Significant Figures

Significant means ‘to have value’.

Rules of Significant Figures

A digit is a significant figure if it is not a 0, or:

- it is a 0 that appears after a significant figure (for example, in 101 the 0 is significant);
- it is a trailing 0 after a decimal point (for example, in 1.10 the 0 is significant).

Example 1

In **5**08, the 5 is the most significant figure as it is the digit with the highest place value – it tells us the number is in the five hundreds.

508 has three significant figures. The 5 and the 8 are significant because they are not 0. The 0 is significant because it appears after the 5 which is significant.

Example 2

In 0.0**3**10, the 3 is the most significant figure as it is the digit with the highest place value – it tells us the number is in the thousandths.

0.0310 has 3 significant figures. The 3 and the 1 are significant because they are not 0. The final 0 is significant because it is a trailing 0 after a decimal place – it gives us information about how accurately we know this number.

Suitable Degrees of Accuracy

If you are not told how many significant figures or decimal places to round to, identify the most harshly rounded number in the question and round your answer to this degree of accuracy.

For example, a question might say:

Calculate 0.25 × 3.94687, giving your answer to a suitable degree of accuracy.

In this case, 0.25 is given to 2 significant figures and 3.94687 is given to 6 significant figures. In this case, you could give your answer to 2 significant figures (or alternatively you could look at the number of decimal places and round to 2 decimal places).

Rounding to 1 Significant Figure

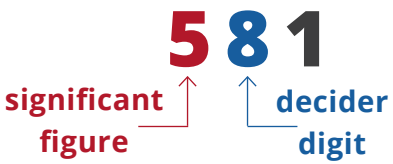
Start counting from the first digit that is not a zero to identify the significant figure needed.

Example 1 — Round 581 to one significant figure.

The significant figure is the **5**.

We need to identify the deciding digit – this is always the first digit to the right of the significant figure.

The deciding digit is **8**.



As the deciding digit is 5 or more, the number is rounded up – 5 rounds up to 6.

The answer cannot be just 6 as the original number is in the five hundreds.

Replace the other 2 digits, up to the decimal point, with zeros.

600

581 rounded to one significant figure is 600.

Note that 581 is nearer to 600 than 500.

Example 2 — Round 0.041 to one significant figure.

The significant figure is the **4**.

The deciding digit is the first digit to the right of the significant figure.

The deciding digit is **1**.

As the deciding digit is less than 5, the number is rounded down. In this case, 4 stays the same.

Make sure you keep the 0s that came before the significant figure so that the 4 is still in the hundredths column.

0.04

Do not write any zeros after the significant figure – a trailing 0 after a decimal is significant. This means that, while 0.04 is rounded to 1 significant figure, 0.040 is rounded to 2 significant figures.

0.041 rounded to one significant figure is 0.04.

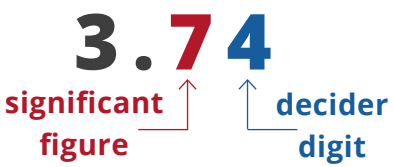
Note that the place value of the 4 stays the same.

Rounding to 2 Significant Figures

Start counting from the first digit that is not a zero to identify the significant figures needed.

Example 1 **Round 3.74 to two significant figures.**

The first significant figure is the **3** and the second significant figure is the **7**.



The deciding digit is the first digit to the right of the last significant figure, the **4**.

As the deciding digit is less than 5, the number is rounded down. In this case, 7 stays the same.

The two significant figures are 3 and 7, and they have the same place values as the original number.

3.7

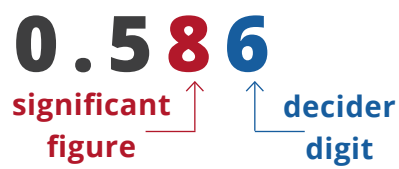
Be careful not to write any zeros after the 7 – these will add extra significant figures.

3.74 rounded to two significant figures is 3.7.

Note that 3.74 is nearer to 3.7 than to 3.8.

Example 2 **Round 0.586 to two significant figures.**

The first significant figure is the **5** and the second significant figure is the **8**. The deciding digit is the **6**.



As the deciding digit is more than 5, the number is rounded up. In this case, the 8 becomes 9.

The place values should not change, so be careful to add a 0 and a decimal point before 59.

0.59

0.586 rounded to two significant figures is 0.59.

Note that 0.586 is nearer to 0.59 than 0.58.

Rounding to 3 Significant Figures

Start counting from the first digit that is not a zero to identify the significant figures needed.

Example 1 **Round 5 789 305 to three significant figures.**

The first significant figure is the **5**, the second significant figure is the **7** and the third significant figure is the **8**.

5 789 305

significant figure **decider digit**

The deciding digit is the first digit to the right of the last significant figure, **9**.

As the deciding digit is 5 or more, the number is rounded up. 8 rounds up to 9.

The answer cannot be just 579 as the original number is in the millions, so fill in any 'gaps' after the last significant figure with zeros to ensure that the place values from the original number are not altered.

5 790 000

5 789 305 rounded to three significant figures is 5 790 000.

Example 2 **Round 0.0059247 to three significant figures.**

The first significant figure is the **5**, the second significant figure is the **9** and the third significant figure is the **2**. The deciding digit is the **4**.

0.0059247

significant figure **decider digit**

As the deciding digit is less than 5, the number is rounded down. In this case, 2 stays the same.

Keep the zeros that came before the first significant figure.

0.00592

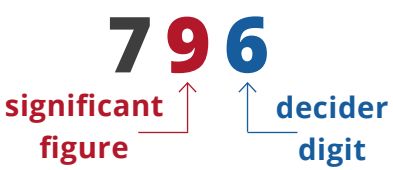
Make sure you don't add any zeros after the last significant figure.

0.0059247 rounded to 3 significant figures is 0.00592.

Rounding When the Significant Figure Is 9 and the Deciding Digit Is 5 or More

Example 1 **Round 796 to two significant figures.**

The first significant figure is **7** and the second significant figure is **9**. The deciding digit is **6**.



As the deciding digit is 5 or more, the number is rounded up. 9 rounds up to 10

The answer cannot be 700 as this is not close enough to 796.

Therefore, 1 has to be carried into the hundreds column.

Finally, 'fill in' any zeros after the last significant figure to keep the place value the same.

800

796 rounded to 2 significant figures is 800.

Note that 796 is nearer to 800 than to 790.

Example 2 **Round 0.97 to one significant figure.**

The significant figure is **9** and the deciding digit is **7**.

As the deciding digit is 5 or more, the number is rounded up. 9 rounds up to 10.

The answer cannot be 0.10 as this is not close to 0.97.

1 has to be carried into the units (ones) column.

No zeros are needed this time as the answer is to one significant figure. Make sure you don't add a 0 after the decimal place – 1.0 has two significant figures, not 1.

1

0.97 rounded to 1 significant figure is 1.

Note that 0.97 is closer to 1 than to 0.9.