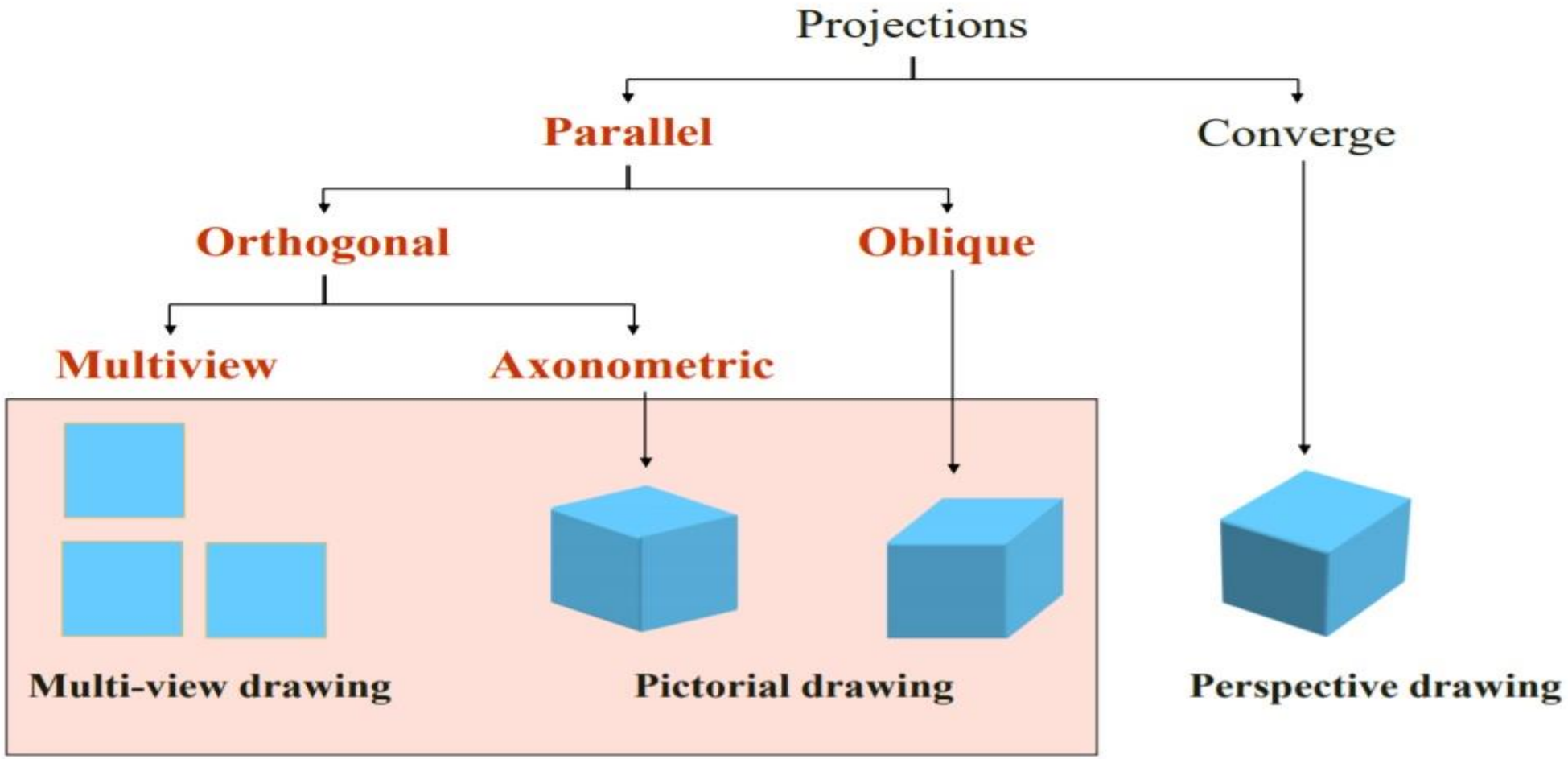
111U06C105 – Engineering Drawing

Module 2.1
ORTHOGRAPHIC PROJECTIONS

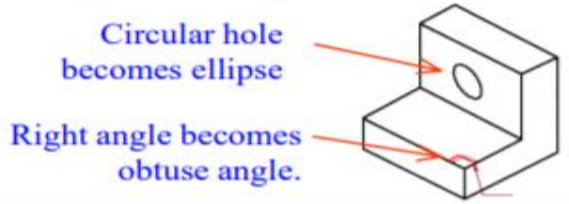
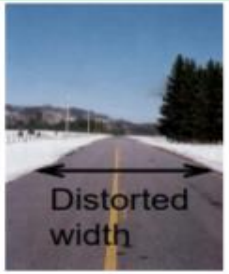
Theory of Projection

- Projection Methods are used to represent a 3D object on a 2D surface.
- The act of obtaining the image of an object is termed "projection".
- The image obtained by projection is known as a "view".
- All projection theory are based on two variables:
  - Lines of projection (sight): *Imaginary ray of light between an observer's eye and an object.*
  - Plane of projection: *Imaginary flat plane which the image is created.*

Different Projection Methods



View Comparison

Type		
Multi-view drawing 	• Accurately presents object's details, i.e. size and shape.	• Require training to visualization.
Pictorial drawing 	• Easy to visualize.	• Shape and angle distortion 
Perspective drawing 	• Object looks more like what our eyes perceive.	• Difficult to create • Size and shape distortion 

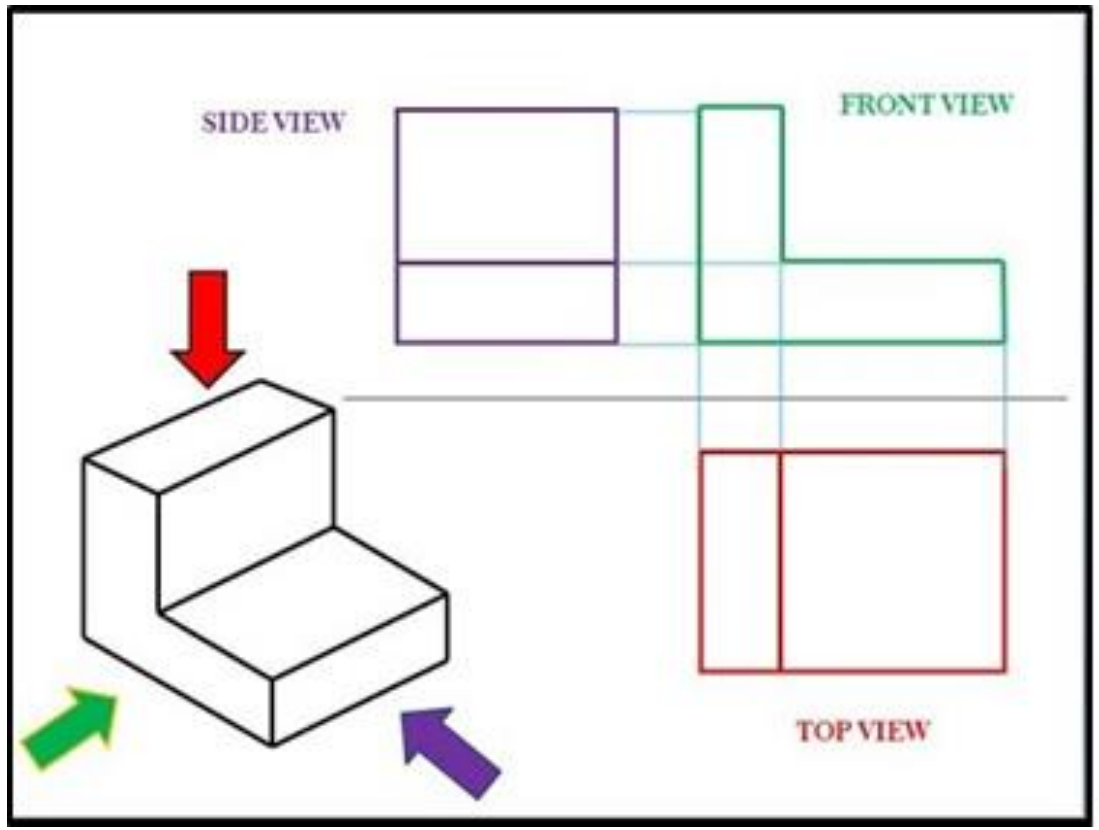
ORTHOGRAPHIC PROJECTION

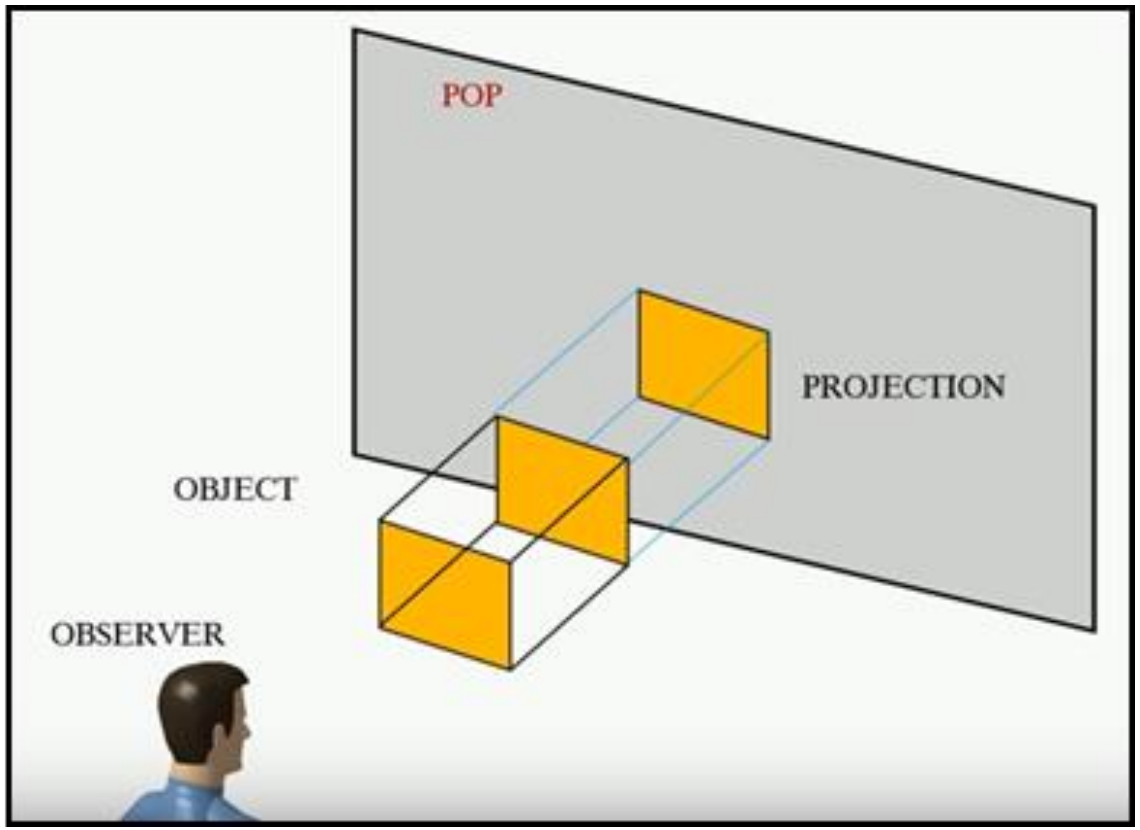
Orthographic Projection is a technical drawing in which different views of an object are projected on different reference planes observing perpendicular to respective reference plane.

The Different Reference planes are:	The Different views are :
Horizontal Plane (HP)	Top View (TV) – Projected on HP
Vertical Plane (VP)	Front View (FV) – Projected on VP
Side or Profile Plane (PP)	Side View (SV) – Projected on PP

Orthographic Projection

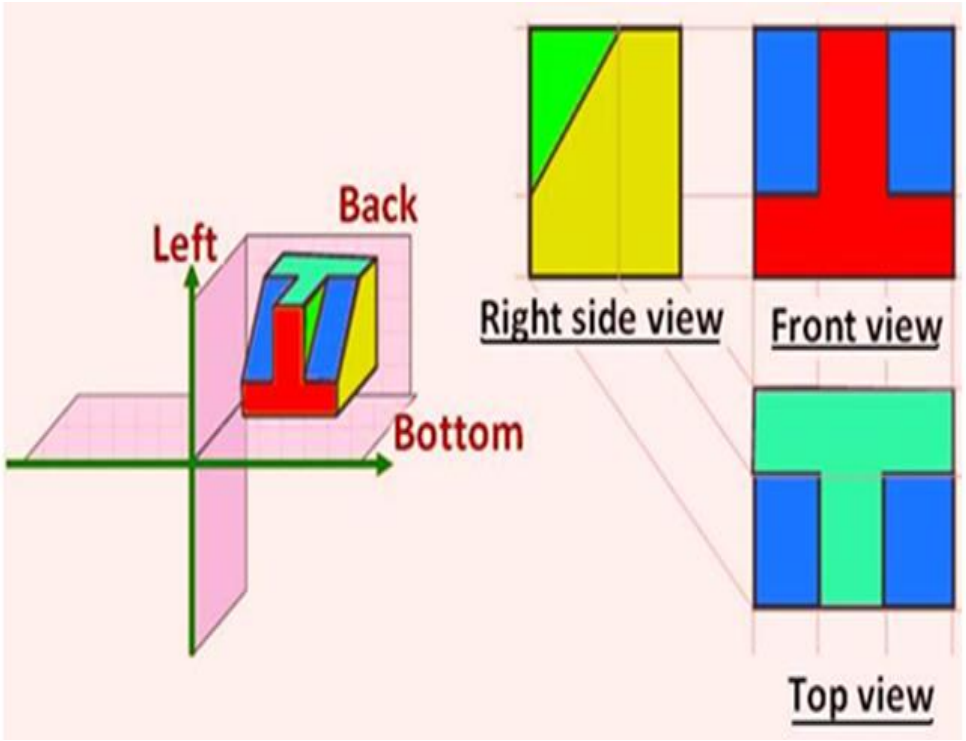
Orthographic Projection: The projection in which the projectors are parallel to each other and perpendicular to the plane

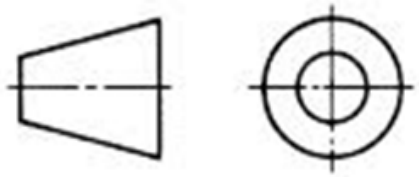




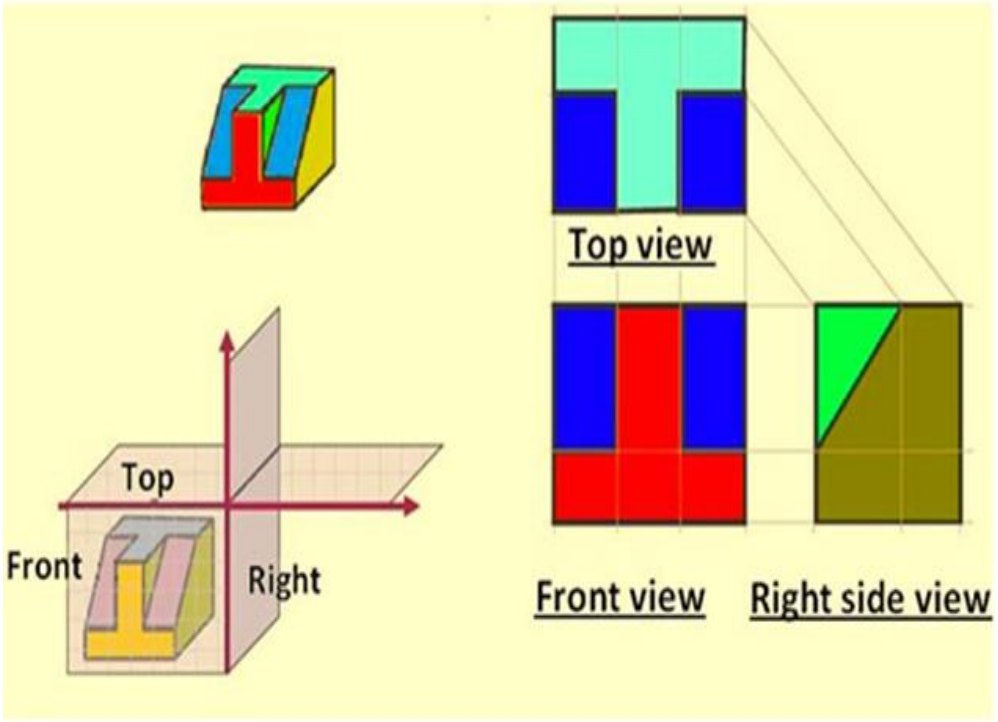
First & Third angle Projection Method

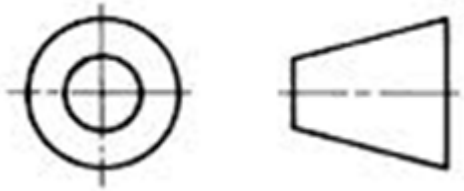
First Angle Projection Method





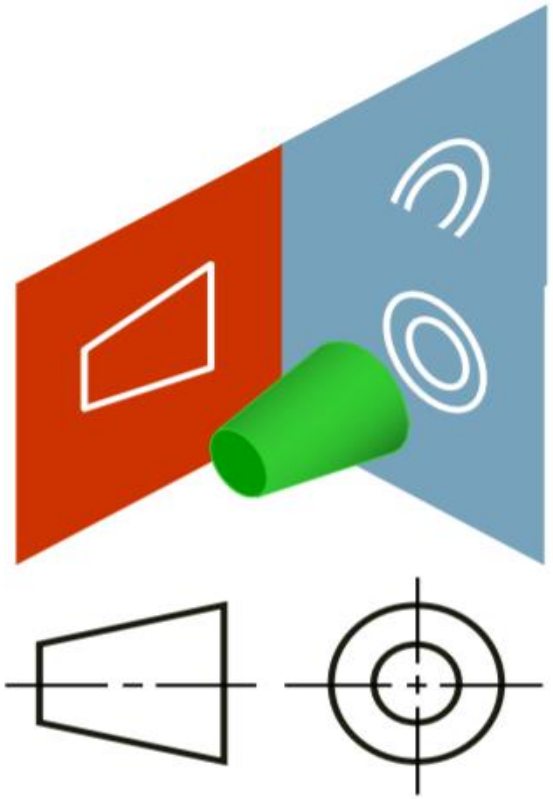
Third Angle Projection Method



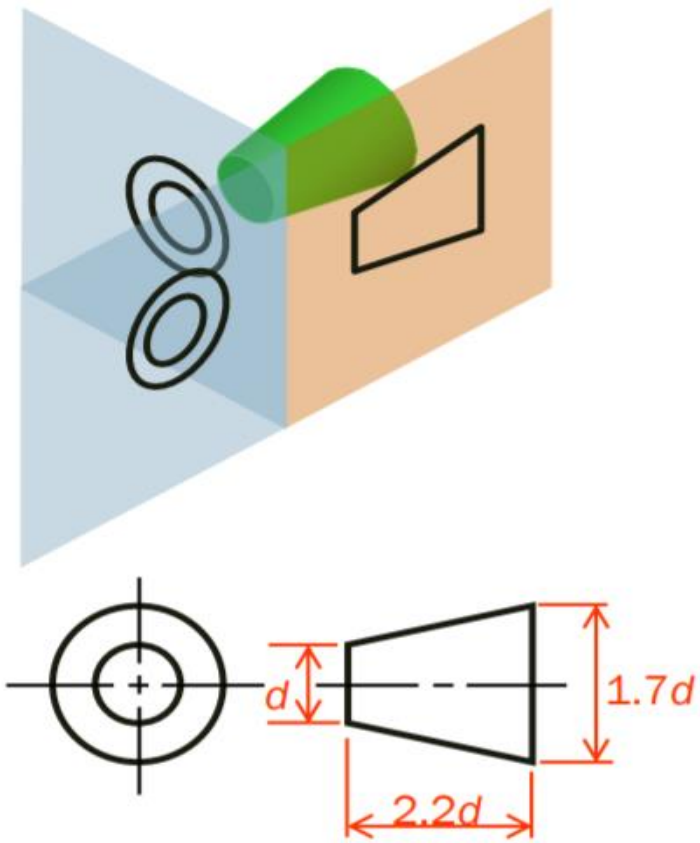


Projection Symbols

1st angle system



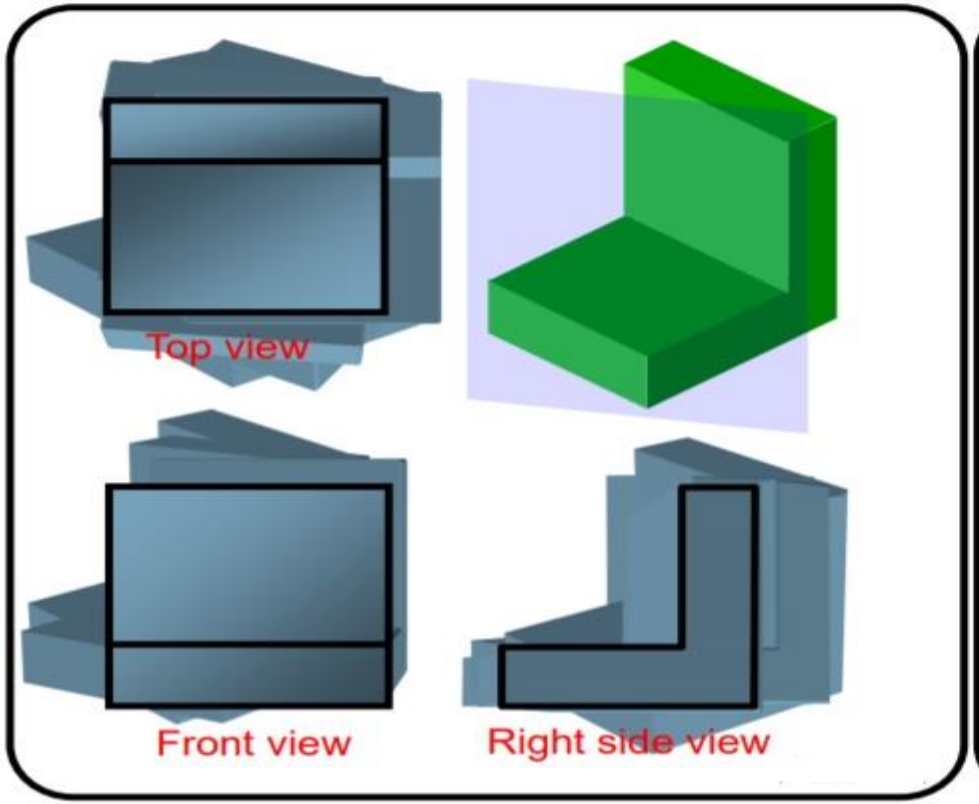
3rd angle system



Methods of Orthogonal Projections

1. Natural Method : Revolves the object with respect to the observer.
2. Glass Box Method / Transparent Method : The observer moves around the object.

1.



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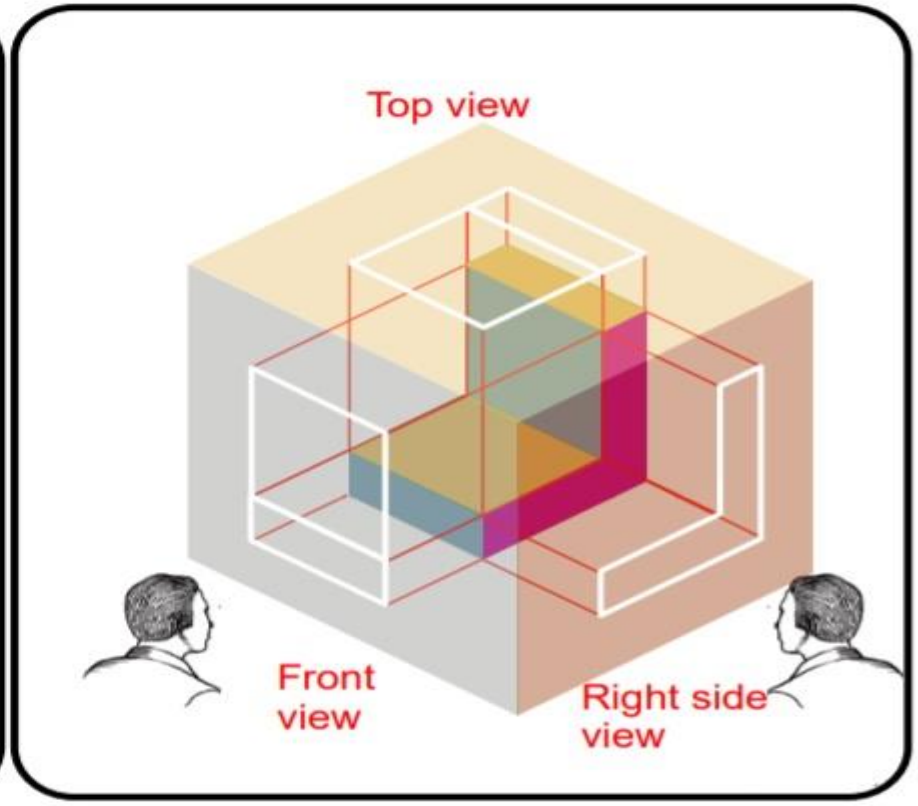
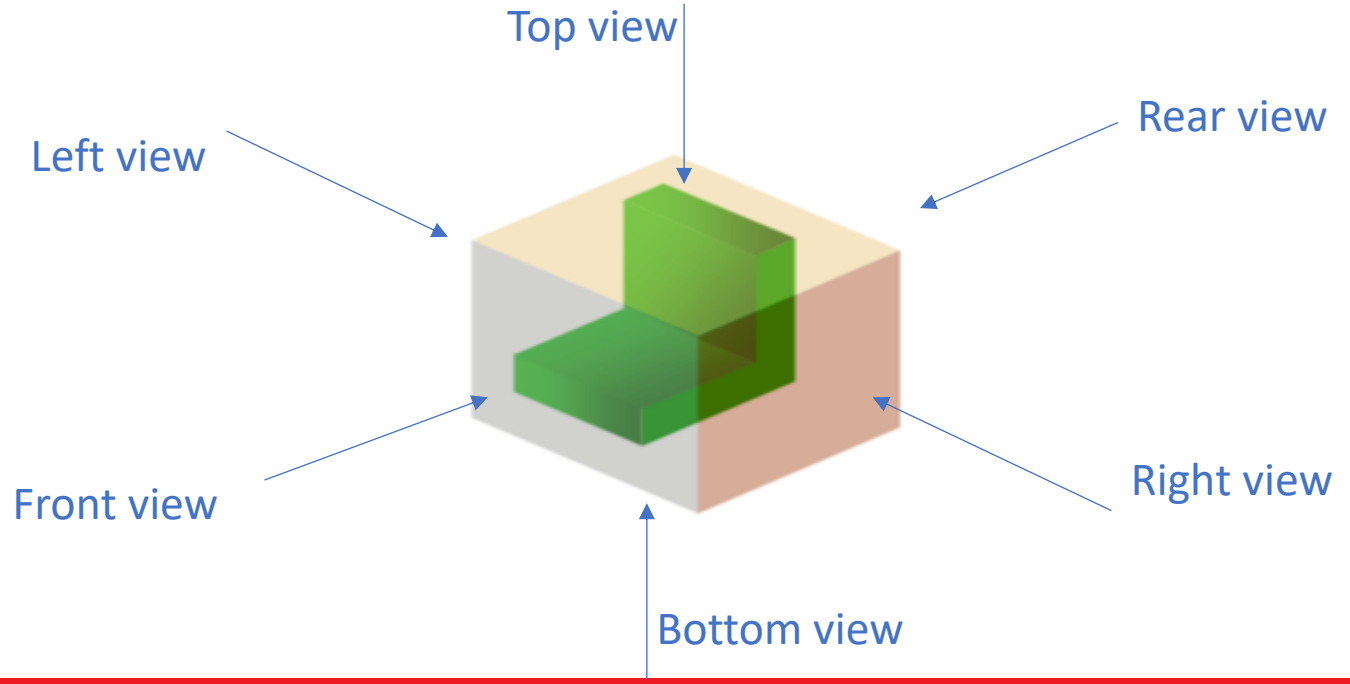
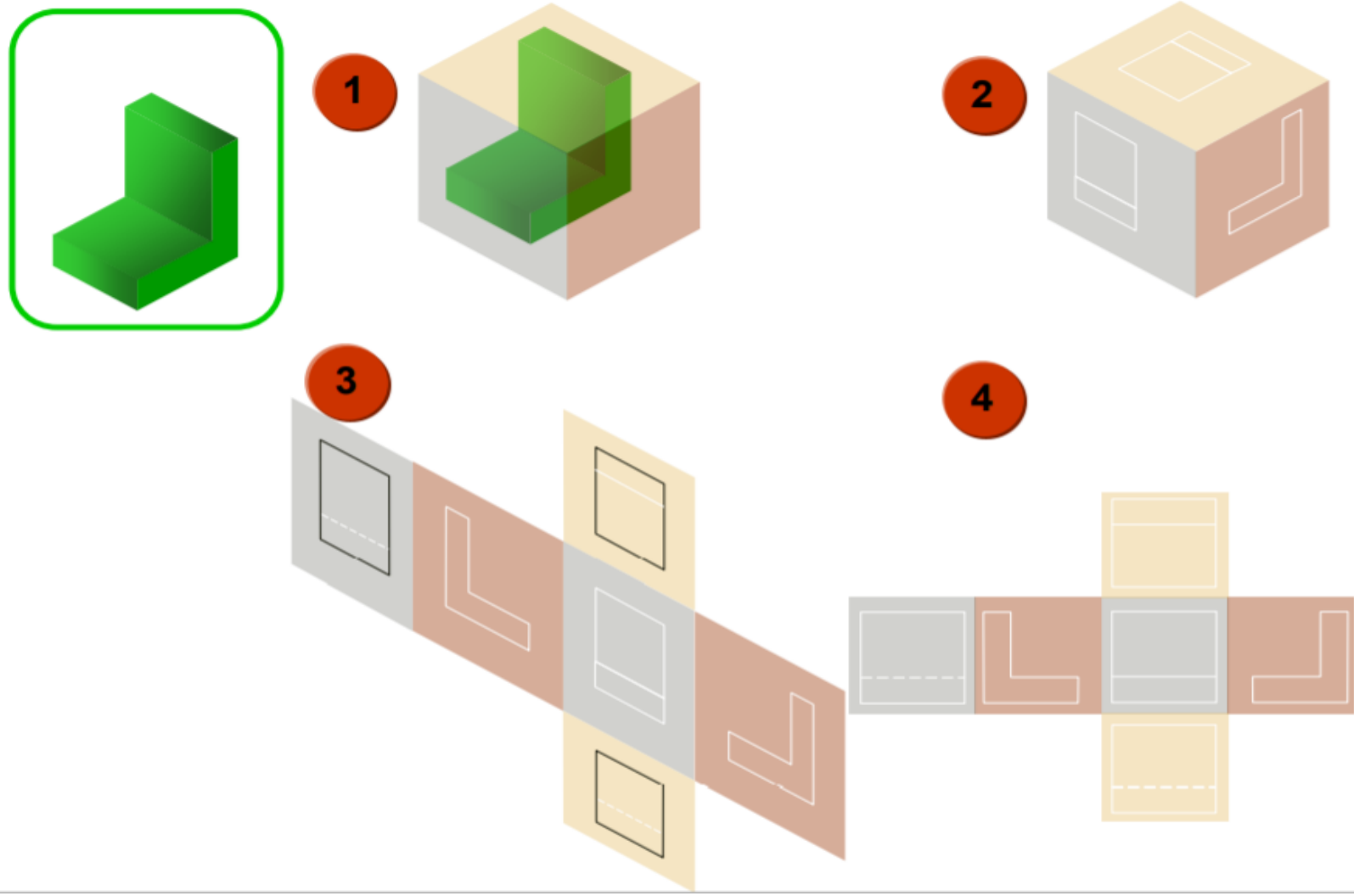


Glass Box Method

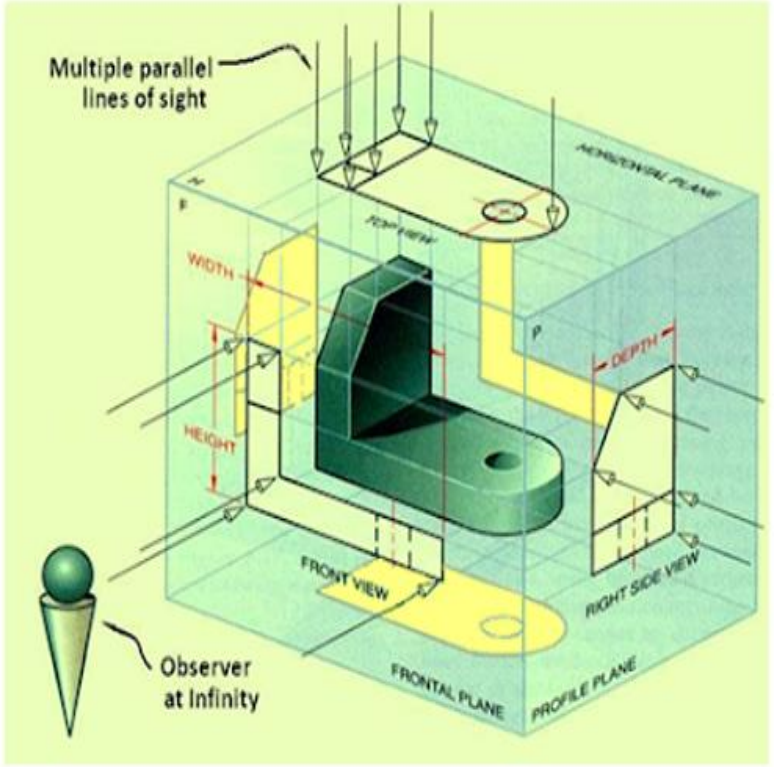
- The object is assumed to be placed in a glass box.
- The 6 sides of the box will be made by the 6 mutually perpendicular planes of projection that are located around the object. Each views will be projected on those planes.
- Unfolding the box produces an arrangement of the six views.

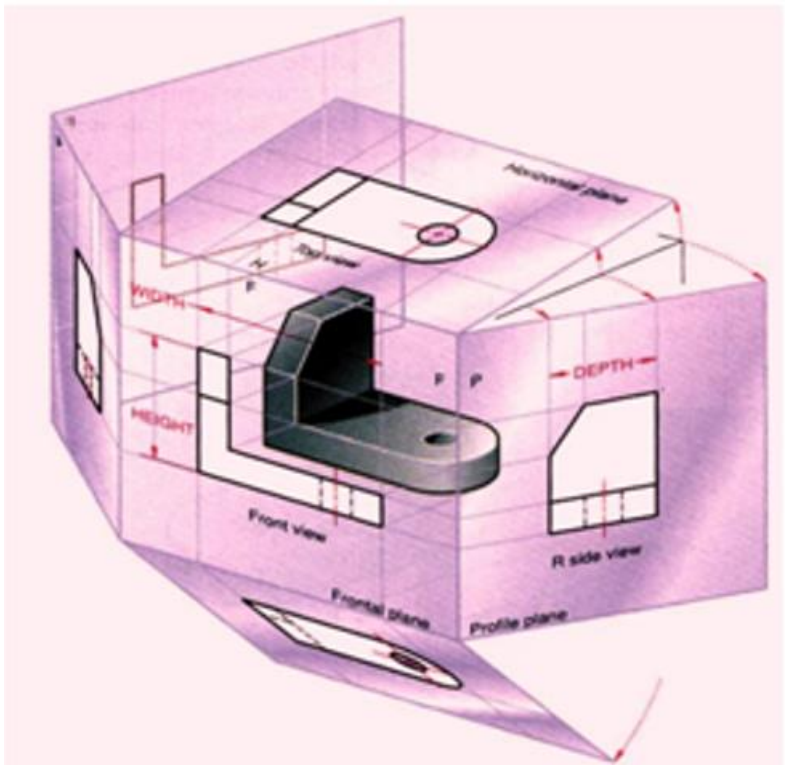


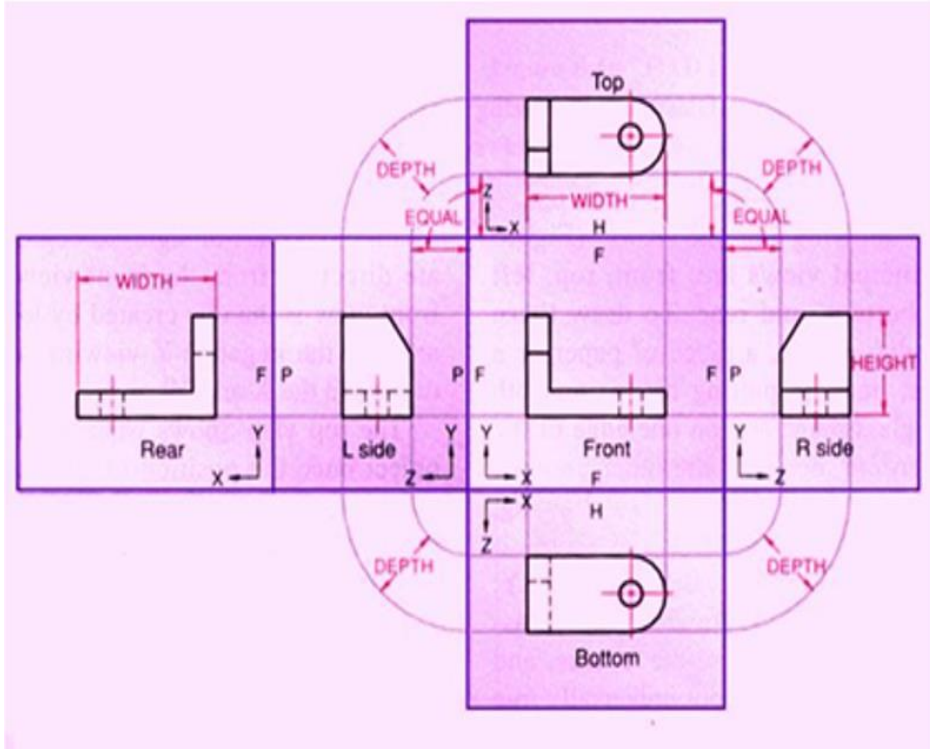
Problem solving Steps



Method of Orthographic Projection

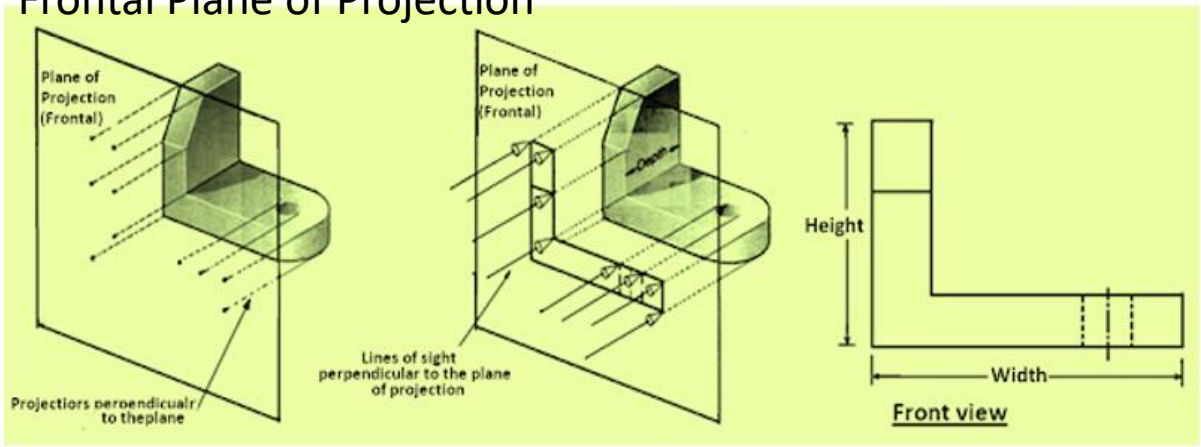




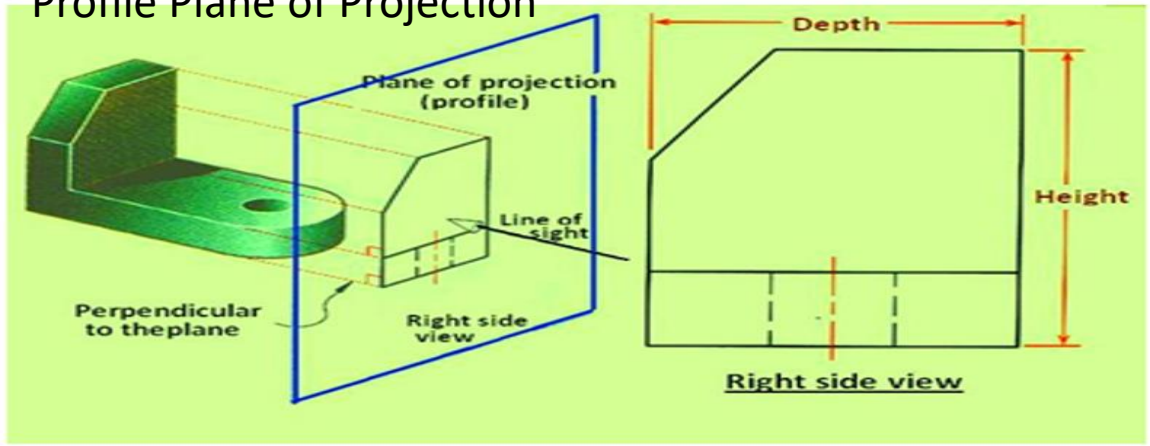


Method of Orthographic Projection

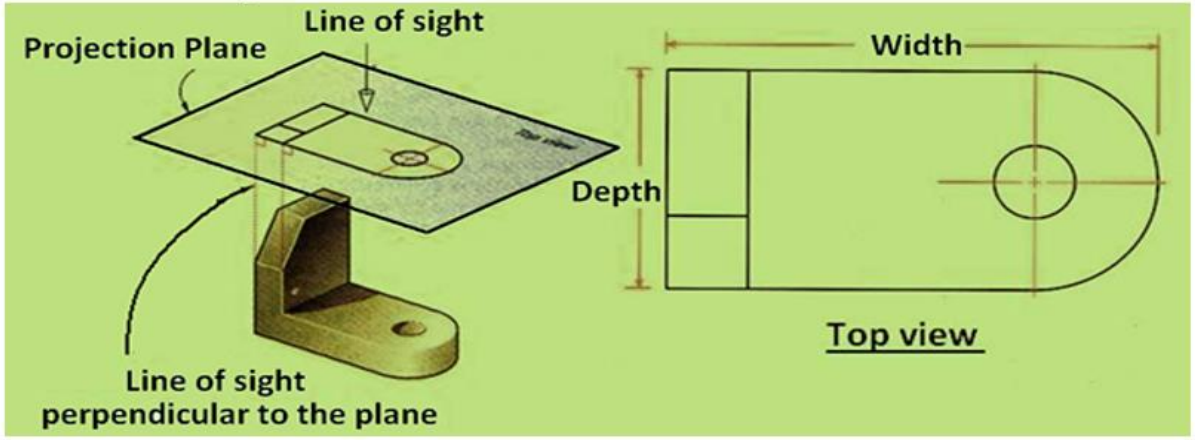
Frontal Plane of Projection

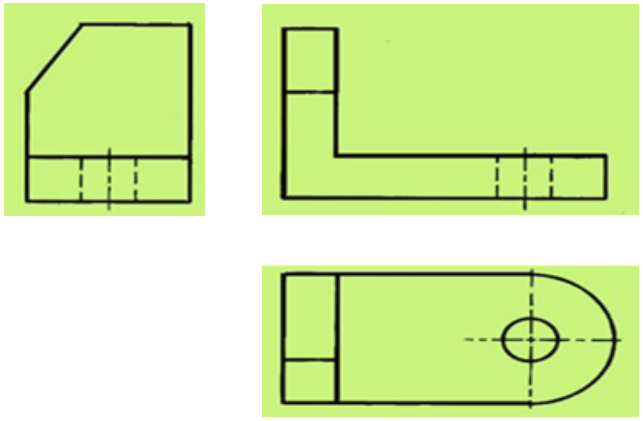


Profile Plane of Projection



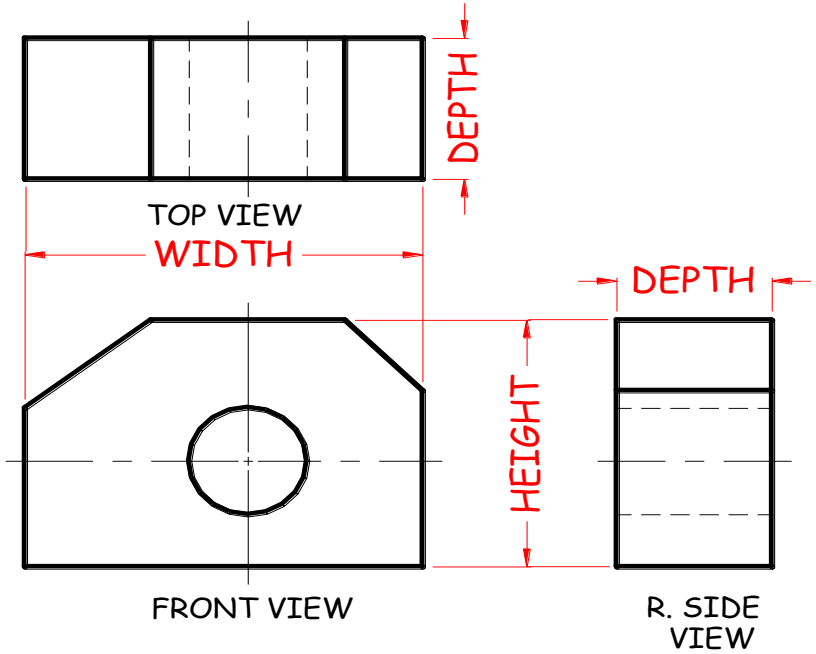
Horizontal Plane of Projection

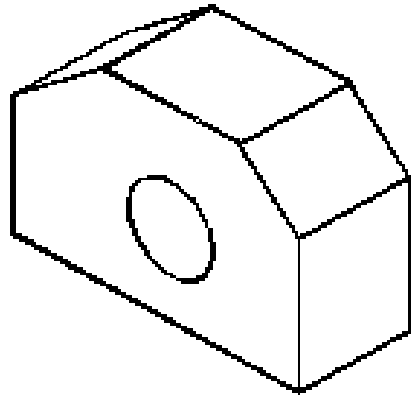




Object Dimensions

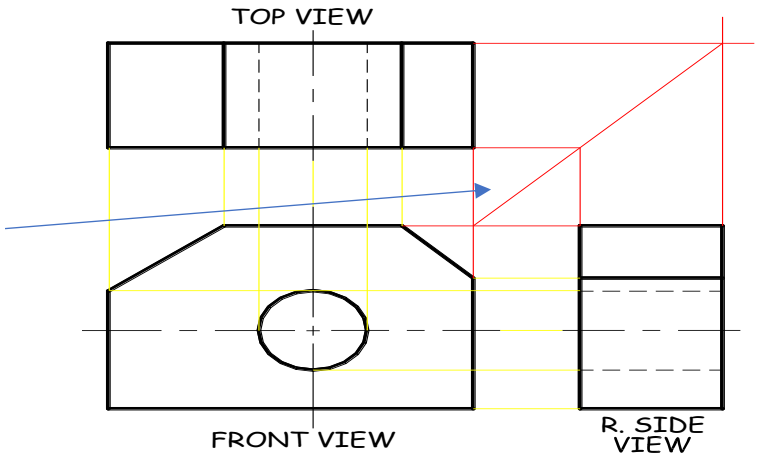
- Top View
  Shows width & depth
- Front View
  Shows width & height
- Side View
  Shows height & depth





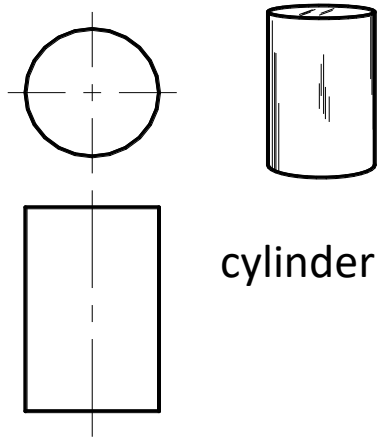
(Third angle projection)

- Depth can be projected between views by using a 45° line

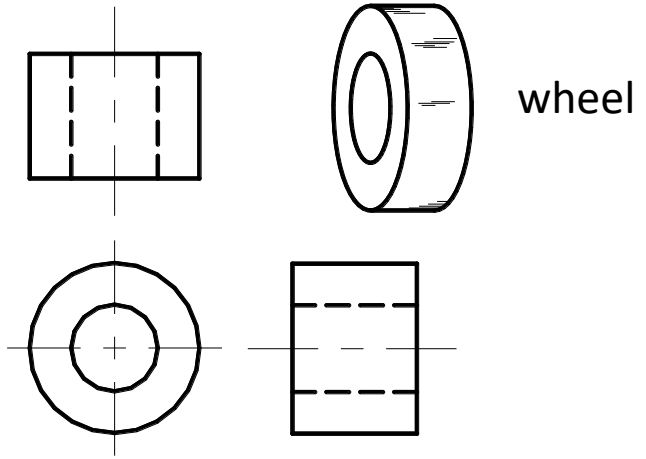


Choosing Views

- Views should be visually balanced within the working space.
- Complex objects require 3 views describe its shape fully.
- Simple objects require only two views. Third view would add nothing to the description.
- Some curved surfaces do not show as curves in all views.



cylinder



wheel

Line Types

Lines signify more than just the geometry of the object so its important to use the appropriate line type.

- Is the feature visible or hidden from view?
- Is the line part of the object or part of a dimension?
- Is the line indicating symmetry?

Illustration	Application
Thick	Outlines, visible edges, surface boundaries of objects, margin lines
Continuous thin	Dimension lines, extension lines, section lines leader or pointer lines, construction lines, boarder lines
Continuous thin wavy	Short break lines or irregular boundary lines – drawn freehand
Continuous thin with zig-zag	Long break lines
Short dashes, gap 1, length 3 mm	Invisible or interior surfaces
Short dashes	Center lines, locus lines Alternate long and short dashes in a proportion of 6:1,
Long chain thick at end and thin elsewhere	Cutting plane lines

Precedence of Lines

- Visible lines takes precedence over all other lines.
- Hidden lines and cutting plane lines take precedence over center lines
- Center lines have lowest precedence
- *NOTE:*

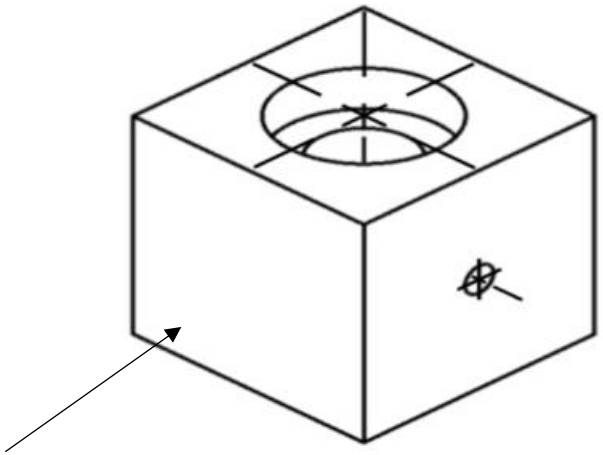
When the Visible line coincides with hidden or center line

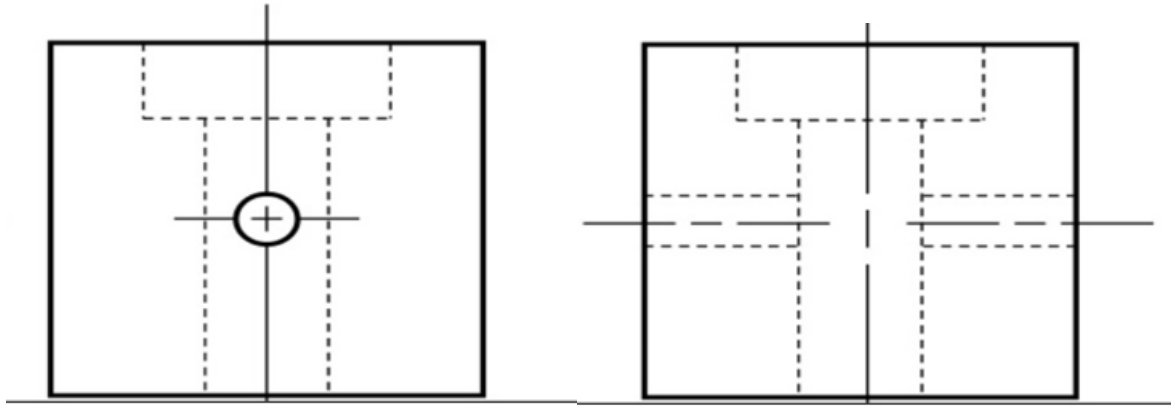
- Visible line is shown

Hidden line coincides with center line

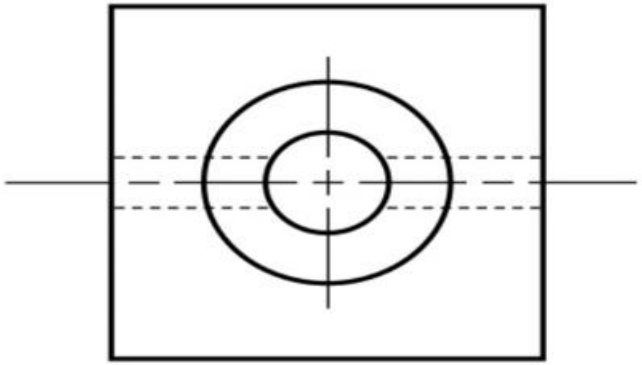
- Hidden line is shown

Precedence of Lines



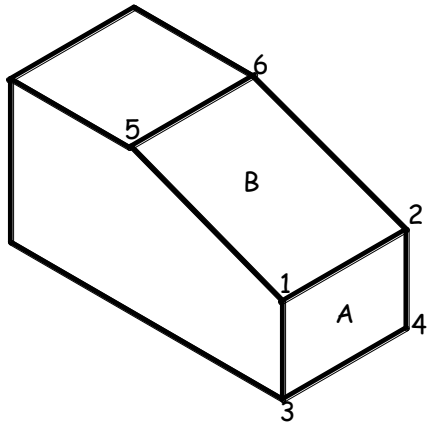


1. Visible
2. Hidden
3. Center



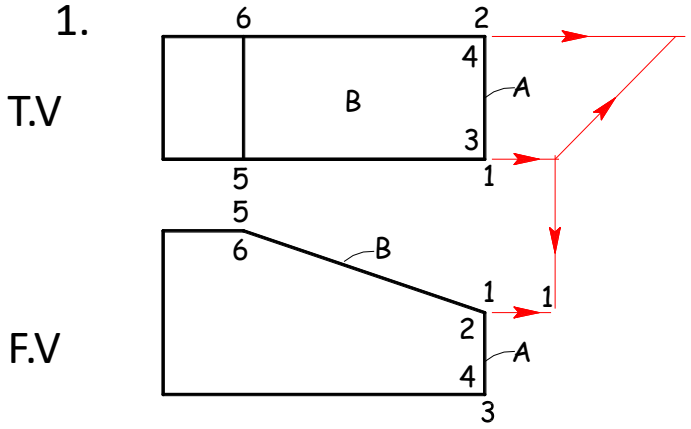
Straight Edges

- Edges that are perpendicular to a plane of projection appear as a point.



- Edges that are parallel to a plane of projection appear as lines
- Edges that are inclined to a plane of projection appear as foreshortened lines

1.



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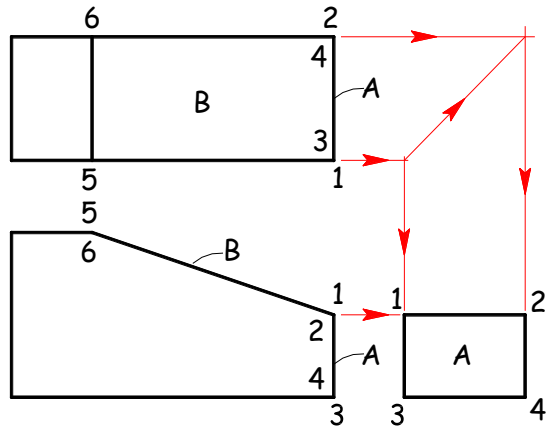

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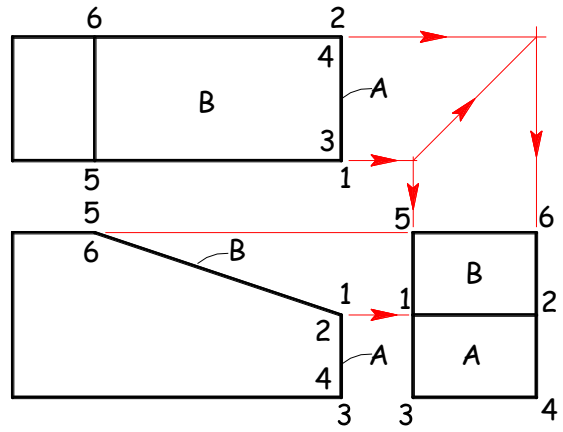
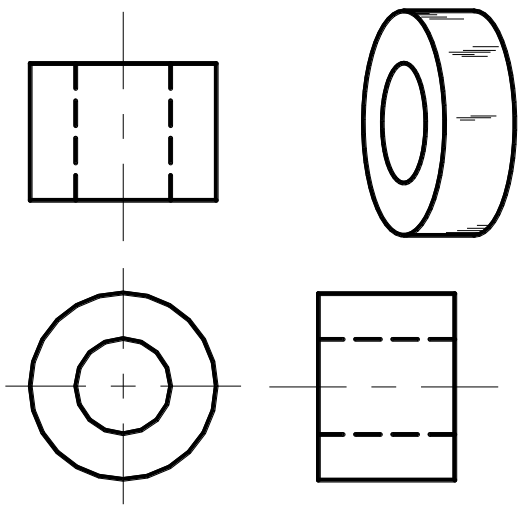
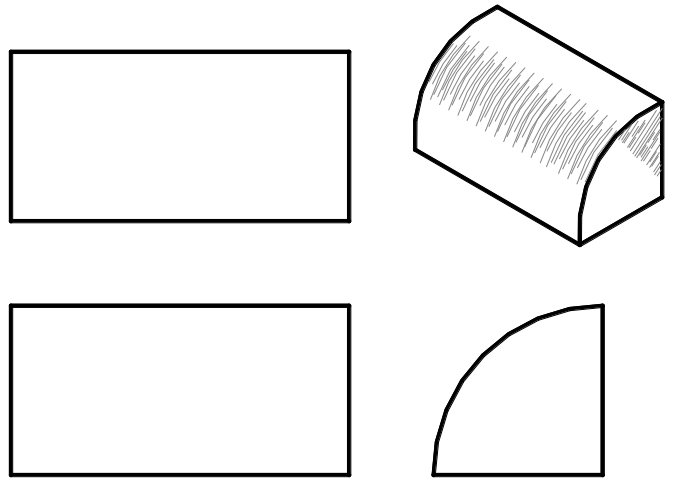


Curved Edges

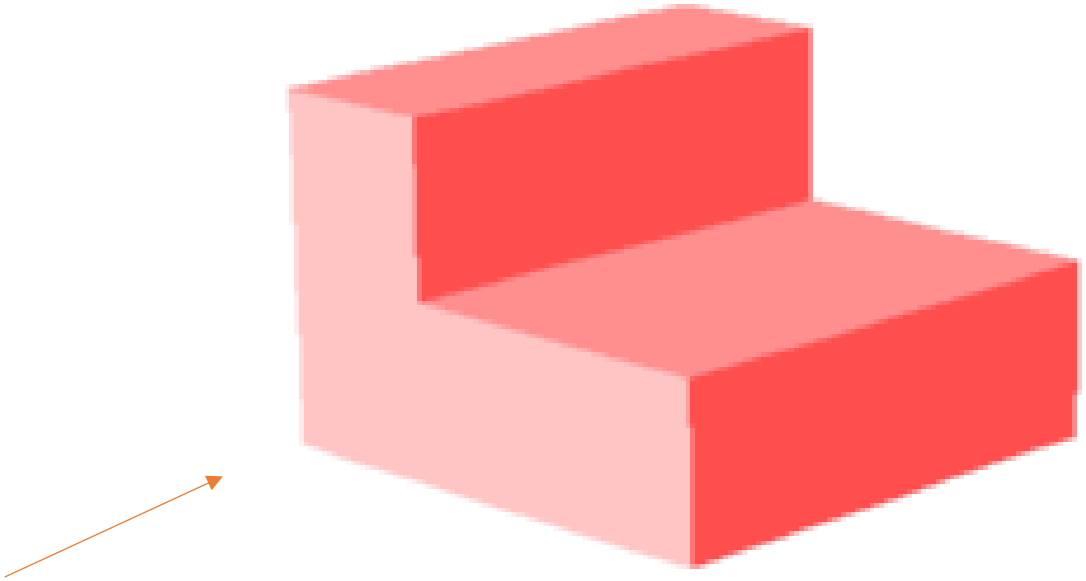
- Curved edges project as straight lines on the plane to which they are perpendicular
- Curved edges project as curved lines on the planes to which they are parallel or inclined

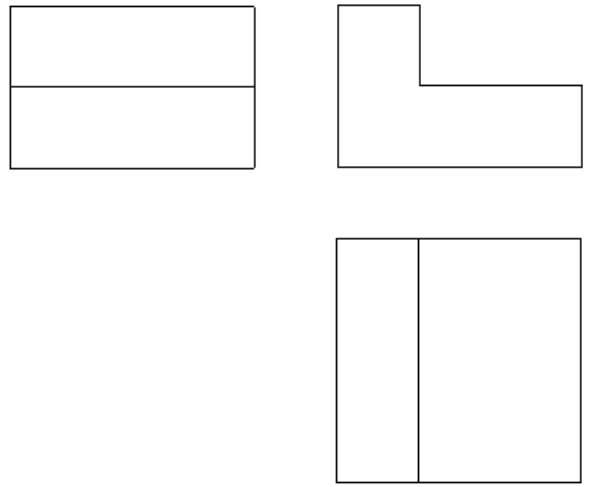




Normal Surfaces

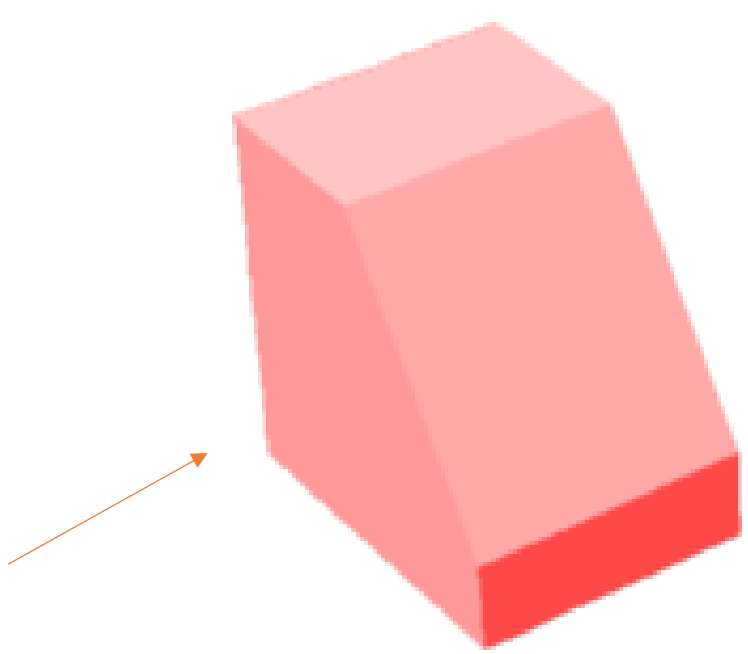
- Normal surfaces appear as an edge in two opposite principal views, and appear a surface in all other principal views.

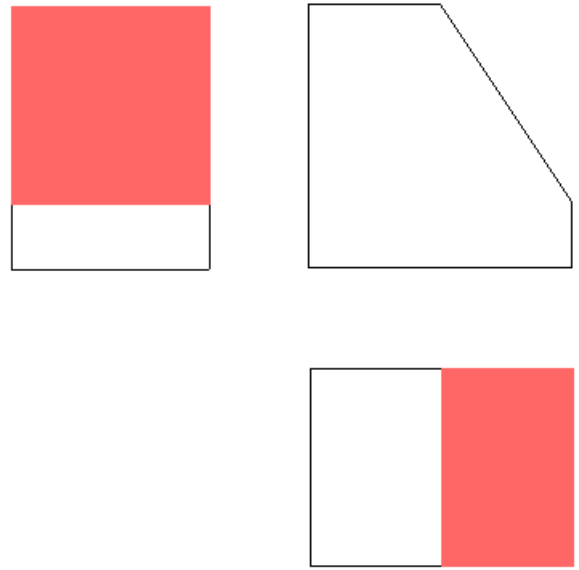




Inclined Surfaces

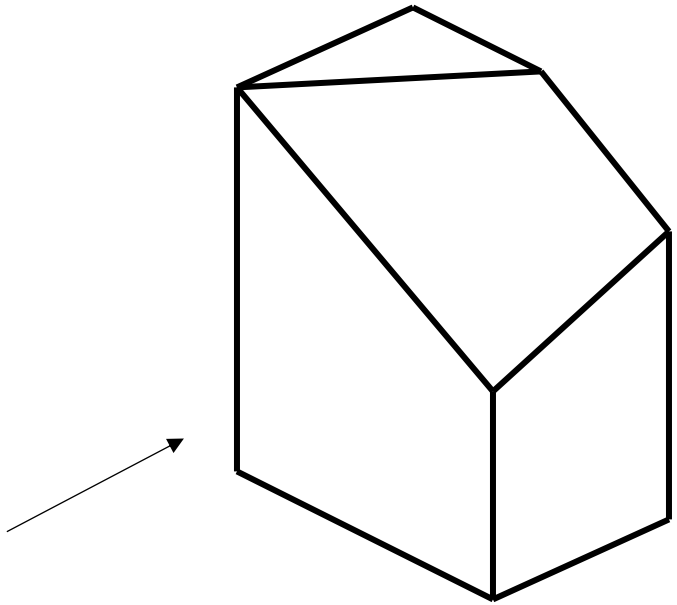
- Inclined surfaces appear as an edge in two opposite principal views, and appear foreshortened (not true size) in all other principal views.

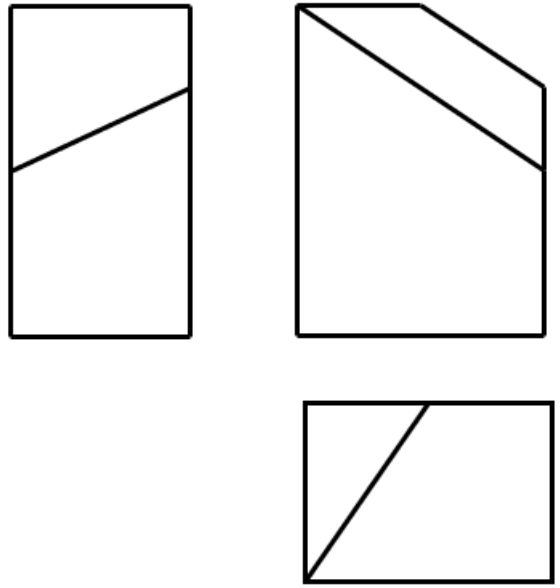




Oblique Surfaces

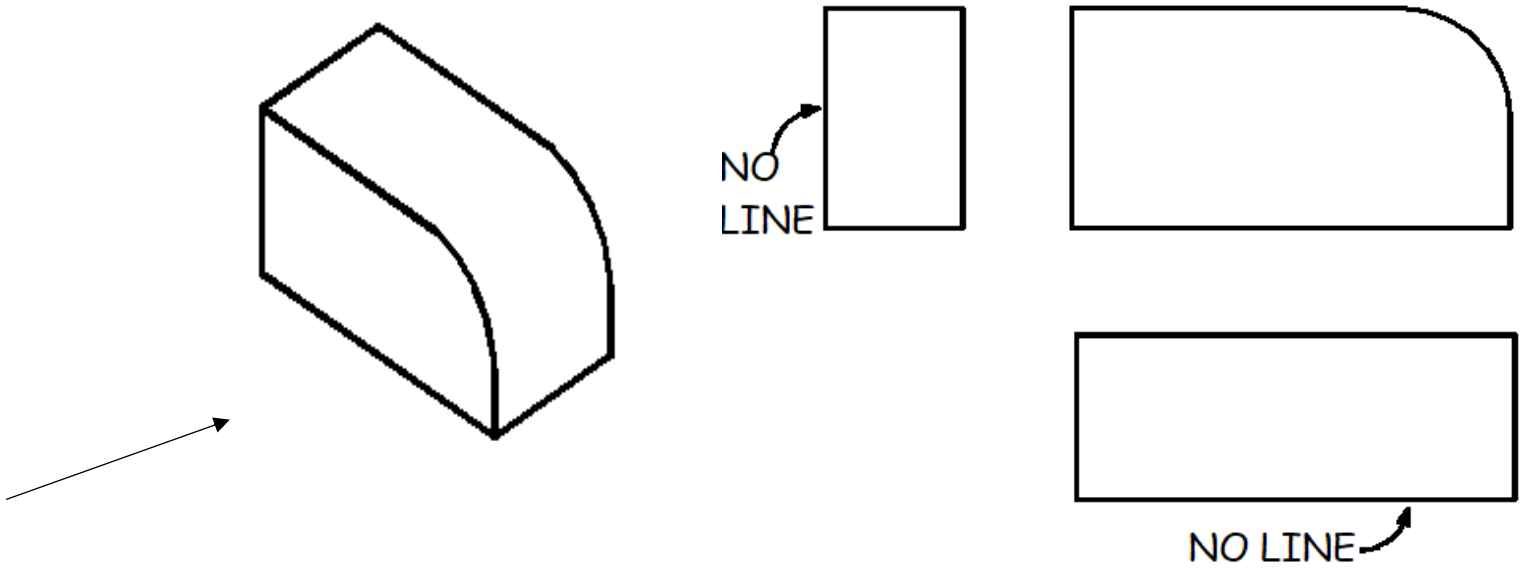
- Oblique surfaces do not appear either as an edge or true size in any principal view.





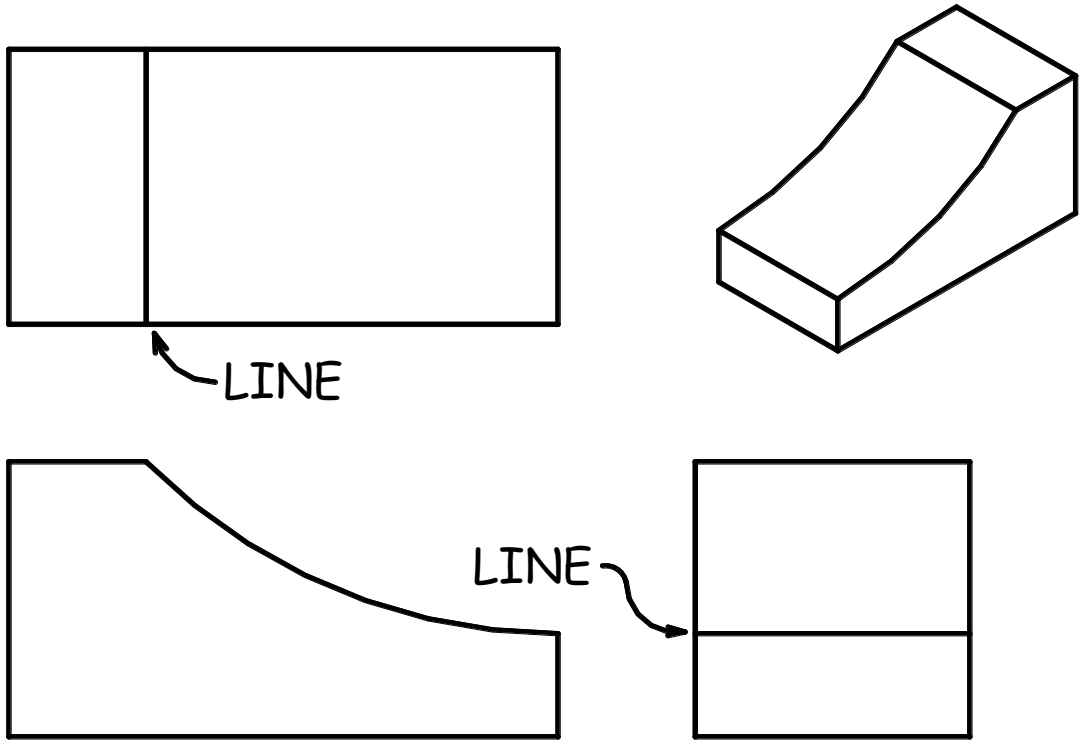
Intersections & Tangencies

- Where a curved surface is *tangent* to a plane surface, no line should be shown where they join



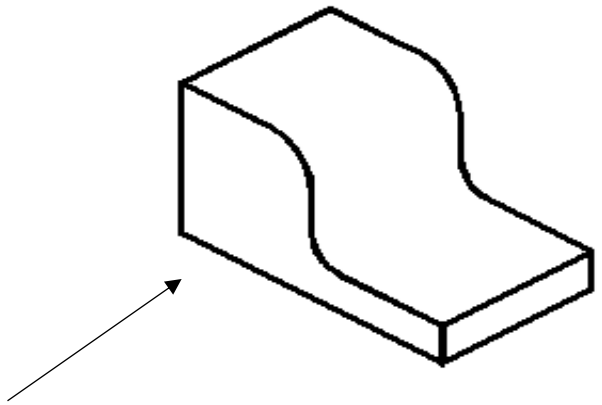
Intersections & Tangencies

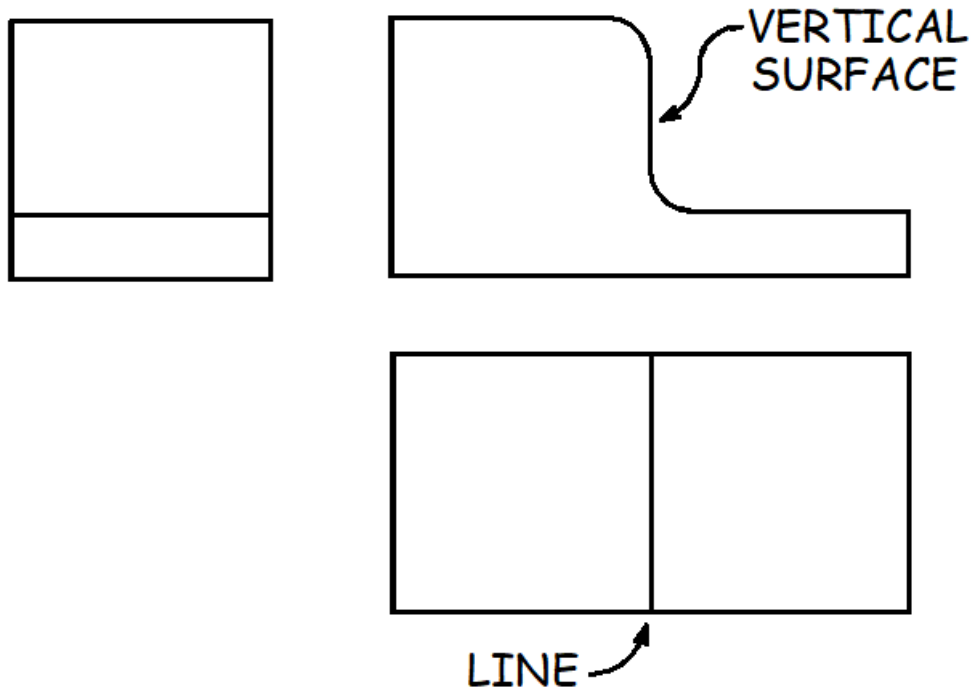
- Where a plane surface intersects a curved surface, an edge is formed



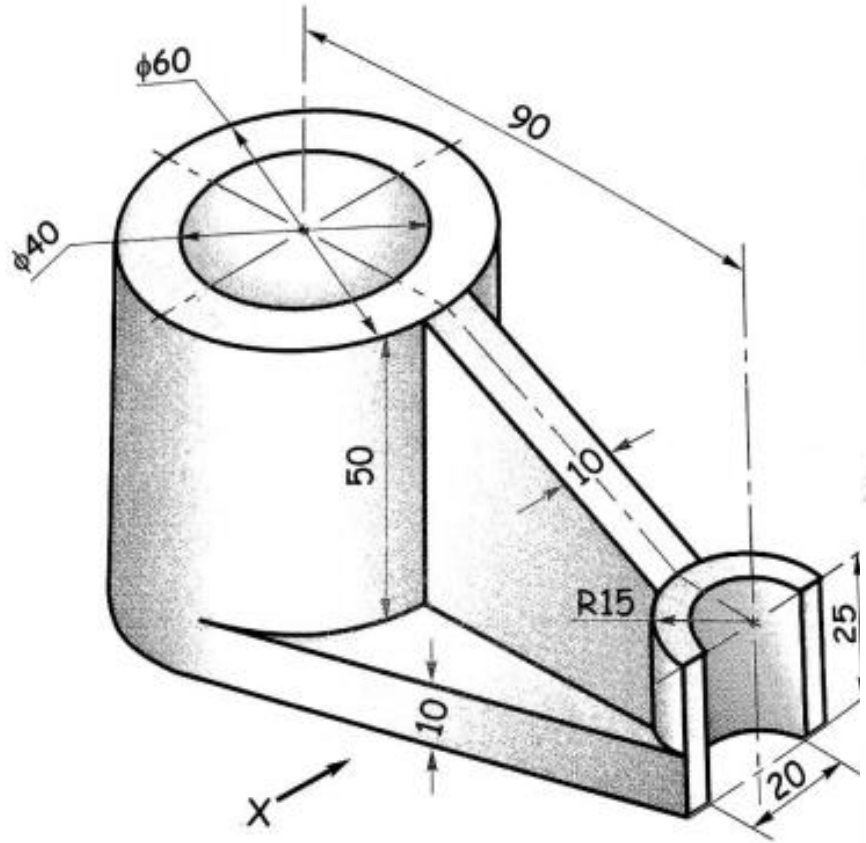
Intersections & Tangencies

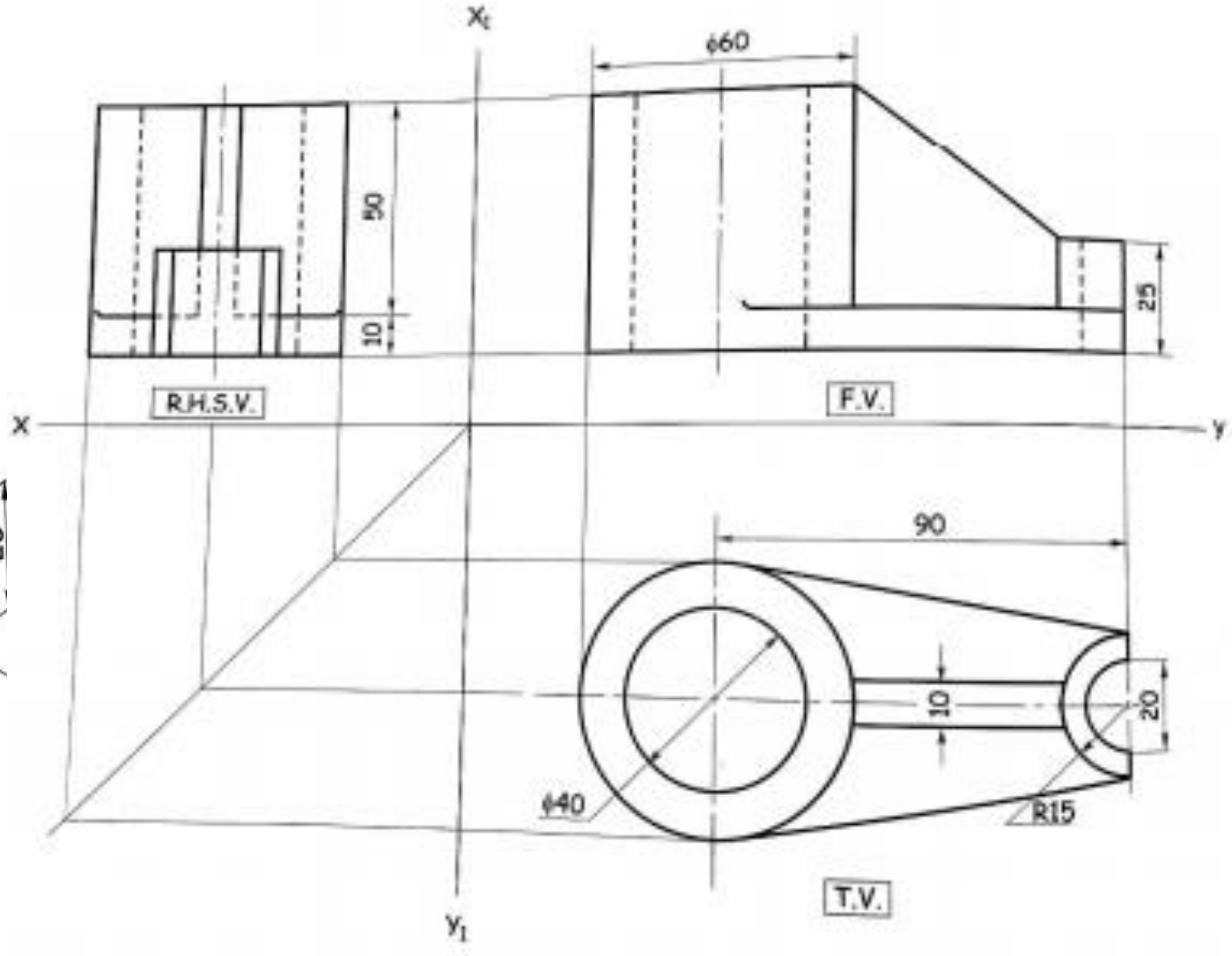
- Where the plane surface is horizontal or vertical, exceptions to these rules may occur



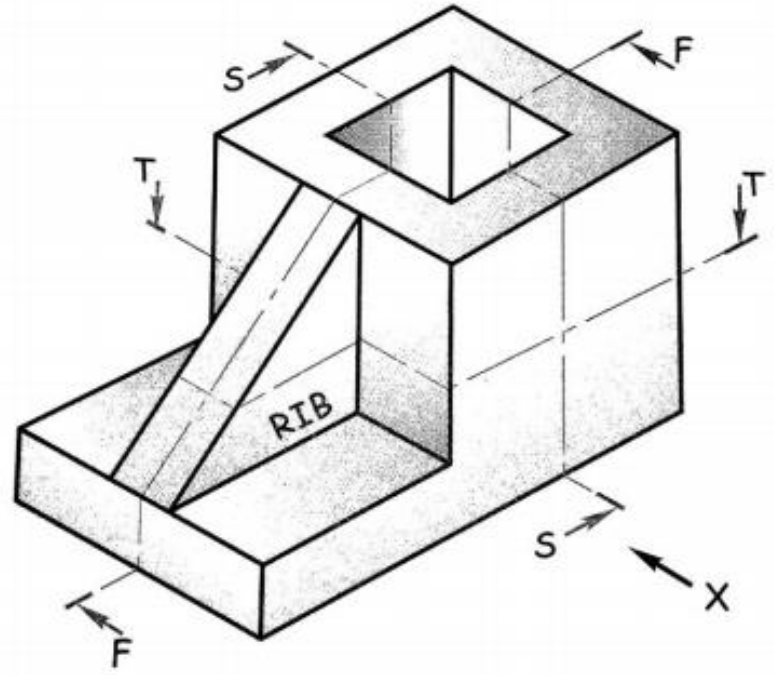


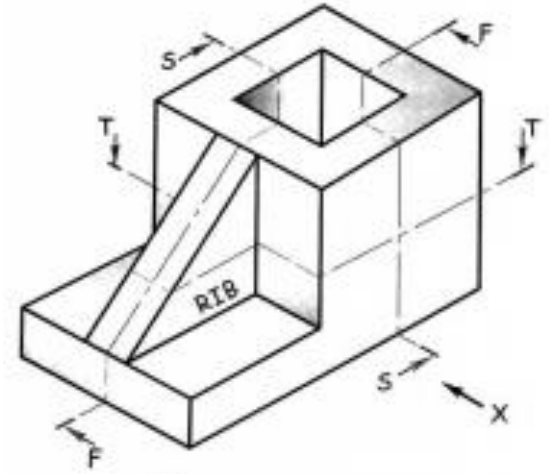
Orthographic projection



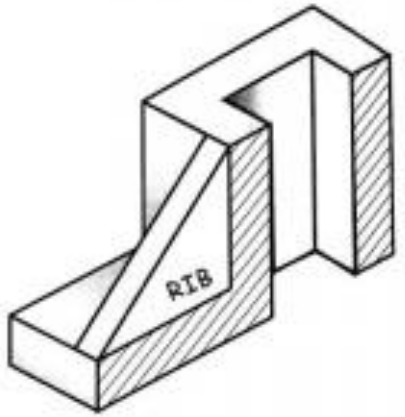


Sectional Orthographic Projection

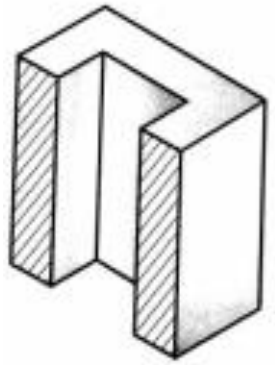




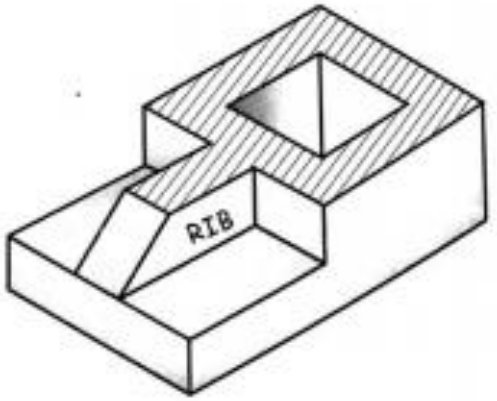
(a)



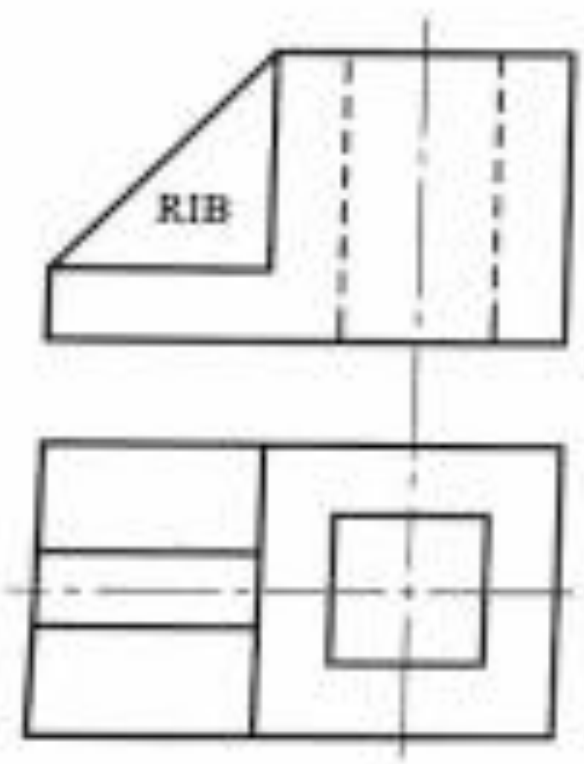
(b)



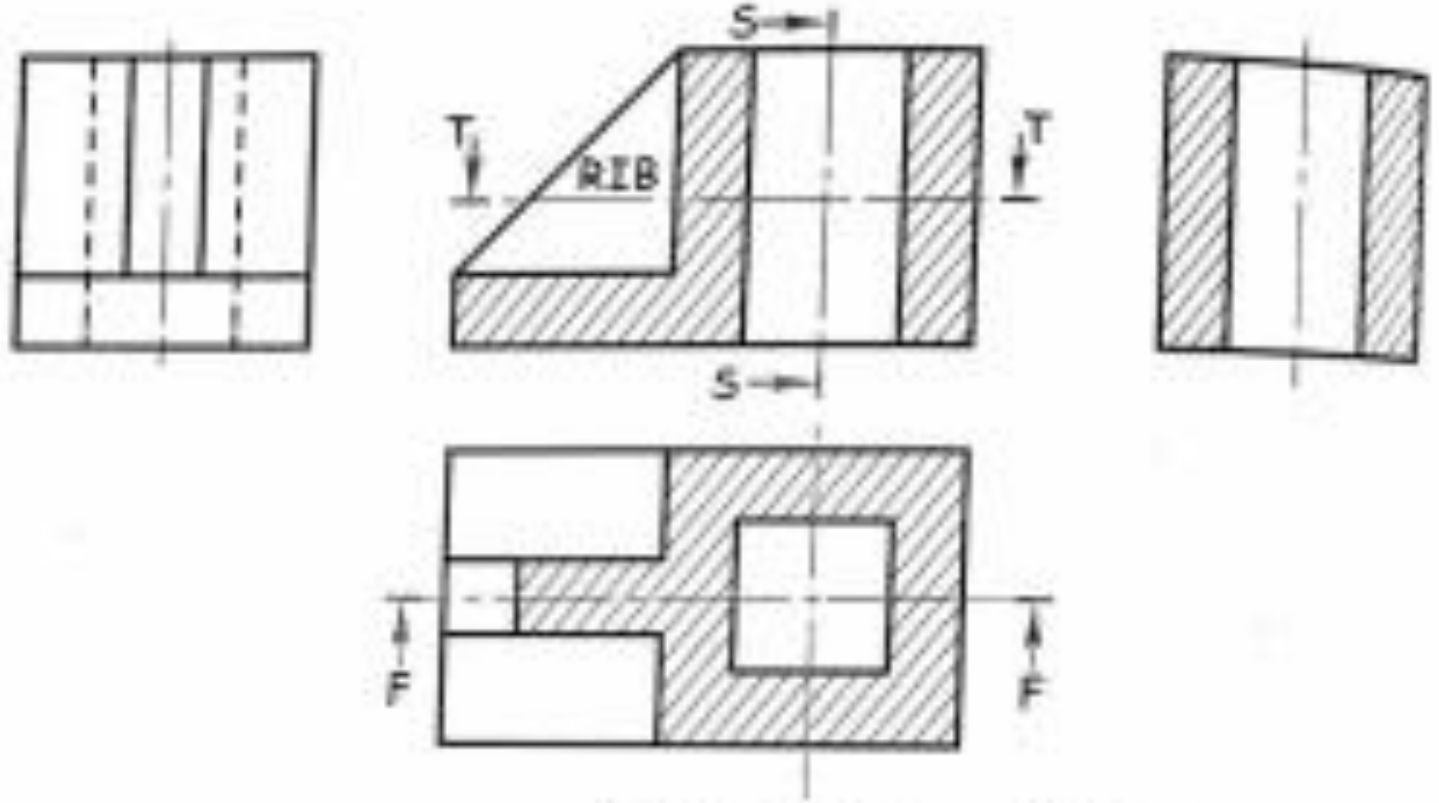
(c)



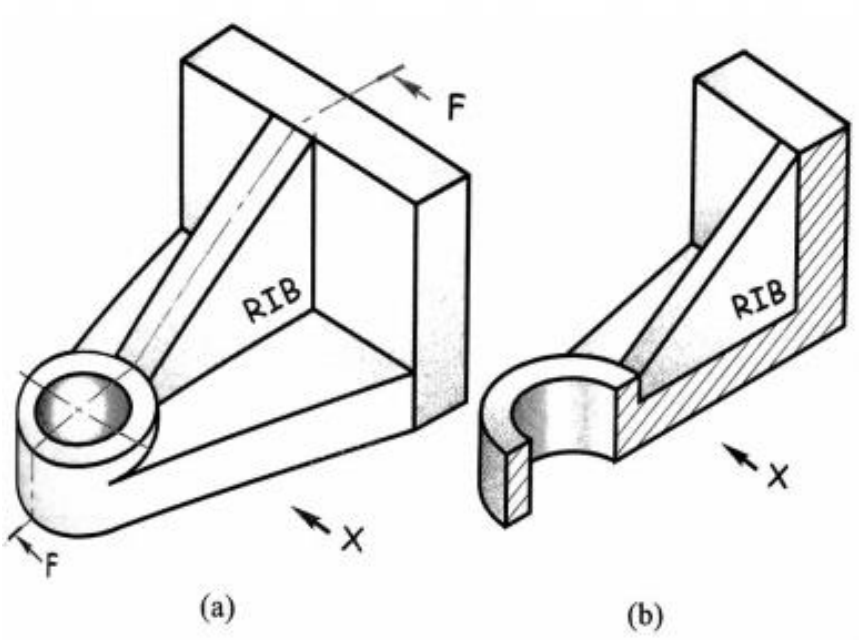
(d)



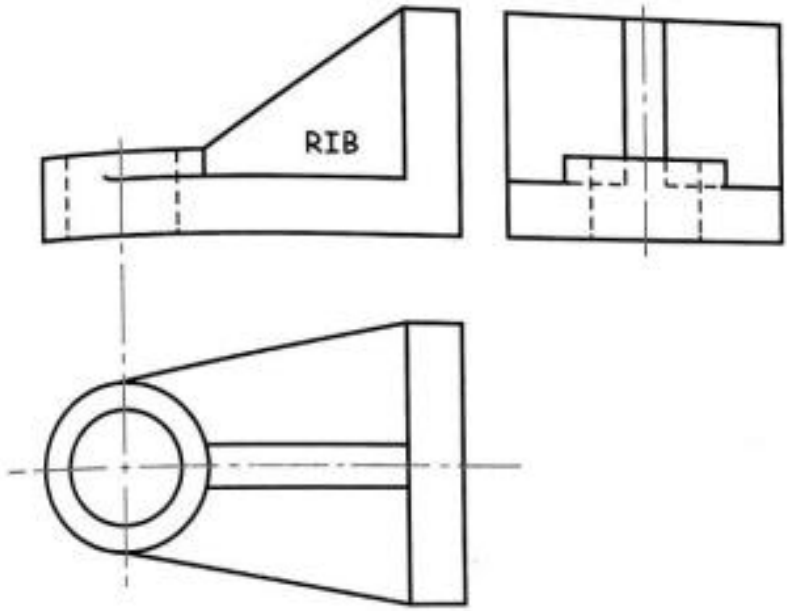
(e) Orthographic View



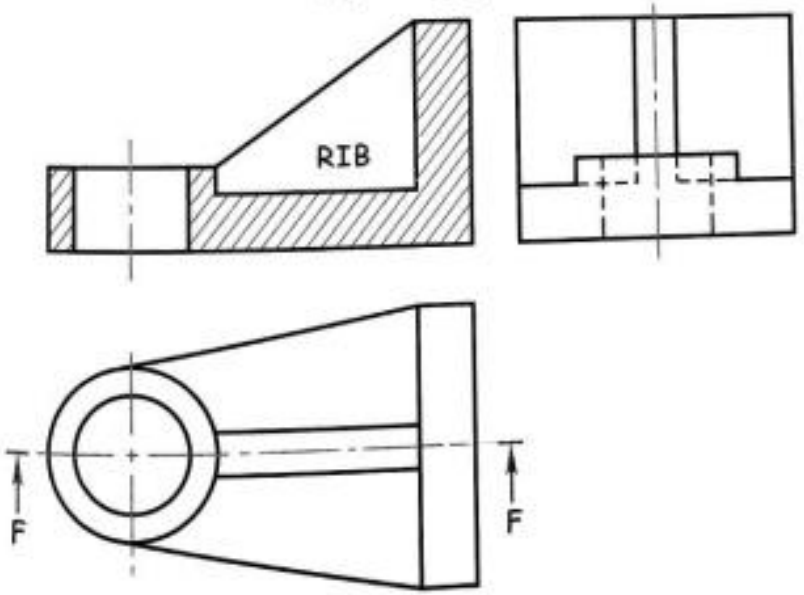
(f) Sectional Orthographic View

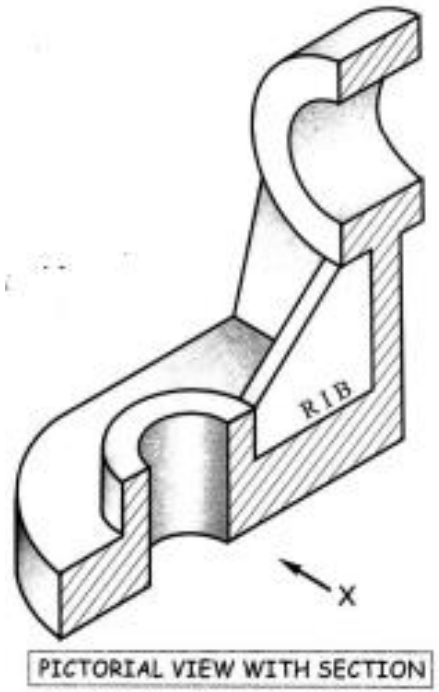


(a) (b)

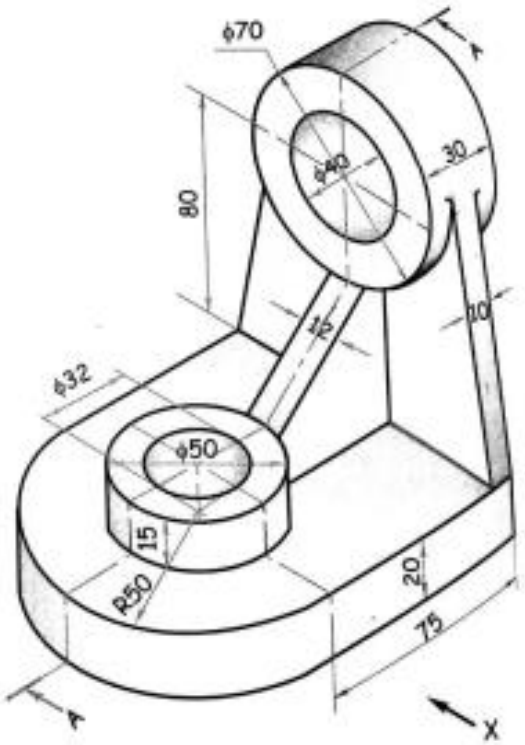


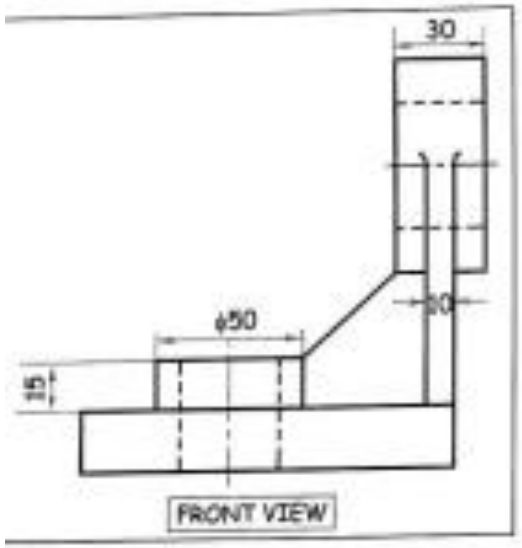
(c) Orthographic View



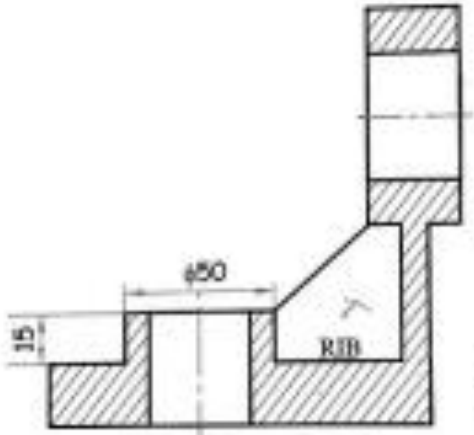


PICTORIAL VIEW WITH SECTION

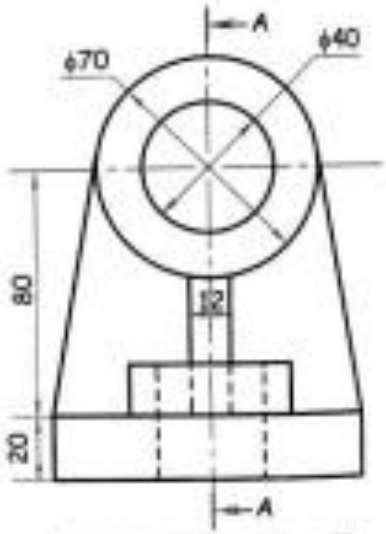




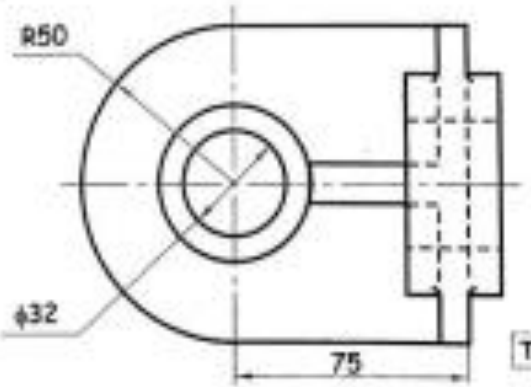
FRONT VIEW



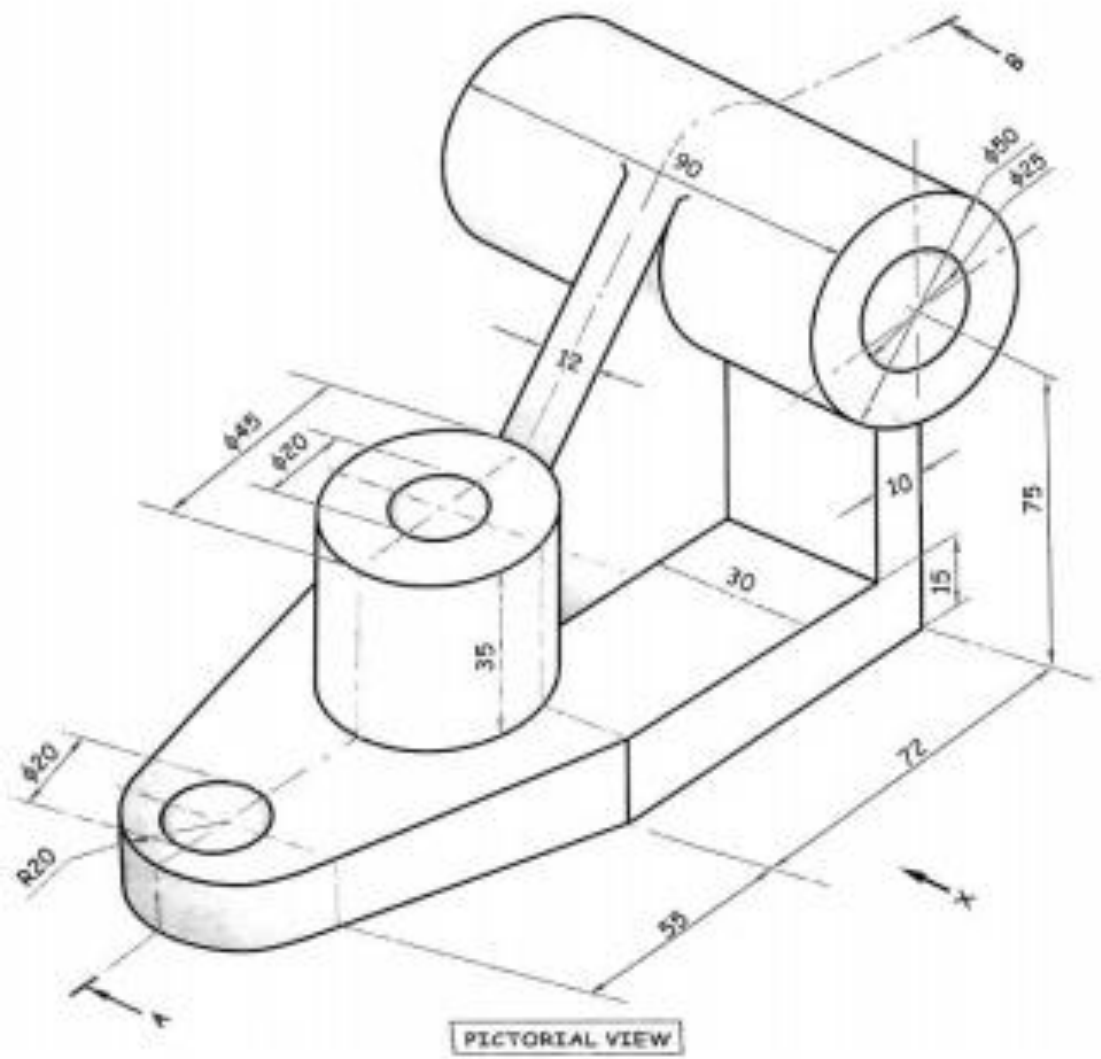
SEC. FRONT VIEW



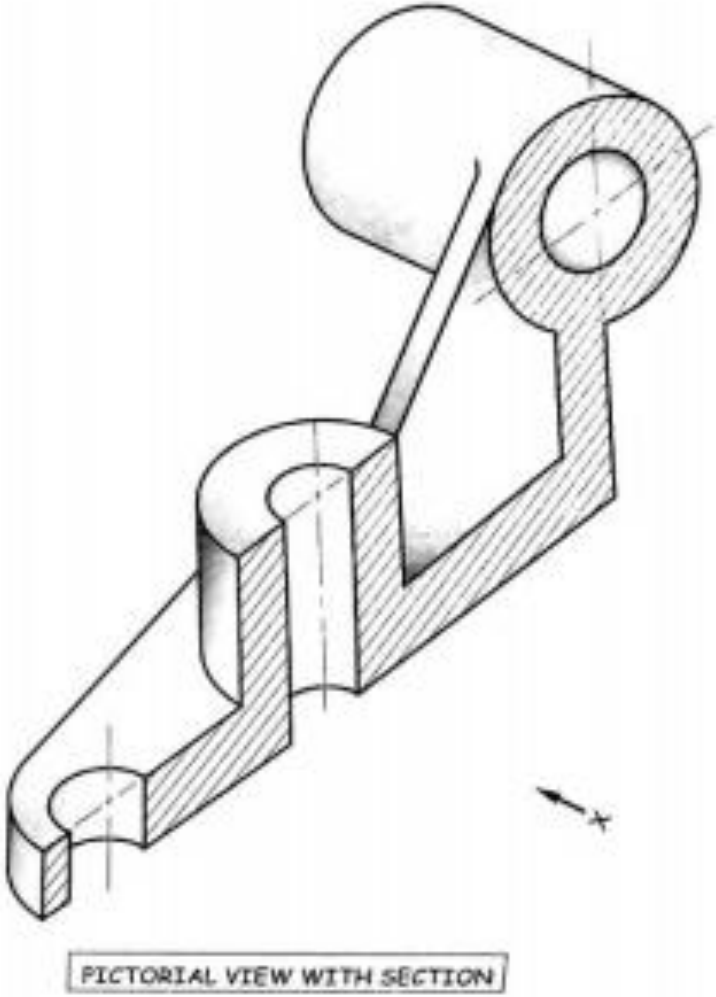
LEFT HAND SIDE VIEW



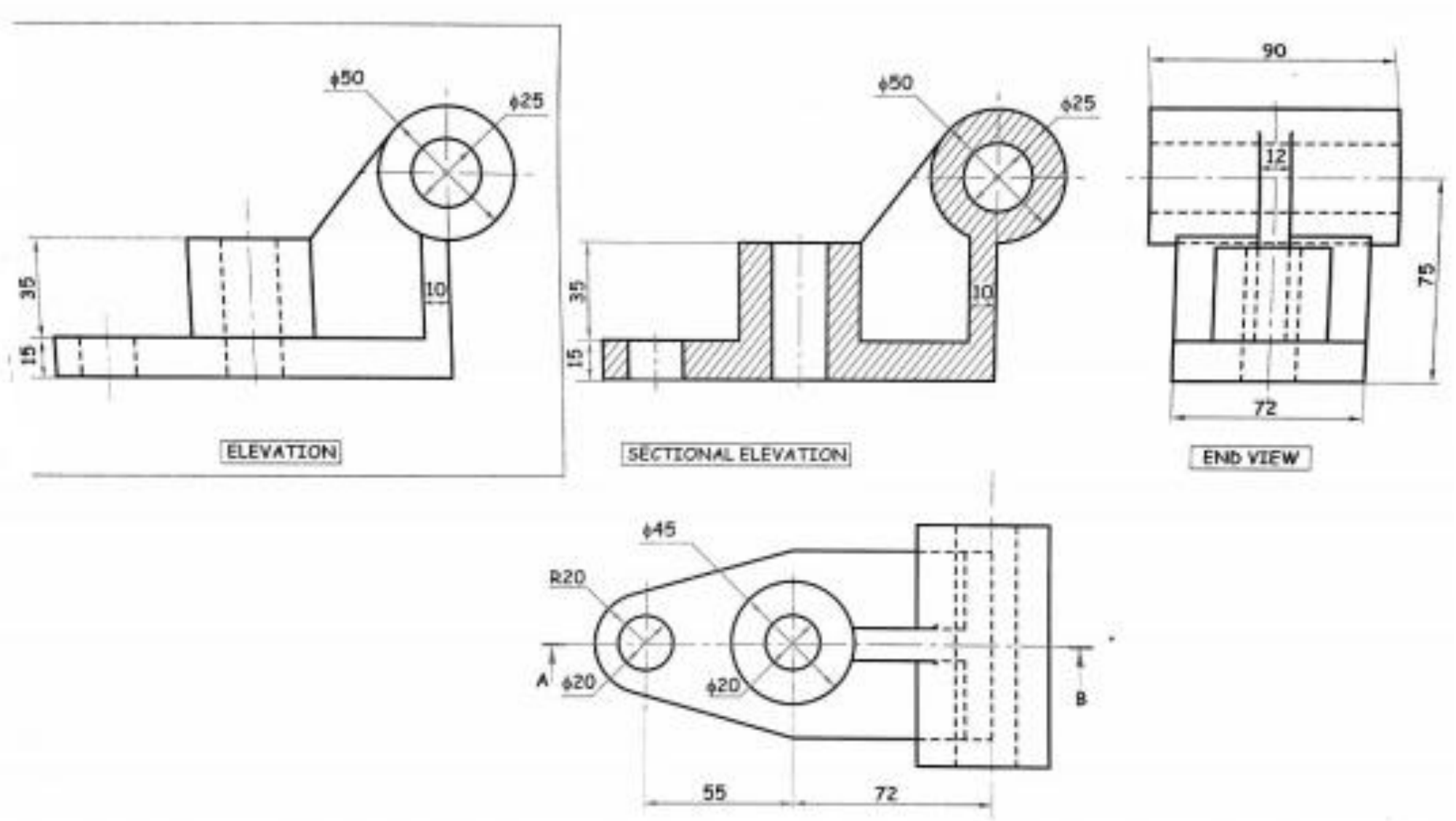
TOP VIEW

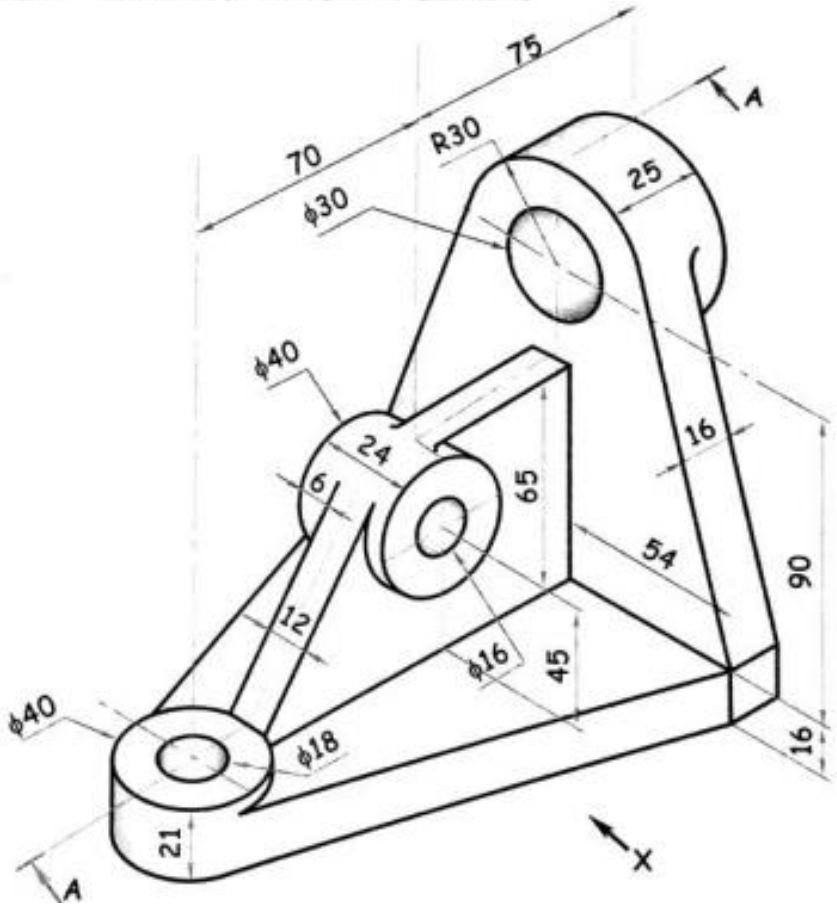


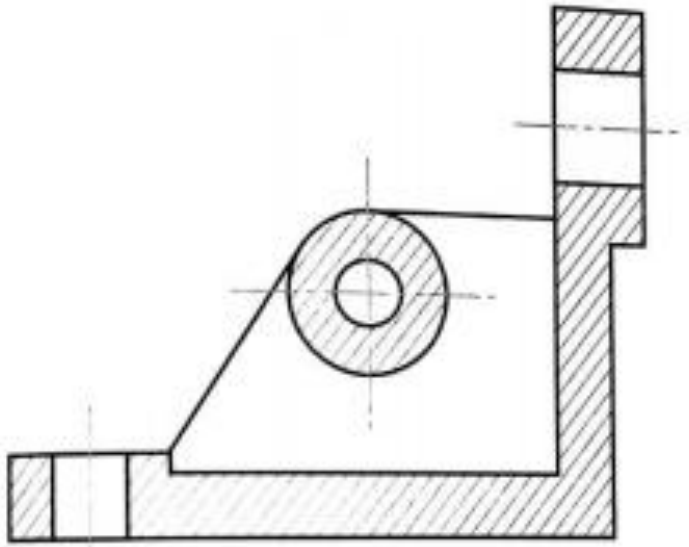
PICTORIAL VIEW



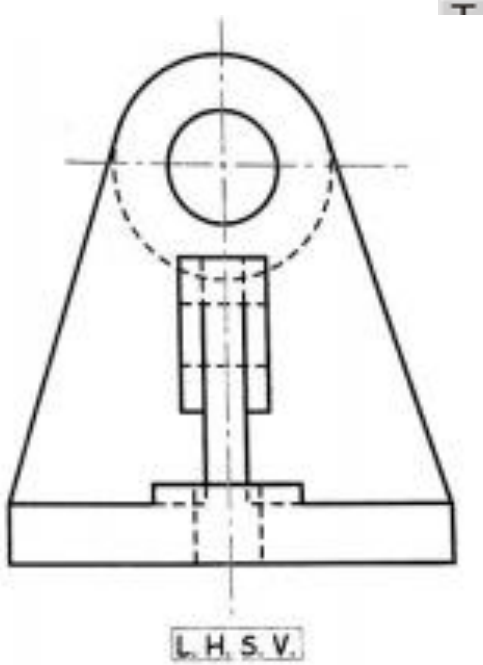
PICTORIAL VIEW WITH SECTION


ϕ50
ϕ25
35
15
10
ELEVATION
ϕ50
ϕ25
35
15
10
SECTIONAL ELEVATION
90
12
75
72
END VIEW
ϕ45
R20
A
ϕ20
ϕ20
B
55
72

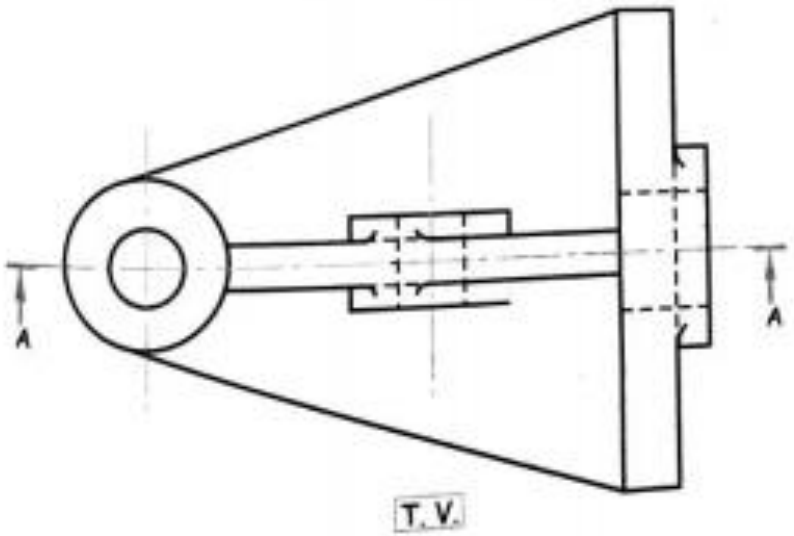




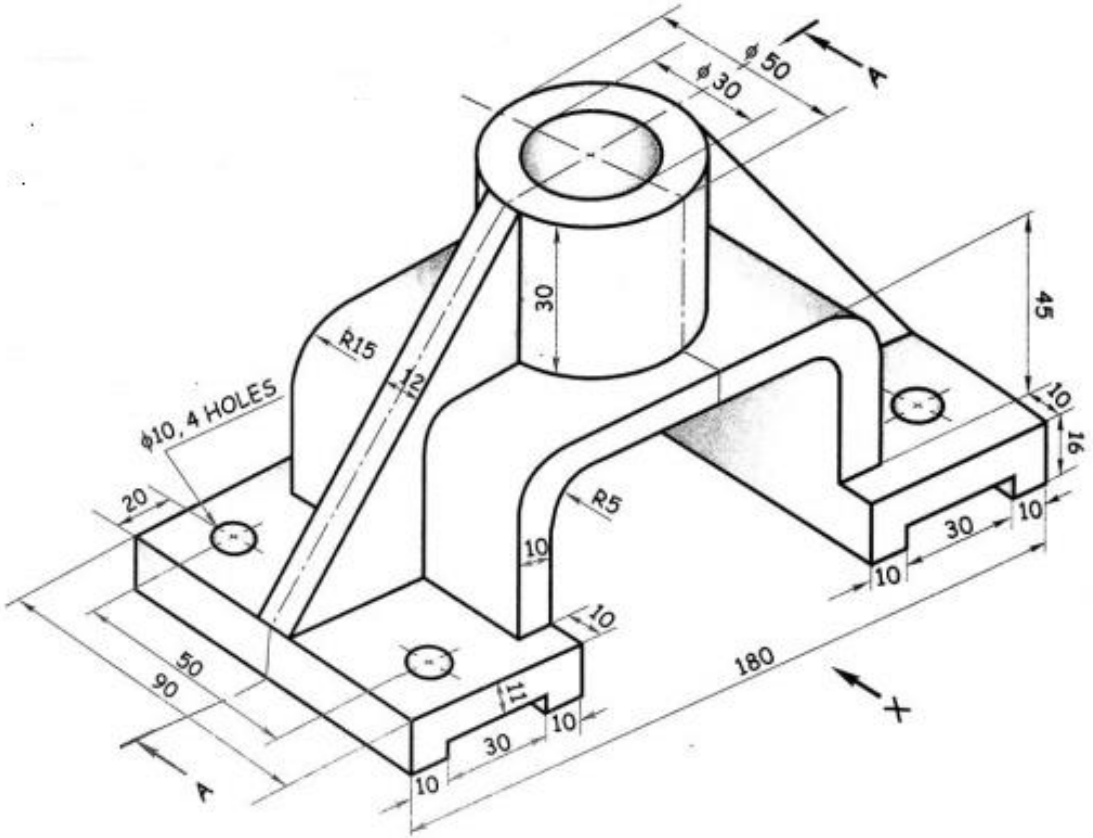
SECTIONAL F. V.

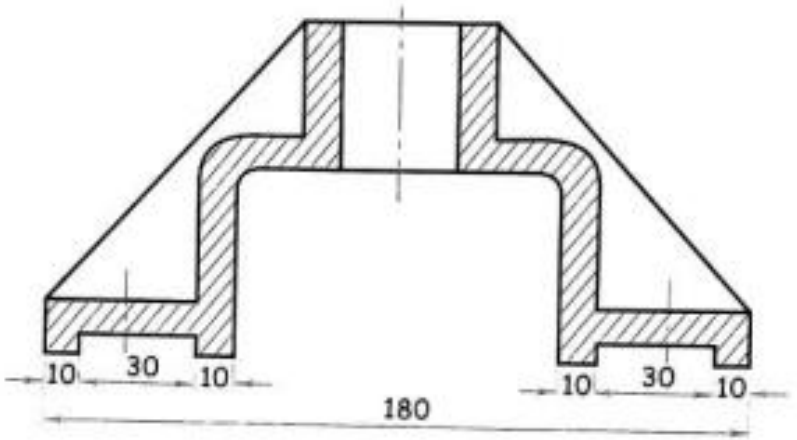


L. H. S. V.

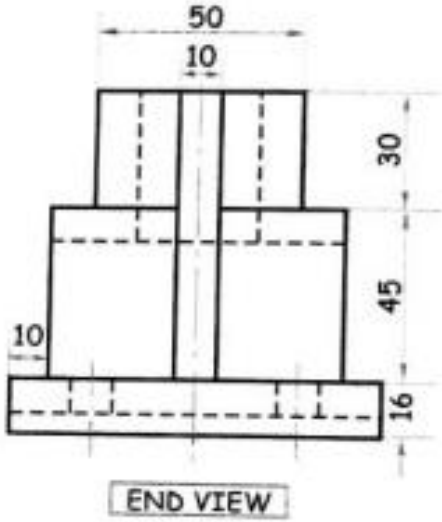


T. V.

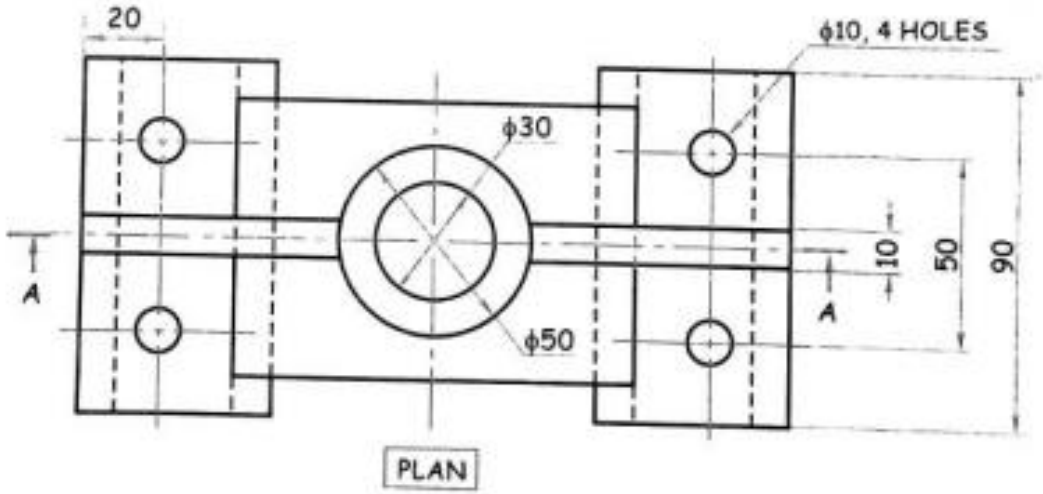




SECTIONAL ELEVATION



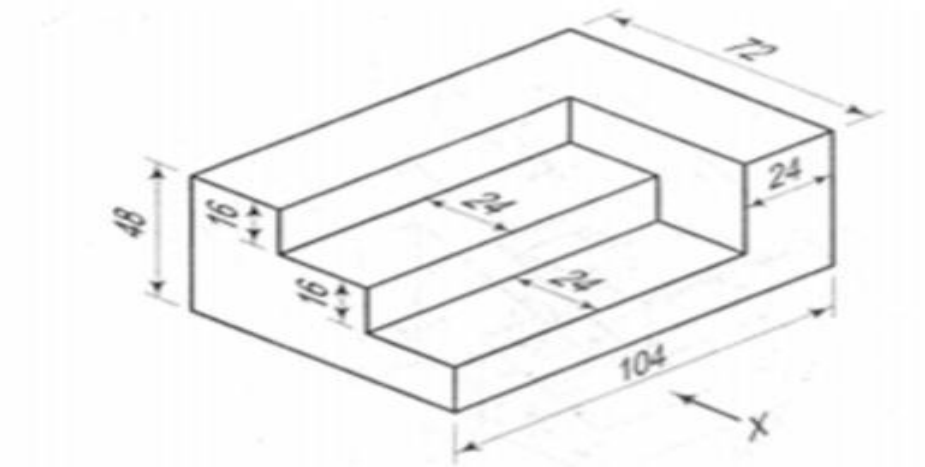
END VIEW



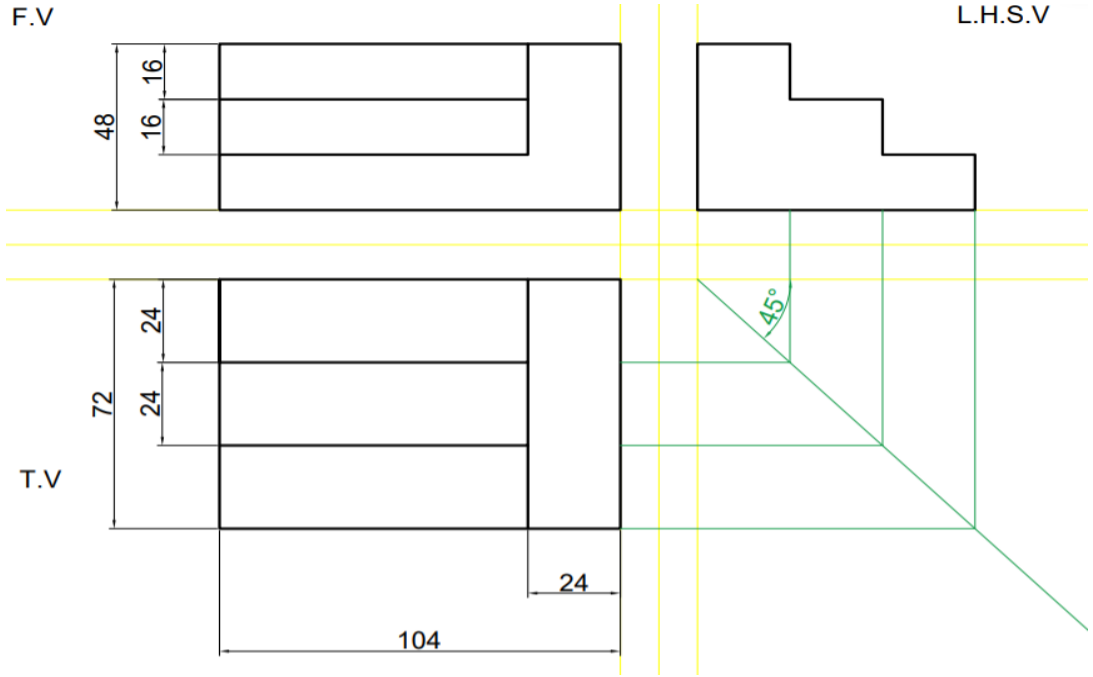
PLAN

Practice Problem 1

Figure below show pictorial views. Draw the T.V, F.V and LHSV views using first angle method of projections.

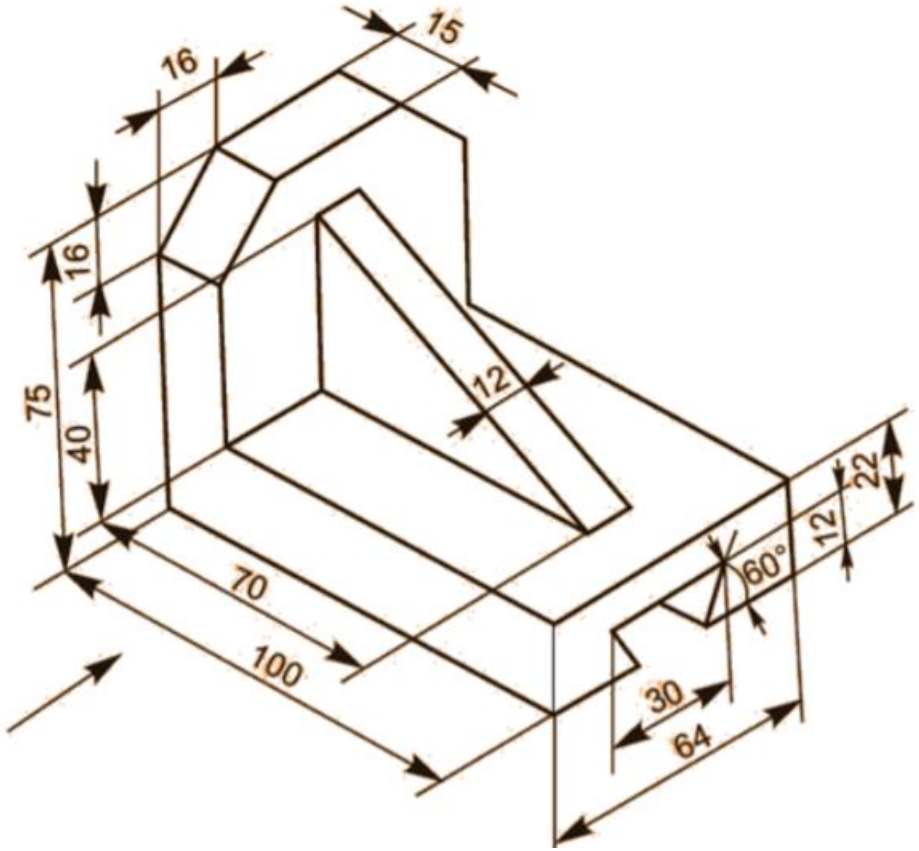


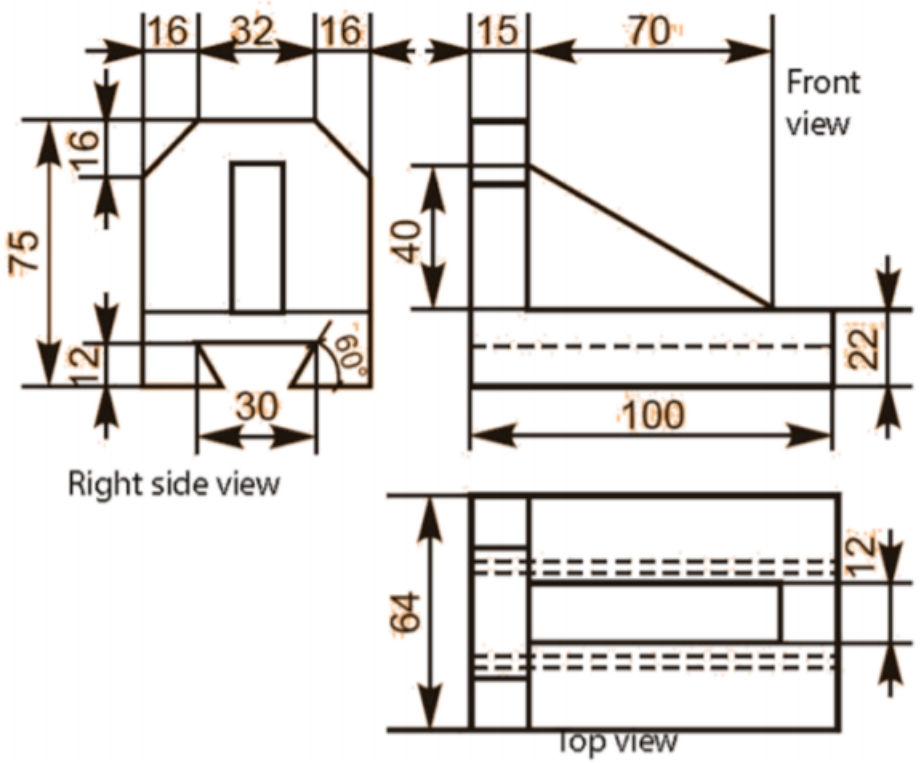
Draw: (i) F.V.
(ii) T.V.
(iii) L.H.S.V.



Practice Problem 2

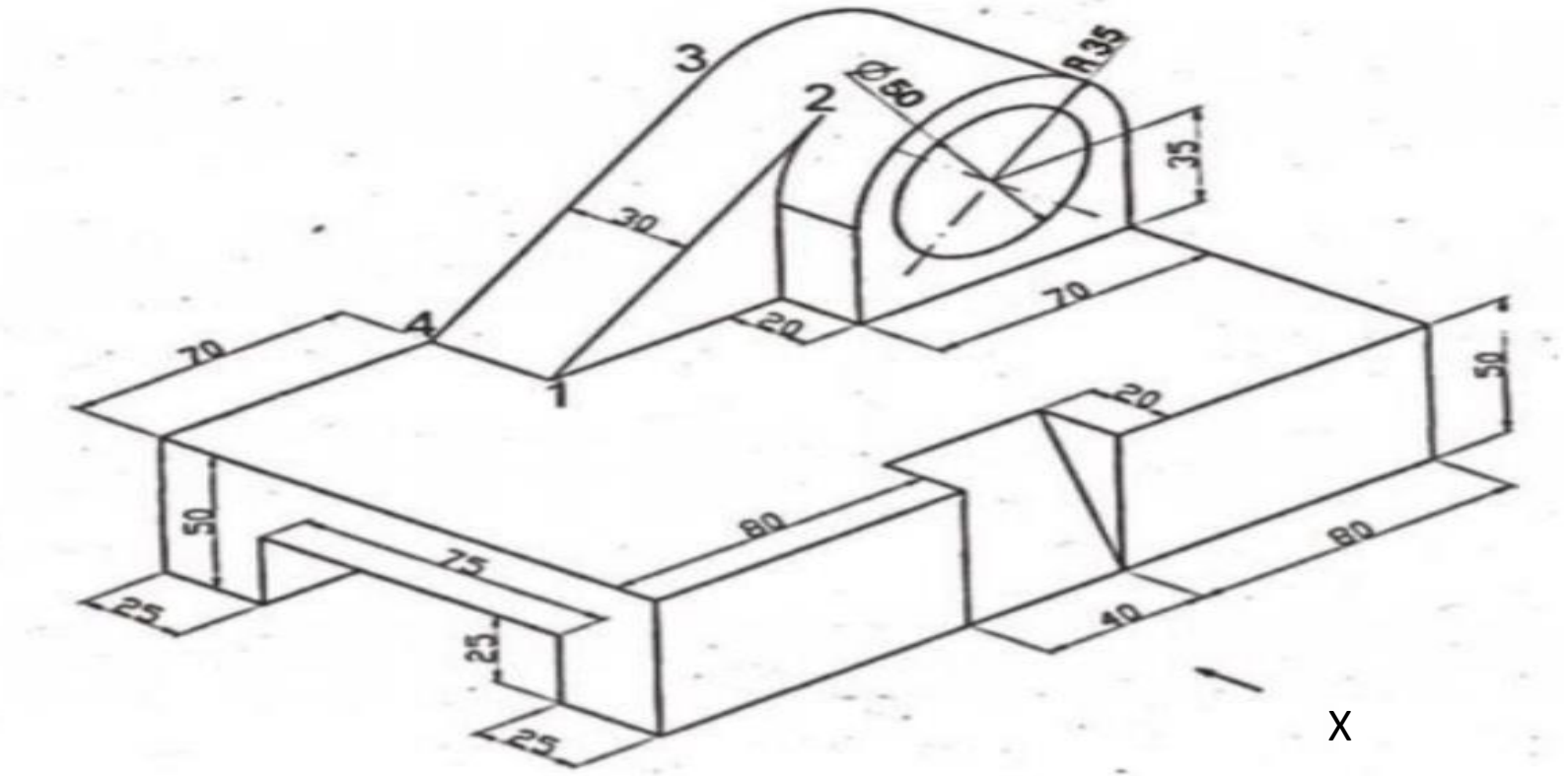
Figure below show pictorial views. Draw the T.V, F.V and RHSV views using first angle method of projections.



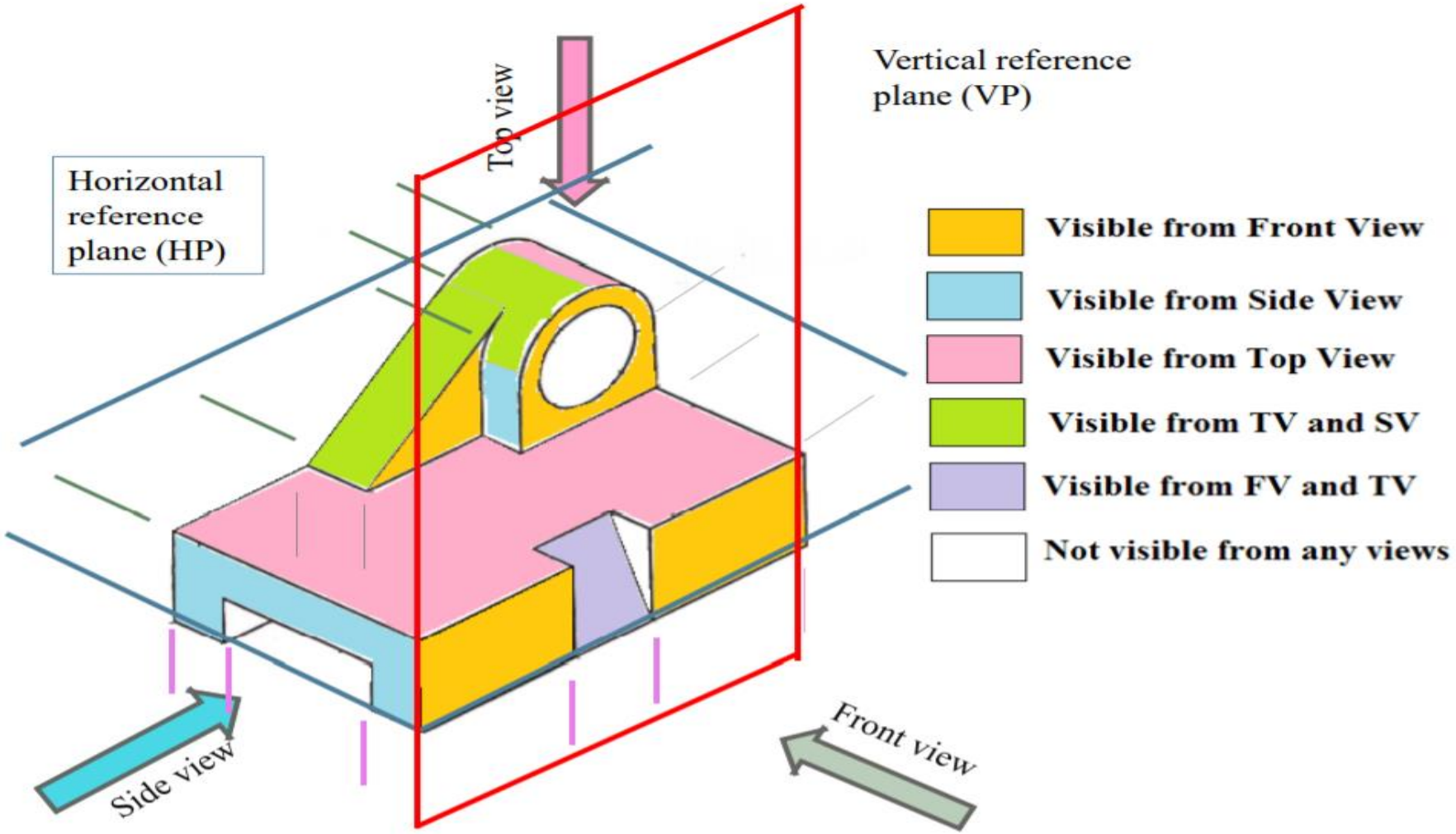


Practice Problem 3

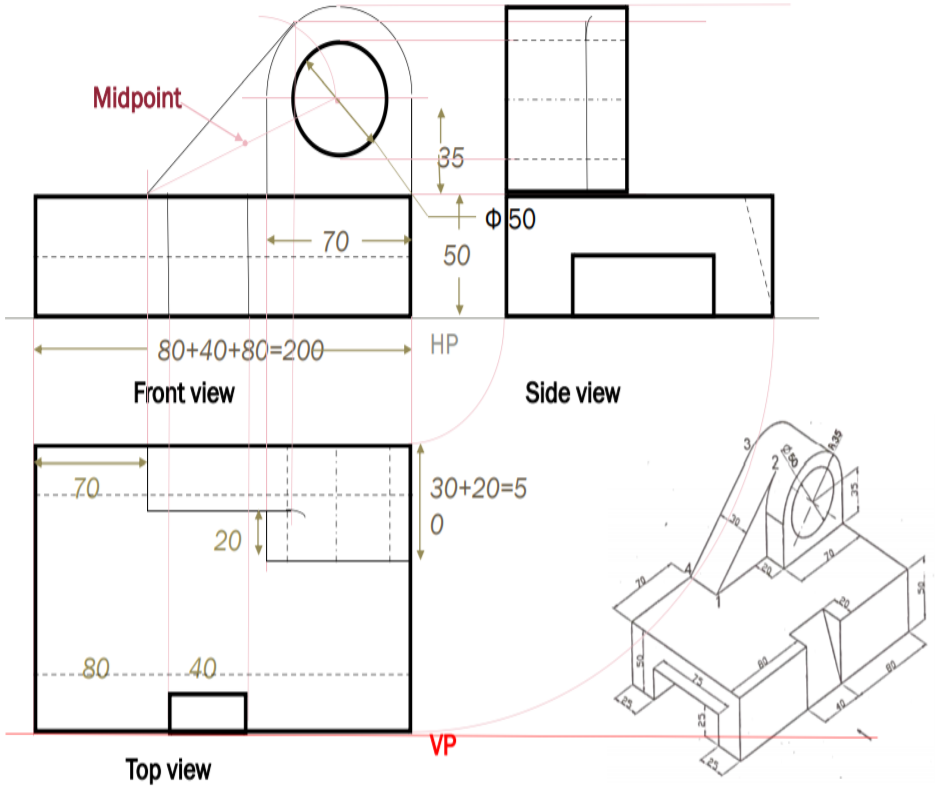
Figure below show pictorial views. Draw the T.V, F.V and LHSV views using first angle method of projections.

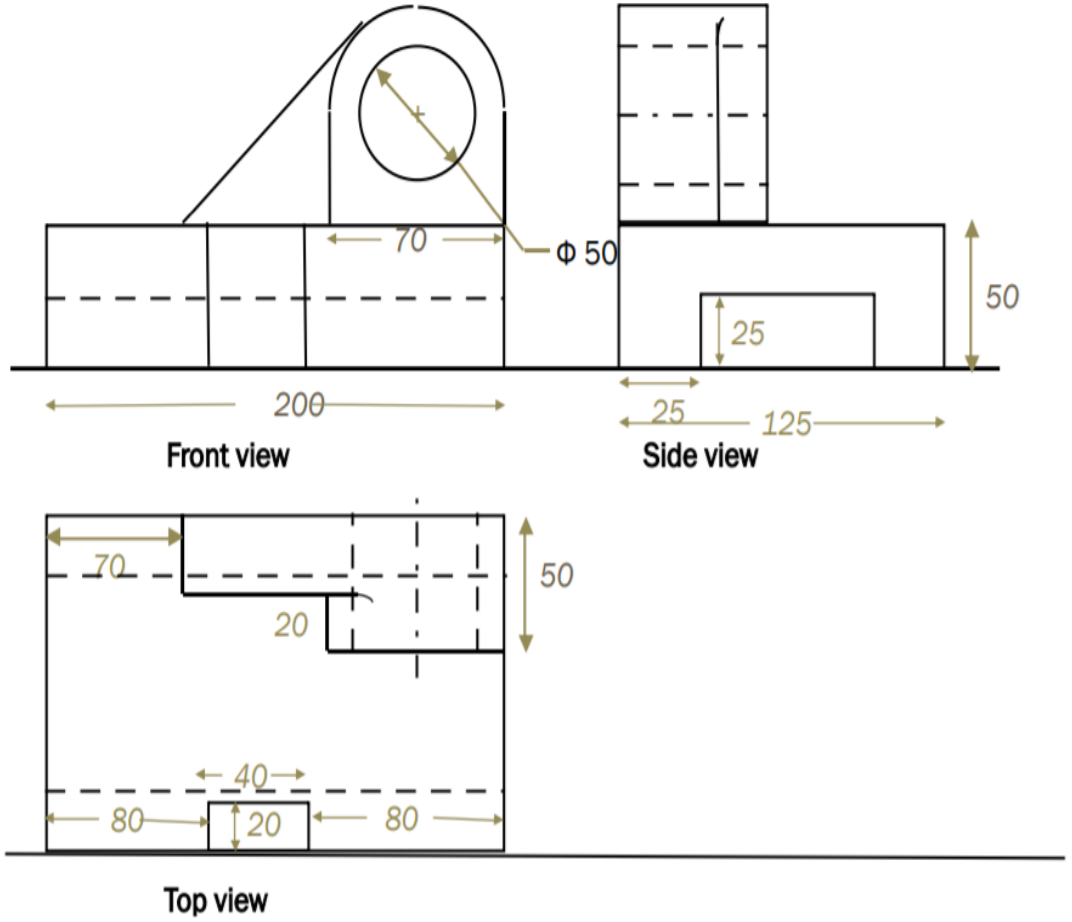


Practice Problem 3



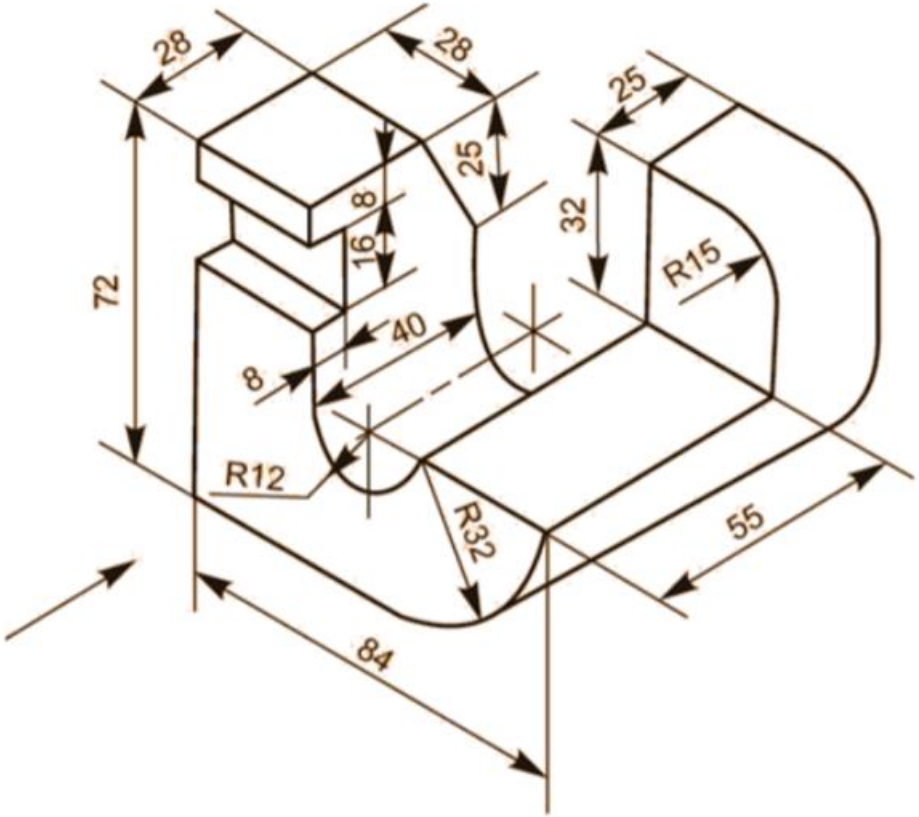
Practice Problem 3 - solution

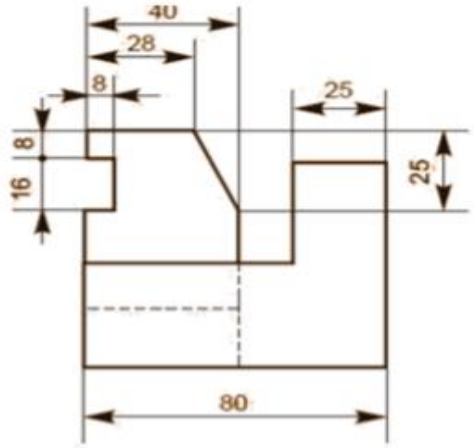




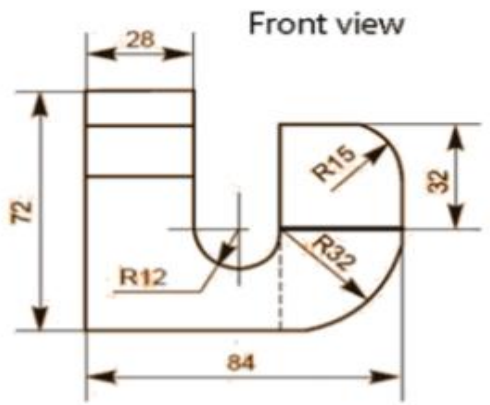
Practice Problem 4

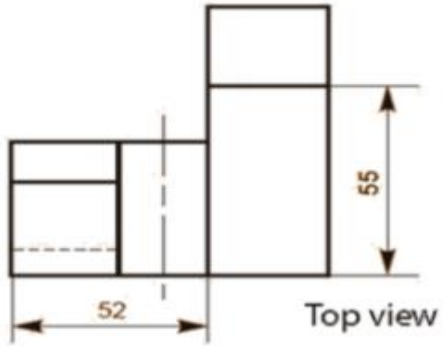
Figure below show pictorial views. Draw the T.V, F.V and RHSV views using first angle method of projections.





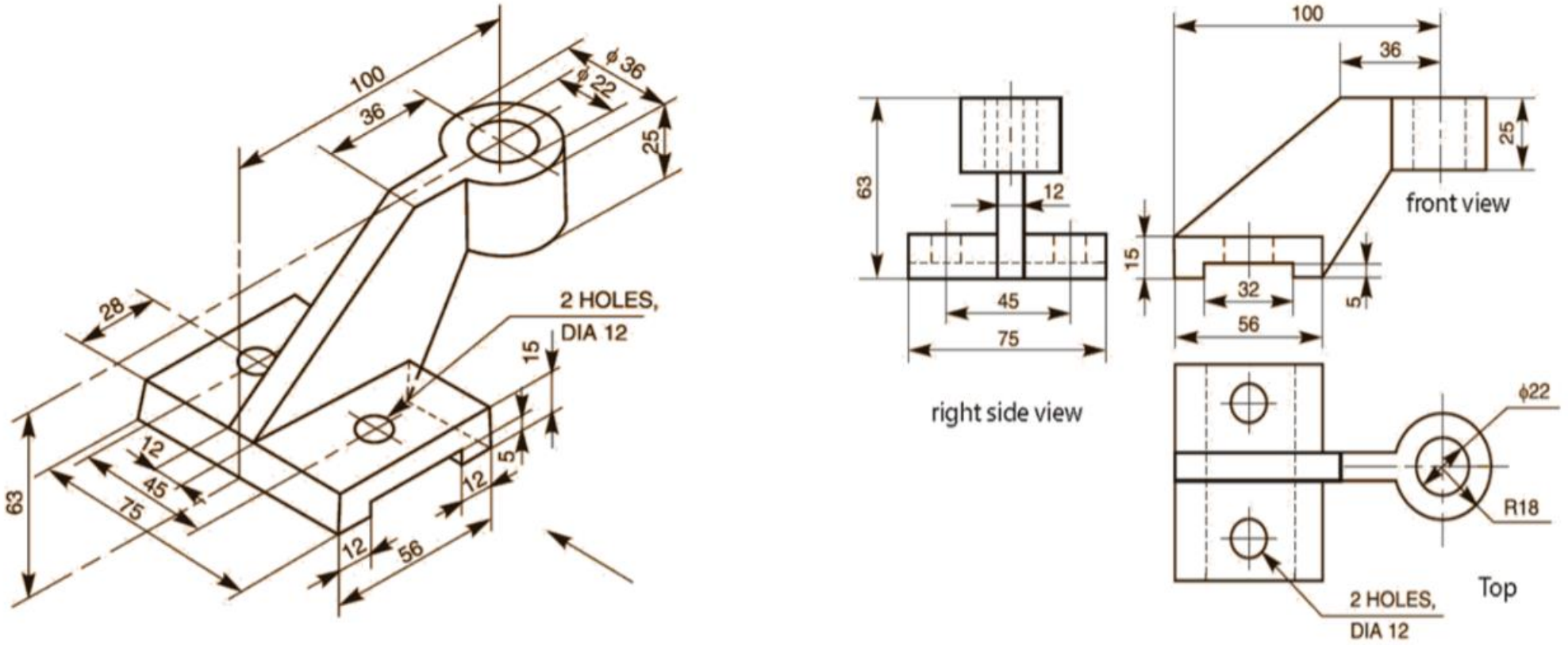
right side view





Practice Problem 5

Figure below show pictorial views. Draw the T.V, F.V and RHSV views using first angle method of projections.



Practice Problem 6

Figure below show pictorial views. Draw the T.V, F.V and LHSV views using first angle method of projections.