

**Quick Check**

**Essential Question**

**Common Core State Standards**

# Lesson 6

## Estimate Quotients

### What You'll Learn

Scan the lesson. List two headings you would use to make an outline of the lesson.

- Estimate by Rounding Dividends
- Estimate by Rounding Divisors

### Essential Question

HOW can estimating be helpful?

### Vocabulary

compatible numbers

### Common Core State Standards

Content Standards  
6.NS.2  
Mathematical Practices  
1, 3, 4, 5

### Vocabulary Start-Up

To determine what a compatible number is, first you must determine what compatible means. Fill in the table below.

Sample answers are given.

Definition:	Example:
Able to exist together with something else in harmony.	Peanut butter and jelly Socks and shoes
What would make numbers compatible?	Non-Example:
Two numbers that are easy to compute.	Oil and water A game for a handheld system and a game for a game console

**compatible**

### Real-World Link

**Remote Control** Latasha and her two sisters want to buy their little brother a remote control helicopter. The helicopter costs \$28.90. They decided to split the cost equally.

- What number that is a multiple of 3 is close to \$28.90? Explain.  
**\$30; \$28.90 is only \$1.10 away from \$30.**
- Use your answer from Exercise 1 to determine about how much each person will pay. Explain.

**Sample answer: about \$10;  $30 \div 3 = 10$**



### Skills Trace

#### Focus

**Objective** Estimate the quotients of decimals and judge the reasonableness of the results.

#### Coherence

##### Previous

Students divided using multi-digit numbers.

##### Now

Students estimate quotients involving decimals.

##### Next

Students will divide decimals.

### Building on the Essential Question

At the end of the lesson, students should be able to answer "When is it helpful to estimate quotients?"

ENGAGE EXPLORE EXPLAIN ELABORATE EVALUATE

## 1 Launch the Lesson

### Ideas for Use

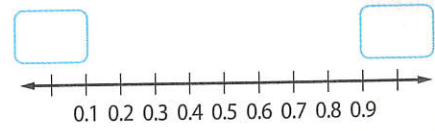
You may wish to launch the lesson using a whole group, small group, think-pair-share activity, or independent activity.



**Pairs Discussion** After completing the graphic organizer, have students work in pairs to write their own definition of compatible numbers. Then have them trade their definition with another pair of students and discuss any differences.

### Alternate Strategy

**AL** Allow students to use a visual to round decimals. Students can use the number line shown to locate their number and decide which whole number is closer to their number.



## 2 Teach the Concept

Ask the scaffolded questions for each example to differentiate instruction.

### Examples



#### 1. Estimate by rounding the dividend.

- AL** • Why should you round 11.75 to 12? Twelve is a multiple of the divisor, 3.
- What is  $12 \div 3$ ? 4
- OL** • Why are 12 and 3 compatible numbers? Three divides evenly into 12.
- BL** • Is  $11.75 \div 3$  greater than, less than or equal to 4? Explain. less; Since 11.75 is less than the rounded number 12,  $11.75 \div 3$  will be less than  $12 \div 3$ .

#### Need Another Example?

Estimate  $44.2 \div 9$ . 5

#### 2. Estimate by rounding the dividend.

- AL** • What do you want to find? the estimated cost of each ticket
- What division expression represents the situation?  $61.25 \div 5$
- What are the compatible numbers you will use? 60 and 5
- OL** • What number should you round 61.25 to? Why? 60; 60 is a multiple of the divisor, 5.
- Will the actual cost be greater than, less than or equal to \$12? greater than
- BL** • What do you think the exact answer will be? Explain your reasoning. \$12.25; See students' work for reasoning.

#### Need Another Example?

The Chu family drove 163.3 miles in 4 hours. Estimate the average number of miles they drove each hour. Justify your answer. 40 mi; Since  $40 \times 4 = 160$  and 160 is about 163.3, the answer is reasonable.

Work Zone

### Estimate by Rounding Dividends

To estimate quotients of decimals, use rounding and compatible numbers. **Compatible numbers** are numbers that are easy to divide mentally.

### Examples



#### 1. Estimate $11.75 \div 3$ .

Round the dividend, 11.75, to a whole number.

The divisor is 3. So, round 11.75 to a whole number that is a multiple of 3.

$$3 \overline{)11.75} \rightarrow 3 \overline{)12} \quad \text{Using multiples of 3, 12 is closest to 11.75}$$

So,  $11.75 \div 3$  is about 4.

2. The Jenkins family bought five tickets to a charity auction. The receipt shows the total cost of the tickets. Estimate the cost of each ticket. Justify your answer.



$$5 \overline{)61.25} \rightarrow 5 \overline{)60} \quad \text{Round 61.25 to 60.}$$

Each ticket costs about \$12.

Since  $5 \times 12 = 60$  and  $60 \approx 61.25$ , the answer is reasonable.

#### Got It? Do these problems to find out.

Estimate each quotient.

a.  $49.3 \div 7$

b.  $25 \overline{)98.1}$

- c. Suppose the Jenkins family decided to purchase 6 tickets for a total price of \$64.50 using a discount. Estimate the cost of each ticket. Justify your answer.

Sample answers given.

a.  $49 \div 7 = 7$

b.  $100 \div 25 = 4$   
about \$11 per ticket;  
 $\$64.50 \div 6 \approx \$66 \div 6 = \$11$

c.  $6 = \$11$

Show your work.



## Estimate by Rounding Divisors

You can also estimate quotients of decimals by rounding the divisors. Choose compatible numbers that are easy to divide mentally.

### Examples



#### 3. Estimate $32 \div 3.9$ .

Round the divisor, 3.9, to a whole number.

The dividend is 32. So, round 3.9 to a whole number that is a factor of 32.

$$3.9 \overline{)32} \rightarrow 4 \overline{)32} \quad \text{Round 3.9 to 4 since 32 and 4 are compatible numbers.}$$

So,  $32 \div 3.9$  is about 8.

**Check by Multiplying**  $3.9 \times 8 = 31.2$   
 $31.2 \approx 32$  ✓

#### 4. Estimate $56 \div 6.8$ .

Round the divisor, 6.8, to a whole number.

The dividend is 56.

So, round 6.8 to a whole number that is a **factor** of 56.

Round 6.8 to 7.

$$6.8 \overline{)56} \rightarrow 7 \overline{)56}$$

So,  $56 \div 6.8$  is about 8.

**Check by Multiplying**  $6.8 \times 8 = 54.4$   
 $54.4 \approx 56$  ✓

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

Estimate each quotient.

d.  $54 \div 9.16$

e.  $10.75 \overline{)99}$

### STOP and Reflect

How does the division fact  $63 \div 9 = 7$  help you to estimate the quotient of  $63 \div 8.4$ ? Answer below.

**Sample answer:** To estimate  $63 \div 8.4$ , use the compatible numbers  $63 \div 9$ . The quotient is about 7.

Show your work.

Sample answers given.

d.  $54 \div 9 = 6$

e.  $99 \div 11 = 9$

## Examples

### 3. Estimate by rounding the divisor.

- AL** • Why should you round 3.9 to 4? Four is a factor of the dividend, 32.
- What is  $32 \div 4$ ? 8
- OL** • Will the exact answer be greater than, less than or equal to 8? Explain. greater than; Since the divisor was rounded up, the answer will be greater than 8.
- BL** • Estimate  $33 \div 3.7$ . What compatible numbers did you use? Explain. See students' work. Students may have used 33 and 3 to get 11 or 32 and 4 to get 8.

### Need Another Example?

Estimate  $72 \div 8.3$ . 9

### 4. Estimate by rounding the divisor.

- AL** • To what number should you round 6.8? Why? 7; Seven is a factor of 56.
- What is  $56 \div 7$ ? 8
- OL** • Will the exact answer be greater than, less than or equal to 8? Explain. greater than; Since the divisor was rounded up, the answer will be greater than 8.
- BL** • Use your estimate and the check to find a better estimate. Explain your reasoning. See students' work. Students should increase the original estimate by one- or two-tenths, then multiply by 6.8 to see how close they are to 56.

### Need Another Example?

Estimate  $40 \div 4.7$ . 8

## Example

IWB



### 5. Estimate by rounding both the dividend and divisor.

- AL** • What division expression can be used to represent the situation?  $704.4 \div 49.9$
- To what number would you round 49.9? **50**
- What number could you round 704.4 to that is compatible with 50? **700**
- OL** • Why should you round to 700 and 50? **700 and 50 are compatible numbers.**
- BL** • Since you rounded both numbers, can you predict if the actual answer is greater than, less than, or equal to 14? Explain. **greater than;  $50 \times 14 = 700$ .  $49.9 < 50$  and  $700 < 704.4$ , so the answer must be greater than 14.**

#### Need Another Example?

The average weight of a panther is 64.2 kilograms. The average weight of a coyote is 14.8 kilograms. About how many times heavier is the panther? Explain why your answer is reasonable. **The panther is about 4 times heavier than the coyote; since  $4 \times 15 = 60$  and 60 is about 64.2, the answer is reasonable.**

## Guided Practice

**Formative Assessment** Use these exercises to assess students' understanding of the concepts in this lesson.



If some of your students are not ready for assignments, use the differentiated activities below.

**AL Think-Pair-Share** Have students work in pairs. Give them a few minutes to think through their responses to Exercises 1–5. Have them share their solutions with their partner and explain why they rounded the way they did.

**BL Trade-a-Problem** Have students create their own problem, similar to Exercise 5 where both quantities need to be rounded. Students trade their problems, solve each other's problem, and compare solutions. If the solutions do not agree, students work together to find the errors.



## Example



5. **STEM** A Pacific Leatherback turtle can have a mass of up to 704.4 kilograms. An Olive Ridley turtle can have a mass of up to 49.9 kilograms. About how many times heavier is the Pacific Leatherback turtle? Explain why your answer is reasonable.

$$49.9 \overline{)704.4} \rightarrow 50 \overline{)700} \quad \begin{array}{l} 14 \\ \text{Round } 49.9 \text{ to } 50 \text{ and } 704.4 \text{ to } 700. \end{array}$$

The Pacific Leatherback is about 14 times heavier than the Olive Ridley turtle.

**Check for Reasonableness** Since  $50 \times 14 = 700$ , and  $700 \approx 704.4$ , your answer is reasonable. ✓

### Got It? Do this problem to find out.

- f. There are approximately 250.9 million cars in the United States. Spain has approximately 25.1 million cars. About how many times more cars does the U.S. have than Spain? Explain why your answer is reasonable.

## Guided Practice



Estimate each quotient. (Examples 1, 3, and 4) **Sample answers: 1–3**

1.  $25 \div 4.7 \approx$   **$25 \div 5 = 5$**

2.  $40.79 \div 7 \approx$   **$42 \div 7 = 6$**

3.  $38.1 \overline{)984.76} \approx$   
 **$1,000 \div 40 = 25$**

4. **STEM** The average yearly precipitation for Gulfport, Mississippi, is 65.3 inches. About how much precipitation does the area receive each month? Explain why your answer is reasonable. (Example 2)

**about 5 in.;  $65.3 \div 12 \approx 60 \div 12 = 5$**

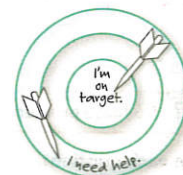
5. Mauricio bought 6.75 yards of fabric for a total of \$47.50. About how much was the cost per yard? Explain why your answer is reasonable. (Example 5)

**about \$7;  $47.50 \div 6.75 \approx 49 \div 7 = 7$**

6. **e Building on the Essential Question** When is it helpful to estimate quotients? **Sample answer: It can be helpful in checking for reasonableness.**

### Rate Yourself!

How confident are you about estimating quotients? Shade the ring on the target.



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



# 3 Practice and Apply

Name \_\_\_\_\_ My Homework \_\_\_\_\_

## Independent Practice

Go online for Step-by-Step Solutions



Estimate each quotient. (Examples 1, 3, and 4) **Sample answers: 1-3, 5**

1.  $32.4 \div 3 \approx$  \_\_\_\_\_  
 $33 \div 3 = 11$



2.  $76.2 \div 18.4 \approx$  \_\_\_\_\_  
 $80 \div 20 = 4$

3.  $11.4 \overline{)35.7} \approx$  \_\_\_\_\_  
 $36 \div 12 = 3$

4. **Financial Literacy** Emily spent a total of \$38.04 on four CDs. If each CD cost the same amount, what is a reasonable amount for the cost of each CD? Explain why your answer is reasonable. (Example 2)

**about \$10;  $\$38.04 \div 4 \approx \$40 \div 4 = \$10$**

5. A recipe for a smoothie calls for 0.75 pound of strawberries. If Kerry has 3.15 pounds of strawberries, how many batches of the recipe can she make? (Example 5)

**about 3**

6. **Financial Literacy** For each handmade greeting card Jacqui sells, she makes a profit of \$0.35. In one week, she made a profit of \$42. She sells the cards for \$0.75 each.

a. About how many greeting cards did Jacqui sell that week?

**about 100 cards;  $\$42 \div 0.35 \approx \$40 \div 0.40 = 100$**

b. About how much did she earn before paying expenses?

**about \$75;  $100 \times \$0.75 = \$75$**



7. **CCSS Justify Conclusions** The average cow produces about 53 pounds of milk per day. If one gallon of milk weighs about 8.5 pounds, estimate the number of gallons of milk a cow produces each day. Explain why your estimate is reasonable.

**about 6 gal;  $53 \div 8.5 \approx 54 \div 9 = 6$**

8. When full, a 22-gallon gas tank holds 129.8 pounds of gasoline. Estimate the weight of one gallon of gasoline. If it costs \$91.30 to fill the gas tank, estimate the cost per gallon.

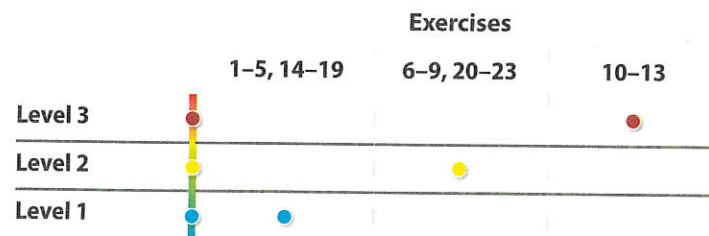
**6 lb; about \$4**

## Independent Practice and Extra Practice

The Independent Practice pages are meant to be used as the homework assignment. The Extra Practice page can be used for additional reinforcement or as a second-day assignment.

### Levels of Complexity

The levels of the exercises progress from 1 to 3, with Level 1 indicating the lowest level of complexity.



### Suggested Assignments

You can use the table below that includes exercises of all complexity levels to select appropriate exercises for your students' needs.

Differentiated Homework Options		
AL	Approaching Level	1-5, 7, 9, 10, 12, 13, 22, 23
OL	On Level	1-5 odd, 6-10, 12, 13, 22, 23
BL	Beyond Level	6-13, 22, 23



## MATHEMATICAL PRACTICES

Emphasis On	Exercise(s)
1 Make sense of problems and persevere in solving them.	11
3 Construct viable arguments and critique the reasoning of others.	7, 12, 13, 19
4 Model with mathematics.	10
5 Use appropriate tools strategically.	9

Mathematical Practices 1, 3, and 4 are aspects of mathematical thinking that are emphasized in every lesson. Students are given opportunities to be persistent in their problem solving, to express their reasoning, and apply mathematics to real-world situations.

### Formative Assessment

Use this activity as a closing formative assessment before dismissing students from your class.

### TICKET Out the Door

Tell students that in the next lesson they will learn to divide decimals by whole numbers. Ask them to write a division problem they think they will learn to solve. **See student's work.**

9. **CCSS Use Math Tools** Use estimation and mental math to find the four missing quantities from the receipt. **1; 2; 4; 8**

Precious Pets			Receipt	
Qty	Description	Unit Price	Total	
	Hamster cage	\$35.99	\$35.99	
	Exercise wheel	\$5.29	\$10.58	
	Softwood bedding	\$6.29	\$25.16	
	Hamster food	\$4.59	\$36.72	
Total			\$108.45	



### H.O.T. Problems Higher Order Thinking

10. **CCSS Model with Mathematics** Write a real-world division problem involving decimals in which you would use compatible numbers to estimate the quotient. **Sample answer: Mrs. Fisher paid \$6.25 for 2.75 lb of apples. About how much did she pay per pound? She paid about \$2 per pound.**
11. **CCSS Persevere with Problems** Determine where to place the decimal point in the dividend and divisor so that the quotient is between 23 and 25.

$$16023 \div 654$$

**Sample answer:  $160.23 \div 6.54$**

12. **CCSS Reason Inductively** Explain how you know which compatible numbers to use when estimating the quotient of a division problem involving decimals. Support your answer with an example. **Sample answer: Look for multiplication or division facts containing numbers close to the decimal dividend and divisor that give a whole number quotient. For example,  $13.8 \div 7.1$  can be changed to  $14 \div 7 = 2$ .**
13. **CCSS Justify Conclusions** Explain how you know which compatible numbers to use when estimating a decimal quotient. Support your answer with an example. **Sample answer: Look for multiplication or division math facts containing numbers close to the decimal dividend and divisor that give the whole number quotient. For example, you can estimate  $13.8 \div 7.1$  by finding  $14 \div 7$ .**