



MATH

STUDENT BOOK

▶ **6th Grade | Unit 3**

MATH 603

Decimals

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Decimals

Introduction

In this unit, we will explore decimal numbers. We will learn about place value and how it is used to read, write, compare, round, and estimate with decimal numbers. We will also add, subtract, multiply, and divide by decimal numbers in order to solve problems. Finally, we will study the metric system, which like the decimal system, is based on the number ten. We will learn about measuring length, mass, and capacity, in the metric system. We will also multiply and divide by powers of ten in order to convert metric units.

Objectives

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

- Identify the place value of decimal numbers.
- Read and write decimal numbers.
- Order, compare, round, and estimate with decimal numbers.
- Add and subtract decimal numbers.
- Multiply and divide by decimal numbers.
- Multiply and divide decimal numbers by powers of ten.
- Understand the metric system and how to convert metric units.

1. DECIMAL NUMBERS

Do you remember what place value is? It's the position of each digit in a number, and it tells how much each digit is worth.

Objectives

Review these objectives. When you have completed this section, you should be able to:

- Identify place value for decimal numbers.
- Read and write decimal numbers.
- Compare and order decimal numbers.
- Round decimal numbers using place value.
- Estimate with decimal numbers using different types of estimation.
- Add and subtract decimal numbers.

Vocabulary

clustering. Method of estimation where you determine what number your values are close to, and then use that number to solve your problem.

decimal fraction. A fraction in which the denominator is 10 or a power of 10.

decimal point. A period separating the whole number and fractional parts of a number.

fraction. A number that expresses a portion of a whole.

front-end. Estimation where only the digits of the largest place value are added or subtracted.

inequality. Statement showing a relationship between numbers that are not necessarily equal; uses the symbols $>$, $<$, or \geq .

number line. A line that graphically represents all numbers.

place value. The position of a digit in a number, which determines its value.

Note: All vocabulary words in this LIFEPAC appear in **boldface** print the first time they are used. If you are not sure of the meaning when you are reading, study the definitions given.

DECIMALS AND PLACE VALUE

The position of each digit in a number tells us how much that digit is worth. For example, in the number 29,071, the 2 is in the ten thousands place. So, there are 2 ten thousands, or twenty thousand. Take a look at the value of each digit.

29,071

2 ten thousands: $2 \times 10,000 = 20,000$

9 thousands: $9 \times 1,000 = 9,000$

0 hundreds: $0 \times 100 = 0$

7 tens: $7 \times 10 = 70$

1 ones: $1 \times 1 = 1$

The number 29,071 is called a whole number because the smallest place value in which it has a digit is the ones place. However, in our world, the numbers we deal with are rarely whole numbers! We have cents to represent numbers that are less than a whole dollar. Measurements are often less than a whole amount, too. For example, in baking, you may need less than a whole cup of an ingredient. Or, in baseball, a player's batting average is always less than 1.

Did you know?

Did you notice that there were zero hundreds? Even though there were no hundreds in the number, we can't just leave the place blank. We have to put a zero in to hold that position. Zero acts as a placeholder.

Let's look at the number line below to see how these numbers that are less than a whole can be represented. Remember that a number line is a graph that represents all numbers, even numbers that are smaller than a whole!

Fractions come between the whole numbers on a number line, and have two parts: the numerator, or the top number, and the denominator, or the bottom number. The numerator tells how many parts we have, and the denominator tells how many total parts there are.

Let's divide the area between 0 and 1 into 10 parts. Now, we can put a point on one of these places. Let's find the fraction that represents this point. Since the space between 0 and 1 is divided into 10 total parts, the denominator of this fraction is 10. To find the numerator, count how many places it is from 0 to our point.

$$\frac{\text{numerator}}{\text{denominator}} = \frac{4}{10} = 0.4$$

This point represents the fraction four-tenths. Four-tenths is called a *decimal fraction* because it has a power of 10 in the denominator. Decimal fractions can be written short hand as decimal numbers using a decimal point.



So, to represent amounts that are part of a whole, we use fractions. The top number, or the numerator, in a fraction tells how many parts we have, and the bottom number, or the denominator, tells how many total parts are in the whole. For example, the fraction $\frac{4}{10}$ tells us that we have four of ten parts. Fractions that have a denominator of ten or a power of ten (like 10, 100, or 1,000) are called decimal fractions. That's because they can be written shorthand as decimal numbers, using a decimal point. The digits to the left of the decimal point represent the whole number part of the number. The digits to the right of the decimal point represent the fraction part of a number.

This might help!

Decimal fractions can be written shorthand because they have a denominator that is a power of ten and our decimal system is based on the number ten. In fact, the prefix "deci-" means ten.

Notice in the chart that the places to the right of the decimal point all end in *-ths*. For example, the hundreds place is to the left of the decimal point. But, the hundredths place is to the right of the point. The tens place is to the left of the decimal point. And, the tenths place is to the right. Also, notice that there is *no* "oneths" place. The first place value to the right of the decimal point is the tenths.

Whole numbers						Fractions (decimals)			
Thousands			Units			Fractions (decimals)			
hundreds	tens	ones	hundreds	tens	ones	tenths	hundredths	thousandths	
100,000	10,000	1,000	100	10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	

↓
decimal point

Example:

Which digit is in the hundredths place? **0.861**

Solution:

The hundredths place is the second place to the right of the decimal. So, the 6 is in the hundredths place. There are six-hundredths.

Key point!

In this decimal number, there is no whole number part. So, we write a zero to the left of the decimal point. This decimal number is between 0 and 1 on the number line.

Example:

What place is the 0 in? **7.08**

Solution:

The zero is in the first place to the right of the decimal point, or the tenths place. That means that there are no tenths.

DECIMAL FRACTIONS

Earlier in the lesson, we saw that decimal fractions can be written shorthand as decimal numbers. Let's practice doing that. It's important to remember that rewriting a number in a different form doesn't change the value of the number.

Example:

Rewrite the following decimal fractions as decimal numbers.

$$15 \frac{72}{100} \quad 125 \frac{1}{10} \quad 8 \frac{55}{1000}$$

Solution:

The decimal point goes between the whole number part and the fraction part of the number. The denominator of each fraction (bottom number) tells us how many places out the digits should go. With tenths, we go out one place; with hundredths, two places; and with thousandths, three places. Notice in the thousandths example that we'll have to use zero as a placeholder.

$$15 \frac{72}{100} \text{ is the same as } 15.72.$$

$$125 \frac{1}{10} \text{ is the same as } 125.1$$

$$8 \frac{55}{1000} \text{ is the same as } 8.055.$$

Key point!

In the thousandths example, we used zero as a placeholder. We had to write the zero in the tenths place because if we didn't it would have changed the number. For example, 8.55 would be $\frac{55}{100}$, not $\frac{55}{1000}$. And, 8.550 would be $\frac{550}{1000}$, not $\frac{55}{1000}$.

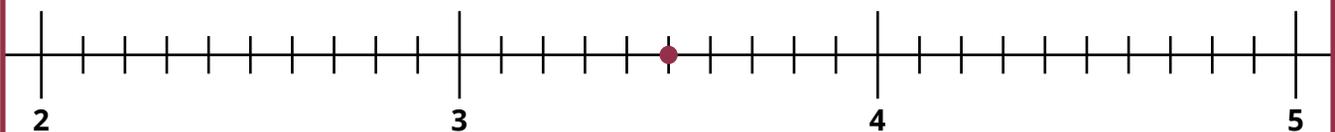
Example:

Represent the following decimal number on a number line.

3.5

Solution:

The decimal number 3.5 represents the number three and five-tenths. It can also be written as the fraction $3 \frac{5}{10}$. It comes between 3 and 4 on the number line because it is a little more than 3, but less than 4.



Reading and writing decimal numbers is very similar to reading and writing whole numbers. In fact, the whole number part of a decimal number is written and read in the same way. Then, the decimal point is written and read as

"and." Finally, the decimal part of the number (digits to the right of the decimal point) is written and read as a fraction. Take a look at some examples.

Example:

15.72 → "Fifteen and seventy-two hundredths"

125.1 → "One hundred twenty-five and one-tenth"

8.055 → "Eight and fifty-five thousandths"

Let's review!

Before going on to the practice problems, make sure you understand the main points of this lesson.

- ✓ Fractions represent amounts that are part of the whole.
- ✓ Decimal fractions (denominator of 10, 100, or 1,000) can be written as decimal numbers.
- ✓ The decimal point is read as "and". It comes between the whole number part and fraction part of a decimal number.
- ✓ The place values to the right of the decimal point end in *-ths*.
- ✓ If there is no whole number part to a number, write a zero to the left of the decimal point. These numbers come between 0 and 1 on the number line.



Match the following items.

- 1.1** _____ a fraction in which the denominator is 10 or a power of 10
- _____ a period separating the whole number and fractional parts of a number
- _____ a number that expresses a portion of a whole
- _____ a line that graphically represents all numbers
- _____ the position of a digit in a number, which determines its value
- a. place value
b. decimal fraction
c. number line
d. fraction
e. decimal point

Answer true or false.

- 1.2** _____ The decimal number 6.05 can be read as "six and five-hundredths."
- 1.3** _____ The decimal number 11.8 can be read as "eleven and eight tens."

Circle each correct answer.

- 1.4** Which digit is in the ones place?
114.92
a. 4 b. 9 c. 1 d. 2
- 1.5** Which digit is in the hundredths place?
52.48
a. 5 b. 2 c. 4 d. 8
- 1.6** Which digit is in the thousandths place?
1,356.209
a. 1 b. 9 c. 3 d. 2
- 1.7** Which digit is in the tens place?
80.315
a. 0 b. 3 c. 8 d. 1
- 1.8** Which place is the 7 in?
502.78
a. tens b. tenths c. ones d. hundredths
- 1.9** Which place is the 1 in?
13.49
a. ones b. tens c. tenths d. hundreds

1.10 Which place is the 0 in?

10.56

- a. ones b. tens c. tenths d. hundreds

1.11 Which place is the 4 in?

815.604

- a. hundreds b. hundredths c. thousandths d. tenths

1.12 Where does the number 8.1 lie on the number line?

- a. Between 1 and 2 b. Between 0 and 1 c. Between 8 and 9 d. Between 7 and 8

1.13 Where does the number 20.7 lie on the number line?

- a. Between 0 and 1 b. Between 2 and 3 c. Between 21 and 22 d. Between 20 and 21

Rewrite the following decimal fractions as decimal numbers.

1.14 $14 \frac{25}{100} =$ _____

1.15 $2 \frac{8}{100} =$ _____

1.16 $50 \frac{427}{1000} =$ _____

SELF TEST 1: DECIMAL NUMBERS

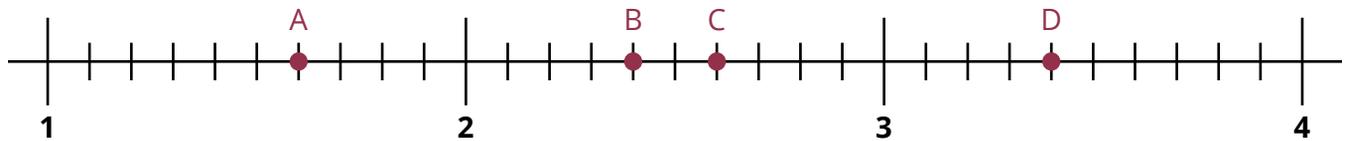
Circle each correct answer (each answer, 7 points).

- 1.01** In the number 29.154, the digit 1 is in the _____ place.
 a. ones b. tenths c. tens d. hundredths

- 1.02** Which digit is in the hundredths place?
 18.36
 a. 1 b. 8 c. 3 d. 6

- 1.03** Rewrite the decimal fraction as a decimal number.
 $8\frac{25}{1000}$
 a. 8.025 b. 8.25 c. 82.5 d. 8.0025

- 1.04** Which letter on the number line represents 2.4?



- a. A b. B c. C d. D
- 1.05** Complete the inequality statement.
 13.01 ___ 13.1
 a. < b. > c. =
- 1.06** Which of the following statements is false?
 a. $1.5 > 1.4$ b. $3.0 = 3$ c. $6.5 < 6.05$ d. $9.12 > 9.02$
- 1.07** Which of the following lists is in order from smallest to largest?
 a. 0.05, 0.2, 0.48, 0.6 b. 0.2, 0.05, 0.48, 0.6
 c. 0.2, 0.48, 0.05, 0.6 d. 0.05, 0.2, 0.6, 0.48
- 1.08** Round each number to the nearest ten and estimate the sum.
 $82.14 + 38.5 + 41.3$
 a. 130 b. 140 c. 150 d. 160
- 1.09** Estimate the difference using front-end estimation.
 $987.12 - 342.5$
 a. 700 b. 600 c. 500 d. 400
- 1.010** Estimate the sum by clustering.
 $28.71 + 29.1 + 32.45 + 31 + 30.9$
 a. 150 b. 130 c. 120 d. 180

- 1.011** At the grocery store, Charlie bought a jar of spaghetti sauce for \$2.49, a package of spaghetti noodles for \$1.58, and a gallon of milk for \$3.17. How much did he spend on these three items?
- a. \$6.04 b. \$6.24 c. \$7.24 d. \$7.04
- 1.012** If Charlie gives the clerk a ten-dollar bill, how much change should he get back?
- a. \$3.76 b. \$2.76 c. \$2.96 d. \$3.24

Fill in each blank with the correct answer (each answer, 7 points).

- 1.013** Add.

$$28.3 + 14.62 = \underline{\hspace{2cm}}$$

- 1.014** Subtract.

$$80.2 - 15.89 = \underline{\hspace{2cm}}$$

Answer true or false (this answer, 2 points).

- 1.015** _____ The number 14.592 rounded to the nearest hundredth is 14.6.

	SCORE _____	TEACHER _____	_____
		initials	date



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