MATH 10 – UNIT 1 – LESSON 5 – RELATING SI (METRIC) AND IMPERIAL UNITS
MEASUREMENT UNIT Name: Key

For this lesson, you will need: a ruler / measuring tape with metric and imperial units, string, calipers, and 2 objects to measure.

Try this! Using a ruler, estimate the length of 1 in. to the nearest tenth of a centimetre, and estimate the length of 1 cm to the nearest fraction of an inch.

1 cm ≅ $\frac{13}{32} = 0.4$ in. 1 in. ≅ 2.5 cm

Convert it!

1. 18 m to ft

$18\text{m} \times \frac{1\text{ft.}}{0.3048\text{m}}$

$\therefore = 59.1\text{ft.}$

$= 59\frac{1}{10}\text{ft.}$

2. 50 ft to m

$50\text{ft.} \times \frac{0.3048\text{m}}{1\text{ft.}}$

$= 15.24\text{m}$

3. 70 km to mi.

$70\text{km} \times \frac{1\text{mi.}}{1.609\text{km}}$

$= 43.5\text{mi}$

$= 43\frac{5}{10}\text{mi} = 43\frac{1}{2}\text{mi.}$

4. 20 mi. to km

$20\text{mi.} \times \frac{1.609\text{km}}{1\text{mi.}}$

$= 32.18\text{km}$

5. 212 cm to ft

$212\text{cm} \times \frac{1\text{in.}}{2.54\text{cm}} \times \frac{1\text{ft.}}{12\text{in.}}$

$= 7\text{ft.}$

6. 650 yd. to km

$650\text{yd.} \times \frac{0.9144\text{m}}{1\text{yd}} \times \frac{1\text{km}}{1000\text{m}}$

$= 0.59\text{km}$

Solve it!

Sandeep is 5 ft. 4 in. tall. To list her height on her driver's license application, Sandeep needs to convert this measurement to centimetres.

a. What is Sandeep's height to the nearest centimetre?

$5\text{ft} \times \frac{12\text{in.}}{1\text{ft.}} = 60\text{in}$

height in in. = 60 + 4 = 64 in.

$64\text{in.} \times \frac{2.54\text{cm}}{1\text{in.}} = 163$

∴ Sandeep's height is approx. 163 cm.

b. Use mental math and estimation to justify that the answer is reasonable.

→ 1 ft. is approx 30 cm (look @ your ruler)

→ 5 ft ≈ 5 × 30 cm = 150 cm

so 163 cm is reasonable.

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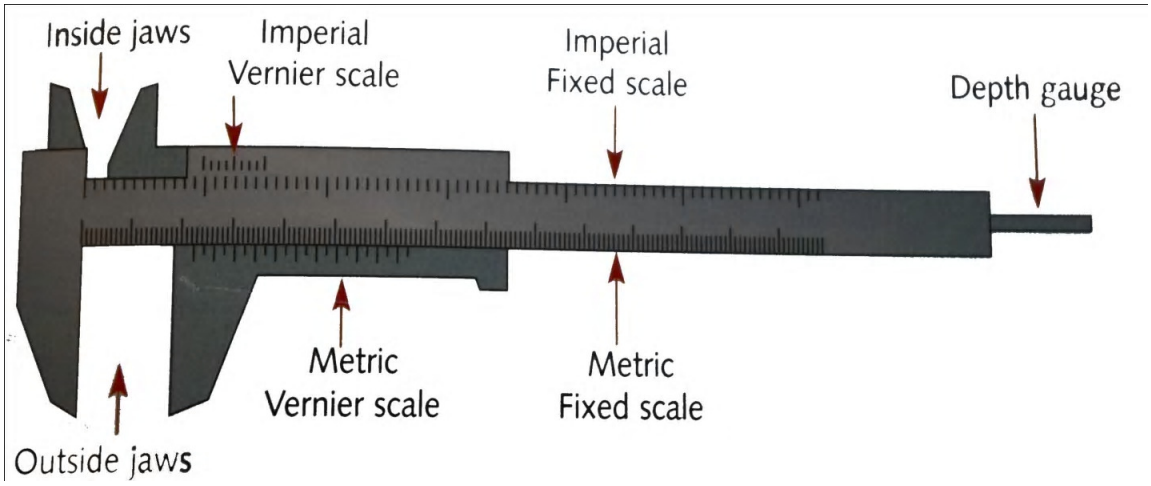
MEASUREMENT UNIT Name: Key

Measuring with Vernier Calipers

Vernier calipers are used to make very precise measurements. They have a main scale, showing to the nearest millimetre like most rulers, but also a Vernier scale that offers an even more precise measurement. (In case you were wondering where the Vernier comes from, they were invented by Pierre Vernier in 1631!)



Measurement Devices:

- Outside jaws: used to measure the outer dimensions of objects
  Ex: the outer diameter of a pipe
- Inside jaws: used to measure the inner dimensions of objects
  Ex: the inner diameter of a pipe
- Stem/depth gauge: used to measure the depth of objects
  Ex: the depth of a small container.

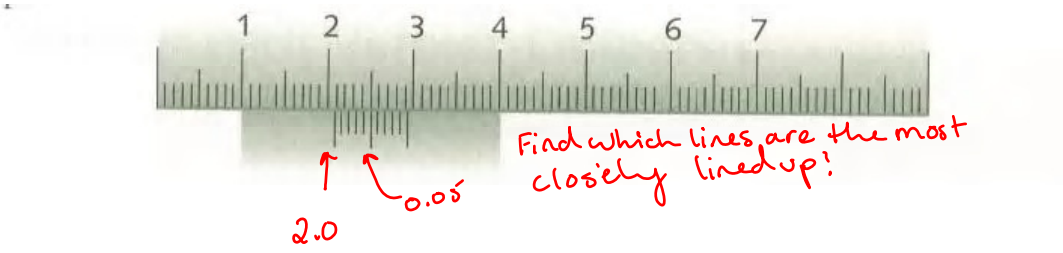
Measurement Scales:

- Fixed scale
  - does not move!
  - looks like a ruler

  metric: divided into mm
- Moving (Vernier) scale
  - measurements are accurate to the nearest hundredth of a cm!

  metric: divided into $\frac{1}{100}$ cm or 0.01cm

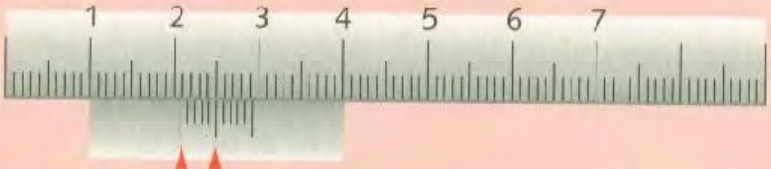
Example: Read the following measurement made in metric units with Vernier calipers.



Find which lines are the most closely lined up!

So... the measurement is 2.05 cm
(2.0 + 0.05)

Solution



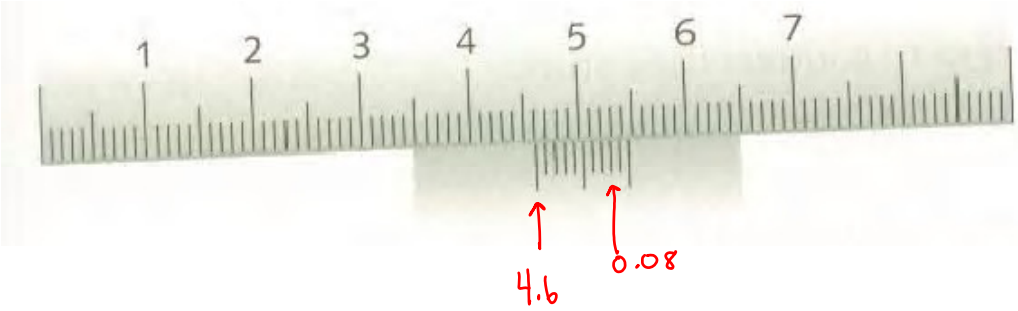
First line on the moving scale reads the fixed scale of 2.0

Best aligns on moving scale at 0.05

First read the fixed scale, using the first line on the moving scale as a pointer. This line points to a place beyond 2.0 cm.
Now find the line on the moving scale that most closely aligns with a line on the fixed scale. The moving scale has 10 divisions, and each division represents 0.01 cm. The line that best matches is the fifth line on the moving scale; that is 0.05 cm.

Therefore the reading of the caliper is:
2.0 + 0.05 = 2.05 cm

Example #2: Read the following Vernier caliper calibrated in metric units.



So the measurement is 4.6 + 0.08 = 4.68 cm

ACTIVITY: Measuring with Vernier Calipers

Instructions: (repeat the following steps for two different objects)

1. Sketch the object.
2. Use a referent to estimate all possible linear measures of the object in imperial units and then again in SI (metric) units. Record these estimates on the sketch. Think height, perimeter, inner diameter and outer diameter.
3. Choose appropriate measuring instruments in both imperial units and SI units to measure the object in as many ways as you can. Record the measurements on the sketch. Make sure you use the Vernier calipers when you can! Think about what you might use the string for...

OBJECT #1

OBJECT #2

Lesson 5 Homework: WS 10-1-5 "Metric / Imperial Conversion & Measure with Vernier Calipers"