BRIDGES IN MATHEMATICS 3

GRADE 3 SUPPLEMENT

Set A5 Number & Operations: Fractions

Includes

Skills & Concepts

- ★ represent fractions as distances on a number line
- ★ solve problems that involve comparing and ordering fractions by using models
- ★ identify equivalent fractions using models, including the number line
- ★ add common fractions with like denominators
- ★ identify fractions of an inch on a ruler
- ★ represent a fraction $\frac{1}{b}$ on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts.
- ★ represent a fraction $\frac{a}{b}$ on a number line diagram by marking off a lengths $\frac{1}{b}$ from 0.
- ★ understand two fractions as equivalent if they are the same size, or the same point on a number line.
- ★ recognize and generate simple equivalent fractions. Explain why the fractions are equivalent using a visual fraction model.
- ★ express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers.
- ★ compare two fractions with the same numerator or the same denominator by reasoning about their size and justify the conclusions using a visual fraction model.
- ★ understand a fraction $\frac{1}{b}$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction $\frac{a}{b}$ as the quantity formed by a parts of size $\frac{1}{b}$.

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Bridges in Mathematics Grade 3 Supplement
Set A5 Numbers & Operations: Fractions

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Bridges in Mathematics is a standards-based K–5 curriculum that provides a unique blend of concept development and skills practice in the context of problem solving. It incorporates the Number Corner, a collection of daily skill-building activities for students.

The Math Learning Center is a nonprofit organization serving the education community. Our mission is to inspire and enable individuals to discover and develop their mathematical confidence and ability. We offer innovative and standards-based professional development, curriculum, materials, and resources to support learning and teaching. To find out more, visit us at www.mathlearningcenter.org.

Set A5 ★ Activity 1

ACTIVITY

Fractions on a Double Number Line

Overview

Students create a double number line marked with 0 and 1 on one side, and fractions on the other. Then they name and locate points along the line, including ½, ¼, and ¾.

Skills & Concepts

★ represent fractions as distances on a number line

★ solve problems that involve comparing and ordering fractions by using models

★ identify equivalent fractions using models, including the number line

★ add common fractions with like denominators

You'll need

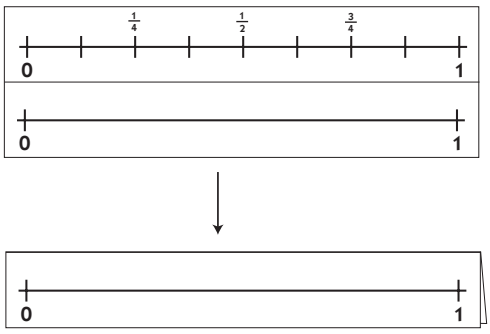
★ Double Number Line (page A5.4, run a half-class set on cardstock, cut in half)

★ scissors

★ a paperclip for each student

Instructions for Fractions on a Double Number Line

1. Give each student a copy of the Double Number Line. Ask them to cut it out along the heavy lines and fold it in half lengthwise.

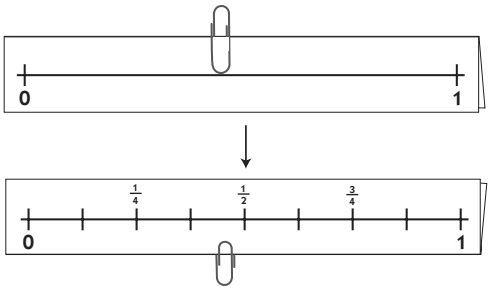


2. Ask students to pair-share any mathematical observations they can make about their Double Number Lines, and then ask volunteers to share their thinking with the class.

> ***Students*** *It looks kind of like a ruler.*
> *It's like a giant inch or something, with 0 at one end and 1 at the other.*
> *There are fractions on the other side: ¼, ½, and ¾.*
> *Some of the marks don't have any numbers.*
> *The mark in the middle says ½. That's because it's halfway between the 0 and the 1.*
> *When you turn it over, the numbers are still right-side up, but there's only a 0 and a 1.*

Activity 1 Fractions on a Double Number Line (cont.)

3. Give students each a paperclip, and ask them to slide the clip down over the fold. Working with the side marked only with 0 and 1, have them slide the paperclip along the fold until they think they've gone exactly halfway. Then have them flip the line over to check. Did the clip land on the mark labeled with the fraction $\frac{1}{2}$?



> ***Lateva*** *Almost! I almost got it exactly. I'm going to turn it over and try again to see if I can get the paperclip to land right on the $\frac{1}{2}$ mark.*

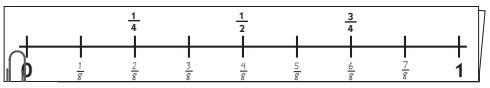
Give students a minute to experiment. Can they develop strategies for getting the paperclip to land exactly on the $\frac{1}{2}$ mark without peeking? Then ask them to slide their paperclip one-fourth of the way along the unmarked line. Can they come up with some strategies for getting the clip to land on or very near the mark labeled with $\frac{1}{4}$?

> ***Thayne*** *I just moved my clip what I thought was halfway down the line and then cut that in half. I got pretty close.*

4. Now talk with students about the marks that haven't yet been labeled with fractions. How would they label some of those marks? Give them a few moments to pair-share ideas and then call on volunteers to share their thinking with the class. Encourage them to explain their thinking.

> ***Olivia*** *It should say $\frac{1}{8}$ on that first mark.*
>
> ***Teacher*** *How are you thinking about that, Olivia?*
>
> ***Olivia*** *Well, the line is divided into 8 parts, right? So each one is one-eighth.*
>
> ***Hector*** *We said the next one would be $\frac{2}{8}$ because that's the same as $\frac{1}{4}$, plus what Olivia said. It goes $\frac{1}{8}$, $\frac{2}{8}$, $\frac{3}{8}$, $\frac{4}{8}$, and you just keep going that way.*
>
> ***Twilight*** *You could also put $\frac{2}{4}$ right under where it says $\frac{1}{2}$, because $\frac{2}{4}$ comes between $\frac{1}{4}$ and $\frac{3}{4}$.*

5. After some discussion, make a sketch of the line on the board and work with input from the class to label each of the marks. Then have students label each of the marks on their own number lines.



Activity 1 Fractions on a Double Number Line (cont.)

6. Now ask them to turn their number line back over to the unmarked side. Challenge them to slide their paperclip three-fourths of the way along the line, and then ask them to check the other side. How close did they come to hitting the mark labeled $^3/_4$? Ask them to share some of their strategies.

7. Repeat step 6 with some of the following fractions. (Vary these as needed to meet the needs of your students.)

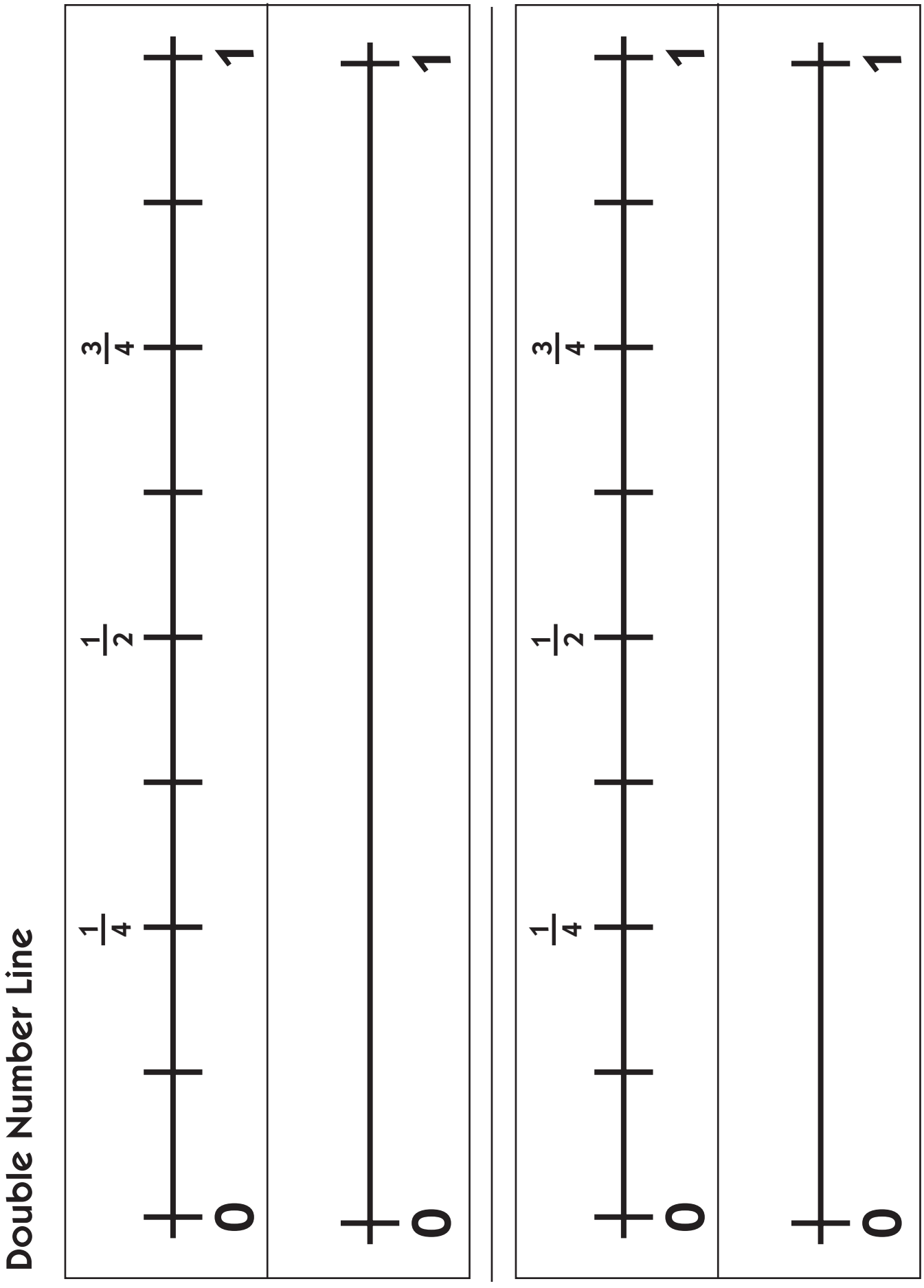
- $^1/_8$
- $^6/_8$
- $^3/_8$
- $^1/_4 + {}^1/_4$
- $^1/_8 + {}^1/_8$

Extensions

- Pose story problems such as the ones below and ask students to enact them by moving their paperclip along the unmarked side of their number line. After each, have them turn their number line over to see how close they came to hitting the mark.
- I ran $^1/_4$ of a mile. Then I took a rest and ran another $^1/_4$ of a mile. How far did I go in all?
- I had 1 whole fruit strip. I ate half of it. How much did I have left?
- Sam's brother gave him 1 whole piece of licorice. He ate $^1/_4$ of it and saved the rest for later. How much did he have left?
- We walked $^2/_8$ of a mile and then another $^1/_8$ of a mile. How far did we go in all?

INDEPENDENT WORKSHEET

See Set A5 Independent Worksheets 1 and 2 for more practice locating and naming fractions on a number line, including halves and fourths.



Set A5 ★ Activity 2

ACTIVITY

Sketching Fractions on a Number Line

Overview

Extending Activity 1, students slide paperclips along the double number line to model fractions and then sketch the fractions on their own number line diagrams.

Skills & Concepts

★ represent a fraction $1/b$ on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts.

★ represent a fraction a/b on a number line diagram by marking off a lengths $1/b$ from 0.

★ understand two fractions as equivalent if they are the same size, or the same point on a number line.

★ recognize and generate simple equivalent fractions. Explain why the fractions are equivalent using a visual fraction model.

★ express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers.

★ compare two fractions with the same numerator or the same denominator by reasoning about their size and justify the conclusions using a visual fraction model.

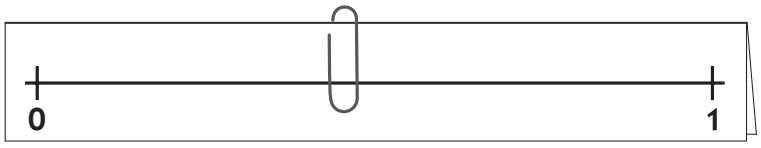
You'll need

★ Double Number Line with paperclip (from Activity 1)

★ Number Line Sketches (page A5.7 & A5.8, run a class set)

Instructions for Sketching Fractions on a Number Line

1. Give each student a copy of the Double Number Line from Activity 1 with attached paperclip.

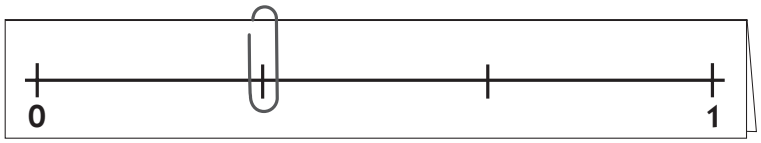


Working with the side marked 0-1, and starting with 0, have students slide the paperclip along the fold until they think they've located the fraction $1/3$. Give students time to pair-share their reasoning. Facilitate a group discussion with opportunities to share the number line model with the class.

Teacher *Where is $1/3$ on your number line and how do you know?*

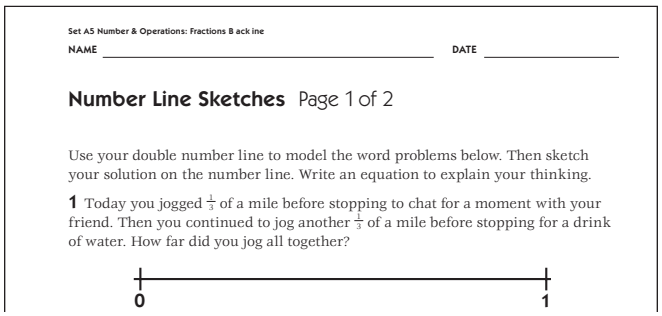
Activity 2 Sketching Fractions on a Number Line (cont.)

Louis *It's on the end by the zero, but pretty close to where 1/2 is. In my mind I divided the number line into three parts to make thirds. I put my paperclip at the first mark.*



Amelia *I slid my paperclip from 0-1 and stopped three times, counting 1/3, 2/3, 3/3. 3/3 is at the end- that's the same as one. Then I put my paperclip back where I said 1/3.*

2. Once you've come to agreement about the placement of 1/3, display the teacher copy of Number Line Sketches and share the first word problem:


Set A5 Number & Operations: Fractions B ack ine

NAME _____ DATE _____

Number Line Sketches Page 1 of 2

Use your double number line to model the word problems below. Then sketch your solution on the number line. Write an equation to explain your thinking.

1 Today you jogged $\frac{1}{3}$ of a mile before stopping to chat for a moment with your friend. Then you continued to jog another $\frac{1}{3}$ of a mile before stopping for a drink of water. How far did you jog all together?

0 1

Ask students to move their paperclip to the place they would stop for a drink of water.

Teacher *Where are you on the number line? How far did you jog all together?*

Give students time to pair-share, followed by group discussion, coming to an agreement about both the fraction number and its location on the number line.

3. Give each student a copy of the blackline, Number Line Sketches. Using class input, label the number line on problem #1.

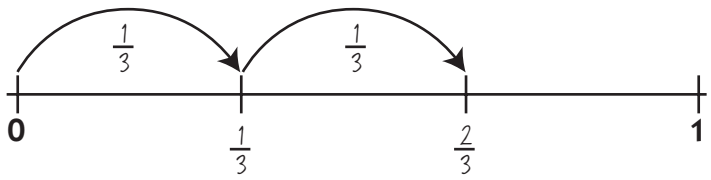
Teacher *How might we model the distance we traveled on this number line?*

Brighton *We'd have to show thirds. Divide the number line into three parts.*

Zach *Then put 1/3 under the first mark and 2/3 under the next mark.*

Maddie *Then you could show the hops like we did on the number line last year when we added.*

Have students model the same visual on their own number lines. Then record 1/3 + 1/3 = 2/3.



4. Repeat step 2 & 3, providing students opportunity to model problems from Number Line Sketches on the double number line before sketching them. As students feel comfortable, they may continue on their own.

NAME _____ **DATE** _____

Number Line Sketches Page 1 of 2

Use your double number line to model the word problems below. Then sketch your solution on the number line. Write an equation to explain your thinking.

1 Today you jogged $\frac{1}{3}$ of a mile before stopping to chat for a moment with your friend. Then you continued to jog another $\frac{1}{3}$ of a mile before stopping for a drink of water. How far did you jog all together?

2 During P.E., teams of 3 people run a relay. Each person runs $\frac{1}{4}$ of the way around the track. Where does the race end?

3 My mom bought a long length of ribbon to make bows for my sister and I. We each get $\frac{2}{6}$ of the ribbon. How much of the total ribbon is used?

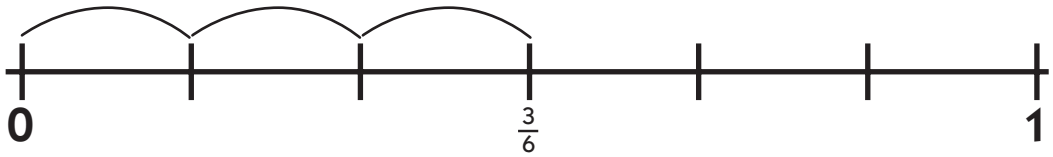
4 On the ranch, fences are located every $\frac{1}{6}$ of a mile. If I stop at the fifth fence, how much of a mile did I travel?

(Continued on back.)

NAME _____ **DATE** _____

Number Line Sketches Page 2 of 2

5 I'm walking my dog $\frac{3}{6}$ of the way to the park this morning. Another fraction name for $\frac{3}{6}$ is _____.



6 In our city, drinking fountains are located every $\frac{1}{8}$ of a mile. If I go a mile, stopping at every fountain, how many times will I stop?

CHALLENGE

7 Write your own fraction word problem below using a number line to model your answer. Write an equation to show your computation.

Set A5 ★ Activity 3

ACTIVITY

I Have, Who Has? Fractions on a Number Line

Overview

After reviewing fractions on the double number line, students play "I Have, Who Has?" using fractions on a number line as a model.

Skills & Concepts

- ★ understand a fraction $1/b$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction a/b as the quantity formed by a parts of size $1/b$.
- ★ represent a fraction $1/b$ on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into *b* equal parts.
- ★ represent a fraction a/b on a number line diagram by marking off a lengths $1/b$ from 0.
- ★ understand two fractions as equivalent if they are the same size, or the same point on a number line.
- ★ recognize and generate simple equivalent fractions. Explain why the fractions are equivalent using a visual fraction model.
- ★ express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers.
- ★ compare two fractions with the same numerator or the same denominator by reasoning about their size and justify the conclusions using a visual fraction model.

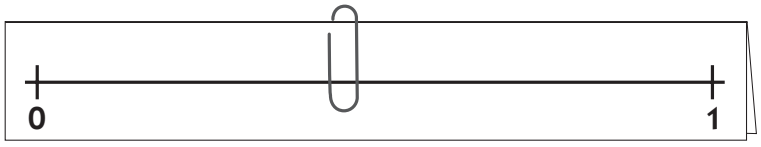
You'll need

- ★ Double Number Line with paperclip (from Activity 1)
- ★ I Have, Who Has? Fraction Cards (pages A5.11–A5.13, run one set on cardstock, cut cards apart.)
- ★ Independent Worksheet 3 Locating, Naming & Comparing Fractions

Instructions for I Have, Who Has? Fractions on a Number Line

1. Ask students to move their paperclip along the 0-1 side of their Double Number Line from Activity 1, to model the following fractions.

½ ⅛ ¼ ⅓ ⅔ ⅙ ⅞ ¾



Activity 3 I Have, Who Has? Fractions on a Number Line (cont.)

Give students opportunities to share. Probe their thinking by asking, "How did you know where to locate the fraction?" You may also ask students with a partner and then as a class to think of another name for a given place on the number line. For example, if the fraction is $\frac{1}{4}$, ask students if they can think of another equivalent fraction ($\frac{2}{8}$).

2. Finally, ask students where they would find $\frac{8}{8}$. Since they've recently located $\frac{7}{8}$, students may use that as referent. Then, ask where they would find $\frac{1}{1}$, $\frac{2}{2}$, etc., making the connection that these fractions represent one whole.

3. Begin today's game, "I Have, Who Has?" by distributing all but the first game card to students. For the game to progress all cards must be used; a capable student may hold more than one card, if necessary. Students may also pair up to share cards in large classrooms.

Game Directions

- Students listen for the fraction pictured on their cards. When a student hears her fraction called, she shows the card and says, "I have _____" and calls for the next card, "Who has _____," using the words at the bottom of her card.
- * Show students card #1: I have (visual number line with $\frac{2}{3}$). Ask them to identify the fraction pictured on the number line, first thinking alone, then pairing up with a partner, and finally sharing with the class. Play continues until all cards have been called.
- **Note** If students need additional support, they might first identify their fraction cards in pairs before beginning the game.

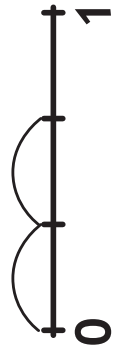
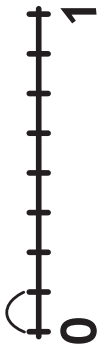
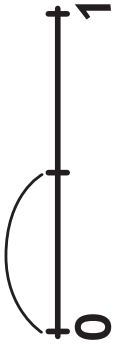
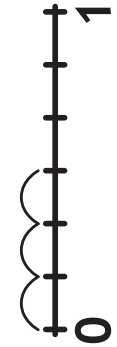
Game Extension

- Immediately following the game, ask 6-8 students to come forward to create a human fraction line with their cards by standing in the order that the cards would fall on the number line. Students with equivalent fractions may line up vertically. Have the audience check for accuracy.

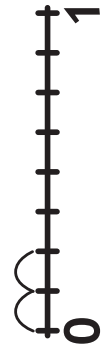
INDEPENDENT WORKSHEET

See Set A5 Independent Worksheet 3 for more practice locating, naming, and comparing fractions on a number line.

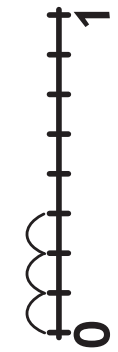
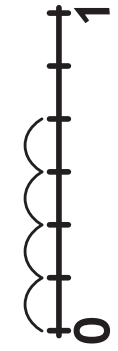
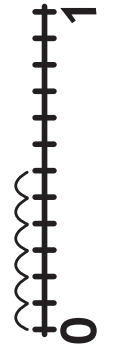
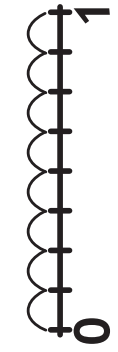
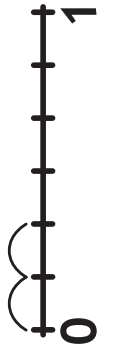
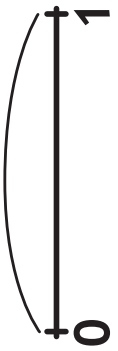
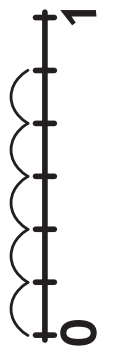
I Have, Who Has? Fraction Cards page 1 of 3

I have  Who has $\frac{1}{8}$?	I have  Who has $\frac{1}{2}$?
I have  Who has $\frac{6}{8}$?	I have  Who has $\frac{3}{6}$?
I have  Who has $\frac{1}{4}$?	I have  Who has $\frac{2}{2}$?
I have  Who has $\frac{3}{4}$?	I have  Who has $\frac{2}{8}$?

I Have, Who Has? Fraction Cards page 2 of 3

I have  Who has $\frac{3}{3}$?	I have  Who has $\frac{5}{8}$?
I have  Who has $\frac{2}{4}$?	I have  Who has $\frac{1}{3}$?
I have  Who has $\frac{4}{8}$?	I have  Who has $\frac{7}{8}$?
I have  Who has $\frac{1}{6}$?	I have  Who has $\frac{3}{8}$?

I Have, Who Has? Fraction Cards page 3 of 3

I have  Who has $\frac{4}{4}$?	I have  Who has $\frac{4}{6}$?
I have  Who has $\frac{6}{12}$?	I have  Who has $\frac{8}{8}$?
I have  Who has $\frac{2}{6}$?	I have  Who has $\frac{1}{1}$?
I have  Who has $\frac{5}{6}$?	I have  Who has $\frac{2}{3}$?

NAME _____ **DATE** _____

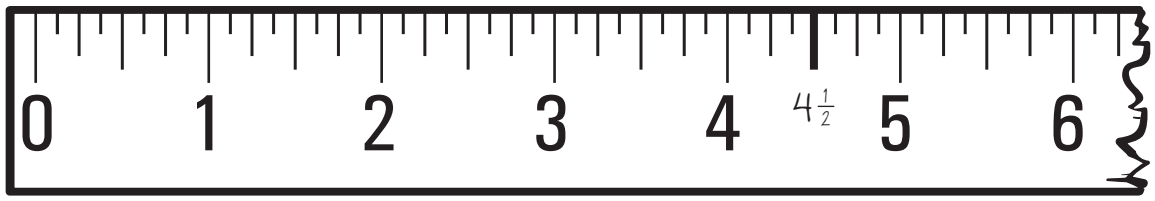
Set A5 ★ Independent Worksheet 1

INDEPENDENT WORKSHEET

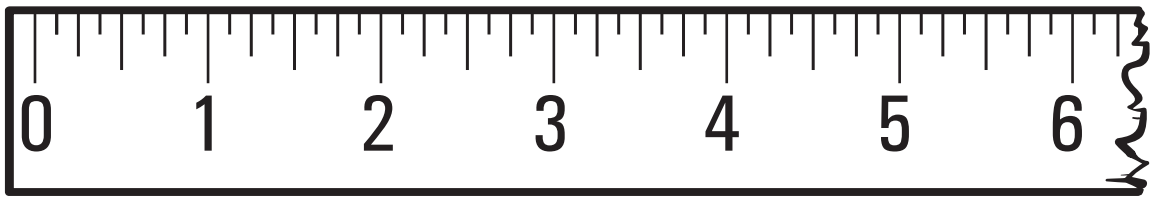
The Broken Ruler, Part 1

1 Find, mark, and label the measurements on the rulers below. The first one has been done for you.

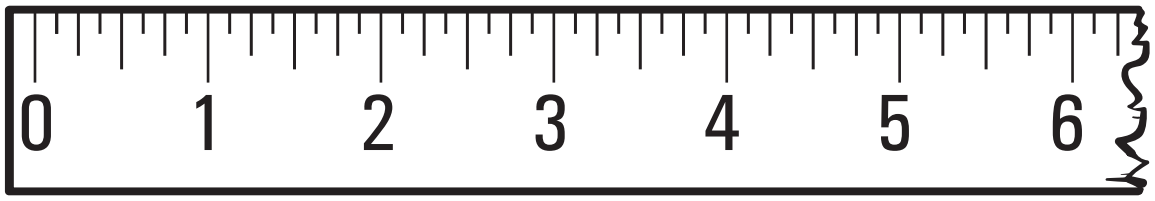
example $4\frac{1}{2}$ inches



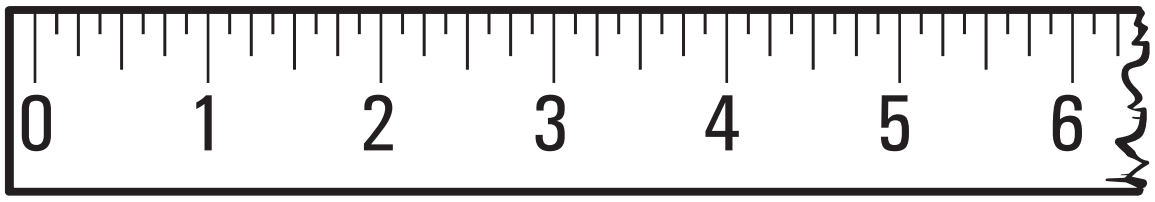
a $3\frac{1}{2}$ inches



b $1\frac{1}{2}$ inches



c $5\frac{3}{4}$ inches



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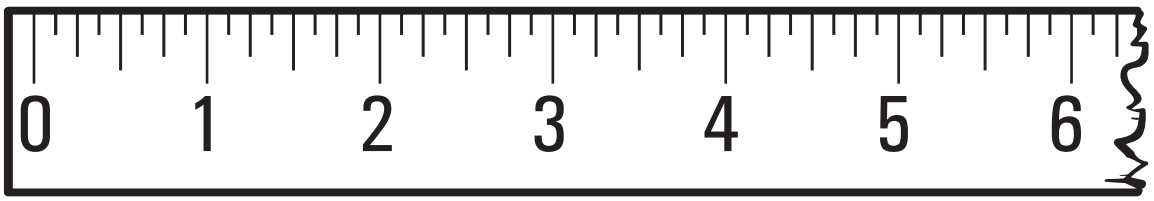
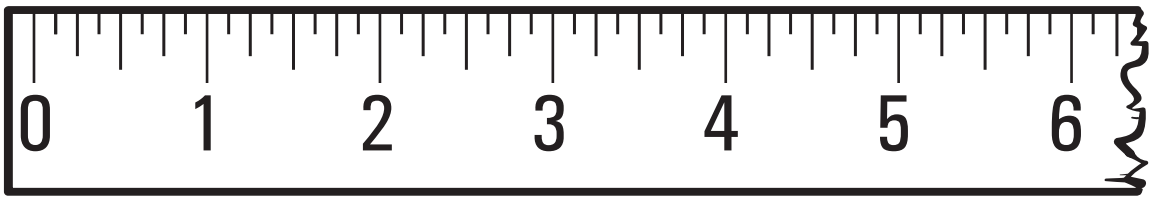
Independent Worksheet 1 The Broken Ruler, Part 1 (cont.)

d $2\frac{1}{4}$ inches



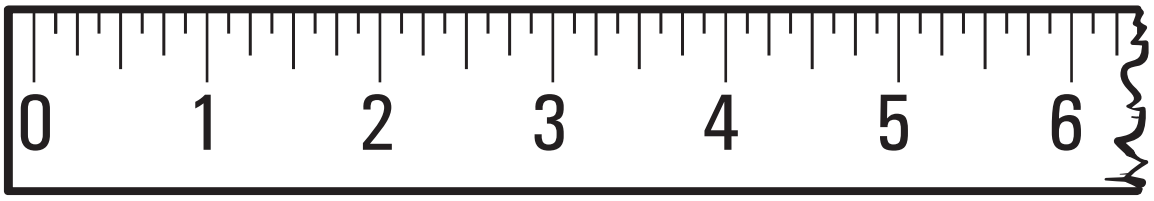
e $4\frac{1}{4}$ inches



2 Share your work with a partner. Does he or she agree with each of the marks you made on the rulers? If not, decide who's correct and fix your work.

CHALLENGE

3 What other fractions do you know? Mark and label them on this ruler.



NAME _____ **DATE** _____

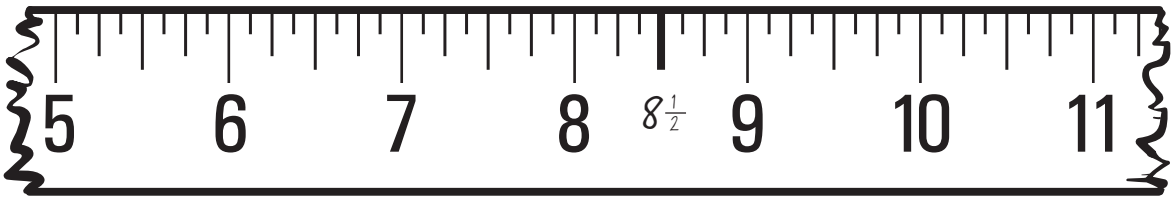
Set A5 ★ Independent Worksheet 2

INDEPENDENT WORKSHEET

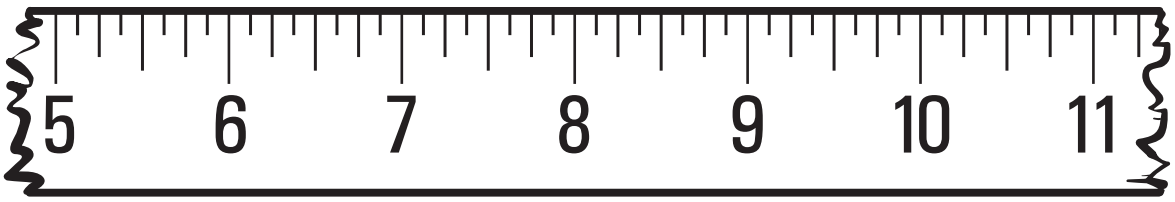
The Broken Ruler, Part 2

1 These rulers have been broken at both ends so they fit on the page. Find, mark, and label the measurements on each. The first one has been done for you.

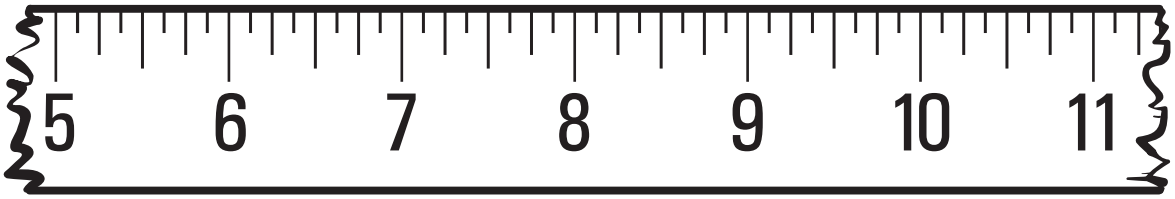
example $8\frac{1}{2}$ inches



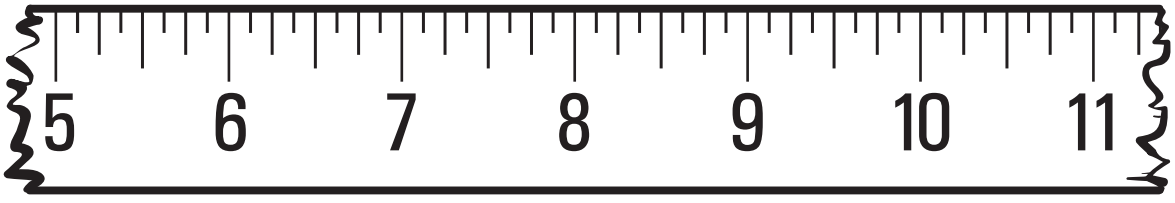
a $6\frac{1}{2}$ inches



b $9\frac{3}{4}$ inches



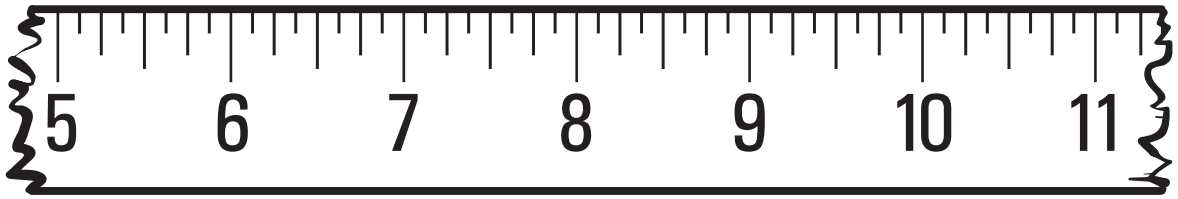
c $8\frac{1}{4}$ inches



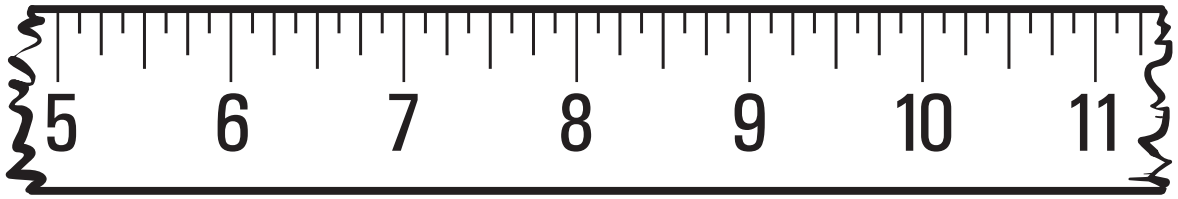
(Continued on back.)

Independent Worksheet 2 The Broken Ruler, Part 2 (cont.)

d $10\frac{1}{4}$ inches



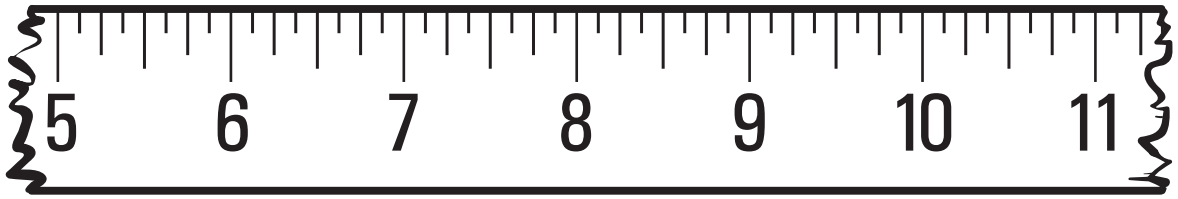
e $7\frac{3}{4}$ inches



2 Share your work with a partner. Does he or she agree with each of the marks you made on the rulers? If not, decide who's correct and fix your work.

CHALLENGE

3 What other fractions do you know? Mark and label them on this ruler.



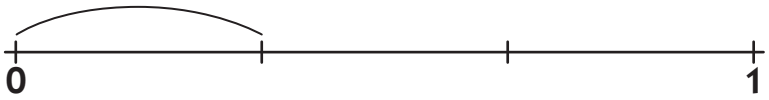
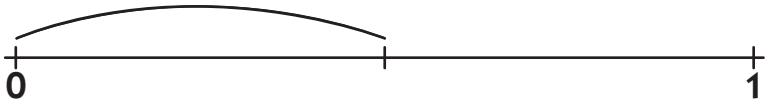
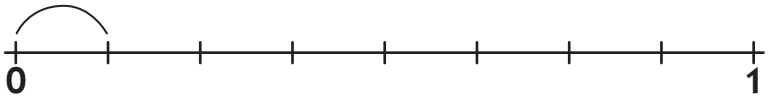
NAME _____ DATE _____

Set A5 ★ Independent Worksheet 3

INDEPENDENT WORKSHEET

Locating, Naming & Comparing Fractions

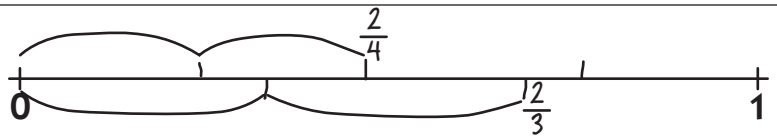
1 Complete the missing information below by writing in the fraction number or sketching the given fraction on a number line.

	Fraction	Number Line
ex.	$\frac{1}{3}$	
a	$\frac{1}{4}$	
b		
c	$\frac{1}{6}$	
d		
e	$\frac{2}{4}$	
f		
g	$\frac{3}{3}$	

(Continued on back.)

Independent Worksheet 3 Locating, Naming & Comparing Fractions (cont.)

2 Use a < (less than), > (greater than) or = (equal) symbol to compare the following fraction pairs. Show your thinking by placing the fractions on the number line.

	Fraction	Number Line
ex.	$\frac{2}{4} < \frac{2}{3}$	
a	$\frac{1}{2}$ $\frac{6}{8}$	0 1
b	$\frac{3}{6}$ $\frac{1}{4}$	0 1
c	$\frac{3}{4}$ $\frac{6}{8}$	0 1
d	$\frac{2}{4}$ $\frac{1}{3}$	0 1
e	$\frac{5}{8}$ $\frac{2}{4}$	0 1
f	$\frac{1}{6}$ $\frac{7}{8}$	0 1
g	$\frac{3}{8}$ $\frac{4}{4}$	0 1
h	$\frac{1}{3}$ $\frac{2}{6}$	0 1
i	$\frac{2}{6}$ $\frac{2}{4}$	0 1