2.5 Estimate with 2-Digit Divisors

Essential Question: How can you use compatible numbers to estimate quotients?

Lesson Opener
Making Connections
Invite students to tell you what they know about estimating.

What is an estimate? (a number that is close to an exact number)
What are compatible numbers? (numbers that are close to exact numbers in a problem and easy to compute with mentally)
Why is it a good idea to calculate an estimate in a problem? (It is a way to see if the exact answer you calculate or will calculate is reasonable.)
Can there be more than one estimate to a problem? (Yes. An estimate, by definition, is not exact.)

Using the Digital Lesson
March has 31 days. Ask students, why are we dividing 214 by 27 rather than 31? (There are usually four Sundays in a month, and the U.S. Post Office does not deliver mail on Sundays and holidays.)

Learning Task
• Ask students what information is given in the problem. (the number of pieces of mail delivered to one house during March)
• What are you being asked to find? (The number of pieces of mail delivered each day—assuming that the same number was delivered each day)
• Ask students if it is reasonable to assume that the same number of pieces of mail are delivered each day. (No, but the quotient gives us a good idea of about how much could be expected.)

Literacy and Mathematics
• Write the word compatible on the board. Discuss how it is used in other situations. For example, friends are compatible.
• Write the word estimate on the board and discuss how it can be used as both a verb and a noun (For example, “Jennifer estimated how many chairs she would need for the meeting.” and “Shanika turned in her estimate of the cost before the deadline.”)

Texas Essential Knowledge and Skills
• **TEKS** Number and Operations—5.3.A
  Estimate to determine solutions to mathematical and real-world problems involving addition, subtraction, multiplication, or division

  **MATHEMATICAL PROCESSES**
  5.1.F Analyze mathematical relationships
  5.1.G Display, explain, and justify mathematical ideas and arguments

Are You Ready?
Access Prior Knowledge
Use the Are You Ready? 2.5 in the Assessment Guide to assess students’ understanding of the prerequisite skills for this lesson.

Vocabulary
• Multimedia eGlossary at thinkcentral.com

Resources
For the student
Interactive Student Edition provides students with an interactive learning environment!

For the teacher
Digital Management Center organizes program resources by TEKS!
eTeacher Edition
Math on the Spot Video Tutor
iTools Virtual Manipulatives
Soar to Success Math Online Intervention

Lesson 2.5 79A
Connect

Discuss the pattern that is generated by the division fact $35 \div 5 = 7$.

- Describe the relationship shared by the dividends, divisors, and quotients in this pattern. Possible answer: The number of zeros in the quotient is found by subtracting the number of zeros in the divisor from the number of zeros in the dividend.

Unlock the Problem

Have you ever visited the Willis Tower in Chicago? Solve the problem to learn how fast one of its elevators travels.

Discuss both steps of the solution. Make sure students understand how rounding and multiples are used to produce the compatible numbers.

Go Deeper

- Suppose we divided 1,353 by 60 to find an exact quotient. Will the exact quotient be greater than or less than the estimate of $1,200 \div 60$? Why?
  The exact quotient will be greater. Possible explanation: 1,353 is greater than 1,200.

Before discussing Step 1, remind students that the partial quotients method of division involves subtracting multiples of the divisor from the dividend. Then say:

- Will the division used to find the exact quotient produce a remainder? Explain how you know.
  Yes. Possible explanation: The dividend will not be a multiple of the divisor because it does not have a zero in its ones place, so it will produce a remainder.

Go to thinkcentral.com for the ELL Activity Guide containing these leveled activities.
**Example** Estimate money.

Miriam has saved $650 to spend during her 18-day trip to Chicago. She doesn't want to run out of money before the trip is over, so she plans to spend about the same amount each day. Estimate how much she can spend each day.

Estimate. $650 ÷ 18 = $36.11 or $600 ÷ 20 = $30

So, Miriam can spend about $30 to $40 each day.

- Given Miriam's situation, which estimate do you think is the better one for her to use? Explain your reasoning.
  
  Possible answer: Miriam should use the estimate of $30, because $40 × 18 = $720, and she does not have enough money to spend $40 a day.

**Try This!**

Find two estimates.

52 ÷ 415

400 + 50 = 8 or 450 + 50 = 9

Estimate the quotient.

38 ÷ 2,764

$2,800 + 40 = $70

**Share and Show**

Accept all reasonable estimates. Possible answers are given.

1. 221/34
   140 ÷ 20 = 7
   160 ÷ 20 = 8

2. 68 ÷ 503
   490 ÷ 70 = 7;
   560 ÷ 70 = 8

3. 81 ÷ 992
   6,400 ÷ 80 = 80;
   7,200 ÷ 80 = 90

4. 33 ÷ 281
   270 ÷ 30 = 9;
   300 ÷ 30 = 10

5. 58 ÷ 365
   1,800 ÷ 60 = 30;
   2,400 ÷ 60 = 40

6. 19 ÷ 112
   4,000 ÷ 20 = 200;
   6,000 ÷ 20 = 300

**Math Talk**

Use Math Talk to focus on students' understanding of reasons for estimating.

**Additional Answer**

Math Talk: Accept all reasonable responses. Possible answer: Exact answer; that way, Miriam will know exactly how much she can spend each day and not risk running out of money on the last few days.

**Try This!**

Have students describe an alternate strategy to find the compatible numbers for 415 ÷ 52.

Possible answer: We could have rounded 52 to 50 and then skip-counted by fifties until we reached multiples that were close to 415.

- Explain to students that to **circumnavigate** the Earth means to travel all the way around the Earth. Provide the following information about historic circumnavigations.

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>Type of Flight</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>W. Post</td>
<td>1933</td>
<td>plane (first solo)</td>
<td>187 hours</td>
</tr>
<tr>
<td>U.S. Air Force B-50 Crew</td>
<td>1949</td>
<td>plane (first nonstop)</td>
<td>94 hours</td>
</tr>
<tr>
<td>B. Piccard and B. Jones</td>
<td>1999</td>
<td>balloon (first nonstop)</td>
<td>19 days</td>
</tr>
<tr>
<td>S. Fossett</td>
<td>2002</td>
<td>balloon (first solo)</td>
<td>13 days</td>
</tr>
<tr>
<td>S. Fossett</td>
<td>2005</td>
<td>plane</td>
<td>67 hours</td>
</tr>
</tbody>
</table>

- Have students write and solve problems that involve division and estimation using the information from the table.

Go to thinkcentral.com for additional enrichment activities in the Enrich Activity Guide.
Problem Solving

Have students explain how they would estimate $458 \div 58$ to focus on students’ understanding of lesson concepts. Possible answer: I would use compatible numbers to estimate $458 \div 58$. $420 \div 60 = 7$; $480 \div 60 = 8$. Since $480$ is closer to $458$, $8$ is a more reasonable estimate.

Extend the discussion by asking students to explain why their estimates will be greater than or less than the exact quotient.

H.O.T. Problem

For Problem 17, remind students to use two sets of compatible numbers.

Go Deeper

Students may have made the generalization that the number of zeros in a dividend minus the number of zeros in a divisor. How does having a basic fact like $20 \div 5 = 4$ change the generalizations students made? Possible answer: Since the basic fact contains a zero in the dividend, we should change the generalization to be the number of zeros that are not part of the basic fact.

COMMON ERRORS

Error A basic division fact pattern is not extended correctly.

Example

$8 \div 2 = 4$

$80 \div 20 = 40$

Springboard to Learning Have students look back at the patterns in Step 2 on page 79 and work with them to develop a rule that describes the patterns. Ask them to write the rule and refer to it each time they use a basic fact pattern to estimate.

Math on the Spot Video Tutor

Through the Math on the Spot Video Tutor, students will be guided through an interactive solving of this type of H.O.T. problem. Use this video to also help students solve the H.O.T. problem in the Interactive Student Edition. With these videos and H.O.T. problems, students will build skills needed in the assessment.

Math on the Spot videos are in the Interactive Student Edition and at thinkcentral.com.

Differentiated Instruction

RtI Rti Tier I Lesson 7

<table>
<thead>
<tr>
<th>Estimate with 2-Digit Divisors</th>
<th>Accept all reasonable estimates. Possible answers are given.</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. $192 \div 28$</td>
<td>$200 \div 20 = 10$</td>
</tr>
<tr>
<td>8. $25 \div 395$</td>
<td>$600 \div 30 = 20$</td>
</tr>
<tr>
<td>9. $867 \div 130$</td>
<td>$720 \div 90 = 80$</td>
</tr>
</tbody>
</table>

Practice: Copy and Solve Use compatible numbers to estimate the quotient.

10. $462 \div 83$
11. $9,144 \div 27$
12. $710 \div 68$
13. $1,607 \div 36$

Possible answers: $450 \div 80 = 6$; $9,000 \div 30 = 300$; $700 \div 70 = 10$; $1,600 \div 40 = 40$

Write Math Explain how you know whether the quotient of $298 \div 31$ is closer to 9 or to 10.

Possible explanation: $300 \div 30 = 10$; $270 \div 30 = 9$. Since $298$ is closer to $300$ than to $270$, the quotient is closer to 10.

Problem Solving Real World

Use the picture to solve 15–16. Possible answers are given.

15. About how many meters tall is each floor of the Chrysler Building?

Possible answer: about 4 m

16. Use estimation to decide which building has the tallest floors. About how many meters is each floor?

Williams Tower; about 5 m

17. Eli needs to save $235. He plans to mow lawns and charge $21 per lawn. How much does he need to make to reach his goal?

Possible answer: $220 \div 20 = 11$; $240 \div 20 = 12$; Rounding up will ensure that Eli earns enough money, while mowing 11 lawns may leave him short of his goal. So, Eli should use the estimate $240 \div 20 = 12$.

Module 2 • Lesson 5 81

Enrich 13

Alphabet Estimation

Place the letters of your answers below each phrase. Possible answers are given.

- $B$, $E$, $K$, $P$, $V$, $X$, $F$
- $B$, $E$, $K$, $P$, $V$, $X$, $F$
- $B$, $E$, $K$, $P$, $V$, $X$, $F$

Answers will vary.

Possible answer: $1,166 = 22$
Daily Assessment Task

18. A meteoroid travels 18 miles per second and is 2,863 miles away from the moon. Estimate how long it will take the meteoroid to reach the moon.

A 120 seconds  
B 150 seconds  
C 200 seconds  
D 280 seconds

19. Apply A playground is 5,583 feet away from Jake’s house. Jake runs 17 feet per second. Which is the best estimate of the amount of time it will take Jake to run to the park?

A 5,000 ÷ 20 = 250 seconds  
B 6,000 ÷ 20 = 300 seconds  
C 6,000 ÷ 10 = 600 seconds  
D 5,000 ÷ 10 = 500 seconds

20. Multi-Step At an orchard, 486 green apples are to be organized into 12 green baskets, and 633 red apples are to be organized into 31 red baskets. Use estimation to decide which color basket has more apples. About how many apples are in each basket of that color?

A red basket, 50 apples  
B green basket: 20 apples  
C red basket, 20 apples  
D green basket: 50 apples

TEXAS Test Prep

21. Anik built a tower of cubes. It was 594 millimeters tall. The height of each cube was 17 millimeters. About how many cubes did Anik use?

A 10  
B 300  
C 30  
D 16

TEXAS Test Prep Coach

Test Prep Coach helps teachers to identify common errors that students can make.

In the Test Prep exercise, if students selected:

A or D They used incorrect compatible numbers.  
B They divided 600 ÷ 2 instead of 600 ÷ 20.

Essential Question

How can you use compatible numbers to estimate quotients? Possible answer: I round the divisor to a multiple of 10, and I round the dividend to the nearest multiple of the new divisor. Then I use a basic division fact pattern of zeros to complete the estimate.
Lesson Check

Fill in the bubble completely to show your answer.

14. Which number sentence with compatible numbers is the most reasonable estimate of the quotient for $478 \div 47$?
   - A $500 \div 25 = 20$
   - B $500 \div 50 = 10$
   - C $400 \div 50 = 8$
   - D $600 \div 40 = 15$

15. Cameron wants to buy a bike for $268. He saves $53 each month from his job. Which is the best estimate of the number of months it will take him to save enough to buy the bike?
   - A $150 \div 50 = 3$ months
   - B $300 \div 60 = 5$ months
   - C $300 \div 50 = 6$ months
   - D $240 \div 60 = 4$ months

16. Leo has 279 comic books in his collection. He puts 34 comic books in each box. About how many boxes of comic books does Leo have?
   - A 6
   - B 11
   - C 9
   - D 5

17. The Alam family has saved $260 to spend on entertainment activities for one week. They want to spend about the same amount of money each day. Which is the best estimate of how much they can spend each day?
   - A $280 \div 7 = 40$
   - B $260 \div 10 = 26$
   - C $240 \div 6 = 40$
   - D $270 \div 9 = 30$

18. Multi-Step At the recycling center, 394 cans are to be organized into 10 green bins, and 560 bottles are to be organized into 12 blue bins. Use estimation to decide which type of bin has more items. About how many items are in the bin?
   - A blue bin, 60
   - B blue bin, 40
   - C green bin, 60
   - D green bin, 40

19. Multi-Step Farmer Theo sells cases of chicken eggs with 30 dozen eggs in a case. If he has 9,370 eggs, about how many cases of eggs does he have?
   - A 20
   - B 17
   - C 30
   - D 35