DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

Course-Computer Graphics & Multimedia (CGM)

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UNIT TWO

Transformation (Projection)

Projection:

Transform 3D objects on to a 2D plane using ***projections***

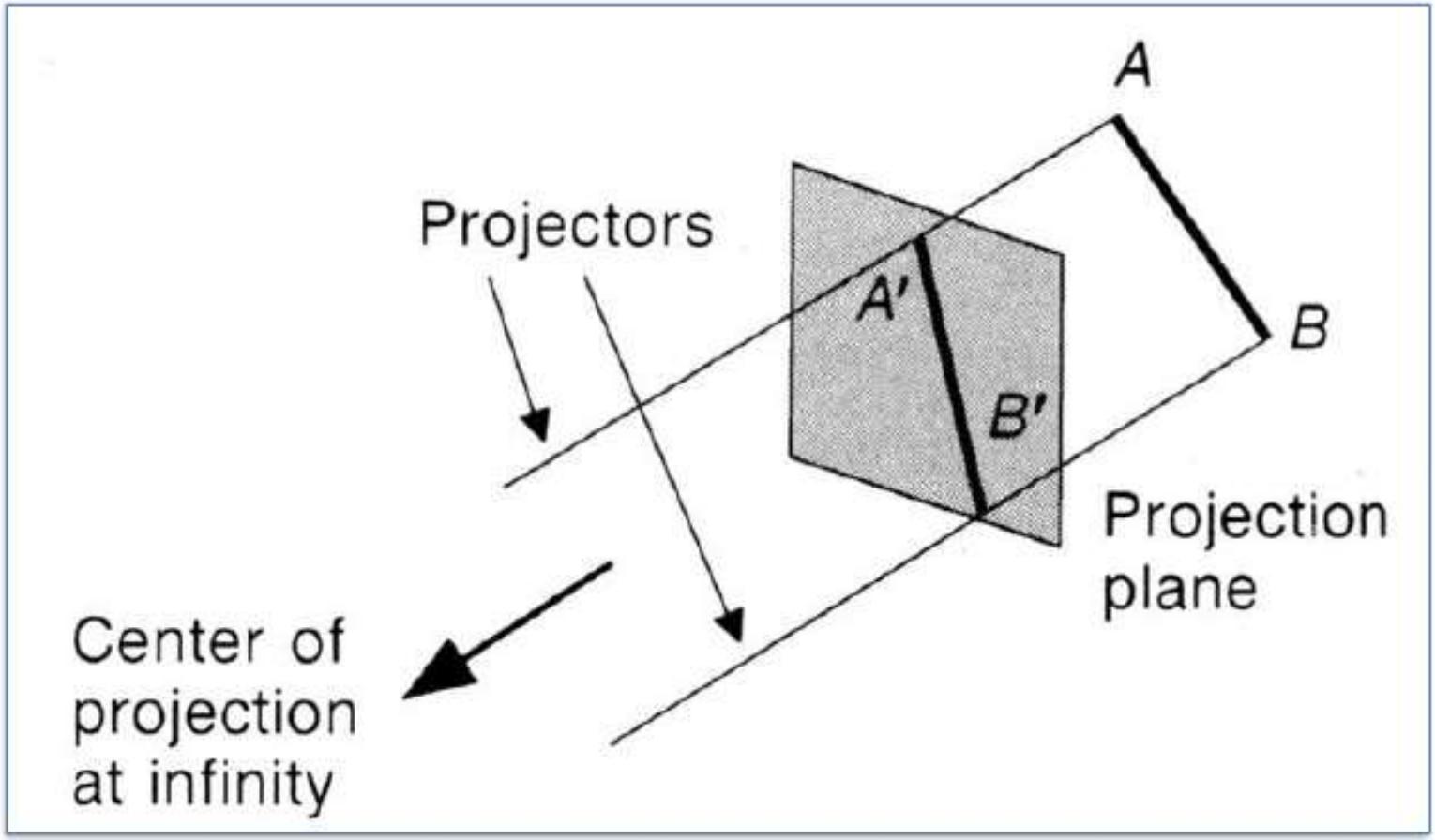
2 types of projections

Perspective

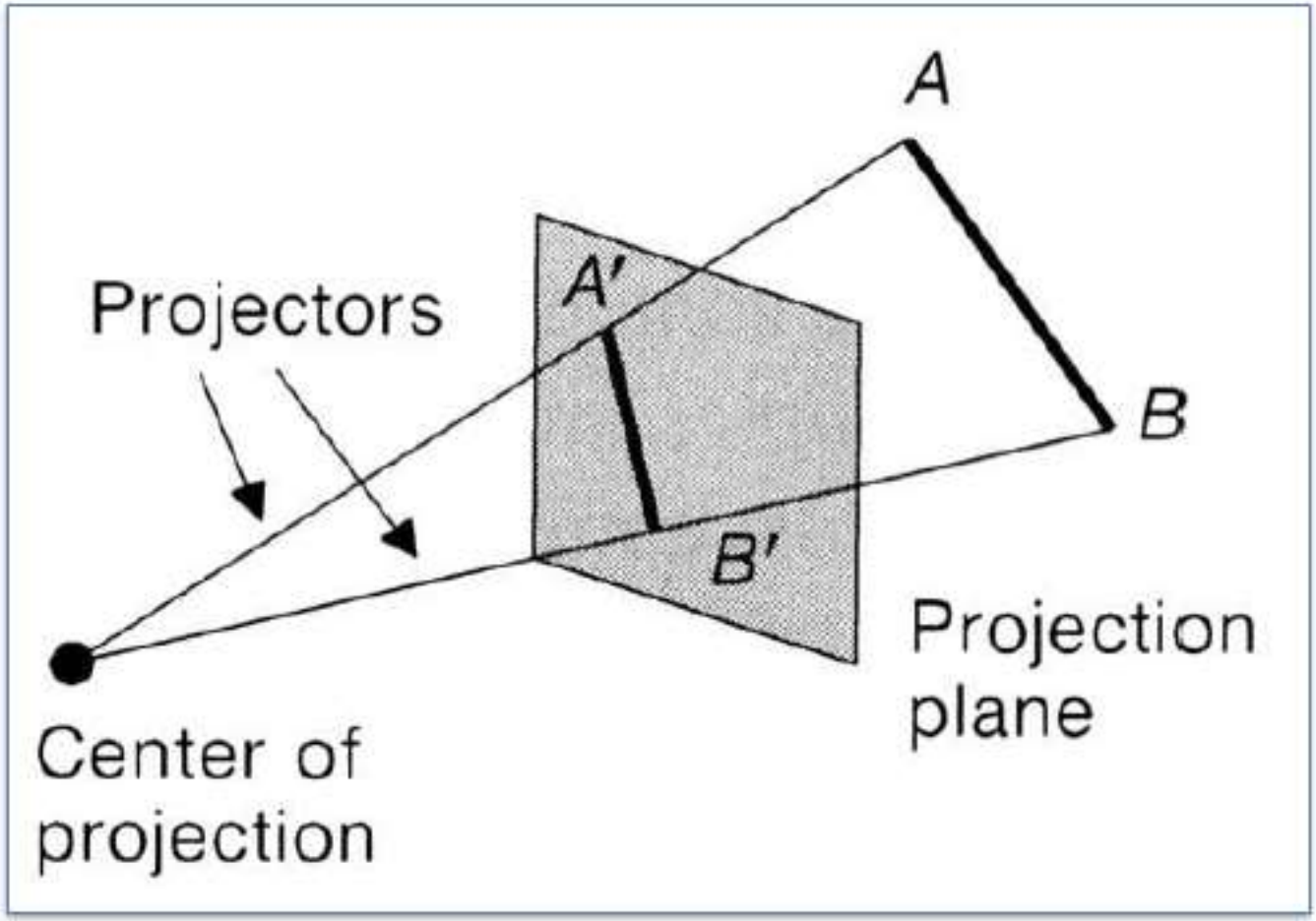
Parallel

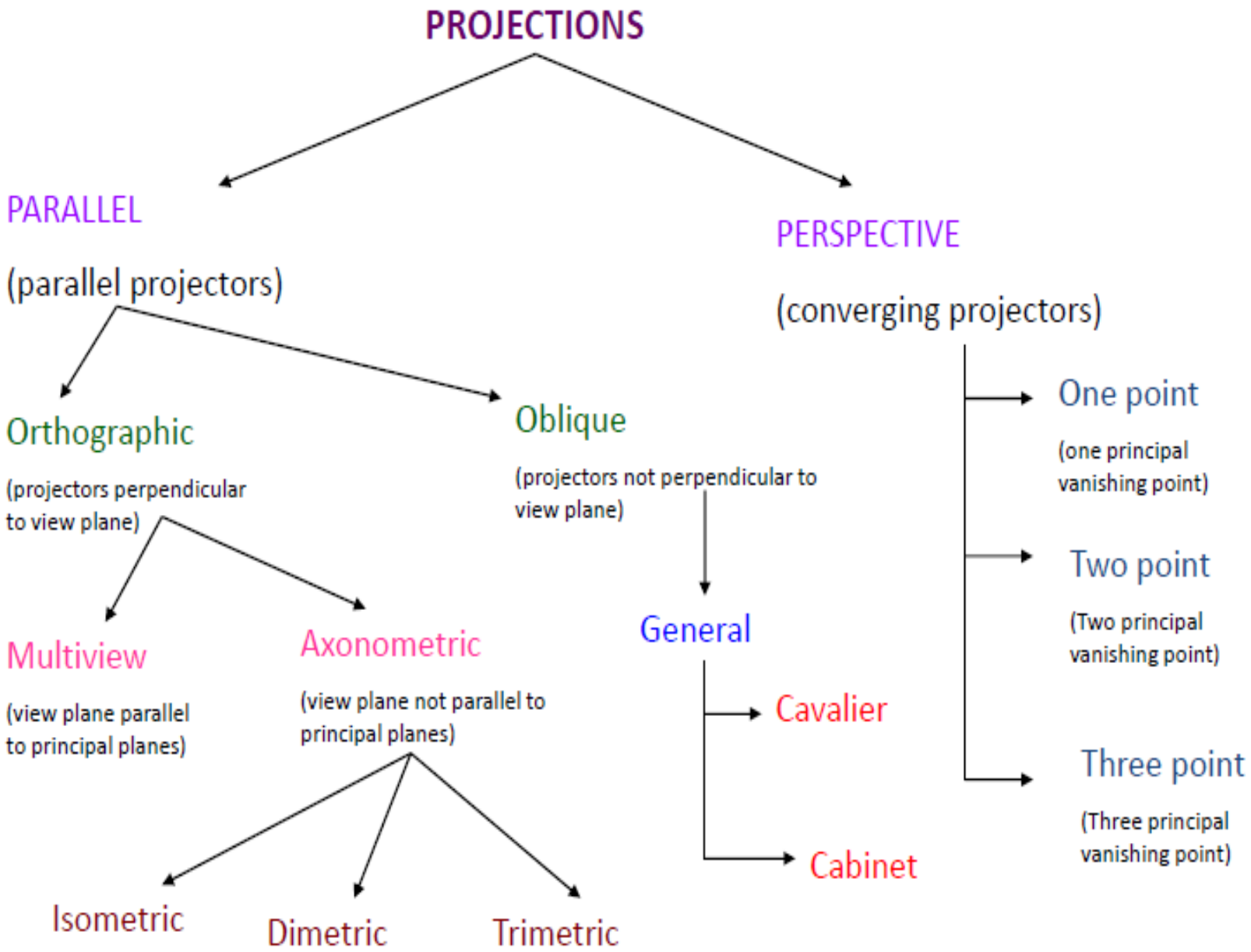
In **parallel projection**, coordinate positions are transformed to the view plane along parallel lines.
In **perspective projection**, object position are transformed to the view plane along lines that converge to a point called **projection reference point (center of projection)**

Parallel Projection



Perspective Projection




PROJECTIONS
PARALLEL
(parallel projectors)
PERSPECTIVE
(converging projectors)
Orthographic
(projectors perpendicular to view plane)
Oblique
(projectors not perpendicular to view plane)
One point
(one principal vanishing point)
Two point
(Two principal vanishing point)
Three point
(Three principal vanishing point)
Multiview
(view plane parallel to principal planes)
Axonometric
(view plane not parallel to principal planes)
General
Cavalier
Cabinet
Isometric
Dimetric
Trimetric

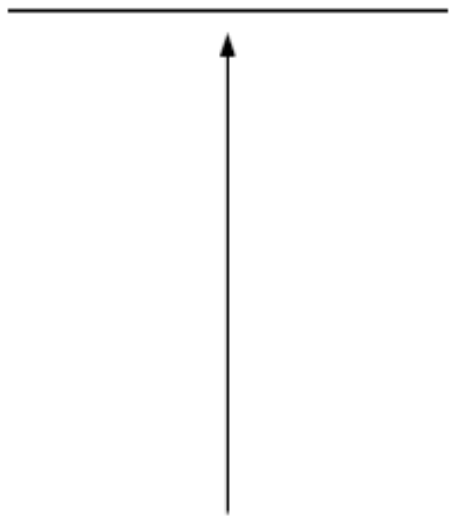
Parallel Projections

- We can define a parallel projection with a projection vector that defines the direction for the projection lines.

2 types:

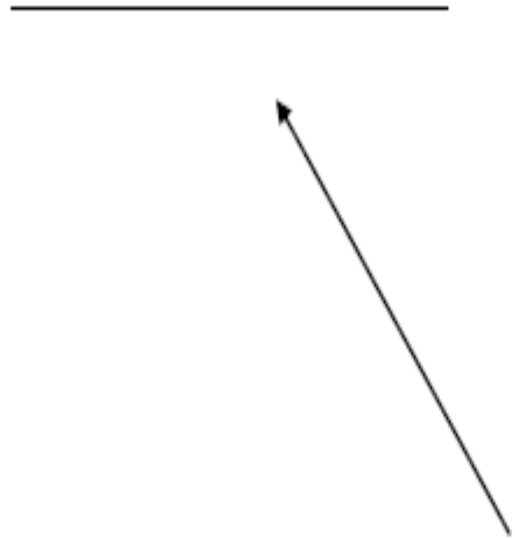
- **Orthographic** : when the projection is perpendicular to the view plane. In short,
  - direction of projection = normal to the projection plane.
  - the projection is perpendicular to the view plane.
- **Oblique** : when the projection is not perpendicular to the view plane. In short,
  - direction of projection ≠ normal to the projection plane.
  - Not perpendicular.

- Orthographic projection



when the projection is perpendicular to the view plane

Oblique projection



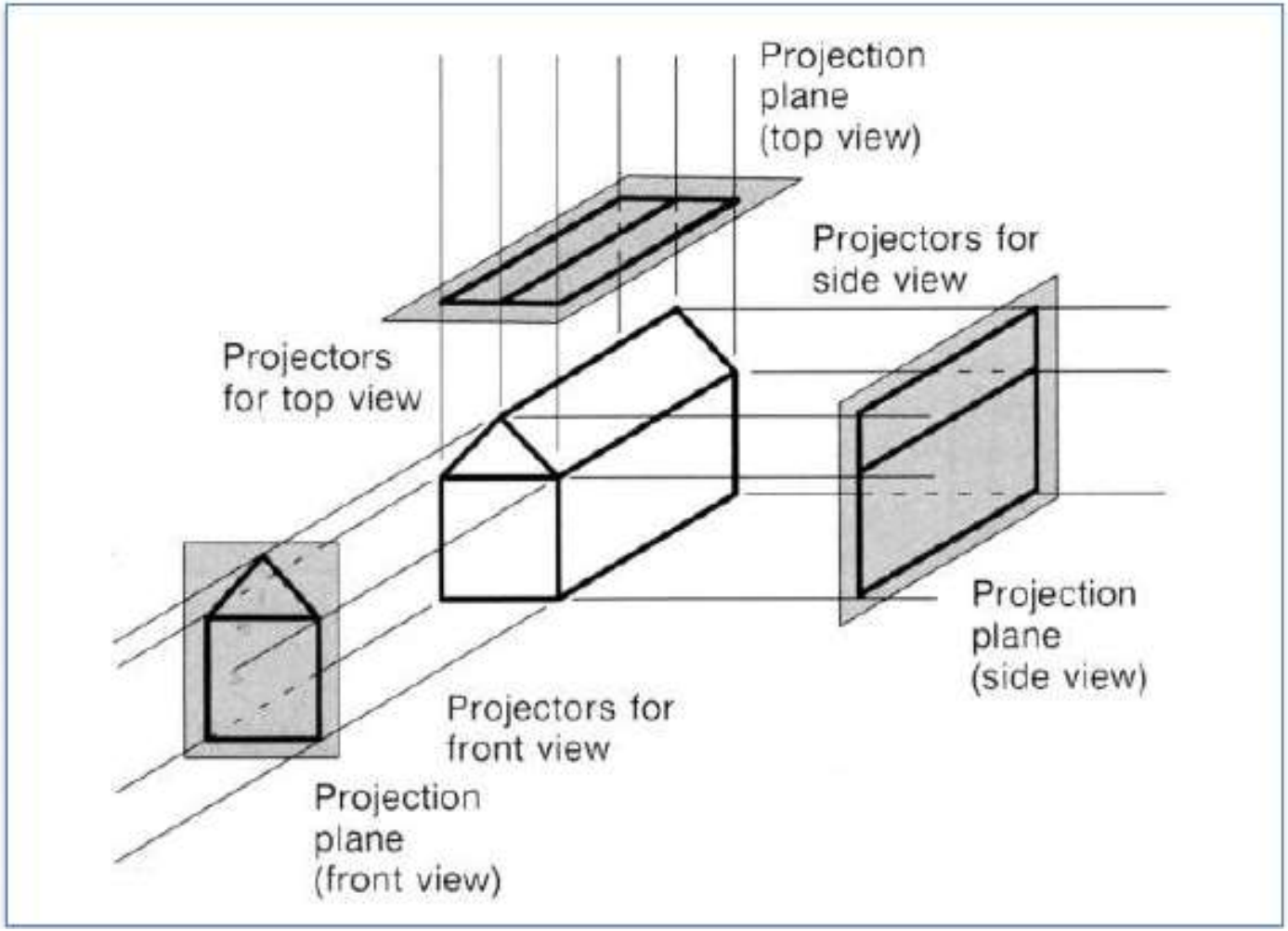
when the projection is not perpendicular to the view plane

Orthographic Projection (Multiview)

- Front, side and rear orthographic projection of an object are called **elevations** and the top orthographic projection is called **plan view**.
- all have projection plane perpendicular to a principle axes.
- Here length and angles are accurately depicted and measured from the drawing, so engineering and architectural drawings commonly employee this.

- However, As only one face of an object is shown, it can be hard to create a mental image of the object, even when several views are available.

Orthogonal projections:



Orthographic Projection (Axonometric)

Axonometric projection is a type of orthographic projection used for creating a pictorial drawing of an object

The three types of axonometric projection are

- **Isometric Projection:** All projectors make equal angles
- **Dimetric:** In these two projectors have equal angles. With respect to two principle axis.
- **Trimetric:** The direction of projection makes unequal angle with their principle axis.

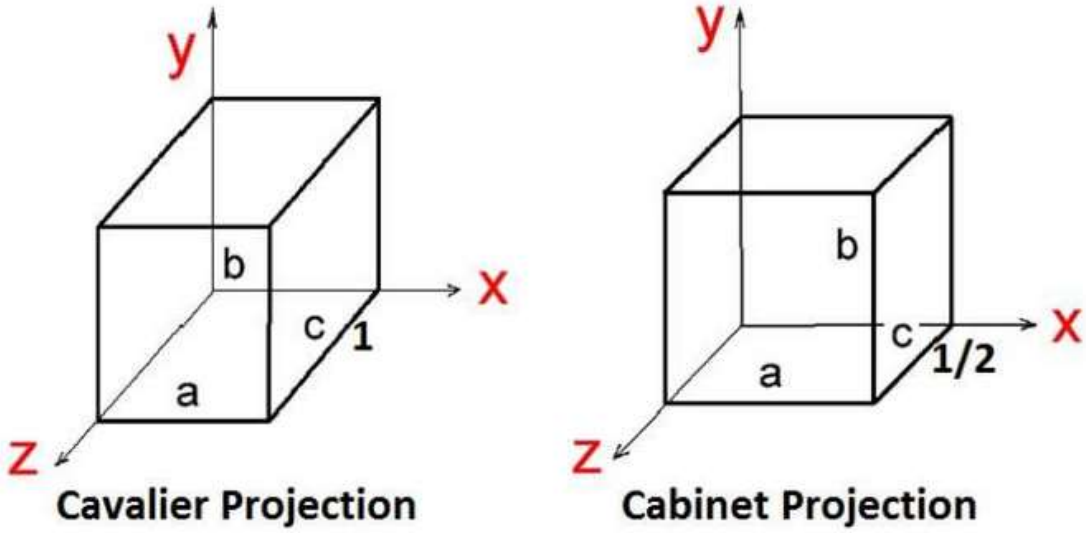
Oblique Projection

In oblique projection, the direction of projection is not normal to the projection of plane. In oblique projection, we can view the object better than orthographic projection.

There are two types of oblique projections −

Cavalier The Cavalier projection makes 45° angle with the projection plane.

Cabinet. The Cabinet projection makes 63.4° angle with the projection plane.



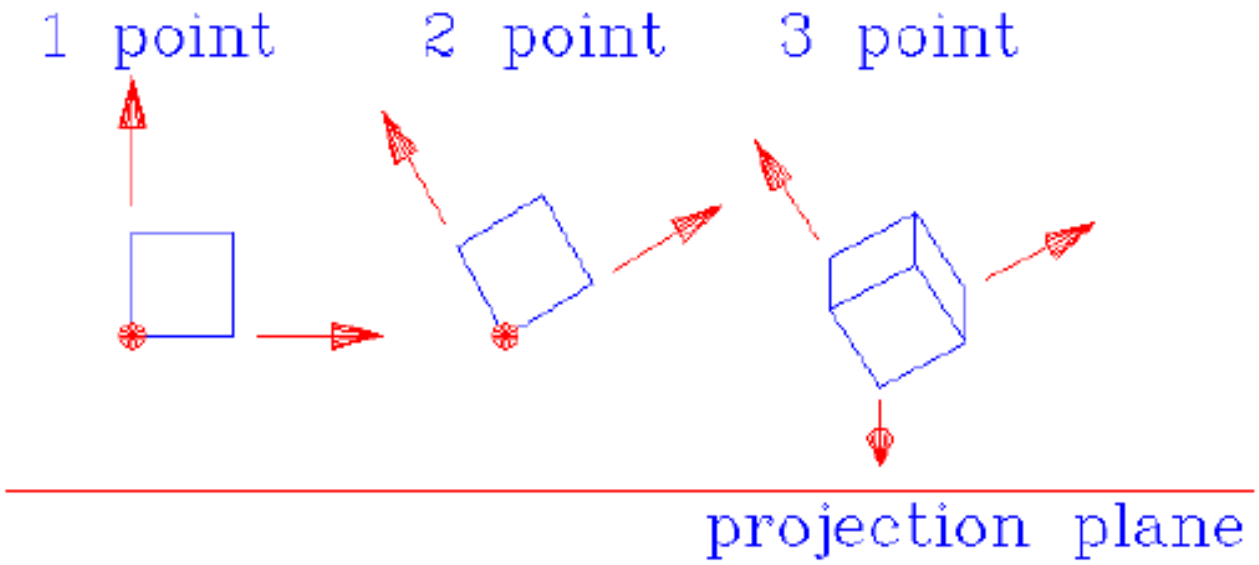
Perspective Projections

- Characteristics:

- Center of Projection (CP) is a finite distance from object
- Projectors are rays (i.e., non-parallel)
- *Vanishing points*
- Objects appear smaller as distance from CP (eye of observer) increases
- Difficult to determine exact size and shape of object
- Most realistic, difficult to execute

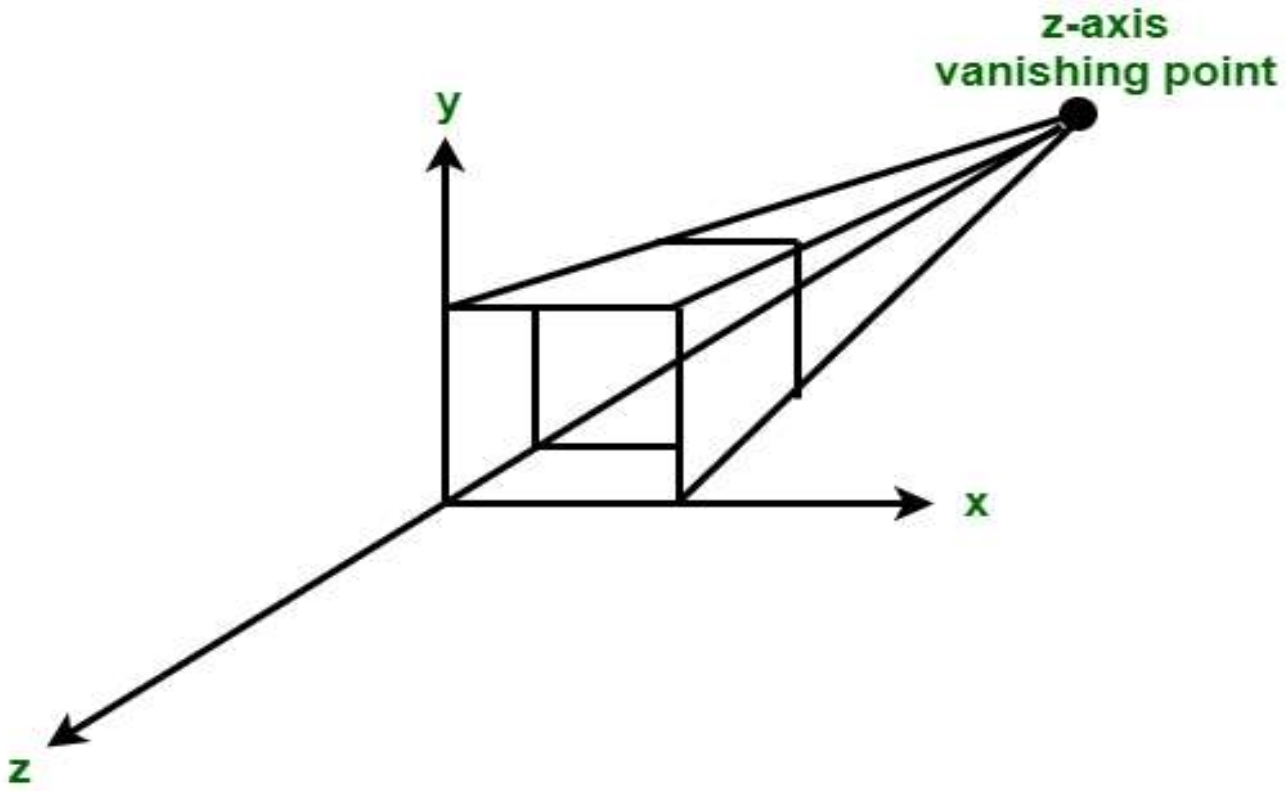
Classes of Perspective Projection

- One-Point Perspective
- Two-Point Perspective
- Three-Point Perspective



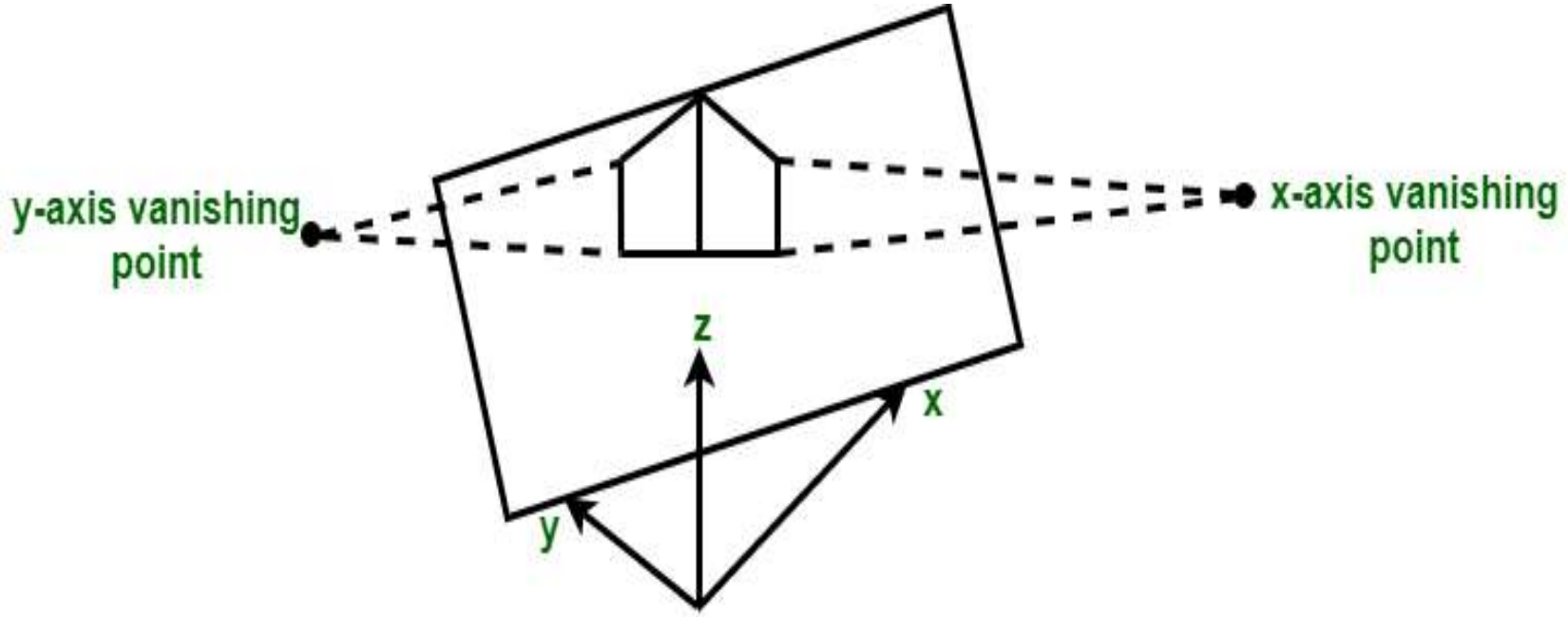
One Point Perspective Projection –

One point perspective projection occurs when any of principal axes intersects with projection plane or we can say when projection plane is perpendicular to principal axis.



Two Point Perspective Projection –

Two point perspective projection occurs when projection plane intersects two of principal axis.



Three Point Perspective Projection –

Three point perspective projection occurs when all three axis intersects with projection plane.