Same Size, Different Cuts

Teacher		**Class**	Grade 4
Subject	Math	**Topic**	Equivalent fractions
Date		**Room**	
Lesson length	60 minutes	**Country**	United States

Students learn why multiplying top and bottom by the same number keeps the value. They draw models to prove and make equivalent fractions.

Curriculum links

- Explain why a fraction a/b is equivalent to a fraction (n × a)/(n × b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size [1]
- Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line [1]
- Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3. Explain why the fractions are equivalent, e.g., by using a visual fraction model [1]

Learning objectives

- Students will draw visual models that prove two fractions are equal.
- Students will explain why a/b equals (n x a)/(n x b) using number and size of parts.
- Students will recognize and generate equivalent fractions by multiplying top and bottom.

Success criteria

- I can explain how part number and size change but value stays the same.
- I can make a match by multiplying the top and bottom by the same number.
- I can spot and show equivalent fractions with a drawing.

What students already know

Show 1/2 shaded on a bar. Ask: How many equal parts? How many shaded? What if I cut each part in two?

Key words

equivalent	having the same value while looking different, like 1/2 = 2/4 [1]
numerator	top number that counts shaded parts
denominator	bottom number that counts all equal parts in the whole
whole	the full shape or amount we start with [2]

Materials

- grid paper
- colored pencils
- rulers
- projector for Slides 1-6 and 8-11
- Video clip 1 (0:00–5:00) on slide 5
- printed Worksheet Task C
- pre-split thirds outlines for support

Before the lesson

- Print Worksheet Task C for pairs and pre-split thirds outlines for support.
- Test Video clip 1 (0:00–5:00) on slide 5 and load Slides 1-6 and 8-11.
- Set out grid paper, colored pencils, and rulers for drawing.

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- whiteboards and markers

Lesson outline

0–5 min **Starter** 5 min · Whole class

Activate ideas about halves and hook students into proving 2/3 equals 4/6.

YOU DO

1. Show Slide 1 title and read the hook in an excited voice.
2. Show Slide 3 and point out 2/4, 3/6, 4/8 all take the same space as 1/2.
3. Ask partners to whisper why more pieces might still be the same amount.
4. State today students will draw models that prove two fractions are equal.

STUDENTS DO

1. Look at Slides 1-3 and listen to the challenge.
2. Whisper to a partner whether more pieces means more color.
3. Share one quick idea with the class.

Say: Can you draw 2/3 so clearly that no one can argue it is also 4/6? Today we prove matches with drawings. We will look at how the number of parts and the size of parts change, while the shaded value stays the same.

Ask: If 2/4 and 1/2 cover the same space, what does that tell us? (They are equivalent, they have the same value [3].) · How could 2/3 and 4/6 be the same if 4 and 6 are bigger? (There are more parts but each part is smaller, shaded size is the same.)

Check understanding: Thumbs up if you think different cuts can show the same amount. If unsure, point again to Slide 3 matches.

Support: Show a 1/2 bar next to a 2/4 bar and have students point to shaded lengths. **Stretch:** Ask which other fraction for one-half they predict: 3/6 or 5/6 and why.

Use: Slides 1-3

5–18 min **Teaching** 13 min · Whole class

Model why 1/2 equals 2/4 using bars and attention to number and size of parts.

YOU DO

1. Show Slide 4 helpers and name strips, circles, and number line for comparing.
2. Play Video clip 1 and tell students to count how shaded pieces grow as cuts grow.
3. Show Slide 6 compare of 1/2 and 2/4 and draw the second cut live.
4. Think aloud about big vs small pieces and write 1/2 = 2/4.

STUDENTS DO

1. Watch the video and count total and shaded parts aloud.
2. Copy the two bars on whiteboards and label 1/2 and 2/4.
3. Choral respond: number of parts went up, size of parts went down.

Say: Two fractions are equivalent if they are the same size [1]. Watch the whole stays the same. When I cut each half into 2 small parts, I have twice as many total parts and twice as many shaded parts, so 1/2 equals 2 times 1 over 2 times 2. More parts, but each smaller.

Worked example: Whole is same rectangle. First: 2 equal parts, 1 shaded, pieces are big, so 1/2. Cut each part into 2 equal parts with dashed lines: now 4 equal parts total, 2 shaded, pieces are small, so 2/4. Shaded area did not move, so 1/2 = (2 x 1)/(2 x 2) = 2/4 [7].

Ask: What happened to the number of parts and the size of each part? (Number went from 2 to 4, size got smaller, while shaded size stayed the same [1].) · Why did we multiply both top and bottom by 2? (Because each original part was cut into 2, so both counts grow by 2 [8].) · Where would both sit on a number line? (At the same point on a number line [1].)

Check understanding: Hold up whiteboards showing 1/2 = 2/4. Reteach with folding paper if many show unequal wholes.

Support: Give pre-folded strips showing only 1/2 = 2/4 and have students count shaded and total parts with a partner. **Stretch:** Have students predict what happens when each fourth is cut into 3 equal parts.

Use: Video clip 1 (0:00–5:00), Slides 4-6

18–30 min **Guided practice** 12 min · Whole class

Prove together why 2/3 equals 4/6 and link the drawing to multiplication.

YOU DO

1. Display Slide 8 task to prove 2/3 equals 4/6 with same-size wholes.
2. Draw a same-size rectangle, split into 3, shade 2 to show 2/3.
3. Add a second cut in each third and count to 6 total and 4 shaded.
4. Show Slide 9 words and label numerator, denominator, and equivalent.

STUDENTS DO

1. Draw along step by step on grid paper with rulers.
2. Count aloud total parts for denominator and shaded for numerator.
3. Read Slide 9 words and tell a partner what equivalent means.

Say: Now we prove 2/3 equals 4/6. I keep the same whole. I cut each third into 2 equal smaller parts. That is why top and bottom both times 2. The drawing shows the same shaded area, just cut differently.

Worked example: Step 1: rectangle split into 3 equal parts, shade 2, so 2/3. Step 2: cut each third into 2 equal parts. Total parts = 3 x 2 = 6, shaded = 2 x 2 = 4, so 4/6. Step 3: lay 4/6 over 2/3, edges match, so 2/3 = 4/6, which are simple equivalent fractions [1]. Increasing both numerator and denominator by the same factor gives an equivalent fraction [8].

Ask: How did the parts change from 2/3 to 4/6? (More parts, 3 to 6, but each smaller, shaded size stayed equal even if divided into different sizes [14].) · What multiplication shows the second cut? ((2 x 2)/(3 x 2) = 4/6.)

Check understanding: Point and show: students point to same-size shaded area and say equal. Fix wholes that are not same size.

Support: Provide outlines already split into thirds so students only add the second cut and count. **Stretch:** Ask students to say what cutting each third into 3 would make before drawing.

Use: Slides 8-9

30–50 min **Main activity** 20 min · Pairs

Have pairs draw and label models that prove equivalent fractions.

YOU DO

1. Hand out grid paper, colored pencils, rulers, and Worksheet Task C.
2. Direct pairs to draw 2/3, then double-cut to 4/6 with = between.
3. Circulate, ask about number and size, and prompt the multiplication label.
4. Stop halfway for two pairs to show same-size shading.

STUDENTS DO

1. Draw, color, and label 2/3 and 4/6 with = between the drawings.
2. Complete Worksheet Task C by cutting into equal pieces and checking number and size.
3. Compare rectangles by laying edges together and fixing mismatched wholes.

Say: Make your proof. Draw two same-size rectangles. First show 2/3. Then cut each piece into 2 to show 4/6. Color carefully, label top and bottom numbers, and write how parts got more but smaller. Your shaded areas must match exactly.

Worked example: Pair model: Left rectangle: 3 columns, 2 colored, label 2/3. Right rectangle same outer size: each column split in half to make 6 small boxes, 4 colored, label 4/6. Underneath: 2/3 = (2 x 2)/(3 x 2) = 4/6. Note: 6 parts vs 3 parts, small vs big, same shaded size [1].

Ask: How do you know your two drawings match? (Same outer whole and same shaded length, so same value [3].) · What did multiplying top and bottom by 2 do in your picture? (It recorded cutting each part into 2 smaller parts, value did not change [7].)

Check understanding: Pairs hold up both drawings for gallery check. If shading mismatches, have them realign wholes and recount.

Support: Provide outlines already split into thirds so students only add the second cut and count. **Stretch:** Have students draw a third version showing 6/9 and write the multiplication used.

Use: Worksheet Task C

50–60 min **Plenary** 10 min · Whole class

Check understanding of parts vs size and the multiply rule for generating matches.

YOU DO

1. Run Slide 10 vote on which helper best shows matches and take quick reasons.
2. Show Slide 11 true-false and have students justify with part number and size.
3. Give exit ticket on whiteboards and collect answers.
4. Restate the rule and preview generating more matches tomorrow.

STUDENTS DO

1. Vote for bars, circles, or number line and explain choice.
2. Answer true-false with thumbs and explain number and size.
3. Write exit answers and show whiteboards.

Say: Equivalent means same value, looks different. You only multiply or divide top and bottom by the same amount to keep the value. Tell me in your own words how more parts can still be the same amount.

Ask: Why is 1/2 = 2/4 true even though 2 and 4 are larger? (More parts but each smaller, same shaded size of same whole [1].) · Does multiplying top and bottom by 3 keep the value? (Yes, multiplying numerator and denominator by the same non-zero number results in an equivalent fraction [7].)

Check understanding: Exit ticket whiteboards: all three must be correct. Pull small group if multiply rule is missed.

Support: Let students point to their 2/3 = 4/6 art while answering. **Stretch:** Ask students to name the multiplier from 3/4 to 12/16 during the vote.

Use: Slides 10-11

Common mistakes

Mistake	How to spot it	How to fix it
Thinking 2/4 is bigger than 1/2 because 2 > 1 and 4 > 2.	Student says larger top or bottom means larger value.	Overlay same-size bars to show same shaded size [1] and stress more parts means smaller parts.
Changing only the numerator or only the denominator.	Student writes 2/3 = 4/3 or 2/5 after cutting.	Recount both: each old part cut into n pieces, so both counts times n, which models (n x a)/(n x b) [1].
Adding the same number instead of multiplying, like 2/3 = 4/5.	Student adds 2 to top and bottom.	Show with drawing that adding breaks equal cuts; you only multiply or divide top and bottom by the same amount to keep the value.

Support

- Provide outlines already split into thirds so students only add the second cut and count.
- Limit first models to halves, fourths, and eighths and model lining up right edges.

Stretch

- Have students draw a third version showing 6/9 and write the multiplication used.
- Have students make a set for 3/4 using eighths and twelfths and explain the pattern.

For the LSE or teaching assistant

Stay with target pairs during main drawing; help align same-size wholes, prompt counting of total vs shaded, and read Task C aloud if needed.

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Check for understanding

Question	Answer
Draw or explain why 1/2 = 2/4 using number and size of parts.	Same whole, 2 parts to 4 parts, pieces smaller, same shaded size.
Fill the missing number: 2/3 = 8/12. What did you multiply by?	4; (4 x 2)/(4 x 3) = 8/12.
True or false: 3/4 = 6/8 because top and bottom were both multiplied by 2.	True.

Homework

On grid paper, draw bars to show one fraction equivalent to 1/3 and write the multiplication.

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