

ESSENTIAL MATHEMATICS 1

WEEK 9 NOTES AND EXERCISES

ESTIMATING LENGTH

It is quite easy to estimate lengths without a ruler. Our body parts can act as a ruler for us. If you enter the length of your little finger, width of your palm length of your shoe and the length of your stride into the memory of your phone you will always have them with you to estimate length.

Some Useful Body Lengths

Length of little finger	5 cm
Length of thumb	3 cm
Width of palm	8 cm
Hand span	21 cm
Shoe length	30 cm
Length of stride	50 cm

Some other useful lengths

Length of a \$50 note	15 cm
Length of an A4 sheet of paper	36 cm

Example

Paula is estimating the length of a table. She counted that it was 5 of her shoes long. Approximately how long is the table?

If our shoe is approximately 30 cm long then the table is $5 \times 30 = 150$ cm long.

Exercise Set 1

Q1. Emma's veranda is 8 shoe lengths wide. Approximately how many cm wide is Emma's veranda?

Q2. A horse is 14 hands high from the ground to its back. Calculate the height of the horse in cm.



Q3. Complete the missing entries in the table.

	Item	Length of body part or other useful measures	Approximate length in cm
a	Children's story book	4 little fingers	
b	Length of work bench	8 \$50 notes	
c	Height of a cake	2 thumbs	
d	Height of skateboard jump	2 lengths of an A4 sheet	
e	Child's height	3.5 hand spans	
f	The distance across the room	11 paces	

Q4. A cubit is the length from the tip of your fingers to our elbow – approximately 47 cm. Alan measured a piece of rope as 15 cubits long. Calculate the length of the rope in **metres**.

The Metric System

Using body parts to estimate lengths can be convenient but it's not very accurate. In the late 18th century the French Academy of Sciences developed a standardised measurement system to replace the wide range of complicated, different and unrelated measurements that existed at the time. This new system was based on standard units and powers of 10. This is the metric system.

In the metric system, the metre is the basic unit for measuring length. Originally one metre was defined as to be one ten-millionth of the distance from the equator to the North Pole at sea level. All other length measurements are based on the length of 1 metre.

Everything in maths that relates to the 'real world' has units. If there is a point to it there are units attached to it. Sometimes the units could be people, buildings, cars, food, shapes... Basically units relate to the **WHAT** in mathematics, and you should **ALWAYS** use them. This helps to convey a clear message to the reader about **WHAT** you are talking about.

There are some units we need to know about formally, and how to convert between them.

LENGTH/DISTANCE → *mm, cm, m, km*

AREA → *mm², cm², m²*

VOLUME → *ml, L, kL, ML*

WEIGHT → *mg, g, kg, metric ton*

TIME → *s, mins, hrs, days, weeks, months, years*

Common Length Measurements

Distances are usually measured in one of the following units

Millimetres (mm)

Centimetres (cm)

Metres (m)

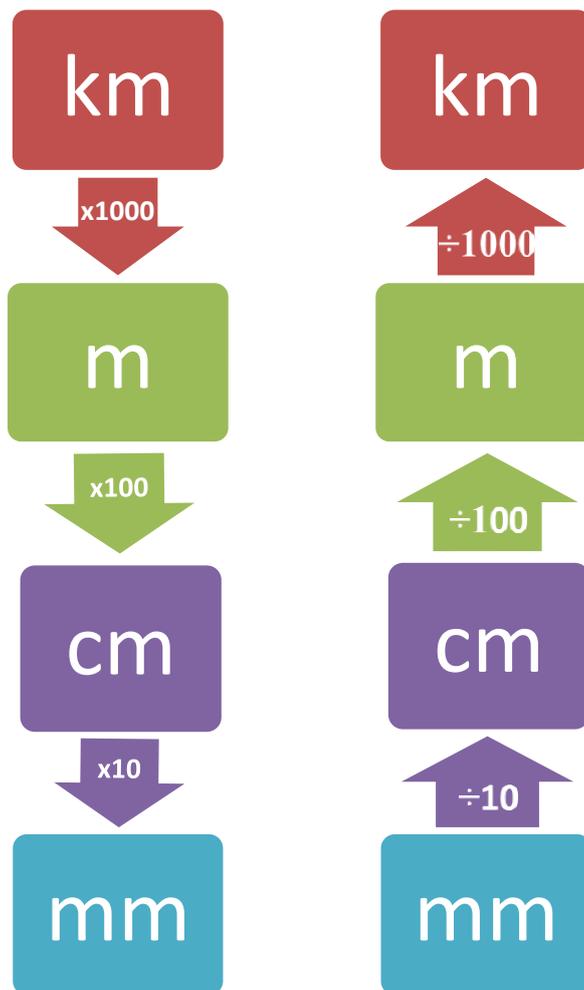
Kilometres (km)

You would be used to most of these through previous experiences in measuring heights, lengths, drawing with your rulers, measuring objects or distances between places.

$$1\text{cm} = 10\text{mm}$$

$$1\text{ m} = 100\text{cm} = 1000\text{mm}$$

$$1\text{km} = 1000\text{m} = 100\,000\text{cm} = 1\,000\,000\text{mm}$$



To move from larger length units to smaller length units multiply by the appropriate number for each step (10, 100, 1000)

To move from smaller length units to smaller length units divide by the appropriate number for each step (10, 100, 1000)

Example

1. Change 6.4km into cm.

I suggest moving through each step.

$$\begin{array}{lclcl} \text{Km} & \rightarrow & \text{m} & & \rightarrow & \text{cm} \\ 6.4 & \rightarrow & 6.4 \times 1000 \text{ m} & & & \\ & \rightarrow & 6400\text{m} & & \rightarrow & 6400 \times 100\text{cm} \\ & & & & \rightarrow & 640\,000\text{cm} \end{array}$$

2. Convert 148900mm into m

$$148900 \div 10 \text{ (into cm)} \div 100 \text{ (into m)} = 148.9\text{m}$$

Exercise Set 2

Q1.

a) 48mm = _____
= _____ cm

b) 41.5cm = _____
= _____ mm

c) 74mm = _____
= _____ cm

d) 64.8cm = _____
= _____ mm

e) 505cm = _____
= _____ m

f) 7557m = _____
= _____ km

g) 2.843km = _____
= _____ m

- h) $8.26\text{m} = \underline{\hspace{2cm}}$
 $= \underline{\hspace{2cm}}\text{cm}$
- i) $85.9\text{cm} = \underline{\hspace{2cm}}$
 $= \underline{\hspace{2cm}}\text{mm}$
- j) $4.507\text{km} = \underline{\hspace{2cm}}$
 $= \underline{\hspace{2cm}}\text{m}$

Q2. Every morning Scott goes to swimming training. This morning Scott completed 78 laps at training. Each lap was 50 m long.

- a) How many metres did Scott swim this morning?
- b) How many kilometres did Scott swim at training this morning?
- c) Scott's coach wants him to swim 4.5 km tomorrow. How many laps of the 50 m pool will Scott have to complete to swim 4.5 km?

Q3. In first class competitions, cricket pitches are 22.6 m long. During a test match Grant ran the length of the pitch 137 times.

- a) Calculate the length he ran in metres.
- b) Calculate the length he ran in kilometres, correct to two decimal places.

Converting Between and Other Metric Units of Length

Even though the metric system is used widely, there are times and places where we use non-metric lengths. Distances at sea and in the air are commonly reported in nautical miles. The depth of water can be reported in fathoms, while many people still use miles, yards, feet and inches to measure distances.

Unit	Metric equivalent	How the unit is used
1 Inch	2.54 cm	Small lengths
1 Foot	30.48 cm	Small lengths
1 Yard	0.9144 m	Old fashioned way to measure lengths where we would use metres today.
1 Mile	1.609 m	Large distances
1 Fathom	1.8288 m	Measure the depth of water
1 Furlong	201.168 m	A length used in horse racing
1 Nautical mile	1.852 km	Measure long distances across water or in the air

Exercise Set 3

Q1. Complete the following statements correct to 1 decimal place.

- a) 80 nautical miles = _____ km b) 2000 feet = _____ m
- c) 4 fathoms = _____ m d) 7 miles = _____ km

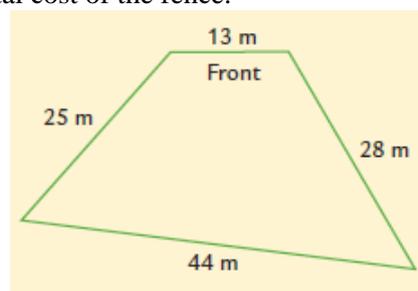
Perimeter

When we measure the distance around the outside of a shape, we measure its perimeter. Home renovators use perimeter calculations to work out quantities of a variety of materials they need to order. For example, most councils require home owners to fence their block of land. The amount of fencing materials needed and the costs are related to the perimeter of the block of land.

Example

The diagram shows Alan's block of land.

- a) What is the perimeter of the block?
b) The front already has a fence but Alan needs to fence the sides and back of the block. The fencing will cost \$49 per metre. Calculate the total cost of the fence.



Solution

a) To calculate the perimeter, just add up all the sides.

$$\text{Perimeter} = 13 \text{ m} + 28 \text{ m} + 44 \text{ m} + 25 \text{ m} = 110 \text{ m}$$

b) To calculate the length of new fence, add the three unfenced lengths.

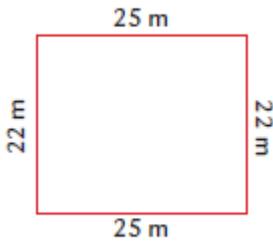
$$\text{Length} = 28 \text{ m} + 44 \text{ m} + 25 \text{ m} = 97 \text{ m}$$

$$\text{Each metre of fence costs } \$49. \text{ Total cost} = \$49 \times 97 = \$4753$$

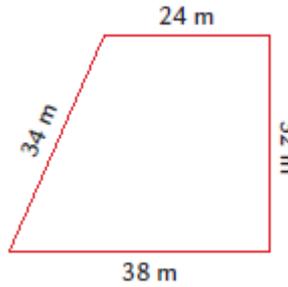
Exercise Set 4

Q1. Determine the perimeter of each of these blocks of land.

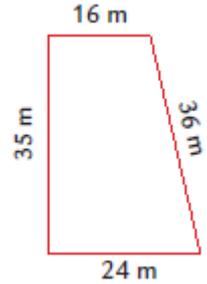
a)



b)

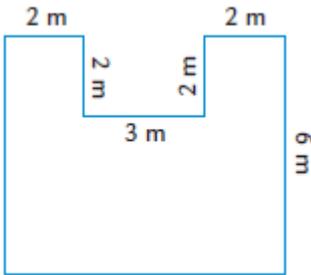


c)

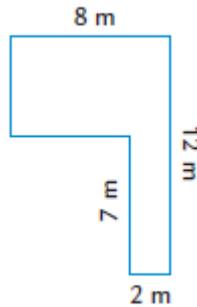


2. Calculate the perimeters of these shapes.

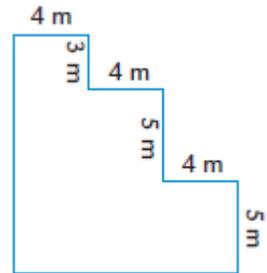
a)



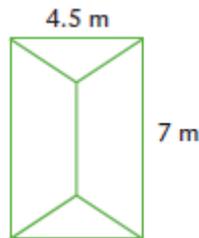
b)



c)

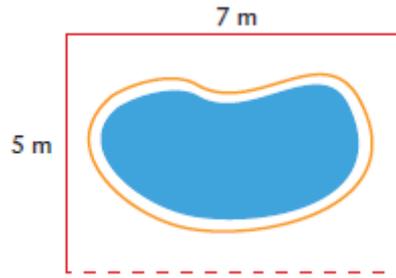


3. Aaron needs to replace the guttering on every side of his garage roof. The guttering he has chosen costs \$57 per metre. How much will the guttering cost?



Q4. Two sides of a swimming pool fence need replacing. The fence costs \$68 per metre.

- a) What length of fence needs to be replaced?
- b) Calculate the cost of replacing the two sides of the fence.



Q5. Anita is replacing the skirting boards in her lounge room. The skirting boards cover the joins walls and the floor. They don't go across doorways.

- a) How many metres of skirting boards will Anita need?
- b) The skirting boards cost Anita \$198. How much does a 3 m length of the skirting board cost?

