Lesson 4

Divide Fractions

Objective Divide fractions.

Vocabulary
- multiplicative inverse
- reciprocal
- invert

Learn About It

Find the products. What pattern do you see?

$3 \times \frac{1}{3} = \blacksquare$ $\quad \frac{5}{4} \times \frac{4}{5} = \blacksquare$ $\quad 2\frac{1}{2} \times \frac{2}{5} = \blacksquare$

The products are all equal to 1.

Any two numbers whose product is 1 are called **multiplicative inverses** or **reciprocals** of each other. For example,

3 and $\frac{1}{3}$ are reciprocals.

$2\frac{1}{2}$ and $\frac{2}{5}$ are reciprocals.

One way to find the reciprocal of a fraction is to **invert** or interchange the numerator and denominator:

$\frac{5}{4}$ is the reciprocal of $\frac{4}{5}$.

Marco is preparing Buffalo chicken wings. He has $\frac{3}{4}$ cup of hot sauce. Each chicken wing needs $\frac{3}{16}$ cup of hot sauce. How many chicken wings can Marco top with hot sauce?

Buffalo chicken wings are often served with celery sticks and blue-cheese dressing.

Divide. $\frac{3}{4} \div \frac{3}{16} = \blacksquare$

Different Ways to Divide $\frac{3}{4}$ by $\frac{3}{16}$

Way 1 You can multiply by the reciprocal.

Since reciprocals are multiplicative inverses, you can use reciprocals to divide fractions.

STEP 1 Rewrite as a multiplication problem, using the reciprocal of the divisor.

$$\frac{3}{4} \div \frac{3}{16}$$

$$= \frac{3}{4} \times \frac{16}{3}$$

STEP 2 Simplify by using prime factorization. Then multiply.

$$\frac{3}{4} \times \frac{16}{3}$$

$$= \frac{\overset{1}{\cancel{3}} \times \overset{1}{\cancel{2}} \times \overset{1}{\cancel{2}} \times 2 \times 2}{\underset{1}{\cancel{2}} \times \underset{1}{\cancel{2}} \times \underset{1}{\cancel{3}}} = \frac{4}{1} = 4$$

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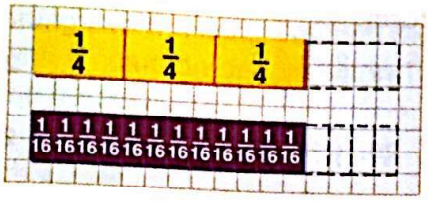
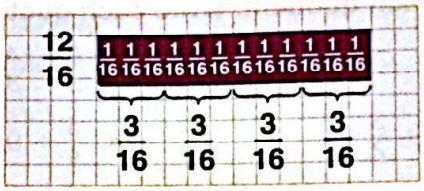
Way 2 You can use models.

STEP 1 Use grid paper to draw fraction models to model $\frac{3}{4}$ in 16ths.



- How many $\frac{3}{16}$ths are in $\frac{3}{4}$?

STEP 2 Count the number of groups of $\frac{3}{16}$.



There are 4 groups of $\frac{3}{16}$ in $\frac{3}{4}$.

$\frac{12}{16} \div \frac{3}{16} = 4$

Solution: Marco can top 4 chicken wings with hot sauce.

Other Examples

A. Whole Number and a Fraction

$$3 \div \frac{3}{5}$$

$$= \frac{3}{1} \div \frac{3}{5}$$

$$= \frac{\overset{1}{\cancel{3}}}{1} \times \frac{5}{\underset{1}{\cancel{3}}} = \frac{1}{1} \times \frac{5}{1} = \frac{5}{1} = 5$$

B. Fraction and a Whole Number

$$\frac{1}{2} \div 10$$

$$= \frac{1}{2} \div \frac{10}{1}$$

$$= \frac{1}{2} \times \frac{1}{10} = \frac{1}{20}$$

Guided Practice

Find the reciprocal of each number.

1. $\frac{11}{5}$ 2. $2\frac{1}{4}$ 3. 9 4. $8\frac{2}{3}$ 5. $\frac{1}{7}$

Ask Yourself
- Did I use the reciprocal of the divisor?
- Did I multiply by the reciprocal?

Find each quotient. Write each quotient in simplest form.

6. $\frac{2}{3} \div \frac{3}{4}$ 7. $\frac{7}{3} \div \frac{5}{6}$ 8. $6 \div \frac{3}{4}$ 9. $\frac{2}{3} \div 10$

10. $\frac{5}{9} \div \frac{7}{3}$ 11. $\frac{1}{5} \div \frac{2}{3}$ 12. $\frac{3}{2} \div \frac{7}{8}$ 13. $\frac{7}{9} \div 14$

Explain Your Thinking Why can you use multiplication to check a division problem?

Go On

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Practice 6.4

Divide Fractions

Find the reciprocal of each number.

1. $\frac{1}{3}$ _____
2. $\frac{5}{6}$ _____
3. 7 _____
4. $1\frac{1}{2}$ _____
5. $2\frac{3}{4}$ _____
6. 5 _____
7. $\frac{15}{16}$ _____
8. 4 _____
9. $2\frac{5}{6}$ _____

Find each quotient. Write each quotient in simplest form.

10. $\frac{1}{2} \div \frac{1}{4}$ _____
11. $\frac{2}{3} \div \frac{4}{9}$ _____
12. $\frac{7}{8} \div 4$ _____
13. $\frac{2}{3} \div \frac{1}{2}$ _____
14. $\frac{15}{16} \div \frac{5}{8}$ _____
15. $\frac{9}{10} \div \frac{3}{4}$ _____
16. $8 \div \frac{4}{5}$ _____
17. $\frac{6}{7} \div \frac{14}{21}$ _____
18. $\frac{5}{8} \div 16$ _____

Algebra • Equations **Find a value for *n* that makes each equation true.**

19. $\frac{3}{4} \div \frac{2}{3} = n$ _____
20. $\frac{2}{3} \div n = \frac{3}{4}$ _____
21. $n \div \frac{10}{21} = 1\frac{3}{4}$ _____

Test Prep

22. Which multiplication problem is the same as the division problem $\frac{2}{3} \div \frac{8}{9}$?

A $\frac{2}{3} \times \frac{8}{9}$

B $\frac{2}{3} \times \frac{9}{8}$

C $\frac{3}{2} \times \frac{8}{9}$

D $\frac{3}{2} \times \frac{9}{8}$

23. Explain how to find the reciprocal of the number *m*.

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