

## Chapter 4

# Multiply and Divide Fractions



## Essential Question

WHAT does it mean to multiply and divide fractions?

### MP Mathematical Practices

1, 2, 3, 4, 5, 6, 7, 8

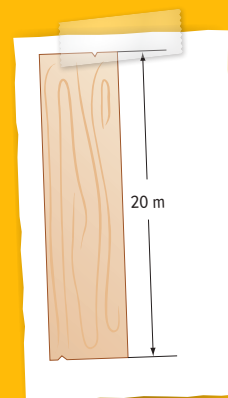


## Math in the Real World

### Construction Builders

measure using fractions and convert measurements between different units.

A 20-meter board needs to be divided into  $2\frac{1}{2}$  meter pieces. On the board below, make the divisions to show the number of pieces.



## FOLDABLES<sup>®</sup> Study Organizer

# 1

Cut out the Foldable in the back of this book.

# 2

Place your Foldable on page 336.

# 3

Use the Foldable throughout this chapter to help you learn about multiplying and dividing fractions.

# What Tools Do You Need?



## Vocabulary

Commutative Property      reciprocals  
dimensional analysis      unit ratio

## Study Skill: Writing Math

**Explain Your Answer** When you explain your answer, you give reasons why your answer is correct.

Salem wants to buy 5 packages of the limited edition cards. Is AED 20 enough for 5 packages, or does Salem need to bring AED 25 to the store to buy them? Explain your answer.

Football Card Prices	
Package	Price (AED)
All-Star	3.75
Limited Edition	4.59
Deluxe	5.99

**Step 1** Estimate.

$$5 \times \text{AED } 4 = \underline{\hspace{2cm}} \quad \text{Round down.}$$

$$5 \times \text{AED } 5 = \underline{\hspace{2cm}} \quad \text{Round up.}$$

**Step 2** Answer the question.

Salem should bring            to the store.

**Step 3** Explain why. Write your explanation in complete sentences.

Using the estimate, Salem knows that the actual cost is between            and           . So            is not enough.

**Practice explaining your answer.**

1. Mariam plans to buy 2 baseballs and 1 baseball glove. Is AED 50 enough to bring to the store or does Mariam need to bring AED 55? Explain your answer.

THE SPORTS COVE	
Baseball.....	6.50
Baseball glove.....	37.99
Baseball cap.....	13.79

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

## What Do You Already Know?

Read each statement. Decide whether you agree (A) or disagree (D). Place a checkmark in the appropriate column and then justify your reasoning.

Multiply and Divide Fractions			
Statement	A	D	Why?
An addition sentence for $3 \times \frac{4}{5}$ is $\frac{4}{5} + \frac{4}{5} + \frac{4}{5}$ .			
A whole number can be written as a fraction with a denominator of 1.			
To multiply two fractions, multiply only the denominators.			
To multiply mixed numbers, multiply the whole numbers then multiply the fractions.			
Any two numbers with a sum of 1 are called reciprocals.			
To divide by a fraction, multiply by its reciprocal.			

## When Will You Use This?

Here is an example of how fractions are used in the real world.

**Activity** Describe a situation where you have had a large amount of something that you need to separate into smaller portions. What method did you use to separate it?

---



---



---



---



---



---

# Are You Ready?

Try the Quick Check below.



## Quick Review

### Example 1

Estimate  $4\frac{5}{6} + 1\frac{1}{8}$ .

Think:  $\frac{5}{6} > \frac{1}{2}$ .  
So,  $4\frac{5}{6}$  rounds to 5.

$$4\frac{5}{6} + 1\frac{1}{8}$$

$$\begin{array}{r} \vdots \\ 5 + 1 = 6 \end{array}$$

Think:  $\frac{1}{8} < \frac{1}{2}$ .  
So,  $1\frac{1}{8}$  rounds to 1.

So,  $4\frac{5}{6} + 1\frac{1}{8}$  is about 6.

### Example 2

Add  $5\frac{9}{10} + 3\frac{3}{4}$ . Write in simplest form.

$$\begin{array}{r} 5\frac{9}{10} \\ + 3\frac{3}{4} \\ \hline \end{array}$$

Rename the fractions using the LCD, 20.

$$5\frac{18}{20} + 3\frac{15}{20}$$

So,  $5\frac{9}{10} + 3\frac{3}{4}$  is equal to  $9\frac{13}{20}$ .

## Quick Check

**Estimate with Fractions** Estimate each sum or difference.

1.  $6\frac{7}{8} + 5\frac{1}{4} \approx$  \_\_\_\_\_

2.  $3\frac{1}{7} + 8\frac{1}{9} \approx$  \_\_\_\_\_

3.  $12\frac{1}{5} - 5\frac{5}{6} \approx$  \_\_\_\_\_

Show your work.

**Add and Subtract Fractions** Add or subtract. Write in simplest form.

4.  $\frac{9}{10} + \frac{3}{5} =$  \_\_\_\_\_

5.  $7\frac{2}{3} - 3\frac{1}{7} =$  \_\_\_\_\_

6.  $9\frac{7}{8} - 2\frac{5}{6} =$  \_\_\_\_\_

7. Suppose a plant grew  $4\frac{1}{2}$  cm one week and  $2\frac{3}{8}$  cm the next week. How many centimeters did it grow during both weeks?

\_\_\_\_\_

## How Did You Do?

Which problems did you answer correctly in the Quick Check?  
Shade those exercise numbers below.

- ①    ②    ③    ④    ⑤    ⑥    ⑦

# Estimate Products of Fractions



## Real-World Link

**Nature** A wildlife preserve has 16 tigers, about  $\frac{1}{3}$  of which are male. The tigers are represented by the counters below.



- Can you separate the counters into three equal groups? Explain.

---



---

- Fill in the multiples of 3 on the number line. Place a dot at 16.



- What multiple of 3 is closest to 16?
- Arrows jump from 0 to 3 to 6. Continue the pattern. How many jumps are from 0 to your answer in Exercise 3?  jumps
- About how many tigers in the preserve are male? Explain.

---



### Essential Question

WHAT does it mean to multiply and divide fractions?

**MP Mathematical Practices**  
1, 3, 4, 5



Which **MP Mathematical Practices** did you use?

Shade the circle(s) that applies.

- |  |   |
|--|---|
| <input type="checkbox"/> ① Persevere with Problems | <input type="checkbox"/> ⑤ Use Math Tools         |
| <input type="checkbox"/> ② Reason Abstractly       | <input type="checkbox"/> ⑥ Attend to Precision    |
| <input type="checkbox"/> ③ Construct an Argument   | <input type="checkbox"/> ⑦ Make Use of Structure  |
| <input type="checkbox"/> ④ Model with Mathematics  | <input type="checkbox"/> ⑧ Use Repeated Reasoning |

## Estimate Using Compatible Numbers

You have already used compatible numbers to estimate quotients. You can also use compatible numbers to estimate products.

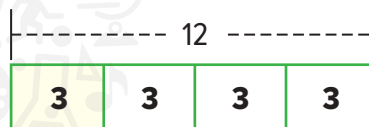
### Examples

#### 1. Estimate $\frac{1}{4} \times 13$ .

Find a multiple of 4 close to 13. 12 and 4 are compatible numbers since  $12 \div 4 = 3$ .

##### Method 1 Use a model.

Divide the bar representing 12 into 4 sections.



Each section is  $\frac{1}{4}$  of 12, or 3.

Label each section 3.

##### Method 2 Use compatible numbers.

$$\begin{aligned} \frac{1}{4} \times 13 &\approx \frac{1}{4} \times 12 \\ &\approx 3 \end{aligned}$$

So,  $\frac{1}{4} \times 13$  is about 3.

### Compatible Numbers

Use compatible numbers to estimate the product of a fraction and a whole number. Find compatible numbers using the denominator of the fraction and the whole number.

Show your work.

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

#### 2. Estimate $\frac{2}{5}$ of 11.

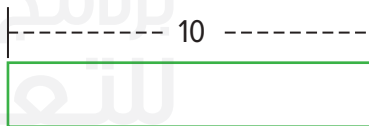
Find a multiple of 5 close to 11. 10 and 5 are compatible numbers since  $10 \div 5 = 2$ .

$$\begin{aligned} \frac{1}{5} \times 11 &\approx \frac{1}{5} \times 10 \\ &\approx 2 \end{aligned}$$

If  $\frac{1}{5}$  of 10 is 2, then

$\frac{2}{5}$  of 10 is  $2 \times 2$ , or .

So,  $\frac{2}{5} \times 11$  is about .



### Got it? Do these problems to find out.

a.  $\frac{1}{5} \times 16$

b.  $\frac{5}{6} \times 13$

c.  $\frac{3}{4}$  of 23

## Estimate by Rounding to 0, $\frac{1}{2}$ , or 1

### Key Concept

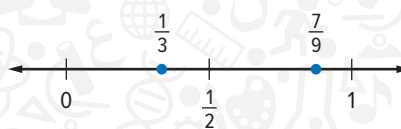
**Words** If the numerator of a fraction between 0 and 1 is almost as large as the denominator, round up. If the numerator is much smaller than the denominator, round down.

**Examples**  $\frac{7}{8}$  rounds to 1;  $\frac{1}{8}$  rounds to 0

Rounding fractions can help you find products of fraction factors.

### Examples

**3.** Estimate  $\frac{1}{3} \times \frac{7}{9}$ .



Dots are placed at  $\frac{1}{3}$  and  $\frac{7}{9}$ .

Round to 0,  $\frac{1}{2}$ , or 1.  $\frac{1}{3}$  is about  $\frac{1}{2}$  and  $\frac{7}{9}$  is about 1.

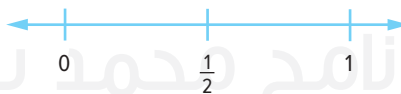
$$\frac{1}{3} \times \frac{7}{9} \rightarrow \frac{1}{2} \times 1$$

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

So,  $\frac{1}{3} \times \frac{7}{9}$  is about  $\frac{1}{2}$ .

**4.** Estimate  $\frac{1}{9} \times \frac{4}{5}$ .

Place dots on the number line at  $\frac{1}{9}$  and  $\frac{4}{5}$ .



Round to 0,  $\frac{1}{2}$ , or 1.  $\frac{1}{9}$  is about 0 and  $\frac{4}{5}$  is about 1.

$$\frac{1}{9} \times \frac{4}{5} \rightarrow 0 \times 1 = \boxed{\phantom{0}}$$

So,  $\frac{1}{9} \times \frac{4}{5}$  is about  $\boxed{\phantom{0}}$ .

Show your work.

d. \_\_\_\_\_

e. \_\_\_\_\_

f. \_\_\_\_\_

**Got it?** Do these problems to find out.

Estimate each product.

d.  $\frac{5}{8} \times \frac{9}{10}$

e.  $\frac{5}{6} \times \frac{9}{10}$

f.  $\frac{5}{6}$  of  $\frac{1}{9}$



## Example

### 5. Estimate the area of the flower bed.

Round each mixed number to the nearest whole number.

$$14\frac{7}{8} \times 6\frac{1}{8} \rightarrow 15 \times 6 = 90$$

So, the area is about 90 square meters.



$6\frac{1}{8}$  m

$14\frac{7}{8}$  m



## Guided Practice

Estimate each product. Use a bar diagram if needed. (Examples 1–4)

1.  $\frac{1}{8} \times 15 \approx$  \_\_\_\_\_

2.  $\frac{2}{5}$  of 26  $\approx$  \_\_\_\_\_

Show your work.

3.  $\frac{1}{5} \times \frac{8}{9} \approx$  \_\_\_\_\_

4.  $6\frac{2}{3} \times 4\frac{1}{5} \approx$  \_\_\_\_\_

5. A border is made of  $32\frac{2}{3}$  bricks that are  $1\frac{1}{6}$  meters long. About how long is the border? (Example 5)

6. A kitchen measures  $24\frac{1}{6}$  meters by  $9\frac{2}{3}$  meters. Estimate the area of the kitchen. (Example 5)

7. **Building on the Essential Question** Why is estimating products of fractions useful? \_\_\_\_\_

### Rate Yourself!

How confident are you about estimating the products of fractions? Color the square that applies.



# Independent Practice

Estimate each product. Use a bar diagram if needed. (Examples 1–4)

1.  $\frac{1}{4} \times 21 \approx$  \_\_\_\_\_

Show your work.

2.  $\frac{5}{7}$  of 22  $\approx$  \_\_\_\_\_

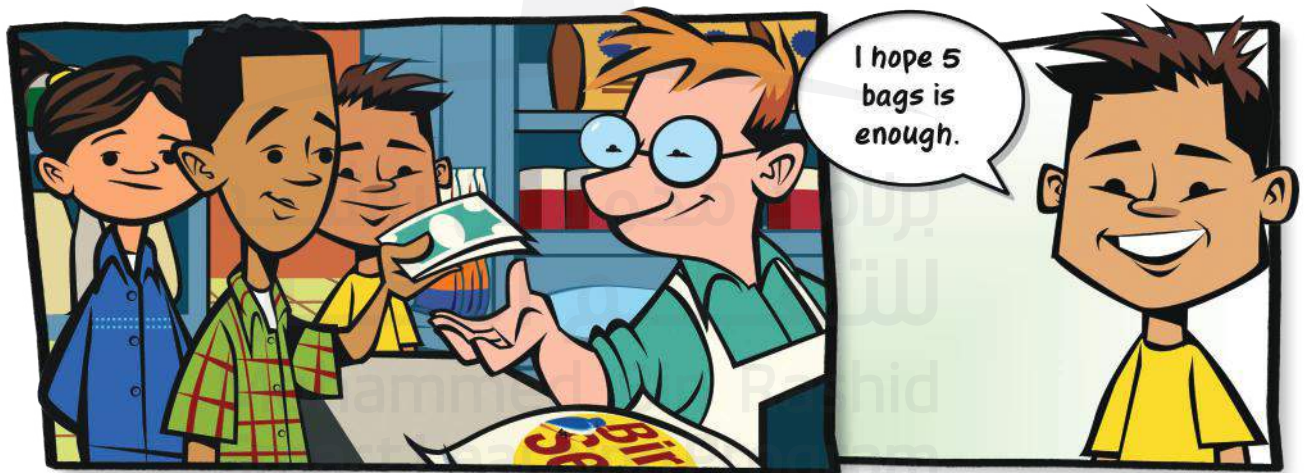
3.  $\frac{5}{7} \times \frac{1}{9} \approx$  \_\_\_\_\_

4.  $4\frac{1}{3} \times 2\frac{3}{4} \approx$  \_\_\_\_\_

5. Nayef is inviting 11 friends over for pizza. He would like to have enough pizza so each friend can have  $\frac{1}{4}$  of a pizza. About how many pizzas should he order? (Example 5)
- \_\_\_\_\_
- \_\_\_\_\_

6. Hakeem's front porch measures  $9\frac{3}{4}$  meters by 4 meters. Estimate the area of his front porch. (Example 5)
- \_\_\_\_\_

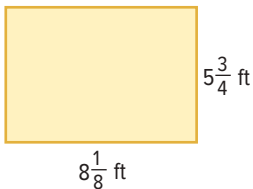
7. **MP Use Math Tools** Refer to the graphic novel frame for Exercises a–b.



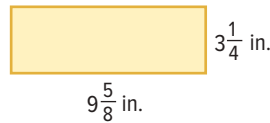
- a. If each bag holds  $3\frac{3}{4}$  kilograms, estimate how many kilograms of birdseed Hamad, Omar, and Ali purchased. \_\_\_\_\_
- \_\_\_\_\_
- b. Suppose each bag costs AED 14.99. Estimate the total cost of 5 bags. \_\_\_\_\_
- \_\_\_\_\_

Estimate the area of each rectangle.

8. \_\_\_\_\_



9. \_\_\_\_\_

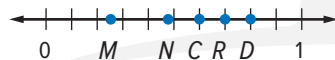


10. **STEM** Abu Dhabi and Dubai received rain on  $\frac{7}{10}$  of the days in a recent month. If this pattern continues, about how many days would it *not* rain in 90 days? \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

 **H.O.T. Problems** Higher Order Thinking

11. **MP Justify Conclusions** By what fraction would you multiply  $8\frac{1}{2}$  so that the product is about 5? Explain your reasoning. \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

12. **MP Persevere with Problems** Determine which point on the number line could be the graph of the product of the numbers graphed at C and D.

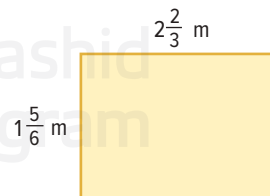


Explain your reasoning. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

13. **MP Reason Inductively** Is the best estimate for the area of the rectangle at the right 2 square meters or 6 square meters? Explain your reasoning.
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_



# Extra Practice

Estimate each product. Use a bar diagram if needed.

14.  $\frac{1}{5} \times 26 \approx 5$  \_\_\_\_\_

Homework Help

$26 \approx 25; \frac{1}{5} \times 25 = \frac{25}{5} = 5$  or 5

15.  $\frac{1}{3}$  of 41  $\approx 14$  \_\_\_\_\_

$41 \approx 42; \frac{1}{3} \times 42 = \frac{42}{3} = 14$  or 14

16.  $\frac{1}{6}$  of 17  $\approx$  \_\_\_\_\_

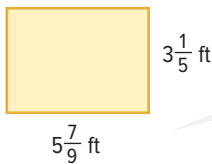
17.  $\frac{2}{9}$  of 88  $\approx$  \_\_\_\_\_

18.  $\frac{2}{3} \times 10 \approx$  \_\_\_\_\_

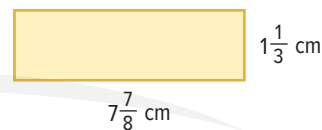
19.  $\frac{3}{8} \times 4 \approx$  \_\_\_\_\_

Estimate the area of the each rectangle.

20. \_\_\_\_\_



21. \_\_\_\_\_



22. Aisha would like to finish  $\frac{2}{5}$  of her book by next Friday. If the book has 203 pages, about how many pages does she need to read? \_\_\_\_\_

23. Fahd is organizing his movie collection. He discovers that  $\frac{5}{8}$  of his movies are action movies. If he has 46 movies, about how many are action movies? \_\_\_\_\_

24. **MP Justify Conclusions** Ali has a collection of 25-fils coins.

If  $\frac{3}{5}$  of his 25-fils coins are dated 2005, what is the approximate value of the 25-fils coins from 2005? Explain your answer to a classmate.



# Power Up! Test Practice

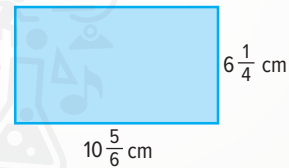
25. The table shows the number of students in grades 6–8 who went to a local museum. Of these, between one half and three fourths packed their lunch. Which of the following ranges could represent the number of students who packed their lunch?

Students Visiting the Museum	
Grade	Number of Students
6	45
7	48
8	40

- less than 70   
  between 70 and 100   
  between 100 and 130   
  more than 130

26. Estimate the area of the rectangle at the right.

Area  $\approx$



## Spiral Review

Round each fraction to 0,  $\frac{1}{2}$ , or 1.

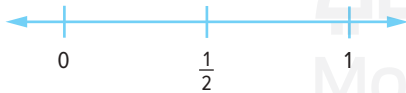
27.  $\frac{7}{12} \approx$  \_\_\_\_\_

28.  $\frac{5}{6} \approx$  \_\_\_\_\_

29.  $\frac{2}{11} \approx$  \_\_\_\_\_

30.  $\frac{4}{9} \approx$  \_\_\_\_\_

31. Graph  $\frac{3}{4}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$ , and  $\frac{2}{3}$ .



32. Graph  $\frac{5}{10}$ ,  $\frac{4}{5}$ ,  $\frac{2}{5}$ , and  $\frac{7}{10}$ .



33. Jasem wants to paint one wall of his room. If the wall is 12 meters wide and 10 meters tall, what is the area of the wall? \_\_\_\_\_

# Multiply Fractions and Whole Numbers

## Vocabulary Start-Up



A commuter train travels back and forth but does not change the distance traveled. In mathematics, operations that follow the **Commutative Property** can be performed in any order. For example, addition and multiplication are commutative.

Draw a line to “Commutative” if the examples can be done in either order. Draw a line to “Not Commutative” if the order changes the outcome.

Commutative

Not Commutative

$12 \div 6; 6 \div 12$

tying your left shoe;  
tying your right shoe

$5 \times 7; 7 \times 5$

play a soccer game; change  
into your team uniform

$15 + 5; 5 + 15$



### Essential Question

WHAT does it mean to multiply and divide fractions?



### Vocabulary

Commutative Property

**MP** Mathematical Practices  
1, 3, 4, 7



## Real-World Link

Some morning routines can be done in any order. Sometimes, the order matters. Describe a situation when the order you perform two actions is important.

---



---



---



Which **MP** Mathematical Practices did you use?

Shade the circle(s) that applies.

- |  |   |
|--|---|
| <input type="checkbox"/> ① Persevere with Problems | <input type="checkbox"/> ⑤ Use Math Tools         |
| <input type="checkbox"/> ② Reason Abstractly       | <input type="checkbox"/> ⑥ Attend to Precision    |
| <input type="checkbox"/> ③ Construct an Argument   | <input type="checkbox"/> ⑦ Make Use of Structure  |
| <input type="checkbox"/> ④ Model with Mathematics  | <input type="checkbox"/> ⑧ Use Repeated Reasoning |

## Key Concept

# Multiply a Whole Number by a Fraction

### Work Zone

**Words** Write the whole number as a fraction. Multiply the numerators and multiply the denominators.

**Example**  $5 \times \frac{3}{4} = \frac{5}{1} \times \frac{3}{4}$  Write 5 as  $\frac{5}{1}$ .

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

Multiply.

$$= \frac{15}{4} \text{ or } 3\frac{3}{4}$$

Simplify.

## Example

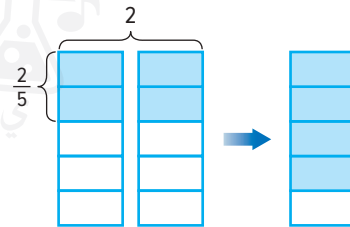
1. Find  $2 \times \frac{2}{5}$ .

**Method 1** Use an area model.

Shade  $\frac{2}{5}$  of each of the first two columns.

A total of  $\frac{4}{5}$  has been shaded.

Shade  $\frac{4}{5}$  on the third column.



**Method 2** Use an equation.

**Estimate**  $2 \times \frac{1}{2} = 1$

$$2 \times \frac{2}{5} = \blacksquare$$

$$2 \times \frac{2}{5} = \frac{2}{1} \times \frac{2}{5}$$
 Write 2 as  $\frac{2}{1}$ .

$$= \frac{2 \times 2}{1 \times 5}$$
 Multiply.

$$= \frac{4}{5}$$
 Simplify.

Using either method,  $2 \times \frac{2}{5}$  is  $\frac{4}{5}$ .

**Check for Reasonableness**  $\frac{4}{5} \approx 1$  ✓

**Got it?** Do these problems to find out.

a.  $6 \times \frac{2}{3}$

b.  $9 \times \frac{1}{3}$

c.  $4 \times \frac{1}{8}$

Show your work.

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

## Multiply a Fraction by a Whole Number

When multiplying whole numbers and fractions, the order of the factors does not change the product. So,  $4 \times \frac{3}{5} = \frac{3}{5} \times 4$ . This is an example of the Commutative Property.

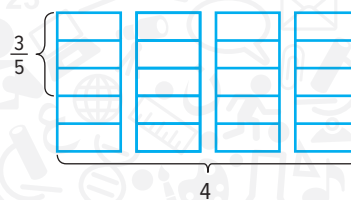
### Examples

2. Find  $\frac{3}{5} \times 4$ .

**Method 1** Use an area model.

Shade  $\frac{3}{5}$  of each of the 4 columns.

A total of  $\frac{12}{5}$  or  $2\frac{2}{5}$  has been shaded.



**Method 2** Use an equation. **Estimate**  $\frac{1}{2} \times 4 = 2$

$$\frac{3}{5} \times 4 = \blacksquare$$

$$\frac{3}{5} \times 4 = \frac{3}{5} \times \frac{4}{1} \quad \text{Write 4 as } \frac{4}{1}.$$

$$= \frac{3 \times 4}{5 \times 1} \quad \text{Multiply.}$$

$$= \frac{12}{5} \quad \text{Simplify. Compare to the estimate.}$$

$$= 2\frac{2}{5}$$

Using either method,  $\frac{3}{5} \times 4$  is  $2\frac{2}{5}$ .

3. Find  $\frac{1}{4} \times 5$ .

**Estimate**  $\frac{1}{4} \times 4 = 1$

$$\frac{1}{4} \times 5 = \frac{1}{4} \times \frac{5}{1} \quad \text{Write 5 as } \frac{5}{1}.$$

$$= \frac{1 \times 5}{4 \times 1} \quad \text{Multiply.}$$

$$= \frac{5}{4} \text{ or } 1\frac{1}{4} \quad \text{Simplify.}$$

**Check for Reasonableness**  $1\frac{1}{4} \approx 1$  ✓

**Got it?** Do these problems to find out.

d.  $\frac{1}{2} \times 3$

e.  $\frac{2}{5} \times 4$

f.  $\frac{3}{4} \times 5$

### Renaming

To rename an improper fraction as a mixed number, divide the numerator by the denominator. Write the remainder as a fraction with the divisor as the denominator.

Show your work.

d. \_\_\_\_\_

e. \_\_\_\_\_

f. \_\_\_\_\_



## Example

4. A sloth spends  $\frac{4}{5}$  of its life asleep. If a sloth lives to be 28 years old, how many years does it spend asleep?

Find  $\frac{4}{5}$  of 28.

**Estimate**  $\frac{4}{5}$  of 30 is 24.

$$\begin{aligned} \frac{4}{5} \times 28 &= \frac{4}{5} \times \frac{28}{1} \\ &= \frac{4 \times 28}{5 \times 1} \end{aligned}$$

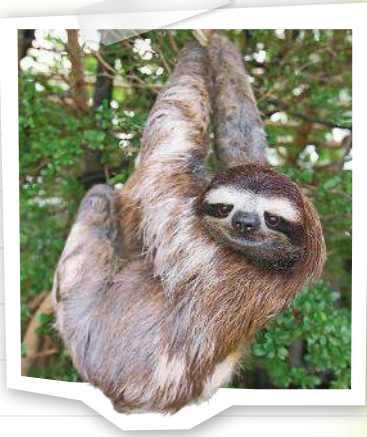
Write 28 as  $\frac{28}{1}$ .

**Multiply.**

$$= \frac{112}{5} \text{ or } 22\frac{2}{5}$$

**Simplify.** Compare to the estimate.

A sloth spends  $22\frac{2}{5}$  years of its life asleep.



## Guided Practice



Multiply. Write in simplest form. (Examples 1–3)

1.  $10 \times \frac{4}{5} =$  \_\_\_\_\_


2.  $2 \times \frac{3}{4} =$  \_\_\_\_\_

Show your work.

3.  $\frac{3}{8} \times 11 =$  \_\_\_\_\_

4.  $\frac{3}{7} \times 9 =$  \_\_\_\_\_

5. A cat spends  $\frac{2}{3}$  of its life asleep. If a cat lives to be 15 years old, how many years did it spend asleep? (Example 4) \_\_\_\_\_

6.  **Building on the Essential Question** How is the process used to multiply a fraction and a whole number similar to the process used to multiply two whole numbers?

---



---



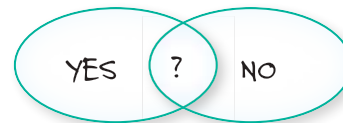
---



---

### Rate Yourself!

Are you ready to move on?  
Shade the section that applies.



**FOLDABLES** Time to update your Foldable!

# Independent Practice

Multiply. Write in simplest form. (Examples 1–3)

1.  $20 \times \frac{3}{4} =$  \_\_\_\_\_

2.  $14 \times \frac{2}{7} =$  \_\_\_\_\_

3.  $10 \times \frac{1}{5} =$  \_\_\_\_\_

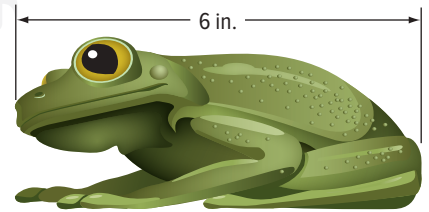
Show your work.

4.  $\frac{3}{4} \times 6 =$  \_\_\_\_\_

5.  $\frac{2}{5} \times 11 =$  \_\_\_\_\_

6.  $\frac{1}{4} \times 6 =$  \_\_\_\_\_

7. **STEM** The male Cuban tree frog is about  $\frac{2}{5}$  the size of the female Cuban tree frog. The average size of the female Cuban tree frog is shown at the right. What is the size of the male Cuban tree frog? (Example 4) \_\_\_\_\_



8. The Mississippi River is the second longest river in the United States, second only to the Missouri River. The Mississippi River is about  $\frac{23}{25}$  the length of the Missouri River. If the Missouri River is 2,540 miles long, how long is the Mississippi River? (Example 4)
- \_\_\_\_\_
- \_\_\_\_\_

9. One evening,  $\frac{2}{3}$  of Mrs. Aisha's students watched a reality television show. Of Mrs. Khadija's students,  $\frac{4}{5}$  watched the same reality show. Which teacher had more students that watched the reality show? Explain.
- \_\_\_\_\_
- \_\_\_\_\_

Teacher	Number of Students
Mrs. Aisha	36
Mrs. Khadija	30
Mr. Saleh	28

10. **MP Persevere with Problems** The table shows where sixth grade students at Al Rawad School attended fifth grade. There are 156 sixth grade students. How many more students attended Al Rawad School than Al Safwa Elementary?
- \_\_\_\_\_

School	Fraction of Students
Al Rawad School	$\frac{1}{2}$
Al Safwa Elementary	$\frac{1}{4}$
Al Tala'eh Elementary	$\frac{1}{6}$
New Students	$\frac{1}{12}$

11. **MP Persevere with Problems** Students at Al Nasr Middle School were recently surveyed. The results reported  $\frac{1}{4}$  of sixth grade students,  $\frac{3}{10}$  of seventh grade students, and  $\frac{2}{7}$  of eighth grade students plan a career in STEM. In which grade do the most students plan to have careers in STEM?


Grade	Total Students
6	152
7	160
8	147

12. **MP Persevere with Problems** Refer to the table in Exercise 11. Suppose in the sixth grade,  $\frac{3}{4}$  of the students want a career in either teaching or STEM. How many sixth grade students did not choose a career in teaching or STEM?

### H.O.T. Problems Higher Order Thinking

13. **MP Identify Structure** Write a real-world problem involving the multiplication of a fraction and a whole number with a product that is between 8 and 10. Then solve the problem.

14. **MP Find the Error** Nader is finding  $\frac{3}{4}$  of 8. Find his mistake and correct it.



$$\frac{3}{4} \times 8 = \frac{24}{32}$$

15. **MP Persevere with Problems** Use the digits 2, 3, and 5 to create a fraction and a whole number with a product greater than 2.

16. **MP Reason Inductively** Fatima made five loaves of banana bread that had  $\frac{1}{4}$  cup of oil in each loaf. After she was done baking, she had  $\frac{5}{8}$  cup of oil remaining. How much oil did she have before baking?



# Extra Practice

Multiply. Write in simplest form.

17.  $12 \times \frac{1}{3} = 4$  \_\_\_\_\_

Homework Help →

$$\frac{\cancel{12}^4}{1} \times \frac{1}{\cancel{3}_1} = \frac{4}{1} \text{ or } 4$$

18.  $18 \times \frac{1}{3} = 6$  \_\_\_\_\_

$$\frac{\cancel{18}^6}{1} \times \frac{1}{\cancel{3}_1} = \frac{6}{1} \text{ or } 6$$

19.  $8 \times \frac{1}{4} =$  \_\_\_\_\_

20.  $\frac{1}{5} \times 7 =$  \_\_\_\_\_

21.  $\frac{3}{7} \times 8 =$  \_\_\_\_\_

22.  $\frac{5}{6} \times 15 =$  \_\_\_\_\_

23. For a singing contest in which 42,000 votes were cast, the winner received  $\frac{3}{5}$  of the votes. How many votes did the winner *not* receive?
- \_\_\_\_\_

24. **STEM** In a recent year, the weather was partly cloudy  $\frac{2}{5}$  of the days. Assuming there are 365 days in a year, how many days were partly cloudy?
- \_\_\_\_\_

25. **MP Model with Mathematics** Write a real-world problem that involves multiplying a fraction and a whole number. Solve the problem and use estimation to check for reasonableness.
- \_\_\_\_\_
- \_\_\_\_\_

Show your work.

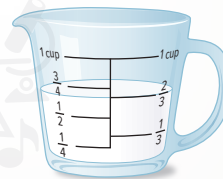
# Power Up! Test Practice

26. Ziad used  $\frac{2}{7}$  of his paycheck to pay his cell phone bill and put  $\frac{1}{3}$  of his paycheck in savings. Based on the amount of money left, which of the following are amounts he could spend on a new video game?

Pay to the order of	1438
Ziad Q.	AED 63.00
Ziad Q.	1438
Time	Net Pay
10 hours	AED 63.00

- AED 20     
  AED 24     
  AED 28     
  AED 34

27. Hassan used the measuring cup shown to measure milk for a batch of muffins. He needs to make 12 batches of muffins for a fund raiser. He bought one gallon of milk. Does he have enough milk for all 12 batches of muffins? Explain your answer. (Hint: one gallon = 16 cups)



## Spiral Review

Multiply.

28.  $22 \times 13 =$  \_\_\_\_\_

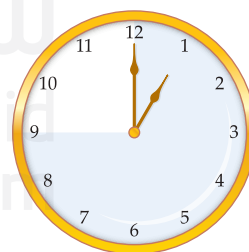
29.  $18 \times 11 =$  \_\_\_\_\_

30.  $17 \times 9 =$  \_\_\_\_\_

31. Huda's guitar lesson lasts  $\frac{3}{4}$  hour. How many minutes does Huda spend at her guitar lesson? Use the clock to help you find your answer.

\_\_\_\_\_

\_\_\_\_\_



32. Fahd has one foot of string. He cuts the string into fourths. How many inches is each piece of string?

\_\_\_\_\_

\_\_\_\_\_

# Multiply Fractions



## Real-World Link

**Reptiles** A chameleon’s body is about  $\frac{1}{2}$  the length of its tongue. A certain chameleon has a tongue that is  $\frac{2}{3}$  foot long.

Use an area model to show  $\frac{1}{2}$  of  $\frac{2}{3}$  or  $\frac{1}{2} \times \frac{2}{3}$ .

1. Divide the rectangle into 2 rows. Then divide it into 3 columns.
2. Shade a rectangle that is  $\frac{1}{2}$  unit wide by  $\frac{2}{3}$  unit long.



3. Refer to the model. The section that was shaded represents  $\frac{1}{2} \times \frac{2}{3}$ . What fraction represents  $\frac{1}{2} \times \frac{2}{3}$ ? \_\_\_\_\_

4. What is the relationship between the numerators and denominators of the factors and the numerator and denominator of the product?

\_\_\_\_\_

\_\_\_\_\_

Which **MP** Mathematical Practices did you use?

Shade the circle(s) that applies.

- |  |   |
|--|---|
| <input type="checkbox"/> 1 Persevere with Problems | <input type="checkbox"/> 5 Use Math Tools         |
| <input type="checkbox"/> 2 Reason Abstractly       | <input type="checkbox"/> 6 Attend to Precision    |
| <input type="checkbox"/> 3 Construct an Argument   | <input type="checkbox"/> 7 Make Use of Structure  |
| <input type="checkbox"/> 4 Model with Mathematics  | <input type="checkbox"/> 8 Use Repeated Reasoning |



### Essential Question

WHAT does it mean to multiply and divide fractions?

**MP** Mathematical Practices  
1, 3, 4, 5, 7

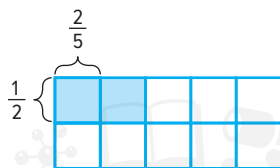
## Key Concept

# Multiply Fractions

### Work Zone

**Words** Multiply the numerators and multiply the denominators.

**Models**



**Numbers**  $\frac{2}{5} \times \frac{1}{2} = \frac{2 \times 1}{5 \times 2}$

**Symbols**  $\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}$ , where  $b$  and  $d$  are not 0.

## Example

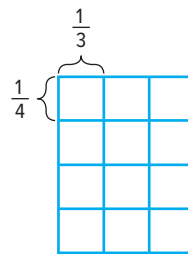
1. Find  $\frac{1}{3} \times \frac{1}{4}$ . Write in simplest form.

**Method 1** Use a model.

Divide the rectangle into 4 rows. Then divide the rectangle into 3 columns.

Shade a section that is  $\frac{1}{4}$  unit wide by  $\frac{1}{3}$  unit long.

The section that is shaded represents  $\frac{1}{4} \times \frac{1}{3}$ , or  $\frac{1}{12}$ .



**Method 2** Use an equation.

$$\frac{1}{3} \times \frac{1}{4} = \blacksquare$$

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

Multiply the numerators.  
Multiply the denominators.

$$= \frac{1}{12}$$

Simplify.

So,  $\frac{1}{3} \times \frac{1}{4}$  is  $\frac{1}{12}$ .

Show your work.

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

**Got it?** Do these problems to find out.

a.  $\frac{1}{2} \times \frac{3}{5}$

b.  $\frac{1}{3} \times \frac{3}{4}$

c.  $\frac{2}{3} \times \frac{5}{6}$

## Simplify Before Multiplying

If the numerators and the denominators have a common factor you can simplify *before* you multiply. Remember that factors are two or more numbers that are multiplied together to form a product.

$$\frac{\overset{1}{\cancel{2}}}{3} \times \frac{5}{\underset{3}{\cancel{6}}} = \frac{1}{3} \times \frac{5}{3} \quad \begin{array}{l} \text{Think: } 2 \div 2 = 1 \\ \text{Think: } 6 \div 2 = 3 \end{array}$$

$$= \frac{5}{9}$$

### Examples

2. Find  $\frac{3}{4} \times \frac{5}{6}$ .

Estimate  $\frac{1}{2} \times 1 = \frac{1}{2}$

$$\frac{3}{4} \times \frac{5}{6} = \frac{\overset{1}{\cancel{3}} \times 5}{4 \times \underset{2}{\cancel{6}}}$$

Divide both the numerator and the denominator by 3.

$$= \frac{5}{8}$$

Simplify. Compare to the estimate.

Check for reasonableness  $\frac{1}{2} \approx \frac{5}{8}$  ✓

3. Find  $\frac{4}{9} \times 18$ .

Estimate  $\frac{1}{2} \times 18 = 9$

$$\frac{4}{9} \times 18 = \frac{4}{9} \times \frac{18}{1}$$

Write 18 as a fraction with a denominator of 1.

$$= \frac{4 \times \overset{2}{\cancel{18}}}{\underset{1}{\cancel{9}} \times 1}$$

Divide both the numerator and the denominator by 9.

$$= \frac{\overset{1}{\cancel{4}}}{1} \text{ or } 4$$

Simplify. Compare to the estimate.

Check for reasonableness  $9 \approx 4$  ✓

**Got it?** Do these problems to find out.

d.  $\frac{3}{4} \times \frac{4}{9}$

e.  $\frac{5}{6} \times \frac{9}{10}$

f.  $\frac{3}{5} \times 10$

### Simplifying

When multiplying fractions, it is easier to find the answer if you simplify before multiplying.

Show your work. →

d. \_\_\_\_\_

e. \_\_\_\_\_

f. \_\_\_\_\_



## Example

4. Saleh had  $\frac{1}{2}$  of the lawn left to mow. On Saturday, he mowed  $\frac{2}{3}$  of what was left. What fraction of the entire lawn did Saleh mow on Saturday?

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

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

Divide both the numerator and denominator by 2.

Simplify.

So, Saleh mowed  $\frac{1}{3}$  of the lawn on Saturday.

## Guided Practice



Multiply. Write in simplest form. (Examples 1–3)

1.  $\frac{1}{8} \times \frac{1}{2} =$  \_\_\_\_\_

2.  $\frac{2}{3} \times \frac{4}{5} =$  \_\_\_\_\_

3.  $\frac{4}{5} \times 10 =$  \_\_\_\_\_


Show your work.

4.  $\frac{3}{4} \times 12 =$  \_\_\_\_\_

5.  $\frac{3}{10} \times \frac{5}{6} =$  \_\_\_\_\_

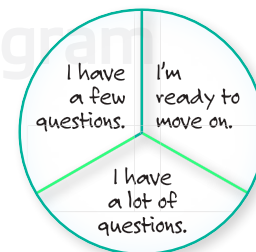
6.  $\frac{3}{5} \times \frac{5}{6} =$  \_\_\_\_\_

7. Rasheed has  $\frac{1}{2}$  of a footlong sub left from yesterday. He ate  $\frac{1}{3}$  of the leftover sandwich as a snack. What fraction of the entire sandwich did he eat as a snack? (Example 4)
- \_\_\_\_\_
- \_\_\_\_\_

8.  **Building on the Essential Question** If two positive fractions are less than 1, why is their product also less than 1?
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

### Rate Yourself!

Are you ready to move on?  
Shade the section that applies.



**FOLDABLES** Time to update your Foldable!

# Independent Practice

**Multiply. Write in simplest form.** (Examples 1–3)

1.  $\frac{1}{3} \times \frac{2}{5} =$  \_\_\_\_\_

2.  $\frac{3}{4} \times \frac{5}{8} =$  \_\_\_\_\_

3.  $\frac{2}{3} \times 4 =$  \_\_\_\_\_

Show your work. →

4.  $\frac{5}{6} \times 15 =$  \_\_\_\_\_

5.  $\frac{2}{3} \times \frac{1}{4} =$  \_\_\_\_\_

6.  $\frac{4}{9} \times \frac{3}{8} =$  \_\_\_\_\_

7. **Financial Literacy** Salwa spent  $\frac{3}{4}$  of her allowance at the mall. Of the money spent at the mall,  $\frac{1}{2}$  was spent on new earphones. What part of her allowance did Salwa spend on earphones? (Example 4)

\_\_\_\_\_

\_\_\_\_\_

8. A paint store has 35 liters of paint in storage,  $\frac{2}{5}$  of which are for outdoor use. The others are for indoor use. If each liter costs AED 22, what is the total cost of the indoor paint in storage?

\_\_\_\_\_

\_\_\_\_\_

9. Homeroom 101 and Homeroom 102 share a hallway bulletin board. If Homeroom 101 uses  $\frac{3}{5}$  of their half to display artwork, what fraction of the bulletin board is used to display Homeroom 101's artwork?

10. **MP Use Math Tools** Mr. Rashid's physical education class lasts  $\frac{7}{8}$  hour.

a. How many minutes are spent warming up and cooling down?

\_\_\_\_\_

\_\_\_\_\_

b. How many minutes are *not* spent on instruction? Explain.

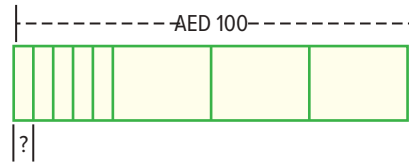
\_\_\_\_\_

\_\_\_\_\_

Part of $\frac{7}{8}$ -hour Class	
playing game	$\frac{1}{2}$
instruction	$\frac{1}{5}$
warm-up and cool-down	$\frac{3}{10}$

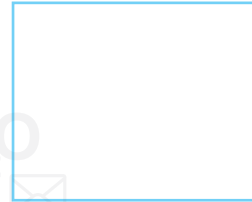
11. **MP Multiple Representations** Use the bar diagram.

a. **Words** Write a real-world problem represented by the bar diagram. \_\_\_\_\_



b. **Models** Draw an area model to represent the situation.

c. **Words** Explain how you would solve your problem.



### **H.O.T. Problems** Higher Order Thinking

12. **MP Reason Inductively** State whether each statement is *true* or *false*. If the statement is *false*, provide a counterexample.

a. The product of two fractions that are each between 0 and 1 is also between 0 and 1. \_\_\_\_\_

b. The product of a mixed number between 4 and 5 and a fraction between 0 and 1 is always less than 4. \_\_\_\_\_

c. The product of two mixed numbers that are each between 4 and 5 is between 16 and 25. \_\_\_\_\_

13. **MP Identify Structure** If the product of two positive fractions  $a$  and  $b$  is  $\frac{15}{56}$ , find three pairs of possible values for  $a$  and  $b$ . \_\_\_\_\_

14. **MP Persevere with Problems** Justify why  $\frac{a}{b} \times \frac{b}{c} \times \frac{c}{d} \times \frac{d}{e}$  is equal to  $\frac{a}{e}$  when  $b$ ,  $c$ ,  $d$ , and  $e$  are not zero. \_\_\_\_\_

15. **MP Model with Mathematics** Write a word problem in which you multiply a fraction by a number greater than 1. Estimate the product, then compare the product to your estimate. \_\_\_\_\_

# Extra Practice

Multiply. Write in simplest form.

16.  $\frac{1}{8} \times \frac{3}{4} = \frac{3}{32}$

Homework Help →

$\frac{1 \times 3}{8 \times 4} = \frac{3}{32}$

17.  $\frac{2}{5} \times \frac{3}{7} = \frac{6}{35}$

$\frac{2 \times 3}{5 \times 7} = \frac{6}{35}$

18.  $\frac{3}{4} \times 2 =$  \_\_\_\_\_

19.  $\frac{3}{8} \times 11 =$  \_\_\_\_\_

20.  $\frac{3}{5} \times \frac{5}{7} =$  \_\_\_\_\_

21.  $\frac{2}{5} \times \frac{5}{6} =$  \_\_\_\_\_

22. The bleachers at a football game are  $\frac{7}{8}$  full, and  $\frac{1}{2}$  of the fans in the bleachers are rooting for the home team. What fraction of the bleachers are filled with home-team fans? Justify your procedure.

\_\_\_\_\_

\_\_\_\_\_

23. The table shows the fraction of the votes that each candidate received. If 230 students voted, how many students voted for each candidate? \_\_\_\_\_

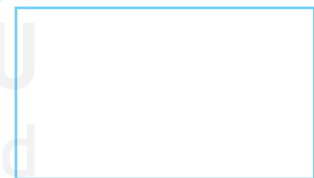
\_\_\_\_\_

\_\_\_\_\_

Candidate	Fraction of Votes
Majed	$\frac{3}{5}$
Fadi	$\frac{3}{10}$
Saleh	$\frac{1}{10}$

24. **MP Model with Mathematics** Ahmed rode  $\frac{5}{8}$  of the water rides at a water park. His sister, Fatima, rode half of the rides that Ahmed rode. What fraction of the water rides did Fatima *not* ride? Support your answer with a model. \_\_\_\_\_

\_\_\_\_\_



25. **MP Justify Conclusions** Laila is making chocolate chip cookies and the recipe calls for  $\frac{3}{4}$  cup of chocolate chips. If she wants to make  $\frac{2}{3}$  of the recipe, what fraction of a cup of chocolate chips will she need? Explain.

\_\_\_\_\_

\_\_\_\_\_



# Power Up! Test Practice

26. The table shows the fraction of votes each candidate received for Student Council president. If 180 students voted, fill in the table to show the number of votes each student received.

Candidate	Fraction of Votes	Number of Votes
Amina	$\frac{1}{5}$	
Lamia	$\frac{3}{10}$	
Maha	$\frac{1}{10}$	
Tahani	$\frac{2}{5}$	

27. Four fifths of Omar's text messages are to his friends. One half of those messages are to his friend Kamal. Omar sends 120 text messages. How many text messages are to Kamal?

## Spiral Review

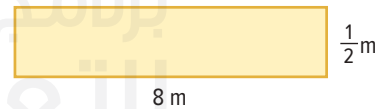
Multiply.

28.  $12 \times 6 \times 9 =$  \_\_\_\_\_

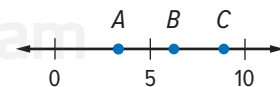
29.  $5 \times 22 \times 3 =$  \_\_\_\_\_

30.  $15 \times 8 \times 11 =$  \_\_\_\_\_

31. Lamya planted a row of flowers in an area with the dimensions shown at the right. What is the area of her flower garden?



32. Without multiplying, determine whether the product of  $5 \times \frac{4}{5}$  is located on the number line at point A, B, or C. Explain your reasoning.

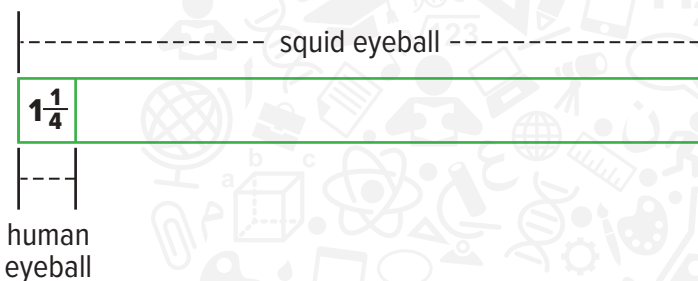


# Multiply Mixed Numbers

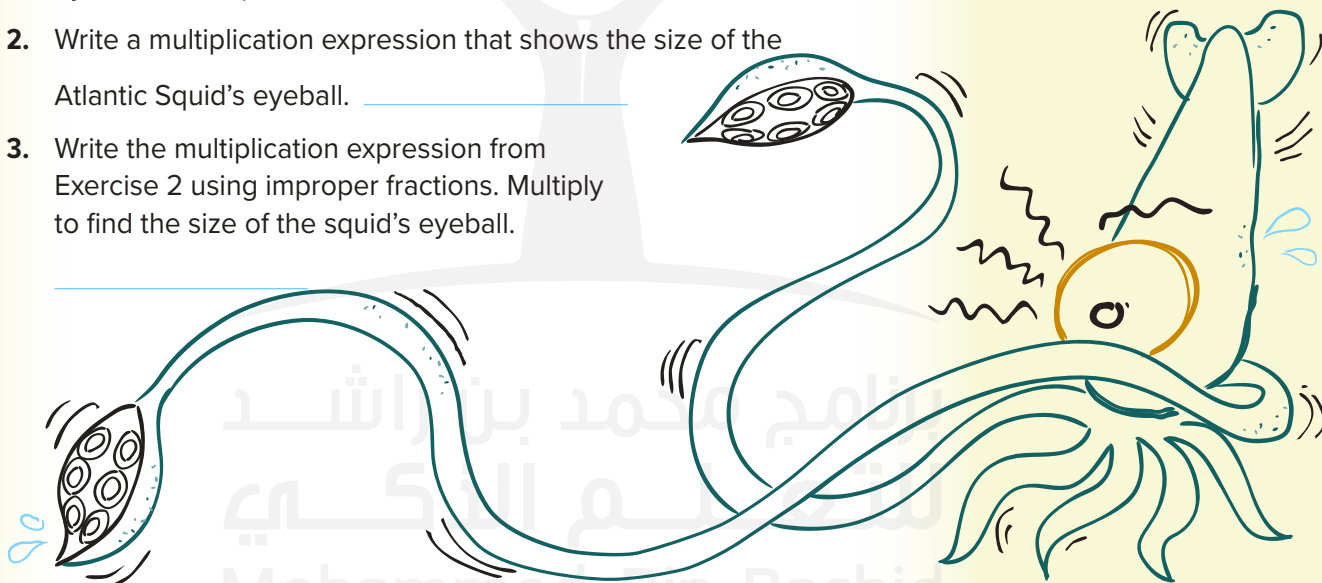


## Real-World Link

**Animals** The eyeball of an Atlantic Giant Squid is about 12 times as large as the average human eyeball. The average human eyeball is  $1\frac{1}{4}$  inches across. Use a bar diagram to compare the average size of a human eyeball to the average size of a Atlantic Giant Squid's eyeball.



- Use the diagram above to compare the average size of the Atlantic Giant Squid's eyeball to the average size of the human eyeball. Use repeated addition.
- Write a multiplication expression that shows the size of the Atlantic Squid's eyeball. \_\_\_\_\_
- Write the multiplication expression from Exercise 2 using improper fractions. Multiply to find the size of the squid's eyeball.  
\_\_\_\_\_



### Essential Question

WHAT does it mean to multiply and divide fractions?



### Mathematical Practices

1, 3, 4, 5

Which **MP** Mathematical Practices did you use?

Shade the circle(s) that applies.

- |  |   |
|--|---|
| <input type="checkbox"/> ① Persevere with Problems | <input type="checkbox"/> ⑤ Use Math Tools         |
| <input type="checkbox"/> ② Reason Abstractly       | <input type="checkbox"/> ⑥ Attend to Precision    |
| <input type="checkbox"/> ③ Construct an Argument   | <input type="checkbox"/> ⑦ Make Use of Structure  |
| <input type="checkbox"/> ④ Model with Mathematics  | <input type="checkbox"/> ⑧ Use Repeated Reasoning |

## Multiply a Fraction and a Mixed Number

To multiply a fraction and a mixed number, first write the mixed number as an improper fraction. Remember that when mixed numbers are written as improper fractions, the denominator does not change. Then multiply as with fractions.

$$2\frac{1}{2} \times \frac{1}{4} = \frac{5}{2} \times \frac{1}{4}$$

$$= \frac{5 \times 1}{2 \times 4}$$

$$= \frac{5}{8}$$

### Examples

1. Find  $\frac{1}{3} \times 1\frac{3}{4}$ . Write in simplest form.

**Estimate** Use compatible numbers.  $\frac{1}{2} \times 2 = 1$

$$\frac{1}{3} \times 1\frac{3}{4} = \frac{1}{3} \times \frac{7}{4}$$

Write  $1\frac{3}{4}$  as  $\frac{7}{4}$ .

$$= \frac{1 \times 7}{3 \times 4}$$

Multiply.

$$= \frac{7}{12}$$

Simplify. Compare to the estimate.

2. Find  $5\frac{1}{2} \times \frac{1}{3}$ . Write in simplest form.

**Estimate**  $\square \times \frac{\square}{\square} = \square$

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

Write  $5\frac{1}{2}$  as an improper fraction.

$$= \frac{\square}{\square} \times \frac{1}{3}$$

Multiply.

$$= \frac{\square}{\square} \times \frac{1}{3}$$

$$= \frac{\square}{\square} \text{ or } 1\frac{\square}{\square}$$

Simplify.

**Check for Reasonableness**  $1\frac{5}{6} \approx 2 \checkmark$

**Got it?** Do these problems to find out.

a.  $\frac{2}{3} \times 2\frac{1}{2}$

b.  $\frac{3}{8} \times 3\frac{1}{3}$



a. \_\_\_\_\_

b. \_\_\_\_\_

## Multiply Mixed Numbers

To multiply two mixed numbers, write each mixed number as an improper fraction. Use the greatest common factor, or GCF, to simplify.

### Examples

3. Find  $1\frac{7}{8} \times 3\frac{1}{3}$ . Write in simplest form.

$$\begin{aligned}
 1\frac{7}{8} \times 3\frac{1}{3} &= \frac{15}{8} \times \frac{10}{3} && \text{Write } 1\frac{7}{8} \text{ as } \frac{15}{8}. \text{ Write } 3\frac{1}{3} \text{ as } \frac{10}{3}. \\
 &= \frac{\overset{5}{\cancel{15}}}{\underset{4}{\cancel{8}}} \times \frac{\overset{5}{\cancel{10}}}{\underset{1}{\cancel{3}}} && \text{Divide 15 and 3 by their GCF, 3.} \\
 & && \text{Then divide 10 and 8 by their GCF, 2.} \\
 &= \frac{25}{4} && \text{Multiply the numerators and multiply the denominators.} \\
 &= 6\frac{1}{4} && \text{Simplify.}
 \end{aligned}$$

4. The Hoover Dam contains  $4\frac{1}{2}$  million cubic yards of concrete. The Grand Coulee Dam, in Washington state, contains  $2\frac{2}{3}$  times as much concrete. How much concrete does it contain?

**Estimate**  $4 \times 3 = 12$

$$\begin{aligned}
 4\frac{1}{2} \times 2\frac{2}{3} &= \frac{9}{2} \times \frac{8}{3} && \text{Write the mixed numbers as improper fractions.} \\
 &= \frac{\overset{3}{\cancel{9}}}{\underset{1}{\cancel{2}}} \times \frac{\overset{4}{\cancel{8}}}{\underset{1}{\cancel{3}}} && \text{Divide 9 and 3 by their GCF, 3.} \\
 & && \text{Then divide 8 and 2 by their GCF, 2.} \\
 &= \frac{3}{1} \times \frac{4}{1} && \text{Multiply the numerators and multiply the denominators.} \\
 &= \frac{12}{1} \text{ or } 12 && \text{Simplify.}
 \end{aligned}$$

There are 12 million cubic yards of concrete in the Grand Coulee Dam.

**Check for Reasonableness**  $12 = 12$  ✓

**Got it?** Do this problem to find out.

- c. Mr. Hamad is laying bricks to make a rectangular patio. The area he is covering with bricks is  $15\frac{1}{2}$  meters by  $9\frac{3}{4}$  meters. What is the area of the patio?

### STOP and Reflect

Is the product of two mixed numbers greater than or less than both the factors? Explain below.

Show your work.

c. \_\_\_\_\_



## Example

5. Mr. Sameh's pecan pie recipe calls for  $1\frac{3}{4}$  cups of pecans. He plans to make 8 pies for his family reunion. How many cups of pecans will Mr. Sameh need?

**Estimate**  $2 \times 8 = 16$

$$1\frac{3}{4} \times 8 = \frac{7}{4} \times \frac{8}{1}$$

Write the mixed number as an improper fraction. Write the whole number as a fraction with a denominator of 1.

$$= \frac{7}{4} \times \frac{8}{1}$$

Divide 8 and 4 by their GCF, 4.

$$= \frac{7}{1} \times \frac{2}{1}$$

Multiply the numerators and multiply the denominators.

$$= \frac{14}{1} \text{ or } 14$$

Simplify.

**Check for Reasonableness**  $14 \approx 16$  ✓

Mr. Sameh will need 14 cups of pecans.



## Guided Practice



Multiply. Write in simplest form. (Examples 1–3)

1.  $\frac{1}{2} \times 2\frac{3}{8} =$  \_\_\_\_\_

2.  $1\frac{3}{4} \times 2\frac{4}{5} =$  \_\_\_\_\_

3.  $1\frac{2}{3} \times 2\frac{4}{7} =$  \_\_\_\_\_

Show your work.

4. Amani is training for a track meet. She ran  $2\frac{1}{4}$  kilometers 5 times this week. How far did Amani run this week?

(Examples 4 and 5) \_\_\_\_\_

### Rate Yourself!

I understand how to multiply mixed numbers.



Great! You're ready to move on!

I still have some questions about multiplying mixed numbers.

**FOLDABLES**

Time to update your Foldable!

5. **Building on the Essential Question** How do you multiply mixed numbers? \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

# Independent Practice

Multiply. Write in simplest form. (Examples 1–3)

1.  $\frac{1}{2} \times 2\frac{1}{3} =$  \_\_\_\_\_

2.  $1\frac{7}{8} \times \frac{4}{5} =$  \_\_\_\_\_

3.  $\frac{7}{8} \times 3\frac{1}{4} =$  \_\_\_\_\_

Show your work.

4.  $1\frac{2}{3} \times 1\frac{1}{4} =$  \_\_\_\_\_

5.  $3\frac{3}{4} \times 2\frac{2}{5} =$  \_\_\_\_\_

6.  $6\frac{2}{3} \times 3\frac{3}{10} =$  \_\_\_\_\_

7. A carp can travel at a speed of  $3\frac{7}{10}$  miles per hour. At this rate, how far can a carp travel in  $2\frac{1}{2}$  hours? (Example 4)

\_\_\_\_\_

\_\_\_\_\_

8. Hind is making fruit salad. She purchased  $9\frac{2}{3}$  ounces each of 6 different fruits. How many ounces of fruit did she purchase? (Example 5)

\_\_\_\_\_

\_\_\_\_\_

9. A waffle recipe calls for  $2\frac{1}{4}$  cups of flour. If Hatem wants to make  $1\frac{1}{2}$  times the recipe, how much flour does he need? (Example 4)

\_\_\_\_\_

\_\_\_\_\_

10. **MP Model with Mathematics** Use the formula  $d = rt$  to find the distance  $d$  a long-distance runner can run at a rate  $r$  of  $9\frac{1}{2}$  kilometers per hour for time  $t$  of  $1\frac{3}{4}$  hours.

\_\_\_\_\_

\_\_\_\_\_

11. **STEM** Earth is about  $92\frac{9}{10}$  million miles from the Sun. Use the table shown.

- a. How far is Venus from the Sun? \_\_\_\_\_
- b. How far is Mars from the Sun? \_\_\_\_\_
- c. How far is Jupiter from the Sun? \_\_\_\_\_
- d. How far is Saturn from the Sun? \_\_\_\_\_

Planet	Approximate Number of Times as Far from the Sun as Earth
Venus	$\frac{3}{4}$
Mars	$1\frac{1}{2}$
Jupiter	$5\frac{1}{4}$
Saturn	$9\frac{1}{2}$

**Multiply. Write in simplest form.**

12.  $\frac{3}{4} \times 2\frac{1}{2} \times \frac{4}{5} =$  \_\_\_\_\_

13.  $\frac{1}{7} \times 5\frac{5}{6} \times 1\frac{1}{4} =$  \_\_\_\_\_

 **H.O.T. Problems** Higher Order Thinking

14. **MP Persevere with Problems** Analyze each product in the table.

First Factor		Second Factor		Product
$\frac{1}{2}$	$\times$	$\frac{3}{4}$	$=$	$\frac{3}{8}$
1	$\times$	$\frac{3}{4}$	$=$	$\frac{3}{4}$
$\frac{3}{2}$	$\times$	$\frac{3}{4}$	$=$	$\frac{9}{8}$

a. Why is the first product less than  $\frac{3}{4}$ ?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

b. Why is the second product equal to  $\frac{3}{4}$ ?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

c. Why is the third product greater than  $\frac{3}{4}$ ?

\_\_\_\_\_

\_\_\_\_\_

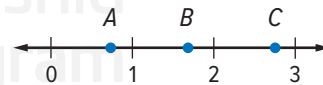
\_\_\_\_\_

d. Based on your observations, make a conjecture about the product when one of the factors is a number less than 1.

\_\_\_\_\_

\_\_\_\_\_

15. **MP Use Math Tools** Without multiplying, determine whether the product of  $2\frac{1}{2} \times \frac{2}{3}$  is located on the number line at point A, B, or C. Explain your reasoning.



\_\_\_\_\_

\_\_\_\_\_

16. **MP Model with Mathematics** Give two examples of mixed numbers that when multiplied by  $\frac{3}{4}$  give a product between  $\frac{3}{4}$  and 1.

\_\_\_\_\_

\_\_\_\_\_

# Extra Practice

Multiply. Write in simplest form.

17.  $\frac{3}{4} \times 2\frac{5}{6} = 2\frac{1}{8}$

Homework Help

$$\begin{aligned} \frac{3}{4} \times 2\frac{5}{6} &= \frac{\cancel{3}^1}{4} \times \frac{17}{\cancel{6}_2} \\ &= \frac{1 \times 17}{4 \times 2} \\ &= \frac{17}{8} \text{ or } 2\frac{1}{8} \end{aligned}$$

18.  $1\frac{4}{5} \times \frac{5}{6} = 1\frac{1}{2}$

$$\begin{aligned} 1\frac{4}{5} \times \frac{5}{6} &= \frac{9}{\cancel{5}_1} \times \frac{\cancel{5}_1}{\cancel{6}_2} \\ &= \frac{3 \times 1}{1 \times 2} \\ &= \frac{3}{2} \text{ or } 1\frac{1}{2} \end{aligned}$$

19.  $\frac{3}{10} \times 2\frac{5}{6} =$  \_\_\_\_\_

20.  $3\frac{1}{5} \times 3\frac{1}{6} =$  \_\_\_\_\_

21.  $4\frac{1}{2} \times 2\frac{5}{6} =$  \_\_\_\_\_

22.  $3\frac{3}{5} \times 5\frac{5}{12} =$  \_\_\_\_\_

23. **MP Model with Mathematics** A reproduction of Claude Monet's *Water-Lilies* has dimensions  $34\frac{1}{2}$  inches by  $36\frac{1}{2}$  inches. Find the area of the painting.

\_\_\_\_\_

\_\_\_\_\_

24. A photograph is  $5\frac{1}{3}$  centimeters wide. It is being enlarged to 3 times its original size. What is the width of the enlarged photograph?

\_\_\_\_\_

\_\_\_\_\_



25. Fairuz is making bracelets with leather bands. Each bracelet uses  $7\frac{3}{4}$  centimeters of leather banding. She plans to make 4 bracelets. How many centimeters of leather banding will she need?

\_\_\_\_\_

\_\_\_\_\_

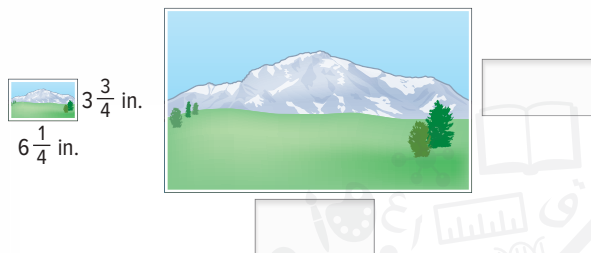
26. **MP Use Math Tools** Find examples of mixed numbers in a newspaper or magazine, on television, or on the Internet. Write a real-world problem in which you would multiply mixed numbers.

\_\_\_\_\_

\_\_\_\_\_

# Power Up! Test Practice

27. The picture below is enlarged to  $4\frac{1}{2}$  times its original size. Fill in the boxes with the deminsions of the enlargement.



28. Najla is interested in the following classes. She wants to know the total time for each class before she decides to sign up. Complete the table to show the total time for each class.

Class	Days Offered	Time (h)	Duration	Total Time (h)
Cooking	M W F	$\frac{3}{4}$	3 weeks	
Aerobics	T R	$\frac{1}{2}$	10 weeks	
Pottery	M W	$2\frac{1}{4}$	8 weeks	
Sewing	T R F	1	6 weeks	
Wood Carving	W F	$1\frac{3}{4}$	5 weeks	

Najla decides on wood carving and wants to take another class. She plans to attend no more than 5 hours of class per week. Which additional class could she choose? Explain.

## Spiral Review

Find each equivalent measurement.

29. 1 meter = \_\_\_\_\_ cm

30. 1 liter = \_\_\_\_\_ mL

31. 1 kg = \_\_\_\_\_ g

# Convert Measurement Units



## Real-World Link

**Animals** The table shows the approximate weights in tons of several large land animals. One ton is equivalent to 2,000 pounds. You can use a ratio table to convert each weight from tons to pounds.

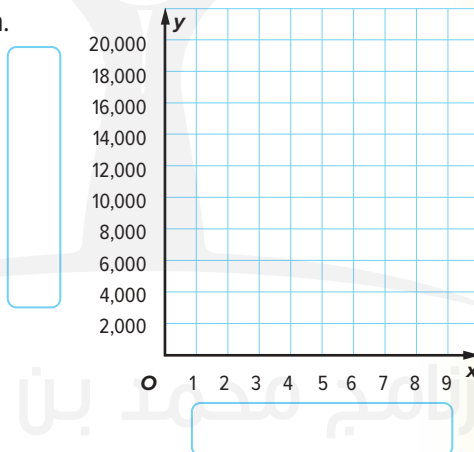
Animal	Weight (T)
Grizzly bear	1
White rhinoceros	4
Hippopotamus	5
African elephant	8

- Complete the ratio table. The first two ratios are done for you. To produce equivalent ratios, multiply the quantities in each row by the same number.

Tons	1	4	5	8
Pounds	2,000	8,000		

- Use the coordinate plane shown.

- Graph the ordered pairs (tons, pounds) from the table on the coordinate plane.
- Label the horizontal axis *Weight in Tons*.
- Label the vertical axis *Weight in Pounds*.
- Connect the points and describe the graph.



### Essential Question

WHAT does it mean to multiply and divide fractions?

Vocab



### Vocabulary

unit ratio  
dimensional analysis

### MP Mathematical Practices

1, 3, 4, 6

Which **MP** **Mathematical Practices** did you use?

Shade the circle(s) that applies.

- |  |   |
|--|---|
| <input type="checkbox"/> 1 Persevere with Problems | <input type="checkbox"/> 5 Use Math Tools         |
| <input type="checkbox"/> 2 Reason Abstractly       | <input type="checkbox"/> 6 Attend to Precision    |
| <input type="checkbox"/> 3 Construct an Argument   | <input type="checkbox"/> 7 Make Use of Structure  |
| <input type="checkbox"/> 4 Model with Mathematics  | <input type="checkbox"/> 8 Use Repeated Reasoning |



## Convert Larger Units to Smaller Units

Each relationship in the table can be written as a ratio. For example, you know that 1 yard = 3 feet. You can use the ratio  $\frac{3 \text{ ft}}{1 \text{ yd}}$  to convert from yards to feet.

Customary Conversions			
Type of Measure	Larger Unit	→	Smaller Unit
Length	1 foot (ft)	=	12 inches (in.)
	1 yard (yd)	=	3 feet
	1 mile (mi)	=	5,280 feet
Weight	1 pound (lb)	=	16 ounces (oz)
	1 ton (T)	=	2,000 pounds
Capacity	1 cup (c)	=	8 fluid ounces (fl oz)
	1 pint (pt)	=	2 cups
	1 quart (qt)	=	2 pints
	1 gallon (gal)	=	4 quarts

Like a unit rate, a **unit ratio** is one in which the denominator is 1 unit. So, the ratio  $\frac{3 \text{ ft}}{1 \text{ yd}}$  is a unit ratio.

**Dimensional analysis** is the process of including units of measurement as factors when you compute.

### Multiplying by 1

The ratio  $\frac{3 \text{ ft}}{1 \text{ yd}}$  is equivalent to 1 because the numerator and the denominator represent the same amount.

Show your work.

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

### Example

#### 1. Convert 20 feet to inches.

Since 1 foot = 12 inches, the unit ratio is  $\frac{12 \text{ in.}}{1 \text{ ft}}$ .

$$\begin{aligned}
 20 \text{ ft} &= 20 \text{ ft} \times \frac{12 \text{ in.}}{1 \text{ ft}} && \text{Multiply by } \frac{12 \text{ in.}}{1 \text{ ft}}. \\
 &= 20 \cancel{\text{ ft}} \times \frac{12 \text{ in.}}{1 \cancel{\text{ ft}}} && \text{Divide out common units, leaving the desired unit, inches.} \\
 &= 20 \times 12 \text{ in.} && \text{Multiply.} \\
 &= 240 \text{ in.}
 \end{aligned}$$

So, 20 feet = 240 inches.

**Got it?** Do these problems to find out.

Complete.

- a. 36 yd = ■ ft      b.  $\frac{3}{4}$  T = ■ lb      c.  $1\frac{1}{2}$  qt = ■ pt



## Example

2. Mahmoud mixes  $\frac{1}{4}$  cup of fertilizer with soil before planting each bulb. How many fluid ounces of fertilizer does he use per bulb?

$$\begin{aligned}\frac{1}{4} \text{ c} &= \frac{1}{4} \cancel{\text{c}} \times \frac{8 \text{ fl oz}}{1 \cancel{\text{c}}} \\ &= \frac{1}{4} \times 8 \text{ fl oz} \\ &= 2 \text{ fl oz}\end{aligned}$$

Since 1 cup = 8 fluid ounces, multiply by  $\frac{8 \text{ fl oz}}{1 \text{ c}}$ .  
Then, divide out common units.

Multiply.

So, 2 fluid ounces of fertilizer are used per bulb.

**Got it?** Do this problem to find out.

- d. Rashid runs  $\frac{1}{8}$  of a mile before tennis practice. How many feet does he run before practice?

Show your work.

d. \_\_\_\_\_

## Convert Smaller Units to Larger Units

Remember that the ratios  $\frac{1 \text{ yd}}{3 \text{ ft}}$  and  $\frac{3 \text{ ft}}{1 \text{ yd}}$  are equivalent. To convert from smaller units to larger units, choose the ratio that allows you to divide out the common units.

**Example:**  $12 \text{ ft} \times \frac{1 \text{ yd}}{3 \text{ ft}}$  ✓

~~$12 \text{ ft} \times \frac{3 \text{ ft}}{1 \text{ yd}}$~~

## Example

3. Convert 15 quarts to gallons.

Since 1 gallon = 4 quarts, and quarts are smaller units than gallons, use the ratio  $\frac{1 \text{ gal}}{4 \text{ qt}}$ .

$$15 \text{ qt} = 15 \text{ qt} \times \frac{1 \text{ gal}}{4 \text{ qt}}$$

Multiply by  $\frac{1 \text{ gal}}{4 \text{ qt}}$ .

$$= 15 \cancel{\text{qt}} \times \frac{1 \text{ gal}}{4 \cancel{\text{qt}}}$$

Divide out common units, leaving the desired unit, gallons.

$$= 15 \times \frac{1}{4} \text{ gal}$$

Multiplying 15 by  $\frac{1}{4}$  is the same as dividing 15 by 4.

$$= 3.75 \text{ gal}$$

e. \_\_\_\_\_

f. \_\_\_\_\_

g. \_\_\_\_\_

**Got it?** Do these problems to find out.

e. 2,640 ft = ■ mi

f. 100 oz = ■ lb

g. 3 c = ■ pt



# Independent Practice

**Complete.** (Examples 1 and 3)

1. 18 ft = \_\_\_\_\_ yd

2. 2 lb = \_\_\_\_\_ oz

3. 6.5 c = \_\_\_\_\_ fl oz

Show your work.

4. 2 mi = \_\_\_\_\_ ft

5. 5,000 lb = \_\_\_\_\_ T

6.  $2\frac{3}{4}$  qt = \_\_\_\_\_ pt

7. One of the largest pumpkins ever grown weighed about  $\frac{3}{4}$  ton. How many pounds did the pumpkin weigh? (Example 2)

\_\_\_\_\_

\_\_\_\_\_

8. A 40-foot power boat is for sale by owner. How long is the boat to the nearest yard? (Example 4)

\_\_\_\_\_

Show your work.

9. A 3-pound veal loin roast can be cut into 10 veal chops of equal weight. How many ounces is each veal chop?

\_\_\_\_\_

\_\_\_\_\_

10. **MP Model with Mathematics** Will a 2-quart pitcher hold the entire recipe of citrus punch given at the right? Explain your reasoning.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Citrus Punch Drink	
2 cups	orange juice
2 cups	grapefruit juice
$\frac{1}{4}$ cup	apricot nectar
$\frac{1}{3}$ cup	pineapple juice
4 cups	ginger ale

11. **MP Multiple Representations** Use the graph at the right.

a. **Numbers** What does an ordered pair from this graph

represent? \_\_\_\_\_

\_\_\_\_\_

b. **Measurement** Use the graph to find the capacity in quarts of a 2.5-gallon container. Explain your reasoning.

\_\_\_\_\_

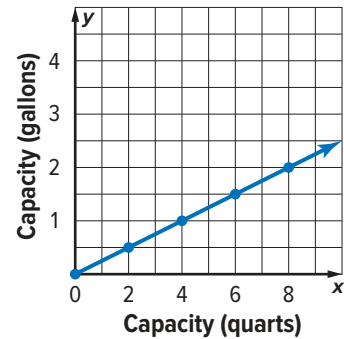
\_\_\_\_\_

c. **Unit Rate** What is the unit rate that converts gallons to quarts?

\_\_\_\_\_

d. **Expressions** Write an expression you could use to convert 2.5 gallons to quarts.

\_\_\_\_\_



**H.O.T. Problems** Higher Order Thinking

12. **MP Model with Mathematics** Write a real-world problem in which you would need to convert pints to cups. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**MP Persevere with Problems** Fill in each  with  $<$ ,  $>$ , or  $=$  to make a true sentence. Justify your answers.

13. 16 in.   $1\frac{1}{2}$  ft

\_\_\_\_\_

\_\_\_\_\_

14.  $8\frac{3}{4}$  gal  32 qt

\_\_\_\_\_

\_\_\_\_\_

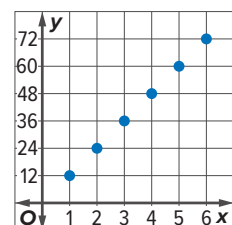
15. **MP Persevere with Problems** Give two different measurements that are equivalent to  $2\frac{1}{2}$  quarts. \_\_\_\_\_

\_\_\_\_\_

16. **MP Model with Mathematics** Write a real-world problem that can be represented by the graph. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



# Extra Practice

Complete.

17.  $72 \text{ oz} = 4\frac{1}{2} \text{ lb}$

Homework Help

$$72 \text{ oz} = 72 \text{ oz} \times \frac{1 \text{ lb}}{16 \text{ oz}}$$

$$= \frac{72}{1} \times \frac{1}{16} \text{ lb}$$

$$= \frac{9}{2} \text{ or } 4\frac{1}{2}$$

18.  $4 \text{ gal} = 16 \text{ qt}$

$$4 \text{ gal} = 4 \text{ gal} \times \frac{4 \text{ qt}}{1 \text{ gal}}$$

$$= \frac{4}{1} \times \frac{4}{1} \text{ qt}$$

$$= \frac{16}{1} \text{ or } 16 \text{ qt}$$

19.  $3 \text{ c} = \text{_____ fl oz}$

20.  $1\frac{1}{4} \text{ mi} = \text{_____ ft}$

21.  $13 \text{ c} = \text{_____ pt}$

22.  $3\frac{3}{8} \text{ T} = \text{_____ lb}$

23. Speed skiing takes place on a course that is  $\frac{2}{3}$  mile long. How many feet long is the course?

\_\_\_\_\_

Show your work.

24. A total of 35 pints of blood were collected at a local blood drive. How many quarts of blood were collected?

\_\_\_\_\_

25. **STEM** On Monday, it snowed a total of 15 inches. On Tuesday and Wednesday, it snowed an additional  $4\frac{1}{2}$  inches and  $6\frac{3}{4}$  inches, respectively. A weather forecaster says that over the last three days, it snowed over  $2\frac{1}{2}$  feet. Is this a valid claim? Justify your answer.

\_\_\_\_\_

\_\_\_\_\_

**MP Be Precise** Complete the following statements.

26. If  $16 \text{ c} = 1 \text{ gal}$ , then  $1\frac{1}{4} \text{ gal} = \text{_____ c}$ .

27. If  $1,760 \text{ yd} = 1 \text{ mi}$ , then  $880 \text{ yd} = \text{_____ mi}$ .

28. If  $36 \text{ in.} = 1 \text{ yd}$ , then  $2\frac{1}{3} \text{ yd} = \text{_____ in.}$

# Power Up! Test Practice

29. The heights of 5 siblings are shown in the table. Determine if each statement is true or false .

- a. Amna is shorter than Hala.  True  False
- b. Ayman is taller than Faris.  True  False
- c. Hala is shorter than Faris.  True  False
- d. Amina is taller than Safiya.  True  False

Sibling	Height
Safiya	65 in.
Faris	$5\frac{2}{3}$ ft
Hala	$1\frac{2}{3}$ yd
Amina	$5\frac{1}{6}$ ft
Ayman	$66\frac{1}{2}$ in.

30. Sort the measurements from least to greatest.

	Measurement
Least	
Greatest	

48 fl oz	$10\frac{3}{4}$ c
$\frac{1}{2}$ gal	$2\frac{1}{4}$ qt
$3\frac{1}{2}$ pt	

## Spiral Review

Divide.

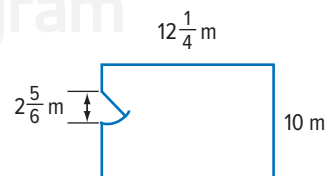
31.  $156 \div 4 =$  \_\_\_\_\_

32.  $212 \div 8 =$  \_\_\_\_\_

33.  $90 \div 12 =$  \_\_\_\_\_

34. Mahmoud baked 78 cookies for a bake sale. He set aside 12 cookies to share with volunteers. The remaining cookies are bagged with 3 cookies in each bag. How many bags does Mahmoud need? \_\_\_\_\_

35. Refer to the diagram of a living room. The doorway will not have a baseboard. How many meters of baseboard are needed to go around the room? \_\_\_\_\_



# MP Problem-Solving Investigation Draw a Diagram

MP Mathematical Practices  
1, 3, 4

## Case #1 Traction Action

Faisal and his friends celebrated his graduation at the FunTimes game center. He spent  $\frac{4}{7}$  of his money at the fun center on go-karts and now he has AED 15 left.

How much money did he spend on go-karts?



1

### Understand *What are the facts?*

You know that Faisal spent  $\frac{4}{7}$  of his money on go-karts. You need to determine how much money he spent on go-karts.

2

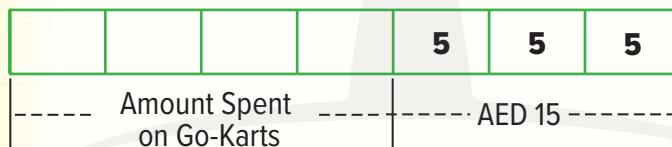
### Plan *What is your strategy to solve this problem?*

He spent a fraction of his money. Draw a bar diagram.

3

### Solve *How can you apply the strategy?*

Complete the bar diagram using information from the problem. Fill in the missing numbers to show the value of each section.



AED  ÷  = AED

So, each section represents AED .

Faisal spent  $4 \times$  AED  or AED  on go-karts.

4

### Check *Does the answer make sense?*

Four sevenths of AED 35 is  $4 \times$   or AED . ✓

## Analyze the Strategy

MP **Justify Conclusions** Suppose Faisal had AED 9 left. How much money did he start with? Explain.

---



---



---

## Case #2 Text Tally

Rashid has  $\frac{3}{5}$  as many saved text messages as Fatima.

Rashid has 24 saved text messages.

How many saved text messages do they have in all?



1

### Understand

Read the problem. What are you being asked to find?

I need to find \_\_\_\_\_.

Underline key words and values in the problem. What information do you know?

Rashid has  as many saved texts as Fatima.

Rashid has  saved texts.

2

### Plan

Choose a problem-solving strategy.

I will use the \_\_\_\_\_ strategy.

3

### Solve

Solve the problem using your problem-solving strategy.

- Divide the tape diagram for Rashid into 3 equal sections and the diagram for Fatima into 5 equal sections.
- Rashid has 24 messages. Fill in the boxes.

Rashid

Fatima

Fatima has   $\times$   =  saved texts.

So, Rashid and Fatima have  + , or  saved texts in all.

4

### Check

Use information from the problem to check your answer.

$$\frac{3}{5} \times \text{} = \underline{\hspace{2cm}}$$



Work with a small group to solve the following cases.  
Show your work on a separate piece of paper.

### Case #3 Internet

Suad spent 25 minutes on the Internet yesterday.

If this is  $\frac{5}{6}$  of the time she spent on the computer, how long did she spend on the computer, but not on the Internet?

### Case #4 Basketball

Marwa practiced shooting a basketball for  $\frac{7}{10}$  of her total practice time. During the other time, she practiced dribbling.

If she practiced dribbling for 18 minutes, how many minutes did she practice shooting?

### Case #5 Biking

Two bike riders, 175 km apart, begin traveling toward each other at noon. One travels at 20 km per hour, the other at 15 km per hour. Also at noon, a fly begins flying between the riders, starting at the front of the slower bike. The fly travels at 20 km per hour and can change direction without losing any time.

How far will the fly travel before the bicycles meet?

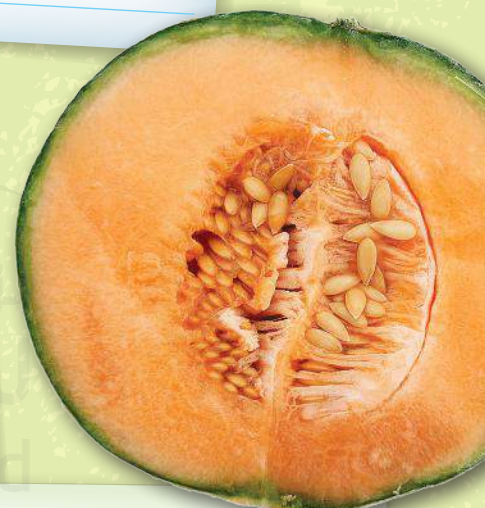
Circle a strategy below to solve the problem.  
• PSL\_Handwriting\_Strategy\_TX

### Case #6 Fruit

Use the table that shows the prices of different amounts of mixed fruit at the grocery store.

How much will 13 kilograms of fruit cost?

Kg	Cost (AED)
2	4.50
4	9.00
6	13.50
8	18.00



# Mid-Chapter Check

## Vocabulary Check



1. **MP Be Precise** Define *Commutative Property*. Provide an example of an operation that is commutative. Provide an example of an operation which is not commutative. (Lesson 2)

---

---

---

## Skills Check and Problem Solving

Multiply. Write in simplest form. (Lessons 1–4)

2.  $8 \times \frac{2}{5} =$  \_\_\_\_\_

3.  $\frac{7}{8} \times \frac{2}{3} =$  \_\_\_\_\_

4.  $4\frac{3}{4} \times 2\frac{1}{8} =$  \_\_\_\_\_

Show your work →

5. A new shirt costs AED 14.99. If the shirt is on sale for  $\frac{1}{5}$  off its price, about how much would you save? (Lesson 1) \_\_\_\_\_

6. **MP Justify Conclusions** Omar needs 24 boards that are  $47\frac{1}{2}$  inches long. (Lesson 5)

a. How many feet of boards should he buy? Explain. \_\_\_\_\_

b. If you can only buy 8-foot boards, how many should he buy? Explain.

---

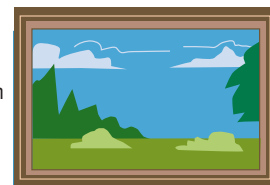
---

---

7. **MP Persevere with Problems** What is the area of the picture and frame shown? Write your answer as a mixed number in simplest form.

(Lesson 4) \_\_\_\_\_

$7\frac{1}{4}$  cm



$11\frac{2}{3}$  cm.

# Inquiry Lab 1

## Divide Whole Numbers by Fractions



**HOW** can a bar diagram help you understand what it means to divide fractions?

**MP** Mathematical Practices  
1, 3, 4

Samy is building a set for the school musical. He has a 3-meter board that he needs to equally divide into  $\frac{1}{2}$ -meter pieces. How many pieces will he have after he cuts the board?

What do you know?

---



---



---

What do you need to find?

---

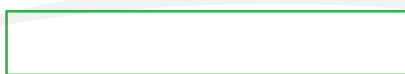


---

### Hands-On Activity 1

#### Step 1

Draw a model that represents the length of the board. Draw lines to separate the board into thirds. Each third represents one foot.



#### Step 2

Divide each foot into halves.

#### Step 3

Determine how many groups of  $\frac{1}{2}$  are in 3. Circle the groups that are the size of the divisor  $\frac{1}{2}$ .

There are  groups of  $\frac{\square}{\square}$ . So,  $3 \div \frac{1}{2} = \square$ .

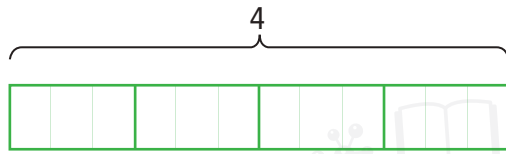
Check by multiplying:  $\square \times \frac{\square}{\square} = \square$  ✓



## Hands-On Activity 2

Find  $4 \div \frac{2}{3}$ .

**Step 1** The model represents 4.



**Step 2** Divide each whole into thirds.

**Step 3** Circle groups of  $\frac{2}{3}$  on the model. *Think: How many groups of  $\frac{2}{3}$  are in 4?*

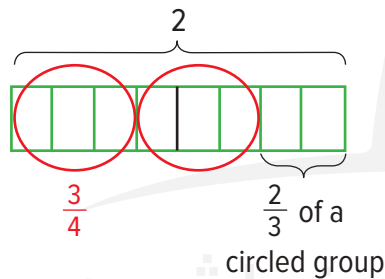
There are  groups of  $\frac{2}{3}$ . So,  $4 \div \frac{2}{3} = \text{}$ .

Check by multiplying:   $\times$   $\frac{\text{}}{\text{}}$  =  ✓

## Hands-On Activity 3

Find  $2 \div \frac{3}{4}$ .

**Step 1** The model represents 2.



**Step 2** Divide each whole into .

**Step 3** Determine how many groups of  $\frac{\text{}}{\text{}}$  are in .

Circle groups of  $\frac{\text{}}{\text{}}$  on the model.

There are  groups of  $\frac{3}{4}$  and  $\frac{2}{3}$  of a group left over. So,  $2 \div \frac{3}{4} = \text{} \frac{\text{}}{\text{}}$ .

Check by multiplying:   $\frac{\text{}}{\text{}}$   $\times$   $\frac{\text{}}{\text{}}$  =  ✓



## Investigate

**MP Model with Mathematics** Work with a partner. Draw a diagram to find each quotient.

1.  $3 \div \frac{1}{3} =$  \_\_\_\_\_

2.  $2 \div \frac{1}{4} =$  \_\_\_\_\_

Show your work.



3.  $6 \div \frac{2}{3} =$  \_\_\_\_\_

4.  $4 \div \frac{1}{2} =$  \_\_\_\_\_



5.  $3 \div \frac{3}{4} =$  \_\_\_\_\_

6.  $4 \div \frac{3}{4} =$  \_\_\_\_\_



7.  $5 \div \frac{2}{3} =$  \_\_\_\_\_

8.  $2 \div \frac{4}{5} =$  \_\_\_\_\_



## Analyze and Reflect

**MP Use Math Tools** Refer to the models you drew on the previous page. Work with a partner to complete the following table. The first one is done for you.

	Division Problem	Quotient	Is the Quotient Less Than or Greater Than the Dividend?
	$3 \div \frac{1}{3}$	9	greater
9.	$2 \div \frac{1}{4}$		
10.	$6 \div \frac{2}{3}$		
11.	$4 \div \frac{1}{2}$		
12.	$3 \div \frac{3}{4}$		
13.	$4 \div \frac{3}{4}$		

14. **MP Reason Inductively** When a whole number is divided by a fraction that is less than one, will the quotient be less than or greater than the whole number? Explain.

---



---



---



## Create

15. **MP Model with Mathematics** Write a story context that involves  $4 \div \frac{4}{5}$ . Solve the problem and multiply to check your answer.

---



---



---

16. **Inquiry** HOW can a bar diagram help you understand what it means to divide fractions? \_\_\_\_\_

---



---

# Divide Whole Numbers by Fractions

## Vocabulary Start-Up



Any two numbers with a product of 1 are called **reciprocals**.

Complete the table below by finding the reciprocal of  $\frac{2}{3}$ . Use the *guess, check, and revise* strategy. The first one is done for you.

Number	Product	Reciprocal
$\frac{1}{2}$	$\frac{1}{2} \times 2 = 1$	2
$\frac{2}{3}$	$\frac{2}{3} \times \frac{\square}{\square} = 1$	$\frac{\square}{\square}$

Describe the relationship between the numerator and the denominator of a number and its reciprocal.

---



## Real-World Link

Another name for reciprocal is *multiplicative inverse*. What are some words in everyday language that are similar to reciprocal or inverse?

---

Pilots can fly in an *inverted* position, or upside down. How can you use the everyday meaning of *invert* to help you remember the mathematical meaning of multiplicative inverse, or reciprocal?

---



### Essential Question

WHAT does it mean to multiply and divide fractions?



### Vocabulary

reciprocals



Mathematical Practices

1, 3, 4, 5



Which **MP** **Mathematical Practices** did you use?

Shade the circle(s) that applies.

- ① Persevere with Problems
- ② Reason Abstractly
- ③ Construct an Argument
- ④ Model with Mathematics
- ⑤ Use Math Tools
- ⑥ Attend to Precision
- ⑦ Make Use of Structure
- ⑧ Use Repeated Reasoning

## Find Reciprocals

Dividing 3 by  $\frac{1}{2}$  gives the same result as multiplying 3 by 2, which is the reciprocal of  $\frac{1}{2}$ . Any two numbers with a product of 1 are called reciprocals.

$$3 \div \frac{1}{2} = 6 \qquad 3 \times 2 = 6$$

### Examples

1. Find the reciprocal of  $\frac{2}{3}$ .

Since  $\frac{2}{3} \times \frac{3}{2} = 1$ , the reciprocal of  $\frac{2}{3}$  is  $\frac{3}{2}$ .

2. Find the reciprocal of  $\frac{1}{8}$ .

Since  $\frac{1}{8} \times \frac{8}{1} = 1$ , the reciprocal of  $\frac{1}{8}$  is  $\frac{8}{1}$  or 8.

3. Find the reciprocal of 5.

Write the whole number as a fraction.

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

Find the missing factor.

$$\frac{\square}{\square} \times \frac{\square}{\square} = 1$$

The reciprocal of 5 is  $\frac{\square}{\square}$ .

**Got it?** Do these problems to find out.

Find the reciprocal of each number.

a.  $\frac{3}{5}$

b.  $\frac{1}{3}$

c. 11

### Reciprocals

The examples suggest that you “invert” the fraction to find the reciprocal. That is, switch the numerator and denominator. You can use reciprocals to divide fractions.

Show your work.

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

# Divide by a Fraction

## Key Concept

**Words** To divide a whole number by a fraction, multiply by its reciprocal.

**Example**  $5 \div \frac{2}{3} = \frac{5}{1} \times \frac{3}{2}$

The division expression  $5 \div \frac{2}{3}$  is read as *5 divided by two thirds*. You need to find how many two thirds are in 5.

### Examples

**4.** Find  $2 \div \frac{1}{3}$ . Write in simplest form.

**Method 1** Use a model.

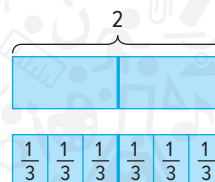
Model the dividend, 2.

Divide each whole into thirds.

**Think:** How many thirds are in 2?

Count the total number of sections.

There are 6 sections.



**Method 2** Use an equation.

$$2 \div \frac{1}{3} = \frac{2}{1} \times \frac{3}{1} \quad \text{Multiply by the reciprocal of } \frac{1}{3}.$$

$$= \frac{6}{1} \text{ or } 6 \quad \begin{array}{l} \text{Multiply the numerators.} \\ \text{Multiply the denominators.} \end{array}$$

**5.** Find  $7 \div \frac{2}{3}$ . Write in simplest form.

$$7 \div \frac{2}{3} = \frac{\square}{\square} \times \frac{\square}{\square} \quad \begin{array}{l} \text{Write the whole number as a fraction.} \\ \text{Multiply by the reciprocal of } \frac{2}{3}. \end{array}$$

$$\frac{\square}{\square} \times \frac{\square}{\square} = \frac{\square}{\square} \quad \begin{array}{l} \text{Multiply the numerators.} \\ \text{Multiply the denominators.} \end{array}$$

$$\frac{\square}{\square} = \frac{\square}{\square} \quad \text{Simplify.}$$

Show your work. →

d. \_\_\_\_\_

e. \_\_\_\_\_

f. \_\_\_\_\_

**Got it?** Do these problems to find out.

d.  $6 \div \frac{1}{3}$

e.  $5 \div \frac{2}{3}$

f.  $4 \div \frac{3}{4}$



## Example



6. At summer camp, the duration of a field hockey game is  $\frac{3}{4}$  hour. The camp counselors have set aside 6 hours for field hockey games. How many games can be played?

Divide 6 by three-fourths.

$$6 \div \frac{3}{4} = \frac{6}{1} \times \frac{4}{3}$$

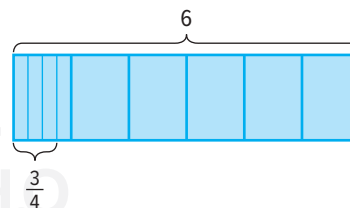
Multiply by the reciprocal.

$$= \frac{\cancel{6}^2}{1} \times \frac{4}{\cancel{3}_1}$$

Divide 3 and 6 by the GCF, 3.

$$= \frac{8}{1} \text{ or } 8$$

Simplify.



So, 8 games can be played.



## Guided Practice

Find the reciprocal of each number. (Examples 1–3)

1.  $\frac{2}{3}$  \_\_\_\_\_

2.  $\frac{1}{7}$  \_\_\_\_\_

3. 4 \_\_\_\_\_

Show your work.

Divide. Write in simplest form. (Examples 4 and 5)

4.  $2 \div \frac{1}{3} =$  \_\_\_\_\_

5.  $2 \div \frac{4}{5} =$  \_\_\_\_\_

6.  $5 \div \frac{2}{7} =$  \_\_\_\_\_

7. A neighborhood development that is 4 acres is to be divided into  $\frac{2}{3}$ -acre lots. How many lots can be created?

(Example 6) \_\_\_\_\_

8. **Building on the Essential Question** Why does a whole number divided by a fraction less than one have a quotient greater than the whole number dividend?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### Rate Yourself!

How well do you understand dividing whole numbers by fractions? Circle the image that applies.



Clear



Somewhat Clear



Not So Clear

**FOLDABLES**

Time to update your Foldable!

# Independent Practice

Find the reciprocal of each number. (Examples 1–3)

1.  $\frac{3}{5}$  \_\_\_\_\_

2.  $\frac{1}{4}$  \_\_\_\_\_

3. 1 \_\_\_\_\_

Show your work.

Divide. Write in simplest form. (Examples 4 and 5)

4.  $3 \div \frac{3}{4} =$  \_\_\_\_\_

5.  $5 \div \frac{3}{4} =$  \_\_\_\_\_

6.  $8 \div \frac{4}{7} =$  \_\_\_\_\_

7.  $6 \div \frac{3}{5} =$  \_\_\_\_\_

8.  $2 \div \frac{5}{8} =$  \_\_\_\_\_

9.  $4 \div \frac{8}{9} =$  \_\_\_\_\_

10. Amer has an 8-meter-long piece of wood that he wants to cut to build a step stool for his tree house. If each piece is going to be  $\frac{5}{6}$  meter long, what is the greatest number of pieces he will be able to use? (Example 6)

\_\_\_\_\_

\_\_\_\_\_

11. The average adult horse needs  $\frac{2}{5}$  bale of hay each day to meet dietary requirements. A horse farm has 44 bales of hay. How many horses can be fed in one day with 44 bales of hay? (Example 6)

\_\_\_\_\_

\_\_\_\_\_

12. **MP Justify Conclusions** Waleed ordered 4 sub sandwiches for a party. Each  $\frac{1}{2}$  sandwich is one serving. Does he have enough to serve 7 friends? How much is leftover or how much more is needed? Explain.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

13. Hind has four hours of free time on Saturday. She would like to spend no more than  $\frac{2}{3}$  of an hour on each activity. How many activities can she do during that time? Justify your procedure.

---

14. **MP Model with Mathematics** Find an example of dividing a whole number by a fraction in a newspaper or on the Internet. Write a real-world problem in which you would divide a whole number by a fraction.

---



### H.O.T. Problems Higher Order Thinking

15. **MP Find the Error** Mariam is solving  $\frac{8}{9} \div 4$ . Find her mistake and correct it.

---



---



---

$$\frac{8}{9} \div 4 = \frac{8}{9} \times \frac{4}{1}$$

$$= \frac{32}{9} \text{ or } 3\frac{5}{9}$$



16. **MP Persevere with Problems** The Snack Shack is making a batch of trail mix. They use  $9\frac{1}{3}$  pounds of granola,  $9\frac{1}{3}$  pounds of mixed nuts, and  $9\frac{1}{3}$  pounds of yogurt raisins to make the trail mix. They divide the mixture into 14 packages. How much is in each package? Explain.

---



---



---

17. **MP Reason Inductively** The bag of peanuts shown is on sale for AED 9.30. The Pep club wants to divide the larger bag into  $\frac{3}{4}$ -pound bags to sell at football games.

a. How much will it cost to fill one smaller bag?

---

b. How many pounds of peanuts will be remaining?

---

c. How many smaller bags can the club get from one 5-pound bag?

---

d. Suppose the club wants to sell 25 smaller bags. How many of the larger bags will they need to purchase? Explain.

---



---



## Extra Practice

Find the reciprocal of each number.

18.  $\frac{1}{10}$  10

19.  $\frac{7}{9}$  \_\_\_\_\_

20. 8 \_\_\_\_\_

Homework Help

$\frac{1}{10} \times \frac{10}{1} = 1$   
The reciprocal is  $\frac{10}{1}$  or 10.

Divide. Write in simplest form.

21.  $2 \div \frac{3}{5} = 3\frac{1}{3}$

22.  $5 \div \frac{5}{6} =$  \_\_\_\_\_

23.  $3 \div \frac{5}{6} =$  \_\_\_\_\_

$2 \div \frac{3}{5} = \frac{2}{1} \times \frac{5}{3}$   
 $= \frac{10}{3}$  or  $3\frac{1}{3}$

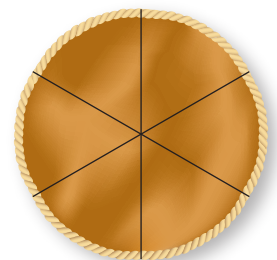
24.  $10 \div \frac{5}{6} =$  \_\_\_\_\_

25.  $4 \div \frac{5}{9} =$  \_\_\_\_\_

26.  $6 \div \frac{2}{3} =$  \_\_\_\_\_

27. Ibrahim has 6 kilograms of pasta. Each time he makes dinner he uses  $\frac{3}{4}$  kilograms of pasta. How many dinners can he make?  
\_\_\_\_\_

28. **MP Use Math Tools** Majed took 4 pumpkin pies to a family gathering. If he divides each pie into six equal-size slices, how many slices can he serve? \_\_\_\_\_



# Power Up! Test Practice

29. Aisha is using the recipe shown to make salad dressing for a salad. She wants to make 20 batches of the recipe. How much vegetable oil and how much vinegar does she need?

vegetable oil:

vinegar:


**Salad Dressing**

$\frac{1}{3}$  cup vegetable oil

$\frac{1}{4}$  cup vinegar

salt and pepper

to taste



30. Zaid has AED 4 to play video games at the mall. Each game costs a 25-fils to play. Which is a correct method for determining the total number of games he can play? Select all that apply.

- Take the number of dirhams he has and multiply it by 0.25.
- Take the number of dirhams he has and divide it by 0.25.
- Take the number of dirhams he has and multiply it by 4.
- Take the number of dirhams he has and divide it by  $\frac{1}{4}$ .

## Spiral Review

Find an equivalent fraction.

31.  $\frac{2}{3} = \frac{\boxed{\phantom{000}}}{9}$

32.  $\frac{3}{5} = \frac{\boxed{\phantom{000}}}{20}$

33.  $\frac{1}{4} = \frac{\boxed{\phantom{000}}}{24}$

34.  $\frac{5}{6} = \frac{\boxed{\phantom{000}}}{18}$

35.  $\frac{3}{4} = \frac{\boxed{\phantom{000}}}{32}$

36.  $\frac{4}{7} = \frac{\boxed{\phantom{000}}}{28}$

37. The table shows how far four students walked in 5 minutes. How far did they walk together?

	Distance (km)
Khalid	$\frac{3}{4}$
Majed	$\frac{1}{2}$
Rashid	$\frac{2}{3}$
Hatem	$\frac{3}{4}$

38. Sixty people can receive a piece of pizza if 5 pizzas are purchased. How many people can receive a slice of pizza if 7 pizzas are purchased?

\_\_\_\_\_

# Inquiry Lab 2

## Divide Fractions



**HOW** can using models help you divide one fraction by another fraction?

**MP** Mathematical Practices  
1, 3, 4

Khalid bought  $\frac{8}{9}$  kilograms of trail mix from the grocery store. He wants to divide the trail mix into  $\frac{2}{9}$ -kilogram bags. How many bags can Khalid make?

What do you know? \_\_\_\_\_

\_\_\_\_\_

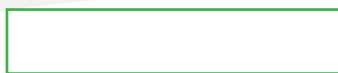
What do you need to find? \_\_\_\_\_

\_\_\_\_\_

### Hands-On Activity 1

To solve the problem use the division sentence  $\frac{8}{9} \div \frac{2}{9}$ . This shows how many groups of  $\frac{2}{9}$  are in  $\frac{8}{9}$ .

**Step 1** To make a bar diagram that represents the amount of Khalid's trail mix, divide the bar into  sections.



**Step 2** Shade  of the sections to represent  $\frac{8}{9}$  kilogram.

**Step 3** Circle each group of  $\frac{2}{9}$  in the shaded section. Determine the number of equal groups of  $\frac{2}{9}$ .

There are \_\_\_\_\_ groups of  $\frac{2}{9}$  in  $\frac{8}{9}$ . So,  $\frac{8}{9} \div \frac{2}{9} = \text{$ .

Khalid can make \_\_\_\_\_ bags of trail mix that each weigh  $\frac{\text{$ }{ kilogram.



## Hands-On Activity 2

Draw a diagram to find  $\frac{3}{4} \div \frac{3}{8}$ .

**Step 1** Rename so the fractions have common denominators. Since 8 is a multiple of 4, rename the fraction  $\frac{3}{4}$  as  $\frac{\square}{\square}$ .

**Step 2** Draw a diagram with  $\square$  sections and shade  $\square$  of the sections to represent  $\frac{6}{8}$  kilogram.



**Step 3** Circle each group of  $\frac{3}{8}$  in the shaded section. Determine the number of equal groups of  $\frac{3}{8}$ .

There are \_\_\_\_\_ groups of  $\frac{3}{8}$  in  $\frac{6}{8}$ .

So,  $\frac{3}{4} \div \frac{3}{8} = \square$ .

## Hands-On Activity 3

Draw a diagram to find  $\frac{2}{3} \div 2$ .

**Step 1** Draw a diagram and shade the sections to represent  $\frac{\square}{\square}$ .



**Step 2** Divide the shaded sections into \_\_\_\_\_ equal groups.

**Step 3** Write the fraction that names each group.  $\frac{\square}{\square}$

So,  $\frac{2}{3} \div 2 = \frac{\square}{\square}$ .



## Investigate

**MP Model with Mathematics** Work with a partner. Draw a diagram to find each quotient.

1.  $\frac{6}{7} \div \frac{2}{7} =$  \_\_\_\_\_

2.  $\frac{4}{5} \div \frac{2}{5} =$  \_\_\_\_\_

Show your work.



3.  $\frac{6}{7} \div \frac{3}{7} =$  \_\_\_\_\_

4.  $\frac{8}{10} \div \frac{2}{5} =$  \_\_\_\_\_



5.  $\frac{3}{4} \div \frac{1}{2} =$  \_\_\_\_\_

6.  $\frac{5}{6} \div \frac{2}{3} =$  \_\_\_\_\_



7.  $\frac{4}{7} \div 2 =$  \_\_\_\_\_

8.  $\frac{12}{13} \div 3 =$  \_\_\_\_\_



## Analyze and Reflect

**MP Use Math Tools** Work with a partner to complete the table. The first one is done for you.

	Division Expression	Quotient	Multiplication Sentence
	$\frac{4}{5} \div \frac{1}{5}$	4	$\frac{1}{5} \times 4 = \frac{4}{5}$
9.	$\frac{8}{9} \div 8$		
10.			$\frac{3}{4} \times \frac{1}{2} = \frac{3}{8}$
11.	$\frac{6}{8} \div \frac{2}{8}$		
12.			$\frac{3}{7} \times 1 = \frac{3}{7}$
13.	$\frac{10}{11} \div 5$		
14.			$\frac{5}{9} \times 1 = \frac{5}{9}$

15. **MP Reason Inductively** Use the table to compare the divisor and dividend to the value of the quotient. When is the quotient greater than 1?

---



---



## Create

16. **MP Make a Conjecture** Some quotients in the table are less than 1. Use the table to write a rule about when the quotient of two fractions will be less than 1.

---

17. **MP Model with Mathematics** Write a story context that involves  $\frac{6}{8} \div \frac{2}{8}$ . Solve the problem and multiply to check your answer.

---



---

18. **Inquiry** HOW can using models help you divide one fraction by another fraction?

---



---

برنامج محمد بن راشد  
 للتعليم الذكي  
 Mohammed Bin Rashid  
 Smart Learning Program

# Divide Fractions



## Real-World Link

**Murals** Three students are painting an art mural. The art mural is half painted.

- Use the picture after Exercise 4. Divide the painted area into 3 equal parts.
- Place an X over each part of the painted area. This represents the part each student has painted. Then divide the unpainted area into the same number of parts.
- What fraction of the whole mural has each student painted?  $\frac{\square}{\square}$
- So,  $\frac{1}{2} \div 3 = \frac{\square}{\square}$ . It is also true that  $\frac{1}{2} \times \frac{1}{3} = \frac{\square}{\square}$ . Compare and contrast the division problem and the multiplication problem.

---



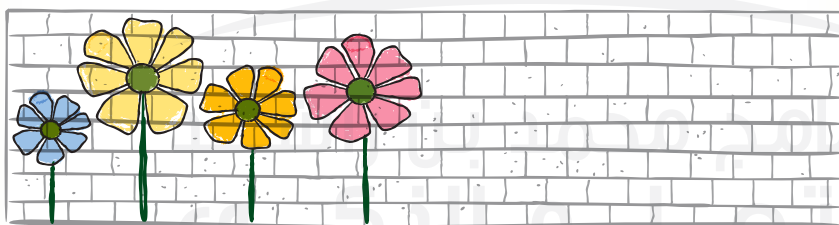
---



---



---



Which **MP** **Mathematical Practices** did you use?

Shade the circle(s) that applies.

- |  |   |
|--|---|
| <input type="checkbox"/> 1 Persevere with Problems | <input type="checkbox"/> 5 Use Math Tools         |
| <input type="checkbox"/> 2 Reason Abstractly       | <input type="checkbox"/> 6 Attend to Precision    |
| <input type="checkbox"/> 3 Construct an Argument   | <input type="checkbox"/> 7 Make Use of Structure  |
| <input type="checkbox"/> 4 Model with Mathematics  | <input type="checkbox"/> 8 Use Repeated Reasoning |



### Essential Question

WHAT does it mean to multiply and divide fractions?

**MP** **Mathematical Practices**  
1, 2, 3, 4, 5, 7, 8



## Key Concept

## Divide by a Fraction

**Words** To divide by a fraction, multiply by its reciprocal.

**Example**

**Numbers**

$$\frac{5}{6} \div \frac{2}{3} = \frac{5}{6} \times \frac{3}{2}$$

**Algebra**

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}, \text{ where } b, c, \text{ and } d \neq 0$$

### Work Zone

### Greatest Common Factor (GCF)

The GCF of two or more numbers is the product of all common prime factors.

$$4 = 2 \times 2$$

$$8 = 2 \times 2 \times 2$$

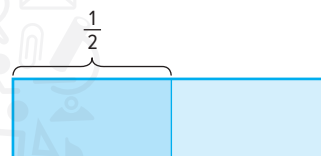
The GCF is  $2 \times 2$  or 4.

### Example

1. Find  $\frac{1}{2} \div \frac{1}{3}$ . Write in simplest form.

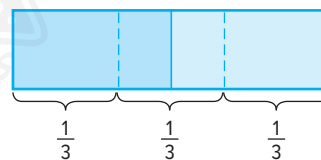
**Method 1** Use a model.

Model the dividend,  $\frac{1}{2}$ .

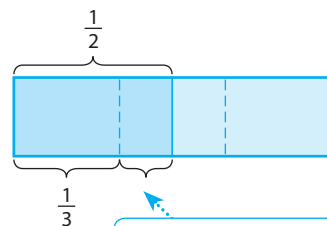


Divide the whole into thirds.

$\frac{1}{2} \div \frac{1}{3}$  means how many thirds are in  $\frac{1}{2}$ .



Count the number of  $\frac{1}{3}$  sections that are in  $\frac{1}{2}$ .



$\frac{1}{2}$  of another third

**Method 2** Use an equation.

$$\frac{1}{2} \div \frac{1}{3} = \square$$

$$\frac{1}{2} \div \frac{1}{3} = \frac{1}{2} \times \frac{3}{1}$$

Multiply by the reciprocal,  $\frac{3}{1}$ .

$$= \frac{3}{2} \text{ or } 1\frac{1}{2}$$

Multiply the numerators.  
Multiply the denominators.

So,  $\frac{1}{2} \div \frac{1}{3} = 1\frac{1}{2}$ .

Check by multiplying:  $\frac{3}{2} \times \frac{1}{3} = \frac{1}{2}$  ✓

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

**Got it?** Do these problems to find out.

a.  $\frac{1}{4} \div \frac{3}{8}$

b.  $\frac{2}{3} \div \frac{3}{8}$

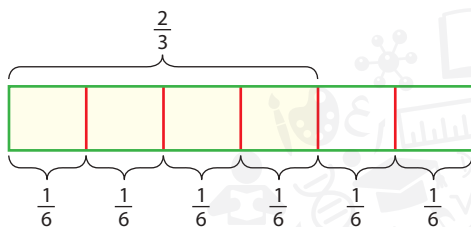
c.  $\frac{5}{6} \div \frac{1}{3}$



### Example

2. Write a story context for  $\frac{2}{3} \div \frac{1}{6}$ . Use a model to solve.

Hind has  $\frac{2}{3}$  kilogram of sunflower seeds. Each day, she feeds the cardinals in her yard  $\frac{1}{6}$  kilogram of seeds. For how many days will she be able to feed the cardinals?



Model  $\frac{2}{3}$ . The whole is divided into six sections. Count the number of  $\frac{1}{6}$  sections.

So, Hind can feed the cardinals for 4 days.

**Got it?** Do this problem to find out.

d. Write a story context for  $\frac{3}{4} \div \frac{1}{8}$ . Use a model to solve.

Show your work.

d. \_\_\_\_\_

## Divide a Fraction by a Whole Number

When you divide a fraction by a whole number, rewrite the whole number as a fraction. Then divide as with fractions.

### Example

3. Find  $\frac{5}{7} \div 10$ . Write in simplest form.

$$\frac{5}{7} \div 10 = \frac{5}{7} \div \frac{10}{1}$$

Write the whole number as a fraction with a denominator of 1.

$$= \frac{5}{7} \times \frac{1}{10}$$

Multiply by the reciprocal.

$$= \frac{\cancel{5}^1 \times 1}{7 \times \cancel{10}_2}$$

Divide 5 and 10 by their GCF, 5.

$$= \frac{1}{14}$$

Multiply the numerators.  
Multiply the denominators.

**Got it?** Do these problems to find out.

e.  $\frac{8}{9} \div 4$

f.  $\frac{4}{5} \div 8$

g.  $\frac{12}{13} \div 4$

e. \_\_\_\_\_

f. \_\_\_\_\_

g. \_\_\_\_\_



## Example

4. Ali is making party favors. He is dividing  $\frac{3}{4}$  kilogram of almonds into 12 packages. Write and solve an equation to find how many kilograms of almonds are in each package.



To find the number of kilograms in each package, solve the equation  $\frac{3}{4} \div 12 = \square$ .

$$\frac{3}{4} \div 12 = \frac{3}{4} \times \frac{1}{12} \quad \text{Multiply by the reciprocal, } \frac{1}{12}.$$

$$= \frac{\overset{1}{\cancel{3}} \times 1}{4 \times \underset{4}{\cancel{12}}} \quad \text{Divide 3 and 12 by their GCF, 3.}$$

$$= \frac{1}{16} \quad \begin{array}{l} \text{Multiply the numerators.} \\ \text{Multiply the denominators.} \end{array}$$

There will be  $\frac{1}{16}$  kilogram of almonds in each package.

## Guided Practice



Divide. Write in simplest form. Check by multiplying. (Examples 1 and 3)

1.  $\frac{1}{4} \div \frac{1}{2} =$  \_\_\_\_\_

2.  $\frac{5}{6} \div \frac{2}{3} =$  \_\_\_\_\_

3.  $\frac{1}{8} \div 3 =$  \_\_\_\_\_

Show your work.

4. Write a story context for  $\frac{2}{3} \div \frac{5}{6}$ . Use a model to solve.  
(Example 2)

---



---



---

5. A neighborhood garden that is  $\frac{2}{3}$  of an acre is to be divided into 4 equal-size sections. Write and solve an equation to find the size of each section. (Example 4)


---



---



---

6.  **Building on the Essential Question** How is the process used to divide fractions similar to the process used to multiply fractions?

---



---



---

### Rate Yourself!

How confident are you about dividing fractions? Shade the ring on the target.



**FOLDABLES** Time to update your Foldable!

# Independent Practice

Divide. Write in simplest form. Check by multiplying. (Examples 1 and 3)

1.  $\frac{1}{8} \div \frac{1}{2} =$  \_\_\_\_\_

2.  $\frac{3}{4} \div \frac{2}{3} =$  \_\_\_\_\_

3.  $\frac{3}{4} \div 9 =$  \_\_\_\_\_



4.  $\frac{1}{6} \div \frac{4}{7} =$  \_\_\_\_\_

5.  $\frac{1}{3} \div 8 =$  \_\_\_\_\_

6.  $\frac{1}{3} \div \frac{5}{6} =$  \_\_\_\_\_

7. Write a story context for  $\frac{5}{6} \div \frac{1}{12}$ . Use a model to solve. (Example 2)

---



---



---



---

Write and solve an equation. (Example 4)

8. A piece of licorice is to be cut into 10 equal-size pieces. If the length of the piece of licorice is  $\frac{2}{3}$  meters, how long will each piece of licorice be?

---



---

9. **MP Use Math Tools** To tie-dye one T-shirt,  $\frac{3}{8}$  cup of dye is needed. The table shows the number of cups of each color of dye in Mr. Rashid's art class. How many T-shirts can be made using only orange dye?

---



---

Amount of Dye	
Color	Number of Cups
red	12
orange	$\frac{3}{4}$

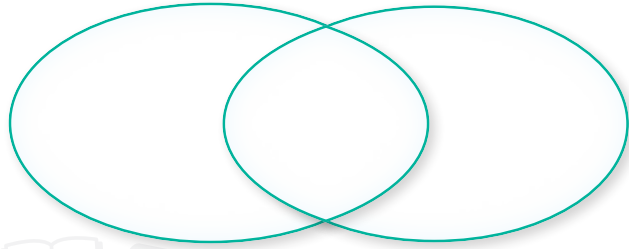
10. **MP Reason Abstractly** Asma has  $\frac{3}{4}$  ton of mulch she is going to divide evenly among 5 flower beds. How much mulch will each flower bed contain?

---

11. **MP Reason Abstractly** Complete the Venn diagram to compare and contrast the division and multiplication problems.

$$\frac{1}{3} \div 6 = ?$$

$$\frac{1}{3} \times \frac{1}{6} = ?$$



## H.O.T. Problems Higher Order Thinking

12. **MP Identify Structure** Find two positive fractions with a quotient of  $\frac{5}{6}$ . Give the equivalent multiplication sentence.

\_\_\_\_\_

13. **MP Identify Repeated Reasoning** Is the quotient  $\frac{2}{3} \div \frac{1}{2}$  greater than or less than 1? Is the quotient of  $\frac{1}{2} \div \frac{2}{3}$  greater than or less than 1? Explain your reasoning.

\_\_\_\_\_

14. **MP Persevere with Problems** Complete the steps to demonstrate why you multiply by the reciprocal when dividing fractions. Find  $\frac{1}{4} \div \frac{3}{8}$ .

**Step 1**

Rewrite it as  $\frac{1}{4} \div \frac{3}{8}$ .

**Step 2**

Multiply the numerator and the denominator by the

reciprocal of  $\frac{\square}{\square}$ .  $\frac{1}{4} \div \frac{3}{8} = \frac{1}{4} \times \frac{\square}{\square}$   
 $\frac{3}{8} \times \frac{\square}{\square}$

**Step 3**

Simplify the denominator.  $\frac{1}{4} \times \frac{8}{3}$

**Step 4**

Simplify the fraction.  $\frac{\square}{\square} \times \frac{\square}{\square}$

15. **MP Reason Inductively** In cooking, 1 drop is equal to  $\frac{1}{6}$  of a dash. If a recipe calls for  $\frac{2}{3}$  of a dash, write an expression that would give the number of drops that are needed.

\_\_\_\_\_

# Extra Practice

Divide. Write in simplest form. Check by multiplying.

16.  $\frac{1}{2} \div \frac{2}{3} = \frac{3}{4}$  \_\_\_\_\_

Homework Help →

$$\frac{1}{2} \div \frac{2}{3} = \frac{1}{2} \times \frac{3}{2}$$

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

$$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12} \text{ or } \frac{1}{2} \checkmark$$

17.  $\frac{1}{5} \div 4 = \frac{1}{20}$  \_\_\_\_\_

$$\frac{1}{5} \div 4 = \frac{1}{5} \times \frac{1}{4}$$

$$= \frac{1}{20}$$

$$\frac{1}{20} \times 4 = \frac{4}{20} \text{ or } \frac{1}{5} \checkmark$$

18.  $\frac{2}{5} \div \frac{3}{4} =$  \_\_\_\_\_

19.  $\frac{2}{7} \div 2 =$  \_\_\_\_\_

20.  $\frac{1}{5} \div \frac{5}{7} =$  \_\_\_\_\_

21.  $\frac{1}{4} \div \frac{3}{5} =$  \_\_\_\_\_

22. Write a story context for  $\frac{1}{4} \div \frac{1}{8}$ . Use a model to solve.

---



---

Write and solve an equation.

23. A relay race is  $\frac{1}{10}$  kilometer long. Four athletes will run an equal distance to complete the relay. How far does each athlete run?

---



---

24. Suad is using  $\frac{5}{6}$  meters of ribbon to make bows for her party favors. Suad needs to make 6 bows. What is the length of the ribbon used for each bow?

---



---

25. A recycling company shreds  $\frac{7}{8}$  ton of aluminum each day. The machines can shred  $\frac{1}{24}$  ton aluminum per cycle. How many cycles will be needed to shred the aluminum?

---



---

26. **MP Reason Abstractly** The recycling company collected  $\frac{7}{4}$  ton of aluminum last Saturday. If  $\frac{7}{8}$  ton of aluminum can be shredded each day, how many days will it take to process what was collected on Saturday?

---

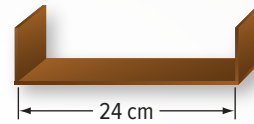


---



# Power Up! Test Practice

27. You have 60 CD cases that you would like to store on the shelf shown. If each CD case is  $\frac{3}{8}$  centimeter wide, is there enough room on the shelf for the CD cases? Explain your reasoning.



28. Which of the following numbers that when divided by  $\frac{1}{2}$ , give a result less than  $\frac{1}{2}$ ? Select all that apply.
- $\frac{3}{8}$      
   $\frac{3}{16}$      
   $\frac{6}{25}$      
   $\frac{1}{3}$

## Spiral Review

Find the greatest common factor of each pair of numbers.

29. 4 and 8 \_\_\_\_\_

30. 6 and 3 \_\_\_\_\_

31. 12 and 8 \_\_\_\_\_

32. 6 and 8 \_\_\_\_\_

33. 12 and 16 \_\_\_\_\_

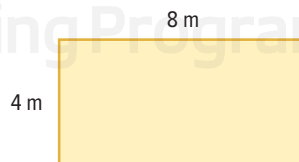
34. 9 and 15 \_\_\_\_\_

35. The set department has a 5 meter board. They cut 2 segments that are  $1\frac{1}{2}$  meters each. How much of the board is left?

\_\_\_\_\_

36. Ammar's family is building the goat pen shown. What is the area of the goat pen?

\_\_\_\_\_  
\_\_\_\_\_



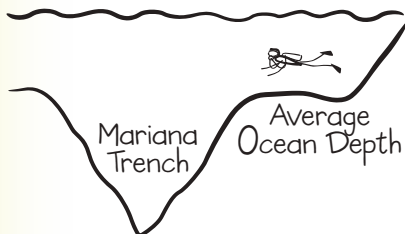
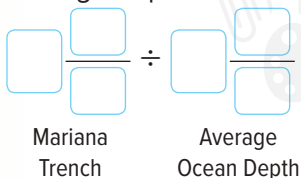
# Divide Mixed Numbers



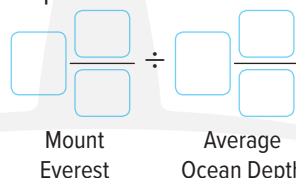
## Real-World Link

**Extreme Geography** The deepest point in Earth's oceans is the Mariana Trench, which is located  $6\frac{4}{5}$  miles beneath the ocean's surface. The average depth of Earth's oceans is  $2\frac{1}{2}$  miles. By contrast, the highest elevation of Earth is Mt. Everest, which is about  $5\frac{1}{2}$  miles high.

- Write a division expression to find how many times as deep the Mariana Trench is than the average depth of the ocean.



- Write a division expression to find how many times as tall Mt. Everest is than the average depth of the ocean.



- Rewrite the mixed number  $6\frac{4}{5}$  as an improper fraction.  $\frac{\square}{\square}$
- Rewrite the mixed number  $5\frac{1}{2}$  as an improper fraction.  $\frac{\square}{\square}$

Which **MP** Mathematical Practices did you use?

Shade the circle(s) that applies.

- |  |   |
|--|---|
| <input type="checkbox"/> 1 Persevere with Problems | <input type="checkbox"/> 5 Use Math Tools         |
| <input type="checkbox"/> 2 Reason Abstractly       | <input type="checkbox"/> 6 Attend to Precision    |
| <input type="checkbox"/> 3 Construct an Argument   | <input type="checkbox"/> 7 Make Use of Structure  |
| <input type="checkbox"/> 4 Model with Mathematics  | <input type="checkbox"/> 8 Use Repeated Reasoning |



### Essential Question

WHAT does it mean to multiply and divide fractions?

**MP** Mathematical Practices

1, 2, 3, 4, 6, 7

# Divide a Mixed Number by a Fraction

Dividing mixed numbers is similar to dividing fractions. To divide mixed numbers, write the mixed numbers as improper fractions and then divide as with fractions.

## Check by Multiplying

You can check the answer of Example 1 by multiplying the quotient by the divisor.

$$\frac{35}{8} \times \frac{2}{5} = \frac{7}{4}, \text{ or } 1\frac{3}{4}$$

## Examples

1. Find  $1\frac{3}{4} \div \frac{2}{5}$ .

**Estimate**  $2 \div \frac{1}{2} = 4$

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

Write the mixed number as an improper fraction.

$$= \frac{7}{4} \times \frac{5}{2}$$

Multiply by the reciprocal.

$$= \frac{35}{8} \text{ or } 4\frac{3}{8}$$

Simplify.

**Check for Reasonableness**  $4\frac{3}{8} \approx 4$  ✓

2. Find  $3\frac{3}{4} \div \frac{4}{5}$ .

**Estimate**  $\square \div \square = \square$

$$3\frac{3}{4} \div \frac{4}{5} = \frac{\square}{\square} \div \frac{4}{5}$$

Write the mixed number as an improper fraction.

$$= \frac{\square}{\square} \times \frac{\square}{\square}$$

Multiply by the reciprocal.

$$= \frac{\square}{\square} \text{ or } \square \frac{\square}{\square}$$

Simplify.

**Check for Reasonableness**  $\square \frac{\square}{\square} \approx \square$  ✓

Show your work.

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

**Got it?** Do these problems to find out.

Divide. Write in simplest form. Check by multiplying.

a.  $2\frac{3}{8} \div \frac{1}{4}$

b.  $2\frac{1}{2} \div \frac{3}{7}$

c.  $5\frac{5}{8} \div \frac{3}{4}$

# Divide by a Mixed Number

To divide a mixed number by another mixed number, change both mixed numbers to improper fractions. Remember to simplify before you multiply.

## Examples

3. Find  $5\frac{1}{2} \div 2\frac{1}{2}$ .

Estimate  $6 \div 3 = 2$

$$5\frac{1}{2} \div 2\frac{1}{2} = \frac{11}{2} \div \frac{5}{2}$$

Write mixed numbers as improper fractions.

$$= \frac{11}{2} \times \frac{2}{5}$$

Multiply by the reciprocal.

$$= \frac{11}{\cancel{2}} \times \frac{\cancel{2}}{5}$$

Divide 2 and 2 by the GCF, 2.

$$= \frac{11}{5} \text{ or } 2\frac{1}{5}$$

Simplify. Compare to the estimate.

4. Find  $4\frac{2}{3} \div 1\frac{3}{4}$ .

Estimate  $\square \div \square = \square \frac{\square}{\square}$

$$4\frac{2}{3} \div 1\frac{3}{4} = \frac{\square}{\square} \div \frac{\square}{\square}$$

Write the mixed numbers as an improper fractions.

$$= \frac{\square}{\square} \times \frac{\square}{\square}$$

Multiply by the reciprocal.  
Divide by the GCF.

$$= \frac{\square}{\square} \text{ or } \square \frac{\square}{\square}$$

Simplify.

Check for Reasonableness  $\frac{\square}{\square} \approx \frac{\square}{\square} \checkmark$

**STOP and Reflect**  
How is dividing two mixed numbers similar to dividing two fractions?

Show your work.

d. \_\_\_\_\_

e. \_\_\_\_\_

f. \_\_\_\_\_

### Got it? Do these problems to find out.

d.  $4\frac{1}{5} \div 2\frac{1}{3}$

e.  $8 \div 2\frac{1}{2}$

f.  $1\frac{5}{9} \div 2\frac{1}{3}$





## Example



5. The average adult male Giant Panda weighs about  $1\frac{1}{5}$  times as much as the average adult female. If the average weight of a male Giant Panda is 330 pounds, how much does the average female Giant Panda weigh?

To find the average weight, solve the equation  $330 \div 1\frac{1}{5} = \square$ .

$$330 \div 1\frac{1}{5} = \frac{330}{1} \div \frac{6}{5}$$

Write the mixed number as an improper fraction.

$$= \frac{330}{1} \times \frac{5}{6}$$

Multiply by the reciprocal.

$$= \frac{\overset{55}{\cancel{330}}}{1} \times \frac{5}{\underset{1}{\cancel{6}}}$$

Divide 330 and 6 by their GCF, 6.

$$= \frac{275}{1} \text{ or } 275$$

Simplify.

So, the average female Giant Panda weighs about 275 pounds.

## Guided Practice



Divide. Write in simplest form. Check by multiplying. (Examples 1–4)

1.  $3\frac{1}{2} \div \frac{1}{2} =$  \_\_\_\_\_

2.  $2\frac{2}{3} \div 1\frac{1}{6} =$  \_\_\_\_\_

3.  $6\frac{2}{3} \div 2\frac{6}{7} =$  \_\_\_\_\_

Show your work.

4. A box of snack-size cracker packs weighs  $28\frac{1}{2}$  ounces. Each snack pack weighs  $4\frac{3}{4}$  ounces. How many snack packs are in the box? (Example 5)
- \_\_\_\_\_

5. The soccer team has  $16\frac{1}{2}$  boxes of wrapping paper left to sell. If each of the 12 players sells the same amount, how many boxes should each player sell? (Example 5)
- \_\_\_\_\_

6. **Building on the Essential Question** How do you divide mixed numbers? \_\_\_\_\_
- \_\_\_\_\_

### Rate Yourself!

I understand how to divide mixed numbers.

Great! You're ready to move on!

I still have some questions about dividing mixed numbers.

**FOLDABLES** Time to update your Foldable!

# Independent Practice

Divide. Write in simplest form. Check by multiplying. (Examples 1–4)

1.  $4\frac{1}{6} \div 10 =$  \_\_\_\_\_

2.  $6\frac{1}{2} \div \frac{3}{4} =$  \_\_\_\_\_

3.  $3\frac{3}{4} \div 5\frac{5}{8} =$  \_\_\_\_\_

Show your work.

4. The length of a kitchen wall is  $24\frac{2}{3}$  meters long. A border will be placed along the wall of the kitchen. If the border comes in strips that are each  $1\frac{3}{4}$  meters long, how many strips of border are needed? (Example 5)
5. Faiza is cutting a roll of biscuit dough into slices that are  $\frac{3}{8}$  cm thick. If the roll is  $10\frac{1}{2}$  cm long, how many slices can he cut? (Example 5)

---



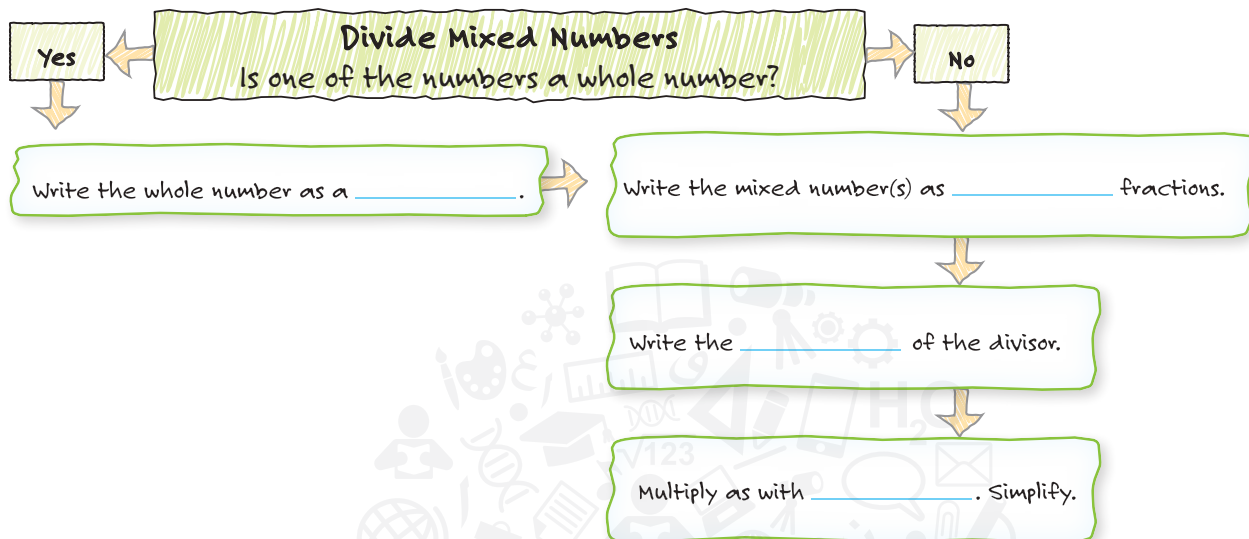
---

6. **MP Be Precise** Refer to the graphic novel frame below for Exercises a–c.



- a. What is the total weight of the birdseed they bought? \_\_\_\_\_
- b. If each smaller bag contains  $1\frac{1}{2}$  kilograms, how many bags can they make?  
 \_\_\_\_\_
- c. Will there be any birdseed left over? Explain. \_\_\_\_\_  
 \_\_\_\_\_

7. **MP Identify Structure** Complete the steps in dividing mixed numbers.



### H.O.T. Problems Higher Order Thinking

8. **MP Which One Doesn't Belong?** Select the expression that has a quotient greater than 1. Explain your reasoning.

$$4\frac{2}{3} \div 5\frac{1}{4}$$

$$3\frac{1}{8} \div 2\frac{2}{5}$$

$$1\frac{6}{7} \div 2\frac{1}{3}$$

$$5\frac{3}{4} \div 7\frac{3}{8}$$

---



---

9. **MP Persevere with Problems** Without dividing, explain whether  $5\frac{1}{6} \div 3\frac{5}{8}$  is greater than or less than  $5\frac{1}{6} \div 2\frac{2}{5}$ .

---



---



---

10. **MP Reason Inductively** Without doing the math, determine which is greater,  $40 \cdot \frac{1}{4}$  or  $40 \div \frac{1}{4}$ . Explain your reasoning.

---



---



---

# Extra Practice

Divide. Write in simplest form. Check by multiplying.

11.  $5\frac{1}{2} \div 2 = 2\frac{3}{4}$

Homework Help

$$\begin{aligned} 5\frac{1}{2} \div 2 &= \frac{11}{2} \div \frac{2}{1} \\ &= \frac{11}{2} \times \frac{1}{2} \\ &= \frac{11}{4} \text{ or } 2\frac{3}{4} \\ \frac{11}{4} \times \frac{1}{2} &= \frac{11}{2} \text{ or } 5\frac{1}{2} \checkmark \end{aligned}$$

12.  $3 \div 4\frac{1}{2} =$  \_\_\_\_\_

13.  $6 \div 2\frac{1}{4} =$  \_\_\_\_\_

14.  $7\frac{4}{5} \div \frac{1}{5} =$  \_\_\_\_\_

15.  $6\frac{1}{2} \div 3\frac{1}{4} =$  \_\_\_\_\_

16.  $8\frac{3}{4} \div 2\frac{1}{6} =$  \_\_\_\_\_

17.  $3\frac{3}{5} \div 1\frac{4}{5} =$  \_\_\_\_\_

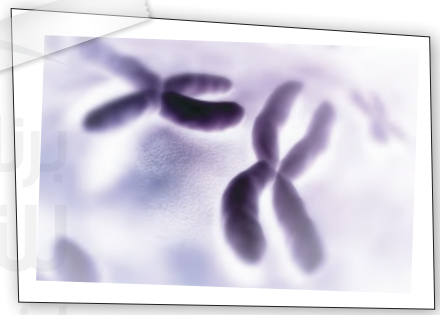
18.  $6\frac{3}{5} \div 2\frac{3}{4} =$  \_\_\_\_\_

19.  $4\frac{2}{3} \div 2\frac{2}{9} =$  \_\_\_\_\_

20. **STEM** A human has 46 chromosomes. This is  $5\frac{3}{4}$  times the number of chromosomes of a fruit fly. Write a division expression to find how many chromosomes a fruit fly has.

\_\_\_\_\_

\_\_\_\_\_



21. **MP Reason Abstractly** How many  $\frac{3}{8}$ -kilogram bags of trail mix can be made from  $6\frac{3}{8}$  kilograms of trail mix? Write a division expression.

\_\_\_\_\_

22. Aisha is setting tiles along the baseboard in her bathroom. One side of the bathroom is  $18\frac{3}{4}$  feet. Each tile is  $1\frac{1}{2}$  feet long. How many tiles does she need for this section? \_\_\_\_\_

# Power Up! Test Practice

23. You have a shelf that holds  $25\frac{1}{2}$  pounds. How many  $1\frac{1}{4}$ -pound books can the shelf hold? Explain your response.

24. Sort the expressions listed at the right into the appropriate bins.

Quotient Less Than 1	Quotient Equal to 1	Quotient Greater Than 1

$7\frac{2}{3} \div 5\frac{3}{8}$	$6\frac{2}{3} \div 6\frac{8}{12}$
$3\frac{2}{5} \div 6\frac{3}{4}$	$5\frac{1}{6} \div 4\frac{2}{5}$
$4\frac{1}{4} \div 4\frac{1}{4}$	$2\frac{1}{4} \div 2\frac{1}{2}$
$12\frac{4}{5} \div 8\frac{1}{4}$	$8\frac{3}{8} \div 8\frac{2}{9}$

## Spiral Review

Multiply. Write in simplest form.

25.  $\frac{3}{4} \times 1 =$  \_\_\_\_\_

26.  $\frac{3}{7} \times 2 =$  \_\_\_\_\_

27.  $\frac{1}{2} \times \frac{1}{2} =$  \_\_\_\_\_

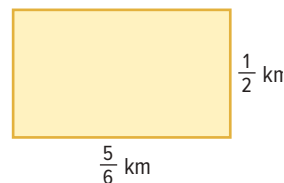
28.  $\frac{1}{2} \times \frac{1}{4} =$  \_\_\_\_\_

29.  $\frac{2}{5} \times \frac{1}{4} =$  \_\_\_\_\_

30.  $\frac{3}{4} \times \frac{2}{3} =$  \_\_\_\_\_

31. Shaima is planting corn on her farm. What is the area of cornfield?

\_\_\_\_\_



# 21<sup>ST</sup> CENTURY CAREER

## in Culinary Arts

### Pastry Chef

Are you creative in the kitchen? Do you enjoy sharing your creations with others? If so, a career as a pastry chef might be perfect for you. Pastry chefs can have different responsibilities, such as creating desserts and dessert menus for restaurants; baking breads, pies, and cakes for neighborhood bakeries; or producing pastries and baked goods for grocery stores. Pastry chefs are not only artistic, but they are also precise and understand mathematics and the chemistry of the ingredients that they are using.



### Is This the Career for You?

Are you interested in a career as a pastry chef? Take some of the following courses in high school to get you started in the right direction.

- ◆ Algebra
- ◆ Chemistry
- ◆ Culinary Operations
- ◆ Food Science Technology

Find out how math relates to a career in Culinary Arts.



## MP You be the Pastry Chef!

Use the information in the recipes below to solve each problem.

1. A chef is making only half of the frosting recipe. How much cream of tartar is needed? How much granulated sugar is needed? \_\_\_\_\_
2. The petits fours recipe is doubled. How much milk is needed for the cake? \_\_\_\_\_
3. If the frosting recipe is tripled, how much water is needed? Justify your procedure.  
\_\_\_\_\_  
\_\_\_\_\_
4. For a wedding, a pastry chef is increasing the cake recipe by  $4\frac{1}{2}$  times. How much butter is needed? flour? \_\_\_\_\_
5. The recipe is increased to make  $1\frac{3}{4}$  times the number of petits four than the original recipe. How much vanilla extract is needed for the cake and the frosting? Justify your procedure.  
\_\_\_\_\_  
\_\_\_\_\_

### Petits Fours Frosting

3 cups granulated sugar  
 $\frac{1}{4}$  teaspoon cream of tartar  
 $1\frac{1}{2}$  cups water  
1 cup powdered sugar, sifted  
 $\frac{1}{2}$  teaspoon vanilla extract  
 $\frac{1}{2}$  teaspoon almond extract

### Petits Fours Cake

$\frac{1}{4}$ cup butter, melted	$\frac{1}{2}$ teaspoon salt
1 cup shortening	$\frac{2}{3}$ cup milk
1 cup granulated sugar	3 egg whites
1 teaspoon vanilla extract	
$1\frac{1}{3}$ cups all-purpose flour	
2 teaspoons baking powder	

## MP Career Project

It's time to update your career portfolio! Use the Internet or another source to research a career as a pastry chef. Write a paragraph that summarizes your findings.

---

---

---

---

---

List the strengths you have that would help you succeed in this career.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

# Chapter Review

## Vocabulary Check

Fill in the blank with the correct vocabulary term. Then **circle** the word that completes the sentence in the word search.

- A number that has a whole number part and a fraction part is a \_\_\_\_\_.
- The \_\_\_\_\_ is the greatest of the common factors of two or more numbers.
- The product of a number and its \_\_\_\_\_ is one.
- The number above the fraction bar is the \_\_\_\_\_.
- The number below the fraction bar is the \_\_\_\_\_.
- A \_\_\_\_\_ is a number that represents part of a whole or part of a set.
- A \_\_\_\_\_ is a unit rate with a denominator of 1 unit.
- A fraction with a numerator that is greater than or equal to the denominator is an \_\_\_\_\_.
- \_\_\_\_\_ are numbers that are easy to divide mentally.
- A fraction in which the GCF of the numerator and the denominator is 1 is written in \_\_\_\_\_.

N	W	V	B	C	H	H	R	O	D	M	D	C	V	P	H	H	P	R	M	R	M
R	O	T	C	A	F	N	O	M	M	O	C	T	S	E	T	A	E	R	G	E	I
K	I	I	O	S	P	Y	K	J	M	L	B	I	Y	Z	S	Q	O	M	R	B	X
H	D	O	T	M	J	C	G	T	P	H	J	S	C	D	B	F	E	E	H	M	E
D	F	E	Z	C	R	T	Q	P	A	I	G	Y	Q	Y	T	Q	C	P	V	U	D
G	E	H	C	Y	A	B	H	S	J	G	V	G	S	S	N	I	D	E	Q	N	N
X	U	N	I	P	F	R	A	C	C	O	O	N	E	V	P	B	N	C	F	E	U
E	M	J	O	C	M	W	F	N	S	P	V	L	D	R	X	I	O	B	O	L	M
H	N	G	K	M	S	N	U	R	V	T	P	T	O	P	D	A	I	B	L	B	B
X	O	W	T	G	I	I	O	K	E	M	N	C	V	U	L	I	T	Y	Z	I	E
B	Z	T	F	W	M	N	X	I	I	P	A	Y	B	W	E	F	A	G	N	T	R
A	X	S	Y	K	Y	C	A	S	T	L	O	I	W	Z	X	M	R	K	L	A	T
T	E	J	K	Q	O	L	P	T	X	C	F	R	I	S	T	K	T	L	A	P	K
R	O	T	A	R	E	M	U	N	O	M	A	Q	P	G	N	C	I	Y	X	M	T
Y	H	W	D	N	X	J	S	M	X	R	X	R	U	M	O	G	N	B	R	O	I
M	F	F	T	B	D	Y	N	A	P	R	G	I	F	J	I	M	U	F	I	C	A

# Key Concept Check

Use Your **FOLDABLES**

Use your Foldable to help review the chapter.

Tape here

Tab 3	<b>Multiply and Divide Fractions</b>	
Tab 2		
Tab 1		
Example		Example
fraction $\times$ mixed number		mixed number $\div$ fraction

## Got it?

The problems below may or may not contain an error. If the problem is correct, write a “✓” by the answer. If the problem is not correct, write an “X” over the answer and correct the problem.

1.  $13 \times \frac{1}{3} = 4\frac{2}{3}$

2.  $16 \times \frac{5}{6} = 19\frac{1}{5}$

3.  $35 \times \frac{3}{7} = 15$

The first one is done for you.

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

4.  $\frac{5}{8} \div \frac{3}{4} = \frac{15}{32}$

5.  $3\frac{2}{3} \div \frac{5}{6} = 4\frac{2}{5}$

6.  $2\frac{2}{3} \div 1\frac{1}{4} = 2\frac{2}{3}$

# Power Up! Performance Task

## Road Trip

Rashid's family is traveling across the country to visit relatives. Mr. Rashid set the cruise control and drove at a constant speed for  $622\frac{1}{2}$  miles. He took breaks, but remained at an average constant speed when driving. Some of the data related to the trip appear in the table below.

Time (h)	3	4	5	6	9	$c$
Distance (mi)	$186\frac{3}{4}$	$a$	$311\frac{1}{4}$	$b$	$560\frac{1}{4}$	$622\frac{1}{2}$

Write your answers on another piece of paper. Show all of your work to receive full credit.

### Part A

What is Mr. Rashid's rate of speed in miles per hour? Express your answer as a fraction or a mixed number.

### Part B

Using the answer from Part A, find the missing values in the table. Express your answer as a fraction or a mixed number.

### Part C

Graph the ordered pairs from the completed table on a coordinate plane. How far will Rashid's family have traveled after 15 hours?

### Part D

The following year, Mr. Rashid rents a vehicle for the same trip. The speedometer in this vehicle registers speeds in kilometers per hour instead of miles per hour. He wants to drive at a constant rate of 70 miles per hour. What is the maximum speed in kilometers per hour that he can drive to not exceed a rate of 70 miles per hour? Express your answer as a mixed number. Recall that 1 mile is approximately equal to  $1\frac{3}{5}$  kilometers.

# Reflect



## Answering the Essential Question

Use what you learned about multiplying and dividing fractions to complete the graphic organizer.



### Essential Question

WHAT does it mean to multiply and divide fractions?



Operation	Dividend and Divisor	Is the answer less than or greater than the dividend? Provide an example.
multiply	whole number by whole number	
multiply	fraction by fraction	
divide	whole number by whole number	
divide	fraction by fraction	



**Answer the Essential Question.** WHAT does it mean to multiply and divide fractions?

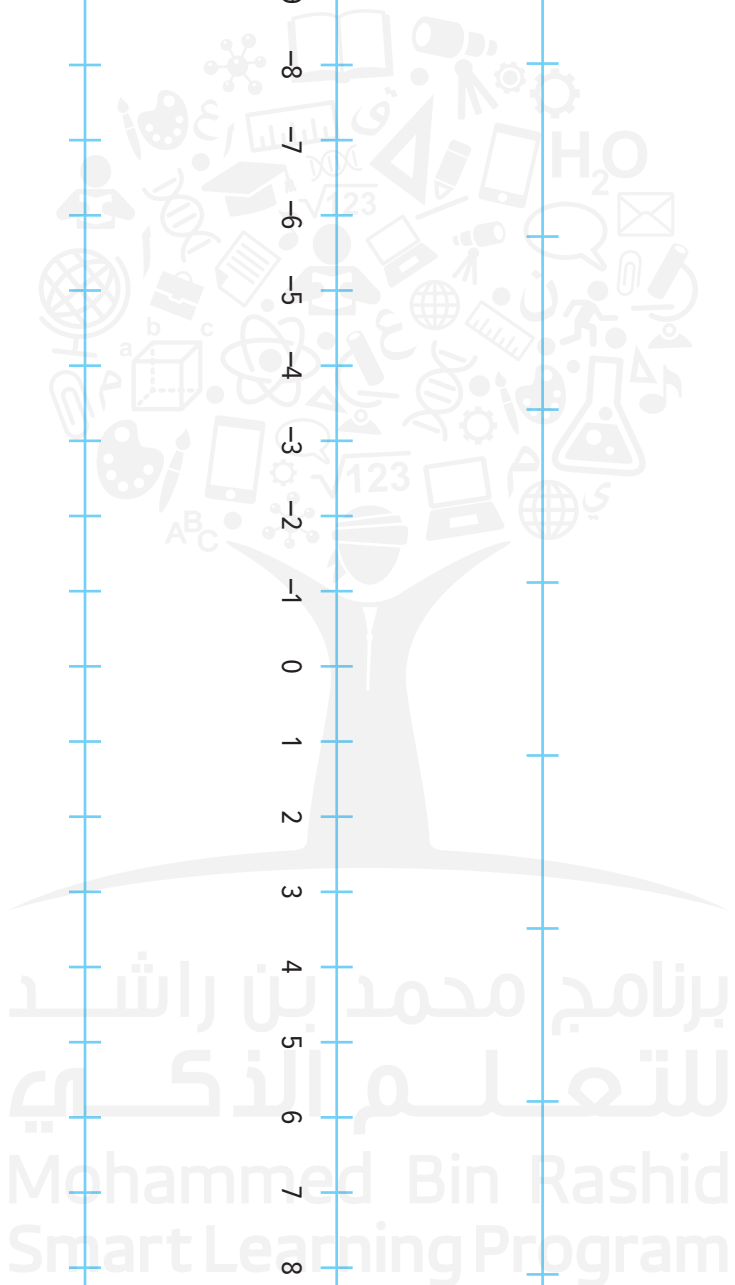
---

---

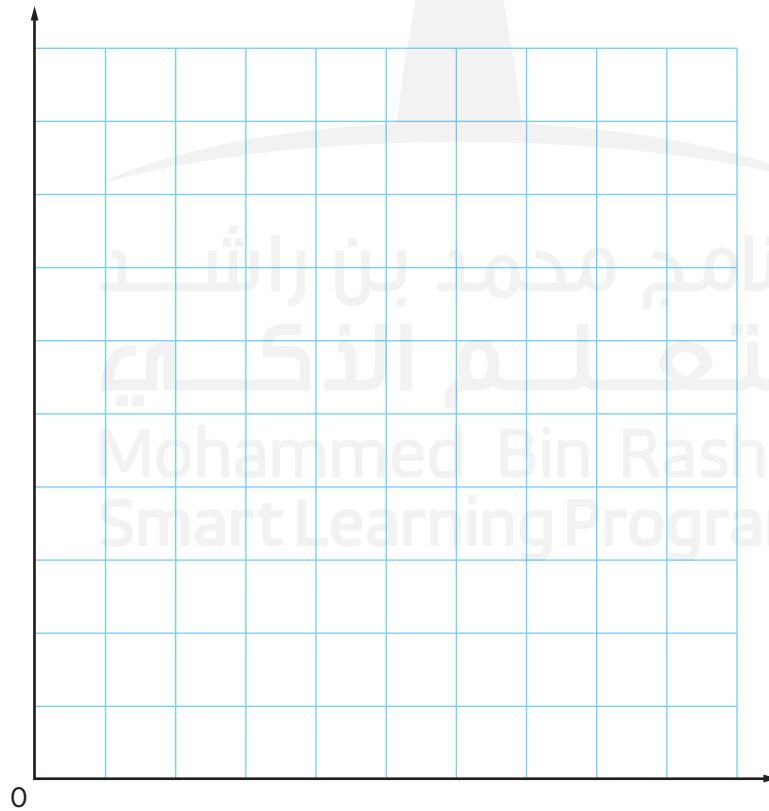
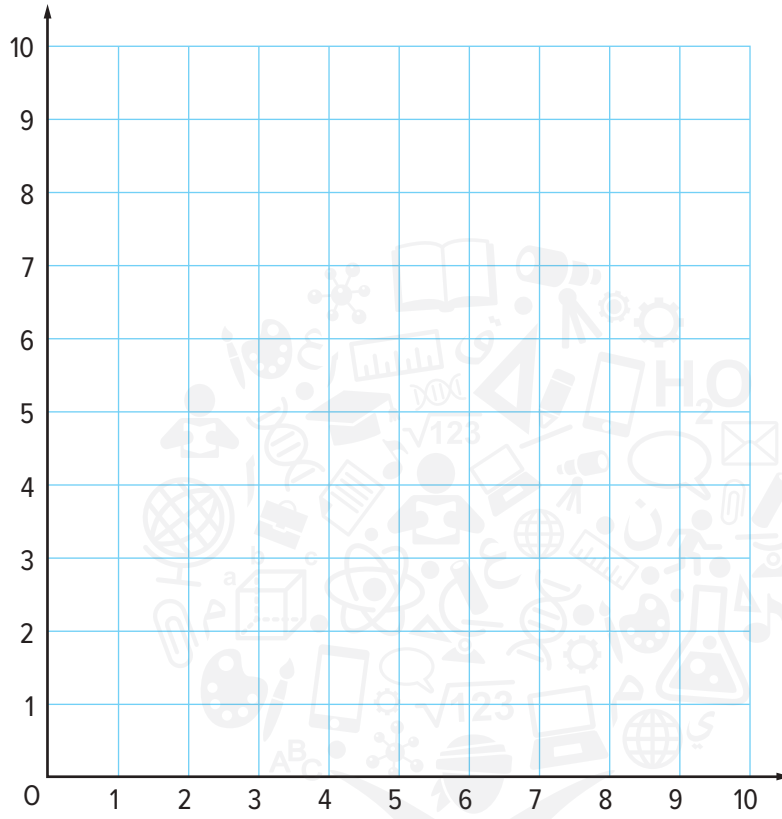
---

---

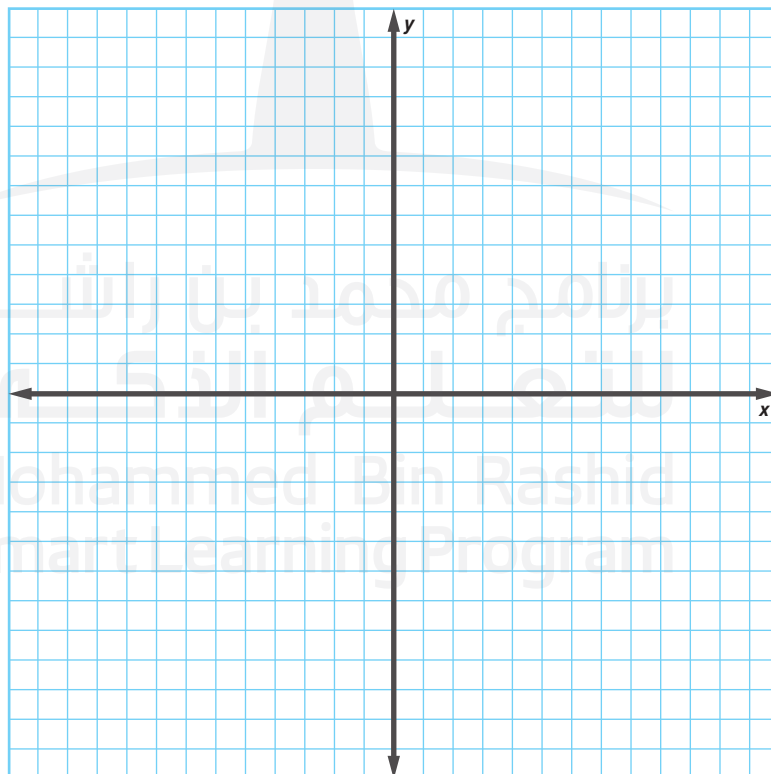
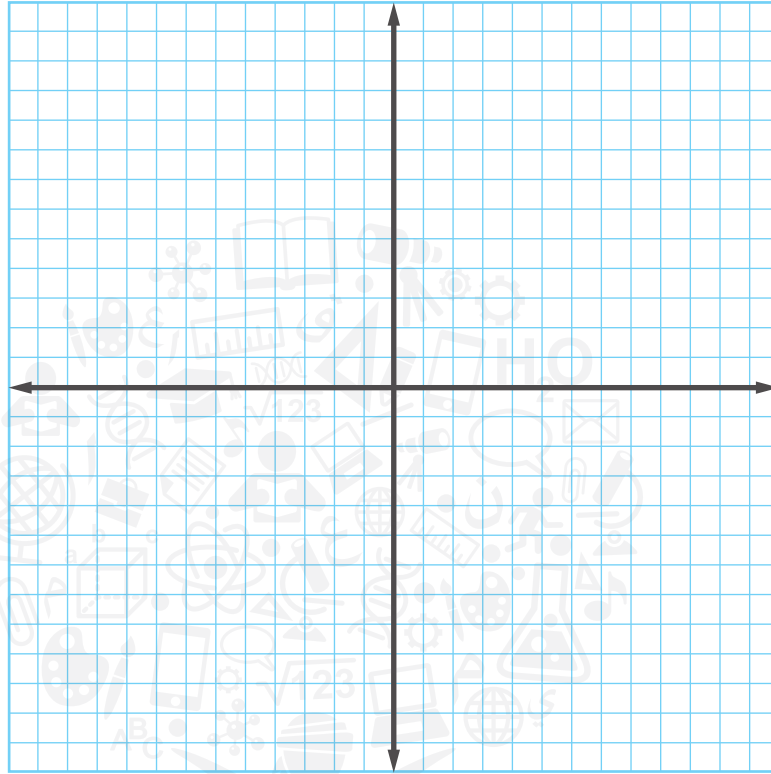
Name \_\_\_\_\_



Name \_\_\_\_\_

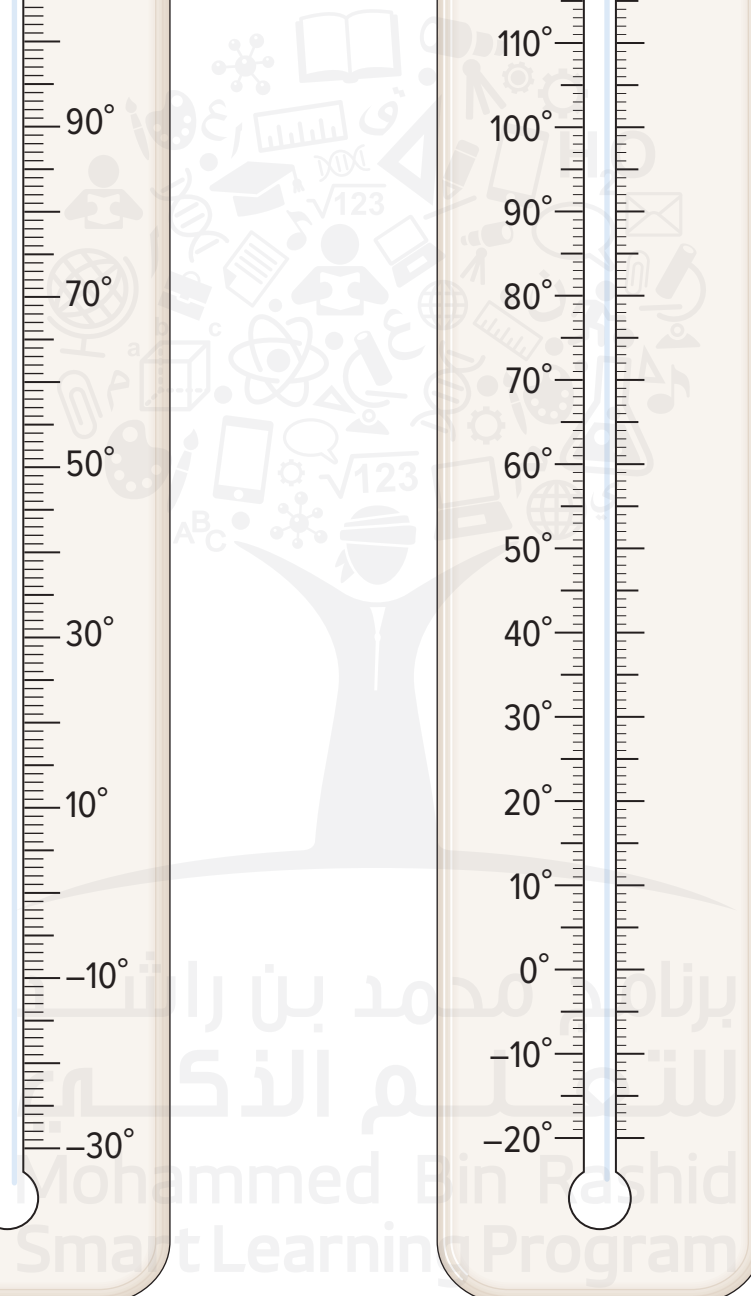
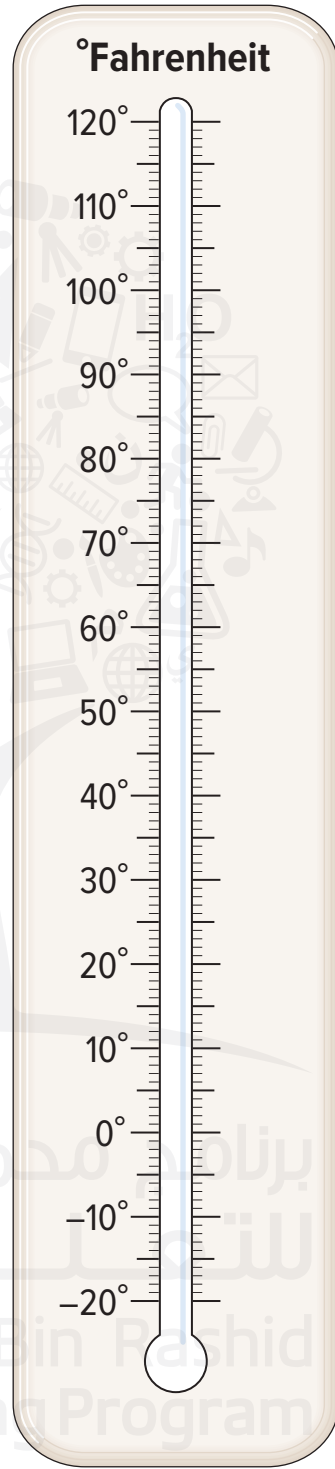
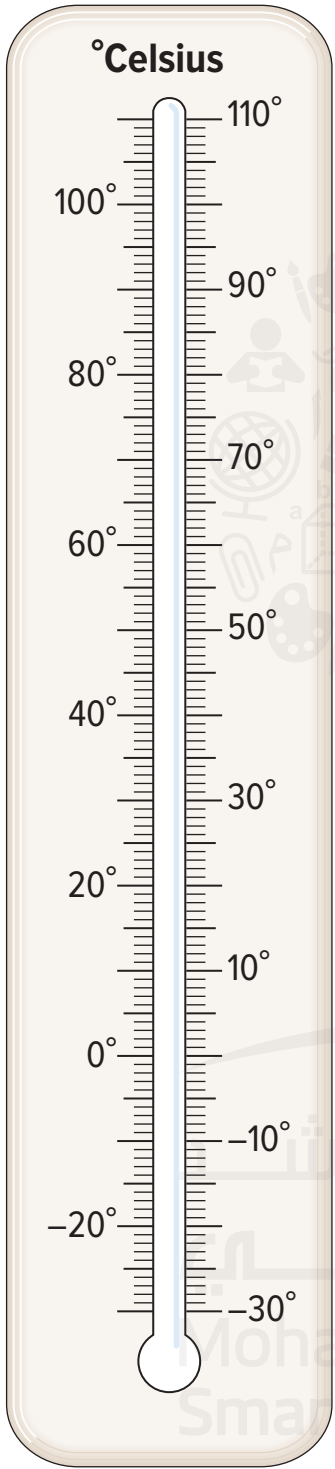


Name \_\_\_\_\_



برنامج محمد بن راشد  
للتنمية الذكية  
Mohammed Bin Rashid  
Smart Learning Program

Name \_\_\_\_\_

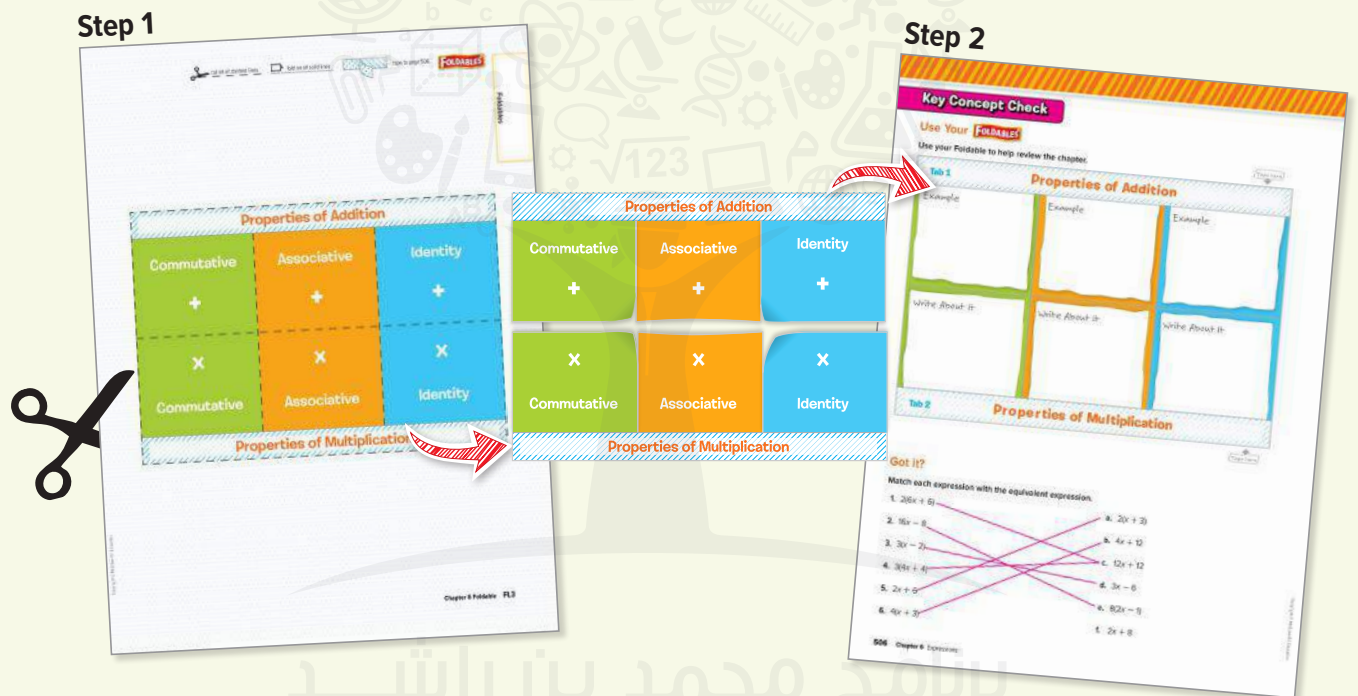


## What Are Foldables and How Do I Create Them?

Foldables are three-dimensional graphic organizers that help you create study guides for each chapter in your book.

**Step 1** Go to the back of your book to find the Foldable for the chapter you are currently studying. Follow the cutting and assembly instructions at the top of the page.

**Step 2** Go to the Key Concept Check at the end of the chapter you are currently studying. Match up the tabs and attach your Foldable to this page. Dotted tabs show where to place your Foldable. Striped tabs indicate where to tape the Foldable.



## How Will I Know When to Use My Foldable?

When it's time to work on your Foldable, you will see a Foldables logo at the bottom of the **Rate Yourself!** box on the Guided Practice pages. This lets you know that it is time to update it with concepts from that lesson. Once you've completed your Foldable, use it to study for the chapter test.

### Rate Yourself!

How well do you understand percent and proportions? Circle the image that applies.



Clear



Somewhat Clear



No So Clear

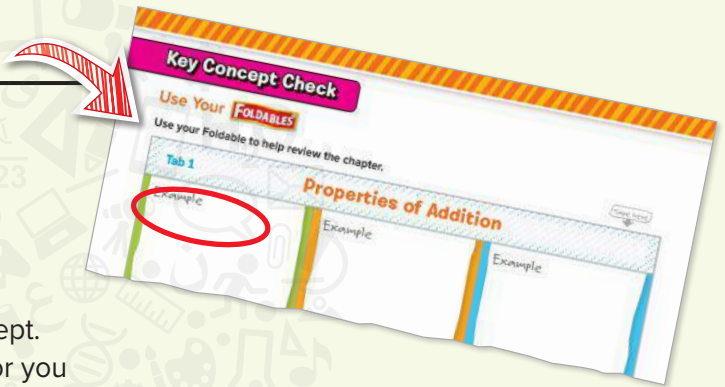
**FOLDABLES®** Time to update your Foldable!

## How Do I Complete My Foldable?

No two Foldables in your book will look alike. However, some will ask you to fill in similar information. Below are some of the instructions you'll see as you complete your Foldable. **HAVE FUN** learning math using Foldables!

### Instructions and what they mean

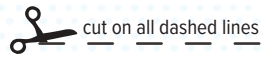
Best Used to...	Complete the sentence explaining when the concept should be used.
Definition	Write a definition in your own words.
Description	Describe the concept using words.
Equation	Write an equation that uses the concept. You may use one already in the text or you can make up your own.
Example	Write an example about the concept. You may use one already in the text or you can make up your own.
Formulas	Write a formula that uses the concept. You may use one already in the text.
How do I ...?	Explain the steps involved in the concept.
Models	Draw a model to illustrate the concept.
Picture	Draw a picture to illustrate the concept.
Solve	
Algebraically	Write and solve an equation that uses the concept.
Symbols	Write or use the symbols that pertain to the concept.
Write About It	Write a definition or description in your own words.
Words	Write the words that pertain to the concept.



### Meet Foldables Author Dinah Zike

Dinah Zike is known for designing hands-on manipulatives that are used nationally and internationally by teachers and parents. Dinah is an explosion of energy and ideas. Her excitement and joy for learning inspires everyone she touches.





cut on all dashed lines



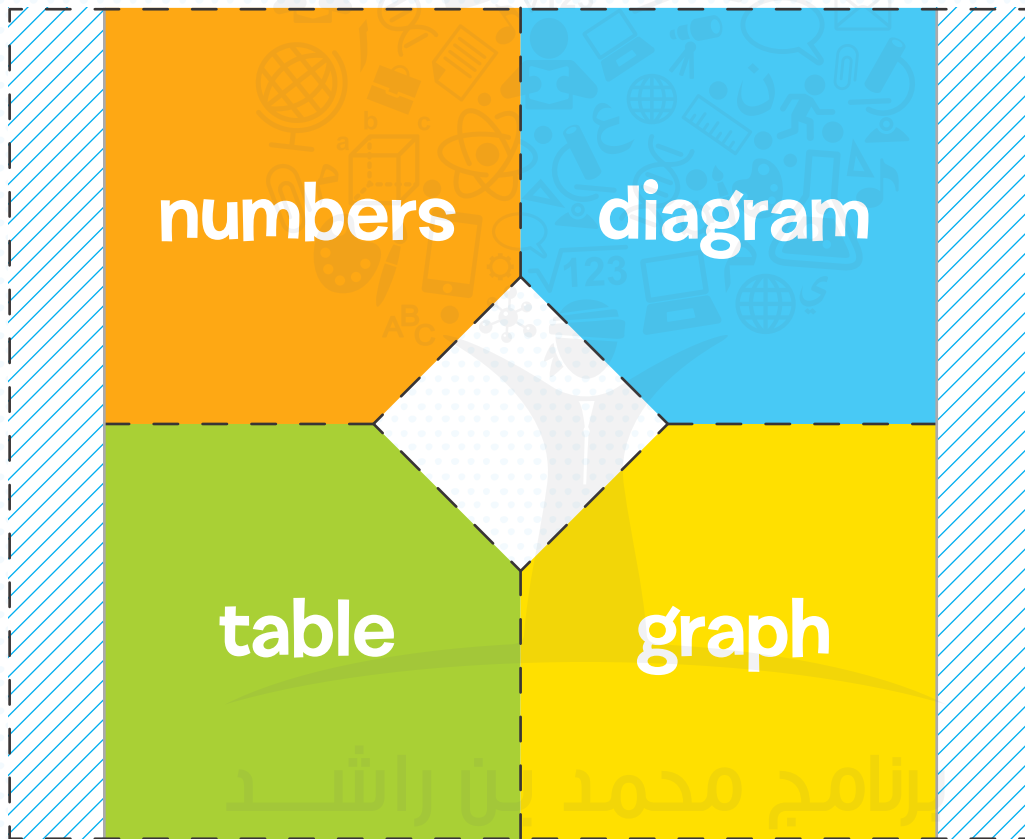
fold on all solid lines



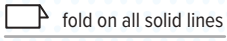
tape to page 82

**FOLDABLES**

Foldables



برنامج محمد بن راشد  
 للتعليم الأكي  
 Mohammed Bin Rashid  
 Smart Learning Program



Write About It

Write About It

Write About It

Write About It

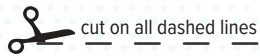
page 82

page 82

Tab 2

Tab 1

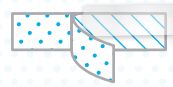
بنامہ محمد بن راشد  
للتعلم الذكي  
Mohammed Bin Rashid  
Smart Learning Program



cut on all dashed lines



fold on all solid lines



tape to page 166

**FOLDABLES**

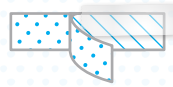
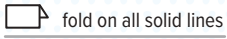
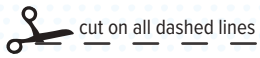
**Fractions, Decimals, and Percents**

**percents and fractions**

**percents and decimals**

**percent of a number**

Mohammed Bin Rashid  
Smart Learning Program



tape to page 166



Write About It

Write About It

Write About It

برنامج محمد بن راشد  
للتعلم الذكي

Mohammed Bin Rashid  
Smart Learning Program

page 166

# UNITS REFERENCE TABLES

SI Base Units		
Quantity	Unit	Unit Abbreviation
Length	meter	m
Mass	kilogram	kg
Time	second	s

SI Derived Units			
Quantity	Unit	Unit Symbol	Unit Expressed in Base Units
Area	meters squared	m <sup>2</sup>	m <sup>2</sup>
Volume	meters cubed	m <sup>3</sup>	m <sup>3</sup>
Density	kilograms per meter cubed	kg/m <sup>3</sup>	kg/m <sup>3</sup>
Velocity	meters per second	m/s	m/s
Acceleration	meters per second squared	m/s <sup>2</sup>	m/s <sup>2</sup>

Unit System Equivalents	
Type of Measurement	Equivalent
Length	1 in = 2.54 cm 1 yd = 0.91 m 1 mi = 1.61 km
Mass and weight	1 oz = 28.35 g 1 lb = 0.45 kg 1 ton (short) = 0.91 tonnes (metric tons) 1 lb = $\frac{4}{45}$ N
Volume	1 in <sup>3</sup> = 16.39 cm <sup>3</sup> 1 qt = 0.95 L 1 gal = 3.78 L
Area	1 in <sup>2</sup> = 6.45 cm <sup>2</sup> 1 yd <sup>2</sup> = 0.83 m <sup>2</sup> 1 mi <sup>2</sup> = 2.59 km <sup>2</sup> 1 acre = 0.40 hectares
Temperature	$^{\circ}\text{C} = \frac{(^{\circ}\text{F} - 32)}{1.8}$ K = $^{\circ}\text{C} + 273$

### Prefixes Used with SI Units

Prefix	Symbol	Scientific Notation	Example
femto	f	$10^{-15}$	femtosecond (fs)
pico	p	$10^{-12}$	picometer (pm)
nano	n	$10^{-9}$	nanometer (nm)
micro	$\mu$	$10^{-6}$	microgram ( $\mu\text{g}$ )
milli	m	$10^{-3}$	milliamps (mA)
centi	c	$10^{-2}$	centimeter (cm)
deci	d	$10^{-1}$	deciliter (dL)
deka	da	$10^1$	decaliter (dam)
hecto	h	$10^2$	hectometer (hL)
kilo	k	$10^3$	kilometer (km)
mega	M	$10^6$	megagram (Mg)
giga	G	$10^9$	gigameter (Gm)
tera	T	$10^{12}$	terahertz (THz)
peta	P	$10^{15}$	petasecond (Ps)

برنامج محمد بن راشد  
 للتعليم الذكي  
 Mohammed Bin Rashid  
 Smart Learning Program