Lesson 25

Objective: Use basic facts to approximate decimal quotients with two-digit divisors, reasoning about the placement of the decimal point.

Suggested Lesson Structure

■ Fluency Practice	(12 minutes)	
■ Application Problem	(7 minutes)	
■ Concept Development	(31 minutes)	
■ Student Debrief	(10 minutes)	
Total Time	**(60 minutes)**	
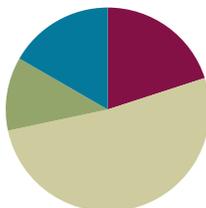
Fluency Practice (12 minutes)

- Rename Tenths and Hundredths **5.NBT.2**   (4 minutes)
- Divide Decimals by 10 **5.NBT.7**   (4 minutes)
- Divide Decimals by Multiples of 10 **5.NBT.7**   (4 minutes)

Rename Tenths and Hundredths (4 minutes)

Materials: (S) Personal white board

Note: This fluency activity prepares students for estimating decimal quotients during the Concept Development.

Repeat the process from Lesson 23 for the following possible sequence: 10 tenths, 90 tenths, 94 tenths, 100 tenths, 700 tenths, 783 tenths, 372 tenths, 9 hundredths, 10 hundredths, 90 hundredths, 98 hundredths, 100 hundredths, 900 hundredths, 980 hundredths, 1,000 hundredths, 7,000 hundredths, 7,400 hundredths, 7,418 hundredths, and 4,835 hundredths.

Divide Decimals by 10 (4 minutes)

Materials: (S) Personal white board

Note: This fluency activity reviews Lesson 24 content.

    T: (Project 3,800 on a place value chart. To the side, write 3,800 ÷ 10.) Say the division sentence.

    S: 3,800 ÷ 10 = 380.

    T: (Cross out each digit, and draw arrows one place value to the right. Write 380 in the place value chart.) When dividing by 10, digits shift how many places to the right?

    S: One.

T: (Project 380 on a place value chart. To the side, write 380 ÷ 10.) On your personal white board, write the division sentence and answer.

S: (Write 380 ÷ 10 = 38.)

Repeat the process for 38 ÷ 10, 3.8 ÷ 10, 270 ÷ 10, 2.7 ÷ 10, 4,900 ÷ 10, 49 ÷ 10, and 0.49 ÷ 10.

Divide Decimals by Multiples of 10 (4 minutes)

Materials: (T) Millions to thousandths place value chart (Lesson 1 Template) (S) Personal white board

Note: This fluency activity reviews Lesson 24 content.

T: (Write 1.2 ÷ 4 = ____.) Solve the division expression saying the whole in tenths.

S: 12 tenths ÷ 4 = 3 tenths.

T: (Write 1.2 ÷ 4 = 0.3. To the right, write 1.2 ÷ 40 = ____.) On your personal white board, write 12 tenths ÷ 40 as a three-step division sentence, taking out the ten.

S: (Write (1.2 ÷ 10) ÷ 4 = 0.12 ÷ 4 = 0.03.)

Repeat the process for 2.4 ÷ 2, 2.4 ÷ 20, 8 ÷ 2, 8 ÷ 20, 0.35 ÷ 5, and 0.35 ÷ 50.

Application Problem (7 minutes)

Ms. Heinz spent 12 dollars on 30 bus tokens for the field trip. What was the cost of 12 tokens?

Note: This Application Problem is based on Lesson 24, where students divided decimals by 10 and multiples of 10. This also asks students to multiply decimals to find the answer, which is a review of the first half of Module 2.

$$\$12.00 \div 30$$
$$= \$12.00 \div (3 \times 10)$$
$$= (\$12.00 \div 3) \div 10$$
$$= \$4.00 \div 10$$
$$= \$0.40$$

1 unit = $0.40
12 units = $0.40 × 12
= $4.80

$$\begin{array}{r} 0.40 \\ \times\ 12 \\ \hline 80 \\ +400 \\ \hline 4.80 \end{array}$$

The cost of 12 tokens was $4.80.

Concept Development (31 minutes)

Materials: (S) Personal white board

Problem 1

39.1 ÷ 17

3.91 ÷ 17

T: In Module 1, we rounded our decimal factors to estimate the product. We will estimate quotients now by rounding the whole and the divisor. (Write 39.1 ÷ 19 horizontally on the board.)

$$39.1 \div 17$$
$$\approx 40 \div 20$$
$$= 4 \div 2$$
$$= 2$$

$$3.91 \div 17$$
$$\approx 4 \div 20$$
$$= 0.4 \div 2$$
$$= 0.2$$

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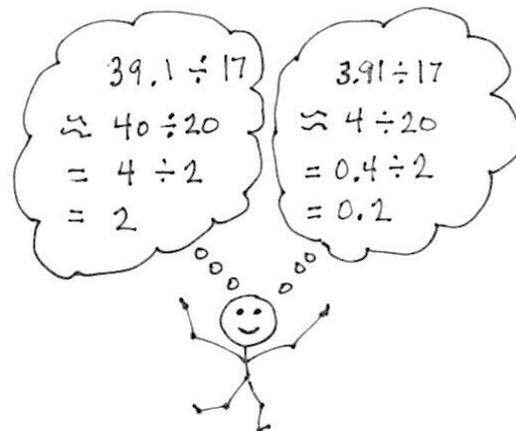
T: Just as we did before, round the divisor first. What is 17 rounded to the nearest ten?

S: 20.

T: Let's record our estimation. (Under the original problem, write ≈ _____ ÷ 20 on the board.) We need to round our whole, 39.1, to a number that can easily be divided by 20. Turn and share your ideas with your partner.

T: What could we round 39.1 to?

S: I can round 39.1 to 40. → I can use mental math to divide 4 tens by 2 tens.

T: (Fill in the blank to get ≈ 40 ÷ 20.) Show me how to find the estimated quotient of 39.1 ÷ 17.

S: 40 ÷ 20 = 4 ÷ 2 = 2.

T: So, 39.1 ÷ 17 ≈ 2.

T: (Write 3.91 ÷ 17 on the board.) Think about the size of this related quotient based on the estimation we just made. Turn and talk.

> **NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:**
>
> Allow students to express the rounded whole number dividends in unit form because these representations may help students *see* the division of a smaller number by a larger number more easily. For example, students who struggle seeing 4 as a number that can be divided by 20 may have more success if it is written as 40 tenths.

S: The whole has the same digits, but it is 1 tenth the size of the first one. → I think the quotient will also be 1 tenth the size of the first one. → The quotient will probably be around 2 tenths because that is 1 tenth as large as 2.

T: Let's estimate the quotient. Because our divisor is the same, let's use the same estimate of 20. Can you think of a multiple of 2 that would be close to 3.91?

S: 4.

T: (Write 4 ÷ 20 ≈ _____.) Show me how to find the estimated quotient. Talk to your partner about your thinking.

S: 4 ÷ 20 = 4 ÷ 10 ÷ 2 = 0.4 ÷ 2 = 0.2. → 4 ones divided by 10 is 4 tenths, and 4 tenths divided by 2 is 2 tenths. → 4 ÷ 2 = 2 and 2 ÷ 10 = 0.2.

T: Show me the equation to find the estimated quotient.

S: 4 ÷ 20 = 0.2.

T: I noticed that you all factored 20 into 2 × 10, but some of you divided by 2 first, and others divided by 10 first. How did this affect your quotient?

S: It didn't affect it, because 2 × 10 and 10 × 2 are both 20. As long as our divisor is still 20, the order doesn't matter.

T: Why is estimating useful?

S: It helps give us a starting place when we need to find the actual quotient, just like with whole numbers. → I'm unsure of the value of 2.42 ÷ 12, but an estimate can help me think about the value of the quotient when a smaller number is divided by a larger number. → 24 tenths divided by 12 is easy: 2 tenths.

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Problem 2

63.6 ÷ 73

6.36 ÷ 73

T: 63.6 pounds of rice were put into 73 bags. About how many pounds of rice were in each bag? (Write the problem horizontally on the board.) Thinking about this story problem, will the number of pounds in each bag be more than 1 pound or less than 1 pound? How do you know?

S: It should be less than 1 pound because there are 73 bags and only 63 pounds. There's not enough to put 1 pound in each bag. → Less than 1 pound. To put 1 pound in each bag, you'd need 73 pounds, and we don't have that much.

MP.1

T: Let's estimate this quotient and test that thinking. Turn and talk.

S: We can estimate the divisor as 70. I can see a 63 in the whole, and that is a multiple of 7. → I will round 73 to 70 and think of a close multiple of 7. 63 is close to 63.6.

T: What is the estimation expression in standard form?

S: 63 ÷ 70. → 63.0 ÷ 70.

T: Show your division in two steps on your personal white board.

S: 63 ÷ 10 = 6.3 and 6.3 ÷ 7 = 0.9. → 63 ÷ 7 = 9 and 9 ÷ 10 = 0.9.
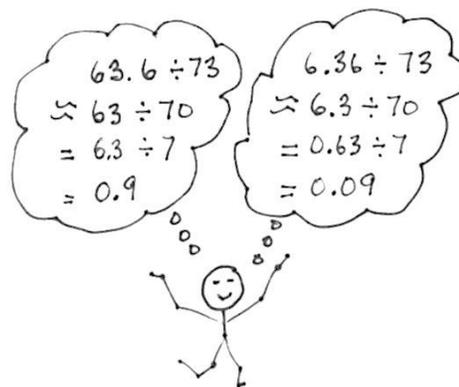
Repeat this sequence with 6.36 ÷ 73. Have students reason about how large the quotient would be and how it relates to the first quotient.

Problem 3

11.72 ÷ 42

T: (Write 11.72 ÷ 42 horizontally on the board.) Read the division expression in word form.

S: 11 and 72 hundredths divided by 42.

T: Estimate the divisor. Turn and talk.

S: 42 is close to 40.

T: Whisper to your partner a multiple of 4 that is close to 11.72. Then, find the estimated quotient.

T: Show how to find the estimated quotient.

S: 1,200 hundredths ÷ 40. → 12 ÷ 40. → 12.00 ÷ 40.

T: (Write the problem horizontally on board.) 11.72 ÷ 42 ≈ 12 ÷ 40. What's your estimate?

S: 30 hundredths. → 0.30. → 3 tenths. → 0.3.

> **NOTES ON MULTIPLE MEANS OF ACTION AND EXPRESSION:**
>
> In this lesson, students use easily identifiable multiples to find an estimated quotient. Remind students about the relationship between multiplication and division (the inverse property), so they can think of the following division sentence as a multiplication equation:
>
> 1,200 ÷ 40 = ___ → 40 × ___ = 1200.

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T: Explain how you found your answer.

S: (Record student thinking on the board.) I divided 1,200 by 10 to get 120. Then, I divided 120 by 4 and got 30.

T: When you are working on your Problem Set, I want you to remember to estimate using easily identifiable multiples.

$$11.72 \div 42$$

$$\approx 1200 \text{ hundredths} \div 40$$
$$= 120 \text{ hundredths} \div 4$$
$$= 30 \text{ hundredths}$$
$$= 0.3$$

$$12 \div 40 = 12 \div 10 \div 4$$
$$= 1.2 \div 4$$
$$= 0.3$$

$$12 \div 40 = 12 \div 4 \div 10$$
$$= 3 \div 10$$
$$= 0.3$$

I see lots of ways to solve

This one is different because we divided by 4 first!

$$\approx 120 \text{ tenths} \div 10 \div 4$$
$$= 12 \text{ tenths} \div 4$$
$$= 3 \text{ tenths}$$
$$= 0.3$$

Problem Set (10 minutes)

Students should do their personal best to complete the Problem Set within the allotted 10 minutes. For some classes, it may be appropriate to modify the assignment by specifying which problems they work on first. Some problems do not specify a method for solving. Students should solve these problems using the RDW approach used for Application Problems.

Student Debrief (10 minutes)

Lesson Objective: Use basic facts to approximate decimal quotients with two-digit divisors, reasoning about the placement of the decimal point.

The Student Debrief is intended to invite reflection and active processing of the total lesson experience.

Invite students to review their solutions for the Problem Set. They should check work by comparing answers with a partner before going over answers as a class.

Look for misconceptions or misunderstandings that can be addressed in the Debrief. Guide students in a conversation to debrief the Problem Set and process the lesson.

NYS COMMON CORE MATHEMATICS CURRICULUM   Lesson 25 Problem Set

Name ___Christopher___   Date _____

1. Estimate the quotients.

   a. $3.24 \div 82 \approx$ 320 hundredths $\div$ 80 = 4 hundredths = 0.04

   b. $361.2 \div 61 \approx$ $360 \div 60 = 6$

   c. $7.15 \div 31 \approx$ $6 \div 30 = (6 \div 3) \div 10 = 2 \div 10 = 0.2$

   d. $85.2 \div 31 \approx$ $90 \div 30 = 3$

   e. $27.97 \div 28 \approx$ $28 \div 28 = 1$

2. Estimate the quotient in (a). Use your estimated quotient to estimate (b) and (c).

   a. $7.16 \div 36 \approx$ $8 \div 40 = (8 \div 4) \div 10 = 2 \div 10 = 0.2$

   b. $716 \div 36 \approx$ $800 \div 40 = 20$

   c. $71.6 \div 36 \approx$ $80 \div 40 = 2$

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Any combination of the questions below may be used to lead the discussion.

- Before students begin the Problem Set, have them predict and sort the tasks in Problem 1 into those with quotients more than 1 and quotients less than 1. Have them justify their thinking as they sort.

- Have students compare estimates for Problems 1(c) and 1(e) and defend their choices.

- Could your answer to Problem 1(c) help you find the answer to Problem 1(d) without having to make another estimate? (Although the divisors round to the same number, another estimate is needed.)

- How is Problem 4 like Problem 1(e)? (Divisors can be left and dividends estimated for both.) Are there other problems where this method of estimating the quotient makes sense?

Exit Ticket (3 minutes)

After the Student Debrief, instruct students to complete the Exit Ticket. A review of their work will help with assessing students' understanding of the concepts that were presented in today's lesson and planning more effectively for future lessons. The questions may be read aloud to the students.

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Name _____   Date _____

1. Estimate the quotients.

    a. 3.24 ÷ 82 ≈

    b. 361.2 ÷ 61 ≈

    c. 7.15 ÷ 31 ≈

    d. 85.2 ÷ 31 ≈

    e. 27.97 ÷ 28 ≈

2. Estimate the quotient in (a). Use your estimated quotient to estimate (b) and (c).

    a. 7.16 ÷ 36 ≈

    b. 716 ÷ 36 ≈

    c. 71.6 ÷ 36 ≈

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3. Edward bikes the same route to and from school each day. After 28 school days, he bikes a total distance of 389.2 miles.

   a. Estimate how many miles he bikes in one day.

   b. If Edward continues his routine of biking to school, about how many days altogether will it take him to reach a total distance of 500 miles?

4. Xavier goes to the store with $40. He spends $38.60 on 13 bags of popcorn.

   a. About how much does one bag of popcorn cost?

   b. Does he have enough money for another bag? Use your estimate to explain your answer.

Name _____   Date _____

Estimate the quotients.

a. 1.64 ÷ 22 ≈

b. 123.8 ÷ 62 ≈

c. 6.15 ÷ 31 ≈

Name _____   Date _____

1. Estimate the quotients.

    a. $3.53 \div 51 \approx$

    b. $24.2 \div 42 \approx$

    c. $9.13 \div 23 \approx$

    d. $79.2 \div 39 \approx$

    e. $7.19 \div 58 \approx$

2. Estimate the quotient in (a). Use your estimated quotient to estimate (b) and (c).

    a. $9.13 \div 42 \approx$

    b. $913 \div 42 \approx$

    c. $91.3 \div 42 \approx$

3. Mrs. Huynh bought a bag of 3 dozen toy animals as party favors for her son's birthday party. The bag of toy animals cost $28.97. Estimate the price of each toy animal.

4. Carter drank 15.75 gallons of water in 4 weeks. He drank the same amount of water each day.

   a. Estimate how many gallons he drank in one day.

   b. Estimate how many gallons he drank in one week.

   c. About how many days altogether will it take him to drink 20 gallons?

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