In Scientific calculation, there are two types of numbers:

- Exact numbers (1 dozen eggs = 12 eggs), (100 cm = 1 meter)...
- Inexact numbers: Arise form measurements.

All measured numbers have an associated Uncertainty.
(Where: The uncertainties drive from the instruments, human errors ...)

- Important to know:
  When reporting a measurement, so that it does not appear to be more accurate than the equipment used to make the measurement allows.
- The number of significant figures in a measurement:
  The number of digits that are known with some degree of confidence plus the last digit which is an estimate or approximation.

  $2.5\underline{3} \pm 0.01$ g 3 significant figures

- **Precision:** Is the degree to which repeated measurements under same conditions show the same results.
- **Significant Figures:** Number of digits in a figure that express the precision of a measurement.

Significant Figures - Rules

Significant figures give the reader an idea of how well you could actually measure/report your data.

1) ALL non-zero numbers (1, 2, 3, 4, 5, 6, 7, 8, 9) are ALWAYS significant.

2) ALL zeroes between non-zero numbers are ALWAYS significant.

3) ALL zeroes which are SIMULTANEOUSLY to the right of the decimal point AND at the end of the number are ALWAYS significant.

4) ALL zeroes which are to the left of a written decimal point and are in a number >= 10 are ALWAYS significant.

Example:

Number	# Significant Figures	Rule(s)
48,923	5	1
3.967	4	1
900.06	5	1,2,4
0.0004 (= 4 E-4)	1	1,4
8.1000	5	1,3
501.040	6	1,2,3,4
3,000,000 (= 3 E+6)	1	1
10.0 (= 1.00 E+1)	3	1,3,4

Remember:

$$0.0004 = 4 \times 10^{-4}$$

ADDITION AND SUBTRACTION:

Count the **Number of Decimal Places** to determine the number of significant figures. The answer cannot **Contain More Places after the Decimal Point than the Smallest Number of Decimal Places** in the numbers being added or subtracted.

Example:

```
   23.112233
    1.3324
+   0.25
------------
```

24.694633 → 24.69

23.112233 (6 places after the decimal point)
1.3324 (4 places after the decimal point)
+ 0.25 (2 places after the decimal point)
24.694633 (on calculator)
24.69 (rounded to 2 places in the answer)

MULTIPLICATION AND DIVISION:

Count the **Number Of Significant Figures. The answer cannot contain More Significant Figures than the Number Being Multiplied or Divided with the Least Number of Significant Figures.**

Example:

```
23.123123
× 1.3344
------------
```

30.855495 → 30.855

23.123123 (8 significant figures)
× 1.3344 (5 significant figures)
30.855495 (on calculator)
30.855 (rounded to 5 significant figures)