

Rounding

Introduction:

If we divide $251/19$ the answer is $13.210526315789473684210526315789\dots$ and there are more numbers after these in fact they never stop.

Now suppose that the 251 is in grams as weighed on a balance but it can only display the result to the nearest gram. Then the 'true' weight is some where in the region of 251 ± 0.5 grams. If the article weighed now has to be divided into 19 parts and each part has to be checked on the same balance then using the figure $13.210526315789473684210526315789\dots$ is somewhat meaningless. So some figure near this can be used this could be 13.21 or even just 13. These numbers are said to be rounded and the act of doing so **rounding**.

In the above example if the balance can only measure to the nearest gram then the reading displayed by $1/19$ of 251 would be 13. This would be rounded to the nearest whole number.

Suppose the balance could read to $1/100$ of a gram then the reading would be 13.21 grams, to the nearest $1/100$ of a gram.

There are several different ways to round and in the last example the number could be said to be rounded to the nearest 0.01 gram or to two decimal places or to four significant figures. two decimal places because it has two number after the decimal point, 0.21 and four significant figures as it has four numbers in it irrespective of how they relate to decimal place, if any.

Thus 13.210 would be to 3 decimal places. 13.2 would be to three significant figures.

Now for 142.4347 **rounding** to the nearest whole number would be 142, two decimal places 142.43 and four significant figures 142.4.

Now for 1424.347 **rounding** to the nearest whole number would be 1424, one decimal places 142.4 and three significant figures 1420. It could also be rounded to the nearest 10 which would also be 1420, to the nearest 100 1400 and to the nearest 1000 1000.

But what if the number had been 1454.637. In the previous example all the rounded numbers were smaller then the original number, this may not always be the case.



Now our number as represented by the orange line on the simple scale above is nearer to 1455 then 1454 to round to the nearest whole number 1455 would be chosen not 1454. In this case the number is bigger then the original figure. The obvious mid point is 1454.5 so any number between 1454 to less then 1454.5 would be rounded to the whole number to 1454, this is called **rounding** down. Any number bigger then 1454.5 to 1455 would be rounded to the whole number to 1455, this is called **rounding** up. But what if the number is in the middle and exactly 1454.5 does it get rounded down to 1454 or rounded up to 1455, both have equal claim. By convention it tends to get rounded up so would become 1455. There are other more sophisticated conventions but we are not concerned with them here.

Can you see why any number between 1453.5 to 1454.4 is rounded to the whole number as 1454

Examples

Rounding to the nearest 10:	$562.5 = 560$	$1274.0 = 1270$	$22.6 = 20$	$135.1 = 140$
Rounding to one decimal place:	$12.456 = 12.5$	$0.092 = 0.1$	$1463.76 = 1463.8$	$12.349 = 12.3$
Rounding to one 1000	$12345 = 12000$	$38769 = 39000$	$1094.8 = 1000$	$27.1 = 0$

Rounding to the nearest tenth (1/10) is the same as rounding to one decimal place. Rounding to the nearest one thousands (1/1000) is the same as rounding to three decimal places.

89.76543765 to the nearest tenth is 89.8 and to the nearest one thousands 89.765. This is equivalent to one and three decimals places respectively.

Negative numbers are treated in a similar fashion so -143.765 round to the nearest 10 is -140 , the only difference is that it is rounding up as -140 is bigger than -143.765 .

Some times numbers are either rounded up or down irrespective of the rules already explained. This is often done with money, interest from the bank rounded down to the nearest penny. Tax however can often be rounded up.

£2573.98 given at interest at 4.5% would give 115.8291 but could be rounded down to £115.82. A tax bill is calculated to be £3457.23 but is rounded up to £3458.

Questions:

- 1.) Round these numbers to the nearest 10: 123.45, 2378, 156.2, 457, 1274, 99
- 2.) Round these numbers to the nearest decimal place: 23.451, 56.789, 83.6478, 365.873, 1.0901
- 3.) Round these numbers to the nearest whole number: 123.87, 89.4, 101, 246.89, 196.04
- 4.) Round these numbers to the nearest two decimal places: 23.451, 56.789, 3.6478, 5.87, 1.0901
- 5.) Round these numbers to the nearest 100 and say which is then the biggest: 356.8, 349.8, 350.1
- 6.) Take the numbers 1 9 5 3 arrange them using all numbers only once so they are close to 9000, 5400, 1400, 10100 and 4000.