# EQUIVALENT DECIMALS

To compute with decimals, an understanding of equivalent decimals is a must. We will first examine some equivalent decimals and how adding and taking away zeros at the end of a decimal number does not change the value of the number.
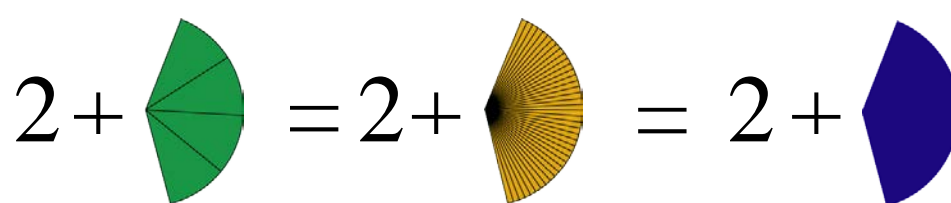
# DECIMAL COMPUTATIONS - ADD, SUBTRACT, AND MULTIPLY

To add and subtract decimals, often times it is necessary to write an equivalent decimal before computing. Remember: line up the decimals when adding and subtracting.

To find the product of two decimals, multiply the decimals. It is not necessary to line up the decimal points. We place the decimal point by counting the number of decimals places to the right of the decimals. We will practice multiplying decimals less than one in value, and practicing multiplying decimals greater than one which includes multiplying by a three-digit number.

## Equivalent Decimals

To make **equivalent decimals**, you may **add on zeros** as needed.
*The zeros do not change the value of the decimal, just its appearance.*

$$2.4 \quad = \quad 2.40 \quad = \quad 2.400$$

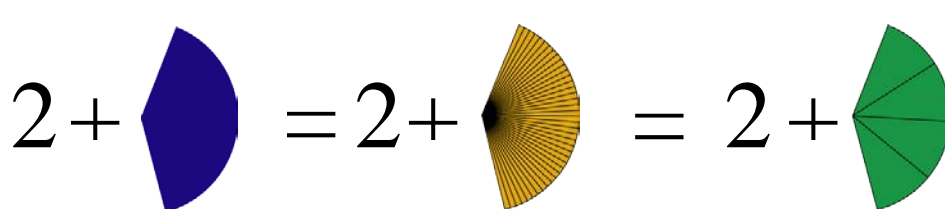$$2+ \text{■} \; = 2+ \text{■} \; = 2+ \text{■}$$

**2 and 4 tenths** *equals* **2 and 40 hundredths** *equals* **2 and 400 thousandths**

*or*

$$2\frac{4}{10} = 2\frac{40}{100} = 2\frac{400}{1000}$$

$$\left( \begin{array}{c} 2\dfrac{40}{100} \div \dfrac{10}{10} = 2\dfrac{4}{10} \\[2ex] 2\dfrac{400}{1000} \div \dfrac{100}{100} = 2\dfrac{4}{10} \end{array} \right)$$

To make **equivalent decimals**, you may **take off zeros** as needed.
*The zeros do not change the value of the decimal, just its appearance.*

$$2.400 \quad = \quad 2.40 \quad = \quad 2.4$$

$$2+ \text{■} \; = 2+ \text{■} \; = 2+ \text{■}$$

**2 and 400 thousandths** *equals* **2 and 40 hundredths** *equals* **2 and 4 tenths**

# Add and Subtract Decimals

To add or subtract decimals, be sure to line up the decimal points so that the place values also line up – tenths with tenths, hundredths with hundredths, and so on.

**sum** – the answer to an addition problem

**difference** – the answer to a subtraction problem

*Example 1*:  Find the sum:  8.3+17.82

$$
\begin{array}{r}
{\scriptstyle 1}\phantom{00} \\
8.3\phantom{0} \\
+17.82 \\
\hline
26.12
\end{array}
$$

\*In tenths column, $8 + 3$ equals 11, so place a one (1) in the answer and carry the other one (1) to ones place.

*Example 2*:  Find the difference:  5.3−3.74

$$
\begin{array}{r}
{\scriptstyle 4\ \ 1210}\phantom{0} \\
\cancel{5}.\cancel{3}\,\cancel{0} \\
-3\,.7\ 4 \\
\hline
1.5\ 6
\end{array}
$$

\*A zero (0) must be put in hundredths place as a place holder.  Then, borrow and subtract.

*Example 3*:  Find the difference:  12−5.35

$$
\begin{array}{r}
9\phantom{000} \\
{\scriptstyle 0\ \ 11\ \cancel{10}\ 10}\phantom{0} \\
\cancel{1}\,\cancel{2}.\cancel{0}\,\cancel{0} \\
-5\,.3\,5 \\
\hline
6.6\ 5
\end{array}
$$

\*Two zeros must be put in tenths and hundredths place as place holders.  Then, borrow and subtract.

*Example 4*:  Find the sum.

$$13.6+7.5=?$$

$$\overset{1\ 1}{\phantom{0}}$$
$$
\begin{array}{r}
13.6 \\
+\ 7.5 \\
\hline
21.1
\end{array}
$$

*Example 5*:  Solve the previous problem using decimal fractions, and then write the answer as a mixed number and a decimal.

$$13.6+7.5=?$$

$$13.6=13\frac{6}{10}$$

$$\underline{+7.5=7\frac{5}{10}}$$

$$20\frac{11}{10}=21\frac{1}{10}
\quad
\left.
\begin{array}{l}
20\frac{11}{10}=20+\frac{10}{10}+\frac{1}{10} \\[2mm]
\qquad =20+\ 1\ +\frac{1}{10}=21\frac{1}{10}
\end{array}
\right\}$$

$$21\frac{1}{10}=21.1$$

*Example 6*:  Find the sum.

$$18.33+7.5=?$$

$$\overset{1}{\phantom{0}}$$
$$
\begin{array}{r}
18.33 \\
+7.50 \\
\hline
25.83
\end{array}
$$
\*Put a zero (0) in hundredths place as a place holder.

*Example 7*:  Solve the previous problem using decimal fractions, and then write the answer as a mixed number and a decimal.

$$18.33 + 7.5 = ?$$

$$18.33 = 18\frac{33}{100} = 18\frac{33}{100}$$

$$+7.5 = 7\frac{5}{10} = 7\frac{50}{100} \qquad \left\{\frac{5}{10} \times \frac{10}{10} = \frac{50}{100}\right\}$$

$$25\frac{83}{100} = 25.83$$

*Example 8*:  Solve the problem using decimal fractions, and then check the answer using regular decimal subtraction.

$$25.2 - 6.9 = ?$$

$$25.2 = 25\frac{2}{10} = 24\frac{12}{10} \qquad \left\{25\frac{2}{10} = 24 + 1 + \frac{2}{10} = 24 + \frac{10}{10} + \frac{2}{10} = 24\frac{12}{10}\right\}$$

$$-6.9 = 6\frac{9}{10} = 6\frac{9}{10}$$

$$18\frac{3}{10} = 18.3$$

☑ *Check*:

$$\begin{array}{r} 25.2 \\ -6.9 \\ \hline 18.3 \end{array} \qquad \begin{array}{r} {\scriptstyle 1\ 14\ 12} \\ \cancel{2}\,\cancel{5}.\cancel{2} \\ -6.9 \\ \hline 1\ 8.\ 3 \end{array}$$

# Multiply Decimals

## Multiplying Decimals Less Than One

To place the decimal point when multiplying decimals, count the decimal places (right of the decimal point) in each factor and total them. The total number is the number of decimal places that will be in the answer.

**product** - the answer to a multiplication problem

*Example 1*: Find the product.

| Multiply: $0.7 \times 0.9$ | *Estimate* *$1 \times 1 = 1$* |
|---|---|

$$
\begin{array}{r}
0.7 \\
\times\, 0.9 \\
\hline
0.63
\end{array}
$$

*1 decimal place
*1 decimal place
*total - 2 decimal places
$(1+1=2)$

**Why two decimal places?**
*Write both decimals as fractions and multiply.*
$$\frac{7}{10} \times \frac{9}{10} = \frac{63}{100} = 0.63$$

The product of 0.7 and 0.9 is 0.63.

☑ *Quick Check*: The estimate of 1 is close to 0.63.

*Example 2*:  Find the product.

| Multiply:  $0.12 \times 0.36$ |
|---|

*Estimate*
*0 × 0 = 0*

$$\begin{array}{r} 0.12 \\ \times\, 0.36 \\ \hline 72 \\ 360 \\ \hline 0.0432 \end{array}$$

*2 decimal places

*2 decimal places

*Zero is a place holder.

*total - 4 decimal places

(2 + 2 = 4)

**Why four decimal places?**
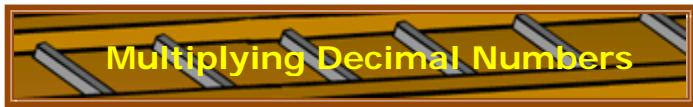*Write both decimals as*
*fractions and multiply.*

$$\frac{12}{100} \times \frac{36}{100} = \frac{432}{10,000} = 0.0432$$

*Note:  The zero in front of the four is a place holder to show four decimal places.

The product of 0.12 and 0.36 is 0.0432.

☑*Quick Check*: The estimate of 0 is close to 0.0432.

*Click on the tracks below to play a game.*

**Multiplying Decimal Numbers**

## Multiplying Decimals Greater Than One

To place the decimal point when multiplying decimals, count the decimal places (right of the decimal point) in each factor and total them.  The total number is the number of decimal places that will be in the answer.

*Example 3*:  Find the product.

| **Multiply:  5.23 × 7.9** |
|:---:|

*Estimate*
*5 × 8 = 40*

$$
\begin{array}{r}
5.23 \\
\times\ \ 7.9 \\
\hline
4707 \\
\underline{36610} \\
41.317
\end{array}
$$

*2 decimal places
*1 decimal place

*Zero is a place holder.
*total - 3 decimal places
(2+1=3)

**Why three decimal places?**
*Write both decimals as mixed numbers and multiply.*

$$5\frac{23}{100}\times7\frac{9}{10}=\frac{523}{100}\times\frac{79}{10}=$$

$$\frac{41,317}{1000}=41\frac{317}{1000}=41.317$$

The product of 5.23 and 7.9 is 41.317.

☑*Quick Check*: The estimate of 40 is close to 41.317.

*Example 4*: Find the product.

**Multiply: $46 \times 2.8$**

*Estimate*
*$50 \times 3 = 150$*

$$\begin{array}{r} 46 \\ \times\ \ 2.8 \\ \hline 368 \\ 920\ \ \\ \hline 128.8 \end{array}$$

\*0 decimal places
\*1 decimal place

\*Zero is a place holder.
\*total - 1 decimal place
(0+1=1)

**Why one decimal place?**
*Write both numbers in*
*fraction form and multiply.*
$$\frac{46}{1} \times 2\frac{8}{10} = \frac{46}{1} \times \frac{28}{10} =$$
$$\frac{1288}{10} = 128\frac{8}{10} = 128.8$$

The product of 46 and 2.8 is 128.8.

☑*Quick Check*: The estimate of 150 is close to 128.8.

*Example 5*: Find the product.

**Multiply: $5.23 \times 3.79$**

*Estimate*
*$5 \times 4 = 20$*

$$\begin{array}{r} 5.23 \\ \times\ \ 3.79 \\ \hline 4707 \\ 36610\ \ \\ 156900\ \ \ \\ \hline 19.8217 \end{array}$$

\*2 decimal places
\*2 decimal place

\*The zeros are place holders.
\*total - 4 decimal places
(2+2=4)

**Why four decimal places?**
*Write both decimals as mixed*
*numbers and multiply.*
$$5\frac{23}{100} \times 3\frac{79}{100} = \frac{523}{100} \times \frac{379}{100}$$
$$\frac{198,217}{10,000} = 19\frac{8,217}{10,000} = 19.8217$$

The product of 5.23 and 3.79 is 19.8217.

☑*Quick Check*: The estimate of 20 is close to 19.8217.