3.0.0. Measuring in the Construction Industry

How do you read a tape measure?

Objectives

- When you have completed this module, you will be able to:
    - Use a standard ruler or tape measure to *read* and label measurements **accurately**.
    - Use a standard ruler or tape measure to *identify* measurements and mark them **accurately**.
    - Use a standard ruler or tape measure to *draw* technical lines **accurately** and with **precision**.

Accuracy vs. Precision

- **<u>Accuracy</u>** refers to the closeness of a measured value to a standard or known value.
  - How correct is your measurement?
- **<u>Precision</u>** refers to the closeness of two or more measurements to each other.
  - Can you repeat a measurement and have the same outcome each time?

Imperial Measurements

- In construction in the United Stes,

Imperial Measurements

- The **imperial system of units** (also known as the **British Exchequer Standards** of 1825) is the system of units first defined in the British Weights and Measures Act 1824 and continued to be developed through a series of Weights and Measures Acts and amendments.

Imperial Measurements

- The imperial units replaced the Winchester Standards, which were in effect from 1588 to 1825.

- This came into official use across the British Empire.

- The imperial system developed from what were first known as English units, as did the related system of United States customary units.
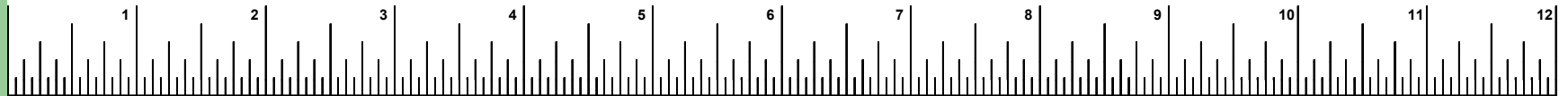
Divisions of a Ruler or Tape Measure.

Feet

Developing Your Skills

- There are three types of assignments for each fraction of an inch.
  - 1", ½", ¼", ¾", $^1/_8$", $^3/_8$", $^5/_8$" $^7/_8$", $^1/_{16}$", $^3/_{16}$", $^5/_{16}$", $^7/_{16}$", $^9/_{16}$", $^{11}/_{16}$", $^{13}/_{16}$", & $^{15}/_{16}$"
- Reading each measurement
- Identifying each measurement
- Drawing each measurement

Inches

- Inches
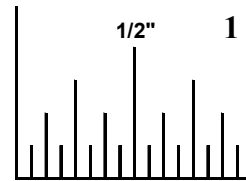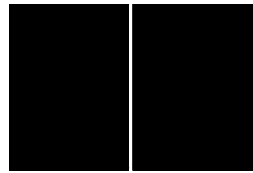   - There are twelve inches per foot.

    - Think of a "dozen."

Half Inches

- Half-inches
  - There are two equal half-inches per inch.
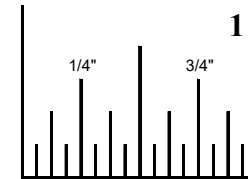

  1/2"   1

  - Think of there being two half dollars in a dollar.

Quarter Inches

- Quarter-inch
  - There are four equal quarter-inches per inch.
  - There are two equal quarter-inches per half inch.

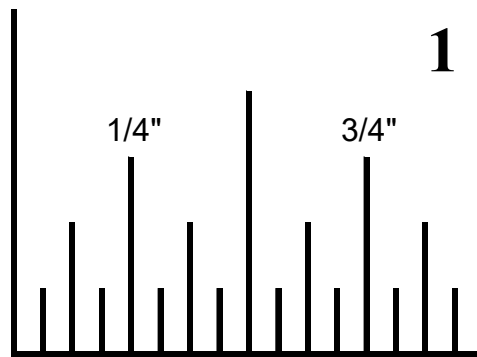
  - Think of there being four quarters in a dollar,

    and

  - two quarters in a half dollar. =
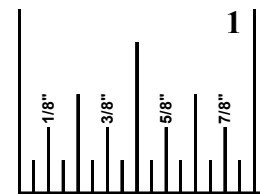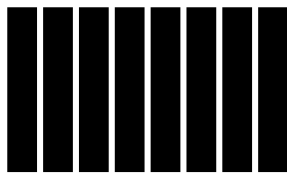
Quarter Inches

- Since measurement fractions are always reduced to their lowest terms, there is:

- 1/4"
- 3/4"
- But no 2/4", since that is the same as 1/2".
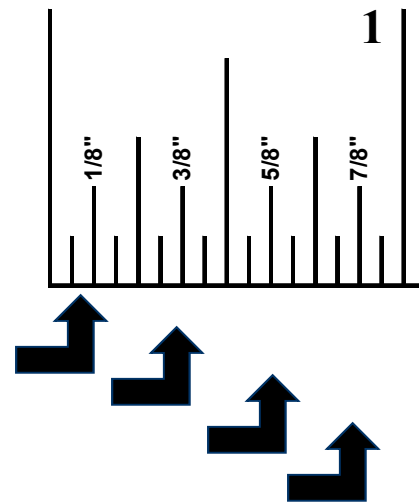
Eighth Inches

- Eighth-inch
  - There are eighth equal eighth-inches per inch.
  - There are four equal eighth-inches per half inch.
  - There are two equal eighth-inches per quarter-inch.

  - Think of an eighth as a quarter that was cut in half.
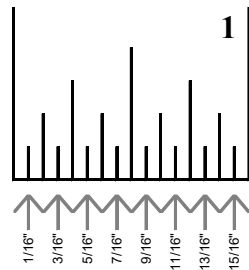
Eighth Inches

- Since measurement fractions are always reduced to their lowest terms, there is:

  - 1/8"
  - 3/8"
  - 5/8"
  - 7/8"
  - but no even numbers, because those would be quarters.

Sixteenth Inches

- Sixteenth-inch

  - There are sixteen equal sixteenth-inches in an inch.

  - There are eight equal sixteenth-inches in a half-inch.

  - There are four equal sixteenth-inches in a quarter-inch.

  - There are two equal sixteenth-inches in an eighth-inch.

Sixteenth Inches

- Since measurement fractions are always reduced to their lowest terms, there is:
  - 1/16"
  - 3/16"
  - 5/16"
  - 7/16"
  - 9/16"
  - 11/16"
  - 13/16"
  - 15/16"
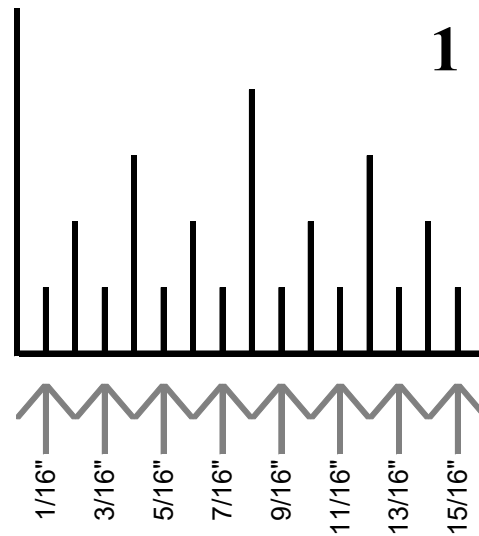
  - But no even numbers, because those would be eighths.

Measuring in the Construction Industry

- In the United States, most construction projects utilize Imperial Measurements, also called SAE (Society of Automotive Engineers), as opposed to using the Metric System.

Measurements are made in feet plus inches.

- There is a standard nomenclature used in the construction industry, so that everyone involved understands what is said and written in regard to measurement.

Feet

- Feet are noted by the number of feet, followed by an apostrophe.
    - 17'
    - Read as "seventeen feet"
    - Remember that the word "feet" has <u>one</u> syllable, so use only <u>one</u> mark (apostrophe).

Inches

- Inches are notated by the number of inches, followed by a close quotation mark.
  - 2"
  - Read as "two inches"
  - Remember that the word "inches" has <u>two</u> syllables, so use <u>two</u> marks (close quotation).

Feet Plus Inches

- Feet plus inches are notated by the number of feet with an apostrophe, followed by a dash (which separates the feet and inches), followed by the number of inches with a close quotation mark.
  - 6'-4"
  - Read as "six feet, four inches"

Fractions of an Inch

- Fractions of an inch are reduced to their lowest terms and are listed after the number of inches, just before the close quotation mark.
    - 3'-5 ½ "
    - Read as "three feet, five and one-half inches"

Fractions of an Inch

- When reduced to their lowest terms, measurement fractions will always have an odd number as the numerator.
  - 1/2"
  - 3/8"
  - 7/16"
  - etc.

Measurements Made in Inches Only.

- 92 5/8"
  - Occasionally, measurements are made in inches only.
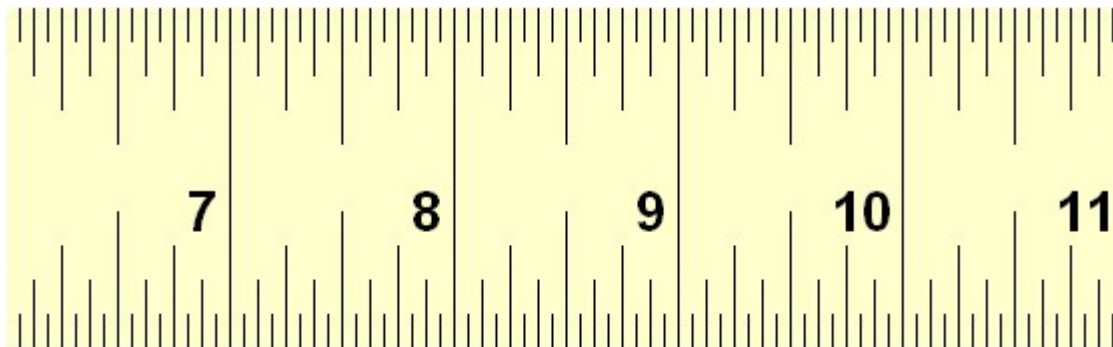 - Read as "ninety-two and five-eighths inches"

Modern Tape Measures

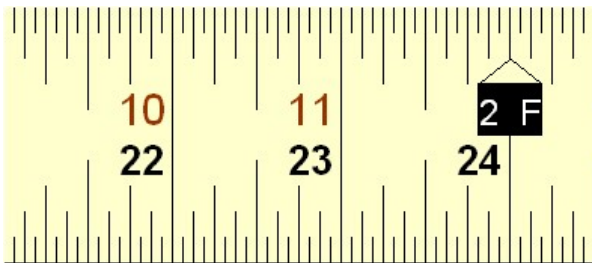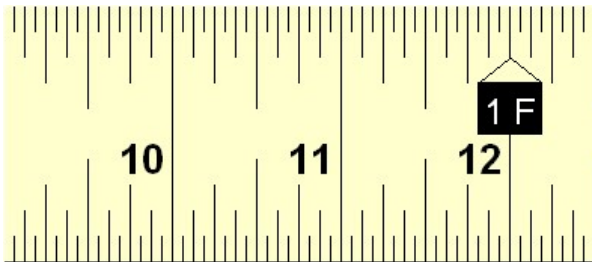On modern tape measures, important lengths are highlighted in color.

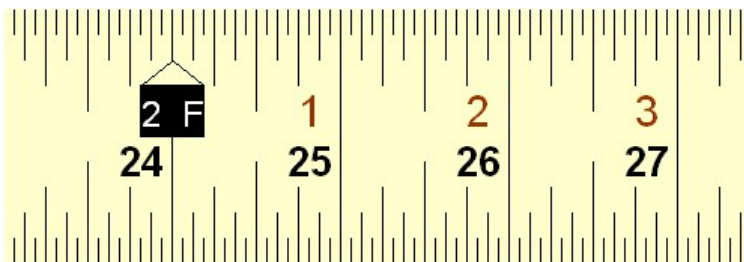# Total Inches

- Total inches are usually written in <u>black</u>.
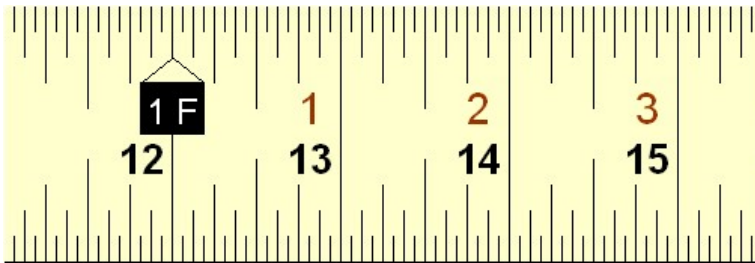
Feet

- Feet are usually highlighted in <u>black</u>.

Inches (within a given foot)

- Inches within each foot are usually written in <u>red</u>.

Multiples of 16"

Multiples of 16" (16", 32", 48", 64", etc.)

are highlighted in <u>red</u>.
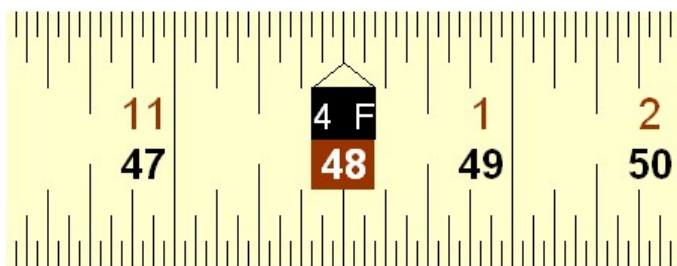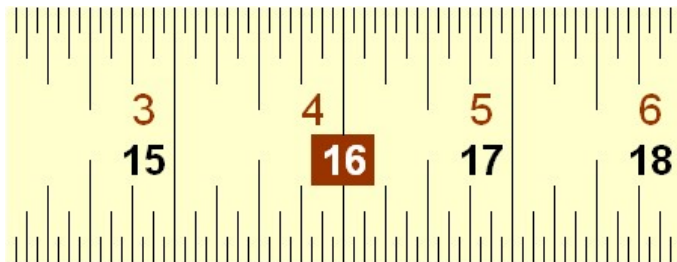
This is used primarily in residential construction.

Conversion Formulas

Converting Feet to inches.

- # of feet x 12 = total number of inches.
- If there is a remainder to start (for example, 3'-5"), add the remainder after you have multiplied.

Converting Inches to Feet

- # of inches ÷ 12 = total number of feet.
- Any remainder after dividing would be written as inches (for example. 3'-5").

Converting Fractions to Decimal

– Nominator ÷ denominator, carried out until there is *no* remainder.

– $^5/_8$ =

$$
\begin{array}{r}
.625 \\
8\ \overline{)5.000} \\
4\ 8 \\
\hline
20 \\
16 \\
\hline
40 \\
40 \\
\hline
0
\end{array}
$$

Converting Decimal to Fraction

– Place the decimal number over its 10's denominator, and reduce to its lowest terms.

– (for example, .625 would be over 1000)

- .625 = $^{625}/_{1000}$ = $^{5}/_{8}$

Multiplying Feet Plus Inches

- Since feet and inches are two different units of measure, they cannot be multiplied.

- The inches must be converted to a fraction, in decimal form, of a foot.

Multiplying Feet Plus Inches

- Think of the inches this way:
  - "Out of twelve inches, there are x."

- To do this, place the number of inches over the number 12.

- **EXAMPLE:**

$$5' - 6'' \ = \ 5' \ \& \ \frac{6''}{12} \ = \ 5 + (6 \div 12) = \ 5.5'$$

Therefore, 5' - 6'' = 5.5', and may now be multiplied by another measurement.

Multiplying Feet Plus Inches

- When there are fractions of an inch, you must first convert them to their decimal form.

    EXAMPLE:

    FIRST, convert the fraction to decimal form.

    $$\frac{1"}{2} \;=\; 1 \div 2 \;=\; 0.5$$

    THEN, convert the inches, with the decimal, to a fraction of a foot, in decimal form.

    $$5' - 6\frac{1"}{2} \;=\; 5' \,\&\, \frac{6.5}{12} \;=\; 5 + (6.5 \div 12) = \;=\; 5.5416'$$

Multiplying Feet Plus Inches

- This is what must be done to calculate area or volume when using Imperial Measurements (Feet plus Inches).

Multiplying Feet Plus Inches

- EXAMPLE of the Application of this practice:
    - Calculate the area of this room:

Multiplying Feet Plus Inches

Multiplying Feet Plus Inches