Ethiopian TVET-System

Furniture Making L-I

Based on Sept. 2012G.C. Occupational standard

Module Title: - CARRY OUT MEASUREMENTS & CALCULATIONS

TTLM Code: IND-FMK1-TTLM 0919v1

This module includes the following Learning Guides

LG08: Obtain Measurements

LG Code: IND-FMK1 M03 LO1-LG08

LG09: Perform simple calculations

LG Code: IND-FMK1 M03 LO2-LG09

LG10: Estimate approximate quantities

LG Code: IND-FMK1 M03 LO3-LG10

Instruction Sheet	LG08: Obtain Measurements

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

1.1 Purpose of obtain measurements
1.2 Methods of obtaining measurement
1.3 Obtain accurate measurement

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

1.1 Purpose of obtain measurements
1.2 Methods of obtaining measurement
1.3 Obtain accurate measurement

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 7
3. Read the information written in the "Information Sheets 1". Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the "Self-check 1" **in page -.15**
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to "Information Sheet 2". However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-check. This will form part of your training portfolio.

Information Sheet-1	Purpose of obtain measurements

Introduction

Purposes carry out measurement and calculations

- Every wood work shop should be adequately equipped with a reasonable quantity and Varity of tools and equipment for work to be done efficiently. It is necessary for you to be not only familiar with the names of the tools but able to identify and correctly. to make it easier to understand the correct application of the various tools they are grouped in to classes as follows: holding and supporting tools, geometrical tools, percussion and impelling tools, boring cutting tools, sharing and paring tools and abrading and scraping tools. The discussion centers on their type, description and uses.

What is Measurement

To *measure* is the act or process of determining the extent, quantity, degree, capacity, dimension, volume, and so forth, of a substance by comparing it with some fixed standard, which is usually fixed by law. A measure may relate to any of these standards. There are many kinds of measures, and practically all of them are standard, but standards vary in different countries. The measures mentioned in this text are all U.S. standards unless designated otherwise.

The study of measurements is sometimes called *menstruation*.

Among the many kinds of measures are the following:

_ *Linear*—Measures of length

_ *Square*—Used to measure areas

_ *Cubic*— Used to measure volume, or volumetric contents

_ *Weight*—Many systems of weights are standard

_ *Time*—Almost standardized all over the world

_ *Circular* or *angular*—The same all over the world

Linear Measure

Table 1.1 shows linear measurement (long) equivalents.

Table 1.1

Measure	***Equivalent***	***Equivalen***
12 inches	1 rod	
3 feet	1 furlong	36 inches
51/2 yards	1 mile1	161/2 feet
40 rods	league (land)	660 feet
8 furlongs	1 mile	5280 feet
3 miles	1 league (land)	

Long Measure

The furlong is practically never used, except at racetracks and in some athletic events.

Table 1.2 shows land survey measurement equivalents.

Land Surveyor's Measure

Measure	***Equivalent***	***Equivalent***
7.92 inches	1 link	
100 links	1 chain	66 feet
10 chains	1 furlong	660 feet
80 chains	1 mile	5280 feet

The use of the surveyor's chain, or Gunter's chain, was abandoned in the late 1800s and was superseded by the steel tape, which is much more accurate. The chain (meaning 66 feet) is still used by the U.S.

General Land Office, however, when surveying very old deeds. The standard surveyor's tape is often called, from habit, a *chain*. It is100 feet long and is graduated in feet except for the last foot, whichis divided into tenths and hundredths of a foot.

Table 5-4 shows nautical measurement equivalents.

Table 5-4 Nautical Measure (U.S. Navy)

Measure	*Equivalent*
6 feet	1 fathom
120 fathoms	1 cable length
The International Nautical Mile*	6076.1033 feet
3 nautical miles	1 marine league

The knot is a measure of speed, not of length, and is equivalent to1 nautical mile per hour. A speed of 16 knots is equal to 16 nautical miles per hour.

Square Measure

Square measure is used to measure areas. In most (but not all) cases, linear units are used to measure the two dimensions, length and width, and their product is the area in square units. Expressed as an equation: length × width = area

The two dimensions, length and width, must be measured in the same units, but any unit of linear measurement may be used. If inches are multiplied by inches, the result will be in square inches; if feet are multiplied by feet, the result will be in square feet, and so

forth (see Figure 5-7).For the small areas commonly found in everyday life (such as tabletops or shelves), the unit most commonly used is the square inch. Plywood and lumber are commonly sold by the square foot.

Carpets and other floor coverings and materials and ceilings are measured in square yards. The carpenter measures roofing by the square of 10 × 10 feet, or 100 square feet. Tracts of land are usually measured in acres or, for large areas, in square miles.

Table 5-5 shows square measure equivalents.

Cubic Measure

Cubic measure is used to determine or appraise volumes. Three dimensions are involved (length, width, and height) and their product is volume. Expressed as an equation:

Length × width × height = volume

Table 5-5 Square Measure

Measure	*Equivalent*	*Equivalent*
144 square inches	1 square foot	
9 square feet	1 square yard	
301/4 square yards	1 square rod	272.25 square feet
160 square rods	1 acre	4840 square yards or 43,560 square feet

640 acres	1 square mile	3,097,600 square yards
36 square miles	1 township	

As with square measure, the usual linear units (inches, feet, and yards) are ordinarily used to measure these three dimensions.

Most small measurements of capacity (such as small shipping cases or small cabinets) are measured in cubic inches. The contents of buildings, their cubage, are ordinarily expressed in cubic feet. Earthwork (either excavated and loose, or in place) is expressed in cubic yards (see Figure 5-8).

DEPTH LENGTH THICKNESS

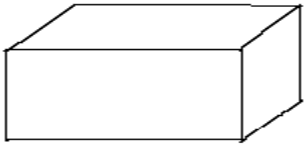


Table 5-6 Cubic Measures of Volume

Measure	***Equivalent***
1728 cubic inches	1 cubic foot
27 cubic feet	1 cubic yard

Dry Measure

Quantities of loose, granular materials (such as grains, some fruits, and certain vegetables) are measured in arbitrary units that, in turn, are defined by means of cubic measures of volume, usually in cubic inches. Their value is sometimes fixed by law.

Table 5-7 shows units of dry measure equivalents for the United States and Table 5-8 shows units of dry measure equivalents for Great Britain and Canada.

Table 5-7 Dry Measure (United States)

Measure	***Equivalent***	***Equivalent***
2 pints	1 quart	67.2 cubic inches
8 quarts	1 peck	537.61 cubic inches
4 pecks	1 bushel	2150.42 cubic inches

Table 5-8 Dry Measure (British and Canadian)

Measure	*Equivalent*	*Equivalent*
1 gallon	.5 peck	277.42 cubic inches
4 pecks	1 bushel	2219.23 cubic inches

The British dry quart is not often used. It is equal to 69.35 cubic inches, or 1.032 U.S. dry quarts.

The weight, rather than the volume, of grains is the standard fixed by the U.S. government (Table 5-9).

Table 5-9 Grain Measure (U.S.)

Measure	*Equivalent*
1 bushel of wheat	60 pounds
1 bushel of barley	48 pounds
1 bushel of oats	32 pounds
1 bushel of rye	56 pounds
1 bushel of corn (shelled)	56 pounds

Board or Lumber Measure

Timbers an d logs are measured in *board* or *lumber measure*. The board foot is 1 foot wide, 1 foot long, and 1 inch thick, there by containing 144 cubic inches. In the retail market, all lumber that is less than 1 inch thick is called one inch. At the sawmills, the full sizes govern the thickness of the saw kerfs; usually about 1/4 inch is allowed for and accounted as sawing loss. Actual finished (dressed) sizes of common lumber and the dimension and timbers for pine are as follows:

_ The standard dressed thickness of 1-inch boards is 3/4 inch.

_ The standard thickness of 2-inch dimension boards is1 1/2 inches.

_ The standard dressed widths of lumber 2 inches thick and less are 1/2 inch less for widths under 8 inches and 3/4 inch less for8-inch widths and wider.

_ The standard dressed widths and thicknesses for lumber and timbers are 1/2 inch less both ways under 8 inches wide and3/4 inch for 8-inch widths and over. So, a 2-inch × 8-inch board would be 1 1/2 inches × 7 1/4 inches. A 2-inch × 10-inch board would be 1 1/2 inches × 9 1/4 inches.

Measures of Weight

The simplest definition of *weight* is the force with which a body is attracted toward the earth. It is a quantity of heaviness. The three systems (or standards) of weights used in the United States are:

_ *Avoirdupois*—Used for almost all ordinary purposes (see Table5-11)

Table 5-11 Avoirdupois Weights

	Measure	*Equivalent*
U.S.	16 drams	1 ounce
	16 ounces	1 pound
	100 pounds	1 hundredweight
	20 hundredweights	1 ton

	Measure	Equivalent
England	14 pounds	1 stone
	112 pounds	1 hundredweight
	20 hundredweight	1 ton
	2240 pounds	

Note: The 2240-pound ton is sometimes used in the United States for weighing coal at the mines and at Customs houses for evaluating shipments from England.

Troy—Used in weighing precious metals and jewels (see Table5-12)

_ *Apothecaries*—Used by pharmacists when compounding drugs (see Table 5-13)

Table 5-12 Troy Weights

Measure	*Equivalent*
3.086 grains	1 carat
24 grains	1 pennyweight
20 pennyweights	1 ounce
12 ounces	1 pound

Table 5-13 Apothecaries Weights

Measure	*Equivalent*
20 grains	1 scruple
3 scruples	1 dram
8 drams	1 ounce
12 ounces	1 pound

This standard of weights is fast becoming obsolete, although pharmacists must be familiar with it. Manufacturing pharmacyistsand chemists are rapidly changing to the metric weights, using the metric *gram* as a basis instead of the apothecaries' scruple (1 scruple
= 1.296 grams).

Circular Measure

This measure is used in astronomy, land surveying, navigation, and in measuring angles of all kinds. Circles of all sizes are divisible into degrees, minutes, and seconds (see Table 5-15). Note that a degree is *not* a measurement of length. It is 1⁄360 of the circumference of a circle with any radius. With widespread use of calculators and the need for accuracy in missiles, the degree has now been divided in decimal form rather than minutes and seconds. Most calculators can carry the degree out to 6 places after the decimal point

Table 5-15 Circular Measures

Measure	***Equivalent***
60 seconds	1 minute
60 minutes	1 degree
360 degrees	1 circle

The Metric System

The base, or fundamental, unit in the metric system is the *meter*.

The meter is defined as the distance between two scribed marks on a standard bar made of platinum-iridium kept in the vaults of the International Bureau of Weights and Measures, near Paris, France. Of course, many other standard meter bars have been made from the measurement on this bar. It is permissible and official to use this measurement in the United States, and, in fact, the yard, the basis for the English system of measurement, has been defined as exactly
3600⁄3937 meter, or 1 meter = 39.37 inches.

The advantage (and immeasurably greater convenience) of the metric system over the English system of units lies in the fact that it is expressed in tenths, thereby readily allowing the use of decimals. However, the American public is accustomed to the English units, and as recent experience indicates, the system should continue for a long time. The metric system is, of course, in common use all over the world with the exception of some English-speaking countries. The meter is used like the yard to measure cloth and short distances.

Units of other denominations are named by prefixing to the word meter the Latin numerals for the lower denominations and the

Greek numerals for the higher denominations, as shown in Table 5-16.

Table 5-16 Denominations

Lower Denomination		***Higher Denomination***	
Deci	1/10	Deka	10
Centi	1/100	Hecto	100
Milli	1/1000	Kilo	1000
Micro	1/1,000,000	Myria	10,000

Therefore, 1 decimeter = 1/10 of a meter, 1 millimeter = 1/1000 of a meter, 1 kilometer = 1000 meters, and so forth. From this explanation of the metric prefixes, the linear equivalents shown in Table 5-17 can easily be understood

Table 5-17 Metric Table of Linear Measure

Metric

Denomination	***Meter***		***U.S. Value***
	1 millimeter	.001	.0394 inches
10 millimeters	1 centimeter	.01	.3937 inches
10 centimeters	1 decimeter	.1	3.937 inches
10 decimeters	1 meter	1.	39.3707 inches
			3.28 feet
10 meters	1 deka meter	10.	32.809 feet
10 deka meters	1 hectometer	100.	328.09 feet
10 hectometers	1 kilometer	1000.	.62138 miles
10 kilometers	1 myriameter	10,000	6.2138 miles

The kilometer is commonly used for measuring long distances.

The square meter (see Table 5-18) is the unit used for measuring ordinary surfaces, such as flooring or ceilings.

Table 5-18 Metric Table of Square Measure

Measure	***Equivalent***	***Equivalent***
100 square millimeters (mm2)	1 square centimeter	0.15+square inch

100 square centimeters (cm2)	1 square decimeter	15.5+square inches
100 square decimeters (dm2)	1 square meter (m2)	1.196+square yards

The acre is the unit of land measure and is defined as a square whose side is 10 meters, equal to a square deka meter, or 119.6 square yards (see Table 5-19).

Table 5-19 Metric Table of Land Measure

Measure	***Equivalent***	***Equivalent***
1 centiare (ca)	1 square meter	1.196 square yards
100 centiares (ca)	1 acre	119.6 square yards
100 ares (A)	1 hectare	2.471 acres
100 hectares (ha)	1 square kilometer	0.3861 square miles

The cubic meter is the unit used for measuring ordinary solids, such as excavations or embankments (see Table 5-20).

Table 5-20 Metric Table of Cubic Measure

Measure	***Equivalent***	***Equivalent***
1000 cubic millimeters (mm3)	1 cubic centimeter	0.061+cubic inches
1000 cubic centimeters (cm3)	1 cubic decimeter	61.026+cubic inches
1000 cubic decimeters (dm3)	1 cubic meter	35.316+cubic feet

The liter is the unit of capacity, both of liquid and of dry measures, and is equivalent to a vessel whose volume is equal to a cube whose edge is 1/10 of a meter, equal to 1.0567 quarts liquid measure, and0.9081 quart dry measure (see Table 5-21).The hectoliter is the unit used for measuring liquids, grain, fruit, and roots in large 036quantities. The gram is the unit of weight equal to the weight of a cube of distilled water, the edge of which is 1/100 of a meter, and is equal to 15.432 troy grains (see Table 5-22).

Geometry

By definition, *geometry* is that branch of mathematics that deals with space and figures in space. In other words, it is the science of the mutual relations of points, lines, angles, surfaces, and solids that are considered as having no properties except those arising from extension and difference of situation.

Lines

The two kinds of lines are straight and curved. A *straight line* is the shortest distance between two points. A *curved line* is one that changes its direction at every point. Two lines are said to be parallel when they have the same direction. A horizontal line is one parallel to the horizon or surface of the Earth. A line is perpendicular with another line when they are at right angles to each other. These definitions are illustrated in Figure 5-9.

Angles

An *angle* is the difference in direction between two lines proceeding from the same point (called the *vertex*). Angles are said to be *right* (90 degrees) when formed by two perpendicular lines (see

Table 5-21 Metric Table of Capacity

10 milliliters (ml.) = 1 centiliter = .0338 fluid ounce

10 centiliters (cl.) = 1 deciliter = .1025 cubic inch

10 deciliters (dl.) = 1 liter = 1.0567 liquid quart

10 liters (l.) = 1 dekaliter = 2.64 gallons

10 dekaliters (dl.) = 1 hectoliter = 26.418 gallons

10 hectoliters (hl.) = 1 kiloliter = 264.18 gallons

10 kiloliters (kl.) = 1 myrialiter (ml.)

1 myrialiter = 10 cubic meters

= 283.72 + bushels = 2641.7 + gallons

1 kiloliter = 1 cubic meter

= 28.372 + bushels = 264.17 gallons

1 hectoliter = 1/10 cubic meter

= 2.8372 + bushels = 26.417 gallons

1 decaliter = 10 cubic decimeters

= 9.08 quarts = 2.6417 gallons

1 liter = 1 cubic decimeter

= .908 quart = 1.0567 quart liquid

1 deciliter = 1/10 cubic decimeter

= 6.1022 cubic inches = .845 gallons

1 milliliter = 10 cubic centimeters

= .6102 cubic inches = .338 fluid ounces

1 centiliter = 1 cubic centimeter

= .061 cubic inches = .27 fluid dram

Figure 5-10A), *acute* (less than 90 degrees) when less than a right angle (see Figure 5-10B), and *obtuse* (more than 90 degrees) when greater than a right angle (see Figure 5-10C).

All angles except right (or 90-degree) angles are called *oblique angles*. Angles are usually measured in degrees (circular measure) (see Figure 5-10D). The *complement* of an angle is the difference between 90 degrees and the angle. The *supplement* of the angle is the difference between the angle and 180 degrees.

Plane Figures

The term *plane figures* means a plane surface bounded by straight or curved lines, and a *plane* (or *plane surface*) is one in which any straight line joining any two points lies wholly in the surface.

Figure 5-11 defines a plane surface. There is a great variety of plane

Table 5-22 Metric Table of Weight Measure

Measure	***Equivalent***	***Equivalent***
10 milligrams (mg)	1 centigram	0.15432 + grains troy
10 centigrams (cg)	1 decigram	1.54324 + grains troy
10 decigrams (dg)	1 gram	15.43248 + grains troy
10 grams (g)	1 dekagram	0.35273 + ounce avoirdupois
10 dekagrams (Dg)	1 hectogram	3.52739 + ounces avoirdupois
10 hectograms (hg)	1 kilogram	2.20462 + pounds avoirdupois
10 kilograms (kg)	1 myriagram	22.04621 + pounds avoirdupois
10 myriagrams (Mg)	1 quintal	220.46212 + pounds avoirdupois

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write the following measures

1. *Linear*—Measures of _____
2. *Square*—Used to measure _____
3. *Cubic*— Used to measure _____
4. *Weight*—Many systems of _____

Note: **Satisfactory rating - 4 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Information Sheet-2	Methods of measurement

Methods of measurement

Measurements Is the first aid important part before the operation starts there fore knowing how to measure the needs length can save time.

We have four methods of measures in any components of building

1. **End to end (effective span)**: it is measurements of a length from end to end of the components

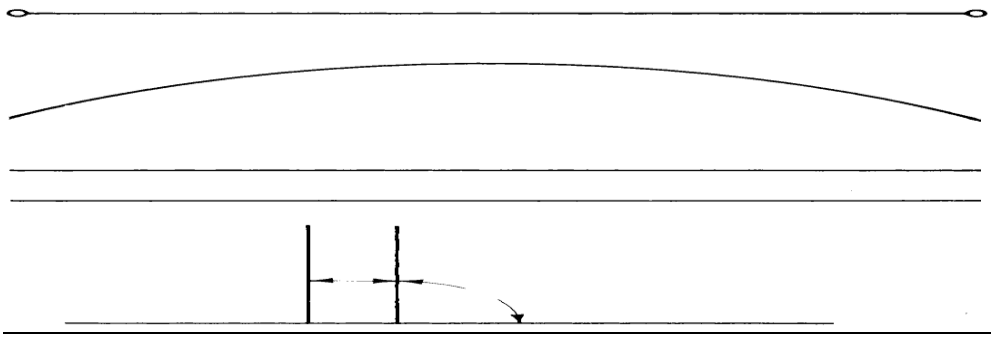
It is known as installation length.

2. End to center: it is measures w/c is taken from the center of structure of building to the end or from the end to center.

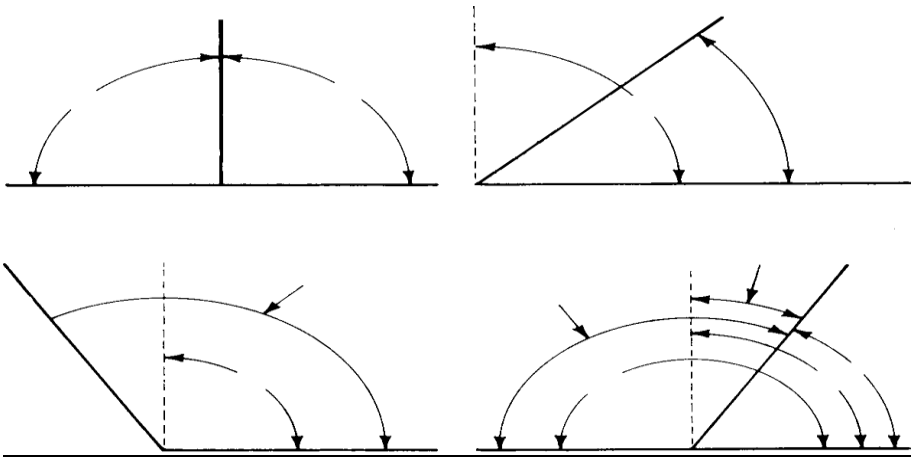
3. Center to center: it is the distance b/n the center of two components of building

It is known as construction length

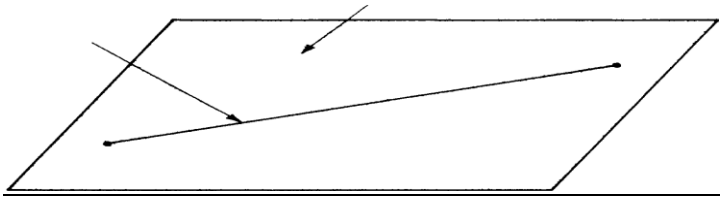
4. **Clear span:** it is the distance b/n two any components of building are internal



Various lines: straight, curved, parallel, an perpendicular.



Various angles: right, acute, obtuse, and complement and supplement of an angle.



A plane surface means that every point on a straight line joining any two points in the surface lies in the surface

Self-Check -2	**Written Test**

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write Methods of measurement

1. _____
2. _____
3. _____
4. _____

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**
You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____
Rating: _____

Name: _____ Date: _____

Information Sheet-3	Obtaining Accurate Measurement

3 Obtaining Accurate Measurement

Measuring and Marking Tools

The starting point of good craftsmanship is proper measuring and marking. Accurate cutting and shaping will be wasted if the project has not been laid out with precision. Some general rules of thumb apply to all measuring and marking tasks. Whether you are using a rule or a square, measure from as few reference surfaces as possible to minimize repeating an error or adding to it. Also, read scales from a straight-on eye position, rather than on an angle, to prevent parallax error, which leads to imprecise readings. And, when scribing the end line of a measurement, use a V-shaped mark, rather than a simple dot or line, to locate your endpoint exactly.

1.1 purpose of obtaining measurements

Measurements are hand tools that are used to get the appropriate measurements of materials a job.

1.2 geometrical tools

Geometrical tools are those that are used for measuring marking out, setting out and testing of a job at various stages.

Among the common tools are

- The rule
- Straight age
- Marking knife
- Using compasses
- Panel gauges
- Calipers
- Try square
- Miter square
- Sliding bevel
- Mortise gauge
- Cutting gauge
- Combination square
- Marking gauge

1.1 measuring and laying out tools (Geometrical tools)

These types of tools are those that are used for

- Measuring
- Setting out and
- Marking out
- Testing of a job at various stages .

Among the common tools are:-

- The rule
- Straight edge
- Marking gauge
- Sliding bevel
- Cutting gauge
- Panel gauges

- Marking knife - Combination square - Mortise gauge
- Using compasses - Miter square - Try square

Measuring and Marking Tools

The starting point of good craftsmanship is proper measuring and marking. Accurate cutting and shaping will be wasted if the project has not been laid out with precision. Some general rules of thumb apply to all measuring and marking tasks. Whether you are using a rule or a square, measure from as few reference surfaces as possible to minimize repeating an error or adding to it. Also, read scales from a straight-on eye position, rather than on an angle, to prevent parallax error, which leads to imprecise readings. And, when scribing the end line of a measurement, use a V-shaped mark, rather than a simple dot or line, to locate your endpoint exactly

1.Rule: - is measuring that is used for setting out checking a work piece. The common Forms of rule are: - 75mm four fold

- 50 mm four fold
- 50 mm two fold and
- 25 mm type

Straight edge: - is made either from steel or wood. It has perfect straight and parallel edges. It is mostly used for testing the evenness of surface and edge of a work -piece or job.

2.Marking knife: - is mad up of tool steel with one end angled and beveled. the cutting edge is used for marking a cut line across the shoulders of joints such as tenons, and trenches to guide sawing or chiseling. the cut line is drown in conjunction with a try square and must be squire (at 90^0) with the face edge

3.compasses: - is a metal (steel) tool in a form of a pair of dividers its main application is for setting out arcs and circles and a work piece or j5.

4. Calipers:- are of two kinds

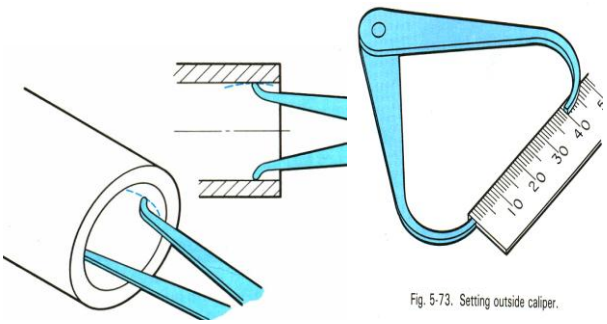


Fig. 5-73. Setting outside caliper.

1. Inside calipers and
2. out side calipers

the inside calipers are mainly used for checking diameters of holes or slats whilst the out side calipers are used for out side diameters of cylindrical objects

6. try-square:-costing of two main parts the blade made of tempered tool steel and the stack made of wood it is used for testing the square ness of surfaces and edges of quark-pieces, outside and inside corners of joints or carcasses, and for marking lines at right-angles to a given surface or edge.

7. Miter square:- has a blade and stack as a try square but the blade is fixed at 45^0 .

8. sliding bevel:- the blade but is slated and is not permanently fixed in the stack but passes through a slat in the stack and held at a required angle by a screw or level is used for testing and setting out bevels or angles other than 45^0 and 90^0.

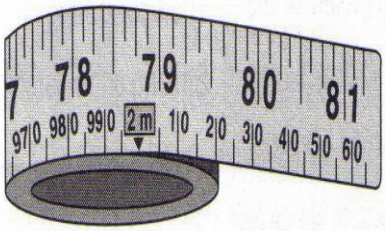
9. Combination square:- consists of a steel graduated blade and a stack often referred to as the head. The head (stack) has two edges, 90^0 and $45^{0.}$ The blade has a square along its length that fits in to a pin in the stock and slide to any length and held in position by a spring loaded screw.

10. Making gauge: - comprises a wooden (beech) stack that slide along the stem a wooden (beech) steam that passes through the center of the block. it is used for making line parallel to a face or an edge of a work piece.

11. Mortise gauge:- is similar to the making gauge and has similar parts stack stem and thumbscrew, but two spurs instead of one. it is used for making two lines parallel to a face or edge of work piece, particularly when marking out mortises and tenon, or the pins and sockets of bridle joints.

12. Cutting gauge:- consists of a stack, stem, thumbscrew but has a cutting blade instead of a pointed super. It it main use is for cutting blade lines parallel to the end of a work piece i.e. cutting across the grain

TAPES AND RULES

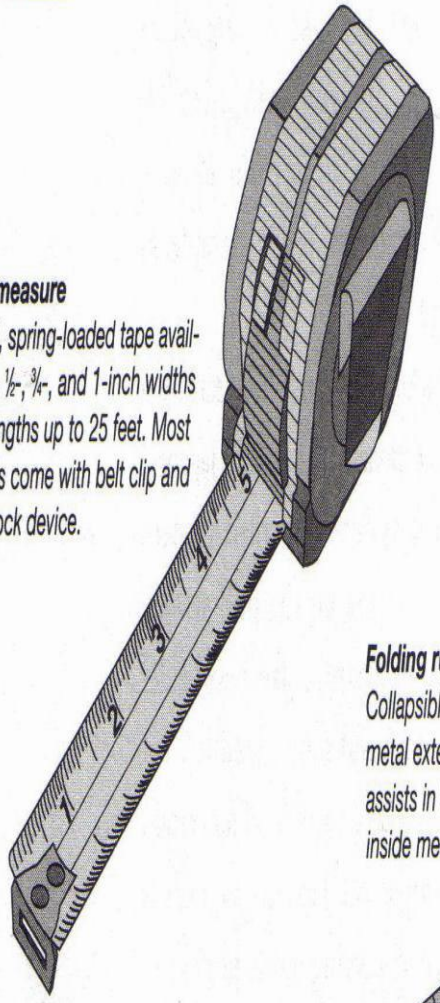


Self-adhesive bench tape

Adhesive-backed tape that mounts to a work surface or the front edge of a workbench. Handy for checking dimensions while work is in progress.

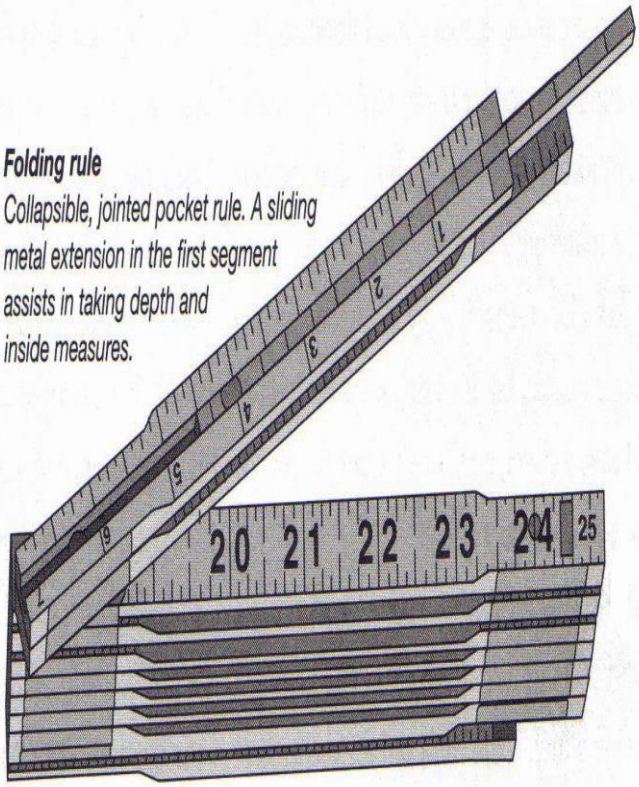
Tape measure

Coiled, spring-loaded tape available in ½-, ¾-, and 1-inch widths and lengths up to 25 feet. Most models come with belt clip and tape-lock device.



Folding rule

Collapsible, jointed pocket rule. A sliding metal extension in the first segment assists in taking depth and inside measures.

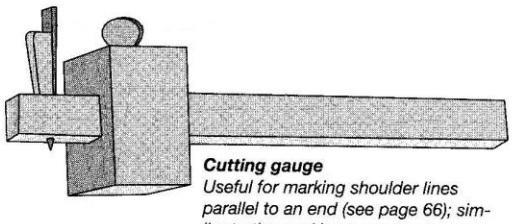


TAPES AND RULES

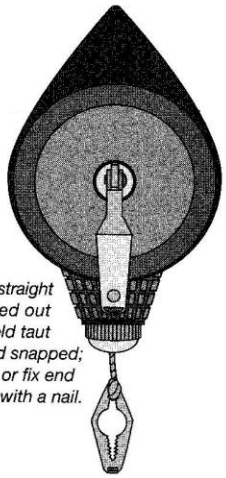
Hook rule
Usually scaled in both directions. The hook at one end facilitates accurate outside measures from an edge; inside measures can be taken from the straight end.

Steel rules
Rigid rules in various lengths from 6 inches to 1 yard; available with either English or metric scales. Ideal for layout work and as a straightedge.

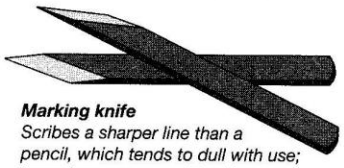
SCRIBING AND MARKING TOOLS



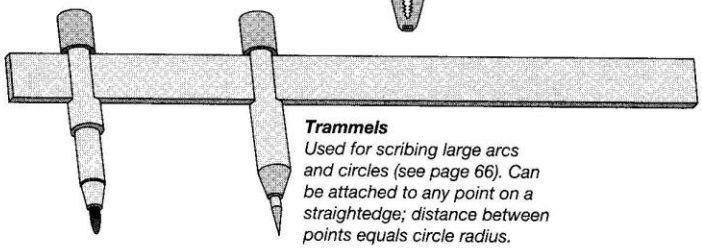
Cutting gauge
Useful for marking shoulder lines parallel to an end (see page 66); similar to the marking gauge and mortise gauge, except the scriber is parallel to the guide fence for scribing sharp lines across the grain.



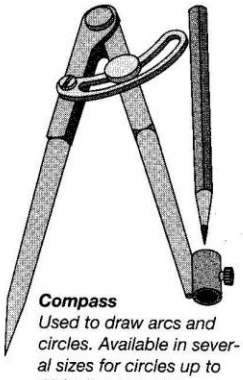
Chalk line
Used to mark long, straight lines. String is reeled out from chalk case, held taut over the surface, and snapped; work with a helper, or fix end of string to surface with a nail.



Marking knife
Scribes a sharper line than a pencil, which tends to dull with use; type shown comes with either left-hand or right-hand cutting edges.

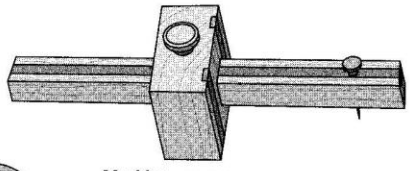


Trammels
Used for scribing large arcs and circles (see page 66). Can be attached to any point on a straightedge; distance between points equals circle radius.

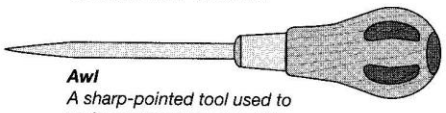


Compass
Used to draw arcs and circles. Available in several sizes for circles up to 16 inches in radius.

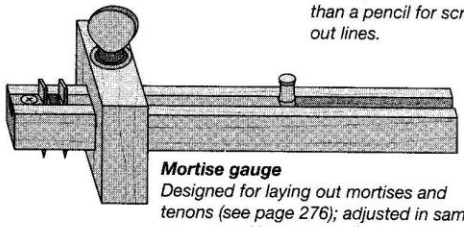
Pounce wheel
Used for transferring paper patterns onto a workpiece. Pattern is positioned atop workpiece and spurred wheel follows pattern and penetrates the paper, leaving indentations in the wood.



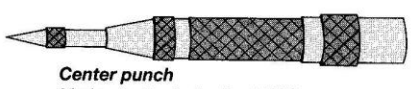
Marking gauge
Features a sharp point for marking lines along the grain parallel to an edge or face; to adjust marking distance, slide shaft through guide fence and lock it in place with the setscrew. Can also be used as a "slitting gauge" to cut thin stock.



Awl
A sharp-pointed tool used to make starting holes for drills, screws, or nails. Also better than a pencil for scribing layout lines.

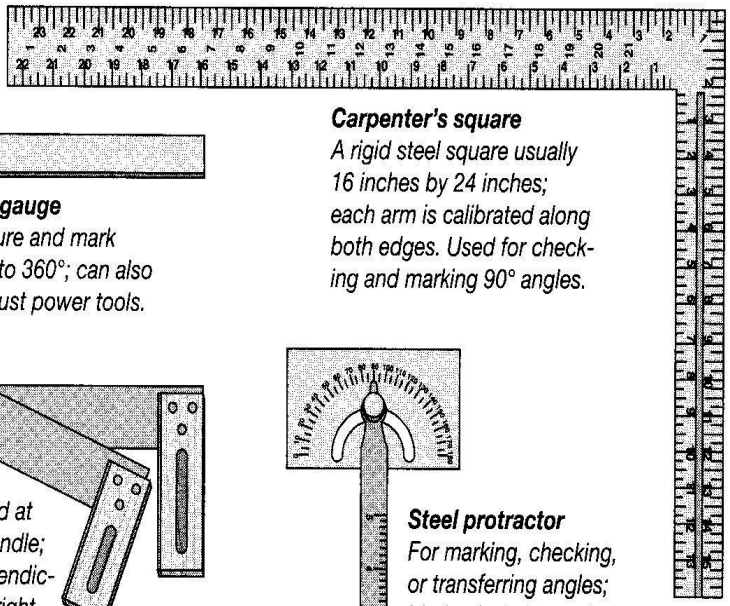


Mortise gauge
Designed for laying out mortises and tenons (see page 276); adjusted in same way as marking gauge, except that one of the pins is adjustable for setting the width of the mortise or tenon.

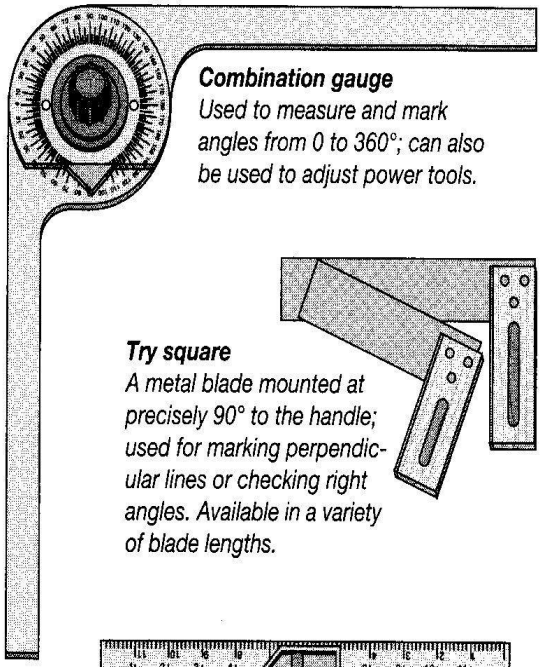


Center punch
Marks starting holes for drill bits or screws. Some models must be tapped with a hammer, while others are spring-loaded.

LEVELS, SQUARES, AND GAUGES



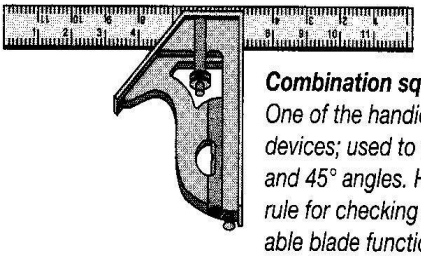
Carpenter's square
A rigid steel square usually 16 inches by 24 inches; each arm is calibrated along both edges. Used for checking and marking 90° angles.



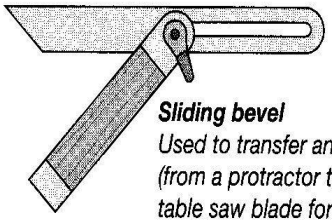
Combination gauge
Used to measure and mark angles from 0 to 360°; can also be used to adjust power tools.

Try square
A metal blade mounted at precisely 90° to the handle; used for marking perpendicular lines or checking right angles. Available in a variety of blade lengths.

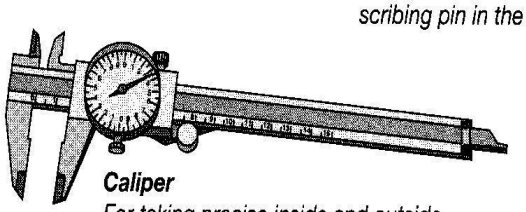
Steel protractor
For marking, checking, or transferring angles; blade pivots to read angles from 0 to 180°.



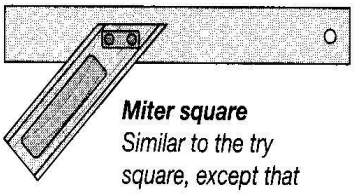
Combination square
One of the handiest of woodworking devices; used to mark and verify both 90° and 45° angles. Handle features a bubble rule for checking level and plumb; removable blade functions as straightedge and ruler. Some models include a detachable scribing pin in the handle.



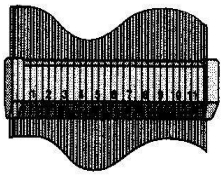
Sliding bevel
Used to transfer angles (from a protractor to a table saw blade for bevel cutting, for example) or to compare angles; the blade slides and pivots and may be locked at any angle.



Caliper
For taking precise inside and outside measurements. For outside measurement, long fingers are adjusted to grip item to be measured; for inside measurement, short fingers are spread until they contact sides. Dial provides reading; available with English or metric scales.

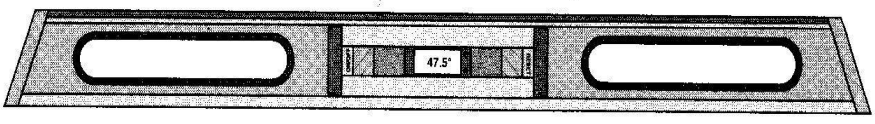


Miter square
Similar to the try square, except that the blade is fixed to the handle at 45°; used to scribe and verify miter and bevel angles.



Contour gauge
Used to copy and transfer curved profiles. Closely spaced sliding pins duplicate the contour when the gauge is pressed against the surface.

Carpenter's level
Used to check whether surfaces are level (horizontal) or plumb (vertical); available in various lengths with either traditional bubble gauges or an electronic display.



Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Write kind of Calipers:- with their use

_____

_____

Note: **Satisfactory rating - 2 points** **Unsatisfactory - below 1 points**
You can ask you teacher for the copy of the correct answers.

Score = _____

Rating: _____

Instruction Sheet	LG09: Performing simple calculations

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Performing purpose of calculations
- Performing simple calculations
- Involving simple calculations(length, perimeter, mass and volume

This guide will also assist you to attain the learning outcome stated in the cover page.
Specifically, upon completion of this Learning Guide, **you will be able to –**

- Perform purpose of calculations
- Perform simple calculations
- Involve simple calculations(length, perimeter, mass and volume

Learning Instructions:

1 Read the specific objectives of this Learning Guide.

2 Follow the instructions described in number 3 to 7.

3 Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.

4 Accomplish the “Self-check 1” **in page -.** 30

5 Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).

6 If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.

7 Submit your accomplished Self-check. This will form part of your training portfolio.

2.1 Performing purpose of calculations

When a client has a job they want done, they will usually want to know in advance how much it is going to cost them. Before you can work this out, you need to have a clear idea of exactly what the client wants.

A variety of things may need to be clarified. For instance, if they want some furniture to be built, you could ask the following questions.

- what size and shape is the furniture to be?
- What materials is it to made of?
- what special features, if any, are wanted?

Measurement (Metric and English system)

Measurement : - is the process or the result of determining that ratio of a physical quantity such as a length of a mass to a unit of Measurement such as the meter or the kilo gram.

❖ The SI unit for the four basic quantities

- Length
- Time
- Mass
- Temperature are:

✓ Meter {M} : SI UNIT of length

✓ SECOND {S}: SI UNIT of Time

✓ KLOGRAM {KG}: SI UNIT of Mass

✓ KELVIN {K}:SI UNIT of Temperature

❖ **There are two types of SI unit base unit &derived unit (**World wide the metric system is the universal system of measurements (System International = **SI**) with standard units for length, weight, time, temperature, etc.

✓ Based unit are the simple measurements for time, length, mass, temperature & amount of substance electric current and length intensity.

✓ Derived units are constructed from the base units

- Unit of measurement –there are basically <u>three</u> kinds of measurements

A. ***<u>Linear measurement</u>*** –in the most any measuring practice measurements of distance in by Centimeter, Meter kilometer etc. ***Length*** 1 cm =10 mm

B. ***<u>Angular measurement:-</u>***in the most of engineering practice the angular measurement in by done.

- Degree (°)
- Minute (')

- Second (")

A circumference of circle is divided in to 360 parts which is called one degree and one degree is to 60 ports is called minute each minute is again divided is to 60 ports and each ports is called second . i.e.

1 circle 360 degree {360°}

1 degree 60 minute {60'}

1 minute 60 sec {60"}

C. ***VOLOUM:*** - in the quantity of three dimensional spaces enclosed by closed boundary the standard unit of volume is the cubic meter {m3}

1 liter =1000cm3=0.001m3

$1m^3$=1000 liter

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1 write the SI unit for the four basic quantities

- Length _____
- Time _____
- Mass_____
- Temperature _____

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Information Sheet-2	• Perform simple calculations

- Perform simple calculations
- the simple calculation consist Addition ,substruction division and multiplication in order to obtain mathematical explanation **(+,-,x.÷)**
- example 200+200=400
- 200-100=100
- 100x10=1000
- 100÷10=100
- **Example**

10 cm = ___?____inches

Choose conversion factor:

$$\frac{2.54\text{ cm}}{1\text{ inch}} \quad \text{or} \quad \frac{1\text{ inch}}{2.54\text{ cm}}$$

Although these are both equivalent, choose the one with the desired unit in the numerator (top)

Example 2

- 10 cm x $\frac{1\text{ inch}}{2.54\text{ cm}}$ = _____

10 cm x $\frac{1\text{ inch}}{2.54\text{ cm}}$ = $\frac{10 \times 1\text{ inch}}{2.54}$ = 3.93 in

Convert the millimeters to

* meters.
* 400 mm = 0.4 m
* 1200 mm = 1.2 m
* Find the area of one board. 0.4 x 1.2 = 0.48 m2
* Multiply the area of one board
* by the number of boards of this
* size that are needed.
* 3 x 0.48 = 1.44 m2

* Look back at section 2.3 if you need to go over how to calculate area.

Self-Check -2	Written Test

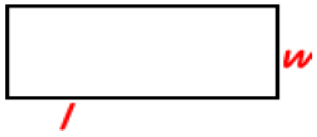
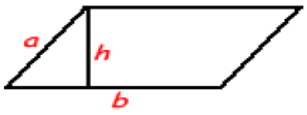
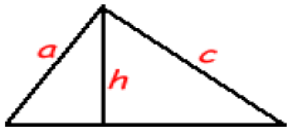
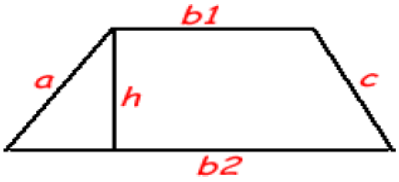
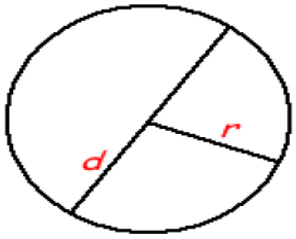
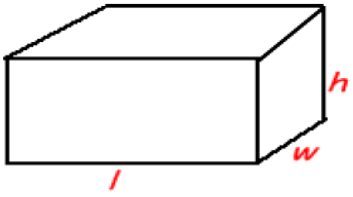
Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Calculations. Remember to use the decimal point!
   a. 300 ÷100 = ----------
   b. 54.67 + 387.24 + 27.54 = ----------

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**
You can ask you teacher for the copy of the correct answers.

Score = _____
Rating: _____

Information Sheet-3	Involve simple calculations(length, perimeter, mass and volume

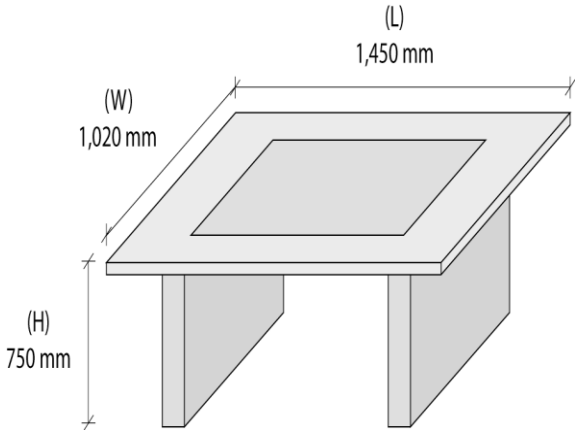
Shapes	Formulas
	**Rectangle** **Area** = Length X Width A = *lw* **Perimeter** = 2 X Lengths + 2 X Widths P = *2l + 2w*
	**Parallelogram** **Area** = Base X Height A = *bh* **Perimeter** = add the length of all sides P = *2a + 2b*
	**Triangle** **Area** = 1/2 of the base X the height A = $\frac{1}{2}$ *bh* **Perimeter** = *a + b + c* (add the length of the three sides)
	**Trapezoid** **Area** = 1/2 of the base X the height A = $(\frac{b1+b2}{2})h$ **Perimeter** = add lengths of all sides P = *a + b1 + b2 + c*
	**Circle** **Radius** = the distance from the center to a point on the circle (r). **Diameter** = the distance between two points on the circle through the center (d = 2r). **Circumference** = the distance around the circle (C = $\pi d = 2\pi r$). (Assume $\pi \approx 3.14$) **Area** = πr^2
	**Rectangular Solid** **Volume** = Length X Width X Height V = *lwh* **Surface** = *2lw + 2lh + 2wh*

Self-Check -3	Written Test

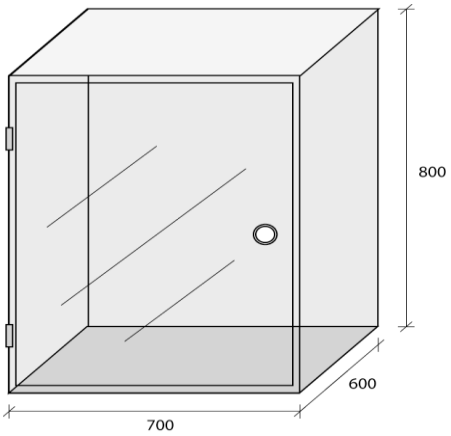
Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. I A, calculate the area of cabinet side?M^2

I,



B, calculate the volume of a cabinet? In M^3



Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Instruction Sheet	LG10: Estimate approximate quantities

This learning guide is developed to provide you the necessary information regarding the following **content coverage** and topics –

- Types and standard unit packaging of material
- Quantities of materials suitable for the work
- Bill of quantity/ relevant furnishing material cost estimates ± 10%

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, **you will be able to –**

- Types and standard unit packaging of material
- Quantities of materials suitable for the work
- Bill of quantity/ relevant furnishing material cost estimates ± 10%

Learning Instructions:

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 7.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1” **in page -.** 40
5. Ask from your teacher the key to correction (key answers) or you can request your teacher to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to “Information Sheet 2”. However, if your rating is unsatisfactory, see your teacher for further instructions or go back to Learning Activity #1.
7. Submit your accomplished Self-cheek

Information Sheet-1	• Types and standard unit packaging of material

Being able to estimate the cost of a job is an important part of any business. Clients need a 'quote' before they give you the job.

Before you can give them this information you need to be able to work out the costs involved in the job.

In this section you will learn how to:

• estimate the amount of material you need for a job

• calculate the cost of these materials

• estimate the total cost of the job.

The section is divided into six parts

Before you start the work must be consider the following activity

- Materials
- Dimensions
- Quantities
- Costs
- Estimating a job

List all the materials

Materials You Will Use When Making Furniture Can Vary Widely Depending On The Job. However The Types Of Materials You Might Need To Work With Include:

• Timber

• Manufactured Board/Particleboard

• MDF

• Plywood

- Laminate
- Glue
- Screws/Nails
- Hinges
- Prefabricated Units

Self-Check -1	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. what activity before you start the work must be consider

I. _____

II. _____

III. _____-

IV. _____

V. _____

Note: **Satisfactory rating - 5 points** **Unsatisfactory - below 4 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Quantities of materials suitable for the work

After a final drawing or print is ready, several additional steps must be taken before construction can begin. You must first make a list called a *bill of materials, materials list,* or *stock bill*. The

Preparing Bill of quantity

After a final drawing or print is ready, several additional steps must be taken before construction can begin. You must first make a list called a *bill of materials, materials list,* or *stock bill*. The procedure for making the list is known as *stock billing*. The list includes the following (now always in this order):

a. Number of pieces
b. Name of part
c. Finish size in thickness, width, and length
d. Materials (This may not be necessary if only one kind of lumber, plywood or other material is involved.)
e. Rough or cut – out size, also called the *stock-cutting* list. (Sometimes a separate form is used for the stock – cutting list; if this is done, the number of pieces, name of part, and materials information should be repeated.)

It is standard practice to list the pieces in order of thickness, width, and length, but in the furniture industry this is sometimes reversed. Lumber thickness depends on whether the boards are purchased rough or surfaced two sides (S2S). Materials as plywood, hardboard or particleboard, the finish cut, and the cutout or rough thickness are the same. For solid lumber, the width of the cut – out or rough size is usually 1/8" to ¼" greater; from ½" to 1" is normally added to the length.

Points to Remember in Stock Billing

- The *net size*s are the actual or finish *size* of the part and are given in thickness, width, and length.
- Rough or cut – out size is the size that must be cut from the standard piece of lumber. This size allows the amount needed for machining.

- In the lumber order always list plywood, particleboard, hardboard, softwood, and hardwood separately.
- Always write sizes in cm/mm.

Self-Check -2	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. write the list Preparing Bill of quantity

1. _____-
2. _____
3. _____
4. _____
5. _____

Note: **Satisfactory rating - 3 points** **Unsatisfactory - below 3 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Information Sheet-3	• Bill of quantity/ relevant furnishing material cost estimates + 10%

Bill of Materials, Cut List and PICK LIST

Bill of materials

A Bill of materials is a complete list of material (solid wood hard ware finishing Material) required to make a project a detailed bill of material

I. Preparing bill of materials

➢ Preparing bill of materials:-is detailed list the materials one needs to build a project. The materials needed to build a furniture article, such as /include.

- ❖ Lumber
- ❖ Plastics
- ❖ Metal hard ware
- ❖ Wooden materials such as ply wood , particle boards, veneers
- ❖ Glue materials, finishing materials , glasses
- ❖ Fasteners such as bolts, screws or nails.

The lumber list indicates the names of the parts, numbers of piece in an article, kind of wood (materials) rough sizes, and finished stock sizes

Purpose of bill of materiel

- ❖ Name of description each parts
- ❖ Kind materiel (sold wood ply wood mahogany oak veneer etc…),
- ❖ Size amount each materiel,
- ❖ Cost of each material ,
- ❖ If you are using a bill f material that is not complete, add necessary information, (working drawing)

Use working drawing is guide to fill out of bill of material because

working drawing is show the dimension of each part,

It al so help determine the kind of materials needed,

- ❖ Hear is a sample Bill of material generated with the Tabul

CUTT WAST (PICK LIST)

II. Preparing cost list

Preparing lumber order: is a cost list prepared in a tabular form and shows the prices of all the materials.

Before preparing the cost list for lumber & wooden materials such as ply wood, particle boards, sliced veneer, hard boards. The quantities of some types of wood necessary to make simple furniture can easily be determined .however, estimating the amounts & figuring the cost become more difficult when larger quantities of wood in different sizes & shapes are to be used.

BILL OF MATERIALS (format 1)

No. of Pieces	**Part Name**	**Material**	**Finish Size**			**Rough Size**		
			T	**W**	**L**	**T**	**W**	**L**

Form for a bill of materials, materials list, or stock bill

Cutting lists of a project All dimensions are given in MM (format 2)

No	Name of parts	Types of Materials	No of pieces	dimensions					
				Initial dimension			final dimension		
				T	W	L	T	W	L
1									
2									
3									
4									
5									
6									

Rule of allowance

- In length add (15 mm -25 mm).
- In width (6mm -10mm).
- In thickness(2mm-5mm) ,
- Same parts do not need as much extra materials long part,

- Rough dimension included in cost calculation but not all because little lumber need in anther projects construction,(reuse)
- Remember = it allowance better to have too want gust a little too match

Plan of procedure

Is a necessary step fore building the project.

- The plane also including a list the necessary tool& machines it al so used to solve the kind of problem is best solve be fore you being construction
- The Plan of procedure keep you 'track' during construction.
- With out plan it is too easy to make mistakes or forget step.
- With out plan it is also easy to waste precious shop time during what to do next , making a Plan of procedure is easy and will actually save your time
- Make a plan of procedure by simple thinking your project through the building process.
- This will help you identify the order in which each parts should be made , with this information you should be able to make organized plan of procedure.
- As you list each step .you need not too detailed , complex step , however , may need same special notes, you know the step are clear and complete if the someone else cane follow the plan to make the project

Self-Check -3	Written Test

Directions: Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What is Preparing bill of materials:----------
2. What is Preparing lumber order

Note: **Satisfactory rating -2 points** **Unsatisfactory - below 1 points**

You can ask you teacher for the copy of the correct answers.

Answer Sheet

Score = _____

Rating: _____

Lo3 Estimate approximate quantities

Lumber list +supply material list

Lumber list is consists of both the cut out size & finished stock list

Before preparing the cost list for lumber, it is necessary to determine the amount consumed in the production of the object in: M^3,$M^{2,}$ M or per standard board

- For lumber, particle board, hard board, it is necessary to estimate cost per m^3 or per standard board sheet.
- For ply wood, sliced veneer, Formica, its cost estimated per m^2 or per standard sheet.

The lumber is sold in cubic inch of lumber in its rough state .apiece of wood 1inch thick, 12inches wide &12inches long contains this amount of lumber.

To determine the cost of solid wood boards in this system is used the following formula:

$$\frac{\text{Pcs (No) x thickness (inch) x width (inch) x length (inch)}}{12} = \text{bdft (board feet)}$$

Or $\frac{\#\text{ pcs x T" x W" x L"}}{12} = \text{bdft}$

Example : to find the board feet in three pieces, 1"x 10"x 4"

$$\frac{3x1x10x4}{12} = 10 \text{ bdft}$$

Thus, the total cost of one kind of lumber is determined by adding the exact board foot amounts & multiplying by the cost per board foot.

The cost per board foot is derived from the lumber prices that are most frequently quoted as the price per 100©or(m)board foot.

Example : 1000bdftof lumber costs $350,so that the cost per bdft will be

350/1000 = 0.350 or 35cents.

There fore, the cost of 10bdft = 10x35 =$3.50.

Pcs (no)thickness(m)width(m)length(m) =m^3

Or # pcs x Tm x Wm x Lm =m^3

Example ; to find the cubic meters in three pieces of lumber 20mmx30mmx1500mm =

3x0.02x0.3x1.5 = 0.027m^3

If the cost of 1m3 lumber is 450Birr, the cost of 0.275$m^3$is

0.0275/1x4510 = 12.15Birr

Needed Materials

____ Slid wood, ___ kilo of vanish, ___ sheet of sand paper,

___ Kilo of glue, ___ kilo of Nile .etc…

To calculate the cost future, the ff procedures:-

- Know the quantity of material used to construct the project type ,
- Know the unit of price fore each materials,
- the calculate the cost material used to cost the project add

  25% wastage for wood,

  5 % wastage for ply wood chip wood hard wood soft wood Formica,
- add cost a labour 20 % of a total martial cost ,
- add martial cost of overhead expenses 15-20 % of total martial cost ,
- add martial cost + overhead expenses, this will be cost price of the project ,
- by add a profit 20-25% of cost price to the cost price ,
- Selling price including .overhead expenses. Equipment power consumed. telephone and other expenses

SELF CHACK #3

COLMON A	COLMON B
1. Lumber lumber, particle board, hard board	A, estimate cost per m^3
2. Play wood Mahogany	B, estimate cost per m^2
Sliced veneer Formica	C, 20 %
3. wastage for wood	D, 20- 25%
4, wastage for ply wood	E, 15-25%
Formica Mahogany	**F, 5%**
5. overhead cost	G, 25%
6, profit cost	H. estimate cost of solid wood hard ware finishing Material
7, labor cost	
8, materiel cost	

Module answer #3

1, A **2,** B **3**, G **4,** F **5**, E **6**, D **7**, C **8**, H

OPERATION SHEET # 1

OBTAINE MESURMENT

Purpose: To *measure* is the act or process of determining the extent, quantity, degree, capacity, dimension, volume, and so forth, of a substance by comparing it with some fixed standard, which is usually fixed by law. A measure may relate to any of these standards.

Equipment, Tools and Materials:

The rule	- Panel gauges	- Sliding bevel
- Straight age	- Calipers	- Mortise gauge
- Marking knife	- Try square	- Cutting gauge
- Using compasses	- Miter square	- Combination square
		- Marking gauge

Procedure:

Obtain measurement

Every wood work shop should be adequately equipped with a reasonable quantity and Varity of tools and equipment for work to be done efficiently. It is necessary for you to be not only familiar with the names of the tools but able to identify and correctly. to make it easier to understand the correct application of the various tools they are grouped in to classes as follows: holding and supporting tools, geometrical tools, percussion and impelling tools, boring cutting tools, sharing and paring tools and abrading and scraping tools. The discussion centers on their type, description and uses.

Measurements are hand tools that are used to get the appropriate measurements of materials a job.

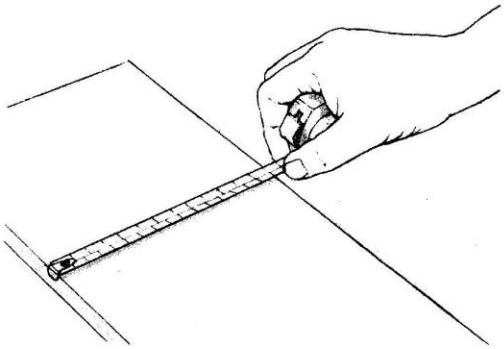
Order of Obtain measurement

Select your measurement tools

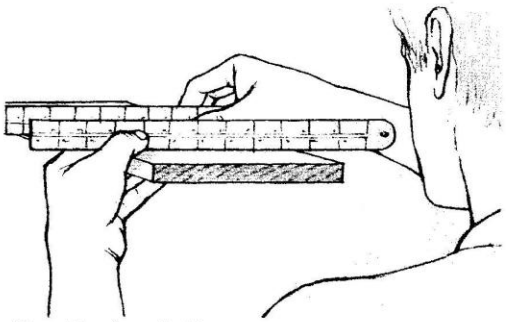
Check the measurement tools up & down

Select marking tool

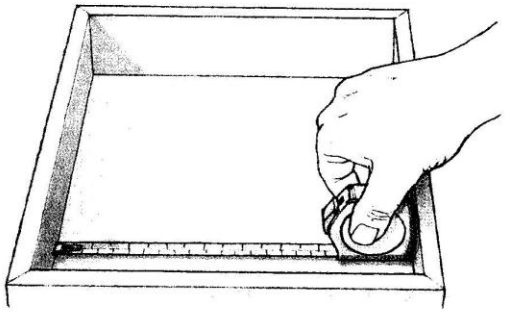
Measure & *marking the true length*



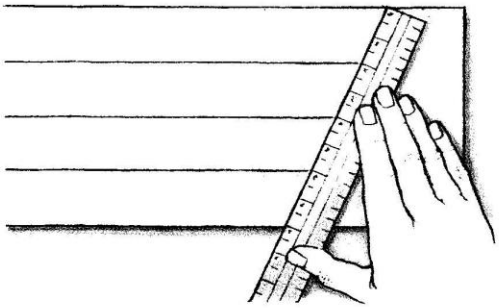
Measuring from edge to edge
When taking external measurements with a tape measure, hook the tip over one edge of the workpiece and read off the dimension against the opposite edge.



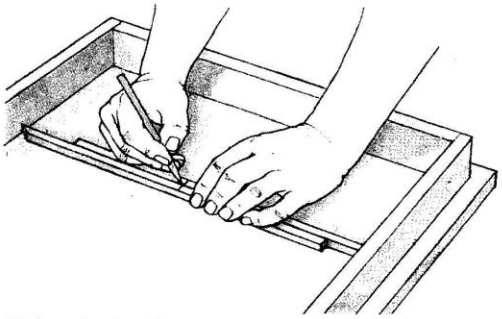
Checking for winding
If you suspect a board is twisted or "winding," hold a steel rule across each end; if the rules appear to be parallel, the board is flat.



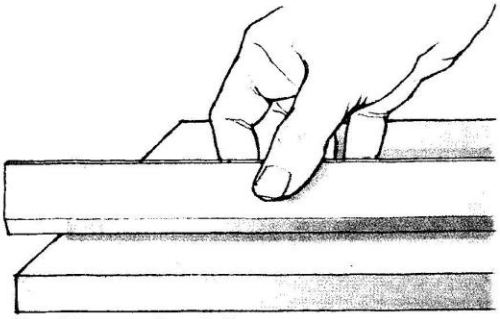
Taking internal measurements
When measuring between two components, the hook riveted to a retractable tape measure slides backward to align with the tip of the tape. Read off the dimension where the tape enters its case, then add the length of the case to arrive at the true measurement.



Dividing a workpiece into equal parts
You can divide a workpiece into equal parts using any rule or tape measure. To divide a board into quarters, for example, align the tip of the rule with one edge and the fourth division with the opposite edge, then mark off the divisions between.



Using pinch rods
Another way to gauge the distance between components is to bridge the gap with two battens held side by side. Draw a mark across both battens to register their relative positions – then, without releasing your grip, transfer them to the work.



Checking a surface is flat
To check that a panel is flat, place a straightedge on the surface. A bump will cause the tool to rock; chinks of light showing beneath the straightedge indicate hollows. Turn the straightedge to various angles to gauge whether the entire surface is flat.

OPERATION SHEET #2

Perform simple calculations

Purpose: A Bill of materials is a complete list of material (solid wood hard ware finishing Material) required tomake a project a detailed bill of material

Equipment, Tools and Materials:

Meter calculator lumber play wood

Procedure:

how to build the project

Lumber list +supply material list

FRONT

Bill of Materials& cutting list

Coffee table

For practical case let us take the bill of material listed

s/no	Name of part	No of piece Article	Kind of Wood	Cut out sizes, mm			Finished sizes, mm		
				T	W	L	T	W	L

1	Rail Front side	 01 02	Solid wood Solid wood	4.5 4.5	08 08	121 121	4.3 4.3	07 07	120 45
2	Leg	04	Solid wood	4.5	08	56	4.3	07	55
3	Stretcher side	02	Solid wood	2.5	4.3	50	2.2	4	48
4	Top –core - face	01 01	Chip wood Formica	2 0.1	50 50	121 121	2.1	48 48	120 120

Plan of procedure

Project coffee table

Tool required, hand saw hand plane

Screwdriver. clamp …

Machine required, circular saw drill. Mortise , band saw jig saw …

Procedure

1.Cut top &base to rough size

2. cut & the leg &rails of the table

3.make joint the the rails

4. make joints the legs

5.assembling (try)the leg &rails

6. assembling the two parts with glue and clamping

7. assembling the four parts with glue and clamping

8.cutting the top of the table

9.laminate the top of the table

10. assembling the top & the legs

11.sanding all parts

12. apply finish

13,deliver to the stored at finishing room ,

OPERATION SHEET # 3

Purpose: Preparing lumber order: is a cost list prepared in a tabular form and shows the prices of all the materials. Before preparing the cost list for lumber & wooden materials such as ply wood, particle boards, sliced veneer, hard boards. The quantities of some types of wood necessary to make a simple furniture can easily be determined .however, estimating the amounts & figuring the cost become more difficult when larger quantities of wood in different sizes & shapes are to be used.

Equipment, Tools and Materials:

Meter. Solid wood. Play wood .chip wood

Calculator. Paper, pencil etc.

Procedure:

Measure check the type of wood

Know the cost of material in (1m^2 Or 1$m^{3)}$

Calculate the given amount need wood

Estimate the the

materiel cost

labor cost

overhead cost

profit cost

Estimate total selling price

COST ESTMATION

Other supply cost (metal, plastic, hard ware, finishing materials)

Item	Quantity	Size	Unit cost	Total cost	Cost summary	remark
Solid wood	0.015 m3	2.5*30*400cm	225 birr	121.5 birr	Lumber cost 261.5 birr	
Play	1.4884 m2	122*244cm	130 birr	65 birr	Supply cost 90	

wood					birr	
Mahanoy	1.4884 m2	122*244cm	150 birr	75 birr	Total cost	
Glue	1kg	1kg	50 birr	50 birr	351.5 birr	
Nail	1/2kg	1kg	20 birr	10birr	Less allow 26.15	
Varnish	1/4kg	1kg	70 birr	17.5 birr	birr Selling price	
Sand paper	0. 50 metro	1 metro	20 birr	10 birr	377.65	
Mordent	1/16	1kg	40 birr	2.5 birr		

LAP Test	**Practical Demonstration**

Name:_____ Date: _____

Time Started: _____ Time Finished: _____

Instructions: You are required to perform the following-

request the carry out measurement and calculations

measurement bill of material cutting list cutting waste & cost calculation

then perform the following task in front of your trainer:

obtain measurement

cutting list cutting

cost calculation

cost estimation

1. Request your trainer for an evaluation and feedback.

REFERENCES

- General Wood working CHRISH.GRONEMAN (6TH Edition)
- The motivate series wood work technology J. K.N.Sackey
- Dr .R.K.sigal work shop practice BabuBanarsi Das Institute of technology
- Chris H.Groneman General wood working, New York Columbus, Ohio.
- Contact your supervisor or trainer if you have any concerns.
- They will be able to help.
- Websites
- Hundreds of pages of online practice in basic math skills.
- www.aaamath.com
- Downloadable worksheets with vocational numeracy exercises.
- www.detya.gov.au/ty/litnet/numeracy/home /nh_0005.htm
- Background to the Metric System plus online exercises to practice converting between metric units.
- www.maths.mq.edu.au/numeracy/tutorial/si.htm