

# Operations with Fractions: Multiplying and Dividing

To multiply fractions, multiply the numerators and multiply the denominators.

## EXAMPLE

1 Find each product.

a.  $\frac{2}{5} \cdot \frac{1}{3}$   
 $\frac{2}{5} \cdot \frac{1}{3} = \frac{2 \cdot 1}{5 \cdot 3}$  Multiply the numerators.  
Multiply the denominators.  
 $= \frac{2}{15}$  Simplify.

b.  $\frac{7}{3} \cdot \frac{1}{11}$   
 $\frac{7}{3} \cdot \frac{1}{11} = \frac{7 \cdot 1}{3 \cdot 11}$  Multiply the numerators.  
Multiply the denominators.  
 $= \frac{7}{33}$  Simplify.

If the fractions have common factors in the numerators and denominators, you can simplify before you multiply by canceling.

## EXAMPLE

2 Find each product. Simplify before multiplying.

a.  $\frac{3}{4} \cdot \frac{4}{7}$   
 $\frac{3}{4} \cdot \frac{4}{7} = \frac{3}{\cancel{4}} \cdot \frac{\cancel{4}^1}{7}$  Divide by the GCF, 4.  
 $= \frac{3}{7}$  Multiply.

b.  $\frac{4}{9} \cdot \frac{45}{49}$   
 $\frac{4}{9} \cdot \frac{45}{49} = \frac{4}{\cancel{9}^5} \cdot \frac{\cancel{45}_5}{49}$  Divide by the GCF, 9.  
 $= \frac{20}{49}$  Multiply.

Two numbers whose product is 1 are called **multiplicative inverses** or **reciprocals**.

## EXAMPLE

3 Name the reciprocal of each number.

a.  $\frac{3}{8}$       b.  $\frac{1}{6}$   
 $\frac{3}{8} \cdot \frac{8}{3} = 1$  The product is 1.       $\frac{1}{6} \cdot \frac{6}{1} = 1$  The product is 1.  
The reciprocal of  $\frac{3}{8}$  is  $\frac{8}{3}$ .      The reciprocal of  $\frac{1}{6}$  is 6.

c.  $2\frac{4}{5}$   
 $2\frac{4}{5} = \frac{14}{5}$  Write  $2\frac{4}{5}$  as an improper fraction.  
 $\frac{14}{5} \cdot \frac{5}{14} = 1$  The product is 1.  
The reciprocal of  $2\frac{4}{5}$  is  $\frac{5}{14}$ .

To divide one fraction by another fraction, multiply the dividend by the multiplicative inverse of the divisor.

### EXAMPLE

**4** Find each quotient.

a.  $\frac{1}{3} \div \frac{1}{2}$   
 $\frac{1}{3} \div \frac{1}{2} = \frac{1}{3} \cdot \frac{2}{1}$  Multiply  $\frac{1}{3}$  by  $\frac{2}{1}$ , the reciprocal of  $\frac{1}{2}$ .  
 $= \frac{2}{3}$  Simplify.

b.  $\frac{3}{8} \div \frac{2}{3}$   
 $\frac{3}{8} \div \frac{2}{3} = \frac{3}{8} \cdot \frac{3}{2}$  Multiply  $\frac{3}{8}$  by  $\frac{3}{2}$ , the reciprocal of  $\frac{2}{3}$ .  
 $= \frac{9}{16}$  Simplify.

c.  $4 \div \frac{5}{6}$   
 $4 \div \frac{5}{6} = \frac{4}{1} \cdot \frac{6}{5}$  Multiply 4 by  $\frac{6}{5}$ , the reciprocal of  $\frac{5}{6}$ .  
 $= \frac{24}{5}$  or  $4\frac{4}{5}$  Simplify.

d.  $\frac{3}{4} \div 2\frac{1}{2}$   
 $\frac{3}{4} \div 2\frac{1}{2} = \frac{3}{4} \cdot \frac{2}{5}$  Multiply  $\frac{3}{4}$  by  $\frac{2}{5}$ , the reciprocal of  $2\frac{1}{2}$ .  
 $= \frac{6}{20}$  or  $\frac{3}{10}$  Simplify.