

Rounding Decimals

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Rounding Numbers

You are often asked to 'round' an answer. This is often because the actual answer is far too long and clumsy to work with, **0.45** is a lot easier to deal with than **0.4499857467385** for example. BUT remember not to round any intermediate working steps ALWAYS leave the rounding to the final answer to the problem. There are two ways in which you can round a number, either to a certain amount of **decimal places** or to a certain number of **significant figures**, we shall discuss both.

Decimal Places

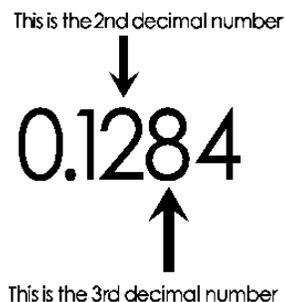
Write the number 0.234765 correct to 4 decimal places (4 d.p.).

To do this we count 1 more digit past the decimal place than the required number of decimal places asked for, so in the example above we will count to the 5th digit, that is, 6. If this digit is **0 – 4** then we leave the number as it is, correct to 4 decimal places. If however, the 5th digit is **5 – 9**, then we add 1 to the previous digit. As the 5th digit in our example is 6, then the answer rounded to 4 decimal places would be **0.2348**.

The reasoning behind this way of rounding is quite straightforward. Take the numbers 0.32341 and 0.32348. We can see that the first number is a lot closer to 0.12340, whereas the second is a lot closer to 0.12350, it is because of this reason that you need to choose either to round up or round down.

Note – If you get asked to round a number such as 3.995 to 2 decimal places, the answer is 4.00.

Example 1: Round 0.1284 to 2 decimal places.



Solution: The 3rd decimal number, 8, is bigger than 4, so we add 1 to the 2nd decimal number 2, and drop the rest of the decimal numbers. The answer is 0.13 (3 d.p.).

Example 2: Round 0.1284 to 1 decimal place.

Solution: The 2nd decimal number, 2, is less than 4, so we do nothing to the 1st decimal number 1, and drop the rest of the decimal numbers. The answer is 0.1 (1 d.p.).

Example 3: Round 0.895 to 2 decimal places.

Solution: The 3rd decimal number, 5, is bigger than 4, so add 1 to the 2nd decimal number to 9 to get 10, and drop the rest of the decimal numbers. But, we have to carry the 1 to the 8 to get 9. So the answer is 0.90 (2 d.p.).

Significant Figures

This is very similar to rounding to a certain amount of decimal places, but this time – as the name sort of suggests – we round to a certain amount of significant figures. But what are these significant figures?

Significant figures are basically any digit that is not a **leading or trailing zero**. For example, **2.5903** has five significant figures (5 sig.fig.), 2, 5, 9, 0 and 3. The number 0.00345 however, has only three significant figures, (3, 4 and 5), as the leading zero digits are not counted.

Round 0.0004857633 to 4 significant figures (4 sig.fig.).

Look for the 5th significant figure, which in this case is a 6. As you will remember from above, if the digit is between 5 and 9 then we round the previous one up, so **0.0004857633** becomes **0.0004858**.

0.00256023164, rounded to 5 decimal places (5 d.p.) is 0.00256, note that this is the same as being rounded to significant figure (3 sig.fig.). You write down the 5 numbers after the decimal point. To round the number to 5 significant figures (5 sig.fig.), you write down 5 numbers, you do not count any leading zeros. So, to 5 significant figures the number is 0.0025602 (5 numbers after the last leading zero).

Rounding Whole Numbers

You may want to round to tens, hundreds, thousands etc, In this case you replace the removed digit(s) with zero(s).

Examples	Because ...
134.9 rounded to tens is 130	... the next digit (4) is less than 5
12 690 rounded to thousands is 13 000	... the next digit (6) is 5 or more

Rounding Decimals

You need to know if you are rounding to tenths, or hundredths, or thousandths, etc., or to "so many decimal places".

Examples	Because ...
3.1416 rounded to hundredths is 3.14	... the next digit (1) is less than 5
1.2635 rounded to tenths is 1.3	... the next digit (6) is 5 or more

Rounding to Significant Figures

To round "so many" significant digits, just **count digits from left to right**, and then round off from there.

Note: if there are leading zeros (such as 0.006), do not count these leading zeros because they are only place holders to show how small the number is.

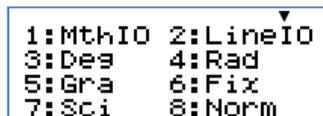
Examples	Because ...
1.239 rounded to 3 significant digits is 1.24	... the next digit (9) is 5 or more
134.9 rounded to 1 significant digit is 100	... the next digit (3) is less than 5

Scientific calculators cannot round to significant figures or the nearest whole number BUT they can be used to round to appropriate decimal place accuracy.

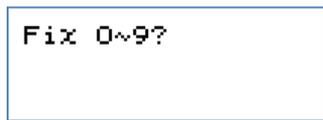
Turn on the **FX82AU** calculator.



Now go into **SETUP** [SHIFT] [MODE].



Select **6: Fix**

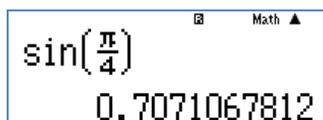
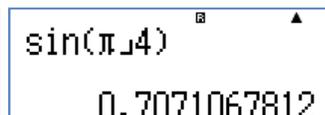
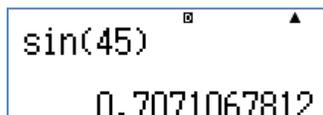


By selecting **[0]** you will record all of the answers calculated correct to the nearest unit. (0 d.p.)

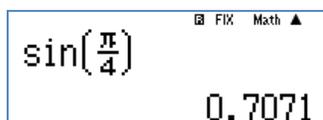
By selecting **[1]** you will record all of the answers calculated correct to the nearest tenth (1 d.p.)

By selecting **[4]** you will record all of the answers calculated correct to the nearest 0.0001 (4 d.p.) etc.,

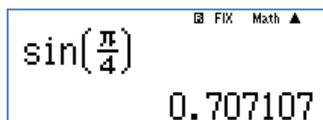
Type in an expression onto the calculator screen that has a decimal answer. For example $\sin(45)$ if you are in degree mode or $\sin(\pi/4)$ you are in radian mode.



These three screen shots are displayed in NORMAL mode.



By selecting **[4]** you have recorded $\sin(\pi/4)$ correct to the nearest 0.0001 (4 d.p.).



By selecting **[6]** you have recorded $\sin(\pi/4)$ correct to the nearest 0.000001 (6 d.p.).