Significant figures
Lesson 1

There are three **rules** on determining how many **significant figures** are in a number:
- Non-zero **digits** are always **significant**.
- Any zeros between two **digits** are **significant**.
- A final zero or trailing zeros in the decimal portion ONLY are **significant**.
- Trailing zeros in a whole number with the decimal shown are significant**.** Placing a decimal at the end of a number, although not usually done, indicates a significant zero.
For example "680." indicates that the trailing zero is significant, hence, there are 3 significant figures in this value.

Consider the following numbers

1) 4.0440 - five significant figures.

2) 0.0665 - three significant figures

3) 4.01×10^{-5} - three significant figures.

4) 5,600 - two significant figures.

5) 0.0010005- five significant figures

6) 1.9500×10^{13} - five significant figures

Rules for addition and subtraction

1) Add or subtract as you would normally.

2) Round the answer to the least number of decimal places of any number in the problem.

Example 1)
3.376898 + 12.1 + 0.25712 = 15.7334018
round to one decimal place 15.7
Example 2)
43.947 - 0.082125 = 43.864875
round to three decimal places 43.865
Example 3)
2,319 + 2,281 = 4,600
The answer, however, is given to two significant numbers but clearly the numbers that were summed have 4 significant figures. Surely we are confident to express the answer to four significant figures. We use scientific notation to indicate that the trailing zeros in the answer are significant.
$4.600 \text{ X } 10^3$
Example 4)
418,231 - 218,431
Once again the correct answer is 200,000, but all of the significant figures are retained. The most correct way to write the answer would be, once again, in scientific notation 2.00000×10^5.

Rule for multiplication and division

The answer is expressed to the LEAST number of significant figures in any number of the problem

Example 1) 3.2 X 2.111 = 6.755 = 6.8

Example 2) 234.519 / 2.3 = 102 = 1.0 X 10^2

Important note. When having many multiplication and division steps in a calculation to avoid truncation error when performing a multiple step calculation always carry through all the digits you have available in a calculation until the very end where you express your final answer to the right number of significant figures.

Example
6 X 6 = *40 (one significant number)*

2.34 - 1.293 = *1.05 (two decimal places)*

10.23 – 4 = *6 (no decimal places)*

(6.31 X 3.391) + 5.77 =
=> *21.39721 + 5.77 =*
=> *27.17 (the final operation gives a number with two decimal places)*

(3.300 – 2.72) / 3.4412 =
=> 0.58 / 3.4412
=> 0.169 three significant numbers

3.12 + 0.8 + 1.033 = *5.0 answer expressed to one decimal place*

345.009 - 23.009 = *322.000 answer expressed to three decimal places*

34.530 + 12.1 + 1 222.34 = *1269.0 answer rounded to one decimal place*

2.33 x 6.085 x 2.1 =
=> *3.0 X 10^1 two significant figures*

0.83 + 2.10 × 0.5896 =
=> 0.83 + 1.23816
=> 2.07 answer must be expressed to two decimal places