SIGNIFICANT FIGURES

A census estimates the size of a city. It determines that 2,228,400 people were living there on June 30, 2005.

Were there exactly 2,228,400 people ?
Is it possible to estimate a population to the very last person ?

Some people were probably born that day. Others died. Some moved out of the city, while others moved in.

2,228,400 has zeroes in the ones and tens places. This indicates that the estimate is only good to the hundreds place.

It is possible that the number was measured to the nearest ten or one. However one cannot tell by simply looking at the number. In the absence of any other information, we have to assume that the two zeroes ARE NOT significant.

Be conservative in your treatment of numbers. Assume that the last non-zero digit is the last significant figure. Keep this assumption unless you are given additional information about the number.

RULE #1: Trailing zeroes are not significant figures. They are simply space fillers that keep the place of the number.
So in 2,228,400 we only have five sig. figs. '2,228,4'

Example #2 - How many significant figures (sig. figs.) are in 40,200 metres ?

Answer: 3 sig figs. The '40,2' are significant. The last two digits are trailing zeroes.

Example #3 - How many significant figures are in 40,200.00 metres ?
Answer: 7 sig. figs.

Examples #2 and #3 are NOT the same. Example #3 contains different information. It has a decimal point followed by two zeroes. It is a very precise (fine) measurement. The person who made this measurement is telling us that he did measure to the second decimal place. By pure chance the last four digits turned out to be zeroes.

RULE #2: If you have a large number that contains a decimal point, then every digit from the beginning of the number to the decimal point is significant. Any digits shown to the right of the decimal point are also significant.

Example #4 - 10,000.0 - has 6 sig. figs.
Example #5 - 890. - has 3 sig. figs.
Example #6 - 890 - has 2 sig. figs. (no decimal point, so we have a trailing zero)

Example #7 - 78.0020 - has 6 sig. figs.

RULE #3: Different rules apply to numbers that are smaller than one. When we have a decimal fraction, then it is the zeroes at the front of the number that are the space fillers. **The number begins at the first non-zero digit.**

Example #8 - 0.0087 - has 2 sig. figs. The '8' and the '7' are both significant. The three zeroes in the front simply tell us that the number begins in the third decimal place.

Example #9 - 0.0200 - has 3 sig. figs. The two zeroes in the front are space fillers. However the '2', and both zeroes to the right of it, are significant. The two right zeroes tell us that the number was estimated to the fourth decimal place. By pure chance we got zeroes in the 3rd and 4th decimal places.

If the 3rd and 4th decimal places were not significant, then the number would have been written as 0.02 .