TISHK INTERNATIONAL UNIVERSITY
SURVEYING AND GEOMATICS ENGINEERING DEPARTMENT

Engineering Drawing II

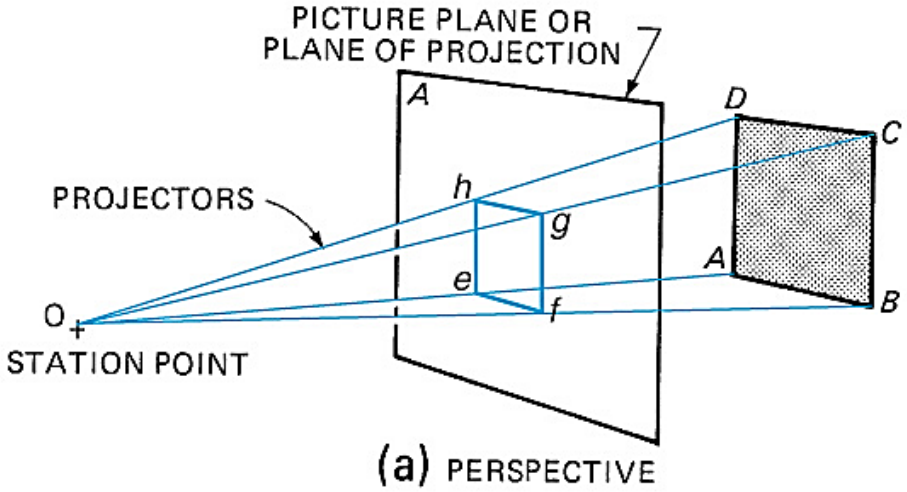
Lecture 2

Orthographic Projection

1. Projection

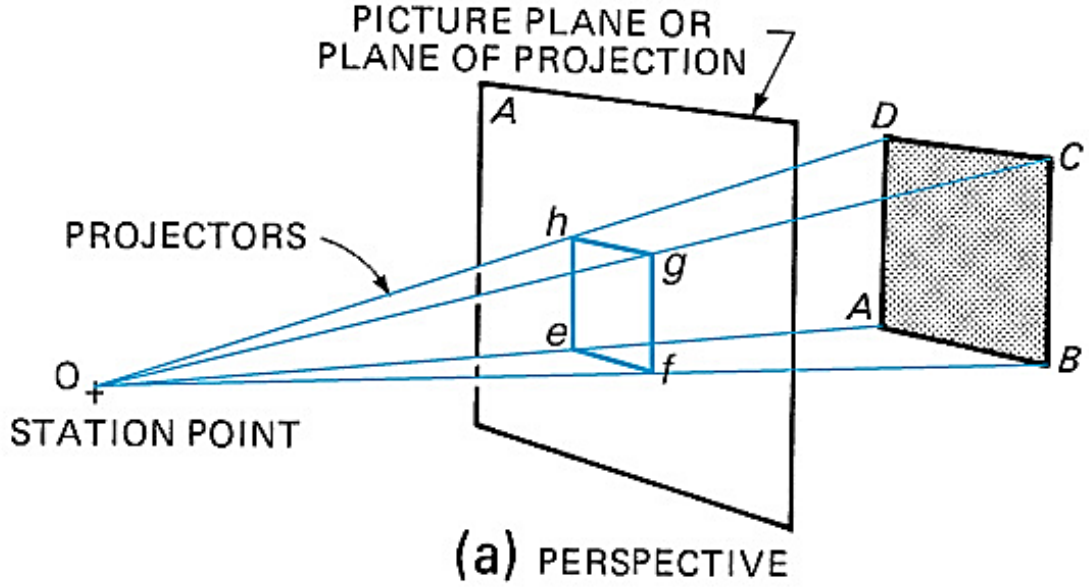
Behind every drawing of an object is a space relationship involving four imaginary things:

1. The observer's eye or the station point
2. The object
3. The plane of projection
4. The projectors or visual rays or lines of sight



1. Projection

- In the diagram, (efgh) is the projection of the object (ABCD) on the plane of projections (A) as viewed by the observer whose eye is at the station point (O).
- The image on the plane is produced by the points at which the projectors pierce the plane of projection.
- The projectors for a “cone” of projectors resulting in a foreshortened image known as a perspective.



1. Projection

To graphically represent a 3-D object on 2-D media (paper, screen etc.)

A projection theory is based on 2 variables:

1) Line of sight

2) Plane of projection

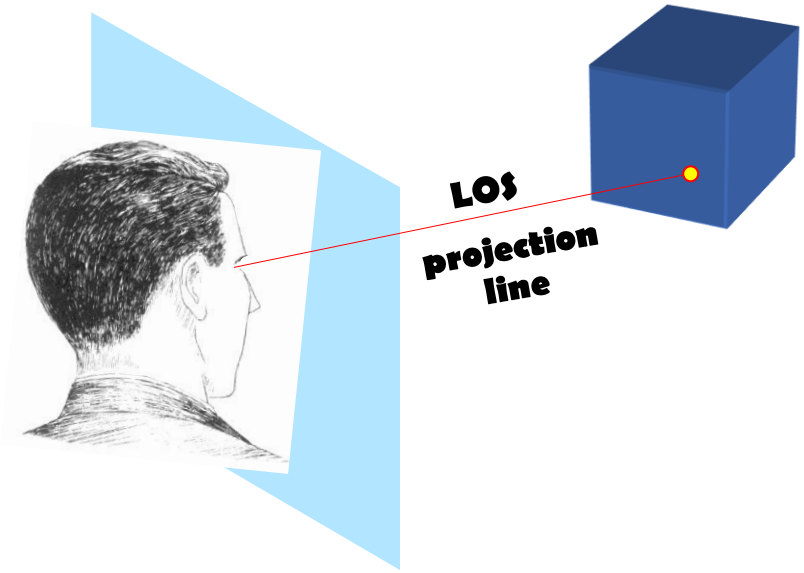
1. Line of sight (LOS)

Is an imaginary ray of light between an observer's eye and an object.

2. Plane of projection

Is an imaginary flat plane upon which the image created by the LOS is projected.

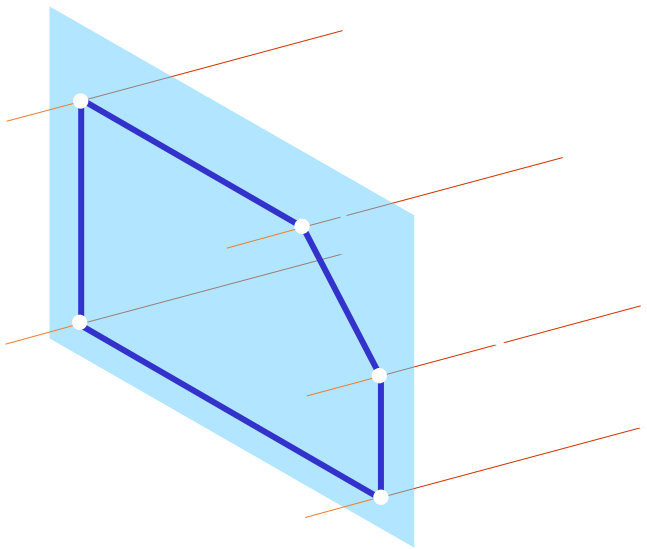
1. Projection



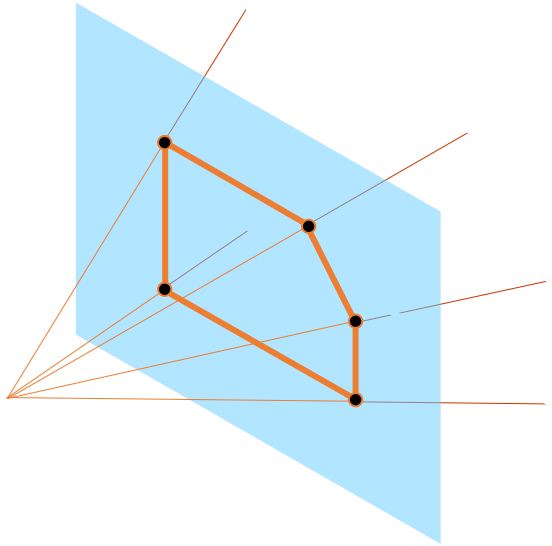
Line of sight

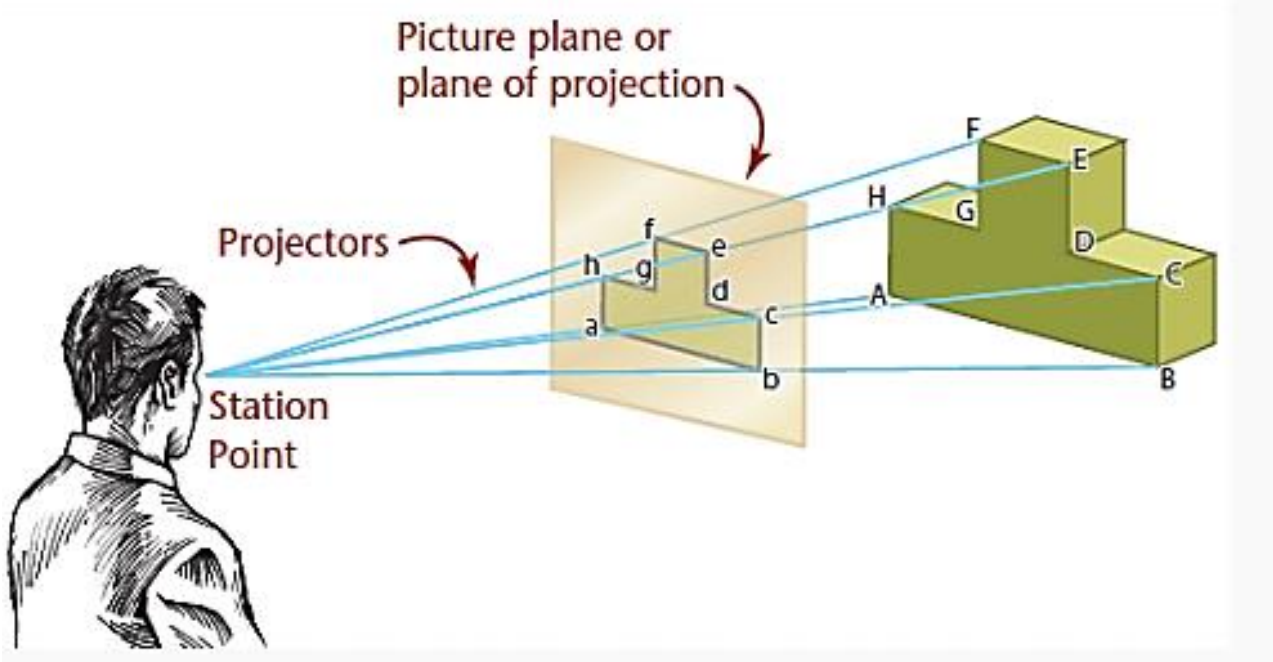
- Lines of sight can be **parallel** or **converge**.

Parallel projection

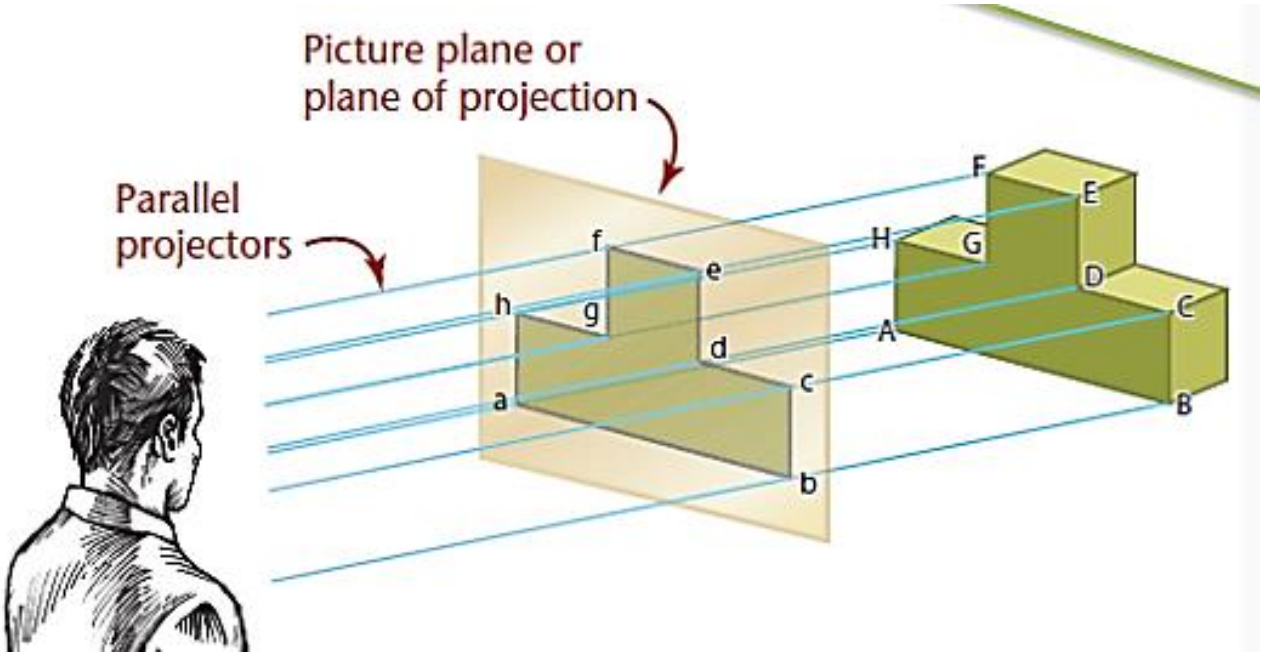


Converge projection





Perspective Projection



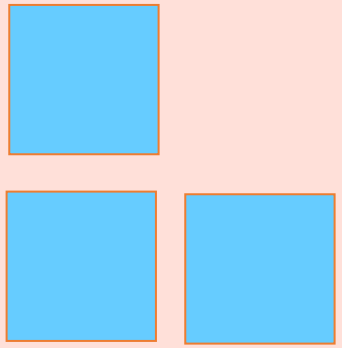
Parallel Projection

Line of sight

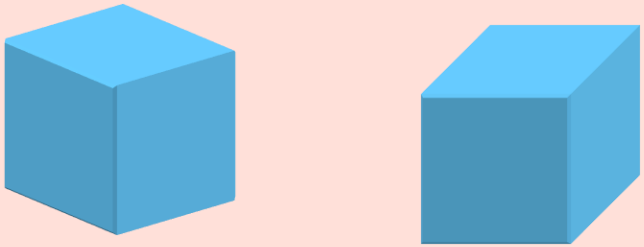
- The parallel projection lines can be **normal** (orthogonal) or **oblique** to the plane of projection.
- In this course, we consider only a parallel and orthogonal projection, i.e. orthographic projection.

Projections

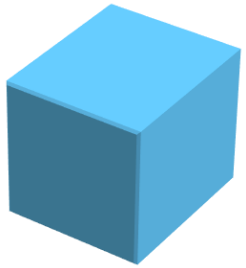
- **Parallel**
  - **Orthogonal**
    - **Multiview**
    - **Axonometric**
  - Oblique
- Converge



Multiview drawing



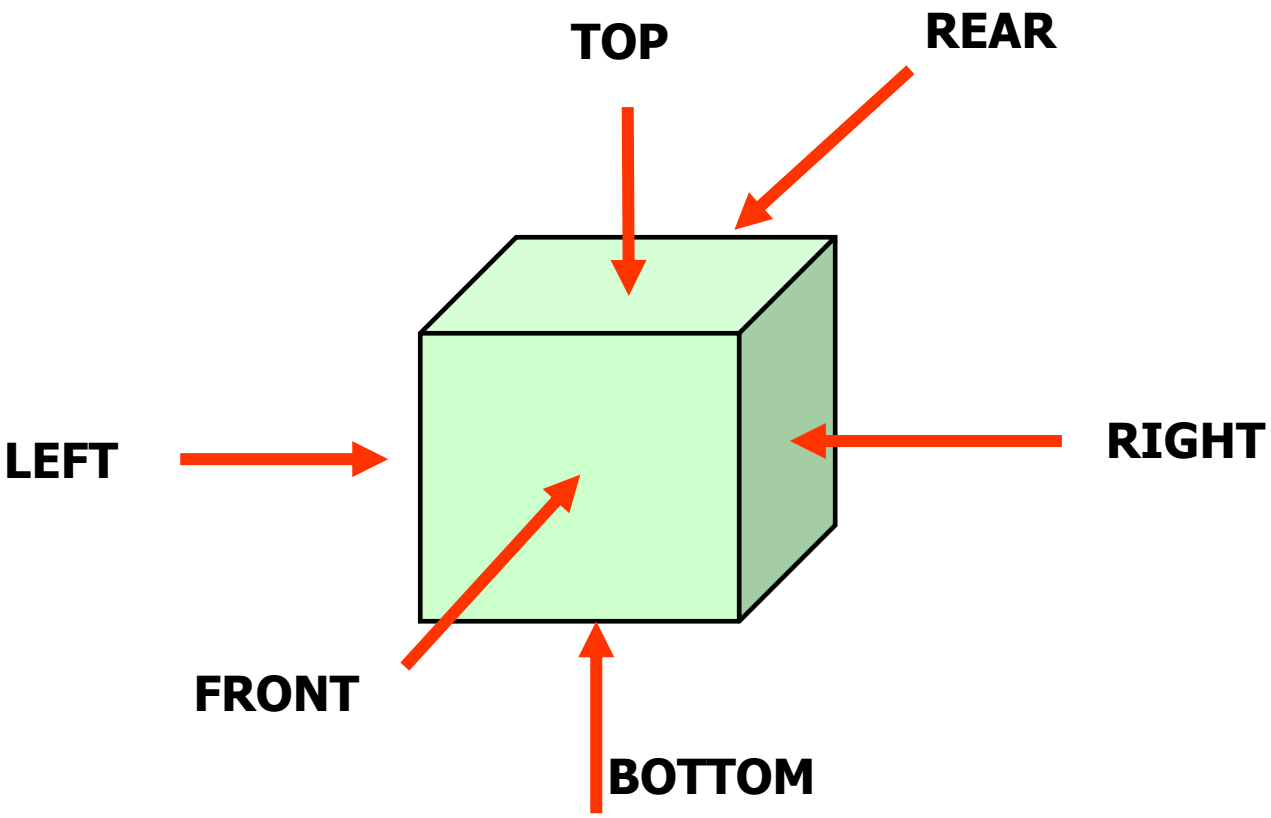
Pictorial drawing



Perspective drawing

2. The Six Standard Views

- Any object can be viewed from six mutually perpendicular views.



Orthographic Views

- **Front View** When the observer looks at the object from the front, the view obtained is called the *front view* (FV) or *Elevation*. FV is seen on the VP.
- **Top View** When the observer looks at the object from above, the view obtained is called *top view* (TV) or *plan.* TV is seen on the HP.
- **Side Views** When the observer looks at the object from side, i.e., from his left-hand side or right hand side, the view obtained is called *side view* (SV). SV is seen on the PP.
  - **Left-Hand Side View** When the observer views the object from his left-hand side, the view obtained is called *left-hand side view* (LHSV).
  - **Right Hand Side View** When the observer views the object from his right-hand side, the view obtained is called as *right-hand side view* (RHSV).
- **Bottom View** When the observer looks to the object from below, the view obtained is called *bottom view* (BV) or *bottom plan*.
- **Rear View** When the observer looks to the object from back, the view obtained is called *rear view* (RV) or *back view* or *rear elevation*.

2. The Six Standard Views

- The top, front, and bottom views align vertically.
- The rear, left-side, front, and right-side views align horizontally.
- To draw a view out of place is a serious error.

3. The Principal Dimensions

Any principal view shows two of the three principal dimensions

Height is shown in the rear, left-side, front, and right side

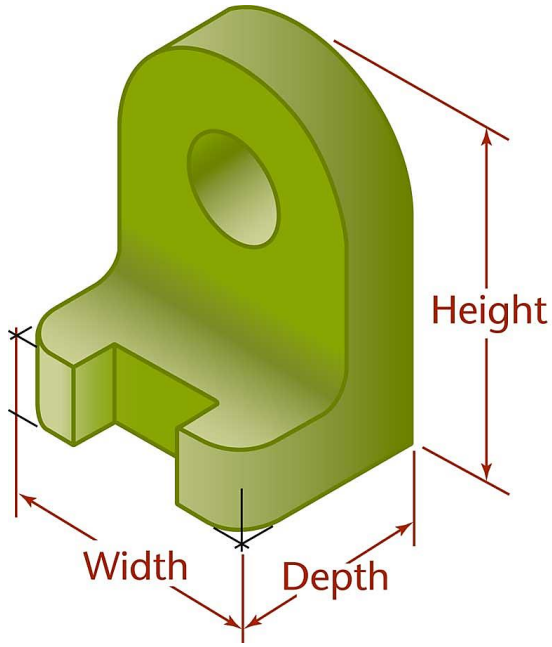
Width is shown in the rear, top, front, and bottom

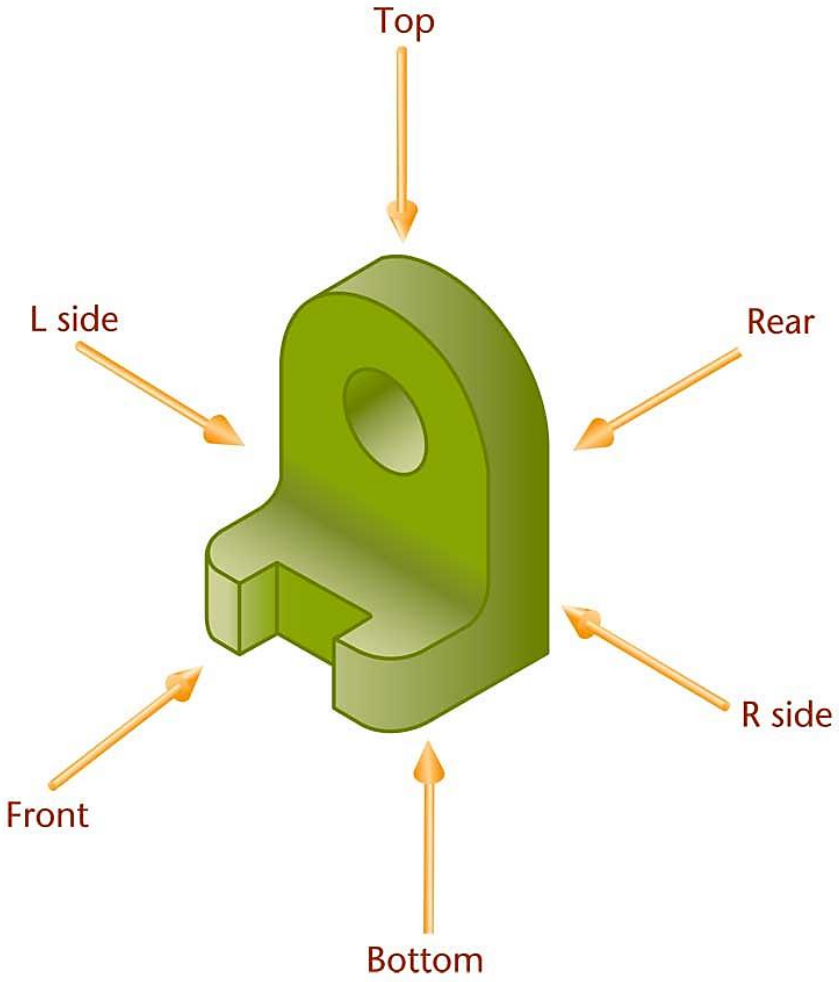
Depth is shown in the left-side, top, right-side, and bottom views

3. The Principal Dimensions

The three principal dimensions of an object are:

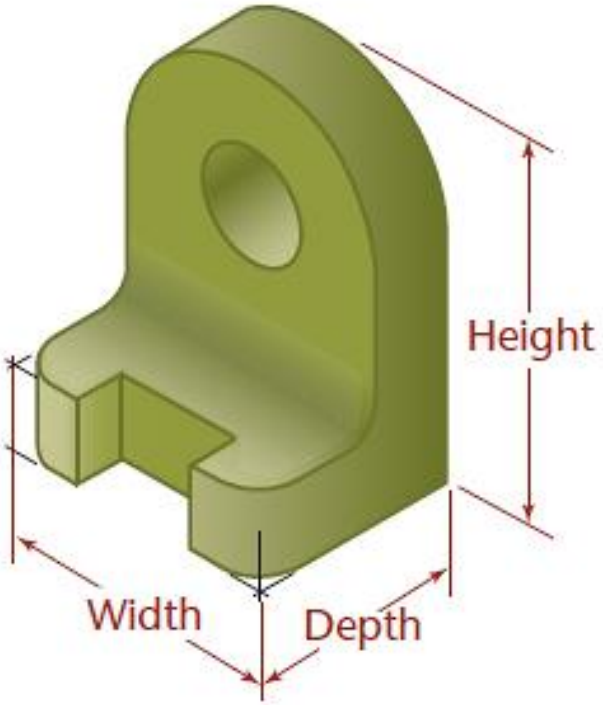
- Width
- Height
- Depth



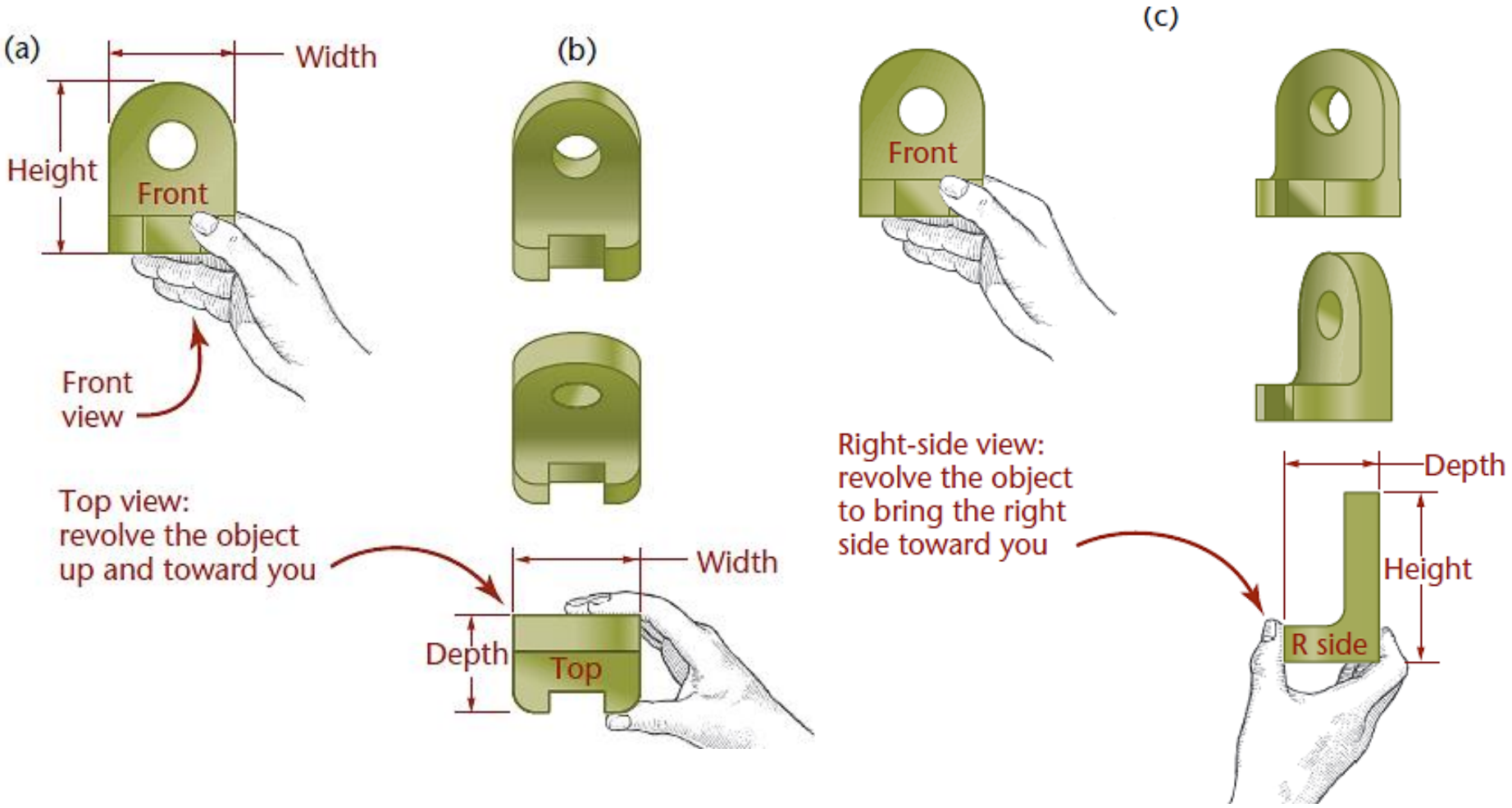


3. The Principal Dimensions

The front view shows only the height and width of the object and not the depth. In fact, any principal view of a 3D object shows only two of the three principal dimensions; the third is found in an adjacent view. Height is shown in the rear, left-side, front, and right-side views. Width is shown in the rear, top, front, and bottom views. Depth is shown in the left-side, top, right-side, and bottom views.



Any object can be viewed from six mutually perpendicular directions, Revolving the Object to Produce Views. You can experience different views by revolving an object.



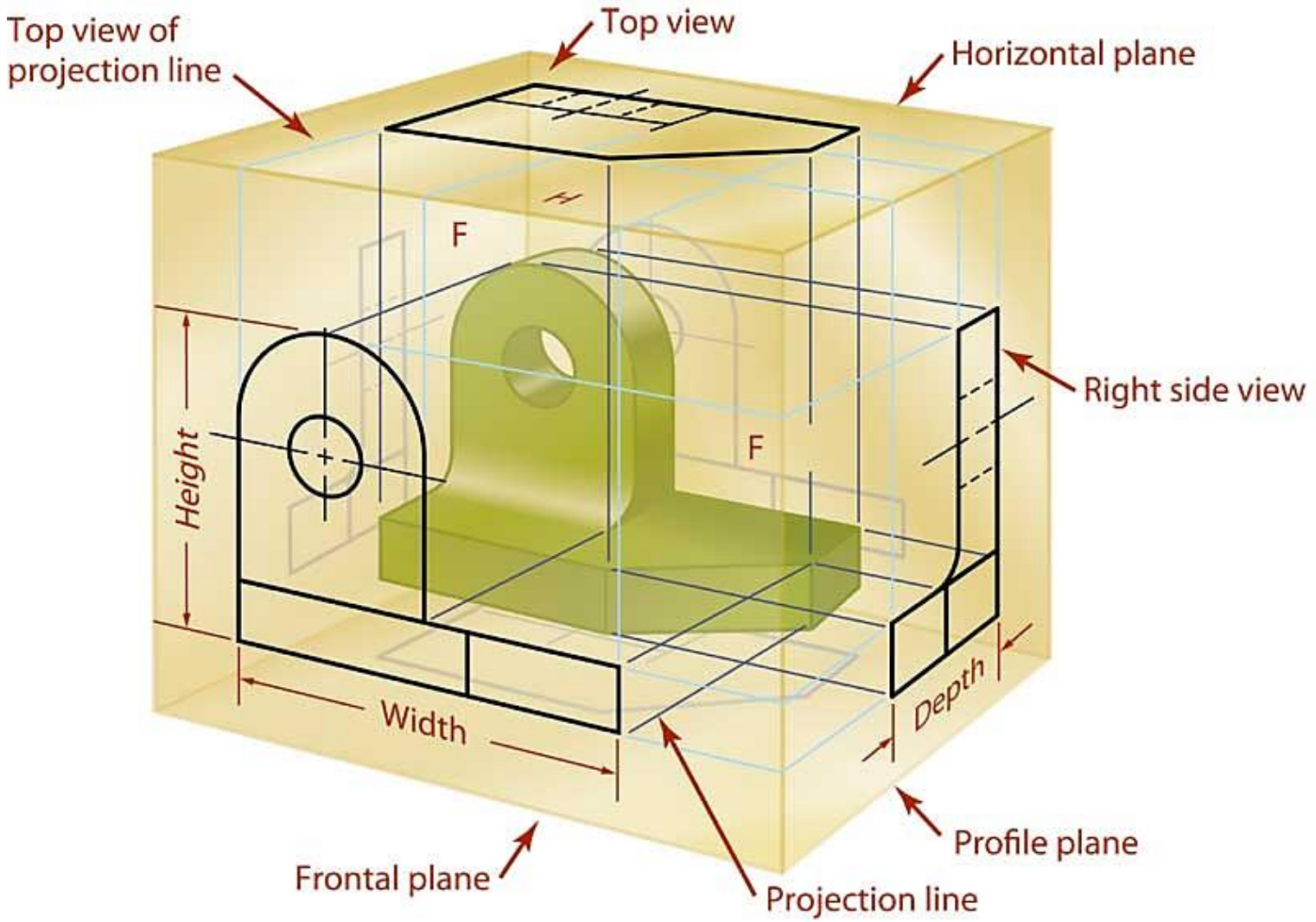
4. The Glass Box Method

One way to understand the standard arrangement of views on a sheet of paper is to envision the object in a glass box

The outside observer would see six standard views of the object through the sides of this imaginary glass box

4. The Glass Box Method

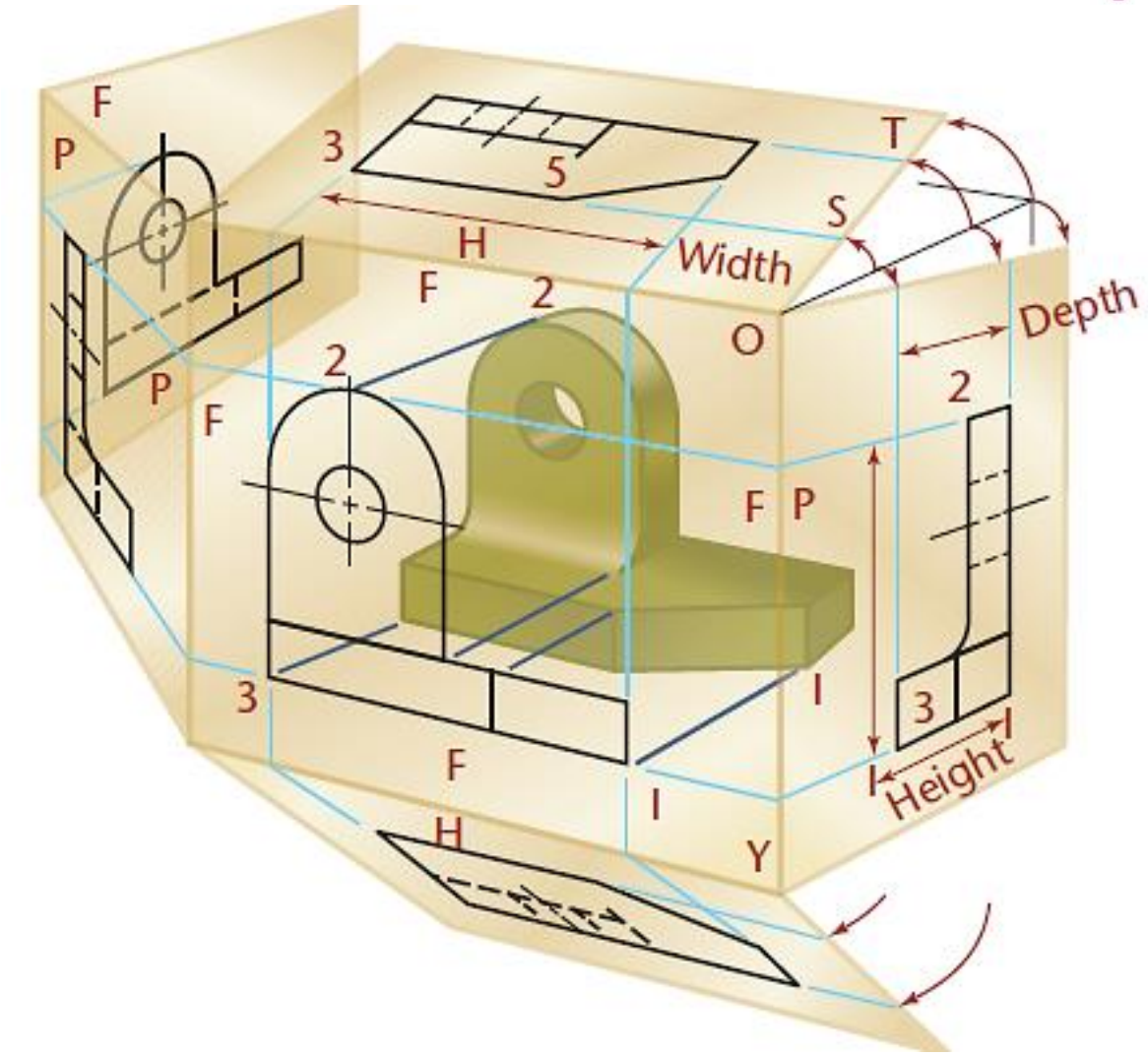
Example -1-



Unfolding the Glass Box

Example -1-

To organize the views of a 3D object on a flat sheet of paper, imagine the six planes of the glass box being unfolded to lie flat.

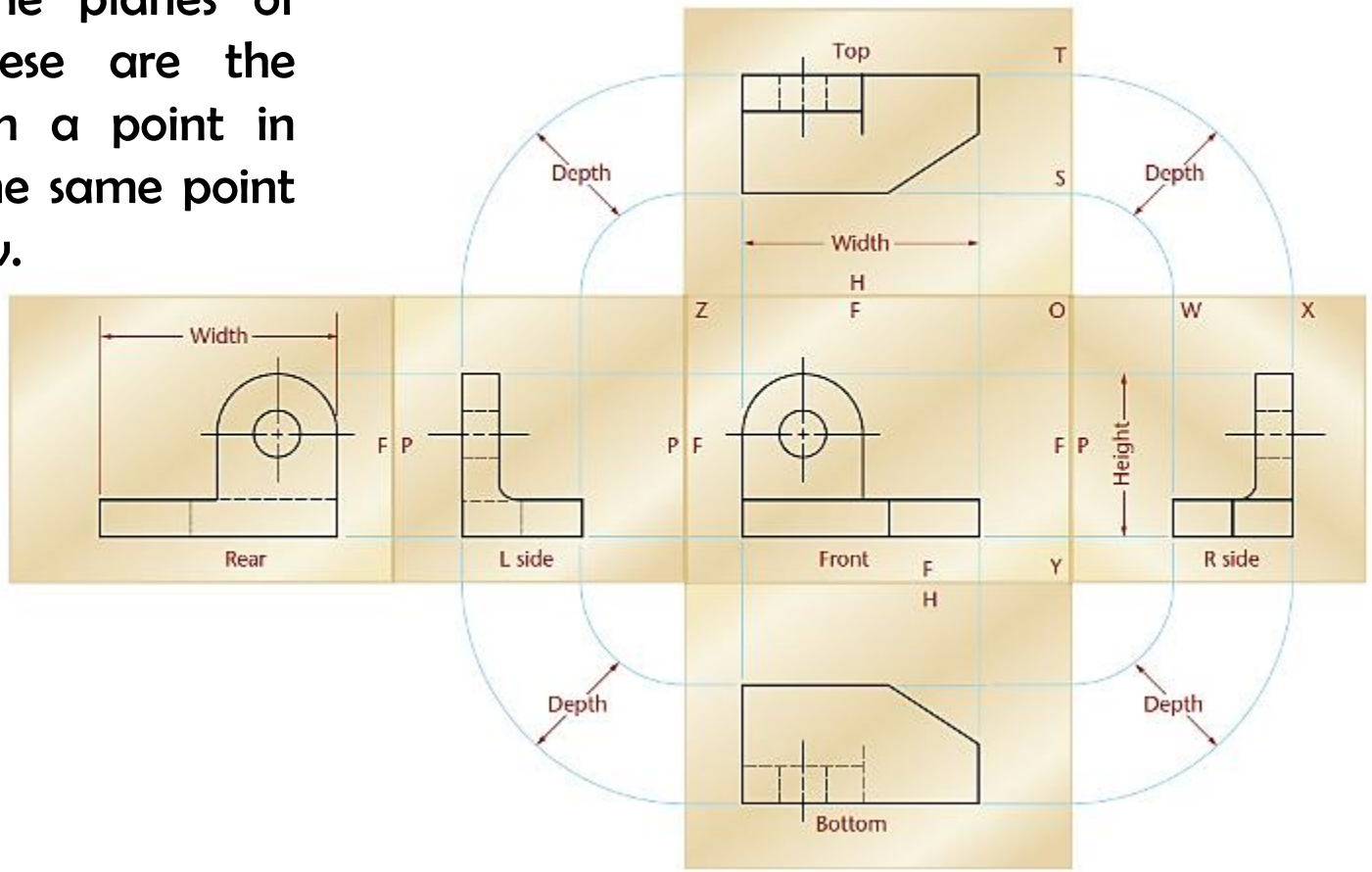


Note the six standard views (front, rear, top, bottom, right side, left side).

Unfolding the Glass Box

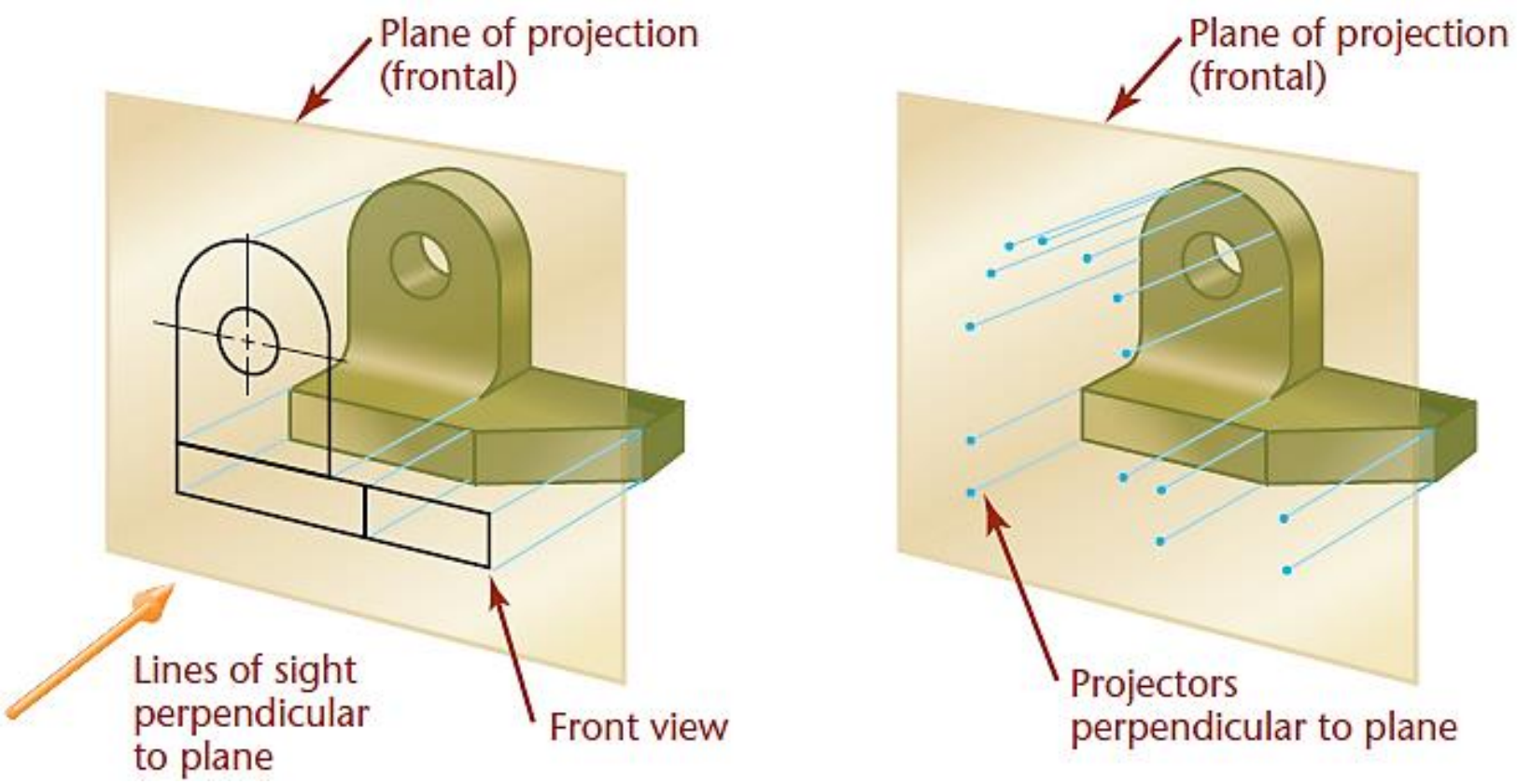
Example -1-

Lines extend around the glass box from one view to another on the planes of projection. These are the projectors from a point in one view to the same point in another view.



Example -1-

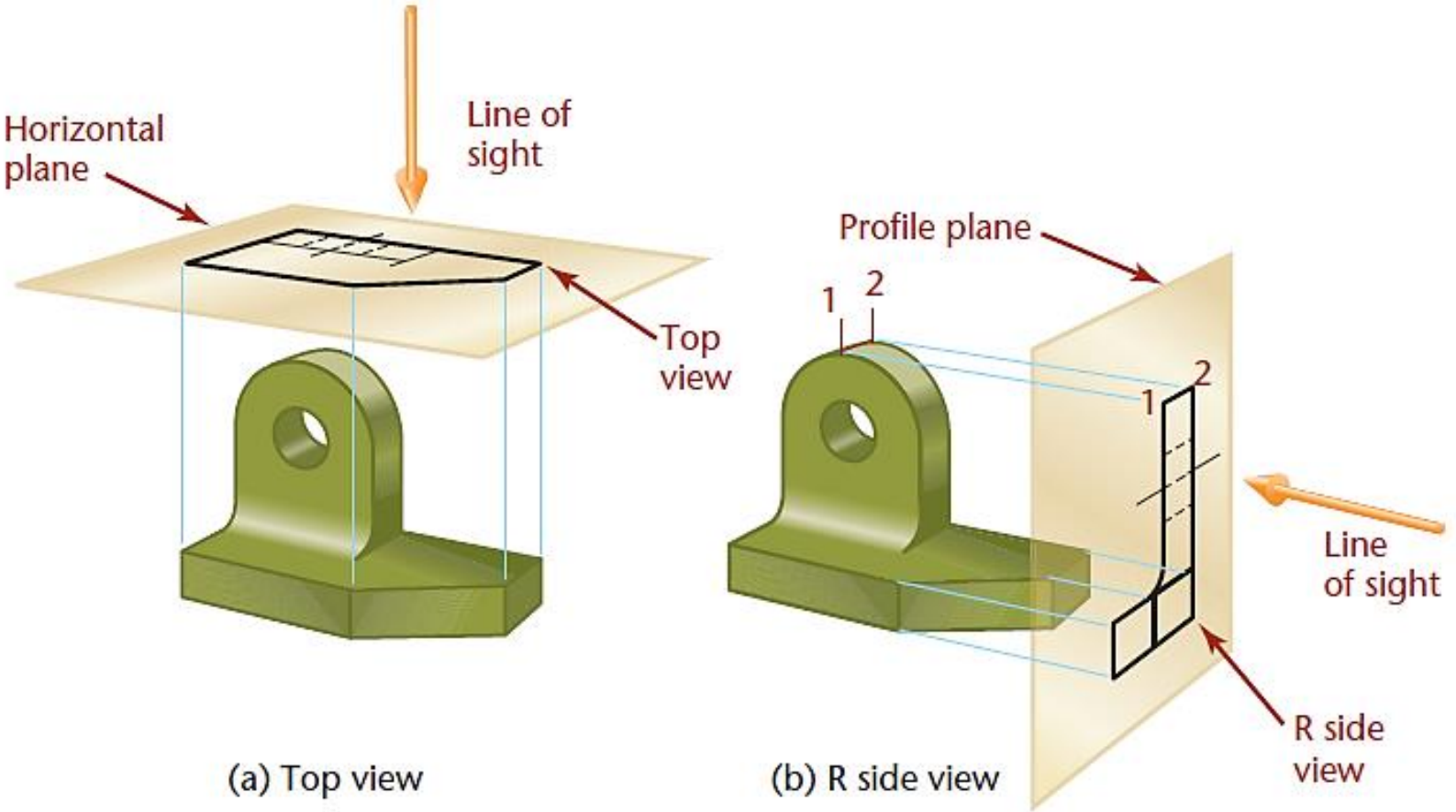
The outline on the plane of projection shows how the object appears to the observer. In orthographic projection, rays (or projectors) from all points on the edges or contours of the object extend parallel to each other and perpendicular to the plane of projection. The word orthographic means "at right angles."



Projection of an Object

Example -1-

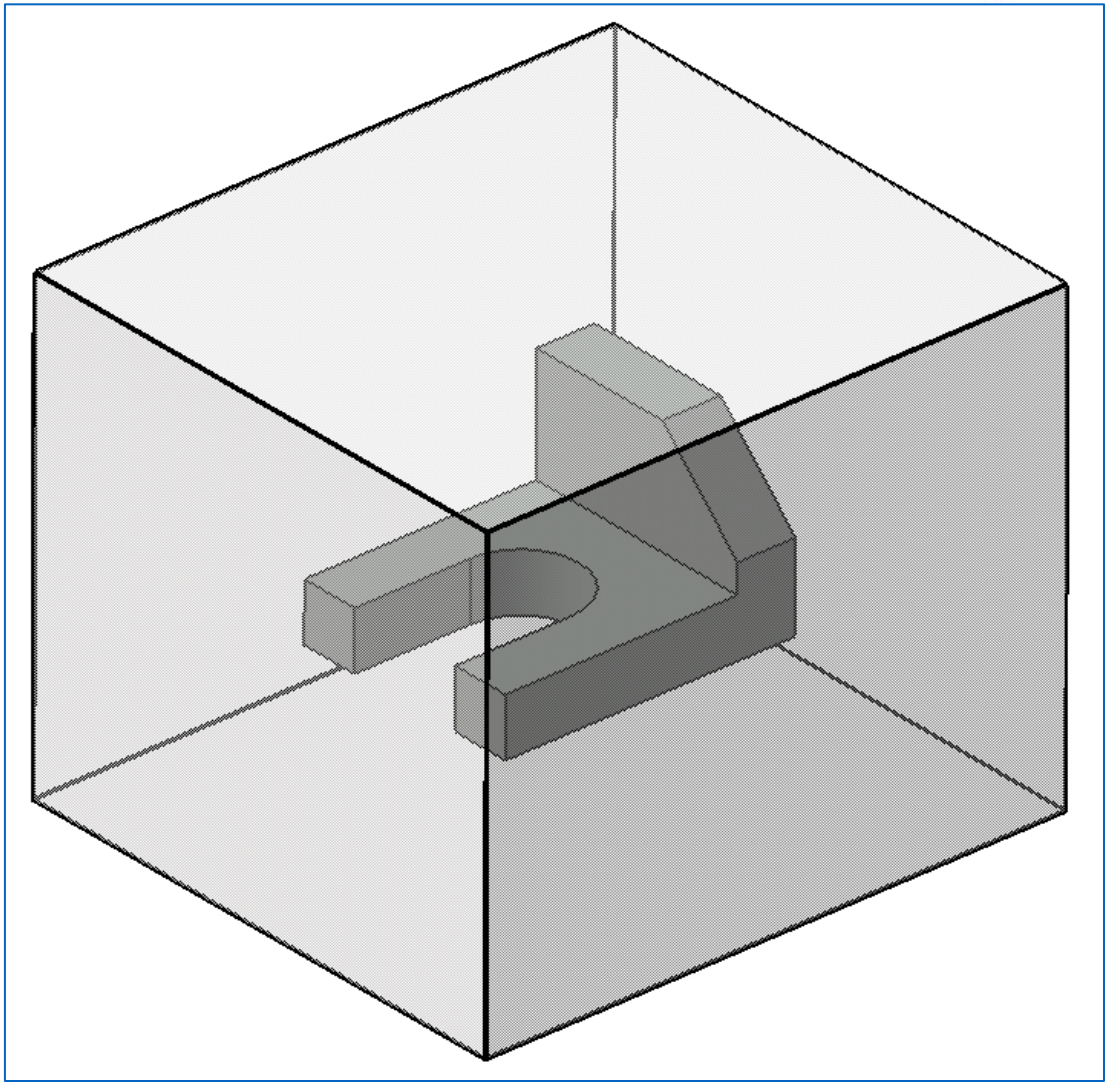
Specific names are given to the planes of projection. The front view is projected to the frontal plane. The top view is projected to the horizontal plane. The side view is projected to the profile plane.



Example -2-

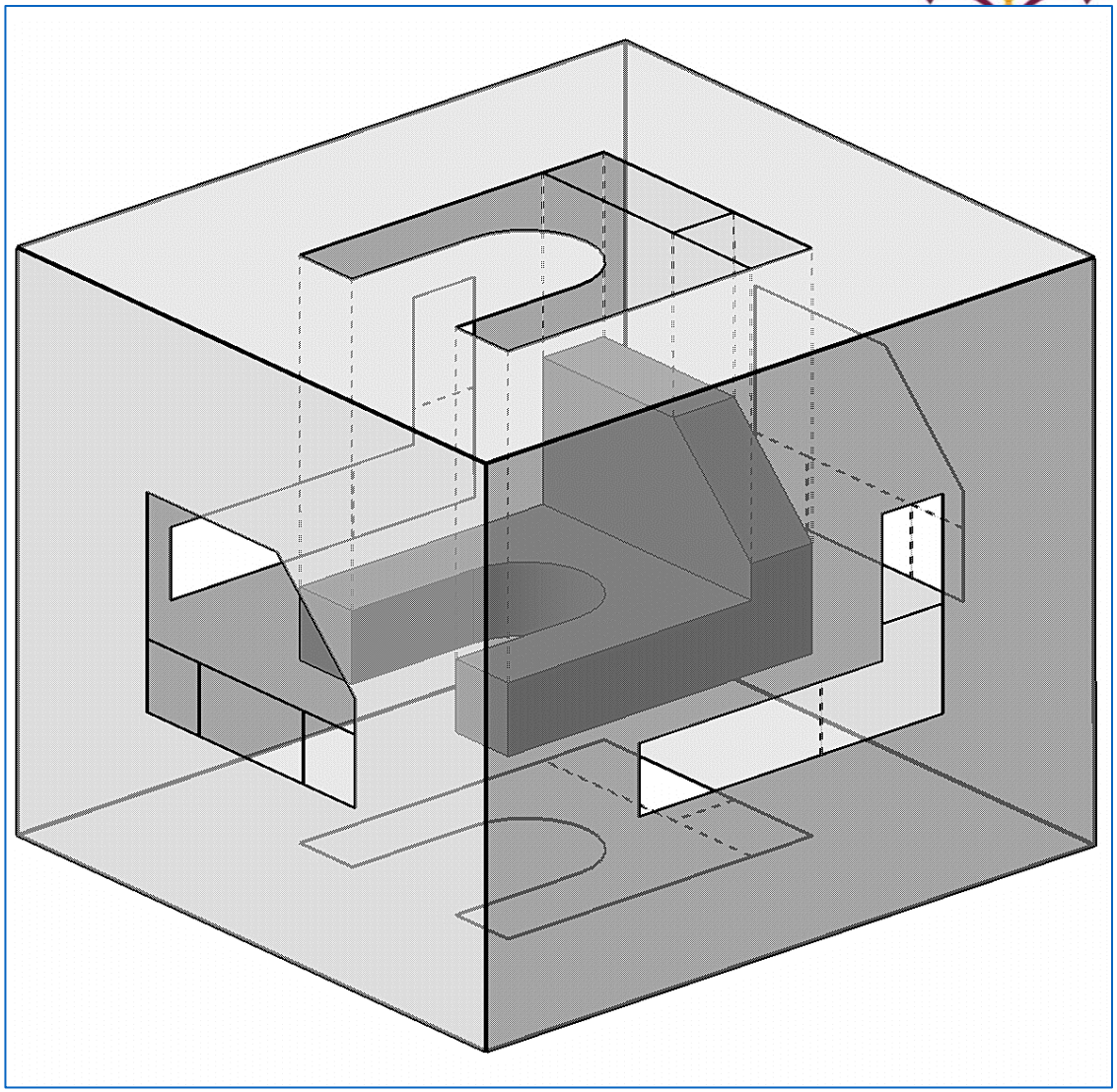
The object is placed in a glass box.

The sides of the box represent the 6 principal planes.



Example -2-

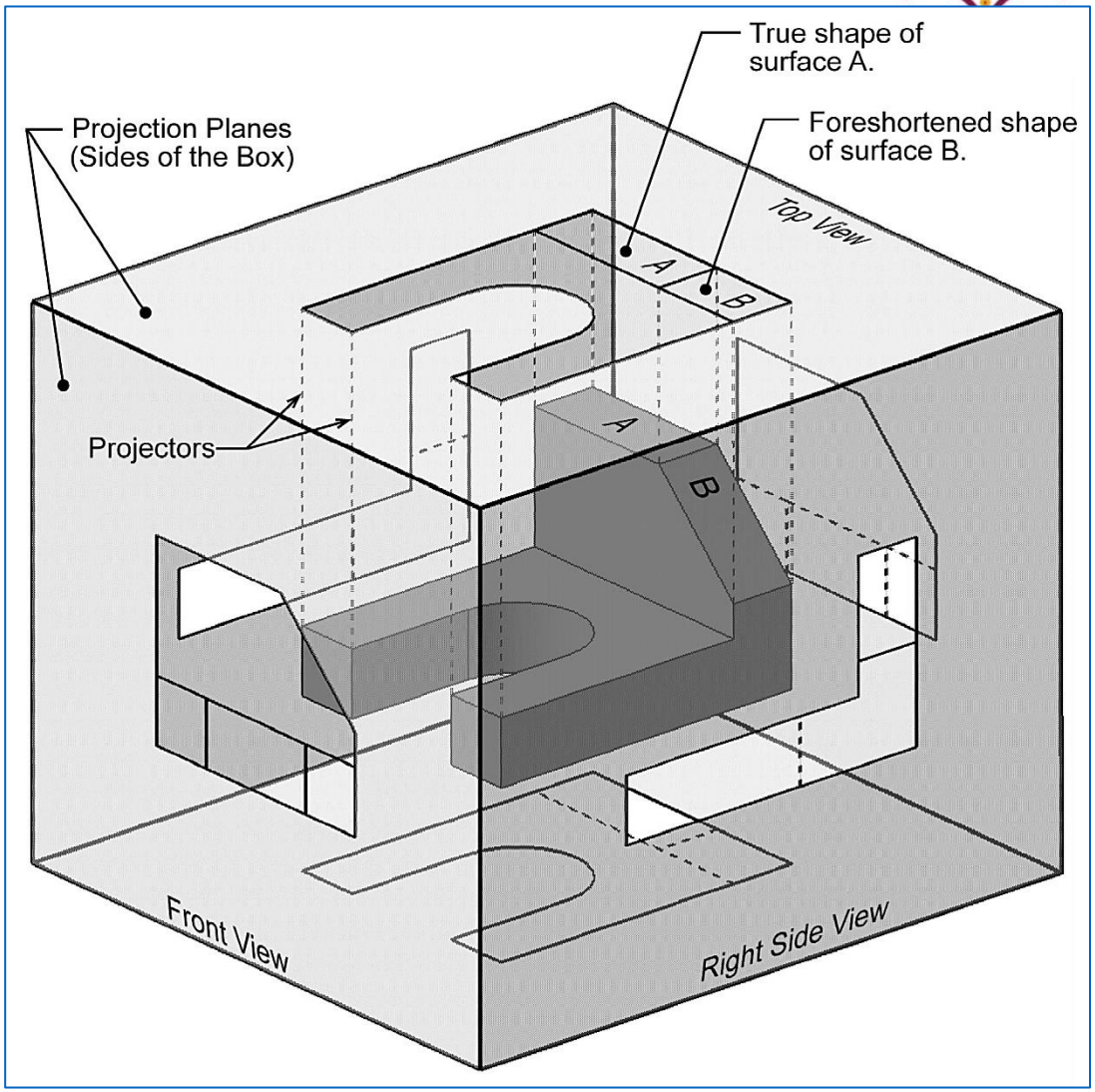
The image of the object is projected on the sides of the box.



Example -2-

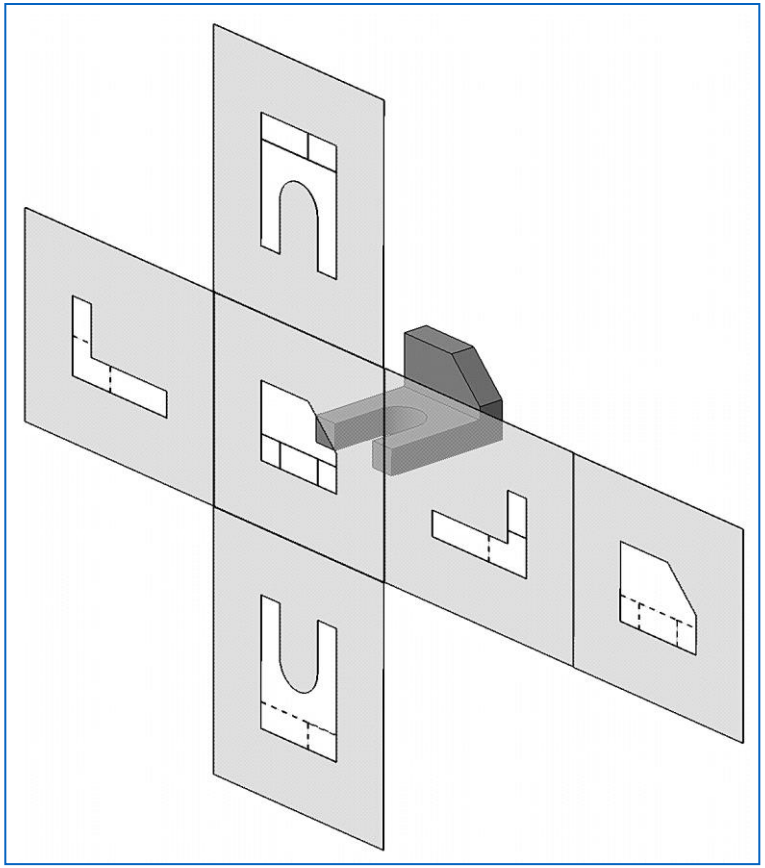
Things to notice!

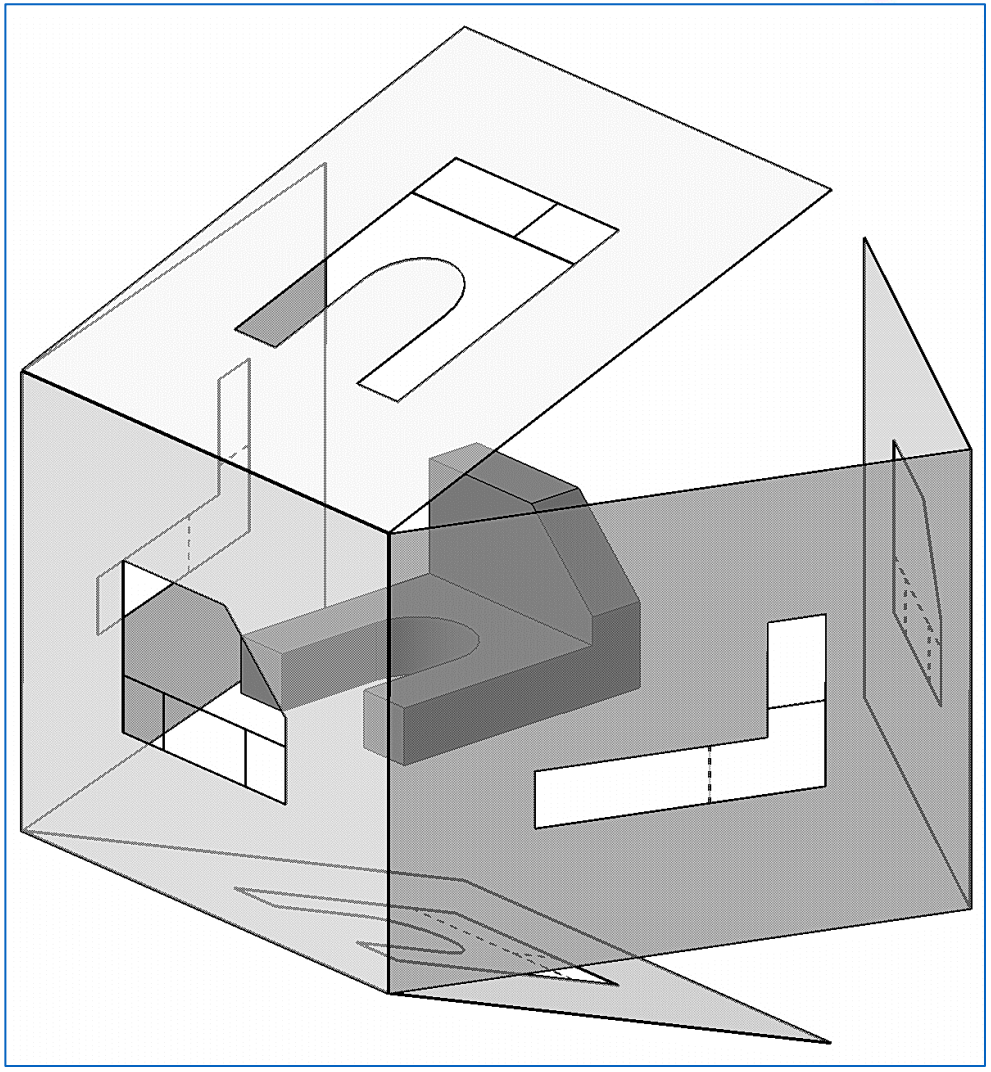
- The projection planes.
- The projectors.
- How surfaces A and B are projected.



Example -2-

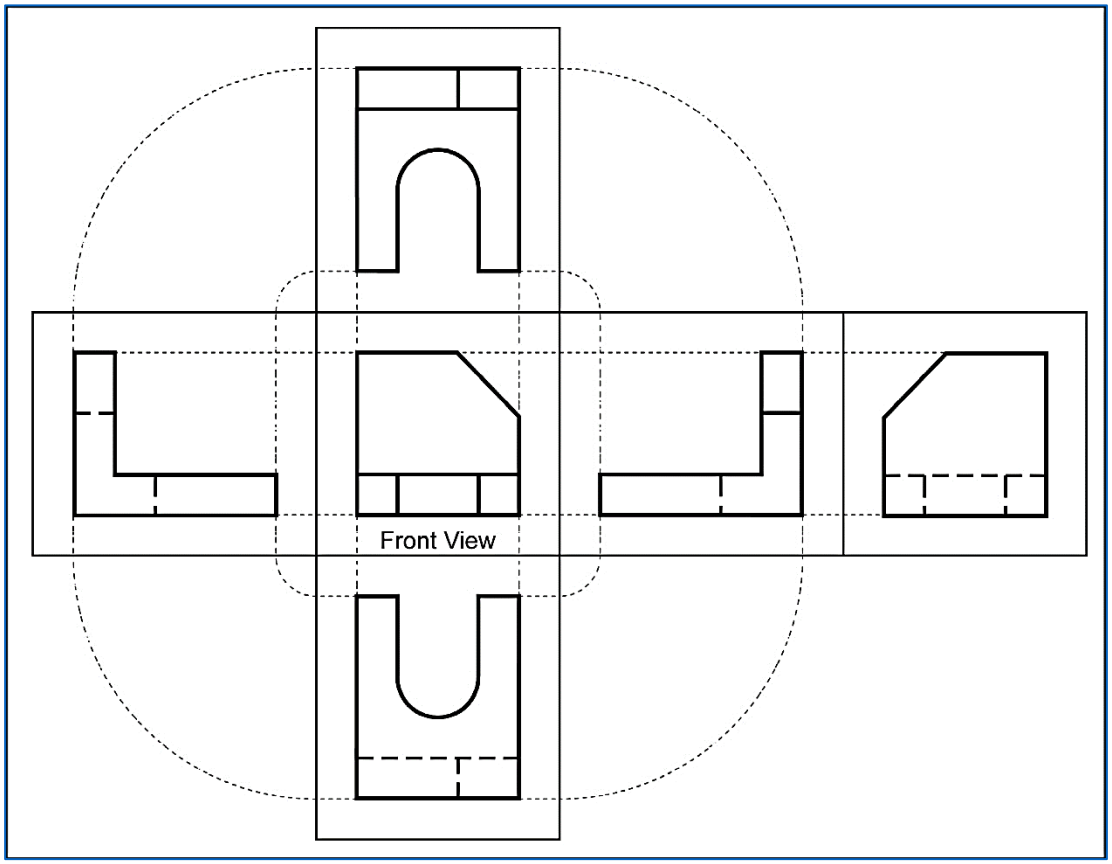
The box is unfolded creating the 6 principal views.



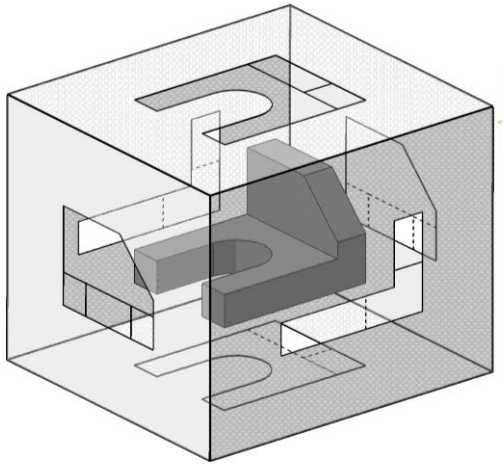


Example -2-

- Label the 5 remaining principal views with the appropriate view name.



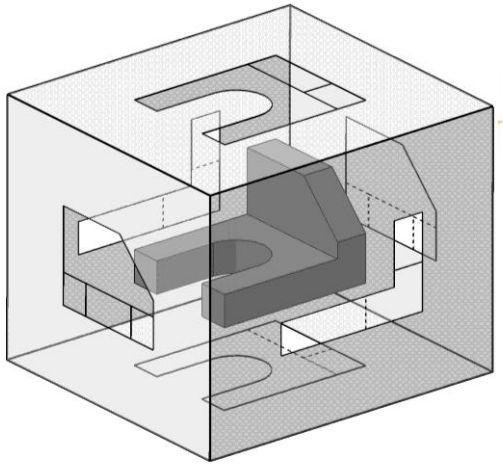
Name each view.



Top

Front View

Name each view.

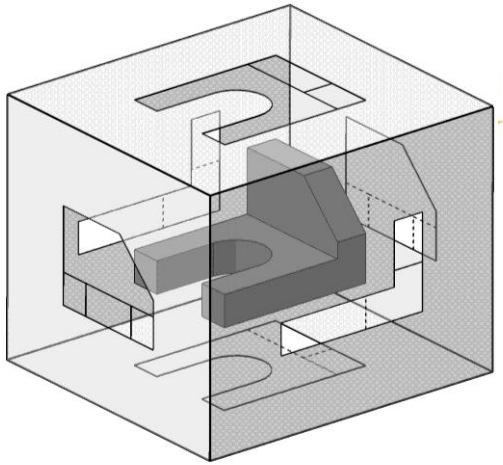


Top

Front View

Right Side

Name each view.



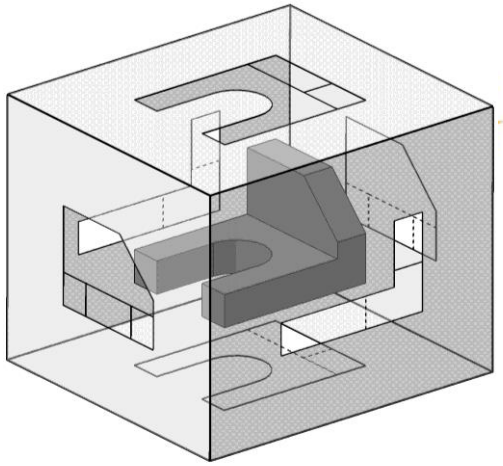
Top

Front View

Right Side

Rear

Name each view.



Top

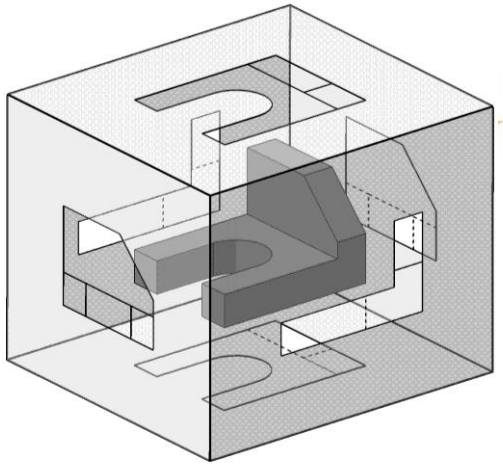
Left Side

Front View

Right Side

Rear

Name each view.



Top

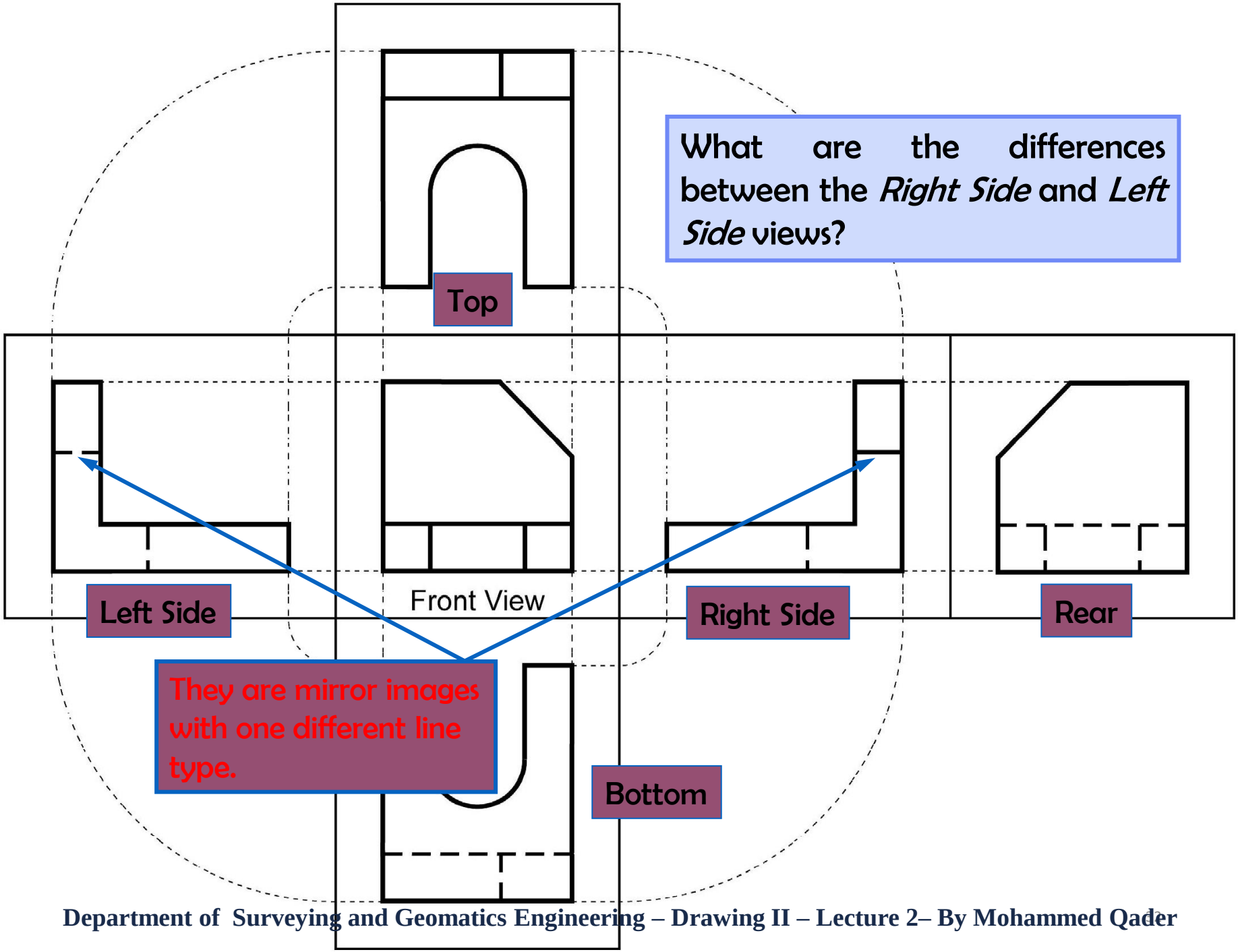
Left Side

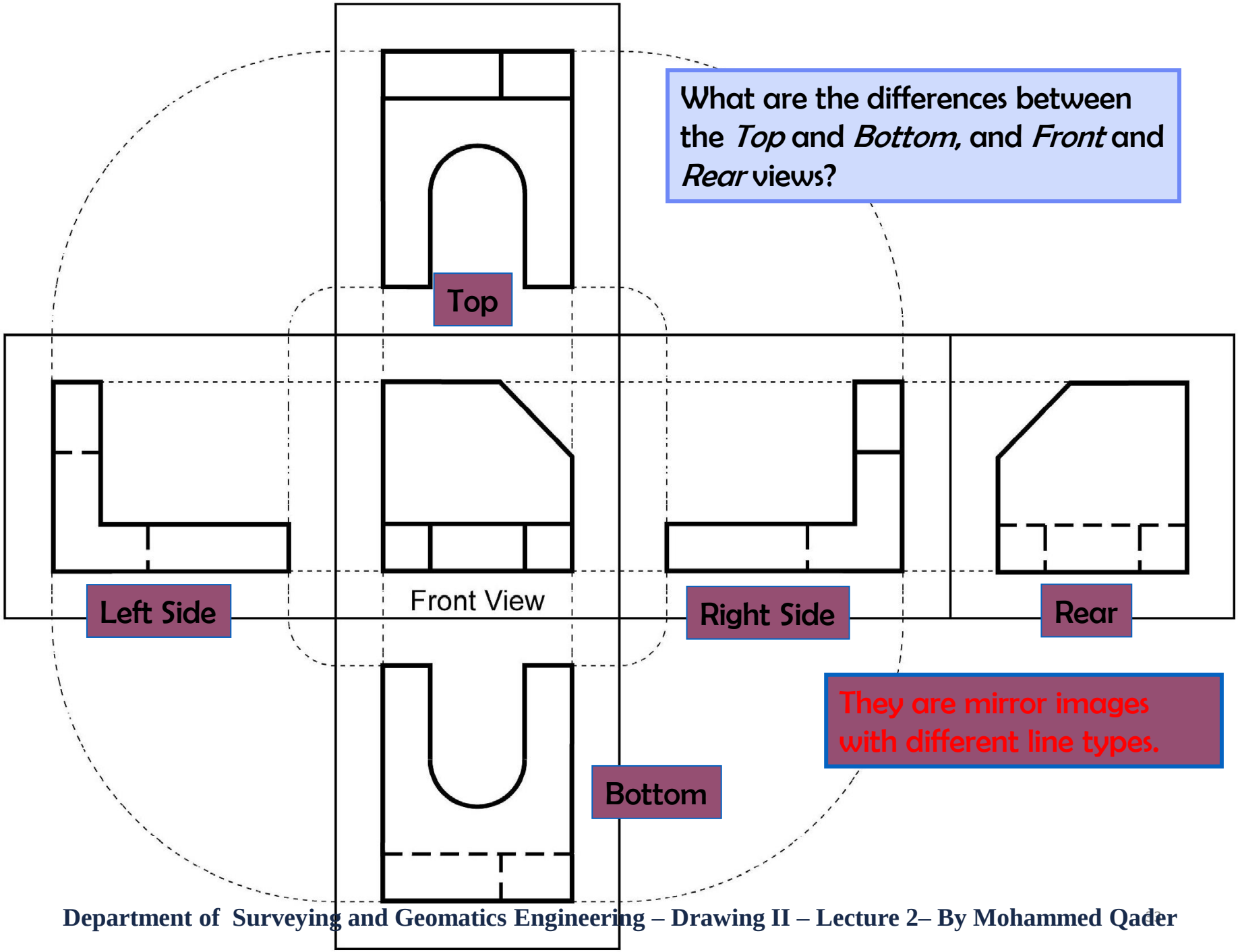
Front View

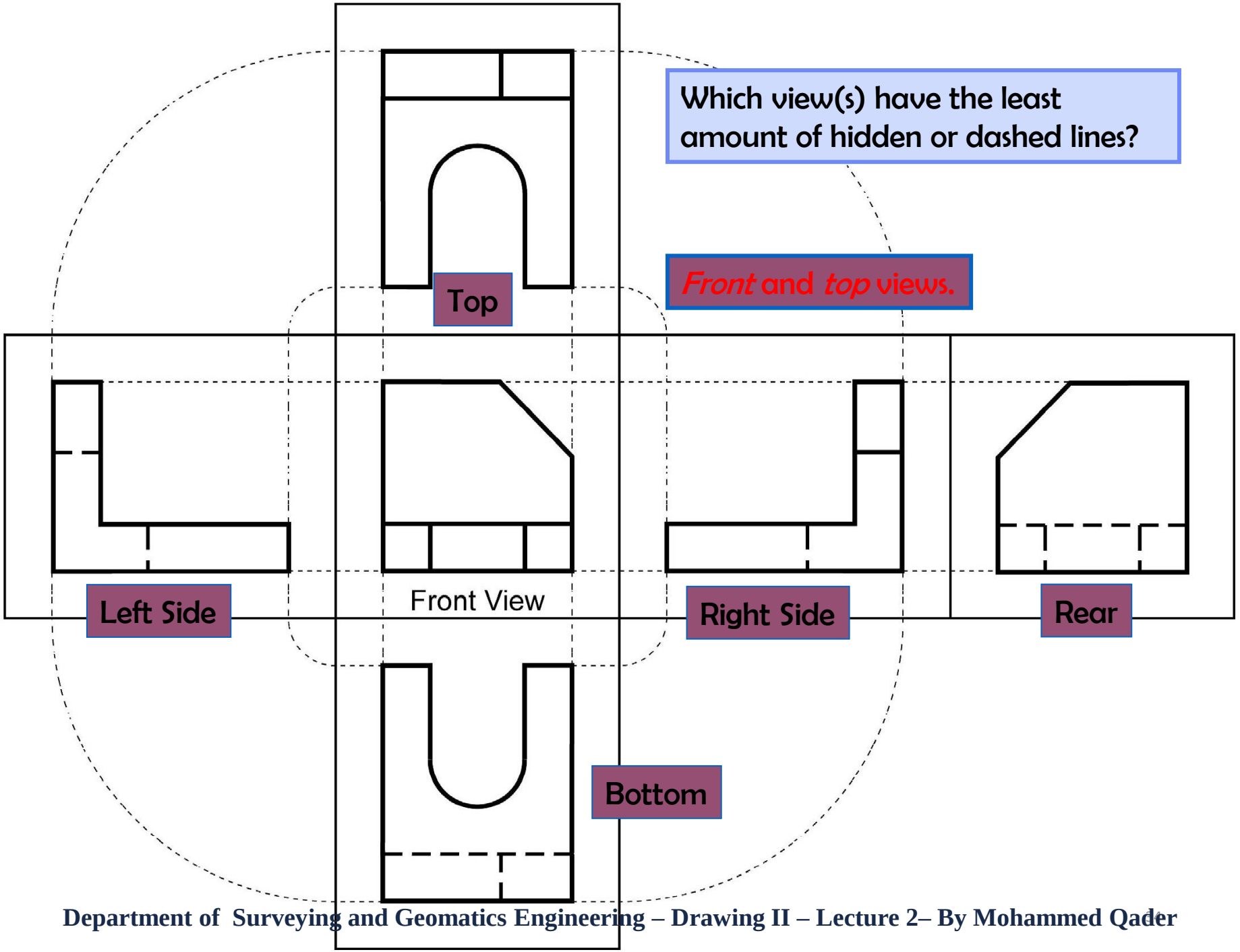
Right Side

Rear

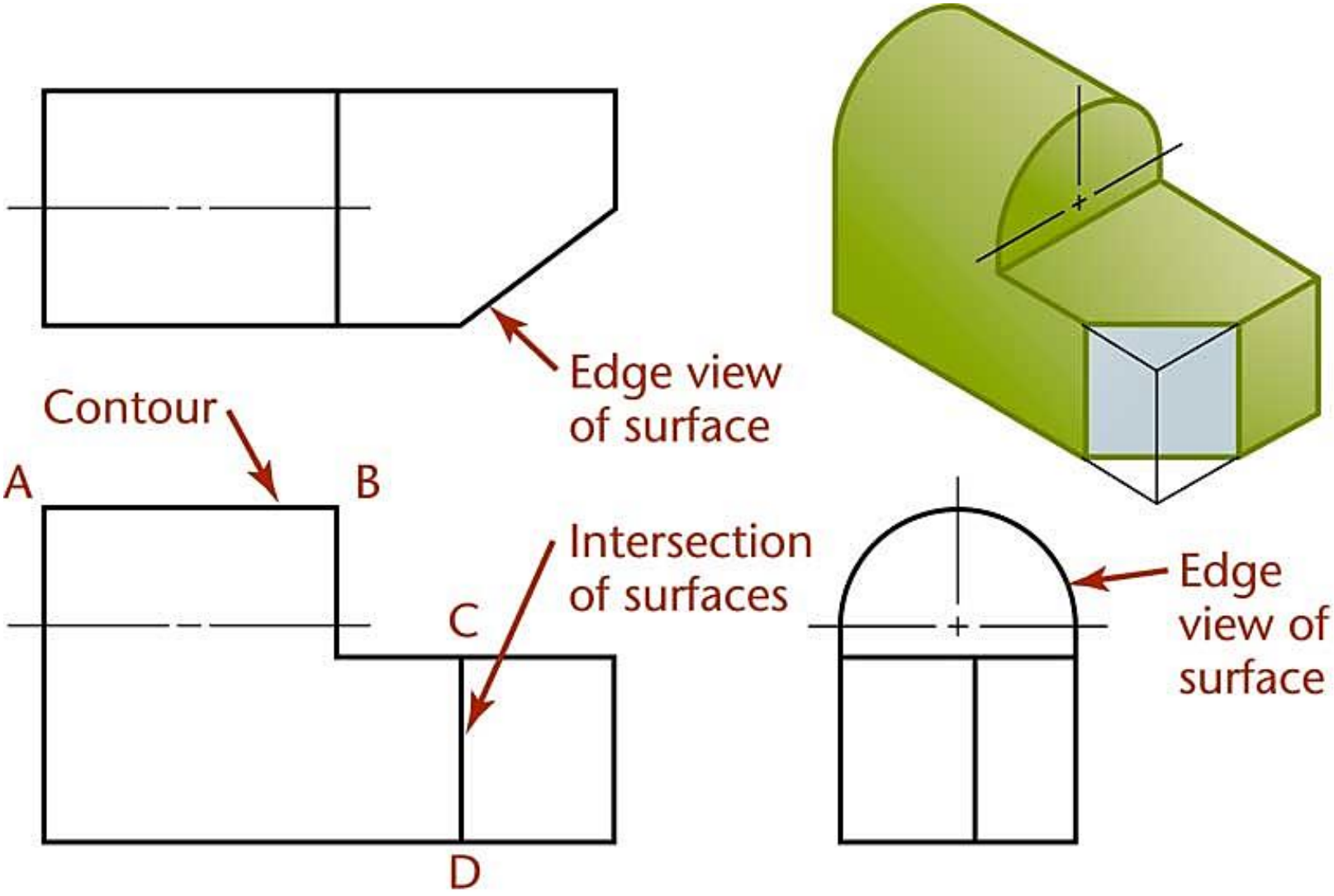
Bottom


What are the differences between the *Right Side* and *Left Side* views?
Top
Left Side
Front View
Right Side
Rear
They are mirror images with one different line type.
Bottom

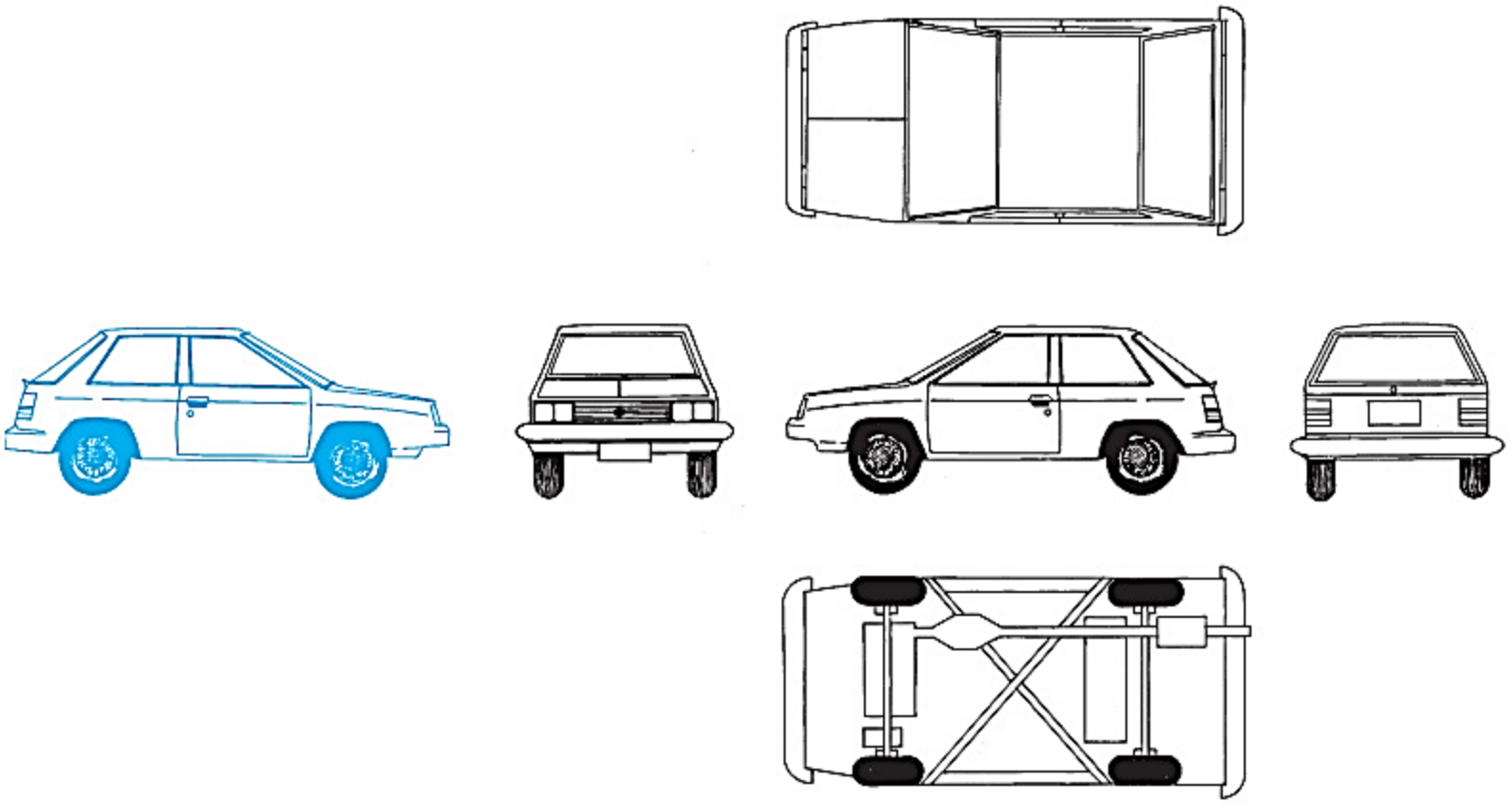

What are the differences between the *Top* and *Bottom*, and *Front* and *Rear* views?
Top
Left Side
Front View
Right Side
Rear
Bottom
They are mirror images with different line types.


Which view(s) have the least amount of hidden or dashed lines?
Front and top views.
Top
Left Side
Front View
Right Side
Rear
Bottom

Example -3-


Edge view
of surface
Contour
A
B
C
D
Intersection
of surfaces
Edge
view of
surface

Example -4-



5. Orthographic Projection

Lesson Objectives

By the end of the lesson:

- Everyone will be able to produce a simple 3rd Angle Orthographic drawing .
- Most will be able to identify the 3rd Angle Orthographic.
- Some will understand *hidden detail* lines and their use.

5. Orthographic Projection

- Orthographic projection is a parallel projection technique in which the parallel lines of sight are perpendicular to the projection plane
- Ortho – Greek word meaning perpendicular.
- Show the views of an object projected in 2-D.
- Usual views are the top, front and right side of the object.
- The remaining 3 views usually don't add any new information.

6. Orthographic Projection Systems

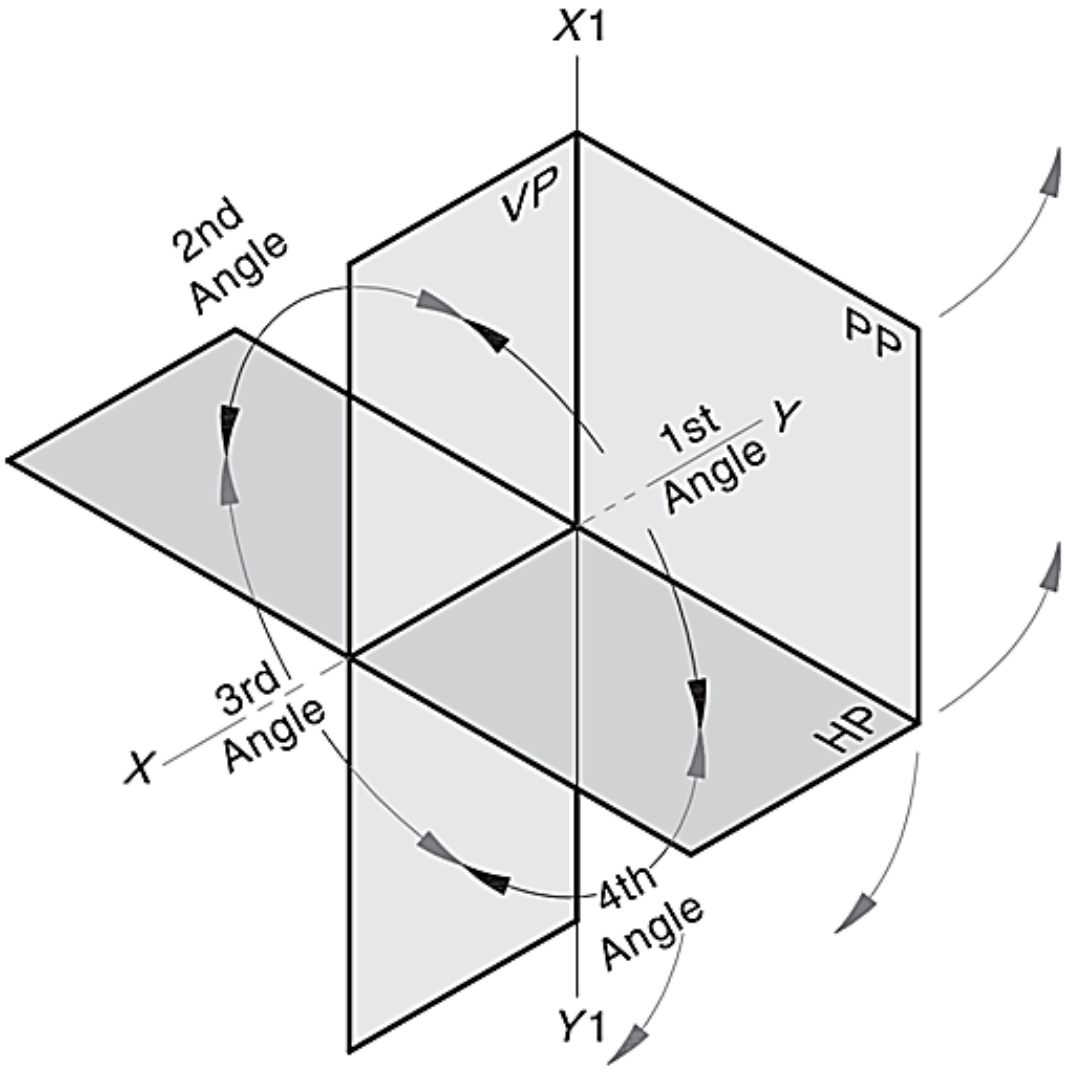
1) If the third quadrant is used, then this system is called the **Third Angle System.**

- In the Third Angle System, the top view is upward while the front view is downward and the side view is towards, aside from the front view.

2) If the first Quadrant is used to draw the projections, then this system is called **First Angle System.**

- In the First Angle System, the top view is placed below while the front view is upward and the side view is by the side of the front view.

Principal planes in drawing

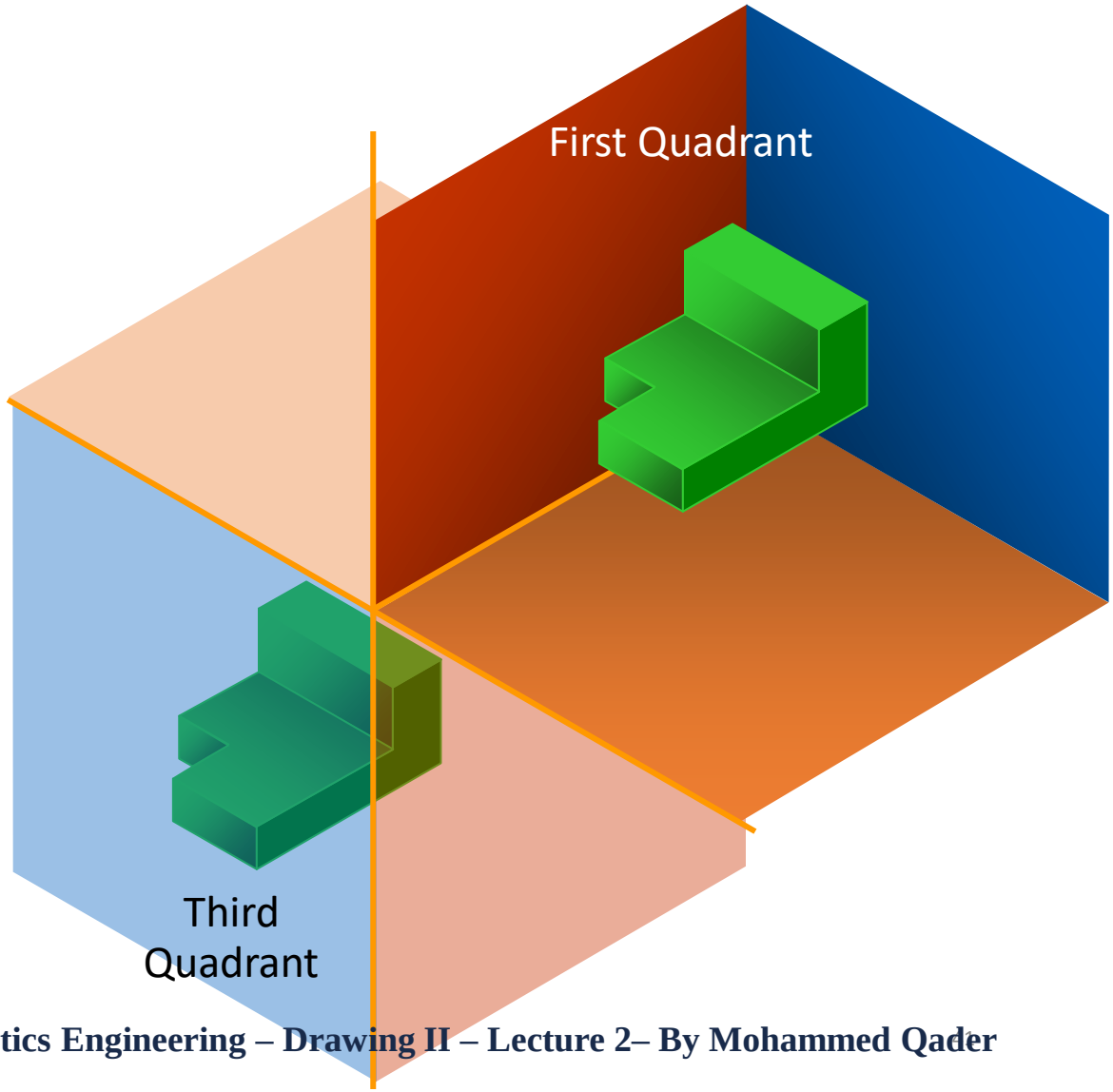


1. Third angle system

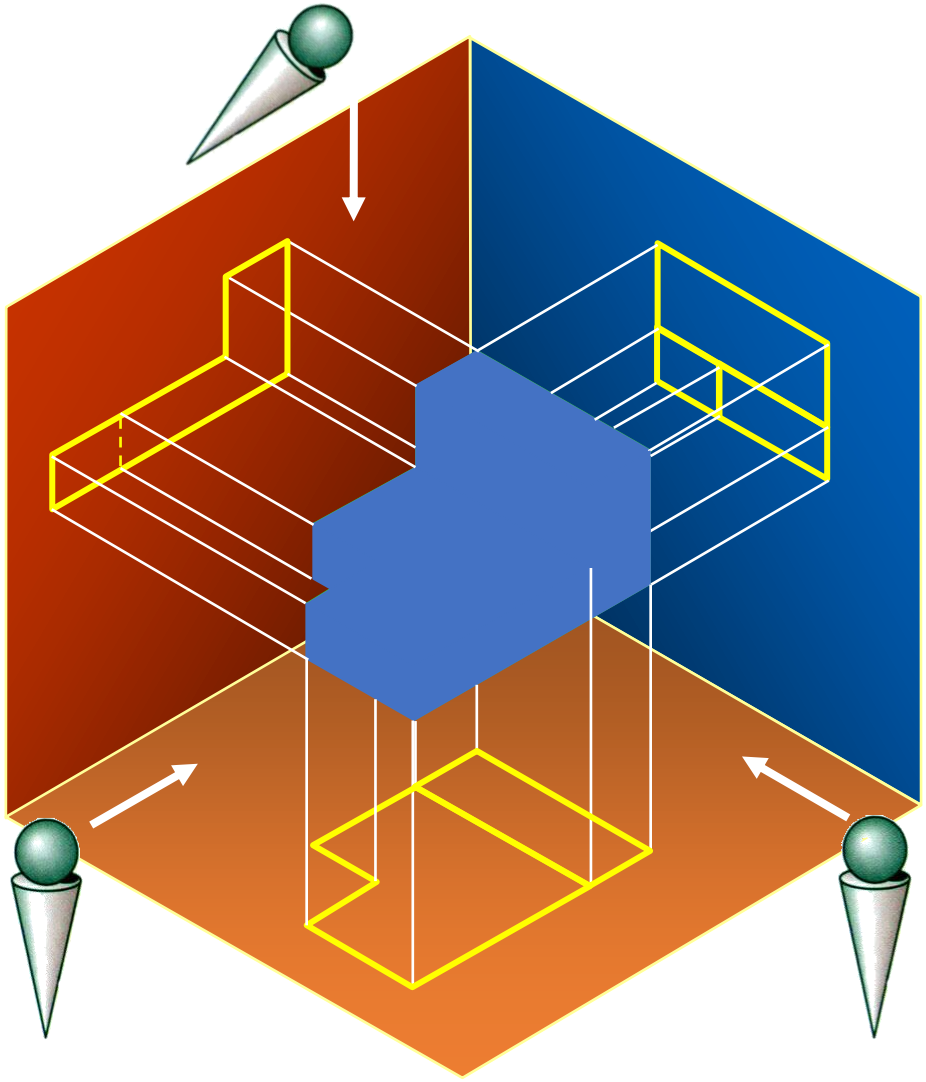
- Canada, USA,
  Japan, Thailand

2. First angle system

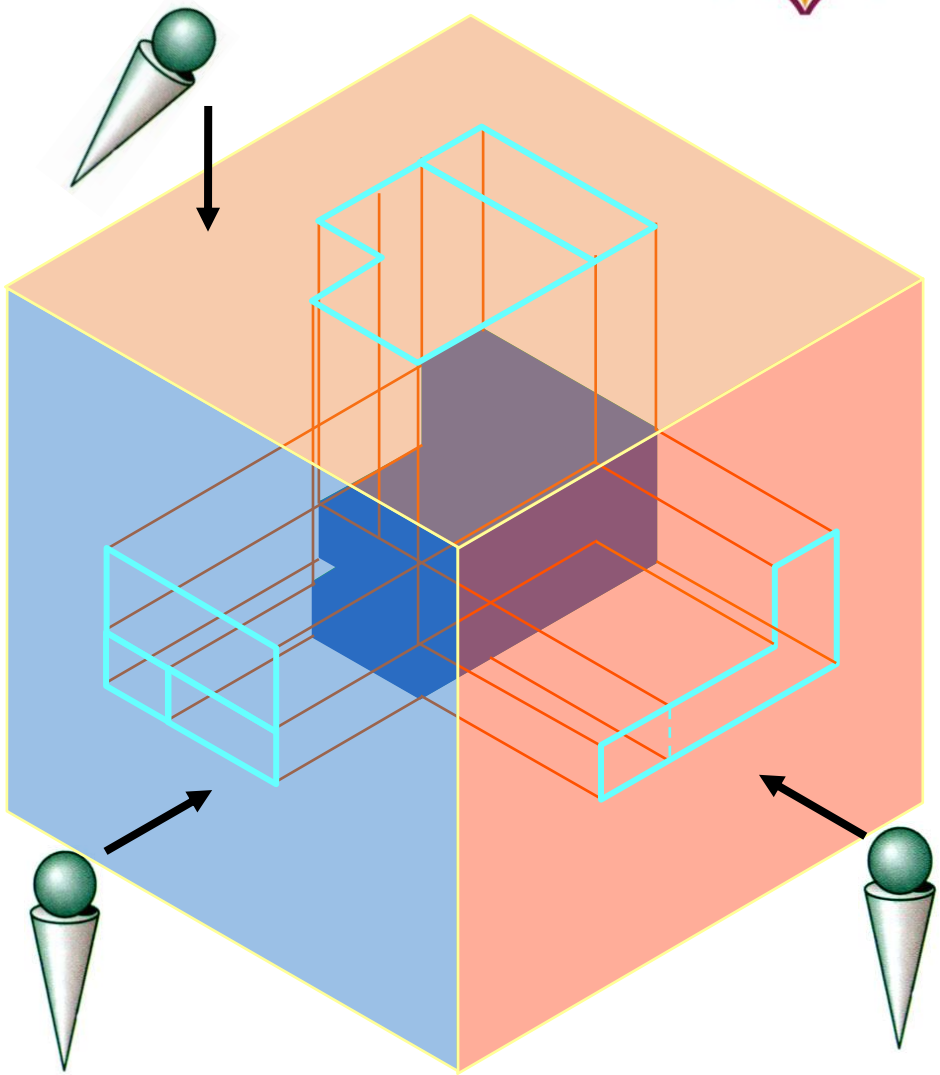
- European country
- ISO standard



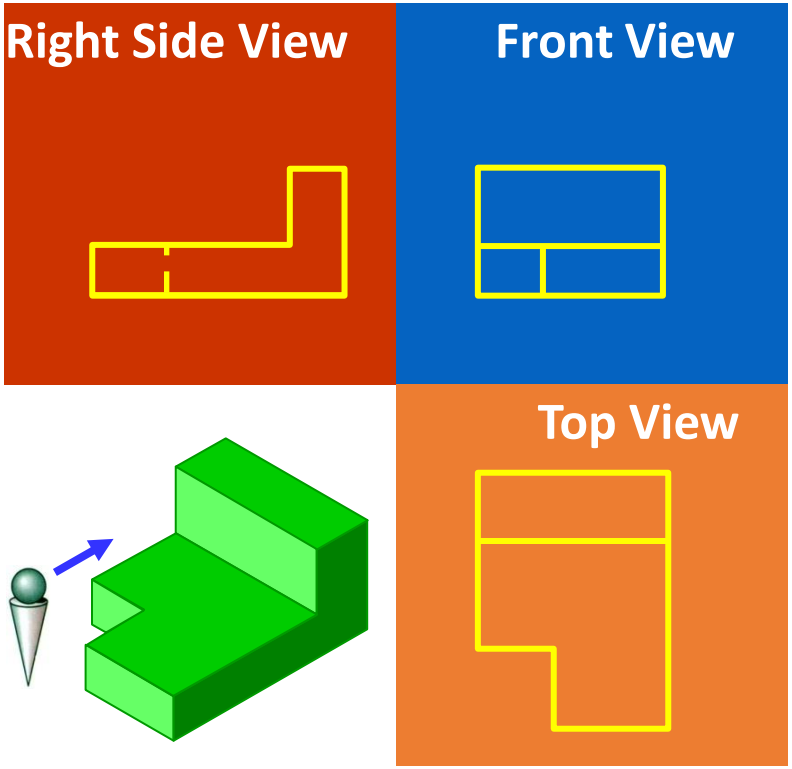
1st angle system



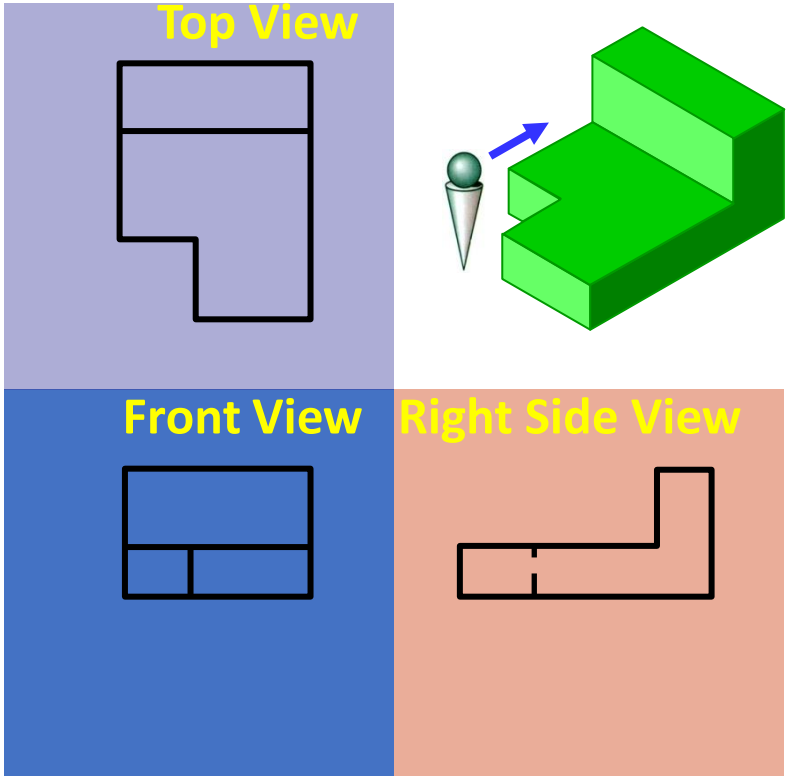
3rd angle system



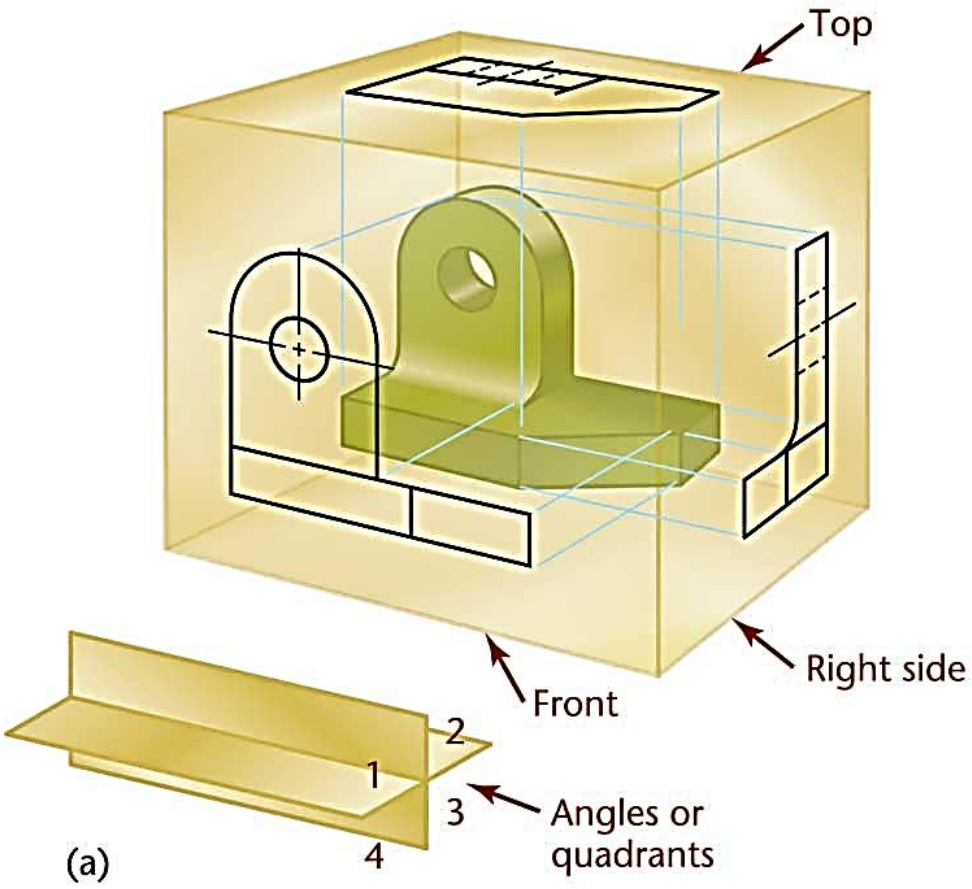
1st angle system

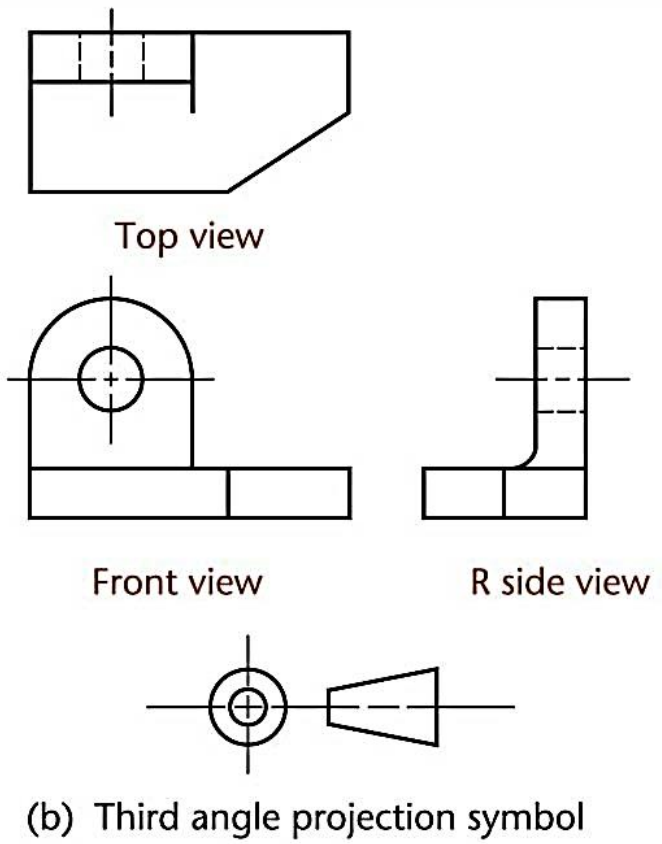


3rd angle system

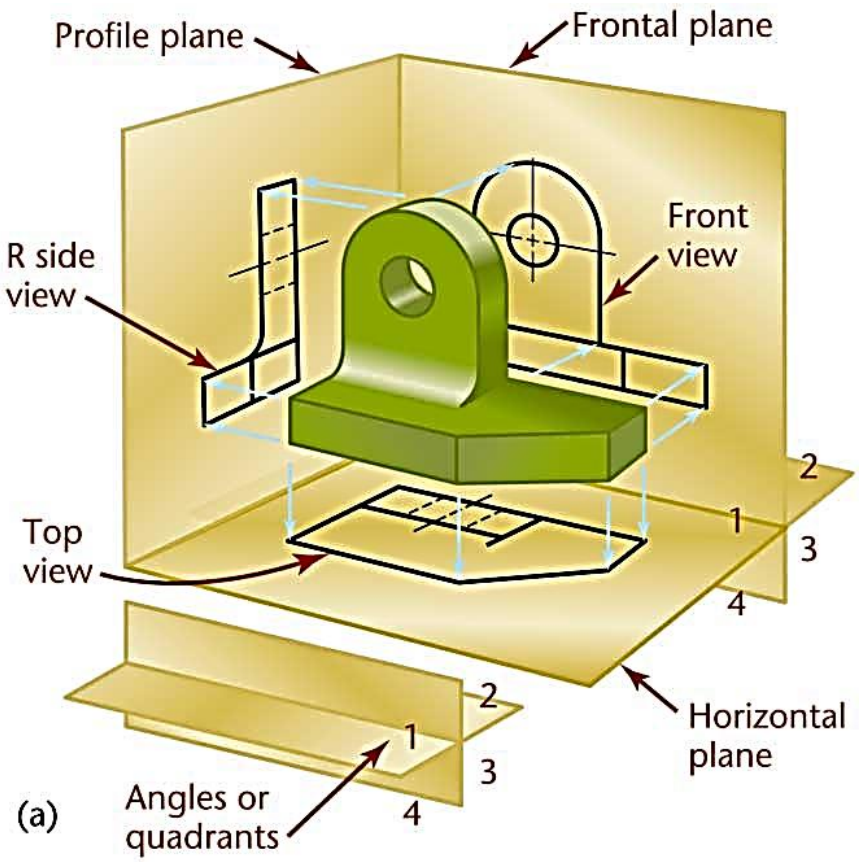


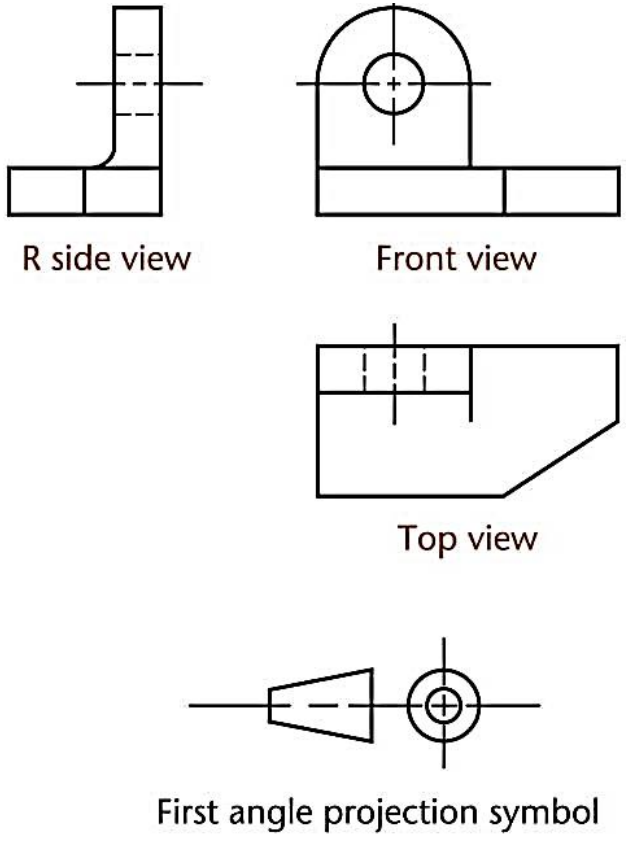
3rd Angle Projection

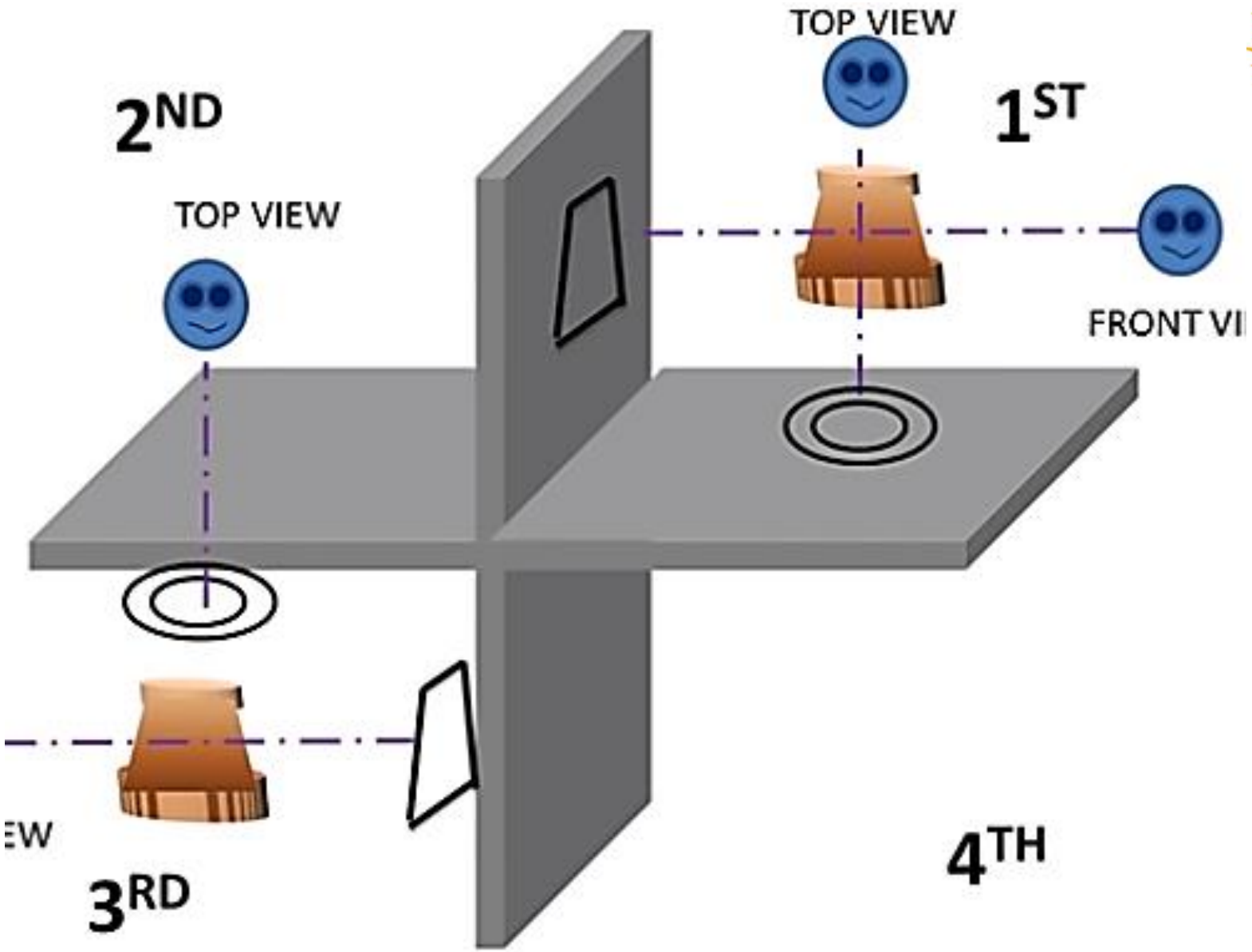




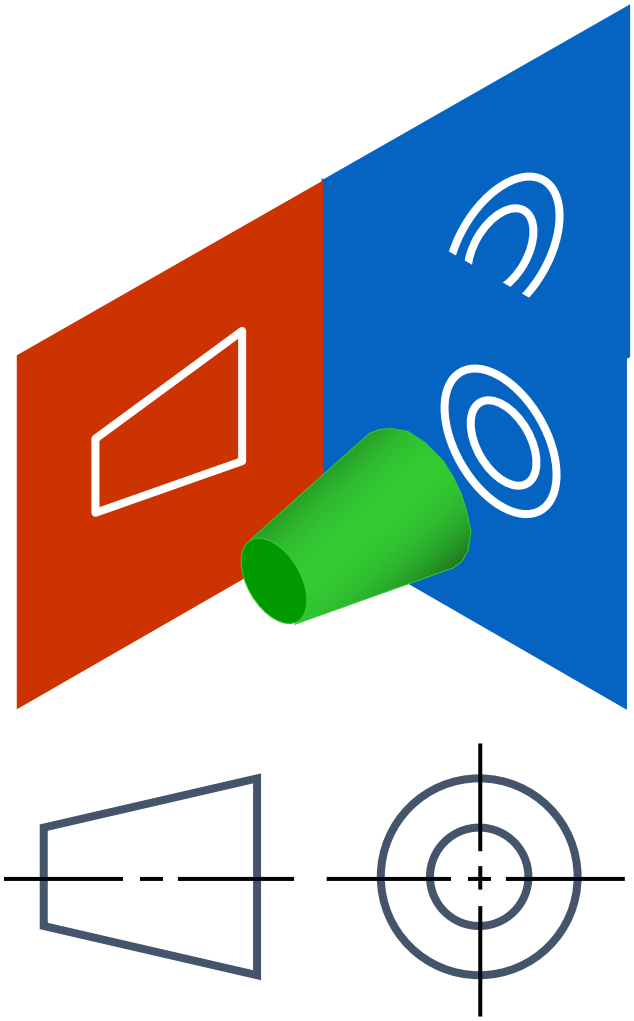
1st Angle Projection



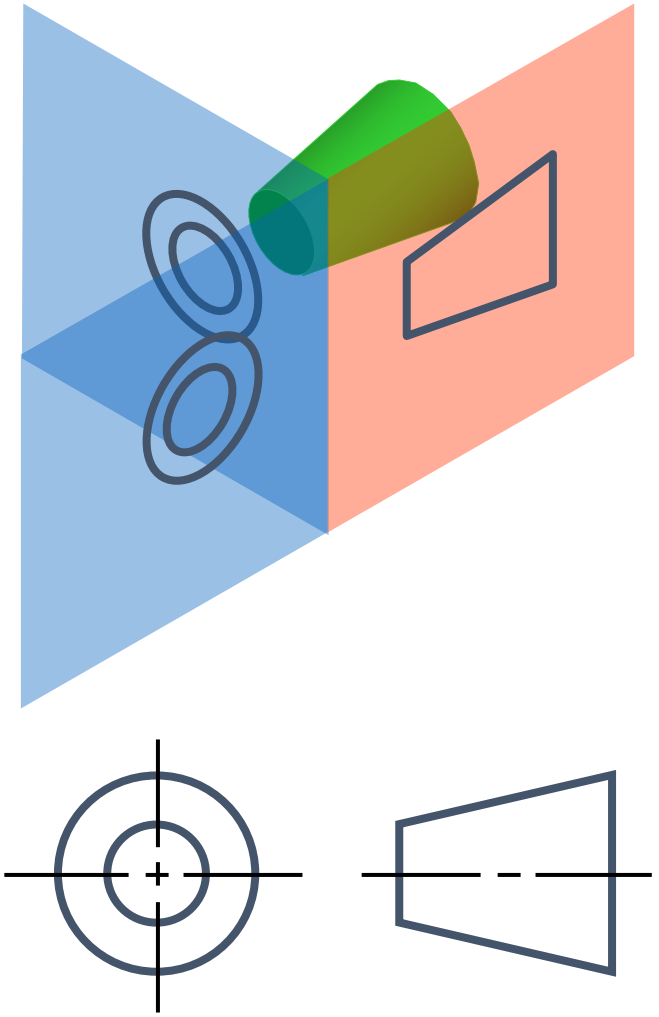



TOP VIEW
2ND
1ST
TOP VIEW
FRONT VI
EW
3RD
4TH

First angle system

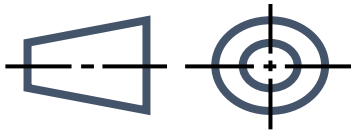


Third angle system



First-angle Projection Method

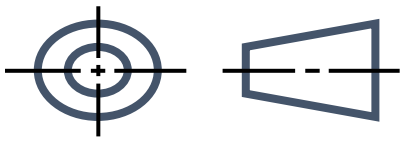
- In first-angle projection, an object is placed in the first quadrant, i.e., above the HP and in front of the VP.
- The object lies in between the observer and the plane of projection.
- The plane of projection is assumed to be non transparent and views drawn on it.
- Front view is above the reference axis and top view lies below the reference axis exactly bellow the front view.
- Right hand side view is drawn to left of front view and Left hand side view is drawn to the right of front view.
- Symbol



Third -angle Projection Method

In third-angle projection, an object is placed in the third quadrant, i.e., below the HP and behind the VP .

- The plane of projection lies in between the observer and the object.
- The plane of projection is assumed to be transparent and views drawn on it.
- Front view is below the reference axis and top view lies above the reference axis exactly above the front view.
- Right hand side view is drawn to right side of front view and Left hand side view is drawn to the left side of front view.
- Symbol



6. Creating an Orthographic Projection

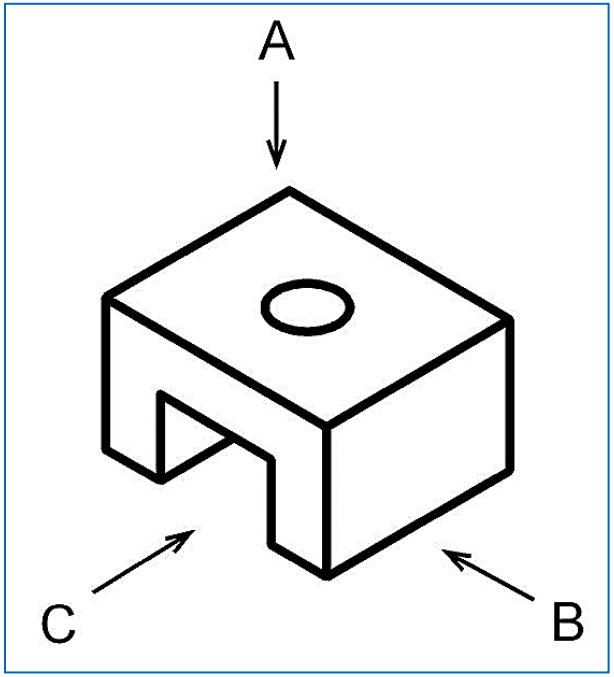
1. Third Angle System

- **Example -5-**

- Choose a front view.

  - Which view shows the most about the object?

Answer ; C



6. Creating an Orthographic Projection

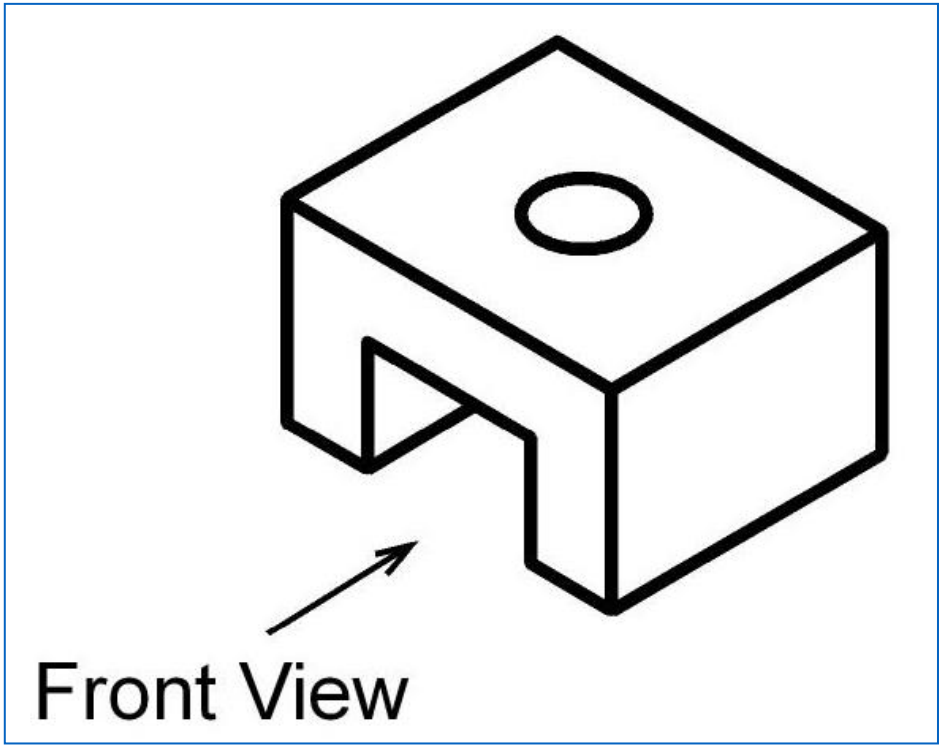
1. Third Angle System

- **Example -5-**
- Decide how many views are needed.
  - How many and which views?

2

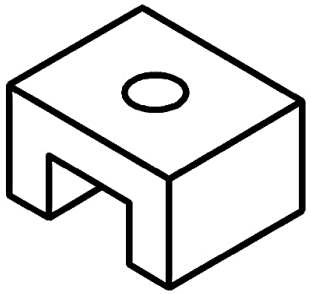
Top and Right side

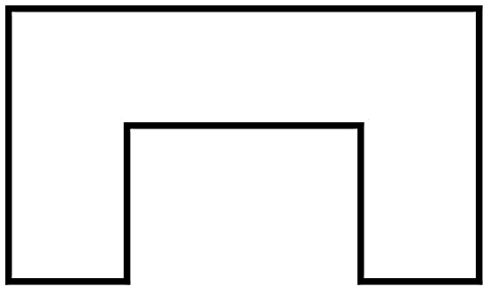
For procedural reasons, we will continue this example by drawing all 3 standard views.



- Draw the visible features of the front view.

TOP VIEW

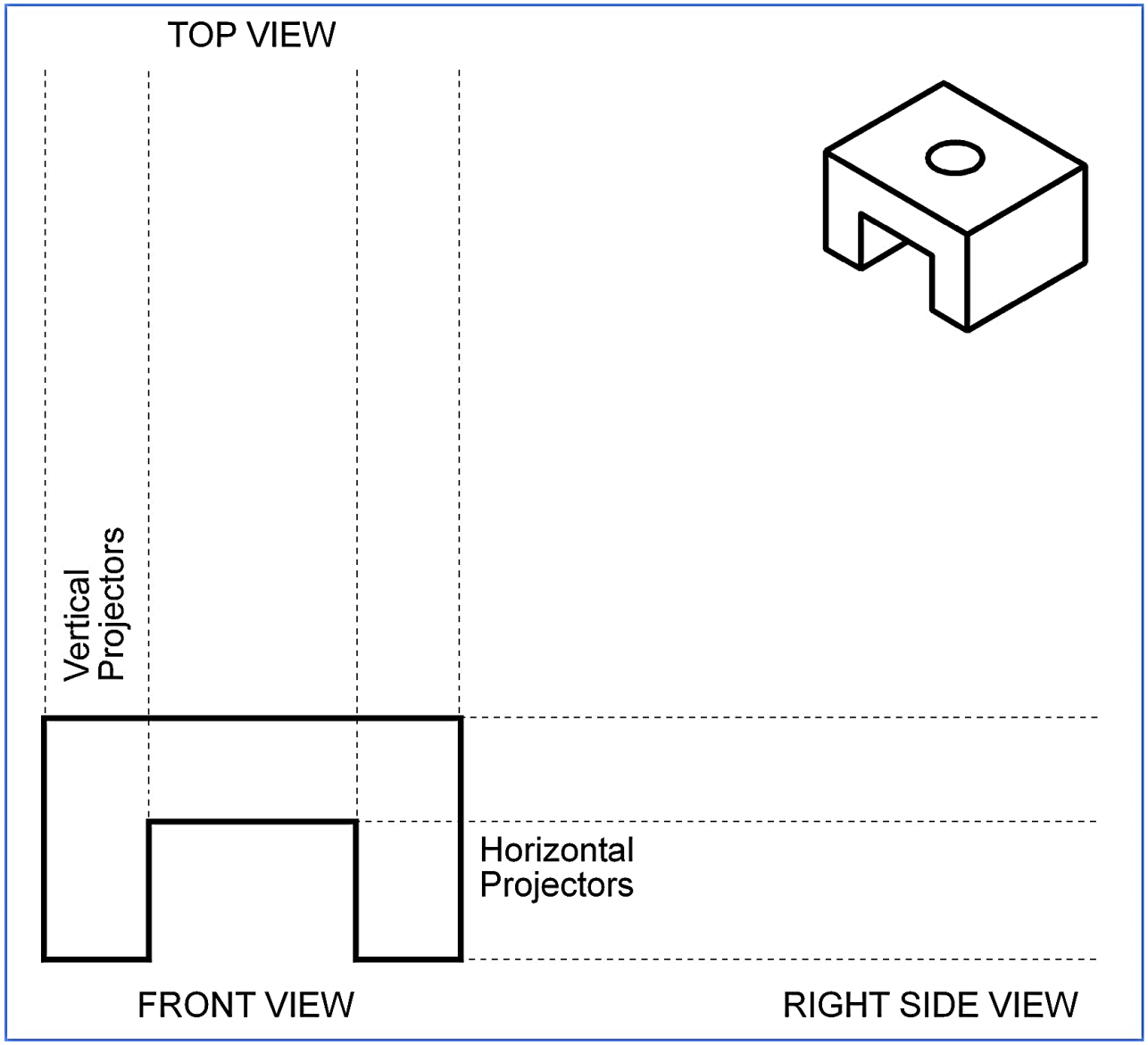




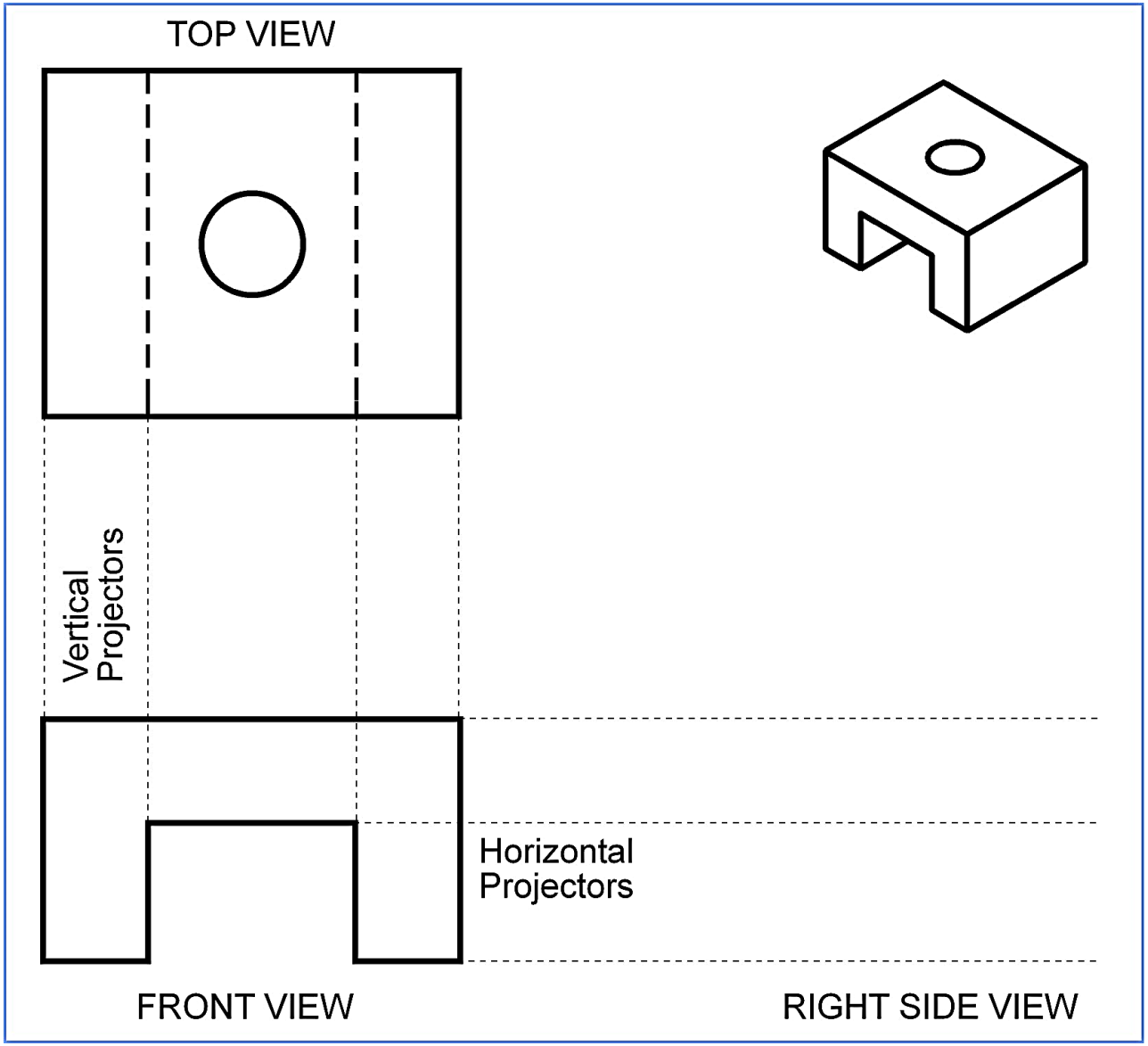
FRONT VIEW

RIGHT SIDE VIEW

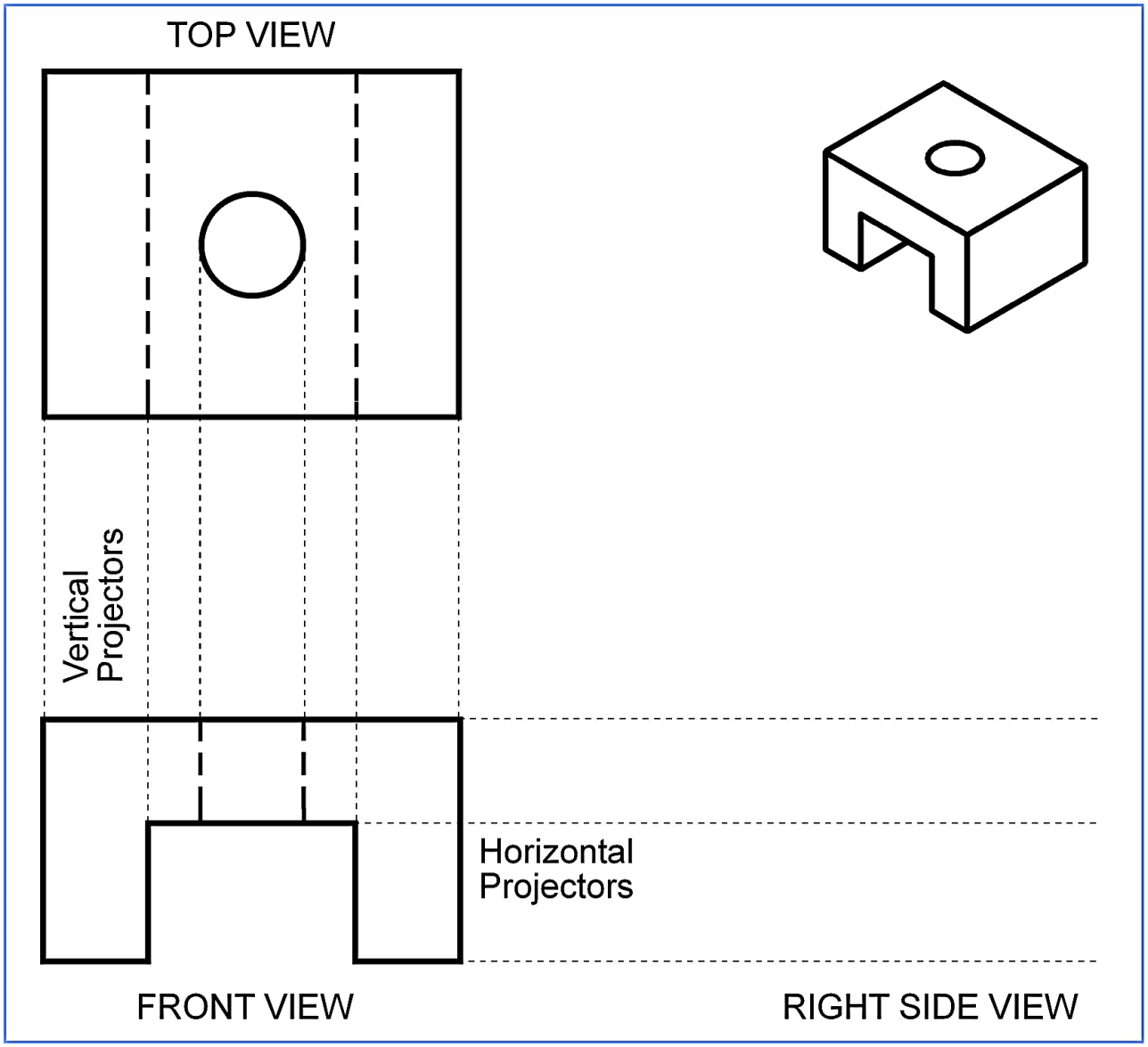
- Draw projectors off of the front view.



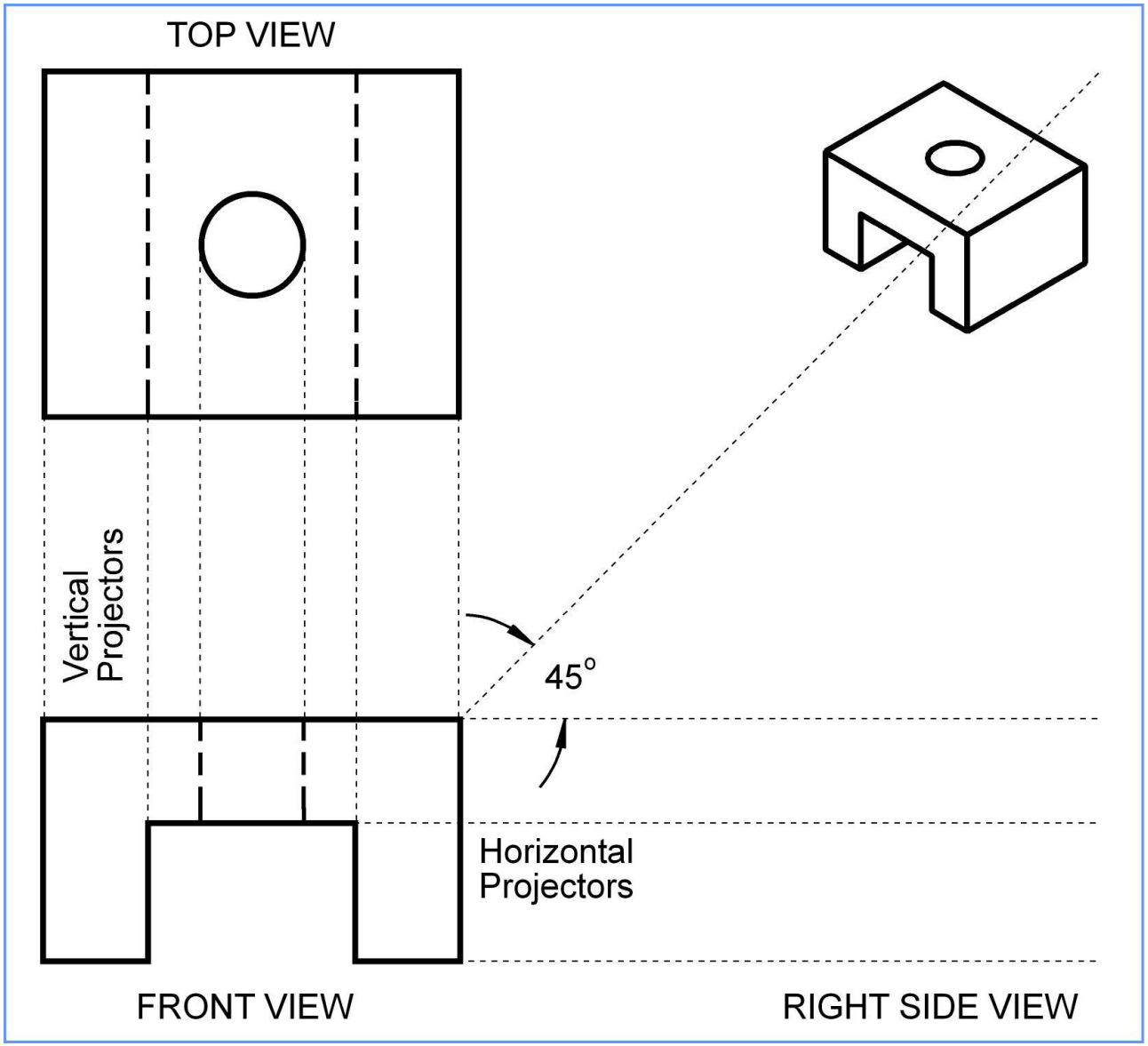
- Draw the top view.



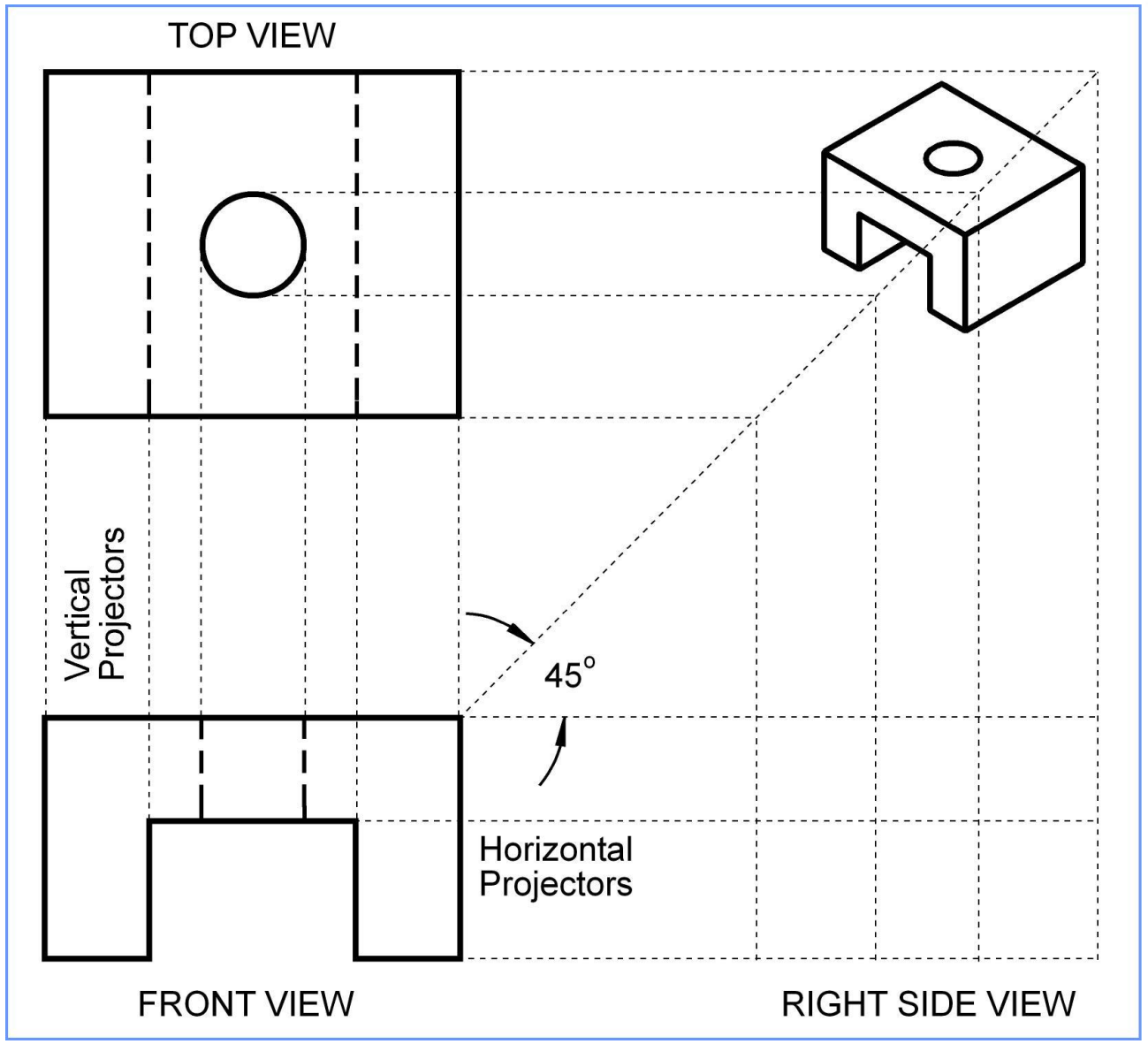
- Project back to the front view.



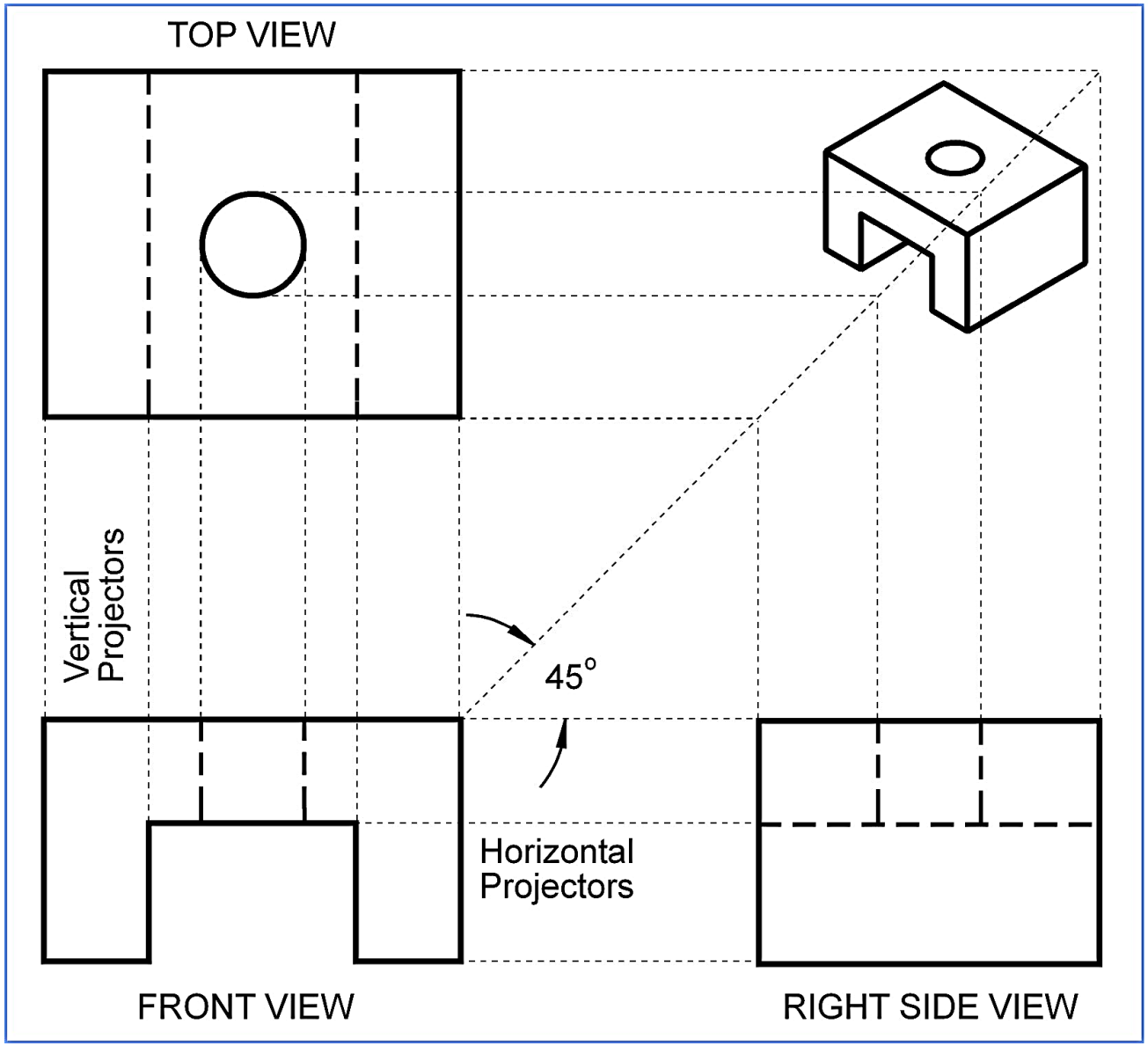
- Draw a 45° projector off the front view.



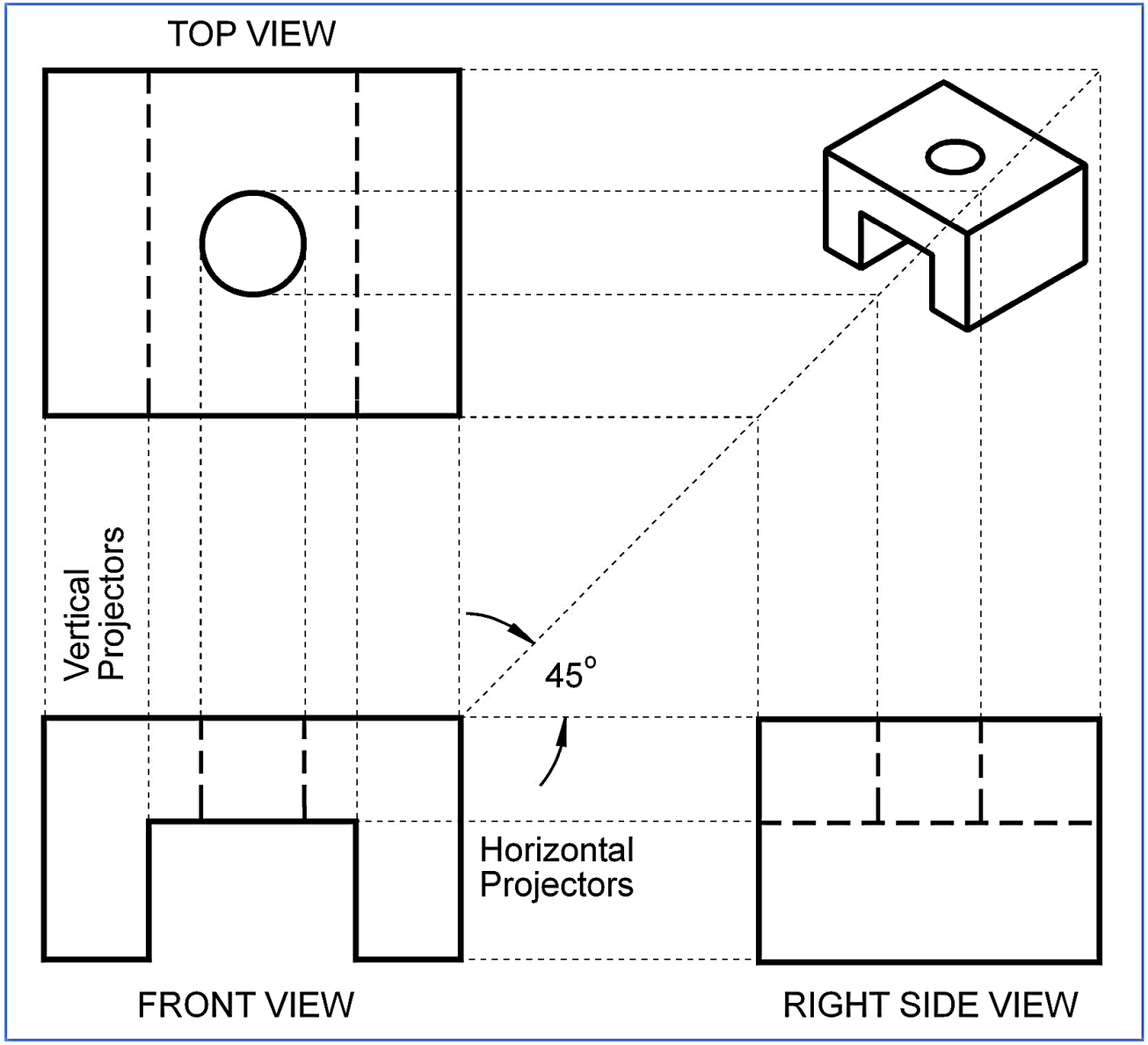
- Draw projectors over to the 45° line and down.



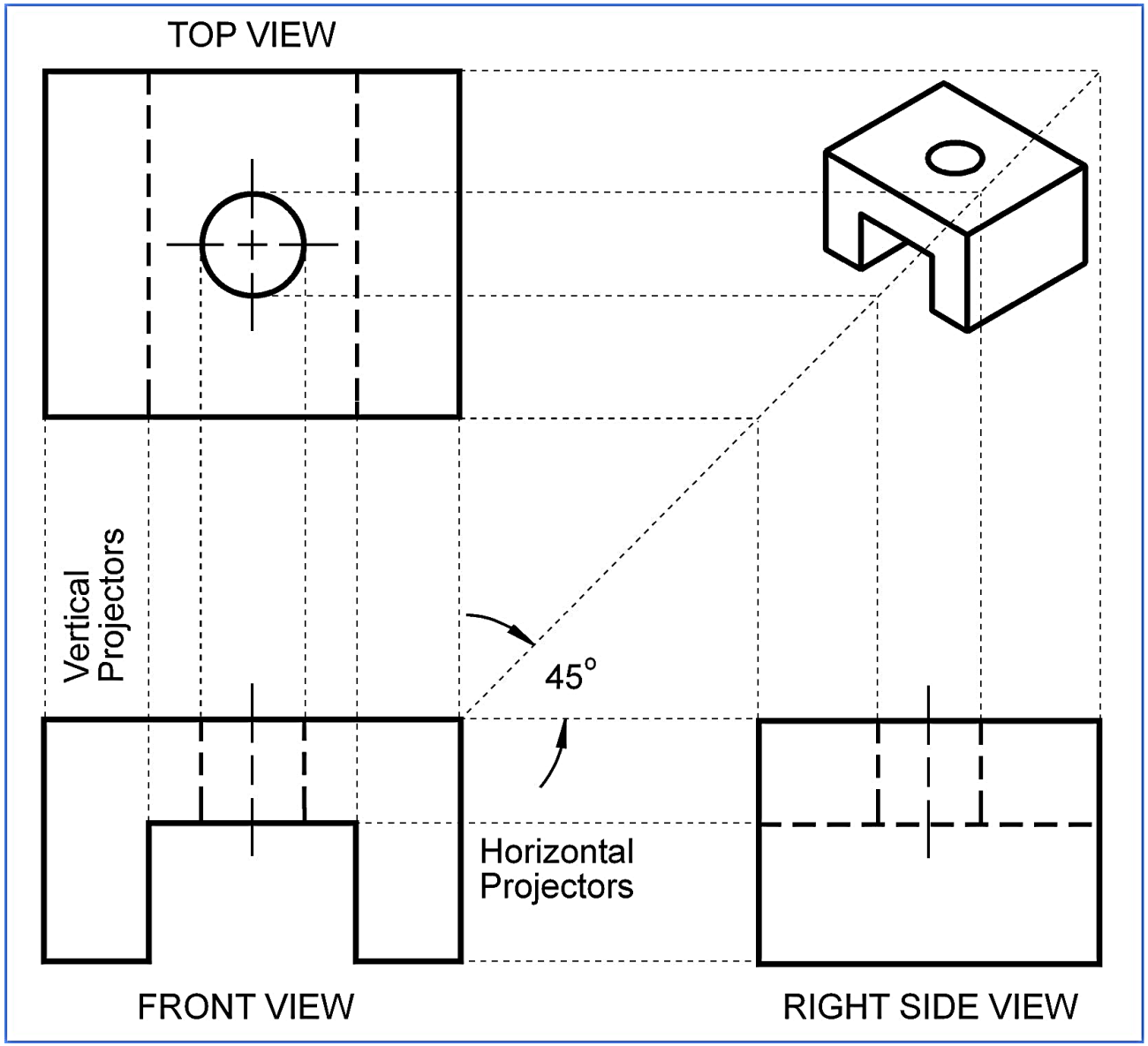
- Draw the right side view.



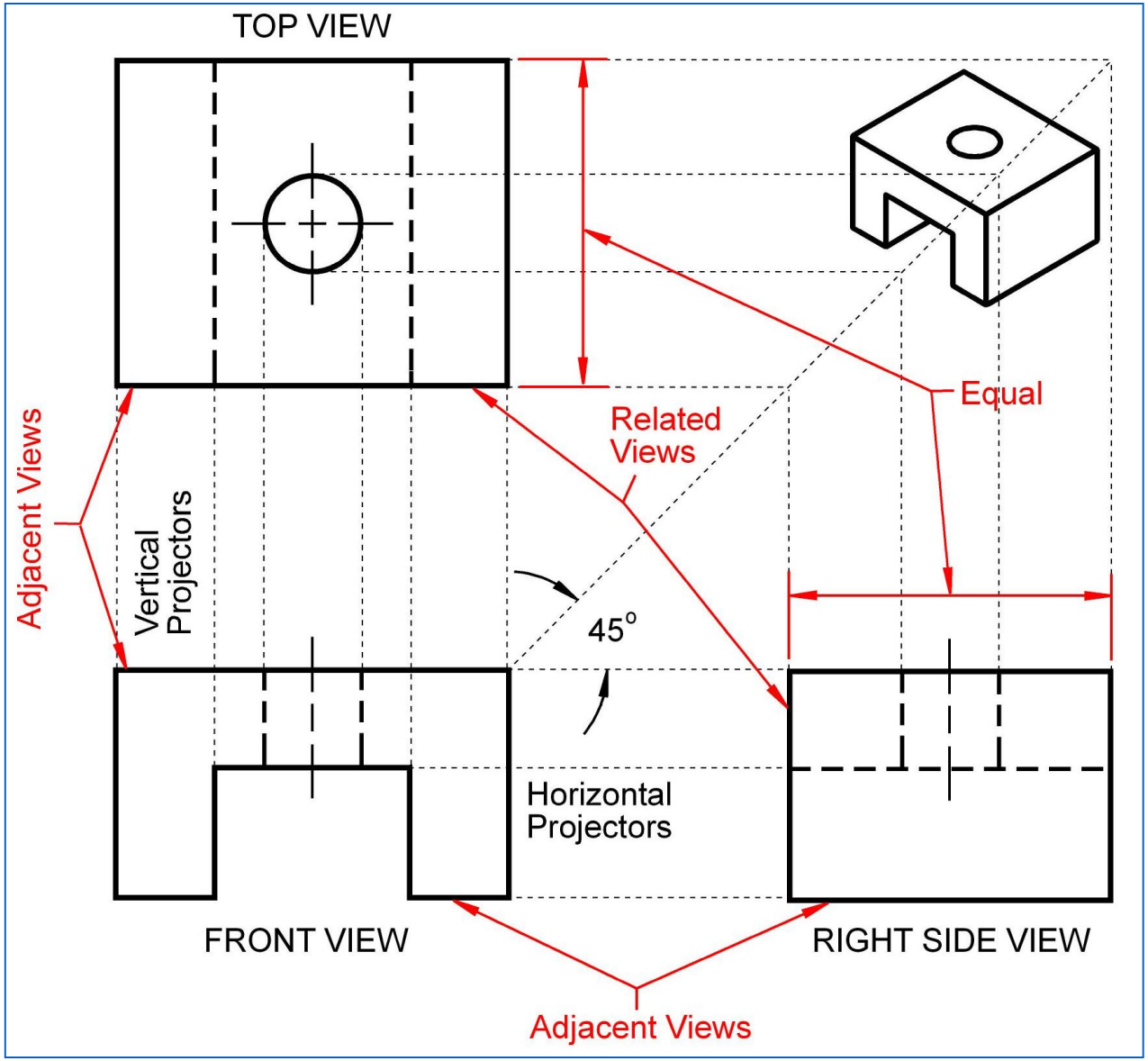
- Project back if needed.



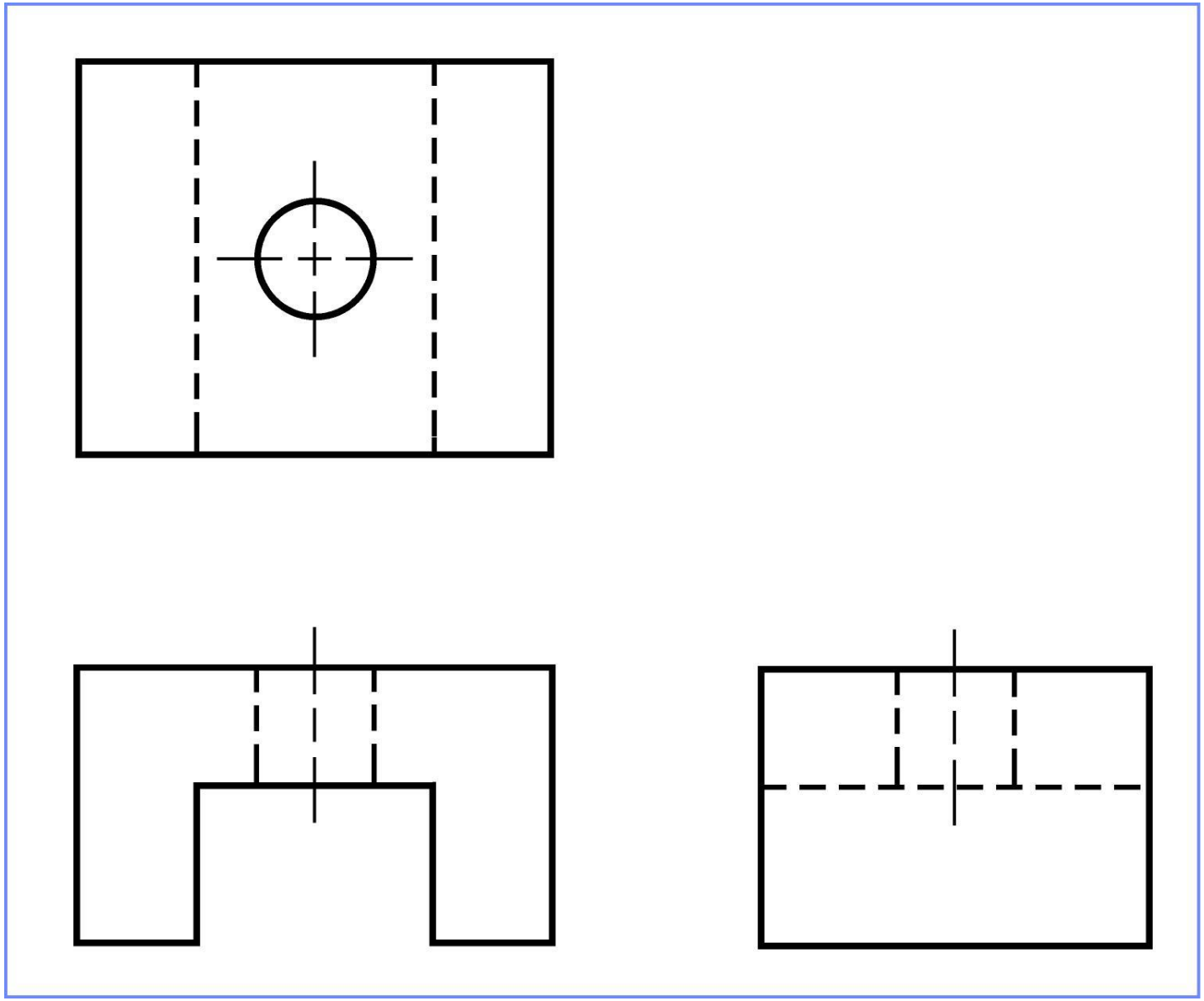
- Draw centerlines where necessary.



Creating an Orthographic Projection

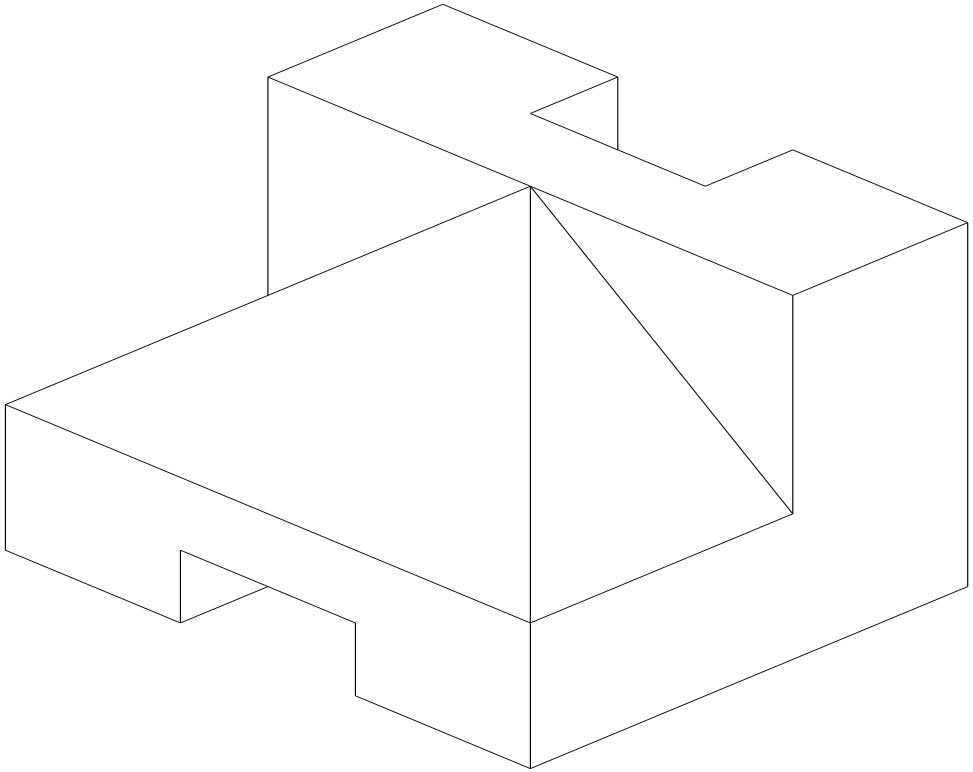


Completed Drawing

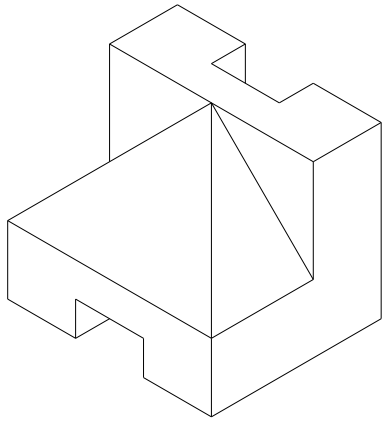


1. Third Angle System

Example -6-

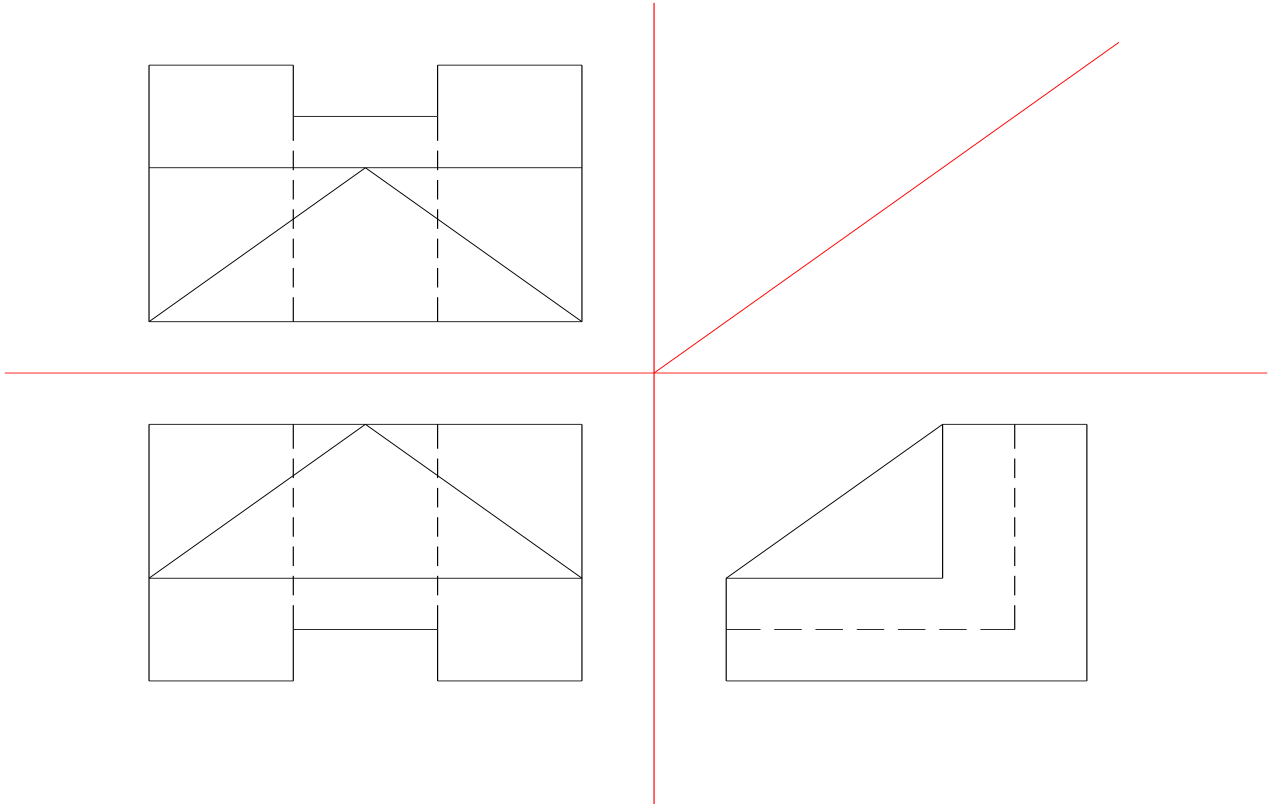


1. Third Angle System



Solution;

TV



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References

1. *Technical Drawing with Engineering Graphics, 14/e Giesecke, Hill, Spencer, Dygdon, Novak, Lockhart, Goodman. © 2012, 2009, 2003, Pearson Higher Education, Upper Saddle River, NJ 07458.*
2. *Internet sources*