Lesson 3

Multiplying Fractions

Problem Solving: More Statistics

Multiplying Fractions

Vocabulary
proper fraction

What happens when we multiply fractions?

Let's review two important points that help us stay organized when we add, subtract, or multiply fractions.

Look at the table. It shows what happens when we multiply two whole numbers. When we multiply two whole numbers, the product is never smaller than the other two whole numbers.

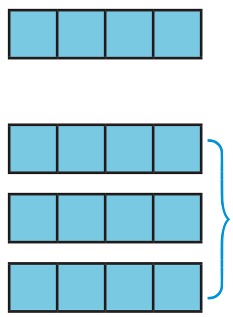
Multiplication of Whole Numbers	
	Product
$3 \cdot 4 =$	12
$6 \cdot 7 =$	42
$200 \cdot 5 =$	1,000
$18 \cdot 1 =$	18

When we multiply fractions, the result is usually the opposite. The product of two proper fractions is usually smaller than the fractions being multiplied. In a **proper fraction**, the numerator is less than the denominator.

Multiplication of Proper Fractions	
	Product
$\frac{1}{2} \cdot \frac{1}{4} =$	$\frac{1}{8}$
$\frac{3}{5} \cdot \frac{1}{2} =$	$\frac{3}{10}$
$\frac{1}{8} \cdot \frac{2}{3} =$	$\frac{2}{24}$
$\frac{4}{6} \cdot \frac{1}{5} =$	$\frac{4}{30}$

This model shows what happens when we multiply 3 • 4. Another way of saying this problem is, "We are multiplying 3 sets of 4."

3 • 4



a set of 4

three sets of 4

3 • 4 = 12

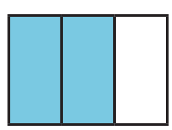
POWER CONCEPT

When multiplying two whole numbers, the product is never smaller than either of the whole numbers being multiplied.

Now let's look at what happens when we multiply $\frac{1}{2} \cdot \frac{2}{3}$. Another way of saying this problem is, "What is $\frac{1}{2}$ of $\frac{2}{3}$?"

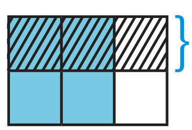
$$\frac{1}{2} \cdot \frac{2}{3}$$

We use the model to identify $\frac{2}{3}$



$\frac{2}{3}$

Then we find $\frac{1}{2}$ of the $\frac{2}{3}$



$\frac{1}{2}$ of $\frac{2}{3}$

POWER CONCEPT

When we multiply two fractions, we take a portion of a fraction.

The model shows the product $\frac{2}{6}$. The two colored and striped squares are the parts. The whole is all six parts.

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

Apply Skills
Turn to ***Interactive Text***, page 7.

Reinforce Understanding
Use the ***mBook Study Guide*** to review lesson concepts.

▶Problem Solving: More Statistics

Vocabulary

median

Why is the mean important?

In the first lesson of this unit, Carmen, the manager of a shoe store, used her spreadsheet to keep track of the mean number of QuikTrax shoes she sold over nine weeks. Here is the table of data.

Week	Number of Pairs of Shoes Sold
May 1 to May 7	47
May 8 to May 14	39
May 15 to May 21	31
May 22 to May 28	39
May 29 to June 4	49
June 5 to June 11	57
June 12 to June 18	50
June 19 to June 25	48
June 26 to July 2	54
Total	**414**

To find the mean, divide the total of the data by the number of data points.

Carmen calculated the mean by dividing the total number of pairs of shoes sold by the number of weeks.

$$\overbrace{414}^{\text{total data}} \div \overbrace{9}^{\text{number of weeks}} = \overbrace{46}^{\text{mean}}$$

The mean is 414 ÷ 9 = 46.

The mean is useful because it helps us make a good guess or prediction. For example, if Carmen wanted to predict how many QuikTrax shoes would be sold next week, the best guess would be the mean. She would predict 46 pairs of shoes.

The mean is just one way of thinking about what is average or typical.

Lesson 3

What is the median?

Another important idea is the **median**. The median is halfway between the minimum and the maximum of a set of numbers. That is, when we count from smallest to largest, it is the number in the middle. The illustration shows that a number like the median is easiest to see when we organize the data from smallest to largest.

half below	31	← minimum
	39	
	39	
	47	
	48	← median
half above	49	
	50	
	54	
	57	← maximum

How do we find the median when we have an even set of numbers?

When we have an even set of numbers, the median is halfway between the two middle numbers.

100	
104	
110	← median = 115
120	
121	
135	

How do we decide which number is the median if the two numbers in the middle are the same?

If the two numbers in the middle are the same, both numbers are the median.

342

379

$$\left.\begin{array}{l}385\\385\end{array}\right\} \longleftarrow \text{median} = 385$$

390

450

How do we present the data to find the mean and the median?

To find the mean and the median in a set of data, we present the data in two ways:

- an ordered list from low to high
- a simple tally chart

Example 1 shows an ordered list from low to high. Example 2 shows a simple tally chart. Both charts show how many students in one class are at a specific height. Some students are shorter than the rest of the class, and some are taller. But what is the average, or mean, height? Also, what is the middle point, or median, where half of the students are below and half are above?

Example 1

Find the mean and the median height of the students using the ordered list.

These are the heights of students from one classroom.

Ordered List (height measured in inches)
61
61
62
62
64
64
65
65
65
65
67
68
68
68
68
68
68
69
69
70
70
71
72

To find the mean, we divide the total number of inches by the total number of students.

The total number of inches is 1,530. The total number of students in the class is 23.

total number of inches

total number of students

1,530 ÷ 23 = 66.5

The mean is 66.5 inches.

To find the median, look for the middle point in the list.

The median is 68 inches.

When we have a long list of data, it is sometimes easier to organize the data in a tally chart. A tally chart uses marks to count the number of times each number appears in the list. In Example 2, we use Xs for the marks.

Example 2

Find the mean and the median height of the students using the tally chart.

Tally Chart (height measured in inches)	
61	x x
62	x x
63	
64	x x
65	x x x x
66	
67	x
68	x x x x x x
69	x x
70	x x
71	x
72	x

median

In the tally chart, we need to remember to count the marks by each number. There are 23 marks, so we divide the sum of the heights by 23 to find the mean.

1,530 ÷ 23 = 66.5

The mean is 66.5 inches.

To find the median, we locate the middle point in the count of students. We start at the first mark and the last mark in the tally chart. Then we move toward the middle number from each end, one mark at a time, until we reach the point in the middle. This point is 68.

The median is 68 inches.

Problem-Solving Activity
Turn to ***Interactive Text***, page 8.

mBook **Reinforce Understanding**
Use the ***mBook Study Guide*** to review lesson concepts.

Homework

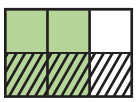
Activity 1

Add and subtract.

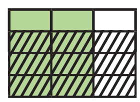
1. $\frac{1}{5} + \frac{2}{5}$
2. $\frac{7}{8} - \frac{5}{8}$
3. $\frac{1}{2} + \frac{1}{4}$
4. $\frac{7}{8} - \frac{1}{2}$
5. $\frac{2}{4} + \frac{1}{3}$
6. $\frac{5}{6} - \frac{1}{9}$

Activity 2

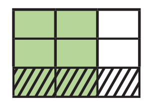
Select the problem that matches the area model.

1. 

(a) $\frac{2}{3} \cdot \frac{2}{3} = \frac{4}{9}$
(b) $\frac{1}{2} \cdot \frac{2}{3} = \frac{2}{6}$
(c) $\frac{1}{3} \cdot \frac{1}{2} = \frac{1}{6}$

2. 

(a) $\frac{3}{4} \cdot \frac{2}{3} = \frac{6}{12}$
(b) $\frac{1}{4} \cdot \frac{3}{4} = \frac{3}{16}$
(c) $\frac{1}{3} \cdot \frac{1}{4} = \frac{1}{12}$

3. 

(a) $\frac{2}{3} \cdot \frac{1}{3} = \frac{2}{9}$
(b) $\frac{1}{3} \cdot \frac{3}{4} = \frac{3}{12}$
(c) $\frac{1}{3} \cdot \frac{1}{2} = \frac{1}{6}$

Activity 3

For each of the data sets, tell the mean and the median.

1. 2, 3, 4, 3, 5, 3, 2, 4, 1
2. 20, 10, 30, 20
3. 300, 200, 100
4. 15, 13, 17, 12, 23, 18, 17, 13

Activity 4 • Distributed Practice

Solve.

1. Write the multiples of 6 starting at 6 and ending at 60.
2. Write the multiples of 8 starting at 8 and ending at 80.
3. What is the LCD for $\frac{1}{5}$ and $\frac{1}{6}$? Use the lists of multiples below to help you.

5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60

4. $500 \div 100$
5. $558 + 552$
6. $65 \cdot 3$
7. $712 - 383$