

# MEASURES

... AND OTHER PUZZLES ...  
AND THE STORIES BEHIND THEM

**Packed with challenges featuring:  
MEASUREMENT OF LENGTH, TIME, quantity,  
speed, distance, units of measurement  
instruments, averages - and much more!**

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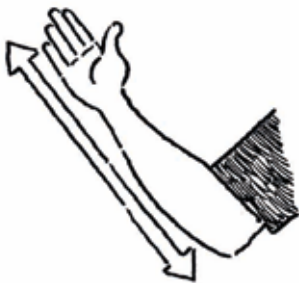


# NAMING THE MEASURE

pes



In early times, measures were often based on things such as the weight of people's bodies or, sometimes, really small things like seeds. But as these all came in different sizes, some system of standard measures was soon needed.



cubitum

palmus



## ROMAN BODY LENGTHS

Like the Egyptians before them, the Romans used measures based on the human body. This is a list of some of their measures.

- a pes (our former measurement - foot)
- a palmus (our palm of the hand)
- a mille passus (our mile, or a thousand paces)
- a stadium (from stade, furlong or racetrack)
- an uncial (our inch)
- a passus (our pace or step)
- a cubitum (our finger to elbow length)
- a digitus (our finger)



*Can you work out the order these Roman lengths should come in from the shortest to the longest?*

- 1
- 3
- 5
- 7

- 2
- 4
- 6
- 8

**Answers on page 32**



Using the standard cubit measure, the Egyptians were able to build the Great Pyramid of Giza accurately. The square base measures exactly 440 cubits by 440 cubits.

An old standard cubit measure.



## THE CUBIT

One of the most widely used standard measures was the Ancient Egyptian measure for length, the cubit. The first standard cubit measure was originally based on the length from the elbow to the fingertips. The cubit measure was made out of black granite and the length of sticks and rules was regularly checked by officials to make sure they were all the same.

## BABYLONIAN SWANS

The Babylonians had a unit of weight called a 'mina' – one of the earliest of all known weights. The 5 mina weight was formed in the shape of a duck while the 30 mina weight was shaped like a swan!



## HEBREW MEASURES

In Ancient Israel, there was a distance called a 'day's journey'. This was the distance of 10 'parasangs', a parasang being just under 4 kilometres. While a 'yoke' was the amount of land a pair of yoked oxen could plough in a single day.



# GOING METRIC

Way back in 1670, a French vicar – and astronomer – called Gabriel Mouton suggested measures that were much easier to use. He had three main ideas.

## Idea no 1.

A decimal system. Instead of different measures being 14x or 3x more or less than each other, they would always be factors of 10 such as 100 or 1000.

It would be so much easier to change to bigger or smaller units.

And we could all stride round the Earth checking our measurements by the lines of longitude.

## Idea no 2.

Standard names and useful prefixes. Each type of measure would keep the same name but have different prefixes to show how much bigger or smaller they were than the base measure.

If measurements were named as parts of a 'metre' – millimetre, centimetre, kilometre – it would show how they were 'connected'.

## Idea no 3

Use the size of the Earth to determine the measures. A metre was estimated as one ten-millionth of the distance around the Earth from pole to Equator. (This idea of Mouton's hasn't completely lasted.)

## THE LENGTH OF A METRE

Mouton's idea for measuring the length of a metre has now been replaced. Instead of using a fraction of the distance around the Earth, a metre is now measured as the distance travelled by light through a vacuum in  $1/299\,792\,458$ th of a second! This is far more complicated!

Another clever feature of the metric system is that the units of measure are connected. A gram of weight is the weight of a cubic centimetre of pure water at a temperature of  $4^{\circ}\text{C}$ . That means 1 litre of water weighs 1 kilogram and takes up 1000 cubic centimetres!