TOPIC 2 › Orthographic projections of solids

LEARNING OUTCOME:

By end of the topic, you should be able to:

1. Projections of simple solids in simple position.
2. Projections of solids with axis inclined to one of the reference planes and axis inclined to both the reference planes.

INTRODUCTION

An engineer must be able to visualize in his mind how an object looks like without actually having the object. He must also be able to describe the object so that others could build it from the information provided on his drawing. The description of an object with lines requires a thorough knowledge of the principles of orthographic projections.

The problem of representing a three-dimensional solid object on a sheet of paper to show the exact shape is done by drawing views of the object as seen from different positions and arranging these views in a systematic manner.

2.1 Alignment of Views

2.1.1 Projection System

The difference between first and third angle projection is in the position of the plan, front and side views. In third angle, what you see from the right would be drawn on the right. **In first angle, the view from the right would be projected through and drawn on the left**.

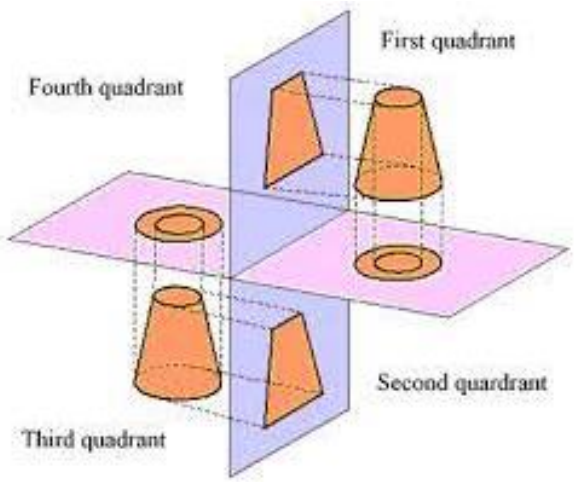
Just because of **the norms** we do this. We consider that horizontal plane rotates in clockwise direction after having projection on it. that's why we use 1st angle and 3rd angle projection. because only in this two quadrants we will get the both views after clockwise rotation of horizontal plane.

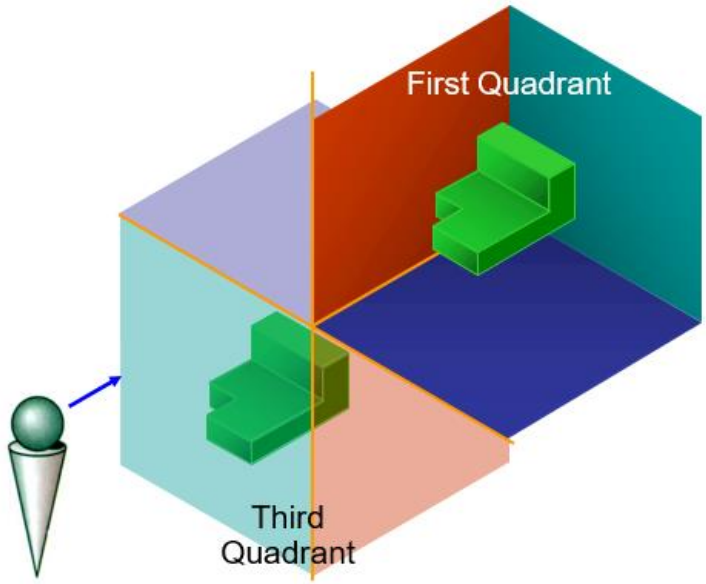
1. First angle system

- European country
- ISO Standard

2. Third angle system

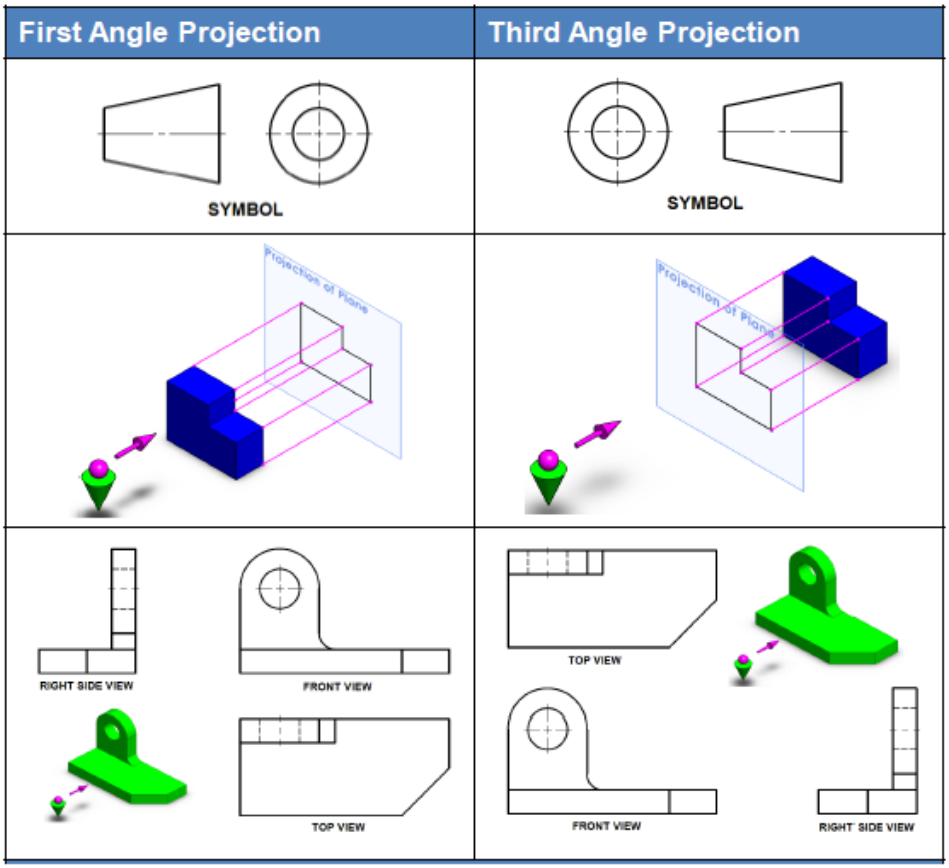
- Canada, USA, Japan, Thailand





These symbols can be added to a drawing to help the reader understand which type of projection is being used. These symbols were included in the projections.

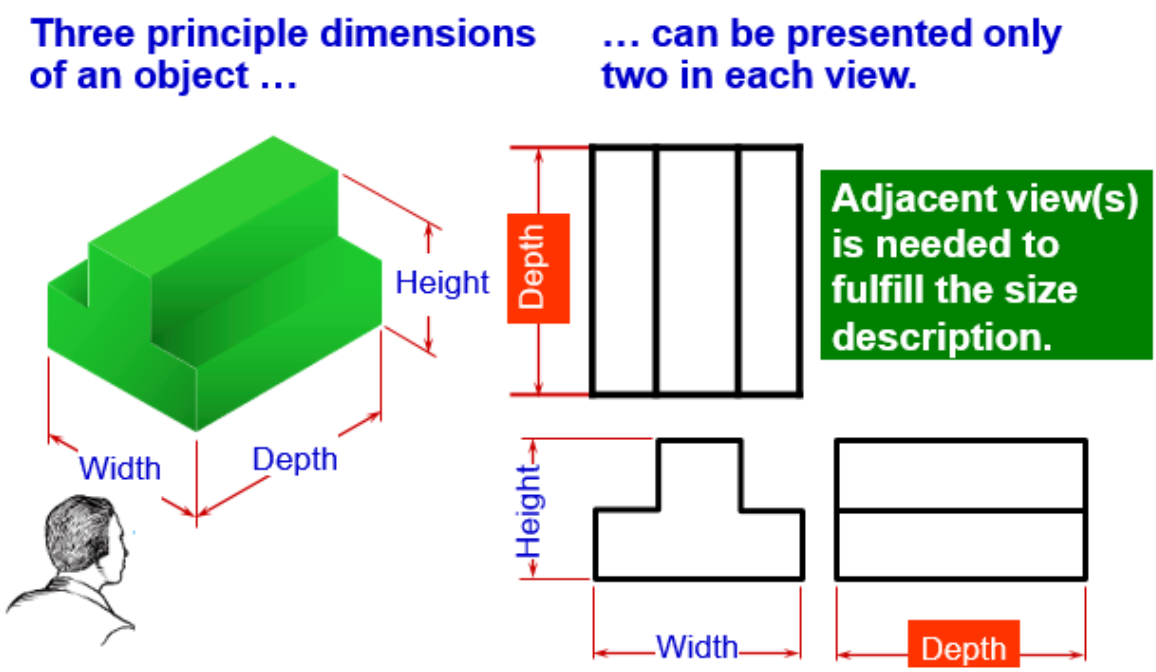
To get the first angle projection, the object is placed in the first quadrant meaning it's placed between the plane of projection and the observer. For the third angle projection, the object is **placed below** and behind the viewing planes meaning the plane of projection is between the observer and the object.



2.2 Multiview Projection

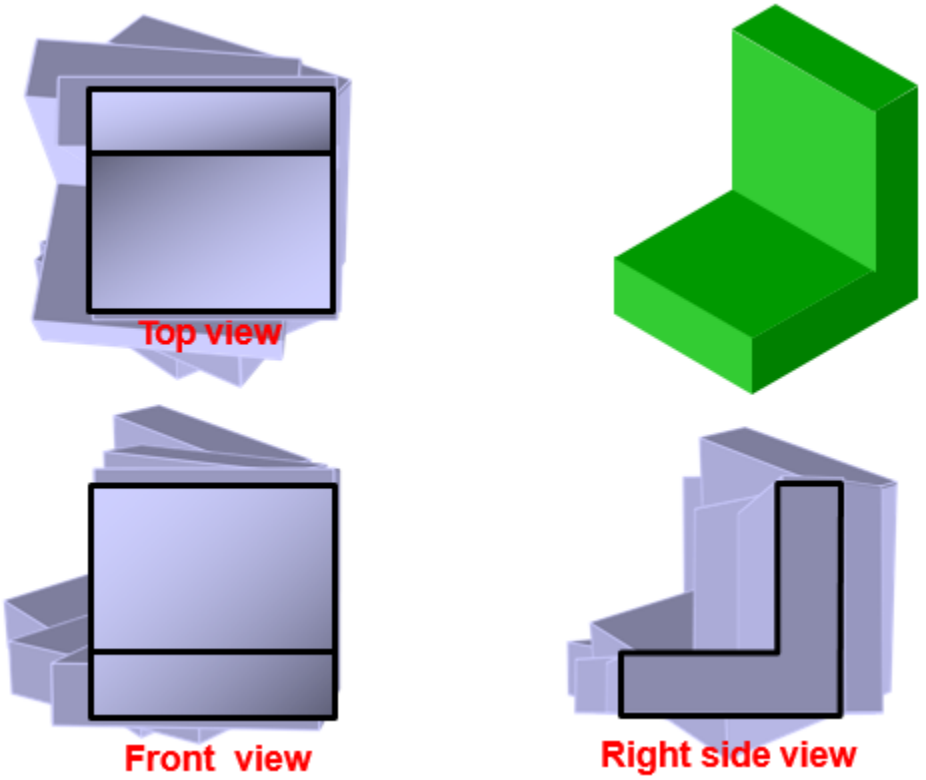
Orthographic views are two-dimensional views of three-dimensional objects.

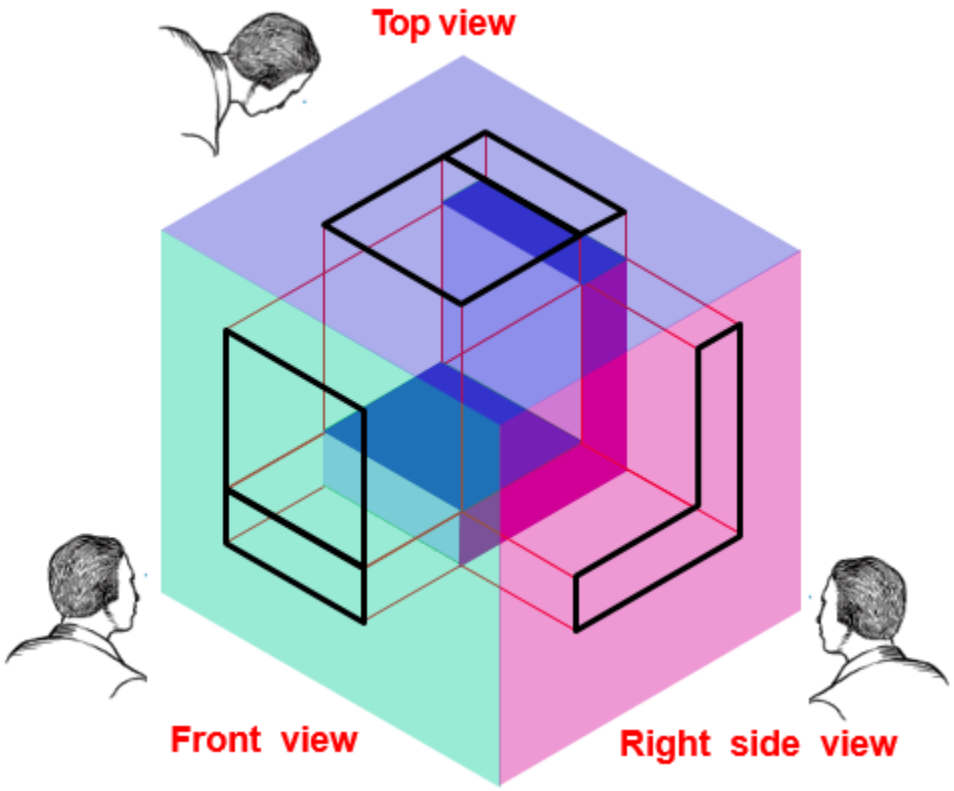
Orthographic views are created by projecting a view of an object onto a plane which is usually positioned so that it is parallel to one of the planes of the object.



2.2.1 To obtain Multiview Representation of an Object

1. Revolve the object with respect to observer.
2. The observer move around the object.


Top view
Front view
Right side view

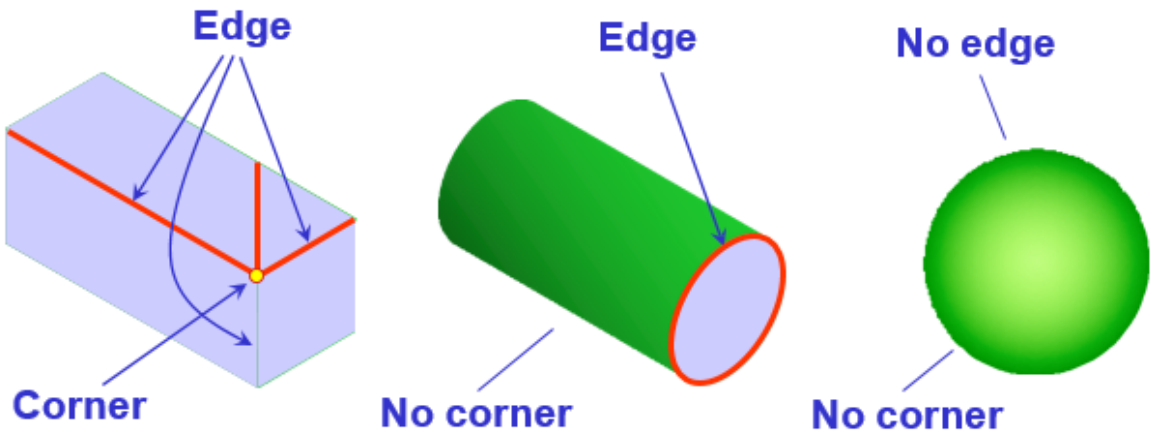


2.3 Orthographic Projection of Object Features

2.3.1 Object Features

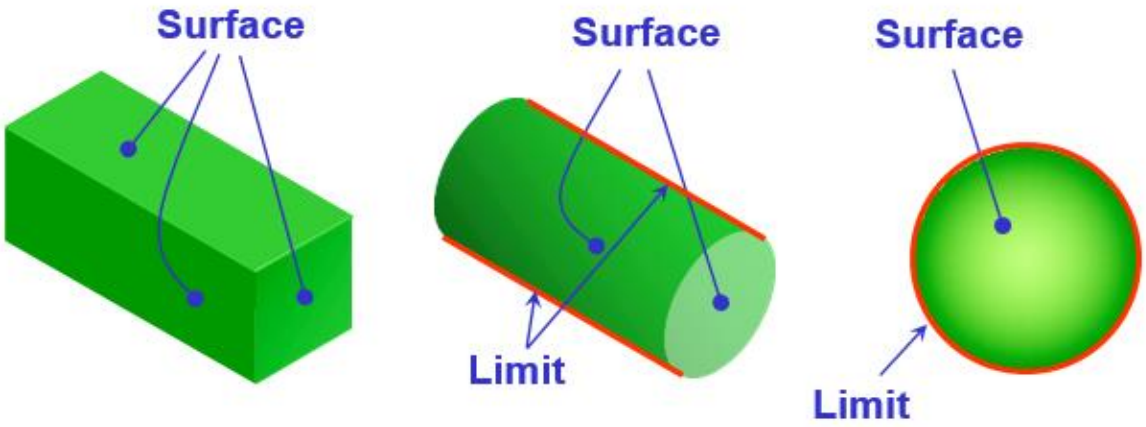
Edges: are lines that represent the boundary between two faces.

Corners: Represent the intersection of two or more edges.



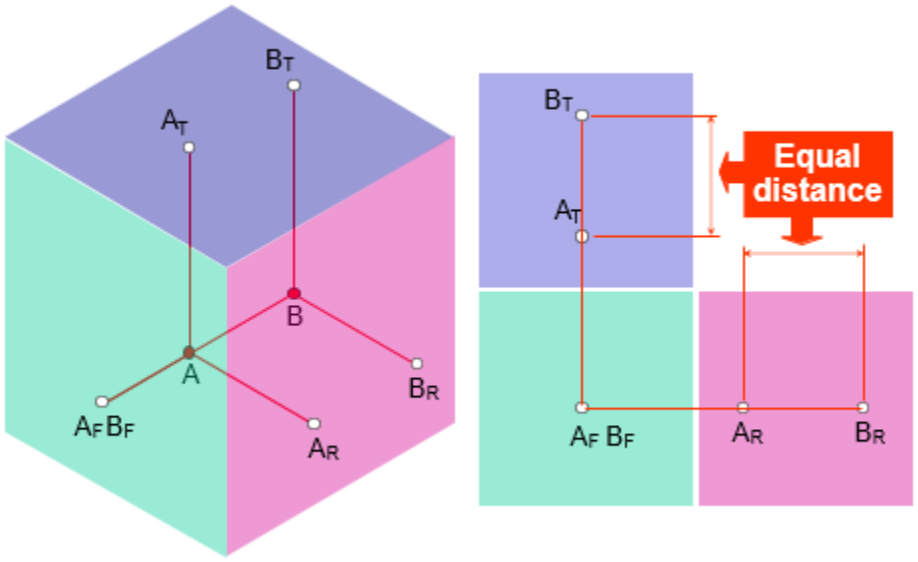
Surfaces: are areas that are bounded by edges or limiting element.

Limiting element: is a line that represents the last visible part of the curve surface.



2.3.2 Projection of Points

A point may be situated, in space, in any one of the four quadrants formed by the two principal planes of projection or may lie in any one or both of them. Its projections are obtained by extending projectors perpendicular to the planes. One of the planes is then rotated so that the first and third quadrants are opened out. The projections are shown on a flat surface in their respective positions either above or below or in *xy*.



2.3.3 Projection of Line

A straight line is the shortest distance between two points. Hence, the projections of a straight line may be drawn by joining the respective projections of its ends which are points.

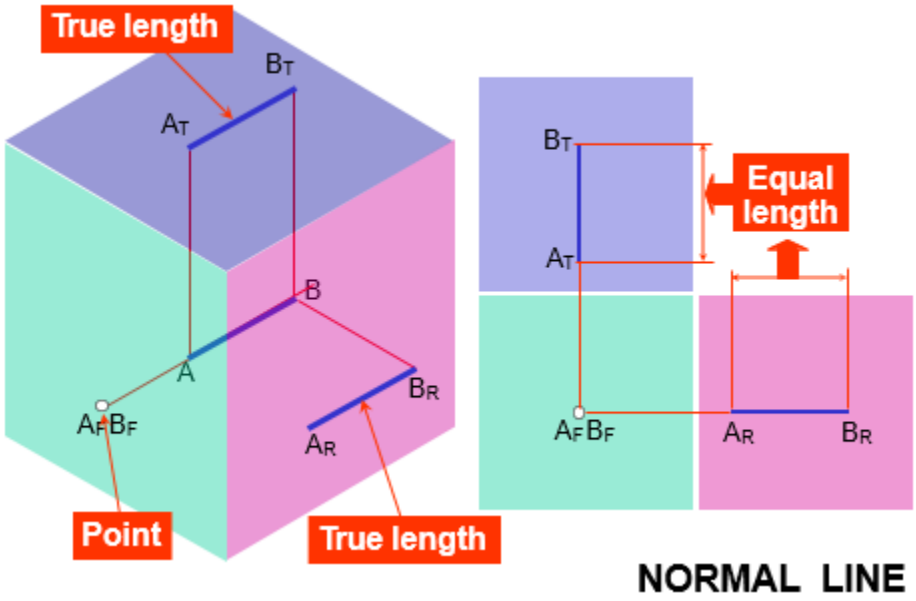
1 . Parallel to one or both the planes.

2. Contained by one or both the planes.

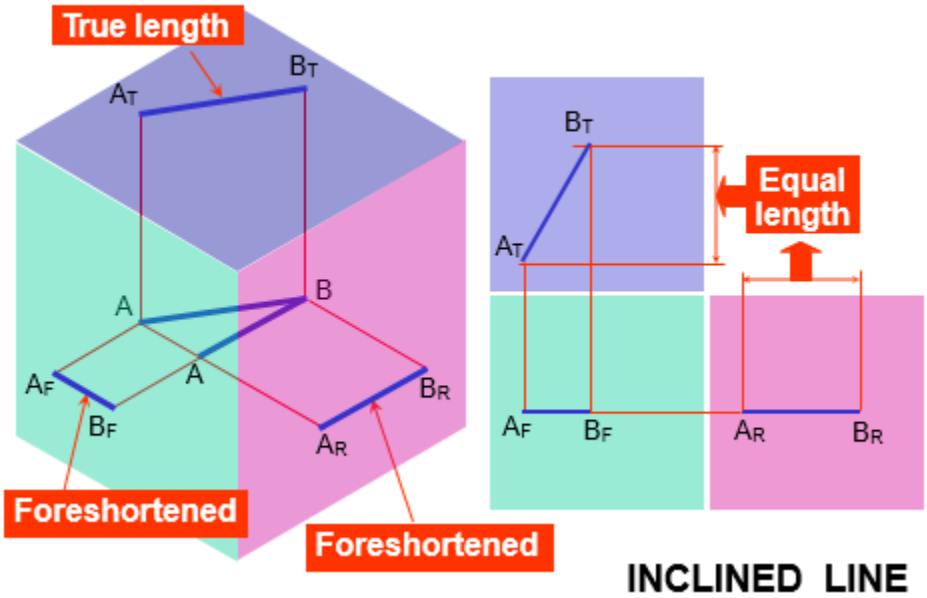
3. Perpendicular to one of the planes.

4. Inclined to one plane and parallel to the other.

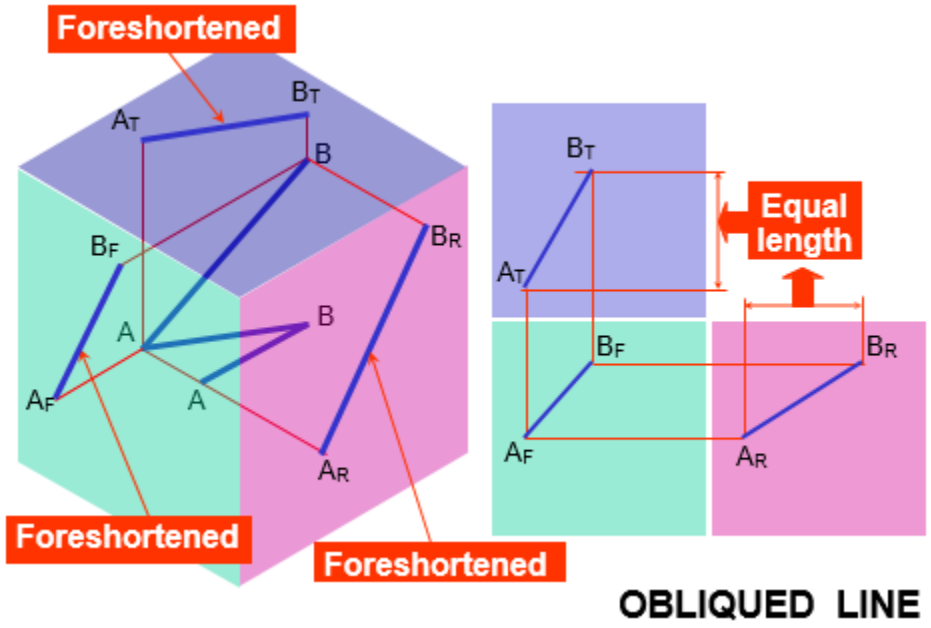
5. Inclined to both the planes.



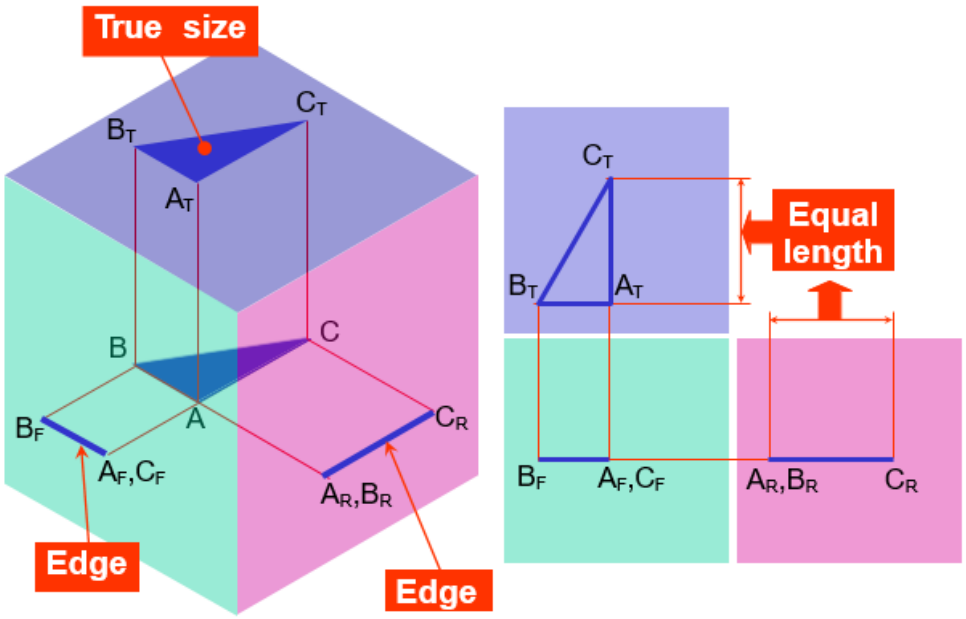
NORMAL LINE



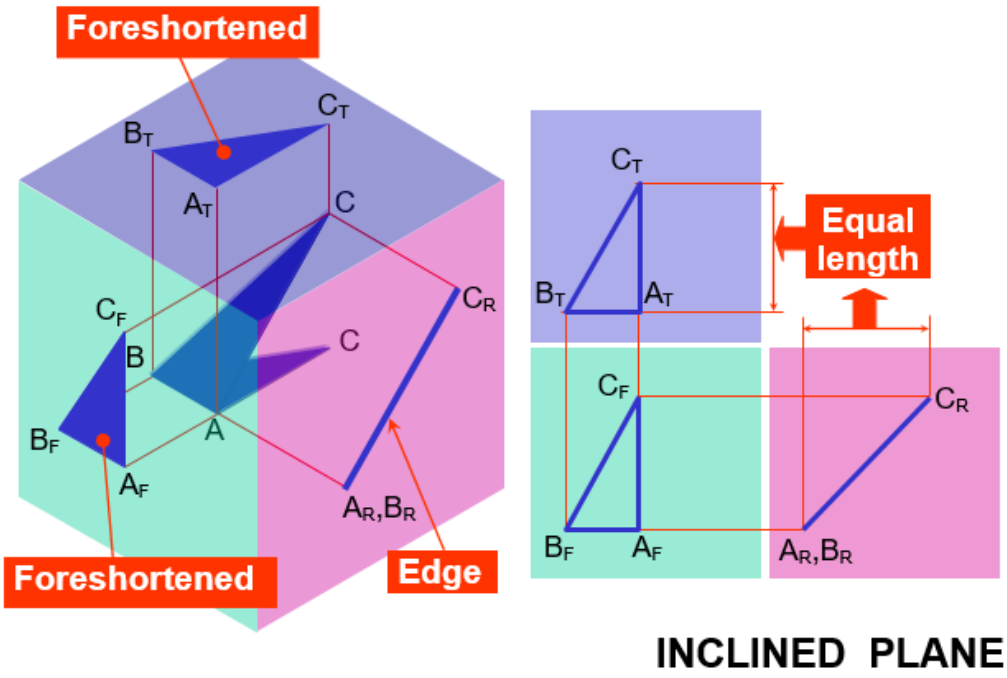
INCLINED LINE



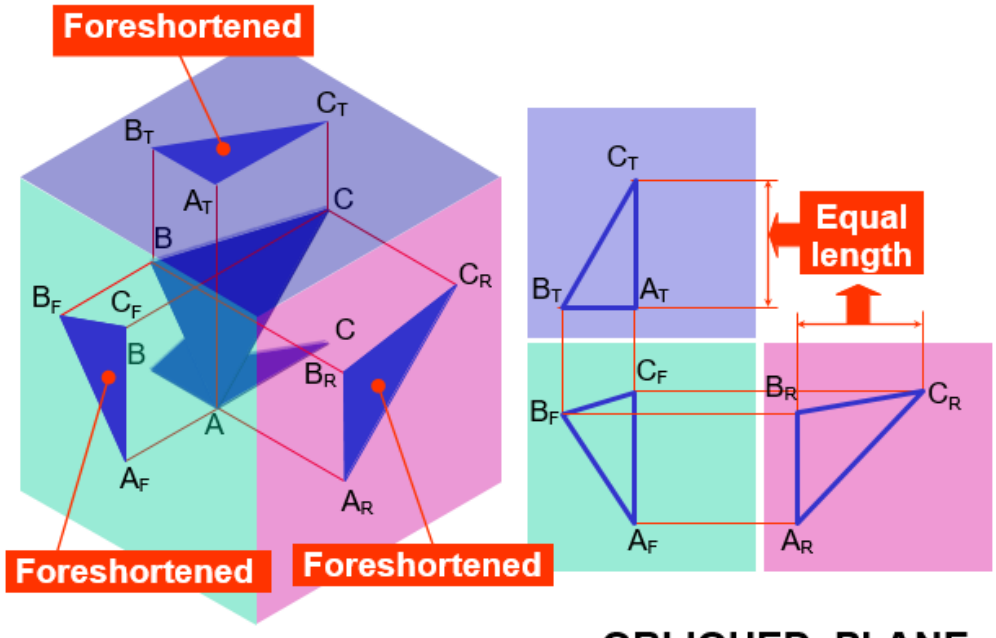
OBLIQUED LINE



NORMAL PLANE



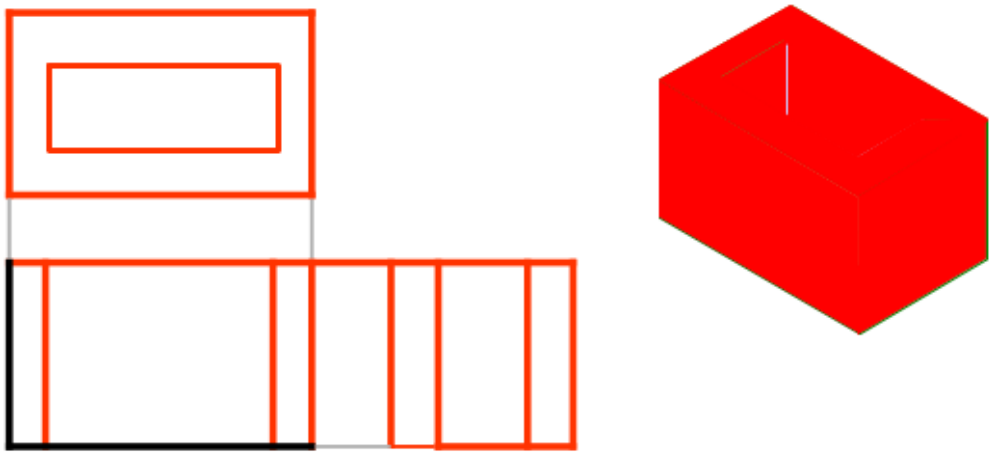
INCLINED PLANE



OBLIQUED PLANE

2.4 Projection of Project

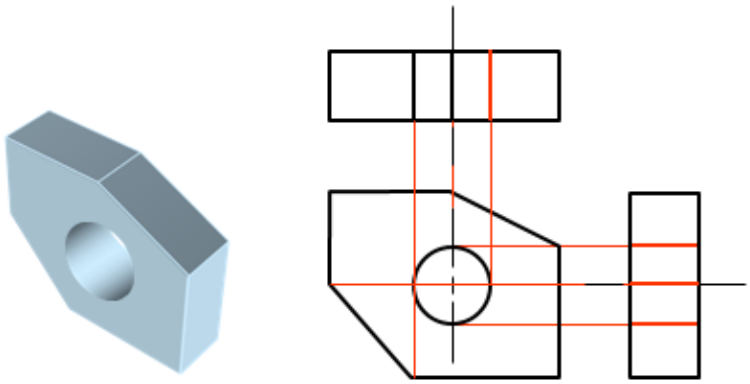
The views are obtained by projecting all object features to the picture plane.



2.4.1 Line Convention

- Precedence of coincide lines.
- Hidden line drawing.
- Center line drawing.

2.4.2 Precedence of Line

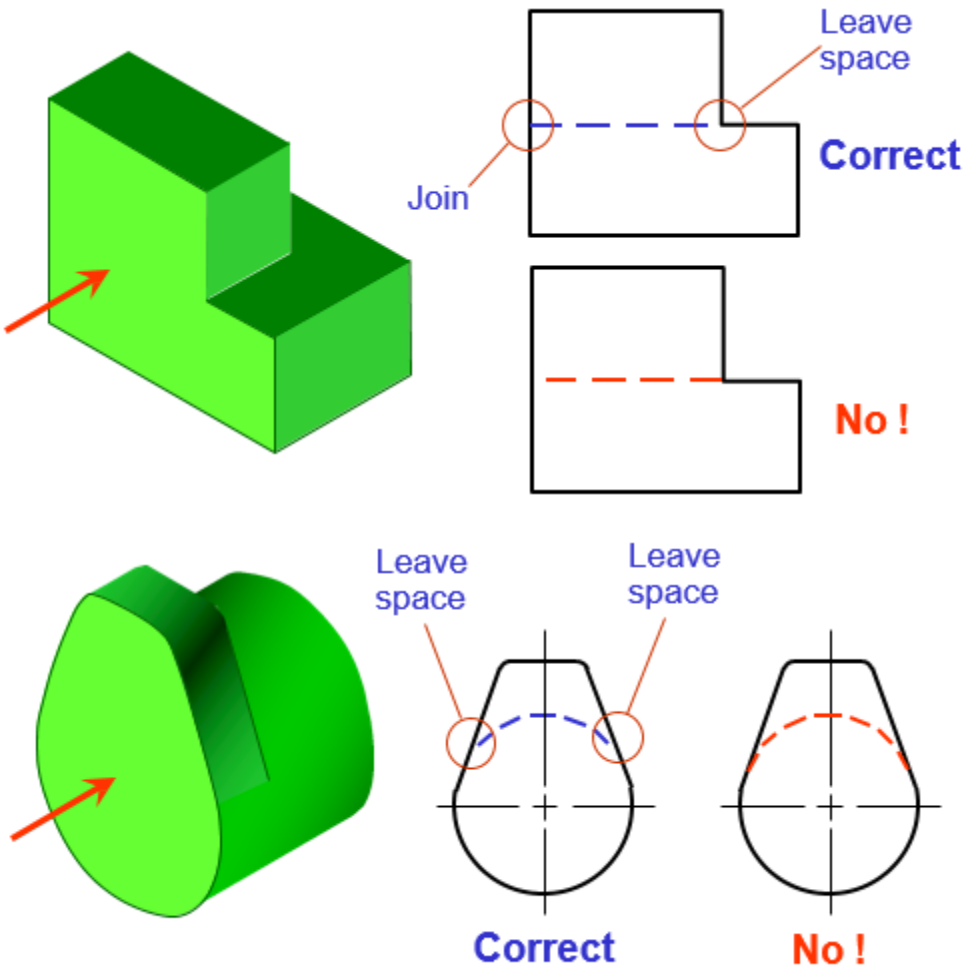


2.4.3 Hidden Line Practice

Hidden lines are used to represent surfaces that are not directly visible in an orthographic view.

A hidden line is used to represent the end view of the surface.

Hidden line should join a visible line, **except** it extended from the visible line.

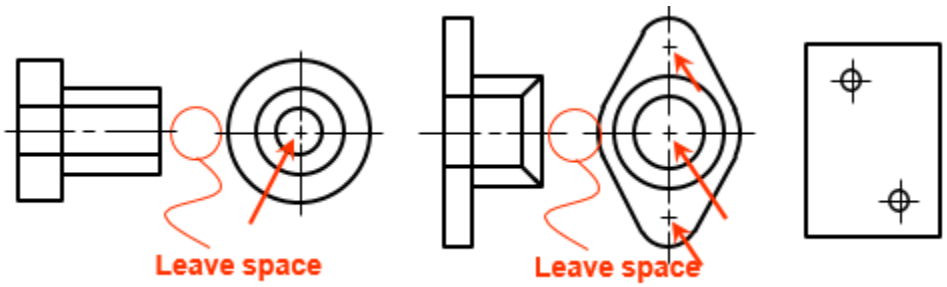


2.4.4 Center Line Practice

In circular view, short dash should cross at the intersections of center line.

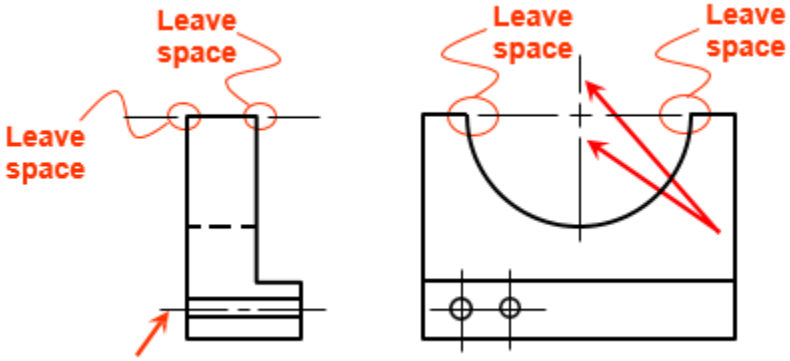
For small hole, center line is presented as thin continuous line.

Center line should not extend between views.



Leave the gap when centerline forms a continuation with a visible or hidden line

Center line should always **start** and **end** with **long dash.**



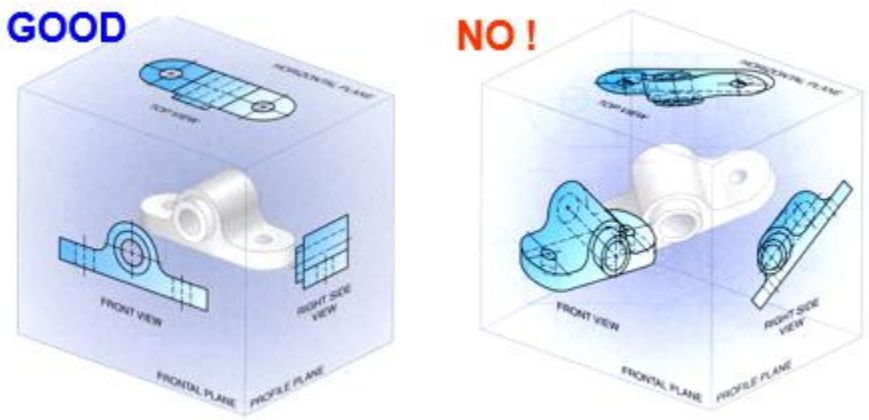
2.5 View Selection Steps

1. Orient the object to the best position relative to a glass box.
2. Select the front view.
3. Select adjacent views.

Step 1: Orient the Object

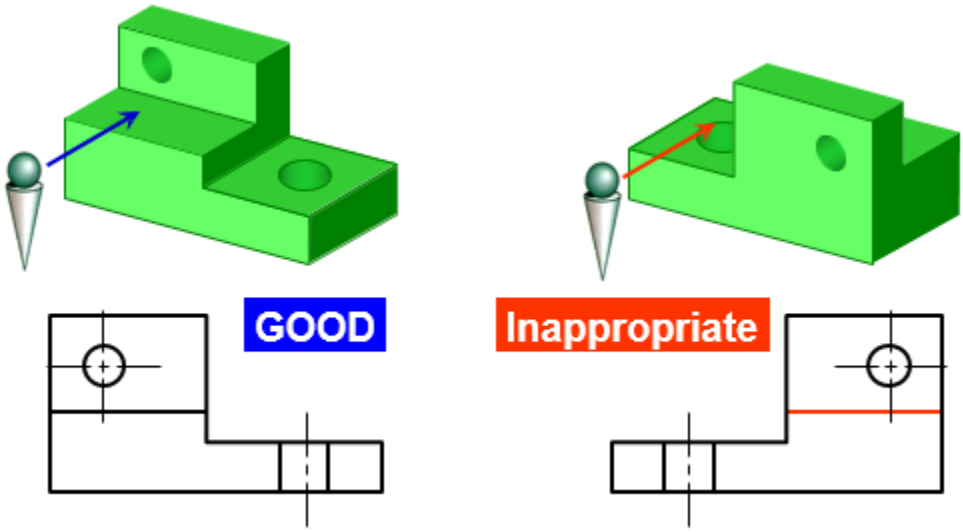
-The object should be placed in its **natural position**.

-The object should presents its features in **actual size** and **shape** in orthographic views.



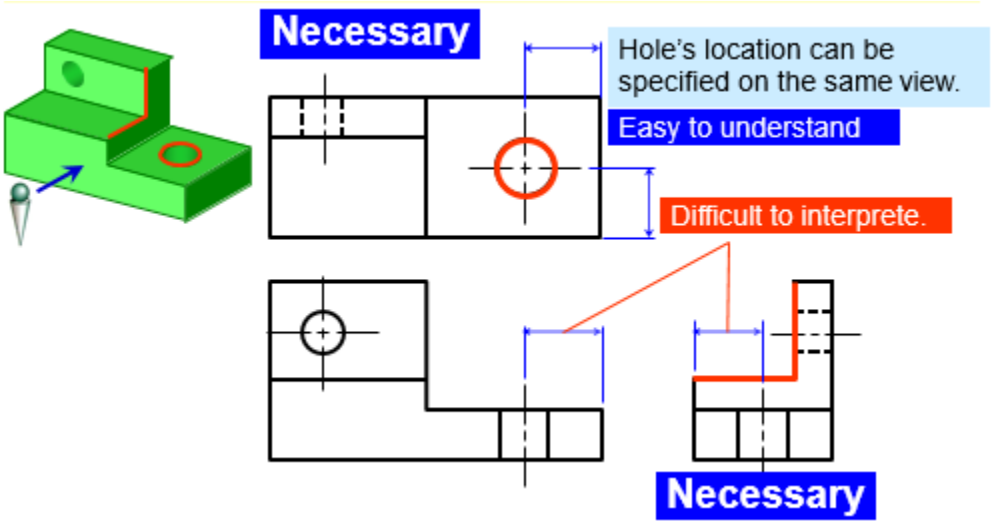
Step 2: Select a Front View

Choose the view that have the fewest number of hidden lines.

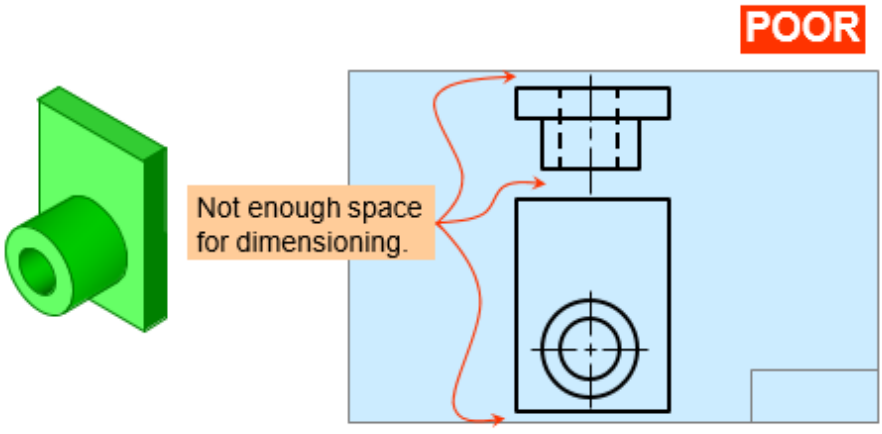


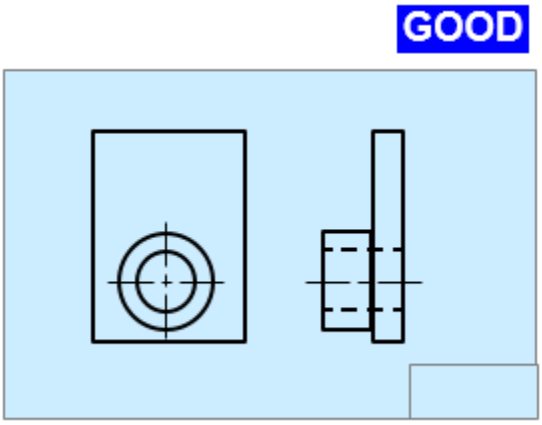
Step 3: Select an Adjacent View

Choose the **minimum** number of views that can represent the major features of the object.



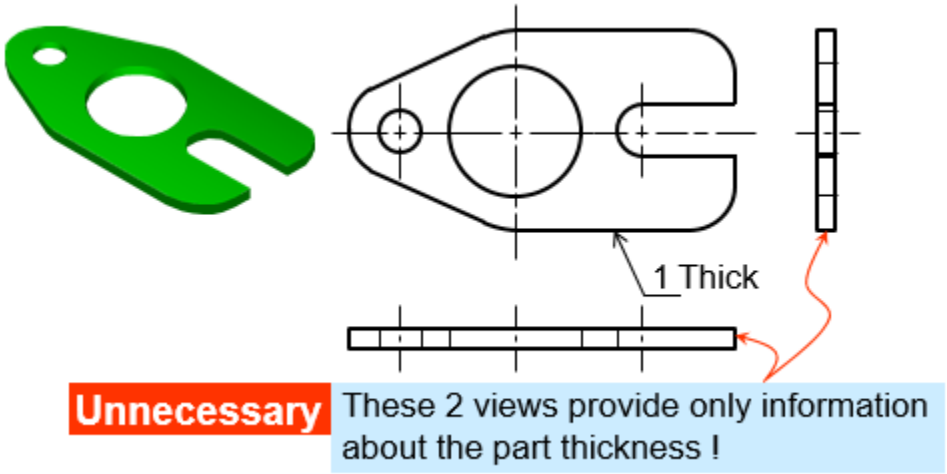
Choose the views that are suitable to a drawing space.



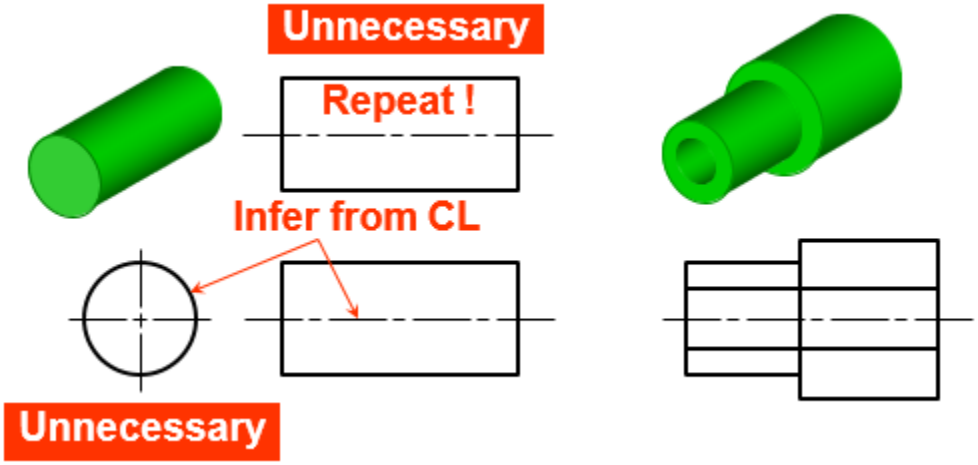


2.6 One-view Drawing

Flat part having a uniform thickness.

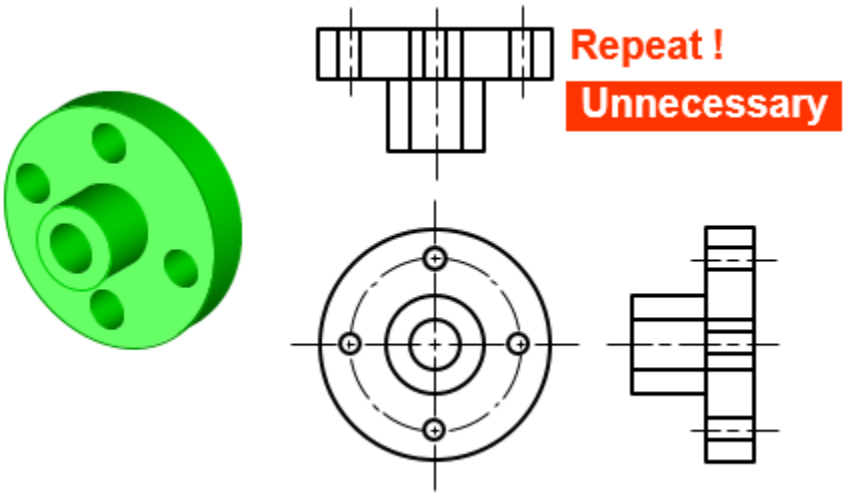


Cylindrical-shaped part.

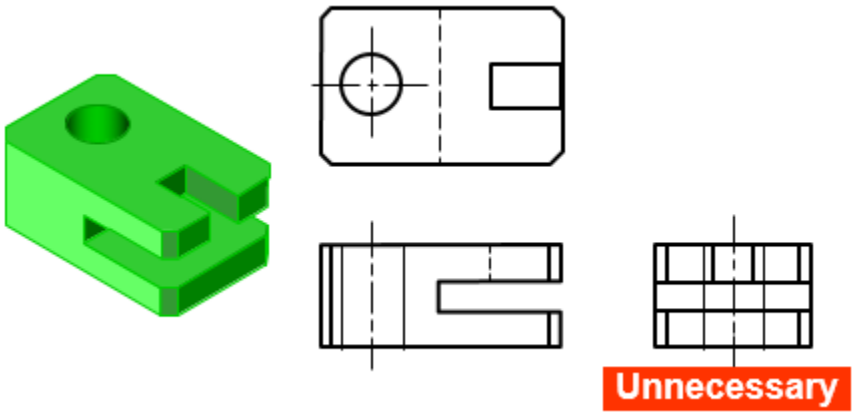


2.7 Two-view Drawing

There exists an identical view.



The 3rd view has no significant contours of the object.



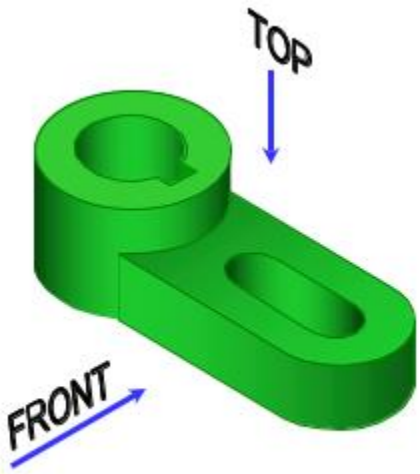
Most of the students in Engineering Drawing course find it difficult to visualize an object from two orthographic views. To overcome this difficulty, assume the object as basic geometrical solids such as prisms, cylinders, pyramids, cones and so on. It is impossible to determine whether the shape is addition or subtraction by observing only one view. Therefore, the each orthographic view of an object must be referred systematically back and forth. Sound knowledge of projections of points, lines, planes and solids is required in solving the problems of missing lines or missing views. In orthographic views, if a line or lines are not drawn in order to test the understanding of students, such lines are known as *missing lines.*

2.8 Orthographic Writing Steps

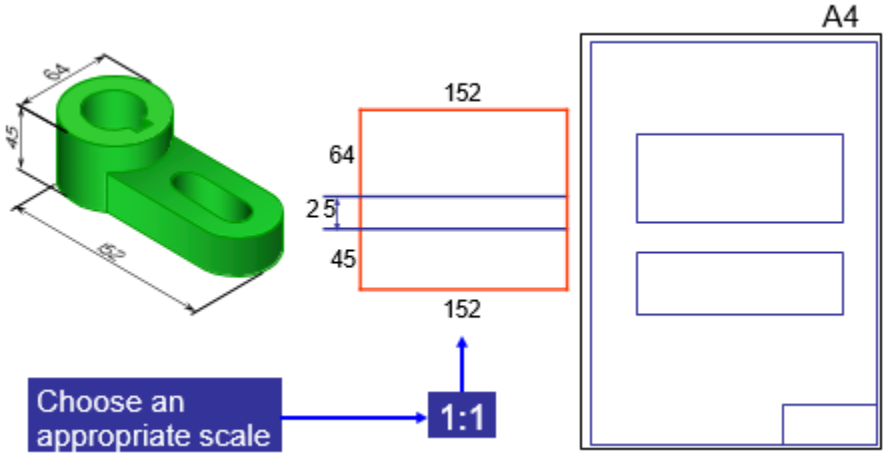
1. Select the necessary views
2. Layout the views.
3. Project the views.
4. Dimension the views.

2.8.1 Select the necessary view

For converting a pictorial view of an object into orthographic views, the direction from which the object is to be viewed for its front view is generally indicated by means of an arrow. When this is not done, the arrow may be assumed to be parallel to a sloping axis. Other views are obtained by looking in directions parallel to each of the other two axes and placed in correct relationship with the front view.



2.8.2 Layout the Views

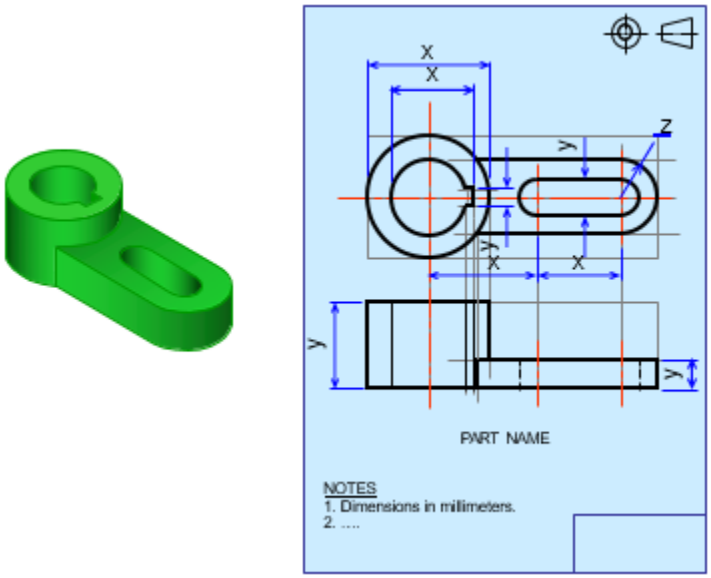


2.8.3 Dimension the Views

Intersection drawings are drawings that show the intersection of two objects. Figure 5-77 shows the intersection between two offset squares.

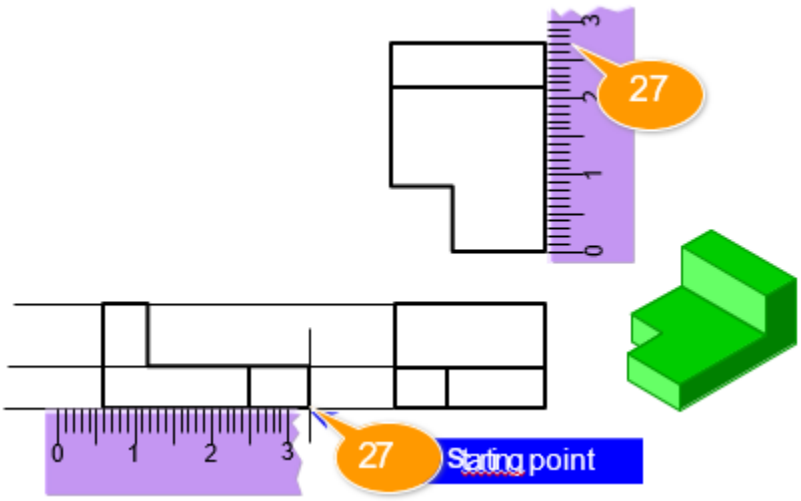
A discussion of intersections has been included at this point in the book because they rely heavily on projection of information between views.

They require not only a knowledge of the principles of projection, but also an understanding about what the various lines represent.

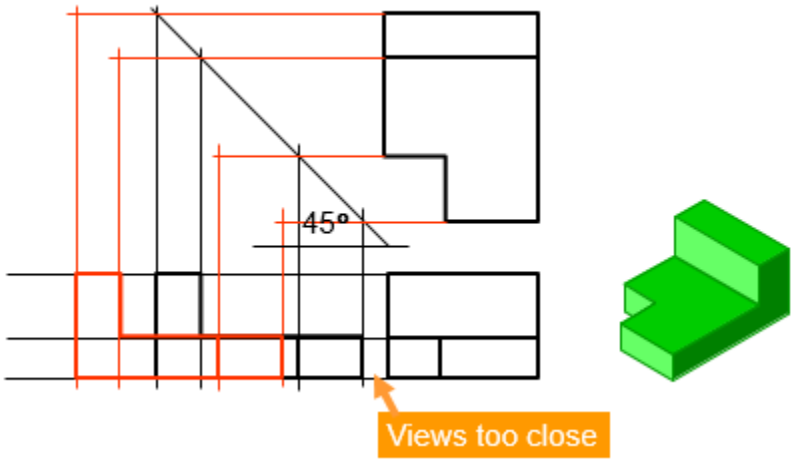


2.8.4 Transferring the Depth Dimension

1. Direct measurement

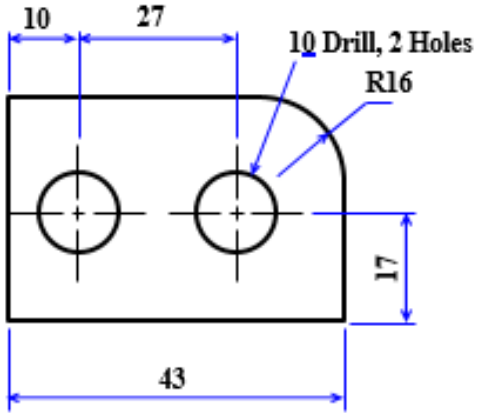


2. Use miter line



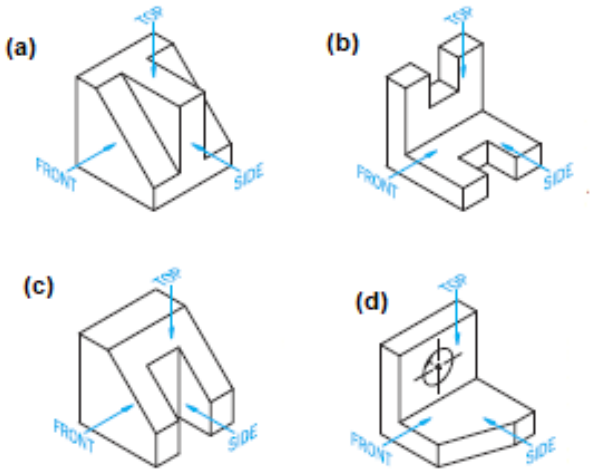
2.9 Basic Dimensioning

1. Extension lines
2. Dimension lines
3. Leader lines
4. Dimension numbers
5. Local notes



Activity : Try identify your learning in multiview projections

The following problems provide you with a pictorial view of a object with required views identified with arrows pointing at the viewing direction and labeled with the specific view orientation. Measure the given pictorial view and transfer your measurements to the required multiviews. Create one set of first-angle projection views and one set of third-angle projection views for each object. Label each view below the view exactly as given in the pictorial, and label each set of views as FIRST ANGLE PROJECTION and THIRD-ANGLE PROJECTION correctly correlated to the sets of multiviews.



SELF-CHECK 1

Answer all questions regarding the orthographic projection:

1. A method of orthographic projection used in most European countries?
2. Name a line that is short and long dashes that represents a circle or hole.
3. What are the 3 most common principal views in orthographic projections?

SUMMARY

Orthographic projection, common method of representing three-dimensional objects, usually by three two-dimensional drawings in each of which the object is viewed along parallel lines that are perpendicular to the plane of the drawing. The commonly views including top, front and side view.

KEY TERMS

Orthographic	Angle system
Projection	Top view
2D/3D view	Front view
Multiview	Side view

REFERENCES

1. N. D. Bhatt, *Engineering Drawing,* Charotar publishing house, 2012.
2. David A. Madsen; *Engineering Drawing & Design* ; Cengage publishng; 2012.