Lesson 14

Multiply Fractions Using an Area Model

Name: _____

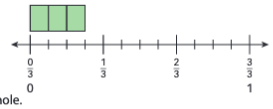
Prerequisite: Model Fraction Multiplication

Study the example problem showing a model of multiplying a fraction by a fraction. Then solve problems 1–7.

Example

What is $\frac{3}{4} \times \frac{1}{3}$?

The number line is divided into thirds. Each third is divided into fourths. Each of these parts is $\frac{1}{12}$ of the whole.



$\frac{3}{4}$ of 1 third is shaded. The whole is divided into twelfths, with 3 twelfths shaded. So, $\frac{3}{4} \times \frac{1}{3} = \frac{3}{12}$.

B 1 Why is the shaded rectangle above the number line in the example divided into 3 parts?

Answers will vary. Possible answer: You are finding $\frac{3}{4}$ of $\frac{1}{3}$, so $\frac{1}{3}$ is divided into 4 parts and 3 of those parts are shaded.

M 2 How would the model in the example change if the problem was $\frac{3}{4} \times \frac{2}{3}$?

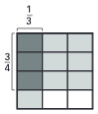
Answers will vary. Possible answer: One more shaded rectangle divided into 3 parts would be shown, showing $\frac{3}{4}$ of another third.

M 3 What is $\frac{3}{4} \times \frac{2}{3}$? Use the number line to the right to model your answer.

$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$

Solve.

B 4 Look at the model and answer the following questions.



Each column is what fraction of the whole? $\frac{1}{3}$

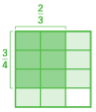
Each row is what fraction of the whole? $\frac{1}{4}$

How many parts are in the whole? 12

The dark gray parts show $\frac{3}{4}$ of $\frac{1}{3}$. What fraction of the whole is $\frac{3}{4} \times \frac{1}{3}$? $\frac{3}{12}$

What is the product of $\frac{3}{4} \times \frac{1}{3}$? $\frac{3}{12}$

M 5 Shade and label the model to show $\frac{3}{4} \times \frac{2}{3}$. Complete the equation.



$\frac{3}{4} \times \frac{2}{3} = \frac{6}{12}$

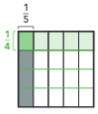
C 6 $\frac{6}{12}$ is equal to $\frac{1}{2}$. How does the model you shaded in problem 6 show that?

Answers will vary. Possible answer: 6 of the 12 equal parts of the model have dark shading and the same number, 6, do not. So, the parts with the dark shading are half of the whole.

M 7 Write a fraction from the box to complete the expression. Then complete the model to show the problem.

$\frac{1}{2}$ $\frac{1}{3}$ $\frac{1}{4}$

$\frac{\boxed{1}}{\boxed{4}} \times \frac{1}{5}$ **Possible answer shown.**



Key		
B Basic	**M** Medium	**C** Challenge

Lesson 14

Name: _____

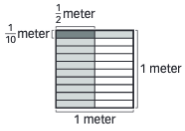
Multiply Unit Fractions to Find Areas

Study the example problem showing multiplying unit fractions to find area. Then solve problems 1–5.

Example

Cardboard that measures 1 meter on each side is cut into cards that are $\frac{1}{10}$-meter wide and $\frac{1}{2}$-meter long. What is the area of each card?

You can model the problem with a picture:



You can model the problem with an equation.

area = $\frac{1}{2} \times \frac{1}{10} = \frac{1 \times 1}{2 \times 10} = \frac{1}{20}$ square meter

M 1 Suppose the length of each card in the example problem is shortened to $\frac{1}{4}$ meter. Will the area of each card now be greater or less than $\frac{1}{20}$ square meter? Explain.

The area of each card will be less than $\frac{1}{20}$ square meter; Possible explanation: There will be 4 cards in each row. Each card will cover less space, so its area will be less.

B 2 Which expression represents the area of a card described in problem 1?

A $\frac{1}{2} \times \frac{1}{4}$

B $\frac{1}{2} \times \frac{1}{10}$

C $\frac{1}{4} \times \frac{1}{10}$

D $\frac{1}{4} \times \frac{1}{20}$

Solve.

M 3 What is the area of a card that is $\frac{1}{10}$-meter wide and $\frac{1}{4}$-meter long?

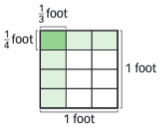
Show your work.

Students may model $\frac{1}{4} \times \frac{1}{10}$ with an area model, an equation, or both.

Solution: **$\frac{1}{40}$ square meter**

M 4 Mr. Von's 5th-grade class is going on a field trip. Each student is given a name card to wear that is $\frac{1}{4}$-foot wide and $\frac{1}{3}$-foot long.

Shade the model to find the area of each name card. Complete the equation.



$\frac{1}{4}$-foot $\times$ $\frac{1}{3}$-foot = $\frac{\boxed{1}}{\boxed{12}}$ square foot

C 5 Signs for science project displays are cut from pieces of poster board that measure 1 yard on each side. Each sign is $\frac{1}{3}$-yard long and $\frac{1}{9}$-yard wide. How many signs can be cut from 1 piece of poster board? What is the area of each sign?

Show your work.

Students may model $\frac{1}{3} \times \frac{1}{9}$ with an area model, an equation, or both.

Solution: **27 signs; $\frac{1}{27}$ square yard**

Name: _____

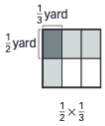
Multiply Fractions Greater than One

Study the example problem showing multiplying fractions greater than 1. Then solve problems 1–6.

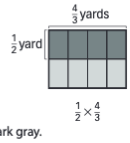
Example

What is the area of a rectangle that is $\frac{1}{2}$-yard wide and $\frac{4}{3}$-yards long?

This area model shows $\frac{1}{2}$ yard $\times \frac{1}{3}$ yard $= \frac{1}{6}$ square yard.



This model uses the same $\frac{1}{6}$-square yard parts to show an area that is $\frac{1}{2}$ yard $\times \frac{4}{3}$ yards.



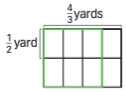
Four $\frac{1}{6}$-square yard parts are shaded dark gray.

$\frac{1}{2}$ yard $\times \frac{4}{3}$ yards $= \frac{4}{6}$ square yard

B 1 How many $\frac{1}{2}$-yard lengths are in 1 yard? 2

B 2 How many $\frac{1}{3}$-yard lengths are in 1 yard? 3

M 3 Draw a line around the part of the model from the example problem that represents 1 square yard.



Does $\frac{4}{6}$ square yard cover more or less area than 1 square yard? Explain.

Less; Possible explanation: 1 square yard covers 6 of the $\frac{1}{6}$-square yard parts, while $\frac{4}{6}$ only covers 4 of the $\frac{1}{6}$-square yard parts and $4 < 6$.

Solve.

M 4 Danah has a strawberry patch in her garden. Its border is $\frac{4}{5}$-meters wide and $\frac{3}{2}$-meters long. What is the area of Danah's strawberry patch?

Show your work.

Students may model $\frac{4}{5} \times \frac{3}{2}$ with an area model, or an equation, or both.

Solution: $\frac{12}{10}$ square meters

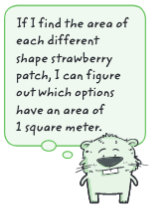
M 5 Danah is planting a second strawberry patch and wants it to have an area of exactly 1 square meter. Which of the following could be the width and length of its borders? Circle the letter for all that apply.

A $\frac{1}{2}$-meter wide and $\frac{3}{2}$-meters long

(B) $\frac{2}{3}$-meter wide and $\frac{3}{2}$-meters long

(C) $\frac{4}{5}$-meter wide and $\frac{5}{4}$-meters long

(D) $\frac{2}{3}$-meter wide and $\frac{6}{4}$-meters long



C 6 Look at problem 5. If Danah wants her strawberry patch to be exactly 1 square meter, can the length of her strawberry patch be greater than 1 meter? Explain.

Yes; Possible explanation: B, C, and D all have lengths greater than 1 meter and their areas are exactly 1 square meter.

Multi-Digit Subtraction—Skills Practice

Name _____

Subtract within 1,000,000. **Form A**

1. 11,223 − 311 = 10,912	2. 2,123 − 1,321 = 802	3. 432,765 − 43,276 = 389,489	4. 80,449 − 24,085 = 56,364
5. 184,234 − 93,517 = 90,717	6. 319,019 − 9,416 = 309,603	7. 62,626 − 6,262 = 56,364	8. 37,740 − 18,870 = 18,870
9. 7,347 − 5,182 = 2,165	10. 956,201 − 524,110 = 432,091	11. 476,747 − 9,696 = 467,051	12. 535 − 353 = 182
13. 90,000 − 1,234 = 88,766	14. 37,665 − 776 = 36,889	15. 215,451 − 8,795 = 206,656	16. 52,252 − 50,992 = 1,260
17. 602,602 − 444,444 = 158,158	18. 5,702 − 2,915 = 2,787	19. 877,007 − 525 = 876,482	20. 13,579 − 2,846 = 10,733

Name _____

Subtract within 1,000,000. **Form B**

1. 13,445 − 522 = 12,923	2. 8,789 − 7,987 = 802	3. 654,631 − 65,432 = 589,199	4. 70,338 − 13,074 = 57,264
5. 162,478 − 81,759 = 80,719	6. 518,018 − 8,515 = 509,503	7. 71,717 − 7,171 = 64,546	8. 51,120 − 25,560 = 25,560
9. 6,536 − 5,372 = 1,164	10. 833,021 − 312,110 = 520,911	11. 596,454 − 9,393 = 587,061	12. 626 − 262 = 364
13. 70,000 − 2,345 = 67,655	14. 28,776 − 887 = 27,889	15. 437,673 − 9,895 = 427,778	16. 32,131 − 30,881 = 1,250
17. 501,501 − 333,333 = 168,168	18. 6,803 − 4,806 = 1,997	19. 966,006 − 414 = 965,592	20. 14,568 − 3,725 = 10,843