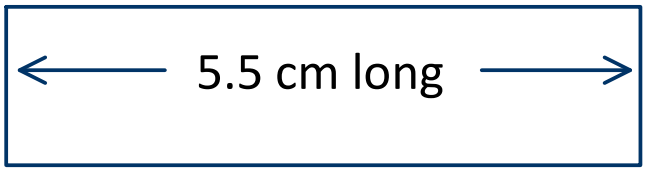
Exact numbers: Counting (or by definition)

Measurements: Contain some uncertainty

length:



marks every 0.1 cm

marks every 1 cm

	Team A:	Team B:	Team C:
	5.6 cm	5.68 cm	5.49 cm
	5.5 cm	5.66 cm	5.51 cm
	5.4 cm	5.67 cm	5.50 cm
Averages:	5.5 cm	5.67 cm	5.50 cm

Quality of measurements:

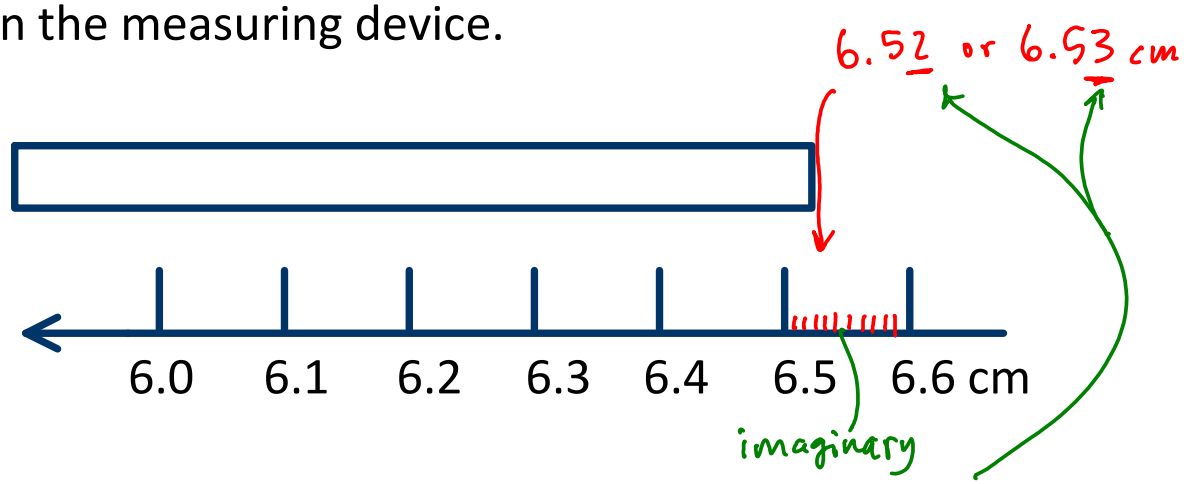
Accuracy: "correctness" - how close to "true" value

A & C more accurate than B

Precision: "repeatability" - how close a group of values are to each other

B & C more precise than A

Precision is usually dependent on how many marks are on the measuring device.



Every metric measurement has exactly one uncertain digit.

Significant figures: used to track uncertainty through calculations

10.0 cm / 3 = 3.33333 .... cm

too many digits!

Which digits in a measurement are significant?

1. All nonzero digits are significant
   a. 23.48 cm 4 sf.
   b. 1.22 cm 3 sf

2. Leading zeroes (to left of nonzero digits) are <u>never</u> significant
   a. 0.00281 cm 3 sf
   b. 0.000281 cm 3 sf

3. Trapped zeroes (interior) are always significant
   a. 0.002081 cm 4 sf
   b. 0.03002005 cm 7 sf

4. Trailing zeroes (to right of nonzero digits) are significant **<u>IF</u>** there's a decimal point anywhere in the measurement
   a. 0.0050 cm 2 sf
   b. 48000.0 cm 6 sf
   c. 48000. cm 5 sf
   d. 48000 cm unclear # sf. <u>avoid this.</u>
   (could assume worst - 2 sf only)

Rounding reduces the number of sig figs in a measurement.

421.38 cm → round to 4 s.f. → 421.4 cm

look at 1 digit to right of last sig fig:

0-4 round down

5-9 round up

922.248 cm → round to 4 s.f. → 922.2 cm

5497 cm → round to 2 s.f. → 5500 cm

5497 cm → round to 3 s.f. → 5500 cm unclear

~~5500.~~

must use scientific notation.

Scientific notation:

- used to easily report very small or very large numbers
- always clearly shows any desired number of significant figures (never ambiguous)

$\# \times 10^{\square}$

between 1-10

power of 10 to change size

$10^0 = 1$

$10^1 = 10$

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

$10^3 = 1000$

$2.00 \times 10^2 = 200.$ preserve 3 sig figs

decimal

$2.000 \times 10^2 = 200.0$ 4 sf

big #

$5500 = 5.50 \times 10^3$

say we want 3 sf

positive power of 10 makes it a large #

Scientific notation

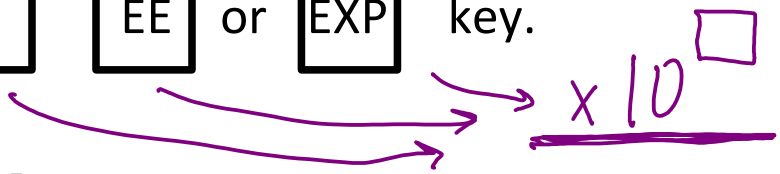
9.78×10^{3} decimal → 9780

placeholder

1.34×10^{-2} decimal → 0.0134

0.000 013 8 sci → 1.38×10^{-5}

To use scientific notation on your calculator, you must use the [E] [EE] or [EXP] key.



To enter 1.38×10^{5} :

1.38 E 5

To enter 2.551×10^{-3} :

text calculator:

numeric calculator: