

Rounding to Significant Figures **Answers**

1. Complete the table by rounding each number to one, two and three significant figures.

Number	Round to One Significant Figure	Round to Two Significant Figures	Round to Three Significant Figures
3578	4000	3600	3580
8502	9000	8500	8500
101 764	100 000	100 000	102 000
347 102	300 000	350 000	347 000
505 297	500 000	510 000	505 000
265.36	300	270	265
489.951	500	490	490
7012.76	7000	7000	7010
131.541	100	130	132
155.85	200	160	156
995 841.23	1 000 000	1 000 000	996 000
4.0052	4	4.0	4.01
111.021	100	110	111
0.05234	0.05	0.052	0.0523
0.09854	0.1	0.099	0.0985
0.18781	0.2	0.19	0.188
0.87423	0.9	0.87	0.874
0.009883	0.01	0.0099	0.00988
0.0009695	0.001	0.00097	0.000970

2. The approximate distance from the Earth to the Sun is 149 597 870 700m. Round this number to two significant figures.

150 000 000 000m

3. A bacterial cell has a length of 0.001375mm. Round this number to three significant figures.

0.00138mm

4. A car travels for 35 seconds at an average speed of 15m/s. Use the equation **distance = speed × time** to calculate the distance travelled by the car. Give your answer to two significant figures.

distance = 35 × 15 = 525m

530m (2s.f.)

5. A solution contains 40g of salt dissolved in 1.9dm³ of water. Use the equation

concentration = $\frac{\text{mass}}{\text{volume}}$ to calculate the concentration of the solution. Give your answer

to four significant figures.

concentration = $\frac{40}{1.9} = 21.052631578\text{g/dm}^3$

21.05g/dm³ (4s.f.)

Rounding to Significant Figures

There are two key rounding rules which you should know:

- If the deciding digit is less than 5 (0, 1, 2, 3 or 4), we round down.
- If the deciding digit is 5 or more (5, 6, 7, 8 or 9), we round up.

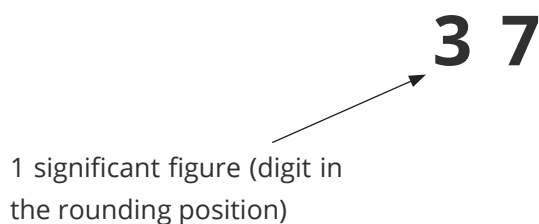
In maths, significant means 'to have value'. For example, in the number 2795, the 2 is the most significant digit, because it tells us that the number is 2 thousand and something. However, in the number 0.052, the 5 is the most significant digit.

Let's look at this in practice.

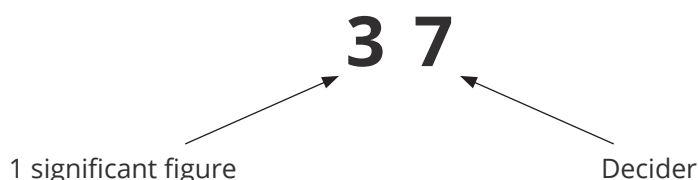
Rounding to One Significant Figure

Example 1: Round 37 to 1 significant figure.

We must firstly identify the column where we are being asked to round. In this case, we are being asked to round the number to one significant figure. When we round to significant figures, we start counting as soon as we reach a number that is not zero. In this example, it is the digit 3.



Now, look at the digit in the column to the right of the 3. This digit will decide what happens to the 3 and is known as the 'decider'. It will determine whether we will be rounding up or down, and therefore whether the digit in the rounding position will increase or stay the same. If the decider digit is 5 or more, it tells us that we will round up. If it is 4 or less, it tells us that we will round down. By applying this rule, we see that we are rounding up, so the 3 needs to be increased to 4. This is because 37 is closer to 40 than it is to 30.



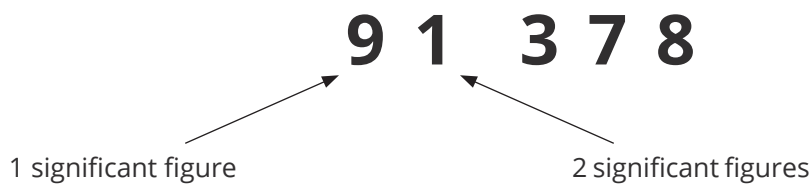
Rounding to Significant Figures

It is vital that the place value of the original digits remains the same. For whole numbers, you will need to replace any rounded digits with the correct number of zeros.

Therefore, 37 rounded to 1 significant figure is 40. Notice how the number now only has **one** 'significant' figure (4) whilst retaining its original place value (the 0 has no value, so is not counted as a significant figure).

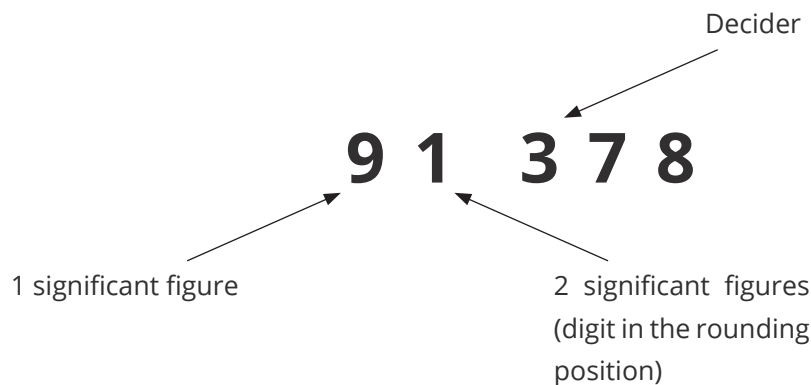
Rounding to Two Significant Figures

Example 2: Round 91 378 to two significant figures.



Again, start by identifying the column where we are being asked to round. In this case, we are rounding to **two** significant figures. Remember we start counting as soon as we reach a number that is not zero. The first significant figure is 9. The second significant figure is 1.

Now, look at the digit and column to the right of the 1. This is the decider digit and determines whether we will be rounding up or down.



We can see that the decider digit here is 3. If the deciding digit is less than 5, then we are rounding down. This means the digit in the rounding position, 1, remains the same and the following three digits are replaced by 0s. Although we haven't changed the value of the 1, we have rounded down, as our number is smaller than our original number, but keeps its original place value.

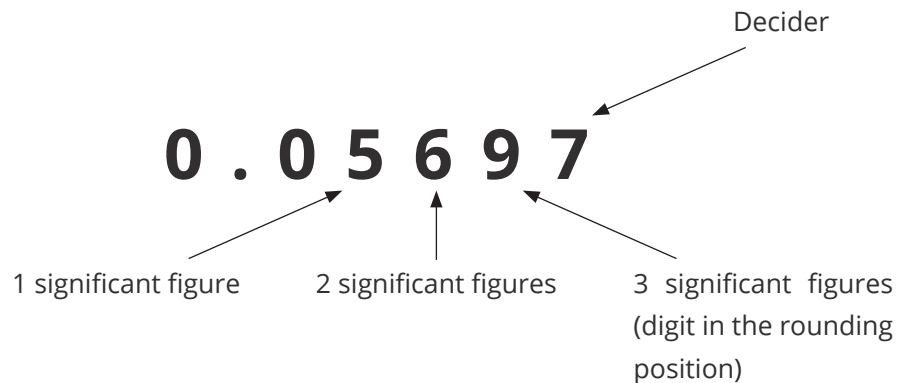
91 378 rounded to 2 significant figures is 91 000.

Rounding to Three Significant Figures

Example 3: Round 0.05697 to three significant figures.

Rounding to three significant figures follows similar steps to rounding to one or two significant figures.

Begin by identifying the digit in the rounding position. This time we have a decimal number which contains 0s at the beginning. Remember, we start counting as soon as we reach a number that is **not** zero.



By applying the rounding rules, the decider digit (7) tells us that we are rounding up. This means the digit in the rounding position (9) needs to be increased. We need to be careful here. If we increase 9 by one, we get 10 but we can't just squeeze 10 into the gap. Instead, we replace the 9 with a 0, and add the 1 to the column to the left (6).

0.05697 rounded to three significant figures is 0.0570. You might think that we don't need the final zero; however, a trailing zero after a decimal place is significant, because it gives us information about how accurately we know the number (0.60 is more accurate than 0.6, for example).

Example 4: Round 14 032.25 to three significant figures.

As before, we identify our rounding digit by counting to the third significant figure, 0. In this case, 0 is significant, because it is between other significant figures and if we removed it we would change their value (the 4 is currently worth 4000, if we removed the 0 the 4 would be worth 400). We look at the next digit, 3, which tells us to round down. We leave the 0, replace the 3 and 2 with 0s, and remove the 0s after the decimal point. This gives us 14 000.

You may notice that 14 000 actually only has two significant figures. In this situation, you can think of rounding to three significant figures as rounding **up to** three significant figures. You will never have to use more significant figures, but sometimes you may have to use less.

Your Turn

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