

Unit 2 Focus

Adding and Subtracting Decimals



UNIT 2 GOALS:

- Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.
- Read, write and compare decimals.
- Add and subtract decimals using concrete models.
- Use exponents to denote powers of 10.

Place Value: What's ten got to do with it? Everything!

When we **multiply** a **decimal fraction** by a power of 10, the **product** will be larger than the original number; therefore we are shifting to the left on the place value chart. The number of times we shift to the left depends on the power of 10. If multiplying by 10, we shift one place to the left. If multiplying by 100, we shift two places to the left and if multiplying by 1000, we shift three places to the left and so on.

Example:

- Record the **digits** of the first factor on the top row of the **place value** chart.
- Draw arrows to show how the value of each digit changes when you multiply or divide.
- Record the product on the second row of the place value chart.

A. $3.452 \times 10 = 34.52$

(34.52 is 10 times greater than 3.452.)

	Tens	Ones	Tenths	Hundredths	Thousandths
		3	4	5	2
	3	4	5	2	

Each digit in 34.52 is 10 times greater than the same digit in 3.452

When we **divide** a **decimal fraction** by a power of 10, the **product** will be smaller than the original number; therefore we are shifting to the right on the place value chart. The number of times we shift to the right depends on the power of 10. If dividing by 10, we shift one place to the right. If dividing by 100, we shift two places to the right and if dividing by 1000, we shift three places to the right and so on.

Example:

- Record the **digits** of the dividend on the top row of the **place value** chart.
- Draw arrows to show how the value of each digit changes when you multiply or divide.
- Record the product on the second row of the place value chart.

B. $345 \div 100 = 3.45$ (3.45 is $\frac{1}{100}$ times as large as 345.)

	Hundreds	Tens	Ones	Tenths	Hundredths
	3	4	5		
			3	4	5

Each digit in 3.45 is $\frac{1}{100}$ of the same digit in 345.

Different ways of naming a decimal fraction

Example 1:



Thirteen thousandths = $0.013 = \frac{13}{1000}$

$$\frac{13}{1000} =$$

$0.013 = 1 \times 0.01 + 3 \times 0.001$

1 hundredth 3 thousandths

13 thousandths

Example 2:

Word Form: Twenty-five and four hundred thirteen thousandths

Standard Form: $25 \frac{413}{1000} = 25.413$

Expanded Forms: (with fractions or with decimals)

$$25 \frac{413}{1000} = 2 \times 10 + 5 \times 1 + 4 \times \left(\frac{1}{10}\right) + 1 \times \left(\frac{1}{100}\right) + 3 \times \left(\frac{1}{1000}\right)$$

$$25.413 = 2 \times 10 + 5 \times 1 + 4 \times 0.1 + 1 \times 0.01 + 3 \times 0.001$$

Comparing Decimal Fractions using Base-Ten Models

Students will build decimal fractions using base-ten blocks to gain a conceptual understanding of decimal fractions and their value.



Comparing Decimal Fractions using Other Strategies

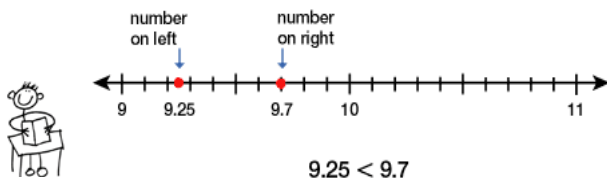
$$9.25 < 9.7$$

Strategy 1: Use a place value chart to compare the decimal fractions.

tens	ones	.	tenths	hundredths
	9	.	2	5
	9	.	7	

The place value chart shows that 9.25 is less than 9.7 because the digit in the tenths place in 9.25 is less than the digit 7 in the tenths place in 9.7.

Strategy 2: Use a number line to compare the decimal fraction. It is important for students to be able to visualize the approximate location of numbers on the number line.



$$9.25 < 9.7$$

The number line shows 9.25 comes before or to the left of 9.7. Since 9.25 comes before 9.7, 9.25 is less than 9.7.

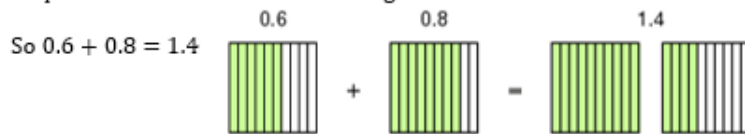
Add and subtract decimals using concrete and pictorial models.

Find $0.6 + 0.8$.

Step 1. Model by shading $\frac{6}{10}$ on one grid and $\frac{8}{10}$ on a second grid.

Step 2. Using additional grids shade to show the total number of tenths

Step 3. Find the total of the shaded grids.



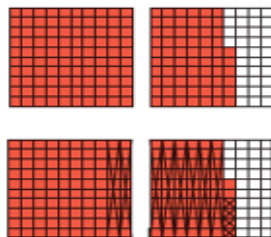
Find $1.66 - 0.84$.

Step 1. Model 1.66 by shading in one whole grid and $\frac{66}{100}$ of a second grid.

Step 2. Subtract 0.84 by crossing out 8 tenths and 4 hundredths.

Step 3. Find the total of the remaining shaded squares.

So, $1.66 - 0.84 = 0.82$



Adding and Subtracting Decimal Fractions using the Standard Algorithm.

Students understand that when adding or subtracting decimal values they must add or subtract like units (tenths to tenths or hundredths from hundredths).

Example $8.74 + 6.5$

Students are careful to set up the problem so that the common place values are aligned.

$$\begin{array}{r} 8.74 \\ + 6.5 \\ \hline 15.24 \end{array}$$

8 ones is lined up with 6 ones. 7 tenths is lined up with 5 tenths. Next, add as you would when adding whole numbers.

Example $8.74 - 6.5$

$$\begin{array}{r} 8.74 \\ - 6.5 \\ \hline 2.24 \end{array}$$

8 ones is lined up with 6 ones. 7 tenths is lined up with 5 tenths. Next, subtract as you would when subtracting whole numbers.

Recognizing Patterns when multiplying by Powers of 10:



The exponent in 10^5 (the 5) indicates the number of times you will multiply by 10.

Example #1:

$$10^5 = 10 \times 10 \times 10 \times 10 \times 10 = 100,000$$

$$10^3 = 10 \times 10 \times 10 = 1,000$$

Example #2:

$$10,000 = 10 \times 10 \times 10 \times 10 = 10^4$$

$$100 = 10 \times 10 = 10^2$$

Example #3:

$$\begin{aligned} &4 \times 10^3 \\ &= 4 \times 10 \times 10 \times 10 \\ &= 4 \times 1,000 \\ &= 4,000 \end{aligned}$$

Convert 3 meters to centimeters.

(1 meter = 100 centimeter) 100 is the same as 10^2

$$\begin{aligned} &3 \text{ m} \times 10^2 \\ &= 3 \times 10 \times 10 \\ &= 3 \times 100 \\ &= 300 \text{ cm} \end{aligned}$$