Common Core Standards:
7.NS.2.a, 7.NS.2.c, 7.NS.3

Multiply and Divide Rational Numbers

Getting the Idea

Use these rules to help you multiply decimals:

- Multiply as you would with whole numbers.
- Count the total number of decimal places in the factors. The sum is the number of decimal places in the product.

Example 1

Multiply.

$3.98 \times 20.5 = \square$

Strategy **Multiply as you would with whole numbers. Place the decimal point.**

Step 1 Multiply as you would with whole numbers.

$$\begin{array}{rcr} 3.98 & \longrightarrow & 398 \\ \times\ 20.5 & \longrightarrow & \times\ 205 \\ \hline & & 1990 \\ & & +\,79600 \\ \hline & & 81590 \end{array}$$

Step 2 Determine the correct number of decimal places.

3.98 has 2 decimal places.

20.5 has 1 decimal place.

$2 + 1 = 3$, so the product has 3 decimal places.

81590 ⟶ 81.590 or 81.59

Solution **$3.98 \times 20.5 = 81.59$**

You can use the **distributive property** to break numbers into easier numbers to compute with.

Example 2

A poster board costs \$0.87. Andrew needs to buy 6 boards for an art project. How much will it cost Andrew to buy all the boards he needs?

Strategy **Use the distributive property.**

Step 1 Write an expression to represent the problem.

Find $6 \times \$0.87$.

Step 2 Break up \$0.87 into easier numbers to work with.

Show \$0.87 as a sum.

$6 \times \$0.87 = 6 \times (\$0.80 + \$0.07)$

Step 3 Use the distributive property.

$6 \times \$0.87 = 6 \times (\$0.80 + \$0.07)$

$= (6 \times \$0.80) + (6 \times \$0.07)$ Distribute the 6.

$= \$4.80 + \$0.42$ Multiply 6 by each addend.

$= \$5.22$ Add.

Solution **It will cost Andrew \$5.22 to buy all the boards he needs.**

Use these rules to divide a decimal by a decimal:

- Multiply the divisor by a power of 10, such as 10 or 100, to make it a whole number. Then multiply the dividend by the same power of 10.
- Divide as you would divide whole numbers.

Example 3

Kaz is competing in a 13.5-kilometer race. There will be water stops every 0.75-kilometer, including at the end of the race. How many water stops will there be in all?

Strategy **Multiply the divisor and the dividend by the same power of 10. Then divide.**

Step 1 Write an expression to represent the problem.

Find $13.5 \div 0.75$.

Step 2 Multiply the divisor by a power of 10 so that it becomes a whole number.

The decimal point in the divisor, 0.75, must be moved two places to the right.

This is the same as multiplying by 100.

$0.75 \times 100 = 0.75_{\text{x}} = 75$

Step 3 Multiply the dividend by the same power of 10.

$13.5 \times 100 = 13.50_{\text{x}} = 1{,}350$

Step 4 Divide.

$$
\begin{array}{r}
18 \\
75\overline{)1350} \\
-75 \\
\hline
600 \\
-600 \\
\hline
0
\end{array}
$$

Solution **There will be 18 water stops in all.**

Sometimes, you will divide until the decimal terminates. Other times, it will be necessary to interpret a remainder.

Example 4

It costs \$0.36 to buy an eraser. Ms. Cole wants to buy as many erasers as she can for \$5.00. How many erasers can Ms. Cole buy?

Strategy **Multiply the divisor and the dividend by the same power of 10. Then divide.**

Step 1 Write an expression to represent the problem.

Find $\$5.00 \div \$0.36$.

Step 2 Multiply the divisor by a power of 10 so that it becomes a whole number.

There are 2 decimal places in 0.36, so multiply by 100.

$0.36 \times 100 = 36$

Step 3 Multiply the dividend by the same power of 10.

$5 \times 100 = 500$

Step 4 Divide.

$$\begin{array}{r} 13 \\ 36\overline{)500} \\ -36 \\ \hline 140 \\ -108 \\ \hline 32 \end{array}$$

Step 5 Interpret the remainder.

The quotient is 13 R32, or $13\frac{32}{36}$.

Since it is not possible to buy $\frac{32}{36}$ of an eraser, the maximum number of erasers that can be bought is 13.

Solution **Ms. Cole can buy 13 erasers with $5.00.**

Use these rules to multiply fractions or mixed numbers.

- To multiply fractions, multiply the numerators. Then multiply the denominators. Write the answer in simplest form.
- To multiply mixed numbers, first rename them as improper fractions.

Example 5

Drake lives $\frac{7}{8}$ mile from the park. After walking $\frac{2}{3}$ of the way to the park, he met Josh.

How far did Drake walk before he met Josh?

Strategy **Multiply the numerators. Then multiply the denominators.**

Step 1 Write an expression to represent the problem.

Find $\frac{2}{3}$ of $\frac{7}{8}$, or $\frac{2}{3} \times \frac{7}{8}$.

Step 2 Multiply the numerators. Then multiply the denominators.

$\frac{2}{3} \times \frac{7}{8} = \frac{2 \times 7}{3 \times 8} = \frac{14}{24}$

Step 3 Write the answer in simplest form.

The GCF of the numerator and the denominator is 2.

$\frac{14}{24} = \frac{14 \div 2}{24 \div 2} = \frac{7}{12}$

Solution **Drake walked $\frac{7}{12}$ mile before he met Josh.**

Example 6

Multiply.

$4\frac{2}{3} \times 1\frac{5}{7} = \square$

Strategy **Rename the mixed numbers as improper fractions. Multiply.**

Step 1 Rename the mixed number $4\frac{2}{3}$.

Multiply the whole-number part by the denominator and then add the numerator. Keep the same denominator.

$4\frac{2}{3} \rightarrow \frac{(4 \times 3) + 2}{3} = \frac{14}{3}$

Step 2 Rename the mixed number $1\frac{5}{7}$.

$1\frac{5}{7} \rightarrow \frac{(1 \times 7) + 5}{7} = \frac{12}{7}$

Step 3 Multiply the numerators and the denominators.

$\frac{14}{3} \times \frac{12}{7} = \frac{168}{21}$

Step 4 Write the answer in simplest form.

The GCF of the numerator and the denominator is 21.

$\frac{168}{21} = \frac{168 \div 21}{21 \div 21} = \frac{8}{1} = 8$

Solution $\mathbf{4\frac{2}{3} \times 1\frac{5}{7} = 8}$

Use these rules when multiplying two rational numbers.

- When both numbers have the same sign, the product is positive.
- When the numbers have different signs, the product is negative.

Example 7

Multiply.

$-5 \times \frac{1}{2} = \square$

Strategy **Rename the whole number as a fraction and multiply.**

Step 1 Rename the whole number as a fraction.

$-5 = -\frac{5}{1}$

Step 2 Multiply.

$$-\frac{5}{1} \times \frac{1}{2} = \frac{-5 \times 1}{1 \times 2} = -\frac{5}{2}$$

Step 3 Convert the improper fraction to a mixed number.

$$-\frac{5}{2} = -5 \div 2 = -2 \text{ R1}$$

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

Step 4 Verify the sign of the product.

The factors have different signs, so the product should be negative.

Solution $\mathbf{-5 \times \frac{1}{2} = -2\frac{1}{2}}$

Coached Example

Mr. Livio earns an hourly wage for every hour he works. Last week, he earned $663.85 and worked for 35.5 hours. How much money does Mr. Livio earn per hour?

To solve the problem, divide 663.85 by _____ to find the amount of money Mr. Livio earns per hour.

Multiply the divisor, 35.5, by _____ to make it a whole number: _____

Multiply the dividend, 663.85, by that same power of 10: _____

Divide as you would with whole numbers.

$355\overline{)6{,}638.5}$

Place a dollar sign and a decimal point in the quotient.

The answer is an amount of money, so be sure to give it two decimal places.

Mr. Livio earns _____ per hour.

Lesson Practice

Choose the correct answer.

1. Marta earns $8.76 per hour at her job. Last week, she worked for 32.5 hours. How much money did Marta earn last week?

A. $259.80
B. $273.60
C. $280.82
D. $284.70

2. Each lap around Spring Reservoir is $2\frac{3}{8}$ miles long. Terrence walked $2\frac{1}{2}$ laps around the reservoir. How many miles did Terrence walk?

A. $4\frac{3}{16}$ miles
B. $5\frac{1}{4}$ miles
C. $5\frac{3}{8}$ miles
D. $5\frac{15}{16}$ miles

3. Pens are on sale for $0.79 each. Tamira is going to buy as many pens as she can for $13.50 for the upcoming school year. How many pens can Tamira buy?

A. 15
B. 16
C. 17
D. 18

4. Jamal found 32 shells at the beach. Hayes found $\frac{7}{8}$ as many shells as Jamal found. How many shells did Hayes find?

A. 24
B. 28
C. 30
D. 39

5. Rochelle's car averages 32.5 miles per gallon on the highway. At that rate, how many gallons of gas will her car use for driving on the highway for 260 miles?

A. 8 gallons
B. 11 gallons
C. 15 gallons
D. 33 gallons

6. A smoothie recipe calls for $\frac{2}{3}$ cup of orange juice per serving. How many cups of orange juice are needed to make 4 servings?

A. $1\frac{1}{3}$ cups
B. 2 cups
C. $2\frac{2}{3}$ cups
D. $3\frac{1}{3}$ cups

7. A trail is 13.5 miles long. There are markers every 0.25 mile along the trail, including at the end of the trail. How many markers are there in all?

A. 4

B. 5

C. 40

D. 54

8. Multiply.

$$-\frac{3}{4} \times -1\frac{1}{5} = \square$$

A. $-\frac{9}{10}$

B. $-\frac{3}{4}$

C. $\frac{3}{4}$

D. $\frac{9}{10}$

9. Last year at Roberts Middle School, $\frac{11}{30}$ of the books in the library were more than 50 years old. At the end of the year, $\frac{1}{10}$ of those books were given to charity.

A. What fraction of all the books was given to charity? Show your work.

B. This year, the school library plans to increase its total of 1,210 books by a factor of 1.1. How many books will the library have? Show your work.

10. Use numbers from the box to complete each equation.

$24\frac{3}{8} \div 6\frac{1}{2} =$ _____

$64\frac{3}{5} \div 6\frac{4}{5} =$ _____

$1\frac{1}{3} \times 13\frac{3}{4} =$ _____

$3\frac{3}{4}$
$9\frac{1}{2}$
$18\frac{1}{3}$

11. Libby pays $22.75 for each hour of private dance lessons. She completed 25.5 hours of lessons last month. Circle the total amount that Libby paid for dance lessons last month.

Libby paid | $580.13 | $225.65 | $48.25 | for private dance lessons.

12. Which problem has a solution of $5.62? Circle all that apply.

A. Hannah earns $9.62 an hour babysitting. She babysat for 4 hours Saturday night. How much did she earn?

B. Six friends went out to lunch. The total bill was $33.72. How much did each friend pay if they split the bill evenly?

C. Javier bought two packs of pencils that cost $2.81 each. How much did he spend on pencils?

13. Milo had $5.20 to spend. He bought packs of gum for $0.65 per pack. Circle the number of packs of gum that Milo bought.

Milo bought | 8 | 9 | 10 | packs of gum.

14. Read each word problem and its stated solution. Is the solution correct? Select True or False.

A. Raj used $4\frac{3}{4}$ cups of sugar for each batch of muffins. He made $3\frac{1}{2}$ batches. Raj used $16\frac{5}{8}$ cups of sugar altogether. ○ True ○ False

B. Bessie added $1\frac{2}{3}$ cups of fertilizer to each bag of topsoil. She used $7\frac{5}{8}$ bags of topsoil. Bessie used $12\frac{17}{24}$ cups of fertilizer altogether. ○ True ○ False

C. Greg had $27\frac{3}{8}$ cups of popcorn. He divided the popcorn evenly among 3 friends. Each friend got $9\frac{1}{2}$ cups of popcorn. ○ True ○ False

15. Use numbers from the box to complete each equation.

$3\frac{2}{5} \times 5\frac{1}{2} =$ _____

$15\frac{2}{5} \div 4\frac{13}{16} =$ _____

$5\frac{4}{7} \times 2\frac{1}{3} =$ _____

$3\frac{1}{5}$
13
$18\frac{7}{10}$

16. Draw a line from each expression to its solution.

A.	3.6×0.7	2.52
B.	$9.66 \div 2.1$	3.7
C.	$5.92 \div 1.6$	4.6
D.	5.2×1.4	7.28