**Goals**

Students will shade the same fractions using different shapes.

**PRIOR KNOWLEDGE REQUIRED**

Can write a fraction for a shape with equal parts
Can divide a shape into equal parts
Knows that equal fractions of the same whole can have different shapes

**MATERIALS**

transparency of BLM 1 cm Grid Paper (p. V-1)
projector
marker for writing on transparencies

Drawing equal parts for different shapes and then shading the same unit fraction. Write on the board:

\[ \frac{1}{4} \]

ASK: What number is the denominator? (4) What does the denominator tell you? (the number of equal parts in the whole) Ask a volunteer to draw a vertical line to divide the shape into two equal parts. Ask a different volunteer to draw a horizontal line to divide the shape into four equal parts. The picture should look like this:

![Diagram of a shape divided into four equal parts](image)

Ask another volunteer to shade the picture to show \( \frac{1}{4} \). (see final picture below)

![Shaded diagram](image)

**Exercises**

1. Draw a line to create 4 equal parts. Then shade \( \frac{1}{4} \) of the whole.
   
   a) ![Diagram](image)  
   b) ![Diagram](image)  
   c) ![Diagram](image)

**Answers:**

a) ![Diagram](image)  
   b) ![Diagram](image)  
   c) ![Diagram](image)
2. Draw a line to create 3 equal parts. Then shade $\frac{1}{3}$ of the whole.

a) b) c) 

Answers: a) b) c) 

Drawing equal parts for different shapes and then shading the same fraction (not a unit fraction). Write on the board:

\[ \frac{2}{5} \]

ASK: What is the denominator? (5) What does it tell us? (the number of equal parts in the whole) Is the pentagon divided into equal parts? (yes) What is the numerator? (2) What does it tell us? (the number of equal parts to shade) Ask a volunteer to shade the fraction.

Exercises: Draw a line to create 8 equal parts. Then shade $\frac{3}{8}$ of the whole.

a) b) c) Bonus: 

Answers: a) b) c) Bonus: 

Shading the whole when given a fraction. SAY: Rob drew a picture of a whole. He started with a unit fraction and then he drew the rest. Draw on the board:

\[ \frac{1}{2} \]

\[ \frac{1}{3} \]

ASK: How many parts are in the picture with $\frac{1}{2}$? (2) How many parts are in the picture with $\frac{1}{3}$? (3) How is the fraction related to the number of parts in the whole picture? (the denominator tells the number of parts) Draw on the board:

\[ \frac{1}{4} \]
ASK: What is the denominator in this picture? (4) How many parts do we need to make a whole picture? (4) Ask a volunteer to draw the other three parts. The final picture is shown in the margin.

**Exercises:** Draw the remaining parts to make a whole.

a) \( \frac{1}{6} \)  

b) \( \frac{1}{5} \)  

c) \( \frac{1}{8} \)  

**Bonus:** \( \frac{1}{25} \)

**Answers:**

a) [Diagram of 6 parts]  
b) [Diagram of 5 parts]  
c) [Diagram of 8 parts]

d) [Diagram of 25 parts]

**Shading the whole when given a fraction, using a grid.** Project BLM 1 cm Grid Paper on the board. Shade squares and write the fraction as shown below:

\( \frac{1}{4} \)

SAY: The shaded region is 1/4 of the whole. To make it easier to see, I will draw a circle around the shaded region. The picture should look like this:

ASK: For the fraction 1/4, how many equal parts are in the whole? (4) How many of the unit fractions 1/4 will I need to make the whole? (4) Ask a volunteer to circle three more equal parts. If students have difficulty, ask them to count the squares in the grid. The final picture should look like this:

**Exercises:** The shaded region is \( \frac{1}{3} \) of the whole. Draw the outline of the whole.

a) [Diagram of 3 parts]

b) [Diagram of 7 parts]

c) [Diagram of 7 parts]

**Bonus:** The shaded region is \( \frac{1}{7} \) of the whole. Draw the outline of the whole.
Answers

a)

b)

c)

Bonus:

Extensions

(MP.1, MP.4, MP.5)

1. Ethan bought 9 DVDs at the video store yesterday. They cost $5 each. Today they are on sale: 3 DVDs for $10. How much money could Ethan have saved if he had waited until today to buy the DVDs? Use any tool you think will help. Show your work.

Answer: $15

Look for students to use an appropriate tool (MP.5) to model the situation (MP.4) and to help them begin to make sense of the problem (MP.1). Drawing a picture will help some students, while others will benefit from using number sentences, which is faster.

Redirecting students: Encourage students to start by writing down what they know in point form (MP.1). Emphasize that reading just the important parts makes it easier to see what is happening.

Individual or small-group follow-up: If some students still don’t understand, go through one sentence at a time and help students isolate the important parts:

Yesterday: 9 DVDs, $5 each  Today: 3 DVDs for $10

ASK: How much did the DVDs cost yesterday? ($45) How much would those same DVDs cost today? PROMPT: How many times does he have to spend $10 to get the same DVDs he bought yesterday? (3 times)

Some students may need to draw a picture:

$10

$10

$10

ASK: What information do you have so far? (Ethan paid $45 yesterday, but could have paid $30 today) Read the question again and have the student answer it: he paid $15 more yesterday than he would have today, because 45 is 15 more than 30.

2. What fraction of the shape in the margin is shaded?

Answer: 1/30
STANDARDS
3.NF.A.1

VOCABULARY
- eighth
- fraction
- fraction strip
- fourth
- greater than
- greater than sign (>)
- half
- less than
- less than sign (<)
- sixth
- third
- whole

Goals
Students will use fraction strips to compare fractions with the same denominator.

PRIOR KNOWLEDGE REQUIRED
Can write a fraction for a shape with equal parts

Review shading fractions of a strip. Draw on the board:

ASK: What fraction can we write for the shaded parts? (3/4) What does the fraction mean? (4 equal parts, 3 parts are shaded) Ask a volunteer to show the same fraction using a rectangle instead of a circle, as shown below:

SAY: When we use a rectangle to show fractions, it is called a fraction strip.

Exercises: Shade the fraction of the fraction strip.

a) 2/3
b) 3/5
c) 5/8

Answers
a) b) c)

Comparing fractions using fraction strips. Draw on the board:

SAY: Tom and Tina bought identical protein bars. Each ate the shaded part of their protein bars. How many parts did Tom eat? (3) How many parts did Tina eat? (5) Who ate more? (Tina) SAY: We know Tina ate more because five is greater than three. ASK: How can we tell just by looking at the picture that Tina ate more? (more is shaded)

ASK: How many parts are in each whole? (8) What fraction can we write for the parts Tom ate? (3/8) What fraction can we write for the parts Tina ate? (5/8) SAY: We know 5/8 is greater than 3/8 because more is shaded.
Exercises

1. Shade the fraction of the strip. Then circle the greater fraction.

   a) \[ \frac{3}{5} \]
   b) \[ \frac{1}{4} \]
   c) \[ \frac{5}{8} \]

   Answers: a) \( \frac{3}{5} \), b) \( \frac{3}{4} \), c) \( \frac{5}{8} \)

2. Shade the fraction of the strip. Then circle the smaller fraction.

   a) \[ \frac{2}{3} \]
   b) \[ \frac{2}{6} \]
   c) \[ \frac{1}{2} \]

   Answers: a) \( \frac{1}{3} \), b) \( \frac{2}{6} \), c) \( \frac{1}{2} \)

Review the signs for greater than (>) and less than (<).

SAY: Mathematicians sometimes use signs instead of words. Write on the board:

\[ > \] is greater than

\[ < \] is less than

Pointing to each sign, SAY: We can use the sign for “is greater than” instead of writing the words. We can use the sign for “is less than” instead of writing the words. Write on the board:

\[ \frac{7}{5} \]

SAY: We read the number sentence from left to right just as we do with words. Point to the \( 7 \) and say “seven.” Point to the sign and say “is greater than.” Point to the \( 5 \) and say “five.” Write on the board:

\[ 4 \] is less than \( 10 \)

Ask a volunteer to rewrite the sentence and replace the words “is less than” with the correct sign. (\( 4 < 10 \)
The open part of the sign is always closest to the bigger number. Write on the board:

\[ 7 > 5 \quad 4 < 10 \]

Point out that the open part of the sign is closest to the 7 in the first pair of numbers, and closest to the 10 in the second pair of numbers.

**Exercises:** Use the correct sign (\(>\) or \(<\)) to compare the numbers.

a) \(5 \quad 7\)  

b) \(10 \quad 3\)  

c) \(9 \quad 4\)  

**Bonus:** \(113 \quad 245\)

**Answers:** a) \(5 < 7\), b) \(10 > 3\), c) \(9 > 4\), Bonus: \(113 < 245\)

*SAY:* We can also use the greater than and less than signs to compare fractions. Draw on the board:

\[
\begin{array}{ccc}
\frac{3}{4} \\
\frac{1}{4}
\end{array}
\]

Ask volunteers to shade the fraction of the strip. Which fraction strip has more shaded? (3/4) Which fraction is greater? (3/4) Write on the board:

\[
\frac{3}{4} \text{ is greater than } \frac{1}{4}
\]

Ask a volunteer to replace “is greater than” with the correct sign. (\(>\))

**Exercises:** Shade the fraction of the strip. Circle the greater fraction. Then write the correct sign to compare the fractions.

a) \[
\begin{array}{ccc}
\frac{5}{6} \\
\frac{2}{6}
\end{array}
\]  

b) \[
\begin{array}{ccc}
\frac{2}{5} \\
\frac{4}{5}
\end{array}
\]

c) \[
\begin{array}{ccc}
\frac{2}{8} \\
\frac{7}{8}
\end{array}
\]

**Bonus:** Write the correct sign: \(\frac{99}{100} > \frac{7}{100}\)

**Answers:** a) \(5/6 > 2/6\), b) \(2/5 < 4/5\), c) \(2/8 < 7/8\), Bonus: \(99/100 > 7/100\)
Making sure fractions are of the same whole. Draw on the board:

SAY: I drew two pizzas that are divided. Ask volunteers to write a fraction for the shaded part of the pizza in each picture. (1/4, 3/4) SAY: Mona is really hungry. She says that 3/4 > 1/4 so she wants the pizza slices from the second picture. ASK: Is she correct? (no) Why? (the pizzas are not the same size) SAY: We cannot compare fractions if the wholes are not the same size.

Extensions

1. Write the fractions in order from smallest to largest.
   a) \(\frac{2}{5}, \frac{3}{5}, \frac{1}{5}\)
   b) \(\frac{3}{7}, \frac{1}{7}, \frac{5}{7}\)

   Answers: a) 1/5, 2/5, 3/5; b) 1/7, 3/7, 5/7

2. Write on the board:

   Dory teaches tennis lessons, so she needs to buy 24 tennis balls. One store sells cans of 3 balls for $5 each. Another store sells cans of 4 balls for $6 each.

   Have students talk with a partner about what they think will cost less, to buy cans of 3 or cans of 4. Some students may predict that cans of 3 will be cheaper because each can costs less; others may think cans of 4 will be cheaper because fewer cans are needed. Continue writing on the board:

   Which store should Dory go to?

   Use concrete materials, a picture, or number sentences to explain. Write what each thing means in the situation.

   Have students do the problem individually.

   Sample solutions
   - I used counters for the 24 tennis balls. For the first store, I grouped counters by 3s and noticed there were 8 groups; since each group costs $5, the total cost would be $40. For the other store, I grouped counters by 4s and saw there were 6 groups; since each group costs $6, the total cost would be $36. Dory should go to the second store.
   - Draw 24 circles for tennis balls, group them by 3s, write the cost of each group, and then total the cost using multiplication or repeated addition. Repeat to group by 4s.
   - Divide 24 ÷ 3 to see how many cans of 3 Dory would need, then multiply the answer (8) by the cost of each can ($5). So she would pay
$40 for the cans of 3. Divide $24 \div 4$ to see how many cans of 4 she would need, then multiply the answer (6) by the cost of each can ($6). So she would pay $36 for the cans of 4. Buying cans of 4 costs less.

Whole-class follow-up: Have several students share their strategies, including one that uses a picture and one that uses number sentences. ASK: How does the picture show the number sentences? Which way was faster? Do both ways work?
Goals

Students will create fraction strips in two ways by using a ruler and strips of paper. Students will use the strips to divide lines and regions into equal parts, identify shaded fractions of a region, and create a whole from a unit fraction.

PRIOR KNOWLEDGE REQUIRED

Can shade a given fraction of a fraction strip

MATERIALS

- centimeter ruler
- inch ruler
- projector
- blank transparencies
- transparent centimeter ruler (for display)
- transparent inch ruler (for display)
- paper cut into strips

Review measuring with a ruler. Distribute centimeter rulers and inch rulers to students. Draw a 5 cm line and a 3-inch line on a transparency and project it on the board. ASK: We want to measure the lengths of these lines using a ruler. What units have we used for measuring? (centimeters, inches) SAY: Let’s measure the first line with a centimeter ruler. Demonstrate measuring the line on the board using a transparent centimeter ruler. ASK: How do we place the ruler? (align the 0 cm mark below the left end of the line) How do we find the length? (draw an arrow from the right end of the line down to the ruler) How long is the line? (5 cm) The final picture should look like this:

```
0 cm 1 2 3 4 5 6
```

Direct students to the line in Question 2.a) on AP Book 3.2 p. 39. Draw a 3-inch line on a transparency and project it on the board. SAY: Let’s measure the line using an inch ruler. ASK: How do we place the ruler? (align the 0 inches mark below the left end of the line) Demonstrate using a transparent inch ruler. ASK: How do we find the length of the line? (draw an arrow from the right end of the line down to the ruler) How long is the line? (3 inches) The final picture is shown on the next page.
Using a ruler to create equal parts on a line. Project a 4 cm line drawn on a blank transparency. Align the 0 cm mark of the transparent ruler below the left end of the line as shown below:

```
0 cm 1 2 3 4 5 6
```

SAY: I want to divide the line into four equal parts. Mark a tick at the left end of the line directly above the 0 cm mark. SAY: Let's use the ruler to make tick marks at 1 cm, 2 cm, 3 cm, and 4 cm. (see picture below)

```
0 cm 1 2 3 4 5 6
```

ASK: How many tick marks did we make? (5) How many equal parts are there? (4) Why is there one more tick mark than parts? (the first tick mark is the start or zero) If necessary, count the parts out loud with the class, as shown in the margin. Repeat with a 3-inch line and a transparent inch ruler.

Have students complete Questions 1–2 on AP Book 3.2 p. 39.

Using a ruler to create a fraction strip. Draw a 4 cm by 1 cm rectangle on a clear transparency. SAY: We can use a ruler to create a fraction strip. Align the 0 cm mark of a transparent centimeter ruler below the bottom left end of the rectangle. Make tick marks along the bottom edge of the rectangle at 1 cm, 2 cm, 3 cm, and 4 cm. SAY: Let's make similar tick marks along the top edge of the rectangle. Move the transparent ruler so that the 0 cm mark is below the top left corner of the rectangle. Make tick marks at 1 cm, 2 cm, 3 cm, and 4 cm along the top edge of the rectangle. SAY: How can we use the marks to create four rectangles? (join them) Use a ruler to join the tick marks and create four rectangles. (See margin for final picture.)

Have students complete Questions 3–4 on AP Book 3.2 p. 39.

Using a strip of paper with one part shaded to create a fraction strip. For the demonstration, you need two blank transparencies on an overhead. Draw a 4 cm rectangle on a transparency and shade a 1 cm rectangle as shown below:
SAY: We can create a fraction strip even if we don’t have a ruler. Place a blank transparency so that its top edge sits below the rectangle. Draw a tick mark on the second transparency in line with the right edge of the shaded rectangle as shown below:

![Fraction Strip Diagram](image1)

SAY: This tick mark will be like the 1 cm mark on our ruler. We can use it to make tick marks that are the same distance apart on the rectangle. Move the second transparency to the right so that the left edge of the transparency lines up with the right edge of the shaded rectangle as shown below:

![Fraction Strip Diagram](image2)

SAY: We can use the new ruler to mark the next rectangle on our fraction strip. Make the mark. Repeat the process twice to make two more tick marks. SAY: The last tick mark should line up with the right edge of the fraction strip. We can use a ruler to draw vertical lines at each tick mark. Draw the vertical lines as shown below:

![Fraction Strip Diagram](image3)

ASK: How many parts do we have? (4) Are they equal? (yes) What fraction can we write for the shaded rectangle? (1/4)

Have students complete Questions 5–6 on AP Book 3.2 p. 40.

**Using a ruler to create the whole from one of the parts.** Draw on a blank transparency:

![Blank Transparency](image4)

SAY: Suppose I cut a long, rectangular banana bread into four equal parts. I just drew one of the equal parts. ASK: What fraction can we write for this part? (1/4) Label the part. ASK: How can we use a ruler to find the shape of the whole banana bread? (measure the piece and create more equal parts) Using a transparent centimeter ruler, align the 0 cm mark below the bottom left end of the part. ASK: How many tick marks will I need for the remaining
parts? (3) Ask a volunteer to use the ruler and make tick marks for the other parts as shown below:

```
0 cm 1 2 3 4 5 6
```

![Image of ruler with tick marks]

Ask another volunteer to draw the other pieces of banana bread. The final picture should look like this:

```
0 cm 1 2 3 4 5 6
```

![Image of banana bread pieces]

**ASK:** What fraction can we write for each equal part? (1/4) What part of the fraction tells us there are four equal parts? (the denominator)

Have students complete **Question 7** on AP Book 3.2 p. 40.

**Extensions**

1. The slice of pizza is one of the equal parts in a circular pizza.

   ![Image of pizza slice]

   Trace the slice enough times so that the slices can be put together to form a circle. What fraction of the pizza is the original slice?

   **Answer:** \( \frac{1}{10} \)

   (MP1, MP2, MP5)

2. Jin teaches tennis lessons. There are 8 people in the class and he needs 5 balls for each person. He already has 22 balls left from the last class. How many cans of 3 does he need to buy? Use concrete materials, a picture, or number sentences. Write what each step means in the situation.

   **Sample answer:** I used number sentences. Jin needs 40 balls because \( 8 \times 5 = 40 \). He already has 22, so he only needs 18 more balls \( (40 - 22 = 18) \). Balls come in cans of 3, so he needs to buy 6 cans \( (18 \div 3 = 6) \).

   Look for students to show what each part of the drawing or what each number sentence means (MP2) in the real world (including the final
answer to the problem), and to choose an appropriate tool (MP.5). Students who struggle to understand the problem will benefit from drawing a picture or using concrete materials, whereas students who already understand the problem (MP.1) will benefit from using number sentences, which is a faster way to solve the problem.

Redirecting students: Suggest students draw a picture of the information that they are given. Encourage them to show what each part of the drawing means. Encourage students to reread the problem as many times as necessary to get all the information.

Whole-class follow-up: Show students the following two solutions:

- $8 \times 5 = 40$
- $40 - 22 = 18$
- $18 \div 3 = 6$

Discuss the following questions as a class:

- How does the picture show the people? The tennis balls? The cans of balls? (the faces, the small circles, the groups of 3 circles)
- Where do you see the 22 in the picture? (the black circles, which are the balls that Jin already has)
- Are there any details in the picture you could leave out to make drawing faster? (the hair, eyes, and mouth—we could just draw circles and say that a circle means a face)
- How would you change the picture to make what it is about clearer? (say what each symbol means)
- How do the number sentences show the people? The tennis balls? The cans of balls? (8 is the number of people, 40 is the number of tennis balls needed, the cans are the 6 groups of 3 needed to make 18)
- What does the 22 in the number sentence mean? (the number of balls that Jin already has)
- How does the picture show the multiplication? The subtraction? The division? (the 5 groups of 8 circles, the subtracted circles are black, the gray circles are made into groups of 3)
- Which way is faster? (using equations is faster to write, but you have to see what equations to use, so drawing a picture might be faster)
- Which way is easier to understand? (answers will vary)
STANDARDS
3.NF.A.2a, 3.NF.A.2b

VOCABULARY
denominator
eighth
fourth
fraction
fraction strip
half
number line
numerator
sixth
third
whole
whole number

Goals
Students will use fraction strips to label fractions on a number line.
Students will use a number line to create fraction strips.

PRIOR KNOWLEDGE REQUIRED
Can shade a given fraction of a fraction strip
Can write a fraction for a given shaded fraction strip
Knows how to read a number line with whole numbers

Review using a number line. Draw on the board:

SAY: The numbers 0, 1, 2, 3, 4, 5, and so on, are called whole numbers. Ask a volunteer to write the whole numbers from 0 to 10 on the number line as shown below:

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Draw on the board:

ASK: What is wrong with this number line? (the tick marks are not equally spaced) SAY: We can use fraction strips to help create number lines that use fractions instead of whole numbers.

Locating a fraction on a number line given a shaded fraction strip.
Draw on the board:

ASK: How many equal parts does the fraction strip show? (2) How many parts are shaded? (1) What fraction can we write for the shaded part? (1/2) SAY: In a fraction strip, the equal parts are parts of a whole or one. We can draw a number line below the fraction strip. The number line will have the whole numbers 0 and 1. Draw the number line underneath the fraction strip, as shown below:

| 0 | 1 |

Ask a volunteer to draw tick marks on the number line directly below each equal part in the fraction strip. (See margin for final picture.)
ASK: Are the tick marks equally spaced? (yes) ASK: Where do you think the fraction 1/2 would appear on the number line? (directly below the right end of the shaded region) Ask a volunteer to write the fraction in the appropriate place on the number line.

SAY: Let’s find the fractions on a number line using a fraction strip. Draw on the board:

![Fraction Strip Diagram]

ASK: How many equal parts does the fraction strip show? (5) How many parts are shaded? (2) What fraction can we write for the shaded part? (2/5) SAY: In a fraction strip, the equal parts are parts of a whole or one. Let’s draw a number line directly below the fraction strip. The number line will have the whole numbers 0 and 1. Draw the number line as shown below:

![Number Line Diagram]

Ask a volunteer to draw tick marks on the number line directly below each equal part in the fraction strip. The final picture should look like this:

![Number Line with Tick Marks]

ASK: How do we know that the tick marks on the number line are equally spaced? (the fraction strip is divided into equal parts) ASK: Where do you think the fraction 2/5 will appear on the number line? (directly below the right end of the shaded region) Ask a volunteer to write the fraction in the appropriate place on the number line.

**Exercises:** Write a fraction for the shaded part of the fraction strip. Then label the fraction on the number line.

a) ![Fraction Strip Diagram](image-a)  
b) ![Fraction Strip Diagram](image-b)  
c) ![Fraction Strip Diagram](image-c)  
d) ![Fraction Strip Diagram](image-d)

**Answers:** a) 3/4, b) 5/8, c) 1/3, d) 3/6
Shading a fraction on a fraction strip given a fraction on a number line.

Draw on the board:

\[ \begin{array}{cccccc}
\hline
& & & & & \\
0 & \frac{3}{8} & & & 1 \\
\hline
\end{array} \]

ASK: What is the denominator in the fraction \( \frac{3}{8} \)? (8) What does it tell us? (there are 8 equal parts) What is the numerator? (3) What does it tell us? (3 parts are shaded) Ask a volunteer to shade the fraction on the fraction strip.

**Exercises:** Shade the fraction of the strip that shows the fraction on the number line.

\[ \begin{array}{ll}
a) & \quad 0 \quad \frac{2}{3} \\
b) & \quad 0 \quad \frac{5}{6} \\
c) & \quad 0 \quad \frac{1}{4} \\
d) & \quad 0 \quad \frac{7}{8} \\
\end{array} \]

**Answers:**

\[ \begin{array}{l}
a) \text{shade 2 of the 3 parts,} \\
b) \text{shade 5 of the 6 parts,} \\
c) \text{shade 1 of the 4 parts,} \\
d) \text{shade 7 of the 8 parts} \\
\end{array} \]

**Counting by unit fractions to make a whole.** Draw on the board:

For each fraction strip, ask a volunteer to write the fraction on the number line in the correct location. (1/3, 2/3, 3/3, 0/3) For the last number line, remind students to write a fraction (not 0). PROMPT: How many parts are shaded? (0) How many equal parts are in the whole? (3)

SAY: Let’s put all our answers on one number line. Draw on the board:

\[ \begin{array}{cccc}
0 & 1 & 2 & 3 \\
\hline
\frac{3}{3} & \frac{3}{3} & \frac{3}{3} \\
\hline
\end{array} \]
SAY: Let’s look for patterns in the fractions. What is the denominator in each fraction? (3) Why? (there are 3 equal parts in each fraction strip) What are the numerators? (0, 1, 2, 3) SAY: Notice that we can just count by 1s to get the numerators.

Repeat the demonstration using a fraction strip with four equal parts. (0/4, 1/4, 2/4, 3/4, 4/4)

As a bonus, ask students to write the fractions on a number line for a fraction strip with 10 equal parts. (0/10, 1/10, 2/10, 3/10, 4/10, 5/10, 6/10, 7/10, 8/10, 9/10, 10/10)

Extensions

1. Jack wrote all the fractions from 0 to 1 for a number including the fractions for 0 and 1. Find the total number of equal parts in the fraction strip if Jack wrote:
   a) 5 fractions
   b) 201 fractions
   **Answers:** a) 4 equal parts, b) 200 equal parts

2. For a number line divided into thirds, the fractions are $0\frac{0}{3}, 1\frac{1}{3}, 2\frac{2}{3}, \text{ and } 3\frac{3}{3}$. When you add all the numerators and denominators in these fractions, the total is 18.
   a) For a number line divided into fourths, what is the total of the numerators and denominators for the fractions from 0 to 1?
   b) How many equal parts are in a number line if the total of the numerators and denominators is 63?
   **Answers:** a) 30, b) 6 equal parts

(MP3, MP6) 3. Is the statement always, sometimes, or never true? In pairs, explain how you know. Use math words. Do you agree with each other? Discuss why or why not.
   a) A quadrilateral with 4 equal sides is a square.
   b) A square has 2 longer sides and 2 shorter sides.
   c) A square is a quadrilateral.
   d) A triangle is a quadrilateral.
   e) A rectangle is a square.
   f) A square is a rectangle.
   **Answers:** a) sometimes, b) never, c) always, d) never, e) sometimes, f) always
Sample explanations

a) sometimes: a quadrilateral with four equal sides that is a square: ☐ (this is a square because it has four equal sides and four right angles); a quadrilateral with four equal sides that is not a square: ☐ (this is not a square because it does not have right angles)

b) never, because all four sides of a square are equal

c) always, because any square has four sides

d) never, because a triangle only has three sides

e) sometimes: a rectangle that is a square: ☐ (this is a rectangle because it has four sides and all the angles are right angles and this is a square because all the sides are equal); a rectangle that is not a square: ☐ (this is a rectangle because it has four sides and all the angles are right angles but this is not a square because not all the sides are equal)

f) always, because every square has four sides and four right angles

Encourage partners to ask questions to understand and challenge each other’s thinking (MP3) and use of terminology (MP6)—see p. A-49 for sample sentence and question stems to guide students. You might have partners alternate initiating the discussion for each part.

Redirecting students: Emphasize that to prove a statement always or never true, you need a reason or you need to check every single example, but to prove a statement sometimes true, you only need one example where it is true and one example where it isn’t.
NF3-10 Fractions on a Number Line (Advanced)
Pages 43–44

STANDARDS
3.NF.A.2a, 3.NF.A.2b

VOCABULARY
denominator
eighth
fraction
fraction strip
greater than sign (>)
half
less than sign (<)
sixth
third
whole

Goals
Students will identify a fraction for a dot marked on a number line.
Students will mark and label fractions with a given denominator on a number line.
Students will use a number line to compare fractions using the signs for greater than and less than.

PRIOR KNOWLEDGE REQUIRED
Can count by unit fractions on a number line

MATERIALS
construction paper for paper folding
scrap paper
scissors
BLM Folding Rulers (p. N-85)

Identifying a fraction for a dot on a number line. Draw on the board:

ASK: How many equal parts are there in the whole? (6) How many equal parts are shaded? (5) What fraction can we write on the number line? (5/6)

SAY: Let’s name the fraction without drawing the fraction strip. Draw the same number line on the board beside the first picture:

Starting at 0, draw an arrow to the next tick mark. Continue doing this until you reach the dot. Ask students to count each arrow as you go. The picture should look like this:

SAY: Notice that this is the same as counting the number of parts we shaded in the fraction strip. Demonstrate by counting the parts in the previous diagram as shown below:
ASK: How many equal parts are in the whole? (6) How can we count the equal parts on the number line? (start at 0 and count tick marks until you get to 1) Have students count with you as you demonstrate on the board:

```
1 2 3 4 5 6
```

SAY: Notice that this is the same as counting the number of equal parts in the whole in the fraction strip. Write on the board:

```
\text{number of tick marks from 0 to the dot} \\
\frac{5}{6} \\
\text{number of tick marks from 0 to 1}
```

Draw on the board:

```
0 \quad 1
```

SAY: I want to find the fraction marked by the dot. ASK: How many parts would be shaded in the fraction strip? (3) Ask a volunteer to draw the arrows to count the parts. ASK: How many equal parts are in the whole? (8) Ask a different volunteer to draw the arrows to count the parts in the whole. The final picture should look like this:

```
0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 1
```

ASK: What is the fraction marked by the dot? (3/8)

**Exercises**

1. Name the fraction marked by the dot.
   a)  
   b)  

2. Draw a dot on the number line to mark the fraction.
   a)  
   b)  

**Bonus:** Name the fraction marked by the dot.

```
0 \quad 1
```

**Answers:** 1. a) 2/5, b) 5/7; 2. a) , b) , Bonus: 25/32
Review paper folding. In advance, cut out pieces of paper for students to do paper folding. Hold up a piece of construction paper. ASK: How we can demonstrate the fraction 1/2? (fold paper once along the middle) Demonstrate the fold as shown below:

Ask students to fold their own piece of paper. ASK: How can we fold the paper to show 1/4? Some students will say to fold down. Tell them they are correct, but that you want to fold it a different way. You want to fold it across again, as shown below:

Ask students to make a second fold in the same way. Unfold the paper. Show how each fold forms 1/4:

ASK: How many equal parts are there? (4) What fraction can we write for each equal part? (1/4) SAY: Notice that all the folds go in the same direction. Using another piece of construction paper, ASK: How can we fold the paper to show 1/3? Students may need to be prompted as this is a more difficult fold to make. Circulate and, if needed, assist students to make the fold. The paper should look like this:

**ACTIVITY**

Students make fraction strips and use them to draw fractions on a number line. Provide a copy of BLM Folding Rulers to each student. Have students cut along the dotted lines to create rectangles. Draw on the board:

0 1
Have students draw a similar line in their notebook. Ask them to cut one folding ruler to the same length as their line. As you circulate, check that students are cutting the ruler to the same length as the line they drew. While they work, cut out a rectangle the same length as the line on the board. SAY: I want to mark this line with fourths. How many equal parts do I need? (4) How can I fold paper to create four equal parts? (fold in half, then fold in half again in the same direction) Using construction paper, demonstrate the folding, then ask students to do the same. SAY: We have just created a fraction strip. We can use the strip to make tick marks for the fractions. Place the fraction strip above the number line on the board and use the folds to make the tick marks, as shown below:

```
0 1
```

Ask a volunteer to shade 1/4 on the fraction strip on the board. Ask a different volunteer to mark 1/4 on the number line. Repeat for 2/4 and 3/4. Ask students to use their folding ruler to mark fourths on the line they drew in their notebook.

Have students complete Questions 2–3 on AP Book 3.2 pp. 43–44. They will need to use BLM Folding Rulers and cut out rectangles of the correct length.

Comparing fractions on a number line. Draw on the board:

```
0 1 2 3 4 5 6
```

ASK: Which number is larger, 3 or 5? (5) Write on the board: “5 > 3.” SAY: 5 is larger than 3. Remind students that the greater than sign stands for “is greater than.” Below the number line, draw two lines: one line from 0 to 3, and the other line from 0 to 5, as shown below:

```
0 1 2 3 4 5 6
```

ASK: How can we tell from these lines that 5 > 3? (the line for 5 is longer) SAY: We can use the same idea to compare fractions. Draw on the board:
SAY: The fraction strips are fractions of the same whole. Pointing to the first strip, ASK: What fraction is shown? (3/6) Ask a volunteer to use a dot to mark the fraction on the number line, and then label it. Pointing to the second strip, ASK: What fraction is shown? (5/6) Ask a different volunteer to use a dot to mark the fraction and label it on the number line. ASK: Which fraction is greater? (5/6) How can you tell by the fraction strips? (it has more shaded) If we drew a line from 0 to 3/6 and a line from 0 to 5/6, which line would be longer? (0 to 5/6) SAY: The dot for 5/6 is farther to the right on the number line than the dot for 3/6. ASK: How can we write 5/6 is greater than 3/6 using the greater than sign? (5/6 > 3/6) Write on the board:

\[
\frac{5}{6} > \frac{3}{6}
\]

**Exercises:** Put a dot on the number line to mark each fraction. Label the fractions. Then use the greater than sign (>) to show which fraction is greater.

**a)** [Diagram of fraction strips]

**b)** [Diagram of fraction strips]

**Answers:** a) 3/4 > 1/4, b) 5/8 > 3/8

SAY: We can also compare fractions with different denominators, as long as the fractions are of the same whole. Draw on the board:

SAY: The fraction strips are the same length, so we know they are parts of the same whole. ASK: What fraction does the first fraction strip show? (2/3) What fraction does the second strip show? (3/4) Ask a volunteer to label the dots on the number line. (2/3 and 3/4) ASK: Which fraction is greater? (3/4) How can we tell from the number line? (it is farther to the right) How can we write this using the greater than sign? (3/4 > 2/3) Draw on the board:

\[
\begin{array}{c}
0 \quad 1 \\
\hline
\frac{1}{8} & \frac{1}{2} & \frac{2}{3} & \frac{3}{4} & 1
\end{array}
\]

ASK: Which fraction is greater, 1/8 or 2/3? (2/3) How can you tell? (it is farther to the right) How do we write this using the greater than sign? (2/3 > 1/8) ASK: Which fraction is smaller, 1/2 or 3/4? (1/2) How do we write this using the less than sign? (1/2 < 3/4)
Have students complete Questions 4–5 on AP Book 3.2 p. 44.

**Bonus:**

a) Which fraction is smaller, \( \frac{3}{10} \) or \( \frac{7}{10} \)?

b) Which fraction is larger, \( \frac{7}{50} \) or \( \frac{14}{50} \)?

**Answers:** a) 3/10, b) 14/50

**Extensions**

1. Use paper folding to make a fraction strip that will help mark a number line in sixths.

   **Answer:** Cut out a rectangular strip and fold it in thirds. Then fold it in half along the same direction, as shown below:

   ![Fraction Strip Diagram](image)

   When unfolded, it will look like the diagram below. Use the strip to mark the number line in sixths.

   ![Number Line with Fractions](image)

2. Cut out a rectangular strip the same size as in Question 1, and fold it twice to create fourths. Use it to mark the same number line from Question 1 in fourths.

   **Answer:**

   ![Fraction Strip Diagram](image)

   When unfolded, it will look like the diagram below. Use the strip to mark the number line in fourths.

   ![Number Line with Fractions](image)

3. Which fractions are the same distance from zero?

   **Answer:** 3/6 and 2/4 are the same distance from zero.

4. Write the fractions on the number line in Question 2 in order from smallest to largest.

   **Answers:** 1/6, 1/4, 2/6, 2/4 and 3/6, 4/6, 3/4, 5/6
5. Read the following problem:

There are 36 students playing on four teams at a soccer tournament. The coaches need 72 orange slices for all the players. If each orange can be cut into 8 slices, how many oranges do the coaches need to buy?

a) Which facts in the problem do you not need? Explain.

b) Solve the problem. Use a number sentence to show the answer.

**Bonus:** Make up a question that you can answer using the facts that you did not need.

**Selected answers:**
a) there are 36 students and four teams;
b) $72 \div 8 = 9$, so the coaches need to buy 9 oranges

Look for students to recognize which information is necessary to answer the question (MP1) and to model the situation (MP4) using either $72 \div 8$ or $8 \times \_ = 72$. If students have not memorized the division facts, look for them to use structure (MP7)—for example, a known multiplication or easier divisions.