

Name _____



★
Solve & Share
★

Joaquin used two types of flour in a muffin recipe. How much flour did he use in all?
Solve any way you choose.

Use Structure
Use what you know
about adding fractions.
Show your work!

Basic Muffins

- $\frac{1}{2}$ c milk
- $\frac{1}{3}$ c melted butter
- 2 eggs
- $1\frac{1}{2}$ c whole wheat flour
- $1\frac{2}{3}$ c buckwheat flour
- 1 tsp baking powder

Lesson 7-8

Add Mixed Numbers

I can ...
add mixed numbers.

 Content Standards 5.NF.A.1 Also 5.NF.A.2
Mathematical Practices MP.3, MP.7

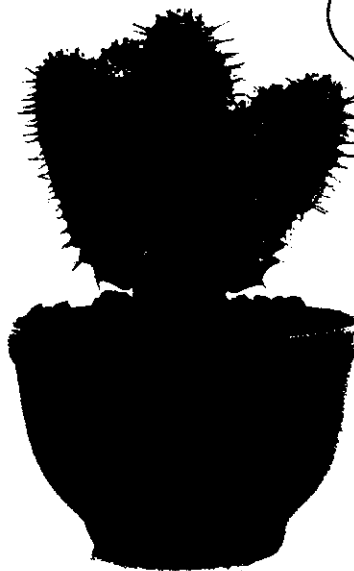
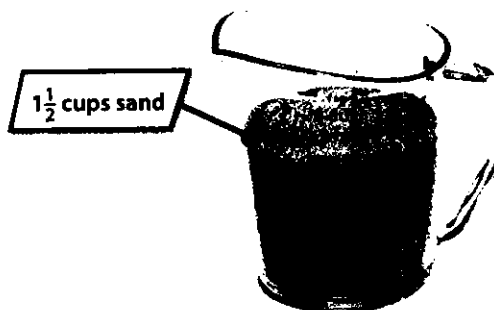


Look Back! How is adding mixed numbers with unlike denominators the same as adding fractions with unlike denominators? How is it different?



A

Rhoda mixes $1\frac{1}{2}$ cups of sand with $2\frac{2}{3}$ cups of potting mixture to prepare soil for her cactus plants. After mixing them together, how many cups of soil does Rhoda have?



You can use addition to find the total amount of soil.

B Step 1

Find $2\frac{2}{3} + 1\frac{1}{2}$.

Write equivalent fractions with a common denominator.

$$\begin{array}{r} 2\frac{2}{3} = 2\frac{4}{6} \\ + 1\frac{1}{2} = 1\frac{3}{6} \\ \hline \end{array}$$

C Step 2

Add the fractions.

$$\begin{array}{r} 2\frac{2}{3} = 2\frac{4}{6} \\ + 1\frac{1}{2} = 1\frac{3}{6} \\ \hline 3\frac{7}{6} \end{array}$$

D Step 3

Add the whole numbers.

$$\begin{array}{r} 2\frac{2}{3} = 2\frac{4}{6} \\ + 1\frac{1}{2} = 1\frac{3}{6} \\ \hline 3\frac{7}{6} \end{array}$$

Rewrite $\frac{7}{6}$ as a mixed number.

$$3\frac{7}{6} = 3 + 1\frac{1}{6} = 4\frac{1}{6}$$

Rhoda has $4\frac{1}{6}$ cups of soil.

Convince Me! Critique Reasoning Kyle used 9 as an estimate for $3\frac{1}{6} + 5\frac{7}{8}$. He got $9\frac{1}{24}$ for the exact sum. Is his calculated answer reasonable? Explain.

☆ Guided Practice

Do You Understand?

- How is adding mixed numbers like adding fractions and whole numbers?
- Look at the example on page 298. Why is the denominator 6 used in the equivalent fractions?

Do You Know How?

In 3–6, estimate and then find each sum.

$$3. \quad \begin{array}{r} 1\frac{7}{8} = 1\frac{\square}{8} \\ + 1\frac{1}{4} = 1\frac{\square}{8} \\ \hline \end{array}$$

$$4. \quad \begin{array}{r} 2\frac{2}{5} = 2\frac{\square}{30} \\ + 5\frac{5}{6} = 5\frac{\square}{30} \\ \hline \end{array}$$

$$5. \quad 4\frac{1}{9} + 1\frac{1}{3}$$

$$6. \quad 6\frac{5}{12} + 4\frac{5}{8}$$

☆ Independent Practice ☆

Leveled Practice In 7–18, estimate and then find each sum.

$$7. \quad \begin{array}{r} 3\frac{1}{6} = 3\frac{\square}{6} \\ + 5\frac{2}{3} = 5\frac{\square}{6} \\ \hline \end{array}$$

$$8. \quad \begin{array}{r} 11\frac{1}{2} = 11\frac{\square}{10} \\ + 10\frac{3}{5} = 10\frac{\square}{10} \\ \hline \end{array}$$

$$9. \quad \begin{array}{r} 9\frac{3}{16} = 9\frac{3}{16} \\ + 7\frac{5}{8} = 7\frac{\square}{\square} \\ \hline \end{array}$$

$$10. \quad \begin{array}{r} 5\frac{6}{7} = 5\frac{\square}{\square} \\ + 8\frac{1}{14} = 8\frac{1}{14} \\ \hline \end{array}$$

$$11. \quad \begin{array}{r} 4\frac{1}{10} \\ + 6\frac{1}{2} \\ \hline \end{array}$$

$$12. \quad \begin{array}{r} 9\frac{7}{12} \\ + 4\frac{3}{4} \\ \hline \end{array}$$

$$13. \quad \begin{array}{r} 5 \\ + 3\frac{1}{8} \\ \hline \end{array}$$

$$14. \quad \begin{array}{r} 8\frac{3}{4} \\ + 7\frac{3}{4} \\ \hline \end{array}$$

$$15. \quad 2\frac{3}{4} + 7\frac{3}{5}$$

$$16. \quad 3\frac{8}{9} + 8\frac{1}{2}$$

$$17. \quad 1\frac{7}{12} + 2\frac{3}{8}$$

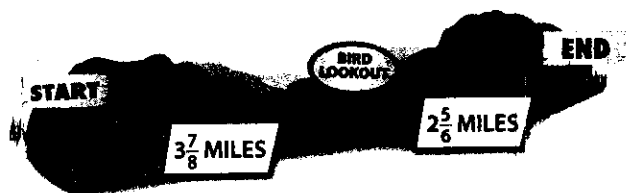
$$18. \quad 3\frac{11}{12} + 9\frac{1}{16}$$

Remember, fractions must have a common, or like, denominator before they can be added.



Problem Solving

19. Use the map to find the answer.



- What is the distance from the start to the end of the trail?
- Louise walked from the start of the trail to the bird lookout and back. Did she walk a longer or shorter distance than if she had walked from the start of the trail to the end? Explain.
- Another day, Louise walked from the start of the trail to the end. At the end, she realized she forgot her binoculars at the bird lookout. She walked from the end of the trail to the bird lookout and back. What is the total distance she walked?

20. **Higher Order Thinking** Twice a day Cameron's cat eats 4 ounces of dry cat food and 2 ounces of wet cat food. Dry food comes in 5-pound bags. Wet food comes in 6-ounce cans.

- How many cans of wet food should he buy to feed his cat for a week?
- How many ounces of wet cat food will be left over at the end of the week?
- How many days can he feed his cat from a 5-pound bag of dry food?

Remember: There are 16 ounces in a pound.



21. Julia bought 12 bags of cucumber seeds. Each bag contains 42 seeds. If she plants one half of the seeds, how many seeds does she have left?

22. **Critique Reasoning** John added $2\frac{7}{12}$ and $5\frac{2}{3}$ and got $7\frac{1}{4}$ as the sum. Is John's answer reasonable? Explain.

Assessment Practice

23. What is the missing number in the following equation?

$$3\frac{1}{3} + \frac{4}{\square} = 4\frac{2}{15}$$

24. Arnie skated $1\frac{3}{4}$ miles from home to the lake. He skated $1\frac{1}{3}$ miles around the lake, and then skated back home. Write an addition sentence to show how many miles Arnie skated in all.

Name _____



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Solve & Share
☆

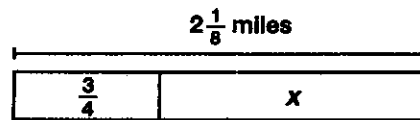
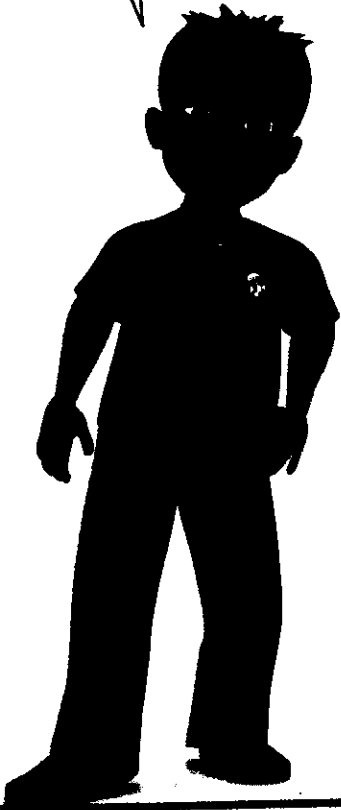
Evan walks $2\frac{1}{8}$ miles to his aunt's house. He has already walked $\frac{3}{4}$ mile. How much farther does he have to go? *Solve this problem any way you choose.*

Lesson 7-10
Subtract Mixed Numbers

I can ...
subtract mixed numbers.

© Content Standards 5.NF.A.1 Also 5.NF.A.2
Mathematical Practices MP3, MP6, MP7

Use Structure
Use what you know about
subtracting fractions.
Show your work!



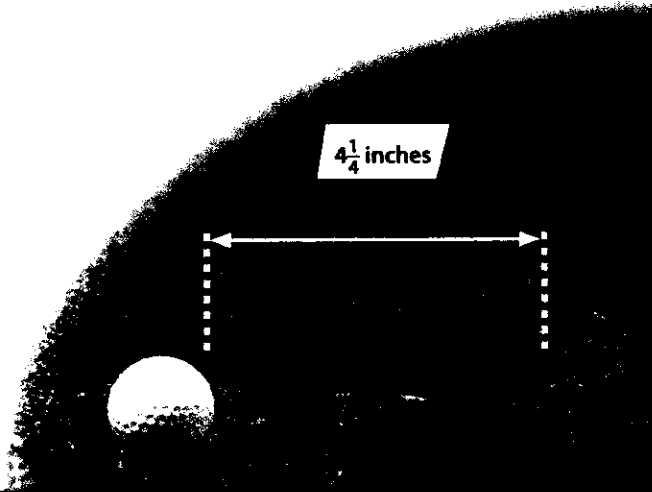
Look Back! Jon said, "Changing $\frac{3}{4}$ to $\frac{6}{8}$ makes this problem easier." What do you think Jon meant?



A

A golf ball measures about $1\frac{2}{3}$ inches across the center. What is the difference between the distance across the center of the hole and the golf ball?

You can use subtraction to find the difference.



B Step 1

Write equivalent fractions with a common denominator.



$$\begin{array}{r} 4\frac{1}{4} = 4\frac{3}{12} \\ - 1\frac{2}{3} = 1\frac{8}{12} \\ \hline \end{array}$$



Since $\frac{8}{12} > \frac{3}{12}$, you can rename 1 as $\frac{12}{12}$ to subtract.

C Step 2

Rename $4\frac{3}{12}$ to show more twelfths.



$$\begin{array}{r} 4\frac{3}{12} = 3\frac{15}{12} \\ - 1\frac{8}{12} = 1\frac{8}{12} \\ \hline \end{array}$$

D Step 3

Subtract the fractions. Then subtract the whole numbers.

$$\begin{array}{r} 4\frac{1}{4} = 4\frac{3}{12} = 3\frac{15}{12} \\ - 1\frac{2}{3} = 1\frac{8}{12} = 1\frac{8}{12} \\ \hline 2\frac{7}{12} \end{array}$$

The hole is $2\frac{7}{12}$ inches wider.

Convince Me! Critique Reasoning Estimate $8\frac{1}{3} - 3\frac{3}{4}$.

Tell how you got your estimate. Susi subtracted and found the actual difference to be $5\frac{7}{12}$. Is her answer reasonable? Explain.

Another Example

Sometimes you may have to rename a whole number to subtract.

Find the difference of $6 - 2\frac{3}{8}$.

$$\begin{array}{r}
 6 \\
 - 2\frac{3}{8} \\
 \hline
 \end{array}
 \quad \xrightarrow{\text{rename}} \quad
 \begin{array}{r}
 5\frac{8}{8} \\
 - 2\frac{3}{8} \\
 \hline
 3\frac{5}{8}
 \end{array}$$

★ Guided Practice



Do You Understand?

- In the example above, why do you need to rename the 6?
- In the example on page 306, could two golf balls fall into the hole at the same time? Explain your reasoning.

Do You Know How?

In 3–6, estimate and then find each difference.

$$\begin{array}{l}
 3. \quad 7\frac{2}{3} = 7\frac{\square}{6} = 6\frac{\square}{6} \\
 \quad \quad - 3\frac{5}{6} = 3\frac{\square}{6} = 3\frac{\square}{6} \\
 \hline
 \end{array}$$

$$\begin{array}{l}
 4. \quad 5 = \square\frac{\square}{4} \\
 \quad \quad - 2\frac{3}{4} = 2\frac{3}{4} \\
 \hline
 \end{array}$$

$$5. \quad 6\frac{3}{10} - 1\frac{4}{5}$$

$$6. \quad 9\frac{1}{3} - 4\frac{3}{4}$$

★ Independent Practice

In 7–18, estimate and then find each difference.

$$\begin{array}{l}
 7. \quad 8\frac{1}{4} = 8\frac{\square}{8} = 7\frac{\square}{8} \\
 \quad \quad - 2\frac{7}{8} = 2\frac{\square}{8} = 2\frac{\square}{8} \\
 \hline
 \end{array}$$

$$\begin{array}{l}
 8. \quad 3\frac{1}{2} = 3\frac{\square}{6} \\
 \quad \quad - 1\frac{1}{3} = 1\frac{\square}{6} \\
 \hline
 \end{array}$$

$$\begin{array}{l}
 9. \quad 4\frac{1}{8} \\
 \quad \quad - 1\frac{1}{2} \\
 \hline
 \end{array}$$

$$\begin{array}{l}
 10. \quad 6 \\
 \quad \quad - 2\frac{4}{5} \\
 \hline
 \end{array}$$

Remember to check that your answer makes sense by comparing it to the estimate.



$$1. \quad 6\frac{1}{3} - 5\frac{2}{3}$$

$$12. \quad 9\frac{1}{2} - 6\frac{3}{4}$$

$$13. \quad 8\frac{3}{16} - 3\frac{5}{8}$$

$$14. \quad 7\frac{1}{2} - \frac{7}{10}$$

$$5. \quad 15\frac{1}{6} - 4\frac{3}{8}$$

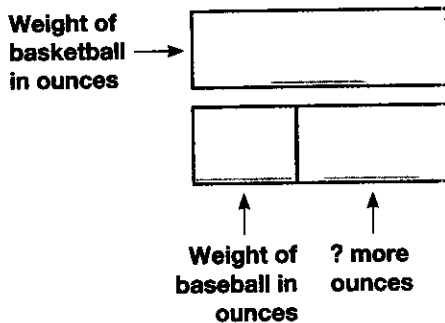
$$16. \quad 13\frac{1}{12} - 8\frac{1}{4}$$

$$17. \quad 6\frac{1}{3} - 2\frac{3}{5}$$

$$18. \quad 10\frac{5}{12} - 4\frac{7}{8}$$

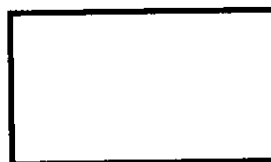
Problem Solving

19. The average weight of a basketball is $21\frac{1}{10}$ ounces. The average weight of a baseball is $5\frac{1}{4}$ ounces. How many more ounces does the basketball weigh? Write the missing numbers in the diagram.

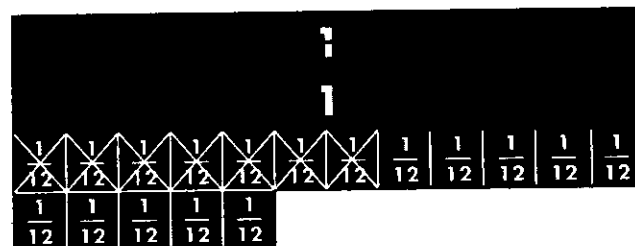


20. **enVision® STEM** The smallest mammals on Earth are the bumblebee bat and the Etruscan pygmy shrew. The length of a certain bumblebee bat is $1\frac{9}{50}$ inches. The length of a certain Etruscan pygmy shrew is $1\frac{21}{50}$ inches. How much smaller is the bat than the shrew?

21. **Be Precise** How are the purple quadrilateral and the green quadrilateral alike? How are they different?



22. **Higher Order Thinking** Sam used the model to find $2\frac{5}{12} - 1\frac{7}{12}$. Did Sam model the problem correctly? Explain. If not, show how the problem should have been modeled and find the difference.



Assessment Practice

23. Choose the correct number from the box below to complete the subtraction sentence that follows.

1 2 3 4 5

$$3\frac{5}{8} - 1\frac{\square}{4} = 2\frac{3}{8}$$

24. Choose the correct number from the box below to complete the subtraction sentence that follows.

2 4 5 10 15

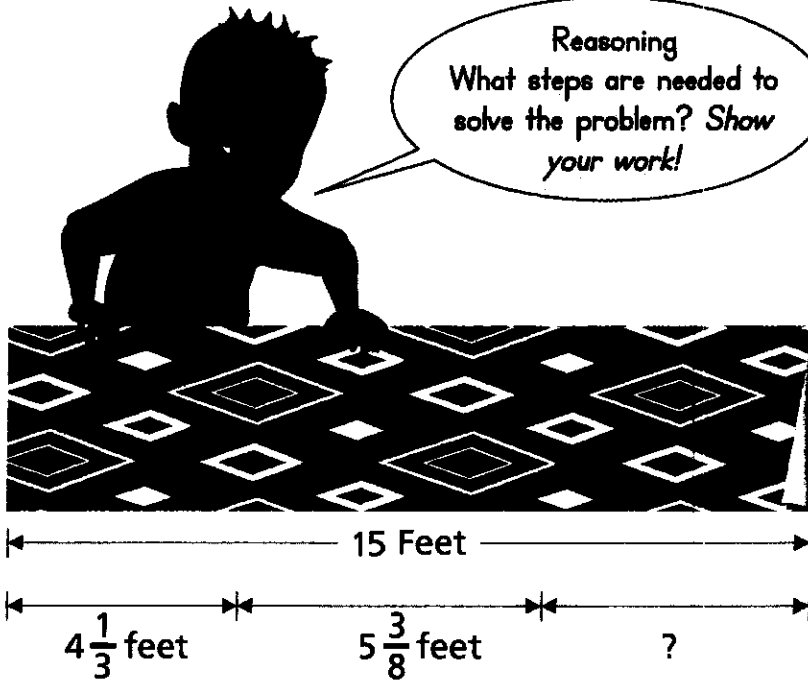
$$14\frac{1}{10} - 3\frac{1}{\square} = 10\frac{3}{5}$$

Name _____



★
Solve & Share
★

Tim has 15 feet of wrapping paper. He uses $4\frac{1}{3}$ feet for his daughter's present and $5\frac{3}{8}$ feet for his niece's present. How much wrapping paper does Tim have left? *Solve this problem any way you choose.*



Lesson 7-11
Add and Subtract
Mixed Numbers

I can ...
add and subtract mixed numbers.

© Content Standards 5.NF.A.1 Also 5.NF.A.2
Mathematical Practices MP.1, MP.2, MP.6

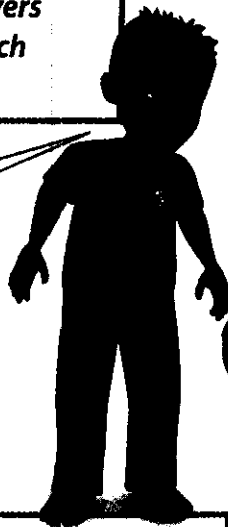
Look Back! In the problem above, how could you have estimated the amount of wrapping paper that is left?



A

Clarisse has two lengths of fabric to make covers for a sofa and chair. The covers require $9\frac{2}{3}$ yards of fabric. How much fabric will Clarisse have left?

Find a common denominator when adding and subtracting fractions.



$7\frac{5}{6}$ yards

$5\frac{3}{4}$ yards

B

Step 1

Add to find out how much fabric Clarisse has in all.

$$\begin{array}{r} 5\frac{3}{4} = 5\frac{9}{12} \\ + 7\frac{5}{6} = 7\frac{10}{12} \\ \hline 12\frac{19}{12} = 13\frac{7}{12} \end{array}$$

Clarisse has $13\frac{7}{12}$ yards of fabric in all.

C

Step 2

Subtract the amount she will use from the total length of fabric.

$$\begin{array}{r} 13\frac{7}{12} = 12\frac{19}{12} \\ - 9\frac{2}{3} = 9\frac{8}{12} \\ \hline 3\frac{11}{12} \end{array}$$

Clarisse will have $3\frac{11}{12}$ yards of fabric left.

Convince Me! Make Sense and Persevere Clarisse has $14\frac{3}{4}$ yards of fabric to cover another sofa and chair. The new sofa needs $9\frac{1}{6}$ yards of fabric and the new chair needs $4\frac{1}{3}$ yards of fabric. Estimate to decide if Clarisse has enough fabric. If so, how much fabric will she have left?

★ Guided Practice

Do You Understand?

- In the example on page 310, why do you add before you subtract?
- In the example on page 310, does Clarisse have enough fabric left over to make two cushions that each use $2\frac{1}{3}$ yards of fabric? Explain.

Do You Know How?

In 3–5, find the sum or difference.

$$\begin{array}{r}
 3. \quad 5\frac{1}{9} \\
 - 2\frac{2}{3} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 4. \quad 2\frac{1}{4} \\
 + 8\frac{2}{3} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 5. \quad 6\frac{7}{25} \\
 - 3\frac{9}{50} \\
 \hline
 \end{array}$$

In 6–9, solve. Do the addition in the parentheses first.

$$\begin{array}{r}
 6. \quad 4\frac{3}{5} + 11\frac{2}{15} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 7. \quad 8\frac{2}{3} - 3\frac{3}{4} \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 8. \quad (7\frac{2}{3} + 3\frac{4}{5}) - 1\frac{4}{15} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 9. \quad 8\frac{2}{5} - (3\frac{2}{3} + 2\frac{3}{5}) \\
 \hline
 \end{array}$$

★ Independent Practice ★

In 10–14, find each sum or difference.

$$\begin{array}{r}
 10. \quad 9\frac{1}{3} \\
 - 4\frac{1}{6} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 11. \quad 12\frac{1}{4} \\
 - 9\frac{3}{5} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 12. \quad 6\frac{3}{5} \\
 + 1\frac{3}{25} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 13. \quad 3\frac{4}{9} \\
 + 2\frac{2}{3} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 14. \quad 5\frac{31}{75} \\
 - 3\frac{2}{25} \\
 \hline
 \end{array}$$

In 15–20, solve. Do the operation in the parentheses first.

$$\begin{array}{r}
 15. \quad (2\frac{5}{8} + 2\frac{1}{2}) - 4\frac{2}{3} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 16. \quad (5\frac{3}{4} + 1\frac{5}{6}) - 6\frac{7}{12} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 17. \quad 4\frac{3}{5} + (8\frac{1}{5} - 7\frac{3}{10}) \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 8. \quad (13 - 10\frac{1}{3}) + 2\frac{2}{3} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 19. \quad (2\frac{1}{2} + 3\frac{1}{4}) - 1\frac{1}{4} \\
 \hline
 \end{array}
 \qquad
 \begin{array}{r}
 20. \quad 2\frac{3}{14} + (15\frac{4}{7} - 6\frac{3}{4}) \\
 \hline
 \end{array}$$

Problem Solving



In 21–23, use the table below.

DATA	Frog Species	Body Length (cm)	Maximum Jump (cm)
	Bullfrog	$20\frac{3}{10}$	$213\frac{1}{2}$
	Leopard frog	$12\frac{1}{2}$	$162\frac{1}{2}$
	South African sharp-nosed frog	$7\frac{3}{5}$	$334\frac{2}{5}$

21. **Be Precise** How much longer is the maximum jump of a South African sharp-nosed frog than the maximum jump of a leopard frog?
22. How many centimeters long is a bullfrog? Round to the nearest whole number.
23. **Higher Order Thinking** Which frog jumps about 10 times its body length? Explain how you found your answer.

24. **Vocabulary** Write three numbers that are **common denominators** of $\frac{7}{15}$ and $\frac{3}{5}$.

25. Marie plants 12 packages of vegetable seeds in a community garden. Each package costs \$1.97 with tax. What is the total cost of the seeds?

Assessment Practice

26. Which equations are true when $5\frac{3}{8}$ is placed in the box?

- $\square - 4\frac{1}{6} = 1\frac{1}{12}$
- $10\frac{11}{12} - 5\frac{3}{8} = \square$
- $\square + 1\frac{1}{4} = 6\frac{5}{8}$
- $3\frac{1}{8} + 1\frac{3}{4} + \frac{1}{2} = \square$

27. Which equations are true when $3\frac{1}{3}$ is placed in the box?

- $3\frac{1}{3} - \square = 0$
- $2\frac{2}{5} + \square = 5\frac{3}{8}$
- $9\frac{1}{12} - 6\frac{3}{4} = \square$
- $\square - 3\frac{1}{9} = \frac{2}{9}$

Name _____



Activity

☆ **Solve & Share** ☆

Sasha walked $\frac{1}{2}$ mile every day for 5 days. How far did she walk? Draw a picture or use any model to help you solve the problem.

Model with Math
What are some different ways you can model multiplication problems?



Lesson 8-1

Multiply a Fraction by a Whole Number

I can ...
multiply a fraction by a whole number.

© Content Standards 5.NF.B.4a Also 5.NF.B.6
Mathematical Practices MP.3, MP.4, MP.7

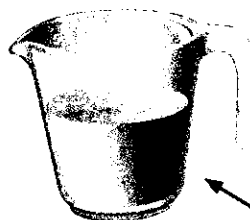
Look Back! How does using a model help you multiply a fraction by a whole number?



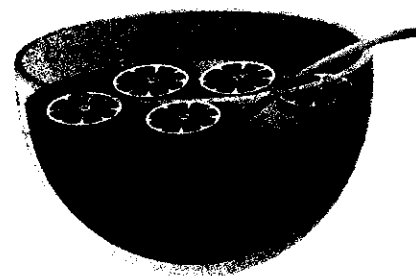
A

Joann wants to make 6 batches of fruit punch. How many cups of orange juice does she need?

I need to find $6 \times \frac{2}{3}$.

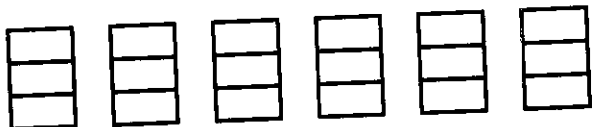


$\frac{2}{3}$ cup of orange juice for each batch



B

One way to represent $6 \times \frac{2}{3}$ is to use repeated addition.



$$\begin{aligned} 6 \times \frac{2}{3} &= \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} + \frac{2}{3} \\ &= \frac{6 \times 2}{3} \\ &= \frac{12}{3} \end{aligned}$$

$$\text{So, } 6 \times \frac{2}{3} = \frac{12}{3} = 4.$$

C

You can think of $\frac{2}{3}$ as 2 times $\frac{1}{3}$.

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

$$\text{So, } 6 \times \frac{2}{3} = 6 \times \left(2 \times \frac{1}{3} \right).$$

Use the Associative Property.

$$\begin{aligned} 6 \times \left(2 \times \frac{1}{3} \right) &= (6 \times 2) \times \frac{1}{3} \\ &= 12 \times \frac{1}{3} \\ &= \frac{12}{3} = 4 \end{aligned}$$

Joann needs 4 cups of orange juice to make 6 batches of punch.

Convince Me! Use Structure Find $10 \times \frac{3}{5}$. Use repeated addition to check your answer. Show all of your work.

☆ Guided Practice

Do You Understand?

1. Explain why $8 \times \frac{3}{4}$ is the same as adding $\frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4} + \frac{3}{4}$.

2. Find $2 \times \frac{3}{5}$. Shade the model to help solve.



Do You Know How?

3. Find $3 \times \frac{2}{3}$ using repeated addition.

4. Find $6 \times \frac{3}{4}$ using the Associative Property.

☆ Independent Practice ☆

Leveled Practice In 5–7, complete each equation to find the product.

$$5. 6 \times \frac{3}{4} = \frac{\square}{\square} + \frac{\square}{\square} + \frac{\square}{\square} + \frac{\square}{\square} + \frac{\square}{\square} + \frac{\square}{\square} = \frac{\square \times \square}{\square} = \frac{18}{4} = \square$$

$$6. 16 \times \frac{3}{8} = 16 \times \square \times \frac{1}{8} = \frac{\square \times 1}{8} = \frac{\square}{\square} = \square$$

$$7. 500 \times \frac{2}{5} = \square \times 2 \times \frac{\square}{5} = \frac{\square \times 1}{5} = \frac{1,000}{\square} = \square$$

In 8–15, find each product. Use models to help, if necessary.

8. $35 \times \frac{2}{5}$

9. $7 \times \frac{5}{12}$

10. $9 \times \frac{2}{3}$

11. $300 \times \frac{1}{2}$

12. $64 \times \frac{3}{8}$

13. $900 \times \frac{2}{3}$

14. $84 \times \frac{1}{4}$

15. $42 \times \frac{2}{7}$

Problem Solving

16. **Higher Order Thinking** Explain how you would find $36 \times \frac{3}{4}$ mentally.

17. Each lap around a track is $\frac{5}{6}$ kilometer. Samantha drove around the track 24 times. How far did Samantha drive?

18. Drake is making capes. He uses $\frac{1}{3}$ yard of fabric for each cape he makes. What is the total amount of fabric Drake needs to make 96 capes?

19. Bradley is making fruit salad. For each bowl of fruit salad, he needs $\frac{3}{4}$ cup of grapes. How many cups of grapes will he use if he makes 24 bowls of fruit salad?

20. **Construct Arguments** Do you think the difference $1.4 - 0.95$ is less than 1 or greater than 1? Explain.

21. Write a multiplication expression that shows 10^6 .

22. The table shows the number of miles each person ran this week. Who ran more miles by the end of the week? How many more?

	Monday	Wednesday	Saturday
Pat	2.75 mi	3 mi	2.5 mi
Toby	2 mi	2.25 mi	3.5 mi

Assessment Practice

23. Select all equations that would be made true with the fraction $\frac{3}{8}$.

- $96 \times \square = 36$
- $38 \times \square = 14$
- $16 \times \square = 6$
- $56 \times \square = 21$

24. Select all equations that would be made true with the number 56.

- $\square \times \frac{1}{2} = 28$
- $\square \times \frac{2}{7} = 16$
- $\square \times \frac{8}{9} = 49$
- $\square \times \frac{1}{4} = 14$

Solve & Share

Brandon has 6 eggs. He needs $\frac{2}{3}$ of the eggs to make an omelet. How many eggs does he need?

Model with Math
Would a drawing help you picture the situation?



Multiply a Whole Number by a Fraction

I can ...

multiply a whole number by a fraction.

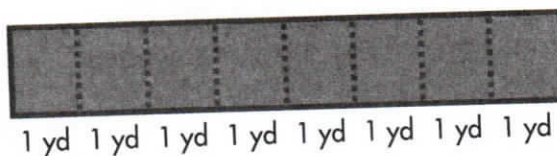
© Content Standards 5.NF.B.4a Also 5.NF.B.6
Mathematical Practices MP.3, MP.4

Look Back! Should your answer be less than or greater than 6? How do you know?



A

Claudia has 8 yards of fabric. She needs $\frac{3}{4}$ of the fabric to make a banner. How many yards of fabric does she need?



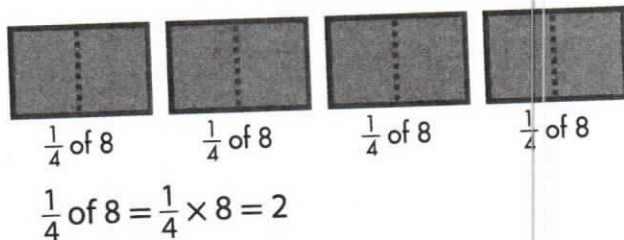
You can use models to represent the problem.



You need to find $\frac{3}{4}$ of 8.

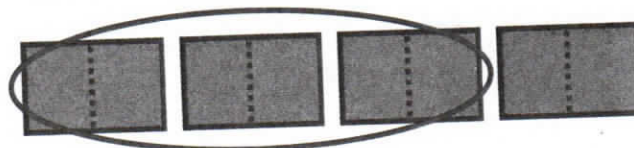
B Step 1

Since you are finding $\frac{3}{4}$ of 8, divide the model into 4 equal parts.



C Step 2

Since you are finding $\frac{3}{4}$ of 8, take 3 of those parts to make 6.



$$\frac{3}{4} \times 8 = (3 \times \frac{1}{4}) \times 8 = 3 \times (\frac{1}{4} \times 8)$$

$$= 3 \times 2 = 6$$

So, $\frac{3}{4} \times 8 = 6$.

Claudia needs 6 yards of fabric to make a banner.

Convince Me! Model with Math

Here is how Lydia found the product $\frac{4}{5} \times 10$.

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

$$= 4 \times \frac{10}{5}$$

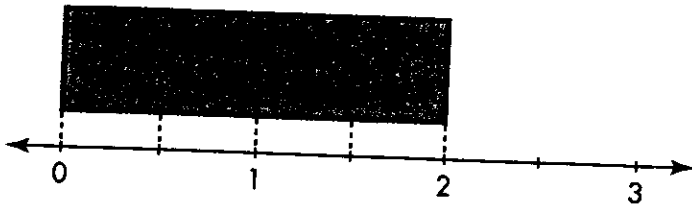
$$= 4 \times 2 = 8$$




Use the model at the right to show that Lydia's answer is correct.

Another ExampleFind $\frac{3}{4} \times 2$.

Divide 2 into 4 equal parts.

Each part is $\frac{1}{2}$. So 3 parts make $\frac{3}{2}$.

So, $\frac{3}{4} \times 2 = \frac{3}{2}$.


 Think three-fourths of 2 wholes.

 ☆ **Guided Practice**
Do You Understand?

1. Explain why the product of $4 \times \frac{2}{3}$ is the same as the product of $\frac{2}{3} \times 4$.
2. In the problem at the top of page 338, what multiplication equation could be used to find how many yards of fabric Claudia did not use?

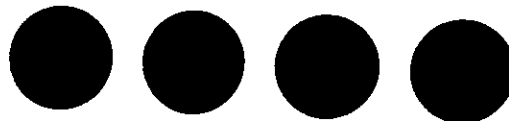
Do You Know How?

In 3 and 4, use the model to find each product.

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



4. $\frac{3}{8} \times 4$


 ☆ **Independent Practice** ☆

In 5–7, find each product. Draw models to help.

5. $\frac{2}{3} \times 15$

6. $\frac{11}{12} \times 6$

7. $\frac{5}{8} \times 16$

Problem Solving

8. **Construct Arguments** Janice said that when you multiply a fraction less than 1 by a nonzero whole number, the product is always less than the whole number. Do you agree? Explain.

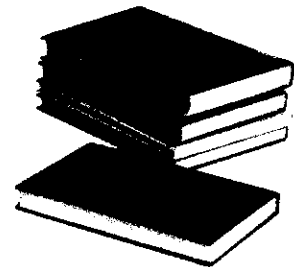
9. **enVision® STEM** A scientist wants to find out how the properties of water change when salt is added to it. For every cup of water she has, she replaces $\frac{1}{8}$ of it with salt. If she has 24 cups of water, how many cups will she replace with salt?

10. Shanna attends school for 1 week longer than $\frac{3}{4}$ of the year. How many weeks in a year does Shanna attend school?



11. **Higher Order Thinking** Gina has 48 stickers. $\frac{3}{8}$ of the stickers have pictures of flowers. $\frac{1}{8}$ of the stickers have pictures of plants. The rest of the stickers have pictures of people. How many stickers have pictures of people? Explain how you found your answer.

12. Two paperback books cost a total of \$10. How much change will Stacy get if she buys two hardcover books and two paperback books and gives the clerk three \$20 bills?



Sale: Hardcover books, \$18.25 each

Assessment Practice

13. Select each expression that has a product of 12.

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

$\frac{5}{12} \times 12$

$\frac{2}{5} \times 30$

$\frac{2}{3} \times 15$

14. Select each equation that would be made true with the number 4.

$\frac{2}{3} \times \square = \frac{8}{3}$

$\frac{5}{6} \times \square = 10$

$\frac{1}{12} \times \square = \frac{1}{3}$

$\frac{3}{8} \times \square = \frac{3}{2}$

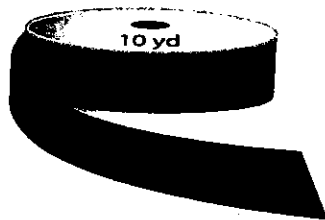
Name _____



Activity

☆ ☆
Solve & Share

Julie has 10 yards of ribbon. She divides the ribbon into 3 equal pieces and uses 2 of the pieces on gifts. How much ribbon does she use? *Solve this problem any way you choose.*



Lesson 8-3
Multiply Fractions and Whole Numbers

I can ...
multiply fractions and whole numbers.

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Mathematical Practices MP3, MP4, MP6



Model with Math You can use words, pictures, and equations to solve the problem. *Show your work in the space above!*

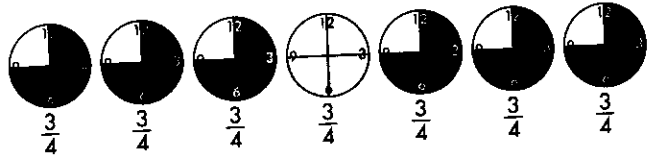
Look Back! Should the answer be less than or greater than 5? How do you know?



How Can You Multiply Fractions and Whole Numbers?

A

Hal spent $\frac{3}{4}$ hour reading each day for 7 days. How much total time did he spend reading?



$\frac{3}{4}$ hours reading each day for 7 days

I need to find $7 \times \frac{3}{4}$.



B Multiply to find the number of fourths.

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

$$= 21 \times \frac{1}{4}$$

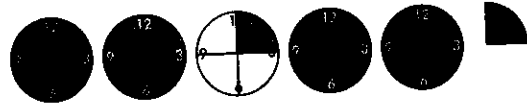
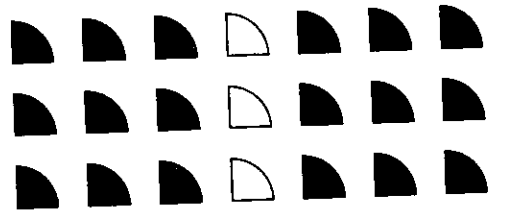
$$= \frac{21}{4}$$

Rewrite as a mixed number.

$$\frac{21}{4} = 5\frac{1}{4}$$

Hal spent $5\frac{1}{4}$ hours reading.

To rename $\frac{21}{4}$, divide the numerator by the denominator.



$$7 \times \frac{3}{4} = 5\frac{1}{4}$$



Convince Me! Be Precise What are the products $\frac{4}{9} \times 6$ and $6 \times \frac{4}{9}$?

☆ Guided Practice

Do You Understand?

1. What is $\frac{3}{4}$ of a ribbon that is 7 feet long?
2. Explain how $\frac{3}{4} \times 7$, $7 \times \frac{3}{4}$, and $3 \times \frac{7}{4}$ are all related.

Do You Know How?

In 3–5, find each product. Write the product as a mixed number.

$$3. \frac{3}{8} \times 4 = \frac{\square \times \square}{\square} = \frac{\square}{\square} = \square \frac{\square}{\square} = \square \frac{\square}{\square}$$

$$4. 8 \times \frac{5}{6} = \frac{\square \times \square}{\square} = \frac{\square}{\square} = \square \frac{\square}{\square} = \square \frac{\square}{\square}$$

$$5. 5 \times \frac{4}{7} = \frac{\square \times \square}{\square} = \frac{\square}{\square} = \square \frac{\square}{\square} = \square \frac{\square}{\square}$$

☆ Independent Practice ☆

Leveled Practice In 6–16, find each product. Write the product as a mixed number.

$$6. \frac{3}{4} \times 14 = \frac{\square \times \square}{\square} = \frac{\square}{\square} = \square \frac{\square}{\square} = \square \frac{\square}{\square}$$

$$7. 600 \times \frac{2}{3} = \frac{\square \times \square}{\square} = \frac{\square}{\square} = \square$$

$$8. \frac{5}{9} \times 37 = \frac{\square \times \square}{\square} = \frac{\square}{\square} = \square \frac{\square}{\square}$$

$$9. \frac{4}{5} \times 500$$

$$10. 5 \times \frac{2}{3}$$

$$11. 17 \times \frac{6}{8}$$

$$12. \frac{9}{10} \times 25$$

$$13. \frac{7}{8} \times 320$$

$$14. 28 \times \frac{7}{12}$$

$$15. \frac{2}{3} \times 1,287$$

$$16. 900 \times \frac{2}{9}$$

Remember: You can use division to rename a fraction as a mixed number.



Problem Solving

17. About 0.6 of the human body is made up of water. If a person has a mass of 75 kilograms, what is the mass of the water in this person's body?

18. **Number Sense** How can you use mental math to find $25 \times \frac{3}{10}$?

19. During a nature walk, Jill identified 20 species of animals and plants.

a **Construct Arguments** Jill said that $\frac{1}{3}$ of the species she identified were animals. Can this be correct? Explain.

b If $\frac{3}{5}$ of the species Jill identified were animals, how many plants did Jill identify?

20. A rectangular painting is 2 feet long and $\frac{5}{6}$ foot wide. What is the area of the painting?



21. **Higher Order Thinking** An art teacher makes a batch of purple paint by mixing $\frac{3}{4}$ cup red paint with $\frac{3}{4}$ cup blue paint. If she mixes 13 batches, how many cups of purple paint will she have?

22. **enVision® STEM** A water molecule is made up of 3 atoms. One third of the atoms are oxygen and the remaining atoms are hydrogen. If there are 114 water molecules, how many hydrogen atoms are there? Show your work.

Assessment Practice

23. Select all that are true.

- $4 \times \frac{3}{5} = 2\frac{2}{5}$
- $\frac{2}{9} \times 18 = \frac{1}{81}$
- $14 \times \frac{3}{7} = 6$
- $\frac{2}{3} \times 6 = \frac{1}{9}$

24. Select all that are true.

- $\frac{3}{4} \times 2 = \frac{3}{8}$
- $\frac{11}{2} \times 4 = 22$
- $5 \times \frac{2}{3} = 3\frac{1}{3}$
- $8 \times \frac{3}{4} = \frac{3}{32}$

Name _____



Lesson 8-4

Use Models to Multiply Two Fractions

Solve & Share

The art teacher gave each student half of a sheet of paper. Then she asked the students to color one fourth of their pieces of paper. What part of the original sheet did the students color? *Solve this problem any way you choose.*

I can ...

use models to multiply two fractions.

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Mathematical Practices MP.1, MP.2, MP.4



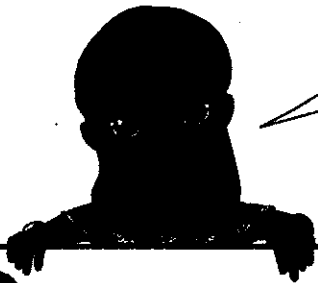
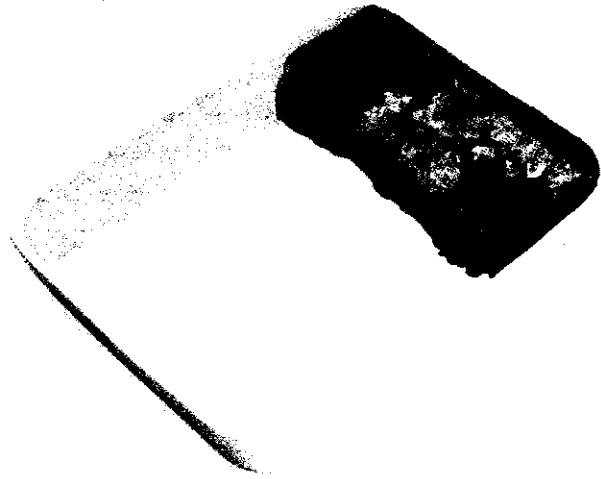
You can draw a picture to represent the problem.

Look Back! Reasoning Should your answer be less than or greater than 1? How do you know?



A

There was $\frac{1}{4}$ of a pan of lasagna left. Tom ate $\frac{1}{3}$ of this amount. What fraction of a whole pan of lasagna did he eat?



Find $\frac{1}{3}$ of $\frac{1}{4}$ to solve the problem.

B One Way

Divide one whole into fourths.

Divide $\frac{1}{4}$ into 3 equal parts.

Divide the other $\frac{1}{4}$ into 3 equal parts.



12 parts make one whole, so one part is $\frac{1}{12}$.

$$\frac{1}{3} \times \frac{1}{4} = \frac{1}{12}$$

C Another Way

Shade 1 of the 3 rows yellow to represent $\frac{1}{3}$.
Shade 1 of the 4 columns red to represent $\frac{1}{4}$.

The orange overlap shows the product.

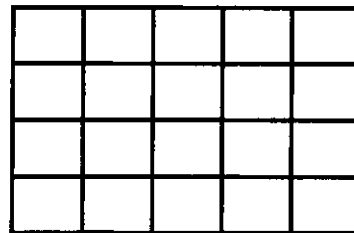


1 out of 12 parts are shaded orange.

$$\frac{1}{3} \times \frac{1}{4} = \frac{1 \times 1}{3 \times 4} = \frac{1}{12}$$

Tom ate $\frac{1}{12}$ of the pan of lasagna.

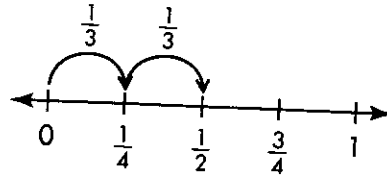
Convince Me! Reasoning Find $\frac{1}{4} \times \frac{1}{5}$ using the model. Explain your work.



Another Example

Find $\frac{2}{3} \times \frac{3}{4}$ using a number line.

$\frac{1}{3}$ means 1 of 3 equal parts, so $\frac{1}{3}$ of $\frac{3}{4}$ is $\frac{1}{4}$.
 $\frac{2}{3}$ means 2 of 3 equal parts, so $\frac{2}{3}$ of $\frac{3}{4}$ is 2 times $\frac{1}{4}$.
 $\frac{2}{3} \times \frac{3}{4} = \frac{2}{4}$ or $\frac{1}{2}$



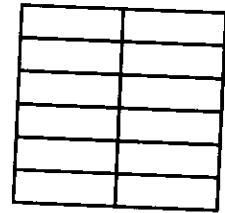
☆ Guided Practice

Do You Understand?

- Use the model in Box C on page 346 to find $\frac{2}{3} \times \frac{2}{4}$.
- Create a story problem for $\frac{2}{3} \times \frac{2}{4}$.

Do You Know How?

- Find $\frac{5}{6} \times \frac{1}{2}$. Shade the model to help solve.
- Find $\frac{3}{4}$ of $\frac{4}{9}$.



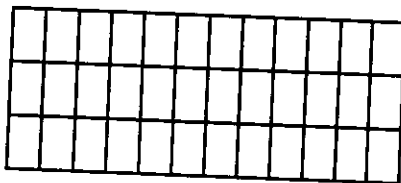
☆ Independent Practice ☆

In 5–6, find each product. Shade the model to help solve.

5. $\frac{1}{3} \times \frac{5}{6}$



6. $\frac{2}{3} \times \frac{1}{12}$



In 7–14, find each product. Use models to help.

7. $\frac{7}{8} \times \frac{1}{2}$

8. $\frac{2}{5} \times \frac{1}{12}$

9. $\frac{5}{7}$ of $\frac{7}{9}$

10. $\frac{1}{2} \times \frac{3}{4}$

11. $\frac{1}{4} \times \frac{7}{8}$

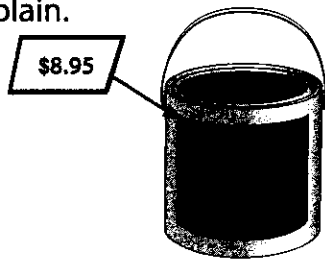
12. $\frac{5}{6}$ of $\frac{9}{10}$

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

14. $\frac{1}{3}$ of $\frac{3}{7}$

Problem Solving

15. **Make Sense and Persevere** Will \$50 be enough to buy 6 cans of paint? Explain.



16. A scientist had $\frac{3}{4}$ of a bottle of a solution. She used $\frac{1}{6}$ of the solution in an experiment. How much of the bottle did she use?

17. **Algebra** What value of n makes the equation $\frac{2}{3} \times n = \frac{4}{9}$ true?

18. Write an expression that shows 10^4 .

19. A plumber charges \$45 for the first hour and \$30 for each additional hour. How much does he charge if it takes him 4 hours to make a repair?

20. **Higher Order Thinking** If $\frac{7}{8}$ is multiplied by $\frac{4}{5}$, will the product be greater than either of the two factors? Explain.

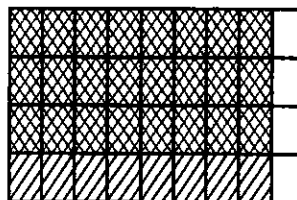
21. In the voting for City Council Precinct 5, only $\frac{1}{2}$ of all eligible voters cast votes. What fraction of all eligible voters voted for Shelley? Morgan? Who received more votes?

Candidate	Fraction of Votes Received
Shelley	$\frac{3}{10}$
Morgan	$\frac{5}{8}$

Assessment Practice

22. Majid made the model to show multiplying a fraction by a fraction. Which multiplication equation does the model show?

- (A) $\frac{3}{4} \times \frac{8}{9} = \frac{2}{3}$
 (B) $\frac{1}{3} \times \frac{1}{8} = \frac{1}{24}$
 (C) $\frac{3}{4} \times \frac{3}{9} = \frac{1}{4}$
 (D) $\frac{3}{9} \times \frac{8}{9} = \frac{8}{27}$



Name _____



Lesson 8-5

Multiply Two Fractions

★ Solve & Share ★

On Dan's eReader, $\frac{2}{3}$ of the books are fiction. Of the fiction books, $\frac{4}{5}$ are mysteries. What fraction of the books on Dan's eReader are mysteries? *Solve this problem any way you choose.*

I can ...
multiply two fractions.

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Mathematical Practices MP4, MP6

You can model with math by writing a multiplication sentence to solve the problem.



Look Back! What fraction of the books are not mysteries? Explain.



How Can You Find the Product of Two Fractions?

A

Amelia takes pictures with her smartphone. Of the pictures, $\frac{5}{6}$ are of animals. What fraction of all her pictures are of dogs?

$\frac{3}{4}$ of her animal photos are of dogs.



You need to find $\frac{3}{4}$ of $\frac{5}{6}$ to answer the question.

B Step 1

Estimate $\frac{3}{4} \times \frac{5}{6}$.

Since both fractions are less than 1, the product will be less than 1.

C Step 2

Multiply the numerators. Then multiply the denominators.

$$\begin{aligned} \frac{3}{4} \times \frac{5}{6} &= \frac{3 \times 5}{4 \times 6} \\ &= \frac{15}{24} \end{aligned}$$

Since $\frac{15}{24} < 1$, the answer is reasonable.

So, $\frac{15}{24}$ or $\frac{5}{8}$ of all Amelia's pictures have dogs in them.

$\frac{15}{24}$ and $\frac{5}{8}$ are equivalent fractions.

Convince Me! Model with Math $\frac{1}{10}$ of the animal pictures on Amelia's smartphone are of cats. Write and solve an equation to find what fraction of all her pictures have cats in them.

☆ Guided Practice

Do You Understand?

- Is the product of $\frac{3}{6} \times \frac{5}{4}$ equal to the product of $\frac{3}{4} \times \frac{5}{6}$? Explain how you know.
- How is adding $\frac{3}{9}$ and $\frac{6}{9}$ different from multiplying the two fractions? Explain.

Do You Know How?

In 3–10, find each product.

- | | |
|--------------------------------------|---------------------------------------|
| 3. $\frac{2}{3} \times \frac{1}{2}$ | 4. $\frac{5}{9}$ of $\frac{1}{9}$ |
| 5. $\frac{7}{10} \times \frac{3}{4}$ | 6. $\frac{1}{3} \times \frac{1}{4}$ |
| 7. $\frac{5}{6}$ of $\frac{3}{7}$ | 8. $\frac{3}{5} \times \frac{11}{12}$ |
| 9. $\frac{4}{10} \times \frac{2}{5}$ | 10. $\frac{3}{4} \times \frac{2}{9}$ |

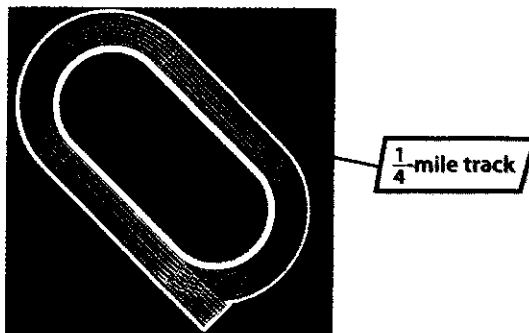
☆ Independent Practice ☆

In 11–30, find each product.

- | | | | |
|--|--|---|--|
| 11. $\frac{9}{10} \times \frac{1}{2}$ | 12. $\frac{5}{6} \times \frac{1}{3}$ | 13. $\frac{4}{7}$ of $\frac{7}{9}$ | 14. $\frac{3}{4} \times \frac{4}{5}$ |
| 15. $\frac{2}{3} \times \frac{7}{8}$ | 16. $\frac{5}{6}$ of $\frac{11}{12}$ | 17. $\frac{1}{3}$ of $\frac{3}{4}$ | 18. $\frac{6}{7} \times \frac{3}{8}$ |
| 19. $\frac{2}{5}$ of $\frac{5}{12}$ | 20. $\frac{2}{3} \times \frac{4}{5}$ | 21. $\frac{1}{2} \times \frac{1}{2}$ | 22. $\frac{1}{2}$ of $\frac{8}{9}$ |
| 23. $(\frac{1}{6} + \frac{1}{6}) \times \frac{3}{4}$ | 24. $(\frac{3}{7} + \frac{2}{7}) \times \frac{2}{3}$ | 25. $\frac{1}{2} \times (\frac{1}{3} + \frac{1}{3})$ | 26. $(\frac{9}{10} - \frac{3}{10}) \times \frac{1}{4}$ |
| 27. $\frac{2}{3} \times (\frac{3}{5} + \frac{1}{5})$ | 28. $(\frac{8}{9} - \frac{1}{3}) \times \frac{3}{4}$ | 29. $(\frac{5}{12} + \frac{1}{6}) \times \frac{5}{6}$ | 30. $\frac{11}{12} \times (\frac{3}{4} - \frac{1}{2})$ |

Problem Solving

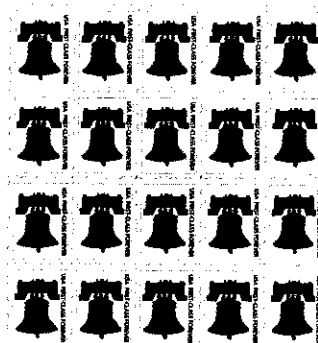
31. Eduardo runs 6 laps around the track at Lincoln Park School. Then he runs $3\frac{1}{2}$ miles to get home. How far will he run in all? Show your work.



32. **Be Precise** To amend the U.S. Constitution, $\frac{3}{4}$ of the 50 states must approve the amendment. If 35 states approve an amendment, will the Constitution be amended?

33. **Higher Order Thinking** In Ms. Barclay's classroom, $\frac{2}{5}$ of the students play chess. Of the students who play chess, $\frac{5}{6}$ also play sudoku. If there are 30 students in her class, how many play chess and sudoku?

34. One sheet of stamps is shown at the right. Emma needs to buy 50 stamps to send out invitations for her graduation party. Will 2 sheets of stamps be enough? How do you know?



Assessment Practice

35. Choose all the expressions that have $\frac{3}{4}$ as a product.

- $\frac{1}{2} \times \frac{1}{2}$
 $\frac{9}{10} \times \frac{5}{6}$
 $\frac{7}{8} \times \frac{6}{7}$
 $\frac{3}{4} \times \frac{3}{4}$
 $\frac{1}{4} \times \frac{1}{2}$

36. Choose all the multiplication sentences that have $\frac{1}{3}$ as the missing part.

- $\frac{4}{5} \times \frac{5}{12} =$
 $\frac{1}{4} \times = \frac{1}{6}$
 $\frac{7}{8} \times = \frac{7}{24}$
 $\frac{5}{6} \times \frac{2}{5} =$
 $\frac{1}{6} \times \frac{2}{3} =$

Name _____



Activity

Lesson 11-1

Model Volume

Solve & Share

Gina is building a rectangular prism out of sugar cubes for her art class project. She started by drawing a diagram of the rectangular prism that is 4 cubes high, 4 cubes long and 2 cubes wide. How many cubes does she use to make the prism? *Solve this problem any way you choose.*

I can ...

find the volume of solid figures.

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Mathematical Practices MP.2, MP.5

Use Appropriate Tools

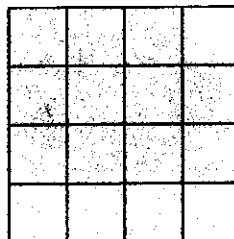
You can use cubes to build a rectangular prism and then draw a picture to show the different faces. *Show your work!*



Side View



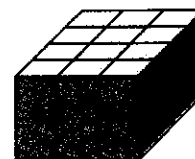
Front View



Top View



Look Back! Gina decided to change her art project and build a rectangular prism that is 3 cubes long, 4 cubes wide, and 2 cubes high. Use the picture to determine the number of cubes she used.



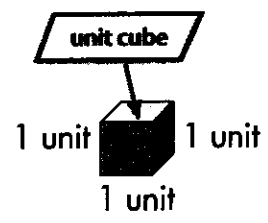
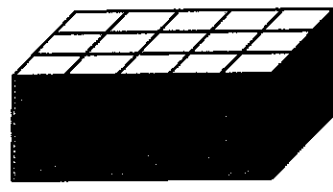
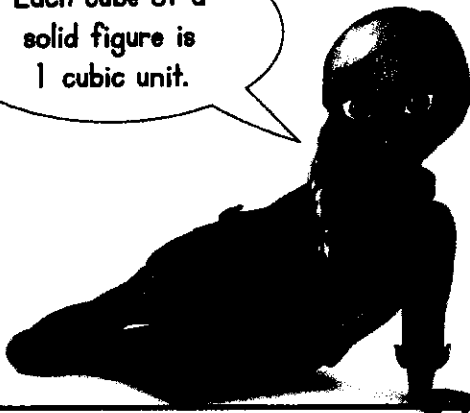
Essential Question

How Can You Measure Space Inside a Solid Figure?

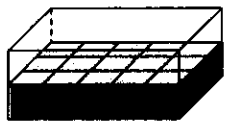
A

Volume is the number of cubic units needed to pack a solid figure without gaps or overlaps. A cubic unit is the volume of a cube measuring 1 unit on each edge. What is the volume of this rectangular prism?

Each cube of a solid figure is 1 cubic unit.

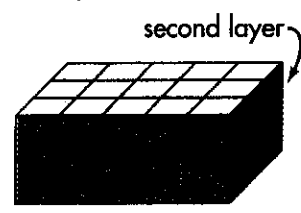


B Use unit cubes to make a model.



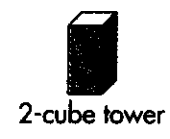
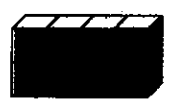
Count the number of cubes.
There are 15 unit cubes in the bottom layer. The volume of the bottom layer is 15 cubic units.

C There are two layers.



Multiply the volume of the bottom layer by 2.
The volume of the prism is 2×15 or 30 cubic units.

Convince Me! Reasoning In the picture below, how many unit cubes does it take to make the rectangular prism below without gaps or overlaps? How many 2-cube towers does it take to make the rectangular prism?



☆ Guided Practice

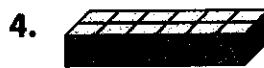
Do You Understand?

1. Make a model of a rectangular prism with a bottom layer that is 3 cubes long by 3 cubes wide. Make a top layer that is the same as the bottom layer. Then draw a picture of your model. What is the volume?

2. **Vocabulary** What is the difference between a unit cube and a cubic unit?

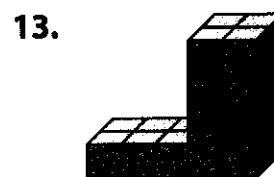
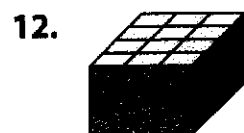
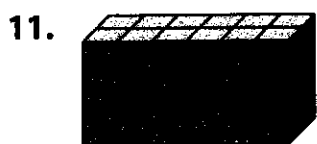
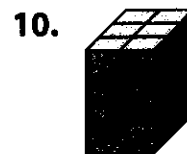
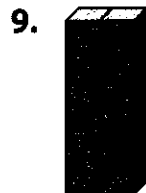
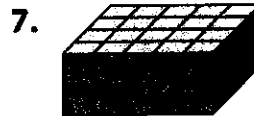
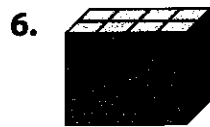
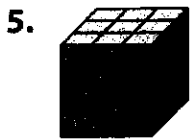
Do You Know How?

In 3 and 4, use unit cubes to make a model of each rectangular prism. Find the volume.



☆ Independent Practice ☆

In 5–13, find the volume of each solid. Use unit cubes to help.



Problem Solving [☆]

In 14–18, use the table.

Compare the volumes of the prisms.
Write $>$, $<$, or $=$ for each \bigcirc .

14. Prism A \bigcirc Prism B

15. Prism B \bigcirc Prism C

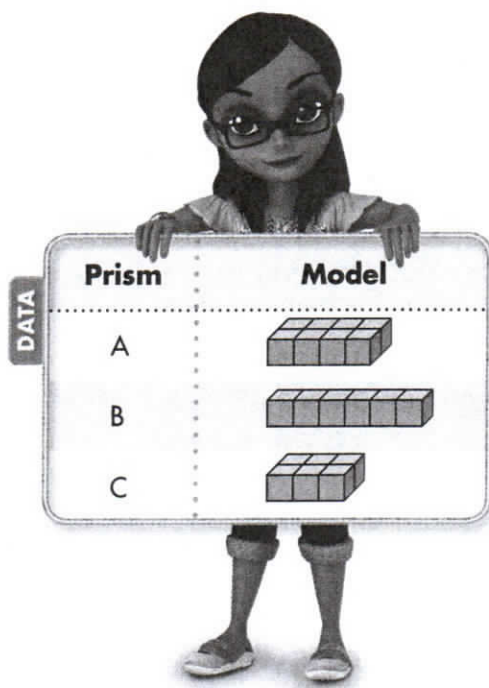
16. Prism C \bigcirc Prism A

17. If you added another layer of unit cubes on top of Prism A, what would the volume of the new solid be in cubic units?

18. If you put Prism C on top of Prism A, what would the volume of the new solid be in cubic units?

19. **Reasoning** In an election, 471 people voted. Candidate B received $\frac{2}{3}$ of the votes. How many votes did Candidate B receive?

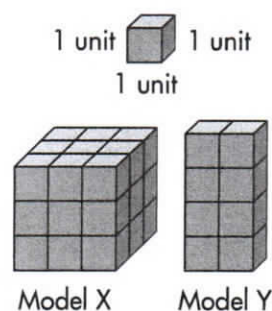
20. **Higher Order Thinking** Ms. Kellson's storage closet is 3 feet long, 3 feet wide, and 7 feet high. Can she fit 67 boxes that each have a volume of 1 cubic foot in her closet? Explain your answer.



Assessment Practice

21. Natalie made the solid figures shown using unit cubes. Which statement about these models is true?

- (A) Model X and Model Y have the same volume.
- (B) The volume of Model X is 9 cubic units greater than the volume of Model Y.
- (C) The volume of Model X is 19 cubic units greater than the volume of Model Y.
- (D) The volume of Model X and Model Y combined is 45 cubic units.



Name _____



Solve & Share

Kevin needs a new aquarium for his fish. The pet store has a fish tank in the shape of a rectangular prism that measures 5 feet long by 2 feet wide by 4 feet high. Kevin needs a fish tank that has a volume of at least 35 cubic feet. Will this fish tank be big enough? *Solve this problem any way you choose.*

Read the problem carefully to make sure that you understand what you are trying to find. *Show your work!*



Lesson 11-2

Develop a Volume Formula

I can ...

find the volume of rectangular prisms using a formula.

© Content Standards 5.MD.C.4, 5.MD.C.5a, 5.MD.C.5b

Mathematical Practices MP.2, MP.3

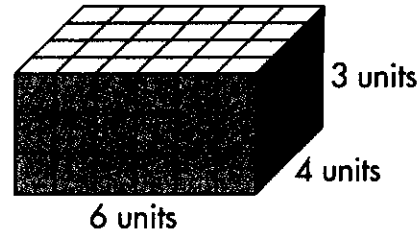
Look Back! Critique Reasoning Malcolm says the volume of the aquarium would change if its dimensions were 2 feet long, 4 feet wide, and 5 feet high. Do you agree? Explain.



A

Remember that volume is the number of cubic units (units^3) needed to pack a solid figure without gaps or overlaps.

Find the volume of the rectangular prism if each cubic unit represents 1 cubic foot.



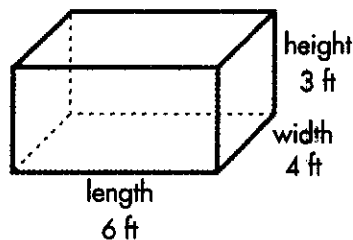
You can find the volume of a rectangular prism by counting cubes or using a formula.

A formula is a rule that uses symbols to relate two or more quantities.

B If the dimensions of a rectangular prism are given as length ℓ , width w , and height h , then use this formula to find the volume V :

Volume = length \times width \times height

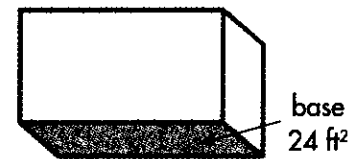
$$\begin{aligned} V &= \ell \times w \times h \\ V &= (6 \times 4) \times 3 \\ V &= 24 \times 3 \\ V &= 72 \end{aligned}$$



The volume of the rectangular prism is 72 cubic feet or 72 ft^3 .

C Another formula for the volume of a rectangular prism is $V = b \times h$, where b is the area of the base.

$$\begin{aligned} V &= b \times h \\ V &= 24 \times 3 \\ V &= 72 \text{ ft}^3 \end{aligned}$$



Convince Me! Reasoning Give the dimensions of a different rectangular prism that also has a volume of 72 ft^3 . Explain how you decided.

★ Guided Practice

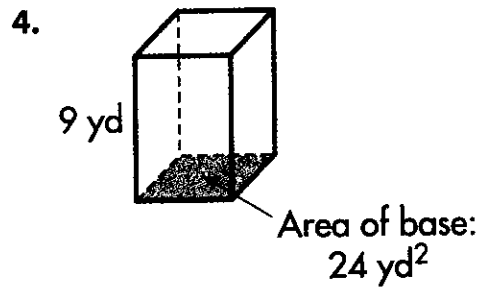
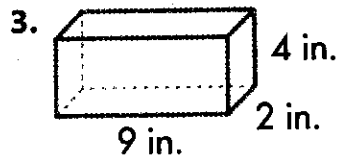


Do You Understand?

1. In the example on page 462, could you first multiply the width by the height? Explain.
2. A wooden block measures 5 centimeters tall, 3 centimeters wide, and 2 centimeters long. The area of the base is 6 centimeters. Draw a rectangular prism to show the block and label it. What is the volume of the block?

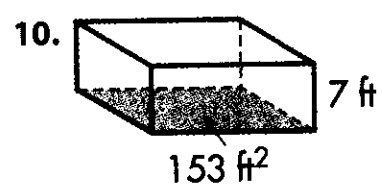
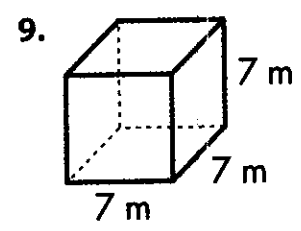
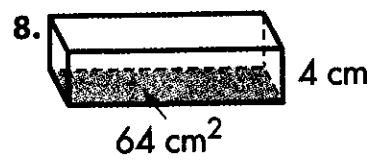
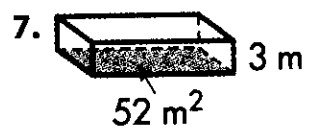
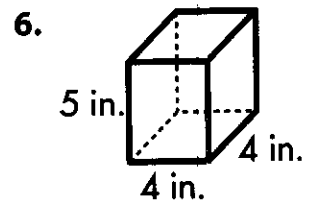
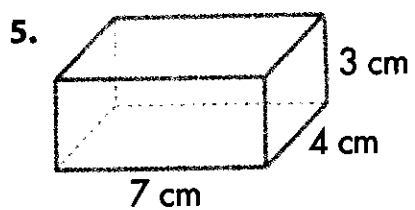
Do You Know How?

In 3 and 4, find the volume of each rectangular prism.



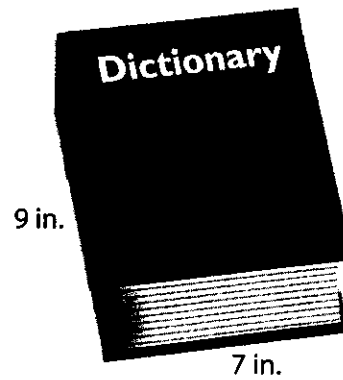
★ Independent Practice ★

In 5–10, find the volume of each rectangular prism.

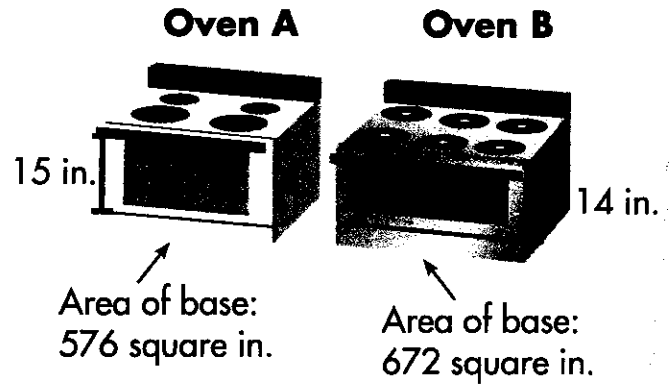


Problem Solving

11. The dictionary is 3 inches thick. What is the volume of the dictionary?



12. **Higher Order Thinking** Two ovens have measurements as shown. Which oven has a greater volume? How much greater is its volume? Show your work.



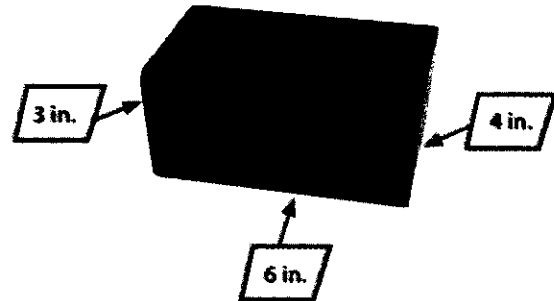
13. The perimeter of an equilateral triangle is 51 feet. What is the length of one of its sides? Explain your work.

14. **Reasoning** Harry is in line at the store. He has three items that cost \$5.95, \$4.25, and \$1.05. Explain how Harry can add the cost of the items mentally before he pays for them.

Assessment Practice

15. Choose all the expressions that can be used to find the volume of this wooden box.

- $(6 \times 4) \times 3$
- $(6 \times 4) + 3$
- 6×4
- $6 \times (4 \times 3)$
- 24×3



☆ Guided Practice

Do You Understand?

1. If you want to convert yards to feet, what operation would you use?
2. If you want to convert feet to miles, what operation would you use?
3. What are some tools you could select to measure length? Explain when you would use them.

Do You Know How?

In 4–8, convert each unit of length.

4. $9 \text{ ft} = \underline{\hspace{1cm}} \text{ yd}$
5. $8 \text{ ft } 7 \text{ in.} = \underline{\hspace{1cm}} \text{ in.}$
6. $5\frac{1}{2} \text{ ft} = \underline{\hspace{1cm}} \text{ in.}$
7. $288 \text{ in.} = \underline{\hspace{1cm}} \text{ yd}$
8. $219 \text{ in.} = \underline{\hspace{1cm}} \text{ ft } \underline{\hspace{1cm}} \text{ in. or } \underline{\hspace{1cm}} \text{ ft}$

☆ Independent Practice ☆

In 9 and 10, complete the table to show equivalent measures.

9.

Feet	Inches
1	
2	
	36
4	

10.

Yards	Feet
1	
	6
3	
4	

Will the number in your answer be greater than or less than the number in the given measurement?



In 11–16, convert each unit of length.

11. $3 \text{ yd} = \underline{\hspace{1cm}} \text{ in.}$

12. $324 \text{ ft} = \underline{\hspace{1cm}} \text{ yd}$

13. $2\frac{2}{3} \text{ mi} = \underline{\hspace{1cm}} \text{ ft}$

14. $56 \text{ ft} = \underline{\hspace{1cm}} \text{ yd } \underline{\hspace{1cm}} \text{ ft}$

15. $12\frac{1}{2} \text{ ft} = \underline{\hspace{1cm}} \text{ in.}$

16. $6 \text{ in.} = \underline{\hspace{1cm}} \text{ ft}$

In 17–19, compare lengths. Write $>$, $<$, or $=$ for each \bigcirc .

17. $100 \text{ ft } \bigcirc 3 \text{ yd}$

18. $74 \text{ in. } \bigcirc 2 \text{ yd } 2 \text{ in.}$

19. $5,200 \text{ ft } 145 \text{ in. } \bigcirc 1 \text{ mi } 40 \text{ in.}$

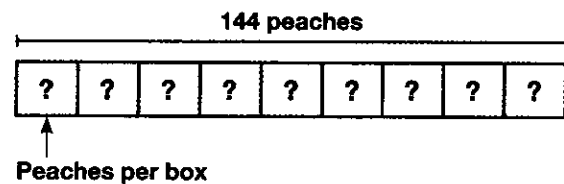
Problem Solving

20. **Number Sense** Which number would be greater, the height of a tree in feet or the height of the same tree in yards?

21. **Reasoning** The dimensions of the nation's smallest post office are 8 feet 4 inches by 7 feet 3 inches. Why would you use the measurement 8 feet 4 inches instead of 7 feet 16 inches?

22. Roger earns \$24 a week mowing lawns. He spends $\frac{1}{6}$ of his earnings on lunch and $\frac{2}{3}$ of his earnings on music. He saves the rest. How many dollars does Roger save? Tell how you found the answer.

23. Ariana has 144 peaches. She has to pack 9 boxes with an equal number of peaches. How many peaches should she pack in each box?



24. **Higher Order Thinking** How do you convert 108 inches to yards?

25. **Vocabulary** What is an appropriate customary unit to use when measuring the length of a driveway? Justify your answer.

Assessment Practice

26. Select all of the measurements greater than 7 feet.

- 2 yards
- 2 yards 2 inches
- 2 yards 2 feet
- 3 yards

27. Select all of the measurements less than 435 inches.

- 37 feet
- 36 feet 2 inches
- 12 yards 3 inches
- 12 feet 3 inches

☆ Guided Practice

Do You Understand?

- To find the number of meters in six kilometers, why do you multiply 6×10^3 ?
- Convert 12.5 centimeters to millimeters. Explain.

Do You Know How?

In 3–6, convert each unit of length.

- 10^3 cm = _____ m
- 58 m = _____ mm
- 1,000 mm = _____ cm
- 3 km = _____ m

In 7 and 8, compare lengths. Write $>$, $<$, or $=$ for each \bigcirc .

- 9,000 m \bigcirc 20 km
- 400 cm \bigcirc 4m

☆ Independent Practice ☆

In 9–14, convert each unit of length.

- 7.5 cm = _____ mm
- 6 m = _____ cm
- 0.8 km = _____ cm
- 17,000 m = _____ km
- 48,000 mm = _____ m
- 4 km = _____ m

In 15–20, compare lengths. Write $>$, $<$, or $=$ for each \bigcirc .

- 25,365 cm \bigcirc 30 m
- 3.6 km \bigcirc 3,600 m
- 1,200 mm \bigcirc 12 m
- 52,800 cm \bigcirc 1 km
- 7,500,000 m \bigcirc 750 km
- 800 m \bigcirc 799,999 mm

In 21 and 22, complete each table.

21.

km	1		0.1
m		500	

22.

m		5	0.5
cm	5,000		

Problem Solving [☆]

23. **Number Sense** Let x = the length of an object in meters and y = the length of the same object in millimeters. Which is a smaller number, x or y ?

24. **Higher Order Thinking** How many millimeters are equal to one kilometer? Show your work.

25. **Reasoning** Which fraction is greater: $\frac{7}{8}$ or $\frac{9}{12}$? Explain how you know.

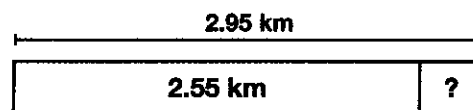
26. A week ago, Trudy bought the pencil shown. Now the pencil measures 12.7 centimeters.

How many centimeters of the pencil have been used?

How do you compare fractions?



27. **enVision[®] STEM** Mount St. Helens, located in Washington, erupted on May 18, 1980. Before the eruption, the volcano was 2.95 kilometers high. After the eruption, the volcano was 2.55 kilometers high. Use the bar diagram to find the difference in height of Mount St. Helens before and after the eruption. Convert the difference to meters.



✓ Assessment Practice

28. Eileen plants a tree that is 2 meters tall in her yard. Which of the following is equivalent to 2 meters?

- (A) 200 mm
- (B) 20 cm
- (C) 200 km
- (D) 2,000 mm

29. Which of these number sentences is **NOT** true?

- (A) $600 \text{ cm} = 6 \text{ m}$
- (B) $1 \text{ m} < 9,000 \text{ mm}$
- (C) $900 \text{ mm} = 9 \text{ cm}$
- (D) $10 \text{ km} > 5,000 \text{ m}$

Guided Practice



Do You Understand?

1. Explain the steps involved in evaluating the expression $[(4 + 2) - 1] \times 3$.
2. Would the value of $(12 - 4) \div 4 + 1$ change if the parentheses were removed? Explain.

Do You Know How?

In 3–6, use the order of operations to evaluate the expression.

3. $[7 \times (6 - 1)] + 100$
4. $17 + 4 \times 3$
5. $(8 + 1) + 9 \times 7$
6. $\{[(4 \times 3) \div 2] + 3\} \times 6$

Independent Practice

Guided Practice In 7–21, use the order of operations to evaluate the expression.

Remember to evaluate inside parentheses, brackets, and braces first.



$$8 \times (3 + 4) \div 2$$

$$8 \times \dots \div 2$$

$$\dots \div 2 = 28$$

$$8. \quad 39 + 6 \div 2$$

$$39 + \dots = 42$$

$$9. \quad 24 \div [(3 + 1) \times 2]$$

$$\dots \div [\dots \times \dots]$$

$$\div \dots = 3$$

$$5 \div 5 + 4 \times 12$$

$$11. \quad [6 - (3 \times 2)] + 4$$

$$12. \quad (4 \times 8) \div 2 + 8$$

$$18 + 7) \times (11 - 7)$$

$$14. \quad 2 + [4 + (5 \times 6)]$$

$$15. \quad (9 + 11) \div (5 + 4 + 1)$$

$$0 - 5 \times 5 \times 2$$

$$17. \quad 120 - 40 \div 4 \times 6$$

$$18. \quad 22 + (96 - 40) \div 8$$

$$1.7 + 0.3) \div 0.1 \times 4$$

$$20. \quad 32 \div (12 - 4) + 7$$

$$21. \quad \{8 \times [1 + (20 - 6)]\} \div \frac{1}{2}$$

Problem Solving

22. Dan and his 4 friends want to share the cost of a meal equally. They order 2 large pizzas and 5 small drinks. If they leave a tip of \$6.30, how much does each person pay?

Menu	
Small pizza	\$8.00
Large pizza	\$12.00
Small drink	\$1.50
Large drink	\$2.25

23. **Higher Order Thinking** Use the operation signs $+$, $-$, \times , and \div once each in the expression below to make the number sentence true.

$$6 \square (3 \square 1) \square 5 \square 1 = 17$$

24. **Be Precise** Carlotta needs $12\frac{1}{2}$ yards of ribbon for a project. She has $5\frac{1}{4}$ yards of ribbon on one spool and $2\frac{1}{2}$ yards on another spool. How much more ribbon does she need?

25. Theresa bought three containers of tennis balls at \$2.98 each. She had a coupon for \$1 off. Her mom paid for half of the remaining cost. How much did Theresa pay? Evaluate the expression $[(3 \times 2.98) - 1] \div 2$.

26. **enVision® STEM** Giraffes are *herbivores*, or plant eaters. A giraffe can eat up to 75 pounds of leaves each day. Write and evaluate an expression to find how many pounds of leaves 5 giraffes can eat in a week.



Evaluate the expression in the parentheses first. Then subtract inside the brackets.

Assessment Practice

27. Which expression has a value of 8?

- (A) $11 - 6 - 3$
- (B) $4 + 30 \div 6$
- (C) $(9 + 7) \div 2$
- (D) $1 + 1 \times (2 + 2)$

28. Using the order of operations, which operation should you perform last to evaluate this expression?

$$(1 \times 2.5) + (52 \div 13) + (6.7 - 5) - (98 + 8)$$

- (A) Addition
- (B) Subtraction
- (C) Multiplication
- (D) Division



☆ Guided Practice

Do You Understand?

1. Why do some numerical expressions contain parentheses?
2. Show how to use a property to write an equivalent expression for $9 \times (7 + 44)$. Can you use a different property to write another equivalent expression? Explain.

Do You Know How?

In 3–6, write a numerical expression for each calculation.

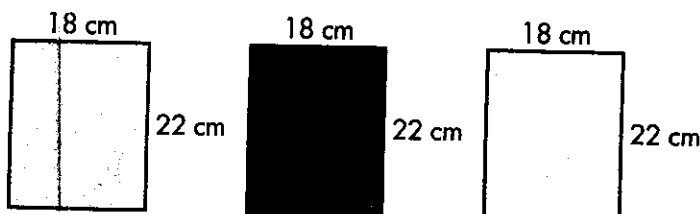
3. Add 8 and 7, and then multiply by 2.
4. Find triple the difference between 44.75 and 22.8.
5. Multiply 4 times $\frac{7}{8}$ and then add 12.
6. Add 49 to the quotient of 125 and 5.

☆ Independent Practice ☆

In 7–11, write a numerical expression for each calculation.

7. Add 91, 129, and 16, and then divide by 44.
8. Find 8.5 times the difference between 77 and 13.
9. Subtract 55 from the sum of 234 and 8.
10. Multiply $\frac{2}{3}$ by 42, and then multiply that product by 10.

11. Write an expression to show the calculations you could use to determine the total area of the rectangles at the right.



Problem Solving

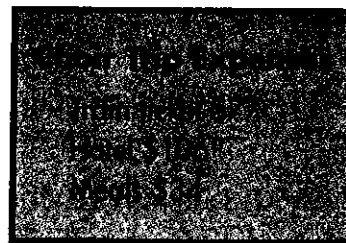
12. Model with Math Ronnie's Rentals charges \$25 plus \$15 per hour to rent a chain saw. David rented a chain saw for 5 hours. Write an expression to show how you could calculate the total amount David paid.

13. Fourteen students bought their art teacher a new easel for \$129 and a set of blank canvases for \$46. Sales tax was \$10.50. They shared the cost equally. Write an expression to show how you could calculate the amount each student paid.

14. Vocabulary When evaluating an expression, why is it important to use the **order of operations**?

15. A storage shed is shaped like a rectangular prism. The width is 8 yards, the height is 4 yards, and the volume is 288 cubic yards. Explain how to find the length of the storage shed.

16. Higher Order Thinking Danielle has a third of the amount needed to pay for her choir trip expenses. Does the expression $(77 + 106 + 34) \div 3$ show how you could calculate the amount of money Danielle has? Explain.



Assessment Practice

17. Which expression represents the following phrase?

Subtract 214 from 721 and then divide by 5.

- (A) $(721 \div 214) - 5$
- (B) $721 - 214 \div 5$
- (C) $(721 \div 5) - 214$
- (D) $(721 - 214) \div 5$

18. What is the first step in evaluating this expression?

$$2 \times (47 + 122) - 16$$

- (A) Multiply 2 and 47
- (B) Multiply 2 and 16
- (C) Add 47 and 122
- (D) Add 2 and 47