

Fractions

UNIT

4

- **Lesson 1 Equivalent Fractions** reviews how to identify and find equivalent fractions using models and multiplication.
- **Lesson 2 Comparing Fractions** reviews how to compare two fractions with different numerators and denominators.
- **Lesson 3 Adding and Subtracting Fractions** reviews how to add and subtract fractions with like denominators, and how to decompose a fraction.
- **Lesson 4 Adding and Subtracting Mixed Numbers** reviews how to add and subtract mixed numbers with like denominators.
- **Lesson 5 Multiplying a Fraction by a Whole Number** reviews how to multiply a fraction by a whole number, using models and equations.
- **Lesson 6 Word Problems with Fractions** reviews how to solve word problems that involve adding and subtracting fractions or multiplying a fraction by a whole number.

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UNIT 4
Fractions

LESSON

1

4.NF.1

Equivalent Fractions



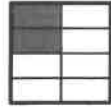
Equivalent fractions are different fractions that have the same value. They show the same part of a whole in different ways.

You can use models to find equivalent fractions.

Nestor made a pan of brownies and cut it into 8 pieces of equal size. Then he ate 2 pieces. What fraction of the pan of brownies did Nestor eat?

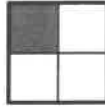
To find the part Nestor ate, you can draw a model.

Draw a square divided into 8 pieces of equal size. Then, shade the pieces out of 8 that Nestor ate.



So, Nestor ate $\frac{2}{8}$ of the pan of brownies.

Look at the diagram again. Another way to describe the amount Nestor ate is 1 out of 4 parts, or $\frac{1}{4}$ of the pan.



You can also find equivalent fractions by multiplying or dividing. Multiply the numerator and denominator by the same number.

Multiply $\frac{1}{4}$ by $\frac{2}{2}$ to find an equivalent fraction in higher terms.

$$\frac{1}{4} \times \frac{2}{2} = \frac{1 \times 2}{4 \times 2} = \frac{2}{8}$$

Divide $\frac{4}{6}$ by $\frac{2}{2}$ to find an equivalent fraction in lower terms.

$$\frac{4}{6} \div \frac{2}{2} = \frac{4 \div 2}{6 \div 2} = \frac{2}{3}$$

Equivalent fractions name the same number in different terms.

$$\frac{1}{2} = \frac{2}{4} \leftarrow \begin{array}{l} \text{Numerator} \\ \text{Denominator} \end{array}$$

The numerator and denominator are the terms of the fraction.

When the numerator and denominator are the same digit, the fraction is equal to 1.

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

When you multiply or divide by 1, the number stays the same. So when you multiply or divide by $\frac{2}{2}$, you are only changing the terms.

Cross multiply to check if two fractions are equivalent. If the products are the same, the fractions are equivalent.

$$\begin{array}{l} \frac{1}{4} = \frac{2}{8} \\ 1 \times 8 = 4 \times 2 \\ 8 = 8 \end{array}$$

If $\frac{a}{b} = \frac{c}{d}$ and $b, d \neq 0$, then $ad = bc$.

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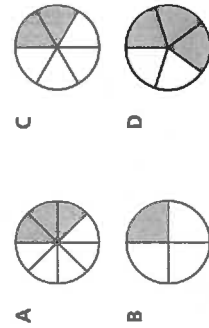
Read each problem. Circle the letter of the best answer.

SAMPLE Which of these fractions is equivalent to $\frac{1}{2}$?

- A $\frac{3}{4}$ B $\frac{2}{2}$ C $\frac{2}{4}$ D $\frac{1}{4}$

The correct answer is C. You can multiply the numerator and denominator of $\frac{1}{2}$ by the same number to find an equivalent fraction. The only answer choice that can be made is $\frac{2}{4}$ by multiplying $\frac{1}{2}$ by $\frac{2}{2}$. $\frac{1}{2} \times \frac{2}{2} = \frac{2}{4}$.

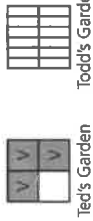
- Maple trees make up $\frac{2}{5}$ of the trees in a park. Which of these fractions is equivalent to $\frac{2}{5}$?
A $\frac{2}{5}$ C $\frac{8}{5}$
B $\frac{4}{10}$ D $\frac{8}{10}$
- Three-fourths of the people on a train are going to work. Which of these fractions is **not** equivalent to $\frac{3}{4}$?
A $\frac{9}{12}$ C $\frac{6}{8}$
B $\frac{3}{8}$ D $\frac{75}{100}$
- Usher swims $\frac{4}{10}$ mile. What fraction of a mile could his brother swim in order to swim the same distance?
A $\frac{6}{12}$ C $\frac{4}{5}$
B $\frac{2}{8}$ D $\frac{2}{5}$
- Which pair of fractions are equivalent?
A $\frac{1}{3}$ and $\frac{3}{6}$ C $\frac{2}{4}$ and $\frac{1}{3}$
B $\frac{2}{6}$ and $\frac{1}{3}$ D $\frac{6}{8}$ and $\frac{8}{6}$
- Which model shows a fraction that is equivalent to $\frac{1}{3}$?



- Gabby feeds her hamster $\frac{1}{6}$ cup of food each day. Which fraction is equivalent to $\frac{1}{6}$?
A $\frac{2}{12}$ C $\frac{7}{12}$
B $\frac{3}{8}$ D $\frac{1}{12}$

Read each problem. Write your answer.

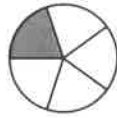
SAMPLE Ted and Todd have gardens of the same size. Ted plants vegetables in $\frac{3}{4}$ of his garden. Todd wants to plant vegetables in an equivalent area. What fraction of his garden should Todd plant with vegetables?



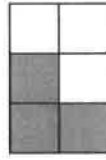
Answer _____

Ted planted vegetables in $\frac{3}{4}$ of his garden. There are 12 sections in Todd's garden. To change $\frac{3}{4}$ to twelfths, multiply: $\frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$. So, Todd will plant vegetables in 9 of the 12 sections, or $\frac{9}{12}$, of his garden.

- What is a fraction equivalent to the shaded part of the model shown here?
Answer _____



- Look at the fraction model here. Then draw and shade an equivalent fraction in the empty box. Name the equivalent fractions.
Answer _____

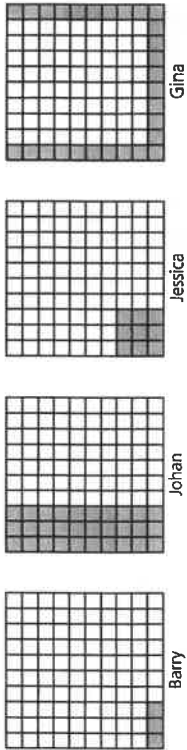


- Kerri runs $\frac{3}{4}$ mile. Her sister runs $\frac{5}{8}$ mile. Did they run equivalent distances? Explain how you know.

- Emily wants to write a fraction equivalent to $\frac{1}{2}$. She wants to have a denominator of 100. What should she multiply the numerator and denominator of $\frac{1}{2}$ by? Explain.

Read each problem. Write your answer to each part.

- 11 Four students are using models to find fractions equivalent to $\frac{3}{10}$.



- Part A** Which student's model represents a fraction equivalent to $\frac{3}{10}$? Name that fraction.

Answer _____

- Part B** Use multiplication to prove that the fraction your answer represents in part A and $\frac{3}{10}$ are equivalent. Show your work.

- 12 The table shows how much water four students drank today.

Student	Amount (in gallons)
Raj	$\frac{2}{3}$
Sue	$\frac{3}{5}$
Troy	$\frac{4}{6}$
Uma	$\frac{1}{2}$

- Part A** Which two students drank the same amount of water?

Answer _____

- Part B** Explain how you know your answer is correct.

Comparing Fractions

4.NF.2

LESSON 2



Different denominators are sometimes called unlike denominators.

When you compare fractions using models, be sure the wholes are the same size.

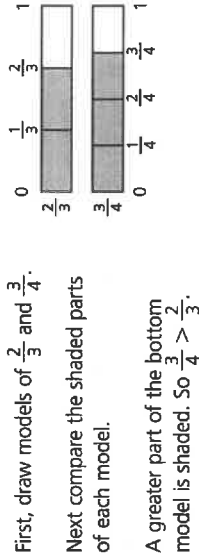
Common denominators are the same multiples of two or more numbers.

When fractions have the same numerator, just compare the denominators.

The greater the denominator is, the smaller the fraction is. $\frac{1}{3} < \frac{1}{2}$ because $3 > 2$.

You can compare fractions with different numerators and denominators by using models.

Which fraction is greater, $\frac{2}{3}$ or $\frac{3}{4}$?



First, draw models of $\frac{2}{3}$ and $\frac{3}{4}$.
Next compare the shaded parts of each model.
A greater part of the bottom model is shaded. So $\frac{3}{4} > \frac{2}{3}$.

Which fraction is smaller, $\frac{2}{3}$ or $\frac{3}{4}$?

First, find a common denominator. List the multiples of each number.

Multiples of 3: 3, 6, 9, 12, ...
Multiples of 4: 4, 8, 12, ...

A common multiple is 12, so a common denominator of $\frac{2}{3}$ and $\frac{3}{4}$ is 12. Change each fraction to twelfths.

$$\frac{2}{3} \times \frac{4}{4} = \frac{8}{12} \quad \frac{3}{4} \times \frac{3}{3} = \frac{9}{12}$$

Now compare the equivalent fractions. Look at the numerators.

$$\frac{8}{12} < \frac{9}{12}$$

Since 8 is less than 9, $\frac{2}{3} < \frac{3}{4}$.

Read each problem. Circle the letter of the best answer.

SAMPLE Tabitha and Jane are competing in a swimming contest. Tabitha swims for $\frac{2}{5}$ mile. Jane swims for $\frac{1}{3}$ mile. Which number sentence is true?

- A $\frac{2}{5} > \frac{1}{3}$ B $\frac{2}{5} < \frac{1}{3}$ C $\frac{2}{5} = \frac{1}{3}$ D $\frac{1}{3} > \frac{2}{5}$

The correct answer is A. A common denominator of 5 and 3 is 15. So $\frac{2}{5}$ is equivalent to $\frac{6}{15}$, and $\frac{1}{3}$ is equivalent to $\frac{5}{15}$. Compare: $\frac{6}{15} > \frac{5}{15}$, so $\frac{2}{5} > \frac{1}{3}$.

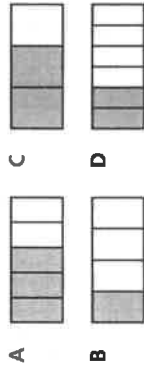
1 In one class, more than $\frac{3}{8}$ of the students play an instrument. Which could be the fraction of students who play an instrument?

- A $\frac{1}{5}$ B $\frac{1}{4}$ C $\frac{3}{3}$ D $\frac{1}{2}$

2 Which number sentence is **not** true?

- A $\frac{7}{12} < \frac{2}{3}$ B $\frac{3}{6} < \frac{5}{12}$ C $\frac{7}{8} > \frac{3}{4}$ D $\frac{7}{10} > \frac{3}{5}$

3 Lisa used less than $\frac{1}{3}$ of a stick of modeling clay. Which picture shows the amount Lisa could have used?



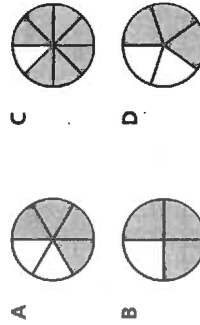
4 Henry bought less than $\frac{5}{8}$ kg of trail mix. Which fraction is less than $\frac{5}{8}$?

- A $\frac{3}{4}$ B $\frac{11}{12}$ C $\frac{7}{8}$ D $\frac{1}{2}$

5 Which number sentence is true?

- A $\frac{1}{3} < \frac{1}{4}$ B $\frac{2}{5} < \frac{7}{10}$ C $\frac{9}{10} < \frac{9}{12}$ D $\frac{3}{8} > \frac{3}{4}$

6 Paul draws a model of a fraction that is greater than $\frac{3}{4}$ but less than $\frac{9}{10}$. Which could be Paul's model?



Read each problem. Write your answer.

SAMPLE Tina, Georgia, and Dave have the same amount of homework. Tina completes $\frac{2}{3}$ of her homework before dinner. Georgia completes $\frac{5}{8}$ of hers, and Dave completes $\frac{3}{4}$ of his. Write the students in order from most homework completed to least.

Answer _____

Change the fractions to equivalent fractions with the same denominator. A common denominator for 3, 8, and 4 is 24. So multiply to find Tina's fraction: $\frac{2}{3} \times \frac{8}{8} = \frac{16}{24}$. Multiply to find Georgia's fraction: $\frac{5}{8} \times \frac{3}{3} = \frac{15}{24}$. Multiply to find Dave's fraction: $\frac{3}{4} \times \frac{6}{6} = \frac{18}{24}$. Compare the numerators: $18 > 16 > 15$. From most homework completed to least, the students are Dave, Tina, Georgia.

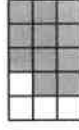
7 Mei answered $\frac{3}{5}$ of the questions on a quiz correctly. Britt answered $\frac{5}{6}$ correctly, and Niel answered $\frac{2}{3}$ correctly. Write the fractions in order from least to greatest.

Answer _____

8 Ridge Trail is $\frac{3}{4}$ mile long. Valley Trail is $\frac{7}{12}$ mile long. Andrea wants to hike the longer trail. Which trail should she hike? Show your work.

Answer _____

9 Umberto believes the model shown here is greater than $\frac{3}{5}$. Is he correct? Explain your answer.



Read the problem. Write your answer to each part.

- 10** Red, yellow, and blue are primary colors. Michael mixes equal parts of primary colors to make new colors. Michael mixes 2 parts blue and 1 part yellow to make green. He mixes 1 part red and 2 parts yellow to make orange.

Part A Which color, green or orange, is less than $\frac{3}{6}$ yellow? Explain your answer.

Part B Draw and label models to show the mixes for green and orange. Label each part in the models with a letter for the color. (Use B for blue, R for red, and Y for yellow.)

The fractional size of a part depends on the number of equal parts in the whole. If there are 3 equal parts, then the parts represent $\frac{1}{3}$'s.

Adding and Subtracting Fractions

4.NF.3.a, b

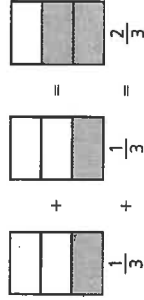
LESSON
3

When you add or subtract fractions, the fractions must have the same denominator.

You can use models to find a sum or difference of fractions with the same denominator.

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

First, draw and shade a model of each fraction.



Then add the shaded part of each model together and draw a model of the sum.

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

When fractions have the same denominator, you can also find a sum or difference by adding or subtracting the numerators.

What is $\frac{3}{4} - \frac{1}{4}$?

Both $\frac{3}{4}$ and $\frac{1}{4}$ have the same denominator. You can find the difference by subtracting their numerators, $3 - 1$, and using their common denominator, 4. Write the answer in lowest terms.

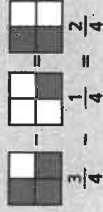
$$\frac{3}{4} - \frac{1}{4} = \frac{3-1}{4} = \frac{2}{4} = \frac{1}{2}$$

So, $\frac{3}{4} - \frac{1}{4} = \frac{1}{2}$.

If the fractions have different denominators, you must first find a common denominator.

When you draw models of fractions to add or subtract, the models for each whole must be the same size. That way, the parts being added are the same size.

You can also use models to find a difference.



Read each problem. Circle the letter of the best answer.

SAMPLE Martin makes spice cookies. He adds $\frac{1}{8}$ teaspoon of cinnamon, $\frac{1}{8}$ teaspoon of allspice, and $\frac{1}{8}$ teaspoon of nutmeg. How much spice did Martin add altogether?

- A 24 teaspoons C $\frac{3}{24}$ teaspoon
 B 3 teaspoons D $\frac{3}{8}$ teaspoon

The correct answer is D. The denominators are the same, so just add the numerators to find the sum: $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{3}{8}$.

1 What is $\frac{9}{10} - \frac{6}{10}$?

- A $\frac{3}{20}$ C $\frac{3}{0}$
 B $\frac{15}{20}$ D $\frac{3}{10}$

2 Which number sentence is true?

- A $\frac{1}{8} + \frac{5}{8} = \frac{6}{16}$ C $\frac{2}{5} + \frac{2}{5} = \frac{4}{25}$
 B $\frac{3}{12} + \frac{7}{12} = \frac{10}{12}$ D $\frac{7}{10} + \frac{7}{10} = \frac{14}{20}$

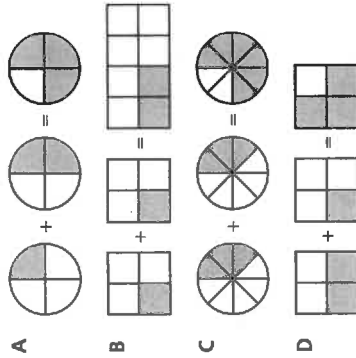
3 Which expression equals $\frac{5}{12}$?

- A $\frac{3}{6} + \frac{2}{6}$ C $\frac{11}{12} - \frac{6}{12}$
 B $\frac{9}{12} - 4$ D $\frac{4}{11} + \frac{1}{11}$

4 What is the answer to $\frac{1}{5} + \frac{2}{5}$?

- A $\frac{3}{5}$ C $\frac{1}{5}$
 B $\frac{2}{5}$ D $\frac{5}{5}$

5 Which model does **not** show a true situation?



6 Which expression equals $\frac{7}{10}$?

- A $\frac{9}{20} - \frac{2}{10}$
 B $7 - \frac{0}{10}$
 C $\frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{4}{10}$
 D $\frac{1}{10} + \frac{2}{10} + \frac{3}{10} + 1$

Read each problem. Write your answer.

SAMPLE Quinn is watching a science movie that is 1 hour long. Each scene in the movie lasts $\frac{1}{6}$ hour. How many scenes are there in the movie?

Answer _____

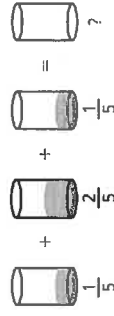
Remember that 1 hour is the same as $\frac{6}{6}$ hour: $\frac{6}{6} = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6}$. So, there are six $\frac{1}{6}$ -hour scenes in $\frac{6}{6}$ or 1 hour.

7 Tyrone wrote $\frac{1}{6}$ of his book report on Monday, $\frac{2}{6}$ on Tuesday, and another $\frac{1}{6}$ on Wednesday. How much of his report did Tyrone write by the end of Wednesday? Show your work.

Answer _____

8 Sonya wants to walk $\frac{8}{10}$ mile. She has already walked $\frac{3}{10}$ mile. How much farther does she have to walk to meet her goal? Explain how you found your answer.

9 Vern believes he can completely fill the empty glass on the right using the liquid in the three glasses shown on the left. Is he correct? Explain your answer.



Read the problem. Write your answer to each part.

- 10** Lois is learning how to read musical notes. She has learned about whole notes, half notes, quarter notes, and eighth notes.

Part A Lois knows that 1 whole note is equal to 4 quarter notes. Write a number sentence that shows this.

Answer _____

Part B Lois believes there are the same number of eighth notes in a half note as there are quarter notes in a whole note. Is she correct? Explain how you got your answer and draw a model to prove it.

The word *quarter* means "one-fourth." You can represent it using the fraction $\frac{1}{4}$.

Adding and Subtracting Mixed Numbers

LESSON

4

4.NF.3.C



A mixed number is made up of a whole number and a fraction.

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

The associative property of addition allows you to group numbers in any way and the sum will be the same.

Always reduce fractions to lowest terms.

An improper fraction is a fraction with a numerator that is equal to or greater than its denominator, such as $\frac{5}{4}$.

To rewrite a mixed number as an improper fraction, multiply the denominator of the fraction by the whole number. Then add the numerator. Write the result over the denominator.

$$6\frac{1}{5} = \frac{(6 \times 5) + 1}{5} = \frac{31}{5}$$

You can add or subtract mixed numbers by adding or subtracting the fractions and then the whole numbers.

Topher biked $3\frac{3}{10}$ miles this morning and $2\frac{1}{10}$ miles this afternoon. How many miles did Topher bike altogether?

Find $3\frac{3}{10} + 2\frac{1}{10}$.

Write the mixed numbers as sums.

$$3 + \frac{3}{10} + 2 + \frac{1}{10}$$

Add the fractions.

$$\frac{3}{10} + \frac{1}{10} = \frac{4}{10} = \frac{2}{5}$$

Add the whole numbers.

$$3 + 2 = 5$$

Then, add the sums together.

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

So, Topher biked $5\frac{2}{5}$ miles altogether.

Sometimes there are not enough fractional parts to subtract from. In that case, you can rename the mixed numbers as improper fractions.

Gary biked $6\frac{1}{5}$ miles. How many more miles did Gary bike than Topher?

Find $6\frac{1}{5} - 5\frac{2}{5}$.

You cannot subtract $\frac{2}{5}$ from $\frac{1}{5}$, so rename both mixed numbers as improper fractions.

$$6\frac{1}{5} = \frac{31}{5} \text{ and } 5\frac{2}{5} = \frac{27}{5}$$

Next, subtract the fractions.

$$\frac{31}{5} - \frac{27}{5} = \frac{4}{5}$$

So, Gary biked $\frac{4}{5}$ mile more than Topher.

Read each problem. Circle the letter of the best answer.

SAMPLE If it snowed $3\frac{2}{3}$ inches in December and $6\frac{1}{3}$ inches in January, how many inches did it snow during both months?

- A 10 B $9\frac{1}{3}$ C $3\frac{1}{3}$ D $2\frac{2}{3}$

The correct answer is A. To find the sum, add $3\frac{2}{3} + 6\frac{1}{3}$. First, add the fractions: $\frac{2}{3} + \frac{1}{3} = \frac{3}{3}$. Rewrite $\frac{3}{3}$ as 1, a whole number. Now, add the whole numbers: $3 + 6 + 1 = 10$. It snowed a total of 10 inches during both months.

1 Find the difference.

$$1\frac{6}{10} - 1\frac{3}{10} = \square$$

- A 3 C $\frac{9}{10}$
B $1\frac{3}{10}$ D $\frac{3}{10}$

2 Add $2\frac{1}{8}$ and $3\frac{3}{8}$.

- A $5\frac{1}{2}$ C $1\frac{1}{2}$
B $5\frac{1}{4}$ D $1\frac{1}{4}$

3 How much greater is $2\frac{3}{8}$ than $\frac{7}{8}$?

- A $3\frac{3}{8}$ C $1\frac{1}{2}$
B $2\frac{1}{2}$ D $\frac{1}{2}$

4 Subtract:

$$14\frac{2}{5} - 2\frac{3}{5} = \square$$

- A $12\frac{1}{5}$ C $11\frac{4}{5}$
B $12\frac{4}{5}$ D $11\frac{1}{5}$

5 Hilary needs to subtract $3\frac{4}{5}$ from $5\frac{1}{5}$. What improper fractions should she use?

- A $\frac{34}{5}$ and $\frac{51}{5}$ C $\frac{15}{5}$ and $\frac{25}{5}$
B $\frac{7}{5}$ and $\frac{6}{5}$ D $\frac{19}{5}$ and $\frac{26}{5}$

6 Which number sentence is correct?

- A $1\frac{5}{6} + 4\frac{3}{6} = 5\frac{1}{2}$
B $3\frac{1}{10} + 1\frac{9}{10} = 5$
C $2\frac{1}{4} + 1\frac{3}{4} = 3$
D $5\frac{2}{3} + 2\frac{2}{3} = 7\frac{1}{3}$

Read each problem. Write your answer.

SAMPLE How can you subtract $9\frac{1}{5}$ from 12? Explain the steps you would take.

Answer _____

The whole number 12 has no fractional part to subtract from. So, first change it to an improper fraction with a denominator of 5. Multiply: $5 \times 12 = 60$. Then write 60 over a denominator of 5: $\frac{60}{5}$. Next, change $9\frac{1}{5}$ to an improper fraction: $9\frac{1}{5} = \frac{5 \times 9 + 1}{5} = \frac{45 + 1}{5} = \frac{46}{5}$. Now, subtract: $\frac{60}{5} - \frac{46}{5} = \frac{14}{5}$. Finally, write the difference as a mixed number: $\frac{14}{5} = 2\frac{4}{5}$.

7 What is the sum of $2\frac{5}{6} + 2\frac{5}{6} + 2\frac{5}{6}$? Show your work.

Answer _____

8 Subtract $6\frac{1}{8} - 1\frac{7}{8}$. Show your work.

Answer _____

9 Dee added $2\frac{3}{4} + 3\frac{3}{4}$ this way:

$$2\frac{3}{4} + 3\frac{3}{4} = 2 + \frac{3}{4} + 3 + \frac{3}{4} = 2 + 3 + \frac{3}{4} + \frac{3}{4} = 5 + \frac{6}{4} = 5 + 1\frac{2}{4} = 6\frac{1}{2}$$

What property allowed Dee to break up the mixed numbers and rearrange them to add the whole numbers and fractions separately? Explain.

Read the problem. Write your answer to each part.

- 10 Phillip plotted four points on a number line, as shown below.



- Part A** Which is greater, the difference between points A and B or the difference between points B and C? Show your work.

Answer _____

- Part B** Phillip added the values of points A and D this way:

$$\frac{7}{8} + 4\frac{7}{8} = 4 + \frac{7}{8} + \frac{7}{8} = 4 + \frac{14}{8} = 4\frac{6}{8} = 4\frac{3}{4}$$

What mistake did Phillip make? Explain and find the correct sum.



What is an improper fraction? How do you change it to a mixed number?

Multiplying a Fraction by a Whole Number

LESSON

5

4.NF4.a, b

You can multiply a fraction by a whole number using a model.

A fraction with a numerator of 1 is called a **unit fraction**.

When you multiply a unit fraction, $\frac{1}{x}$, by a whole number, a , the product can be a whole number or a mixed number. If the whole number is evenly divisible by the denominator, the result is a whole number.

Every whole number can be written as a fraction with a denominator of 1.

$$a = \frac{a}{1}$$

Reduce a fraction to lowest terms by dividing the numerator by the denominator.

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

Draw 4 squares. Divide each into thirds ($\frac{1}{3}$'s).

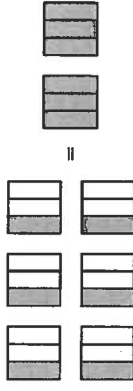


To find $4 \times \frac{1}{3}$, shade $\frac{1}{3}$ of each square.



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

Now find $3 \times \frac{2}{3}$. Think: $\frac{2}{3}$ is the same as $2 \times \frac{1}{3}$. So you can rewrite $3 \times \frac{2}{3}$ as $3 \times 2 \times \frac{1}{3}$ or $6 \times \frac{1}{3}$.



You can also multiply a fraction by a whole number using an equation:

What is $10 \times \frac{3}{5}$?

Write the whole number as a fraction with a denominator of 1. Then multiply the numerators. Multiply the denominators.

$$10 \times \frac{3}{5} = \frac{10}{1} \times \frac{3}{5} = \frac{10 \times 3}{1 \times 5} = \frac{30}{5} = 30 \div 5 = 6$$

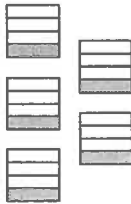
Read each problem. Circle the letter of the best answer.

SAMPLE Find $8 \times \frac{1}{5}$.

- A $\frac{5}{8}$ B $\frac{1}{40}$ C $1\frac{3}{5}$ D 40

The correct answer is C. To find $8 \times \frac{1}{5}$, change 8 to an improper fraction, $\frac{8}{1}$. Multiply the numerators and multiply the denominators: $\frac{8 \times 1}{1 \times 5} = \frac{8}{5}$. Then divide the numerator by the denominator to write the fraction in lowest terms: $8 \div 5 = 1\frac{3}{5}$.

1 Which problem does the model represent?



- A 4×5 C $5 \times \frac{1}{4}$
 B $4 \times \frac{1}{5}$ D $5 \times \frac{1}{5}$

2 Find $9 \times \frac{1}{6}$.

- A $\frac{6}{9}$ C $1\frac{1}{2}$
 B $\frac{2}{3}$ D $\frac{1}{54}$

3 $16 \times \frac{1}{8}$ is 2. What is $16 \times \frac{5}{8}$?

- A 8 C 40
 B 10 D 80

4 Which expression is the same as $2 \times \frac{3}{4}$?

- A $2 \times \frac{4}{3}$ C $8 \times \frac{1}{3}$
 B $2 \times \frac{1}{4}$ D $6 \times \frac{1}{4}$

5 Multiply.

$$7 \times \frac{3}{7} = \square$$

- A $\frac{1}{3}$ C 21
 B 3 D 49

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

- A 6 C 12
 B 8 D 24

7 Which expression is the same as $6 \times \frac{2}{3}$?

- A $18 \times \frac{1}{2}$ C $6 \times \frac{3}{2}$
 B $12 \times \frac{1}{3}$ D $6 \times \frac{1}{3}$

Read each problem. Write your answer.

SAMPLE Find the product of $12 \times \frac{5}{6}$.

Answer _____

You can use a shortcut to find the product of $12 \times \frac{5}{6}$. First multiply the whole number times the numerator of the fraction: $12 \times 5 = 60$. Then divide the result by the denominator: $\frac{60}{6} = 60 \div 6 = 10$. The product is 10.

8 $144 \times \frac{1}{12} = 12$. What is $144 \times \frac{5}{12}$?

Answer _____

9 Write an expression that is equivalent to $16 \times \frac{3}{8}$ using a unit fraction.

Answer _____

10 Find $9 \times \frac{7}{10}$. Show your work. Use the shortcut.

Answer _____

11 Explain how to use a model to find $24 \times \frac{1}{6}$.

Read the problem. Write your answer to each part.

12 Jeanine knows that $25 \times \frac{1}{5}$ is 5.

Part A Jeanine says that $\frac{3}{5}$ is the same as $3 \times \frac{1}{5}$. Is she correct? Draw models to prove your answer.

Think of how the fraction $\frac{1}{5}$ is related to the fraction $\frac{3}{5}$.

Answer _____

Part B How can Jeanine use what she knows to find $25 \times \frac{3}{5}$? Explain.

Word Problems with Fractions

LESSON

6

4.NF.3.d, 4.NF.4.c

You can use fractions to solve many kinds of word problems. Think carefully about the operation you need to use.

You can use a model to solve problems with fractions.

An advertising agency rents $\frac{5}{12}$ of the offices in a building. A publishing company rents $\frac{3}{12}$ of the offices. Together, what fraction of the building's offices do the advertising agency and the publishing company rent?

To find a sum, add the two fractions. Divide a bar into 12 equal parts. Shade 5 parts to show the $\frac{5}{12}$. Shade 3 more parts to show the $\frac{3}{12}$.



$$\frac{5}{12} + \frac{3}{12} = \frac{8}{12}$$

Together, the advertising agency and publishing company rent $\frac{8}{12}$ of the offices. In lowest terms, this is $\frac{2}{3}$ of the offices.

You can use an equation to solve problems with fractions.

Lawyers rent the rest of the offices in the building. What fraction of the floors do lawyers rent?

To find the fraction of the offices in the building rented by the lawyers, you need to subtract. Subtract the fraction of all the offices rented by the advertising agency and the publishing company, $\frac{8}{12}$, from the fraction that represents all the offices in the building, $\frac{12}{12}$.

$$\frac{12}{12} - \frac{8}{12} = \frac{4}{12}$$

Lawyers rent $\frac{4}{12}$ of the offices in the building.

Remember that the denominator of the fractions is the number of parts your model should be divided into. The numerators of the fractions are the number of parts to shade.

You can also use your bar model to find the fraction of offices rented by lawyers.

You shaded 5 parts to show the fraction of offices rented by the advertising agency and 3 parts to show the fraction of offices rented by the publisher.

The 4 unshaded parts of the bar show the $\frac{4}{12}$ of the offices that are rented by lawyers.

92

UNIT 4
Fractions

91

UNIT 4
Fractions

Read each problem. Circle the letter of the best answer.

SAMPLE Tauno makes 5 pecan pies. He uses $\frac{2}{3}$ cup brown sugar in each one. How much brown sugar does he use altogether?

- A $\frac{10}{15}$ cup B $2\frac{2}{3}$ cups C $3\frac{1}{3}$ cups D $5\frac{2}{3}$ cups

The correct answer is C. To combine equal amounts, you need to multiply. So multiply $\frac{2}{3}$ by 5: $5 \times \frac{2}{3} = \frac{5}{1} \times \frac{2}{3} = \frac{10}{3}$. Remember to change the improper fraction to a mixed number: $\frac{10}{3} = 3\frac{1}{3}$. Tauno uses $3\frac{1}{3}$ cups of brown sugar altogether.

1 Delliha bought a yard of satin ribbon. She cut off $\frac{4}{6}$ yard to decorate a package.

What part of a yard does Delliha have left?

- A $\frac{1}{6}$ B $\frac{1}{3}$ C $\frac{1}{2}$ D $\frac{2}{3}$

2 Two years ago, Anja grew $\frac{1}{12}$ foot. Last year, she grew another $\frac{1}{4}$ foot. This year she grew $\frac{2}{12}$ foot. How much did Anja grow in three years?

- A $\frac{3}{12}$ foot B $\frac{1}{2}$ foot C $\frac{7}{12}$ foot D 7 feet

3 The Lew family eats $\frac{3}{8}$ of a stew at dinner. They eat another $\frac{2}{8}$ of it at lunch the next day. How much of the stew is left?

- A $\frac{7}{8}$ B $\frac{5}{8}$ C $\frac{3}{8}$ D $\frac{1}{8}$

4 In March, $3\frac{4}{10}$ inches of rain fell. In April, $4\frac{9}{10}$ inches of rain fell. How many more inches of rain fell in April than in March?

- A $\frac{5}{10}$ B $1\frac{5}{10}$ C $1\frac{6}{10}$ D $8\frac{3}{10}$

5 A scientist does an experiment with 12 plants. He gives each plant exactly the same amount of water, $\frac{1}{5}$ liter. How much water does he give the plants in all?

- A $\frac{1}{60}$ liter B $1\frac{2}{5}$ liters C $2\frac{2}{5}$ liters D 12 liters

6 A lake is $5\frac{2}{5}$ miles long. Another nearby lake is $6\frac{4}{5}$ miles long. How much shorter is the first lake than the second lake?

- A $1\frac{1}{5}$ miles B $1\frac{2}{5}$ miles C $7\frac{3}{5}$ miles D $11\frac{2}{5}$ miles

Read each problem. Write your answer.

SAMPLE Enzo has a part-time job. Last week, he worked $2\frac{3}{8}$ days. This week he worked $3\frac{7}{8}$ days. How many days did Enzo work at his part-time job in the past two weeks?

Answer _____

To find total time worked, add $2\frac{3}{8} + 3\frac{7}{8}$. First, add the whole numbers: $2 + 3 = 5$. Then add the fractions: $\frac{3}{8} + \frac{7}{8} = \frac{10}{8}$. Change the improper fraction to $1\frac{2}{8}$, or $1\frac{1}{4}$ in lowest terms. Finally, add the sums: $5 + 1\frac{1}{4} = 6\frac{1}{4}$. Enzo worked $6\frac{1}{4}$ days.

7 Eddie did jumping jacks for 3 minutes. Next, he jumped rope for $8\frac{1}{4}$ minutes. Then, he did chin-ups for $2\frac{1}{4}$ minutes. Eddie did not rest between exercises. How long did Eddie's workout take? Show your work.

Answer _____

8 A metal bar is $\frac{84}{100}$ inch long. A watchmaker trims $\frac{17}{100}$ inch from the end of the bar. How long is the trimmed bar? Write an equation to represent this problem and then solve it.

Answer _____

9 Karen walks a total of $\frac{3}{4}$ mile to and from school each day. How many miles does Karen walk in a week of 5 days? Draw and label a model on this number line to show this.

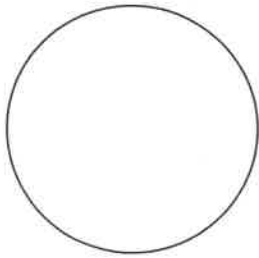


Answer _____

Read the problem. Write your answer to each part.

- 10** Mrs. Wright includes money in her budget for utilities. Utilities are things like electricity and phone service. In the average month, Mrs. Wright spends $\frac{3}{10}$ of the utilities money on electricity. She spends $\frac{4}{10}$ of it on gas to heat the house. She spends $\frac{1}{10}$ on water. The rest of the money goes to a company that provides cable, Internet, and phone service.

Part A What fraction of the utilities money does Mrs. Wright spend on electricity, gas, and water? Use the circle to model the answer.



How many equal parts should the circle model have to represent Mrs. Wright's utilities money?

Explain how you found your answer.

Part B What fraction of the utilities money does Mrs. Wright spend on cable, Internet, and phone service? Explain how you found your answer.

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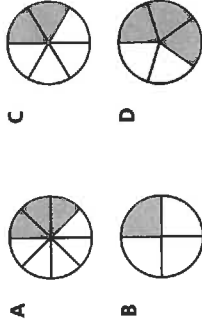
UNIT 4
Fractions

REVIEW

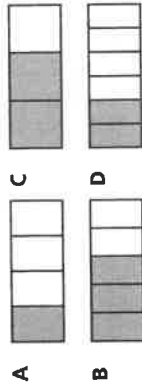
Fractions

Read each problem. Circle the letter of the best answer.

- 1** Which fraction is equivalent to $\frac{6}{24}$?



- 5** A contractor pours more than $\frac{6}{10}$ of a sidewalk. Which model shows a fraction greater than $\frac{6}{10}$?



- 6** Which fraction is greater than $\frac{1}{3}$ and less than $\frac{3}{4}$?

- A $\frac{1}{4}$ C $\frac{5}{6}$
B $\frac{2}{6}$ D $\frac{7}{12}$

- 3** Which pair shows equivalent fractions?

- A $\frac{1}{4}$ and $\frac{2}{6}$ C $\frac{2}{3}$ and $\frac{8}{12}$
B $\frac{3}{8}$ and $\frac{6}{12}$ D $\frac{3}{4}$ and $\frac{5}{8}$

- 4** Subtract $4\frac{1}{6} - \frac{5}{6}$.

- A $3\frac{1}{3}$ C $4\frac{2}{3}$
B $3\frac{2}{3}$ D 5

- 7** Multiply $5 \times \frac{5}{10}$.

- A $5\frac{1}{2}$ C $2\frac{2}{5}$
B $2\frac{1}{2}$ D $1\frac{1}{10}$

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UNIT 4
Fractions

Read each problem. Write your answer.

8 What is $\frac{9}{12} - \frac{4}{12}$?

Answer _____

9 Add $1\frac{5}{6} + 3\frac{2}{6}$. Show your work.

Answer _____

10 Find the product of $6 \times \frac{3}{8}$. Show your work.

Answer _____

11 At the deli, Chan Hee bought $\frac{3}{4}$ lb of American cheese. He also bought $\frac{3}{4}$ lb of Swiss cheese and $\frac{1}{4}$ lb of Jack cheese. How much cheese did Chan Hee buy?

Answer _____

12 Charlayne paddled $2\frac{3}{10}$ miles on the first day of a canoe trip. She paddled $4\frac{6}{10}$ miles on the second day. How much farther did Charlayne paddle the second day than the first day?

Answer _____

Read the problem. Write your answer to each part.

13 Mrs. Jenkins is buying pizza for the soccer team to eat after practice. Mrs. Jenkins estimates that each player will eat $\frac{3}{8}$ of a pizza.

Part A There are 17 players on the soccer team. If Mrs. Jenkins' estimate is correct, how much pizza will they eat? Show your work.

Answer _____

Part B Mrs. Jenkins orders 6 pizzas. If her estimate of how much pizza each player will eat is accurate, will there be enough pizza? Explain your answer.
