# ME 160

# MECHANICAL ENGINEERING DRAWING-I

Offered to:
Students of ME Dept.
Level 1, Term 1

Instructors:

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# WHAT IS DRAWING?

1. Graphical language that communicates ideas and information.

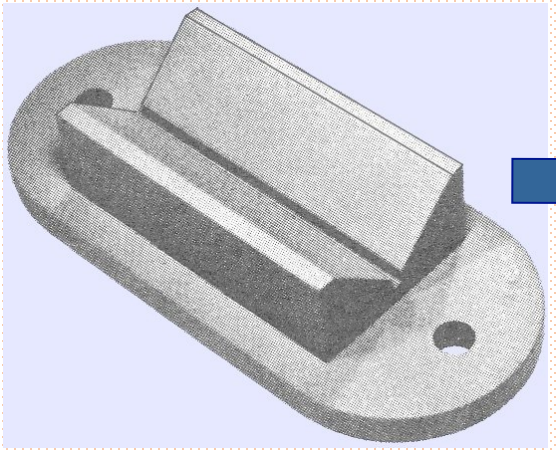
## Difference between Drawing And Art?

| Engineering Drawing | Artistic Drawing |
|---|---|
| Represents **objective facts**: Information. | Represents **subjective impression**: Emotions or Senses. |
| **Only trained** people can appreciate. | **Anyone** can appreciate. |
| Enable Communication with **precision.** | Yields **ambiguous** communication. |

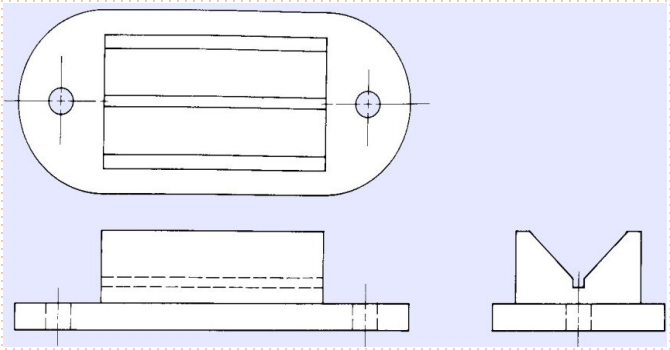
# WAYS OF DRAWING

- Objects may be drawn in different ways

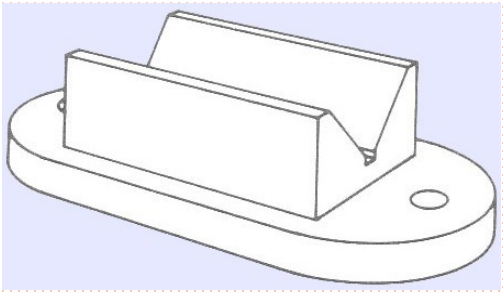
-A ***multiview drawing*** or ***orthographic view*** is one that shows two or more two-dimensional views of a three-dimensional object.



Multiview



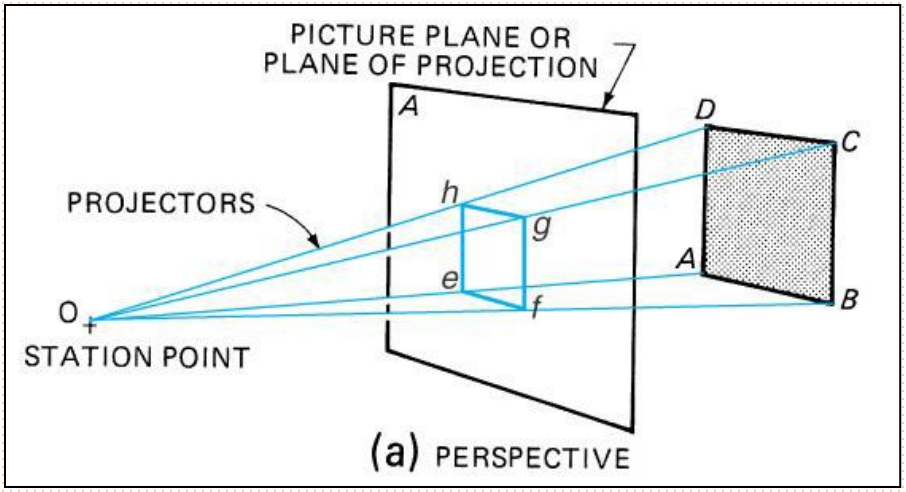
Isometric view

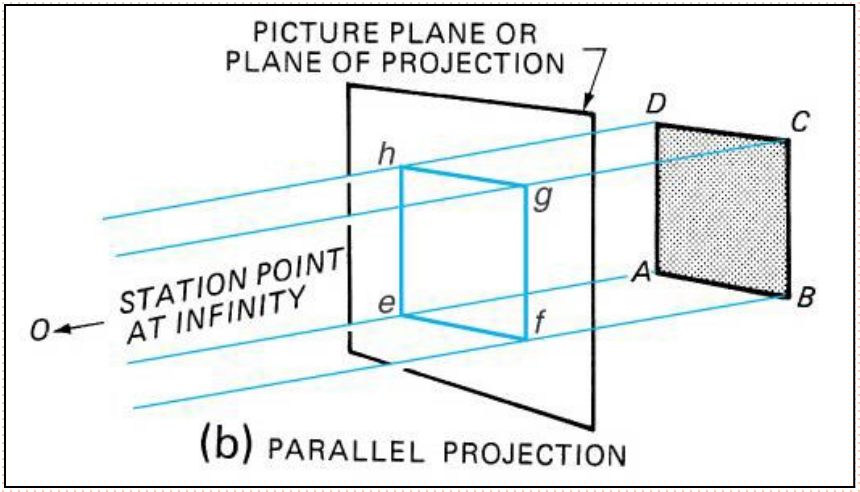


- Better for showing true size and shape
- Each view only shows two dimensions

- Better for visualizing the object
- All three dimensions shown on a single view

# TWO BASIC PROJECTION TYPES



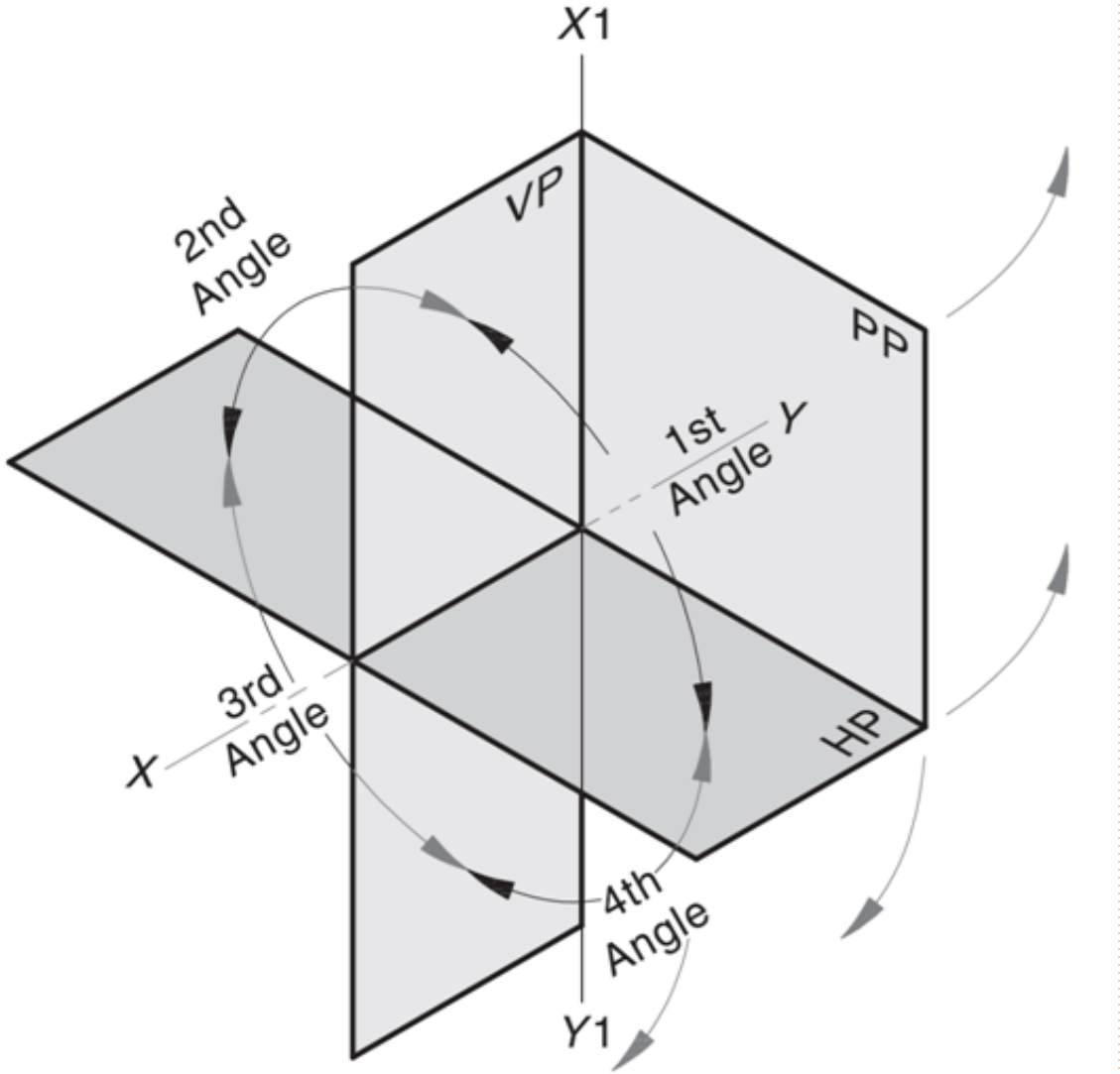

** Throughout our ME 160 course we will follow Parallel Projection.

# PRINCIPAL PLANES IN DRAWING

HP- Horizontal Plane;

VP-Vertical Plane;

PP-Profile plane



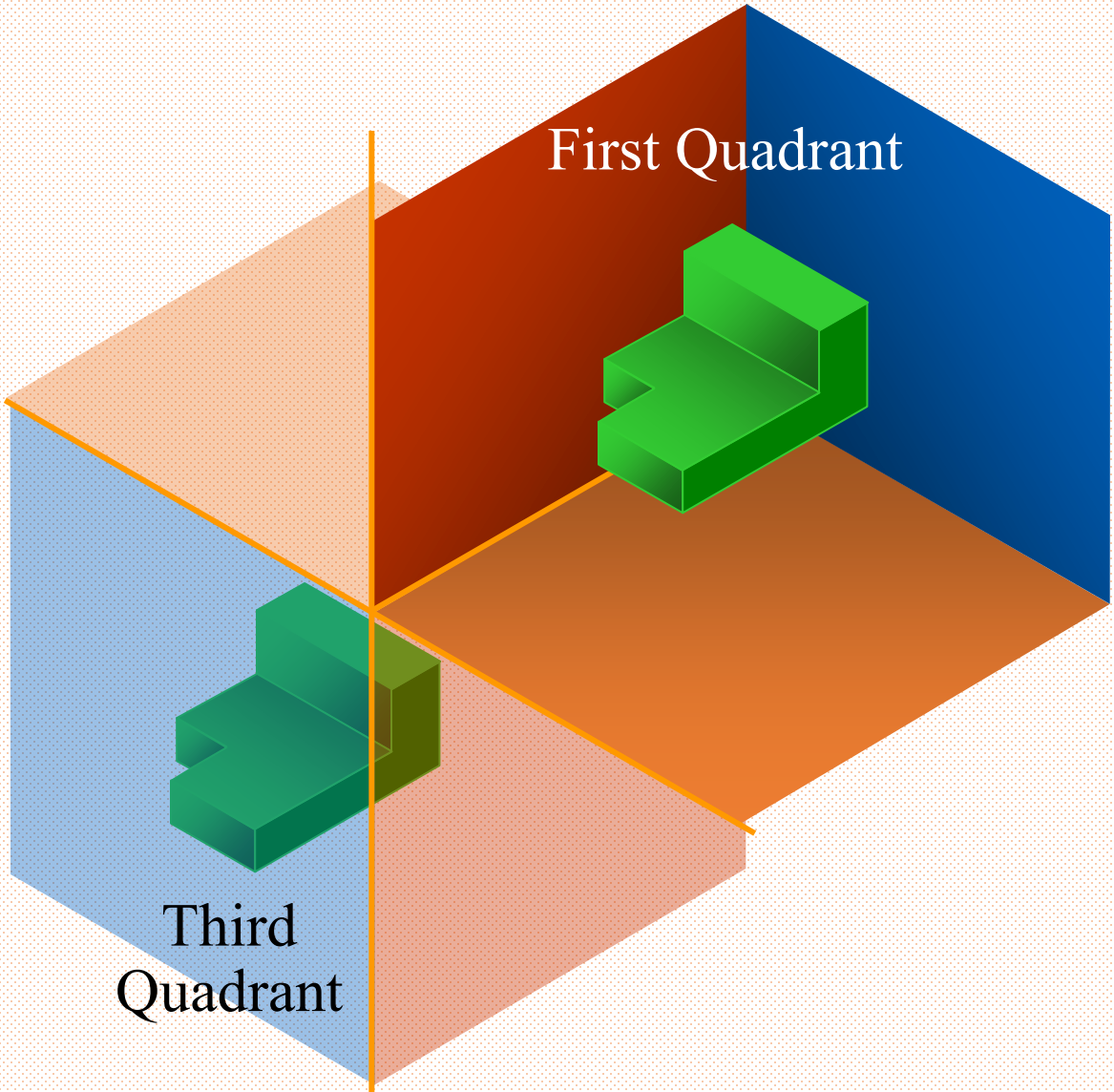

# PROJECTION SYSTEMS

**1. First angle system**

- European country

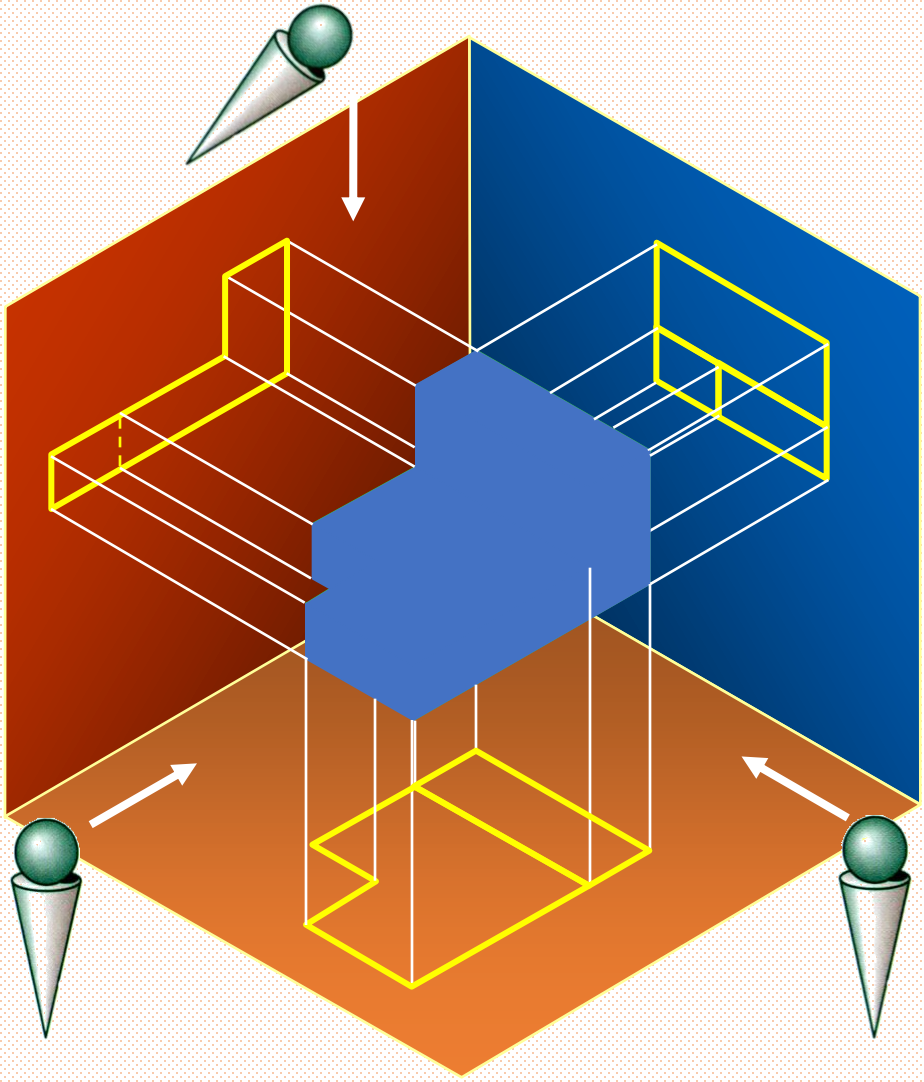
**2. Third angle system**

- Canada, USA,
  Japan, Thailand

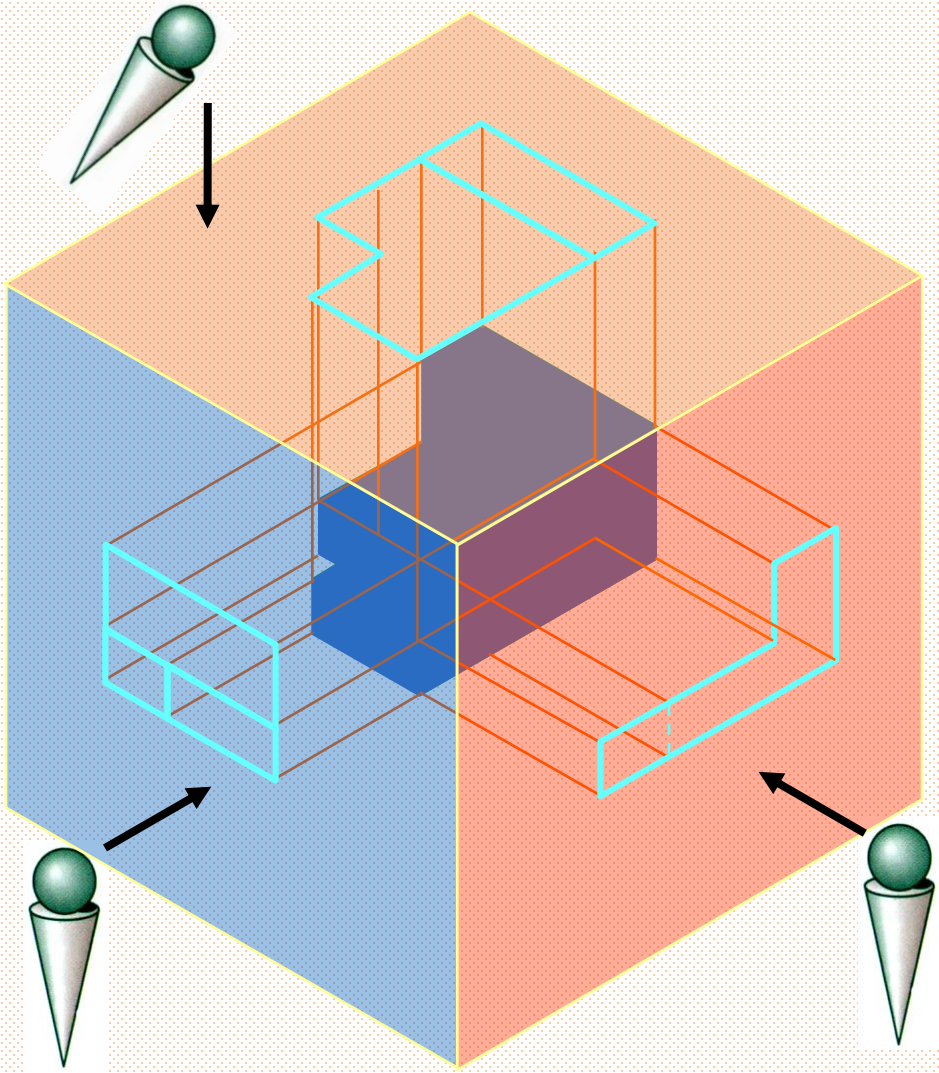


# ORTHOGRAPHIC PROJECTION

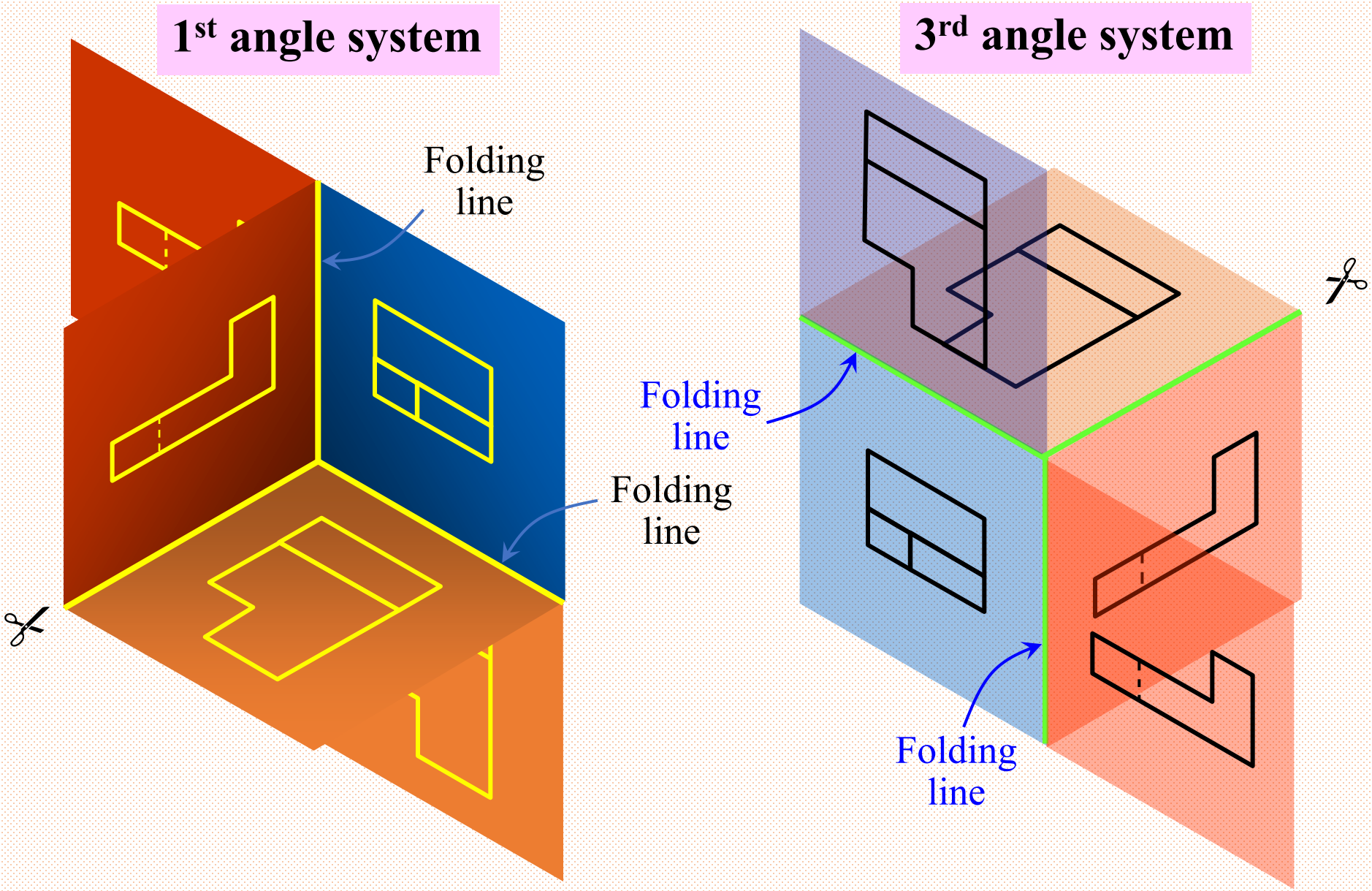
**1st angle system**



**3rd angle system**



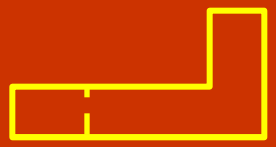
# ORTHOGRAPHIC VIEWS



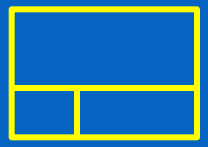
# ORTHOGRAPHIC VIEWS

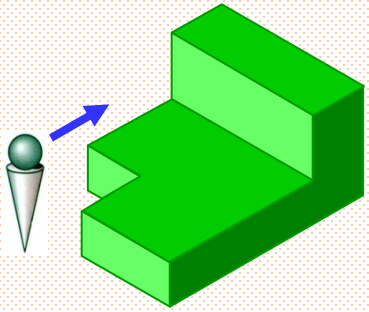
## 1st angle system

Right Side View

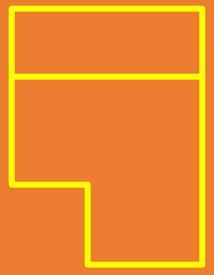


Front View



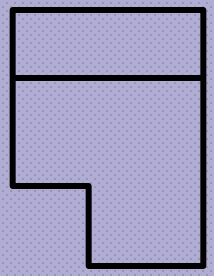


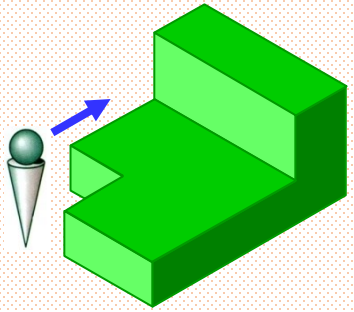
Top View



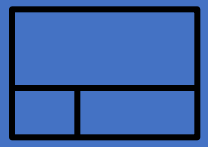
## 3rd angle system

Top View

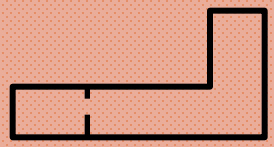




Front View

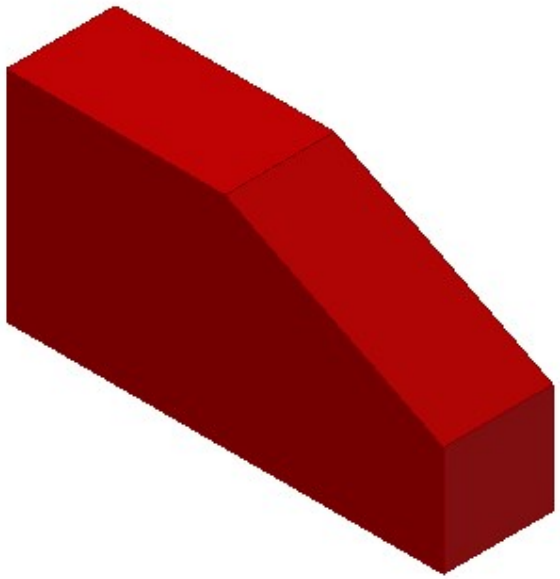


Right Side View



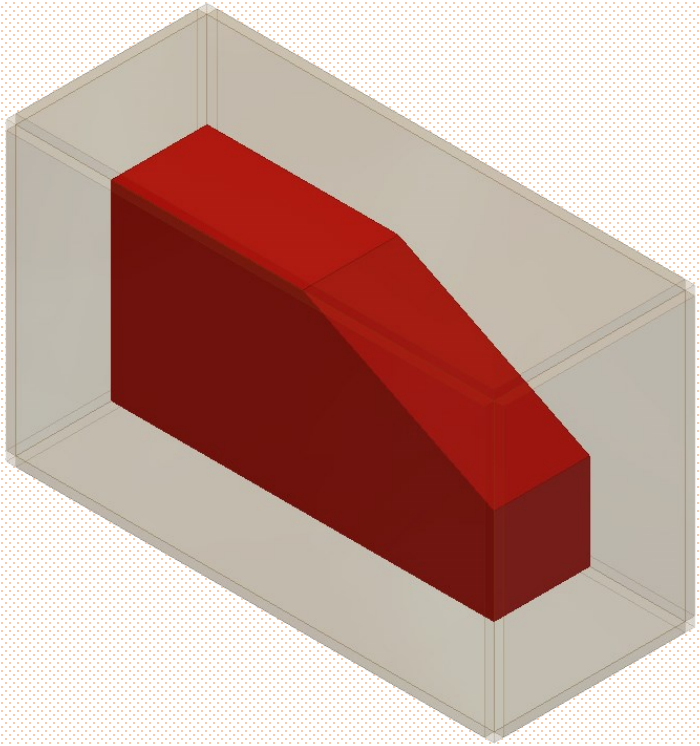
# ORTHOGRAPHIC PROJECTION

The best way to understand ***orthographic projection*** is to imagine an object contained inside a glass box.



# ORTHOGRAPHIC PROJECTION

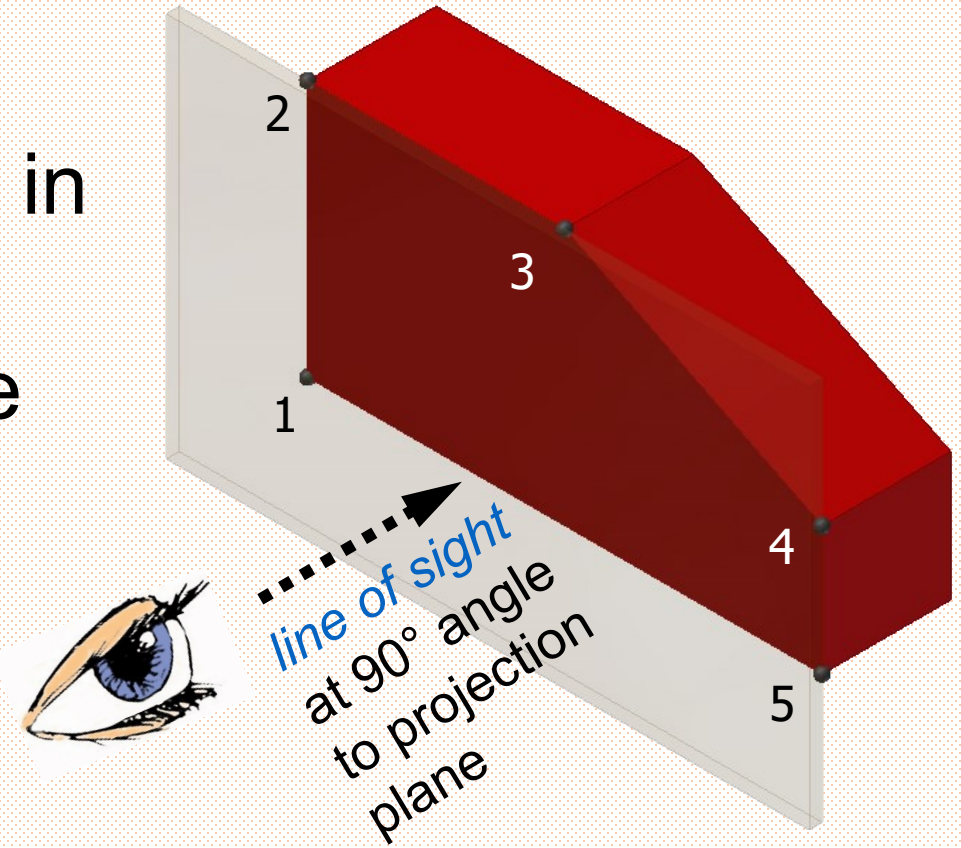
There is a total of six glass walls surrounding the object. Each wall represents a ***projection plane*** onto which a two- dimensional object view will be created.



# ORTHOGRAPHIC PROJECTION

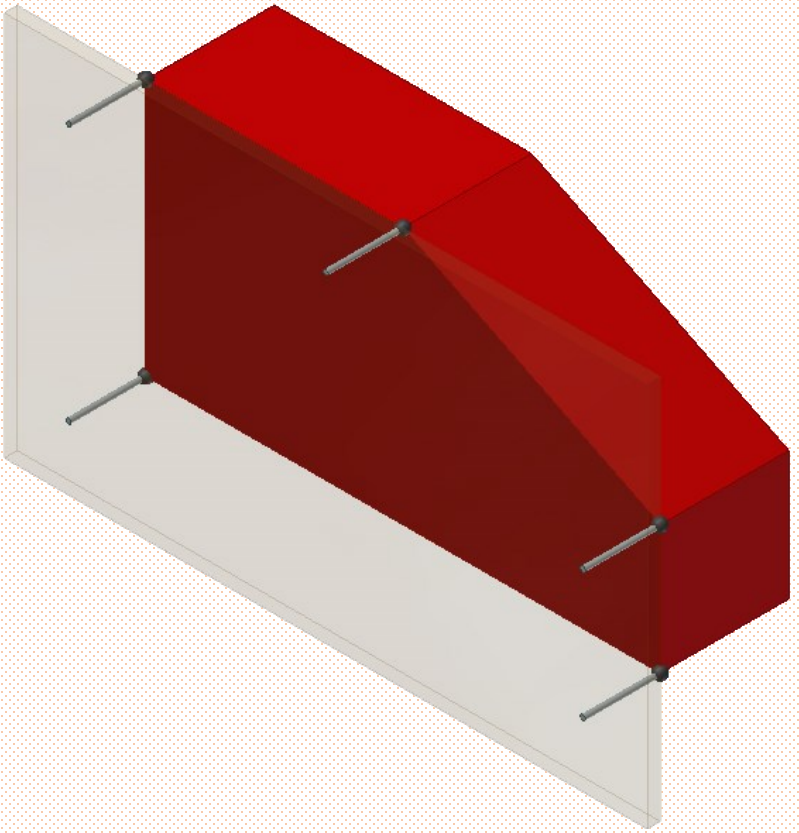
Start by focusing only on the front ***projection plane***.

A person standing in front of the object would see only the five corners identified in black.



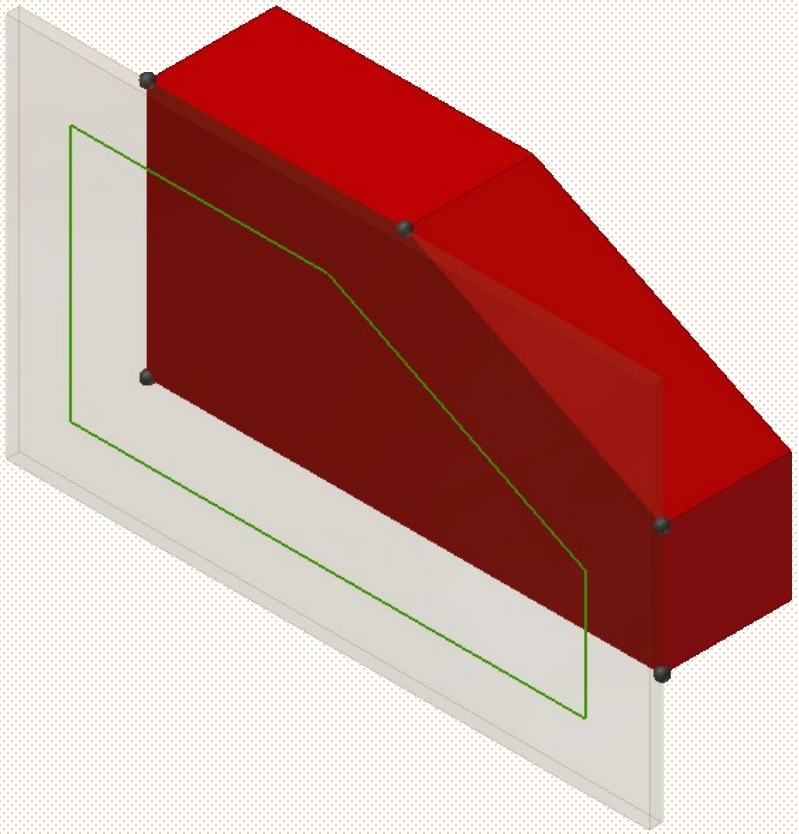
# ORTHOGRAPHIC PROJECTION

***Projection lines*** are used to project each corner outward until they reach the ***projection plane***.



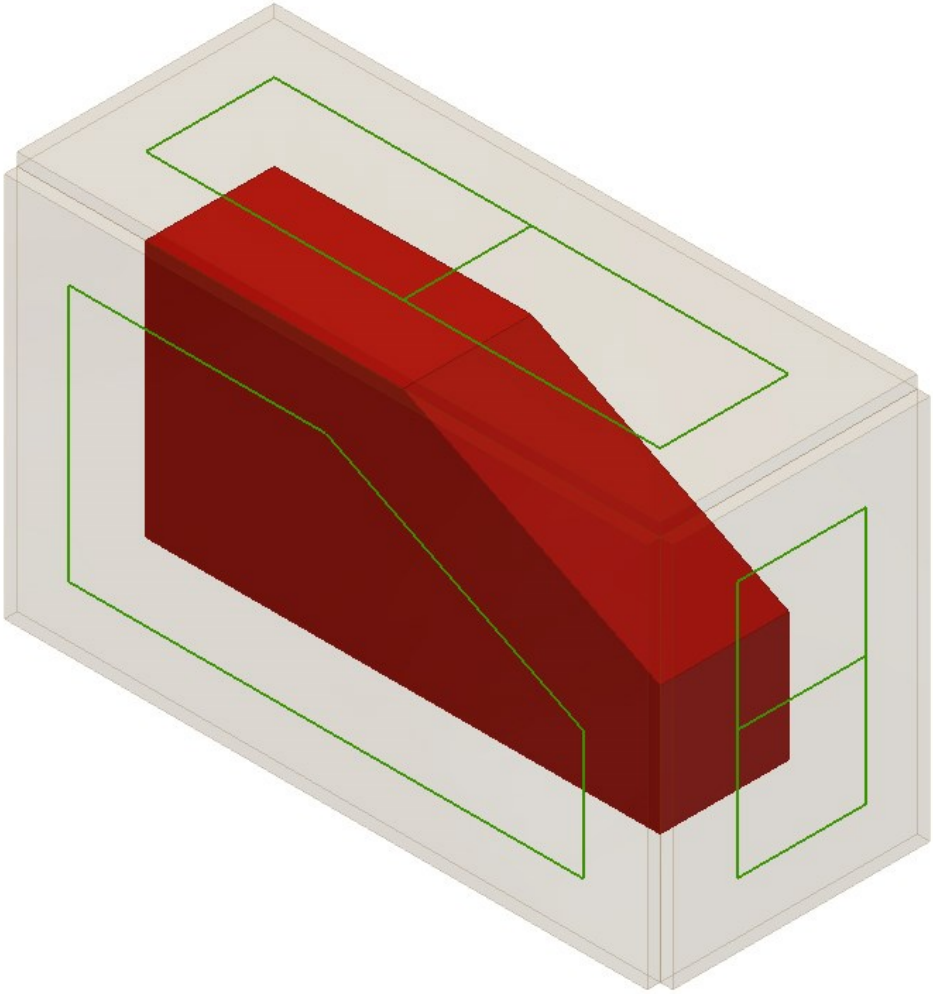
# ORTHOGRAPHIC PROJECTION

The *visible edges* of the object are then identified on the ***projection plane*** by connecting the projected corners with ***object lines***.



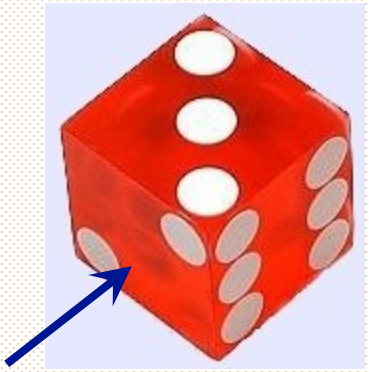
# ORTHOGRAPHIC PROJECTION

The ***orthographic projection*** process is then repeated on the other ***projection planes***.

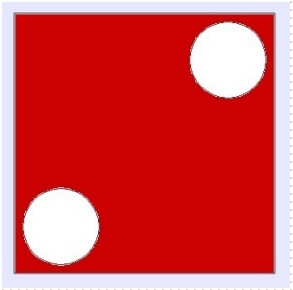


# ORTHOGRAPHIC VIEW

- Cubes (like these dice) have 6 sides



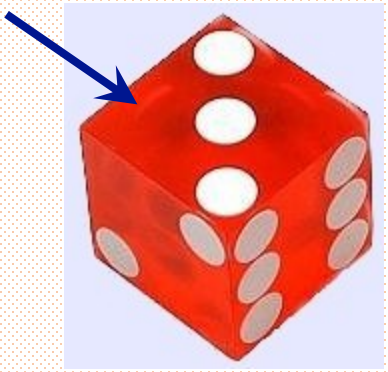
Since each side of the die will have its own view… then there must be **SIX** possible orthographic views!

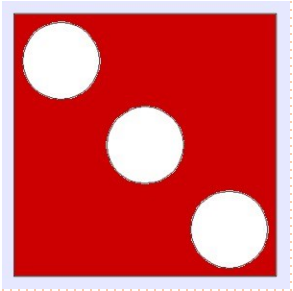


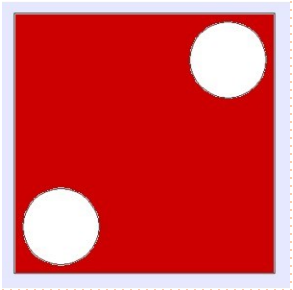
**Front**

# ORTHOGRAPHIC VIEW

- Cubes (like these dice) have 6 sides







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**Front**

**Top**

# ORTHOGRAPHIC VIEW

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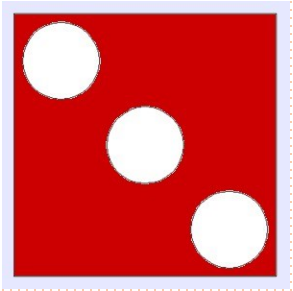

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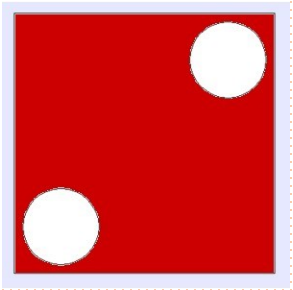
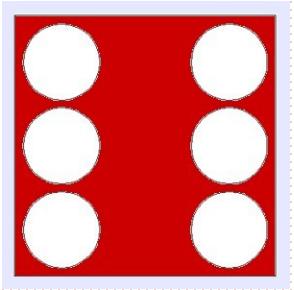


**Front**

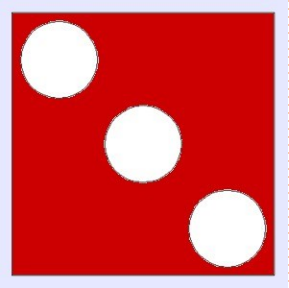


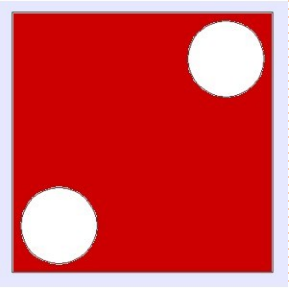
**Top**

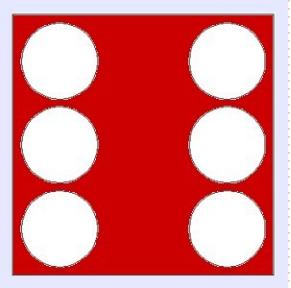
**Right Side**

# ORTHOGRAPHIC VIEW

- Cubes (like these dice) have 6 sides







The **Front**, **Top**, and **Right Side** are the views that are usually drawn.

Since each side of the die will have its own view… then there must be **SIX** possible orthographic views!

| | |
|---|---|
| **Front** | **Back** |
| **Top** | **Bottom** |
| **Right Side** | **Left Side** |

# ORTHOGRAPHIC VIEW



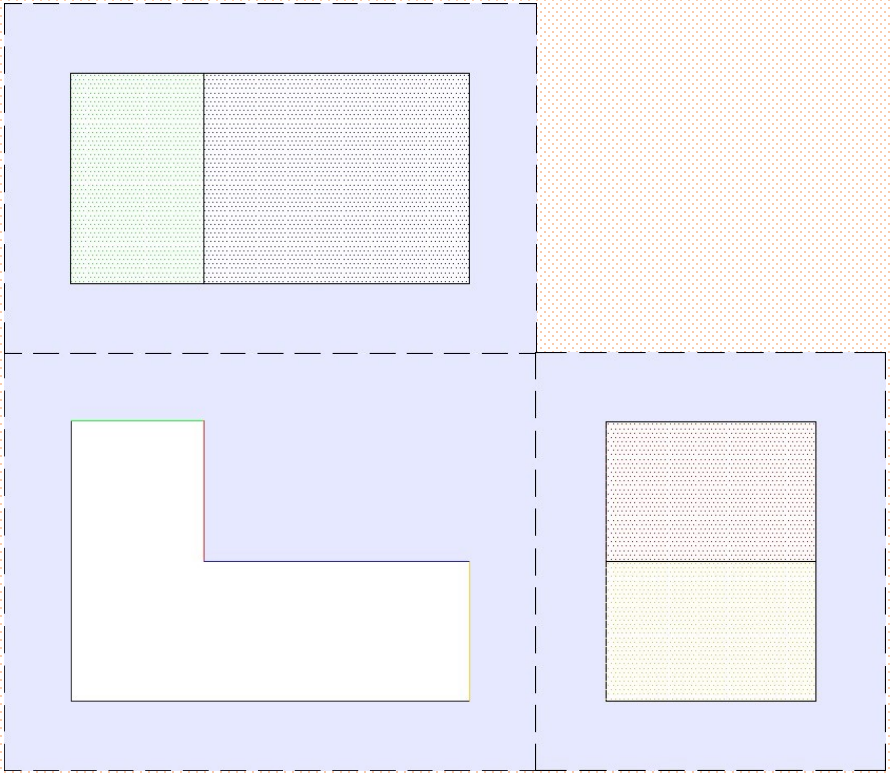
Imagine “unfolding” the cube to get proper view alignment.

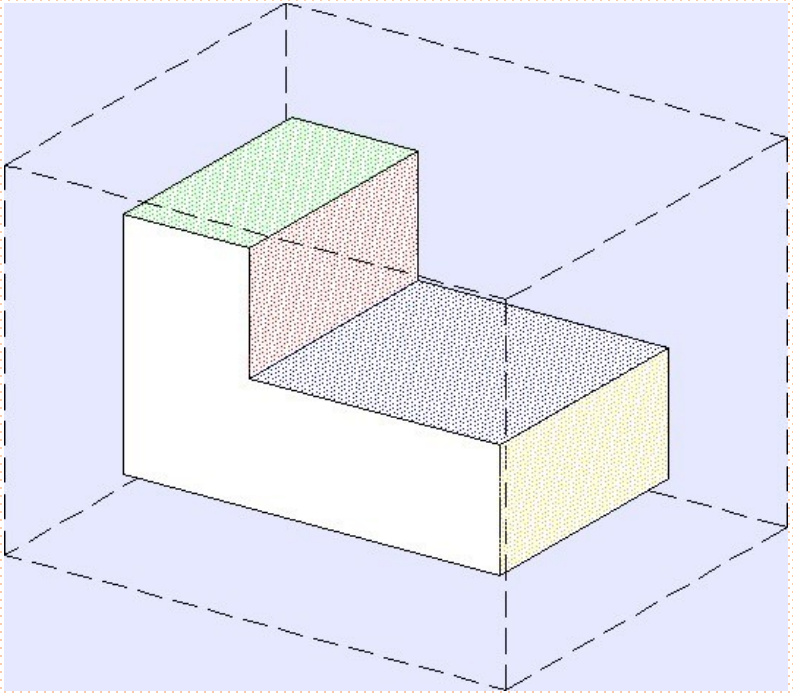
The back view can be placed in any of these four locations.

- All the views MUST be arranged correctly

# ORTHOGRAPHIC VIEW

- Place the object in a glass box
- Draw the projected view on the projection plane
- Then “unfold” the box





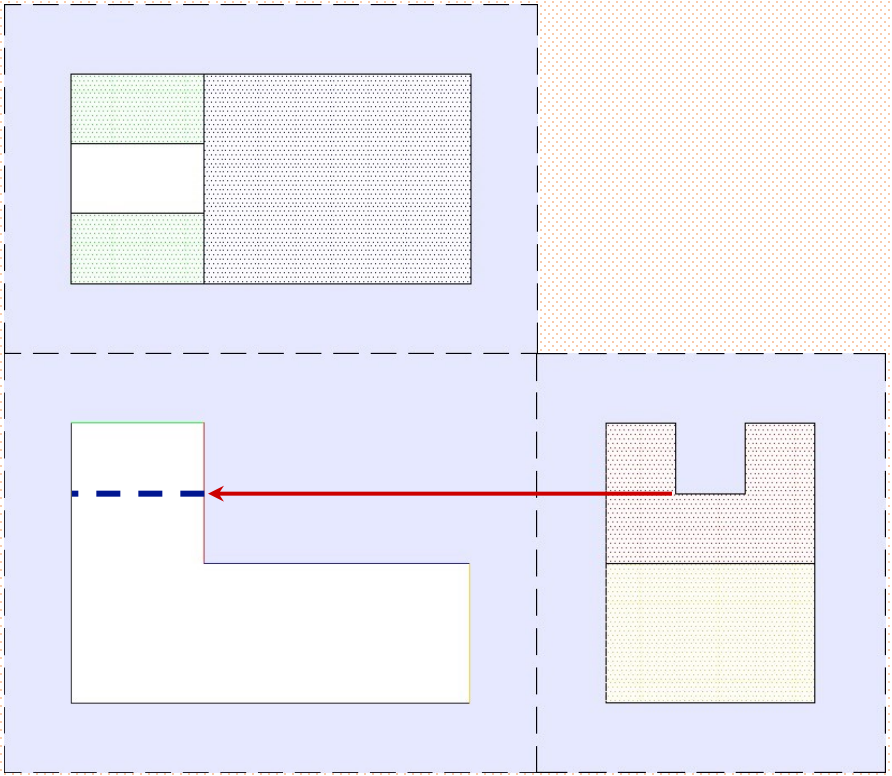
**Front** view is always central

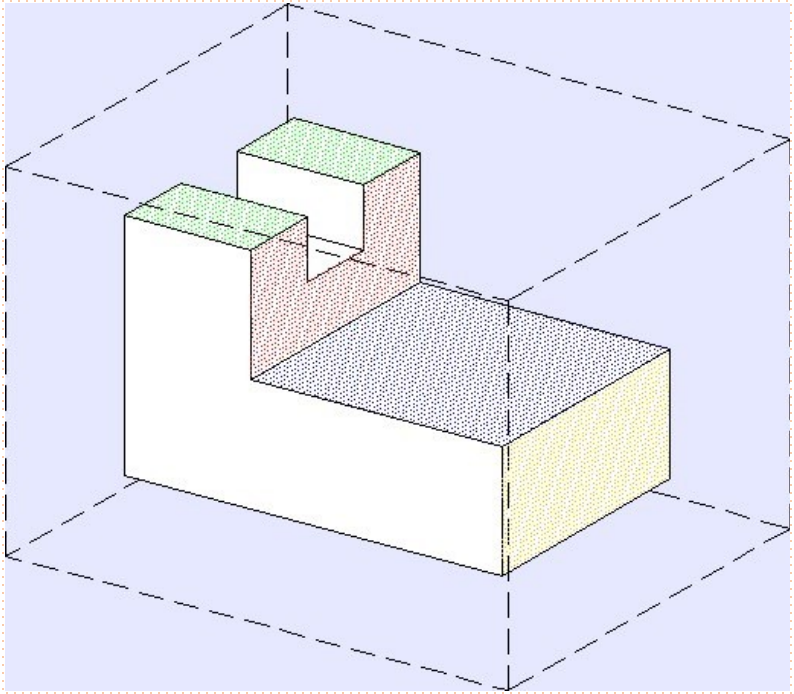
**Top** view goes above

**R.Side** view goes to the right

# ORTHOGRAPHIC VIEW

- **Hidden lines** show details that are not seen in all views

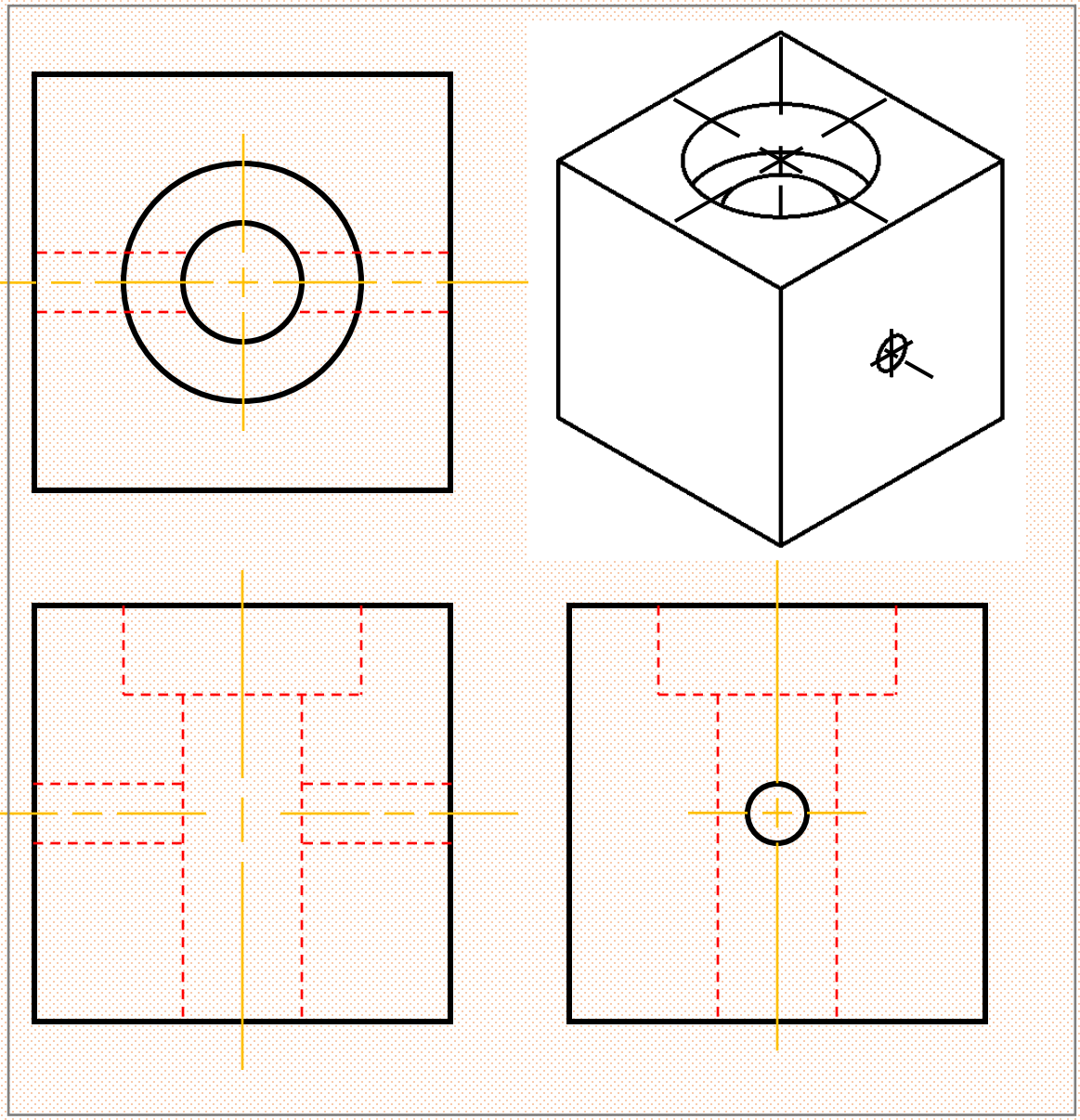




**Project** from hidden detail to the other views

Draw **hidden lines** (dashed) to show the detail

# ORTHOGRAPHIC VIEW

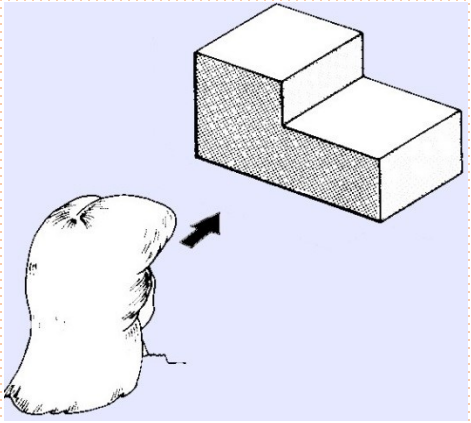


## Line Types An Example:

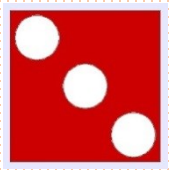
1. Visible
2. Hidden
3. Center

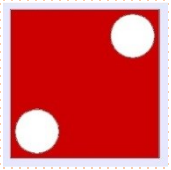
# ORTHOGRAPHIC VIEW

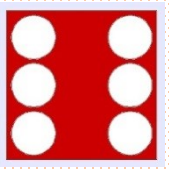
- An orthographic view is drawn **looking straight at one side** of the object (at 90° to it)



- There are **6 possible orthographic views**: Front, Back, Top, Bottom, Left Side, Right Side

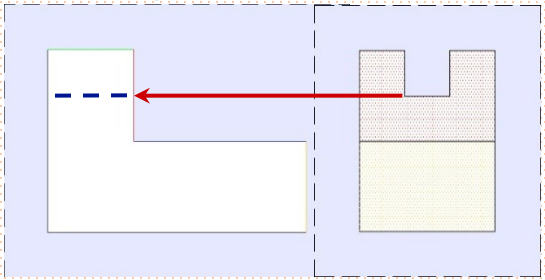




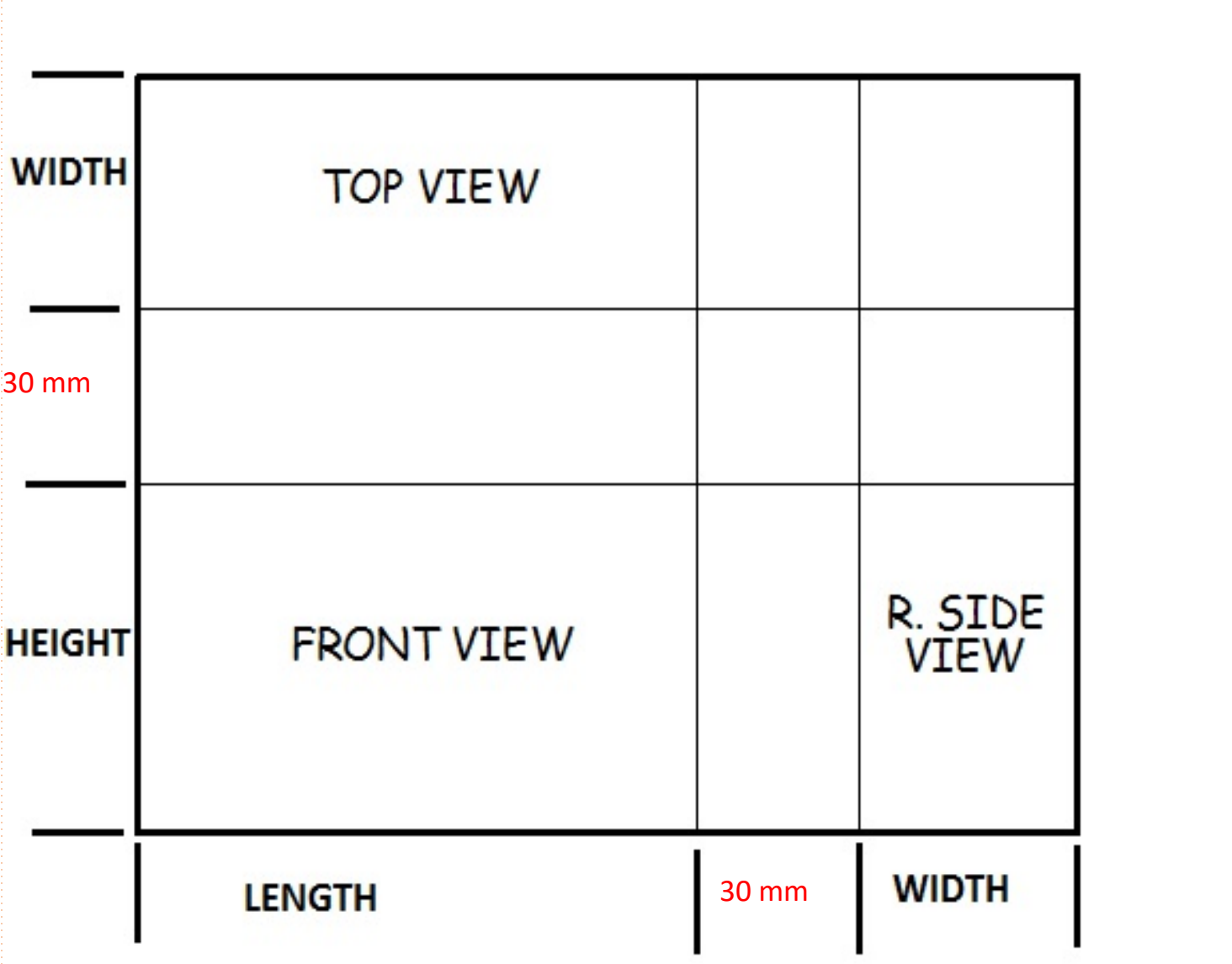


- The **Front, Top, and R.Side** views are usually all that are drawn

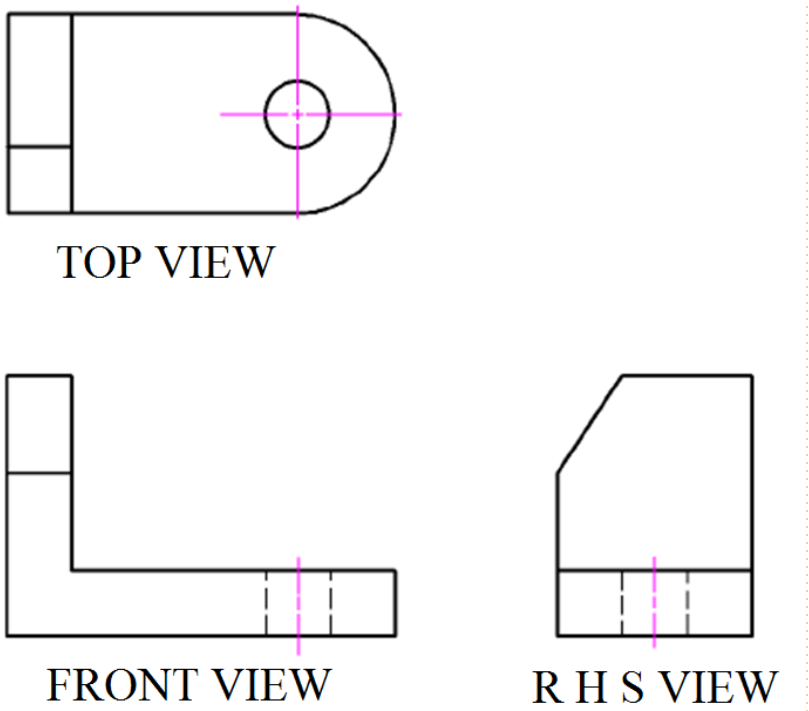
- **Hidden lines** show details you can't see in all views

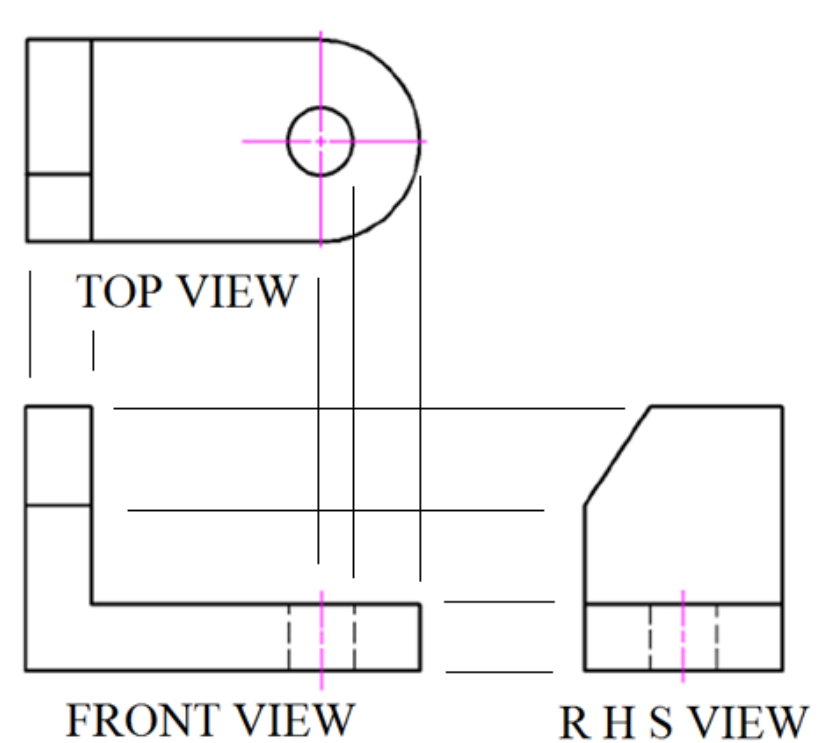


# LAYOUT OF VIEWS



# SAMPLE ORTHOGRAPHIC VIEW



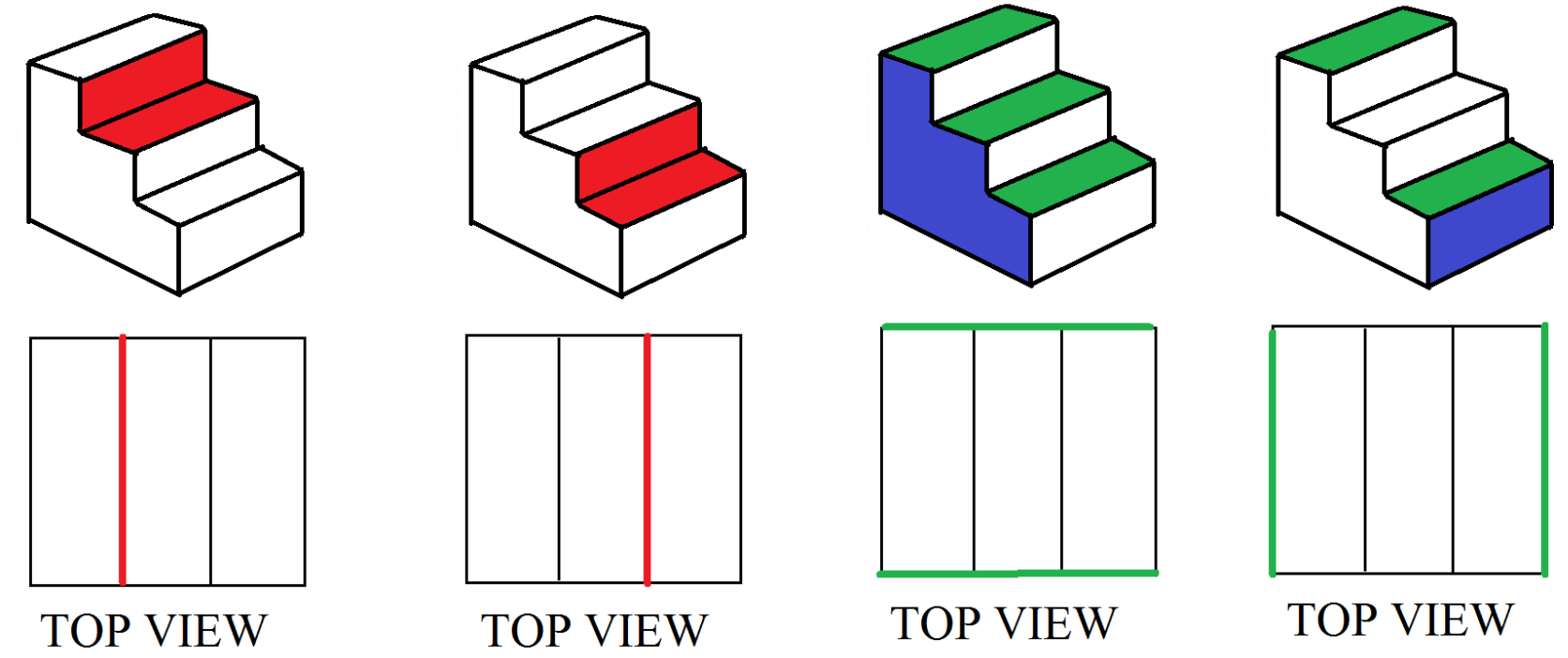




** All views must be aligned with respect to each other – feature to feature.

# WHERE TO DRAW LINE?

1. When there is an intersection of planes.
2. When there is a plane parallel to eye.
3. When the angle between the tangent planes of intersecting planes is not $0^0$ or $180^0$.
4. When the tangent plane of a surface is parallel to eye.

# WHERE TO DRAW A LINE?

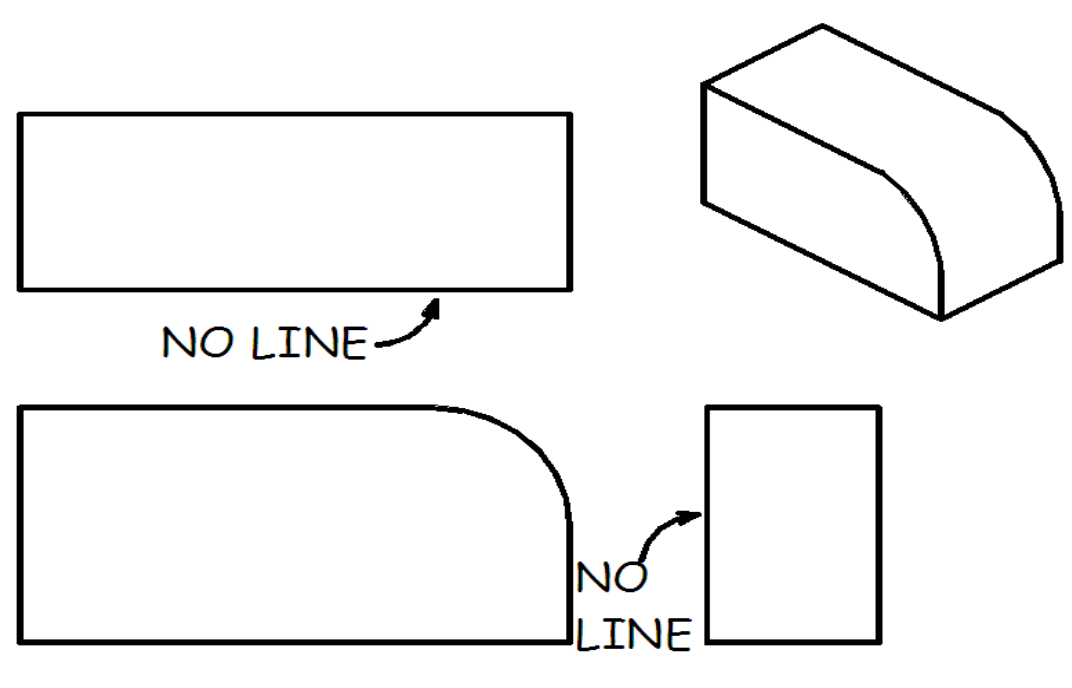



Red Line is due to the intersection of two red planes shown in the isometric view.

Each segment of green line is due to the intersection of blue plane and green planes

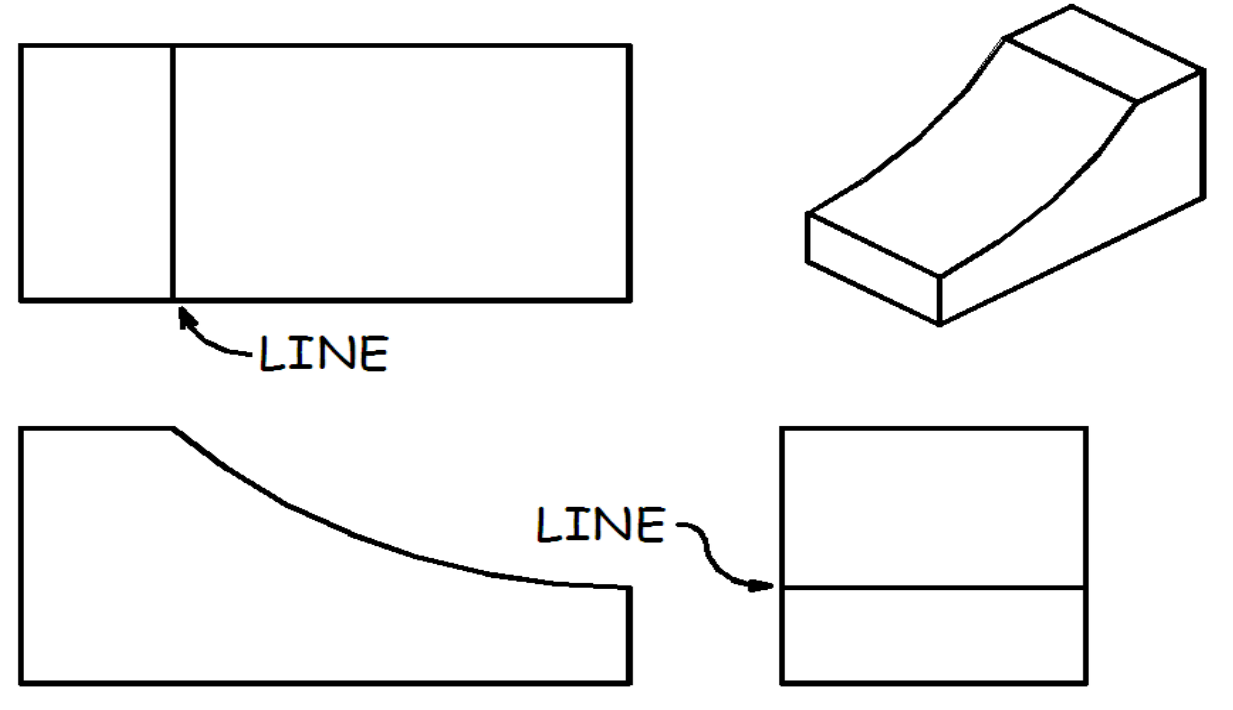
# WHERE TO DRAW A LINE?

- Where a curved surface is *tangent* to a plane surface, no line should be shown where they join

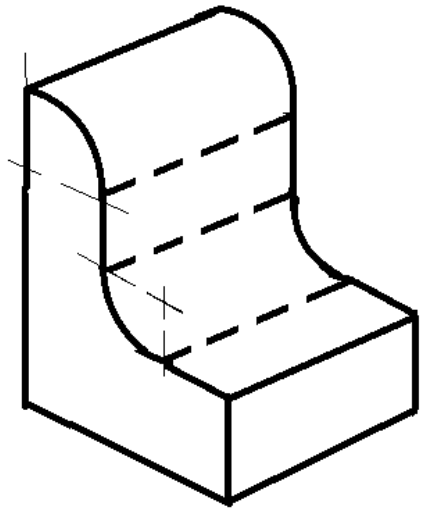


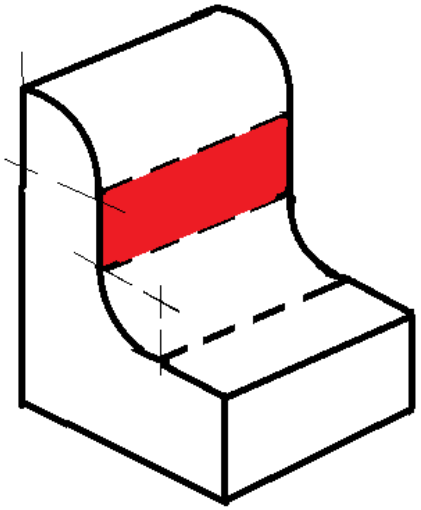
# WHERE TO DRAW A LINE?

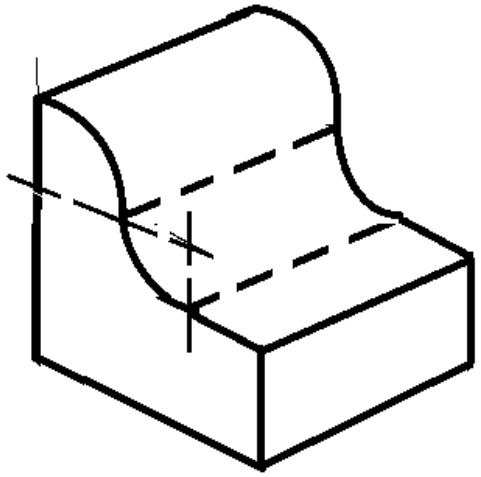
- Where a plane surface intersects a curved surface, an edge is formed



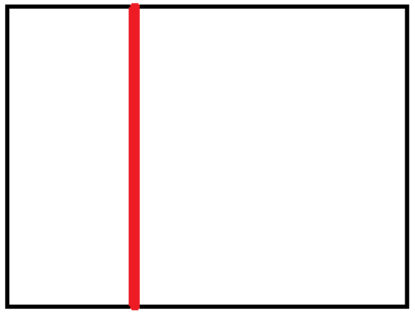
# WHERE TO DRAW A LINE?







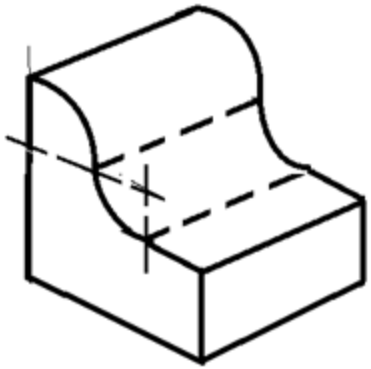
TOP VIEW

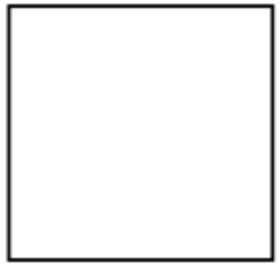


TOP VIEW

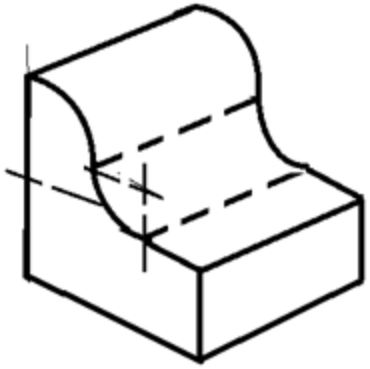
The red line is due to the parallel plane shown in isometric view (Red Plane)

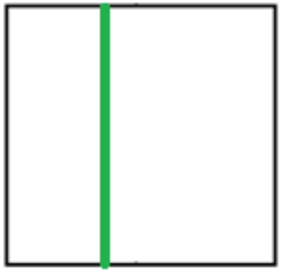
# WHERE TO DRAW A LINE?



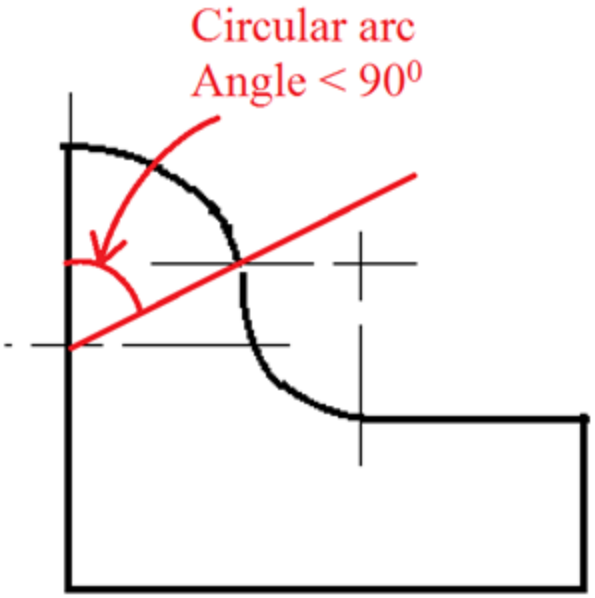


TOP VIEW

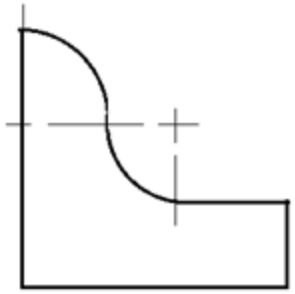




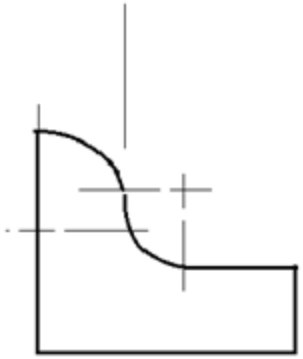
TOP VIEW




FRONT VIEW



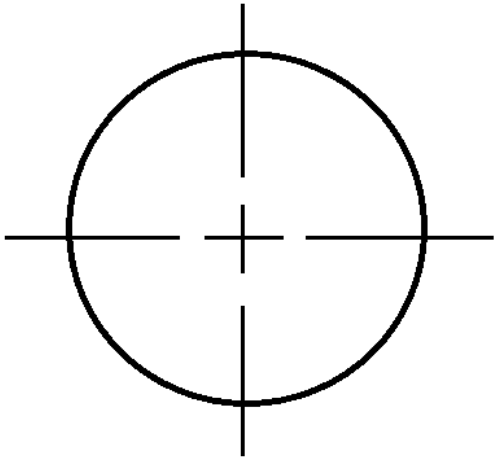
FRONT VIEW



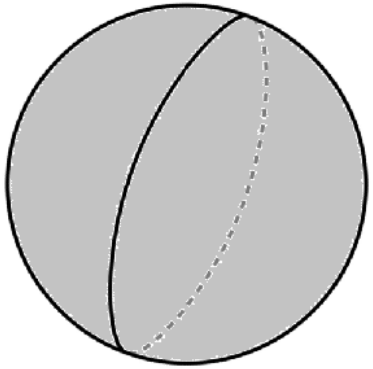
FRONT VIEW

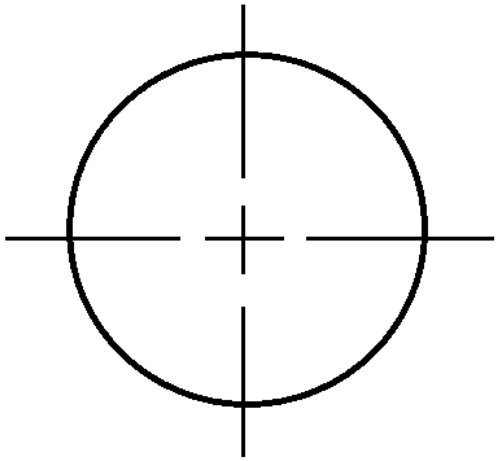
Green line is because the angle between the tangents of the two intersecting planes are neither $0^0$ nor $180^0$.

# WHERE TO DRAW A LINE?

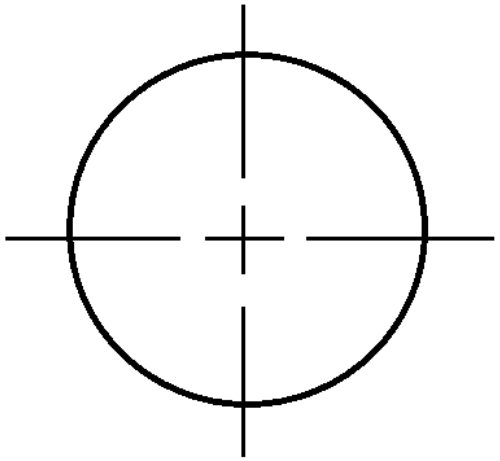


TOP VIEW





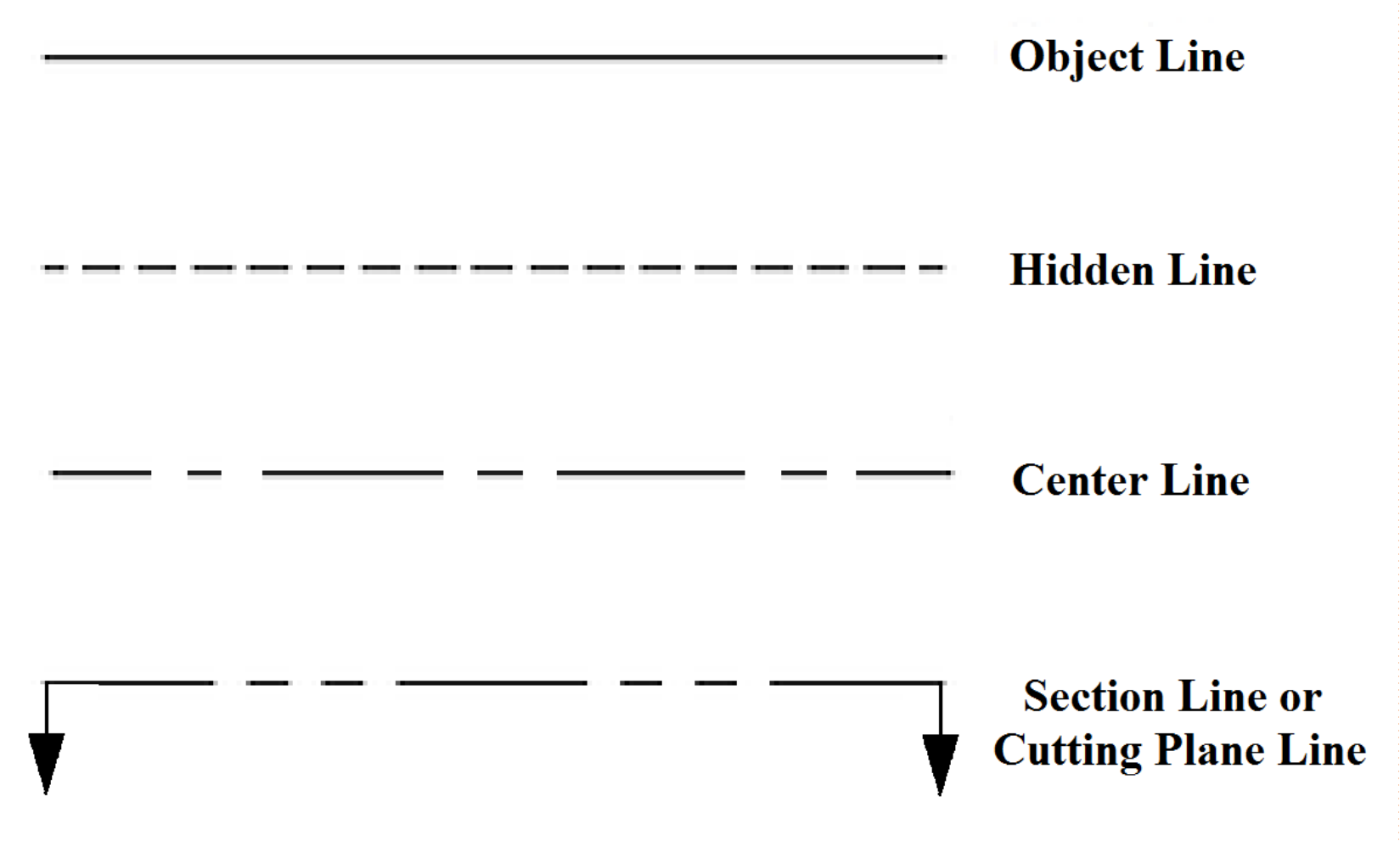
FRONT VIEW



RHS VIEW

The circular views are due to the tangent of the curved surface that is parallel to the eye when seen from each side.

# DIFFERENT TYPES OF LINES



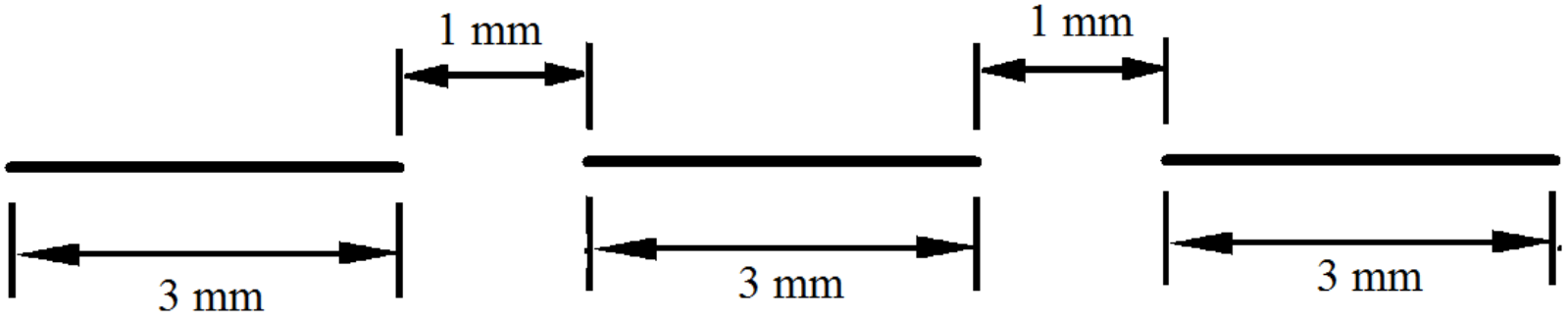
# LINE SPECIFICATIONS

Object Line

Thickness: 100 %

Hidden Line

Thickness: 50 %

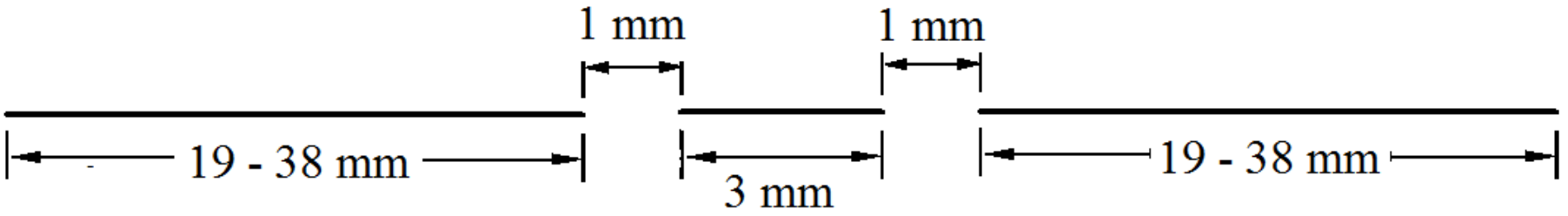



**N.B.: All Percentages are with respect to the object line**

# LINE SPECIFICATIONS

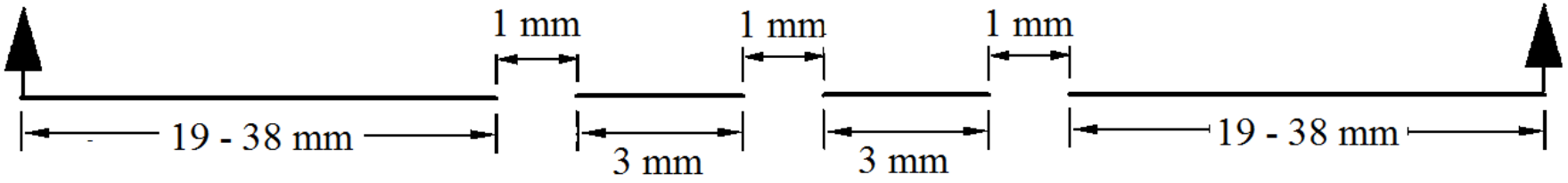
## Center Line

Thickness: 50 %




## Section Line

Thickness: 125 %




**N.B.: All Percentages are with respect to the object line**

# RULES FOR DIMENSIONING

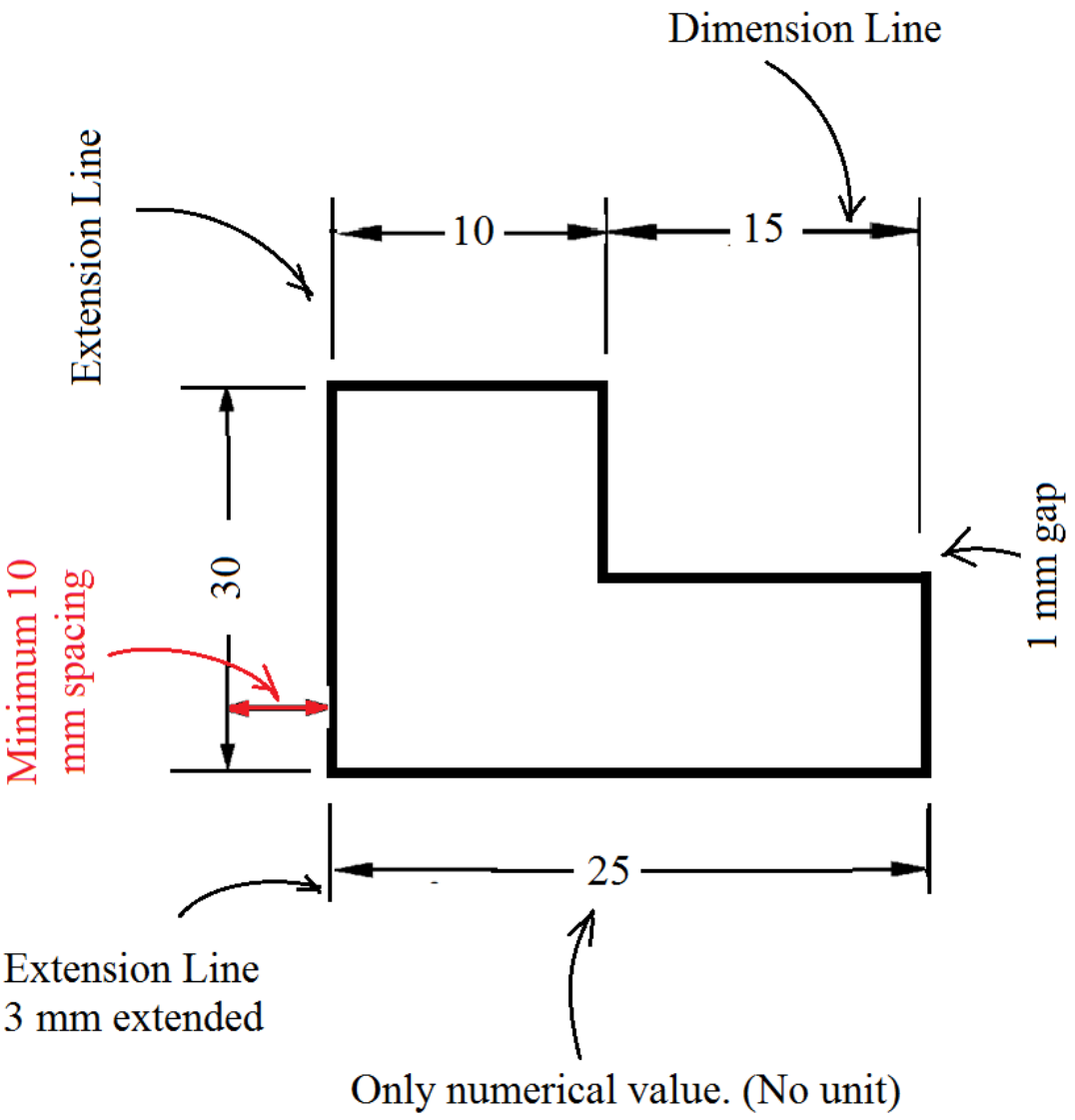
** Two types of lines are used for dimensioning in orthographic views:
(a) Extension Line (b) Dimension Line

** Generally two Types of dimensioning is used in Mechanical Engineering Drawing:
(a) Linear (b) Circular

** All the dimensions must be presented in ‘mm’.

** All the numerical values must be center aligned.

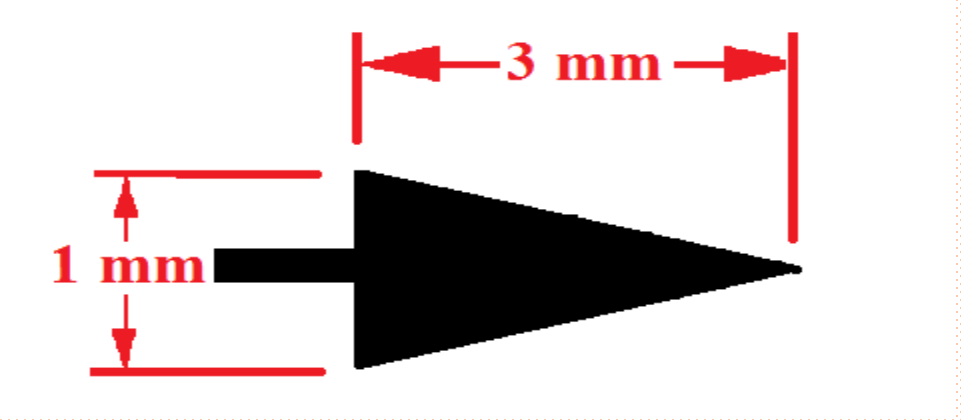
# LINEAR DIMENSIONING



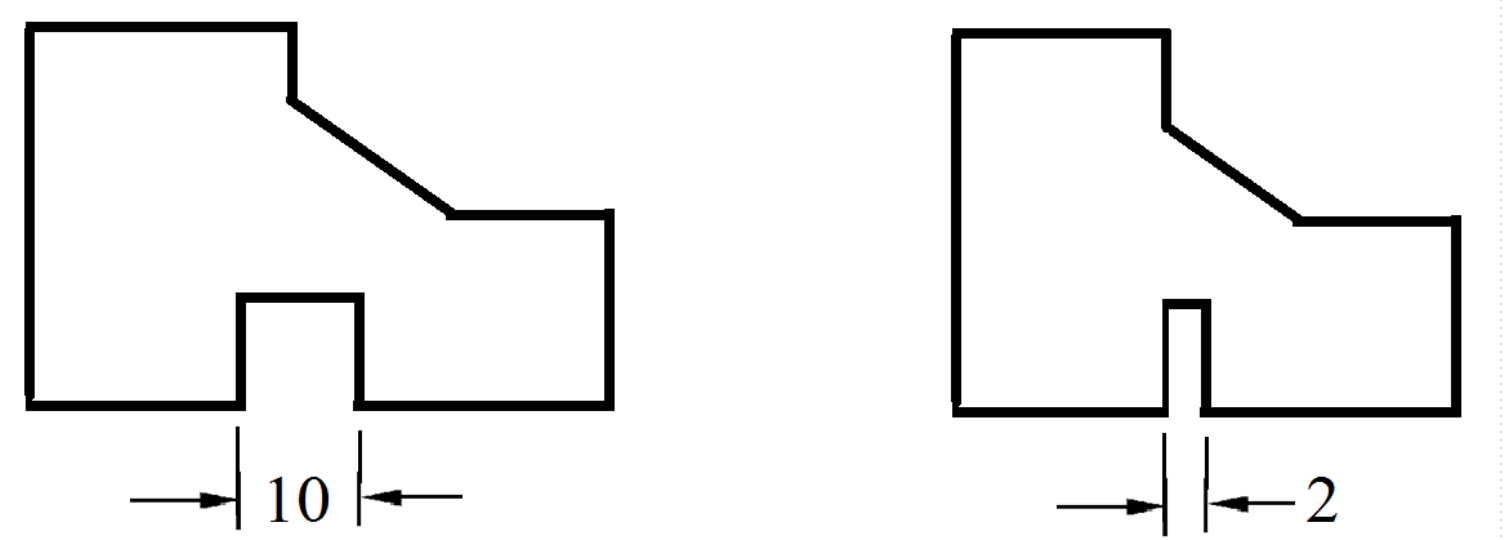

1. Dimension and extension lines must be either horizontal or vertical.
2. No dimension/extension line can cross over another dimension/extension line.
3. There must be one arrowhead at each end of dimension line.
4. The thickness of both extension and dimension line is 25%.
5. No dimensioning is allowed inside the object.

# ARROWHEAD

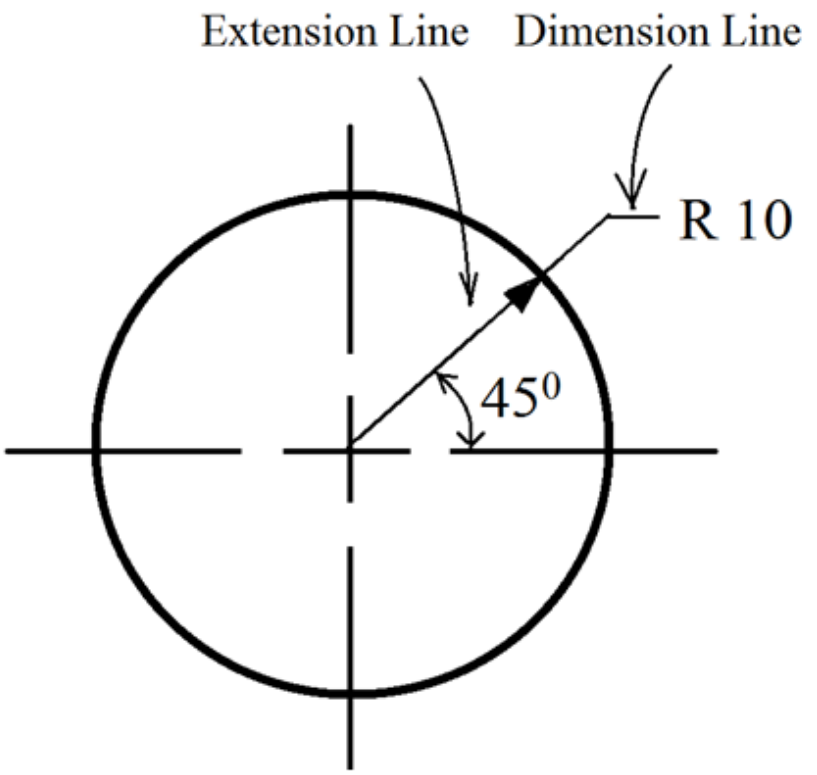
** Must be filed.
** Length to width ratio is 3:1.




# NARROW DIMENSIONING



# CIRCULAR DIMENSIONING



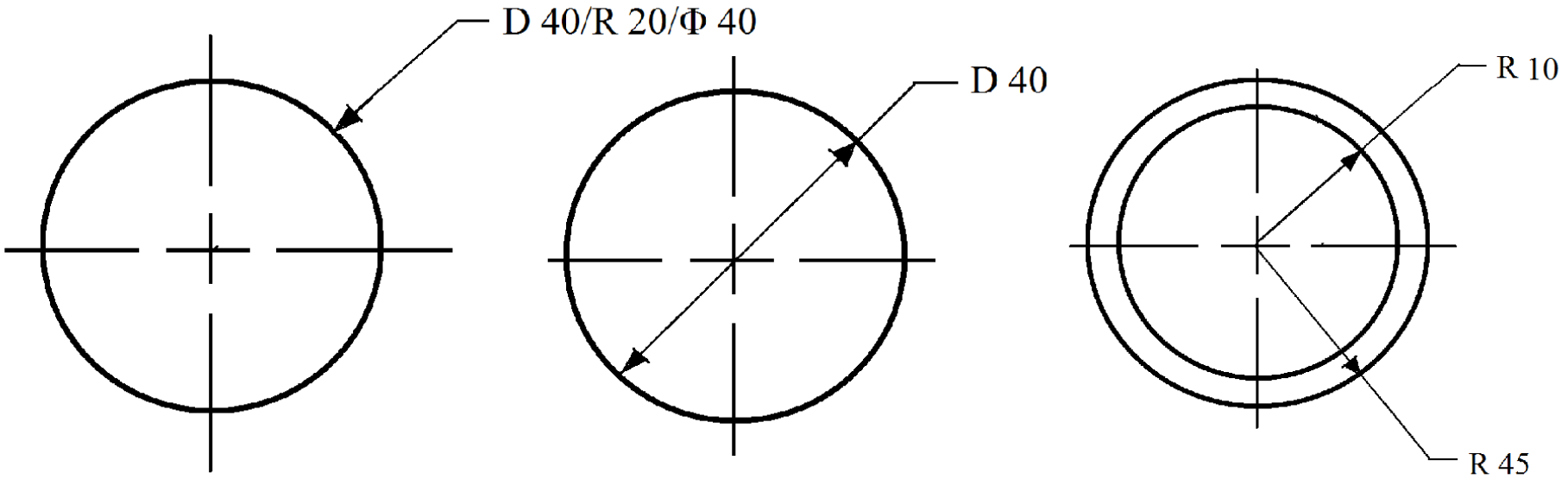

Length of dimension line 3 - 6 mm

R 10 represents Radius = 10

Before dimensioning Centerline must be drawn.

1. Dimension lines must be either horizontal or vertical.
2. Extension line preferably be inclined at an angle of $45^0/135^0/225^0/315^0$.
3. No dimension/extension line can cross over another dimension/extension line.
4. There must be one arrowhead on the extension line.
5. The thickness of both extension and dimension line is 25%.
6. No dimensioning is allowed inside the object.
7. The arrowhead must touch the circle whose dimension is being shown.

# CIRCULAR DIMENSIONING

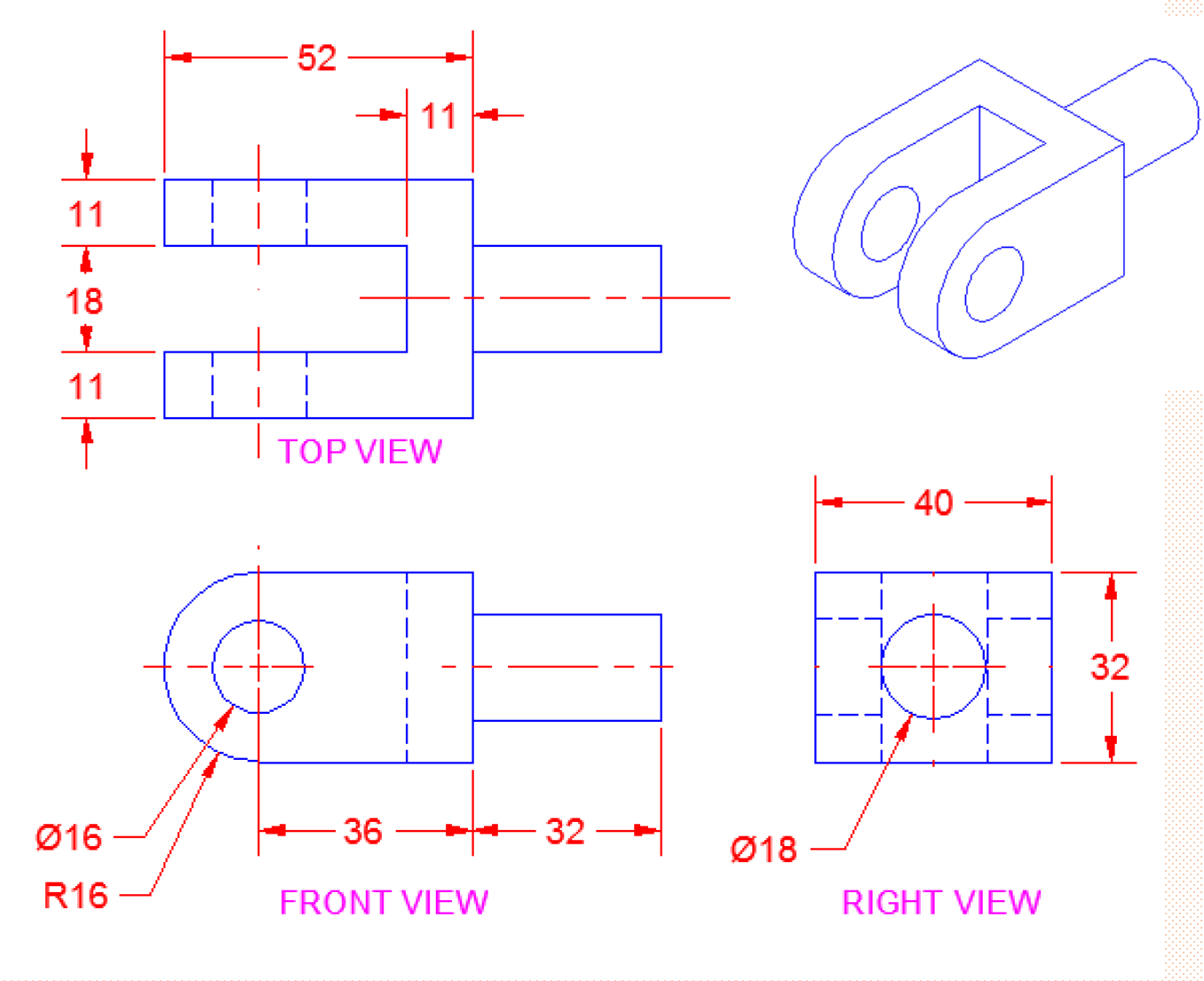



D = Diameter; R = Radius; Φ = Diameter;

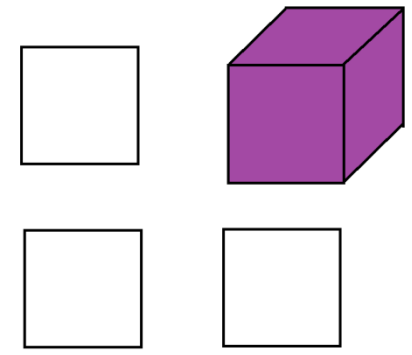
DRILL = Diameter; REAM = Diameter;

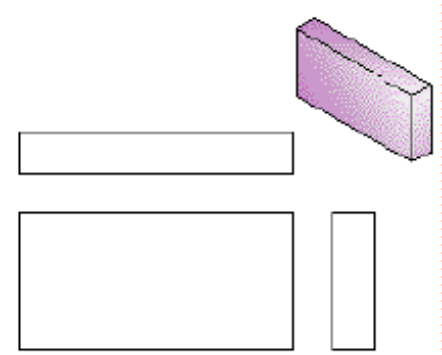
The projection of the extension line in first figure must go through the center of the circle

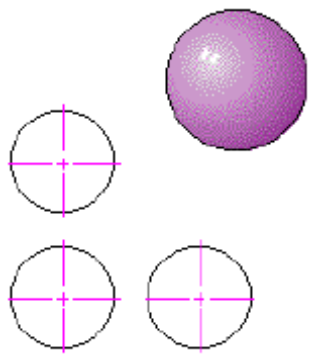
# COMPLETE DIMENSIONING

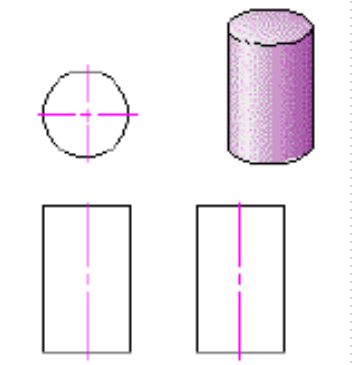


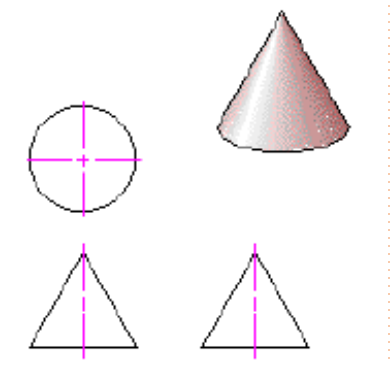
# DIFFERENT TYPES OF VIEWS

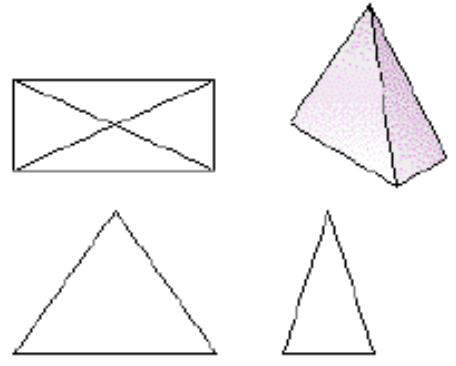






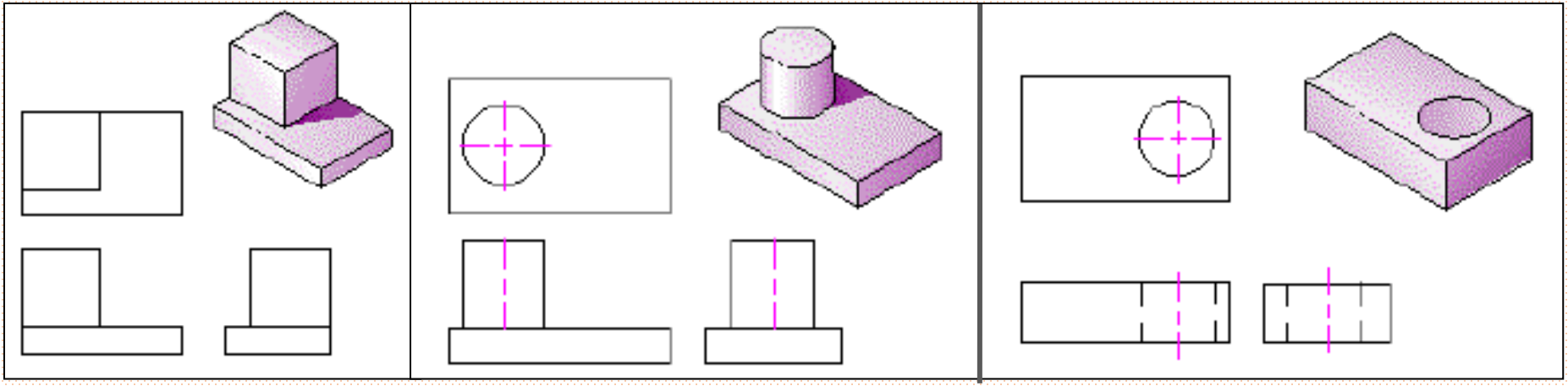


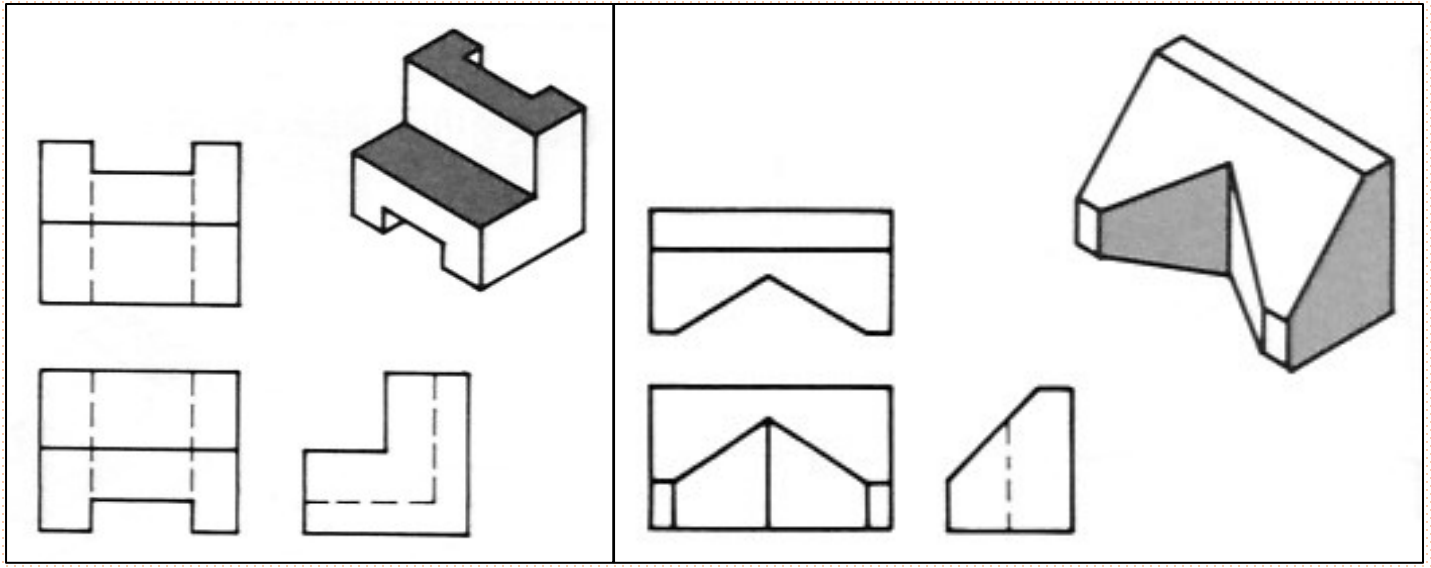




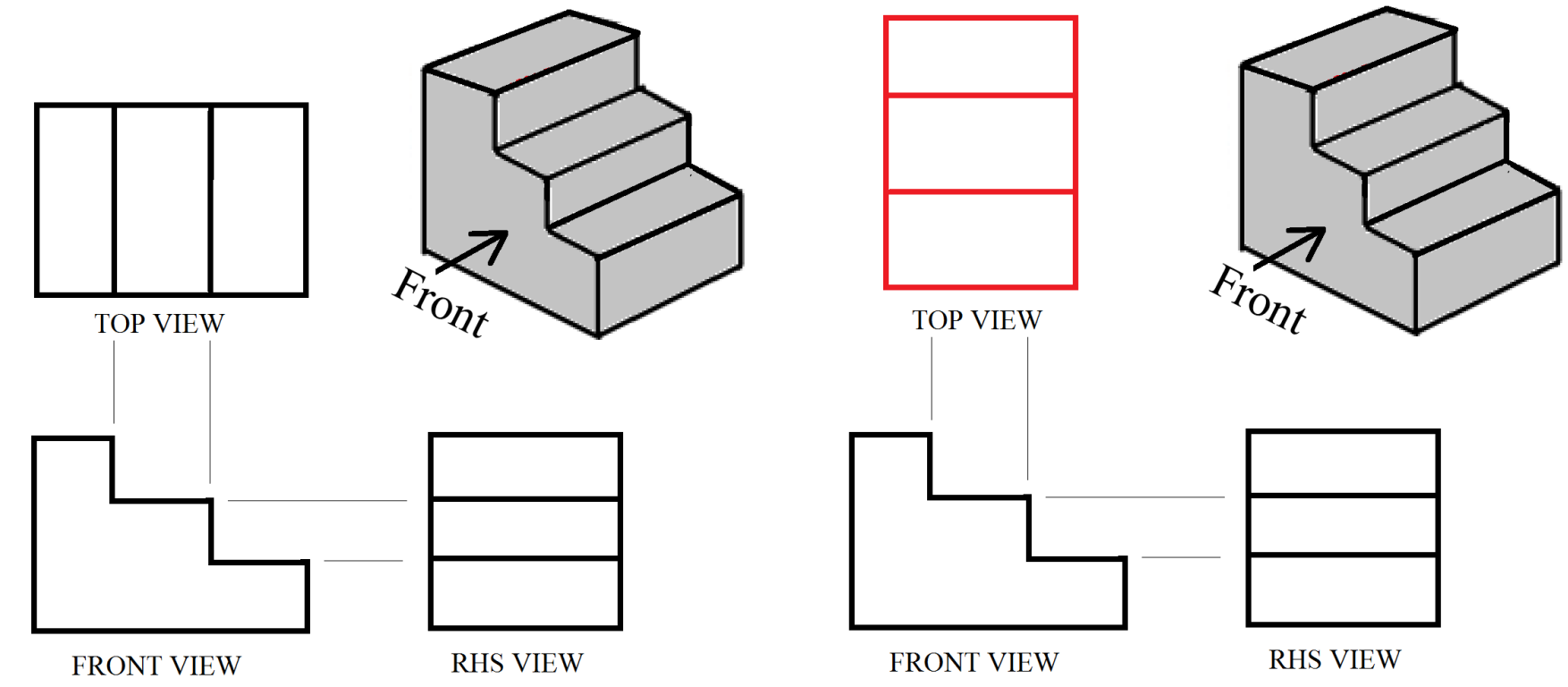
** Some objects do not need all three of the orthographic views.

# SAMPLE OF SOME ORTHOGRAPHIC VIEWS

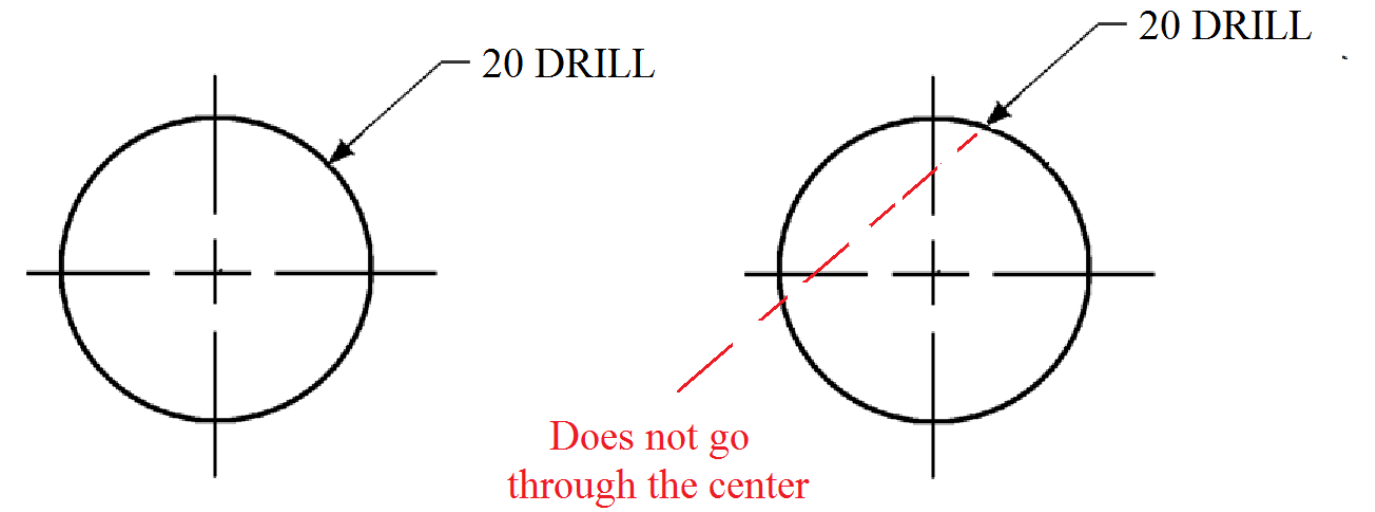


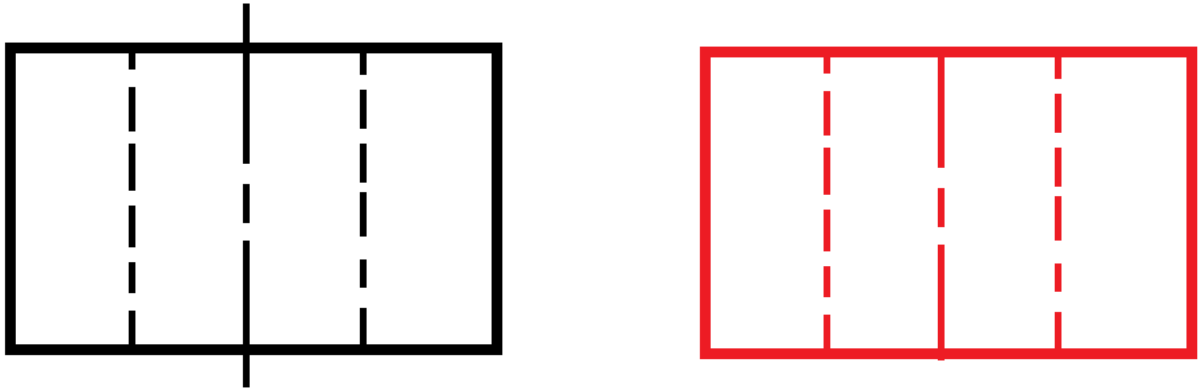


# SOME COMMON MISTAKES



# SOME COMMON MISTAKES



No extension for hydden line ; 3 - 6 mm extension for center line

# Thank you…

"Believe you can and you're halfway there"

- Theodore Roosevelt