

# 9.3

## Multiplying a Whole Number by a Fraction

### You will need

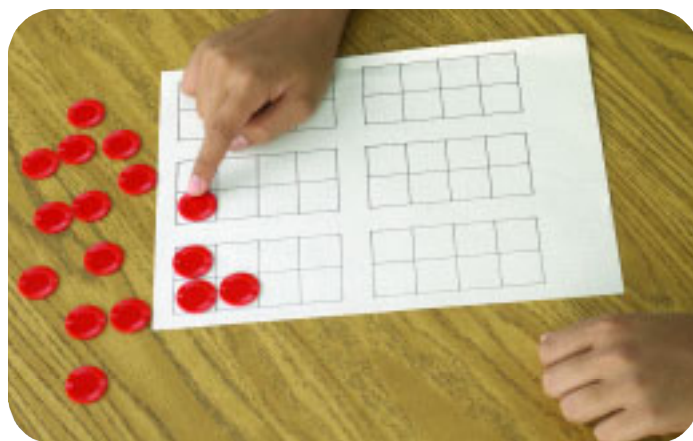
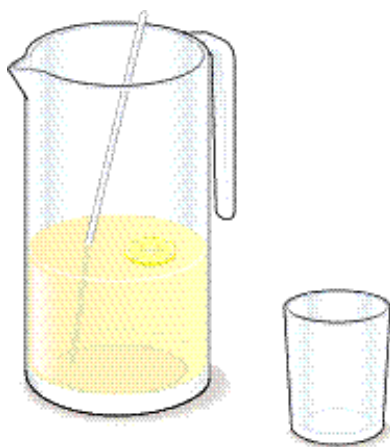
- grid paper
- counters
- fraction strips
- number lines

### GOAL

Use repeated addition to multiply fractions by whole numbers.

### Learn about the Math

Leah is having a party. After a couple of hours, she notices that six lemonade pitchers are each only  $\frac{3}{8}$  full. She decides to combine the leftovers to use fewer pitchers.



? **How many pitchers will be filled with the left-over lemonade?**

- Sketch the pitchers. Estimate how many pitchers you think the lemonade will fill completely. Explain your thinking.
- Use grid paper. Draw six 4-by-2 rectangles. Put counters on three of the eight squares in each rectangle to model the six  $\frac{3}{8}$  full pitchers.
- How many squares, in total, are covered by counters? If a full pitcher represents  $\frac{8}{8}$ , what improper fraction represents the total amount of lemonade?
- Describe how you could move the counters to create as many full pitchers as possible. What part of a full pitcher would be left? Write the total amount of lemonade left over as a mixed number.
- Use fraction strips or a number line to find the total amount of lemonade remaining.

## Reflecting

1. How could you have predicted the numerator of your improper fraction in step C? Explain.
2. How could you have predicted that the amount left in the last pitcher would be a fraction with a denominator of 8?
3. Why could you write either  $\frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8} + \frac{3}{8}$  or  $6 \times \frac{3}{8}$  to describe the total amount of lemonade in the pitchers?

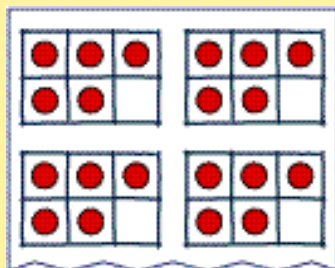
## Work with the Math

### Example 1: Multiplying a fraction by a whole number using grid paper

Multiply  $4 \times \frac{5}{6}$  using grids and counters.

#### Chang's Solution

$4 \times \frac{5}{6}$  is 4 sets of  $\frac{5}{6}$ .



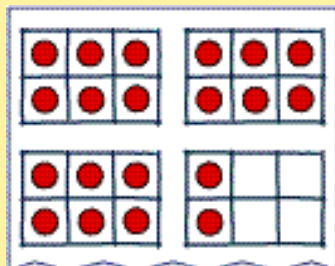
I used 3-by-2 rectangles, since I want to show sixths and  $3 \times 2 = 6$ . (I could have used 6-by-1 rectangles instead.)

I showed four sets of  $\frac{5}{6}$  by putting counters on 5 out of 6 squares in each of the 4 rectangles.

$4 \times 5 = 20$  squares are covered.

Since each square represents  $\frac{1}{6}$ , the 20 covered squares represent  $\frac{20}{6}$ .

$$4 \times \frac{5}{6} = \frac{4 \times 5}{6} \\ = \frac{20}{6}$$



I'll write the improper fraction as a mixed number.

I moved 3 counters from the last rectangle to complete the other 3 rectangles. That means I filled 3 rectangles and there are 2 squares in another rectangle. So,  $\frac{20}{6} = 3\frac{2}{6}$ .

The fraction  $\frac{2}{6}$  can be written in lowest terms as  $\frac{1}{3}$ .

$$4 \times \frac{5}{6} = \frac{20}{6} \\ = 3\frac{2}{6} \text{ or } 3\frac{1}{3}$$



### Example 2: Multiplying a fraction by a whole number using fraction strips

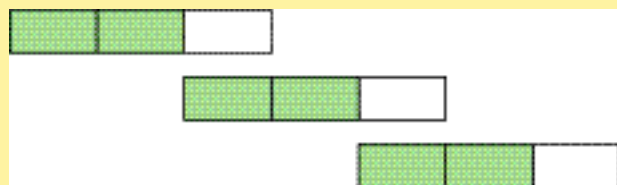
Multiply  $3 \times \frac{2}{3}$  using fraction strips.

#### Yuki's Solution

$3 \times \frac{2}{3}$  is 3 sets of  $\frac{2}{3}$ .



I made three  $\frac{2}{3}$  strips.



I put the strips together.

$$3 \times \frac{2}{3} = \frac{6}{3} \text{ or } 2$$

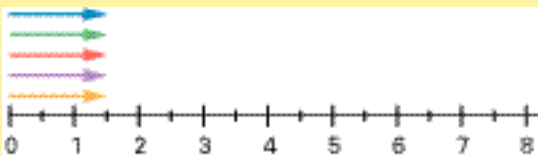


### Example 3: Multiplying a fraction by a whole number using a number line

Multiply  $5 \times \frac{3}{2}$  using a number line.

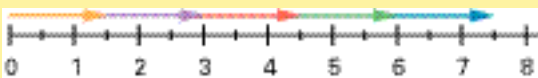
#### Ryan's Solution

$5 \times \frac{3}{2}$  is 5 sets of  $\frac{3}{2}$ .



I used a long number line marked in halves.

I drew 5 arrows. Each arrow shows  $\frac{3}{2}$ .



I put the arrows together to model  $5 \times \frac{3}{2}$ .

$$5 \times \frac{3}{2} = \frac{15}{2} \text{ or } 7\frac{1}{2}$$



## A Checking

4. Jennifer pours  $\frac{2}{3}$  of a cup of water into a pot and repeats this seven times. How many full cups of water, in total, does she pour into the pot? Write your answer as a mixed number.

5. a) Multiply  $4 \times \frac{5}{12}$  using a grid and counters. Make a sketch to show your work.  
b) Write your answer as an improper fraction and as a mixed number.

6. a) Write  $5 \times \frac{3}{4}$  as a repeated addition sentence.  
 b) Use fraction strips or a number line to calculate the answer.  
 c) Write your answer as an improper fraction and as a mixed number.

## B Practising

7. Multiply using grids and counters. Show your work.
- a)  $2 \times \frac{1}{3}$       c)  $6 \times \frac{3}{8}$       e)  $3 \times \frac{6}{7}$   
 b)  $5 \times \frac{3}{5}$       d)  $4 \times \frac{2}{5}$       f)  $8 \times \frac{4}{2}$
8. Write as a repeated addition. Use fraction strips or a number line to calculate each answer.
- a)  $2 \times \frac{1}{3}$       c)  $4 \times \frac{5}{2}$       e)  $6 \times \frac{3}{5}$   
 b)  $2 \times \frac{5}{4}$       d)  $5 \times \frac{1}{6}$       f)  $7 \times \frac{7}{6}$
9. Replace each missing value with a single-digit number to make the sentence true.
- a)  $4 \times \frac{1}{\square} = 2$   
 b)  $5 \times \frac{\square}{9} = 4 \frac{\square}{9}$   
 c)  $\square \times \frac{4}{5} = 4 \frac{4}{5}$   
 d)  $\square \times \frac{\square}{8} = 1 \frac{7}{8}$
10. Art class is  $\frac{5}{6}$  of an hour each school day. How many hours of art does a student have in five days?
11. Kevin needs  $\frac{2}{3}$  c. of sugar to make his favourite brownie recipe. How many cups of sugar does he need to make six batches of brownies for a bake sale?

12. Katya says that multiplying  $17 \times \frac{1}{4}$  will tell her how many dollars that 17 quarters is worth. Do you agree? Explain.

13. a) Multiply  $4 \times \frac{3}{5}$ .  
 b) Rewrite  $\frac{3}{5}$  as a percent, and multiply by 4.  
 c) Explain how you can use the calculation in part (b) to check your answer to part (a).
14. At a party, Raj notices that 15 pitchers of lemonade are filled to the same level, but not to the top. He combines all the lemonade to fill six whole pitchers. What fraction of each of the 15 pitchers was full?

15. A whole number multiplied by  $\frac{3}{5}$  is 9. What is the number?

## C Extending

16.  $\square \times \frac{5}{8}$  can be written as a whole number. What possible numbers can replace  $\square$ ? Explain.
17. a) Use fraction strips divided into thirds to represent  $6 \times \frac{2}{3}$ .  
 b) Use fractions strips to represent  $\frac{2}{3}$  of 6.  
 c) Explain why  $\frac{2}{3}$  of 6 is the same as  $6 \times \frac{2}{3}$ .
18. a)  $2 \times \frac{4}{5}$  means the same as doubling  $\frac{4}{5}$ . Explain why.  
 b) What would  $\frac{1}{2} \times \frac{4}{5}$  mean?  
 c) How can you calculate the answer for  $\frac{1}{2} \times \frac{4}{5}$ ?  
 d) How can you check whether your answer for  $\frac{1}{2} \times \frac{4}{5}$  is correct?