Decimals: ordering, rounding and calculations (7–9)

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1 Ordering decimals

We can order decimals by writing each number with the same amount of decimal places (these are the amount of figures after the decimal point). Placing a zero in at the end of a decimal does not change its value: 5.3 is equivalent in size to 5.30 or 5.300.

Example.

3.6	3.09	3.299	3.91	3.913
		Write all numbers		
		↓ with 3 decimal		
		places		
3.600	3.090	3.299	3.910	3.913

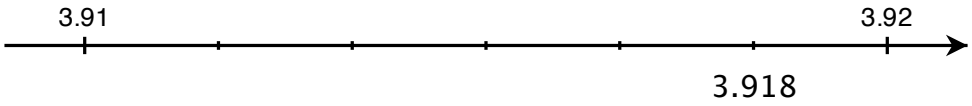
Hence, from smallest to largest, the numbers would be:

$$3.09 \quad 3.299 \quad 3.3 \quad 3.91 \quad 3.913$$

The last two decimals are distinguished by looking at the third decimal place. They both contain 9 tenths (first decimal place) and 1 hundredth (second decimal place) but 3.91 does not contain any thousandths (third decimal place) whereas 3.913 contains three thousandths.

2 Rounding decimals

Whenever you use your calculator to perform a calculation, you should always write down the full answer first. However, you may then wish to round your answer to a certain number of decimal places. Take, for instance, 3.918: at the moment this has three decimal places but we may wish to round it to two decimal places. Which two 2 decimal place values does it sit between and which one is it closer to?



We can see that 3.918 is 3.92 to two decimal places.
To round decimal places, look to one more decimal place than you need. If this extra decimal place is less than five, leave the number as it is. If it is five or more, round up. For instance:

4.1863	round to three decimal places	4.186|3	this is 4.186 (to 3dp)
4.1863	round to two decimal places	4.18|63	this is 4.19 (to 2dp)
3.98	round to one decimal place	3.9|8	this is 4.0 (to 1dp)

Make sure you can find these key features on your calculator:

$$\sqrt{96} = 9.797958971\ldots \quad = 9.8\text{(to 1d.p.)} \qquad 4.2^3 = 74.088 \quad = 74.09\text{(to 2d.p.)} \qquad \frac{3.6+7.89}{(1-0.8)^2} = 287.25 \quad = 287.3\text{(to 1 d.p.)}$$

3 Decimal calculations

3.1 Adding and subtracting decimals

Ensure that the decimal points are correctly aligned. Writing each number with an equal amount of decimal places, as in ordering, may help.

Example. Work out $3.6 + 6.21$.

$$\begin{array}{rrrr} 6 & . & 2 & 1 \\ & 3 & . & 6 \\ \hline 6 & 3 & .2 & 7 \end{array} \text{ + } \textit{Wrong} \qquad \begin{array}{rrrr} 6 & . & 2 & 1 \\ 3 & . & 6 & 0 \\ \hline 9 & . & 8 & 1 \end{array} \text{ + } \textit{Correct}$$

3.2 Multiplying Decimals

Look at the pattern in this table of multiplications:

$$\begin{aligned} 0.\underline{3} \times 0.\underline{4} &= 0.\underline{12} && \text{1d.p.} \times \text{1d.p.} = \text{2d.p.} \\ 0.00\underline{5} \times 0.0\underline{3} &= 0.000\underline{15} && \text{3d.p.} \times \text{2d.p.} = \text{5d.p.} \\ \underline{1.1} \times 0.0\underline{9} &= 0.0\underline{99} && \text{1d.p.} \times \text{2d.p.} = \text{3d.p.} \\ 1.3^2 &= \underline{1.3} \times \underline{1.3} \\ &= \underline{1.69} && \text{1d.p.} \times \text{1d.p.} = \text{2d.p.} \end{aligned}$$

To obtain the answer, we multiply the key numbers together (these are underlined above) then we restore the required amount of decimal places by noticing that the amount of decimal places in the question is the same as in the answer.

Example. Work out 0.009×0.8.
Since $9 \times 8 = 72$ and the question has 4 decimal places in total, the solution is 0.0072, which also has 4 decimal places.

Hint. *You may think this answer is small, but* 0.009×0.8 *is a little bit of a little bit . . . this would be a tiny bit!*
We may be able to do the calculations in our head (like the example above) or may need long multiplication to assist us e.g 2.3×0.035:
Do 23 x 35 using long multiplication:

$$\begin{array}{cccc} & 2 & 3 & \\ & 3 & 5 & \times \\ \hline 1 & 1 & 5 & \\ 6 & 9^{1} & 0 & \\ \hline 8_{1} & 0 & 5 & \end{array}$$

Now we need to restore the 3 decimal places, getting 0.805.

3.3 Division with decimals

If we are dividing a decimal by a whole number, using the "box" method, as in primary school, is best:

Example. Find $7.836 \div 3$.

$$3) \begin{array}{cccc} 2. & 6 & 1 & 2 \\ \hline 7. & 8^{1} & 3 & 6 \end{array}$$

Notice the decimal points are in line.
If we are dividing a decimal by a decimal, it is best to scale both numbers up to whole numbers first, by multiplying each value by the same multiple of ten (e.g. 10, 100, 1000, . . .) E.g. to find $0.09 \div 0.003$:

$$\begin{aligned} \frac{0.09}{0.003} &= \frac{0.09}{0.003} \quad \begin{array}{l} \times 1000 \\ \times 1000 \end{array} \\ &= \frac{90}{3} \\ &= 30 \end{aligned}$$

Example. Follow these calculations:

$$\frac{0.6}{0.0002} = \frac{6000}{2} \qquad \frac{2.6}{0.13} = \frac{260}{13}$$
$$= 3000 \qquad = 20$$

Hint. *in these two examples, the answer is always a large number. If you think of a division as a "fits into", we are fitting a smaller number into a larger number, so it will fit many times.*