Scientific Notation and Significant Figures

Scientific Notation:

Purpose:
To simplify writing of large or small numbers. (faster)
To show significant figures (more obvious later).

How to write: 1 digit, then the decimal, then any other significant digits, then x 10^x.

3,400,000 = 3.4 x 10^6

Remember: positive exponents = a bigger number. (you are adding zeros to the right hand side).
Negative exponents = a smaller number (less than 1) – (you move the decimal to the left)

0.003 = 3 x 10^{-3}

32,000,500 = 3.20005 x 10^7
(I dropped the last 2 zeros because they are not significant.)

Significant figures: all digits are significant that are not just there to show a big or little number (just place holders). All non-zeros are significant. Zeros in between non-zeros are significant.

3,400,000 – the five 0's are just there as place holders – not significant.
- only 2 sig figs.

3,000,500 – only 2 zeros are place holders – 5 sig figs.

0.00045 – all zeros here are place holders – not sig. – 2 sig figs.

Harder ones:

a) 3,400,000.0 – the ".0" is not necessary – so must be significant – 7 or 8 sig figs
b) 0.004200 – the 0's on the right are not necessary – so sig. – 4 sig figs.

(a great power of sci notation is that it removes doubt, because it only shows significant figures:
a) 3.400000 x 10^6 show that there are only 7 sig figs
b) 4.200 x 10^{-3})

More examples:
0.00045 – 2 sig figs
3,200.01 – 6 sig figs
4,502.134 – 7 sig figs
5,000,000,000,000,000 – 1 sig figs
5,200.00 – 6 sig figs
0.00102000 – 6 sig figs (0's on the right are) 1.02000 x 10^{-3}
5 – 1 sig fig
5.0 – 2 sig figs

Math with sig figures –

1) **Mult and Div** (**round to the least number of sig figs**.) – the answer has the same # of sig figs as the number with the least number of sig figs.

Ex. 2,301 (has 4 sig figs) mult by 32 (has 2 sig figs) answer will have 2 sig figs.

2,301 x 32 = 73,632 but with correct sig figs = 74,000
23.01 x 32 = 7,400

45.024 ÷ 3 = [calculator =15.008] = 20 (answer has 1 sig fig, because 3 has 1 sig fig) = 2 x 10

Addition and Subtraction (**round to the least number of decimal places**) – the answer will have the same # of sig figs to the right of the decimal as the number with the least # of sig figs to the right of the decimal.

Ex 1 - 25.02 (2 sig figs to the right) + 3.1 (has 1 sig fig to right) = (answer has 1 sig fig to the right) = 28.12 = 28.1 (only 1 sig fig to the right)

Ex 2 – 12,004 + 3.0045 = 12,007.0045 (calculator) = 12,007 (no sig figs after the decimal)

Ex 3 – 23,045,051.1256 + 2.2 = 23,045,053.3 (with sig figs)

Remember – with mult. and div you care about total # of sig figs; with add and sub you care about sig figs after the decimal.