

Lesson 1 Early Measurement

HOW DID IT ALL BEGIN?

Most of the early measurements were based upon various human body parts as a way of measuring. Most often the body part used was that of the King!

5,000 years ago the ancient Egyptians invented:

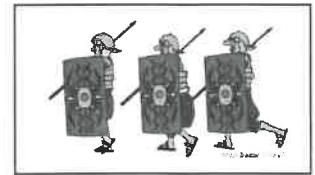
- Cubits - distance from the tip of the elbow to the tip of the middle finger
- Span - thumb to the pinkie of an open hand

The Greeks developed the "foot" as their fundamental unit of length. Legend has it that this Greek unit was based on the actual measurement of Hercules' foot.



People measured a yard of cloth by the distance between the end of the outstretched arm and their chin.

The Romans gave use the Uncias [inch] which was based on the width of a Roman's thumb. The Mille [mile] was based on the length of a step, about 2.5 feet. 1000 double paces formed a mile.



It was evident that everyone's body was different sizes. This caused confusion in measurement.

Common Imperial Units of Measurement

Length

1 foot = 12 (1' = 12")

1 yard = 3' or 36" (inches)

1 fathom = 6 feet (water depth measurement)

1 mile = 5280 ft or 1760 yd (mph = 1 mile/hour)

1 nautical mile = 6076 feet (knot = 1 nm/hour)

Volume

1 imp gallon = 4 quarts

1 imp quart = 2 pints = 40 oz.

1 imp pint = 20 oz = 2.5 cups

1 cup = 10 oz

1 US gallon = 4 quarts = 128 oz.

1 US quart = 2 pints = 32 oz.

1 US pint = 16 oz = 2.5 cups

1 cubic yard = 27 cubic feet

Area

1 square foot = 144 square inches

1 square yard = 9 square feet

1 acre = 43560 square feet (1" by 99 miles)

Weight

1 pound (lbs) = 16 oz

1 stone = 14 lbs (most common stone was 14 lbs but it ranged +/- 4 lbs)

1 ton (short) = 2000 lbs

Part 2 Converting between Imperial Measurements

Lucky for you we will focus on converting between lengths only in this course.

Proportions are your best friend when converting between various measurements.

Imperial System: US system and also use in the trades.

The base unit for length is a foot.

- The imperial system is not a decimal system. Instead each group of units has a particular relationship.
 - 12 inches in 1 foot
 - 3 feet in each yard

Some common Imperial Units	
Unit	Abbreviation
Inch	<u>in</u>
Foot	<u>ft</u>
Yard	<u>yd</u>
Mile	<u>mi</u>

Imperial Conversion Table
1 foot = <u>12</u> inches
1 yard = <u>3</u> feet = <u>36</u> inches
1 mile = 1760 yards = <u>5280</u> feet

To convert imperial units, it is easiest if you use a proportion

- A unit conversion factor is a fraction that is equal to 1.
- The numerator (top) of the fraction contains the **units** of the unit you want to convert to.

Ex 1

94 inches to feet

$$\frac{1 \text{ ft}}{12 \text{ in}} = \frac{x}{94 \text{ in}}$$

$$x = 7.83$$

$$\frac{12 \text{ in}}{1 \text{ ft}} = \frac{x}{0.83}$$

note 0.83'
is not 8"
 $6'' = \frac{6 \text{ in}}{12 \text{ in}} = 0.5$

7' and 9.96"

Ex 2

33 ft to yards

$$\frac{1 \text{ yd}}{3 \text{ ft}} = \frac{x}{33 \text{ ft}} \quad x = 11 \text{ yd}$$

Show you know

6 miles to yards

$$\frac{1760 \text{ yd}}{1 \text{ mi}} = \frac{x}{6 \text{ mi}} \quad x = 10560 \text{ yd}$$

10 yards to inches

$$\frac{36''}{1 \text{ yd}} = \frac{x}{10 \text{ yd}} \quad x = 360''$$

Converting between Imperial measurements

When you have multiple measurements, it is easier if they are all in the same units. For example, you need to build a table and you determine you will need 4 legs that are 32" long and the table will be 6 feet long. How much would you need in total?

Ex. 6 feet 4 inches to inches

$$\frac{12''}{1'} = \frac{x}{6'} \quad x = 72''$$

$$72'' + 4'' = 76 \text{ inches}$$

Show you know

9' 3" to inches

4.5 yards to inches

Ex 2

125 inches to feet and inches

Show you know

217 feet to yards and feet

222 inches to feet and inches

Adding Imperial Units

When we add lengths that contain more than 1 unit we need to convert the length into 1 unit.

How much pipe do I need to buy, if I need a piece 2 feet long, a piece 5'4" long and 7'2" long?

*if the question doesn't say which units the answer must be in you can give the answer as either feet or inches. Sometimes converting to certain units will be more useful.

a ~~B~~ ~~C~~

a. Everything into inches

A) $\frac{12''}{1'} = \frac{x}{2'}$
 $x = 24''$

B) $\frac{12''}{1'} = \frac{x}{5'}$
 $x = 60''$
 $60'' + 4'' = 64''$

C) $\frac{12''}{1'} = \frac{x}{7'}$
 $x = 84''$
 $84'' + 2'' = 86''$

b. Into feet.

B) $\frac{1'}{12''} = \frac{x}{4''}$
 $x = 0.\bar{3}$ or $\frac{1}{3}$
 $5.\bar{3}'$

C) $\frac{1'}{12''} = \frac{x}{2''}$
 $x = 0.\bar{16}$
 $7.\bar{16}'$

c. Into feet and inches

add inches first
 $4'' + 2'' = 6''$

then feet
 $2' + 5' + 7' = 14'$

put them together
 $14' 6''$

$2' + 5.\bar{3}' + 7.\bar{16}' = 14.5'$