Operations with Decimals

Objective 1

Perform Addition and Subtraction with Decimals

The technique for performing **addition and subtraction** with decimals requires that we arrange our numbers in columns of common place value. Because decimal values have a labeled decimal point, we can use it as a guide.

Example 1: Calculate the sum of 82.3, 0.54, and 32.

We will use the vertical format to get the result. Be sure to line up the numbers in columns according to place value.

$$\begin{array}{r} 82.30 \\ 0.54 \\ +\ 32.00 \\ \hline 114.84 \end{array}$$

Note: In this problem we must line up the numbers by place value. The decimal point is used as a guide. Notice that we wrote 82.3 as 82.30 and 32 as 32.00. This was to match the place value of 0.54.

Note: When subtracting two decimal numbers, we also line up the numbers by place value.

Answer the following homework questions.

In Exercises 1 - 15, add or subtract as indicated. Be sure to follow the rules for Order of Operations.

1) $0.2+0.3$
2) $0.0008+0.7$
3) $1.8-0.5$
4) $2.1-0.0004$
5) $0.5-0.019$
6) $0.2-(1.5-3)$
7) $-1.2+(2-0.5)$
8) $1.05-(-3.2)$
9) $2.17+(-5-1.4)$
10) $-(5-2.9)+2.7$
11) $-(1-2.7)-(1+5.4)$
12) $1.4-2.04-5$
13) $-0.008-5.4+10$
14) $-1.009-0.2$
15) $2-(4.1-60.8)$

Objective 2

Perform Multiplication and Division with Decimals

Suppose we want to calculate the product of 0.7 and 0.4. It may be easier to perform this calculation by first converting the decimals to fractions.

$$0.7 \cdot 0.4 = \frac{7}{10} \cdot \frac{4}{10} = \frac{28}{100} = \boxed{0.28}$$

$$2.41 \cdot 1.8 = 2\frac{41}{100} \cdot 1\frac{8}{10} = \frac{241}{100} \cdot \frac{18}{10} =$$

$$\frac{4338}{1000} = \boxed{4.338}$$

To calculate the product of 2.41 and 1.8 using the vertical format, we do not have to line up the decimals! We line up the numbers on the right. The calculation is shown below.

$$\begin{array}{r} 2.41 \\ \times \quad 1.8 \\ \hline \end{array}$$

First multiply 241 by 8.

$$\begin{array}{r} {\scriptstyle 3}\,241 \\ \times \quad 8 \\ \hline 1928 \end{array}$$

Next, multiply 241 by 10.

$$\begin{array}{r} 241 \\ \times \quad 10 \\ \hline 2410 \end{array}$$

Now add the results.

$$\begin{array}{r} 241 \\ \times \quad 18 \\ \hline 1928 \\ +2410 \\ \hline 4338 \end{array}$$

At this point, our result is **4338**. But this is not the final answer. We need to know where to place the decimal point. To figure out where, we count the number of decimal places in the two numbers we multiplied together. We count from the right as shown below.

$$\begin{array}{r} 2.41 \\ \times \quad 1.8 \\ \hline \end{array}$$

We count a total of three place values.

Finally, we place the decimal three places from the right in our result. 4338 **4.338**

Next, we will perform long division with decimal numbers. Consider $1.36 \div 0.4$ or $\frac{1.32}{0.6}$.

$$0.4\overline{)1.36}$$

Our divisor is **0.4** and our dividend is **1.36**. When performing long division, we want our dividend to be a whole number.

If we look at our problem in fractional form, we can see that multiplying both numerator and denominator by 10 will make our dividend a whole number. Note that multiplying a number by 10 moves the decimal point one place value to the right.

$$\frac{1.36}{0.4}\left(\frac{10}{10}\right) = \frac{13.6}{4}$$

This process is replicated in long division notation as follows.

$$0.4\overline{)1.36} \quad = \quad 4\overline{)13.6}$$

Now we place our decimal above the long division symbol and perform long division.

$$\begin{array}{r} \\ \hline 4\overline{)13.6} \end{array}$$

After making the dividend a whole number, we perform long division just as if we are using whole numbers. Note the we do not move the decimal when we get our final answer.

$$4\overline{)13.6}$$

How many times does 4 go into 1? Zero

$$\begin{array}{r} 0. \\ 4\overline{)13.6} \end{array}$$

How many times does 4 go into 13? Three

$$\begin{array}{r} 03. \\ 4\overline{)13.6} \\ -12 \\ \hline 16 \end{array}$$

Subtract. ← 3×4 goes here.

Bring down the 6.

How many times does 4 go into 16? Four

$$\begin{array}{r} 03.4 \\ 4\overline{)13.6} \\ -12 \\ \hline 16 \\ -16 \\ \hline 0 \end{array}$$

Subtract. ← 4×4 goes here.

There are 0 units left over.

Finally, $1.36 \div 0.4$ equals **3.4**.

Answer the following homework questions.

16) Find the product of 3.5 and 0.4.

17) Find the product of 2.09 and 8.1.

18) Find the quotient of 15.2 and 0.8.

19) Find the quotient of 10.5 and 0.05

In Exercises 20 – 25, multiply and divide as indicated.

20) $3.76(0.4)$

21) $0.25 \cdot 0.2$

22) $1.44 \div 1.2$

23) $13.2 \div 0.11$

24) $13.87 \div 7.3$

25) $29.25 \div 4.5$