
2124000 \\
+\ 2655000 \\
\hline
4895820
\end{array}
$$

16. The price per share of ENVX stock is dropping at a rate of $1.45 each hour.

a. Write the rate as a negative number.

b. What rational number represents the change in the price per share after 5 hours?

c. What is the price per share after 5 hours?

17. Ming incorrectly says that this product is $\frac{4}{63}$.

$$-\left(-\frac{4}{9}\right) \cdot \left(-\frac{1}{7}\right)$$

a. What is the correct product?

b. What error could Ming have made?

18. Higher Order Thinking Place the products in order from least to greatest.

$4\frac{4}{7} \cdot 4\frac{4}{7}$

$5\frac{6}{7} \cdot \left(-6\frac{6}{7}\right)$

$-5\frac{1}{8} \cdot \left(-2\frac{1}{4}\right)$

Assessment Practice

19. Multiply $-2\frac{1}{4} \cdot (16.4)$.

20. Suppose there is a 1.3°F drop in temperature for every thousand feet that an airplane climbs into the sky. The temperature on the ground is −2.8°F.

PART A

Write a multiplication expression to represent the change in temperature after the plane ascends 10,000 feet.

PART B

What will the temperature be when the plane reaches an altitude of 10,000 feet?

$-2\frac{1}{4} \cdot 16.4$

-2.25×16.4

$4\overline{)1.000}$ → 0.25, 8, 20, −20, 0

225 × 16.4

19)

$-225 \times +164$

900

13500

+22500

3690 0

-36.9

2×16

1

16

× 2

32