Career & Technical Education

Chapter 2

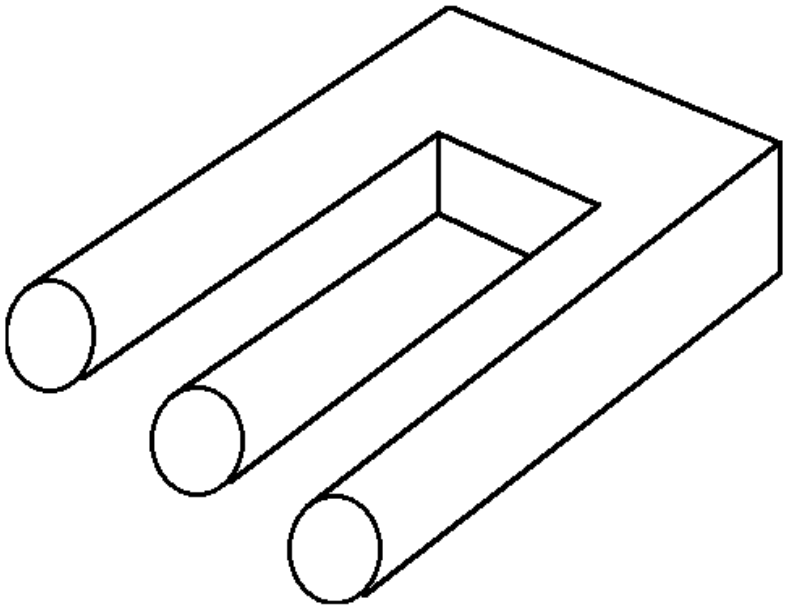
Design and Sketching

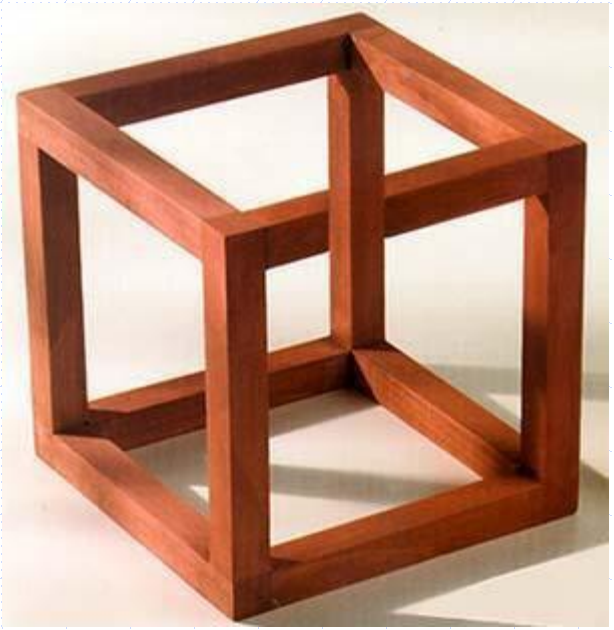
Chapter 2 – Design and Sketching

ENGINEERING DESIGN PROCESS

Design vs. Engineering

- Can we engineer these designs?





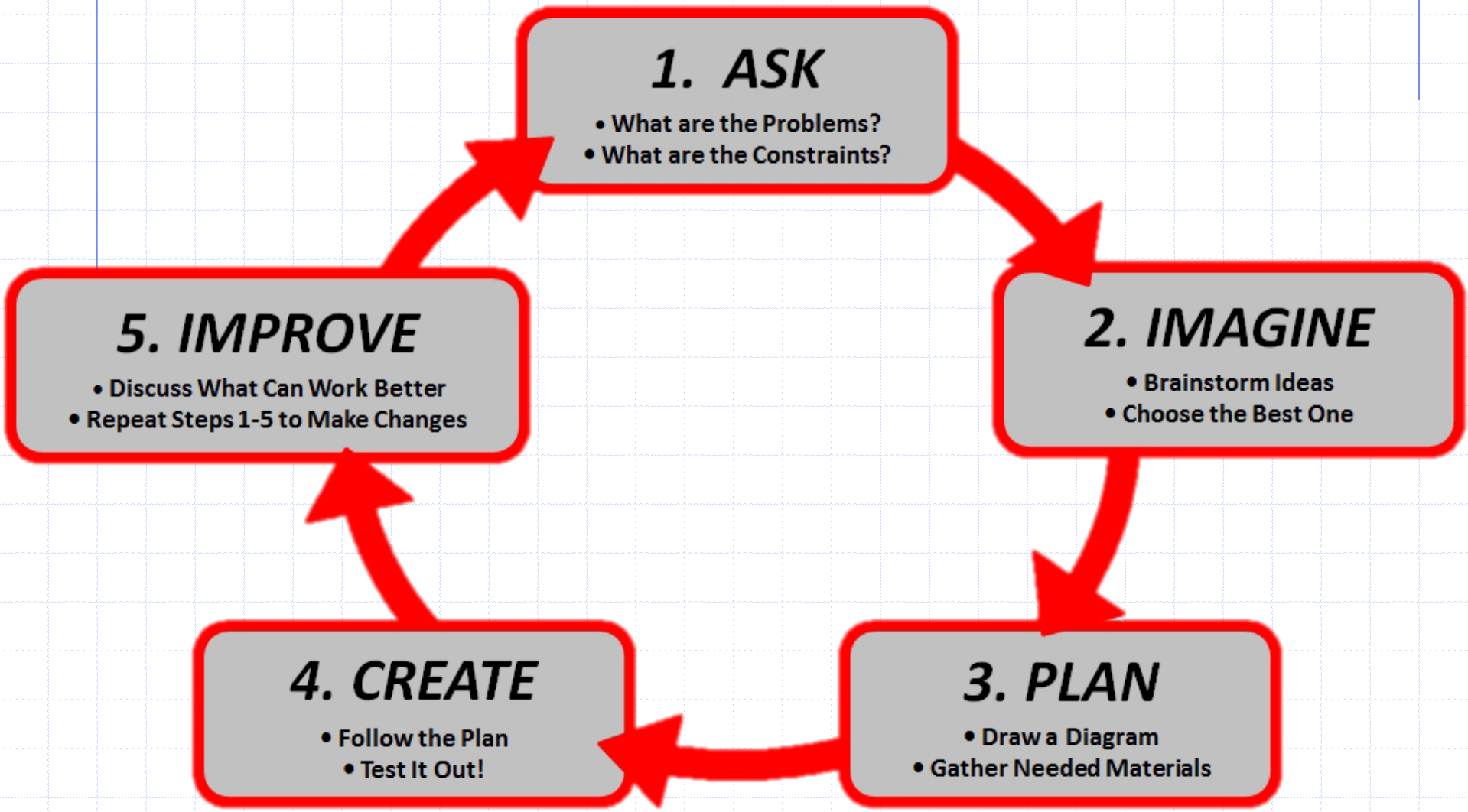
Engineering Design Process

Engineering Design Process

- The Engineering Design Process is a series of steps that develops a new product or system.

Once you improve your design, repeat the Engineering Design Process again to refine your technology.

Engineering Design Process



Chapter 2 - Design and Sketching

SKETCHING & MULTIVIEW DRAWINGS

Sketching

- Sketching – A rough drawing that shows the main features of an object.

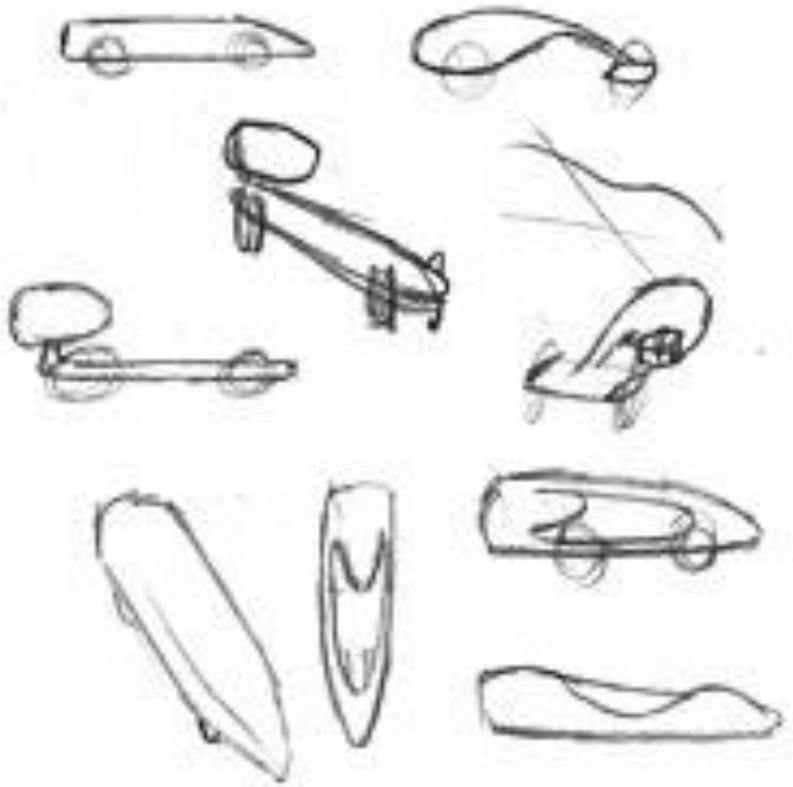
Done freehand, without the aid of drafting equipment except a paper and pencil.

Types of Sketching:

- Thumbnail Sketches
- Multiview Sketches

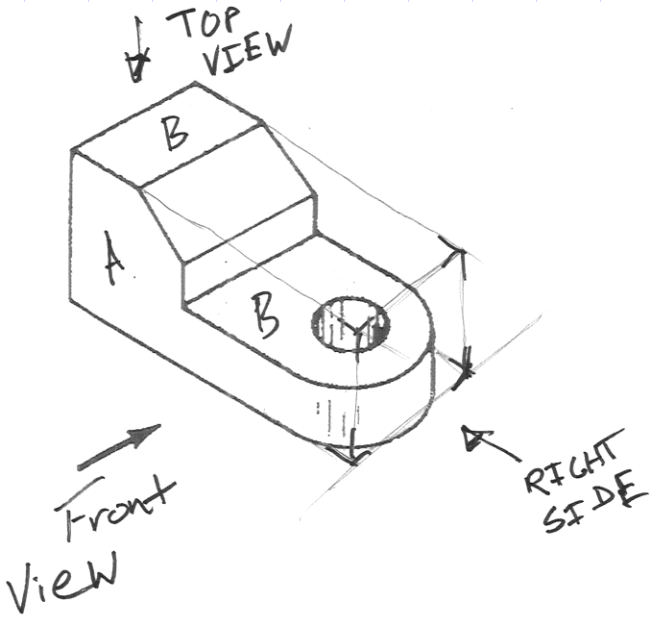
Thumbnail Sketches

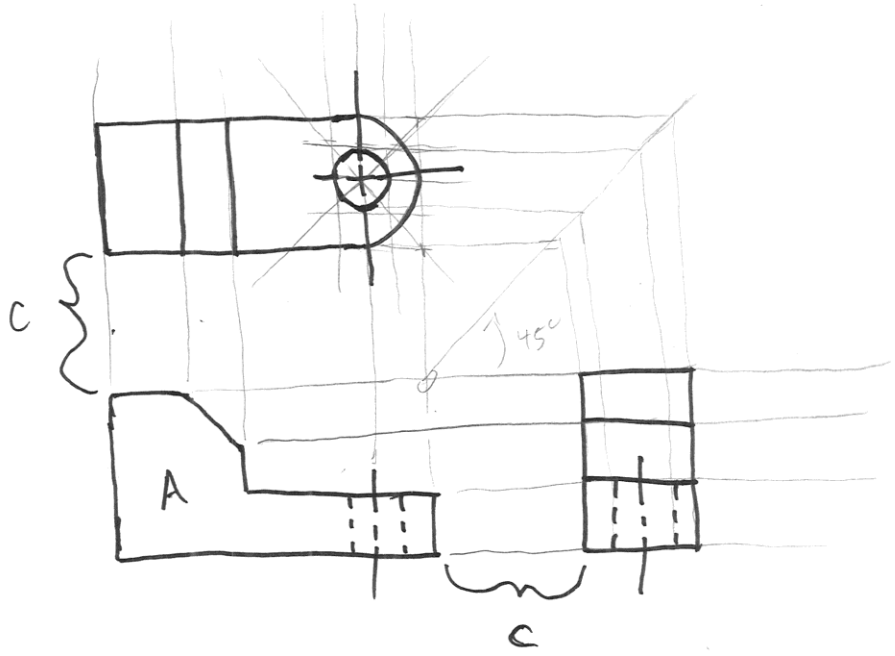
- Thumbnails Sketches
  - Thumbnail sketches are small, quick, sketchy, doodles drawn on just about anything. They do not need to be perfect, they convey an idea.



Multiview Sketches

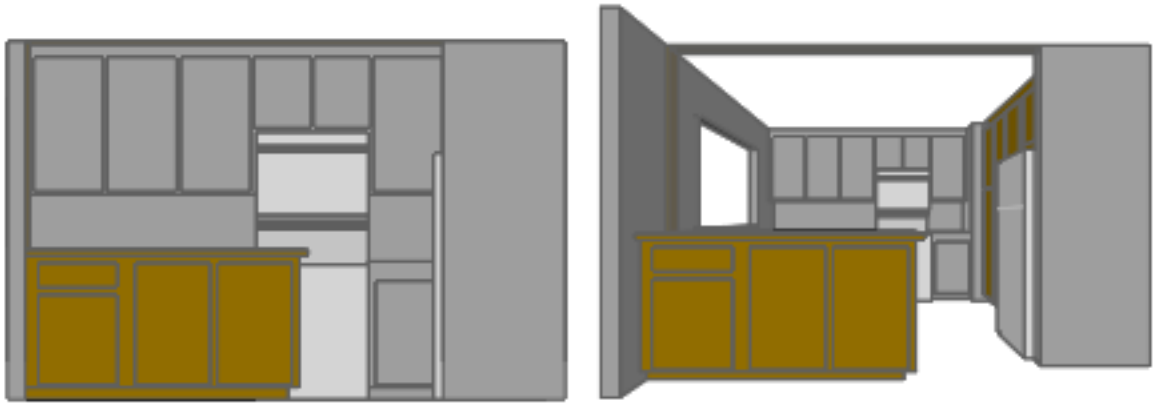
- Multiview Sketches
  - Multiple two-dimensional sketches describing a three-dimensional object.





Projection

- Perspective projection vs Parallel Projection

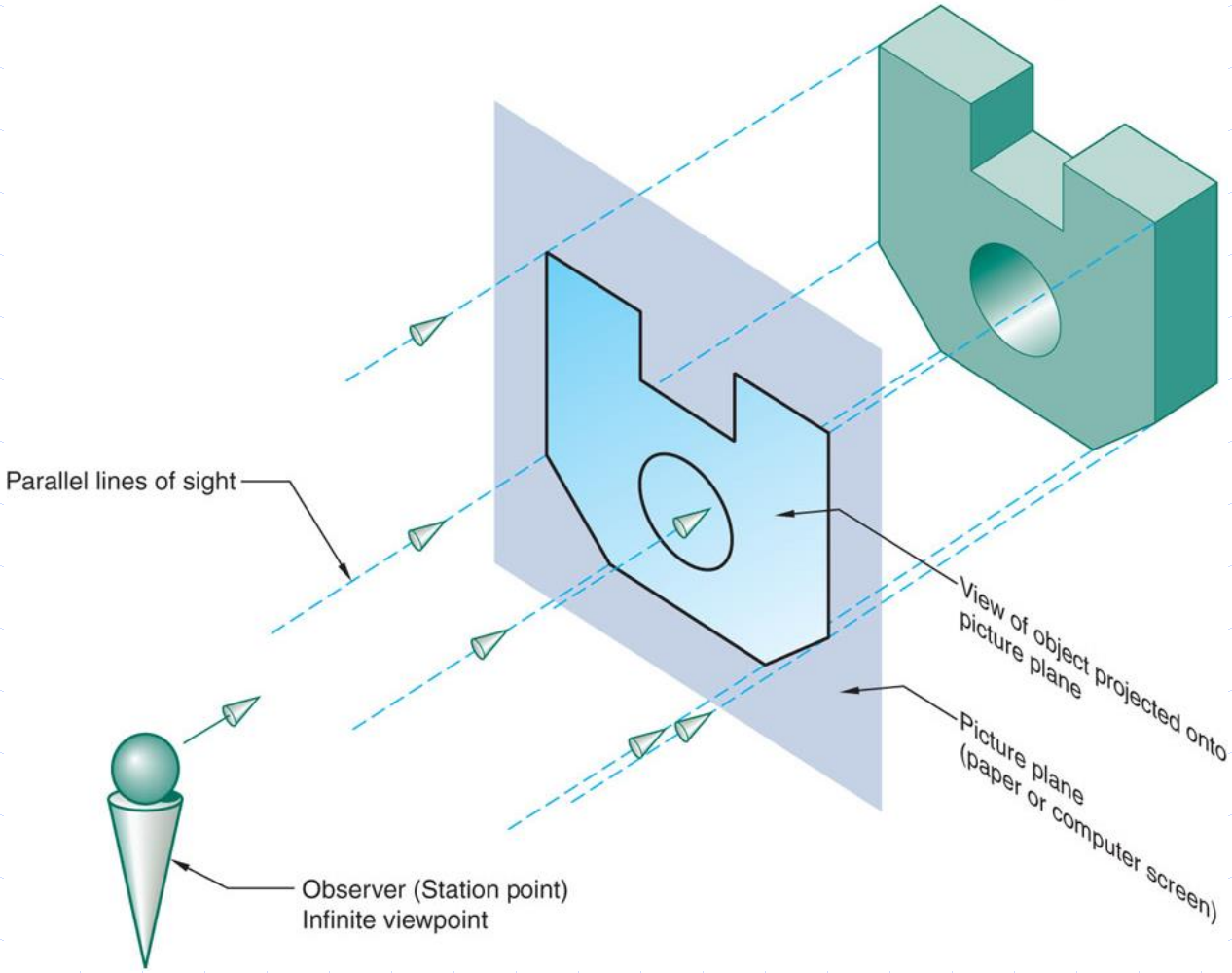


Parallel projection

Perspective projection

- Multiview drawings use Parallel Projection

Parallel Projection

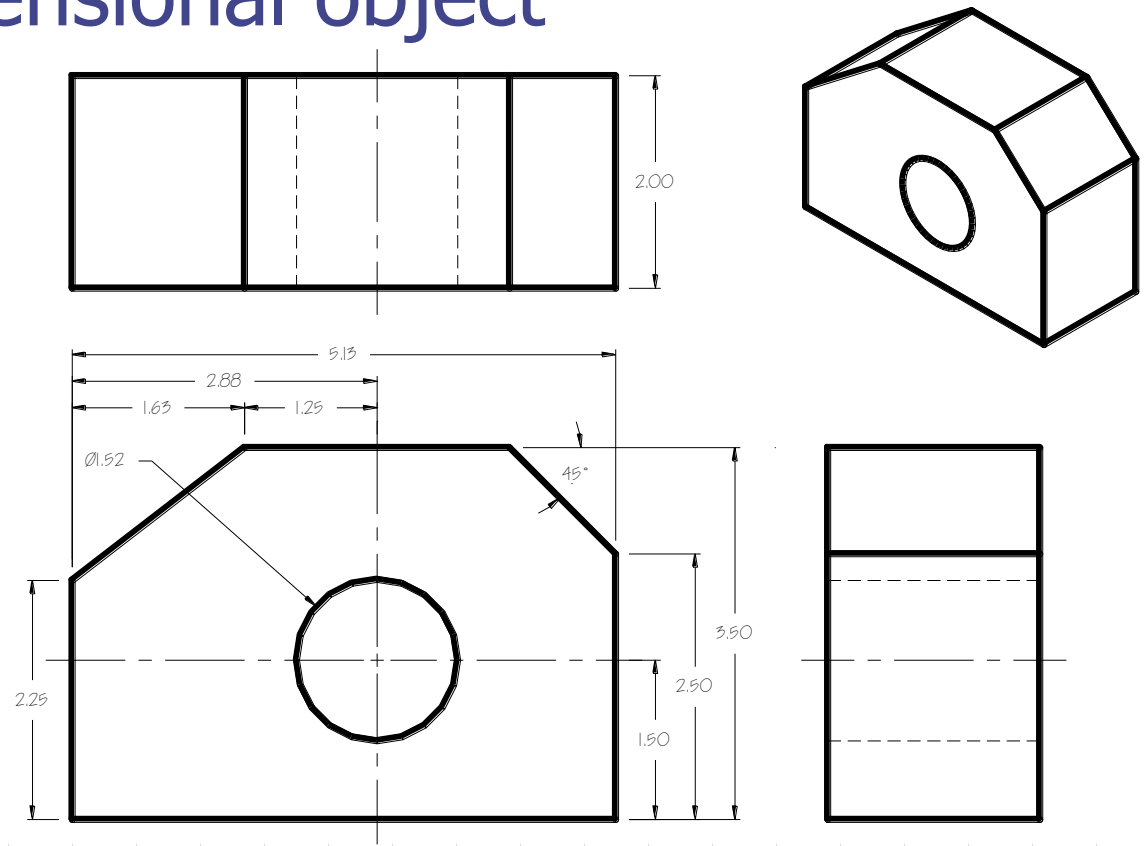


Multiview Drawing

- Another name for Multiview Drawing is *Orthographic Projection*
- Involves visualization and implementation
  - Ability to see clearly in the mind's eye an object
  - Process of drawing the object

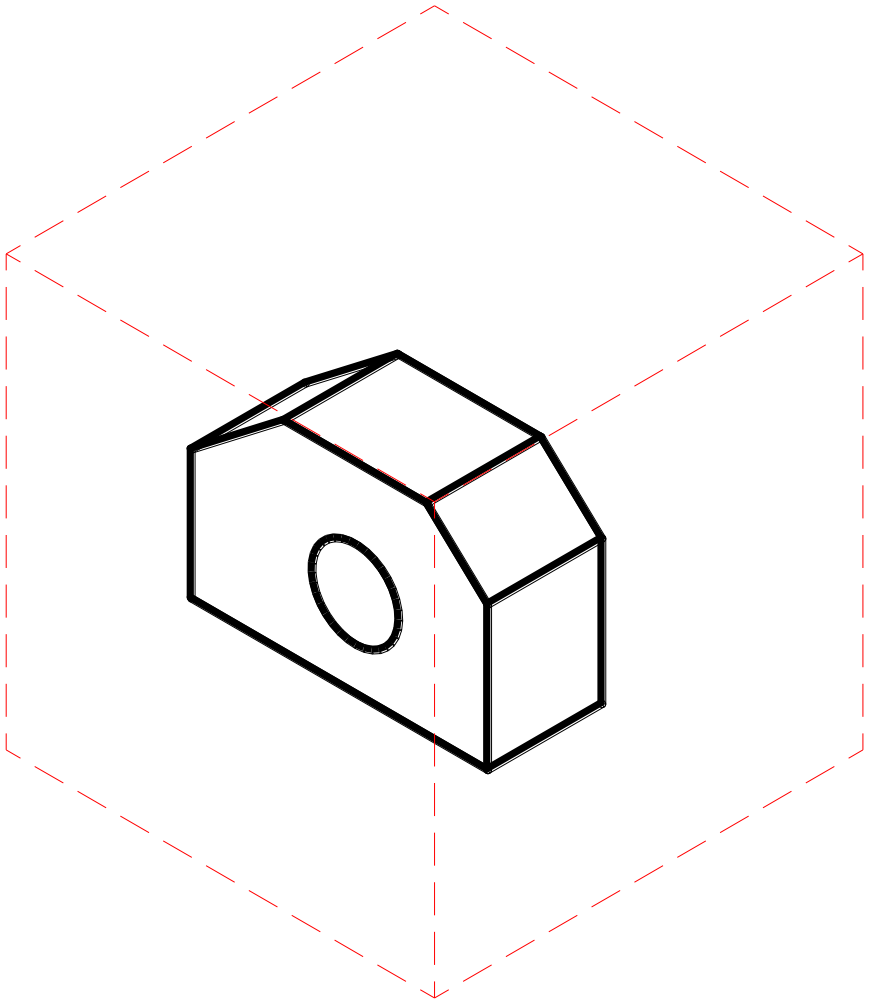
Multiview Drawing

- A system and standard that allows you to make a two-dimensional drawing of a three-dimensional object

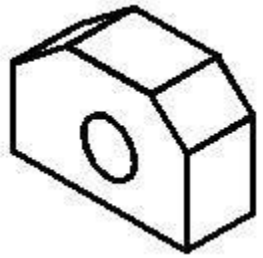


Viewing Objects

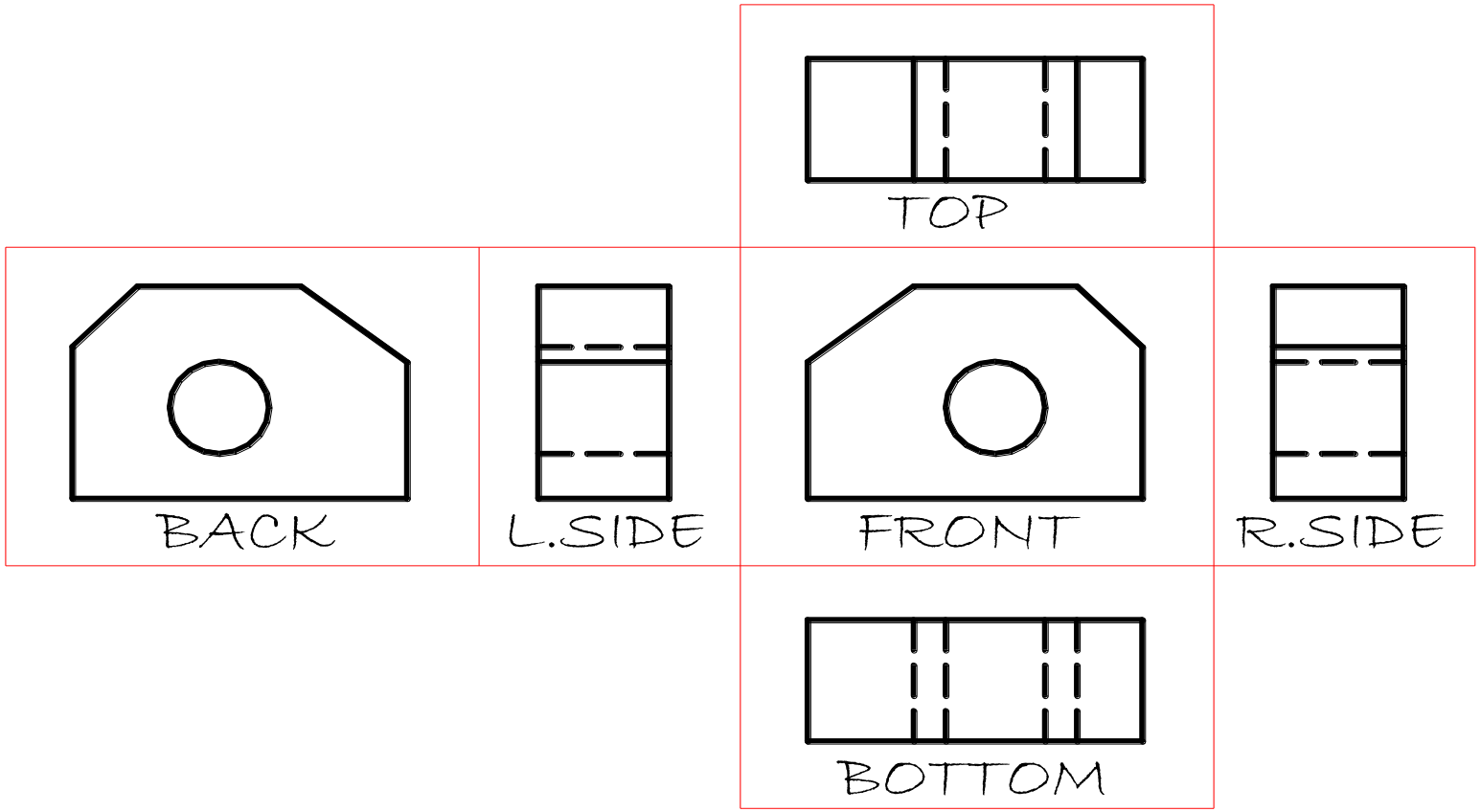
- A box is formed by six mutually perpendicular planes of projection that are located around the object



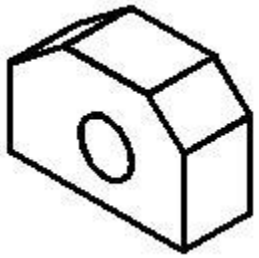
Viewing Objects



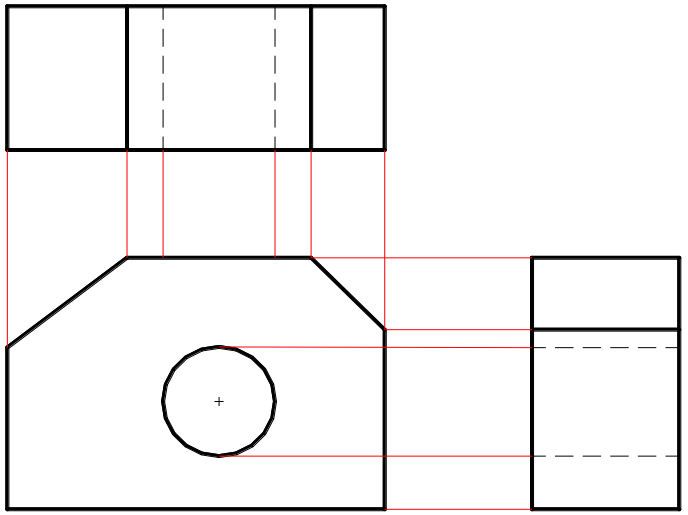
- Unfolding the box produces an arrangement of the six views



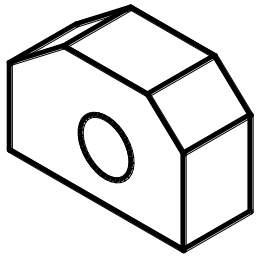
Viewing Objects



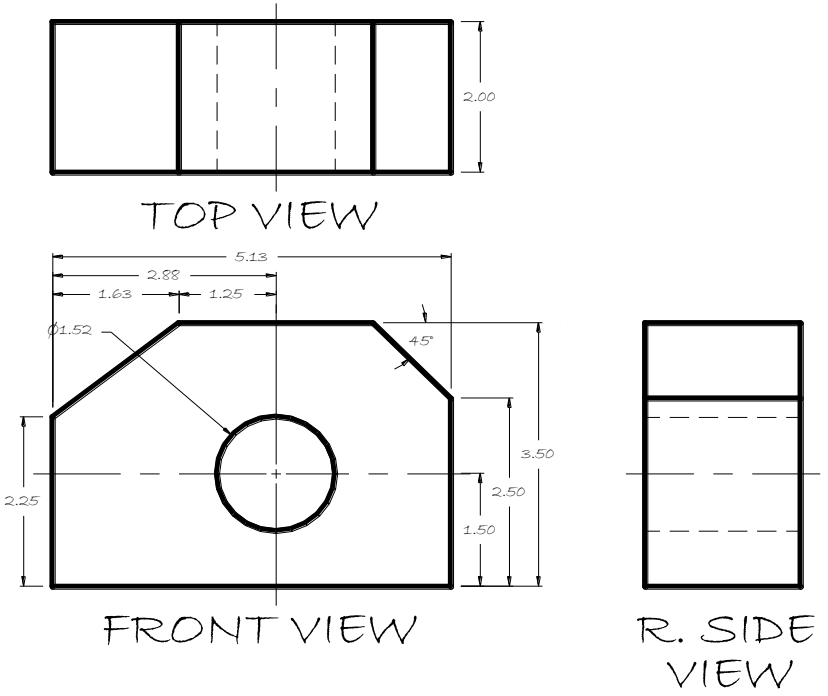
- Each view is placed in a constant location relative to the other views
- Each view must be placed in its correct position
- Views and features must be aligned



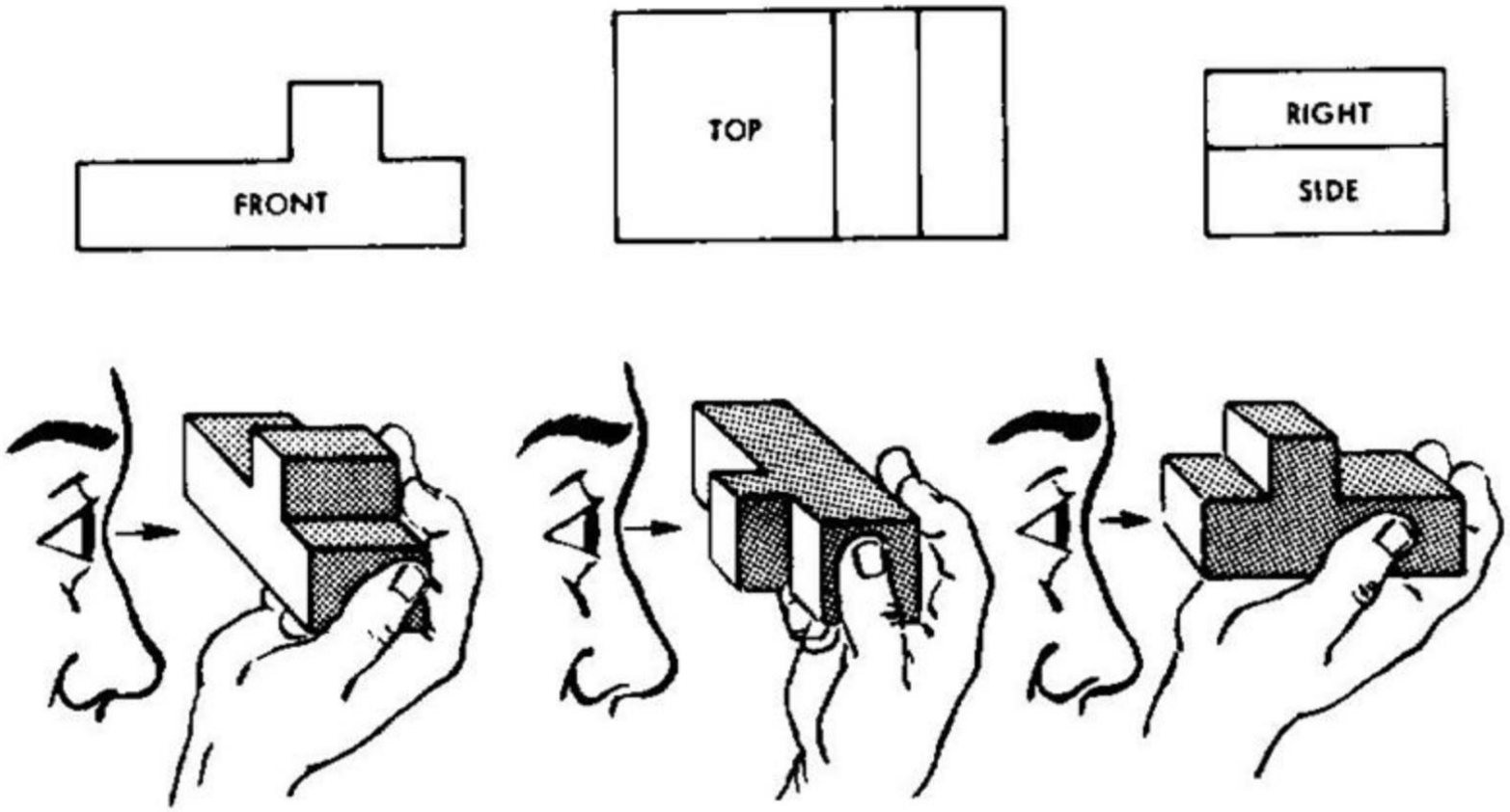
Choosing Views



- Most commonly used views
  - Front View
  - Top View
  - Right Side View
- Most descriptive view is typically designated as the Front View

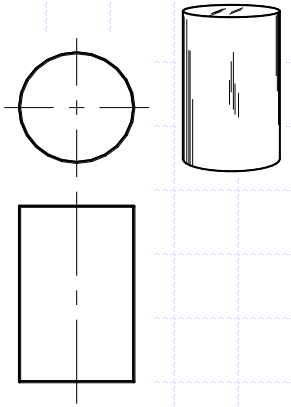


Visualizing the Object Views

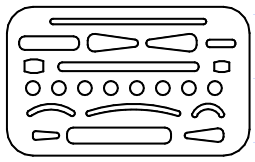


Choosing Views

- Complex objects require three views to describe its shape
- Simple objects can be described with two views
  - Ex: Soda Can

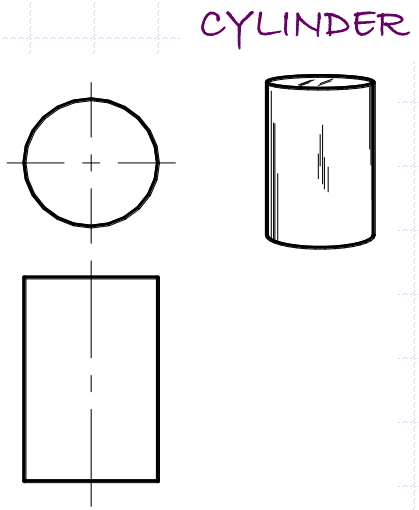


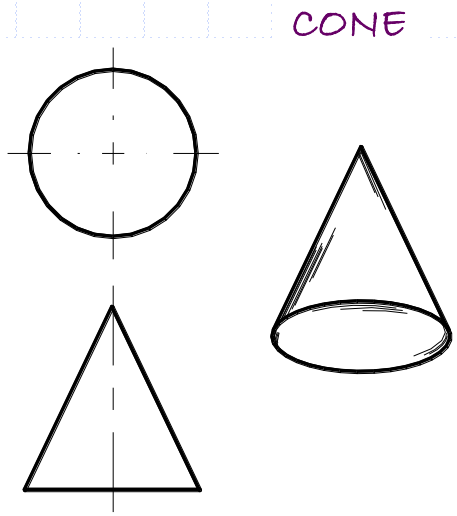
- Thin objects can be described with only one view
  - Depth is given in a note
  - Ex: Erasing Shield

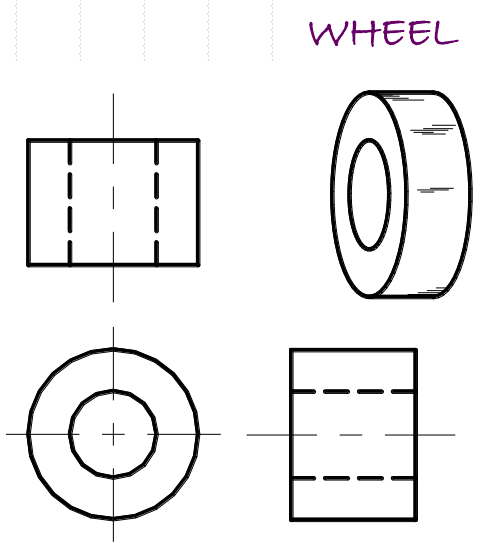


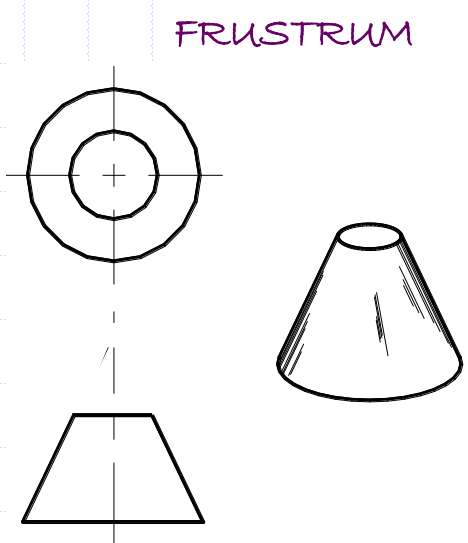
Curved Surfaces

- Some curved surfaces do not show as curves in all views



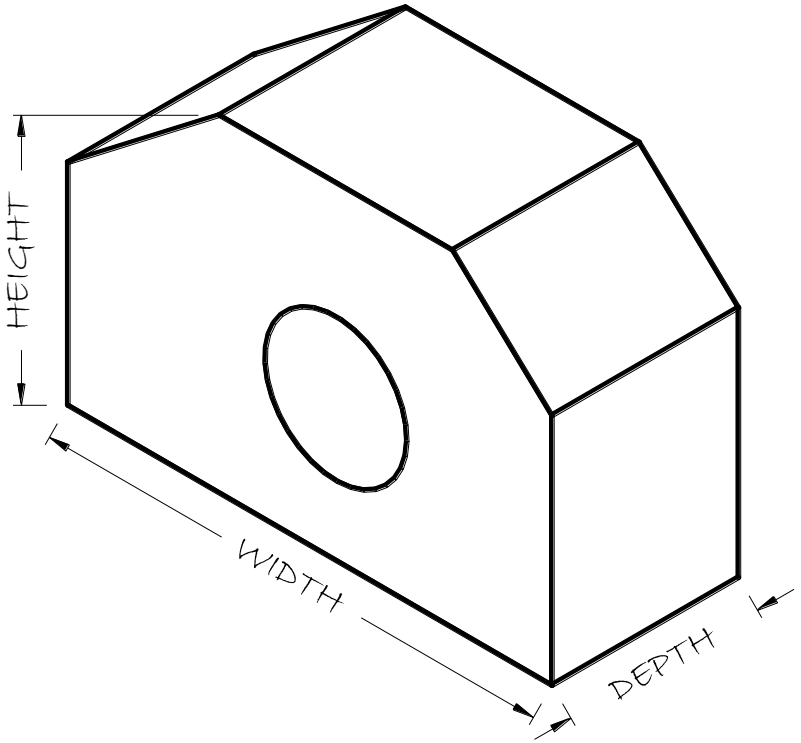




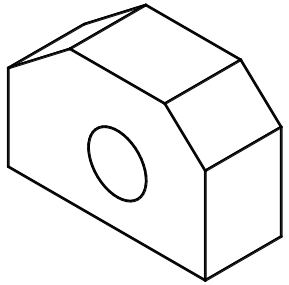


Object Dimensions

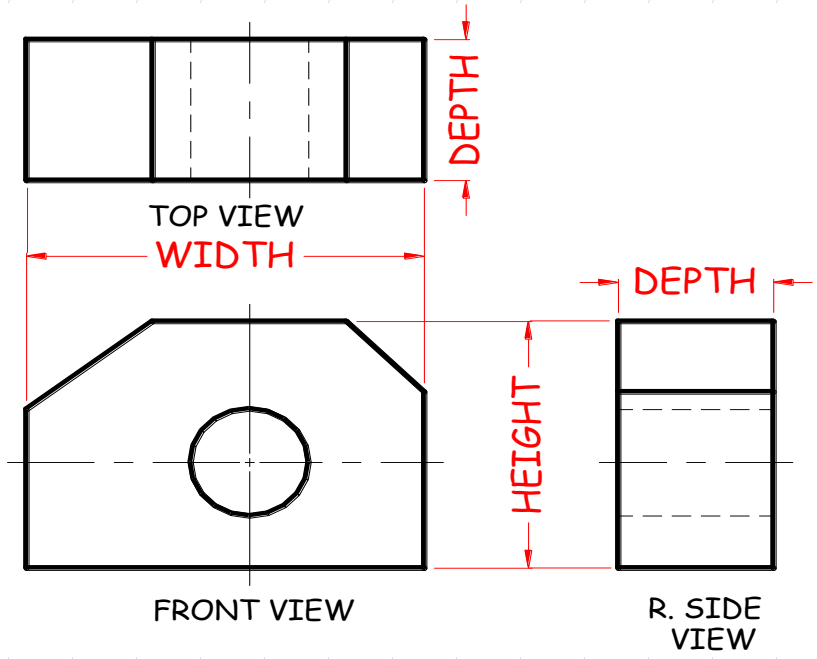
- All objects have 3 dimensions
  - ***Height***
    - Distance from top to bottom
  - ***Width***
    - Distance from side to side
  - ***Depth***
    - Distance from the front to back



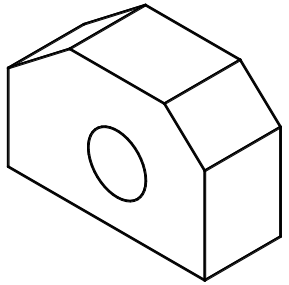
Object Dimensions



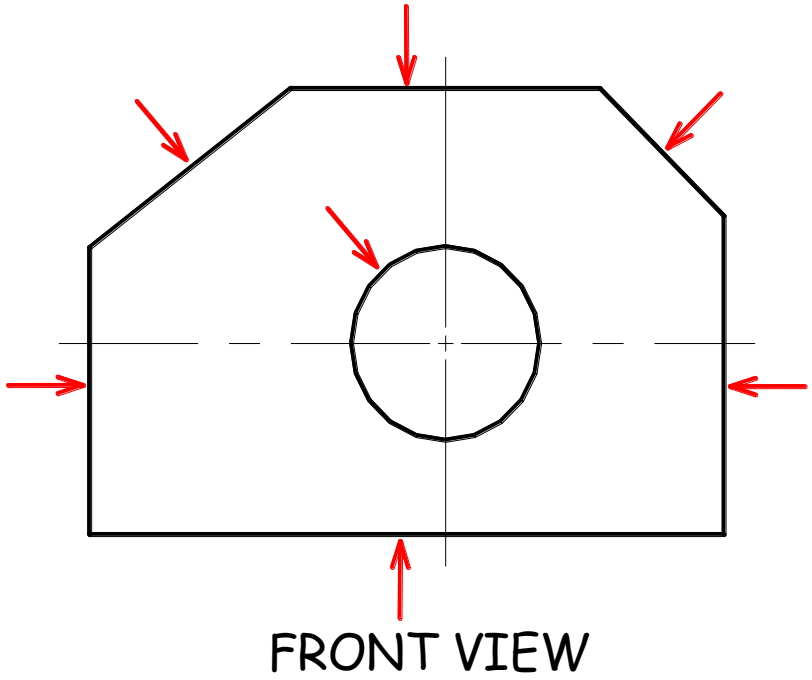
- Front View
  - Shows width & height
- Top View
  - Shows width & depth
- Side View
  - Shows height & depth



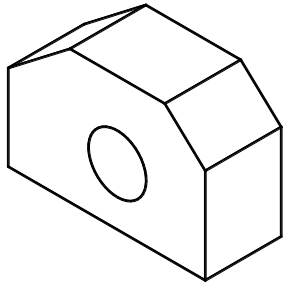
Line Types - Visible



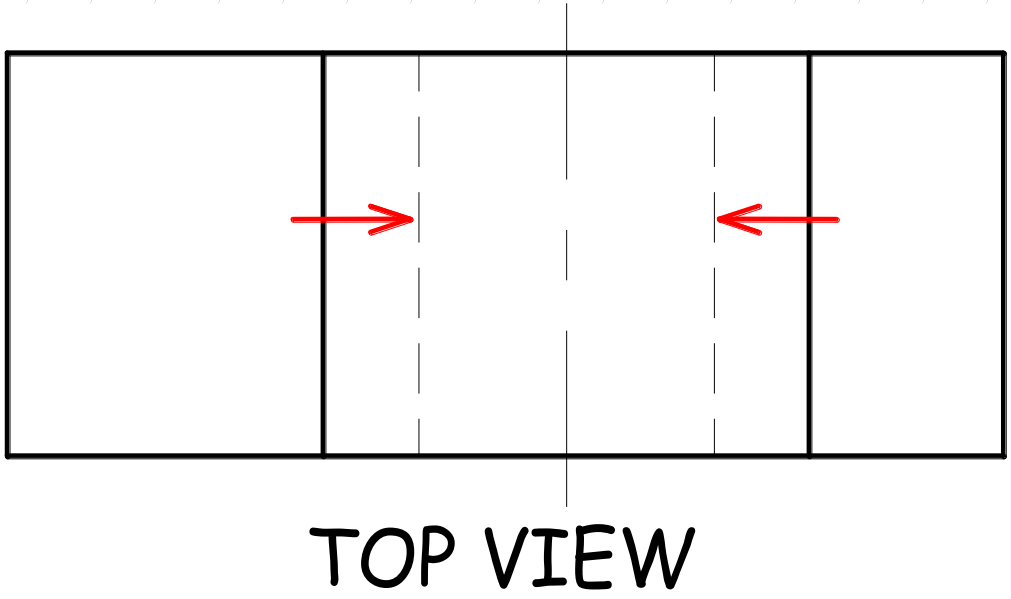
- Edges that can be seen in a given view are *Visible* lines
- Visible lines are thick and dark



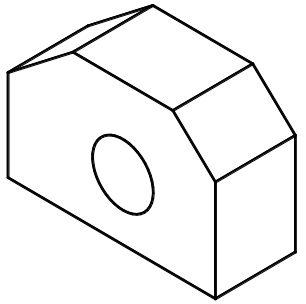
Line Types - Hidden



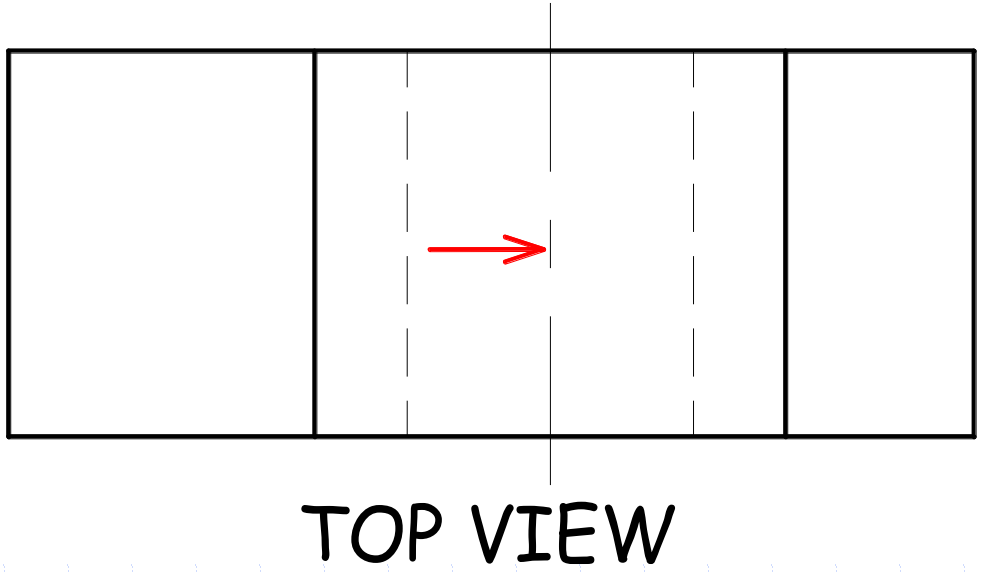
- Edges that cannot be seen from a given view are indicated by *Hidden* lines



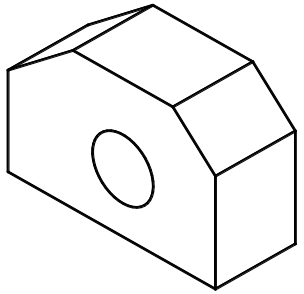
Line Types – Center



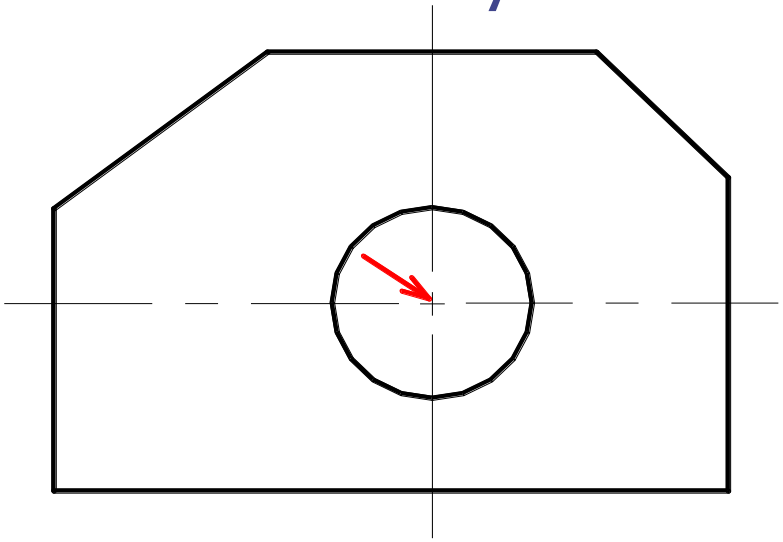
- *Center lines* indicate axes of symmetry

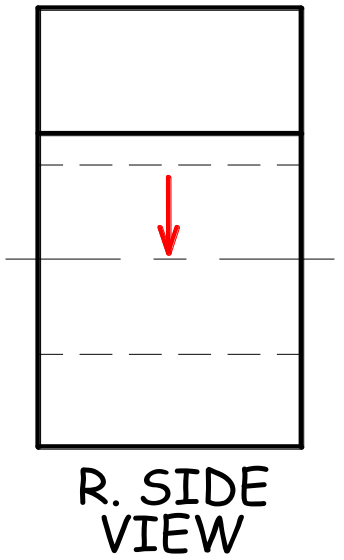


Line Types – Center



- Perpendicular lines for circular objects
  - Small dashes cross at the center point of feature
  - One center line drawn to indicate longitudinal axis of cylinder or hole



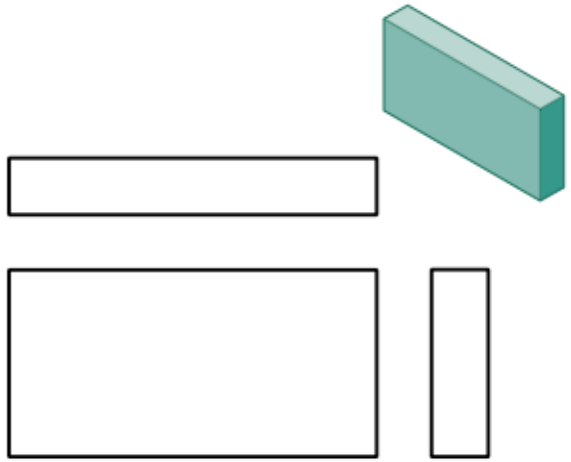


Career & Technical Education

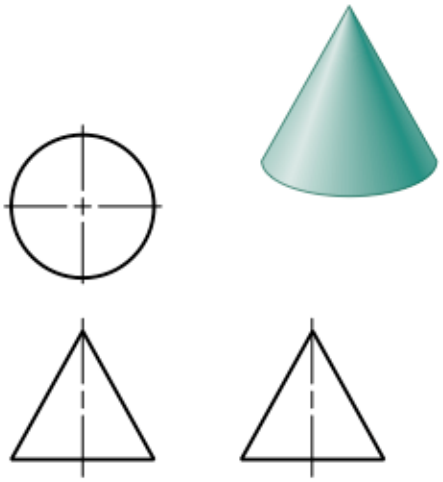
Multiview Drawing

Visualize objects and views

Examples

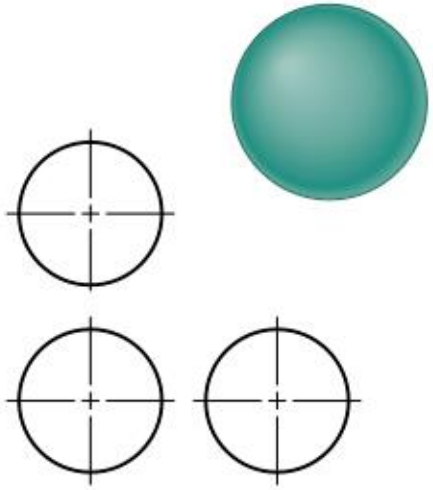


Rectangular prism

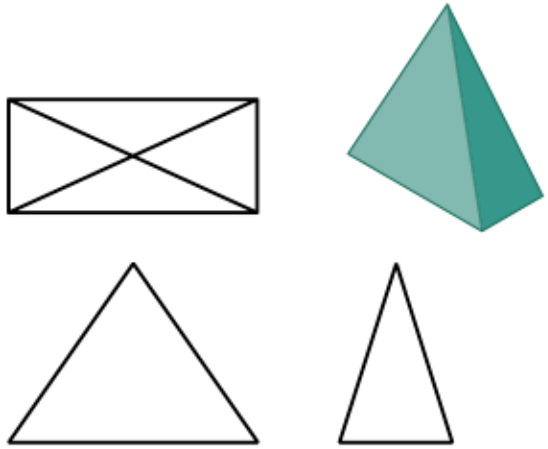


Cone

Examples

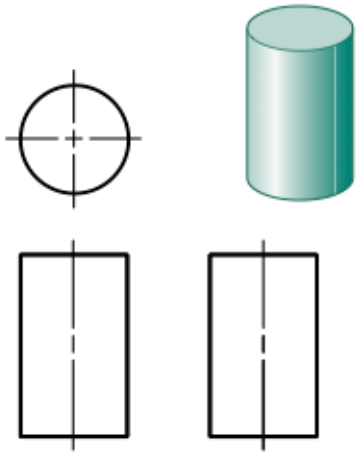


Sphere

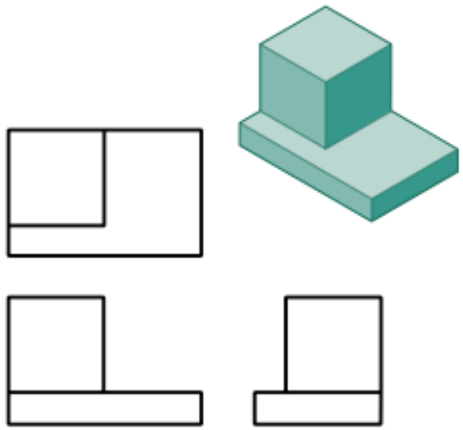


Pyramid

Examples

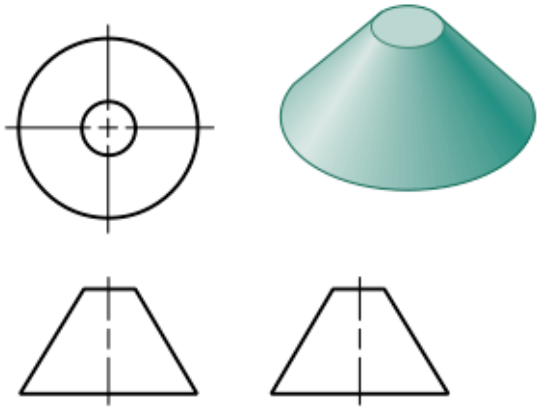


Cylinder

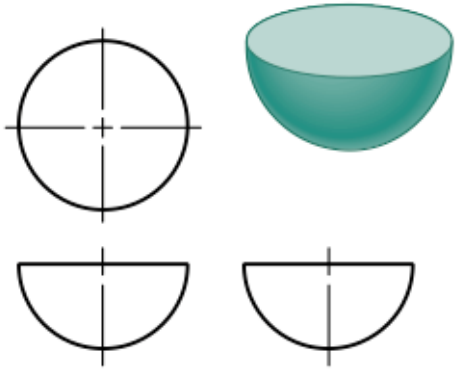


Prism and cube

Examples

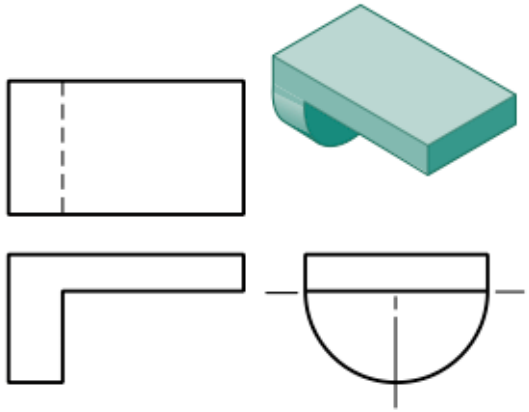


Truncated cone

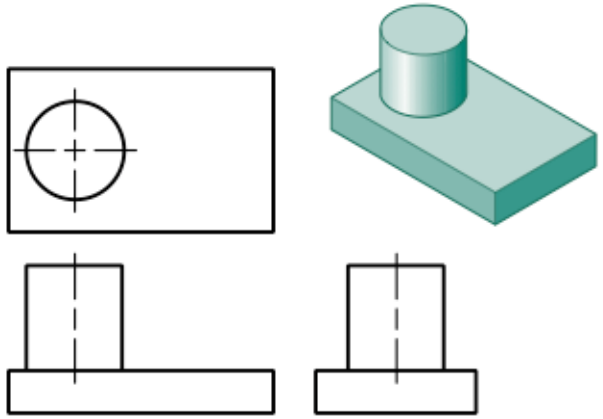


Partial sphere

Examples

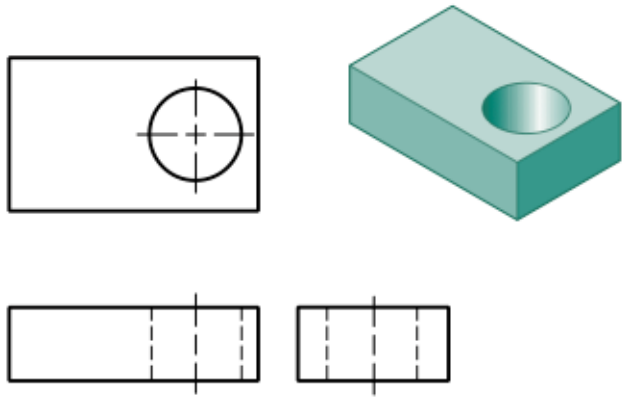


Prism and partial cylinder



Prism and cylinder

Examples

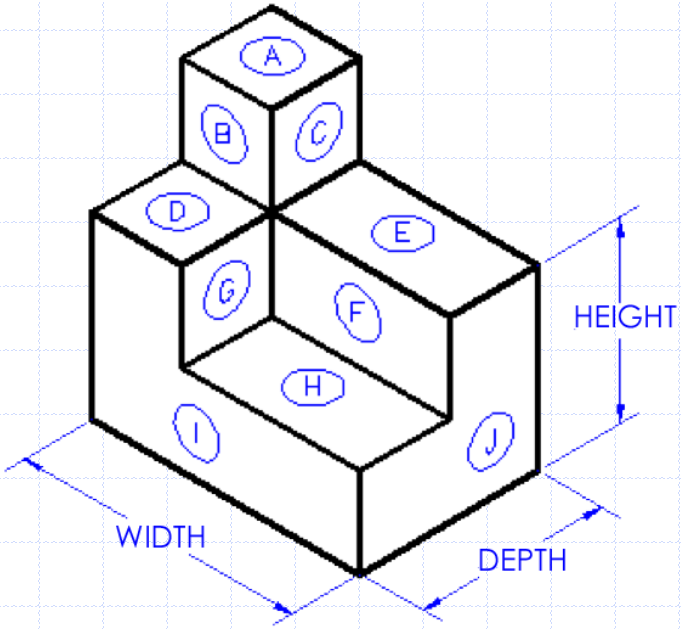


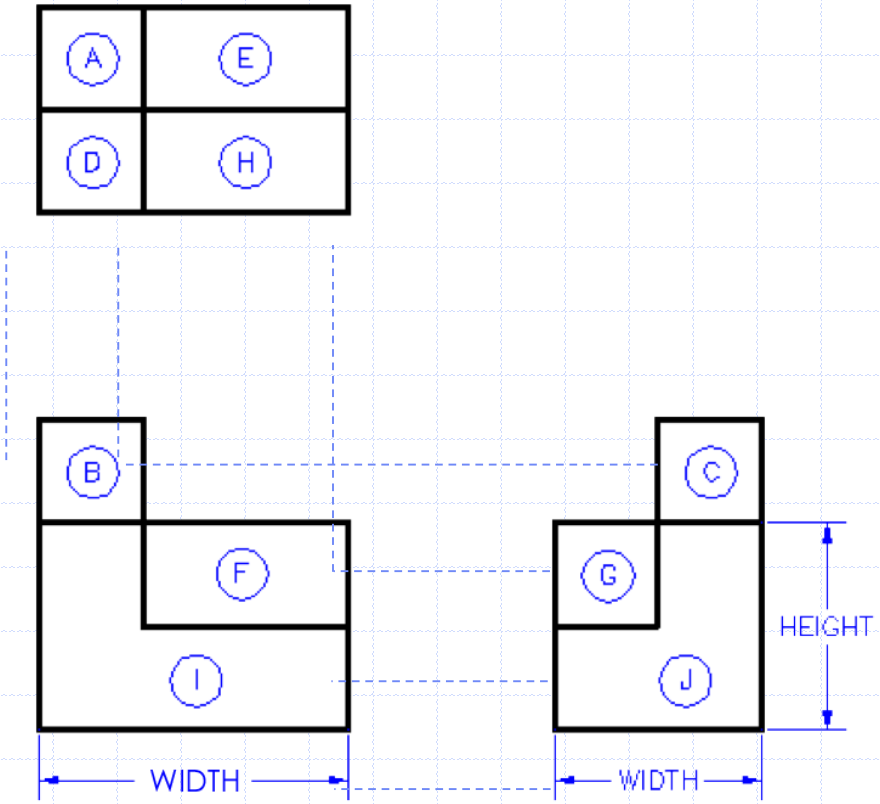
Prism and negative cylinder (hole)

Chapter 2 – Design and Sketching

SURFACES AND PICTORALS

SURFACE IDENTIFICATION





Pictorial Sketches

- A Pictorial Sketch is a picture like sketch in which the width, height, and depth of a object are shown in one view.

Pictorial Sketches

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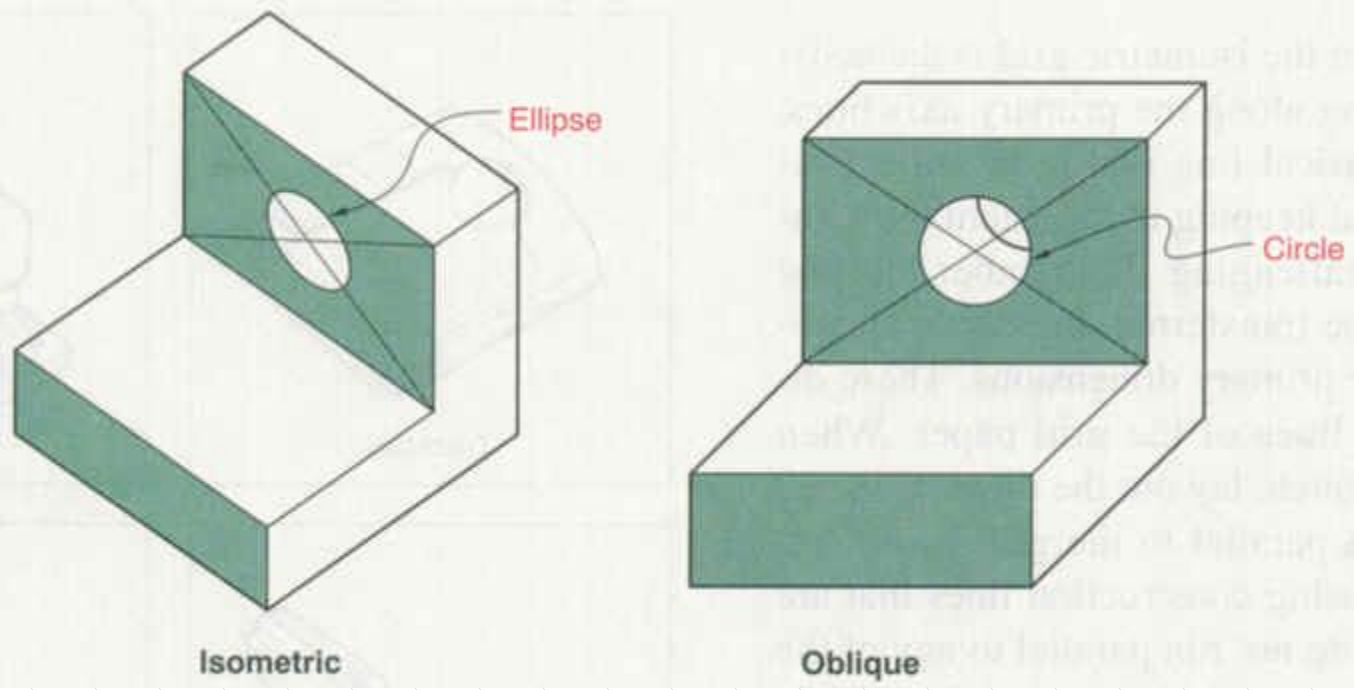
  - An oblique sketch is a type of pictorial sketch in which two of the axes are at right angles (90 degrees) to each other.

Pictorial Sketches

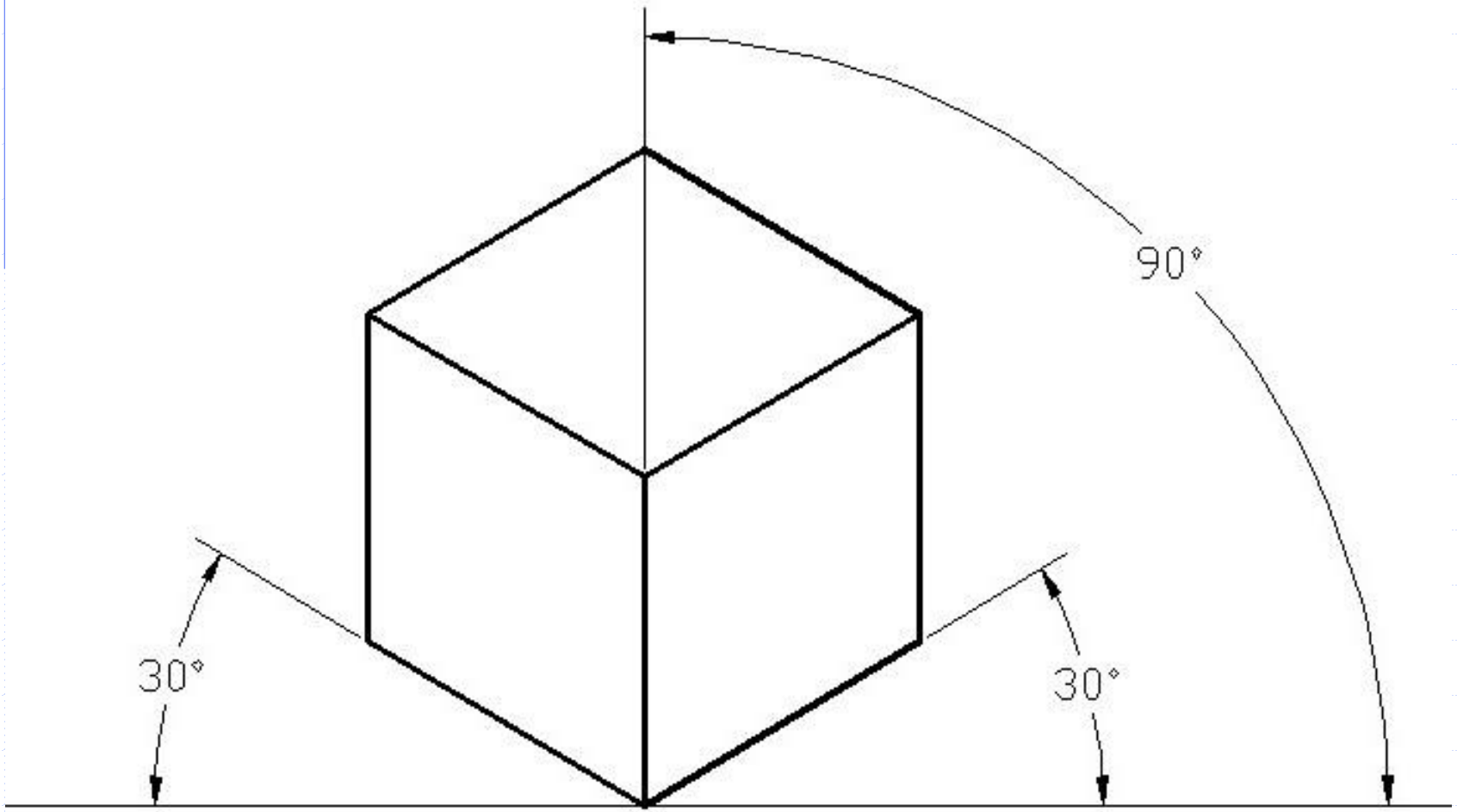
- A Pictorial Sketch is a picture like sketch in which the width, height, and depth of a object are shown in one view.
  - An oblique sketch is a type of pictorial sketch in which two of the axes are at right angles (90 degrees) to each other.
  - An isometric sketch is a type of pictorial sketch that relies on three axes to show width height and depth. However , an isometric sketch, shows the axes spaced equally. (120 degrees)

Pictorial Sketches

- A Pictorial Sketch is a picture like sketch in which the width, height, and depth of a object are shown in one view.



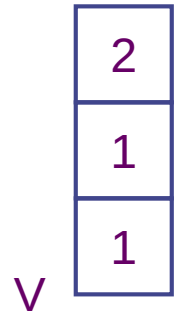
Isometric Sketching



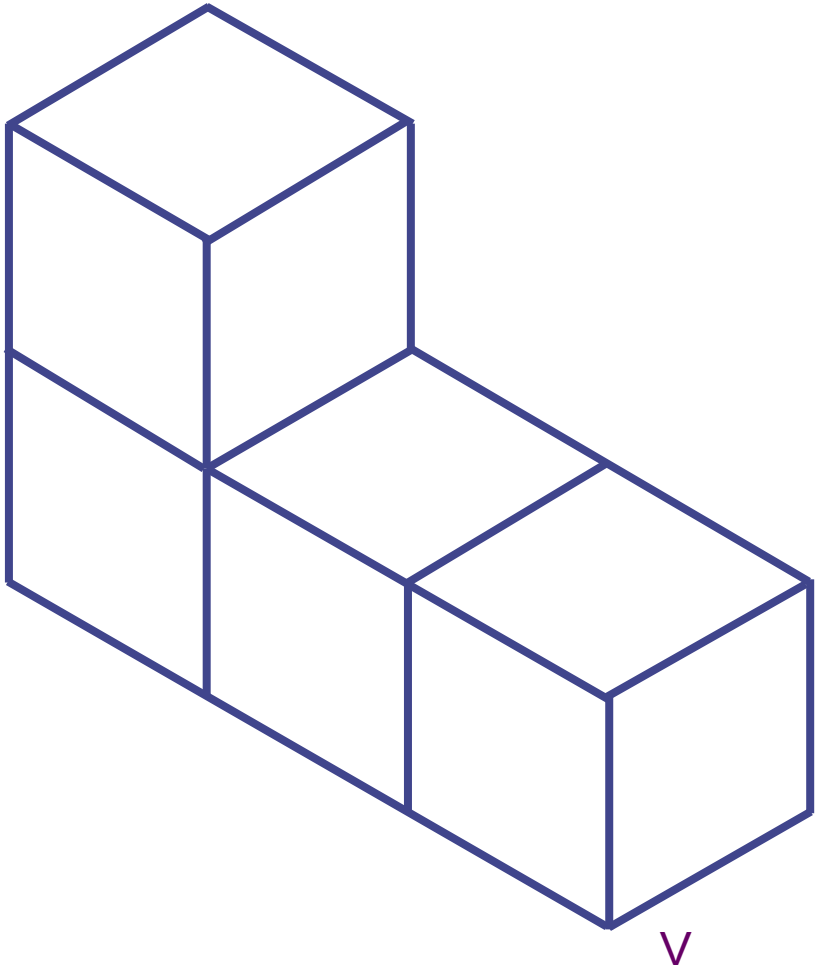
CODED PLANS

- Shows height of each “cube” stack.
- Each corner could be a viewpoint of the object.
- Viewpoint means the direction in which an observer is viewing the object.
- Similar to a top view in an Orthographic Projection.

VISUALIZE OBJECT



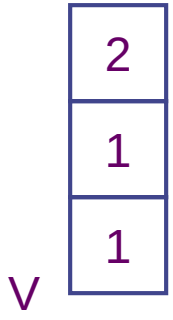
V = Viewpoint



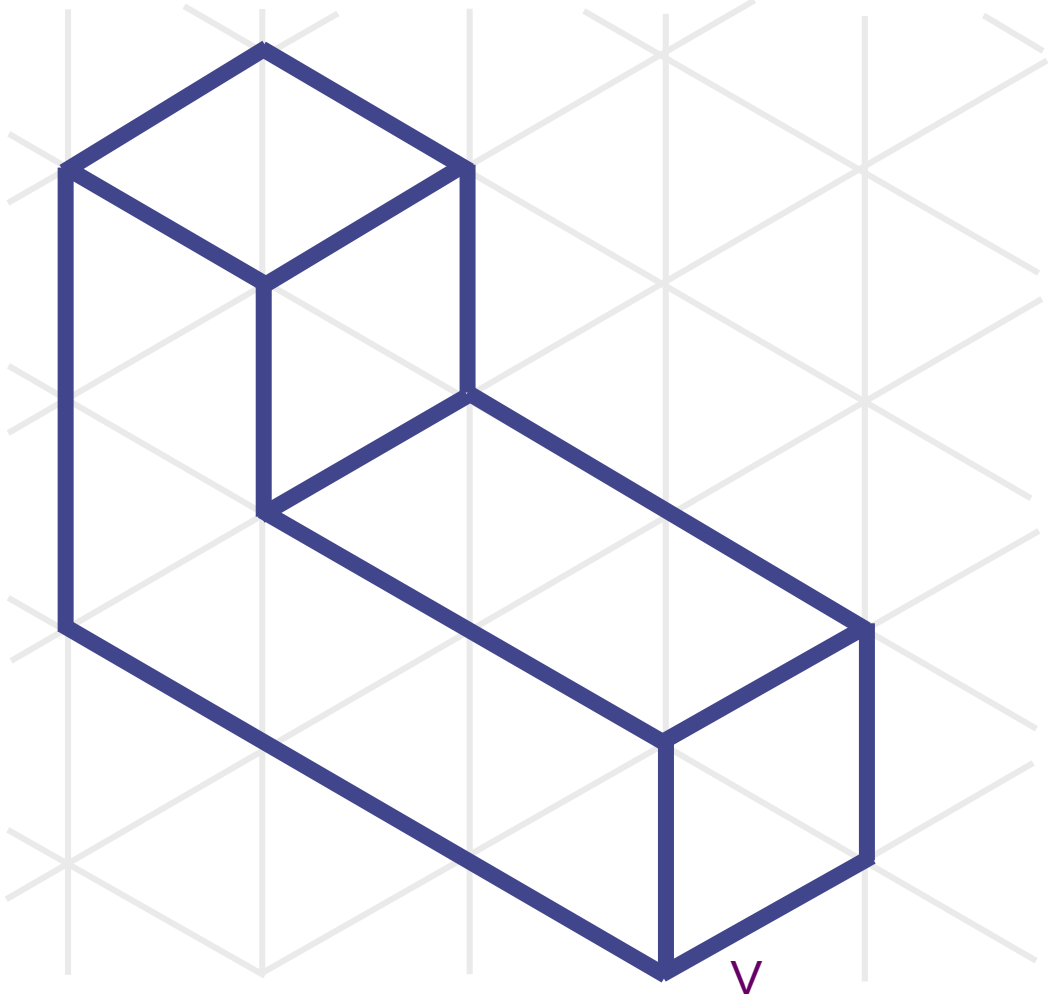
FOR SKECTHING –

DO NOT SHOW EACH CUBE. SHOW ONLY VISIBLE SURFACES AND EDGES, AS IF CUBES HAVE BEEN COMBINED.

EXAMPLE #1



V = Viewpoint



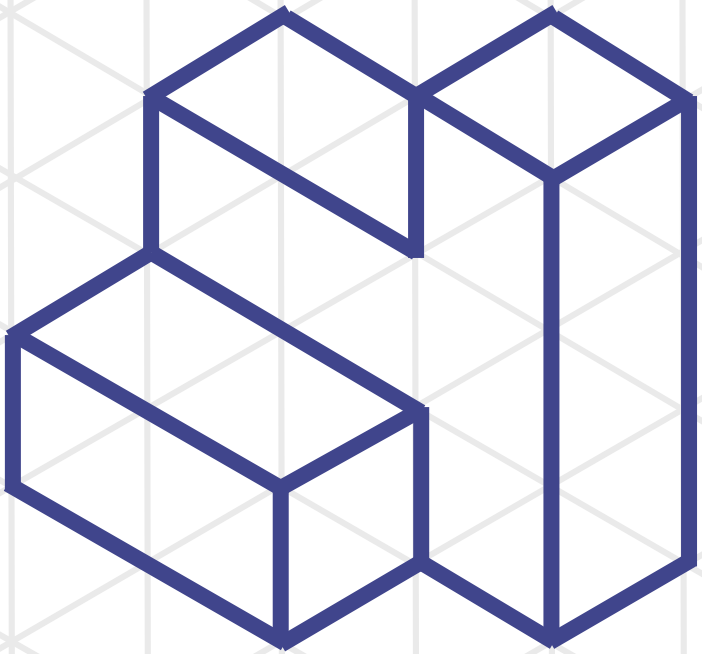
Note location of viewpoint and coded plan noting height of object. Click to start animation.

EXAMPLE #2

2	2	3
1	1	

V

Click to start animation.



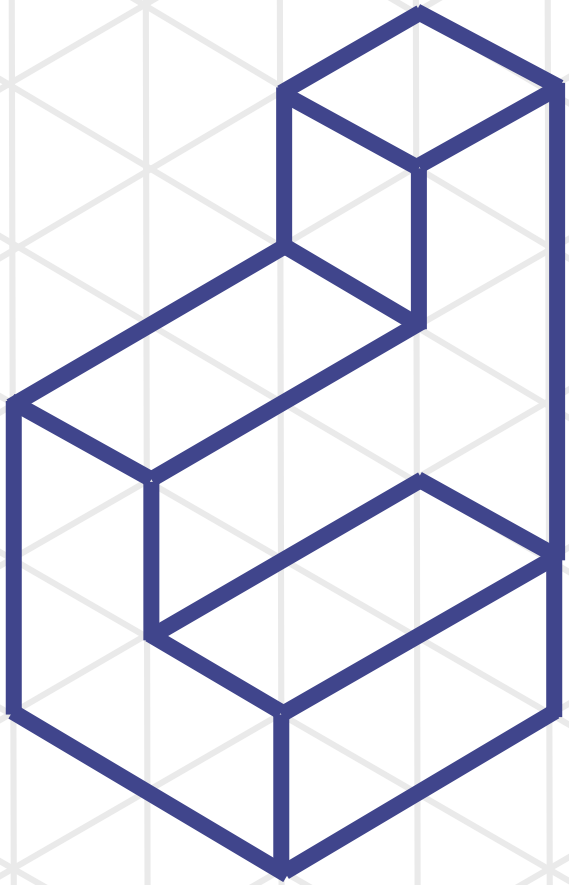
VIEWPOINT

- Viewpoints can make the object appear differently.
- Example #2 is redrawn with a different viewpoint.

DIFFERENT VIEWPOINT

2	2	3
1	1	

V



Click to start animation.

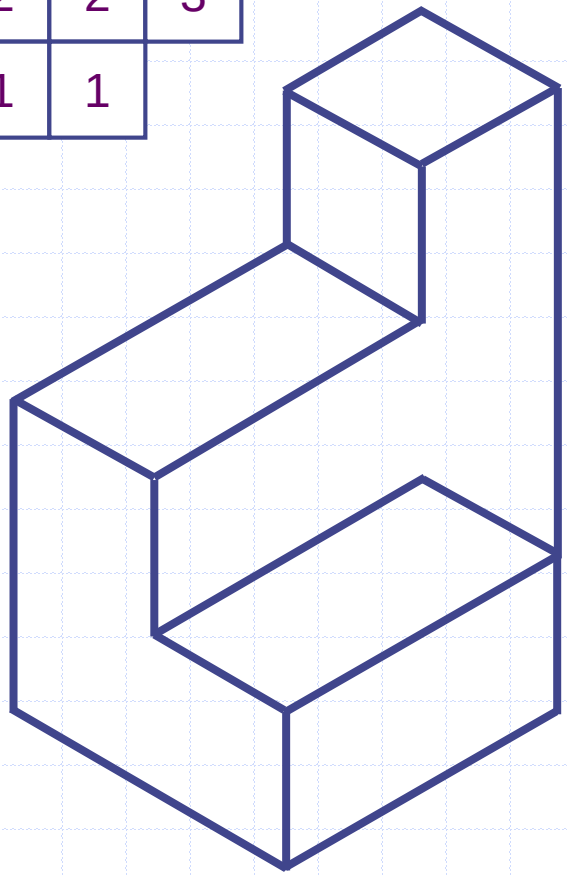
COMPARISON OF VIEWPOINTS

- Different look
- Optical illusion of height
- Viewpoints can show or exclude details

COMPARE

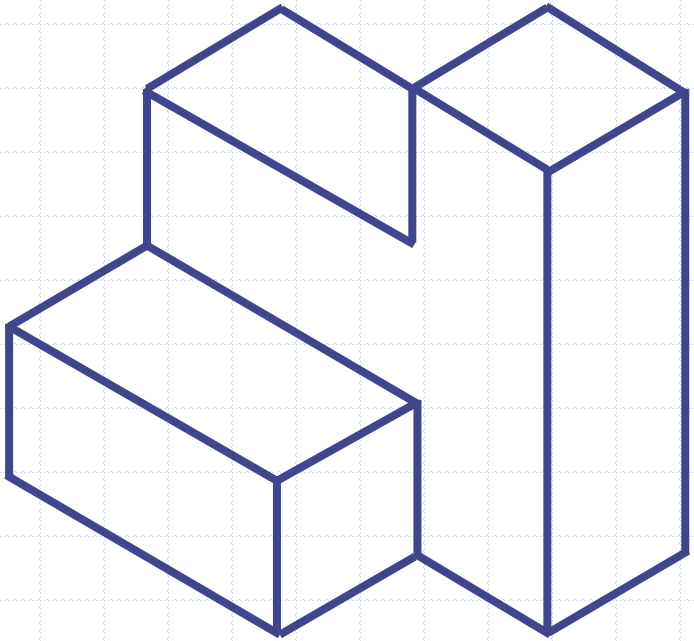
2	2	3
1	1	

V

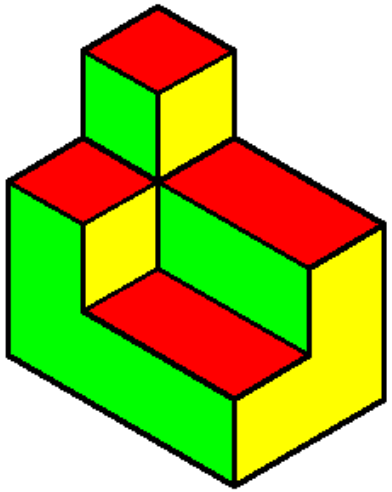


2	2	3
1	1	

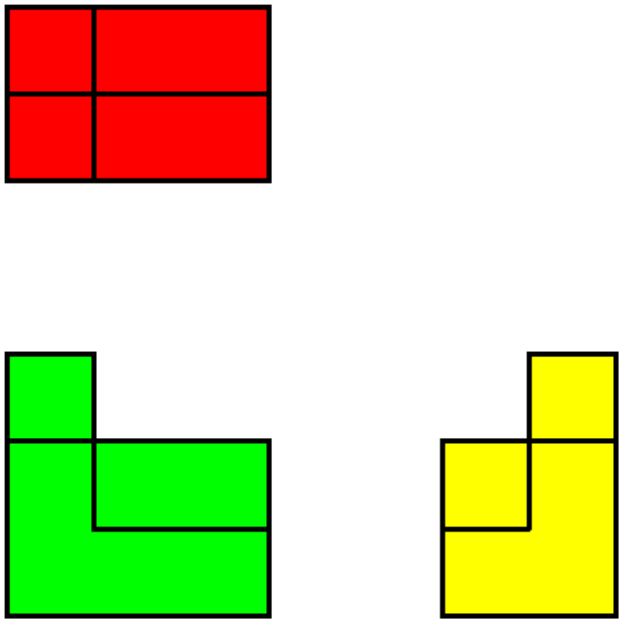
V



ORTHOGRAPHIC vs. ISOMETRIC



ISOMETRIC DRAWING



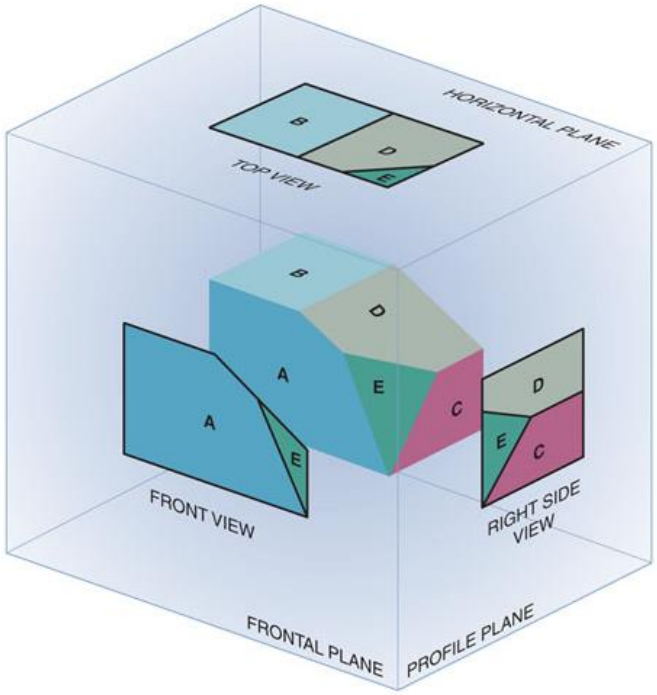
ORTHOGRAPHIC DRAWING

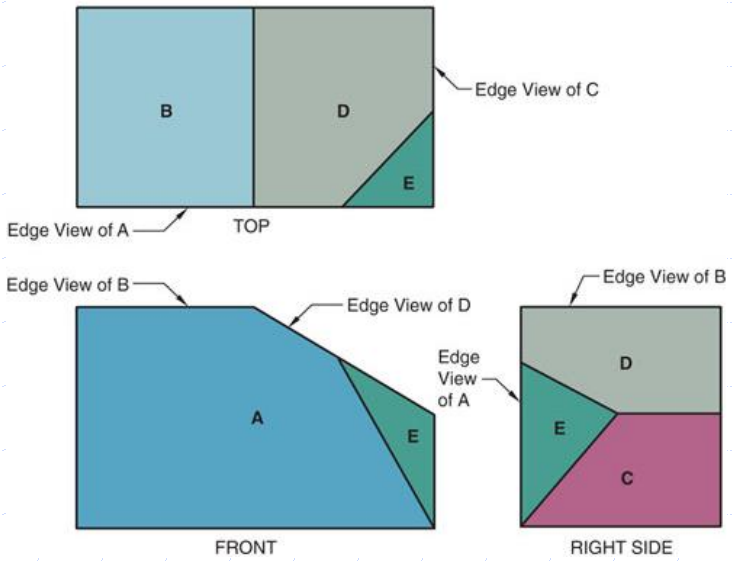
A **normal or principal plane** is parallel to one of the principal planes of projection, and therefore is perpendicular to the line of sight.

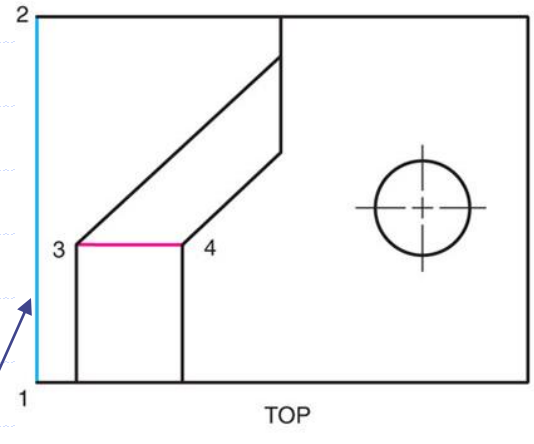
- **Frontal plane** (plane A)
- **Horizontal plane** (plane B)
- **Profile plane** (plane C)

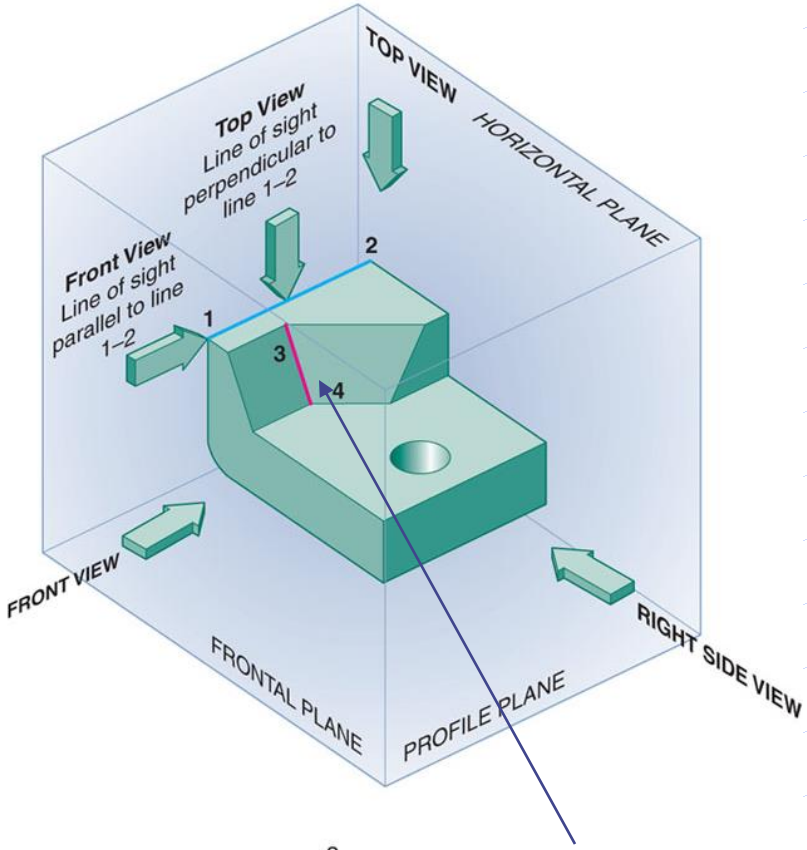
Inclined plane (plane D)

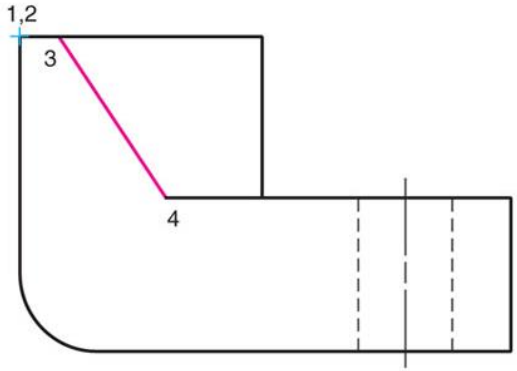
Oblique plane (plane E) is oblique to all principal planes of projection. An oblique surface does not appear in its true shape or size, or as a line in any of the principal views: instead, an oblique plane always appears foreshortened in any principal view.

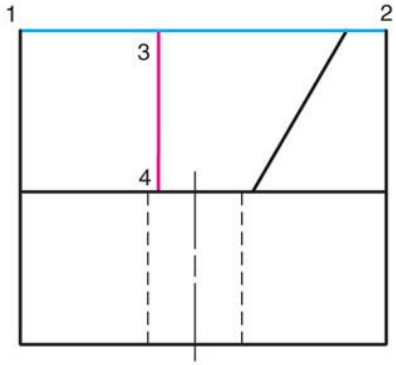





2
3
4
1
TOP


TOP VIEW
HORIZONTAL PLANE
Top View
Line of sight
perpendicular to
line 1–2
Front View
Line of sight
parallel to line
1–2
2
1
3
4
FRONT VIEW
FRONTAL PLANE
PROFILE PLANE
RIGHT SIDE VIEW


1,2
3
4
FRONT


1
2
3
4
RIGHT SIDE