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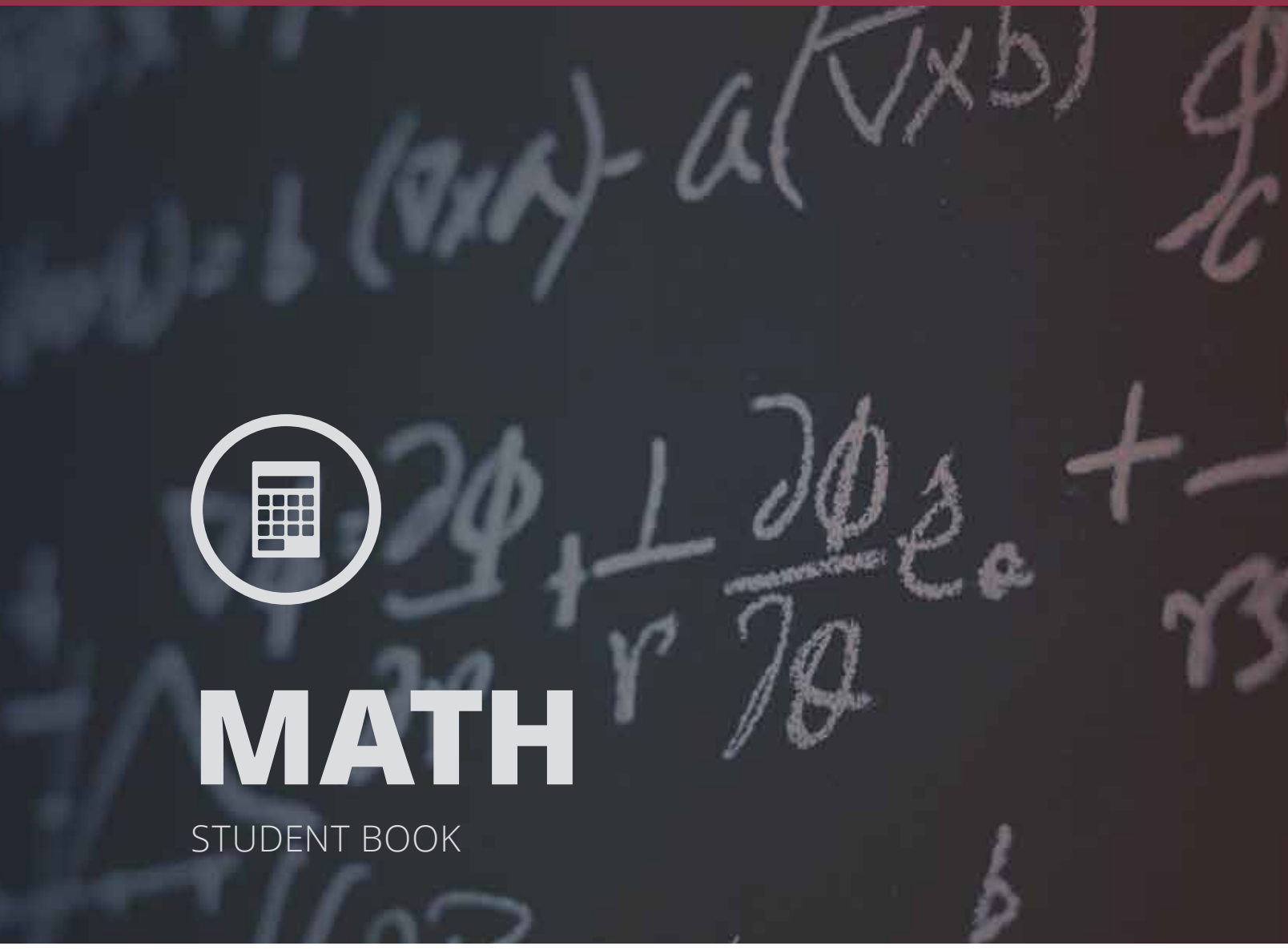


MATH

STUDENT BOOK

7th Grade | Unit 3

Alpha Omega
PUBLICATIONS

Math 703
Decimals

LIFEPAC Test is located in the center of the booklet. Please remove before starting the unit.

Author:
Glynlyon Staff

Editors:
Alan Christopherson, M.S.
Michelle Chittam

Westover Studios Design Team:
Phillip Pettet, Creative Lead
Teresa Davis, DTP Lead
Nick Castro
Andi Graham
Jerry Wingo

804 N. 2nd Ave. E.
Rock Rapids, IA 51246-1759

Decimals

Introduction

In this unit, students will work with decimal numbers. They will learn how place value can be used to compare, order, and round decimal numbers. In addition, students will use the rules for adding, subtracting, multiplying, and dividing decimals to estimate and solve problems. They will learn that fractions and decimals are different ways to write equivalent values and that scientific notation is a method for writing large numbers. Students will finish the unit by looking at the metric system and learning how to convert between metric units.

Objectives

Read these objectives. The objectives tell you what you will be able to do when you have successfully completed this LIFEPAC. When you have finished this LIFEPAC, you should be able to:

- Compare and order decimal numbers.
- Round and estimate decimal numbers.
- Add, subtract, multiply, and divide decimal numbers.
- Convert between decimal numbers and fractions.
- Solve application problems that contain decimal numbers and fractions.
- Write and interpret numbers in scientific notation.
- Convert between metric (SI) units.

Survey the LIFEPAC. Ask yourself some questions about this study and write your questions here.

1. Decimals and Their Operations

Comparing and Ordering Decimals

Have you ever been asked to put a list of words in alphabetical order? You can do a similar thing in math except that it's not called alphabetical order. In math, you learn to put groups of numbers in both *ascending order* and *descending order*. Can you guess what those terms mean? How about a little hint? Think of an airplane flight. Read on to learn what those terms mean and how they apply to math.

Objectives

- Identify the larger decimal in pairs or small groups of decimals.
- Put a group of decimals in ascending and descending order.

Vocabulary

ascending order—numbers going up in value

descending order—numbers going down in value

inequality—sentence showing a relationship between numbers or expressions that are not necessarily equal; uses the symbols >, <, or ≠

Recognizing Decimal Place Values

Decimals are a math concept that you work with each and every day. Every time you use money, you are using decimals. Think about what one dollar and fifty-seven cents looks like when written out using numbers. It looks like $1.57. Notice that a decimal is used to separate the dollars from the cents. This is because dollars are whole while cents are parts of a whole, or in this case part of a dollar.

What are the place values of the 5 and 7 in $1.57? Remember that it takes one hundred cents to equal a whole dollar. So fifty-seven cents is the same as fifty-seven hundredths of a dollar. The 5 is located in the tenths place, and the 7 is located in the hundredths place. Do you remember the other decimal place values that aren't used as often as tenths and hundredths?

Think about it! Remember that all numbers can be represented on a number line. Decimal numbers come between the whole numbers on the number line because the digits to the right of the decimal point represent part of the whole.

Note: Be careful when naming the decimal place values. Notice that they don't start with the ones like the whole number place values.

Take a look at some examples identifying decimal place values.

Example:

- What is the place value of the 3 in the number 0.15634?

Solution:

- The 1 is in the tenths place.
- The 5 is in the hundredths place.
- The 6 is in the thousandths place.
- The 3 is in the ten thousandths place.
- The 4 is in the hundred thousandths place.
- So the 3 is in the ten thousandths place.

Example:

- Which digit is in the thousandths place in the number 2.05738?

Solution:

- The 0 is in the tenths place.
- The 5 is in the hundredths place.
- The 7 is in the thousandths place.
- The 3 is in the ten thousandths place.
- The 8 is in the hundred thousandths place.
- So the 7 is in the thousandths place.

Comparing Decimals

Comparing two numbers is very similar to comparing the size of two objects. For example, suppose you are asked to compare the sizes of a basketball and a baseball. You could say that the basketball is bigger than the baseball. Or you could say that the baseball is smaller than the basketball. When comparing two decimal numbers, you can say that one number is larger or smaller in value than the other.

Instead of using words when you compare decimals, you will use symbols. More specifically, you will use the *inequality* symbols < (less than) and > (greater than). Sometimes, you may even have to use the equal sign because the two numbers being compared are actually equal to one another.

Take a closer look at comparing decimals. The steps for comparing decimal numbers are easy to remember and follow.

Example:

- Which is larger: 0.879 or 0.877?

Solution:

- The first step is to line up the decimal points:
  - 0.879
  - 0.877
- Compare each place value and notice that the first two numbers after the decimal are the same but the third number in is larger in the first number.
  - 0.879 > 0.877

Example:

- Which is larger: 9.087 or 9.0870?

Solution:

- The first step is to line up the decimal points:
  - 9.087
  - 9.0870

- Notice this time that the second number has an additional place value.
- It helps if the two numbers being compared are the same length. You can add zeroes after the last digit in the number without changing its value:
  - 9.0870
  - 9.0870
- At this point, you would usually compare each place value, but you can see that the numbers are identical, or equal, which you can indicate as follows:
  - 9.087 = 9.0870

Example:

- Which is larger: 7.193 or 7.139?

Solution:

- The first step is to line up the decimal points:
  - 7.193
  - 7.139
- Begin by comparing the whole number portion to the left of the decimal point. In this case, both numbers are 7, so you must keep going. If the whole number portion had not been equal, the number with the larger whole number would be the greater value.
- Look at the portion of each number to the right of the decimal point. The first number has 193 after the decimal, and the second number has 139 after the decimal. Compare these numbers digit by digit, beginning with the tenths place, until you either find a difference or reach the end of the numbers. In this case, both numbers have 1 in the tenths place, so look at the hundredths. The first number has 9 in the hundredths place and the second number has 3 in the hundredths place. The first number is greater than the second number. It does not matter that the second number has a greater value in the thousandths place because the first number has already been ruled the greater number based on the value of the hundredths place.
  - 7.193>7.139

You can also compare more than two numbers at a time using the same steps. This is a handy skill especially when you are asked to put numbers in a specified order. Now you're going to learn a little more about putting a group of numbers in order.

Ordering Decimals

You might be asked to put a group of numbers in either ascending or descending order. But what does that mean? Think about an airplane. When the plane takes off, it is ascending, or rising to its flying altitude, but when the plane is preparing to land, it is descending, or losing altitude.

You can also think about a flight of stairs. When you go up the stairs, you are ascending, but when you go down the stairs, you are descending. The terms mean the same things when applied to numbers. When you are asked to put numbers in ascending order, you will want to order them by increasing value, or from smallest to largest. If you are asked to put numbers in descending order, you will want to order them by decreasing value, or from largest to smallest.

Now that you know what those two terms mean, use the skills that you learned for comparing decimal numbers to order decimal numbers. Remember that in order to compare decimal numbers, you need to first line up the decimal points and then identify the first place value (from left to right) that differs. Once you identify where they differ, you can then compare those two numbers to determine which is larger. This will help you put them in the correct order. Take a look at a couple of examples.

Example:

- Put the following list of decimals in ascending order.
  - 25.6, 25.61, 25.67, 25.68, 25.72, 25.73, 25.76, 25.77

Solution:

- 25.6, 25.61, 25.67, 25.68, 25.72, 25.73, 25.76, 25.77

Example:

- Put the following list of decimals in descending order.
- 0.054, 0.164, 0.038, 0.07, 0.162, 0.099, 0.016

Solution:

- 0.164, 0.162, 0.099, 0.07, 0.054, 0.038, 0.016

Let's Review

Decimals are numbers that are located between the whole numbers on a number line. They are used a lot in everyday life, especially when dealing with money. It is important that you are able to work with them in ways other than adding, subtracting, multiplying, and dividing:

- Be sure you are able to identify the place values to the right of the decimal point.
- Make sure that you are able to compare decimals and put them in ascending and descending order.
- Remember that ascending order gets larger while descending order gets smaller.

Complete the following activities.

1.1 Which of the following numbers has the smallest value?

☐ 19.45 ☐ 19.445 ☐ 19.5 ☐ 19.454

1.2 Which number below does not have the same value as the other decimals?

☐ 23.040 ☐ 23.04000 ☐ 23.04001 ☐ 23.04

1.3 A librarian arranged some books on the shelf using the Dewey decimal system. Choose the group of book numbers that is listed in ascending order.

☐ 549.010, 549.101, 549.02, 549.3 ☐ 101.2, 101.04, 104.21, 110.0

☐ 392.4, 397.46, 399.53, 399.062 ☐ 834, 834.19, 834.2, 834.29

1.4 Which number sentence below is *not* correct?

☐ 24.154 < 24.15 ☐ 24.67 = 24.6700

☐ 23.07 < 23.072 ☐ 28.045 > 28.044

1.5 Which symbol makes the following number sentence correct?
4.567 _____ 4.576

☐ < ☐ > ☐ =

1.6 In the number 11.278, the 7 is located in the _____ place.

☐ ones ☐ hundredths

☐ tenths ☐ thousandths

1.7 In the number 0.02415, the 4 is located in the _____ place.

☐ tenths ☐ hundredths ☐ ten thousandths

☐ thousandths

1.8 Which number below has the largest value?

☐ 54.026 ☐ 54.029 ☐ 54.0229 ☐ 54.0269

1.9 The top five students in Mrs. Seller's class have the following GPAs.

Student	GPA
Emily	3.61
Stacy	3.76
David	3.67
John	3.89
Debbie	3.95

Who has the highest GPA?

- ☐ Stacy
- ☐ Emily
- ☐ David
- ☐ Debbie
- ☐ John

Arrange the numbers from smallest to largest.

1.10 3.148 1.483 4.831 8.314

1.11 5.2394 5.2943 5.2439 5.239

1.12 4.0819 4.089 4.081 4.819

1.13 9.0001 9.100 9.0100 9.0010

1.14 6.8267 6.2678 6.6782 6.7826

Rounding and Estimating Decimals

Imagine being asked to solve the following problem using mental math.

12.846 - 9.489

Just the thought of this might make you get a little nervous, but what if there was a way to make the problem easier?

This lesson will help you to understand more about *rounding* and *estimating*, which are both useful skills when using mental math. They are also good skills to have in real-world applications, such as when dealing with money.

Objectives

- Round decimals to specified place values.
- Apply rounding skills to help with estimating.

Vocabulary

estimation—an approximate value close to the actual value

rounding—a method of approximating a number

Rounding Decimal Numbers

A good example of everyday use of decimal numbers is money. Dollars represent whole amounts; cents represent fractional parts of one whole dollar. Since one hundred cents are in a dollar, three hundred and twenty-seven cents is written as $3.27. Ten dollars and fifty cents is written as $10.50.

Because we use decimals in our money system, it is crucial to understand not only how to use and work with decimals, but also how to make them more manageable. One way to make decimal numbers easier to work with is to round them. When rounding decimal numbers, follow these steps:

1. Look at the number to the right of the place you are rounding.
2. If that number is greater than or equal to 5, round the number to the left up.
3. If that number is less than 5, keep the number to the left the same.

Now take a look at an example of rounding with money.

Example:

- Casey and her friends meet up at a pizza restaurant after school. None of them really has that much money, so they decide to put their money together. After they order, Casey determines the amount each person should pay by using her calculator. The price each person should pay comes to $1.538. Everyone is confused about the amount. How much should each person pay? Casey explains that they just need to round the amount to the nearest hundredth.

Solution:

- Which number is in the hundredths place?
- 3
- Look to the right of 3 at the 8. Since 8 is more than 5, the 3 rounds up to 4.
- So $1.538 rounded to the nearest hundredth is $1.54.

Take a look at some more examples of rounding decimals. You will continue to use the same rules for rounding as previously explained.

Example:

- Round 23.802 to the nearest tenth.

Solution:

- Which number is in the tenths place?
- 8
- Look to the right of 8 at the 0. Since 0 is less than 5, the 8 doesn't change.
- So 23.802 rounded to the nearest tenth is 23.8.

Example:

- Round 126.80361 to the nearest thousandth.

Solution:

- Which number is in the thousandths place?
- 3
- Look to the right of 3 at the 6. Since 6 is greater than 5, the 3 rounds up to 4.
- So 126.80361 rounded to the nearest thousandth is 126.804

Example:

- Round 42.4847 to the nearest hundredth.

Solution:

- Which number is in the hundredths place?
- 8
- Look to the right of 8 at the 4. Since 4 is less than 5, the 8 doesn't change.
- So 42.4847 rounded to the nearest hundredth is 42.48.

Do not be tempted to round other place values first. Just because there is a 7 at the end of the number does not mean you should round the 4 to 5 before rounding the 8. Only look at the digit to the immediate right of the place value in question. All other digits do not affect the rounding.

Example:

- Round 77.11195 to the nearest ten thousandth.

Solution:

- Which number is in the ten thousandths place?
- 9
- Look at the number to the right of 9. It is 5, so the 9 rounds up to 10.

This might help! When a 9 is rounded to the nearest whole number, which is 10, the 9 becomes a zero and the digit in the previous place value rounds up. In this example, the 9 became a 0, and the 1 to its left rounded up to 2.

- So 77.11195 rounded to the nearest ten thousandth is 77.1120.

Now that you understand how to round a decimal number, take a look at how rounding skills can be applied to estimating.

Estimating with Decimals

An estimate is an inexact measurement or approximation. Estimates are not exact, or precise, answers, but they should be close to the exact answer. After arriving at an estimate, you may need to determine if it is appropriate or reasonable for the situation.

When estimating, it is important to know the rules of rounding. The situation for which the rounded number is being used should also be considered. It will help you make a good decision about which unit the number should be rounded to. Finally, in all real-world problems, you must consider what the problem is asking you and then use your experience to make a decision about the reasonableness of your answer. Take a look at a situation in which estimation will help you find an answer.

Keep in mind! In general, the smaller the unit that each value is rounded to, the more accurate the estimated value will be. For example, if two numbers are rounded to the nearest tenth, their estimated sum will be more accurate than if they are rounded to the nearest whole number.

Suppose you want to buy lunch from your school cafeteria. You order a chicken sandwich that costs $2.69, fries for $1.49, an apple for $0.45, and milk for $0.69. About how much money do you need to buy your food?

There are different strategies that can be used to estimate the cost of this meal. Take a look at the different strategies.

1. Round each number to the nearest whole dollar:
   - The amount $2.69 rounded to the nearest whole dollar is $3.00.
   - The amount $1.49 rounded to the nearest whole dollar is $1.00.
   - The amount $0.45 rounded to the nearest whole dollar is $0.00.
   - The amount $0.69 rounded to the nearest whole dollar is $1.00.
   - $3 + $1 + $0 + $1 = $5
2. Round each number to the nearest tenth:
   - The amount $2.69 rounded to the nearest tenth is $2.70.
   - The amount $1.49 rounded to the nearest tenth is $1.50.
   - The amount $0.45 rounded to the nearest tenth is $0.50.
   - The amount $0.69 rounded to the nearest tenth is $0.70.

This might help! One way to make adding the rounded numbers easier is to look for groups of numbers that add up to a dollar. For example, $1.50 and $0.50 have a sum of $2.00. Then $2.70 and $0.70 can be added to get $3.40. So the total sum is $2.00 + $3.40, or $5.40.

   - $2.70 + $1.50 + $0.50 + $0.70 = $5.40

When estimating with money, you should probably use the larger estimate. If something costs a little more than you thought it would, wouldn't you rather have too much money than not enough? The exact amount of money needed to buy the food is $5.32. So in this example, $5.40 is a better estimate than $5.00.

As you can see, rounding is a key part of estimating. Once you understand the best way to round the numbers, estimating is easy!

Let's Review

Before moving on to the practice problems, be sure you are able to do each of the following:

- Round decimal numbers to various decimal places.
- Estimate an answer through rounding.

Complete the following activities.

1.15 Which of the following is a reasonable estimated answer to the following problem?
989,867 ÷ 999

☐ 10 ☐ 100 ☐ 1,000 ☐ 10,000

1.16 The exact answer and the estimated answer will always be the same.

○ True
○ False

1.17 Round 3,989.23655 to the nearest thousandth.

☐ 3,989.236 ☐ 3,989.237 ☐ 3,989.240 ☐ 4,000

1.18 Round 111.11111 to the nearest ten thousandth.

☐ 111.11 ☐ 111.111 ☐ 111.1111 ☐ 111.11111

1.19 Round 259.98991 to the nearest hundredth.

☐ 259.99 ☐ 259.990 ☐ 259.9899 ☐ 260.00001

1.20 Andrea's family stopped at the gas station to get gas. At gas stations, the price of gas per gallon is given to the nearest thousandth. In order to determine how much money he would need to pay for the gas, Andrea's dad asked her to round the price of gas per gallon to the nearest hundredth. The gas price per gallon rounded to the nearest hundredth was $2.50. Which of the following prices could have been the original gas price?

☐ $2.493 ☐ $2.498 ☐ $2.505 ☐ $2.509

1.21 Ricardo's family is on vacation. The first day they drove 348.9 miles. The second day they drove 527.2 miles. The third day they drove 221.7 miles. About how far did Ricardo's family drive on their vacation?

☐ 1,000 miles ☐ 1,050 miles ☐ 1,100 miles ☐ 1,200 miles

1.22 Brian decided to start a dog-walking service. He's going to charge each dog owner $4.50 to walk one dog and $6.75 to walk two dogs. Approximately how much will he earn if he walks 13 single dogs and 9 sets of two dogs?

☐ $55.00 ☐ $75.00 ☐ $100.00 ☐ $128.00

1.23 If each number is rounded to the nearest hundred, which statement is true?

$A = 196.3 + 238.89 + 384.92$ $B = 329.11 + 288.06 + 106.4$

☐ $A = B$ ☐ $A < B$ ☐ $A > B$

1.24 If each number is rounded to the nearest whole number, which statement is true?

$A = 6.9 + 8.3$ $B = 6.2 + 8.5$

☐ $A = B$ ☐ $A < B$ ☐ $A > B$

1.25 Round 941.3849 to the nearest thousandth.

1.26 Round 1532.6994 to the nearest hundredth.

1.27 Round 52.694509 to the nearest ten thousandth.

1.28 Round 914.657 to the nearest tenth.

1.29 Round 619.99999 to the nearest ten thousandth.

Adding and Subtracting Decimals

Have you ever wanted to ask your teacher, "When am I ever going to use this math?" In math, it's often hard to see how you might use a new skill outside of the classroom. This lesson is one of the few in which it is easy to determine how it applies outside of class. This lesson reviews how to add and subtract decimals. You use decimals every time you spend money, so knowing how to add and subtract them is extremely useful.

Objectives

- Add and subtract decimals.

Vocabulary

difference—the result or answer to a subtraction problem

sum—the result or answer to an addition problem

Adding Decimals

Knowing how to add decimals is a key skill, especially in the United States because our money system relies heavily on the use of decimals. Almost every time you go to the store and purchase more than one item, you need to know how to add decimals.

Adding decimals is similar to adding whole numbers but with one important difference. When you add decimals, make sure you line up the decimal points in each number being added. It is very easy to forget this step, so be careful not to skip it! Here are the steps for adding decimal numbers:

1. Line up the decimal points.
2. Add zeroes to the end of any number that is shorter than the other numbers.
3. Add from right to left.
4. Bring the decimal point straight down in the *sum*.

Now take a look at some examples of adding decimals.

Example:

- Add 13.01 + 4.427.

Solution:

- Set up your addition problem vertically lining up the decimal points. Add zeros after the decimal point to make the numbers of equal length. Like any addition problem, work from right to left to add the numbers in each place. The final step is to bring the decimal straight down.

$$\begin{array}{r} 13.010 \\ +\ 4.427 \\ \hline 17.437 \end{array}$$

You may also be asked to add more than two addends at the same time. Even though there are more numbers being added, the rules don't change. Take a look at a few examples.

Example:

- Tamika bought a CD for $12.96, a shirt for $14.99, and a pair of flip-flops for $4.50. How much money did she spend at the store?

Solution:

- First, identify the dollar amounts that need to be added:

  $12.96, $14.99, and $4.50

- Next, set up your addition problem vertically, lining up the decimal points:

$$\begin{array}{r} 12.96 \\ 14.99 \\ +\ \ 4.50 \\ \hline \end{array}$$

- Last, add from right to left and bring the decimal point straight down:

$$\begin{array}{r} {\scriptstyle 12\ 1} \\ 12.96 \\ 14.99 \\ +\ \ 4.50 \\ \hline 32.45 \end{array}$$

- Tamika spent $32.45 at the store.

Example:

- What is the sum of 5.06 + 11.189 + 7.4005?

Solution:

- Line up the decimal points and add from right to left:

$$\begin{array}{r} 5.0600 \\ 11.1890 \\ +\ 7.4005 \\ \hline 23.6495 \end{array}$$

- The sum of 5.06, 11.189, and 7.4005 is 23.6495.

It doesn't matter if you are adding two, four, or a hundred numbers; the only rule you have to remember is to line up the decimal points before you start adding.

Now take a look at subtracting decimals.

Subtracting Decimals

You subtract decimal numbers the same way you add them. Here are the steps:

1. Line up the decimal points.
2. Add zeroes to the end of a number if it is shorter than the other number.
3. Subtract from right to left.
4. Bring the decimal point straight down in the *difference*.

Example:

- Subtract 8.36 - 2.18.

Solution:

- Line up the numbers vertically and subtract from right to left.

$$\begin{array}{r} {\scriptstyle 2\ 1} \\ 8.36 \\ -\ 2.18 \\ \hline 6.18 \end{array}$$

Example:

- Subtract 19.895 - 8.231.

Solution:

- Line up the decimal points and subtract from right to left:

$$\begin{array}{r} 19.895 \\ -\ \ 8.231 \\ \hline 11.664 \end{array}$$

- The difference of 19.895 and 8.231 is 11.664.

Example:

- Subtract 24.88 - 9.518.

Solution:

```
 24.88
- 9.518
```
Line up the decimals.

```
 24.880
- 9.518
```
Add zeroes to make numbers the same length.

```
 1 14  7 10
 24.880
- 9.518
 15.362
```
Subtract from right to left.

- The difference of 24.88 and 9.518 is 15.362.

Example:

- Travis bought a giant candy bar for $1.57 including tax, If he paid the cashier $5, how much change should he receive?

Solution:

- Line up the decimal points and subtract from right to left: Add zeros to fill in the cents.

$$\begin{array}{r} \$5.00 \\ -1.57 \\ \hline \$3.43 \end{array}$$

- Travis should receive $3.43 back from the cashier.

Let's Review

Before moving on to the practice problems, be sure that you can do each of the following:

- Add decimal numbers.
- Subtract decimal numbers.

Complete the following activities.

1.30 Timmy put $0.82 in his piggy bank on Monday, $0.70 on Tuesday, and $0.25 on Wednesday. What is the total amount he put in his piggy bank?

☐ $0.98 ☐ $1.14 ☐ $1.57 ☐ $1.77

1.31 A coat costs $35.72. The tax is $2.41. What's the total cost?

☐ $2.41 ☐ $35.72 ☐ $33.31 ☐ $38.13

1.32 Add 26.2 + 0.07 + 21.

☐ 29.0 ☐ 47.27 ☐ 26.48 ☐ 54.2

1.33 Add 5.46 + 21.3 + 0.02. What number is in the hundredths place in the sum?

☐ 1 ☐ 2 ☐ 7 ☐ 8

1.34 Jose and Alexia were lab partners in science class. They needed to weigh three samples of rock to the nearest thousandth. The first sample weighed 3.346 grams, the second weighed 2.479 grams, and the third weighed 9.240 grams. How much did the samples weigh altogether?

☐ 15.065 g ☐ 11.719 g ☐ 5.825 g ☐ 0.069 g

1.35 Subtract 0.64 - 0.38.

☐ 0.26 ☐ 1.00 ☐ 1.02 ☐ 1.26

1.36 Subtract 0.6 - 0.23.

☐ 0.27 ☐ 0.17 ☐ 0.37 ☐ 0.07

1.37 Subtract 0.58 - 0.21. What is the place value of the 7 in the difference?

☐ ones ☐ tens ☐ tenths ☐ hundredths

1.38 Eighty-three and seventy-four hundredths minus sixty-one and ninety-seven hundredths equals _____.

☐ 22.23 ☐ 21.77 ☐ 21.23 ☐ 22.78

1.39 A jeweler needed two diamonds of exactly the same weight to make a ring. The first stone she selected weighed 0.642 carat, the second weighed 0.599 carat, and the third weighed 0.625 carat. By how much did the heaviest stone outweigh the lightest?

☐ 0.043 carat ☐ 0.042 carat ☐ 0.041 carat ☐ 0.04 carat

1.40 The floor at a roller skating rink is 72.25 feet long and 51.5 feet wide. How much longer is the rink than it is wide?

☐ 671.0 ft ☐ 67.10 ft ☐ 21.25 ft ☐ 20.75 ft

1.41 Nate and SuLee were practicing the long jump during track practice. Nate jumped 10.25 feet. SuLee jumped 12.75 feet. How much farther did SuLee jump than Nate?

☐ 2.5 ft ☐ 25.5 ft ☐ 23 ft ☐ 22.1 ft

1.42 $32.14 + 17.43 =$

1.43 $143.849 + 62.37 =$

1.44 $6.9724 + 32.577 =$

1.45 $942.627 - 62.411 =$

1.46 $250.18 - 36.427 =$

Multiplying and Dividing Decimals

In this lesson, you'll be learning how to multiply and divide with decimal numbers. Make sure you know the vocabulary terms.

Objectives

- Calculate the product of two decimal numbers.
- Calculate the product of a whole number and a decimal number.
- Calculate the quotient of two decimal numbers.
- Divide decimal numbers by powers of ten.

Vocabulary

dividend—the number being divided
divisor—the number divided by
factor—a number to be multiplied
product—the result or answer to a multiplication problem
quotient—the result or answer to a division problem

Multiplying Decimals and Whole Numbers

The process for multiplying decimals and whole numbers is almost the same as the process for multiplying two whole numbers, but there's one extra step. The last step is to count up the total number of digits to the right of the decimal point in the decimal number and have that same number of digits after the decimal point in the *product*.

Example:

- Find the product of 36.23 and 16.

Solution:

$$\begin{array}{r} 36.23 \\ \times \quad 16 \\ \hline 21738 \\ +36230 \\ \hline 579.68 \end{array}$$

Make note! The zero (in red) is optional; it is simply used as a place holder.

- Notice that there are two digits to the right of the decimal point in 36.23. In the product, the decimal point is placed so that there are the same number of digits to the right of the decimal point: 579.68.

Example:

- What is the product of 10.321 and 151?

Solution:

$$\begin{array}{r} 10.321 \\ \times \quad 151 \\ \hline 10321 \\ 516050 \\ +1032100 \\ \hline 1558.471 \end{array}$$

- Notice that there are three digits to the right of the decimal point in 10.321. In the product, the decimal point is placed so that there are the same number of digits to the right of the decimal point: 1,558.471.

Because of the way the decimal system is designed, multiplying any number by a power of ten can be done without following all the steps previously shown. It can be done using mental math (without pencil or paper).

To multiply a number by a power of ten, move the decimal point to the right as many places as there are zeros in the power of 10:

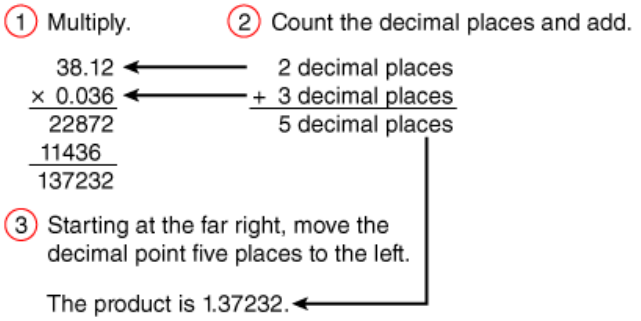
- 742.0413 · 10 = 7,420.413 (one zero—move one place to the right)
- 742.0413 · 100 = 74,204.13 (two zeros—move two places to the right)
- 742.0413 · 10,000 = 7,420,413 (four zeros—move four places to the right)

Sometimes you have to add zeros to have enough decimal places:

- 742.0413 · 100,000 = 74,204,130 (five zeros—move five places to the right by adding one zero)

Multiplying Decimals

To multiply two decimal numbers, carry out all the steps of multiplication that you did for whole numbers. Then count the number of places after the decimal points in both *factors*, add them, and count off that many decimal places in the product, starting from the right.



Example:

- Find the product of 25.25 and 0.15.

Solution:

```
  25.25   ← 2 digits to the right of the decimal point
× 0.15    ← 2 digits to the right of the decimal point
  12625
   2525
0000
  3.7875  ← Starting at the far right, move the decimal point
            4 places to the left.
```

Example:

- What is the product of 1.0252 and 1.2?

Solution:

```
  1.0252  ← 4 digits to the right of the decimal point
×   1.2   ← 1 digit to the right of the decimal point
  20504
 10252
1.23024   ← Starting at the far right, move the decimal point
            5 places to the left.
```

Dividing Decimals

Division problems containing decimal numbers are one reason to be grateful for calculators! However, you won't always have a calculator handy when you need one. This lesson will walk you through the process of dividing decimal numbers using long division.

If the *divisor* is not a whole number, change it to a whole number by multiplying the divisor by some power of ten. Then multiply the *dividend* by that same power of ten. Multiplying by a power of ten allows you to

move the decimal point to the right in both the dividend and divisor. Then the *quotient* has as many decimal places as the dividend does.

Take a look at an example. Divide 6.4 by 0.04:

$$0.04\overline{)6.4}$$

In this example, there are two places to the right of the decimal point in the divisor. So multiply both the dividend and the divisor by 100 (or move the decimal point two places to the right) in order to make the divisor a whole number. The divisor becomes 4 and the dividend becomes 640. Notice that a zero was added to the end of the dividend so that the decimal point could be moved the appropriate number of places:

Vocabulary! Remember that the dividend is the number being divided and the divisor is the number you're dividing by. So 6.4 is the dividend and 0.04 is the divisor.

$$0.04\overline{)6.40}$$

Now divide as usual. The dividend doesn't have any decimal places, so the quotient won't have any decimal places either:

- 640 ÷ 4 = 160

If the divisor doesn't divide into the dividend evenly, add zeroes to the right of the last digit in the dividend and keep dividing until it comes out evenly or a repeating pattern shows up. If there is no decimal point in the dividend, put one at the end of the number and then add zeroes to the right of it. The decimal point in the quotient should be directly above the decimal point in the dividend.

Example:

- Divide 47.382 by 0.14. Round the quotient to the nearest hundredth.

Solution:

- You want to divide by a whole number. So multiply 0.14 by 100 to get 14. Then multiply 47.382 by 100 to get 4,738.2. Now you can divide:

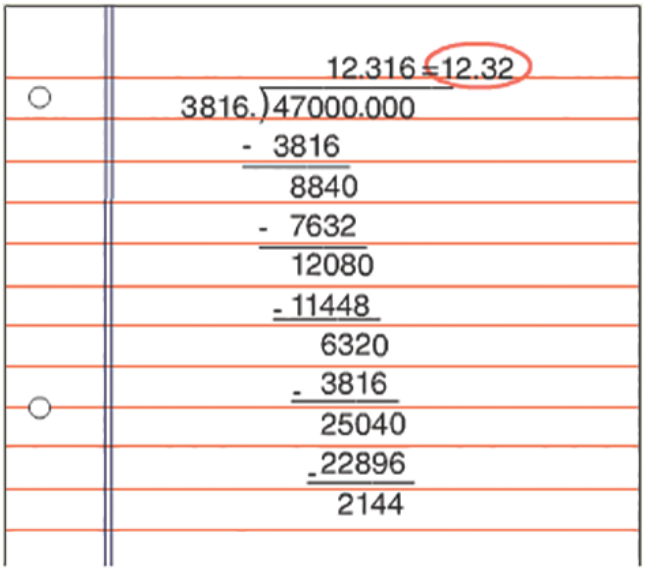
$$\begin{array}{r} 338.442 = 338.44 \\ 14\overline{)4738.200} \\ \underline{42} \\ 53 \\ \underline{42} \\ 118 \\ \underline{112} \\ 62 \\ \underline{56} \\ 60 \\ \underline{56} \\ 40 \\ \underline{28} \\ 12 \end{array}$$

- Notice the divisor doesn't divide into the dividend evenly, so zeroes were added to the right of the last digit in the dividend. You can carry out the division to as many places as you like by adding zeros to the end of the dividend. Always carry the division out one more place than you wish to round to so that you know whether to round up or down. The decimal point in the result should be directly above the decimal point in the dividend.

Example:

- Divide 47 by 3.816. Round the quotient to the nearest hundredth.

Solution:



Dividing by Powers of 10

Because of the way the decimal number system is designed, multiplying any number by a power of ten can be done using mental math.

Think about it! Multiplication and division are inverse (or opposite) operations. So it makes sense that the decimal point moves in opposite directions for the two operations. When multiplying by powers of ten, move the decimal point to the right. When dividing by powers of ten, move the decimal point to the left.

Division by powers of ten is just as easy as multiplication, but with division, you move the decimal point to the left as many places as there are zeros in the power of ten:

- 421.3 ÷ 10 = 42.13 (one zero—move one place to left)
- 421.3 ÷ 100 = 4.213 (two zeros—move two places to the left)
- 421.3 ÷ 1,000 = 0.4213 (three zeros—move three places to the left)

You may have to add zeros to be able to move the decimal point the correct number of places.

Example:

$$421.3 \div 10{,}000 =$$

Solution:

- $421.3 \div 10{,}000 = 0.04213$ (four zeros – move four places to the left) Notice that an additional zero was added to the left of the original numbers before the decimal point to allow the decimal to move four places to the left.

Let's Review

Before moving on to the practice problems, be sure that you can do each of the following:

- Multiply and divide decimal numbers by powers of ten.
- Multiply decimal and whole numbers.
- Multiply decimal numbers.
- Divide decimal numbers.

Complete the following activities.

1.47 Multiply. 6.421 · 10 = _____

- ☐ 0.6421
- ☐ 64.21
- ☐ 642.10
- ☐ 6,421

1.48 Multiply. 0.0483 · 100 = _____

- ☐ 0.000483
- ☐ 0.483
- ☐ 4.83
- ☐ 48.300

1.49 While doing a math problem in class, Jared's answer was different from his teacher's. So she had him come up and work the problem on the board. Here's Jared's work.

$$\begin{array}{r} 36.47 \\ \times\ \ 12 \\ \hline 7294 \\ +\ 3647 \\ \hline 109.41 \end{array}$$

What was his mistake?

- ☐ He multiplied incorrectly.
- ☐ He left out the place holder under the 4.
- ☐ There are not enough numbers after the decimal.
- ☐ The sum of 7,294 and 3,647 is incorrect.

1.50 Tina missed this problem on her test. What was her mistake?

$$\begin{array}{r} 9012.2 \\ \times\ \ \ 15 \\ \hline 450610\ \textbf{(A)} \\ +\ 901220\ \textbf{(B)} \\ \hline 1,351.830\ \textbf{(C)} \end{array}$$

- ☐ The multiplication is wrong in part A.
- ☐ The multiplication is wrong in part B.
- ☐ The place holder was left out in part B.
- ☐ The decimal was moved too many places in part C.

1.51 Multiply. 1.4 · 0.32 = _____

- ☐ 0.448
- ☐ 0.0448
- ☐ 4.480
- ☐ 44.80

1.52 The product of 23.4556 and 6.66 rounded to the nearest ten is 156.

- ○ True
- ○ False

1.53 In a multiplication problem, if the first factor has 5 digits after the decimal and the second factor has 4 digits after the decimal, then the product will have _____ digits after the decimal.

☐ 1 ☐ 4 ☐ 5 ☐ 9

1.54 Divide. 27.6 ÷ 100 = _____

☐ 0.276 ☐ 2.76 ☐ 276 ☐ 2,760

1.55 Divide. 495 ÷ 10,000 = _____

☐ 0.00495 ☐ 0.0495 ☐ 0.4950 ☐ 4.950

1.56 Divide 8.931 ÷ 0.46. Round the quotient to the nearest hundredth.

☐ 1.94 ☐ 14.92 ☐ 19.24 ☐ 19.42

1.57 Divide 63.5 ÷ 0.25. Round the quotient to the nearest ten-thousandth.

☐ 0.0039 ☐ 0.3900 ☐ 2.0540 ☐ 254

1.58 Multiply. $65.4796 \cdot 100 =$

1.59 Divide. $185.77 \div 10 =$

1.60 Multiply. $6.8 \times 1.4 =$

1.61 Multiply. $54.21 \times 0.06 =$

1.62 Divide. $4.08 \div 3.4 =$

Review the material in this section in preparation for the Self Test. The Self Test will check your mastery of this particular section. The items missed on this Self Test will indicate specific areas where restudy is needed for mastery.

Self Test 1: Decimals and Their Operations

Complete the following activities (5 points, each numbered activity).

1.01 You do not need to line up the decimal points when subtracting two decimal numbers.

- ○ True
- ○ False

1.02 Which list of decimal numbers is in ascending order?

- ☐ 0.13, 0.31, 0.04, 0.5
- ☐ 12.252, 12.26, 12.387, 12.4
- ☐ 1.411, 1.2, 1.056, 1.007
- ☐ 6.009, 6.015, 6.241, 6.2

1.03 Multiply. Do not round your answer. Be sure to include a decimal point in your answer. $1.7 \cdot 11.59 =$

1.04 Which of the following would you round and estimate to a sum of 11?

- ☐ 3.41 + 8.051
- ☐ 4.25 + 8.103
- ☐ 3.65 + 7.992
- ☐ 4.89 + 7.431

1.05 Which statement about $1.23 \div 0.15$ is true?

- ☐ The dividend should become 15.
- ☐ The quotient does not have a hundredths place.
- ☐ The divisor is a whole number.

1.06 1.320 ____ 1.302

- ☐ =
- ☐ <
- ☐ >

1.07 Round 604.2978 to the hundredths place.

- ☐ 604
- ☐ 604.30
- ☐ 604.29
- ☐ 600

1.08 Terrance is planning to make an online purchase. He is buying a tie for $13.42, a shirt for $25.76, and a pair of pants for $19.80. What will be his total before tax?

- ☐ $57.98
- ☐ $47.98
- ☐ $41.16
- ☐ $58.98

1.09 Divide. 3.451 ÷ 1.7 = _____

☐ 203 ☐ 20.3 ☐ 2.03 ☐ 0.203

1.010 Jenna had $180.47 in her checking account. She bought groceries for $75.11 and gas for $29.64. How far below $100 is her checking account now?

☐ $24.28 ☐ $75.72 ☐ $80.47 ☐ $4.74

1.011 When comparing two decimal numbers, you should always line up the decimals and then compare the digits from left to right.

○ True
○ False

1.012 Round 15.6895 to the nearest tenth.

☐ 15.7 ☐ 15.6 ☐ 15.68 ☐ 15.69

1.013 Multiply. 16.3 · 1.18 = _____

☐ 1,923.4 ☐ 192.34 ☐ 19.234 ☐ 1.9234

1.014 Use rounding to estimate the difference of 18.14 - 9.88.

☐ 6 ☐ 9 ☐ 7 ☐ 8

1.015 The school hiking club has completed 4 out of 5 hikes so far this year. They have hiked 4.6 miles, 3.7 miles, 5.1 miles, and 2.9 miles. If their goal is to hike 20 total miles, how many miles does the last hike need to be?

☐ 4.7 miles ☐ 3.7 miles ☐ 2.7 miles ☐ 1.7 miles

1.016 Round 1342.5414 to the nearest thousandth.

1.017 Add. $561.48 + 99.6 =$

1.018 Subtract. $912.3 - 44.87 =$

1.019 Multiply. $35.7 \times 4.86 =$

1.020 Divide. $9.315 \div 3.45 =$

80/100 **SCORE** _____ **TEACHER** _____ _____
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