Computer Aided Machine Drawing

2- Orthographic Projections

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Introduction

- The purpose of drawing is to define an object for its shape and size.
- All objects that are seen by us are 3-dimensional known as pictorial views
- To visualize a 3D object in a better way on a 2D sheet, various projection methods have been developed.
- When a 3D object is drawn on a 2D sheet using multi-views, this system is called as orthographic projection and the views are called Orthographic views or multi-view drawing.

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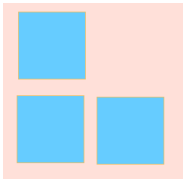
Introduction

- Orthographic drawing can be define as the drawing of 3D object in 2D and the drawing are made in views like front, side and top.
- Pictorial drawing would be purely an illustration of how the object looks.



Multi-view drawing

Pictorial drawing

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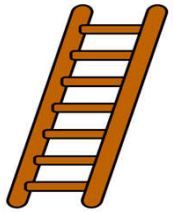
Features of Pictorial Projection

- We easily get the idea of actual shape of an object.
- But this method cannot be universally adopted, mainly because all objects except simplest one cannot be drawn easily and rapidly.
- Other drawbacks of pictorial projection are all the lines cannot be measured from pictorial views and objects are liable to appear distorted.



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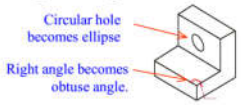
Comparison of Multi-view and Pictorial drawing

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 

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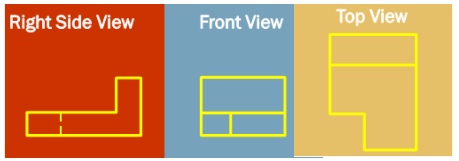
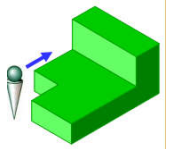
Features of Orthographic Projection

- In machine drawing, orthographic projection is universally used.
- The only disadvantage of this method is that shape cannot be easily interpreted by an untrained eye.
- It requires thorough understanding of the principles of projection and a great practice to read orthographic views.





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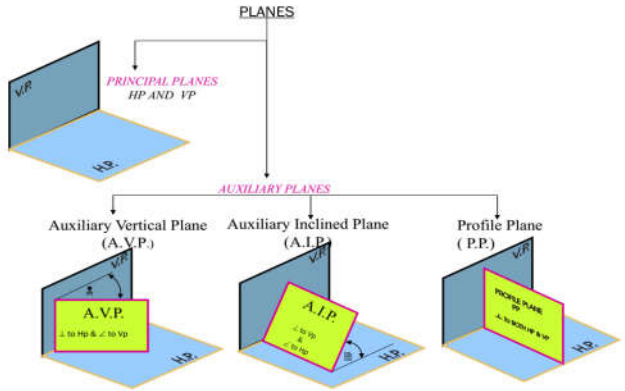
Projection Planes



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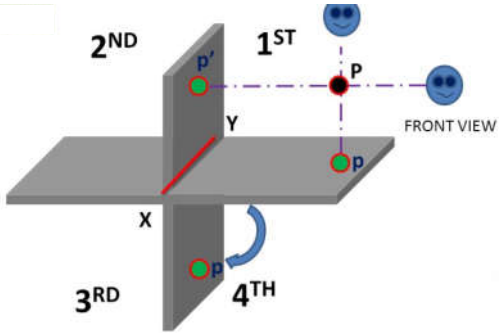
Four Quadrants



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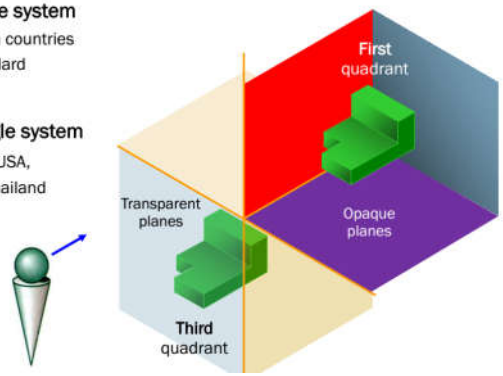
Angle of Projection

1. First angle system
   - European countries
   - ISO standard
2. Third angle system
   - Canada, USA, Japan, Thailand

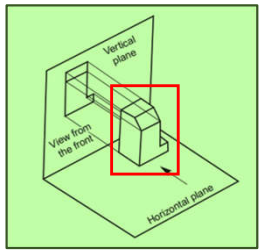


First Angle Projection Method

- In first angle projection, the object is imagined to be positioned in the first quadrant.
- The view from the front of the object is obtained by looking at the object from the right side of the quadrant.
- The object is between the observer and the plane of projection (vertical plane). Here, the object is imagined to be transparent and the projection lines are extended from various points of the object to intersect the projection plane.
- Hence, in first angle projection, any view is so placed that it represents the side of the object away from it.

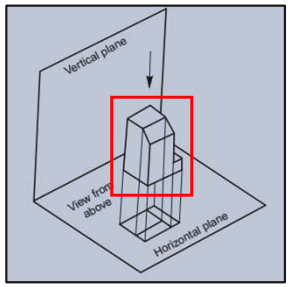
First Angle Projection Method – View from front

- The view from the front of an object is defined as the view that is obtained as projection on the vertical plane by looking at the object normal to its front surface.
- It is the usual practice to position the object such that its view from the front reveals most of the important features.



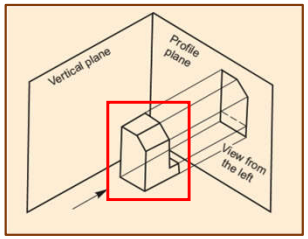
First Angle Projection Method – View from above

- The view from above of an object is defined as the view that is obtained as projection on the horizontal plane, by looking the object normal to its top surface.

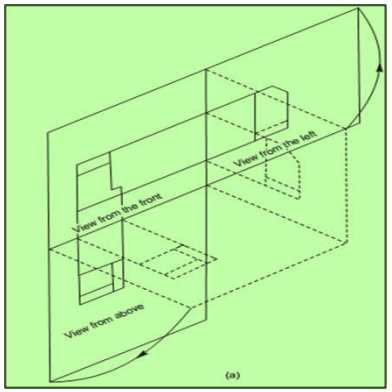


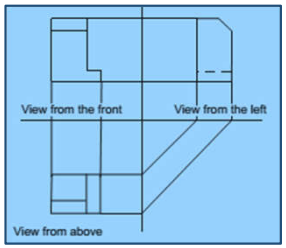
First Angle Projection Method – View from side

- The view from the side of an object is defined as the view that is obtained as projection on the profile plane by looking the object, normal to its side surface.
- As there are two sides for an object, viz., left side and right side, two possible views from the side, viz., view from the left and view from the right may be obtained for any object.



First Angle Projection Method – Presentation of Views

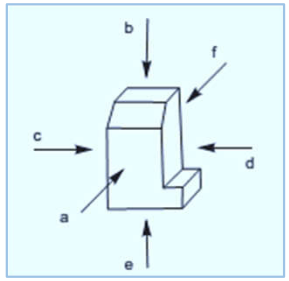




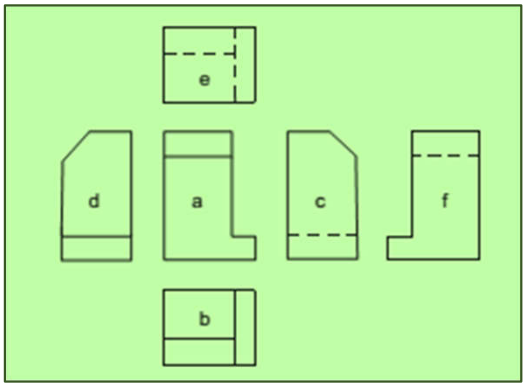
Designation and relative position of views in First angle

- An object positioned in space may be imagined as surrounded by six mutually perpendicular planes.
- So, for any object, six different views may be obtained by viewing at it along the six directions, normal to these planes.

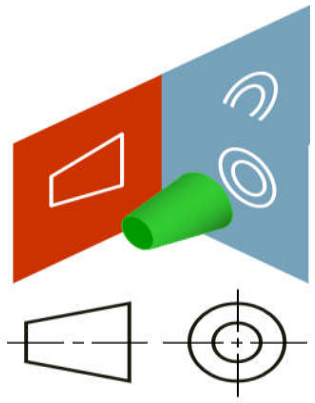
1. View in the direction a = view from the front
2. View in the direction b = view from above
3. View in the direction c = view from the left
4. View in the direction d = view from the right
5. View in the direction e = view from below
6. View in the direction f = view from the rear



Designation and relative position of views in First angle



First Angle Projection – Conventional Representation



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Third Angle Projection Method

- In third angle projection, the object is imagined to be positioned in the third quadrant.
- The plane of projection (vertical plane) is between the observer and the object.
- The planes are assumed to be transparent.
- Hence, in third angle projection, any view is so placed that it represents the side of the object towards the observer.
- We get a more natural arrangement of views. For example: plan comes on the top of the elevation and the side views also come on the same side from which they are viewed.

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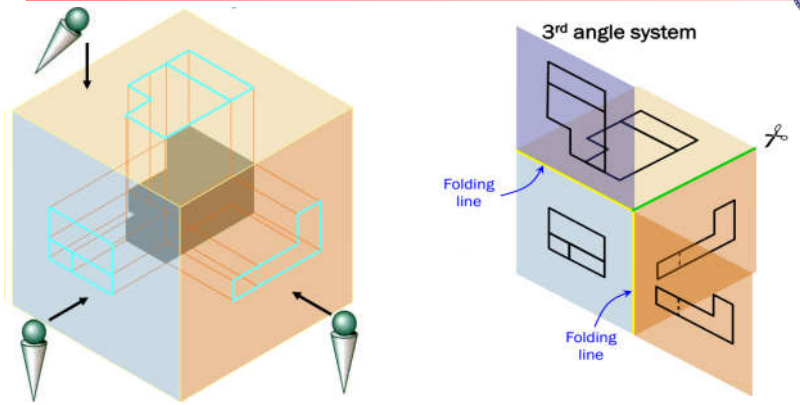
Third Angle Projection Method



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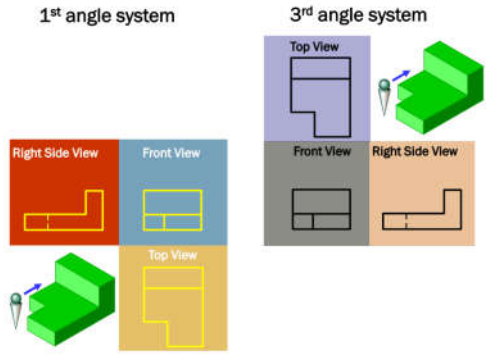
Comparison of First and Third Angle Projection method



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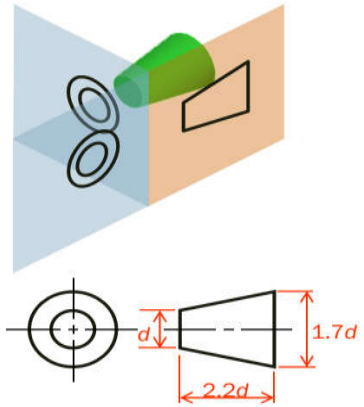
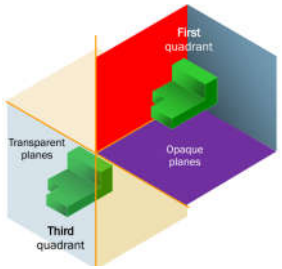
Third Angle Projection – Conventional Representation



Second and Fourth angle projection

- It is assumed that horizontal plane (H.P.) is hinged to vertical plane (V.P.) and the H.P. is revolved to bring it in the same plane as V.P.
- If the second and fourth angle projection is adopted, the plan (top view) and elevation (front view) may overlap and hence they are not used.



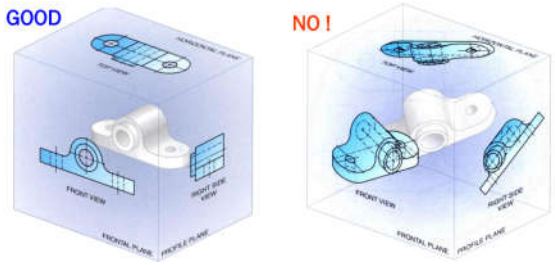
Orthographic Projections

View selection has 3 steps

Orient the object → Select front view → Select adjacent views

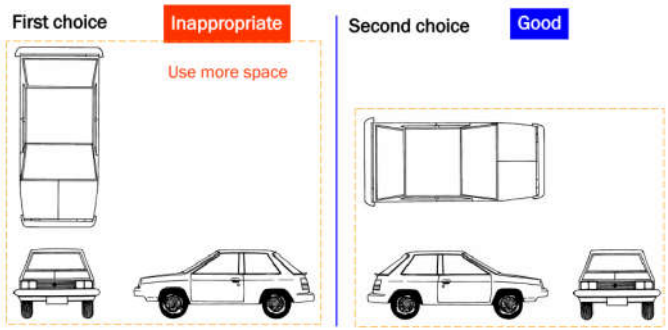
Orthographic Projections – Orientation of Object

- The object should be placed in its natural position.
- The orthographic views should represent the true size and true shape of an object (as much as possible).



Orthographic Projections – Selection of front view

1. The longest dimension of an object should be presented as a width (in a front view).



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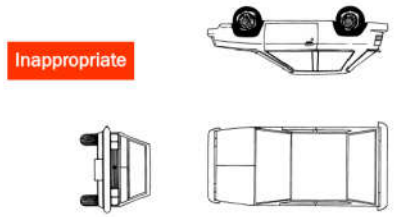
Orthographic Projections – Selection of front view

2. The adjacent views project from the selected front view should be appeared in a natural position.



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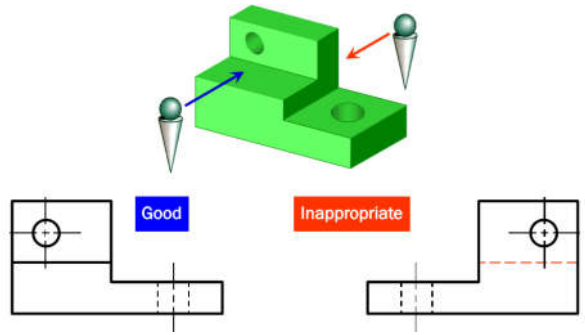
Orthographic Projections – Selection of front view

3. It has the fewest number of hidden lines.



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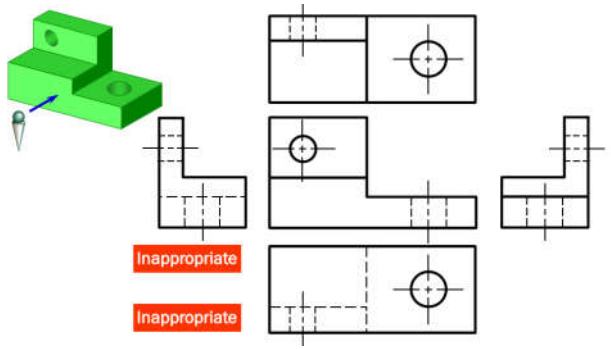
Orthographic Projections – Selection of adjacent view

1. Choose the view that has the fewest number of hidden lines.



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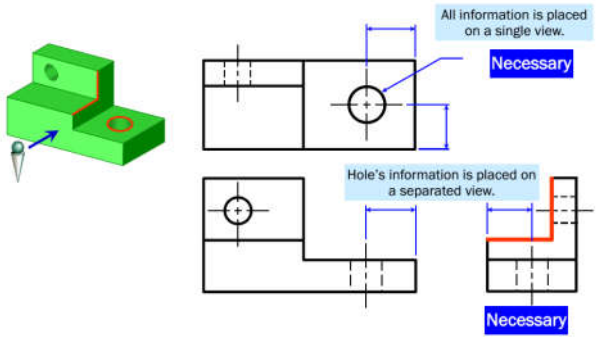
Orthographic Projections – Selection of adjacent view

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



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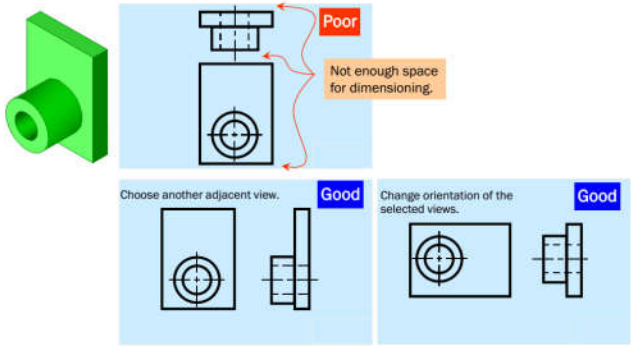
Orthographic Projections – Selection of adjacent view

3. Choose the views that are suitable to a drawing sheet.



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Orthographic Projections – Selection of views

- For describing any object completely through its orthographic projections, it is important to select a number of views.
- The number of views required to describe any object will depend upon the extent of complexity involved in it.
- The higher the symmetry, the lesser the number of views required.

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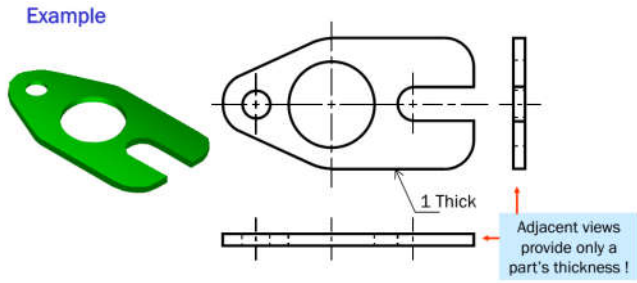
Object that requires only one-view

- Flat (thin) part having a uniform thickness such as a gasket, sheet metal etc.



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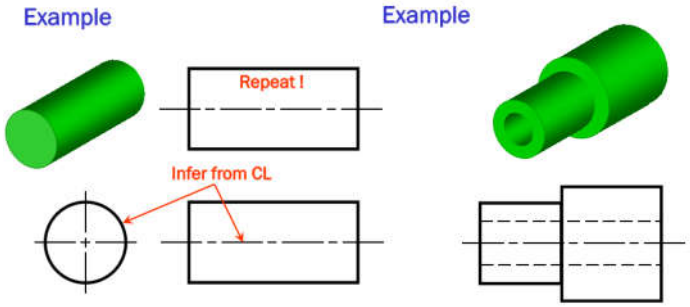
Object that requires only one-view

- Cylindrical-shaped part.



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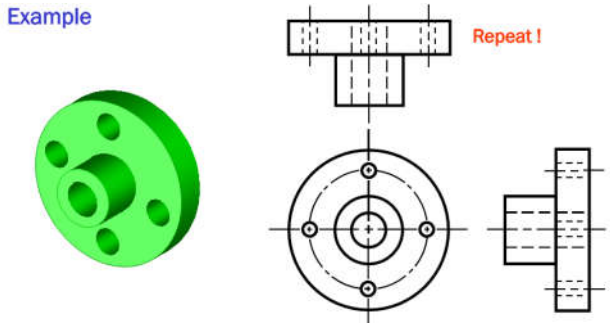
Object that requires two views

- Identical adjacent view exists



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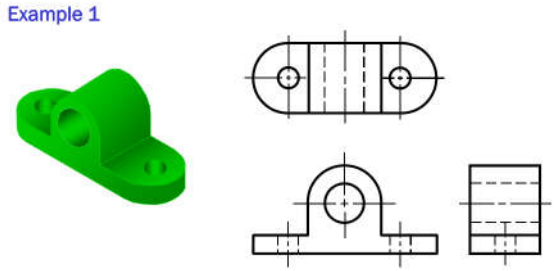
Object that requires two views

- The 3rd view has no significant contours of the object. (provides no additional information)



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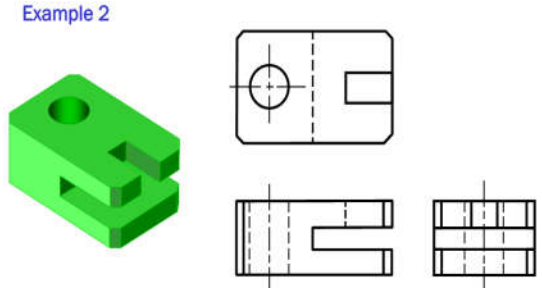
Object that requires two views

- The 3rd view has no significant contours of the object. (provides no additional information)



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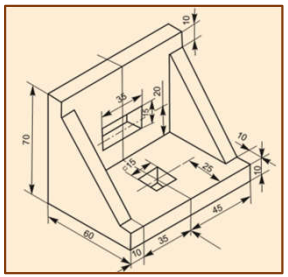
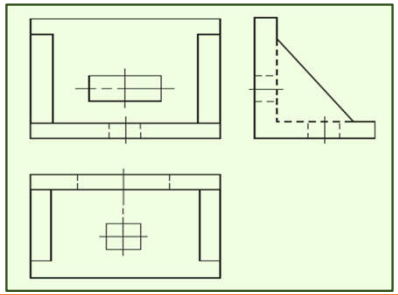
Object that requires three views

- In general, most of the objects consisting of either a single component or an assembly of a number of components, are described with the help of three views.
- In such cases, the views normally selected are the views from the front, above and left or right side.





Position of the Object

- It is important to understand the significance of the position of the object relative to the planes of projection.
- To get useful information about the object in the orthographic projections, the object may be imagined to be positioned properly because of the following facts :

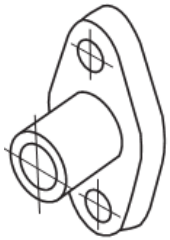
1. Any line on an object will show its true length, only when it is parallel to the plane of projection.

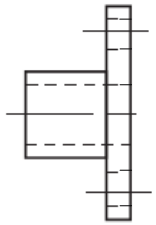
2. Any surface of an object will appear in its true shape, only when it is parallel to the plane of projection.

In the light of the above, it is necessary that the object is imagined to be positioned such that its principal surfaces are parallel to the planes of projection

Orthographic Projections – Hidden lines

- While obtaining the projection of an object on to any principal plane of projection, certain features of the object may not be visible.
- The invisible or hidden features are represented by short dashes of medium thickness.

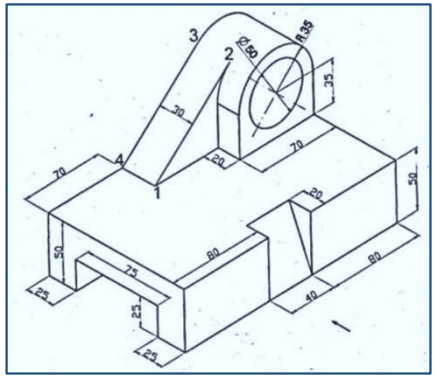




Steps for Drawing Orthographic Projections

- Identify surfaces perpendicular or inclined to the view
- Surfaces parallel to the view would not be visible in that view.
- First draw horizontal and vertical reference planes (easily identifiable on drawing)
- Start drawing from the reference planes.

Orthographic Projections -Example 1



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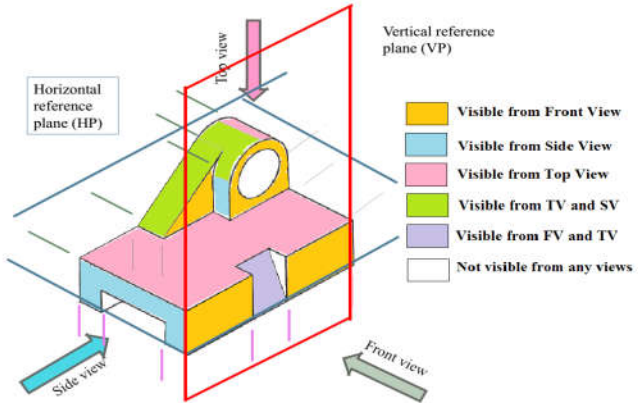
Orthographic Projections -Example 1



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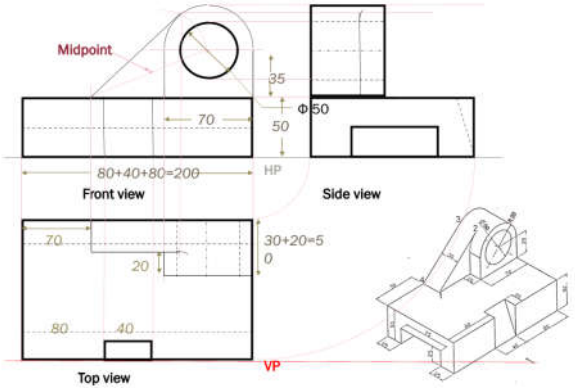
Orthographic Projections -Example 1



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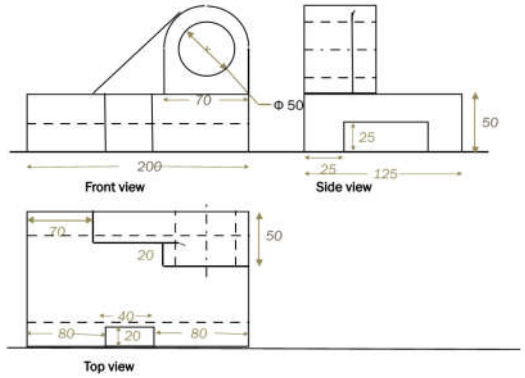
Orthographic Projections -Example 1



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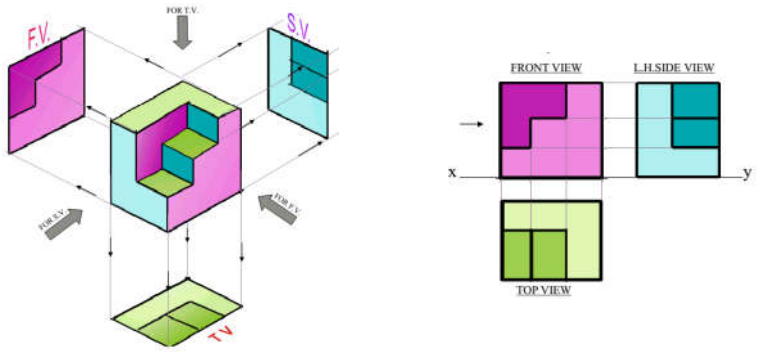
Orthographic Projections -Example 2



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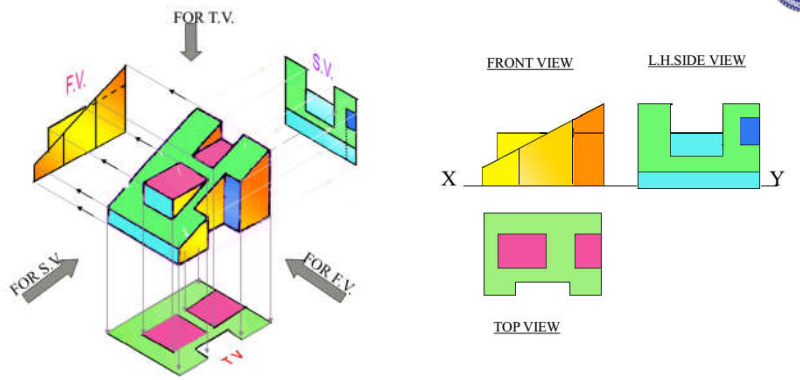
Orthographic Projections -Example 3



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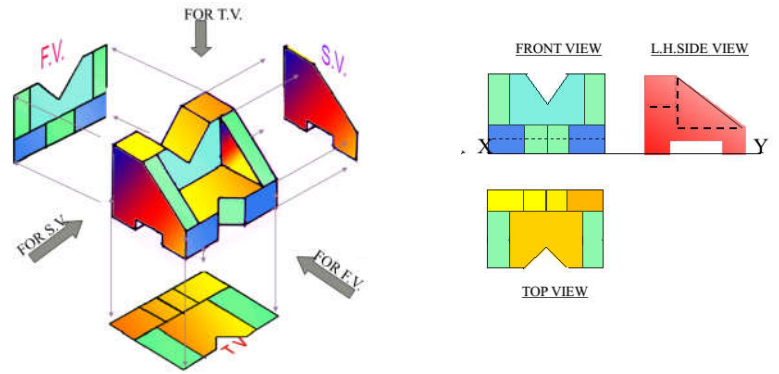
Orthographic Projections -Example 4



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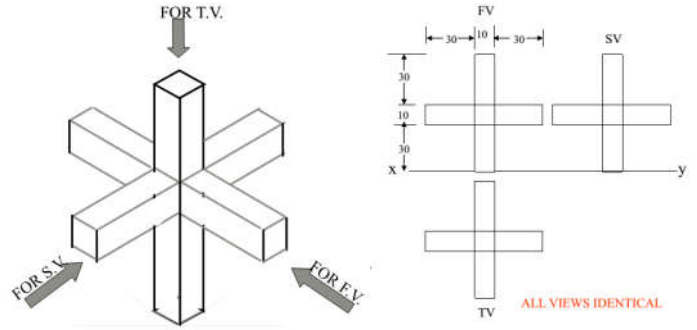
Orthographic Projections -Example 5



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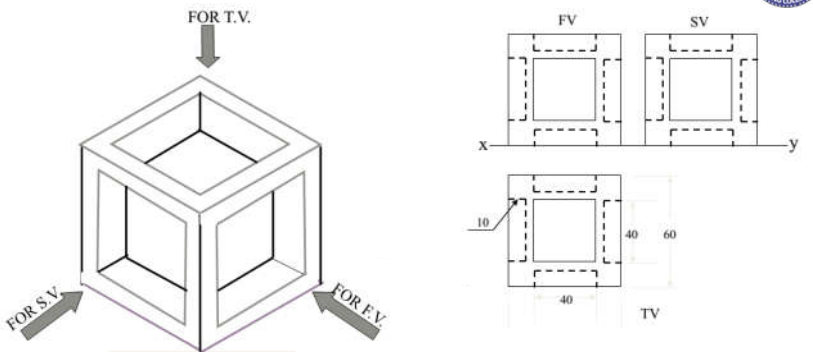
Orthographic Projections -Example 6



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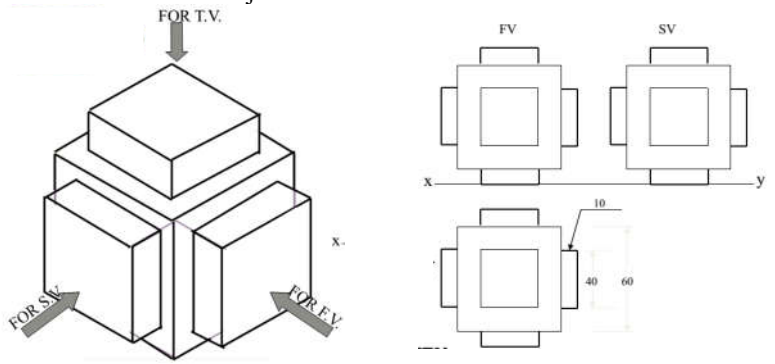
Orthographic Projections -Exercise 1

1. Draw three views of the object shown below:



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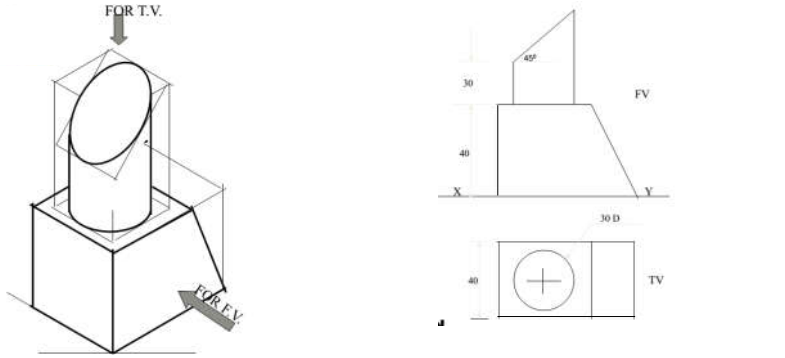
Orthographic Projections -Exercise 2

1. Draw front and top view of the object shown below:



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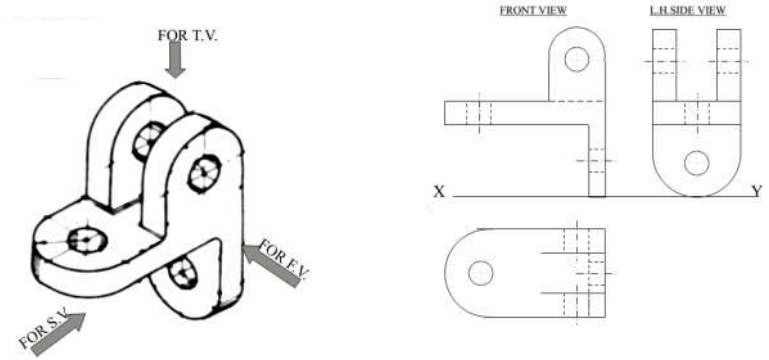
Orthographic Projections -Exercise 3

1. Draw three views of the object shown below:



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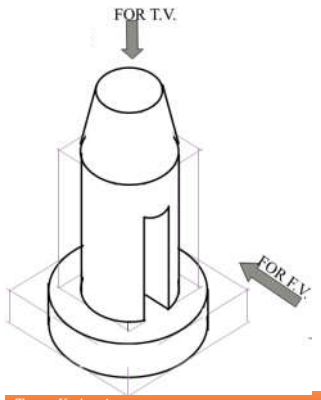
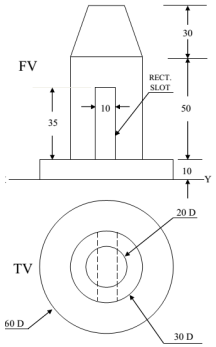
Orthographic Projections -Exercise 4





Thanks for your kind attention