In science, it's not just enough to know a number—we also have to know *how specific* that number is. This is expressed through *significant figures*.

For instance, the number 2.5 is different than the number 2.50. In science, when we say "2.5 cm" we are saying that the number could be anywhere from 2 cm to 3 cm, and we think it's about half way between (maybe we measured it using a ruler marked every centimeter). 2.50 cm, on the other hand, indicates that when we made the measurement, we were sure that it was somewhere between 2.5 cm and 2.6 cm (maybe this ruler was marked every millimeter), and that it looked pretty close to exactly on the 3.5 mark. Note that the last digit is always an estimate—when reporting a measurement, you include all of the digits you can be sure of, plus one extra digit which you estimate.

We can express how specific a number is by counting its significant figures. Here are some examples:

- 5.31 has three significant figures—all three of its digits are significant. If a measurement is reported as 5.31, it could be anywhere from 5.3 to 5.4 (but it looked like it was close to 5.31).
- 05.31 also has three significant figures—zeroes in front don't count.
- 5.310 has four significant figures—zeros at the end after a decimal point make the answer more specific. If a measurement is reported like this, it could be anywhere from 5.31 to 5.32.
- 0.0351 has three significant figures—here, the zeroes in front are needed for the decimal, but they don't make the answer any more specific (they just tell us how big they are). If a measurement is reported like this, it could be anywhere from 0.035 to 0.036.
- 35,1000 also has three significant figures—we have zeroes on the end because we need them to make the number the right size, but they're not making the answer more specific either. If a measurement is reported like this, it could be anywhere from 35,1000 to 35,2000.
- 35,1040 has *five* significant figures—there's the zero in the middle, but because of the 4, we know that the measurement went down to the tens.
- 35,1000.0 has seven significant figures—if you have a decimal point, all zeroes on the end count (if you only wanted three significant figures, you wouldn't put the decimal part).
- 35,1000. (note the decimal point on the end) has six significant figures—the above principle applies even if there aren't any digits after the decimal.

Sometimes to make the significant figures work, we need to use scientific notation. Let's say we measured something to four significant figures. We can't answer like 35,100, because that would incorrectly imply that we only had three significant figures. 35,100. (with a decimal on the end) is also wrong, because that has five significant figures. Instead, we must report the answer as $3.510 \cdot 10^4$. That way, we can make it clear that we have four significant figures.

When we're doing math, we must take care to not give an answer that is more specific than the numbers we are working from. Here are some examples:

- 2.87 + 2.929 = 5.77
  We round the last digit, because if we included it we would have more significant figures than what we started with (2.87 only has 3 significant figures, so we can't give an answer with 4 significant figures because we're not sure what the last digit is).
- 6.78 + 7.856 = 14.64
  When adding, we can gain new significant figures in the front when numbers carry over. However, we still can't have more signifiant figures than we started with at the end of the number. Therefore, we round off the last digit of our answer. In other words, when you are

adding or subtracting, you keep the number of decimal digits the same as the least among the numbers you are adding.

- 2.4865 * 9,080 = 22,600.
  The rules for multiplication are simple: never give more sig figs than you started with. Because 9,080 only has 3 sig figs, we can only give 3 sig figs in our answer.

The rules for subtraction are the same as for addition, and the rules for division are the same as for multiplication.