

Multiplying Fractions

Unit 9 Overview: 6 lessons

Students see a fraction as copies of a unit fraction: $5/4$ is 5 copies of $1/4$, or $5 \times 1/4$. They multiply a whole number by a unit fraction with jumps on a number line, then by any fraction with strips and equations: $3 \times 2/5$ is 6 copies of $1/5$, or $6/5$. They find which two whole numbers a product is between, with the fraction first too, and solve story problems about equal groups of a fraction. In some states the unit ends with a fraction as sharing: 3 muffins shared equally by 5 friends is $3/5$ of a muffin each. Multiplying a fraction by a fraction is 5th grade work.

THE UNIT, DAY BY DAY

Day 1	Pre-Check	What students already know, before the first lesson.
Day 2	9.1 Copies of a unit fraction	I can write a fraction as copies of a unit fraction.
Day 3	9.2 Times a unit fraction on a number line	I can multiply a whole number by a unit fraction.
Day 4	9.3 Whole number times a fraction	I can multiply a whole number by a fraction.
Day 5	9.4 Between which two whole numbers?	I can tell which two whole numbers a product is between.
Day 6	9.5 Story problems	I can solve stories that multiply a fraction by a whole number.
Day 7	9.6 A fraction as sharing ★	I can share things equally and write the share as a fraction.
Day 8	Unit Review	The review, to go over together.
Day 9	Unit Test	Form A; Form B (other numbers) is for a retest.

★ Taught in 4th grade in some states. Skip these lessons if yours teaches them in another grade; animalmath.com/standards shows your state's list.

GET READY FOR THE UNIT

- Paper strips all the same length, cut into unit fractions (halves to twelfths), several of each for every pair
- Number lines from 0 to 5 in halves, thirds, fourths, fifths and eighths, and one taped on the floor
- Colored pencils and whiteboards
- Paper circles and rectangles to cut and share, and scissors
- Story cards with equal groups of a fraction: laps, cups, hops, ribbons

HOW EACH LESSON GOES

1. **Warm up** (5 min)
2. **Teach** (10 min)
3. **Try it together** (10 min)
4. **Practice** (15 min)
5. **Exit ticket** (5 min): a quick check on the lesson.

Each lesson page ends with the Animal Math sheets, makers, tools and quizzes for it. "Sheet 3" is the third worksheet of a pack; a color pack prints each sheet again in black and white.

CHECKING AS YOU GO

PRINTABLE	Pre-Check: Day 1, with a key	EXIT TICKET	Exit Tickets: one a lesson, four to a page
PRINTABLE	Unit Review: the day before the test	PRINTABLE	Unit Test: Forms A and B, with keys



Multiplying Fractions

Lesson 9.1: Copies of a unit fraction

GOAL Students see a fraction as copies of its unit fraction and write it as a whole number times the unit fraction: $5/6 = 5 \times 1/6$. They write products of a whole number and a unit fraction as fractions, past 1 too.

About 45 minutes

I can write a fraction as copies of a unit fraction.

THE LESSON

- 1 Warm up** (5 min) Write $3 + 3 + 3 + 3$ as a multiplication. Then write $1/5 + 1/5 + 1/5 + 1/5$ the same way. (4×3 , then $4 \times 1/5$.)
- 2 Teach** (10 min) Shade $5/6$ of a strip one sixth at a time: 5 copies of $1/6$. Write $5/6 = 1/6 + 1/6 + 1/6 + 1/6 + 1/6 = 5 \times 1/6$. Past 1: $7/3$ is 7 copies of $1/3$, two whole strips and one third more, so $7/3 = 7 \times 1/3$. Going back, $6 \times 1/10$ is 6 copies of one tenth: $6/10$.
Say: "A fraction is copies of its unit fraction. $5/6$ is 5 copies of $1/6$, so $5/6 = 5 \times 1/6$."
- 3 Try it together** (10 min) Pairs build $4/5$ and $9/4$ with paper unit fractions and write each as a product. Then they write $8 \times 1/12$ and $3 \times 1/2$ as fractions and check with pieces.
- 4 Practice** (15 min) Students count the unit fractions and write fractions as products, and products as fractions, on sheet 1 of Multiplying Fractions by Whole Numbers.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 9.1** and circle a face beside the "I can" line. Question 1: 11 and 9 in the boxes. Question 2: $7/10$ and $11/6$; $7/70$ means the denominator was multiplied too.

Need help? Lay paper unit fractions down one at a time, saying "one sixth, two sixths" as they go.

Ready for more? Write $13/4$ as a product, then as a mixed number. How many whole strips does it fill?

GET READY

- Paper unit fractions
- Colored pencils

WORDS TO USE

unit fraction: one equal part of a whole, like $1/6$

copies: the same amount again and again

product: the answer when we multiply

ASK

- What is the unit fraction?
- How many copies of it are there?
- How would you write that as a multiplication?

WATCH FOR

Multiplies the denominator too

($6 \times 1/10 = 6/60$). Shade it: 6 tenths are still tenths.

Counts all the parts, not the shaded ones. Point to each shaded part as it is counted.

ON ANIMAL MATH

PRINTABLE

Multiplying Fractions by Whole Numbers: sheet 1

QUIZ

Fraction Operations Quiz: the Times a Whole Number level

EXIT TICKET

4th Grade Multiplying Fractions Exit Tickets: Exit Ticket 9.1

Multiplying Fractions

Lesson 9.2: Times a unit fraction on a number line

GOAL Students multiply a whole number by a unit fraction with jumps on a number line: each jump is the unit fraction and the whole number counts the jumps. They see that $4 \times \frac{1}{4} = 1$, and that products go past 1.

About 45 minutes

I can multiply a whole number by a unit fraction.

THE LESSON

- 1 Warm up** (5 min) Count by fifths together from 0 to 2 on a number line. Where is $\frac{5}{5}$? Where is $\frac{10}{5}$?
- 2 Teach** (10 min) On a number line from 0 to 2 in fourths, start at 0 and make 5 jumps of $\frac{1}{4}$: $5 \times \frac{1}{4} = \frac{5}{4}$. Where did the fourth jump land? On 1, so $4 \times \frac{1}{4} = 1$. Then jumps of $\frac{1}{3}$ on a line in thirds: 5 jumps land on $\frac{5}{3}$, between 1 and 2, so $5 \times \frac{1}{3} = \frac{5}{3}$.
Say: "Each jump is one unit fraction. The whole number tells how many jumps. Where I land is the product."
- 3 Try it together** (10 min) Pairs draw the jumps for $9 \times \frac{1}{8}$ and $7 \times \frac{1}{12}$ and write each product. Then: how many jumps of $\frac{1}{5}$ land on 1? Of $\frac{1}{8}$? Two students walk the jumps on the floor line.
- 4 Practice** (15 min) Students start at 0, draw the jumps and write the products on sheet 2 of Multiplying Fractions by Whole Numbers.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 9.2** and circle a face beside the "I can" line. Question 1: $10 \times \frac{1}{3} = \frac{10}{3}$; $\frac{10}{30}$ means the denominator was multiplied too. Question 2: 10 and 12, the jumps that make 1.

Need help? Walk the jumps on the floor number line, saying each fraction out loud.

Ready for more? How many jumps of $\frac{1}{12}$ land on 2? Write it as a multiplication.

GET READY

- Number lines from 0 to 3 in thirds, fourths and eighths, and from 0 to 1 in twelfths
- A number line taped on the floor

WORDS TO USE

jump: one move along the line, the size of the unit fraction

land: the point where the last jump ends: the product

ASK

- How long is each jump?
- How many jumps make 1 whole?
- Where will the next jump land?

WATCH FOR

Counts the marks, not the jumps. Point to each jump as it is counted.

Stops at 1, thinking the product must be less than 1. Keep jumping: the line goes on past 1.

ON ANIMAL MATH

PRINTABLE

Multiplying Fractions by Whole Numbers: sheet 2

QUIZ

Fraction Operations Quiz: the Times a Whole Number level

EXIT TICKET

4th Grade Multiplying Fractions Exit Tickets: Exit Ticket 9.2

Multiplying Fractions

Lesson 9.3: Whole number times a fraction

GOAL Students multiply a whole number by any fraction as copies of the fraction: $4 \times \frac{2}{3}$ is 4 copies of 2 thirds, 8 copies of $\frac{1}{3}$, so $\frac{8}{3}$. The whole number times the numerator gives the parts; the denominator stays.

About 45 minutes

I can multiply a whole number by a fraction.

THE LESSON

- 1 Warm up** (5 min) 3 groups of 4 apples is 3×4 . What is 3 groups of 2 sixths? Students draw it. (6 sixths.)
- 2 Teach** (10 min) Draw 4 strips, each with $\frac{2}{3}$ shaded. Count the shaded thirds: $2 + 2 + 2 + 2 = 8$ thirds. So $4 \times \frac{2}{3} = 8 \times \frac{1}{3} = \frac{8}{3}$. Multiply the whole number by the numerator; the denominator stays, because the parts are still thirds. Then with no picture: $7 \times \frac{3}{10} = 21 \times \frac{1}{10} = \frac{21}{10}$.
Say: "A whole number times a fraction is copies of the fraction. I multiply the whole number by the numerator. The parts stay the same size, so the denominator stays."
- 3 Try it together** (10 min) Pairs shade strips for $3 \times \frac{3}{8}$ and write $9 \times \frac{1}{8} = \frac{9}{8}$. Then they multiply $7 \times \frac{2}{3}$, and $\frac{5}{6} \times 5$ with the fraction first, and say why the order does not change the product.
- 4 Practice** (15 min) Students count the shaded parts on the strips and multiply on sheet 3 of Multiplying Fractions by Whole Numbers.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 9.3** and circle a face beside the "I can" line. Question 1: 12 and $\frac{12}{5}$; $\frac{12}{15}$ means the denominator was multiplied too. Question 2: $\frac{16}{5}$ and $\frac{25}{8}$; $\frac{25}{40}$ means both numbers of the fraction were multiplied.

Need help? Draw every copy as its own strip and count the shaded parts.

Ready for more? Find four ways to write $\frac{12}{10}$ as a whole number times a fraction.

GET READY

- Paper strips
- Colored pencils and whiteboards

WORDS TO USE

groups of: copies of the same fraction

numerator: the top number: how many parts

denominator: the bottom number: the size of the parts

ASK

- How many copies of the fraction are there?
- How many unit fractions is that in all?
- Why does the denominator stay the same?

WATCH FOR

Multiplies the denominator too ($4 \times \frac{2}{3} = \frac{8}{12}$). Draw the copies: the parts are still thirds.

Adds the whole number to the numerator ($4 \times \frac{2}{3} = \frac{6}{3}$). Draw 4 strips of $\frac{2}{3}$ and count the parts.

Thinks a fraction first means a different answer. Turn it around: $\frac{2}{3} \times 4$ is 4 copies of $\frac{2}{3}$.

ON ANIMAL MATH

PRINTABLE

Multiplying Fractions by Whole Numbers: sheet 3

QUIZ

Fraction Operations Quiz: the Times a Whole Number level

EXIT TICKET

4th Grade Multiplying Fractions Exit Tickets: Exit Ticket 9.3

Multiplying Fractions

Lesson 9.4: Between which two whole numbers?

GOAL Students multiply, then find which two whole numbers the product is between by counting the wholes in it, with the fraction first too. They tell without multiplying whether a product is more or less than the whole number.

About 45 minutes

I can tell which two whole numbers a product is between.

THE LESSON

- 1 Warm up** (5 min) Is $9/4$ more or less than 2? Than 3? How do you know? ($8/4$ is 2 and $12/4$ is 3.)
- 2 Teach** (10 min) Multiply $5 \times 2/3 = 10/3$. How many wholes? 3 thirds make 1, so 9 thirds make 3, and $10/3$ is 1 third more: between 3 and 4, or $3 \frac{1}{3}$. Then without multiplying: $8 \times 3/4$ is less than 8, because $3/4$ is less than 1, and $8 \times 5/4$ is more than 8, because $5/4$ is more than 1.
Say: "To find the whole numbers, I see how many wholes fit in the product. Times a fraction less than 1, the product is less than the whole number."
- 3 Try it together** (10 min) Pairs multiply $7 \times 3/4$ and $2/3 \times 8$, mark each product on a number line and name the two whole numbers it is between. Then they decide without multiplying: is $9 \times 7/8$ more or less than 9?
- 4 Practice** (15 min) Students multiply and write the two whole numbers each product is between, then circle more or less without multiplying, on sheet 4 of Multiplying Fractions by Whole Numbers.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 9.4** and circle a face beside the "I can" line. Question 1: $21/5$ is between 4 and 5, and $27/8$ between 3 and 4; 21 and 22 means the numerator was used, not the wholes. Question 2: $22/5 = 4 \frac{2}{5}$.

Need help? Mark the product on a number line with the whole numbers labeled in color.

Ready for more? Find a whole number that times $2/3$ gives a product between 4 and 5. Is there more than one?

GET READY

- Number lines from 0 to 6 in thirds and fourths
- Whiteboards

WORDS TO USE

between: more than one number and less than the next

more or less: times a fraction less than 1 makes less than the whole number

ASK

- How many fifths make 1 whole? 4 wholes?
- Is the fraction more or less than 1? So is the product more or less than the whole number?
- Does it matter which number comes first?

WATCH FOR

Names the numbers around the numerator (between 21 and 22). Ask how many wholes the parts make.

Thinks multiplying always makes a bigger number. 8 copies of something less than 1 is less than 8.

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PRINTABLE

Multiplying Fractions by Whole Numbers: sheet 4

QUIZ

Fraction Operations Quiz: the Times a Whole Number level

EXIT TICKET

4th Grade Multiplying Fractions Exit Tickets: Exit Ticket 9.4

Multiplying Fractions

Lesson 9.5: Story problems

GOAL Students solve story problems about equal groups of a fraction: they draw a tape with a box for each group, write the equation, multiply and answer with a mixed number and the unit.

About 45 minutes

I can solve stories that multiply a fraction by a whole number.

THE LESSON

- 1 Warm up** (5 min) Read: Each glass holds $\frac{1}{4}$ liter. How much do 3 glasses hold? Students draw it. ($\frac{3}{4}$ liter.)
- 2 Teach** (10 min) Read: Each lap of the track is $\frac{3}{4}$ mile. Kim runs 5 laps. How far does she run? Draw a tape of 5 boxes with $\frac{3}{4}$ in each. Write $5 \times \frac{3}{4} = ?$ Five groups of 3 fourths is 15 fourths: $\frac{15}{4}$, or $3\frac{3}{4}$ miles. Check: it is less than 5 miles, because each lap is less than 1 mile.
Say: "Equal groups of a fraction is multiplication. I draw the groups, write the equation and answer with the unit."
- 3 Try it together** (10 min) Pairs solve with tape diagrams: A batch of granola uses $\frac{3}{4}$ cup of oats. How much for 3 batches? Then: A snail crawls $\frac{5}{12}$ meter an hour. How far does it crawl in 5 hours?
- 4 Practice** (15 min) Students write an equation and solve the stories on sheet 5 of Multiplying Fractions by Whole Numbers, then the tape diagram stories on sheet 4 of Fraction Word Problems and the add, subtract or multiply stories on sheet 5. Early finishers double and triple a recipe on sheet 2 of Recipe Math.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 9.5** and circle a face beside the "I can" line. Question 1: $6\frac{2}{3}$ meters ($\frac{20}{3}$); $10\frac{2}{3}$ means the hops were added to the fraction. Question 2: $4\frac{1}{8}$ cups ($\frac{33}{8}$).

Need help? Draw a tape with one box for each group and write the fraction in every box.

Ready for more? Write a story for $9 \times \frac{3}{5}$ and solve it. Between which two whole numbers is the answer?

GET READY

- Story cards
- Whiteboards
- A measuring cup or a ruler to act out a story

WORDS TO USE

equal groups: groups that are all the same size

equation: a number sentence with an equals sign

tape diagram: a bar cut into one box for each group

ASK

- What are the equal groups? How many are there?
- Is the answer more or less than the number of groups? Why?
- What unit goes with your answer?

WATCH FOR

Adds the whole number and the fraction ($5 + \frac{3}{4}$). Draw the groups: 5 laps of $\frac{3}{4}$ mile.

Multiplies the denominator too. The groups are still fourths of a mile.

Leaves the answer as a fraction when the story asks how many miles. Make the wholes: $\frac{15}{4}$ is 3 whole miles and $\frac{3}{4}$.

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PRINTABLE **Multiplying Fractions by Whole Numbers:** sheet 5

PRINTABLE **Fraction Word Problems:** sheets 4-5

PRINTABLE **Recipe Math:** sheet 2 for early finishers

QUIZ **Fraction Operations Quiz:** the Times a Whole Number level

EXIT TICKET **4th Grade Multiplying Fractions Exit Tickets:** Exit Ticket 9.5

Multiplying Fractions

Lesson 9.6: A fraction as sharing

GOAL

Students share things equally by cutting each thing into as many parts as there are people, and write each share as a fraction: 2 pizzas shared by 3 is $\frac{2}{3}$ of a pizza each, and $2 \div 3 = \frac{2}{3}$.

About 45 minutes

★ Taught in 4th grade in some states

I can share things equally and write the share as a fraction.

THE LESSON

- 1 Warm up** (5 min) 2 friends share 1 apple equally. How much does each get? ($\frac{1}{2}$.) What if 3 friends share it?
- 2 Teach** (10 min) Read: 2 pizzas are shared equally by 3 friends. Cut each pizza into 3 slices, one for each friend. Each friend gets 1 slice of each pizza: 2 slices of $\frac{1}{3}$, or $\frac{2}{3}$ of a pizza. So $2 \div 3 = \frac{2}{3}$. Then 5 sandwiches shared by 2: each sandwich in halves, 5 halves each, so $\frac{5}{2}$, or 2 $\frac{1}{2}$ sandwiches.
Say: "When I share things equally, each share is the number of things over the number of people: 2 shared by 3 is $\frac{2}{3}$ each."
- 3 Try it together** (10 min) Pairs share paper shapes and write the division and the fraction: 3 muffins among 5 friends, then 7 crackers among 4. Which share is more than 1 whole?
- 4 Practice** (15 min) Students shade one share and write the division and the fraction, then share more things than people and write a mixed number, on sheet 1 of Dividing Unit Fractions and Whole Numbers.
- 5 Exit ticket** (5 min) Students do **Exit Ticket 9.6** and circle a face beside the "I can" line. Question 1: $\frac{4}{3}$, or $1\frac{1}{3}$, each waffle cut into 3 parts; $\frac{3}{4}$ means the numbers were swapped. Question 2: $\frac{7}{8}$; $\frac{8}{7}$ means the order was flipped.

Need help? Act it out with paper shapes and scissors, handing out the parts.

Ready for more? 5 friends share some pizzas, and each gets $\frac{7}{5}$ of a pizza. How many pizzas were there?

GET READY

- Paper circles and rectangles to share
- Scissors and colored pencils

WORDS TO USE

share equally: give everyone the same amount

share: the amount each person gets

division: sharing: $2 \div 3$ is 2 shared by 3

ASK

- How many parts do you cut each thing into?
- How many parts does each person get?
- Is each share more or less than 1 whole?

WATCH FOR

Puts the number of people on top (3 shared by 5 is $\frac{5}{3}$). The things shared go on top: say "3 shared by 5".

Cuts each thing into the number of things, not people. Each thing is cut once for every person sharing.

Thinks a share must be less than 1. With more things than people, each gets more than 1 whole.

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PRINTABLE

Dividing Unit Fractions and Whole Numbers: sheet 1

EXIT TICKET

4th Grade Multiplying Fractions Exit Tickets: Exit Ticket 9.6