

Lesson 9

MULTIPLY AND DIVIDE DECIMALS NY-6.NS.3

INTRODUCTION

Real-World Connection

Andre's grandmother asked him to buy 5.5 pounds of apples at the produce stand. Apples cost \$2.29 per pound. What will be the total cost of Andre's apples? Let's practice the skills in the **Guided Instruction** and **Independent Practice** and, at the end of the lesson, see how much the apples cost!

What I Am Going to Learn

- How to multiply and divide decimals using the standard algorithm
- How to solve problems involving multiplying and dividing decimals

What I May Already Know

- I know how to multiply and divide multi-digit whole numbers.
- I know how to multiply and divide decimals to hundredths.

Vocabulary in Action

To multiply decimals, multiply as if the numbers are whole numbers. Then, place the decimal point in the **product**.

- Place the decimal in the product by counting the number of decimal places in the **factors**. The product will have the same number of decimal places.

To divide decimals, divide as if both numbers are whole numbers. Then, place the decimal point in the **quotient**.

- If the **divisor** is a whole number, the decimal point in the quotient is in the same place as in the **dividend**. The decimal point in the quotient is directly above the decimal point in the dividend.
- If the divisor is a decimal number, the divisor and dividend are each multiplied by the same power of 10 so that the divisor becomes a whole number.

WORDS TO KNOW

product

factor

quotient

divisor

dividend



THINK ABOUT IT

The digits are the same for 54×73 and 5.4×7.3 . The only difference is place value. 54×73 is 100 times as much as 5.4×7.3 because each factor is 10 times as much.

THINK ABOUT IT

When both numbers are multiplied by 10, the quotient does not change. Just as $30 \div 6 = 5$, $300 \div 60 = 5$.

EXAMPLE

Find the product of 5.4 and 7.3.

Estimate: $5.4 \approx 5$, $7.3 \approx 7$, $5 \times 7 = 35$; Both numbers were rounded down, so the product should be a little more than 35.

You can either multiply as if the numbers were 54 and 73 or multiply with the decimals in place since the result will be the same.

$$\begin{array}{r} 54 \\ \times 73 \\ \hline 162 \\ + 3780 \\ \hline 3942 \end{array} \quad \text{or} \quad \begin{array}{r} 5.4 \\ \times 7.3 \\ \hline 162 \\ + 3780 \\ \hline 3942 \end{array}$$

Whether you multiply with or without decimals in place, there are 2 decimal places in the factors, one in each, so there will be 2 decimal places in the product: $3,942 \rightarrow 39.42$.

This result agrees with the estimate since 39.42 is a little more than 35.

The product of 5.4 and 7.3 is 39.42.

Dividing decimals is a related process.

EXAMPLE

Find the quotient of $779.1 \div 8.4$.

Estimate: $779.1 \approx 800$, $8.4 \approx 8$, $800 \div 8 = 100$.

So, the quotient should be a little less than 100.

Use long division to write the problem.

Multiply the divisor and dividend by 10 so 8.4 becomes 84 and 779.1 becomes 7,791.

Move the decimal point directly up into the quotient.

Now use whole-number long division.

$$\begin{array}{r} 92.75 \\ 84 \overline{)7791.00} \\ \underline{-756} \\ 231 \\ \underline{-168} \\ 630 \\ \underline{-588} \\ 420 \\ \underline{-420} \\ 0 \end{array}$$

The quotient is 92.75.

Notice that zeros are inserted after the dividend. This allows you to keep dividing, but does not change the quotient. The decimal 0.75 would have been the remainder in whole-number division of the "before a zero is brought down" 63 divided by the divisor 84. $\frac{63}{84} = \frac{3}{4} = 0.75$.

GUIDED INSTRUCTION

A rancher owns property that is 3.2 km long and 5.9 km wide. If the property is rectangular, how many square kilometers does she own?

1. Find the product: 3.2×5.9

Step One Estimate.

$$3.2 \approx 3, 5.9 \approx 6, 3 \times 6 = 18$$

3.2 was rounded down, so the product is a little more than 18.

Step Two Multiply 32 and 59.

$$32 \times 59 = 1,888$$

Step Three Place the decimal point in the product.

The estimate tells us that the decimal point goes after 18: 18.88.

There are 2 decimal places in the factors, so there are 2 in the product: 18.88.

32×59 is 100 times as much as 3.2×5.9 ;

1,888 is 100 times as much as 18.88.

Step Four Write the product.

$$3.2 \times 5.9 = \boxed{}$$



THINK ABOUT IT

When the divisor decreases, the quotient increases because there will be more groups.

$24.75 \div 11 = 2.25$, and 0.11 is 100 times less than 11, so the quotient of $24.75 \div 0.11$ is 225, which is 100 times as much as 2.25.

2. Find the quotient: $24.75 \div 0.11$

Step One Estimate.

$$0.11 \approx 0.1 \text{ and } 24.75 \approx 25$$

$$25 \div 1 = 25$$

$$25 \div 10 = \boxed{}$$

$$25 \div 100 = \boxed{}$$

Step Two Write the problem as long division.

$$0.11 \overline{)24.75}$$

Step Three Rewrite the divisor as a whole number.

Multiply the divisor and dividend by 100.

$$11 \overline{)2475.}$$

Step Four Move the decimal directly up into the quotient.

$$11 \overline{)2475.}$$

Step Five Use whole-number long division.

$$\begin{array}{r} 225. \\ 11 \overline{)2475.} \\ \underline{-22} \\ 27 \\ \underline{-22} \\ 55 \\ \underline{-55} \\ 0 \end{array}$$

Step Six Write the quotient.

The estimate shows that the quotient is reasonable.

$$24.75 \div 0.11 = \boxed{}$$

3. Which expression has either a product or a quotient of 20.54?

(A) 8.3×2.4

(B) 19.28×1.3

(C) $12.324 \div 0.6$

(D) $8.22 \div 0.5$



TIPS AND HINTS

Estimate first to eliminate any incorrect answer choices.

Learning Together

Work with a partner to answer this question. If you are working on a division problem and you multiply the divisor by 10 to change it to a whole number, but forget to multiply the dividend by 10 before you divide, how will your answer compare to the correct answer?



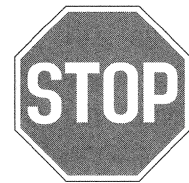
How Am I Doing?

What questions do you have?

How do you multiply and divide two decimal numbers?

What is an everyday example of multiplying or dividing decimal numbers?

Circle the sign that shows how you are doing with the skill.



I am stuck.



I almost have it.



I understand the skill.

INDEPENDENT PRACTICE 1

1 What is 31.71 divided by 7?

- A 0.0453
- B 4.53
- C 45.3
- D 453

2 Mariana spent \$166.50 on games played at a laser tag arena last year. If the laser tag arena charges \$4.50 per game, how many games did Mariana play at the arena last year?

- A 33
- B 35
- C 37
- D 39

3 A landscape designer is planning a garden for a customer. The customer wants the garden to be at least 4.67 square yards. The space that is available is 1.75 yards wide. Which is the minimum length, in yards, the garden must be to meet the customer's needs?

- A 2.67
- B 2.92
- C 6.42
- D 8.17

THINK ABOUT IT

Why don't you need to move the decimals before starting to divide?

SKETCH IT

If you are not sure whether to multiply or divide to find the total cost, draw a picture of what is happening in the problem.

TIPS AND HINTS

Remember that, in geometry, square yards indicate area.

- 4 The distance from Tampa, Florida to Boston, Massachusetts is 1,181 miles.

A plane has the flight details shown below.

FLIGHT 697	
Departing Tampa	8:10 p.m.
Arriving in Boston	11:16 p.m.

TIPS AND HINTS

Start with a quick estimate so you know what answer to expect.

Use the rounded numbers
3 hours and 1,200 miles.

To the nearest mile per hour, what is the average speed for this flight?

Show your work.

Answer _____ miles per hour



INDEPENDENT PRACTICE 2

1 Which solution can be used to solve the equation below?

$$7.25 \div 6.25 = \underline{\quad}$$

A 1.16

C 11.16

B 1.91

D 11.19

2 Which of these expressions has a product of 15.57?

A 29.1×0.47

B 29.1×4.7

C 17.3×0.9

D 17.9×0.09

3 Which equation is **not** correct?

A $31.59 \div 8.1 = 3.9$

B $67.1 \div 5.5 = 12.2$

C $48.9 \times 3.8 = 185.82$

D $80.2 \times 6 = 4,812$

4 Which expression has a product with a non-zero digit in the thousandths place?

A 0.15×1.2

B 12.7×2.9

C 0.84×3.1

D 6.9×5.0

5 Which of the following products will have three digits to the right of the decimal point?

- A 1.2×4.5
- B 6.32×1.37
- C 2.673×1.323
- D 3.4×1.26

6 Which of the following quotients is the greatest?

- A $30.75 \div 1.23$
- B $3.075 \div 12.3$
- C $0.3075 \div 0.123$
- D $307.5 \div 123$

7 The unit of currency in Thailand is the baht. One baht is worth \$0.02. The unit of currency in Morocco is the dirham. One dirham is worth \$0.11. How many more baht than dirhams will you get for every U.S. dollar?

- A 11
- B 39
- C 41
- D 59

- 8 Jon needs to multiply 5.96×4.013 . Before he multiplies, he wants to estimate the product so he can check that his answer is reasonable.

What would be a good whole-number estimate for the product?

Show your work.

Answer _____

Jon multiplies the numbers on his calculator but he forgets to include the decimal points. He gets 2,391,748. Where should the decimal point be placed in the number?

Answer _____

Explain your answer.

- 9 Is the multiplication problem below correctly solved?

$$\begin{array}{r} 19.5 \\ \times 3.6 \\ \hline 1170 \\ + 5850 \\ \hline 702.0 \end{array}$$

Explain your answer.

EXIT TICKET

NY-6.NS.3

Now that you have mastered multiplying and dividing with decimals, let's solve the problem in the **Real-World Connection**.

Andre's grandmother asked him to buy 5.5 pounds of apples at the produce stand. Apples cost \$2.29 per pound. What will be the cost of the apples? Find an estimate and the exact answer. Explain your work.