Operations with Decimals

? ESSENTIAL QUESTION

How can you use operations with decimals to solve real-world problems?

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Real-World Video

The gravitational force on Earth's moon is less than the gravitational force on Earth. You can calculate your weight on the moon by multiplying your weight on Earth by a decimal.

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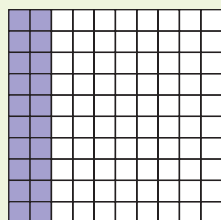Complete these exercises to review skills you will need for this module.
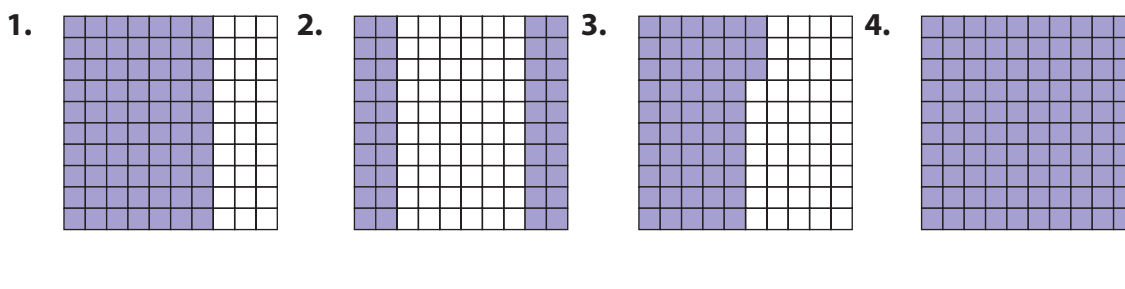
Represent Decimals

EXAMPLE

Think: 1 square = 1 of 100 equal parts
$= \frac{1}{100}$, or 0.01

10 squares = 10 of 100 equal parts
$= \frac{1}{10}$, or 0.1

So, 20 squares represent 2×0.1, or 0.2.

Write the decimal represented by the shaded square.

1. _____

2. _____

3. _____

4. _____

Multiply Decimals by Powers of 10

EXAMPLE 6.574×100 *Count the zeros in 100: 2 zeros.*

$6.574 \times 100 = 657.4$ *Move the decimal point 2 places to the right.*

Find the product.

5. 0.49×10 _____   **6.** $25.34 \times 1,000$ _____   **7.** 87×100 _____

Words for Operations

EXAMPLE   Write a numerical expression for the product of 5 and 9.   *Think: Product means "to multiply."*

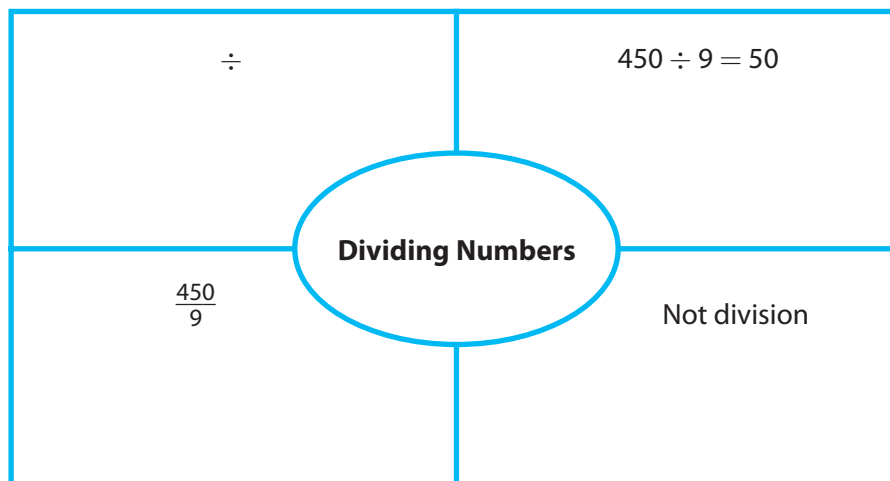5×9 *Write 5 times 9.*

Write a numerical expression for the word expression.

8. 20 decreased by 8 _____   **9.** the quotient of 14 and 7 _____

10. the difference between 72 and 16 _____   **11.** the sum of 19 and 3 _____

Reading Start-Up

Visualize Vocabulary

Use the ✔ words to complete the chart. You may put more than one word in each section.

$\div$	$450 \div 9 = 50$
Dividing Numbers	
$\dfrac{450}{9}$	Not division

Understand Vocabulary

Match the term on the left to the definition on the right.

1. divide   **A.** The bottom number in a fraction.

2. denominator   **B.** The top number in a fraction.

3. quotient   **C.** To split into equal groups.

4. numerator   **D.** The answer in a division problem.

Active Reading

Booklet Before beginning the module, create a booklet to help you learn the concepts in this module. Write the main idea of each lesson on its own page of the booklet. As you study each lesson, record examples that illustrate the main idea and make note of important details. Refer to your finished booklet as you work on assignments and study for tests.

Unpacking the Standards

Understanding the standards and the vocabulary terms in the standards will help you know exactly what you are expected to learn in this module.

COMMON CORE **6.NS.2**

Fluently divide multi-digit numbers using the standard algorithm.

Key Vocabulary

quotient *(cociente)*
The result when one number is divided by another.

What It Means to You

You will use your prior knowledge of division of whole numbers to perform division with decimals.

UNPACKING EXAMPLE 6.NS.2

Eugenia and her friends bought frozen yogurt for 45 cents per ounce. Their total was $11.25. How many ounces did they buy?

Divide 11.25 by 0.45.

$$
\begin{array}{r}
25 \\
0.45\overline{)11.25} \\
\underline{90} \\
225 \\
\underline{225} \\
0
\end{array}
$$

They bought 25 ounces of frozen yogurt.

COMMON CORE **6.NS.3**

Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

Key Vocabulary

algorithm *(algoritmo)*
A set of rules or a procedure for solving a mathematical problem in a finite number of steps.

What It Means to You

You will use your prior knowledge of operations with whole numbers to perform operations with decimals.

UNPACKING EXAMPLE 6.NS.3

Estimate and find the exact answer.

A. 3.25×4.8

$3 \times 5 = 15$

$$
\begin{array}{r}
3.25 \\
\times\ 4.8 \\
\hline
2600 \\
13000 \\
\hline
15.600
\end{array}
$$

B. $132.5 - 18.9$

$133 - 19 = 114$

$$
\begin{array}{r}
132.5 \\
-18.9 \\
\hline
113.6
\end{array}
$$

Visit **my.hrw.com** to see all the **Common Core Standards** unpacked.

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Dividing Whole Numbers

? **ESSENTIAL QUESTION**

How do you divide multi-digit whole numbers?

EXPLORE ACTIVITY Real World

COMMON CORE 6.NS.2

Estimating Quotients

You can use estimation to predict the quotient of multi-digit whole numbers.

A local zoo had a total of 98,464 visitors last year. The zoo was open every day except for three holidays. On average, about how many visitors did the zoo have each day?

$$\overset{\text{quotient}}{\text{divisor}\,)\,\overline{\text{dividend}}}$$

A To estimate the average number of visitors per day, you can divide the total number of visitors by the number of days. To estimate the quotient, first estimate the dividend by rounding the number of visitors to the nearest ten thousand.

98,464 rounded to the nearest ten thousand is _____.

B There were 365 days last year. How many

days was the petting zoo open? _____

C Estimate the divisor by rounding the number of days that the zoo was open to the nearest hundred.

_____ rounded to the nearest hundred is _____.

D Estimate the quotient. _____ ÷ _____ = _____

The average number of visitors per day last year was about _____.

Reflect

1. How can you check that your quotient is correct?

_____

_____

2. **Critical Thinking** Do you think that your estimate is greater than or less than the actual answer? Explain.

_____

Using Long Division

The exact average number of visitors per day at the zoo in the Explore Activity is the quotient of 98,464 and 362. You can use long division to find this quotient.

EXAMPLE 1   *Real World*   COMMON CORE **6.NS.2**

A local zoo had a total of 98,464 visitors last year. The zoo was open every day except three holidays? On average, how many visitors did the zoo have each day?

STEP 1   362 is greater than 9 and 98, so divide 984 by 362. Place the first digit in the quotient in the hundreds place. Multiply 2 by 362 and place the product under 984. Subtract.

$$
\begin{array}{r}
2 \\
362\overline{)\,98{,}464} \\
-72\ 4 \\
\hline
26\ 0
\end{array}
$$

STEP 2   Bring down the tens digit. Divide 2,606 by 362. Multiply 7 by 362 and place the product under 2,606. Subtract.

$$
\begin{array}{r}
27 \\
362\overline{)\,98{,}464} \\
-72\ 4 \\
\hline
26\ 06 \\
-25\ 34 \\
\hline
72
\end{array}
$$

STEP 3   Bring down the ones digit. Divide the ones.

$$
\begin{array}{r}
272 \\
362\overline{)\,98{,}464} \\
-72\ 4 \\
26\ 06 \\
-25\ 34 \\
\hline
724 \\
-724 \\
\hline
0
\end{array}
$$

The average number of visitors per day last year was 272.

YOUR TURN

Find each quotient.

3. 34,989 ÷ 321 _____

4. 73,375 ÷ 125 _____

Dividing with a Remainder

Suppose you and your friend want to divide 9 polished rocks between you so that you each get the same number of polished rocks. You will each get 4 rocks with 1 rock left over. You can say that the quotient $9 \div 2$ has a remainder of 1.

EXAMPLE 2 — Real World   COMMON CORE   6.NS.2

Callie has 1,850 books. She must pack them into boxes to ship to a bookstore. Each box holds 12 books. How many boxes will she need to pack all of the books?

Divide 1,850 by 12.

$$
\begin{array}{r}
154\ \text{R2} \\
12\overline{)1{,}850} \\
-12 \\
\hline
65 \\
-60 \\
\hline
50 \\
-48 \\
\hline
2
\end{array}
$$

The quotient is 154, remainder 2. You can write 154 R2.

Reflect

5. **Interpret the Answer** What does the remainder mean in this situation?

    _____

    _____

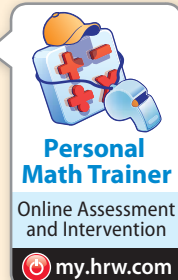6. **Interpret the Answer** How many boxes does Callie need to pack the books? Explain.

    _____

    _____

YOUR TURN

Divide.

7. $5{,}796 \div 25$ _____   8. $67\overline{)3{,}098}$ _____

9. A museum gift shop manager wants to put 1,578 polished rocks into small bags to sell as souvenirs. If the shop manager wants to put 15 rocks in each bag, how many complete bags can be filled? How many rocks will be left over? _____

Guided Practice

1. Estimate: 31,969 ÷ 488 (Explore Activity)

Round the numbers and then divide.

31,969 ÷ 488 = _____ ÷ _____ = _____

Divide. (Example 1, Example 2)

2. 3,072 ÷ 32 = _____

```
        9□
32 )3, 0 7 2
   −□□□
      1 9 2
   −□□□
        □
```

3. 4,539 ÷ 51 = _____

```
       □□
51 )4, 5 3 9
   −□□□
      4 5 9
   −□□□
        □
```

4. 9,317 ÷ 95 = _____

```
       □□
95 )9, 3 1 7
   −□□□
     □□□
   −□□□
       □
```

5. 2,226 ÷ 53 = _____

6. Divide 4,514 by 74. _____

7. 3,493 ÷ 37 = _____

8. 2,001 ÷ 83 = _____

9. 39,751 ÷ 313 = _____

10. 35,506 ÷ 438 = _____

11. During a food drive, a local middle school collected 8,982 canned food items. Each of the 28 classrooms that participated in the drive donated about the same number of items. Estimate the number of items each classroom donated. (Explore Activity) _____

12. A theater has 1,120 seats in 35 equal rows. How many seats are in each row? (Example 1) _____

13. There are 1,012 souvenir paperweights that need to be packed in boxes. Each box will hold 12 paperweights. How many boxes will be needed? (Example 2) _____

❓ ESSENTIAL QUESTION CHECK-IN

14. What steps do you take to divide multi-digit whole numbers?
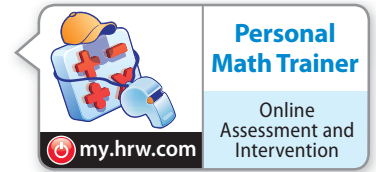
_____

_____

_____

_____

_____

5.1 Independent Practice

COMMON CORE 6.NS.2

Divide.

15. $44{,}756 \div 167 =$ _____

16. $87{,}628 \div 931 =$ _____

17. $66{,}253 \div 317 =$ _____

18. $76{,}255 \div 309 =$ _____

19. $50{,}779 \div 590 =$ _____

20. $97{,}156 \div 107 =$ _____

21. $216{,}016 \div 368 =$ _____

22. $107{,}609 \div 72 =$ _____

23. Emilio has 8,450 trees to plant in rows on his tree farm. He will plant 125 trees per row. How many full rows of trees will he have? Explain.

_____

_____

24. Camilla makes and sells jewelry. She has 8,160 silver beads and 2,880 black beads to make necklaces. Each necklace will contain 85 silver beads and 30 black beads. How many necklaces can she make? _____

25. During a promotional weekend, a state fair gives a free admission to every 175th person who enters the fair. On Saturday, there were 6,742 people attending the fair. On Sunday, there were 5,487 people attending the fair. How many people received a free admission over the two days?

_____

26. How is the quotient $80{,}000 \div 2{,}000$ different from the quotient $80{,}000 \div 200$ or $80{,}000 \div 20$?

_____
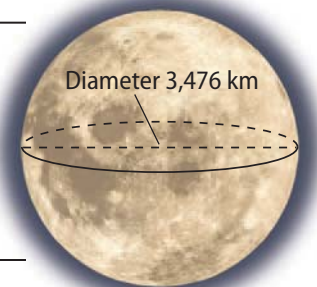
_____

27. Given that $9{,}554 \div 562 = 17$, how can you find the quotient $95{,}540 \div 562$?

_____

_____

28. **Earth Science** The diameter of the Moon is about 3,476 kilometers. The distance from Earth to the Moon is about 384,400 kilometers. About how many moons could be lined up in a row between Earth and the Moon? Round to the nearest whole number.

_____

Diameter 3,476 km

29. Vocabulary Explain how you could check the answer to a division question in which there is a remainder.

_____

_____

_____

30. Yolanda is buying a car with a base price of $16,750. She must also pay the options, fees, and taxes shown. The car dealership will give her 48 months to pay off the entire amount. Yolanda can only afford to pay $395 each month. Will she be able to buy the car? Explain.

Jackson Auto Dealer	
4-door sedan	
base price	**$16,750**
options	**$ 500**
fees	**$ 370**
taxes	**$ 1,425**

_____

_____

_____

_____

H.O.T. **FOCUS ON HIGHER ORDER THINKING**

31. Check for Reasonableness Is 40 a reasonable estimate of a quotient for 78,114 ÷ 192? Explain your reasoning.

_____

_____

32. Critique Reasoning Harrison predicted that the actual quotient for 57,872 ÷ 305 will be less than the estimate 60,000 ÷ 300 = 200. Is Harrison correct? Explain how Harrison arrived at his prediction (without dividing the actual numbers).

_____

_____

_____

_____

33. Make a Prediction In preparation for a storm, the town council buys 13,750 pounds of sand to fill sandbags. Volunteers are trying to decide whether to fill bags that can hold 25 pounds of sand or bags that can hold 50 pounds of sand. Will they have more or fewer sandbags if they fill the 25-pound bags? How many more or fewer? Explain your reasoning.

_____

_____

_____

Work Area

Adding and Subtracting Decimals

? ESSENTIAL QUESTION

How do you add and subtract decimals?

EXPLORE ACTIVITY

Real World

COMMON CORE 6.NS.3

Modeling Decimal Addition

You have probably used decimal grids to model decimals. For example, the decimal 0.25, or $\frac{25}{100}$, can be modeled by shading 25 squares in a 10×10 grid. You can also use decimal grids to add decimal values.

A chemist combines 0.17 mL of water and 0.49 mL of hydrogen peroxide in a beaker. How much total liquid is in the beaker?

A How many grid squares should you shade to represent 0.17 mL of water? Why?

_____

B How many grid squares should you shade to represent 0.49 mL of hydrogen peroxide?

_____

C Use the grid at the right to model the addition. Use one color for 0.17 mL of water and another color for 0.49 mL of hydrogen peroxide.

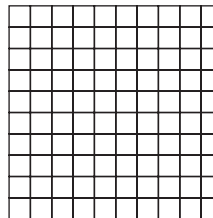**D** How much total liquid is in the beaker? $0.17 + 0.49 =$ _____ mL
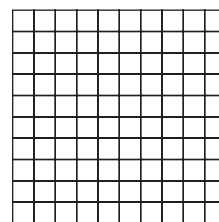
Reflect

Multiple Representations Show how to shade each grid to represent the sum. Then find the sum.

1. $0.24 + 0.71 =$ _____
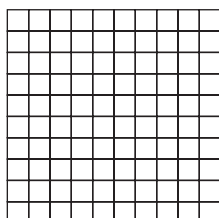
2. $0.08 + 0.65 =$ _____

Adding Decimals

Adding decimals is similar to adding whole numbers. First align the numbers by place value. Start adding at the right and regroup when necessary. Bring down the decimal point into your answer.

EXAMPLE 1

COMMON CORE 6.NS.3

Susan rode her bicycle 3.12 miles on Monday and 4.7 miles on Tuesday. How many miles did she ride in all?

STEP 1 Align the decimal points.

STEP 2 Add zeros as placeholders when necessary.

	3	.	1	2
+	4	.	7	0
	7	.	8	2

STEP 3 Add from right to left.

Susan rode 7.82 miles in all.

STEP 4 Use estimation to check that the answer is reasonable. Round each decimal to the nearest whole number.

$$
\begin{array}{r}
3.12 \\
+ 4.70 \\
\hline
7.82
\end{array}
\longrightarrow
\begin{array}{r}
3 \\
+ 5 \\
\hline
8
\end{array}
$$

Since 8 is close to 7.82, the answer is reasonable.

Reflect

3. Why can you rewrite 4.7 as 4.70?

_____

_____

4. Why is it important to align the decimal points when adding?

_____

_____

YOUR TURN

Add.

5. $0.42 + 0.27 =$ _____

6. $0.61 + 0.329 =$ _____

7. $3.25 + 4.6 =$ _____

8. $17.27 + 3.88 =$ _____

Subtracting Decimals

The procedure for subtracting decimals is similar to the procedure for adding decimals.

EXAMPLE 2 · Real World

COMMON CORE **6.NS.3**

A Mia is 160.2 centimeters tall. Rosa is 165.1 centimeters tall. How much taller is Rosa than Mia?

My Notes

STEP 1 Align the decimal points.

STEP 2 Add zeros as placeholders when necessary.

		4		1	
1	6	5	·	1	
− 1	6	0	·	2	
		4	·	9	

STEP 3 Subtract from right to left, regrouping when necessary.

Rosa is 4.9 centimeters taller than Mia.

To check that your answer is reasonable, you can estimate. Round each decimal to the nearest whole number.

$$\begin{array}{ccc} 165.1 & \longrightarrow & 165 \\ -\ 160.2 & \longrightarrow & -\ 160 \\ \hline 4.9 & & 5 \end{array}$$

Since 5 is close to 4.9, the answer is reasonable.

B Matthew throws a discus 58.7 meters. Zachary throws the discus 56.12 meters. How much farther did Matthew throw the discus?

STEP 1 Align the decimal points.

STEP 2 Add zeros as placeholders when necessary.

			6	10	
5	8	·	7	0	
− 5	6	·	1	2	
	2	·	5	8	

STEP 3 Subtract from right to left, regrouping when necessary.

Matthew threw the discus 2.58 meters farther than Zachary.

To check that your answer is reasonable, you can estimate. Round each decimal to the nearest whole number.

$$\begin{array}{ccc} 58.7 & \longrightarrow & 59 \\ -\ 56.12 & \longrightarrow & -\ 56 \\ \hline 2.58 & & 3 \end{array}$$

Since 3 is close to 2.58, the answer is reasonable.
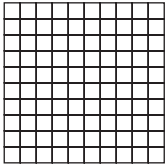
Math Talk
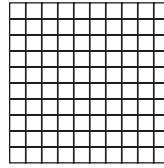**Mathematical Practices**
How can you check a subtraction problem?

Guided Practice

Shade the grid to find each sum. (Explore Activity)

1. $0.72 + 0.19 =$ _____

2. $0.38 + 0.4 =$ _____

Add. Check that your answer is reasonable. (Example 1)

3.
$$54.87 \longrightarrow 55$$
$$+\ 7.48 \longrightarrow +\ 7$$

4.
$$2.19 \longrightarrow \boxed{}$$
$$+\ 34.92 \longrightarrow +\ \boxed{}$$

5.
$$0.215 \longrightarrow \boxed{}$$
$$+\ 3.74 \longrightarrow +\ \boxed{}$$

Subtract. Check that your answer is reasonable. (Example 2)

6.
$$9.73 \longrightarrow 10$$
$$-\ 7.16 \longrightarrow -\ 7$$

7.
$$18.419 \longrightarrow \boxed{}$$
$$-\ 6.47 \longrightarrow -\ \boxed{}$$

8.
$$5.006 \longrightarrow \boxed{}$$
$$-\ 3.2 \longrightarrow -\ \boxed{}$$

Add or subtract. (Example 1, Example 2)

9. $17.2 + 12.9 =$ _____

10. $28.341 + 37.5 =$ _____

11. $25.36 - 2.004 =$ _____

12. $15.52 - 8.17 =$ _____

13. $25.68 + 12 =$ _____

14. $150.25 - 78 =$ _____

15. Perry connects a blue garden hose and a green garden hose to make one long hose. The blue hose is 16.5 feet. The green hose is 14.75 feet. How long is the combined hose? (Example 1)

_____

16. Keisha has $20.08 in her purse. She buys a book for $8.72. How much does she have left? (Example 2)
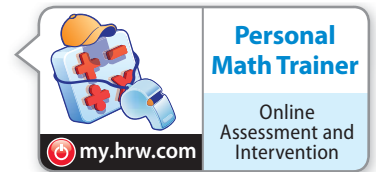
_____

? ESSENTIAL QUESTION CHECK-IN

17. How is adding and subtracting decimals similar to adding and subtracting whole numbers?

_____

_____

5.2 Independent Practice

COMMON CORE 6.NS.3

Add or subtract.

18. $28.6 - 0.975 =$ _____

19. $5.6 - 0.105 =$ _____

20. $7.03 + 33.006 =$ _____

21. $57.42 + 4 + 1.602 =$ _____

22. $2.25 + 65.47 + 2.333 =$ _____

23. $18.419 - 6.47 =$ _____

24. $83 - 12.76 =$ _____

25. $102.01 - 95.602 =$ _____

26. Multiple Representations Ursula wrote the sum $5.815 + 6.021$ as a sum of two mixed numbers.

   a. What sum did she write? _____

   b. Compare the sum of the mixed numbers to the sum of the decimals. _____

Use the café menu to answer 27–29.

27. Stephen and Jahmya are having lunch. Stephen buys a garden salad, a veggie burger, and lemonade. Jahmya buys a fruit salad, a toasted cheese sandwich, and a bottle of water. Whose lunch cost more? How much more?

_____

28. Jahmya wants to leave $1.75 as a tip for her server. She has a $20 bill. How much change should she receive after paying for her food and leaving a tip?

_____

29. What If? In addition to his meal, Stephen orders a fruit salad for take-out, and wants to leave $2.25 as a tip for his server. He has a $10 bill and a $5 bill. How much change should he receive after paying for his lunch, the fruit salad, and the tip?

_____

30. A carpenter who is installing cabinets uses thin pieces of material called shims to fill gaps. The carpenter uses four shims to fill a gap that is 1.2 centimeters wide. Three of the shims are 0.75 centimeter, 0.125 centimeter, and 0.09 centimeter wide. What is the width of the fourth shim?

_____

Café Menu

Garden Salad **$2.29**
Fruit Salad **$2.89**

Veggie Burger **$4.75**
Toasted Cheese Sandwich **$4.59**

Bottle of Water **$1.39**
Lemonade **$1.29**

31. A CD of classical guitar music contains 5 songs. The length of each song is shown in the table.

Track 1	Track 2	Track 3	Track 4	Track 5
6.5 minutes	8 minutes	3.93 minutes	4.1 minutes	5.05 minutes

    a. Between each song is a 0.05-minute break. How long does it take to listen to the CD from the beginning of the first song to the end of the last song? _____

    b. **What If?** Juan wants to buy the CD from an Internet music site. He downloads the CD onto a disc that can hold up to 60 minutes of music. How many more minutes of music can he still buy after downloading the CD? _____

H.O.T. FOCUS ON HIGHER ORDER THINKING

Work Area

32. **Analyze Relationships** Use the decimals 2.47, 9.57, and 7.1 to write two different addition facts and two different subtraction facts.

_____

_____

33. **Communicate Mathematical Ideas** The Commutative Property of Addition states that you can change the order of addends in a sum. The Associative Property of Addition states that you can change the grouping of addends in a sum. Use an example to show how the Commutative Property of Addition and the Associative Property of Addition apply to adding decimals.

_____

_____

_____

_____

34. **Critique Reasoning** Indira predicts that the actual difference of $19 - 7.82$ will be greater than the estimate of $19 - 8 = 11$. Is Indira correct? Explain how Indira might have arrived at that prediction without subtracting the actual numbers.

_____

_____

_____

LESSON

5.3 Multiplying Decimals

COMMON CORE 6.NS.3
Fluently ...multiply...
multi-digit decimals using
the standard algorithm....

? **ESSENTIAL QUESTION**

How do you multiply decimals?

EXPLORE ACTIVITY COMMON CORE 6.NS.3

Modeling Decimal Multiplication

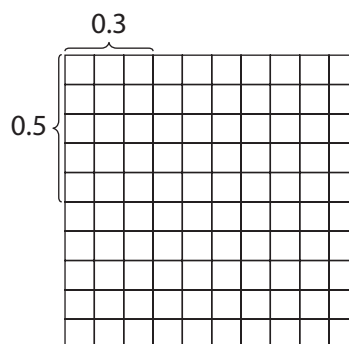**Use decimal grids or area models to find each product.**

A **0.3 × 0.5**

0.3 × 0.5 represents 0.3 of 0.5. Shade 5 *rows* of the decimal grid to represent 0.5.

Shade 0.3 of each 0.1 that is already shaded

to represent 0.3 of _____.

_____ square(s) are double-shaded.

This represents _____ hundredth(s), or 0.15.

0.3 × 0.5 = _____

0.3

0.5

B **3.2 × 2.1**

Use an area model. In the model, the large squares represent wholes, the small rectangles along the right and lower edges represent tenths, and the small squares at the lower right represent hundredths. The model is 3 and 2 tenths units long, and 2 and 1 tenth unit wide.

The area of the model is

_____ whole(s) + _____ tenth(s) + _____ hundredth(s) square units.

3.2 × 2.1 = _____

3.2

2.1
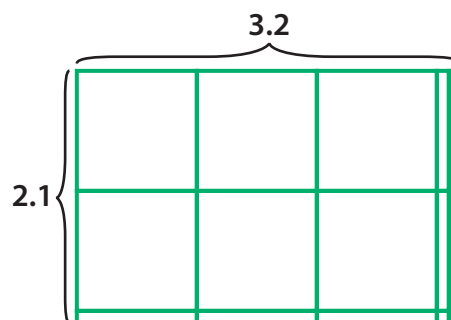
Reflect

1. **Analyze Relationships** How are the products 2.1 × 3.2 and 21 × 32 alike? How are they different?

_____

_____

Multiplying Decimals

To multiply decimals, first multiply as you would with whole numbers. Then place the decimal point in the product. The number of decimal places in the product equals the sum of the number of decimal places in the factors.

EXAMPLE 1   Real World

COMMON CORE   6.NS.3

Delia bought 3.8 pounds of peppers. The peppers cost $1.99 per pound. What was the total cost of Delia's peppers?

$$
\begin{array}{r}
1.99 \\
\times \ \ 3.8 \\
\hline
1592 \\
+ \ 5970 \\
\hline
7.562
\end{array}
$$

←   2 decimal places
← +   1 decimal place

←   3 decimal places

The peppers cost $7.56.

> **Round the answer to hundredths to show a dollar amount.**

Reflect

2. **Communicate Mathematical Ideas** How can you use estimation to check that you have placed the decimal point correctly in your product?

_____

_____

_____

_____

_____

YOUR TURN

Multiply.

3. 12.6 ← ☐ decimal place(s)

× 15.3 ← + ☐ decimal place(s)

378

☐

+ ☐

☐ ← ☐ decimal place(s)

4. 9.76 ← ☐ decimal place(s)

× 0.46 ← + ☐ decimal place(s)

☐

+ ☐

☐ ← ☐ decimal place(s)

Estimating to Check Reasonableness

In Example 1, you used estimation to check whether the decimal point was placed correctly in the product. You can also use estimation to check that your answer is reasonable.

EXAMPLE 2

Blades of grass grow 3.75 inches per month. If the grass continues to grow at this rate, how much will the grass grow in 6.25 months?

$$
\begin{array}{r}
3.75 \quad \leftarrow \quad \text{2 decimal places} \\
\times \ 6.25 \quad \leftarrow + \quad \text{2 decimal places} \\
\hline
1875 \\
7500 \\
+ \ 225000 \\
\hline
23.4375 \quad \leftarrow \quad \text{4 decimal places}
\end{array}
$$

The grass will grow 23.4375 inches in 6.25 months.

Estimate to check whether your answer is reasonable.

Round 3.75 to the nearest whole number. _____

Round 6.25 to the nearest whole number. _____

Multiply the whole numbers. _____ × _____ = 24

The answer is reasonable because 24 is close to 23.4375.

YOUR TURN

Multiply.

5.
$$
\begin{array}{r}
7.14 \\
\times \ 6.78 \\
\hline
5712 \\
\end{array}
$$

6.
$$
\begin{array}{r}
11.49 \\
\times \ 8.27 \\
\hline
\end{array}
$$

7. Rico bicycles at an average speed of 15.5 miles per hour.

What distance will Rico bicycle in 2.5 hours? _____ miles

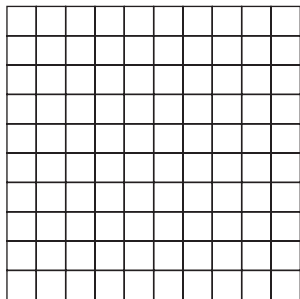**8.** Use estimation to show that your answer to **7** is reasonable.

_____

My Notes

1. Use the grid to multiply 0.4 × 0.7.
   (Explore Activity)

   0.4 × 0.7 = _____

2. Draw an area model to multiply 1.1 × 2.4.
   (Explore Activity)

   1.1 × 2.4 = _____

Multiply. (Example 1 and Example 2)

3. 0.18 × 0.06 = _____

4. 35.15 × 3.7 = _____

5. 0.96 × 0.12 = _____

6. 62.19 × 32.5 = _____

7. 3.4 × 4.37 = _____

8. 3.762 × 0.66 = _____

9. Chan Hee bought 3.4 pounds of coffee that cost $6.95 per pound.

   How much did he spend on coffee? $_____

10. Adita earns $9.40 per hour working at an animal shelter.

   How much money will she earn for 18.5 hours of work? $_____

Catherine tracked her gas purchases for one month.

11. How much did Catherine spend on gas in week 2?

   $_____

12. How much more did she spend in week 4 than

   in week 1? $_____

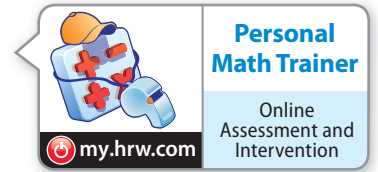| Week	Gallons	Cost per gallon ($)
1	10.4	2.65
2	11.5	2.54
3	9.72	2.75
4	10.6	2.70

? ESSENTIAL QUESTION CHECK-IN

13. How can you check the answer to a decimal multiplication problem?

   _____

   _____

5.3 Independent Practice

COMMON CORE **6.NS.3**

Make a reasonable estimate for each situation.

14. A gallon of water weighs 8.354 pounds. Simon uses 11.81 gallons of water while taking a shower. About how many pounds of water did Simon use?

_____

15. A snail moves at a speed of 2.394 inches per minute. If the snail keeps moving at this rate, about how many inches will it travel in 7.489 minutes?

_____

16. Tricia's garden is 9.87 meters long and 1.09 meters wide. What is the area of her garden?

_____

Kaylynn and Amanda both work at the same store. The table shows how much each person earns, and the number of hours each person works in a week.

	Wage	**Hours worked per week**
Kaylynn	$8.75 per hour	37.5
Amanda	$10.25 per hour	30.5

17. Estimate how much Kaylynn earns in a week.

_____

18. Estimate how much Amanda earns in a week.

_____

19. Calculate the exact difference between Kaylynn and Amanda's weekly salaries.

_____

20. Victoria's printer can print 8.804 pages in one minute. If Victoria prints pages for 0.903 minutes, about how many pages will she have?

_____

A taxi charges a flat fee of $4.00 plus $2.25 per mile.

21. How much will it cost to travel 8.7 miles? _____

22. **Multistep** How much will the taxi driver earn if he takes one passenger 4.8 miles and another passenger 7.3 miles? Explain your process.

_____

_____

_____

Kay goes for several bike rides one week. The table shows her speed and the number of hours spent per ride.

	Speed (in miles per hour)	Hours Spent on Bike
Monday	8.2	4.25
Tuesday	9.6	3.1
Wednesday	11.1	2.8
Thursday	10.75	1.9
Friday	8.8	3.75

23. How many miles did Kay bike on Thursday? _____

24. On which day did Kay bike a whole number of miles? _____

25. What is the difference in miles between Kay's longest bike ride and her shortest bike ride? _____

26. **Check for Reasonableness** Kay estimates that Wednesday's ride was about 3 miles longer than Tuesday's ride. Is her estimate reasonable? Explain.

_____

_____

_____

_____

H.O.T. **FOCUS ON HIGHER ORDER THINKING**

Work Area

27. **Explain the Error** To estimate the product 3.48 × 7.33, Marisa multiplied 4 × 8 to get 32. Explain how she can make a closer estimate.

_____

28. **Represent Real-World Problems** A jeweler buys gold jewelry and resells the gold to a refinery. The jeweler buys gold for $1,235.55 per ounce, and then resells it for $1,376.44 per ounce. How much profit does the jeweler make from buying and reselling 73.5 ounces of gold?

_____

29. **Problem Solving** To find the weight of the gold in a 22 karat gold object, multiply the object's weight by 0.917. To find the weight of the gold in an 18 karat gold object, multiply the object's weight by 0.583. A 22 karat statue and a 14 karat gold statue both weigh 73.5 ounces. Which one contains more gold? How much more gold does it contain?

_____

? **ESSENTIAL QUESTION**

How do you divide decimals?

EXPLORE ACTIVITY COMMON CORE 6.NS.3

Modeling Decimal Division

Use decimal grids to find each quotient.

A **6.39 ÷ 3**

Shade grids to model 6.39. Separate the model into 3 equal groups.
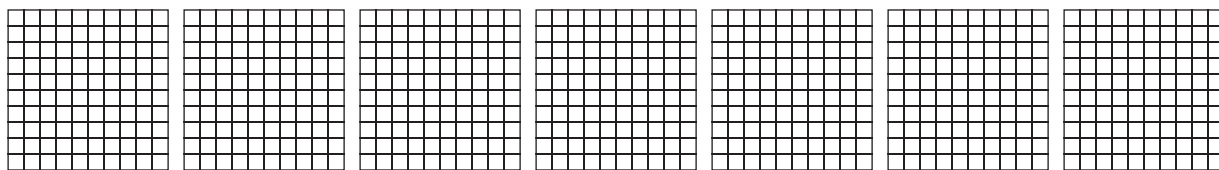
How many are in each group? _____

6.39 ÷ 3 = _____

B **6.39 ÷ 2.13**

Shade grids to model 6.39. Separate the model into groups of 2.13.

How many groups do you have? _____

6.39 ÷ 2.13 = _____

Reflect

1. **Multiple Representations** When using models to divide decimals, when might you want to use grids divided into tenths instead of hundredths?

_____

_____

My Notes

Dividing Decimals by Whole Numbers

Dividing decimals is similar to dividing whole numbers. When you divide a decimal by a whole number, the placement of the decimal point in the quotient is determined by the placement of the decimal in the dividend.
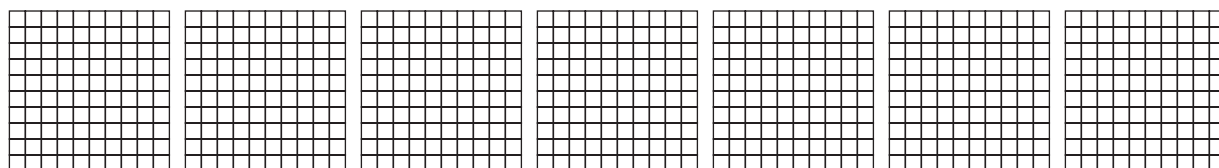
EXAMPLE 1   Real World

COMMON CORE 6.NS.3

A **A high school track is 9.76 meters wide. It is divided into 8 lanes of equal width for track and field events. How wide is each lane?**

Divide using long division as with whole numbers.

Place a decimal point in the quotient directly above the decimal point in the dividend.

Each lane is 1.22 meters wide.

$$
\begin{array}{r}
1.22 \\
8\overline{)9.76} \\
-8 \\
\hline
1\,7 \\
-1\,6 \\
\hline
16 \\
-16 \\
\hline
0
\end{array}
$$

B **Aerobics classes cost \$153.86 for 14 sessions. What is the fee for one session?**

Divide using long division as with whole numbers.

Place a decimal point in the quotient directly above the decimal point in the dividend.

The fee for one aerobics class is \$10.99.

$$
\begin{array}{r}
10.99 \\
14\overline{)153.86} \\
-14 \\
\hline
13 \\
-0 \\
\hline
13\,8 \\
-12\,6 \\
\hline
1\,26 \\
-1\,26 \\
\hline
0
\end{array}
$$

Reflect

2. **Check for Reasonableness** How can you estimate to check that your quotient in **A** is reasonable?

_____

_____

_____

_____

YOUR TURN

Divide.

3. $5\overline{)9.75}$

4. $7\overline{)6.44}$

Dividing a Decimal by a Decimal

When dividing a decimal by a decimal, first change the divisor to a whole number by multiplying by a power of 10. Then multiply the dividend by the same power of 10.

EXAMPLE 2 *Real World*

COMMON CORE 6.NS.3

A Ella uses 0.5 pound of raspberries in each raspberry cake that she makes. How many cakes can Ella make with 3.25 pounds of raspberries?

STEP 1 The divisor has one decimal place, so multiply both the dividend and the divisor by 10 so that the divisor is a whole number.

$0.5\overline{)3.25}$ $0.5\overline{)3.25}$

$0.5 \times 10 = 5$

$3.25 \times 10 = 32.5$

Ella can make 6 cakes.

STEP 2 Divide.

$$
\begin{array}{r}
6.5 \\
5\overline{)32.5} \\
-30 \\
\hline
2\ 5 \\
-2\ 5 \\
\hline
0
\end{array}
$$
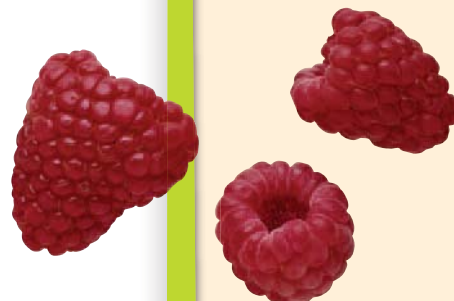
Math Talk
Mathematical Practices

The number of cakes Ella can make is not equal to the quotient. Why not?

B Anthony spent $11.52 for some pens that were on sale for $0.72 each. How many pens did Anthony buy?

STEP 1 The divisor has two decimal places, so multiply both the dividend and the divisor by 100 so that the divisor is a whole number.

$0.72\overline{)11.52}$ $0.72\overline{)11.52}$

$0.72 \times 100 = 72$

$11.52 \times 100 = 1152$

Anthony bought 16 pens.

STEP 2 Divide.

$$
\begin{array}{r}
16 \\
72\overline{)1152} \\
-72 \\
\hline
432 \\
-432 \\
\hline
0
\end{array}
$$

YOUR TURN

Divide.

5. $0.5\overline{)4.25}$

6. $0.84\overline{)15.12}$

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Divide. (Explore Activity, Examples 1 and 2)

1. $4 \overline{)\,29.5}$ _____

2. $3.1 \overline{)\,10.261}$ _____

3. $2.4 \overline{)\,16.8}$ _____

4. $0.96 \overline{)\,0.144}$ _____

5. $38.5 \div 0.5 =$ _____

6. $23.85 \div 9 =$ _____

7. $5.6372 \div 0.17 =$ _____

8. $8.19 \div 4.2 =$ _____

9. $66.5 \div 3.5 =$ _____

10. $0.234 \div 0.78 =$ _____

11. $78.74 \div 12.7 =$ _____

12. $36.45 \div 0.09 =$ _____

13. $90 \div 0.36 =$ _____

14. $18.88 \div 1.6 =$ _____

15. Corrine has 9.6 pounds of trail mix to divide into 12 bags. How many pounds of trail mix will go in each bag? _____

16. Michael paid $11.48 for sliced cheese at the deli counter. The cheese cost $3.28 per pound. How much cheese did Michael buy? _____

17. A four-person relay team completed a race in 72.4 seconds. On average, what was each runner's time? _____

18. Elizabeth has a piece of ribbon that is 4.5 meters long. She wants to cut it into pieces that are 0.25 meter long. How many pieces of ribbon will she have? _____

19. Lisa paid $43.95 for 16.1 gallons of gasoline. What was the cost per gallon, rounded to the nearest hundredth? _____

20. One inch is equivalent to 2.54 centimeters. How many inches are there in 50.8 centimeters? _____

? ESSENTIAL QUESTION CHECK-IN

21. When you are dividing two decimals, how can you check whether you have divided the decimals correctly?
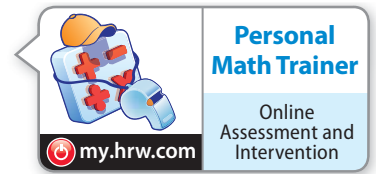
_____

_____

_____

_____

5.4 Independent Practice

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Use the table for 22 and 23.

Custom Printing Costs				
Quantity	25	50	75	100
Mugs	$107.25	$195.51	$261.75	$329.00
T-shirts	$237.50	$441.00	$637.50	$829.00

22. What is the price per mug for 25 coffee mugs?   _____

23. Find the price per T-shirt for 75 T-shirts.   _____

A movie rental website charges $5.00 per month for membership and $1.25 per movie.

24. How many movies did Andrew rent this month if this month's bill was $16.25?   _____

25. Marissa has $18.50 this month to spend on movie rentals.

  a. How many movies can she view this month? _____

  b. **Critique Reasoning** Marisa thinks she can afford 11 movies in one month. What mistake could she be making?

  _____

  _____

Victoria went shopping for ingredients to make a stew. The table shows the weight and the cost of each of the ingredients that she bought.

Ingredient	Weight (in pounds)	Cost
Potatoes	6.3	$7.56
Carrots	8.5	$15.30
Beef	4	$9.56
Bell peppers	2.50	$1.25

26. What is the price for one pound of bell peppers?   _____

27. Which ingredient costs the most per pound?   _____

28. **What If?** If carrots were $0.50 less per pound, how much would Victoria have paid for 8.5 pounds of carrots?   _____

29. Brenda is planning her birthday party. She wants to have 10.92 liters of punch, 6.5 gallons of ice cream, 3.9 pounds of fudge, and 25 guests at the birthday party.

    a. Brenda and each guest drink the same amount of punch. How many liters of punch will each person drink? _____

    b. Brenda and each guest eat the same amount of ice cream. How many gallons of ice cream will each person eat? _____

    c. Brenda and each guest eat the same amount of fudge. How many pounds of fudge will each person eat? _____

To make costumes for a play, Cassidy needs yellow and white fabric that she will cut into strips. The table shows how many yards of each fabric she needs, and how much she will pay for those yards.

Fabric	Yards	Cost
Yellow	12.8	$86.40
White	9.5	$45.60

30. Which costs more per yard, the yellow fabric or the white fabric? _____

31. Cassidy wants to cut the yellow fabric into strips that are 0.3 yards wide. How many strips of yellow fabric can Cassidy make? _____

H.O.T.   **FOCUS ON HIGHER ORDER THINKING**

32. **Problem Solving** Eight friends purchase various supplies for a camping trip and agree to share the total cost equally. They spend $85.43 on food, $32.75 on water, and $239.66 on other items. How much does each person owe? _____

33. **Analyze Relationships** Constance is saving money to buy a new bicycle that costs $195.75. She already has $40 saved and plans to save $8 each week. How many weeks will it take her to save enough money to purchase the bicycle? _____

34. **Represent Real-World Problems** A grocery store sells twelve bottles of water for $13.80. A convenience store sells ten bottles of water for $11.80. Which store has the better buy? Explain.

_____

_____

_____

Applying Operations with Rational Numbers

ESSENTIAL QUESTION

How can you solve problems involving multiplication and division of fractions and decimals?

Interpreting a Word Problem

When you solve a word problem involving rational numbers, you often need to think about the problem to decide which operations to use.

EXAMPLE 1 *Problem Solving*

COMMON CORE **6.NS.3**

Math On the Spot
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Naomi earned $54 mowing lawns in two days. She worked 2.5 hours yesterday and 4.25 hours today. If Naomi was paid the same amount for every hour she works, how much did she earn per hour?

Analyze Information

Identify the important information.

- Naomi made $54 mowing lawns.
- Naomi worked 2.5 hours yesterday and 4.25 hours today.
- You are asked to find how much she earned per hour.

Formulate a Plan

- The total amount she earned divided by the total hours she worked gives the amount she earns per hour.
- Use the expression $54 \div (2.5 + 4.25)$ to find the amount she earned per hour.

Solve

Follow the order of operations.

$(2.5 + 4.25) = 6.75$ *Add inside parentheses.*

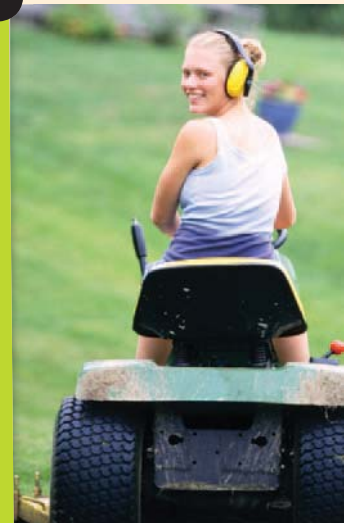$54 \div 6.75 = 8$ *Divide.*

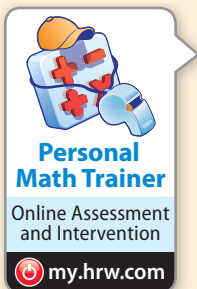Naomi earned $8 per hour mowing lawns.

Justify and Evaluate

You added 2.5 and 4.25 first to find the total number of hours worked. Then you divided 54 by the sum to find the amount earned per hour.

YOUR TURN

1. Casey buys 6.2 yards of blue fabric and 5.4 yards of red fabric. If the blue and red fabric cost the same amount per yard, and Casey pays $58 for all of the fabric, what is the cost per yard?

_____

Converting Fractions and Decimals to Solve Problems

Recall that you can use a number line to find equivalent fractions and decimals. If a fraction and a decimal are equivalent, they are represented by the same point on a number line.

EXAMPLE 2

COMMON CORE   6.NS.3

Each part of a multipart question on a test is worth the same number of points. The whole question is worth 37.5 points. Roz got $\frac{1}{2}$ of the parts of a question correct. How many points did Roz receive?

Solution 1

STEP 1 Convert the decimal to a fraction greater than 1.

$$\frac{1}{2} \times 37.5 = \frac{1}{2} \times \frac{75}{2}$$ *Write 37.5 as $37\frac{1}{2}$, or $\frac{75}{2}$.*

STEP 2 Multiply. Write the product in simplest form.

$$\frac{1}{2} \times \frac{75}{2} = \frac{75}{4} = 18\frac{3}{4}$$ *Roz received $18\frac{3}{4}$ points.*

Solution 2

STEP 1 Convert the fraction to a decimal.
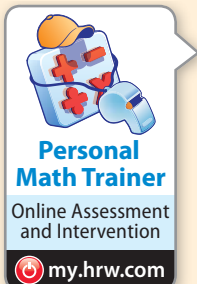
$$\frac{1}{2} \times 37.5 = 0.5 \times 37.5$$

STEP 2 Multiply.

$$0.5 \times 37.5 = 18.75$$ *Roz received 18.75 points.*

Math Talk

Mathematical Practices

Do the solutions give the same result? Explain.

YOUR TURN

2. The bill for a pizza was $14.50. Charles paid for $\frac{3}{5}$ of the bill. Show two ways to find how much he paid.

_____

5.5 Guided Practice

1. Bob and Cheryl are taking a road trip that is 188.3 miles. Bob drove $\frac{5}{7}$ of the total distance. How many miles did Bob drive? (Example 1)

_____

2. The winner of a raffle will receive $\frac{3}{4}$ of the $530.40 raised from raffle ticket sales. How much money will the winner get? (Example 2)

_____

5.5 Independent Practice

COMMON CORE 6.NS.3

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3. Chanasia has 8.75 gallons of paint. She wants to use $\frac{2}{5}$ of the paint to paint her living room. How many gallons of paint will Chanasia use?

_____

4. Harold bought 3 pounds of red apples and 4.2 pounds of green apples from a grocery store, where both kinds of apples are $1.75 a pound. How much did Harold spend on apples?

_____
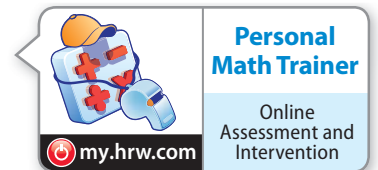
Samuel and Jason sell cans to a recycling center that pays $0.40 per pound of cans. The table shows the number of pounds of cans that they sold for several days.

Day	Samuel's cans (pounds)	Jason's cans (pounds)
Monday	16.2	11.5
Tuesday	11.8	10.7
Wednesday	12.5	7.1

5. Samuel wants to use his earnings from Monday and Tuesday to buy some batteries that cost $5.60 each. How many batteries can Samuel buy? Show your work.

_____

6. Jason wants to use his earnings from Monday and Tuesday for online movie rentals. The movies cost $2.96 each to rent. How many movies can Jason rent? Show your work.

_____

7. Multistep Samuel and Jason spend $\frac{3}{4}$ of their combined earnings from Wednesday to buy a gift. How much do they spend? Is there enough left over from Wednesday's earnings to buy a card that costs $3.25? Explain.

_____

_____

8. **Multiple Representations** Give an example of a problem that could be solved using the expression $9.5 \times (8 + 12.5)$. Solve your problem.

_____

_____

_____

_____

Tony and Alice are trying to reduce the amount of television they watch. For every hour they watch television, they have to put $2.50 into savings. The table shows how many hours of television Tony and Alice have watched in the past two months.

	Hours watched in February	Hours watched in March
Tony	35.4	18.2
Alice	21.8	26.6

9. Tony wants to use his savings at the end of March to buy video games. The games cost $35.75 each. How many games can Tony buy?

_____

10. Alice wants to use her savings at the end of the two months to buy concert tickets. If the tickets cost $17.50 each, how many can she buy?

_____

H.O.T. **FOCUS ON HIGHER ORDER THINKING**

Work Area

11. **Represent Real-World Problems** A caterer prepares three times as many pizzas as she usually prepares for a large party. The caterer usually prepares 5 pizzas. The caterer also estimates that each party guest will eat $\frac{1}{3}$ of a pizza. Write an expression that represents this situation. How many party guests will the pizzas serve?

_____

Nadia charges $7.50 an hour for babysitting. She babysits 18.5 hours the first week of the month and 20 hours the second week of the month.

12. **Explain the Error** To find her total earnings for those two weeks, Nadia writes $7.5 \times 18.5 + 20 = \$158.75$. Explain her error. Show the correct solution.

_____

_____

_____

13. **What If?** Suppose Nadia raises her rate by $0.75 an hour. How many hours would she need to work to earn the same amount of money she made in the first two weeks of the month? Explain.

_____

Ready to Go On?

5.1 Dividing Whole Numbers

1. Landon is building new bookshelves for his bookstore's new mystery section. Each shelf can hold 34 books. There are 1,265 mystery books. How many shelves will he need to build? _____

5.2 Adding and Subtracting Decimals

2. On Saturday Keisha ran 3.218 kilometers. On Sunday she ran 2.41 kilometers. How much farther did she run on Saturday than on Sunday? _____

5.3 Multiplying Decimals

3. Marta walked at 3.9 miles per hour for 0.72 hours. How far did she walk? _____

Multiply.

4. 0.07×1.22 _____   **5.** 4.7×2.65 _____

5.4 Dividing Decimals

Divide.

6. $64 \div 0.4$ _____   **7.** $4.7398 \div 0.26$ _____

8. $26.73 \div 9$ _____   **9.** $4 \div 3.2$ _____

5.5 Applying Multiplication and Division of Rational Numbers

10. Doors for the small cabinets are 11.5 inches long. Doors for the large cabinets are 2.3 times as long as the doors for the small cabinets. How many large doors can be cut from a board that is $10\frac{1}{2}$ feet long? _____

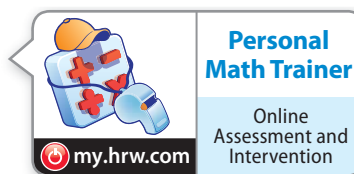### ? ESSENTIAL QUESTION

11. Describe a real-world situation that could be modeled by dividing two rational numbers.

_____

_____

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Selected Response

1. Delia has 493 stamps in her stamp collection. She can put 16 stamps on each page of an album. How many pages can she fill completely?

Ⓐ 30 pages   Ⓒ 31 pages

Ⓑ 32 pages   Ⓓ 33 pages

2. Sumeet uses 0.4 gallon of gasoline each hour mowing lawns. How much gas does he use in 4.2 hours?

Ⓐ 1.68 gallons

Ⓑ 3.8 gallons

Ⓒ 13 gallons

Ⓓ 16 gallons

3. Sharon spent $3.45 on sunflower seeds. The price of sunflower seeds is $0.89 per pound. How many pounds of sunflower seeds did Sharon buy?

Ⓐ 3.07 pounds

Ⓑ 3.88 pounds

Ⓒ 4.15 pounds

Ⓓ 4.34 pounds

4. How many 0.4-liter glasses of water does it take to fill up a 3.4-liter pitcher?

Ⓐ 1.36 glasses   Ⓒ 8.2 glasses

Ⓑ 3.8 glasses   Ⓓ 8.5 glasses

5. Each paper clip is $\frac{3}{4}$ of an inch long and costs $0.02. Exactly enough paper clips are laid end to end to have a total length of 36 inches. What is the total cost of these paper clips?

Ⓐ $0.36   Ⓒ $0.96

Ⓑ $0.54   Ⓓ $1.20

6. Nelson Middle School raised $19,950 on ticket sales for its carnival fundraiser last year at $15 per ticket. If the school sells the same number of tickets this year but charges $20 per ticket, how much money will the school make?

Ⓐ $20,600   Ⓒ $26,600

Ⓑ $21,600   Ⓓ $30,600

7. Keri walks her dog every morning. The length of the walk is 0.55 kilometer on each weekday. On each weekend day, the walk is 1.4 times as long as a walk on a weekday. How many kilometers does Keri walk in one week?

Ⓐ 2.75 kilometers

Ⓑ 3.85 kilometers

Ⓒ 4.29 kilometers

Ⓓ 5.39 kilometers

Mini-Task

8. To prepare for a wedding, Aiden bought 60 candles. He paid $0.37 for each candle. His sister bought 170 candles at a sale where she paid $0.05 less for each candle than Aiden did.

a. How much did Aiden spend on candles?

_____

b. How much did Aiden's sister spend on candles?

_____

c. Who spent more on candles? How much more?

_____