Day 1: What is a Fraction?

Introduction to Fractional Parts

Target Group: Adaptable for 2-4th grades; Meets 3rd grade CCSS

Prior Knowledge: Students should have an understanding that fractions are equal parts of a whole.

Lesson Objective: Students will be able to define a fraction by explaining the meaning of its top and bottom parts.

- CCSS.Math.Content.3.NF.A.1
  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 $1/b$.

Time: 45 minutes – 60 minutes

Materials:

- Activity Sheet for each student (see below)
- Laptop/Computer for each student
- *Fractions Intro* Simulation: http://phet.colorado.edu/en/simulation/fractions-intro
- Projector/document camera (optional)

Time	Procedure	Teaching Tips
5 minutes	1. *Activate Background Knowledge:* Ask students to brainstorm what they know about fractions with a partner. Have you heard of any common fractions like "one-fourth" or "one-half?" When might people use fractions in daily life? (time, cooking, eating, sharing). Share ideas with whole class.	• "Turn and Talk" or "Think-Pair-Share" routines are in place so students know the norms and engage in discussion effectively.
5 minutes	2. Distribute Activity sheets and have students access the *Fractions Intro* sim: http://phet.colorado.edu/en/simulation/fractions-intro 3. *Explore (#1):* Tell students that they will have 5 minutes to explore the features of the sim. Throughout this time, they may share their findings with their partner. 4. While students are exploring, monitor discussions and findings so that you can call on certain students to share features with the whole group. 5. Share important features.	• Set up student laptops with sim prior to lesson to save time; if not possible, create a link so students may just click rather than typing in the URL. The sim can also be downloaded directly to the computer. • Project the sim for the class to see as you highlight features • If students don't bring it up, show that the fractions in the sim can be represented different ways – these are *representations*. You can show a fraction in numbers,

		different shapes, a cake, on a # line, etc.
10 minutes	6. *Review today's learning objective:* Read learning objective with students or tell students "Today we're going to learn what the top # and the bottom # of a fraction mean. You'll be using the sim and following along on your activity sheet." 7. Review the directions on the activity sheet (Students will be working on the first tab and the Max should be set at 1). Provide students with 10 minutes to work through #2 – 5 on their activity sheets. 8. Monitor student work as you walk around. Ask questions and have students make predictions that will extend their thinking. For example: "What would happen if I increase the (bottom/top) number even more?"	• Encourage students to talk with their partner if they are having difficulty
15 minutes	*9. Share the Learning:* • *3 minutes*: Display the first part of question #6 and read with students. Have students take a minute to think/write down their ideas. Then have students turn and talk with their partner. Again, monitor discussion so you can highlight key understandings or misconceptions. • *3 minutes:* Repeat procedure for the second part of number 6. • *8 – 10 minutes:* Call students' attention back to whole group to share ideas together. Project the sim, if possible, and ask students what they learned about the top number in a fraction. • *"How would you describe the top number in a fraction?" "How does changing the top number change the amount?"* • Repeat for the bottom #. 10. *Introduce vocabulary*: Once students have demonstrated an understanding of the top/ bottom #s in a fraction, introduce and define the terms *numerator* and *denominator*.	• Students can talk with their partner at their desks with the sim in front of them for Turn/Talk. When discussing with whole class, I like to pull the kids to a different part of the room. The change in location keeps kids from engaging with computer, allows them a quick moving break, and shifts their focus. We have a class meeting area where I have kids move to. • Use the projected sim to reinforce the ideas that students share.
10 minutes	11. Students will apply their understanding of numerators and denominators as they play	• Keep track of how

local 8/26/14 8:01 PM
Comment [1]: Suggested language

	the game "Build a Fraction" on the second tab. While they will start at level 1, the game will differentiate itself for students as they progress through the levels. 12. Encourage partners to share strategies and work through challenges together. 13. After 10 minutes, wrap up today's lesson with a discussion of student strategies, successes, and challenges from the game.	students are doing and if some students have different ways of representing a fraction (i.e. 3/3 = 1)

Name _____ Date_____

I. What is a Fraction?

Lesson Objective: We will be able to define a fraction by explaining the meaning of its top and bottom parts.

1. Explore: Take 5 minutes to explore the sim before beginning this worksheet.

First Screen: Intro
Keep the "Max" button set to 1.
2. Choose a representation and make a fraction. Then write and sketch the fraction.

Fraction Name:	
Sketch/Drawing:	

3. Increase or decrease the top part of the fraction. What happens? Write and sketch the new fraction.

Fraction Name:	
Sketch/Drawing:	

4. Go back to your original fraction (from #2). Increase or decrease the bottom part of the fraction. What happens? Write and sketch the new fraction.

Fraction Name:	
Sketch/Drawing:	

5. Try different representations of the fractions above. Observe how the amount changes when the numerators & denominators are increased or decreased.

local 8/26/14 8:01 PM
Comment [2]: Monitor student exploration and discussion to share as a whole class.

local 8/26/14 8:01 PM
Comment [3]: Before beginning #2, project the sim and discuss features students found during explore.

local 8/26/14 8:01 PM
Comment [4]: If students don't bring it up, show that the fractions in the sim can be represented different ways – these are *representations*. You can show a fraction in numbers, different shapes, a cake, on a # line, etc.

local 8/26/14 8:01 PM
Comment [5]: Monitor student work and discussion. Ask questions and have students make predictions that will extend their thinking. For example, "What would happen if you increase the (top/bottom) number even more? and "What do you notice about the size of the pieces in a fraction?" (*they are always the same size*)

local 8/26/14 8:01 PM
Comment [6]: Circulate to monitor student work and discussion. Ask questions and have students make predictions that will extend their thinking. For example: "What would happen if I increase the (top/bottom) number even more?" and "What do you notice about the size of the pieces in a fraction?" (*they are always the same size*)

6. **Think-Pair-Share:** 

- What do you notice about the size of the pieces in any given fraction?

- How would you describe the top part of a fraction? How does changing the top number change the amount? Do you and your partner agree on the meaning of the top part?

- How would you describe the bottom part of a fraction? How does changing the bottom number of a fraction change the amount? Do you and your partner agree on the meaning of the top part?

local 8/26/14 8:01 PM
Comment [7]: Read the question in the first bullet together, then allow students to think/take notes about their own understanding before sharing with their partner. Repeat for each bullet.

local 8/26/14 8:01 PM
Comment [8]: Whole Class Discussion: After "Think-Pair-Share," call students to a meeting area (or have them turn around/close laptops) to discuss key concepts and introduce the terms numerator and denominator.

Second Screen: Build a Fraction

7. Click on the second tab. Select "Level 1" in the top row to begin the activity. Using your knowledge of the top/bottom parts of a fraction, build fractions that match the numeric representations.

Day 2: Ordering and Comparing Fractions

Target Group: Adaptable for 2-4th grades; Meets 3rd grade CCSS

Prior Knowledge: All pieces in a fraction are equivalent in size; Numerators are the top parts of fractions & tell how many equal parts are being considered; Denominators are the bottom parts of fractions & tell how many equal parts the whole is partitioned into.

Lesson Objective: Students will use their knowledge of numerators and denominators to order and compare fractions.

- CCSS.Math.Content.3.NF.A.1
  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 $1/b$.
- CCSS.Math.Content.3.NF.A.3
  Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

Time: 45 minutes – 60 minutes
Materials:

1. Activity Sheet for each student (see below)
2. Laptop/Computer for each student
3. *Fractions Intro* Simulation: http://phet.colorado.edu/en/simulation/fractions-intro
4. Projector/document camera (optional)
5. Food to represent a whole (candy bars/gum/crackers, etc) (optional)

Time	Procedure	Teaching Tips
5 minutes	• *Review Previous Learning:* Project the Fractions Intro tab and display a fraction. Have students turn and talk with a partner to share their understandings of fractions as you ask each of the following questions: 1. What do you notice about the size of the pieces in the fraction? (*all pieces are equivalent)* 2. What does the top part of a fraction mean? What about the bottom part? 3. How does changing the numerator of a fraction change the amount? The denominator?	• As students share during the class discussion, project the sim so that students can demonstrate key concepts of equal parts, numerators, and denominators.
5 minutes	• *Explore*: Students will have 5 minutes to explore the *Fractions Intro* sim as teacher circulates and supports student exploration.	• If possible, set up student laptops with the sim prior to lesson to save time.
10 minutes	• Distribute Activity Sheets. • Read today's Learning Objective with students. • Present the pie question and have students predict who ate more pie. You can set this up as a *Think-Pair-Share/Turn and Talk* or by a	• Turn and Talk/Think-Pair-Share are interchangeable, depending on your classroom norms.

	show of hands. • Students test predictions by recreating the pies in either the Fraction Lab or Intro tabs (#1). Students will sketch their fractions on the Activity Sheet. • *Turn and Talk:* Who ate more pie? What did you notice about the fraction that represented the larger portion of pie?	Whatever terminology you use, it is assumed that the norms for effective partner discussion are in place.
10 minutes	• *Order from least to greatest:* Students will work on #3 by building the fractions and then ordering them from least to greatest. • Monitor student discussion and work as they complete this task. • *Discussion*: Students will first engage in a turn-and-talk conversation with their partner discussing the question: Is there a rule for ordering/comparing fractions when the bottom number, the denominator, is the same but the numerators are different? Encourage students to use examples as evidence to support their thinking. • *Whole Group Discussion*: Share the learning with the class. Ask various partners to share their thinking/rule for ordering. Call on student pairs that you listened in on while monitoring conversations. Other students can piggy-back on these ideas. • *Concept Target*: When the denominator is the same, the whole is cut into equal sized pieces. The larger the numerator, the greater the fraction because it represents a greater number of pieces of the whole. Once students have verbalized this learning, emphasize the concept using a real-life example. The cake representation is a good visual, or you can bring in real food (candy bars, pieces of gum, graham crackers, etc). For example, show (or pass out) a candy bar cut into 6 equal pieces. Show the size 1 out of 6, 2 out of 6, etc. • *Turn and Talk:* Have students explain *why* the rule works.	• The discussion component of the lesson (partner talk and whole group) are essential components for solidifying student understanding & clearing misconceptions. • Students can talk with their partner at their desks with the sim in front of them for Turn/Talk. When discussing with whole class, I like to pull the kids to a different part of the room. The change in location keeps kids from engaging with computer, allows them a quick moving break, & shifts their focus. We have a class meeting area where I have kids move to. • If possible, project the sim while sharing so that students can demonstrate what they mean if needed. • Post the rule (If the denominators are the same, the bigger the numerator, the greater the fraction) somewhere in your classroom for students to refer to.
10 minutes	• Ask: Will the rule "The greater the numerator, the greater the fraction" work for all fractions? Can you think of a time it won't work? What if the numerators are all the same but the	

	denominators are different numbers? • Have students share predictions. • Read #6 with the students and have students share their ideas of who ate more pie. • Send students back to their desks to work on #s 6 - 8. Monitor student discussion and work as they complete these tasks. • *Whole Group Discussion:* Share the learning with the class. Ask various partners to share their thinking/rule for ordering. Call on student pairs that you listened in on while monitoring conversations. Other students can piggy-back on these ideas. • *Concept Target:* The greater the denominator, the smaller the pieces. Write the fractions ½ and ¼ on the board. Ask students if they'd rather share their food between 2 people or 4 people. Have volunteers break their food item into equal pieces based on their answers. Call students up to project their pieces under the document camera so students can see the size of ½ and ¼. Ask students to repeat the rule: With like numerators, the greater the denominator, the smaller the fraction. • *Turn and Talk:* Have students explain *why* the rule works. Using the cake representation or food will help students know that the bigger denominator means that the whole is cut into *more* pieces, so the pieces are smaller. • Write ½ > ¼ on the board and read the phrase together. Referring again to the food (or the sim cake representation!), emphasize that ½ is the larger fraction and it represents more of the whole because it is divided into fewer pieces. ¼ is smaller because it represents less of the whole, since the whole is divided into more pieces. • In #9, students will apply their knowledge of comparing/ordering fractions independently. They may use the sim to help if needed! • Early finishers may choose to play Build a Fraction or Matching Game.	• Post rule in the classroom.

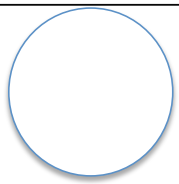
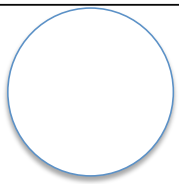
Name _____ Date _____

II. Ordering and Comparing Fractions

Lesson Objective: We will use our knowledge of numerators and denominators to order and compare fractions.

Mrs. Hixson & Mr. Huey have apple pies that are the same size. Mrs. Hixson eats $\frac{2}{8}$ of her apple pie. Mr. Huey eats $\frac{5}{8}$ of his. Who ate more pie?

1. Choose the **Intro** Tab. Build Mrs. Hixson's & Mr. Huey's pies and sketch them below.

Mrs. Hixson's pie	Mr. Huey's pie
	

2. Turn and Talk: Who ate more pie? What did you notice about the fraction that represented the larger portion of pie?

3. Build the following fractions and sketch them in the table below.

$\frac{2}{6}$	$\frac{1}{6}$	$\frac{5}{6}$	$\frac{3}{6}$

4. Put the above fractions in order from least to greatest. ___, ___, ___, ___

5. Turn and Talk: Is there a rule for ordering/comparing fractions when the bottom number, the denominator, is the same? Write down your thinking!

local 8/26/14 8:03 PM
Comment [9]: Before passing out Activity Sheet, review previous lesson's concepts of numerator (top #) and denominator (bottom #/total # of = pieces)

local 8/26/14 8:03 PM
Comment [10]: Allow students 5 minutes to review/explore the Fractions Intro sim.

local 8/26/14 8:03 PM
Comment [11]: Ask students to make predictions and share their thinking in either whole group or turn/talk

local 8/26/14 8:03 PM
Comment [12]: Share answers briefly as a whole class.

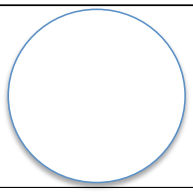
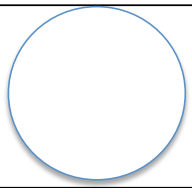
local 8/26/14 8:03 PM
Comment [13]: Whole Group Discussion: After students have shared their thinking with their partner, call whole class together to share ideas. I like to move students to a class meeting area, with the sim projected for students to use while explaining their rule.

local 8/26/14 8:03 PM
Comment [14]: Students should generate the rule that when the denominator is the same, the greater the numerator, the greater the fraction. Have students explain *why* this rule works.

local 8/26/14 8:03 PM
Comment [15]: Demonstrate this rule using different representations and real life examples. Illustrating the rule using food is a fun, accessible example for students. Using a candy bar, for example, you can show students that 2/6 < 4/6. That means a whole candy bar is cut into 6 = pieces. 4 out of 6 is more of the whole than 2 out of 6.

6. Mrs. Hixson & Mr. Huey have apple pies that are the same size. Mrs. Hixson eats $\frac{1}{8}$ of her apple pie. Mr. Huey eats $\frac{1}{2}$ of his. Who ate more pie?

Build Mrs. Hixson & Mr. Huey's pies and sketch them below.

Mrs. Hixson's pie	Mr. Huey's pie
	

8. Try out these fractions.

$\frac{2}{4}$	$\frac{2}{3}$	$\frac{2}{8}$	$\frac{2}{5}$

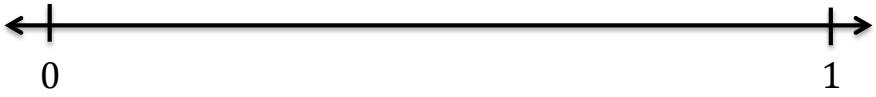
7. Put the fractions above in order from least to greatest. ___, ___, ___, ___

8. Turn and Talk: With your partner, come up with a rule for ordering and comparing fractions if the numerators are the same but the denominators are different.

Application:

Ava and Mia are comparing the fractions $\frac{2}{3}$ and $\frac{2}{6}$.

Ava says that 2/3 is greater, but Mia says that 2/6 is greater. Using this number line, help the girls figure out who is right. Explain your thinking.



Write a fraction that is between 2/3 and 2/6. $\frac{\square}{\square}$

local 8/26/14 8:03 PM
Comment [16]: 1. Before students return to their desks, ask, "What if the top number (the numerator) remains the same, but the bottom number changes? How can you figure out which fraction is bigger?" Allow students to make predictions before reading question 6.

local 8/26/14 8:03 PM
Comment [17]: Read #6 together and ask students to make predictions and share their thinking in either whole group or turn/talk using the fractions in the problem.

local 8/26/14 8:03 PM
Comment [18]: After students take notes and share their thinking with their partner, bring students to the meeting area for whole group discussion. Again, use a real-life example to demonstrate the rule. During discussion, show students different representations of the fractions and how the rule applies to real-world examples. Write ½ and ¼ on the board then pass out (or show) a whole candy bar(s). ½ means the candy bar is cut into 2 = pieces. ¼ means it is cut into 4 = pieces.

local 8/26/14 8:03 PM
Comment [19]: Students may explain the rule in multiple ways. Be flexible and accept any rules that students can explain and apply in an example. If students share different rules, discuss how the rules are similar.

Day 3: Equivalent Fractions

Target Group: Adaptable for 2-4th grades; Meets 3rd grade CCS

Prior Knowledge: All pieces in a fraction are equivalent in size; Numerators indicate the number of equal parts being considered; Denominators indicate the total number of equal part into which a whole is partitioned.

Lesson Objective: Students will use their knowledge of numerators and denominators to order and compare fractions.

- CCSS.Math.Content.3.NF.A.1
  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 $1/b$.
- CCSS.Math.Content.3.NF.A.3
  Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

Time: 45 minutes – 60 minutes
Materials:

6. Activity Sheet for each student (see below)

- Laptop/Computer for each student
- *Build a Fraction* Simulation: http://phet.colorado.edu/en/simulation/build-a-fraction
- Projector/document camera (optional)

Time	Procedure	Teaching Tips
10 minutes	1. Distribute activity sheets and have students access the *Build a Fraction* Sim: http://phet.colorado.edu/en/simulation/build-a-fraction 4. *Explore*: Students will review previous learning as they play Build a Fraction for 5 minutes. Monitor student work and encourage students to talk with their partner if they are stuck. 5. After 5 minutes, have students open the 3rd tab, "Fraction Lab." Allow students to explore the features of this tab for 5 minutes. 6. Project the sim for everyone to see, and have students share interesting features or observations of the Fraction Lab tab. 7. Read today's objective with the class. Ask students what smaller word "equivalence" sounds like (*equal*). Tell students that fractions that represent the same amount can have different names and are called equivalent fractions.	• To save time, set up the sim on student laptops prior to lesson; if not possible, have a link students can click or download the sim to the desktop rather than typing in URL. • Circulate and take note of features that students should share with whole class. (For #2, students will need the rectangle shape. Point out how to change this if a student does not bring it up during discussion.)

10 minutes	6. Look at number 1 with students. They will use the Fraction Lab to find 3 other fractions that are equivalent, or the same, as ½. Encourage students to share their ideas with their partner. 7. Circulate and take note of how students are solving the problem. There are several strategies that students may use. For example, some students may use the ½ piece and use the partitioning arrows to find fractions of the same size. Others may create more than one representation to compare. 8. As students are finishing up, project the Fraction Lab for class discussion. 9. Call on students to share equivalent fractions and their strategies for finding them.	• I like to move kids from their desks to our meeting area for whole group discussion. • Highlight various strategies by calling on students you noted while circulating. This will help struggling students with #s 3-4.
10 minutes	10. After class discussion & visuals, send pairs back to their computers to work on problems #3-5. 11. Offer assistance if needed, but encourage student partners to work together before helping. 12. Share solutions for number 5 with the class. Use a document camera to project student work, if possible.	• Question # 5 may be answered in different ways. Look for students who notice the numerical relationships ($\frac{1}{4}$ is two $\frac{1}{8}$ sized pieces; $\frac{2}{8}$ is $\frac{2}{2}$ x $\frac{1}{4}$) and students who use visual representations to explain equivalence. Share model answers highlighting both types of solutions before moving onto #6.
10 minutes	13. Guide students to look at the pictorial models of the fractions in the box on the back of the activity sheet. Looking at the models, you can see that the amounts are the same, even though the wholes are cut into different size pieces. Ask students how many sixths are in one third and how many twelfths are in one fourth to elicit the multiplicative property of equivalence. 14. In #6, have students turn and talk about the	

	shared relationship between the equivalent numerators and denominators. Students will try to determine if there is a rule for finding equivalent fractions. 15. For students who come up with the rule (multiply or divide the numerator and denominator by the same number), they can test different fractions from the front of their activity sheet. 16. After most students have finished partner discussion and writing down their ideas, call all students together for a class discussion. Project the sim as students share their thinking.	• Depending on level of students, some may figure out that you can multiply to find equivalent fractions while others may rely on the visual. Be flexible, and share both in the group discussion.

Name _____ Date_____

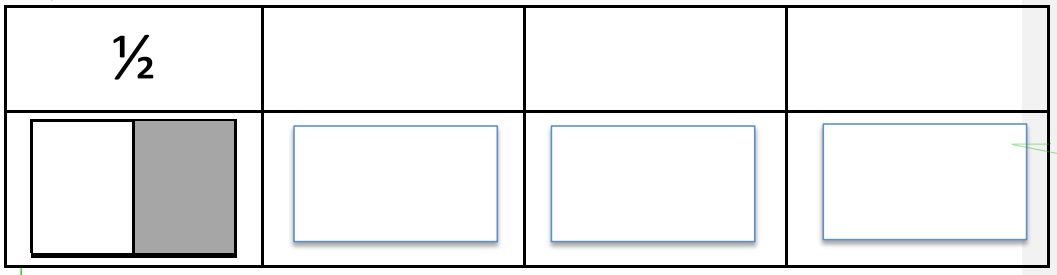
III. Equivalent Fractions

Lesson Objective: We will use our knowledge of numerators and denominators and visual representations to find equivalent fractions.

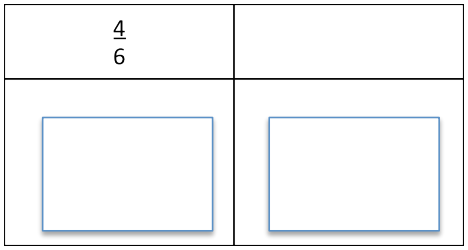
1. Explore: Play with the first tab, "Build a Fraction," for 5 minutes.

Third Tab: Fraction Lab

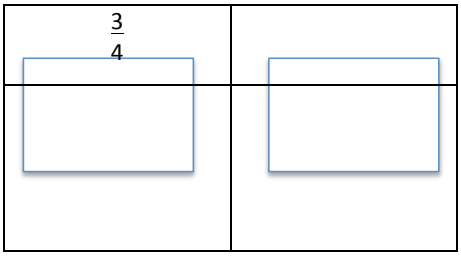
2. Find three or more fractions that are equivalent to ½. Sketch your findings below.



3. Represent $\frac{4}{6}$ two different ways.



4. Represent $\frac{3}{4}$ two different ways.



5. How can you explain to a student who has not played the sim that 1 = 2 ?
Use words, symbols, or pictures to help them see the equivalence. 4 8

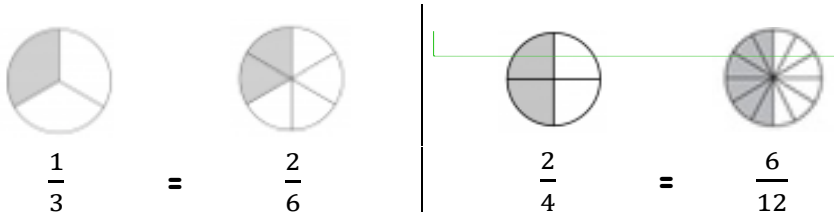
local 8/26/14 8:03 PM
Comment [20]: Read the objective with students before working on #2. Ask students to think of a math word that sounds like equivalent. (equal!)

local 8/26/14 8:03 PM
Comment [21]:

local 8/26/14 8:03 PM
Comment [22]: Share student ideas and strategies from #2 (on projected Activity Sheets or sim, if possible) before progressing to #3-4.

local 8/26/14 8:03 PM
Comment [23]: Point out that using an equal sign between to fractions tells us that the fractions are equivalent because it shows that the numbers represent the same part of a whole. In math, this is the shorter way of saying that ¼ is equivalent to 2/8 without having to write out all of the words.

local 8/26/14 8:03 PM
Comment [24]: Discussion Point



$\frac{1}{3} = \frac{2}{6}$ | $\frac{2}{4} = \frac{6}{12}$

local 8/26/14 8:03 PM

Comment [25]: Ask students how many sixths are in 1/3 and how many twelfths are in ¼.

6. Turn and Talk: Try to identify a relationship between the two numerators and the two denominators in each of the equivalent fraction pairs above. Share your ideas.

How can you tell when fractions are equivalent? Can you find a pattern?