Significant figures

We round 5 and above up in all cases and 4 and below down.

Examples:

2 sf

1.119 = 1.1
1.452 = 1.5
1.456 = 1.5
1.449 = 1.4

3 sf

1.119 = 1.12
1.452 = 1.45
1.456 = 1.46
1.449 = 1.45

hhttp://www.gedling.notts.sch.uk/Departments/Maths/roundrev.htm

Decimal Places

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A number may be required to a certain degree of accuracy. Commonly this is specified in the form of to a number of decimal places.
The method employed is to look at the digit following the place specified, and to round up if that digit is 5 or greater.

Examples

(a) Round to 2 decimal places 23.3234
(b) Round to 3 decimal places 100.0998

(a) 23.3234 is 23.32 to 2 decimal places, since the third digit after the decimal point is a 3 which is less than 5.

(b) 100.0998 is 100.100 to 3 decimal places, since the fourth digit is an 8 which is not less than 5. Notice that the carry effect of addition has left the second and third decimal places as zero. This is correct, to omit them is a common error !

Significant Figures

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A number is written as a series of digits from left to right. The left-most non zero digit is called the most significant. This is because of place value, hundreds (even one) is worth more than tens (even nine of them). Tens are worth more than units, units more than tenths. Tenths are likewise worth more than hundredths and so on.

Examples of most significant digits

(a) 175434 (b) 0.0003467
(c) 10009 (d) 0.01001001

Rounding to a given number of significant figures

This is very like rounding to a given number of decimal places. Except that we begin at the most significant digit - that is the first significant figure. Count along the required number of digits (including zeros), and if the digit after the required number of significant figures is five or more round up.

Examples of rounding to a given number of significant figures

Round to 1 significant figure the following numbers...
(a) 2524 ⟶ 2000 ⟶ The zeros are needed to keep place value
(b) 12.25 ⟶ 10 ⟶ No point in a decimal point !
(c) 0.0098 ⟶ 0.01 ⟶ Think about this one, it may seem strange.
Round to 3 significant figures the following numbers...
(a) 8895457845 ⟶ 8,900,000,000 ⟶ Commas help readability of large numbers.

(b) 0.00005645898 ⟶ 0.0000565 ⟶ Rounded up

Error Bounds

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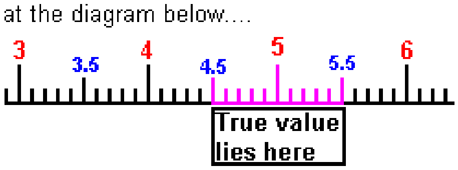
If you are told that the number of people in the world is 5,000,000,000 is it true ? That depends on your point of view, there may be some error in this figure, but how much? It appears to be to the nearest billion, so it lies in the region of ... 4,500,000,000 to 5,500,000,000 These are the error bounds. Look at the diagram below....



Notice that a similar diagram could be drawn for a statement like the cliff was 5 metres high, or 0.5% of a food product is fat. The accuracy of the statement gives rise to error bounds for the true value.

Decimal Places and significant figures

If a number has an accuracy to a stated number of decimal, or significant figures, the error bound can be established by considering what would be the highest value that would round down to it, and the lowest value that would round up to it. This invariably results in a 5 in the position of the last digit.

Examples

Find the error bounds for 1.20 to 2 decimal places, and 300 to 1 significant figure. 1.195 to 1.205 and 250 to 350

Comment Many students have difficulty with the upper error bound being (say) .5 and not .4 To understand think about .4999999..... this would still round down, and is equal to .5

Proof: 5 – 4.9999..... = 0.0000.... = 0