TVET CERTIFICATE III in MASONRY

# MASONRY BASIC DRAWING

MASBD301

## Apply masonry basic drawing

Competence

**Credits:** 10

**Learning hours:** 100

**Sector:** Construction and building services

**Sub-sector:** Masonry

**Module Note Issue date:** June, 2020

**Purpose statement**

This core module describes the skills, knowledge and attitude to be acquired by the learner to draw and interpret construction drawings at construction site or in the office in order to perform the construction work efficiently.

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| | 3.4. Appropriate interpretation of construction drawing plan | |

# Learning Unit 1 – Use construction drawing documents, materials and equipment.

## LO 1.1 – Identify construction drawing materials

- CONTENT/TOPIC 1: GENERAL INTRODUCTION TO CONSTRUCTION DRAWING

➢ **DEFINITION OF DRAWING:**

**Drawing:** is the art of representation of an object by the use of systematic lines.

There are two classification of drawing: Artistic drawing and technical drawing

1. **Technical drawing:**

Is the art and science of describing structures and structural details completely and accurately by graphical means?

2. **Artistic drawing:**

Artistic drawing is the type of drawing that hides among its lines the feelings of the artists who draw them.

➢ **DEFERENCE BETWEEN ARTISTIC DRAWING AND TECHNICAL DRAWING**

| **Artistic drawing** | **technical drawing** |
|---|---|
| an artistic drawing is usually interpreted Differently by everyone who sees it. | whereas a technical drawing must communicate the same message to every user or reader of the drawing |

- CONTENT/TOPIC 2: DRAWING TERMINOLOGY

➢ **Points**

The construction of geometric figures begins from representation of points on drawings. A point represents an exact location in space which has neither width, height nor depth. Points are commonly represented by intersection of two lines, a short cross bar on a line or by small cross.


➢ **LINES**

**A line can be defined as:**

- ✓ A path between two points
- ✓ A moving point
- ✓ Geometric figure that has only one
- ✓ The shortest distance between two points is called straight line and it is commonly referred simply as a ''line''**.**

➢ **PLANES**

**Planes of Projection**

There are three planes perpendicular to each other, which are the basis of multi-view projection. These are:

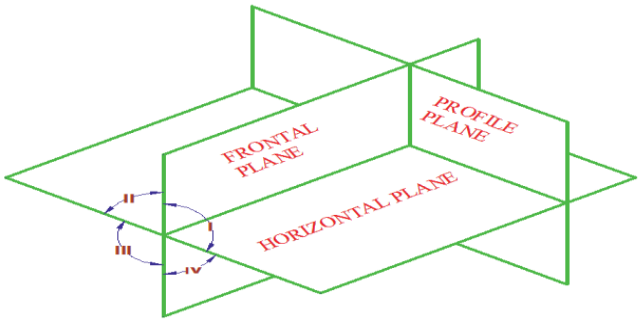
**- Horizontal projection plane.**

**- Frontal projection plane.**

**- Profile projection plane.**

The position of these planes is illustrated on the figure below.

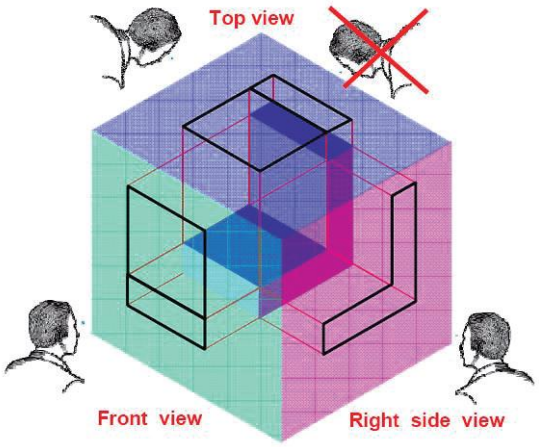
The lines of intersection of these three planes are called reference lines.




➢ **SECTIONS**

A cross **section**, also simply called a **section**, represents a vertical plane cut through the object.

- **DRAWING VIEWS**




In multi-view projections, lines of sight (projectors) are perpendicular to the planes of projection. The projection of an object on the vertical/frontal projection plane is commonly known as front view. Similarly, horizontal projection of an object is called top view and the profile projection of an object is known as side view.

- **PROJECTIONS**

The term 'projection' can be defined as the representation of an object on a picture planes as it would appear to an observer stationary at a point and viewing along the direction of projection. Hence, in order to carry out the process of projection, five major constituting elements should be fulfilled:

A. an object to be projected,

B. an observer who is viewing the object,

C. a station point where the observer is located,

D. projection

Rays or projectors emitting from the observer to the picture plane, and

E. a plane of projection or picture plane on which the projection is made.

- **PERSPECTIVES**

Perspective is a technique for depicting three-dimensional volumes and spatial relationships in two dimensions, as if from the view-point of an observer. The main characteristic of perspective is that objects appear smaller the further they are from the observer.

Perspective is often used to generate 'realistic' images of buildings to help people understand how they will look on the inside, from the outside, or within their context.

The information needed to construct a perspective image is the eye level and the vanishing point (or points):

- The eye level. This is an imaginary line drawn horizontally at the height of a viewer's eye that establishes the position of the horizon.
- Vanishing points locate the convergence points of lines moving away from the observer.

There are several different types of perspective depending on the number of vanishing points:

- One-point perspective: The object's 'front' faces the observer and there is only one vanishing point on the horizon line (also called the 'centre of vision').
- Two-point perspective: There are two vanishing points on the horizon, allowing two external faces of cubic forms to drawn.
- Three-point perspective: Where forms are inclined away from the normal vertical picture plane, as well as receding into the horizon. This requires a third vanishing point, and is often used to depict buildings from above (bird's eye view) or below (worm's eye view).
- Four-point perspective: The curvilinear version of two-point perspective, used to represent 360-degree panoramas. It can also be used with a horizontal or vertical horizon line.
- Zero-point perspective: This has no vanishing points and occurs when the observer is facing a non-linear scene that contains no parallel lines, such as a mountainous landscape.

Constructing perspective drawings of buildings is extremely complicated, but the process has been much simplified recently by the development of computer aided design (CAD), building information modelling (BIM) and other forms of computer generated imagery (CGI).

- CONTENT/TOPIC 3 : INTRODUCTION TO THE PAPER FORMAT

Standard paper sizes. Standard drawing sheet sizes are in three series, designated An, Bn & Cn.

Most popular series used in masonry basic drawing are An Series drawing papers.

**NOTE:** each paper size into **A series papers(A1,A2,A3,A4,A5,A6,A7,A8)** is equal to its preceding paper size by taking the longest side dividing by two and maintain the width of the same preceding paper to be the length the following paper size.

**STEPS OF FINDING A SERIES PAPER FORMAT SIZES**

Eg: in order to get A1

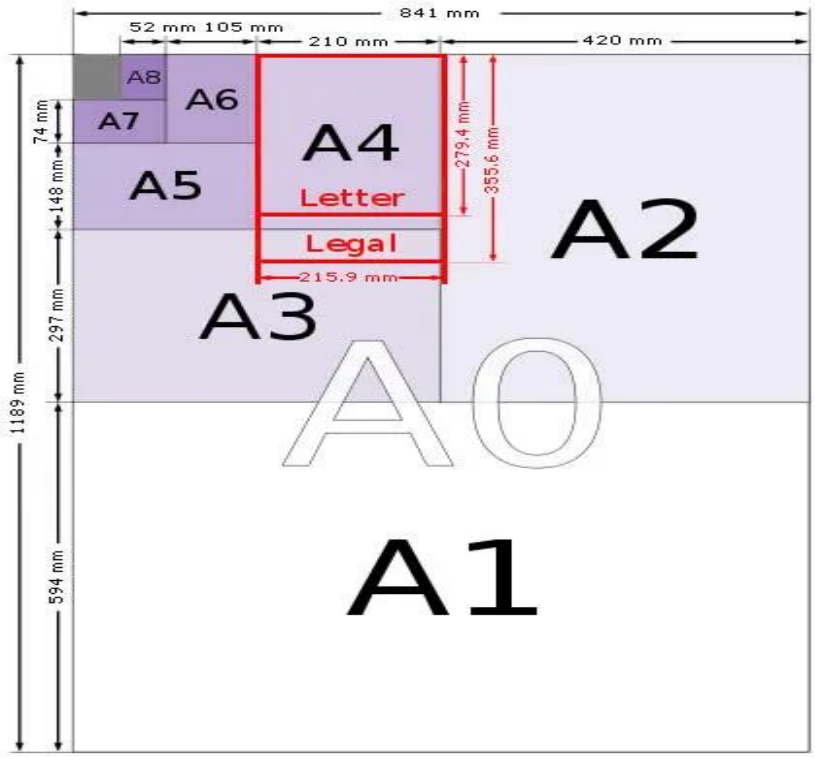
**Step 1:** take the preceding paper size A0 (841*1189) mm

**Step 2:** fold AO PAPER length into two with 1189/2=594mm, 1 neglected

**Step 3:** consider the obtained value on step 2 as the width of concerned paper format (the following paper) **step 4:**(841mm) the former width of A0 has become the length of the following paper ( A1) paper.

**Table below shows frames of the A-series and their particular application.**

| Designation | Paper frame size (mm) | Border width (mm) | | Drawing frame size (mm) | | Applications |
|---|---|---|---|---|---|---|
| | | Left and right | Top and bottom | Width | Height | |
| $A_0$ | 841 X 1189 | 28 | 20 | 1133 | 801 | Technical drawings, posters |
| $A_1$ | 594 X 841 | 20 | 14 | 801 | 566 | |
| $A_2$ | 420 X 594 | 14 | 10 | 566 | 400 | Drawings, diagrams and large tables |
| $A_3$ | 297X 420 | 10 | 7 | 400 | 283 | |
| $A_4$ | 210 X 297 | 7 | 5 | 283 | 200 | Letters, magazines, catalogs... |
| A5 | 148X210 | | | | | Note pads |




A Series Paper Sizes Chart.

- CONTENT/TOPIC 4: DRAWING MATERIALS
  - **DRAWING PAPER**
    - **Types of papers:**
- **White plain paper**
- **Dimensional sheet (grid paper)**
- **Tracing paper**
- **Bristol**

Drawing papers are the materials on which the drawings are made. Depending on its application different types of drawing papers are available. These are**: white plain paper, Dimensional sheet or grid paper (profile paper, plane/profile paper, cross section paper), tracing paper and Bristol paper.**

1. **White plain papers:**

Are general purpose for office uses and drawings? They are manufactured according to ISO (International Organization for Standardization).

**2. Dimensional sheet or grid paper**

**(Profile, Plane/ Profile and Cross- section papers):** The first two are used for road design and the later one is used for drawing road cross sections, rough design, sketching, preparing schedules, plotting graphs, etc.

**3. Tracing paper:** is a high-grade white transparent paper, upon which copies or "tracings" are made for the purpose of reproducing by blueprinting or by other similar processes. Tracing may be made in ink, usually it takes ink well, and from which pencil lines can easily be erased. Reproductions (printing) can be made directly from pencil drawings on tracing paper however, for better results in production, a pencil drawing on tracing paper is usually inked over. This paper must not be folded.

**4. BRISTOL**

Bristol generally describes a drawing paper that is glued together under pressure to form multi-ply sheets. Bristol sheets provide a stiff, strong surface to work on without the need for mounting. The felt sides of the paper (typically the more desirable working side for the artist) are exposed so there are two workable surfaces in one sheet.

- **DRAFTING OR MASKING TAPE**

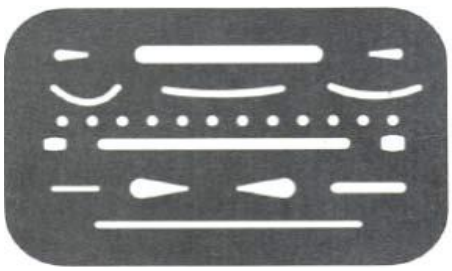
Before starting drawing, it is a common practice to attach the drawing paper to the drawing board in order to avoid unnecessary errors due to misalignment. Drafting tape is used for attaching the paper to the drawing board. Thumbtacks (thumbnails) can also be used for fixing the paper to the drawing board. However, their use is not recommended because they have the tendency to affect the smoothness of the drawing board. Typical type of drafting tape is shown in Fig bellow.

- **ERASER AND ERASING SHIELD**
  - **ERASER**

In the process of making a drawing, corrections and changes may be required. To do so, erasers are used to clean unnecessary line works.


- **ERASING SHIELD**

An erasing shield restricts the erasing area so that the correctly drawn lines will not be disturbed during the erasing procedure. It is made from a thin flat piece of metal with variously sized cutouts. The shield is used by placing it over the line to be erased and erasing through the cut out.



## LO 1.2 – Identify construction drawing instruments and equipment

- CONTENT/TOPIC 1: WRITING INSTRUMENTS

➢ **INK-PEN( RAPIDOGRAPH)**

Rapidograph is a type of drawing pen by which lines are drawn on tracing papers. It produces light resistant, waterproof, precise and consistent ink lines for any application. Since most radiograph pens require different pen sizes (line widths) for various Projects, they are manufactured in different sizes.

➢ **DRAWING PENCIL**

One of the most important drawing materials is the drawing pencil.

**The two types of pencils used in drawing are:**

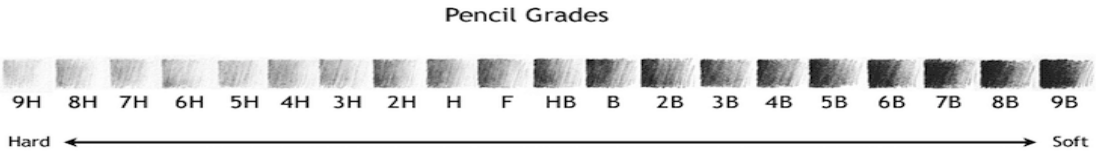
a) **Wooden pencil**

b) **Mechanical pencil and**

Drawing pencils with different grades of hardness are available. The grade of a pencil is designated by a number and a letter. The grades are 9B (very soft), 8B, 7B, 6B, 5B, 4B, 3B, 2B, B, HB, F, H, 2H, 3H, 4H, 5H, 6H,7H, 8H, to 9H (very hard)

Generally speaking, the soft (B) grades are used for **freehand sketching** and the hard (H) Grades are used for **instrumental drawings**.

**Graphite Pencil Grades**





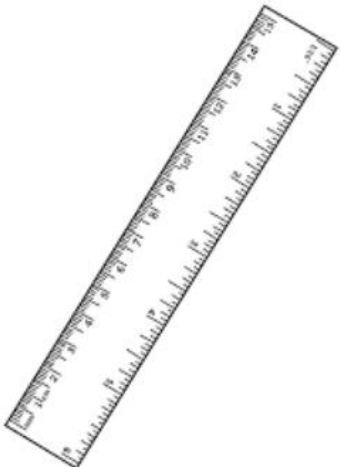
a) **Wooden pencils**

b) **mechanical pencils**

a wide variety of lead grades are available in different sizes, such as 0.3, 0.5, 0.7, and 0.9 diameters. Here, no sharpening of leads is necessary.

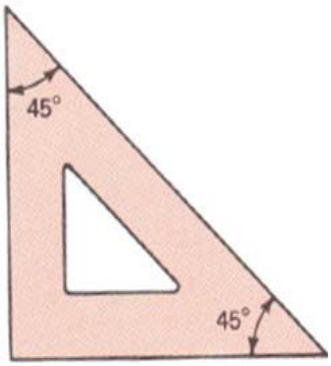
- CONTENT/TOPIC 2: TRACING INSTRUMENTS

  - **RULERS**

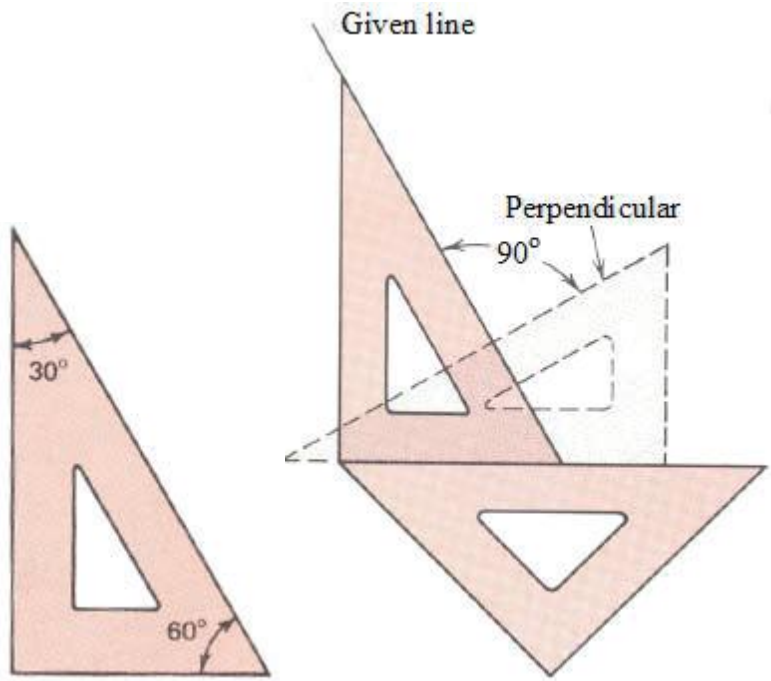


  - **SET SQUARES :**

- **$45^0$ SET SQUARE**

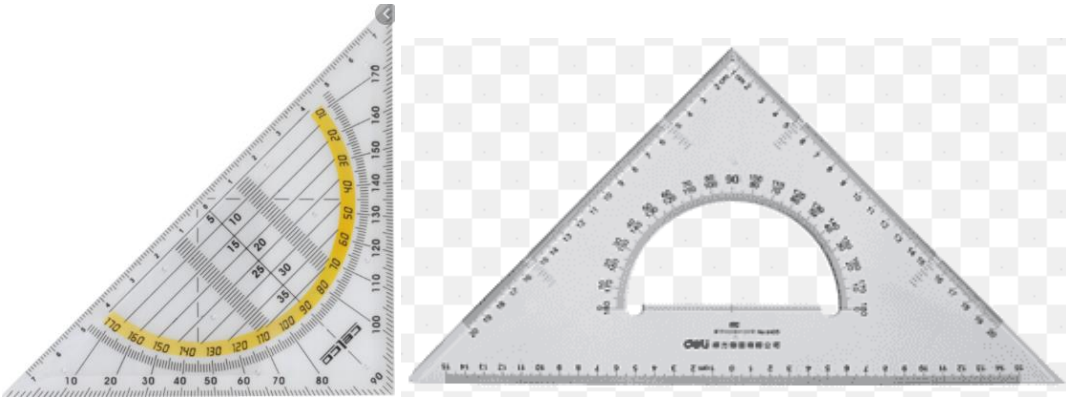



- **$30^0$-$60^0$ SET SQUARE**

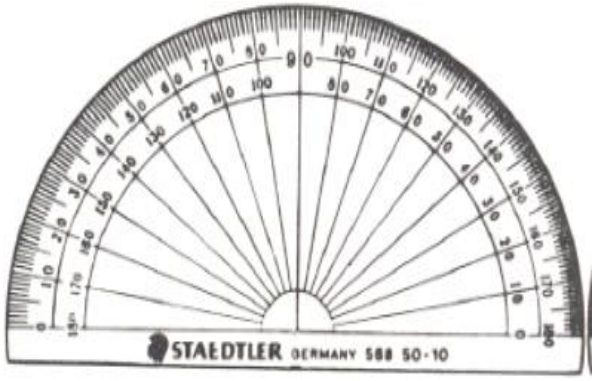



- **$45^0$ SET SQUARE WITH PROTRACTOR**

**$45^0$ SET SQUARE WITH PROTRACTOR**



- **PROTRACTOR**

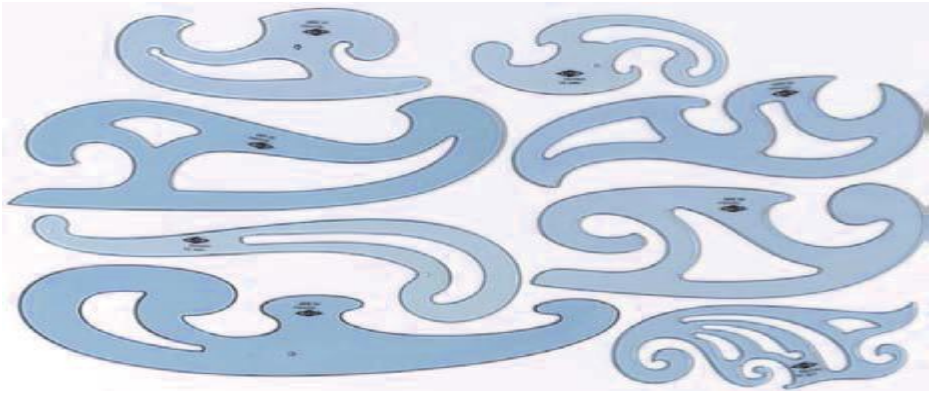


- **COMPASS**

Compasses are used to draw circles and arcs. Depending on their application we can divide them into two, bow compass and beam compass

- CONTENT/TOPIC 3: ACCESSORIES INSTRUMENT

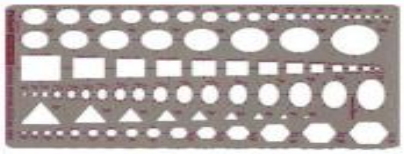
- **FRENCH CURVE**



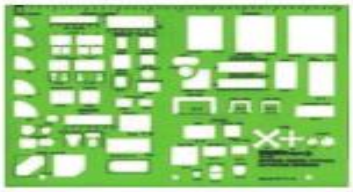
- **TEMPLATE**

A template is a thin and flat piece of plastic containing various cutout shapes. It is designed to increase the speed and accuracy of the drafter.

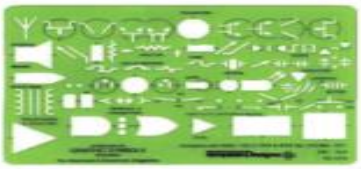
- **Examples of template**



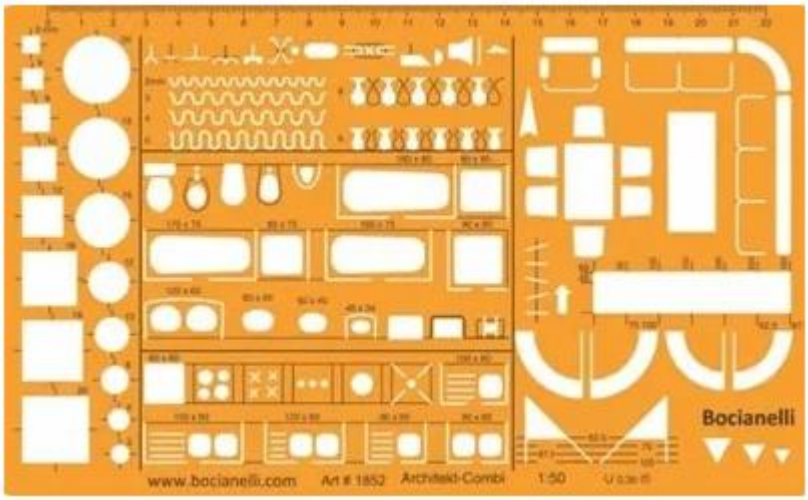
*a) Geometric shapes drafting template*



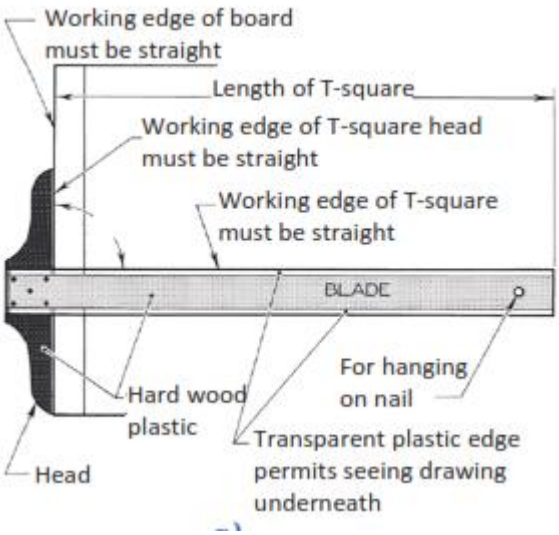
*b) Architectural drafting template*



*c) Electrical drafting template*




**T-SQUARE**




- **PROPORTION DIVIDER**

A divider is a drawing instrument used for dividing distances into equal parts or for laying off a series of equal spaces. Dividers are designed to be operated with one hand and are used for making distances or transferring measurements.

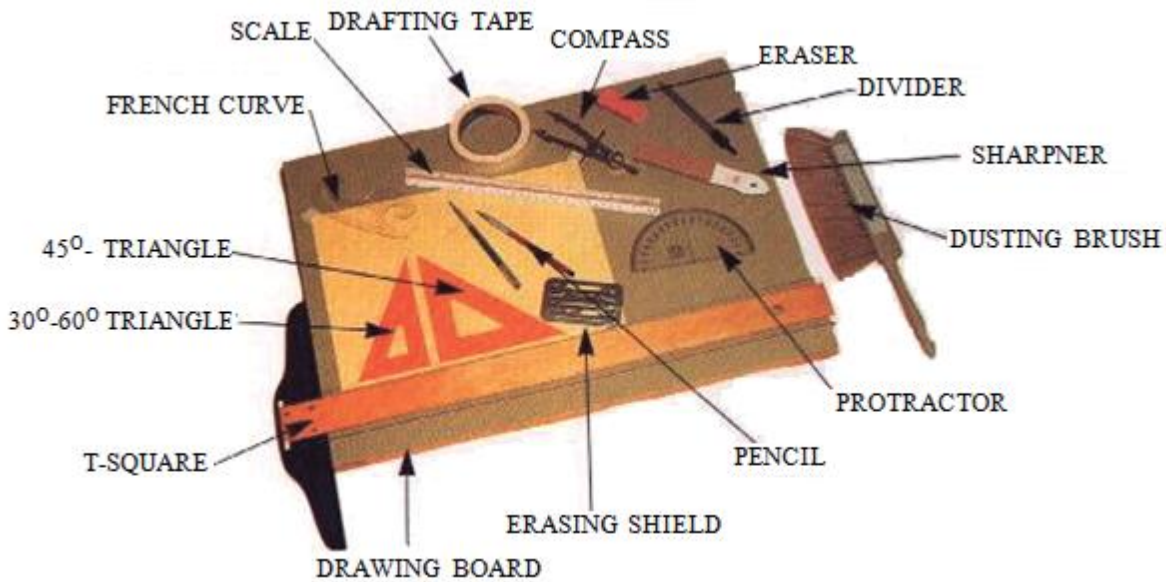

- **SCALE RULER**

A scale is an item of drawing instrument that has been carefully graduated (marked) and calibrated (labeled) in convenient increments for the user. Scales enable a user to make size reductions or enlargements rapidly and accurately. Scales Are graduated in such a way that they can be used to draw objects to scale by direct measurement without any calculation.

*a) Triangular scale*

- **PENCIL SHARPENER**

- **DRAWING BOARD**




**EXAMPLES OF OTHER TYPES OF DRAWING BOARDS**

a) Drawing tables

b) Drafting machine

c) Portable drawing board

d) Tracing table

**The table below shows the standard sizes of drawing board with its corresponding drawing papers.**

Table 1.1. Standard dimension of Engineer's Drawing Board

| Designation | Length x Width (mm) | Recommended for use with sheet sizes |
|---|---|---|
| D0 | 1500 x 1000 | A0 |
| D1 | 1000 x 700 | A1 |
| D2 | 700 x 500 | A2 |
| D3 | 500 x 500 | A3 |

D0 and D1 for drawing offices, for students use – D2

## LO 1.3 – Use drawing materials instruments and equipment

- CONTENT/TOPIC 1: USE OF DRAWING MATERIALS INSTRUMENT AND EQUIPMENT

### ➢ Drawing Sheet

Drawing sheet is a white paper on which an object is drawn which is available in various sizes. The sheet used for engineering should be of good quality. It should be white in color with uniform thickness with must resist the easy torn of paper. The surface of sheet must be smooth.

### ➢ Eraser

Eraser is used to remove the lines or spots which drawn by mistake or with wrong measurements.

The eraser used should be of good quality and soft. It should not damage the paper while erasing.

- **Pencils**

Pencil is used to draw on the paper. Any type of pencil is not suitable for drawing. There are some limitations, the drawing appearance should be very neat and understandable.

Every line of the drawing should indicate its importance. It depends upon the hardness of pencil.

Following grades are used in engineering drawings.

| Grade of Pencil | Used to Draw |
|---|---|
| 3H | Construction lines |
| 2H | Dimension lines, center lines, sectional lines, hidden lines |
| H | Object lines, lettering |
| HB | Dimensioning, boundary lines |

- **Use of drawing ruler:** A **ruler** is a stationery item and drafting tool **used** when **drawing** lines, as a guide for cutting, and for various other **uses**.

**E.g:** draw a straight line by the use of ruler and pencil

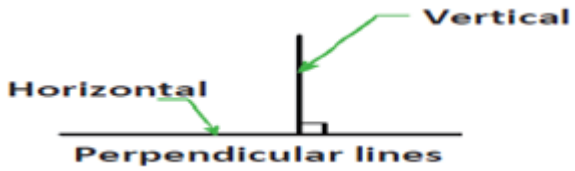

- **Drawing Board**

Drawing board is generally made of soft wood and it is in rectangular shape. It is used to support drawing sheet, so, the size of board is made according the size of the drawing sheet.

- **T-Square**

T square is used to draw horizontal and vertical lines on drawing sheet. It made of wood or plastic and in T shape. The vertical part of T is called as blade and horizontal part of T is called as head.

**E.g:** Draw perpendicular lines using ruler and protractor




- **Compass**

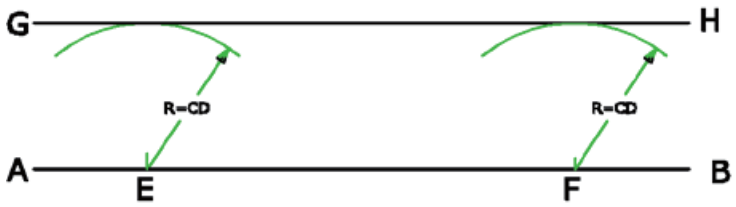
Compass is used to draw an arc or circle with known dimensions on engineering drawing. It is generally made of steel and consists two legs. One leg contains needle at the bottom and other leg contains a ring in which a pencil is placed.

**Activity 1: Drawing Parallel Lines using ruler and compass**

To draw a line parallel to a given line through a given distance

**Method 1:**

1. Draw a line AB at any angle.
2. Locate point E near A and point F near B on line AB.
3. E and F as centers and radius CD, draw two arcs.
4. Draw a line (GH) tangent to the arcs using any straight edge.

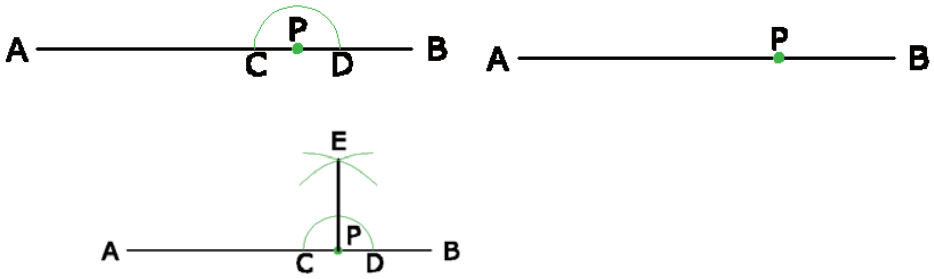



**Activity 2: Drawing Perpendicular Lines using ruler and compass**

Constructing perpendicular to a line through a point on the line

1. Draw line AB and locate point P on it.
2. With arbitrary radius r and p as a center, strike arcs to intersect AB at C and D.

3. With radius greater than ½ CD, and centers at C and D, draw arcs to intersect at E. Use straight edge to draw line EP. EP ⊥ AB.



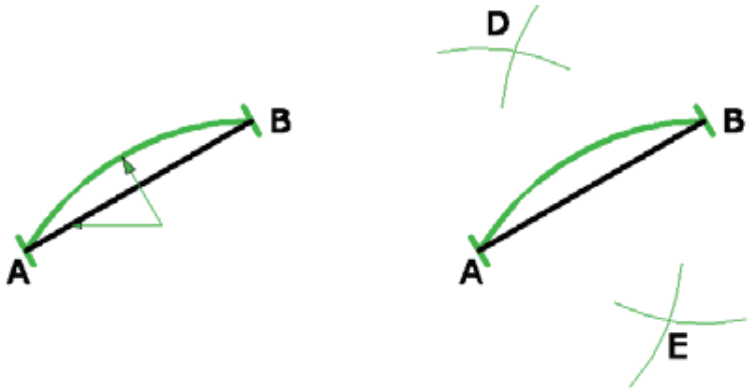

**Activity 3: Constructing a perpendicular bisector of a given line or arc ruler and compass**

1. Draw line or arc AB.

2. Adjust your compass to a radius greater than ½ AB.

3. With centers at A and B, draw intersecting arcs at D and E.

4. Draw a line DE. DE ⊥ AB and AC=CB.




**Activity 4: by the use of ruler and compass**

**Dividing Lines into n Number of Congruent Line Segments (Equal parts)**

In this example, n=5.

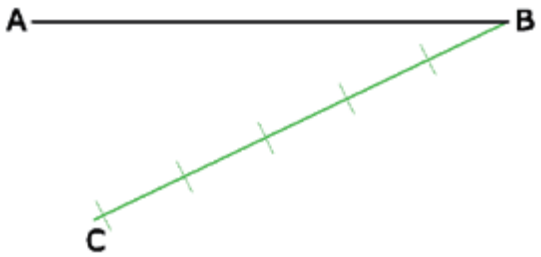
**1.** Draw a line segment AB.

**2.** Either from A or B, draw a line at any convenient acute angle to AB. Here from B and label its one end as c.

**3.** From the intersection point of the lines (B) with compass or scale, step off as many equal divisions as needed, in this case five equal parts.

**4.** Draw a line from the last (fifth) interval to A.

**5.** Through each of the other points on line BC, draw lines parallel to line A5 intersecting AB. Now line AB is divided into five equal parts. Use a triangle and T-square to draw the parallel lines.



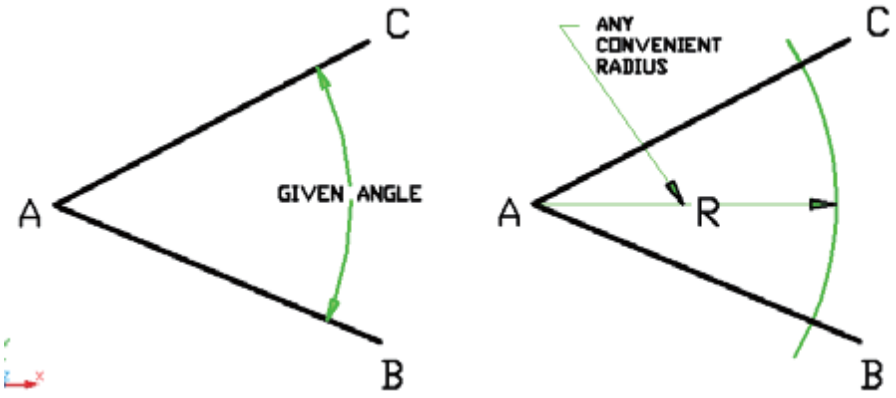

**Activity 5 : by the use of ruler and compass divide the angles below into 2**

TO BISECT AN ANGLE MEANS TO DIVIDE IT INTO HALF.

To trisect an angle means to divide it into three equal parts.

**Bisecting an Angle**

1. Draw the angle CAB.
2. Set the compass to any radius R.
3. Mark off two points E and F from A equal to the radius R on AC and AB respectively.
4. With centers at E and F, strike intersecting arcs of equal radius r at point D.
5. Draw line AD. This line bisects the angle CAB.




- **Divider**

The divider looks like a compass, but the difference is the two legs of divider are provided with needles. This is used to divide a line or curve into equal parts. It is also used to check the measurements.

- **Set Squares**

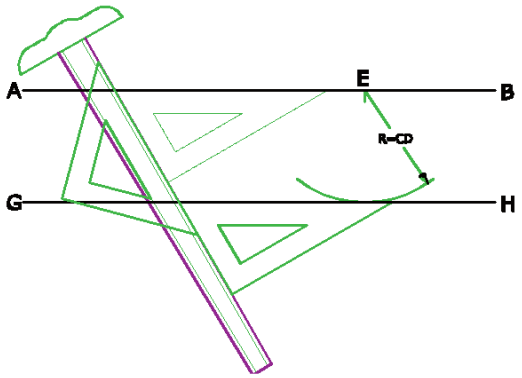
Set squares are used to draw lines with an angle between them. In most of the structures, 30, 45, 60 and 90-degree lines are most common. So, set squares make the work easier for this type of drawings.Generally, set squares are of two types. One is 45 degree set square and another one is called as 30 – 60 degree set square. Both are required in the drawing. 45 set square has a side of 25 cm while 30-60 set square has 25 cm length on one side.

**Draw parallel lines using ruler, set square and compass**

**Activity 1: Drawing Parallel Lines**

**Method 2: (preferred method)**

1. Draw line AB at any angle.
2. Open your compass to radius = CD.
3. With any point E on AB as a center, and radius = CD, strike an arc.
4. Align your set square with line AB with the T-square or another set square as a support.
5. Slide the set square until it is tangent to the arc.
6. Draw line GH using the edge of your set square.




- **Protractor**

Protractor is used to draw and measure the angles of lines in the drawing. It is transparent and made of plastic. It is in the shape of semi-circle, and the edge of semi-circle part consists reading with one-degree accuracy. The bottom line joins the $0^{o}$ to the $180^{o}$. The center of this bottom line is marked as “O” or “C” from which the angles are measured.

**Activity 1: by the use of ruler and protractor Trisect the Straight Line below**

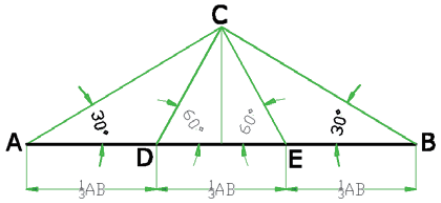
**Using 30-60° set square.**

1. Draw a straight line AB.

2. Draw 30◦ lines from points A and B.

3. Extend them to intersect at C.

4. Draw 60◦ lines with the horizontal from point C in both direction and extend them to intersect AB at D and E. Check that AD=DE=EB.




- **Drawing Templates**

Templates are nothing but plastic or wooden boards which contains spaces of several shapes or letters. Non-dimensional shapes or variety font letters are drawn by using templates which makes drawing easier and perfect.

- **French Curves**

French curves are made of plastic and they are in irregular shapes. Sometimes the drawing requires irregular curves or shapes or arcs which cannot be drawn using compass. In that case French curves are suitable.

Generally French curves are more suitable for small curves and for long curves splines are used.

- **Paper Holders**

When the drawing sheet is placed on the board it may not be in fixed position. To fix the drawing sheet to the board paper holders are used.

Generally used paper holders are thumb pins, spring clips, stick tapes etc. Care should be taken while removing the clips or tapes otherwise the sheet may tore. Paper Holders

When the drawing sheet is placed on the board it may not be in fixed position. To fix the drawing sheet to the board paper holders are used.

Generally used paper holders are thumb pins, spring clips, stick tapes etc. Care should be taken while removing the clips or tapes otherwise the sheet may tore.

# Learning Unit 2 – Apply lines and symbols used in drawing

## LO 2.1 – Interpret lines

- CONTENT/TOPIC 1: DEFINITION OF LINES USED IN DRAWING

**DEFINITION OF LINES USED IN DRAWING**

Lines of various forms and thickness are used as alphabets of the graphic language. If these lines are properly and systematically composed, they have the capacity to describe the shape of an object adequately. It is beneficial to develop the capacity of discriminating each line in shape and thickness.

Just as in English textbook the correct words are used for making correct sentences; in Engineering

Graphics, the details of various objects are drawn by different types of lines. Each line has a definite meaning and sense to convey.

IS 10714 (Pint 20): 2001 (General principles of presentation on technical drawings) and SP 46:2003 specify the following types of lines and their applications:

• **Visible Outlines, Visible Edges:** Type 01.2 **(Continuous wide lines)** the lines drawn to represent the visible outlines/ visible edges / surface boundary lines of objects should be outstanding in appearance.

• **Dimension Lines:** Type 01.1 (**Continuous narrow Lines**) Dimension Lines are drawn to mark dimension.

• **Extension Lines:** Type 01.1 (**Continuous narrow Lines**). There are extended slightly beyond the respective dimension lines.

- **Construction Lines:** Type 01.1 (**Continuous narrow Lines**) Construction Lines are drawn for constructing drawings and should not be erased after

Completion of the drawing.

• **Hatching / Section Lines:** Type 01.1 (Continuous Narrow Lines) Hatching Lines are drawn for the sectioned portion of an object. These are drawn inclined at an angle of 45° to the axis or to the main outline of the section.

• **Guide Lines:** Type 01.1 (Continuous Narrow Lines) Guide Lines are drawn for lettering and should not be erased after lettering.

• **Break Lines:** Type 01.1 (Continuous Narrow Freehand Lines) Wavy continuous narrow line drawn freehand is used to represent bre~ of an object.

• **Break Lines:** Type 01.1 (**Continuous Narrow Lines with Zigzags**) Straight continuous ~arrow line with zigzags is used to represent break of an object.

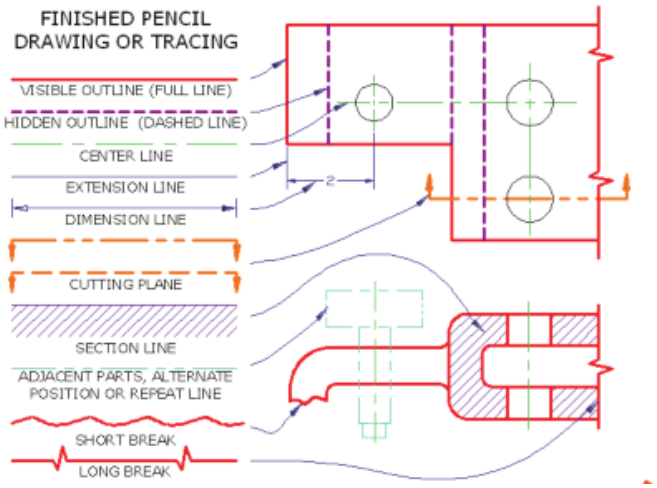
• **Dashed Narrow Lines:** Type 02.1 **(Dashed Narrow Lines)** Hidden edges / Hidden outlines of objects are shown by dashed lines of short dashes of equal lengths of about 3 mm, spaced at equal distances of about 1 mm. the points of intersection of these lines with the outlines / another hidden line should be clearly shown.

• **Center Lines:** Type 04.1 (Long-Dashed Dotted Narrow Lines) Center Lines are drawn at the center of the drawings symmetrical about an axis or both the axes. These are extended by a short distance beyond the outline of the drawing.

• **Cutting Plane Lines:** Type 04.1 and Type 04.2Cutting Plane Line is drawn to show the location of a cutting plane. It is long-dashed dotted narrow line, made wide at the ends, bends and change of direction. The direction of viewing is shown by means of arrows resting on the cutting plane line.

• **Border Lines:** Border Lines are continuous wide lines of minimum thickness 0.7 mm

**Examples of illustrations of some line types are seen on the figure below:**




- CONTENT/TOPIC 2: TYPES OF LINES USED IN DRAWING AND SIZE OF LINES

All the main line types are listed in the table bellow:

| No. | Line description and Representation | Applications |
|---|---|---|
| 01.1 | Continuous narrow line<br>B ——— | Dimension lines, Extension lines |
| | | Leader lines, Reference lines |
| | | Short centre lines |
| | | Projection lines |
| | | Hatching |
| | | Construction lines, Guide lines |
| | | Outlines of revolved sections |
| | | Imaginary lines of intersection |
| 01.1 | Continuous narrow freehand line<br>C ~~~ | Preferably manually represented termination of partial or interrupted views, cuts and sections, if the limit is not a line of symmetry or a center line[a]. |
| 01.1 | Continuous narrow line with zigzags<br>A /\/\/\ | Preferably mechanically represented termination of partial or interrupted views, cuts and sections, if the limit is not a line of symmetry or a center line[a]. |
| 01.2 | Continuous wide line<br>——— | Visible edges, visible outlines |
| | | Main representations in diagrams, maps, flow charts |
| 02.1 | Dashed narrow line<br>D — — — — — — | Hidden edges |
| | | Hidden outlines |
| 04.1 | Long-dashed dotted narrow line<br>E ——.——.—— | Center lines / Axes, Lines of symmetry |
| | | Cutting planes (Line 04.2 at ends and changes of direction) |
| 04.2 | Long-dashed dotted wide line<br>F ——.——.—— | Cutting planes at the ends and changes of direction outlines of visible parts situated in front of cutting plane |

Drawing lines may be categorized into three groups based on their weights or thickness:

- **THICK LINE:**

  **Example:** object line, cutting plane line and the short break lines

- **THIN LINE:**

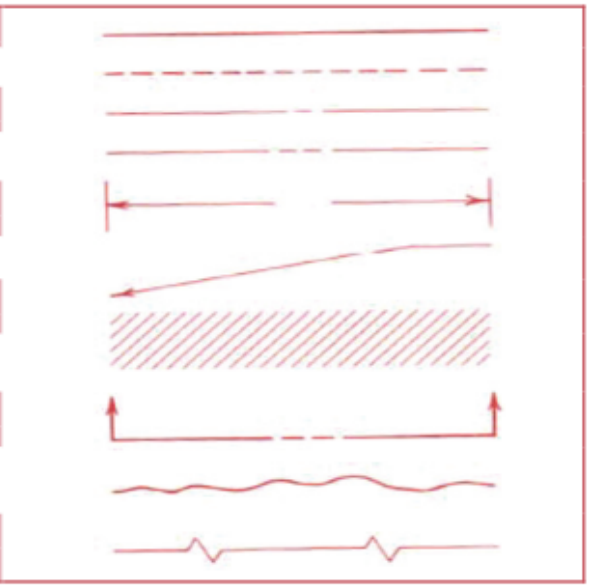
**Example:** The center lines, dimension lines, extension lines, long-break lines, and phantom lines

- **MEDIUM LINE:**

  **Example:** hidden line

Note: In fact, thick lines are (0.5 to 0.8 mm) wide, thin lines between (0.03 to 0.5 mm) wide. The actual width each line is governed by the size, the style of the drawing and the smallest size to which it is to be reduced. The description and illustrations shown in Figure bellow would be of great help to understand the function of each line.

| Types of Lines | Weight |
|---|---|
| Object | Thick |
| Hidden | Medium |
| Center | Thin |
| Phantom | Thin |
| Extension & Dimension | Thin |
| Leader | Thin |
| Section | Thin |
| Cutting plane | Thick |
| Short break | Thick |
| Long break | Thin |



- CONTENT/TOPIC 3: LETTERING

**Definition:** The art of writing the alphabets A, B, C…Z and numbers such as 1, 2, 3…0 etc. is known as lettering. It is an important part of drawing and is used to write letters, dimensions, notes and other necessary information required to complete execution of machine or structure, etc.

**Feature of lettering**

a. Uniformity

b. Neatness

c. Rapidity

All lettering works are done either by freehand or by using drawing instruments.

Skill and proficiency in freehand lettering can be achieved by the proper selection of appropriate sizes and style of lettering.

**Height of letters and numerals**

The height of letters and numerals recommended for use in engineering drawing are 2.5, 3.5, 5, 7, 10, 14 and 20mm. Height of the letters and numerals will be different for different purposes and may be selected suitably for their purpose.

**Classification of lettering**

1. **Gothic lettering**

The letter in which all the alphabets are of uniform width or thickness is known as gothic lettering

2. **Freehand lettering**

The art of writing alphabets without the use of instruments is called freehand lettering.

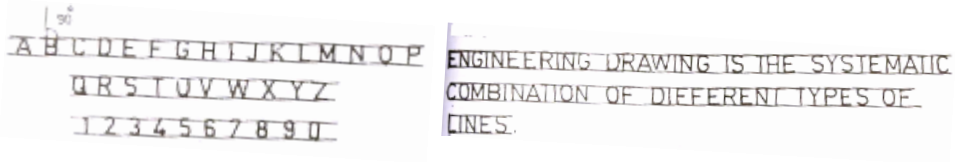
3. **Roman lettering**

**Style of freehand lettering**

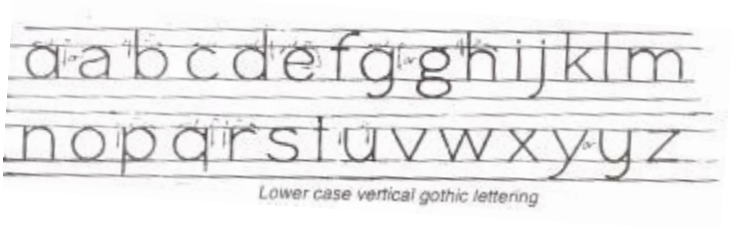
**a) Vertical or upright freehand lettering**

i) Single stroke vertical freehand lettering

ii) Lower case vertical freehand lettering




(i) Single stroke freehand lettering



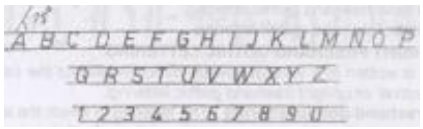
Lower case vertical gothic lettering

iii) Lower case vertical freehand lettering

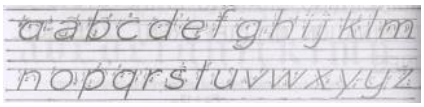
**b) Inclined or Italic freehand lettering**

i) Single stroke italic freehand

ii) Lower case Italic freehand




i. Single stroke Italic free hand lettering (Height=3mm)




ii) Lower case Italic free hand

**SPACING OF LETTERS**

The spacing means the distance which is to be left between the two adjacent letters in all types of lettering

Note: - The space between each word should be kept equal to height of letter

d. The space between the two lines should be left equal to twice the height of letter.
e. The space between the two lines should be kept not less than half or more than one and a half times the height of letter.

h: Lettering height (capital letters)

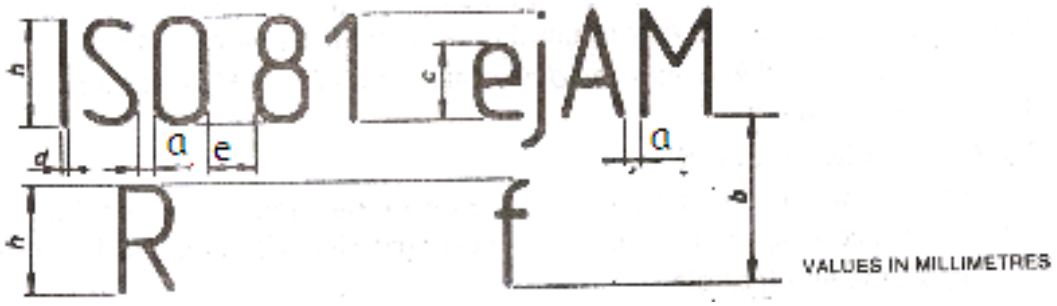
c: Height of lower case letters

a: Spacing between characters

b: Minimum spacing of base line

e: Minimum spacing between words

d: Thickness of lines




| CHARACTERISTIC | | RATIO | DIMENSION | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| LETTERING HEIGHT<br>HEIGHT OF CAPITALS | h | (14/14) h | 2.5 | 3.5 | 5 | 7 | 10 | 14 | 20 |
| HEIGHT OF LOWER-CASE LETTERS (WITHOUT STEM OR TAIL) | c | (10/14) h | - | 2.5 | 3.5 | 5 | 7 | 10 | 14 |
| SPACING BETWEEN CHARACTERS | a | (12/14) h | 0.35 | 0.5 | 0.7 | 1 | 1.4 | 2 | 2.8 |
| MINIMUM SPACING OF BASE LINES | b | (20/14) h | 3.5 | 5 | 7 | 10 | 14 | 20 | 28 |
| MINIMUM SPACING BETWEEN WORDS | e | (6/14) h | 1.05 | 1.5 | 2.1 | 3 | 4.2 | 6 | 8.4 |
| THICKNESS OF LINES | d | (1/14) h | 0.18 | 0.25 | 0.35 | 0.5 | 0.7 | 1 | 1.4 |

- CONTENT/TOPIC 1: DEFINITION AND FUNCTION OF SYMBOLS FOR CONSTRUCTION DRAWING

- **Definition of symbols for construction drawing**

**Services symbols:** represent the mechanics of a building, and help to identify such elements as mechanical ventilation, soil pipes, and incoming power for **example**. They should show the locations and directions in which they are travelling, and highlight where new and old infrastructures are combined or replaced.

**Lighting symbols: lighting symbols** provide a simple and clear **means** of identifying positions, types, amounts and power outputs.

**Electrical symbols:**

A simple geometrical symbol used to represent a component of a circuit in a schematic circu it diagram.

**Plan, elevation and section symbols**

- **Function of symbols for construction drawing**

One of the main functions of graphic symbols on construction drawings is to reference other drawings within the set. For example, a circle drawn around an area of a drawing with an extension to a number would indicate that this portion of the drawing has been drawn to a larger scale to provide more information than would be possible at the existing scale . In the preparation of working drawings for the building-construction industry, architects and engineers have devised systems of abbreviations, symbols, and keynotes to simplify the work of those preparing the drawings and to keep the size and bulk of the construction documents to an acceptable, comprehensible way.

Architectural drawing symbols also form an important role in any architecture drawing and help to define elements such as floor levels, lighting types and service locations. Electrical layouts in particular, require many different items and abbreviations, and accompanied by a key, symbols provide a clear and tidy method of identifying their placement, type and use.

The below architectural symbols, are broken down into the following categories:

- Services symbols
- Lighting symbols
- Electrical symbols
- Plan, elevation and section symbols
- CONTENT/TOPIC 2: TYPES OF SYMBOLS USED IN CONSTRUCTION DRAWING

➢ **MASONRY SYMBOLS**

## MATERIALS SYMBOLS

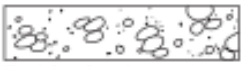
### Earthworks


Earth/compact fill


Porous fill/gravel


Rock

### Concrete


Cast-in-place/precast


Lightweight


Sand/mortar/
plaster/cut stone

### Masonry


Adobe/rammed earth


Common/face


Fire brick


Concrete block


Gypsum block


Structural facing tile

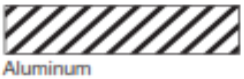
### Stone


Bluestone/slate/
soapstone/flagging

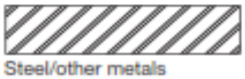

Rubble


Marble

### Metal

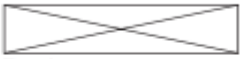

Aluminum


Brass/bronze


Steel/other metals

### Wood


Finish


Rough


Blocking


Hardboard


Plywood – large scale


Plywood – small scale

## MATERIALS SYMBOLS *(cont.)*

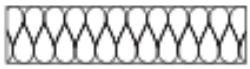
### Glass

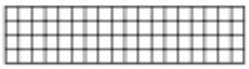

Glass


Structural


Glass block

### Insulation


Batt/loose fill


Rigid

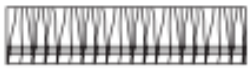

Spray/foam

### Finishes


Acoustical tile


Ceramic tile – large scale

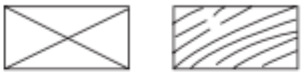
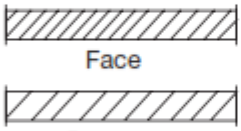
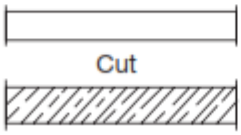
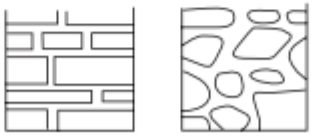
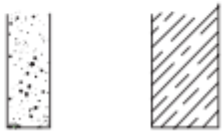

Ceramic tile – small scale

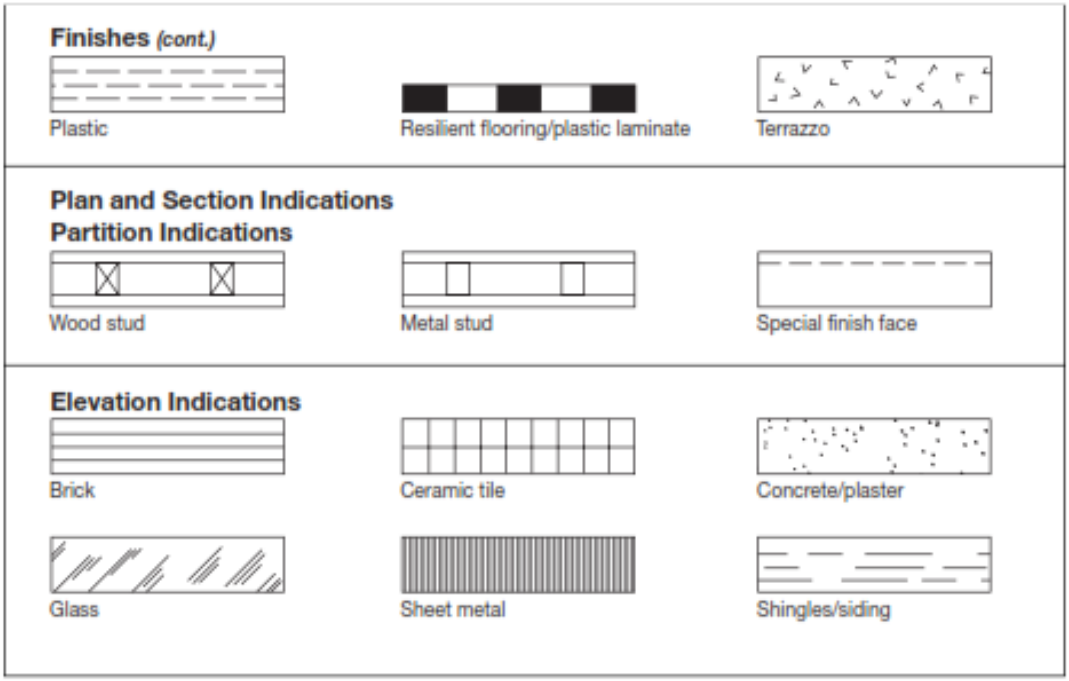

Carpet and pad

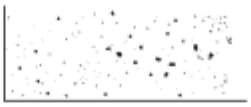
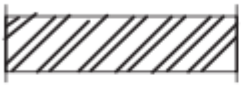
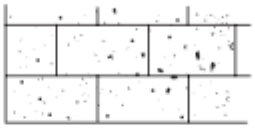
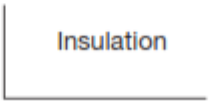

Gypsum wallboard

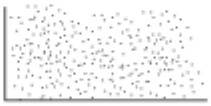
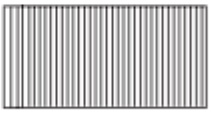

Metal lath and plaster

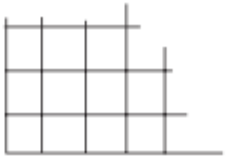
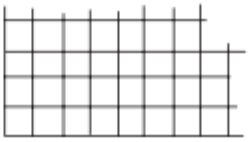
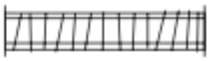
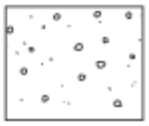
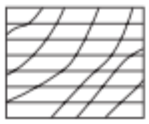
## MATERIAL INDICATION SYMBOLS

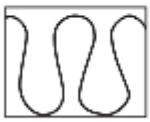
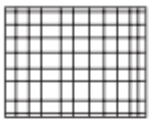
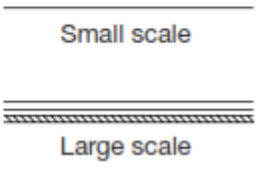
| Material | Plan | Elevation | Section |
|---|---|---|---|
| Wood | Floor areas left blank |  Siding Panel |  Framing Finish |
| Brick |  Face Common |  Face or common | Same as plan view |
| Stone |  Cut Rubble |  Cut Rubble |  Cut Rubble |

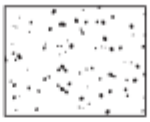
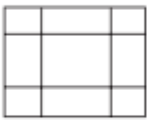
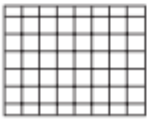


| | | | |
|---|---|---|---|
| Concrete |  |  | Same as plan view |
| Concrete block |  |  | Same as plan view |
| Earth | None | None |  |
| Glass |  |  |  Large scale  Small scale |
| Insulation | Same as section |  Insulation |  Loose fill or batt  Board |

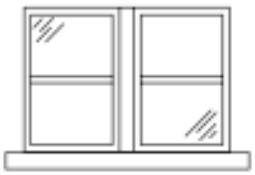
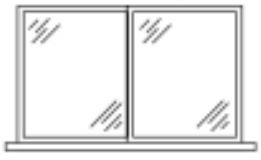
| MATERIAL INDICATION SYMBOLS *(cont.)* | | | |
|---|---|---|---|
| **Material** | **Plan** | **Elevation** | **Section** |
| Plaster | Same as section | Plaster  | Stud  Lath and plaster |
| Structural steel |  | Indicate by note |  |
| Sheet metal flashing | Indicate by note |  |  Show contour |

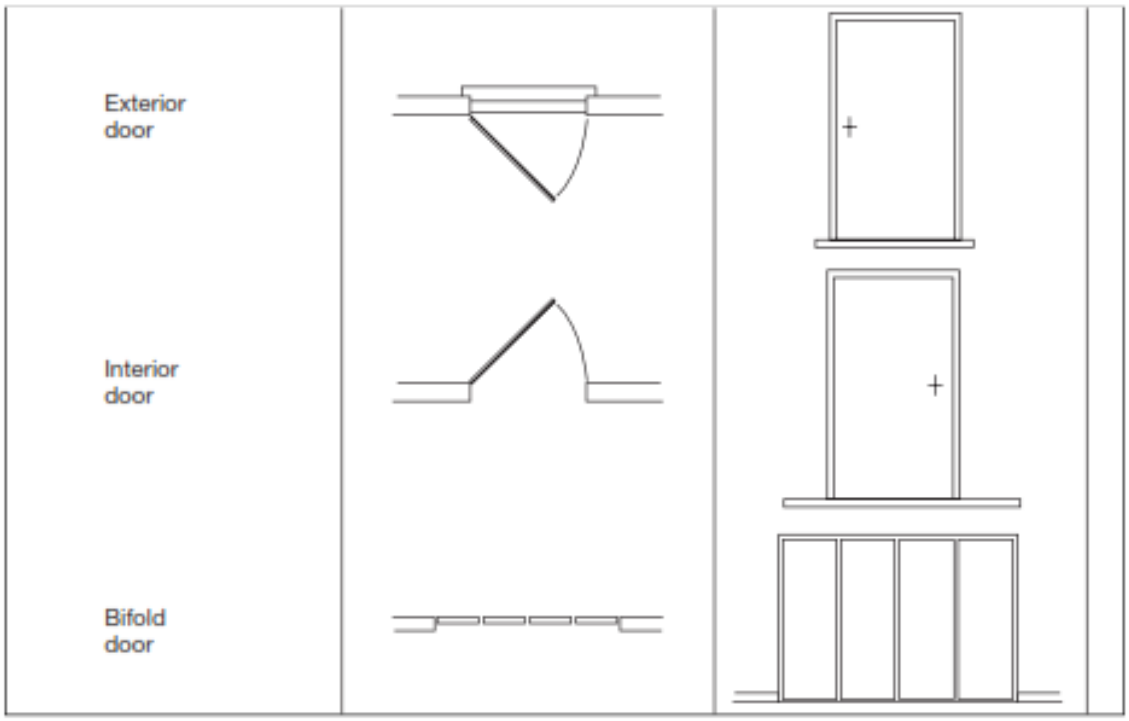
| | | | |
|---|---|---|---|
| Tile |  Floor |  Wall |  |
| Porous fill | None | None |  |
| Plywood | Indicated by note | Indicated by note |  |

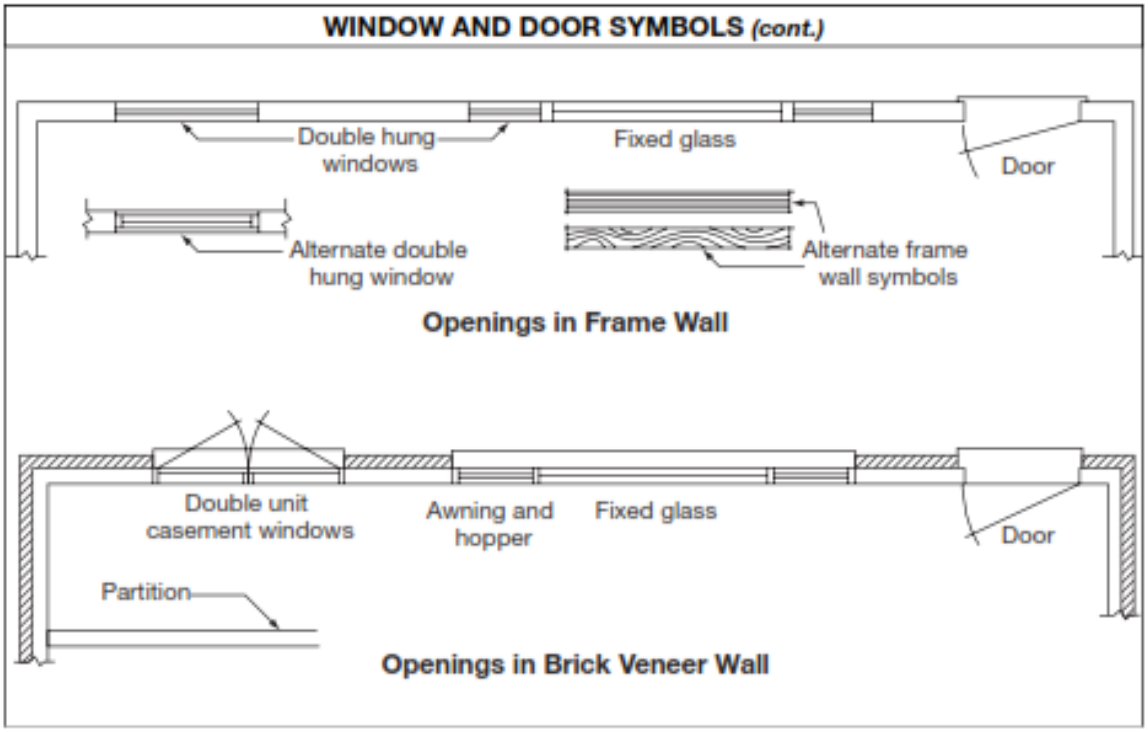
| MATERIAL INDICATION SYMBOLS *(cont.)* | | | |
|---|---|---|---|
| **Material** | **Plan** | **Elevation** | **Section** |
| Batt insulation |  | None | Same as plan |
| Rigid insulation |  | None | Same as plan |
| Glass |  |  |  Small scale Large scale |

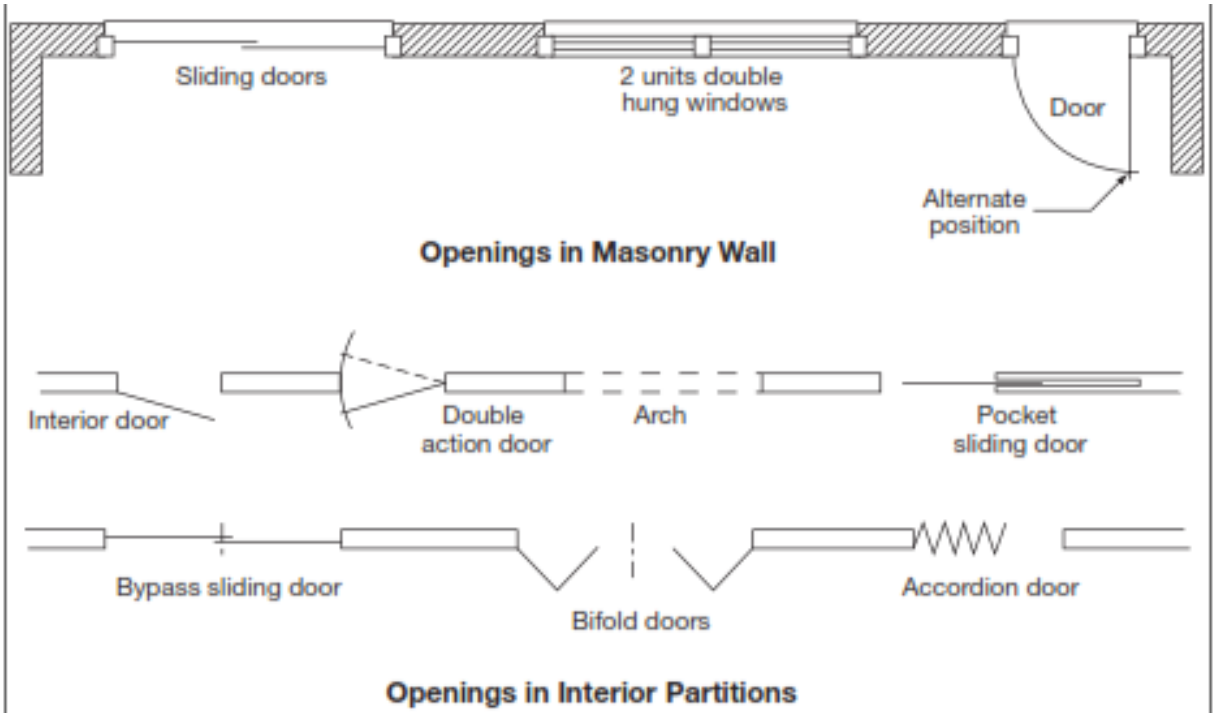
| | | | |
|---|---|---|---|
| Gypsum wallboard |  |  | Same as plan |
| Acoustical |  | None |  |
| Ceramic wall tile |  |  | Same as plan |
| Floor tile |  | None |  |

**WINDOW AND DOOR SYMBOLS**

| Type | Plan | Elevation |
|---|---|---|
| Double hung windows |  |  |
| Casement windows |  |  |
| Slider |  |  |

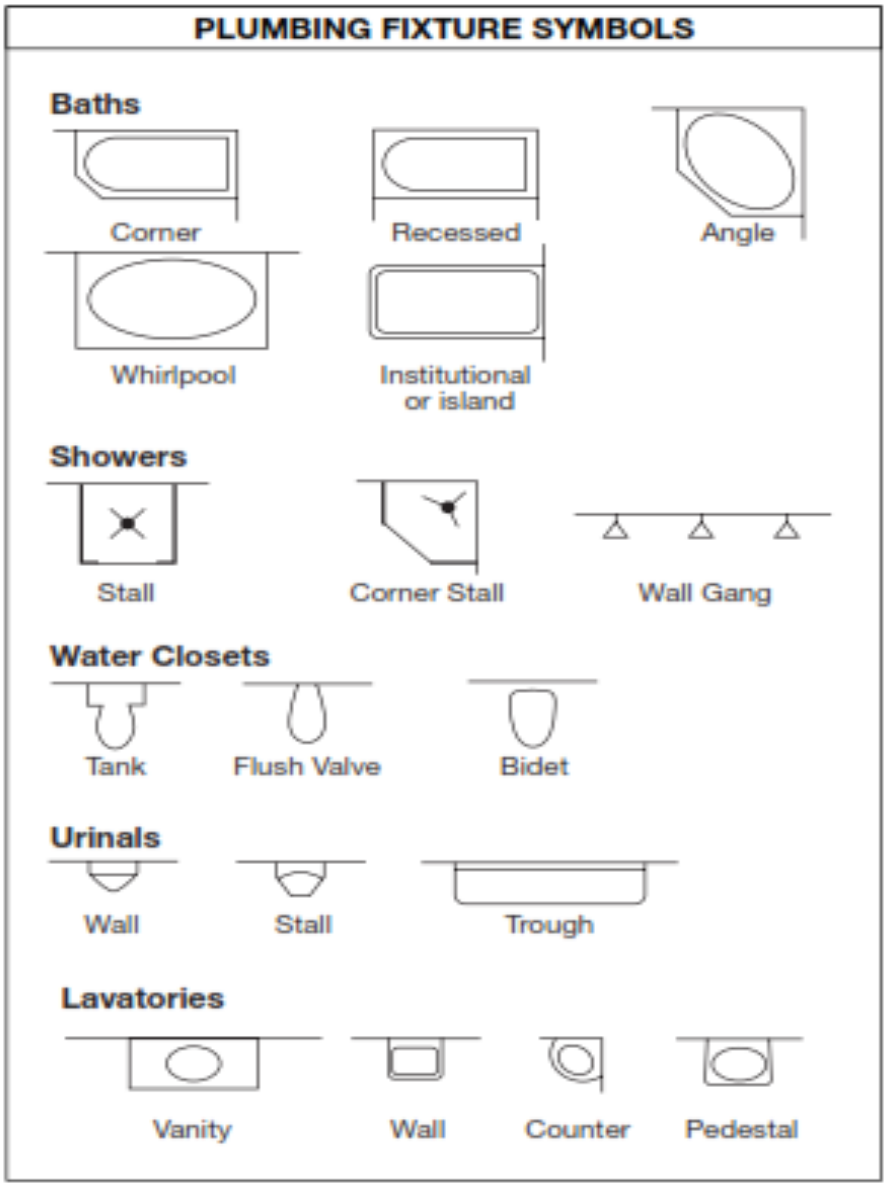

Exterior door
Interior door
Bifold door


WINDOW AND DOOR SYMBOLS (cont.)
Double hung windows
Fixed glass
Door
Alternate double hung window
Alternate frame wall symbols
Openings in Frame Wall
Double unit casement windows
Awning and hopper
Fixed glass
Door
Partition
Openings in Brick Veneer Wall



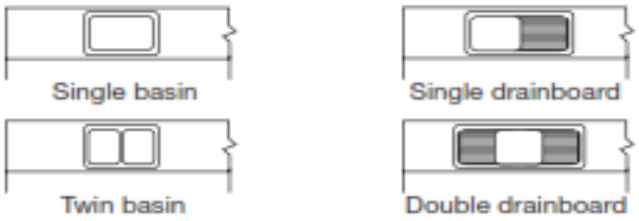

- **PLUMBING SYMBOLS**

## PLUMBING FIXTURE SYMBOLS



## PLUMBING FIXTURE SYMBOLS *(cont.)*

### Kitchen Sinks




### Drinking Fountains or Electric Water Coolers


### Dishwasher


### Laundry Trays


### Service Sinks

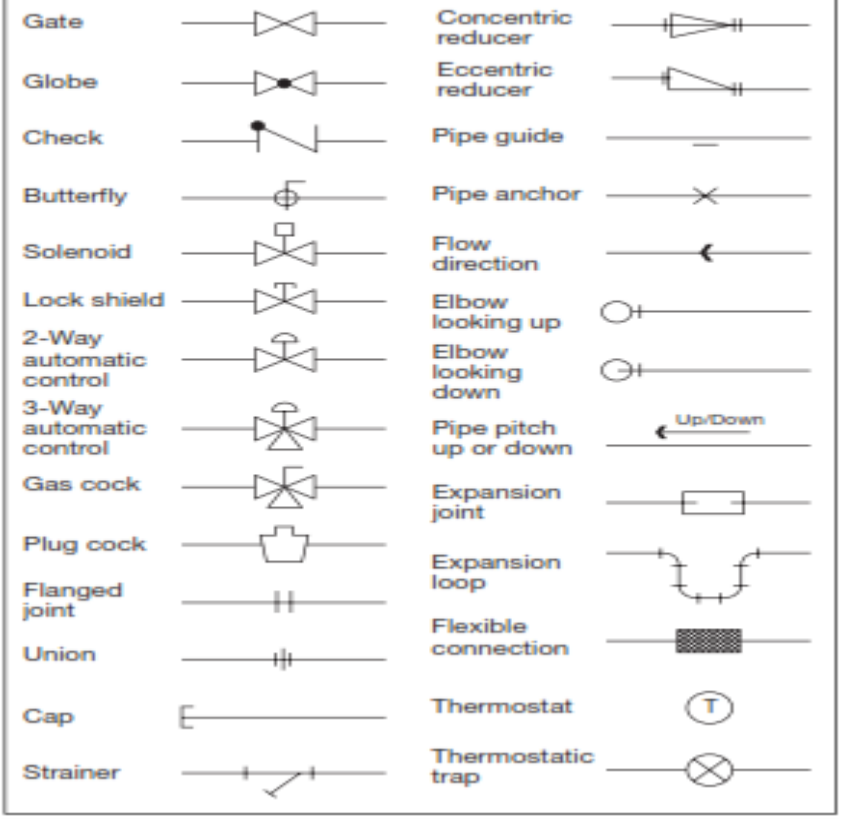

### Wash Fountains


### Hot Water

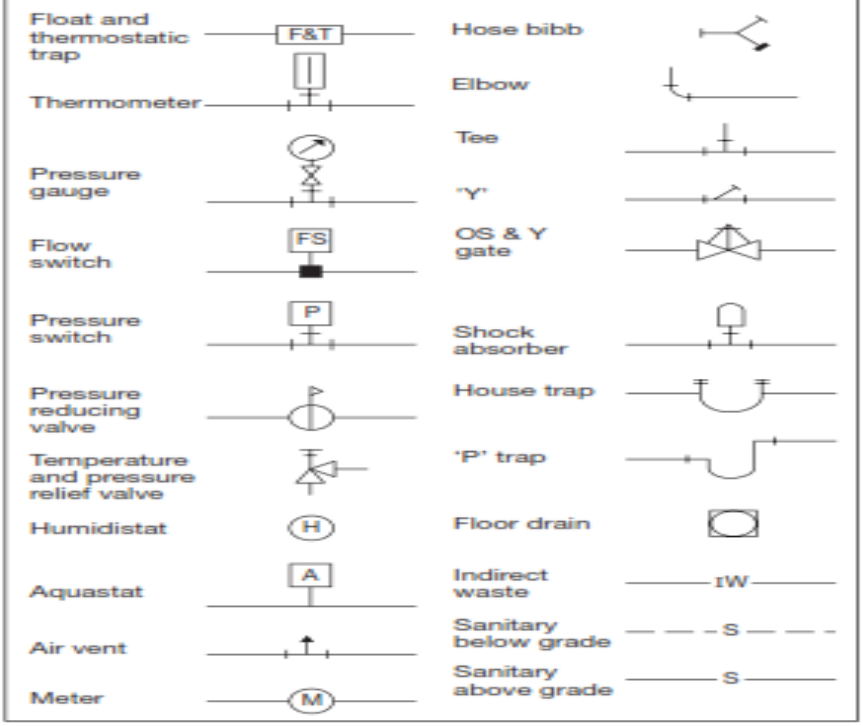

### Separators

## PIPING SYMBOLS

### Valves, Fittings and Specialties



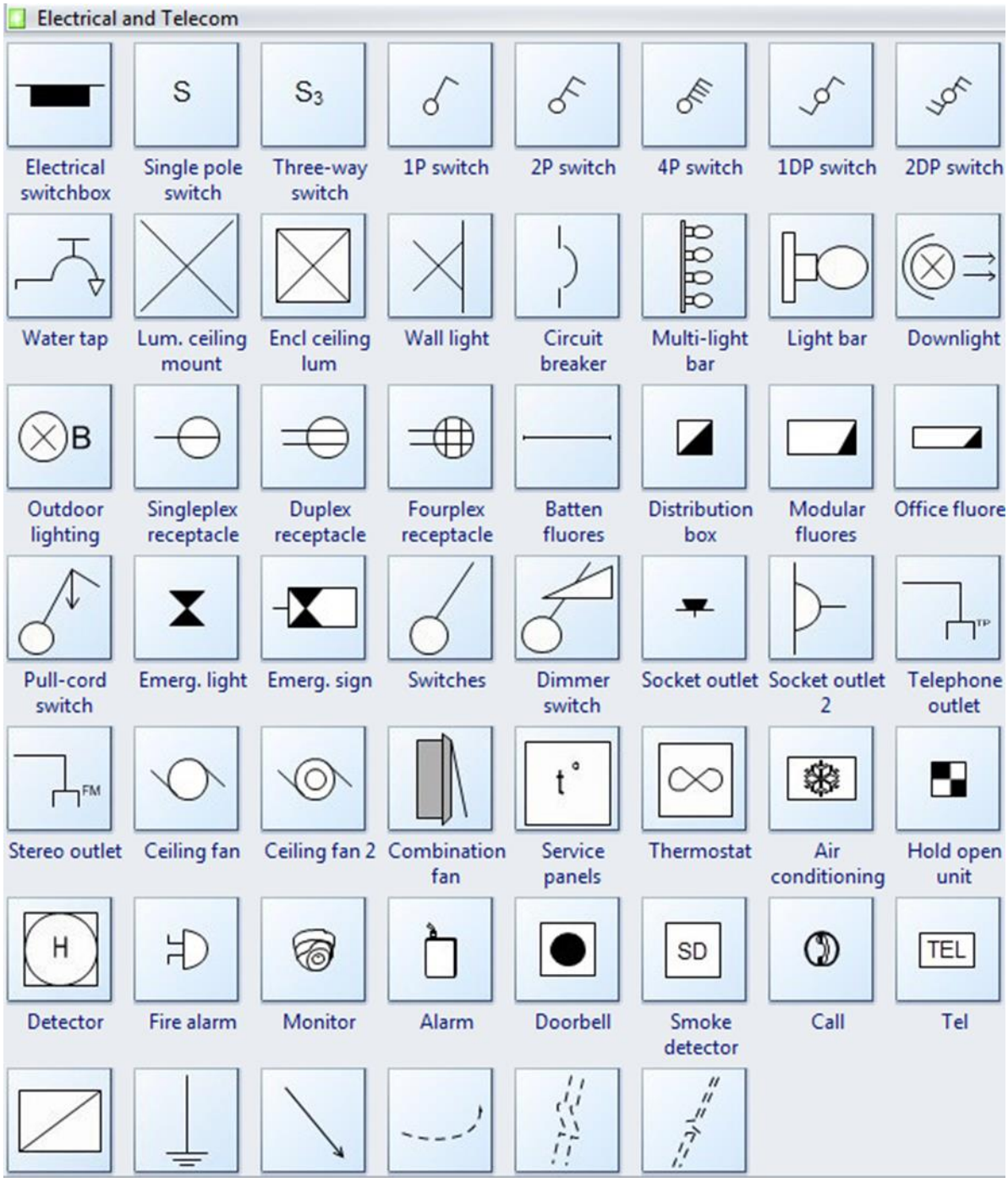

## PIPING SYMBOLS *(cont.)*



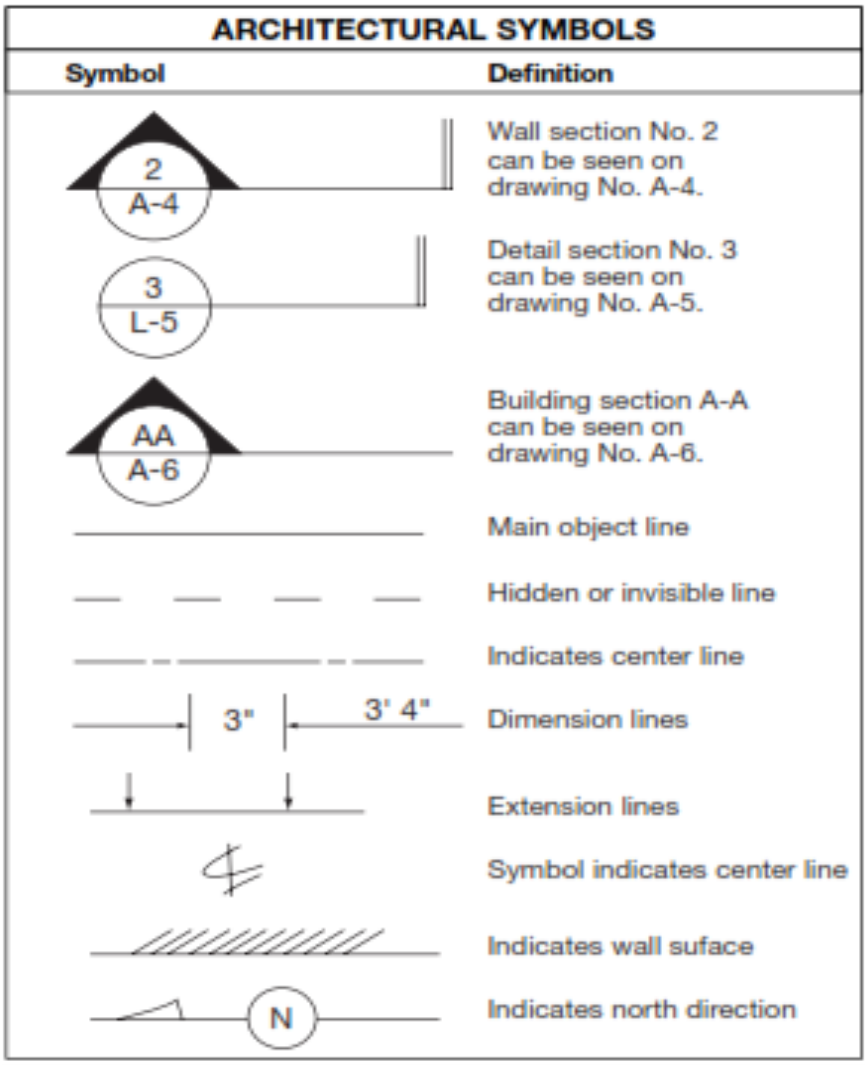
## PIPING SYMBOLS *(cont.)*

| | | | |
|---|---|---|---|
| Storm below grade | — — – ST — — – | Gas-low pressure | ——— G ——— |
| Storm above grade | ——— ST ——— | Gas-medium pressure | ——— MG ——— |
| Vent | — — — — — — | Gas-high pressure | ——— HG ——— |
| Combination waste & vent | ——— CWV ——— | Compressed air | ——— CA ——— |
| Acid waste below grade | — — – AW — — - | Vacuum | ——— V ——— |
| Acid waste above grade | ——— AW ——— | Vacuum cleaning | ——— VC ——— |
| Acid vent | — — – AV – — — | Nitrogen | ——— N ——— |
| Cold water | ——— – ——— CW | Nitrous oxide | ——— $N_2O$ ——— |
| Hot water | ——— – – ——— HW | Oxygen | ——— O ——— |
| Hot water circulation | ——— – – – ——— HWC | Liquid oxygen | ——— LOX ——— |
| Drinking water supply | ——— DWS ——— | Liquid petroleum gas | ——— LPG ——— |
| Drinking water return | ——— DWR ——— | | |

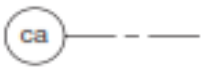
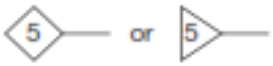
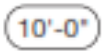
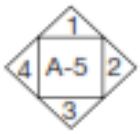
**ELECTRICALSYMBOLS**



- **ARCHITECTURAL SYMBOLS**



**ARCHITECTURAL SYMBOLS *(cont.)***

| Symbol | Definition |
|---|---|
|  | Column line grid |
|  | Partition type |
|  | Window type |
|  | Door number |
|  | Room number |
|  | Ceiling height |
|  | Revision marker |
|  | Break in a continuous line |
|  | Refer to note #3 |
|  | Elevation marker |
|  | Interior elevations 1,2,3 & 4 can be seen on drawing A-5. Direction of triangle indicates elevation. |

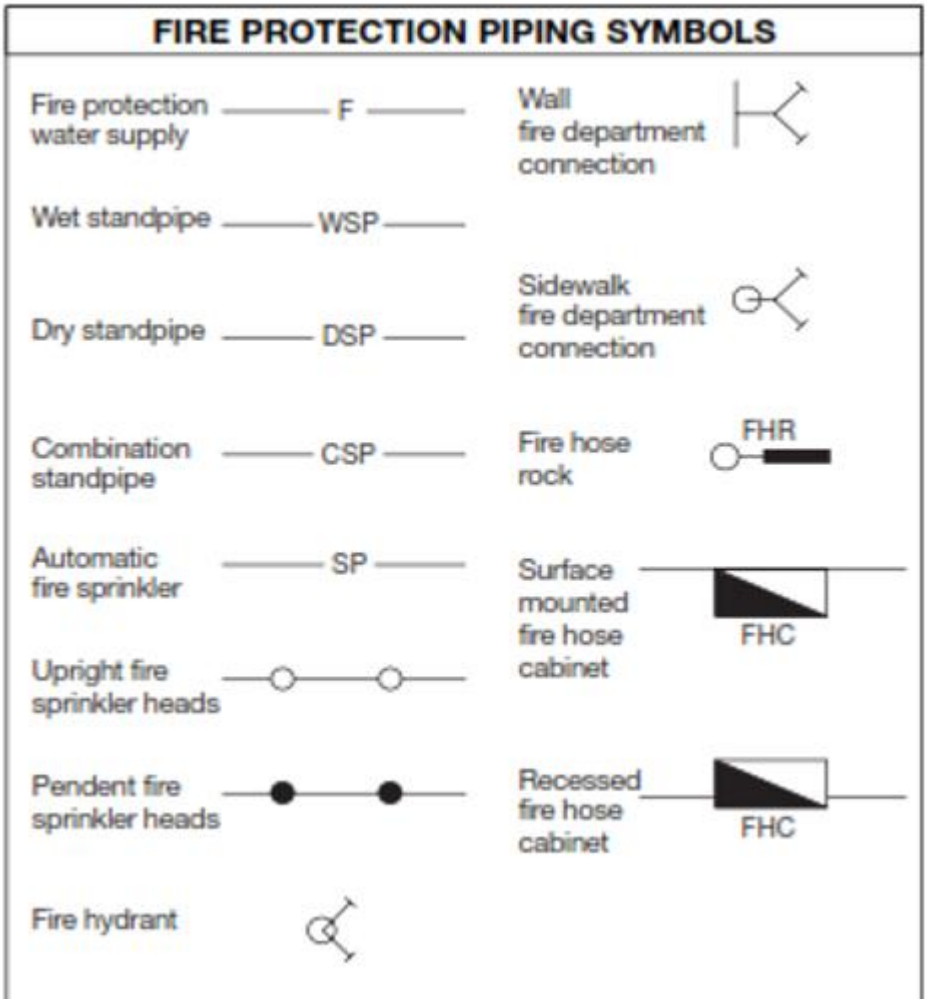
- **MECHANICAL SYMBOLS**

## HEATING PIPING

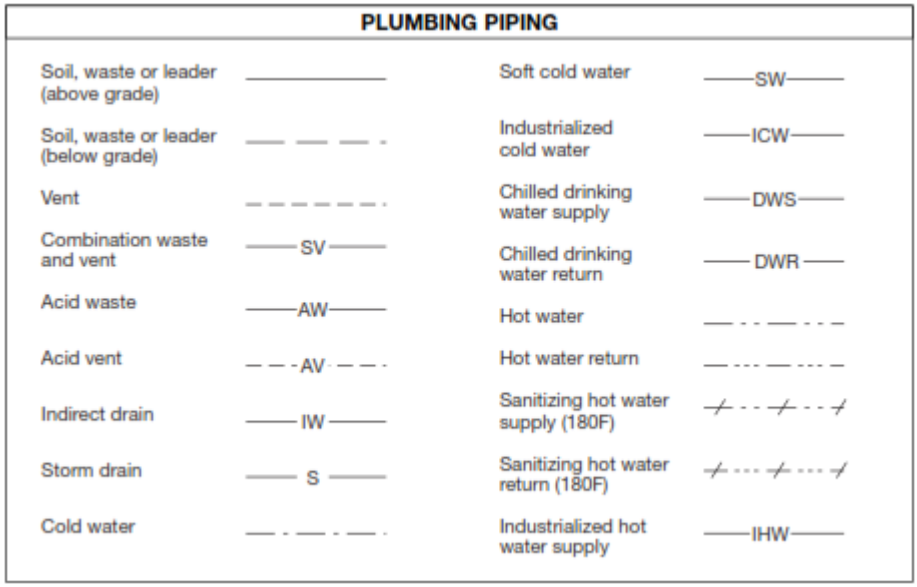
| | | | |
|---|---|---|---|
| High pressure steam | HPS | Make up water | MU |
| Medium pressure steam | MPS | Air relief line | V |
| Low pressure steam | LPS | Fuel oil suction | FOS |
| High pressure return | HPR | Fuel oil return | FOR |
| Medium pressure return | MPR | Fuel oil vent | FOV |
| Low pressure return | LPR | Compressed air | A |
| Boiler blow off | BD | Hot water heating supply | HW |
| Condensate or vacuum pump discharge | VPD | Hot water heating return | HW |
| Feedwater pump discharge | PPD | | |

## AIR CONDITIONING PIPING

| | | | |
|---|---|---|---|
| Refrigerant liquid | RL | Chilled water return | CHWR |
| Refrigerant discharge | RD | Make up water | MU |
| Refrigerant suction | RS | Humidification line | H |
| Condenser water supply | CWS | Drain | D |
| Condenser water return | CWR | Brine supply | B |
| Chilled water supply | CHWS | Brine return | BR |



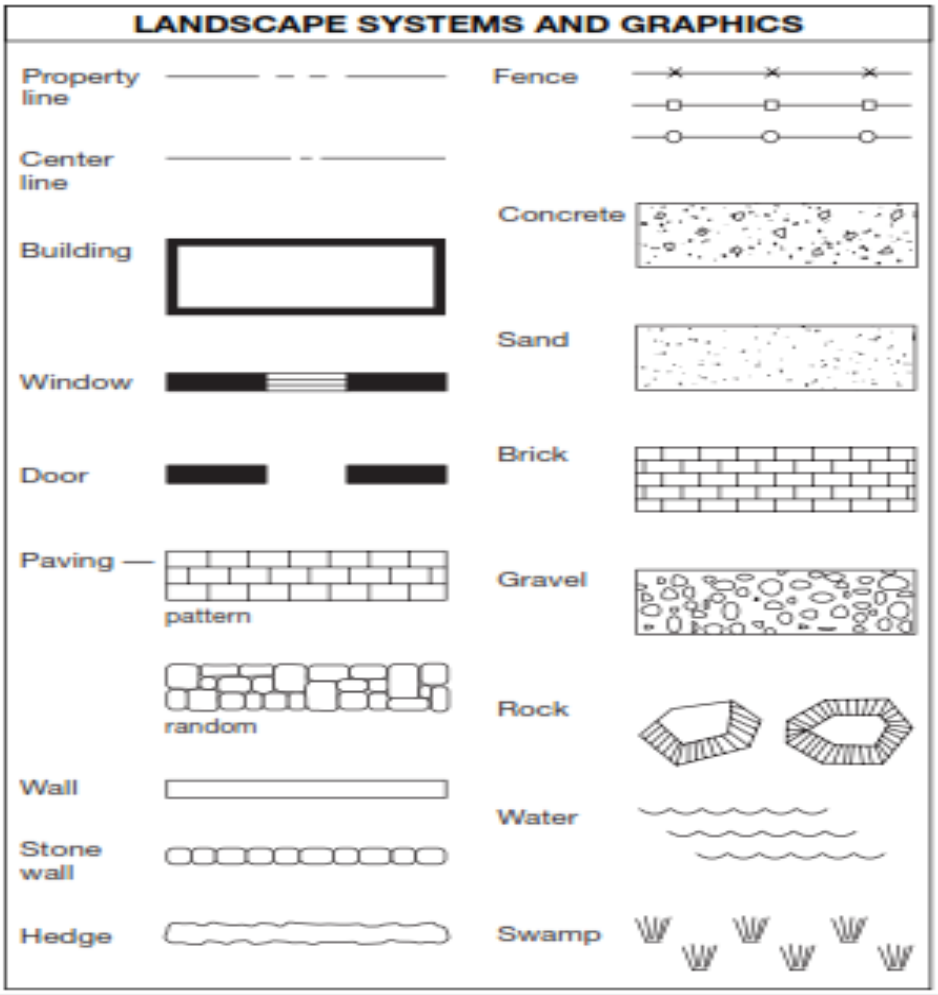

- **SPECIAL SYMBOLS**

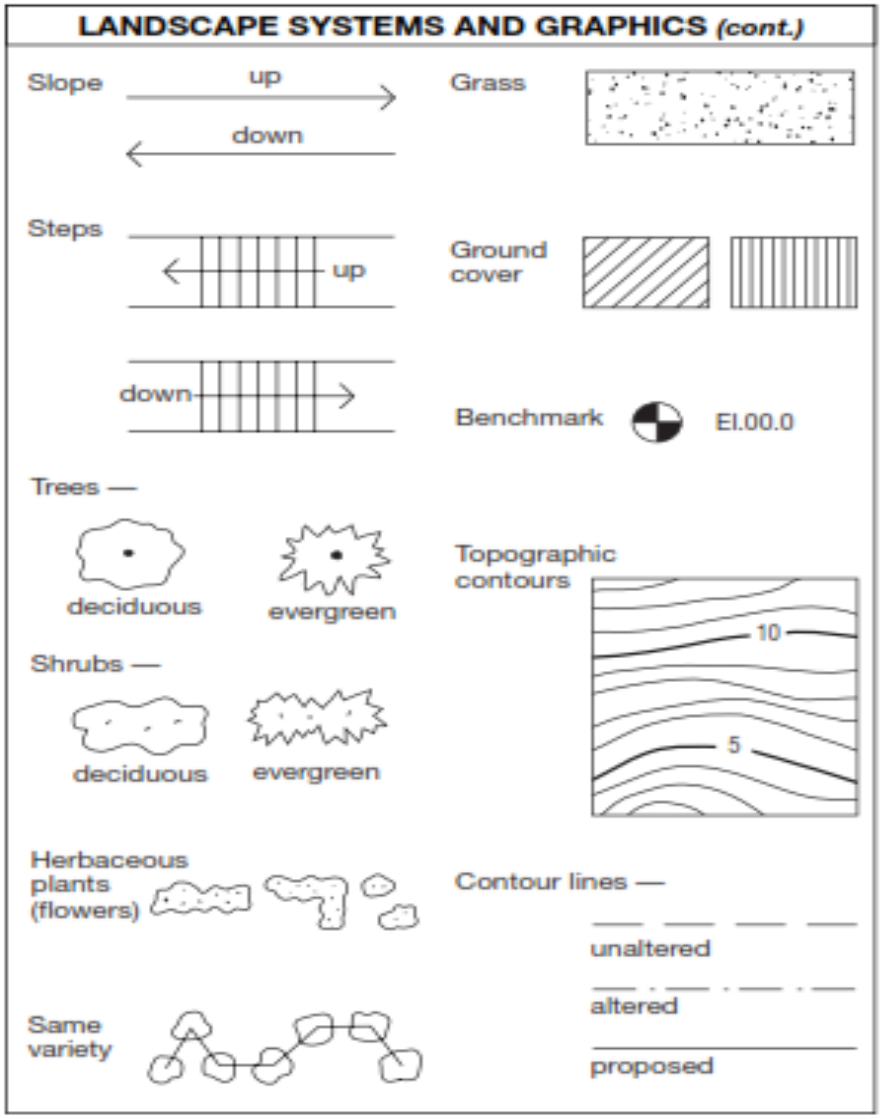


## PLUMBING PIPING *(cont.)*

| | | | |
|---|---|---|---|
| Industrialized hot water return | IHR | Gas – low pressure | G G |
| Tempered water supply | TWS | Gas – medium pressure | MG |
| Tempered water return | TWR | Gas – high pressure | HG |
| Fire line | F F | Compressed air | A |
| Wet standpipe | WSP | Vacuum | V |
| Dry standpipe | DSP | Vacuum cleaning | VC |
| Combination standpipe | CSP | Oxygen | O |
| Main supplies sprinkler | S | Liquid oxygen | LOX |
| Branch and head sprinkler | | Nitrogen | N |

| | | | |
|---|---|---|---|
| Liquid nitrogen | LN | Pneumatic tubes tube runs | PN |
| Nitrous oxide | NO | Cast iron | CI |
| Hydrogen | H | Culvert pipe | CP |
| Helium | HE | Clay tile | CT |
| Argon | AR | Ductile iron | DI |
| Liquid petroleum gas | LPG | Reinforced concrete | RCP |
| Industrial waste | INW | Drain – open tile or agricultural tile | |


LANDSCAPE SYSTEMS AND GRAPHICS
Property line
Center line
Building
Window
Door
Paving
pattern
random
Wall
Stone wall
Hedge
Fence
Concrete
Sand
Brick
Gravel
Rock
Water
Swamp




## LO 2.3 – Apply techniques of freehand sketching

- CONTENT/TOPIC 1: INTRODUCTION ON FREEHAND SKETCHING
  - **SKETCHING**

**What do you think is the use of sketching for engineers and designers?**

Sketching is as much a thinking process as it is a communication technique and it is a rapid method of drawing. In addition Sketching is almost always the first step in the preparation of masonry Drawings.

Freehand sketches have the following uses:

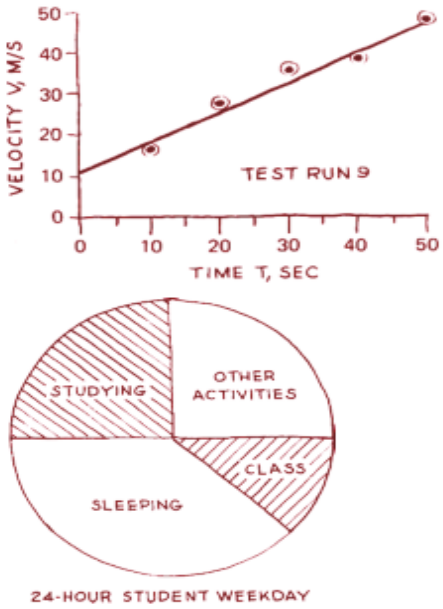
- Transferring information, obtained in the field or shop, to the engineering office.

- Conveying the ideas of the designer to the draftsman.
- Making studies of the layout of the views required in an instrumental drawing.
- A means of making preliminary studies of a design to show how it functions.
- Furnishing a three-dimensional picture of an object; this will help to interpret the orthographic views.

## ➢ TYPES OF FREEHAND SKETCHING

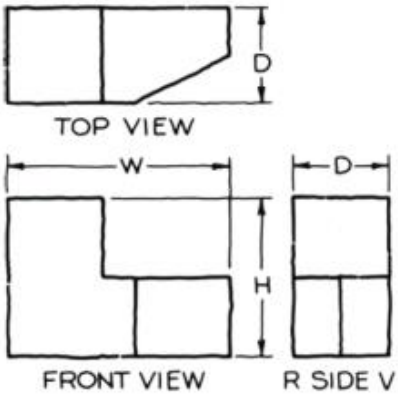
Freehand sketches can be categorized into three:

1. Sketches which communicate technical Data such as charts, graphs, maps, and diagrams as shown in Figure bellow:



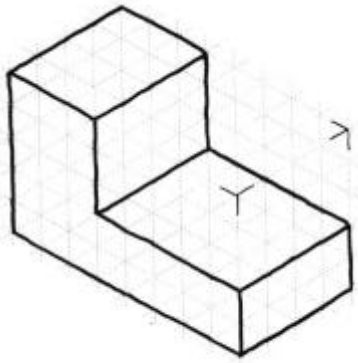

*Communication of information using charts and graphs*

2. Sketches which illustrate two dimensions of an object such as a multiview representation of an object as shown in Figure bellow:




*Multi-view representation of an object*

3. Sketches which are two dimensional representations of three dimensional objects such as pictorial sketches of an object, as shown on the figure bellow:

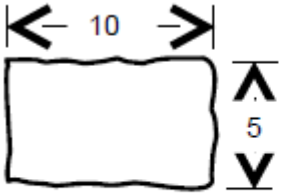


*Pictorial representation of an object*

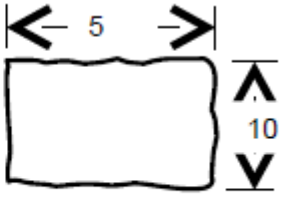
Notes: The work piece (object) is carefully studied and all the necessary dimensions are measured. The views that are necessary to completely describe the object are very roughly drawn (free hand). All dimensions are indicated on the sketch as deemed necessary. In most situations, axonometric views of the object are drawn. Sketches are never submitted anywhere. They are just drawn to assist you at a later time when preparing standard drawings. There are no hard rules or general guidelines with respect to sketches. Nevertheless, sketches should be drawn accurately so that they may prove useful at a later stage.

**Hand Drafts** are actually proper engineering drawings drawn free hand. The similarity between a sketch and a hand draft is that they are both drawn free hand. But unlike sketches,

hand drafts are drawn following all the rules and guidelines governing engineering drawings hand drafts are drawn roughly to scale and all the necessary dimensions are indicated. Only those views, which are necessary to completely describe the object, are presented. The hand draft is then given to the draftsman who “copies” the same into a proper engineering drawings. This ensures that the draftsman produces an engineering drawings exactly the same way as you want it to appear. In short, a hand draft saves you time and effort that you will otherwise need to prepare a proper engineering drawings , hence enabling you to leave the later exercise to a draftsman.




YES



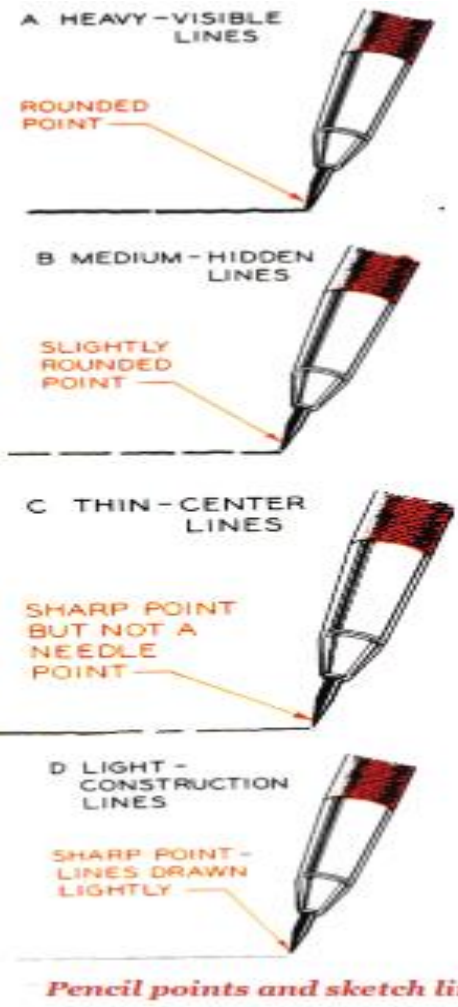

NO

- CONTENT/TOPIC 2: SHARPENING PENCILS AND APPLICATION OF FREEHAND

SKETCHING

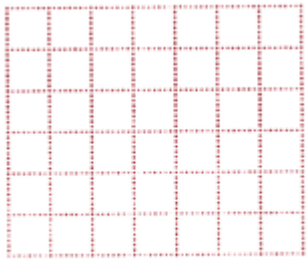
❖ **SHARPENING PENCILS**

A sketching pencil should be sharpened on a file or piece of sandpaper to conical point. The point then should be rounded slightly on the back of the sketch pad or another sheet of paper to the correct degree of dullness. The alphabets of lines that are sketched freehand are all made with the same pencil grade. The variation in the lines is achieved by varying the sharpness of the pencil point as shown below




*Pencil points and sketch lines*

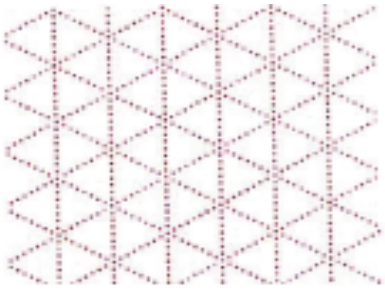
- Eraser
- Blank paper
- Rectangular grid paper



*(a) Rectangular grid*

- Isometric grid paper

(a)



❖ **Application of freehand sketching**

- **Practice:1**

Sketch multi-view and pictorial representation of any object, which is familiar to you?

- **Practice: 2**

Sketch a multi-view on a plain A4 drawing paper and rectangular grid paper. Then explain the difference between drawing sketches on a plain paper and on grip paper?

- **Practice:3**

Sketch horizontal, vertical and inclined lines on a plain sheet of A4 size paper. Sketch about Ten more parallel lines spaced by eye about 15mm apart. Try to keep the lines reasonably parallel?

- **Practice:4**

Sketch several differently spaced boarder lines around the edges of a plain sheet of A4 size paper. Try to produce neat square corners where the lines intersect. Avoid extending one line beyond another?

# Learning Unit 3 – Perform 2 & 3 dimensional drawing

## LO 3.1 – Apply 2 & 3 dimensional drawing

- CONTENT/TOPIC 1: INTRODUCTION ON 2&3 DIMENSIONAL DRAWING AND TYPES OF ANGLES

➢ **2D FIGURES**

A **two-dimensional** (**2D**) **object** is an **object** that only has two dimensions, such as a length and a width, and no thickness or height.

➢ **3D OBJECTS**

A three-dimensional (3D) **object** is an **object** with three dimensions: a length, a width, and a height. The flat sides of three-dimensional **objects** are **two-dimensional** shapes.

❖ **TYPES OF ANGLES**

➢ Acute angle is less than 90°

➢ Right angle is 90°exactly

➢ Obtuse angle is greater than 90° but less than 180°

➢ Straight angle is 180° exactly

➢ Reflex angle is greater than 180°

➢ Full rotation angle is 360°exactly

**Note: The figure bellow describes in details different types of angles**

Names of Angles

As the Angle Increases, the Name Changes:


| Type of Angle | Description |
|---|---|
| Acute Angle | is less than 90° |
| Right Angle | is 90° exactly |
| Obtuse Angle | is greater than 90° but less than 180° |
| Straight Angle | is 180° exactly |
| Reflex Angle | is greater than 180° |
| Full Rotation | is 360° exactly |

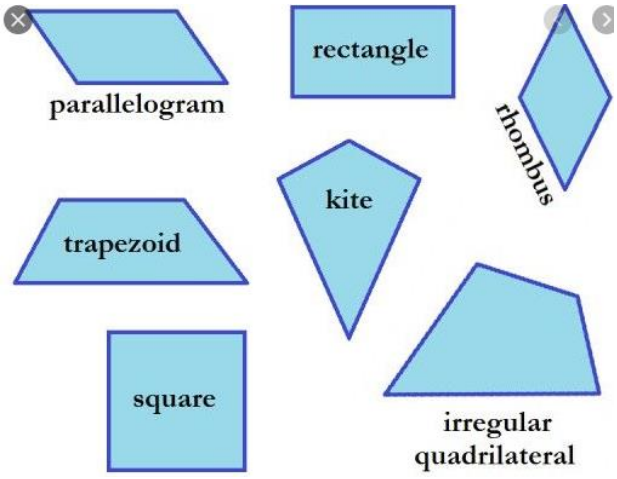
- CONTENT/TOPIC 2: APPLICATION OF ANGLES

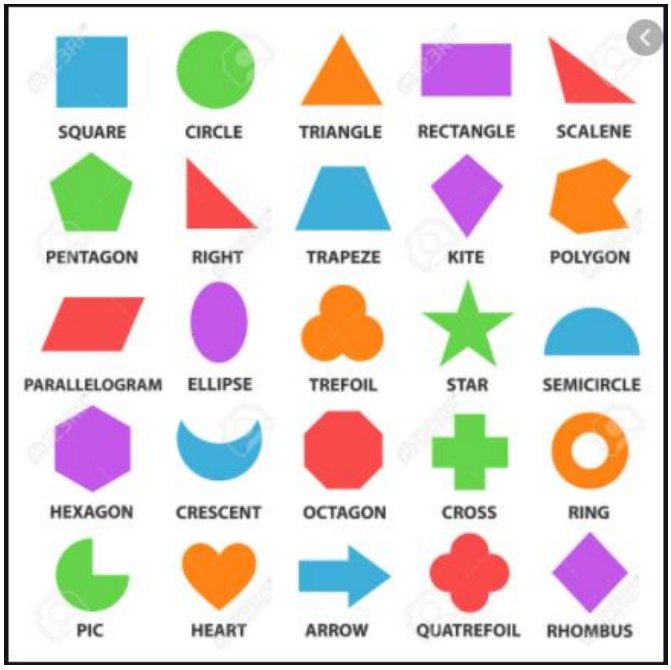
**Figures**

**Note:** while constructing geometric figures we apply angles on different directions

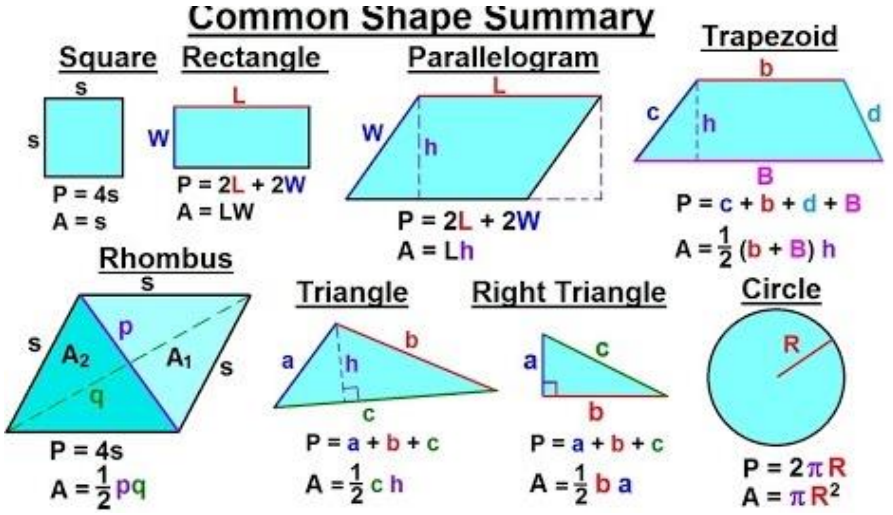
**Examples of application of angles on objects**

**Example 1**



**Example 2**

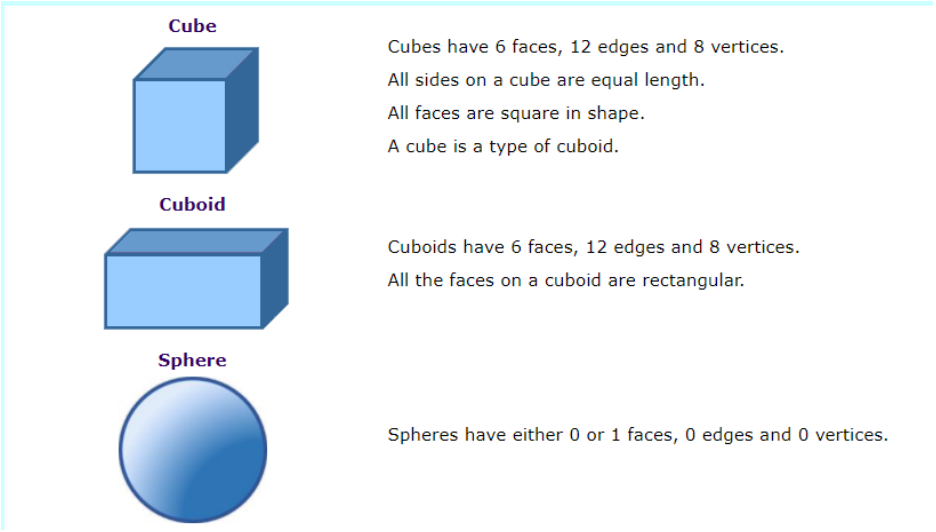



- **Objects**

  **Note:** while constructing geometric objects we apply angles on different directions

- **Examples of application of angles on objects**

- **Example 1**



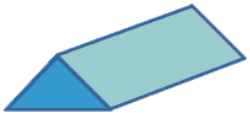
**Cylinder**

Cylinders have either 2 or 3 faces, 0 or 2 edges, and 0 vertices.

**Cone**

Cones have either 1 or 2 faces, 0 or 1 edges, and 1 apex (which is described by some mathematicians as a vertex).

**Triangular Prism**



Triangular Prisms have 5 faces, 9 edges, and 6 vertices.

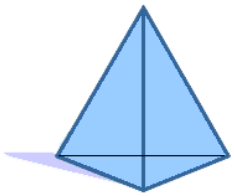
The two faces at either end are triangles, and the rest of the faces are rectangular.

**Hexagonal Prism**

Hexagonal Prisms have 8 faces, 18 edges, and 12 vertices.

The two faces at either end are hexagons, and the rest of the faces are rectangular.

**Triangular-based Pyramid**

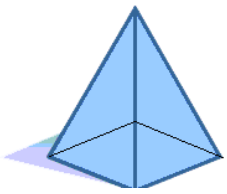


Triangular-based pyramids have 4 faces, 6 edges and 4 vertices.

The base is a triangle. All of the faces are triangular.

*If the triangular faces making up the prism are all equilateral, then the shape is also called a Tetrahedron.*

**Square-based Pyramid**

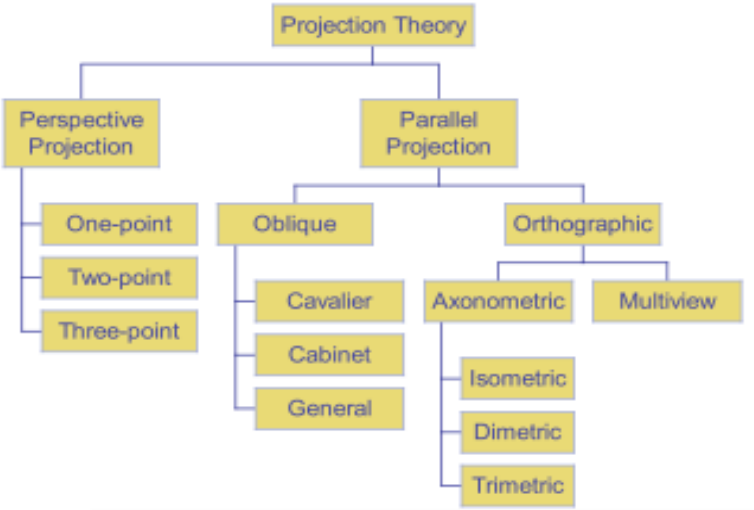


Square based pyramids have 5 faces, 8 edges and 5 vertices

The base is a square. All the other faces are triangular.

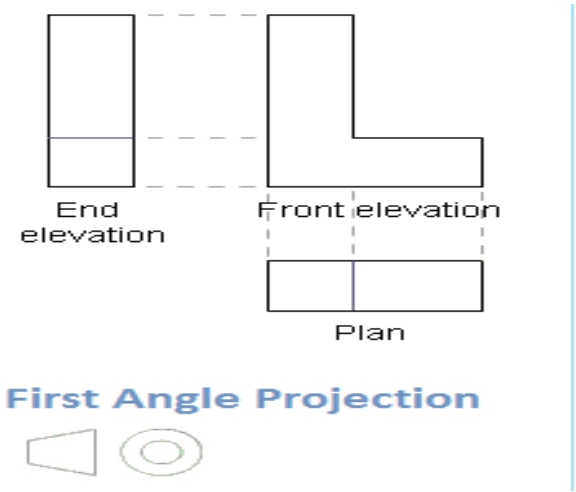
- CONTENT/TOPIC 3: PROJECTIONS

Depending on the position of the observer relative to the object, projection can be categorized into two broad types namely: **central or perspective projection and parallel projection.**

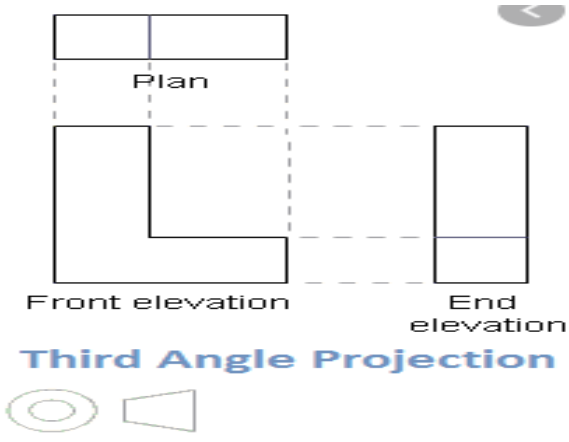


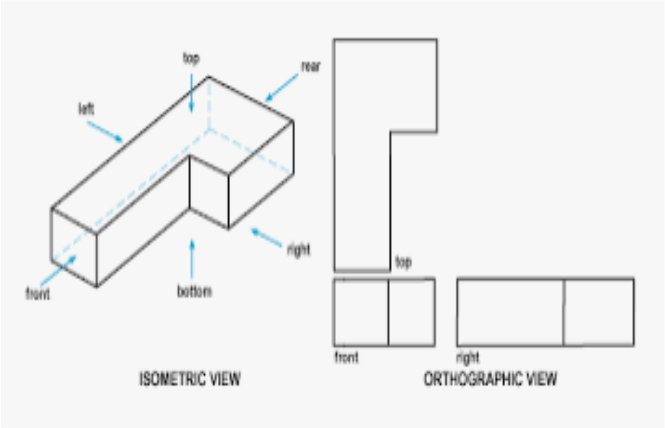

*Projection tree*

- **first angle orthographic projection**

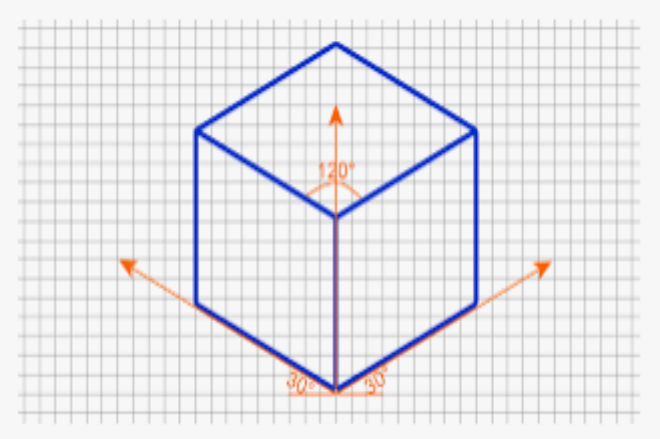



- **Third angle orthographic projection**





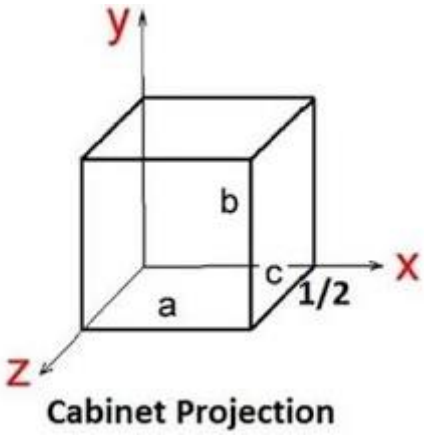

- **Isometric projection**



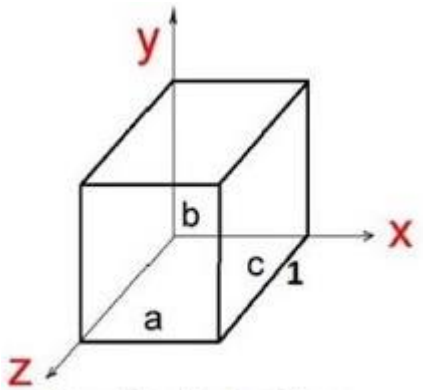

- **Oblique projection :**

It is classified into two: cabinet and cavalier projection.

- **Cabinet projection**




- **cavalier projection**



Cavalier Projection

## LO 3.2 – Identify dimensions and scales

- CONTENT/TOPIC 1: DRAWING SCALE AND DIMENSIONING

**Representative Fraction**

The ratio of the dimension of the object shown on the drawing to its actual size is called the Representative Fraction (RF)

$$RF = \frac{\text{Drawing size of an object}}{\text{Its actual size}} \text{ (in same units)}$$

For example, if an actual length of 3 metres of an object is represented by a line of 15mm length on the drawing

$$RF = \frac{15mm}{3m} = \frac{15mm}{(3\times1000)mm} = \frac{1}{200} \text{ or } 1:200$$

.

- **The recommended scales in masonry Drawing are:**

| True Size | 1:1 | | |
|---|---|---|---|
| Scales for Reduction | 1:2<br>1:20<br>1:200 | 1:5<br>1:50<br>1:500 | 1:10<br>1:100<br>1:1000 |
| Scales for Enlargement | 2:1<br>20:1<br>200:1 | 5:1<br>50:1<br>500:1 | 10:1<br>100:1<br>1000:1 |

- ✓ **SIZES OF REPRESENTATIVE FRACTION SCALE**
- Full size scale.
- Reducing scale
- Enlarging scales

- ✓ **TYPES OF SCALES**

The types of scales normally used are:

1. Plain scales.
2. Diagonal Scales.
3. Vernier Scales.

- ➢ **DIMENSIONS**

Dimensioning is the art by which the dimensions of an object are written on its drawing.

The correct dimensioning requires a systematic way in which the dimensions are written on the drawing.

- ➢ **ELEMENTS USED IN DIMENSIONING**

- Dimension lines
- Extension lines
- leaders
- arrowheads
- dimension value

- ➢ **TYPES OF DIMENSIONS**

- Linear dimension
- Radial dimension
- Angular dimension

**Principles of dimensions**

1. Dimension should be placed between views whenever possible unless required elsewhere.
2. Dimension should be placed outside the views of an object.
3. Dimension given on one view should not be repeated on another view.
4. Dimension should be taken from visible outline than the invisible (hidden) line.
5. Use only one system of dimension

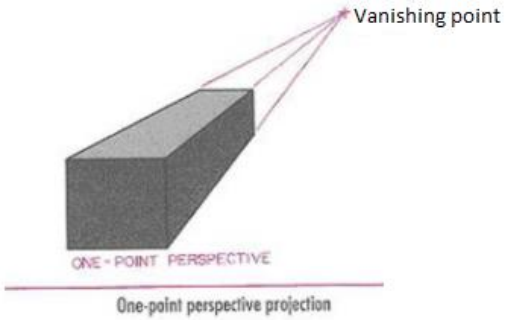
## LO 3.3 – Apply projections

- CONTENT/TOPIC 1: TYPES OF PROJECTIONS

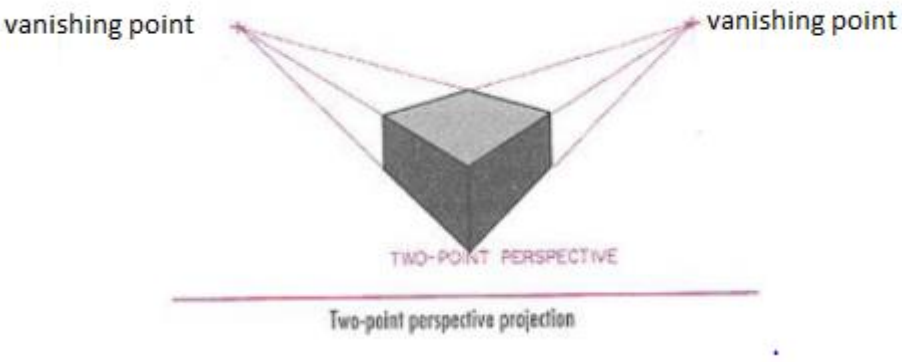
Depending on the position of the observer relative to the object, projection can be categorized into two broad types namely: **central or perspective projection and parallel projection.**

- **CENTRAL OR PERSPECTIVE PROJECTION**

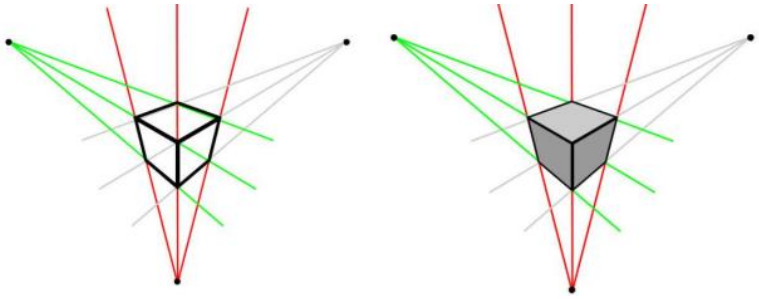
### a) One point perspective




### b) Two point perspective




### c) Three point perspective



➢ **PARALLEL PROJECTION.**

Parallel projection can be further divided into two groups depending on the angle formed between projectors and picture plane. These are:

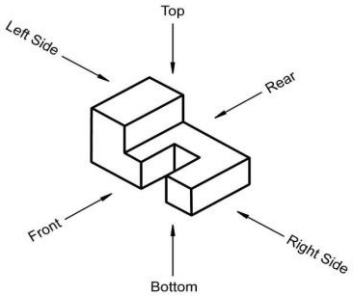
a) **OBLIQUE PROJECTION**
   - **Cavalier projection**
   - **Cabinet projection**

b) **ORTHOGRAPHIC PROJECTION.**
   - **Axonometric projection**
     - **Isometric projection**
     - **Diametric projection**
     - **Trimetric projection**

**Multi view projection**

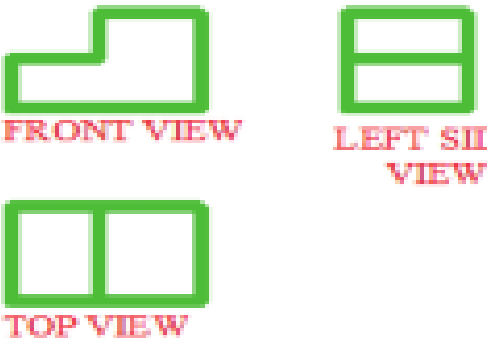
**The Six Principal Views**

The 6 principal views are created by looking at the object, straight on, in the directions indicated.



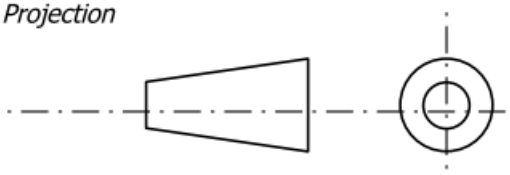

❖ **Different methods of projections:**

- First angle orthographic projection

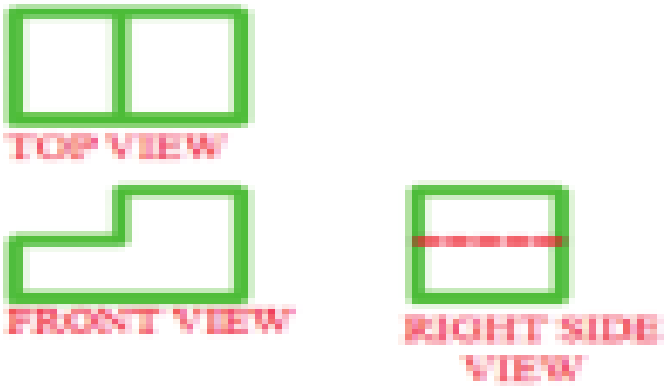



*The First Angle Projection*

Symbol:

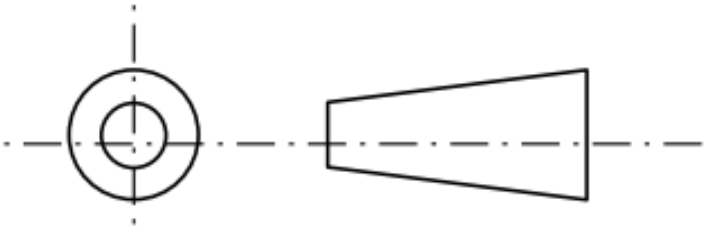


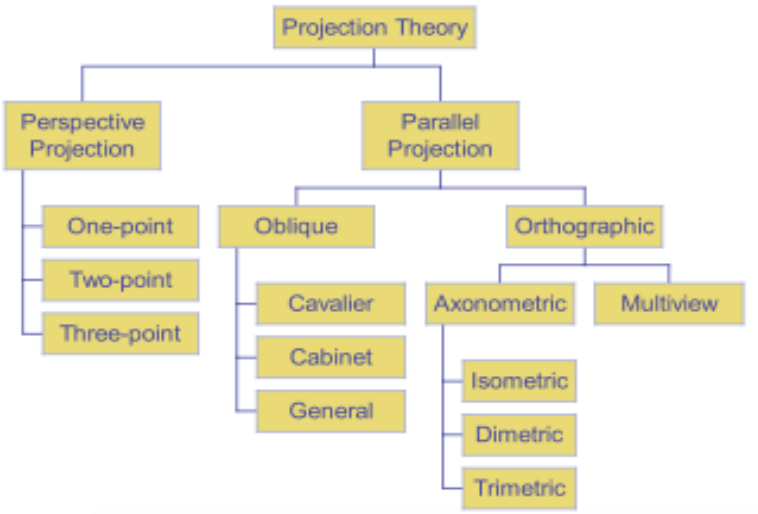
- Third angle orthographic projection




*The Third Angle Projection*

Symbol:






***Projection tree***

Note: **TYPES OF PICTORIAL DRAWING**

Pictorial drawing, as discussed earlier, is a means by which the three principal faces and Dimensions of an object are represented on a single 2D projection plane (sheet of paper)

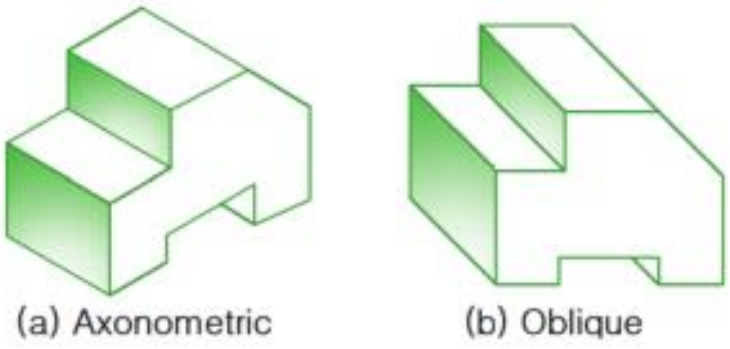
Pictorial drawing is divided into three classifications:

i. **Axonometric projection,**

**ii. Oblique projection, and**

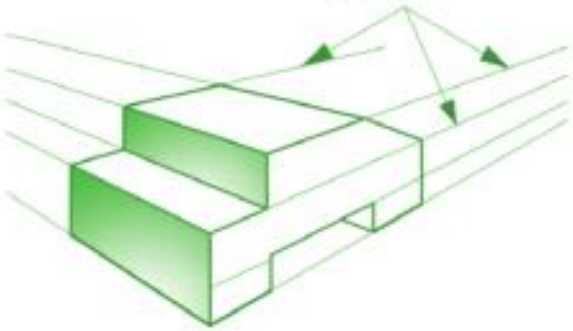
**iii. Perspective or central projection.**

The difference among the three projection types is illustrated pictorially as shown in Figure below:



(a) Axonometric (b) Oblique

converging lines

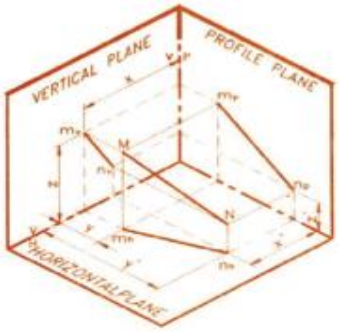


(c) Perspective

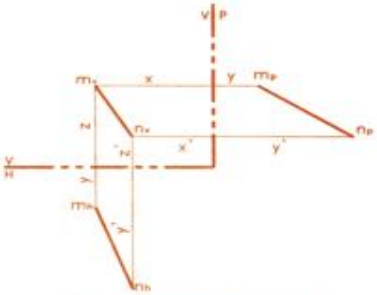
- CONTENT/TOPIC 2: APPLICATION OF PROJECTIONS

**Projection of lines**

The projection of a straight line can be obtained finding the projections of the end points of the line and joining the respective projections by straight lines. Figure below shows the principal projections of line *MN* in space. As shown in the figure, the distance y of point *M* in front of the vertical plane is shown on both the horizontal and profile projection planes. This is because both planes are common perpendicular to the vertical plane. The projections of point *N* are also located in a similar way, at a distance of *y'* from the reference lines.




(a) Pictorial representation



(b) Orthographic views

*principal projections of a line*

**ACTIVITY 1**

1. Sketch a line when it is

- Parallel to the vertical plane
- Parallel to the profile plane
- Parallel to the horizontal plane and observe their appearances in different projection planes.

2. Imagine a line inclined to the three principal planes and show its projection on the three Projection planes with the help of sketch.

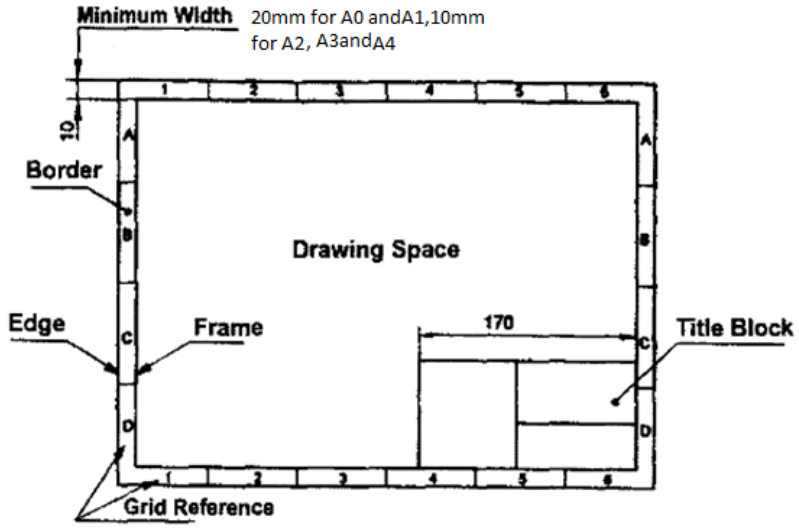
4. How do you think you can find the true length of an inclined line to all the principal planes?

## LO 3.4 – PRESENT DRAWING SHEETS

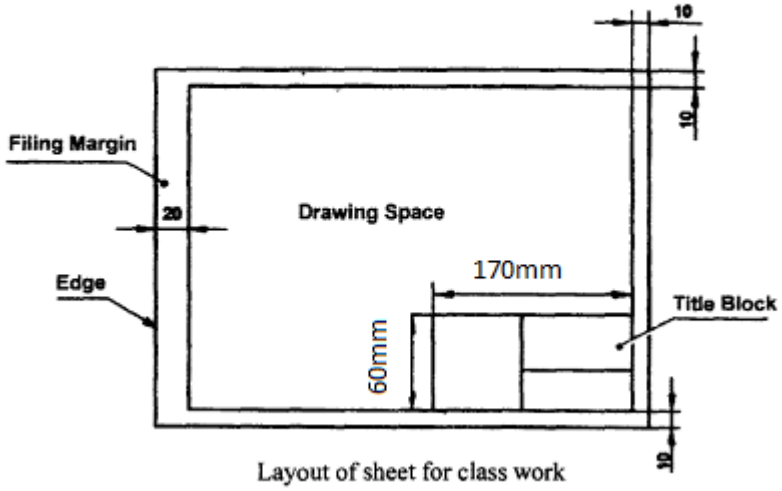
- CONTENT/TOPIC 1: INTRODUCTION ON SHEET LAYOUT , MARGIN AND READING OF TITLE BLOCK

**Introduction on sheet layout and margin**

- Drawing paper layout(drawing paper parts)2
  - ✓ Margin
  - ✓ Border line
  - ✓ Revision block
  - ✓ Drawing space
  - ✓ Tittle block




General features of a drawing sheet



Layout of sheet for class work

**Reading of title block**

**Title Block**

The title block should lie within the drawing space at the bottom right hand corner of the sheet.

The title block can have a maximum length of 170 mm providing the following information.

- **ELEMENTS OF THE TITLE BLOCK**

1. title of the drawing (title of the project)
2. Drawing number.
3. Scale.
4. Symbol denoting the method of projection.
5. name of the firm, and
6. Initials of staff who have designed, checked and approved.
7. name of the owner
8. date
9. location of the project
10. the name of sponsor

- **PURPOSE OF TITLE BLOCK**

The **title block** of a drawing, usually located on the bottom or lower right hand corner, contains all the information necessary to identify the drawing and to verify

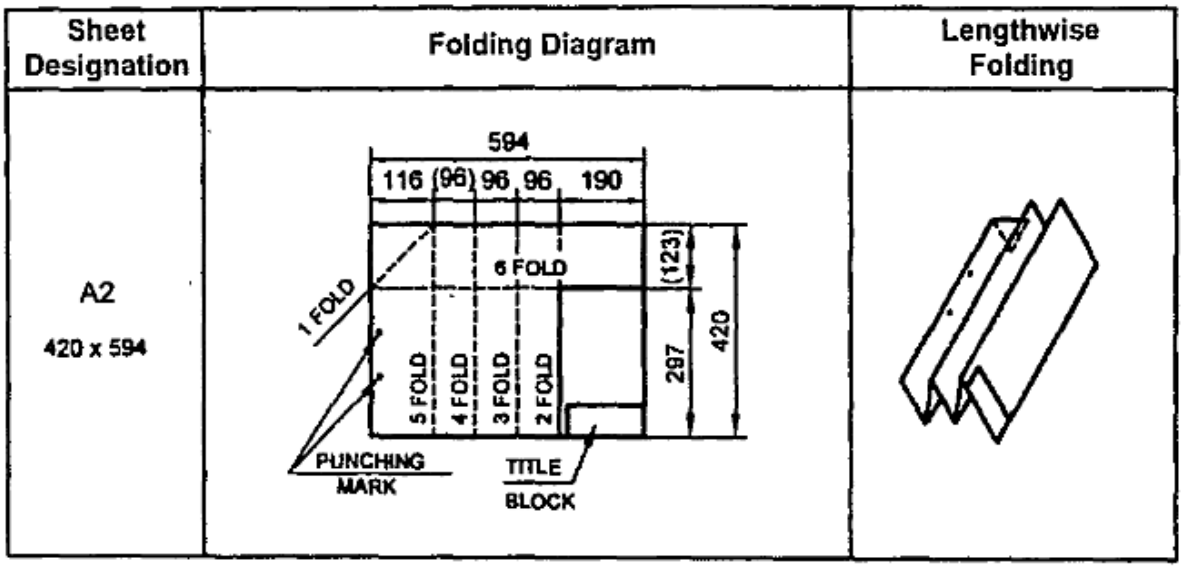
its validity. ... The drawing **title** and the drawing number are used for identification and filing **purposes**.

- CONTENT/TOPIC 2: FOLDING DRAWING SHEETS

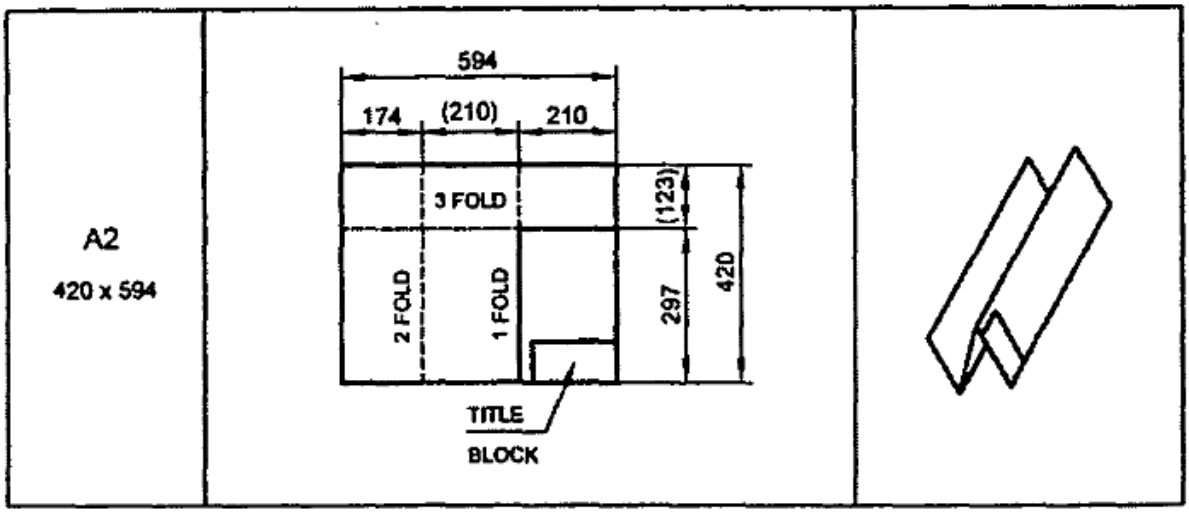
- **Folding drawing sheets**

IS: 11664 - 1999 specifies the method of folding drawing sheets. Two methods of folding of drawing sheets, one suitable for filing or binding and the other method for keeping in filing cabinets are specified by BIS. In both the methods of folding, the Title Block is always visible.

Shows the method in which drawing sheets may be unfolded and refolded, without the necessity of removal from the file.




(a) Folding of drawing sheet for filing or binding



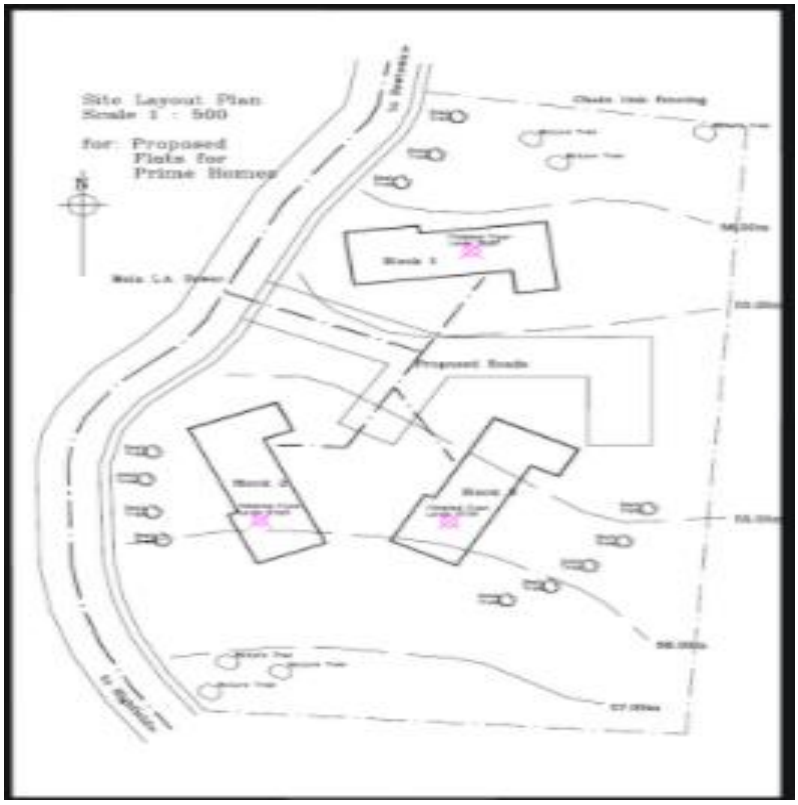

(b) Folding of drawing sheet for storing in filing cabinet

## LO 3.5 – DRAW A HOUSE PLAN

- CONTENT/TOPIC 1: PLANS

### SITE PLAN

A site plan is an architectural plan, landscape architecture document, and a detailed engineering drawing of proposed improvements to a given lot.




**FOUNDATION PLAN:**

The foundation plan is a plan view drawing, in section, showing the location and size of footings,

Piers, columns, foundation walls, and supporting beams.

**A foundation plan ordinarily includes the following:**

- Footings for foundation walls, piers, and columns (hidden lines)
- Foundation walls
- Piers and Columns
- Dwarf walls (low walls built to retain an excavation or embankment)
- Partial walls, Doors, and Bath fixtures if the house has a basement
- Openings in foundation wall such as windows, doors and vents
- Beams and Pilasters
- Direction, size, and spacing of floor joists or trusses
- Drains and sump (if required)

• Details of foundation and footing construction

• Complete dimensions and notes

**Drawing a foundation plan includes the following steps. All items will not apply to every situation:**

1. Select the scale for the drawing.

2. Locate the outline of the foundations walls from the floor plan.

3. Draw the foundation walls, piers and columns and the foundation for a chimney.

4. Indicate breaks in the foundation wall for windows, doors, access holes, and vents.

5. Layout and draw the footings for the foundation walls. Use hidden lines.

6. Draw the footings to be used for the piers and columns.

7. Draw the footings for the fireplace and chimney.

8. Locate the supporting beam if one is required. Draw the beam using a thick centerline symbol.

9. Show the size, spacing, and direction of floor joists or trusses.

10. Identify the location of sections and all other additional information.

11. Draw the necessary sections and dimensions.

12. Determine the location of dimensions needed to show the size of all aspects of the foundation. The length and thickness

of all foundation wall segments must be dimensioned. Piers are dimensioned to the center rather than to the edge.

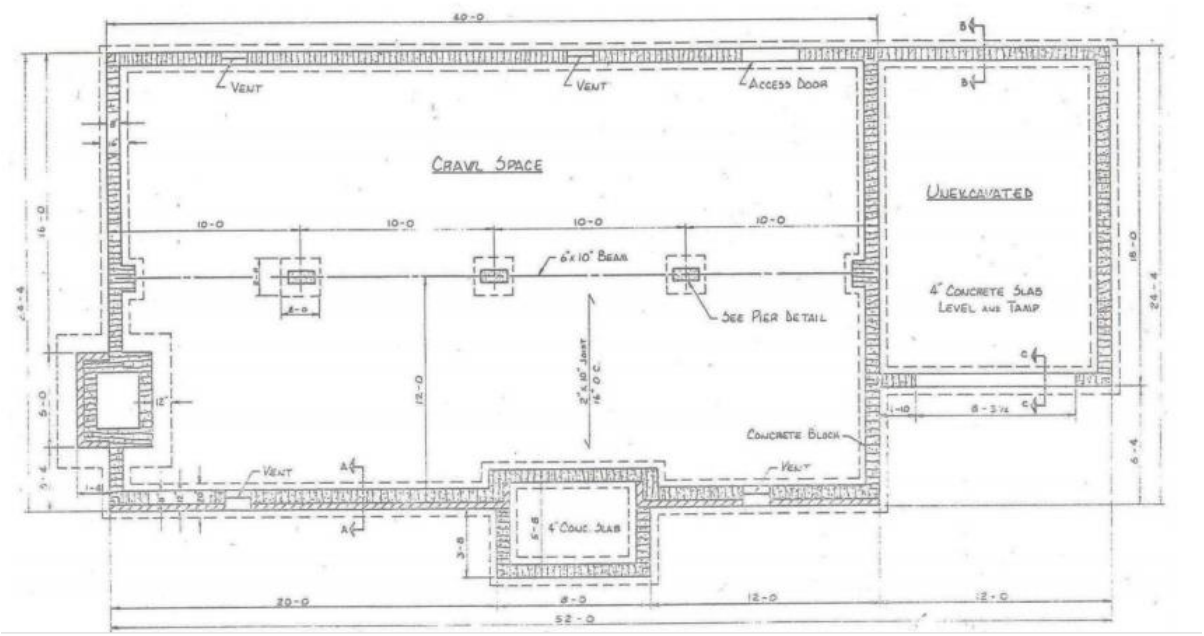
13. Draw dimensions.

14. Letter necessary notes.

15. Shade foundation wall drawings.

16. Check drawing.

**FOUNDATION PLAN EXAMPLE**




**FLOOR PLAN:** A floor plan is a scaled diagram of a room or building viewed from above. The floor plan may depict an entire building, one floor of a building, or a single room. It may also include measurements, furniture, appliances, or anything else necessary to the purpose of the plan.

Floor plans are useful to help design furniture layout, wiring systems, and much more. They're also a valuable tool for real estate agents and leasing companies in helping sell or rent out a space.

What are the key characteristics of a good floor plan when designing your house?

- **Versatile and flexible.** Make sure in the future an office can easily be turned into a child's bedroom whether for your family or a future buyer's.
- **Ideal room layout.** Make sure bedrooms are far from entertaining spaces. Bathrooms shouldn't face common entertainment spaces like dining rooms or

living rooms. Most people will like if the kitchen opens to the dining or living rooms so whoever is cooking can still interact with guests or keep an eye on the kids playing.

- **Size matters.** Whenever designing any room or hallway, think about how many people will be in that space at one time. Do they have room to move around? Is there room for furniture to accommodate all the planned activities?
- **Fits your priorities and lifestyle.** If entertaining is important, make sure there's a good flow from the kitchen to an outside space and living room. If you work from home, make sure your office gets ideal light and is perhaps in a quiet location. When you do laundry, is it ok if you have to climb three floors to get from your master bedroom to the laundry room?

**Find the balance between architectural details and practical considerations.** Think about the safety of kids, cleaning, heating and cooling bill before falling in love with some majestic staircase or floor to ceiling windows.

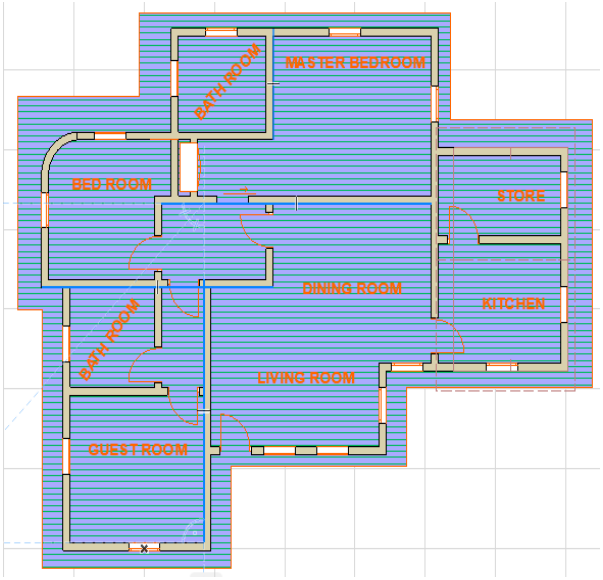
How to Draw a Floor Plan?

There are a few basic steps to creating a floor plan:

- **Choose an area.** Determine the area to be drawn. If the building already exists, decide how much (a room, a floor, or the entire building) of it to draw. If the building does not yet exist, brainstorm designs based on the size and shape of the location on which to build.
- **Take measurements.** If the building exists, measure the walls, doors, and pertinent furniture so that the floor plan will be accurate. If the layout is being created for an entirely new area, be sure that the total area will fit where it is to be built. It is advisable to examine buildings built in similar areas to use as an estimate for this floor plan.
- **Draw walls.** Add walls for each room of the building, taking care to draw them to scale.
- **Add architectural features.** Begin adding features to the space by including the unchangeable things, like the doors and windows, as well as the refrigerator,

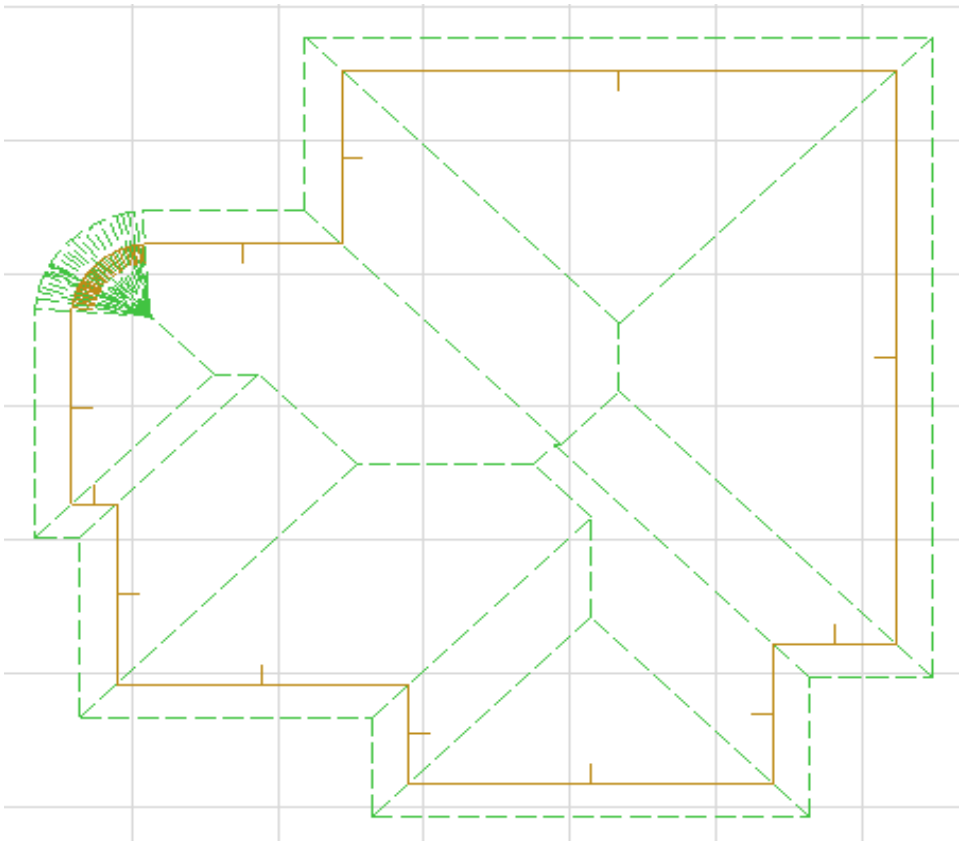
dishwasher, dryer, and other important appliances that must be placed in a specific location.

**FLOOR PLAN**





**ROOF PLAN**



- CONTENT/TOPIC 2: ELEVATIONS

The elevation plans are scaled drawings which show all four sides of the home with all perspective flattened. These plans are used to give the builder an overview of how the finished home will look and the types of exterior finishing materials.

For each side of the house, elevation drawings should show:

- Each wall length and its height,
- The roof width and height,
- The visible portion of the foundation,
- Any exterior features (such as decks, porches and stairs),
- Window and door trim,
- Eaves
- Exterior wall and roof finishings (e.g. wood siding on exterior walls, asphalt shingles on roof)
- The finished ground level.

To draft your elevation plans, you will start with your floor plans for the main floor of your house. The easiest method is to draw your elevations to the same scale as your floor plans. To make the process a bit easier:

- Tape your main floor plan drawing to the surface of your work table with the front side of the house facing towards you.
- Tape the sheet of paper for your elevation drawing just below or above the floor plan.

With this method you will transfer each feature on the front face of the house to the other sheet of paper.

The drawing to the right shows a completed elevation drawing and the floor plan it was taken from. The dotted lines show places where the walls bump in or out.

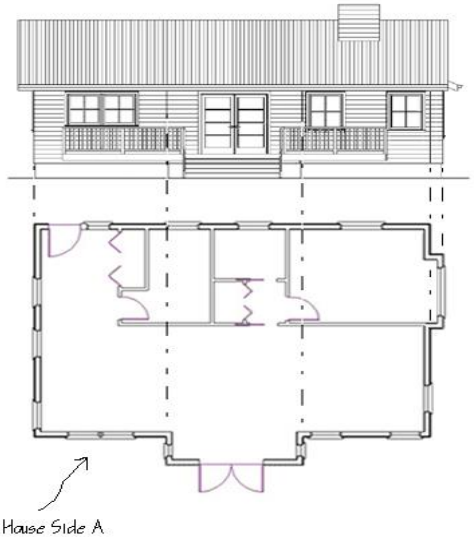
**Step by Step Guide to Drawing House Elevations**

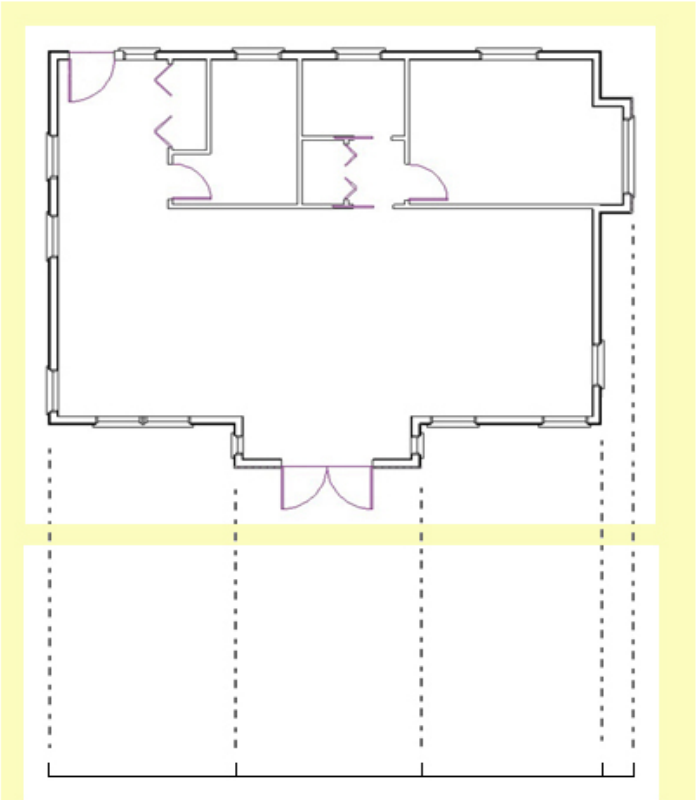
**Drawing Main Floor Wall Baseline**

To draw the initial baseline for the main floor,

1. Using your floor plan drawings and starting at the extreme left end of any walls on this side of the house on the ground floor, measure the horizontal distance of this wall. Make sure you are including the thickness of any siding material for the exterior side walls for this level. This siding can be very thin in the case of purging or thick in the case of stone or brick.
2. Draw a faint line the same length of this wall towards the bottom left third of your page. This faint horizontal line will later be erased since it will not be visible from the outside of the house (unless the exterior finish of the house changes at this exact point). It is drawn now only as a reference from which to measure to the top of the next floor or roof line.
3. Make a small upward tick mark at the end of this wall.
4. If there is another exterior wall at the same elevation to the right of this wall (for example a wall that bumps out or recedes in from this first wall), measure this wall in the same way as the first.

5. Draw this next line as a continuation of the first line. Do not erase the tick mark that indicates the division between these walls.
6. Continue on marking walls in this way until you reach the end of walls on this side of the house.



**Determining and Drawing Wall Heights**

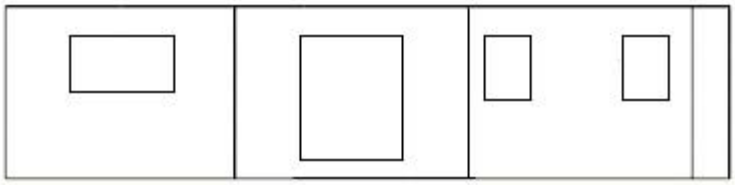
**Next you will draw the vertical lines for the exterior walls on this side. For each of the wall bases:**

1. Determine how high the wall will be above its unfinished floor height. To do this you will need to consider the height of the ceiling of the rooms within this section of the house and add to that the height of any floor or ceiling joists above it. Also add on the height of any sub-flooring, if there are floors above.
2. Draw faint vertical lines up from each of the wall base lines to the height you have determined in the previous step. (Later you will draw a darker line which includes the finished material on the outside of the home.)
3. Draw a faint horizontal line at the level of the upper ceiling joists or subfloor above this level.
4. If there is another floor above this level, continue on to the step 5. Otherwise move on to the next section, Draw Window and Door Outlines.
5. Using the floor plans for the next level up, perform steps 1 through 3 again making tick marks where you will need to draw any vertical walls. Once again determine the heights of these walls then draw a faint horizontal line to show the level of the top of the sub-flooring or ceiling joists for the next level.
6. Continue repeating the above steps until you have no floors above the current level. Then move on to the next section, Draw Window and Door Outlines.

**Draw Window and Door Outlines**

For all of your windows and doors, measure from the horizontal lines of your floors to position the exterior doors and windows. Your construction drawings, usually the cross-sections, will detail the height at which each window should be placed. A separate window and door schedule gives the dimensions for all your windows and doors.

At this point, using your architect's scale for accuracy, draw just the outline of the window and door outside dimensions to the same scale as your walls, floors and roof. Later you will draw the exterior window and door trim.



**Drawing the Roofs**

The roof lines can be of many styles: gable, shed, hip, gambrel, etc.

To draw the roof for each elevation view, first consider whether your roof will overhang and drop below the exterior wall on the elevation plan you are currently drafting. For a shed or gable roof with eaves, the roof on two sides will drop lower than where it connects with the wall. From the view of the other two sides it will stay at one level. Take a look at the elevations at the very top of this page to see an illustration of this.

**Dropping Roofs**

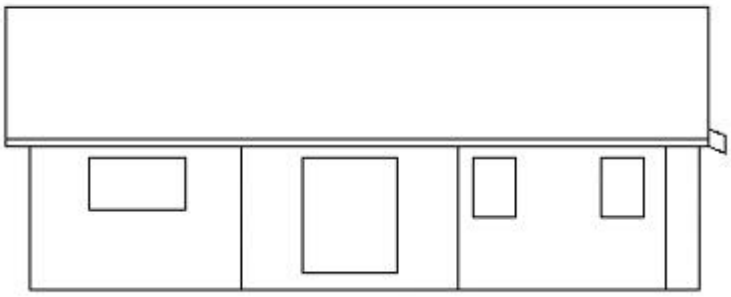
If this level has an overhanging roof that slopes down over the wall, you will need to do some calculations for roof overhang before you draw the horizontal line for the wall top.

If there is a roof overhang at this level which drops down over the wall, calculate how much the roof will drop in the actual overhang area. To do this,

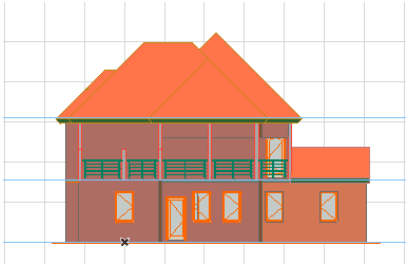
1. Take the slope or pitch of your roof, which is usually described as the rise over run in the form of 5:12, 6:12, 14:12, etc. The first number refers to how many inches (or centimetres) the roof will rise (or drop) over a horizontal distance indicated by the second number (which in North America is usually 12 inches).
2. Take your horizontal roof overhang to determine what the vertical roof overhand drop will be. For instance if you have a 5:12 roof pitch and a 12 inch horizontal roof overhang, the roof will drop a total of 5 inches. If your horizontal roof overhang was 18 inches, the roof would drop 18/12 x 5 = 1.5 x 5 inches = 7.5 inches.

3. Now you will need to subtract this drop from the height of the wall that you previously calculated since in the elevation drawing this roof line will drop below the top of the wall height. Using this new calculated height, draw the line showing the lower edge of the roof line.

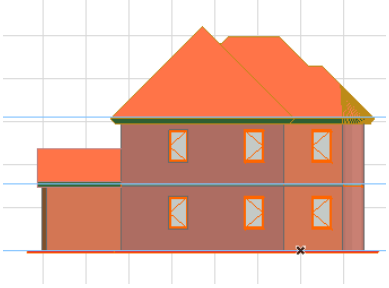
   **(http://www.the-house-plans-guide.com/)**



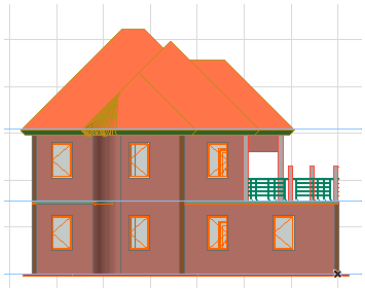
**FRONT VIEW**



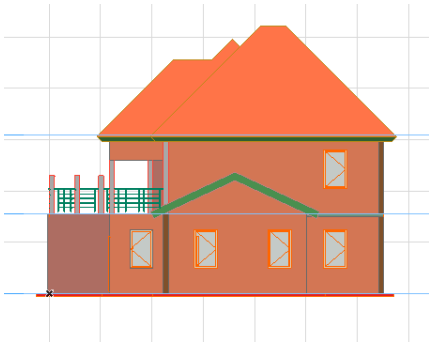
**BACK VIEW**



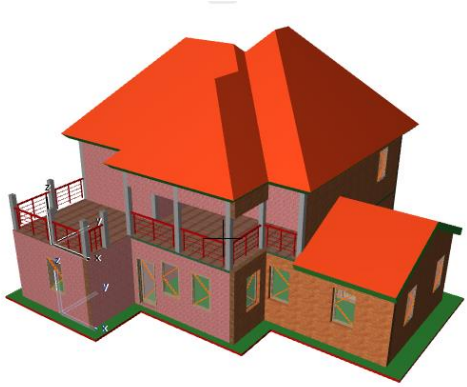
**LEFT VIEW (WEST ELEVATION)**



**RIGHT VIEW (EAST ELEVATION)**



**PERSPECTIVE**



- CONTENT/TOPIC 3: SECTIONS

**Sectioning of a house plan:**

**What are Cross Sections?**

Cross section drawings show views of the home as though you had sliced down through the house from the top with a saw and looked in from the resulting opening. This view will help the builder better understand your interior and exterior construction details.

The more complex the home design, the more cross sections you should provide. These drawings are used to show such things as wall and roof framing details, exterior wall layers, stair construction and even interior details such as variances in floor and ceiling heights, soffits, moldings and cabinetry. Cross sections also show window details such as dimensions, exact locations with respect to interior walls and their heights relative to the ceiling or floor. Cross sections in general do not show finished wall or flooring materials aside from sections that specifically detail wall or floor layers.

**How Many Cross Sections are required?**

The number of cross sections needed completely depends on the complexity of the design, your planning department requirements and who is building the house. If you have a very experienced construction crew and you plan to be on the job site often to answer questions, you will not have to detail items that involve common construction details for your region. If however, you are designing a home that does not follow the standards for your region, for instance you are planning to frame your exterior walls in a unique way in order to accommodate a different type of insulation or exterior finishing, it will be important to provide detailed cross sections for these elements.

In general, you should create cross sections for the following:

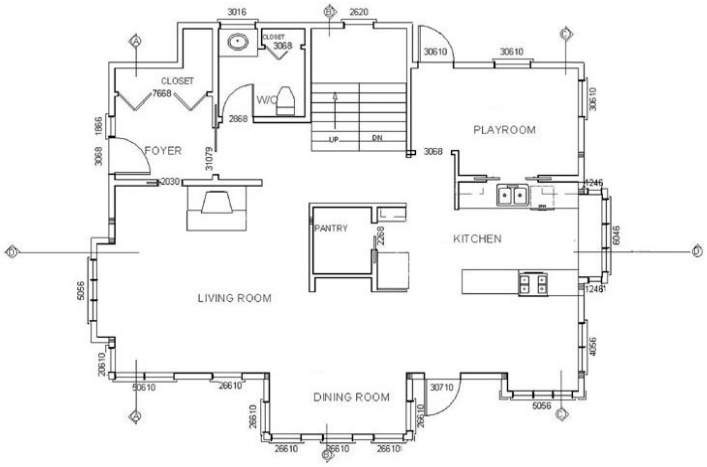
- Exterior wall layers
- Structural walls, posts or beams
- Stair framing details
- Floor and ceiling heights and variances
- Molding and trim work (only one is required for the house interior if all doors, windows and baseboards are to be trimmed in the same way)
- Cabinetry or custom built furniture (even if the construction crew is not responsible for this work it is good to include these so that they understand where cabinetry or furniture will need to be attached to the framing)
- Any other details that will help the builder understand the home design

The cross sections are created once your floor plans and elevations are finished. You need to have completed the structural design for the house, that is, determined the required size and location of all structural walls, posts and beams.

**Steps to Drawing a Cross Section**

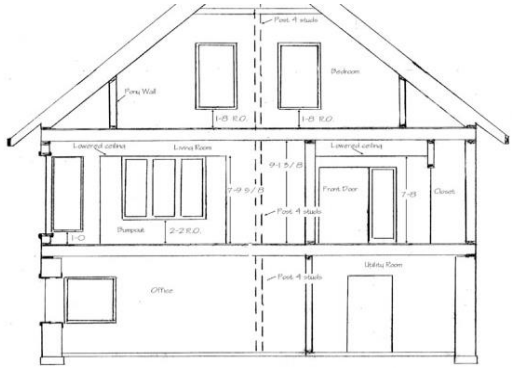
**1. Choose a Cross Section Line**

To create a cross section, first draw a line on your floor plan that cuts through a section of the house for which you need to show cross section detail.




On the floor plan drawing above, at the upper and lower left there are two "A"s surrounded by circular icons with an arrow. These icons indicate that the construction drawings will contain a detailed cross section for this slice of the house. The arrow indicates in which direction the cross section "looks". Note that cross sections are also indicated for sections B-B, C-C and D-D.

The drawing below is the resulting A-A cross section. This tutorial will demonstrate how to draw this cross section.

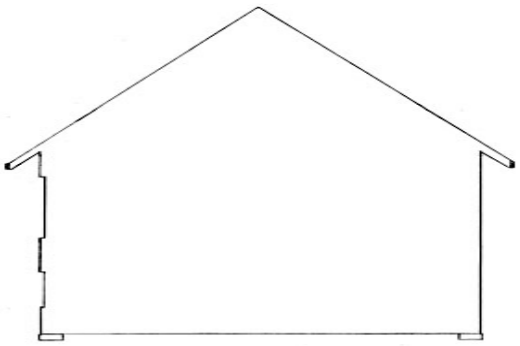


The purpose of the A-A cross section is to show the basic shell of the house, the structural posts holding up the roof beam, the rough opening height of the windows and ceiling heights, including a lowered ceiling in the entrance. These structural posts, beams and windows will show up in other drawings but from a top-down view. These views combine to make the house more understandable as well as give further design details.

**2. Draw the House Envelope**

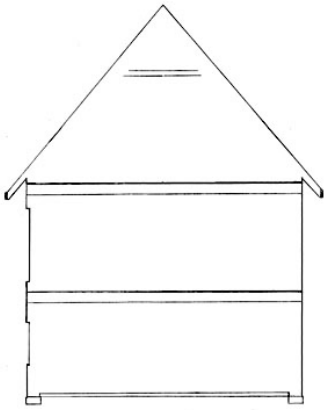
Start by drawing the width of the outer envelope of your house design through a given cross section line. Use the measurements on the floor plan drawings, house elevations and your other design notes to create accurate and to scale lines. Include the:

- House footings
- Foundation walls
- Above ground exterior walls
- Any windows that the section cuts through
- Exterior roof lines

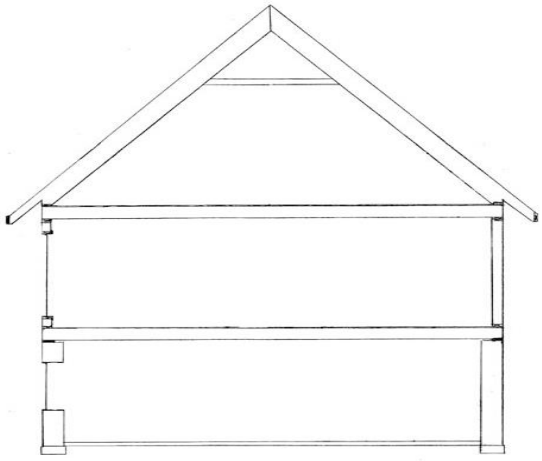


**3. Draw Floors and Ceilings**

Next draw both the upper and lower lines of all floors and ceilings. You need to know the thickness of the flooring or ceiling joists and any attached flooring (usually plywood, oriented strand board or chip board). The heights from each floor to the ceiling or floor joists above must be accurately drawn to scale. Only include the framing materials in this drawing, not the finished ceiling and floor materials.

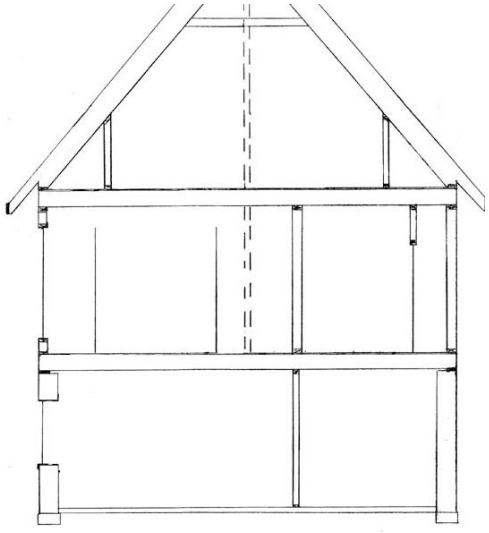


**4. Side Wall Windows, Doors and Framing**



For the two side walls at either side of the drawing, draft in any exterior window or door headers, sills or wall plates as well as the inside dimension of all of the above elements in the first step. See the drawing above.

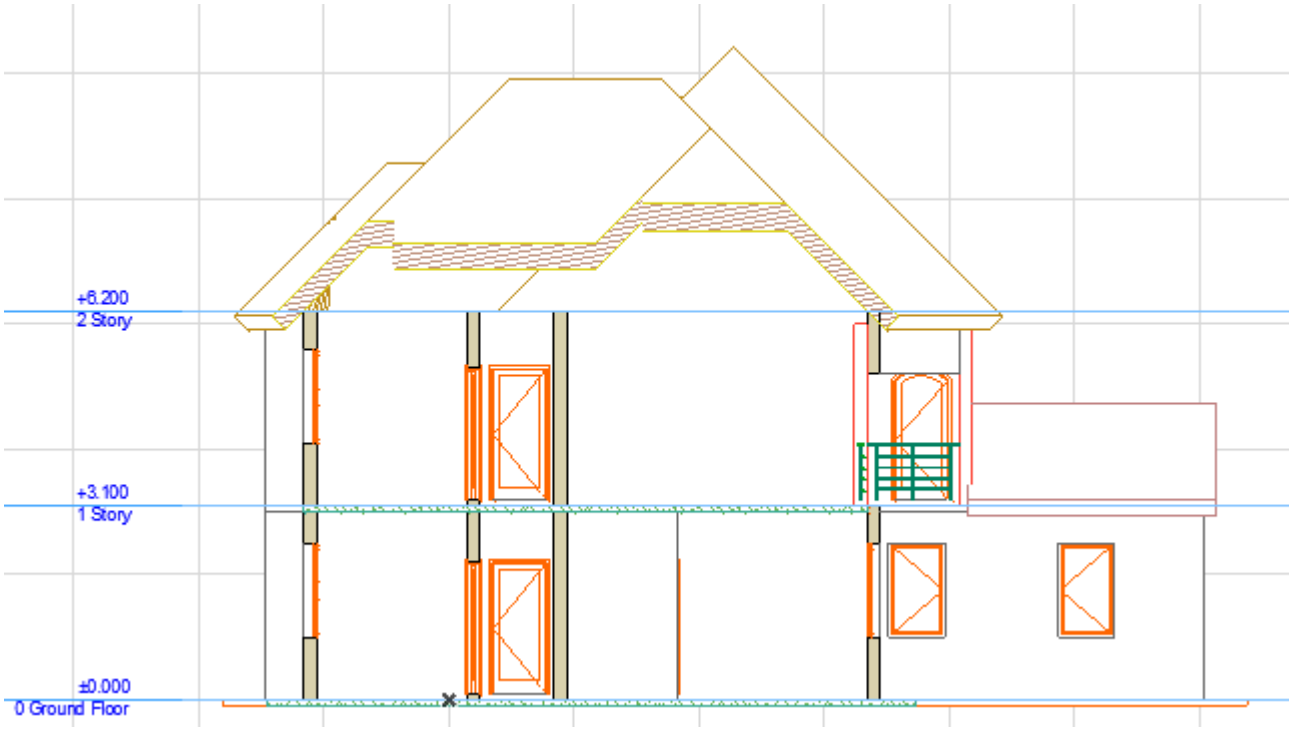
**5. Interior Walls and Structural Elements**



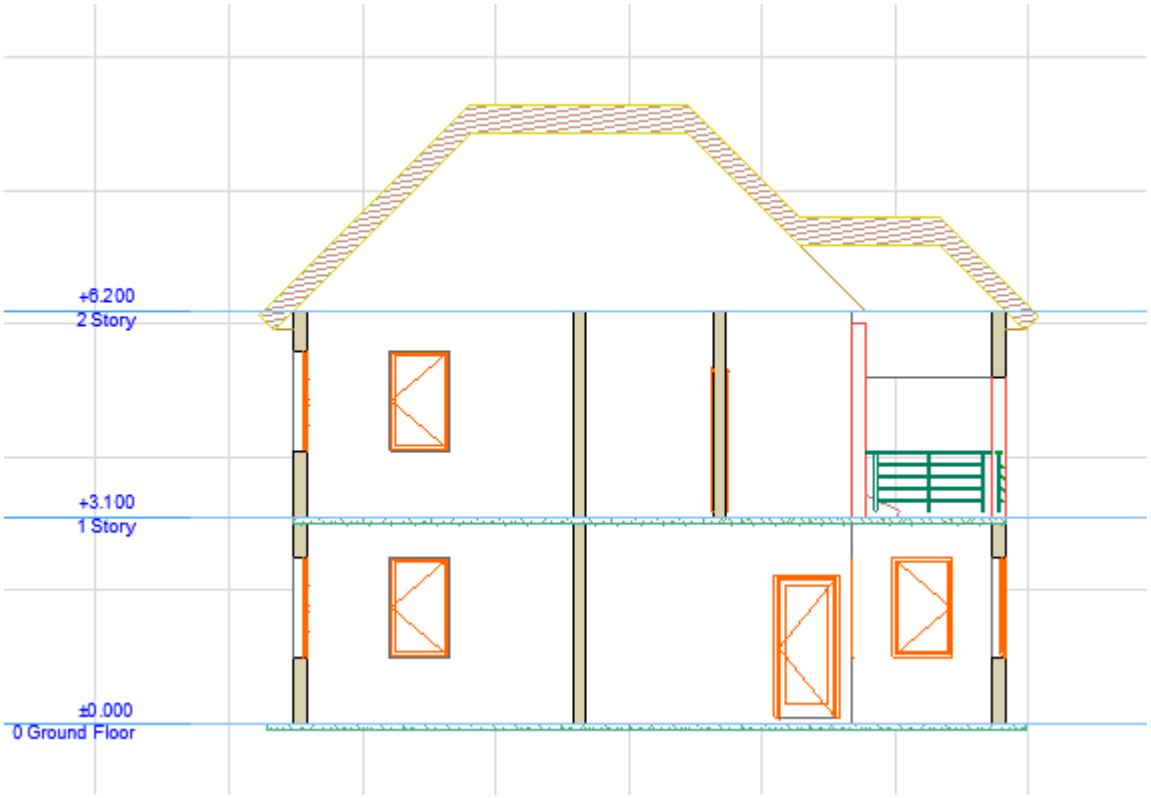
Next draft interior walls, including their plates and any structural posts or beams visible in this section.

**6. Facing Wall Windows and Doors**

**LONGITUDINAL SECTION:** The term **longitudinal section** pertains to a **section** done by a plane along the long axis of a structure.




**TRANSVERSAL SECTION**: a portion thereof, drawn as if it were cut vertically to show its interior; often taken at right angles to the longitudinal axis of the building.


+6.200
2 Story
+3.100
1 Story
±0.000
0 Ground Floor

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