Lesson 8

Divide Fractions

Real-World Link

Oranges Deandre has three oranges and each orange is divided evenly into fourths. Complete the steps below to find $3 \div \frac{1}{4}$.

Step 1 Draw three oranges. The first one is drawn for you.

Step 2 Imagine you cut each orange into fourths. Draw the slices for each orange.

So $3 \div \frac{1}{4} = 12$. Deandre will have ☐ orange slices.

1. Find $3 \div \frac{1}{2}$. Use a diagram. _____

2. What is true about $3 \div \frac{1}{2}$ and 3×2? _____

Which MP Mathematical Practices did you use? Shade the circle(s) that applies.

① Persevere with Problems	⑤ Use Math Tools
② Reason Abstractly	⑥ Attend to Precision
③ Construct an Argument	⑦ Make Use of Structure
④ Model with Mathematics	⑧ Use Repeated Reasoning

Essential Question

WHAT happens when you add, subtract, multiply, and divide fractions?

CCSS Common Core State Standards

Content Standards
7.NS.2, 7.NS.2c, 7.NS.3, 7.EE.3

MP Mathematical Practices
1, 3, 4, 5

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Key Concept

Divide Fractions

Watch

Words To divide by a fraction, multiply by its multiplicative inverse, or reciprocal.

Examples

Numbers	Algebra
$\frac{7}{8} \div \frac{3}{4} = \frac{7}{8} \cdot \frac{4}{3}$	$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c}$, where $b, c, d \neq 0$

Work Zone

Dividing 3 by $\frac{1}{4}$ is the same as multiplying 3 by the reciprocal of $\frac{1}{4}$, which is 4.

reciprocals

$3 \div \frac{1}{4} = 12 \qquad 3 \cdot 4 = 12$

same result

STOP and Reflect

What is the reciprocal of $\frac{2}{3}$? of 15? of $\frac{4}{9}$? Write your answers below.

Is this pattern true for any division expression?

Consider $\frac{7}{8} \div \frac{3}{4}$, which can be rewritten as $\frac{\frac{7}{8}}{\frac{3}{4}}$.

$$\frac{\frac{7}{8}}{\frac{3}{4}} = \frac{\frac{7}{8} \times \frac{4}{3}}{\frac{3}{4} \times \frac{4}{3}}$$

Multiply the numerator and denominator by the reciprocal of $\frac{3}{4}$, which is $\frac{4}{3}$.

$$= \frac{\frac{7}{8} \times \frac{4}{3}}{1}$$

$\frac{3}{4} \times \frac{4}{3} = 1$

$$= \frac{7}{8} \times \frac{4}{3}$$

So, $\frac{7}{8} \div \frac{3}{4} = \frac{7}{8} \times \frac{4}{3}$. The pattern is true in this case.

Examples

Tutor

1. **Find $\frac{1}{3} \div 5$.**

$$\frac{1}{3} \div 5 = \frac{1}{3} \div \frac{5}{1}$$

A whole number can be written as a fraction over 1.

$$= \frac{1}{3} \times \frac{1}{5}$$

Multiply by the reciprocal of $\frac{5}{1}$, which is $\frac{1}{5}$.

$$= \frac{1}{15}$$

Multiply.

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2. **Find $\frac{3}{4} \div \left(-\frac{1}{2}\right)$. Write in simplest form.**

Estimate $1 \div \left(-\frac{1}{2}\right) = \square$

$\frac{3}{4} \div \left(-\frac{1}{2}\right) = \frac{3}{4} \cdot \left(-\frac{2}{1}\right)$ Multiply by the reciprocal of $-\frac{1}{2}$, which is $-\frac{2}{1}$.

$= \frac{3}{\cancel{4}_{2}} \cdot \left(-\frac{\cancel{2}^{1}}{1}\right)$ Divide 4 and 2 by their GCF, 2.

$= -\frac{3}{2}$ or $-1\frac{1}{2}$ Multiply.

Check for Reasonableness $-1\frac{1}{2} \approx -2$ ✓

Got it? **Do these problems to find out.**

Divide. Write in simplest form.

a. $\frac{3}{4} \div \frac{1}{4}$ b. $-\frac{4}{5} \div \frac{8}{9}$ c. $-\frac{5}{6} \div \left(-\frac{2}{3}\right)$

Show your work.

a. _____

b. _____

c. _____

Divide Mixed Numbers

To divide by a mixed number, first rename the mixed number as a fraction greater than one. Then multiply the first fraction by the reciprocal, or multiplicative inverse, of the second fraction.

Example

Tutor

3. **Find $\frac{2}{3} \div 3\frac{1}{3}$. Write in simplest form.**

$\frac{2}{3} \div 3\frac{1}{3} = \frac{2}{3} \div \frac{10}{3}$ Rename $3\frac{1}{3}$ a fraction greater than one.

$= \frac{2}{3} \cdot \frac{3}{10}$ Multiply by the reciprocal of $\frac{10}{3}$, which is $\frac{3}{10}$.

$= \frac{\cancel{2}^{1}}{\cancel{3}_{1}} \cdot \frac{\cancel{3}^{1}}{\cancel{10}^{5}}$ Divide out common factors.

$= \frac{1}{5}$ Multiply.

Got it? **Do these problems to find out.**

Divide. Write in simplest form.

d. $5 \div 1\frac{1}{3}$ e. $-\frac{3}{4} \div 1\frac{1}{2}$ f. $2\frac{1}{3} \div 5$

d. _____

e. _____

f. _____

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Example

Watch Tutor

4. **The side pieces of a butterfly house are $8\frac{1}{4}$ inches long. How many side pieces can be cut from a board measuring $49\frac{1}{2}$ inches long?**

To find how many side pieces can be cut, divide $49\frac{1}{2}$ by $8\frac{1}{4}$.

Estimate Use compatible numbers. $48 \div 8 = 6$

$49\frac{1}{2} \div 8\frac{1}{4} = \frac{99}{2} \div \frac{33}{4}$ Rename the mixed numbers as fractions greater than one.

$= \frac{99}{2} \cdot \frac{4}{33}$ Multiply by the reciprocal of $\frac{33}{4}$, which is $\frac{4}{33}$.

$= \frac{\overset{3}{\cancel{99}}}{\underset{1}{\cancel{2}}} \cdot \frac{\overset{2}{\cancel{4}}}{\underset{1}{\cancel{33}}}$ Divide out common factors.

$= \frac{6}{1}$ or 6 Multiply.

So, 6 side pieces can be cut.

Check for Reasonableness Compare to the estimate. $6 = 6$ ✓

Guided Practice

Check

Divide. Write in simplest form. (Examples 1 – 3)

1. $\frac{1}{8} \div \frac{1}{3} =$ _____

Show your work.

2. $-3 \div \left(-\frac{6}{7}\right) =$ _____

3. $-\frac{7}{8} \div \frac{3}{4} =$ _____

4. On Saturday, Lindsay walked $3\frac{1}{2}$ miles in $1\frac{2}{5}$ hours. What was her walking pace in miles per hour? Write in simplest form. (Example 4) _____

5. **Bulding on the Essential Question** How is dividing fractions related to multiplying? _____

Rate Yourself!

Are you ready to move on? Shade the section that applies.

For more help, go online to access a Personal Tutor. Tutor

FOLDABLES Time to update your Foldable!

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Name _____ My Homework _____

Independent Practice

Go online for Step-by-Step Solutions eHelp

Divide. Write in simplest form. (Examples 1 – 3)

1. $\frac{3}{8} \div \frac{6}{7} =$ _____

2. $-\frac{2}{3} \div \left(-\frac{1}{2}\right) =$ _____

3. $\frac{1}{2} \div 7\frac{1}{2} =$ _____

4. $6 \div \left(-\frac{1}{2}\right) =$ _____

5. $-\frac{4}{9} \div (-2) =$ _____

6. $\frac{2}{3} \div 2\frac{1}{2} =$ _____

7. Cheryl is organizing her movie collection. If each movie case is $\frac{3}{4}$ inch wide, how many movies can fit on a shelf $5\frac{1}{4}$ feet wide? (Example 4)

_____

8. Use the table to solve. Write your answers in simplest form.

Bird	Maximun Weight (lb)
Golden Eagle	$13\frac{9}{10}$
Northern Bald Eagle	$9\frac{9}{10}$
Red-Tailed Hawk	$3\frac{1}{2}$

a. How many times as heavy is the Golden Eagle as the Red-Tailed Hawk? _____

b. How many times as heavy is the Golden Eagle as the Northern Bald Eagle? _____

9. MP **Model with Mathematics** Draw a model of the verbal expression below and then evaluate the expression. Explain how the model shows the division process.

one half divided by two fifths _____

Show your work.

_____

_____

_____

_____

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Copy and Solve **For Exercises 10 and 11, show your work on a separate piece of paper.**

10. MP **Multiple Representations** Jorge recorded the distance that five of his friends live from his house in the table shown.

Student	Miles
Lucia	$5\frac{1}{2}$
Lon	$8\frac{2}{3}$
Sam	$12\frac{5}{6}$
Jamal	$2\frac{7}{9}$
Tye	$17\frac{13}{18}$

   a. **Numbers** Tye lives about how many times farther away than Jamal?

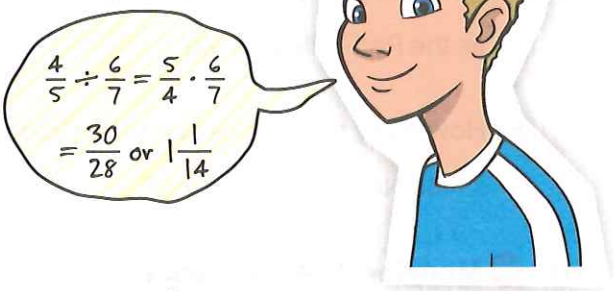
   b. **Algebra** The mean is the sum of the data divided by the number of items in the data set. Write and solve an equation to find the mean number of miles that Jorge's friends live from his house. Write your answer in simplest form.

   c. **Model** Draw a bar diagram that can be used to find how many more miles Lon travels than Lucia to get to Jorge's house.

11. Tara bought a dozen folders. She took $\frac{1}{3}$ of the dozen and then divided the remaining folders equally among her four friends. What fraction of the dozen did each of her four friends receive? How many folders was this per person?

H.O.T. Problems

12. MP **Find the Error** Blake is finding $\frac{4}{5} \div \frac{6}{7}$. Find his mistake and correct it.



13. MP **Persevere with Problems** If $\frac{5}{6}$ is divided by a certain fraction $\frac{a}{b}$, the result is $\frac{1}{4}$. What is the fraction $\frac{a}{b}$? _____

14. MP **Reason Inductively** So far, the Rabun family has traveled 30 miles in $\frac{1}{2}$ hour. If it is currently 3:00 P.M. and their destination is 75 miles away from them, at what time will the Rabun family reach their destination? Explain how you solved the problem

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Name _____ My Homework _____

Extra Practice

Divide. Write in simplest form.

15. $\frac{5}{9} \div \frac{5}{6} = \frac{2}{3}$

$\frac{5}{9} \div \frac{5}{6} = \frac{5}{9} \times \frac{6}{5}$

$= \frac{\cancel{5}^{1}}{\cancel{9}_{3}} \times \frac{\cancel{6}^{2}}{\cancel{5}_{1}}$

$= \frac{1 \times 2}{3 \times 1}$

$= \frac{2}{3}$

Homework Help

16. $-5\frac{2}{7} \div \left(-2\frac{1}{7}\right) =$ _____

17. $-5\frac{1}{5} \div \frac{2}{3} =$ _____

18. Vinh bought $4\frac{1}{2}$ gallons of ice cream to serve. If a pint is $\frac{1}{8}$ of a gallon, how many pint-sized servings can be made? _____

19. William has $8\frac{1}{4}$ cups of fruit juice. If he divides the juice into $\frac{3}{4}$-cup servings, how many servings will he have? _____

20. MP **Justify Conclusions** So far, a storm has traveled 35 miles in $\frac{1}{2}$ hour. If it is currently 5:00 P.M. and the storm is 105 miles away from you, at what time will the storm reach you? Explain how you solved the problem.

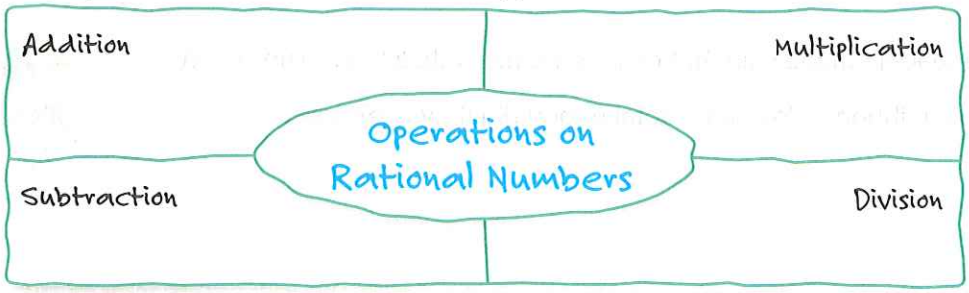
_____

_____

_____

21. Find $\frac{1\frac{2}{3}}{9} \div \frac{1\frac{1}{9}}{3}$. Write in simplest form. _____

22. MP **Use Math Tools** Write the letter of each statement below in the section of any operation to which the statement applies.



A Use a common denominator.

B Multiply by the multiplicative inverse.

C Write the result in simplest form.

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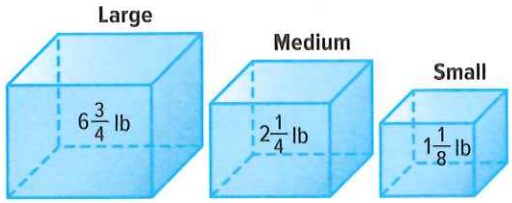
Power Up! Common Core Test Practice

23. Tracy has $94\frac{1}{4}$ inches of string that she uses for making bracelets. She uses $7\frac{1}{4}$ inches of string to make each bracelet. How many bracelets can Tracy make?

24. A grocery store offers 3 different size boxes of peanuts as shown below.



Write large, medium, or small in each box to make a true statement.

The _____ box is 3 times larger than the _____ box.

The _____ box is 6 times larger than the _____ box.

The _____ box is 2 times larger than the _____ box.

Common Core Spiral Review

Add or subtract. Write in simplest form. 5.NF.2

25. $\frac{1}{5} + \frac{1}{4} =$ _____

26. $\frac{1}{3} - \frac{1}{6} =$ _____

27. $\frac{4}{9} + \frac{2}{7} =$ _____

28. $\frac{11}{15} - \frac{3}{20} =$ _____

29. The cheerleaders made spirit buttons for the basketball team. They used blue and red ribbons. How much total ribbon did they use? 5.NF.2

Ribbon	
Blue	Red
$\frac{3}{8}$ ft	$\frac{3}{8}$ ft

_____

30. How much longer is a $2\frac{1}{2}$-inch-long piece of string than a $\frac{2}{5}$-inch-long piece of string? 5.NF.2 _____

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