Operations with Decimals

WORKSHEETS
Multiplying and dividing by powers of ten

Move the decimal point depending on the number of zeros.

\[ \times = \text{decimal point moves right} \quad \div = \text{decimal point moves left} \]

1 Calculate these multiplication and division questions involving powers of 10:

a \[ 5 \times 1,000 \]

\[ 5 \times 1,000 = 5.0 \times 1,000 \]

The whole number in decimal form

\[ = 5.0 \]

We can simply add the same number of zeros to the end of the whole number

\[ = 5,000 \]

Fill the empty bounces with 0s

If the decimal point is on the left after dividing, an extra 0 is placed in front.

b \[ 8 \div 100 \]

\[ 8 \div 100 = 8.0 \div 100 \]

The whole number in decimal form

\[ = 0.08 \]

\[ \div 100 \text{ has 2 zeros, so move decimal point 2 spaces left} \]

Fill the empty bounces with 0s and put a zero in front

c \[ 1.25893 \times 10,000 \]

\[ 1.25893 \times 10,000 = 12,589.3 \]

Move decimal point 4 spaces right

\[ = 12,589.3 \]

No empty bounces to fill, so this is the answer

d \[ 24.905 \div 100,000 \]

\[ 24.905 \div 100,000 = 0.00024905 \]

Move decimal point 5 spaces left

\[ = 0.00024905 \]

Fill empty bounces with 0s and put a zero in front

e \[ 260.15 \times \frac{1}{1,000} \]

\[ 260.15 \times \frac{1}{1,000} = 260.15 \div 1,000 \times \frac{1}{1,000} \]

is the same as \[ \div 1,000 \]

\[ = 0.26015 \]

Move decimal point 3 spaces left

Place a leading zero in front of the decimal point
Multiplying and dividing by powers of ten

1. Calculate these multiplications. Remember, multiply means move decimal point to the right:
   - a. $8 \times 100$
   - b. $3.4 \times 10$
   - c. $29 \times 1,000$
   - d. $12.45 \times 10,000$
   - e. $0.512 \times 100$
   - f. $0.0000469 \times 1,000,000$

2. Calculate these divisions. Remember, divide means move decimal point to the left:
   - a. $2 \div 100$
   - b. $4,590 \div 1,000$
   - c. $0.014 \div 10$
   - d. $70.80 \div 10,000$
   - e. $1,367.512 \div 1,000$
   - f. $421,900 \div 100,000,000$

Here are some of the powers of 10 using exponent notation. The power = the number of zeros.

$10^1 = 10$
$10^2 = 100$
$10^3 = 1,000$
$10^4 = 10,000$
$10^5 = 100,000$
$10^6 = 1,000,000$

3. Calculate these mixed problems written using exponent notation:
   - a. $31 \times 10^2$
   - b. $2,400 \div 10^5$
   - c. $0.0027 \times 10^6$
   - d. $90.008 \times 10^4$
   - e. $3.45 \div 10^3$
   - f. $2,159,951 \div 10^7$
### For these calculations:

- **i** Show where our character needs to spray paint a new decimal point, and
- **ii** write down the two numbers the new decimal point is between to solve the puzzle

<table>
<thead>
<tr>
<th>Calculation</th>
<th>New Decimal Point</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>a 2,830.3920 × 100</td>
<td>2 8 3 0 3 9 • 2 0</td>
<td>I 9 and 2</td>
</tr>
<tr>
<td>b 23,857 ÷ 1,000</td>
<td>2 3 8 5 7</td>
<td>N</td>
</tr>
<tr>
<td>c 0.4763892 × 10⁵</td>
<td>0 4 7 6 3 8 9 2</td>
<td>A</td>
</tr>
<tr>
<td>d 382,961 ÷ 10,000</td>
<td>3 8 2 9 6 2</td>
<td>O</td>
</tr>
<tr>
<td>e 19,238.07 × 10¹</td>
<td>1 9 2 3 8 0 7</td>
<td>X</td>
</tr>
<tr>
<td>f 8.9236701 × 10,000</td>
<td>8 9 2 3 6 7 0 1</td>
<td>T</td>
</tr>
<tr>
<td>g 20,917,983 × (\frac{1}{1,000,000})</td>
<td>2 0 9 1 7 9 8 3</td>
<td>R</td>
</tr>
<tr>
<td>h 83,917 ÷ 10⁵</td>
<td>8 3 9 1 7</td>
<td>I</td>
</tr>
<tr>
<td>i 902,873.021 × (\frac{1}{10²})</td>
<td>9 0 2 8 7 3 2 0 1</td>
<td>D</td>
</tr>
<tr>
<td>j 0.08390 × 10³</td>
<td>0 0 8 3 9 0</td>
<td>P</td>
</tr>
</tbody>
</table>

This is another mathematical name for a decimal point:

- 0 and 9
- 8 and 9
- 8 and 7
- 9 and 2
- 0 and 7
- 3 and 9
- 8 and 2
- 0 and 8
- 3 and 8
- 6 and 7
Adding and subtracting decimals

Just add or subtract the digits in the same place value.
To do this, line up the decimal points and matching place values vertically first.

- Add 2.45 to 6.31 (i.e. 2.45 + 6.31)
  \[
  \begin{array}{c}
  2.45 \\
  6.31 \\
  \hline
  8.76
  \end{array}
  \]
  Decimal points lined up vertically
  Add matching place values together

- Subtract 5.18 from 11.89 (i.e. 11.89 − 5.18)
  \[
  \begin{array}{c}
  11.89 \\
  5.18 \\
  \hline
  6.71
  \end{array}
  \]
  Decimal points lined up vertically
  Subtract matching place values

1. Calculate each of these further additions and subtractions

   a. \[24.105 + 11.06 + 6.5902\]

      \[
      \begin{array}{c}
      24.105 \\
      11.06 \\
      6.5902 \\
      \hline
      \text{Add matching place values together}
      \end{array}
      \]

      \[
      24.105 + 11.06 + 6.5902 = 41.7552
      \]

Rounding decimal values before adding is sometimes used to quickly approximate the size of the answer.

b. Round each value in question (i) to the nearest whole number before adding.

   \[24.105 + 11.06 + 6.5902 \approx 24 + 11 + 7\]
   \[\approx 42\]
   Values rounded to nearest ones
   Approximate value for addition

Note: Rounding values before adding/subtracting is not as accurate as rounding after adding/subtracting.

c. \[80.09 - 72.6081\]

      \[
      \begin{array}{c}
      80.09 \\
      72.6081 \\
      \hline
      \text{Subtract matching place values}
      \end{array}
      \]

      \[
      80.09 - 72.6081 = 7.4819
      \]

Any place value spaces are treated as 0s
Fill each place value space in the top number with a “0” when subtracting.
Adding and subtracting decimals

1. Complete these additions and subtractions:

   a. \[0.14 + \quad 0.73\]
   b. \[1.68 + \quad 5.30\]
   c. \[0.246 + \quad 0.832\]
   d. \[12.194 + \quad 9.057\]

   e. \[0.99 - \quad 0.26\]
   f. \[5.074 - \quad 1.064\]
   g. \[5.24 - \quad 0.83\]
   h. \[24.158 - \quad 13.694\]

2. Calculate these additions and subtractions, showing all working:

   a. Add 8.75 to 1.24
   b. Subtract 3.15 from 4.79

   c. Add 0.936 to 0.865
   d. Add 2.19, 5.6, and 0.13

   e. Subtract 0.9356 from 8.6012
   f. Add 10.206, 4.64, and 8.0159
Adding and subtracting decimals

3 Approximate these calculations by rounding each value to the nearest whole number first.

a  5.7 + 6.2 ≈  
≈  

b  0.9 + 9.4 ≈  
≈  

c  8.3 − 1.9 ≈  
≈  

d  11.3 − 0.2 ≈  
≈  

e  8.34 + 1.61 + 0.54 ≈  
≈  

f  2.71 + 3.80 + 1.92 ≈  
≈  

Calculate parts e and f again, this time rounding after adding the numbers to get a more accurate approximate value.

g  8.34 + 1.61 + 0.54  
h  2.71 + 3.80 + 1.92

4 Calculate these subtractions, showing all your working:

a  7.8 − 2.56  
b  13.09 − 8.4621  
c  0.52 − 0.12532
Multiplying with decimals

Just write the terms as whole numbers and multiply. Put the decimal point back in when finished. The number of decimal places in the answer = the number of decimal places in the question!

1. **Calculate** $4 \times 1.2$

   \[
   4 \times 12 = 48 \quad \text{Multiply both terms as whole numbers}
   \]
   
   \[
   48
   \]
   
   \[
   4 \times 1.2 = 4.8
   \]

2. **Calculate** $0.02 \times 1.45$

   \[
   2 \times 145 = 290 \quad \text{Multiply both terms as whole numbers}
   \]
   
   \[
   \frac{4321}{290}
   \]
   
   \[
   0.02 \times 1.45 = 0.0290 \quad \text{4 decimal places in question} = \text{4 decimal places in answer}
   \]

Let’s do the second one again but this time change the decimals to equivalent fractions first.

\[
0.02 \times 1.45 = \frac{2}{100} \times \frac{145}{100}
\]

\[
= \frac{2 \times 145}{100 \times 100}
\]

\[
= \frac{290}{10,000}
\]

\[
= 290 \div 10,000
\]

\[
= 0.0290
\]

\[
= 0.0290
\]

Try this method for yourself on the first example above, remembering that $4 = \frac{4}{1}$ as a fraction.
Multiplying with decimals

1. Calculate these whole number and decimal multiplications, showing all your working:
   
   a. \(0.8 \times 2\) 
   b. \(5 \times 1.5\) 
   c. \(0.14 \times 6\) 
   
   d. \(0.62 \times 4\) 
   e. \(3 \times 0.032\) 
   f. \(1.134 \times 2\)

2. Calculate these decimal multiplications, showing all your working:
   
   a. \(3.8 \times 0.2\) 
   b. \(1.09 \times 0.08\) 
   c. \(2.7 \times 2.5\) 
   
   d. \(7.1 \times 1.4\) 
   e. \(3.21 \times 2.1\) 
   f. \(17.2 \times 9.3\)
Dividing with decimals

We move the decimal point before dividing if needed.
To find the quotient when working with decimals, the question must be changed so the divisor is a whole number.

\[
\text{dividend} \div \text{divisor} = \text{quotient}
\]

Calculate \(4.28 \div 4\)

\[
\begin{array}{c}
10.7 \\
\hline
4 \overline{)4.28} \\
\end{array}
\]

Divisor already a whole number so no change needed

\[4.28 \div 4 = 1.07\]

Calculate \(0.0456 \div 0.006\)

\[
\begin{array}{c}
0.0456 \\
\hline
0.006 \overline{)0.0456} \\
\end{array}
\]

Move both decimal points right until divisor is a whole number

\[0.0456 \div 0.006 = 45.6 \div 6\]

Quotient > Dividend
if divisor < 1

\[
\begin{array}{c}
0.7 \\
\hline
6 \overline{)45.36} \\
\end{array}
\]

\[0.0456 \div 0.006 = 7.6\] Drop off any 0s at the front of the answer

Here’s another example showing how to treat remainders.

Calculate \(1.26 \div 0.8\)

\[
\begin{array}{c}
1.26 \\
\hline
0.8 \overline{)1.26} \\
\end{array}
\]

Move both decimal points right until divisor is a whole number

\[1.26 \div 0.8 = 12.6 \div 8\]

Add 0s on the end of the dividend for each new remainder

\[
\begin{array}{c}
0.1.5 \\
\hline
8 \overline{)12.60} \\
\end{array}
\]

\[1.26 \div 0.8 = 1.575\] Drop off any 0s at the front
Dividing with decimals

1 Calculate these decimal and whole number divisions:

\[ \begin{align*}
\text{a} & \quad 3.6 \div 4 \\
\text{b} & \quad 17.5 \div 5 \\
\text{c} & \quad 16.2 \div 9 \\
\text{d} & \quad 0.63 \div 3 \\
\text{e} & \quad 0.489 \div 5 \\
\text{f} & \quad 10.976 \div 7
\end{align*} \]

\[ \begin{align*}
3.6 \div 4 &= \underline{0.9} \\
17.5 \div 5 &= \underline{3.5} \\
16.2 \div 9 &= \underline{1.8} \\
0.63 \div 3 &= \underline{0.21} \\
0.489 \div 5 &= \underline{0.0978} \\
10.976 \div 7 &= \underline{1.568} \\
\end{align*} \]

2 Calculate these decimal divisions, showing all your working:

\[ \begin{align*}
\text{a} & \quad 5.2 \div 0.4 \\
\text{b} & \quad 9.6 \div 0.6 \\
\text{c} & \quad 0.56 \div 0.8 \\
\text{d} & \quad 1.58 \div 0.4 \\
\text{e} & \quad 0.8125 \div 0.05 \\
\text{f} & \quad 5.3682 \div 0.006
\end{align*} \]

\[ \begin{align*}
5.2 \div 0.4 &= \underline{13} \\
9.6 \div 0.6 &= \underline{16} \\
0.56 \div 0.8 &= \underline{0.7} \\
1.58 \div 0.4 &= \underline{3.95} \\
0.8125 \div 0.05 &= \underline{16.25} \\
5.3682 \div 0.006 &= \underline{894.6933} \\
\end{align*} \]