

# Pre-Engineering & Computer-Aided Design I



## Segment 5

# Projection Systems: Orthographic

# Orthographic Projection

## Lesson Objectives

- **Define Orthographic Projection and It's Main Advantage**
- **Explain View Selection**
- **Explain the Glass Box Approach**
- **Define First and Third Angle Projections**
- **Clarify Line Precedence**
- **Complete Two View and Three View Drawings**

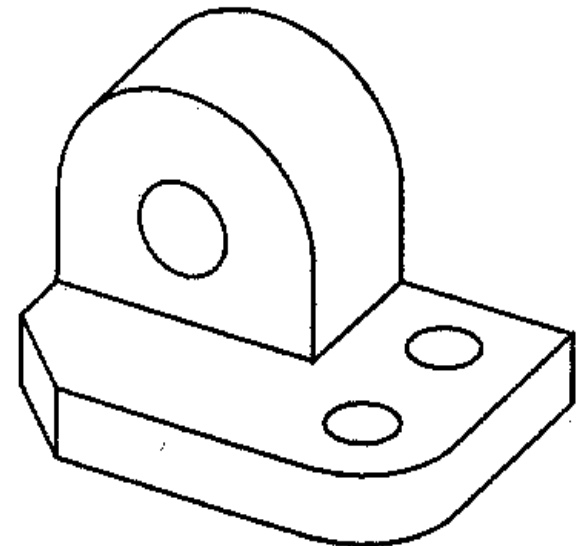
# Orthographic Projection

## What is Orthographic Projection?

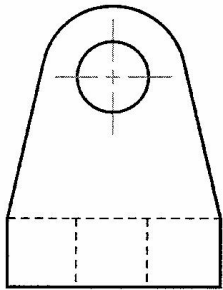
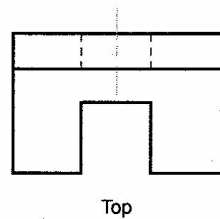
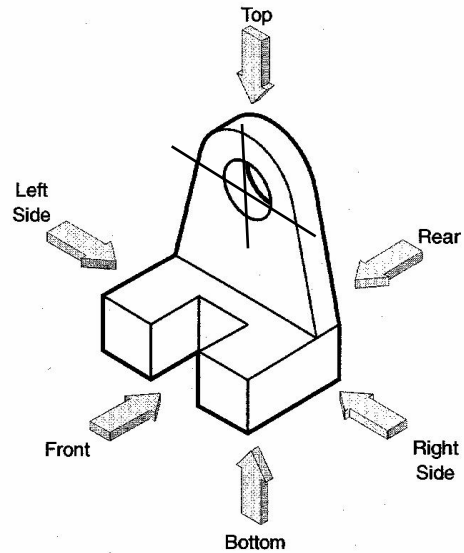
- *Ortho* – Greek word meaning perpendicular
- Shows the Views of an Object Projected in 2D, Usually the Top, Front, and Right Side Views

## What is the Advantage?

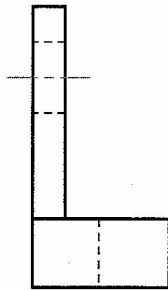
- Represents Features of an Object More Accurately



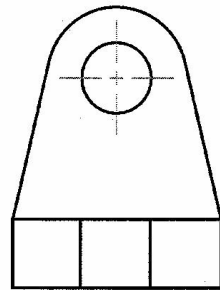
# Orthographic Projection



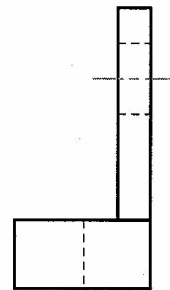
Rear



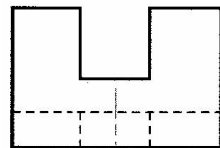
Left Side



Front



Right Side



Bottom

**Defining the  
Six Principal  
Views or  
Orthographic  
Views**

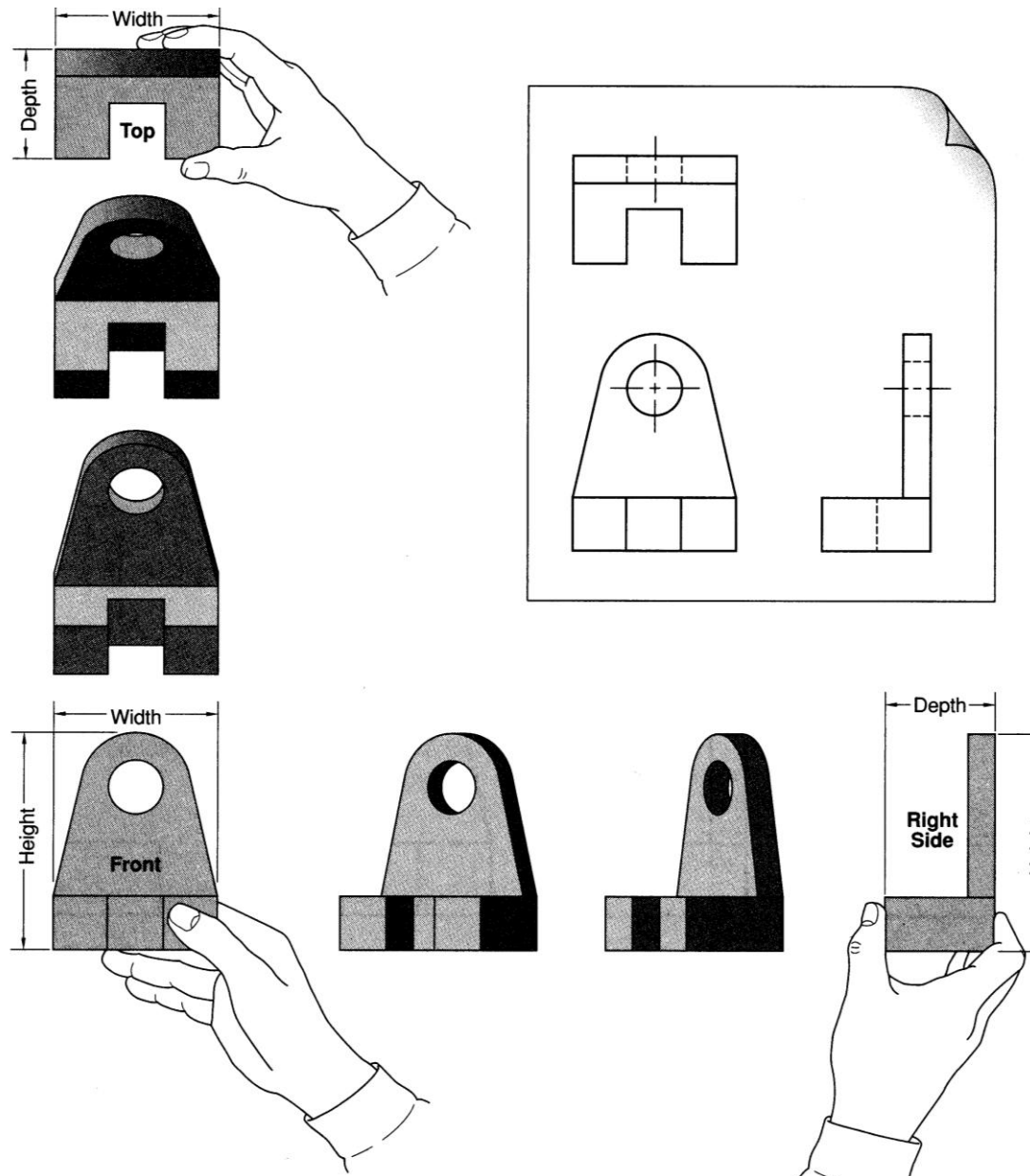
# Orthographic Projection

## Deciding Which Views to Present

### General Guidelines

- **Pick a Front View That is Most Descriptive of Object**
- **Normally the Longest Dimension is Chosen as the Width (or Depth)**
- **Most Common Combination of Views to Use: Front, Top, and Side View**
- **Any Other View Different From the Principal Views is Called an Auxiliary View**

# Orthographic Projection



# Orthographic Projection

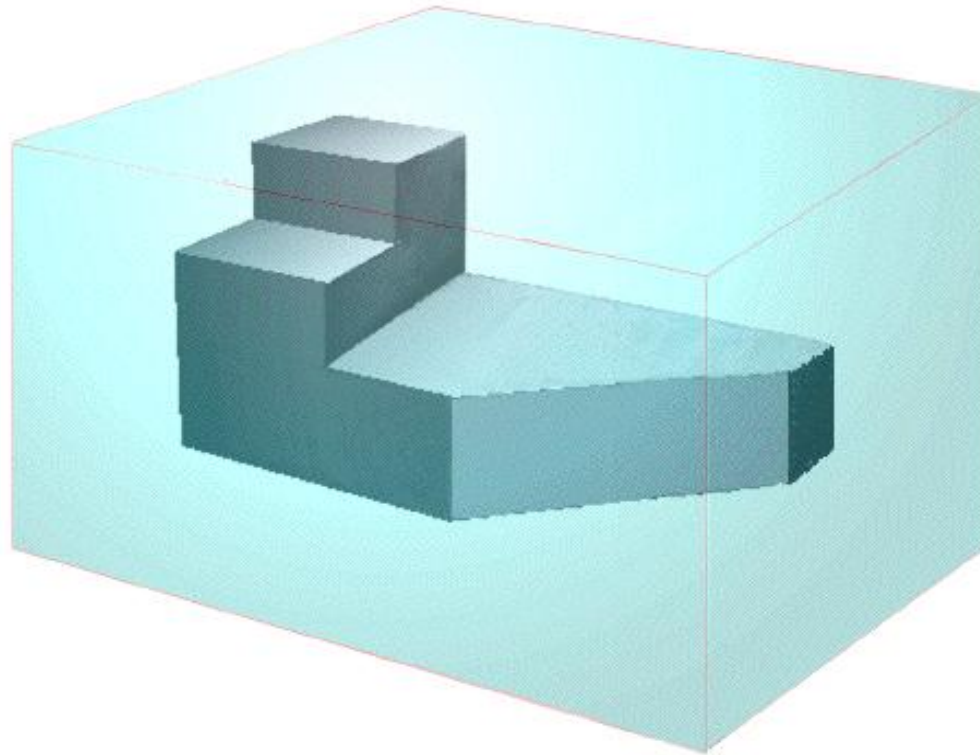
## Glass Box Approach

- **Most Powerful Technique to Understand Orthographic Projection**
- **Suspend the Object With Transparent Strings Inside a Glass Box**
- **Freeze the View From Each Direction (Each of the Six Sides of the Box) and Unfold the Box**
- **Animation illustrates glass-box approach**

# Orthographic Projection

## Glass Box Approach

Projection of points to the three views

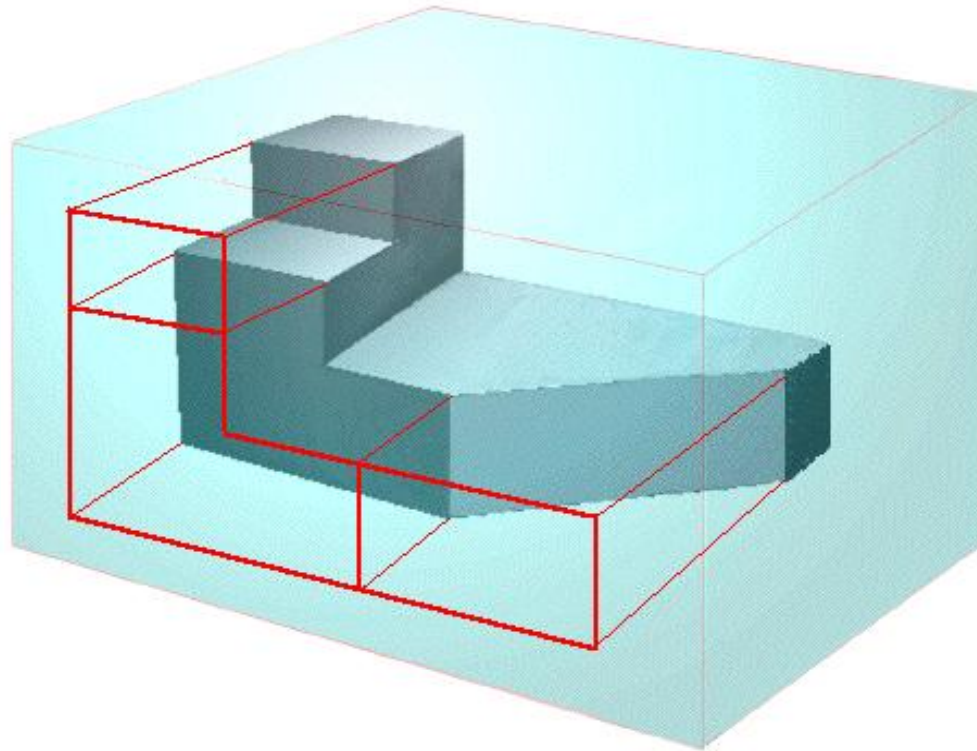




# Orthographic Projection

## Glass Box Approach

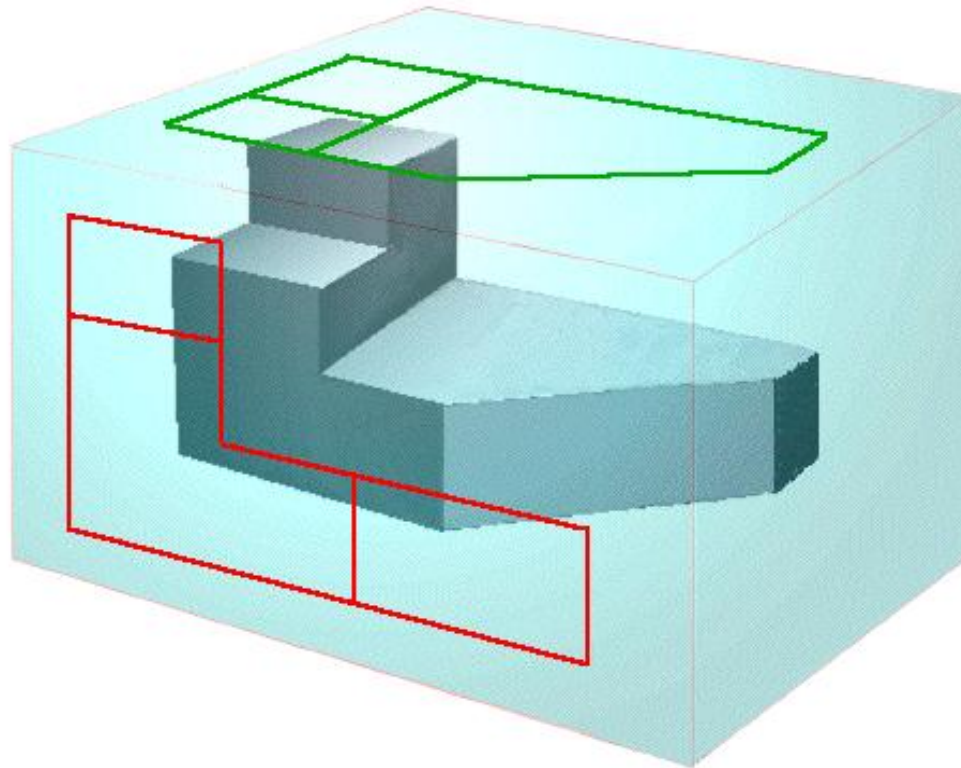
Projection of points to FRONT VIEW



# Orthographic Projection

## Glass Box Approach

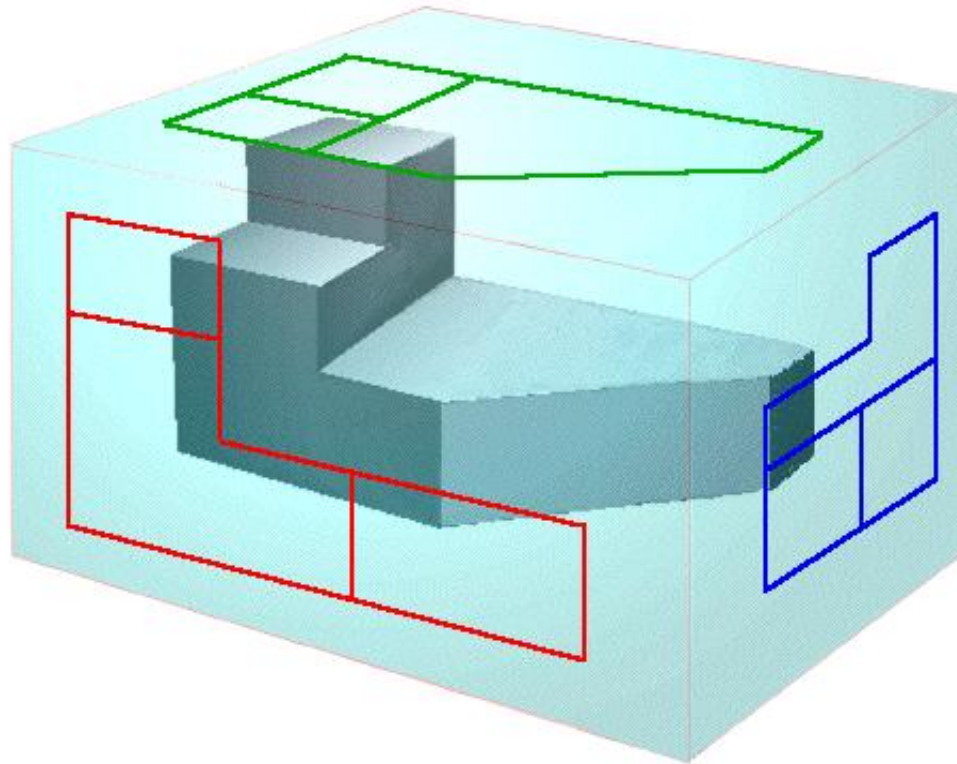
Projection of points to TOP VIEW



# Orthographic Projection

## Glass Box Approach

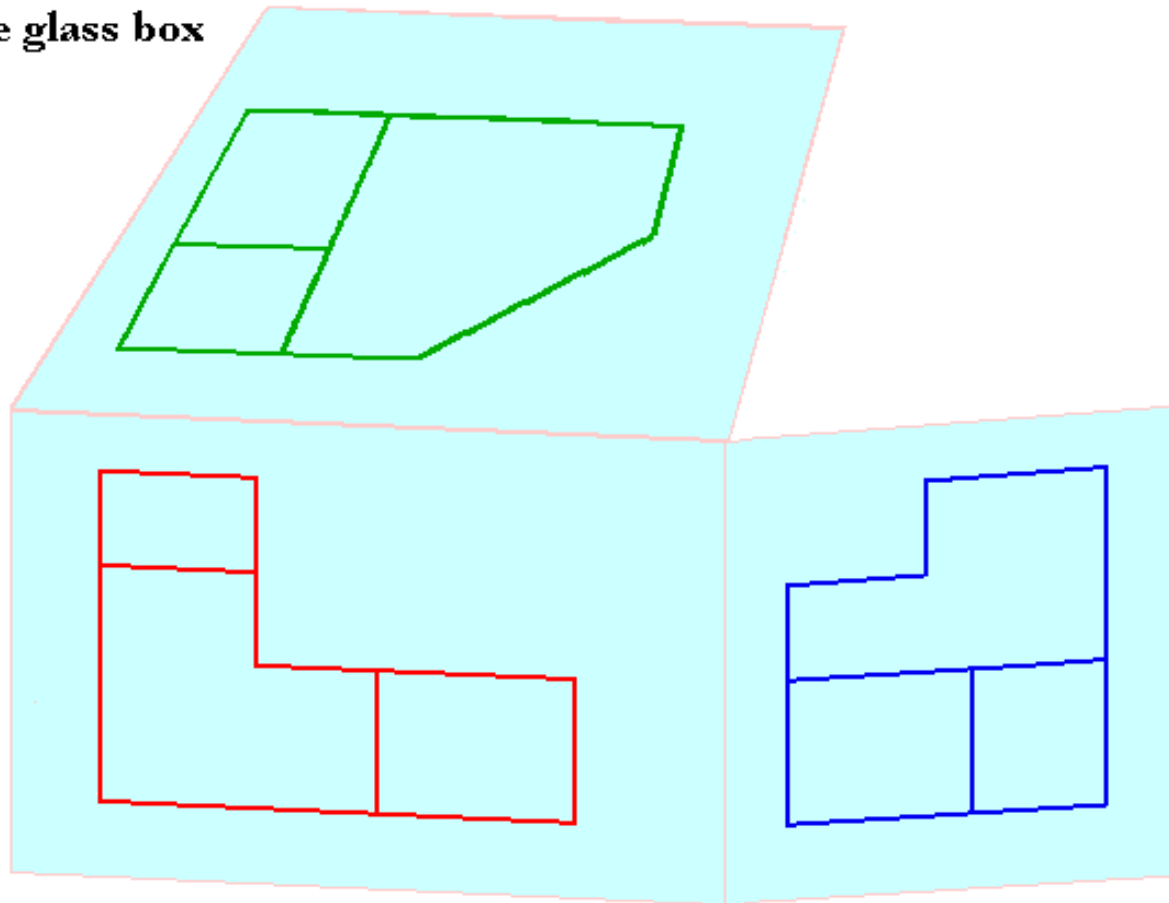
Projection of points to RIGHT SIDE VIEW



# Orthographic Projection

## Glass Box Approach

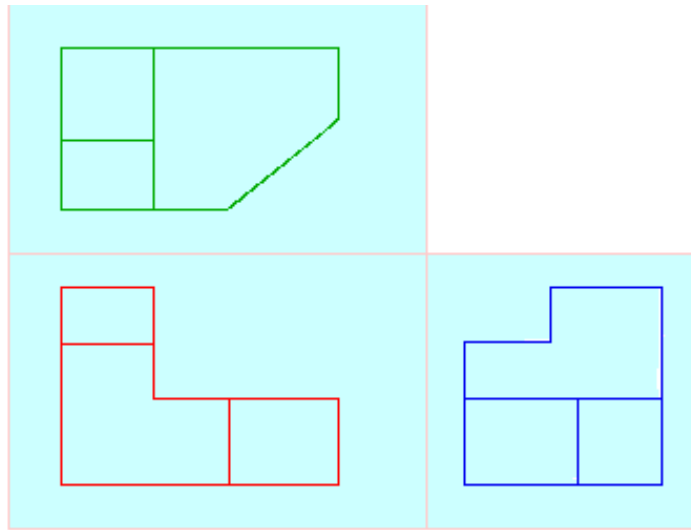
Unfold the glass box



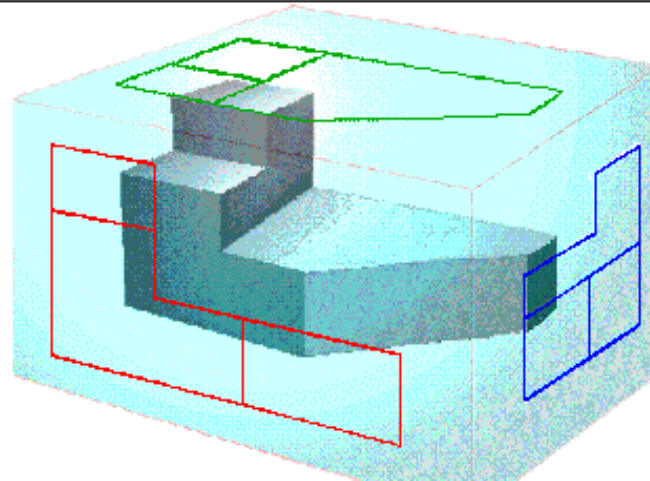
# Orthographic Projection

## Glass Box Approach

Unfolded  
glass-box

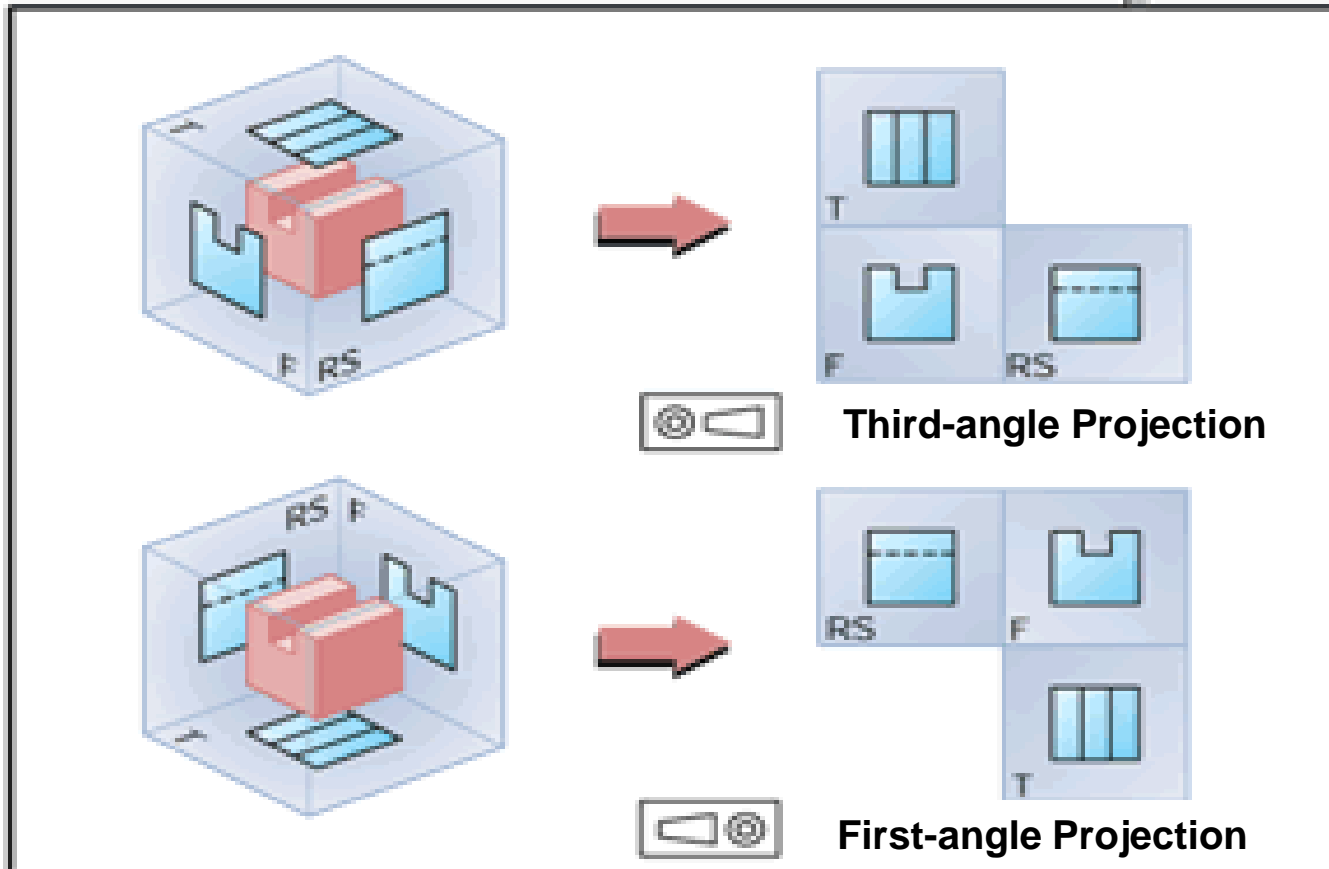


Object in the  
glass-box



# Orthographic Projection

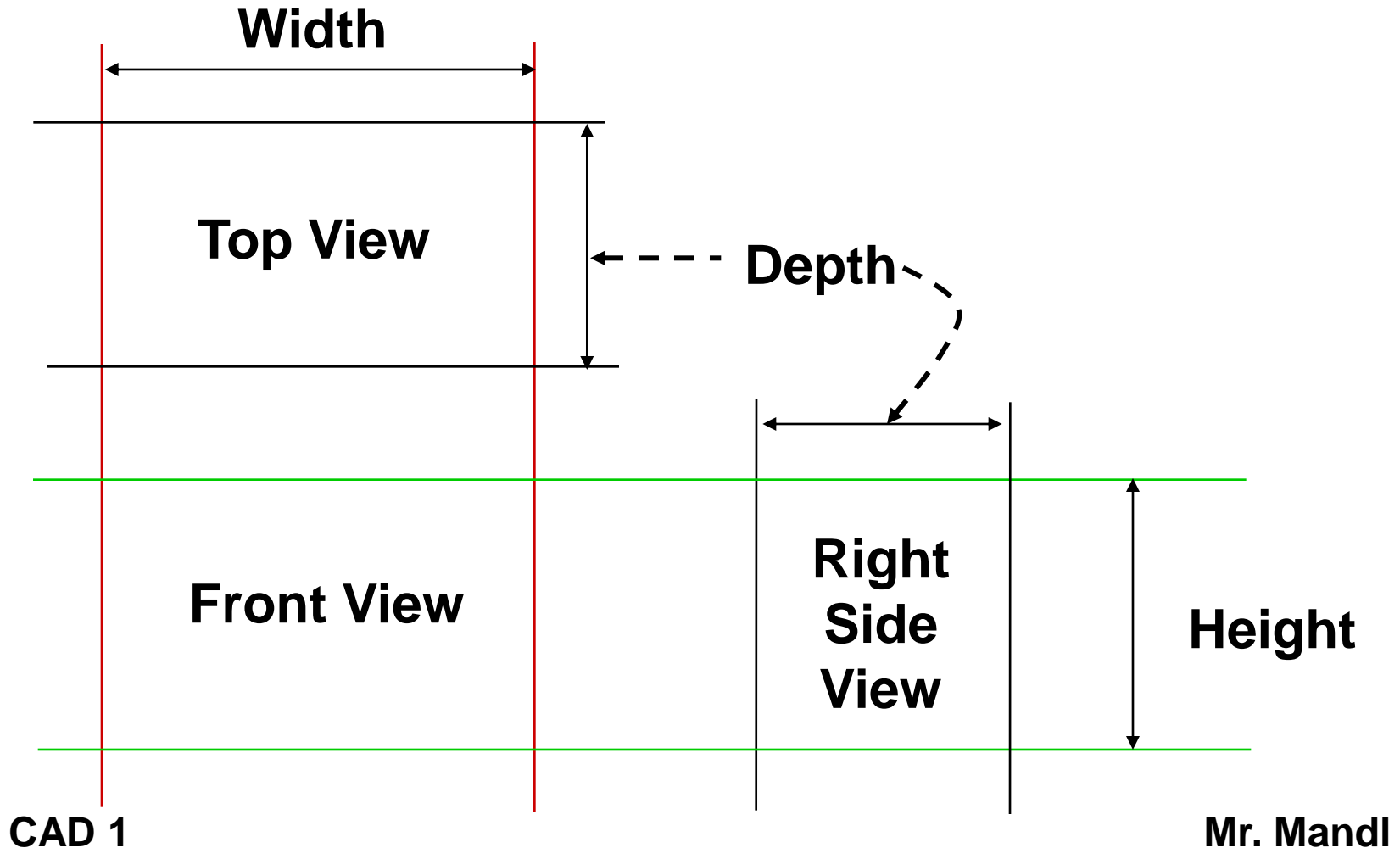
## First and Third Angle Projections



- **First Angle – International**
- **Third Angle – U.S.**

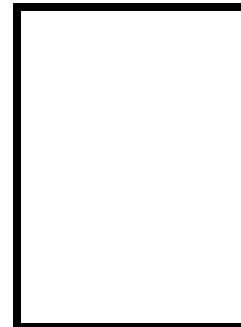
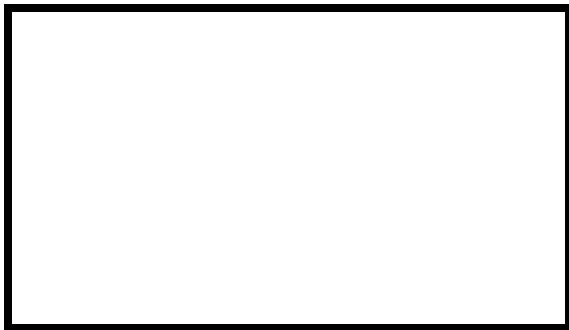
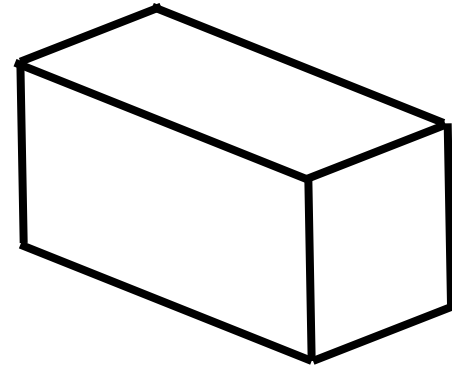
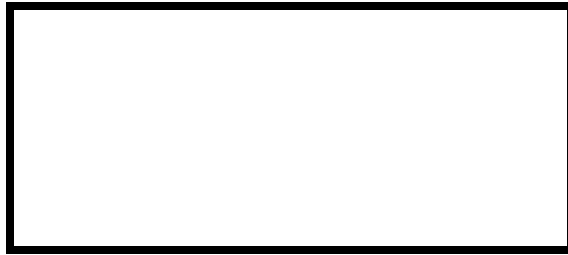
# Orthographic Projection

## Conventional Orthographic Views



# Orthographic Projection

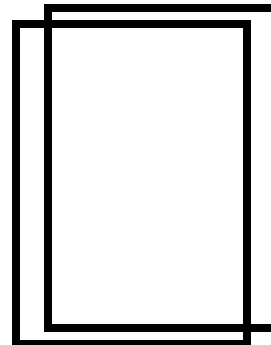
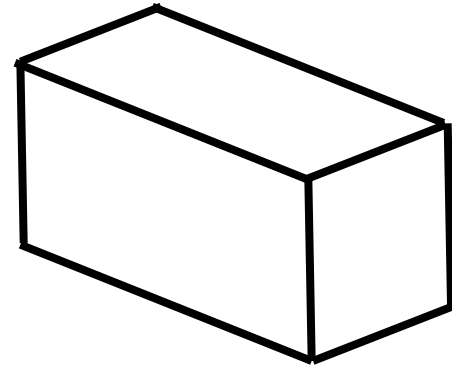
Are The Orthographic Views OK?





# Orthographic Projection

Orthographic Views Must Be In Projection



# Orthographic Projection

## Hidden and Center Lines

- ***Hidden Line*** – Used to Represent Features That Cannot be Seen in the Current View

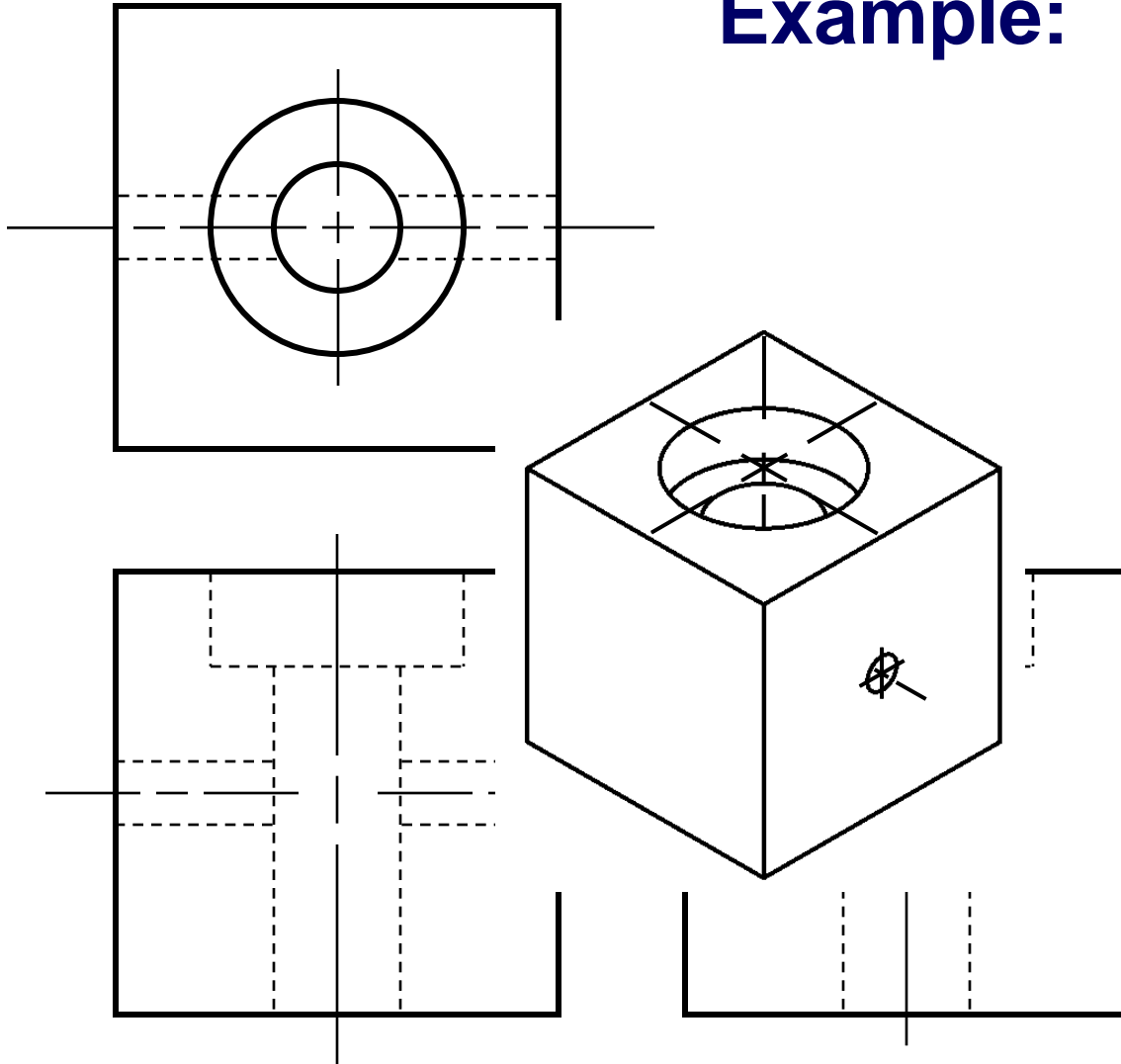


- ***Centerlines*** – Used to Represent Symmetry and to Mark the Center of Circles and the Axes of Cylinders, and the Axes of Symmetrical Parts, Such as Nuts & Bolts



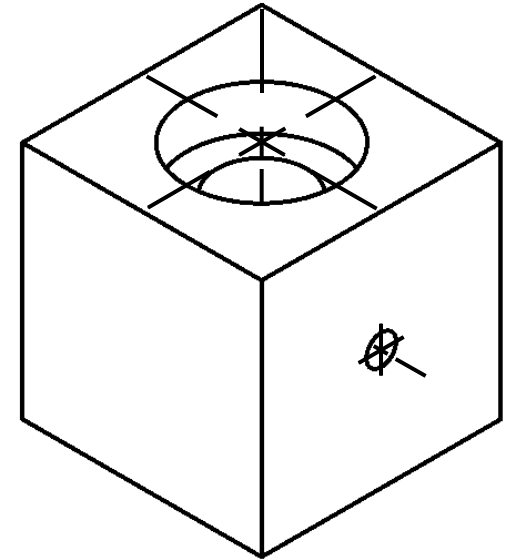
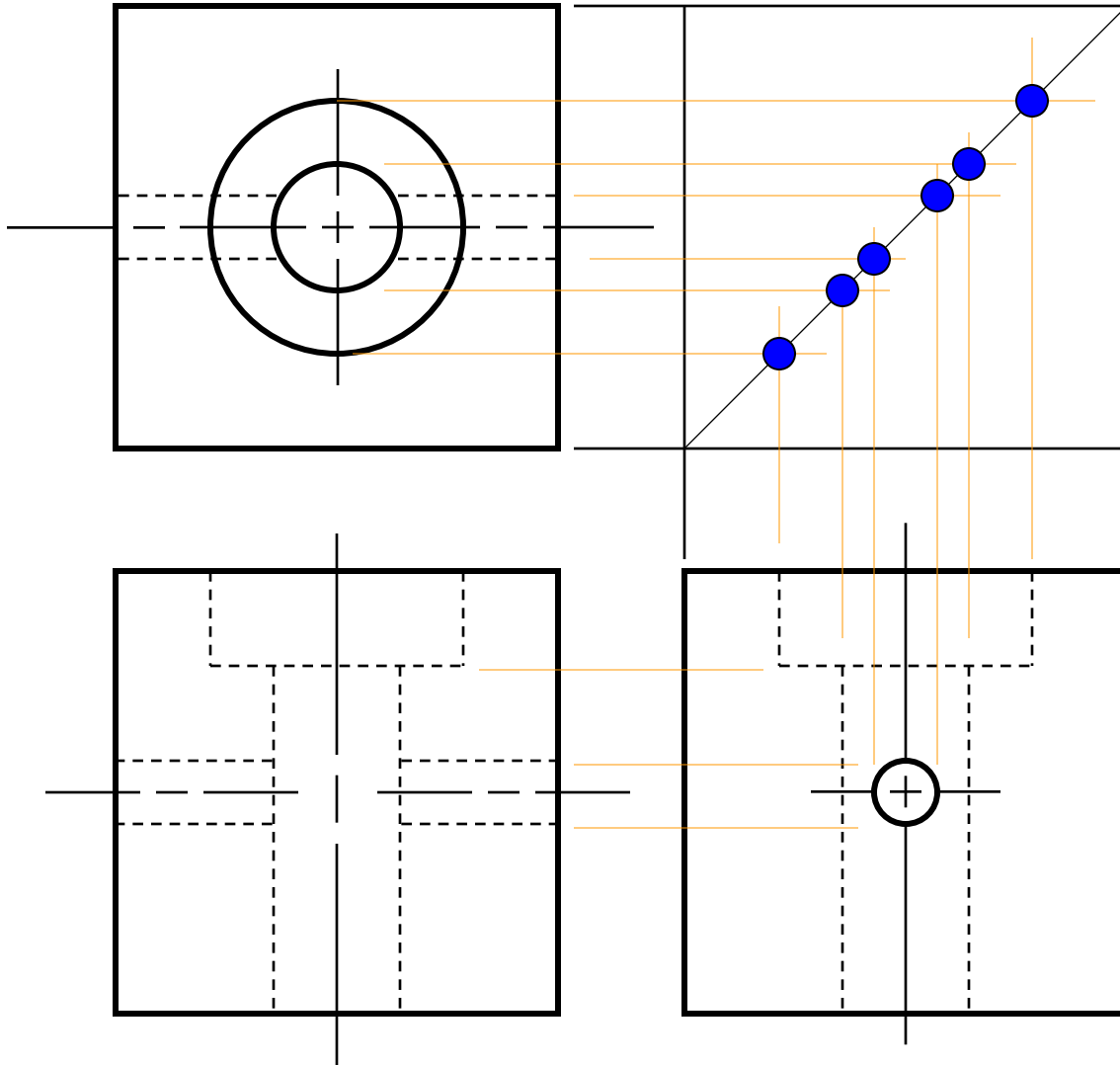
# Orthographic Projection

Example:



1. Visible
2. Hidden
3. Center

# Orthographic Projection



# Orthographic Projection

## Precedence of Lines

- ***Visible lines*** takes precedence over all other lines

 .35 mm Line Weight

- ***Hidden lines*** and ***cutting plane lines*** take precedence over center lines

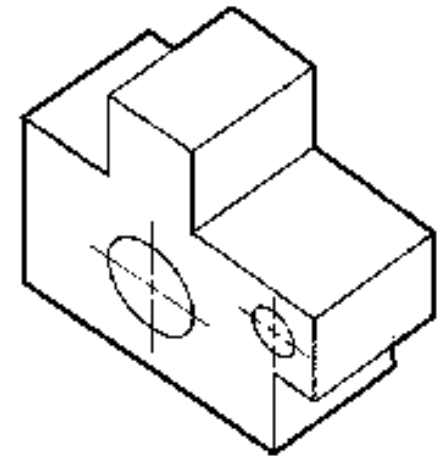
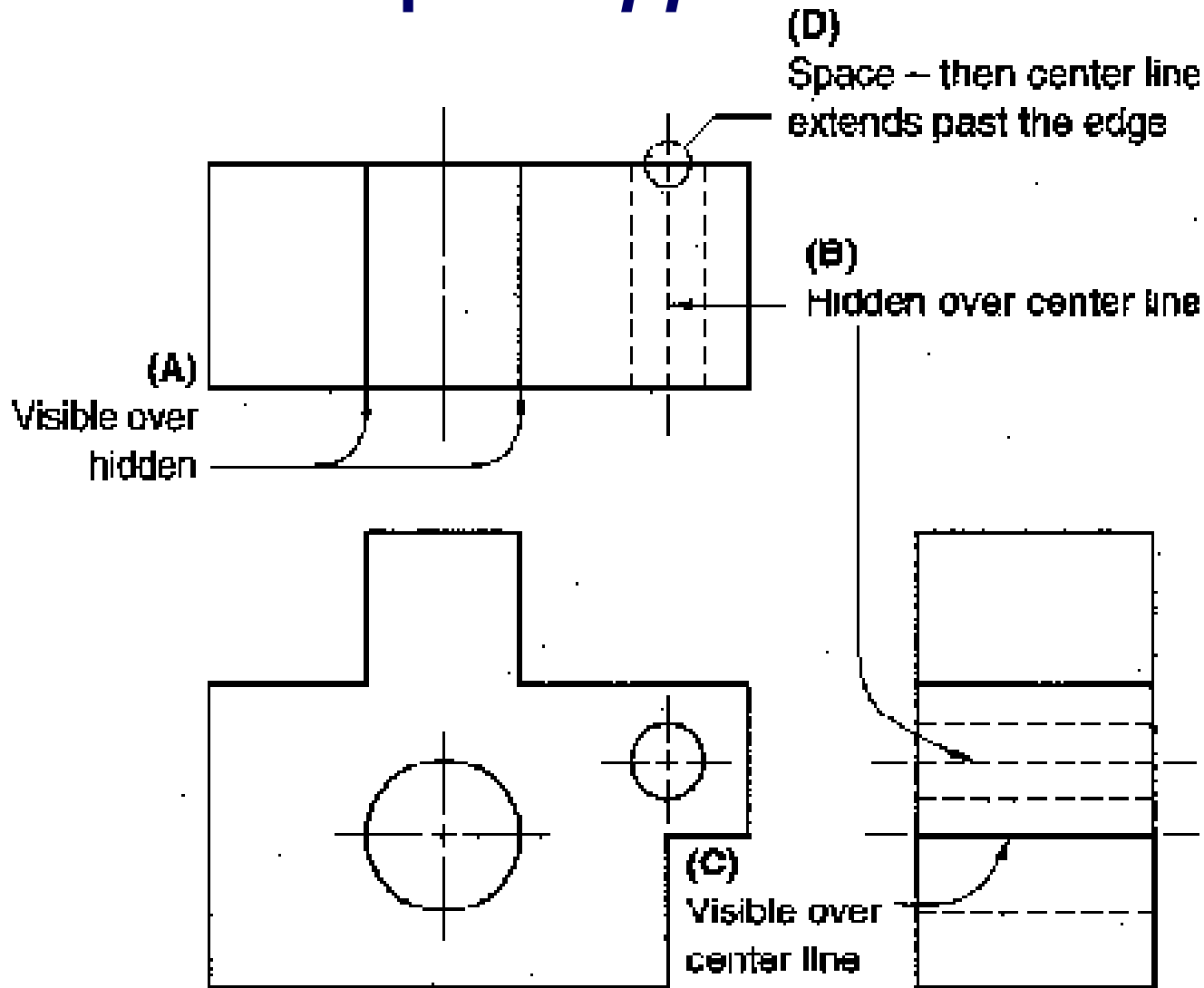
 0.05 mm Line Weight

- ***Center lines*** have lowest precedence

 0.05 mm Line Weight

# Orthographic Projection

## Example: *Application of Precedence*



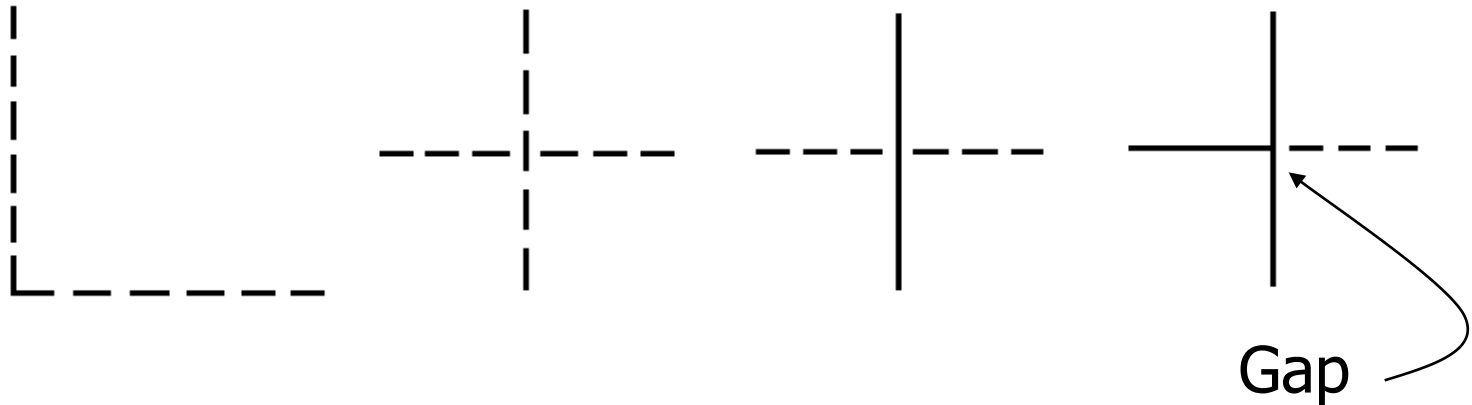
# Orthographic Projection

## Intersecting Lines in Orthographic Projections

### Solid Line Intersections



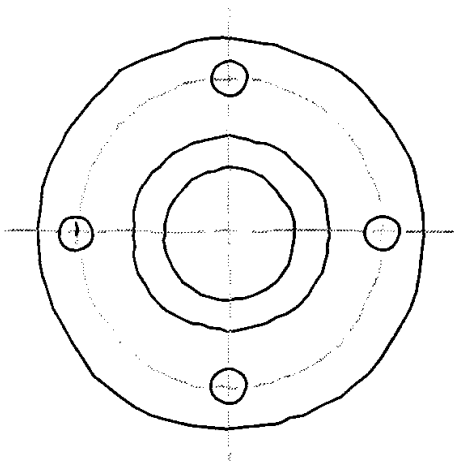
### Hidden Line Special Case Intersections



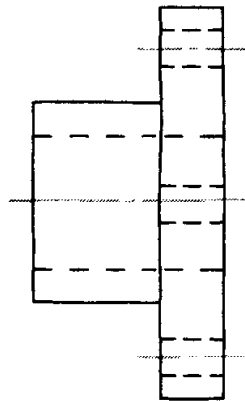
# Orthographic Projection

## Two-View Drawings

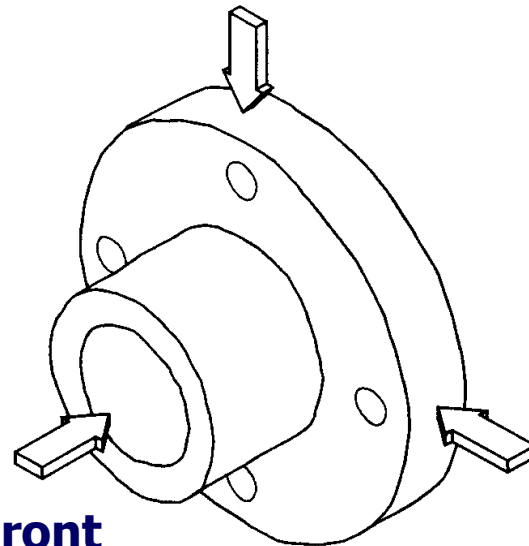
- **Some Objects Can Be Fully Described By Two Views, Look For:**
  - **Symmetry or Bodies of Rotation**



**Front View**



**Right Side View**



**Front View**

**Right Side**

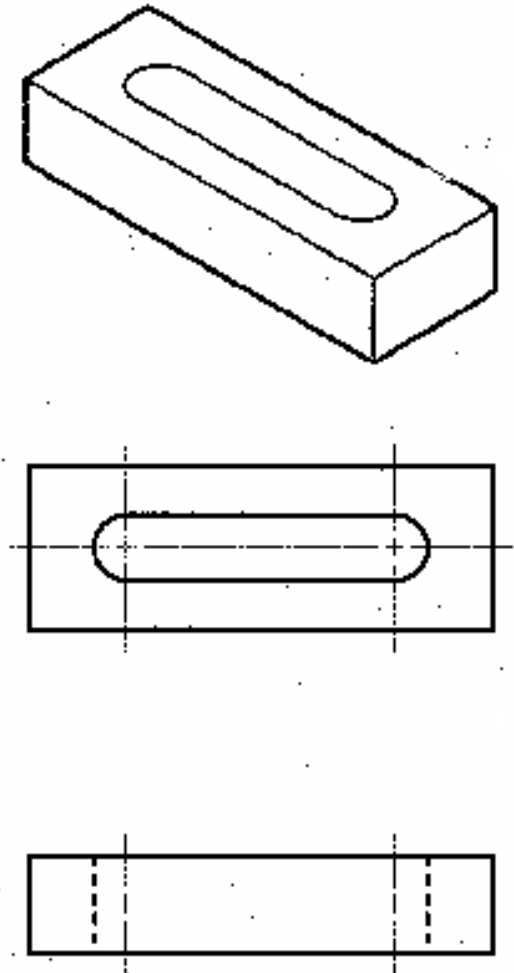
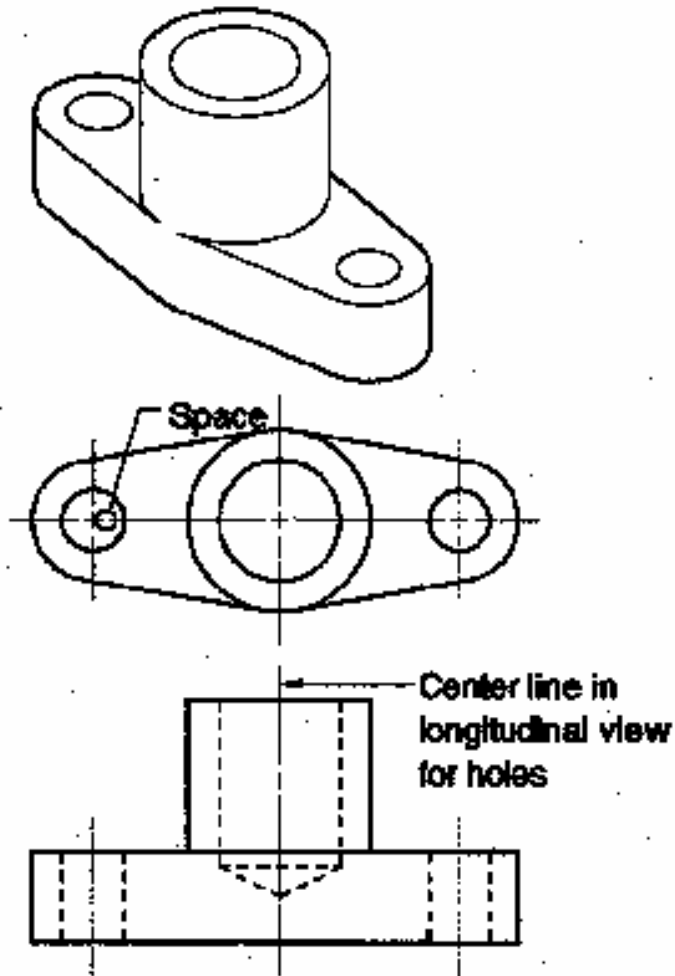
CAD 1

Mr. Mandl



# Orthographic Projection

## Other Two-View Examples



# Orthographic Projection

## Review Questions

- Based on the lines of sight, orthographic projection drawing is classified as a \_\_\_\_\_ projection technique.
- There are \_\_\_\_\_ standard principal views of orthographic projections.
- Each view in an orthographic projection concentrates on \_\_\_\_\_ dimensions of the object

# Orthographic Projection

Animation – Glass Box Theory.



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