Approximations, decimal places and significant figures

Year 11 General Maths
Units 1 and 2

Learning Objectives

By the end of the lesson, I hope that you understand and can apply the following to a range of questions from the Unit 1 and 2 General Mathematics course.

- To be able to round numbers to the required accuracy.
- To be able to express numbers in scientific notation.
- To be able to round numbers to the required significant figures.

Recap

This is the start of a new section of work but it has been covered in previous years of Mathematics teaching. It is, perhaps, one of the subjects which could be considered the most important.

Lots of marks are given and removed in VCAA exams for rounding values to the correct number of decimal places or significant figures.

So many General Maths students don’t know how to do this and lose lots of marks across their exams.

This lesson will look at, once again, improving your understanding of rounding to decimal places and significant figures.

Rounding to a number of decimal places

As the name suggests, this whole concept relates to the position of the numbers **after the decimal point.**

If I want to round to 1 decimal place (1dp) then I am looking to keep the first number after the decimal point.

If I want to round to 2 decimal places (2dp), I am looking to keep the first two numbers after the decimal point.

But …. It might be that a number has more than 2 numbers after the decimal point. What do we do???

We **round**.

5 or more ↑1

0 - 4 =

$$12.345\,106$$

This number has 6 decimal places at the moment.

The rules for rounding to the nearest ten, hundred, thousand etc

This all relies on your knowledge to **place value**.

If you know which number is in the ten, hundred, thousands etc column, then you are able to round using the following rules:

If the number **after the one I am trying to keep** is a 5 or more, then we add one to the number **we are trying to keep.** The rest of the numbers become zeros**.**

If the number after the one I am trying to keep is a 0 to 4, then we do not change the number we are trying to keep. The rest of the numbers become zeros.

Example: Round 34 867 to the nearest thousand.

10 000 100

34 867

1000 10

34900

The rules for rounding decimal numbers

If the number **after the one I am trying to keep** is a 5 or more, then we add one to the number **we are trying to keep.**

If the number after the one I am trying to keep is a 0 to 4, then we do not change the number we are trying to keep.

Let's do some examples to make this clear!

Example: Round 94.738 295 to two decimal places.

9 4 7 3 8 . 2 9 | 5

9 4 7 3 8 . 3

Lots of examples

Let’s use the number below to round to 1 dp, 2 dp and 3 dp.

Note: I always draw the line in to show which number I am looking at keeping and which number might cause a chance.

$$10.499502$$

10.5 (1 dp)

10.5 (2 dp)

10.5 (3dp)

Rounding to significant figures

Significant figures works in exactly the same way as decimal places … except we don’t look at the decimal point, we start counting at the first **non-zero number**.

The rules pretty much stay the same.

The important thing is to remember that the numbers we “don’t want anymore” become zeros. Any zeros after the decimal point can be removed. We cannot ignore the zeros before the decimal point.

Let’s look at some examples!

Example

Write each number in scientific notation, then round to two significant figures.

$$9764.809\ 4$$

$$97|64 \cdot 8094$$

$$98\underline{00}\ (2sf)$$

$$0.000\ 004\ 716\ 8$$

$$0.000\ 004\ 7|16\ 8$$

$$0.000\ 004\ 7\ (2sf)$$

Example

Round the following to 3 significant figures.

57.892 607

57.9 (3sf)

0.000 471 68

0.000472 (3sf)

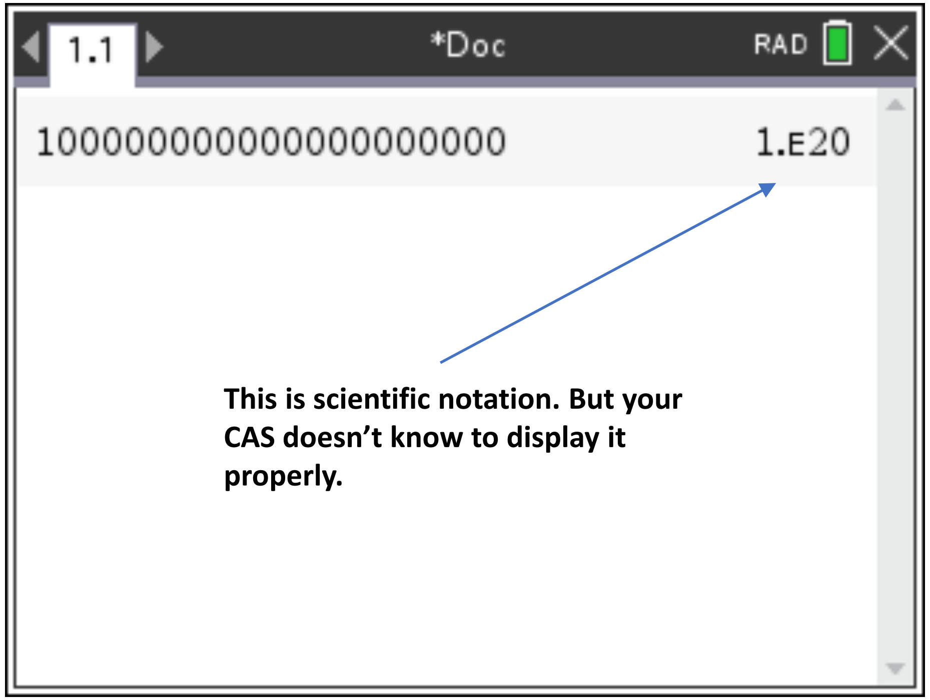
Scientific notation

We can write really large (or really small) numbers in a much simpler way!

For example, 1 million can be written as 1×10^6

Another example is that 0.000 000 000 1 can be written as 1×10^{-10}

Many of you might have seen scientific numbers before on your CAS.



This is scientific notation. But your CAS doesn't know to display it properly.

$1E20 = 1 \times 10^{20}$

$1E7 = 1 \times 10^{7}$

$1.43E6 = 1.43 \times 10^{6}$

When you see the little "E" just think of it as $\times 10$

Converting into scientific notation (numbers bigger than 1)

This is going to be long explanation! So … I'm not going to be able to type too much here. Hopefully, by the end of the explanation it will make sense.

1×10^{20}

Remember: For raw numbers which are bigger than one, the power will be positive and you are trying to move the decimal point to between the first two non-zero numbers.

$10 = 1 \times 10^1$

$100 = 1 \times 10 \times 10 = 1 \times 10^2$

$1000 = 1 \times 10 \times 10 \times 10 = 1 \times 10^3$

$10000 = 1 \times 10^4$

$1.0000. = 1 \times 10^4$

Converting into scientific notation (numbers smaller than 1)

This is going to be long explanation! So … I'm not going to be able to type too much here. Hopefully, by the end of the explanation it will make sense.

Remember: For raw numbers which are smaller than one, the power will be negative, and you are trying to move the decimal point to between the first two non-zero numbers.

0.0001.

1×10^{-4}

Converting from scientific notation (positive powers)

This is going to be long explanation! So … I'm not going to be able to type too much here. Hopefully, by the end of the explanation it will make sense.

Note: For powers which are positive, you will move the decimal point to the right. You will move the decimal point the same number of places as the power.

$$1.34 \times 10^3$$
$$= 1.34 \times \underline{1000}$$
$$= \underline{\underline{1\,340}}$$

$$2.763 \times 10^2$$
$$= 2.763 \times 100$$
$$= \underline{\underline{276.3}}$$

Converting from scientific notation (negative powers)

This is going to be long explanation! So … I'm not going to be able to type too much here. Hopefully, by the end of the explanation it will make sense.

Note: For powers which are negative, you will move the decimal point to the left. You will move the decimal point the same number of places as the power.

1.27×10^{-2}

$0.01\ 27$

0.0127

1.047×10^{-3}

$0.001\ 047$

$= 0.001047$

Work to complete

The work I am asking to be completed for this topic is shown below.

This is the minimum work which should be completed. The more questions which are answered the better your chance of success in exams. Questions towards the end of the exercises and in the Chapter Review are the best practice you can do.

Questions to complete:
Exercise 10A: All