Principle of Projection

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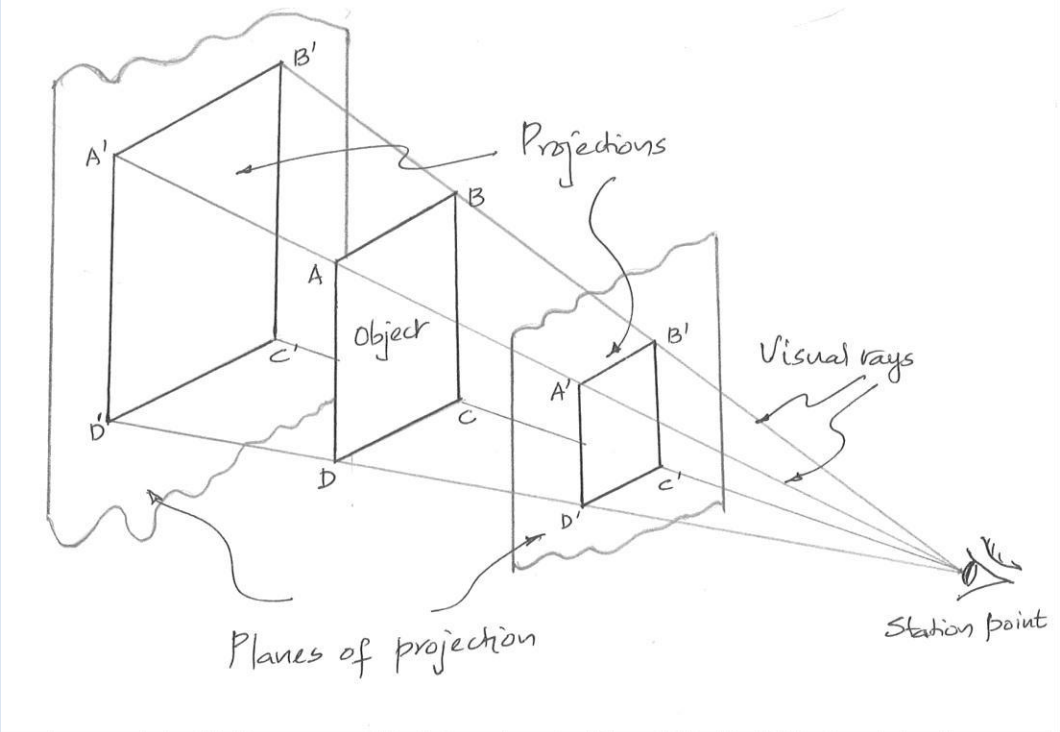
Projection

Projection is defined as a geometrically represented image of an object obtained on a surface or plane.

Perspective Projection

Perspective projection represents objects as perceived by the human eye. It is a pictorial drawing by the intersection of observer's visual rays converging on a plane. The observer's eye - station point or point of sight - is located at a finite distance from the picture plane. Depending on the position of the picture plane, the size of the projection may vary.



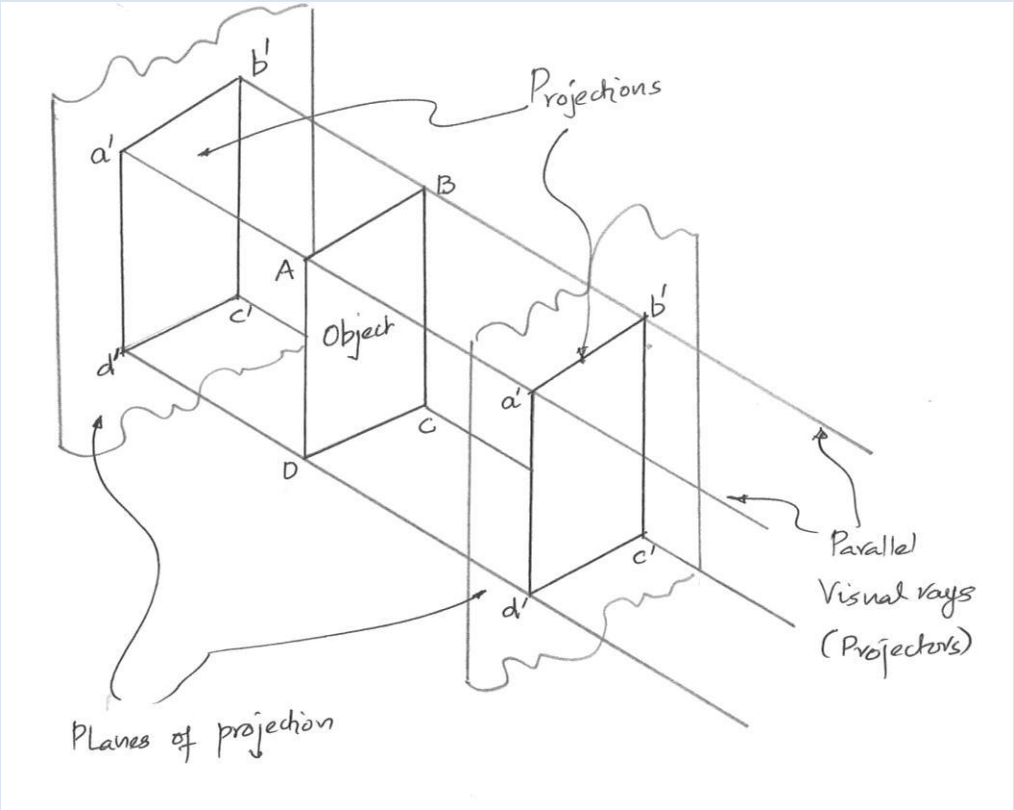
Principle of Perspective Projection

Parallel Projection

Parallel projection is obtained by assuming the observer at infinite distance from the

object. Hence, the visual rays are considered as parallel to one another. These rays or lines of sight are used to project the object on a standard plane.

The object is projected to a plane by drawing straight lines from each and every point on the object. These lines used for projecting the object are ‘projectors’. The plane to which the object is projected is the ‘plane of projection’. All projectors are parallel to one another and perpendicular to the plane of projection. The image or view obtained on the plane is the ‘projection’.



Parallel Projection

Orthographic Projections

In orthographic projection the visual rays are parallel to one another and at right angle to the planes of projection.

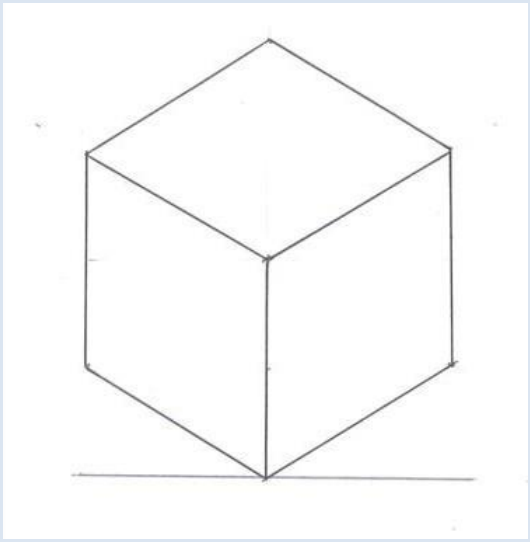
Pictorial Projections

A pictorial projection is a single view representation, giving 3D idea of the object.

1. Isometric projection
2. Perspective projection
3. Oblique projection

Isometric Projection

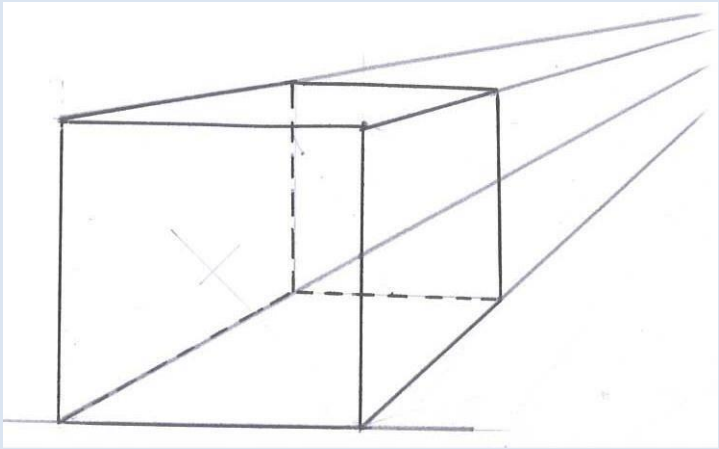
Isometric projection is a technique where three-dimensional objects are represented in two dimensional drawings. In isometric projection, the three coordinate axes appear equally shortened and the angle between any two of them is 120 degrees.



Isometric projection of a cube

Perspective Projection

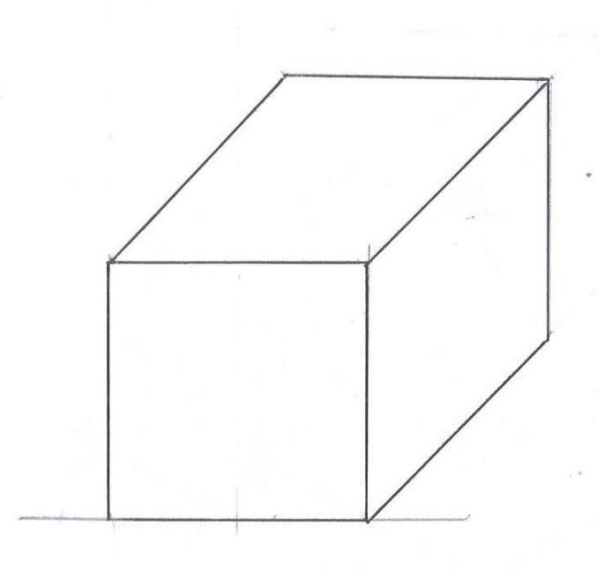
Perspective projection represents objects as perceived by the human eye.



Perspective projection of a cube

Oblique Projection

Oblique projection is a method to represent 3D objects in 2D drawings in which the projection lines are drawn at 45°angle to the horizontal.



Oblique projection of cube

Orthographic Projections

Orthographic Projections

In orthographic projection, an object is represented by projecting its views on imaginary orthogonal planes. Any object, irrespective to the dimensions, (1D, 2D or 3D objects) is converted to 2D drawings or projections.

Reference planes

Principal planes - horizontal plane and vertical plane –are the main reference planes used in orthographic projections.

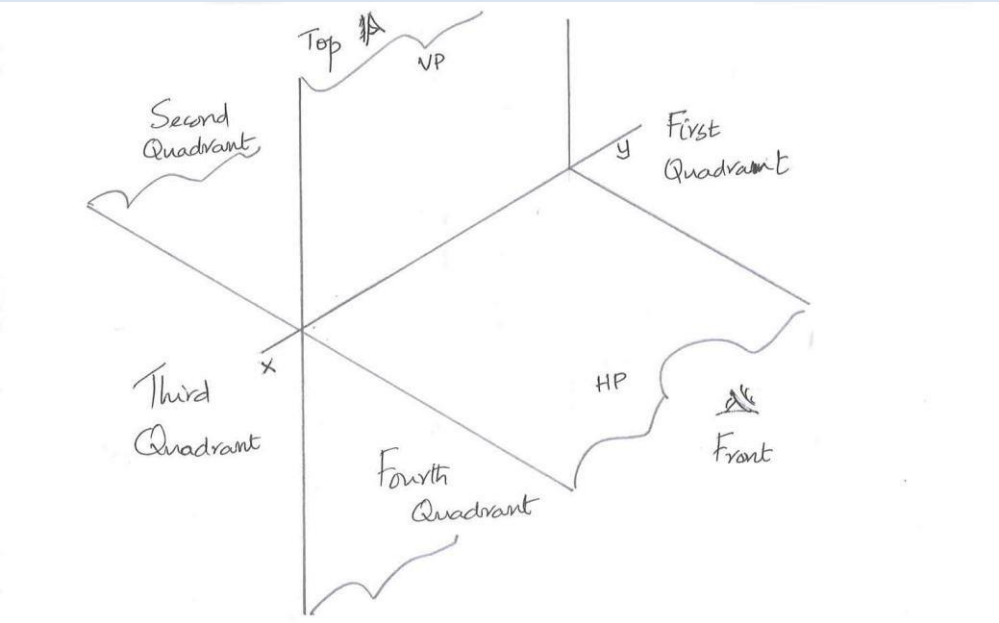
Profile plane, auxiliary vertical plane, and auxiliary inclined plane are also used as reference planes when two views of the object are not sufficient.

Principal Planes

Horizontal and Vertical planes are the principal planes used in orthographic Projections.

Horizontal Plane (HP)

A plane of reference which is assumed to be parallel to the plane along the horizon or a plane which is perpendicular to the gravity field at a place. In orthographic projection, there is only one horizontal plane.



Principal Planes and Quadrants

Vertical Plane (VP)

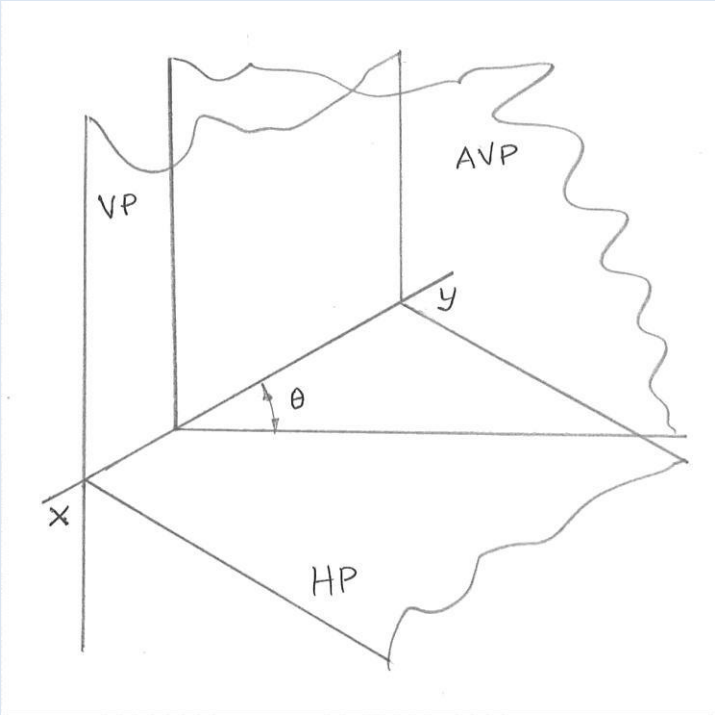
A reference plane which is assumed to be along or parallel to the gravity field. This

plane will be perpendicular to the horizontal plane.

Auxiliary Planes

Auxiliary Vertical Plane (AVP)

Planes perpendicular to HP but inclined to VP are AVPs. Projection on an AVP is called as auxiliary front view.



Auxiliary Vertical Plane

Auxiliary Inclined Plane (AIP)

Planes perpendicular to VP and inclined to HP are coming under this category. The projection on an AIP is auxiliary top view.

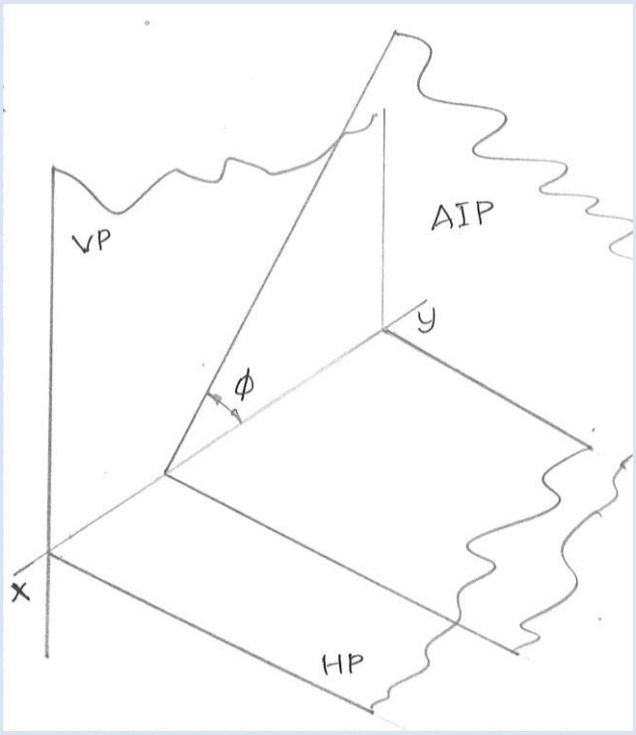
Profile planes (PP)

Planes perpendicular to both horizontal and vertical planes are profile planes. Projections on profile planes are known as side views.

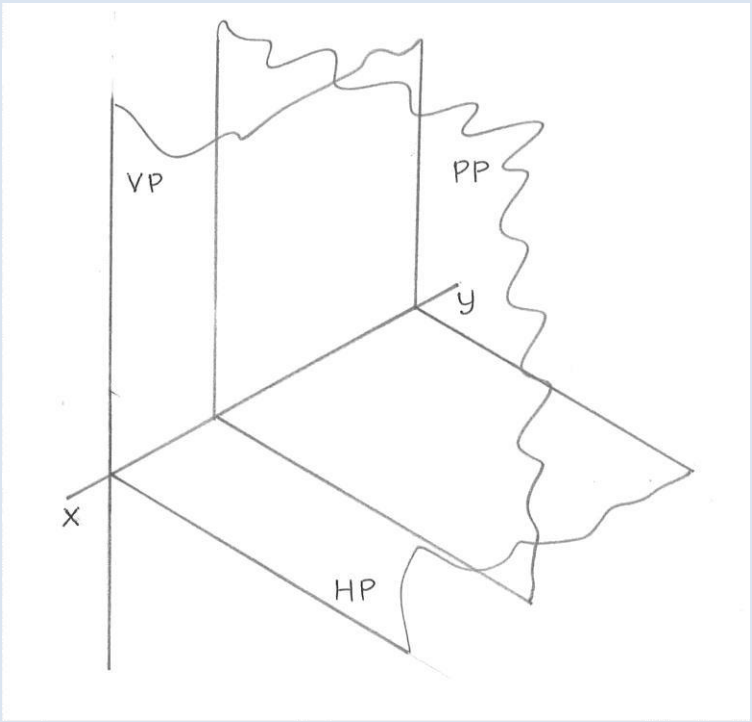
Main Reference Line, x-y

The line of intersection of Horizontal plane (HP) and Vertical plane (VP) is the main reference line, x-y

The lines of intersection of auxiliary planes with principal planes are auxiliary reference lines. While drawing auxiliary projections, auxiliary reference lines are used for representing projections.



Auxiliary Inclined Plane



Profile Plane

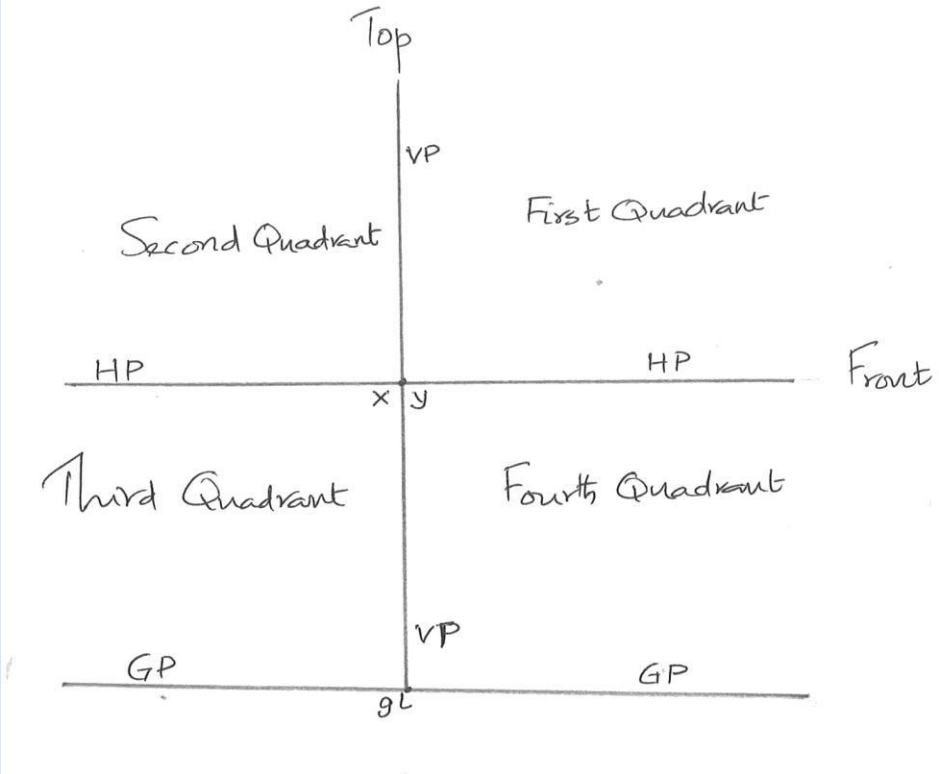
Ground Plane (GP) and Ground Line (*g-l*)

A plane parallel to HP, assumed to be attached at the bottom most edge of VP is ground plane.

The line of intersection of GP with VP is called as ground line (*g-l*).

Basic characteristics of planes of projection

- *Planes are assumed to have enormous area so that any object irrespective to the size can be projected to the plane.*
- *Planes do have negligible thickness, such that they appear as lines while observing along the plane.*
- *Planes are assumed to be transparent, so that irrespective to the quadrant where the object situates the observer can view it directly from both front and top.*
- *Planes are not rigidly attached to the other plane(s), such that one plane can be rotated about the line of intersection to make coinciding with the other.*



Principal Planes, Ground Plane and Quadrants viewing along x-y

Quadrants

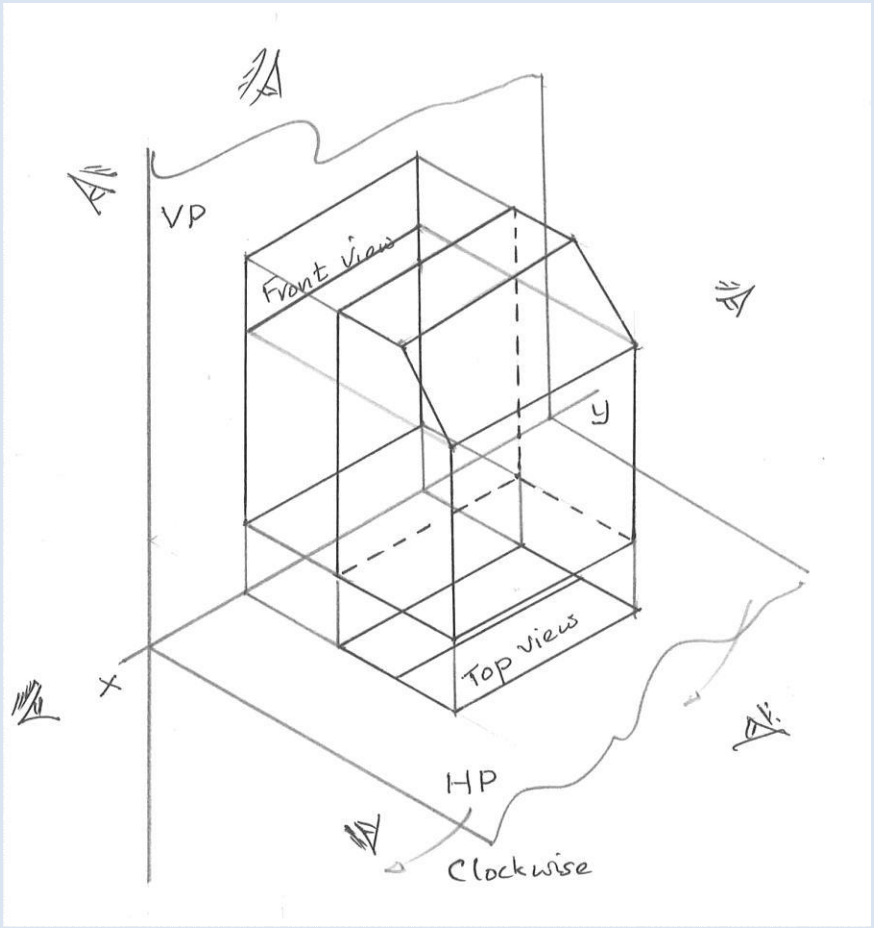
The whole space available is divided in to four quadrants using HP and VP. Viewing along x-y, starting from above HP and in front of VP, the numbering of quadrants starts, which is the First quadrant. Moving in anticlockwise direction, above HP and behind VP is the Second quadrant; below HP and behind VP, the Third quadrant, and below HP and in front of VP, the Fourth quadrant.

As GP is attached to the bottom end of VP, there is no space below GP or objects are assumed to be situating either in the First or Second or Third or Fourth quadrant.

Multi-view Representations

Multi-view representations show more than one standard 2D views of an object. 3D objects are represented by different views or projections on imaginary planes.

In orthographic projections six views of an object can be represented. They are: front view, top view, side view from left is called left side view, side view from right is called right side view, bottom view and back view However most common views are top view and front view.



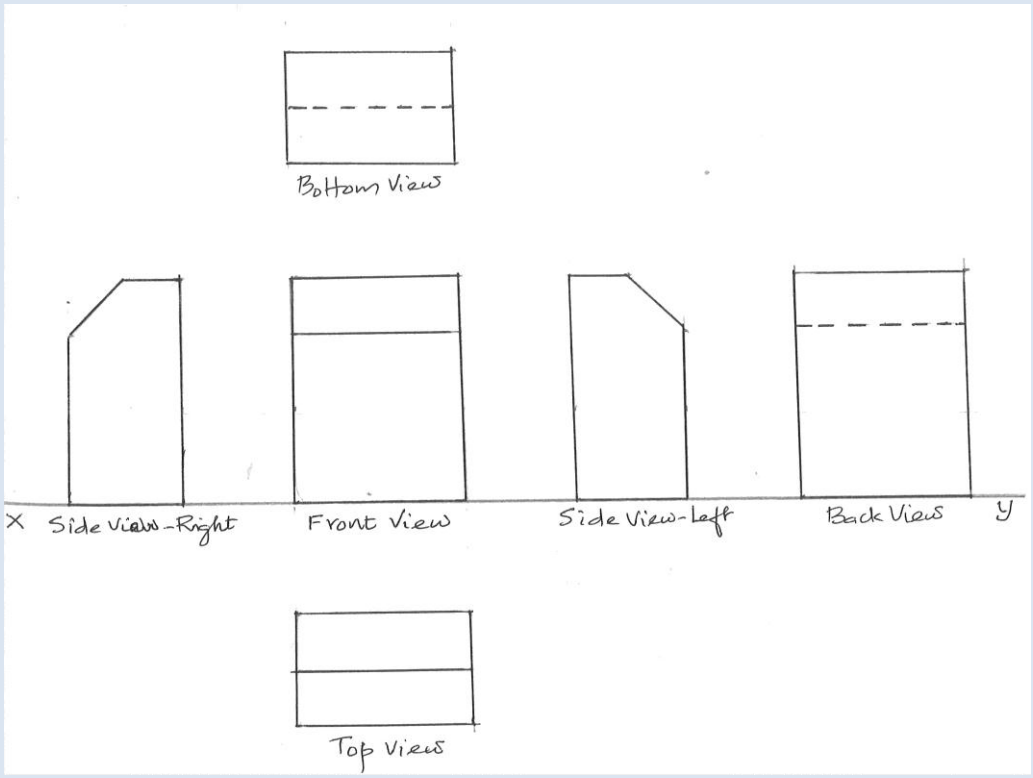
Directions of Observation of an Object in the First Quadrant

First Angle Projection

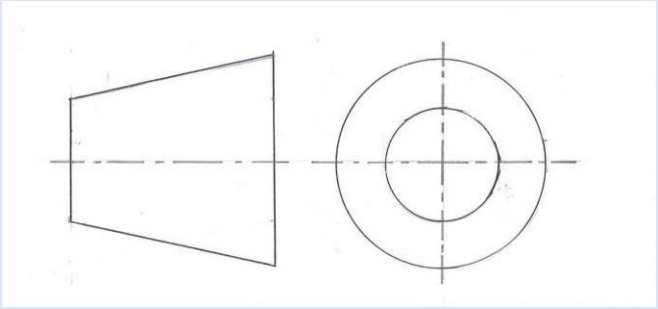
Projection of any object drawn assuming the object in the first quadrant is First Angle Projection. As per recommendation of Bureau of Indian Standards First angle projection is followed in India.

Third Angle Projection

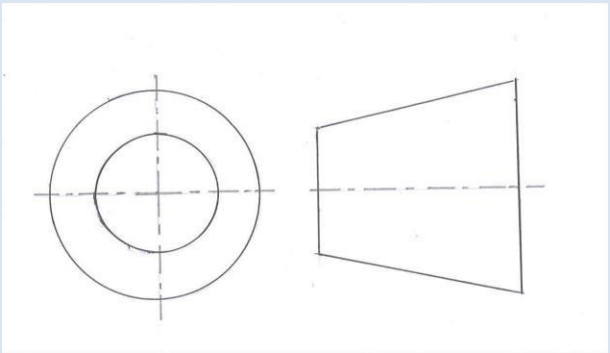
Projection of any object drawn assuming the object in the third quadrant is Third Angle Projection.



Six Views of the Object



Symbol of First angle projection



Symbol of Third angle projection

Projections of Points

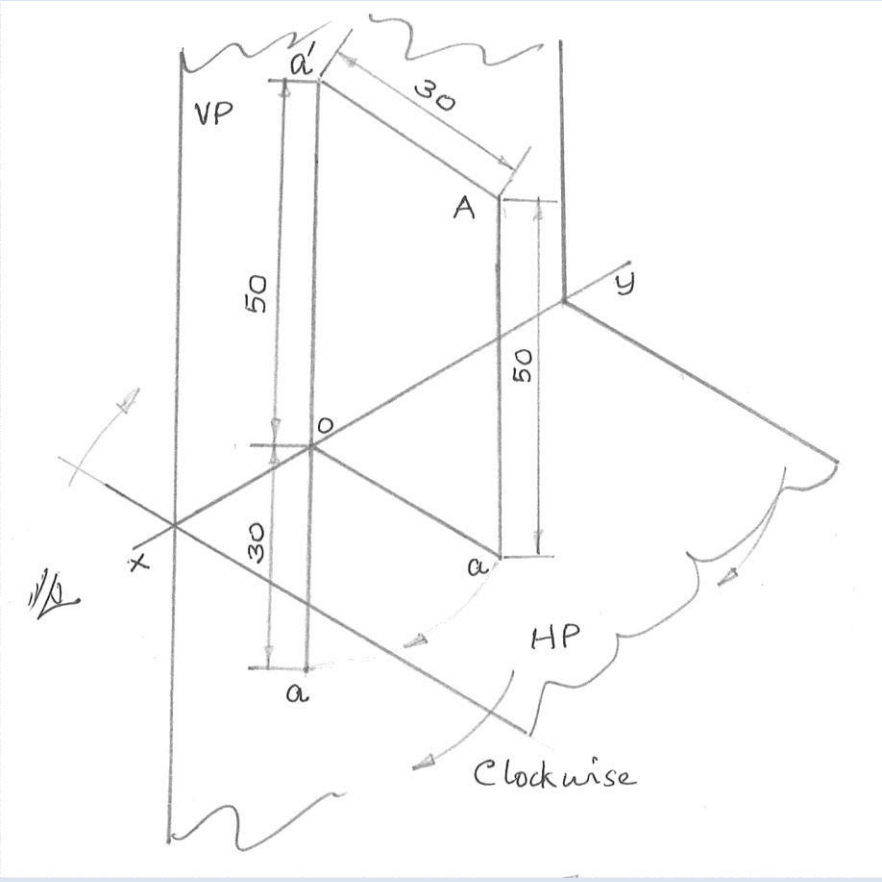
Point, the simplest Object

A point will be the simplest object available. It can be treated as a zero dimensional object (no length, no breadth, and no height). A point can bedenoted by any English alphabet in graphics.

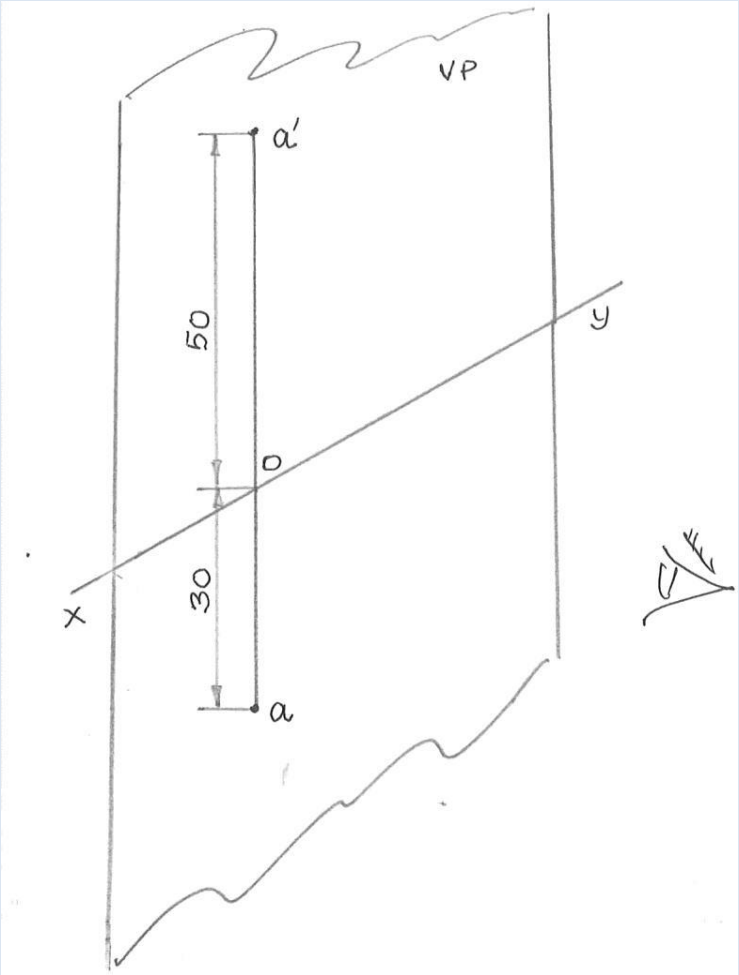
A point can situate in any of the quadrant, say First or Second or Third or Fourth.

Point is in the First quadrant

A point is in the first quadrant. It is 50 mm above HP and 30 mmaway from VP. Draw the projections.



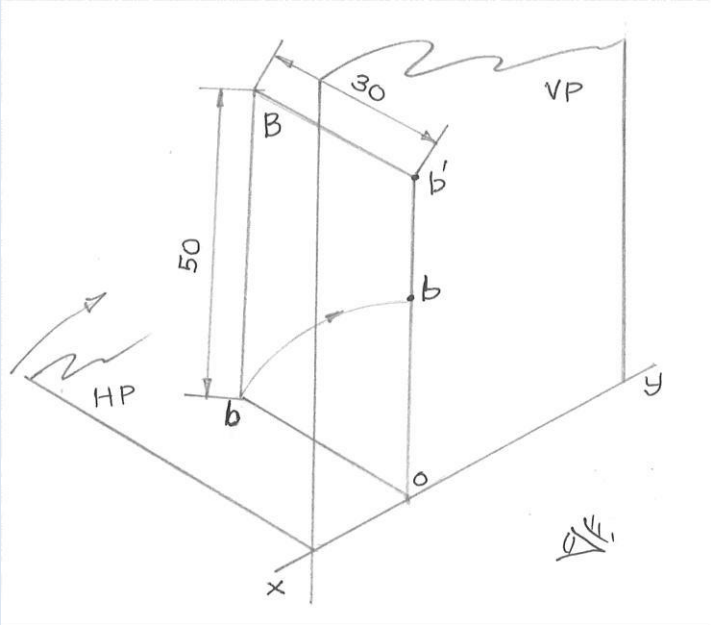
Point in the first quadrant


VP
a'
50
y
O
30
X
a

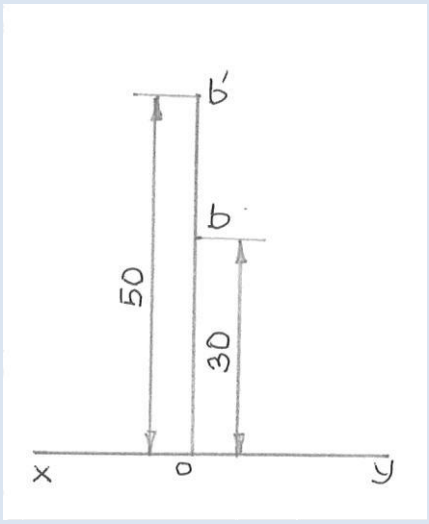
Point is in the Second quadrant

A point B is 50 mm above HP and 30 mm behind VP. Draw the projections.

When the point is in the second quadrant .both the projections will be above x-y. The distance of front view ***a'*** from x-y is 50 mmwhile that of top view ***a*** from x-y is 30 mm. These are respectively the distancesof the point from HP and VP.



Point is in the second quadrant



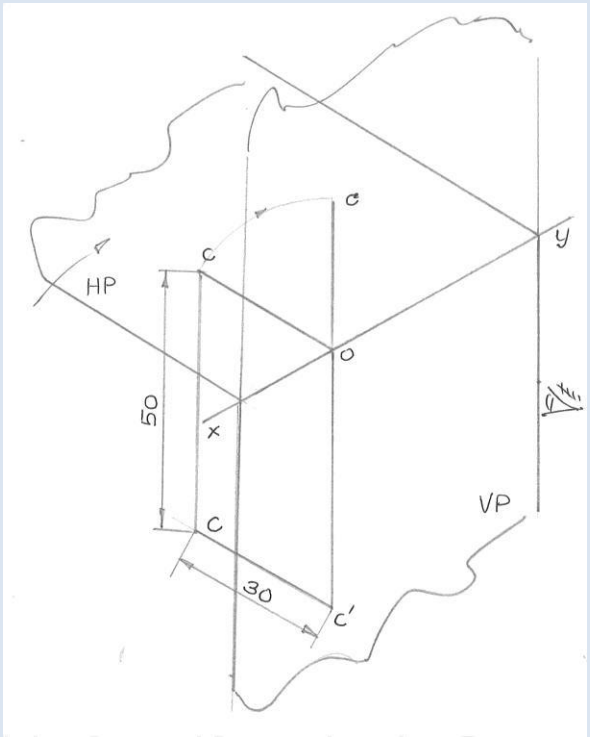
Projections of B when it is in the second quadrant

When a point is in the second quadrant, both the views, the front view and top view, will be above x-y.

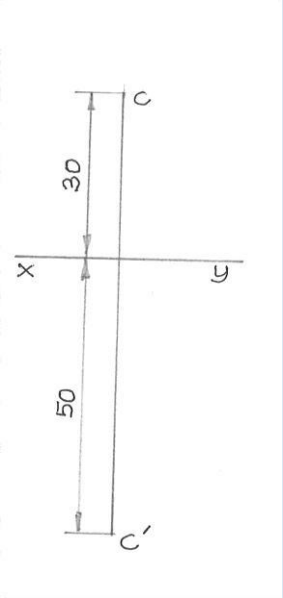
Point is in the Third quadrant

A point C is 50 mm below HP and 30 mm behind VP. Draw the projections.

When the point is in the third quadrant. the top view will be abovex-y and front view, below x-y.



Point is in the third quadrant



Projections when the point is in the third quadrant

The point C is 50 mm below HP and 30 mm behind VP. After obtaining the projections on HP and VP independently, both the projections are made on the same plane.

The distance of the front view to x-y will be equal to the distance of the point from HP, and the distance of the top view from x-y will be equal to the distance of the point from VP.

When a point is in the third quadrant, the top view will be above x-y and front view, below x-y.

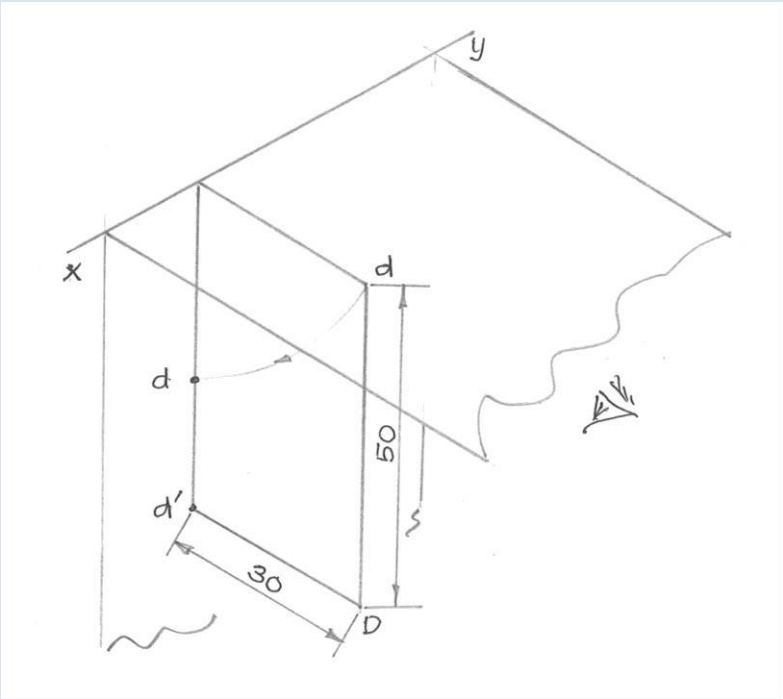
Point is in the Fourth quadrant

A point D is 50 mm below HP and 30 mm in front of VP. Draw the projections.

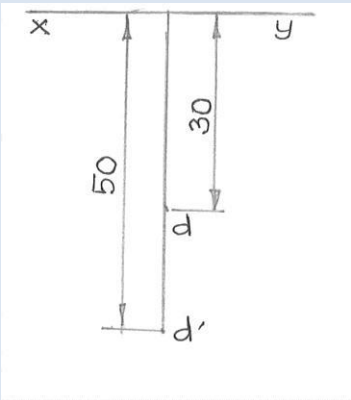
When the point is in the fourth quadrant, both the views, front andtop view, will be below x-y.

The distance of the front view to x-y will be equal to the distance of the point from HP, and the distance of the top view from x-y will be equal to the distance of the point from VP.

- *When a point is in the fourth quadrant, both the views, front view and top view, will be below x-y.*
- *Irrespective to the quadrant, the distance of the front view to x-y will be equal to the distance of the point from HP, and the distance of the top view from x-y will be equal to the distance of the point from VP.*



Point is in the fourth quadrant



Projections of a point when it is in the fourth quadrant