Dear Family,

This week your student is learning how to use an algorithm to divide with whole numbers and decimals.

When dividing with whole numbers, a remainder can be expressed as a decimal.

Dividing 34 by 4 shows that a runner who completes a 4-mile course in 34 min needs 8.5 min to run each mile.

$$\begin{array}{r} 8.5 \\ 4\overline{)34.0} \\ -32 \downarrow \\ \hline 20 \leftarrow \text{20 tenths} \\ -20 \leftarrow \text{5 tenths} \times 4 = 20 \text{ tenths} \\ \hline 0 \end{array}$$

Your student will be learning to solve problems like the one below.

> Find 27.5 ÷ 2.5.

➤ **ONE WAY** to divide by a decimal is to use equivalent fractions.

First, write the division problem as a fraction.

$$27.5 \div 2.5 = \frac{27.5}{2.5}$$

Multiply the numerator and denominator by **10** to get an equivalent fraction with a whole-number denominator.

$$\frac{27.5 \times 10}{2.5 \times 10} = \frac{275}{25}$$

27.5 ÷ 2.5 is equivalent to 275 ÷ 25, which equals 11.

➤ **ANOTHER WAY** is to use an algorithm.

First, multiply 2.5 and 27.5 by **10** to write an equivalent division problem with a whole-number divisor.

Then, divide 275 by 25.

Using either method, the answer is 11.

$$2.5\overline{)27.5} \longrightarrow \begin{array}{r} 11 \\ 25\overline{)275} \\ -25 \downarrow \\ \hline 25 \\ -25 \\ \hline 0 \end{array}$$

$\times 10 \quad \times 10$

▶ Use the next page to start a conversation about division.

Divide Whole Numbers and Multi-Digit Decimals

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LESSON 8 Divide Whole Numbers and Multi-Digit Decimals   **167**

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Activity Thinking About Division Around You

➤ **Do this activity together to investigate division in the real world.**

Have you ever seen dogs with police officers at an airport or train station? These dogs have an important job to help keep communities safe, but first they must go through a lot of training!

Training for three pairs of dogs and officers costs $90,000. Since 90,000 ÷ 3 = 30,000, a community should budget $30,000 to train each pair!

? Where else do you see division in the world around you?

Explore The Standard Algorithm for Division with Whole Numbers

Previously, you used area models and partial quotients to divide. In this lesson, you will learn about an algorithm for division.

25,650 game pieces
6 pieces in each package

➤ **Use what you know to try to solve the problem below.**

On Monday, a board game factory makes 25,650 game pieces. The game pieces are put into packages of 6 pieces each. How many packages of game pieces does the factory make on Monday?

TRY IT

✏️ **Math Toolkit** base-ten blocks, base-ten grid paper, grid paper

DISCUSS IT

Ask: How is your solution similar to mine? How is it different?

Share: My solution is similar to yours . . . It is different . . .

◎ **Learning Targets** SMP 1, SMP 2, SMP 3, SMP 4, SMP 5, SMP 6, SMP 7, SMP 8
• Fluently divide multi-digit numbers using the standard algorithm.
• Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

CONNECT IT

1 **Look Back** How many packages of game pieces does the factory make on Monday? Explain how you know.

2 **Look Ahead** One way to divide whole numbers is to use partial quotients. Another way is to use a shortened form of the partial quotients strategy, sometimes called the standard algorithm. You can use these two division strategies to find 384 ÷ 4.

Partial Quotients

$$
\begin{array}{r}
96 \\
\underline{6} \\
90 \\
4\overline{)384} \\
-\,360 \\
\hline
24 \\
-\,24 \\
\hline
0
\end{array}
$$

Standard Algorithm

$$
\begin{array}{r}
96 \\
4\overline{)384} \\
-\,36\downarrow \\
\hline
24 \\
-\,24 \\
\hline
0
\end{array}
$$

a. Look at the partial quotients strategy. What are the partial quotients? How do you use the them to find the total quotient?

b. Look at the standard algorithm division strategy. The digit 9 is written in the tens place of the quotient. What partial quotient does this digit represent? How do you know?

3 **Reflect** How is using the standard algorithm similar to using partial quotients to divide a three-digit number by a one-digit number? How is it different?

Prepare for Dividing Whole Numbers and Multi-Digit Decimals

1 Think about what you know about dividing with partial quotients. Fill in each box.
Use words, numbers, and pictures. Show as many ideas as you can.

What Is It?	What I Know About It

partial quotients

Examples	Examples
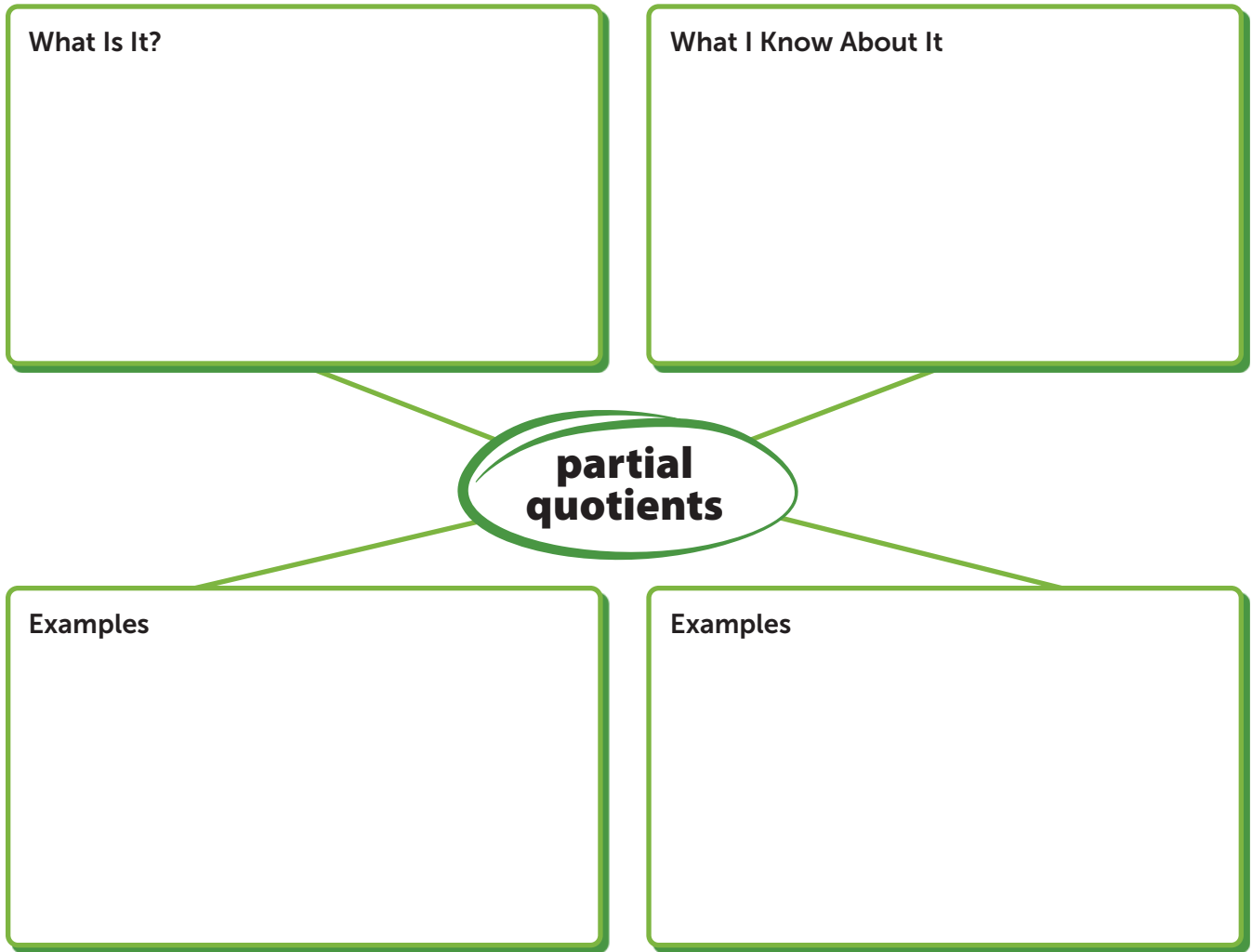
2 Erik finds 516 ÷ 12. The partial quotients he finds are 40 and 3. What is the quotient? Explain.

3 A factory receives an order for 94,500 tennis balls for a major U.S. tournament. Three tennis balls are packed into each can.

a. How many cans of tennis balls does the factory pack for the order?
Show your work.

SOLUTION _____

b. Check your answer to problem 3a. Show your work.

Develop Using the Standard Algorithm for Division

➤ **Read and try to solve the problem below.**

The librarians at a new city library order 11,328 books. They estimate that 32 books can fit on each shelf. Based on this estimate, how many shelves does the library need to hold all the books?

TRY IT

✏️ **Math Toolkit** base-ten blocks, base-ten grid paper, grid paper

DISCUSS IT

Ask: How is your strategy similar to mine? How is it different?

Share: My model shows . . .

LESSON 8   Divide Whole Numbers and Multi-Digit Decimals   **173**

➤ **Explore different ways to understand using an algorithm to divide whole numbers.**

The librarians at a new city library order 11,328 books. They estimate that 32 books can fit on each shelf. Based on this estimate, how many shelves does the library need to hold all the books?

Model It
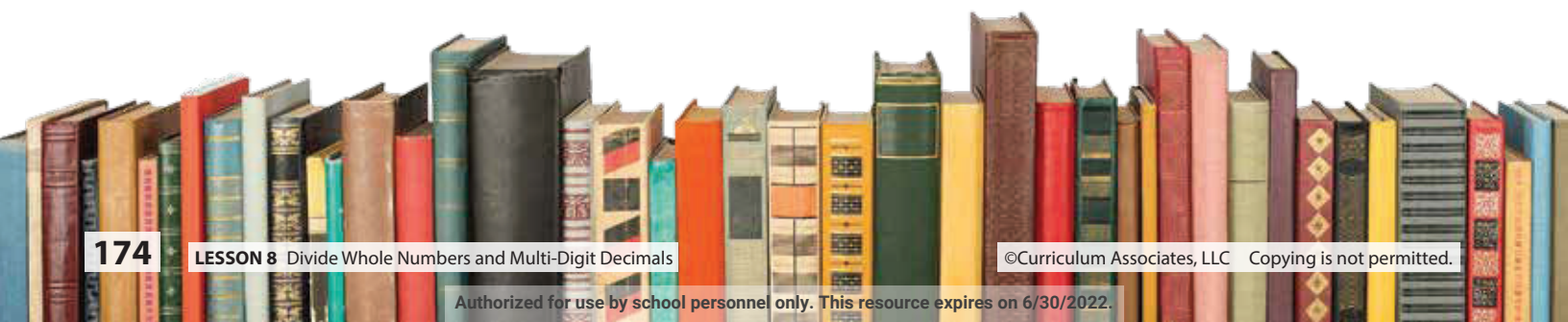
You can divide using partial quotients.

$$
\begin{array}{r}
4 \\
50 \\
300 \\
32\overline{)11{,}328} \\
-\ 9{,}600 \quad \leftarrow\ 300 \times 32 \\
1{,}728 \\
-\ 1{,}600 \quad \leftarrow\ 50 \times 32 \\
128 \\
-\ 128 \quad \leftarrow\ 4 \times 32 \\
0
\end{array}
$$

Model It

You can divide using the standard algorithm for division.

Many of the zeros shown in the partial quotients strategy are not written when you use the standard algorithm.

| 3 groups of **32** in **113** | 5 groups of **32** in **172** | How many groups of **32** in **128**? |

$$
\begin{array}{r}
3 \\
32\overline{)11328} \\
-\ 96 \\
\hline
17
\end{array}
\qquad\longrightarrow\qquad
\begin{array}{r}
35 \\
32\overline{)11328} \\
-\ 96\!\downarrow \\
\hline
172 \\
-\ 160 \\
\hline
12
\end{array}
\qquad\longrightarrow\qquad
\begin{array}{r}
35 \\
32\overline{)11328} \\
-\ 96 \\
\hline
172 \\
-\ 160\!\downarrow \\
\hline
128
\end{array}
$$

CONNECT IT

➤ **Use the problem from the previous page to help you understand how to use an algorithm to divide whole numbers.**

1. Look at the second **Model It**. The first digit to be written in the quotient is 3. Explain how this 3 represents the partial quotient 300 in the first **Model It**.

2. What is the value of the number 96 in the second **Model It**? How do you know?

3. Why is the digit 2 from the dividend brought down to make 172?

4. How many shelves does the library need to hold all the books? How could you use estimation to check your answer?

5. When you use the standard algorithm for division, how do you know where to write each digit of the quotient?

6. **Reflect** Think about all the models and strategies you have discussed today. Describe how one of them helped you better understand how to use the standard algorithm for division to divide whole numbers.

Apply It

➤ **Use what you learned to solve these problems.**

7 Members of a school band sell 1,680 bags of popcorn to raise money. There are 112 band members. Each band member sells the same number of bags. How many bags of popcorn does each band member sell? Show your work.

SOLUTION _____

8 Nathan incorrectly divides 33,947 by 83. Describe his mistake.

Nathan

```
        49
   83)33947
     − 332
        747
      − 747
          0
```

9 Find 62,208 ÷ 36. Show your work.

SOLUTION _____

Practice Using the Standard Algorithm for Division

➤ **Study the Example showing how to divide whole numbers using the standard algorithm. Then solve problems 1–4.**

Example

A restaurant uses 450,000 eggs in a year. One week, the cook needs to place an order for 8,640 eggs. The eggs come to the restaurant in boxes of 180 eggs each. How many boxes of eggs should the cook order for the week?

You can use the standard algorithm to divide 8,640 by 180.

4 groups of **180** in **864**   8 groups of **180** in **1,440**

$$
\begin{array}{r}
4 \\
180\overline{)864}0 \\
-720 \\
\hline
144
\end{array}
\quad\longrightarrow\quad
\begin{array}{r}
48 \\
180\overline{)8640} \\
-720\downarrow \\
\hline
1440 \\
-1440 \\
\hline
0
\end{array}
$$

The cook should order 48 boxes of eggs.

1 The cook in the Example needs 11,160 eggs during a holiday week. How many boxes of eggs should the cook order for the holiday week? Show your work.

SOLUTION _____

2 Platon's mom buys a car using a loan. She repays the loan by paying $22,032 in 48 equal monthly payments. How much is each payment? Show your work.

Total to repay loan:
$22,032

Length of loan:
48 months

SOLUTION

3 Find the quotient 40,936 ÷ 34. Show your work.

SOLUTION

4 Francisca incorrectly divides 31,104 by 18. Describe her mistake.

Francisca

```
           1 7 3
  18)31,104
     − 18
       13 1
     − 12 6
           5 4
         − 5 4
             0
```

Develop Expressing Remainders as Decimals

➤ **Read and try to solve the problem below.**

Serafina is taking ballet folklórico lessons at the local dance school. A semester of lessons costs $318. There are 24 lessons in a semester and each lesson costs the same amount. How much does each lesson cost?

TRY IT

✎ **Math Toolkit** base-ten blocks, base-ten grid paper, grid paper

DISCUSS IT

Ask: How did you get started?

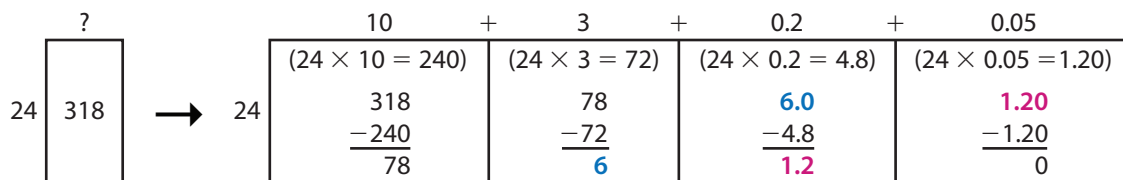**Share:** At first I . . .

➤ **Explore different ways to express remainders as decimals.**

Serafina is taking ballet folklórico lessons at the local dance school. A semester of lessons costs $318. There are 24 lessons in a semester and each lesson costs the same amount. How much does each lesson cost?
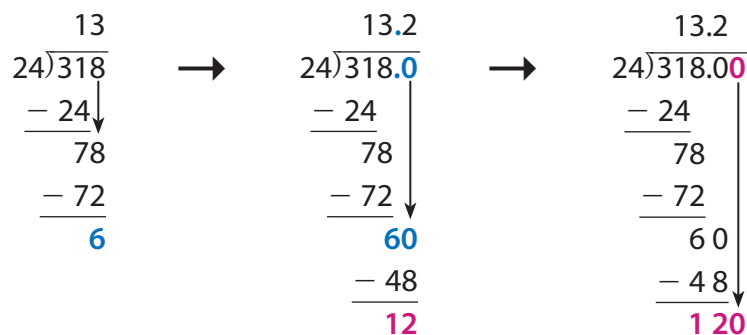
Model It

You can use an area model to divide.

If there is a remainder, you can express it as a decimal by adding more parts to the model.

	?	
24	318	

→

	10 +	3 +	0.2 +	0.05
24	(24 × 10 = 240)	(24 × 3 = 72)	(24 × 0.2 = 4.8)	(24 × 0.05 = 1.20)
	318	78	6.0	1.20
	−240	−72	−4.8	−1.20
	78	6	1.2	0

Model It

You can use the standard algorithm to divide and write a remainder as a decimal.

```
       13
   24)318
     − 24↓
       78
     − 72
        6
```
→
```
      13.2
   24)318.0
     − 24
       78
     − 72↓
       60
     − 48
       12
```
→
```
      13.2
   24)318.00
     − 24
       78
     − 72
       6 0
     − 4 8↓
       1 20
```

CONNECT IT

➤ **Use the problem from the previous page to help you understand how to express remainders as decimals.**

1 Look at the area model in the first **Model It**. The first two partial quotients are 10 and 3. Why is the next partial quotient less than 1?

2 Look at the second **Model It**. The dividend is written first as 318, then as 318.0, and then as 318.00. Why are 0s shown in the tenths and hundredths places?

3 How much does each lesson cost? How can you check your answer?

4 The division at the right shows dividing the decimal 318.6 by a whole number. How is this division like the one shown in the second **Model It**? How is it different?

```
         13.275
   24)318.600
      − 24
        78
       − 72
          6 6
         − 4 8
           1 80
          − 1 68
             120
            − 120
               0
```

5 When you use the standard algorithm to divide by a whole number, how can you write a remainder as a decimal?

6 **Reflect** Think about all the models and strategies you have discussed today. Describe how one of them helped you better understand how to express a remainder as a decimal.

Apply It

➤ **Use what you learned to solve these problems.**

7 What is the value of 8.25 ÷ 66? Show your work.

SOLUTION _____

8 Jason says that 1,330 ÷ 28 is equal to 47.14. Do you agree? If so, show how Jason could have gotten his answer. If not, explain the mistake that Jason made and show how to find the correct quotient.

9 Bianca is making necklaces for her friends. She has 6.3 m of leather cord. Bianca cuts the cord into 14 equal pieces, one for each necklace. How long is each piece? Show your work.

SOLUTION _____

Practice Expressing Remainders as Decimals

➤ **Study the Example showing how to express remainders as decimals.
Then solve problems 1–5.**

> **Example**
>
> **Fadil is making a batch of 18 rolls. The dough for the rolls weighs 29.7 oz.
> Fadil wants to make each roll the same size. How much should each roll weigh?**
>
> You can use an algorithm to divide 29.7 by 18.
>
> <pre>
>   ┌──────────────────┐
>   │ 5 groups of 18 in 90 │
>   └──────────────────┘
>   1.6   1.65
>   18)29.7   ──➤   18)29.70
>   − 18↓   − 18
>   ─────   ─────
>   11 7   11 7
>   − 10 8   − 10 8↓
>   ─────   ─────
>   9   90
>   − 90
>   ─────
>   0
> </pre>
>
> Each roll should weigh 1.65 oz.

1 Look at the Example. Suppose Fadil decides to use the dough to make 12 rolls
instead of 18 rolls. How much should each roll weigh? Show your work.

SOLUTION _____

2 Insert a decimal point in the number 3625 to show the correct quotient.

$29 \div 8 = 3625$

3 A stack of 50 cards is 1.9 cm thick. All cards in the stack have the same thickness. How thick is one card? Show your work.

SOLUTION _____

4 Find the quotient 9.43 ÷ 82. Show your work.

SOLUTION _____

5 A school receives gifts of $600 and $800. The money is split equally among the school's 16 clubs. How much money does each club receive? Show your work.

SOLUTION _____

Develop Dividing Multi-Digit Decimals

Bananas
$0.48 for each pound
$2.64 spent

➤ **Read and try to solve the problem below.**

A soccer coach buys bananas for her team. The total cost is $2.64. How many pounds of bananas does the coach buy?

TRY IT

✎ **Math Toolkit** base-ten blocks, base-ten grid paper, grid paper

DISCUSS IT

Ask: How does your work show the total cost of the bananas?

Share: In my work . . . represents . . .

➤ **Explore different ways to divide multi-digit decimals.**

A soccer coach buys bananas for her team. The total cost is $2.64. Each pound of bananas costs $0.48. How many pounds of bananas does the coach buy?

Model It

You can use what you know about place value to help you divide with decimals.

2.64	÷	0.48	= ?
264 hundredths	÷	48 hundredths	= ?
264	÷	48	= ?

Divide the hundredths as you would with whole numbers.

$48\overline{)264}$

Model It

You can use what you know about equivalent fractions to help you divide with decimals.

First, write the division problem as a fraction.

$$2.64 \div 0.48 = \frac{2.64}{0.48}$$

Next, multiply the numerator and denominator by the same power of 10 to write an equivalent fraction with a whole-number denominator.

$$\frac{2.64 \times 100}{0.48 \times 100} = \frac{264}{48}$$

$$2.64 \div 0.48 = 264 \div 48$$

$0.48\overline{)2.64} \longrightarrow 48\overline{)264}$

× 100   × 100

➤ **Use the problem from the previous page to help you understand how to divide multi-digit decimals.**

1 Look at the first **Model It**. Why can you use 264 ÷ 48 to find 2.64 ÷ 0.48?

2 Look at the pattern in the division problems. How could you use this pattern to help you divide two decimals?

$$4{,}200 \div 600 = 7$$
$$420 \div 60 = 7$$
$$42 \div 6 = 7$$
$$4.2 \div 0.6 = 7$$
$$0.42 \div 0.06 = 7$$

3 Look at the arrows in the second **Model It**. Multiplying by 100 moves each digit in a number two places to the left. Why do you need to multiply both the dividend and the divisor by the same power of 10?

4 How many pounds of bananas does the coach buy? How do you know that your answer is reasonable?

5 How do you rewrite a division problem involving a decimal divisor in order to use the standard algorithm to find the quotient?

6 **Reflect** Think about all the models and strategies you have discussed today. Describe how one of them helped you better understand how to divide multi-digit decimals.

Apply It

➤ **Use what you learned to solve these problems.**

7 Find the value of 54.08 ÷ 6.4. Show your work.

SOLUTION _____

8 Muna incorrectly divides 48.6 by 0.75. Describe her mistake.

$$0.75\overline{)48.6} \longrightarrow 75\overline{)486.00}$$

$$
\begin{array}{r}
6.48 \\
75\overline{)486.00} \\
-\ 450 \\
\hline
36\ 0 \\
-\ 30\ 0 \\
\hline
6\ 00 \\
-\ 6\ 00 \\
\hline
0
\end{array}
$$

9 A pile of soil has a volume of 67.5 ft³. A worker's wheelbarrow holds 2.25 ft³ of soil when full. How many times does the worker need to fill the wheelbarrow to move all of the soil to a vegetable garden? Show your work.

SOLUTION _____

Practice Dividing Multi-Digit Decimals

➤ **Study the Example showing how to divide multi-digit decimals. Then solve problems 1–5.**

Example

A lake is 8.75 mi long. Yukio and his stepdad are paddling a canoe on the lake. They travel 2.5 mi each hour. At this speed, how many hours does it take them to travel the length of the lake?

You can divide decimals by writing an equivalent problem with a whole number divisor. Multiply the dividend and the divisor by the same power of 10.

$$
2.5\overline{)8.75} \quad \longrightarrow \quad
\begin{array}{r}
3.5 \\
25\overline{)87.5} \\
-75 \\
\hline
12\,5 \\
-12\,5 \\
\hline
0
\end{array}
$$

×10   ×10

It takes Yukio and his stepdad 3.5 h to travel the length of the lake.

1. Show how to use a power of 10 to write 42.66 ÷ 2.97 as an equivalent expression with a whole number divisor.

2. Find the quotient 27.47 ÷ 4.1. Show your work.

SOLUTION _____

3 Ellie earns money by raking leaves. She earns $2.25 for each bag she fills with leaves. This week, she earns $24.75. How many bags of leaves does Ellie fill this week? Show your work.

SOLUTION _____

4 Which expression is equivalent to 8.508 ÷ 70.9?

A 8.508 ÷ 709

B 85.08 ÷ 709

C 850.8 ÷ 709

D 8,508 ÷ 709

5 What is the value of 0.5 ÷ 0.8? Show your work.

SOLUTION _____

Refine Dividing Whole Numbers and Multi-Digit Decimals

➤ **Complete the Example below. Then solve problems 1–9.**

Example

A bag of peanuts costs $2.16 and a granola bar costs $1.08. A group of 4 friends buys 3 bags of peanuts and 1 granola bar to share. They decide to split the cost equally. How much does each friend pay?

Look at how you could show your work using algorithms.

Cost of Peanuts:

$$\begin{array}{r} \overset{1}{2}.16 \\ \times \quad 3 \\ \hline 6.48 \end{array}$$

One share:

$$\begin{array}{r} 1.89 \\ 4\overline{)7.56} \\ -4 \\ \hline 35 \\ -32 \\ \hline 36 \\ -36 \\ \hline 0 \end{array}$$

Total cost:

$$\begin{array}{r} \overset{1}{6}.\overset{1}{4}8 \\ +1.08 \\ \hline 7.56 \end{array}$$

SOLUTION _____

CONSIDER THIS . . .
Splitting the cost equally is the same as dividing the total cost by the number of people.

PAIR/SHARE
What is a different sequence of operations you could use to find how much each friend pays?

Apply It

1 To find a softball player's batting average, divide the player's number of hits by the player's number of turns at bat. Kazuko has 26 hits in 125 turns at bat. Savanna has 11 hits in 50 turns at bat. Who has a greater batting average? Show your work.
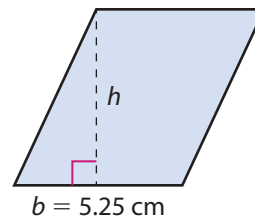
CONSIDER THIS . . .
A batting average is written as a decimal rounded to three decimal places.

PAIR/SHARE
Would your answer change if Savanna has 15 hits in 50 turns at bat? Explain.

SOLUTION _____

2 The area of the parallelogram is 29.4 cm². What is the parallelogram's height? Show your work.

h

$b = 5.25$ cm

SOLUTION

3 A football stadium has a total of 22,392 seats. Of these seats, 1,920 are VIP seats. The rest of the seats are divided into 24 equal sections of standard seats. How many seats are in each section of standard seats?

A 933

B 853

C 80

D 11

Chase chose A as the correct answer. How might he have gotten that answer?

4 A middle school has a bridge-building contest. Teams of students try to build the strongest bridge using craft sticks and glue. Each team is given 75 craft sticks. There are 1,635 craft sticks available. Tell whether each statement is *True* or *False*.

	True	False
a. There are enough craft sticks for 23 teams.	○	○
b. If there are 20 teams, there will be 135 craft sticks left over.	○	○
c. If each team is given 60 craft sticks, there will be enough for 28 teams.	○	○
d. The teachers need 15 more craft sticks to have enough craft sticks for 22 teams.	○	○

5 Elon and Rachel want to find 28.25 ÷ 0.7. Elon says you should multiply the dividend and the divisor by 10 before dividing. Rachel says you should multiply the dividend and the divisor by 100 before dividing. Who is correct? Explain.

6 An adventure race is 9.75 mi long. The race is divided into equal sections. Each section is 0.75 mi long. The race organizer needs 4 volunteers in each section. How many volunteers does the race organizer need? Show your work.

SOLUTION

7 Fernando is playing a video game. He has 13,782 coins. He buys 2 dance moves. What is the greatest number of costumes Fernando can buy with the coins he has left? Show your work.

Item	Coins Needed
Dance move	175
Costume	850

SOLUTION _____

8 Based on the equation $287 \div 8.2 = 35$, which equations are true? Select all that apply.

A $2.87 \div 3.5 = 0.082$

B $287 \div 35 = 8.2$

C $2{,}870 \div 350 = 8.2$

D $2.87 \div 0.82 = 0.35$

E $28.7 \div 82 = 0.35$

9 **Math Journal** Choose a decimal with a 7 in the tenths place. Divide your decimal by 0.25. Explain how you found the quotient.

✅ **End of Lesson Checklist**

☐ **INTERACTIVE GLOSSARY** Write a new entry for *standard*. Write at least one synonym for *standard*.

☐ **SELF CHECK** Go back to the Unit 2 Opener and see what you can check off.