

# EPICS 151/155 GRAPHICS

## Field Sketching

- **A TA Will Sign You In When Your Homework Packet Is Graded**
- **Please Have Your Homework Packet Out Ready To Be Collected**
- **Please Have Your Sketchbook Ready To Be Collected**



COLORADO SCHOOL OF MINES

# LEARNING OBJECTIVES (Today)

**7 - Visually depict ideas to teammates, supervisors, and stakeholders through the use of field sketching for the purposes of communication as well as idea development and development through iteration.**

7.4 Sketch detail views as necessary to depict key idea and design details.

**8 - Model and communicate formalized design ideas through the use of standardized engineering graphics conventions as applied to engineering sketching and computer-aided design/solid modeling software.**

8.1 Identify and apply the various linetypes used in engineering drawings

8.4 Apply the principles of orthographic projections to construct two-dimensional multi view drawings.

8.5 Apply the principles of isometric projection to create three-dimensional isometric pictorial drawings.

8.6 Construct auxiliary views and determine when auxiliary view are appropriate.

8.7 Depict the interior view of an object as a section view, and determine when section views are appropriate, and what type of section view is appropriate.

8.8 Apply the conventions of lettering, dimensioning, threads, hole, and other notations as necessary to annotate an engineering drawing.

## **FULL EPICS LEARNING OBJECTIVES:**

[https://docs.google.com/spreadsheets/d/19XAVW\\_yVpUE\\_aav6DE7cKGfWpa08FwQgPujBFvb-mKo/edit#gid=356595662](https://docs.google.com/spreadsheets/d/19XAVW_yVpUE_aav6DE7cKGfWpa08FwQgPujBFvb-mKo/edit#gid=356595662)

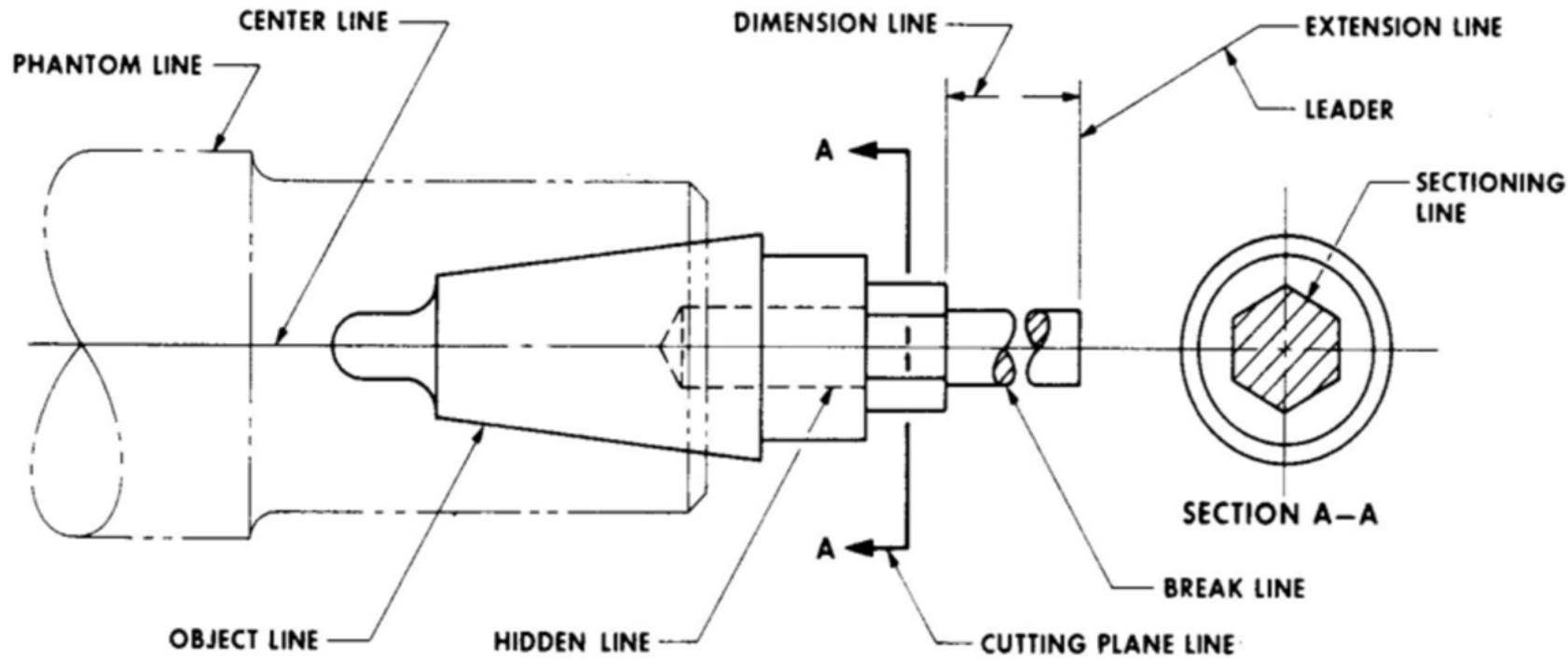
# TODAY

- Week 3 Homework & Your Sketchbook Are Due
- Review Basic Linetypes
- Auxiliary View
- Section Views
- Detail Views
- Dimensioning
- **Homework Summary**
- **Rubrics Summary**
- **Pre-Work for Next Field Sketching Session**
- **Resources**

# BASIC LINETYPES REFRESHER

## Consider Precedence of Line

- Continuous Lines (used for objects) Have Precedence Over Hidden
- Hidden Lines Have Precedence Over Center Lines
- Construction/Guidelines are Lightest and Not Shown on Production Drawings



# AUXILIARY VIEW

## WHAT IS AN AUXILIARY VIEW?

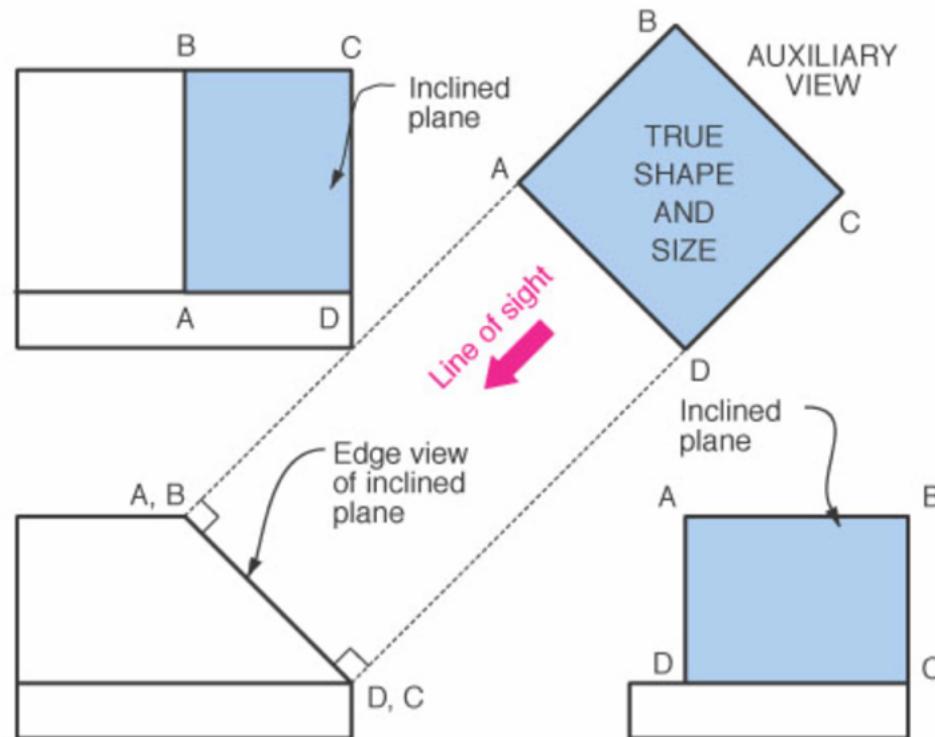
A View Used to Project Inclined Surfaces to See True Size and Shape

### 1. Draw Guidelines Perpendicular to the Sloped Surface

- Projection from Sloped Surface is True Length

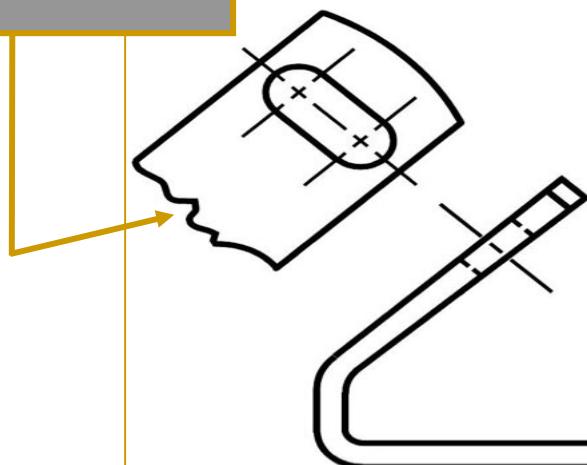
### 2. Get Depth from the Side View

- We can determine an accurate depth, because the depth is not distorted.
- Do not try to project
- Take measurements

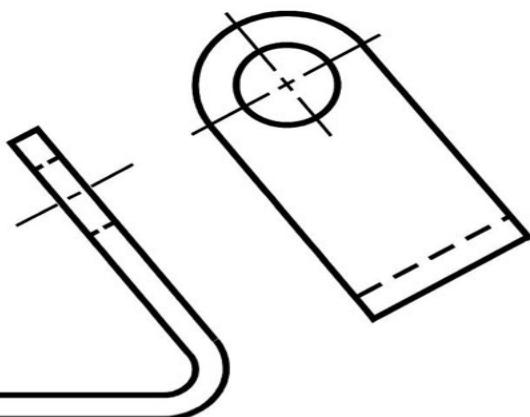


# AUXILIARY VIEW

Partial auxiliary view

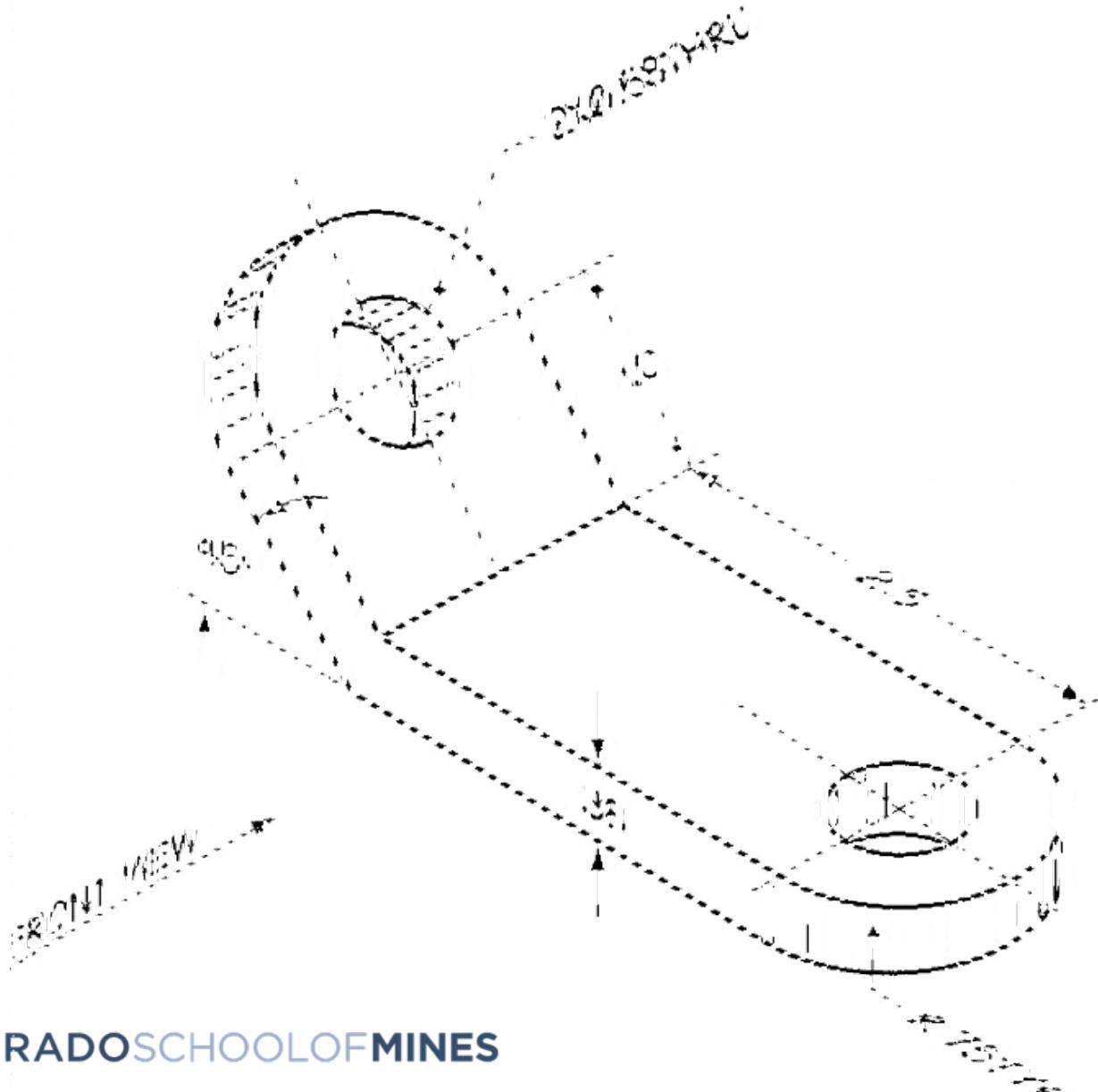


Aligned with the angled surface



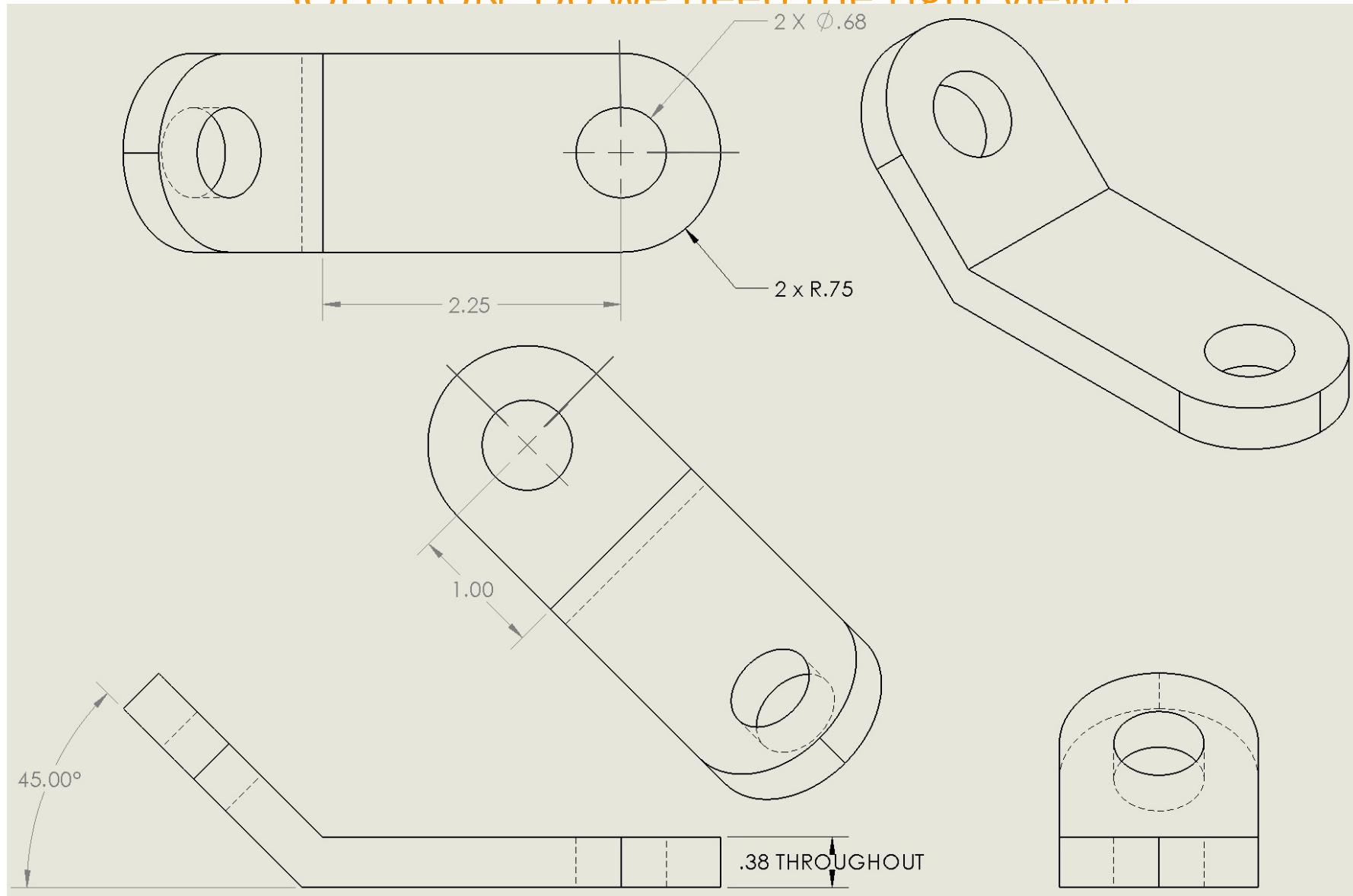
# IN CLASS ACTIVITY: Auxiliary Views

\*SKETCH THE TOP, FRONT, AND AUXILIARY VIEWS\*



# IN CLASS ACTIVITY: Auxiliary Views

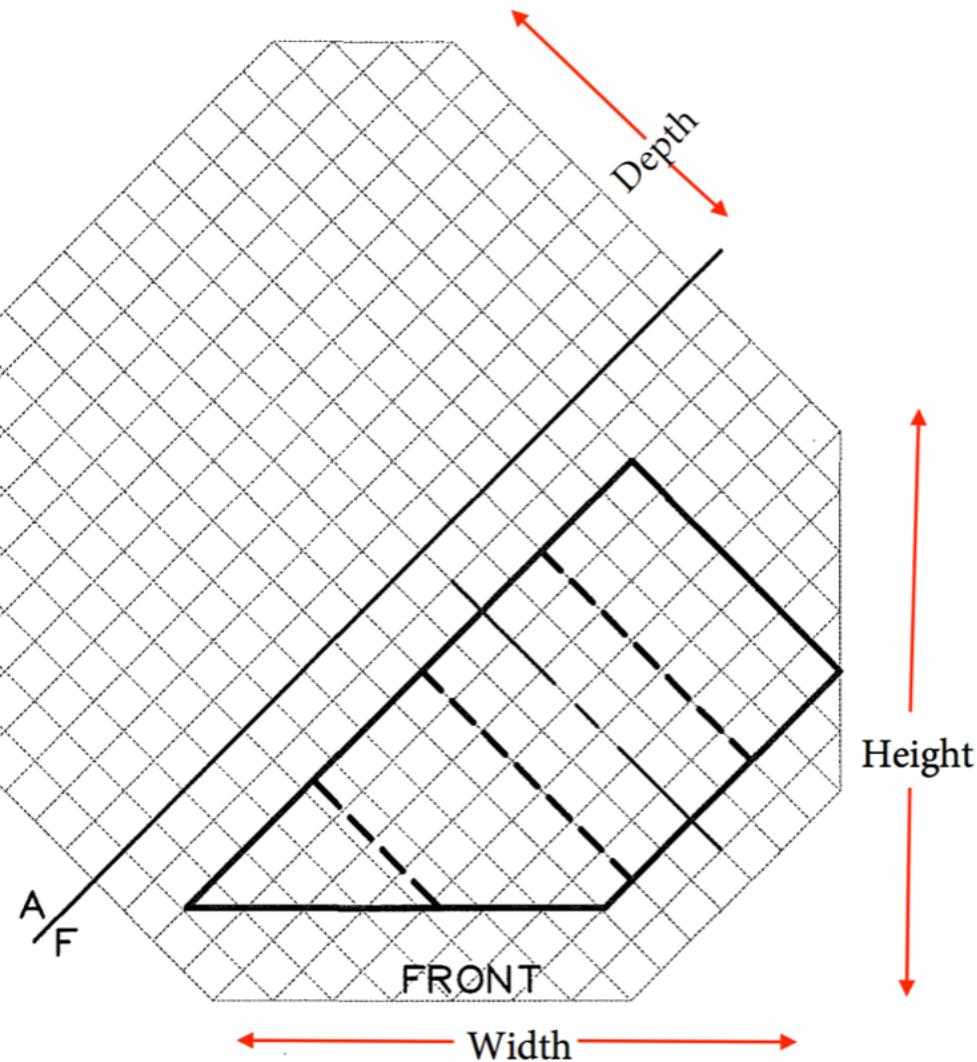
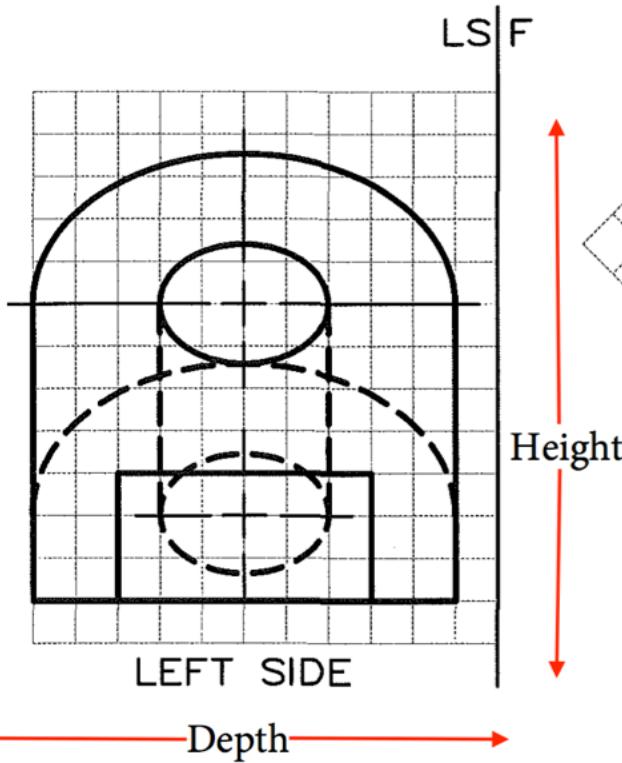
## SOLUTION Do we need the right view??



# IN CLASS ACTIVITY: Auxiliary Views

## \*Homework Packet AUX~6 Top Problem\*

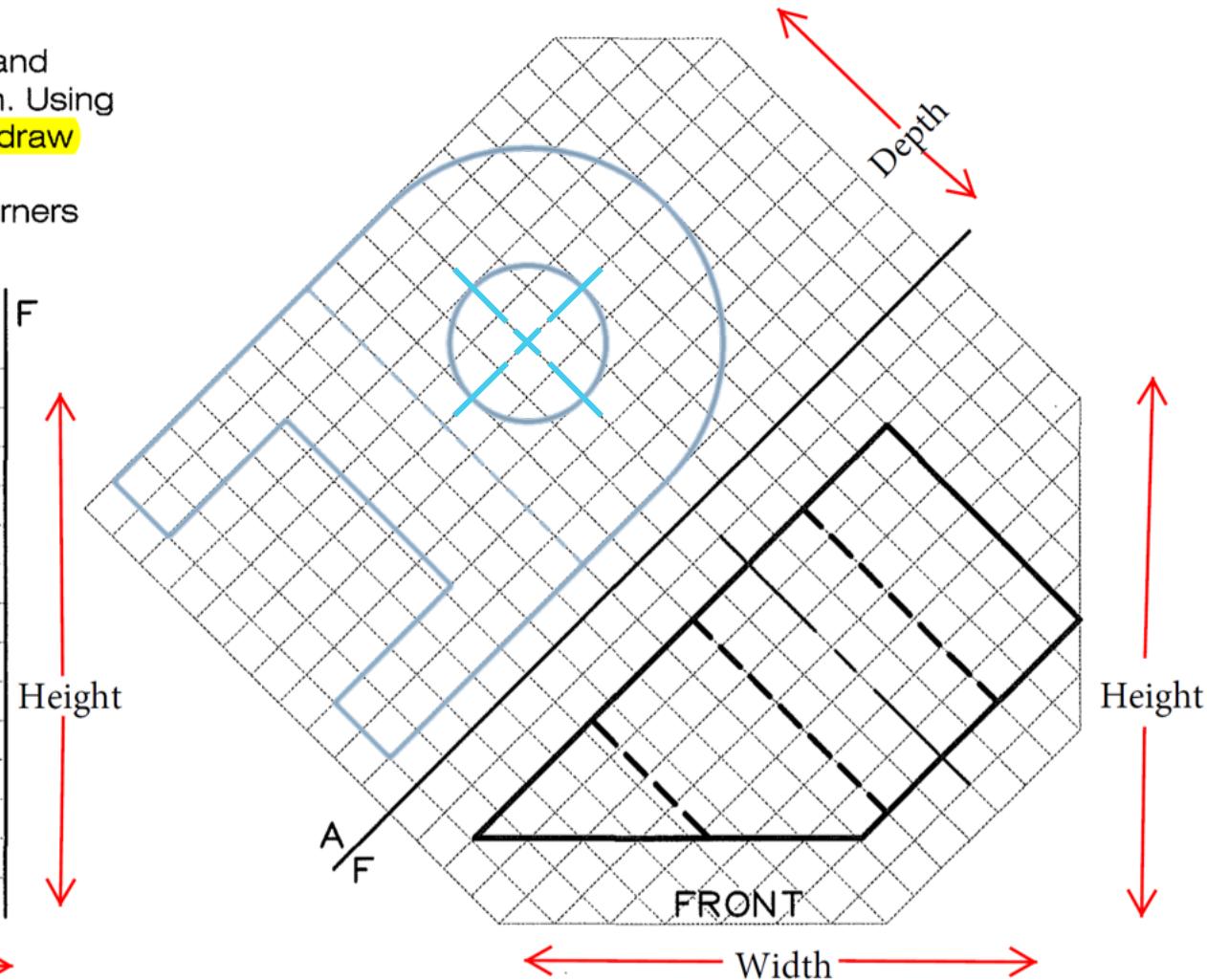
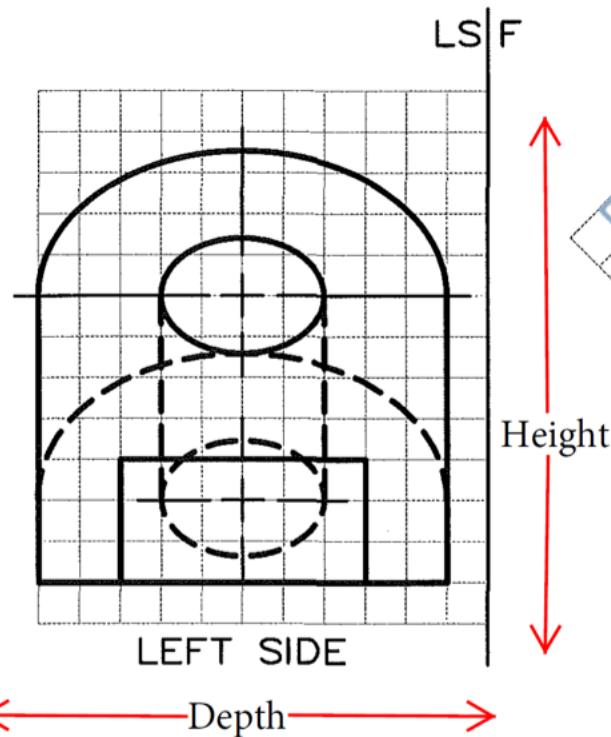
1. The complete FRONT and LEFT SIDE views are given. Using the fold lines to measure, draw the AUXILIARY view of the inclined surface. Label corners for reference.



# IN CLASS ACTIVITY: Auxiliary Views

## \*Homework Packet AUX~6 Top Problem\*

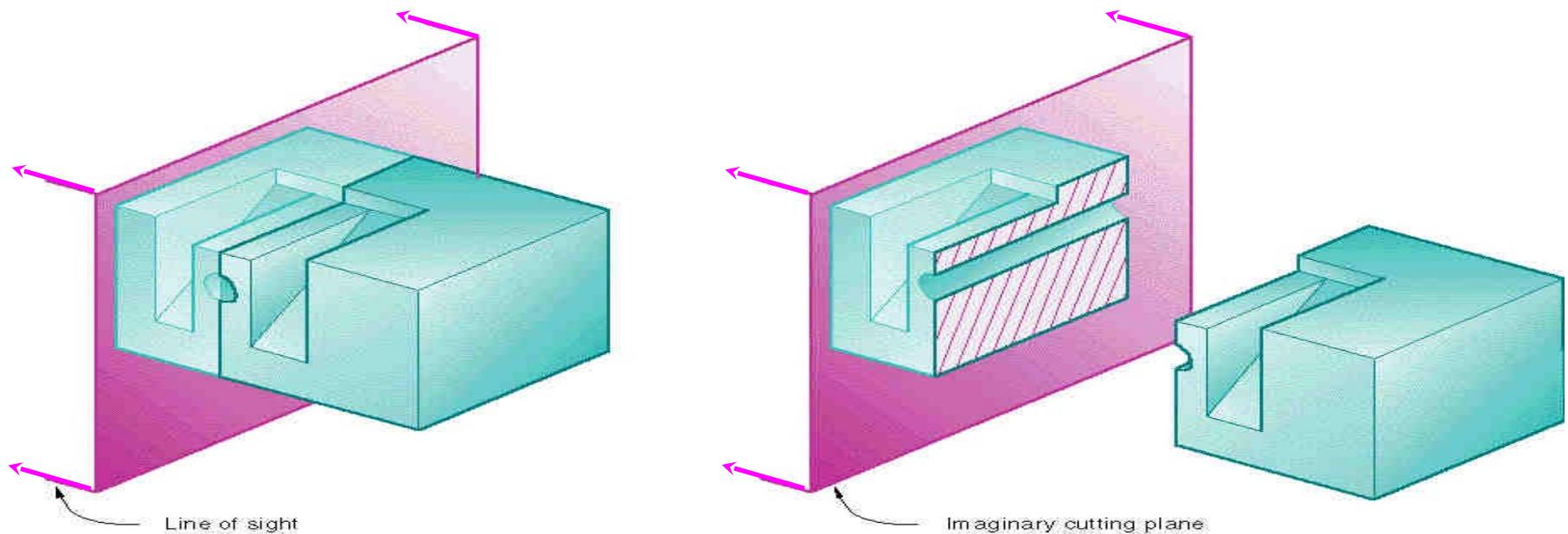
1. The complete FRONT and LEFT SIDE views are given. Using the fold lines to measure, draw the AUXILIARY view of the inclined surface. Label corners for reference.



# SECTION VIEW

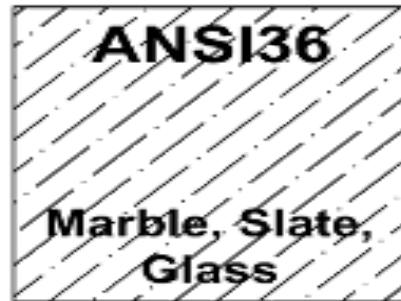
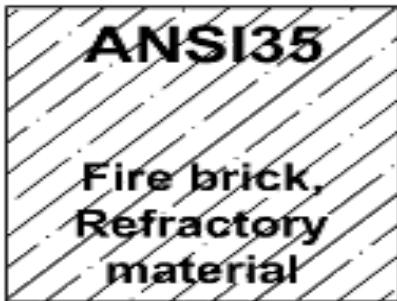
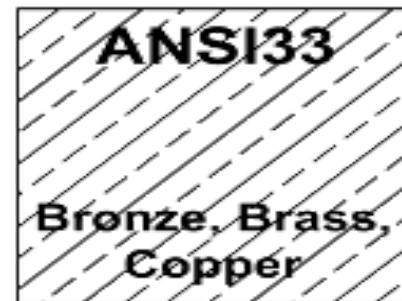
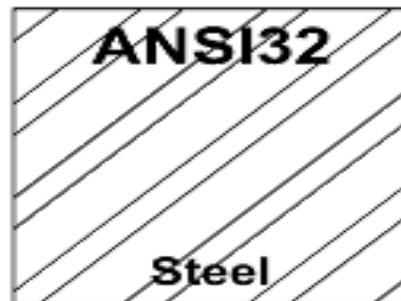
## WHAT IS A SECTION VIEW?

- A view used to show an area or hidden part of an object by cutting away or removing some of that object
- The cut line is the cutting plane



# SECTION LINES (Hatching)

- Section Lines Indicate Material Type
- Scale of Section Lines Can Be Modified to Provide Clarity When Cutting Through Different Parts of the Same Material



# EXAMPLES OF SECTION TYPES

- 1. Full**
- 2. Half**
- 3. Offset**
- 4. Broken-out Sections**
- 5. Revolved**
- 6. Removed**

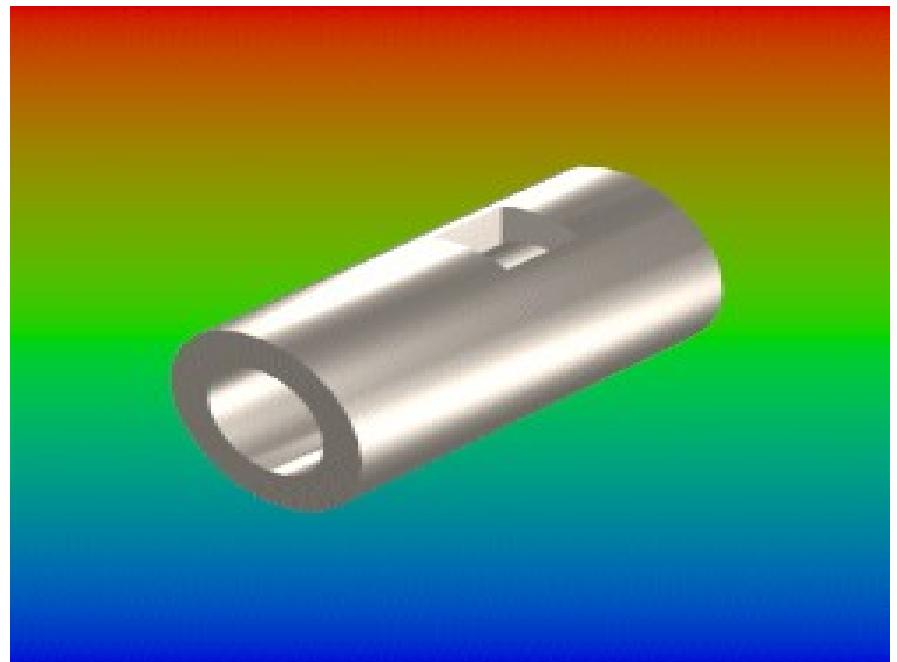
## Conventions:

- 1. Multiple**
- 2. Aligned**
- 3. Assembly**

# 1. Full Section View

In a full section view,  
the cutting plane  
cuts across the  
entire object

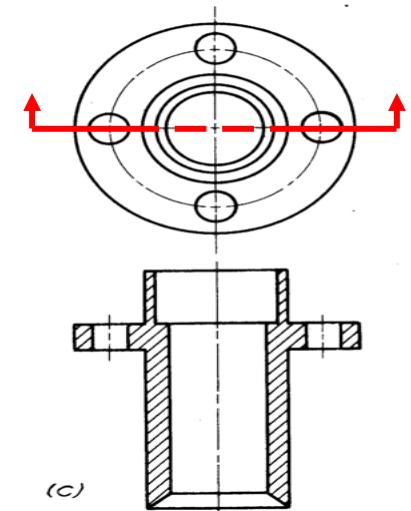
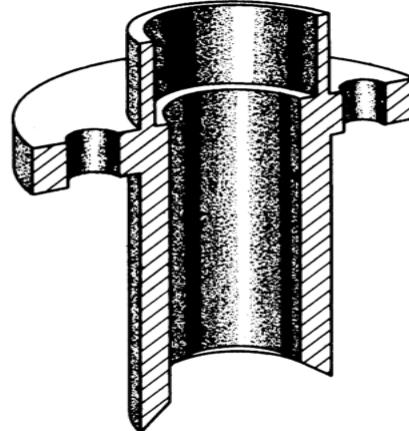
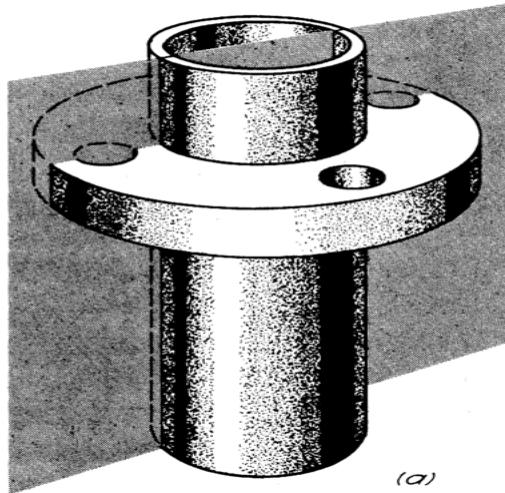
Note that hidden  
lines become visible  
in a section view



# SECTION TYPES

## 1. Full

- Show Cutting Plane in the Top View
- Section Shown as a Front View
- Crosshatching Indicates Surfaces of Material Cut by the Plane
- No Hidden Lines
- Interior Lines Behind the Cutting Plane Become Visible



# IN CLASS ACTIVITY: Full Section

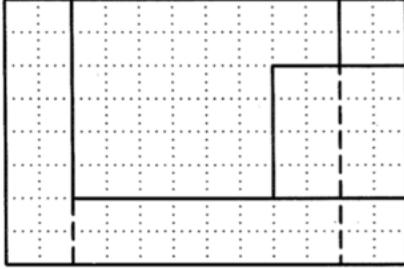
## \*Homework Packet J - 11\*

Copyright 1993  
J.W. & O.B. Craig

FILE NUMBER ..... GRADE .....

LABEL SURFACES, NUMBER CORNERS WHEN INDICATED.

Don't forget to add the cutting plane line and arrows!



GIVEN: TOP VIEW AND PICTORIAL FULL SECTION VIEW.  
SKETCH: FRONT FULL SECTION VIEW AND RIGHT SIDE VIEW.

WHAT MATERIAL IS SHOWN?

Don't forget to reference the cutting plan!

ORTHOGRAPHIC VIEWS

S-1 SECTIONAL VIEWS. NAME ..... DATE .....

# IN CLASS ACTIVITY: Full Section

## \*Homework Packet J - 11\*

**ANSI31**

Iron, Brick,  
Stone  
masonry

**ANSI32**

Steel

**ANSI33**

Bronze, Brass,  
Copper

**ANSI34**

Plastic,  
Rubber

**ANSI35**

Fire brick,  
Refractory  
material

**ANSI36**

Marble, Slate,  
Glass

**ANSI37**

Lead, Zinc,  
Magnesium,  
Insulation

**ANSI38**

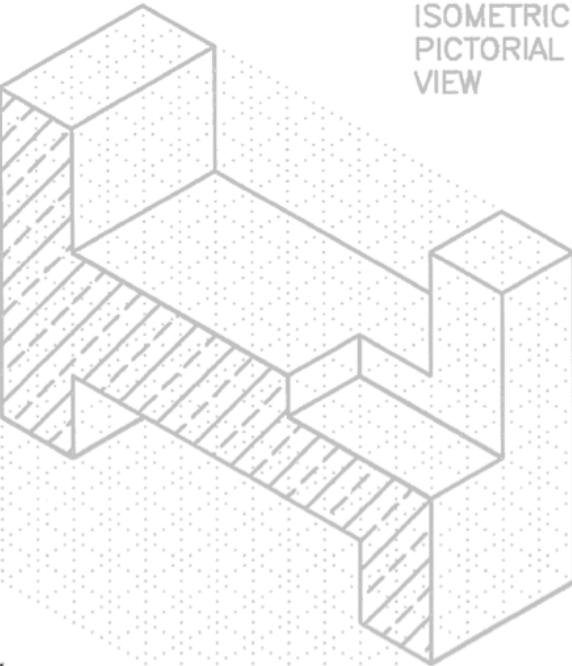
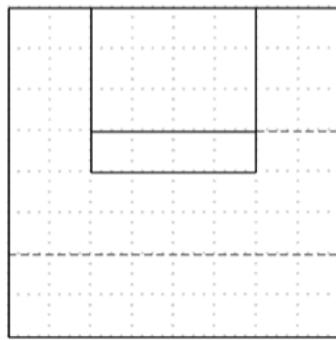
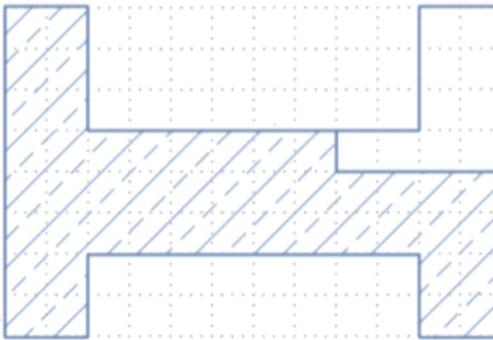
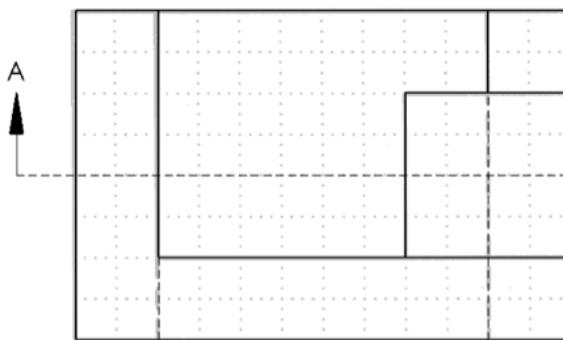
Aluminum

# IN CLASS ACTIVITY: Full Section

## \*Homework Packet J - 11\*

LABEL SURFACES, NUMBER CORNERS  
WHEN INDICATED.

Don't forget to add the cutting plane line and arrows!



ISOMETRIC  
PICTORIAL  
VIEW

GIVEN: TOP VIEW AND  
PICTORIAL FULL SECTION VIEW.  
SKETCH: FRONT FULL SECTION  
VIEW AND RIGHT SIDE VIEW.

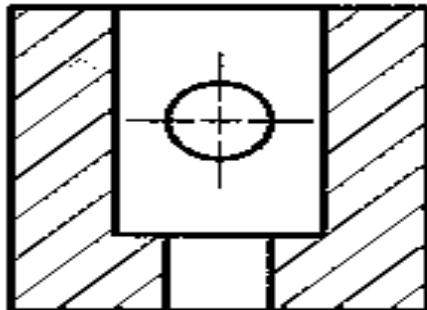
WHAT MATERIAL IS SHOWN?  
**Bronze/brass/copper**

SECTION A-A

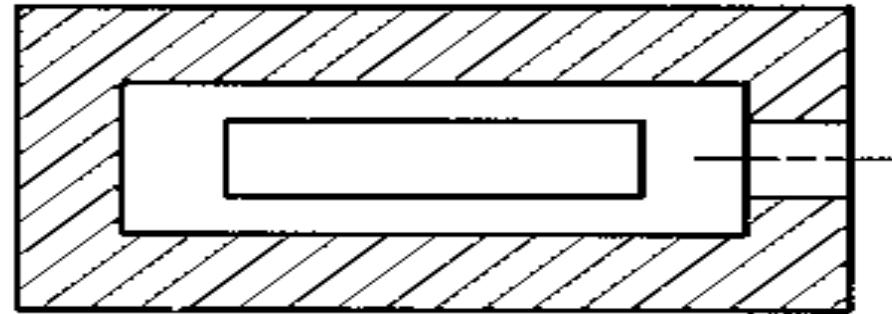
# SECTION CONVENTIONS

## 1. Multiple

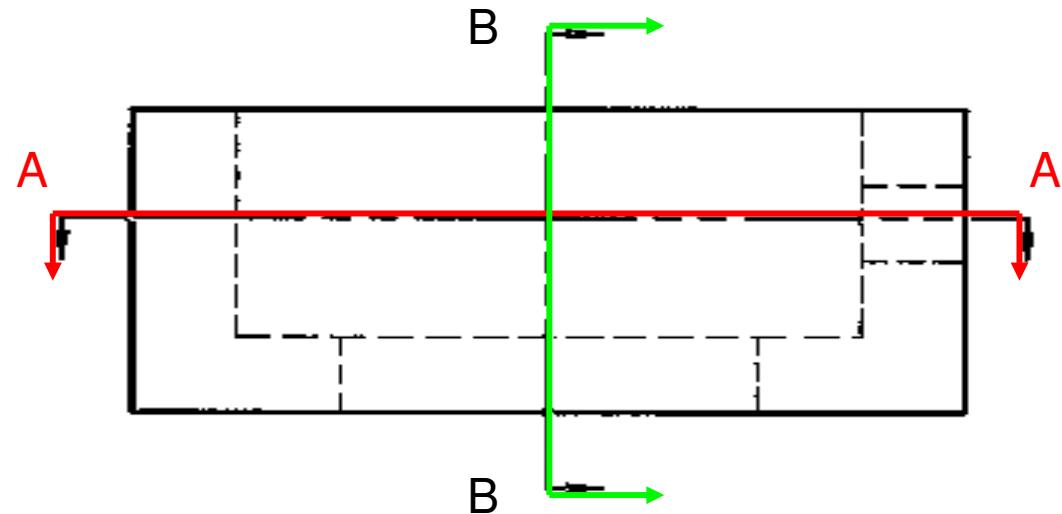
- Section Planes Cut Through Different Locations
- Notice the direction of arrows
- Notice Cutting Plane References



SECTION B-B



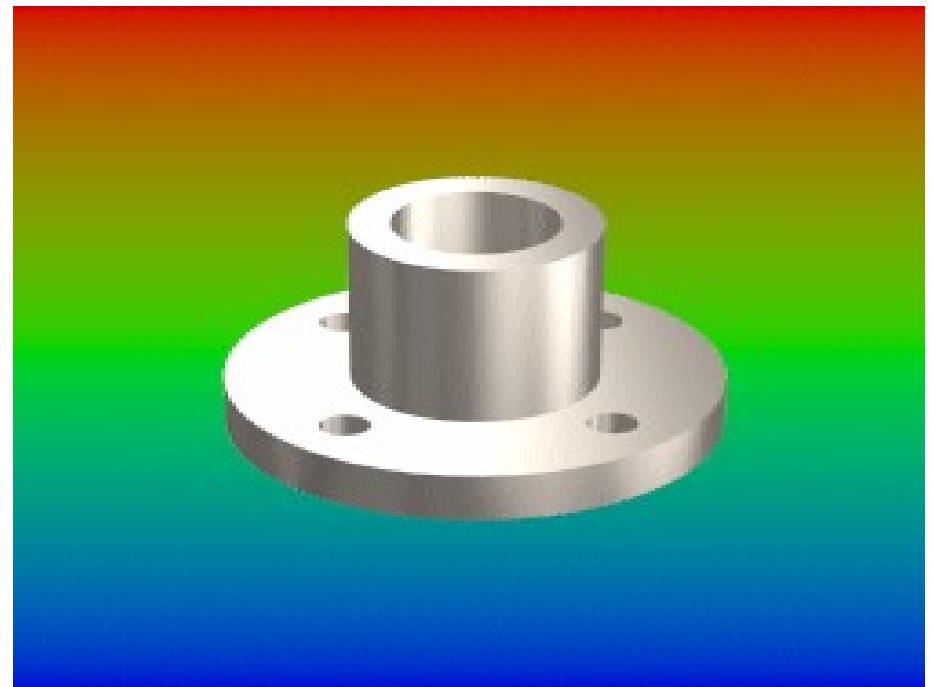
SECTION A-A



## 2. Half Section View

The cutting planes do not cut all the way through to the object. They cut only half way.

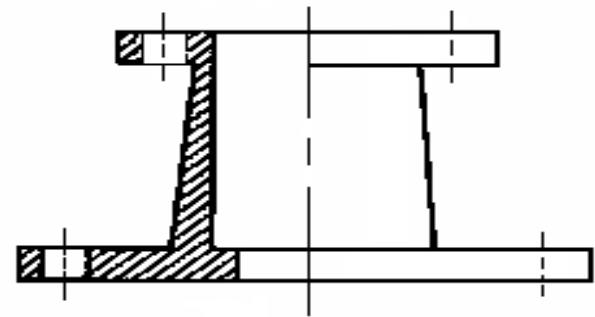
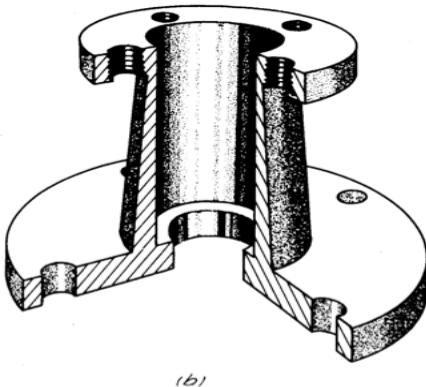
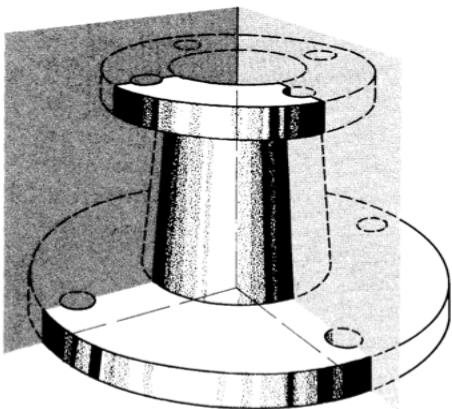
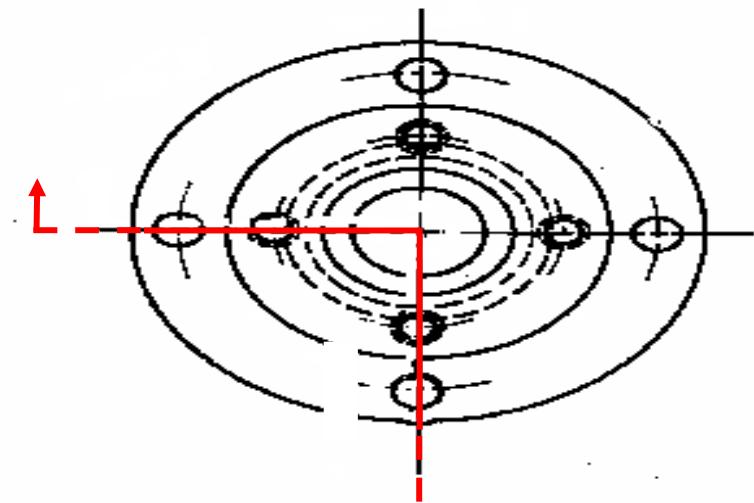
They intersect at the centerline.



# SECTION TYPES

## 2. Half

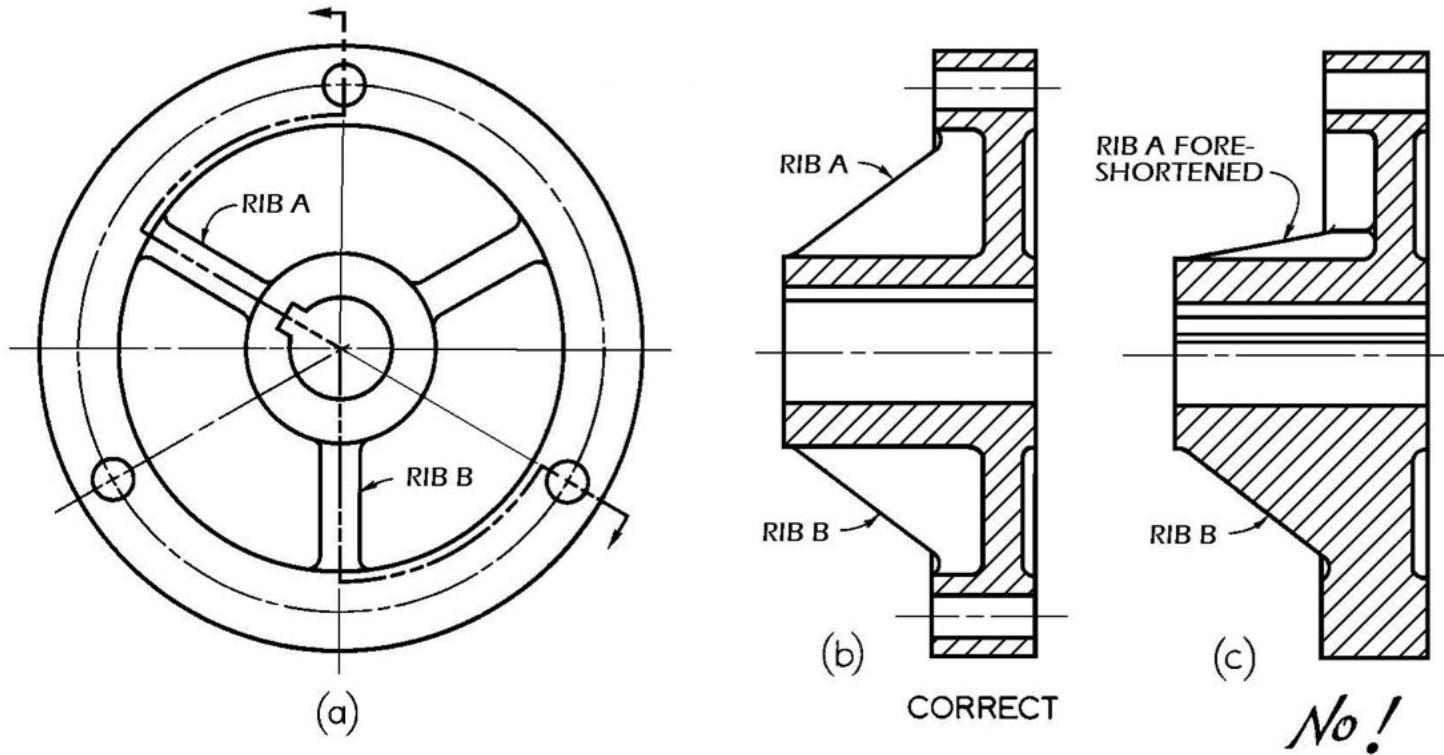
- Typically Used for Symmetric Parts
- Intersects at the Centerline



# SECTION CONVENTIONS

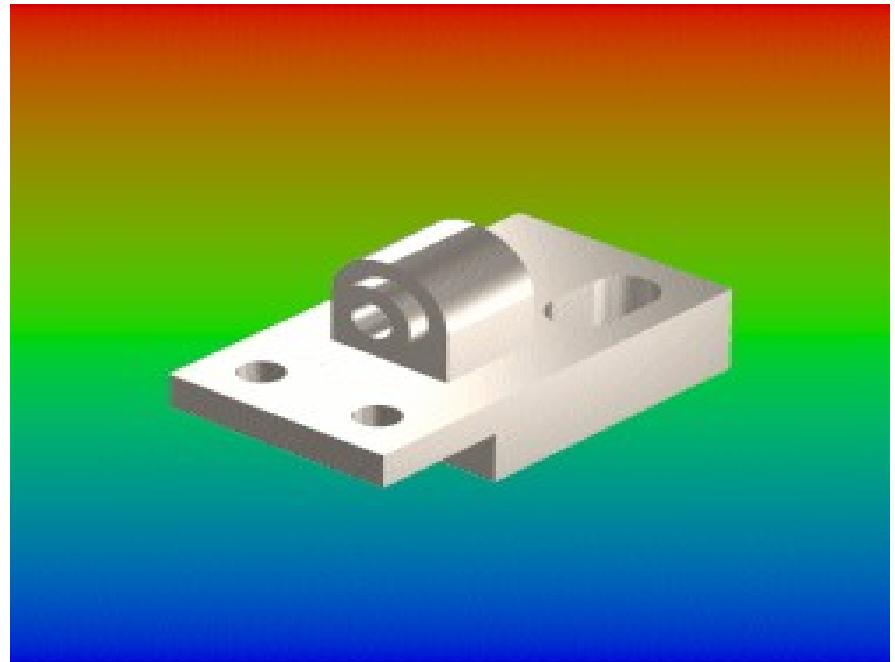
## 2. Aligned

- Used for Symmetrical Circular Parts, OR “Bent” Parts
- Cutting Plane is Placed to Show the Most Detail and for Clarity
- Ribs and Spokes Are Not Hatched for Clarity



# 3. Offset sections

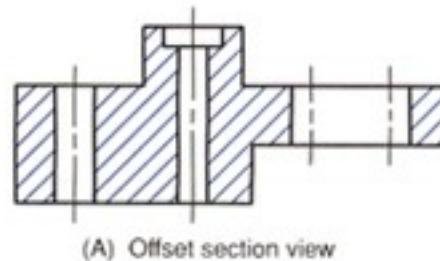
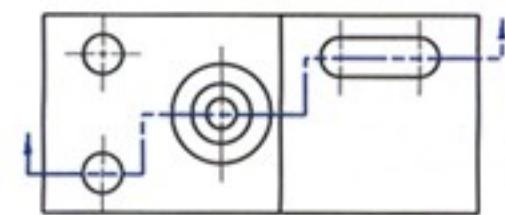
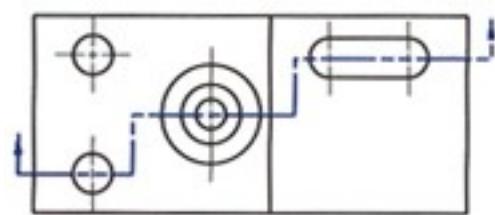
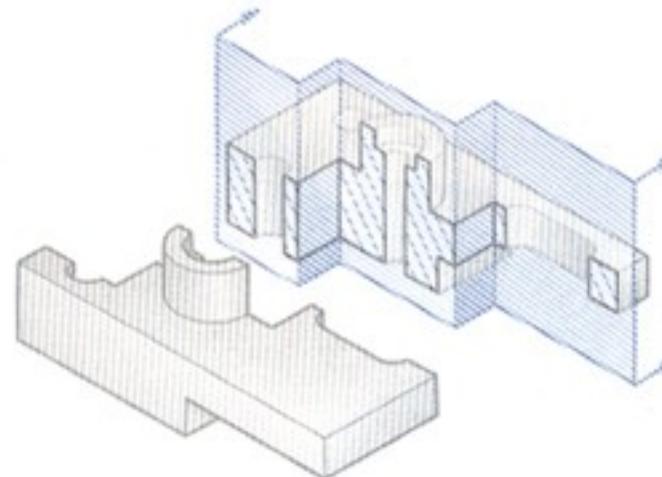
Offset sections are used to show interior features that do not lie along a straight line



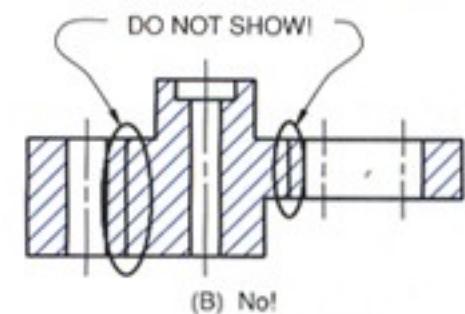
# SECTION TYPES

## 3. Offset

- Used to Show Parts and Features that Do Not Line Up with Each Other
- Cutting Plane Does Not Travel in a Straight Line
- Offset or Bend Lines in the Cutting Plane Do Not Appear in the Section



(A) Offset section view

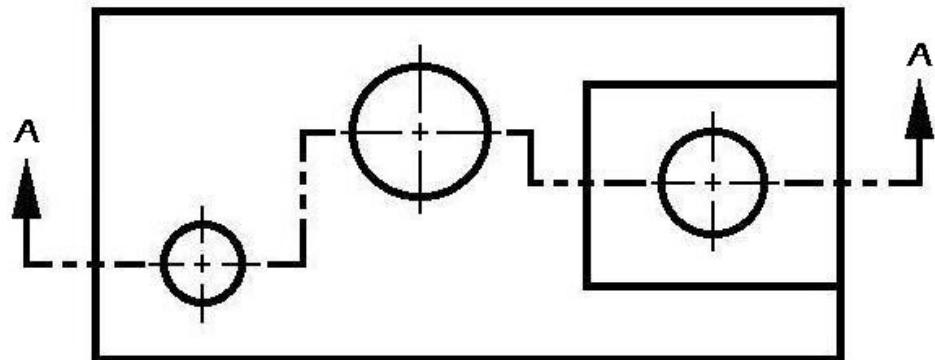


(B) No!

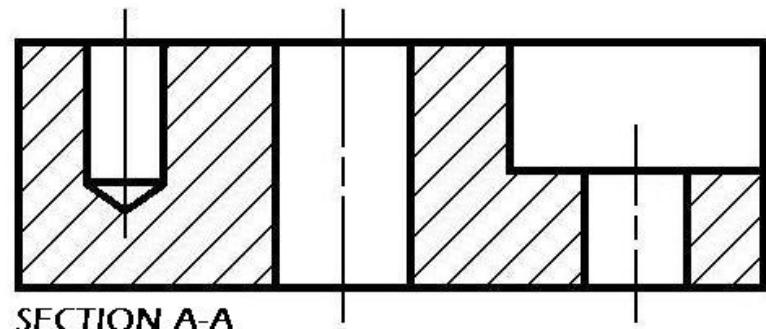
# SECTION TYPES

## 3. Offset

\*NOTE: We'd Need the Additional Principle Views to Understand Features (e.g., height, drilled hole, through holes) to Draw the Section View\*

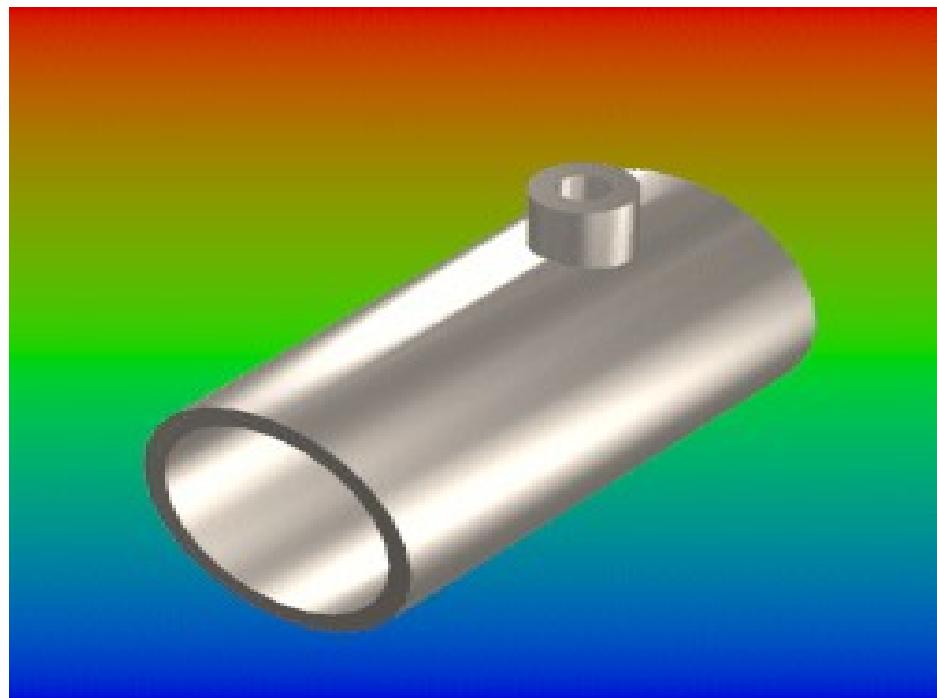


OFFSET SECTION LINE



# 4. Broken Out Sections

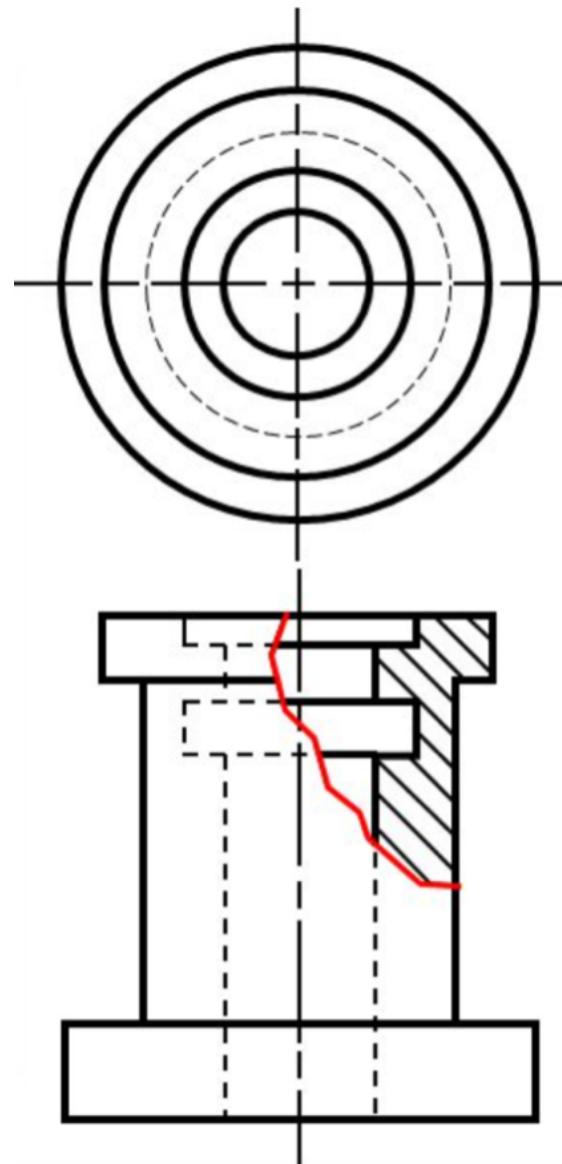
A broken-out section view is created by breaking off part of the object to reveal interior features



# SECTION TYPES

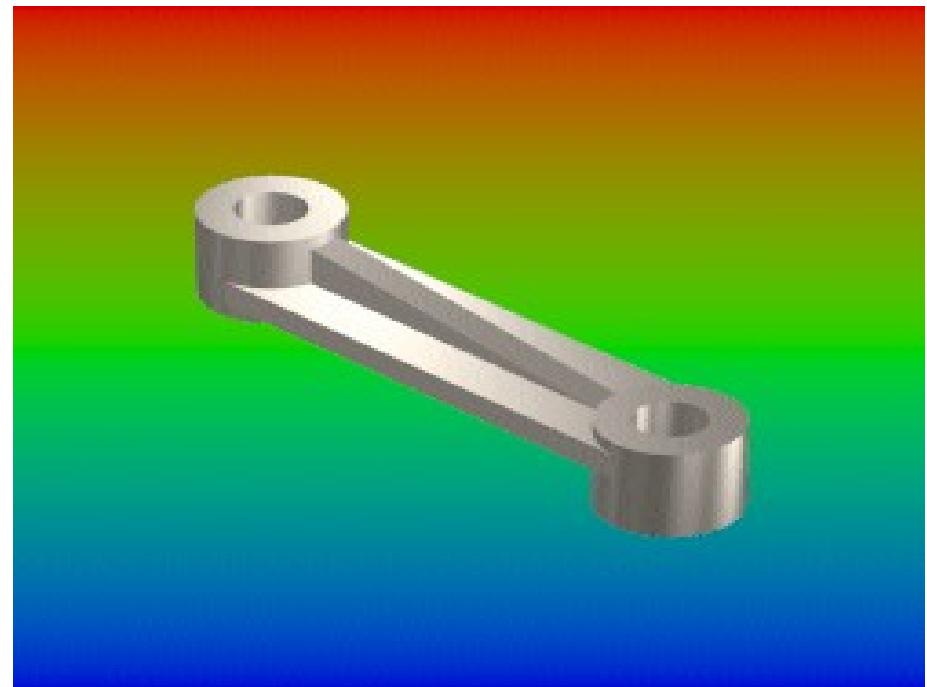
## 4. Broken Out

- A Breakline is used to Remove a Small Amount of Material from Isometric View to Show Key Detail
- No Cutting Plane



# 5. Revolved Sections

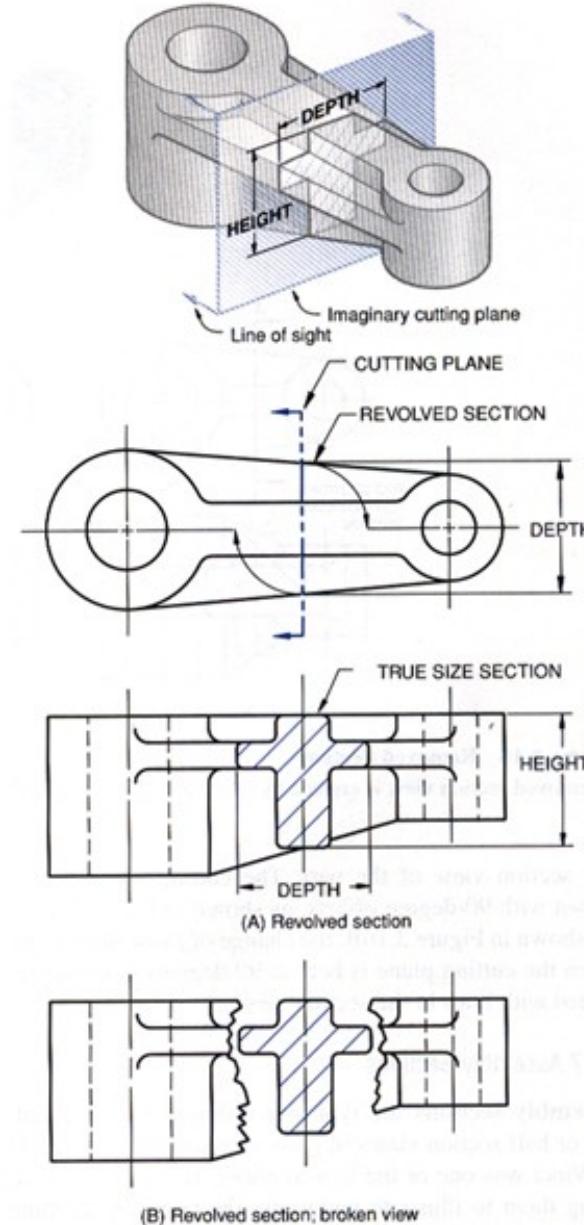
A Revolved section is created by passing a cutting plane through the object, then revolving the cross section 90 degrees



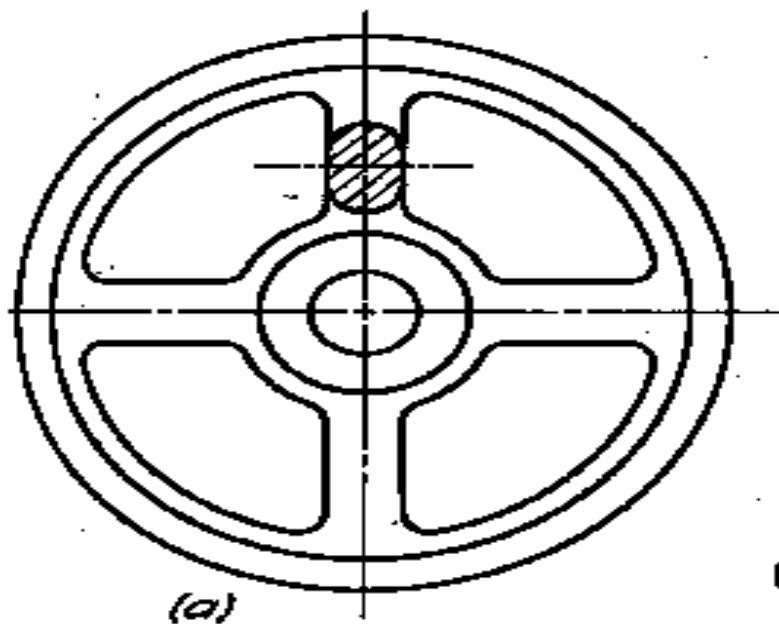
# SECTION TYPES

## 5. Revolved

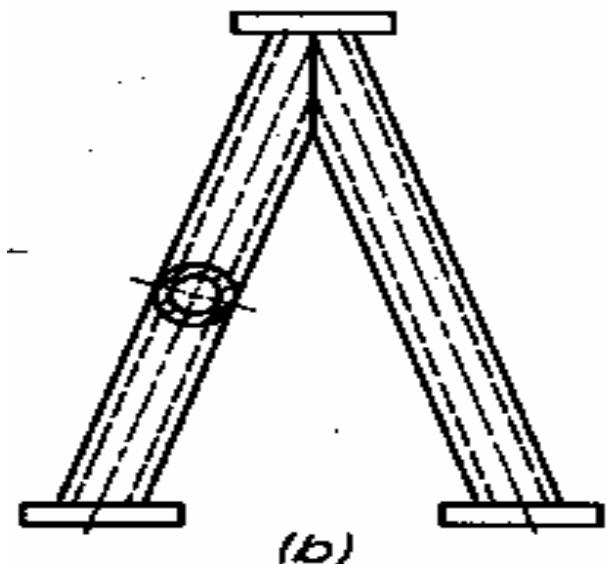
- Cutting Plane is Perpendicular to the Centerline or Axis of Object and Revolved 90 Degrees Clockwise
- If Too Crowded, Can Depict as Revolved in a Broken or Removed View



# 5. Revolved Sections



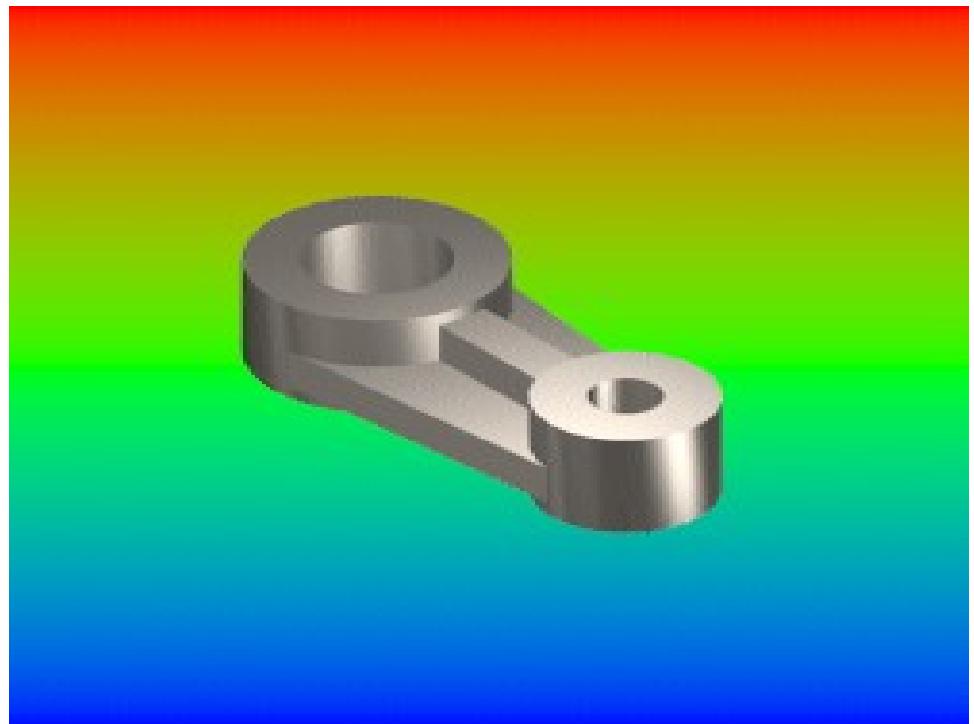
E



(b)

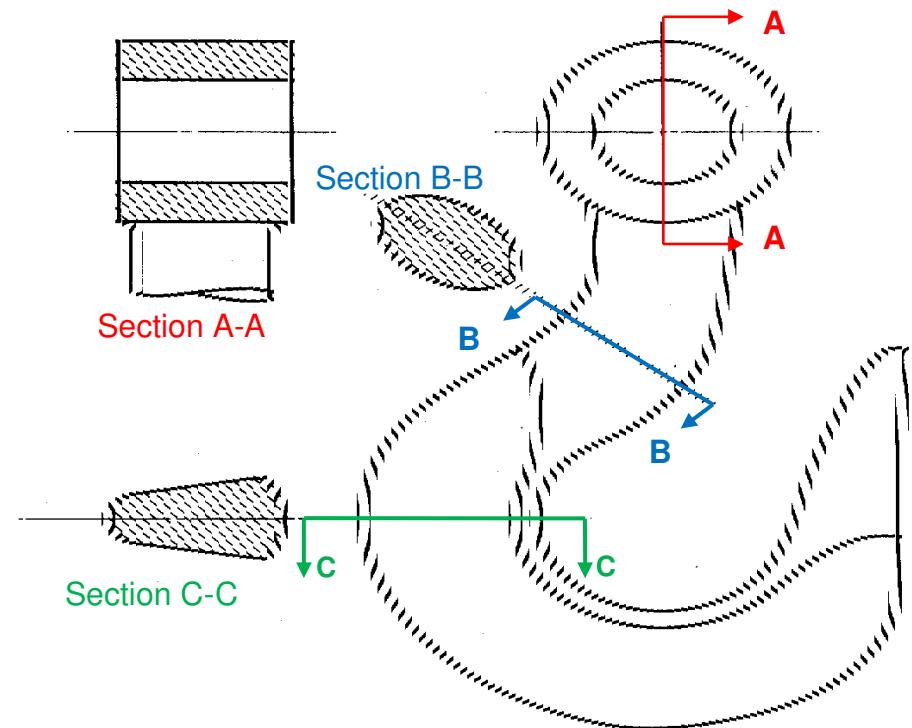
# 6. Removed Sections

A removed section view is created by making a cross section, then moving it to an area adjacent to the view.



# 6. Removed Sections

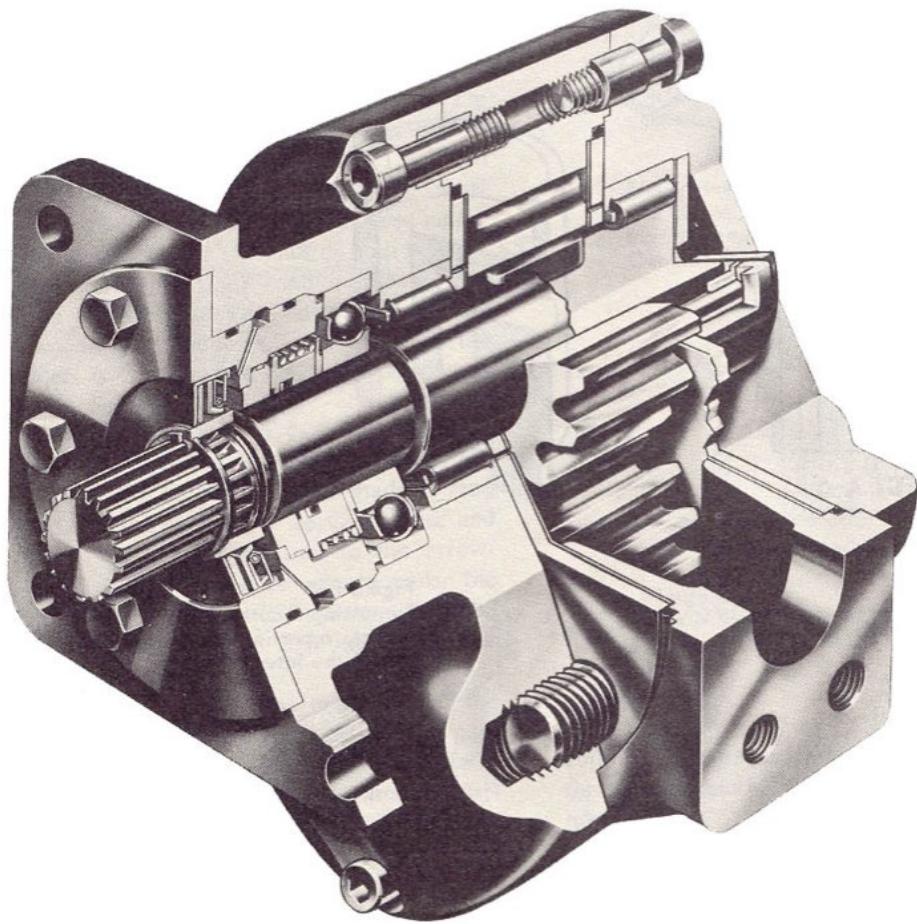
Removed sections are like revolved sections but moved aside. Note how they are named.



# SECTION CONVENTIONS

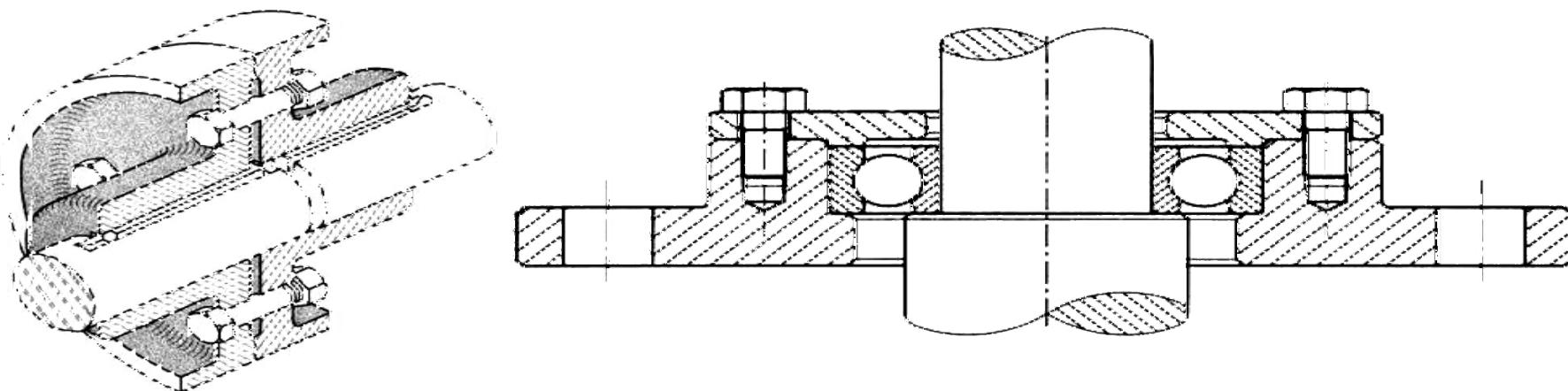
## 3. Assembly

- Show How Parts Fit Together
- Allows Clarity of Complicated Assemblies
- Provides Clarity about How Parts Fit Together and Function



# CONVENTIONAL PRACTICE

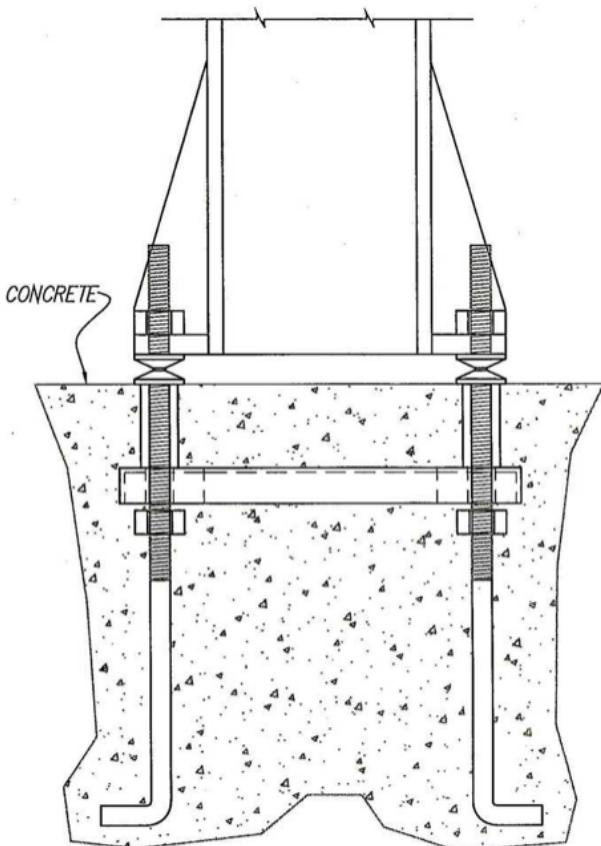
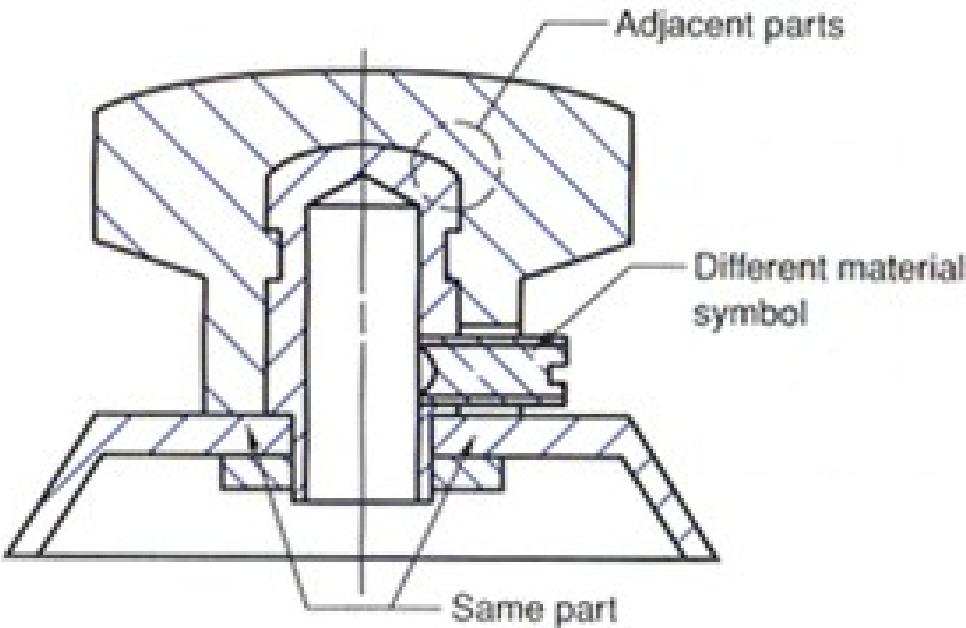
In ***sectioned assemblies*** we do NOT section or hatch ***standard parts*** (fasteners like nuts, bolts, and screws, and washers , pins, keys, shafts, etc.).



# SECTION CONVENTIONS

## 3. Assembly

- Standard Parts, Such as Fasteners and Shafts are Not Cut and Section Lined
- Adjacent Parts of the Same Material are Section Lined at Different Angles



# Section View Characteristics Summary

<b>Full sections</b>		Show cutting plane*
<b>Half sections</b>		Show line-of-site arrows**
<b>Offset sections</b>	Do not show imaginary edge lines	Label as necessary, esp. if >1 of above Show centerlines Hatch cut material Hidden lines become visible No hidden lines in sectioned areas Hidden lines optional in non-sectioned areas
<b>Broken-out sections</b>		Use conventions for circular patterned features (holes, spokes, etc.) and similarly for aligned views Ribs, webs, spokes, lugs get separated with visible lines and no or alternate hatching Do not section or hatch standard parts
<b>Revolved sections</b>		
<b>Removed sections</b>		

\*Except Broken-out, optional center line or axis for Revolved, and optional for Removed Sections

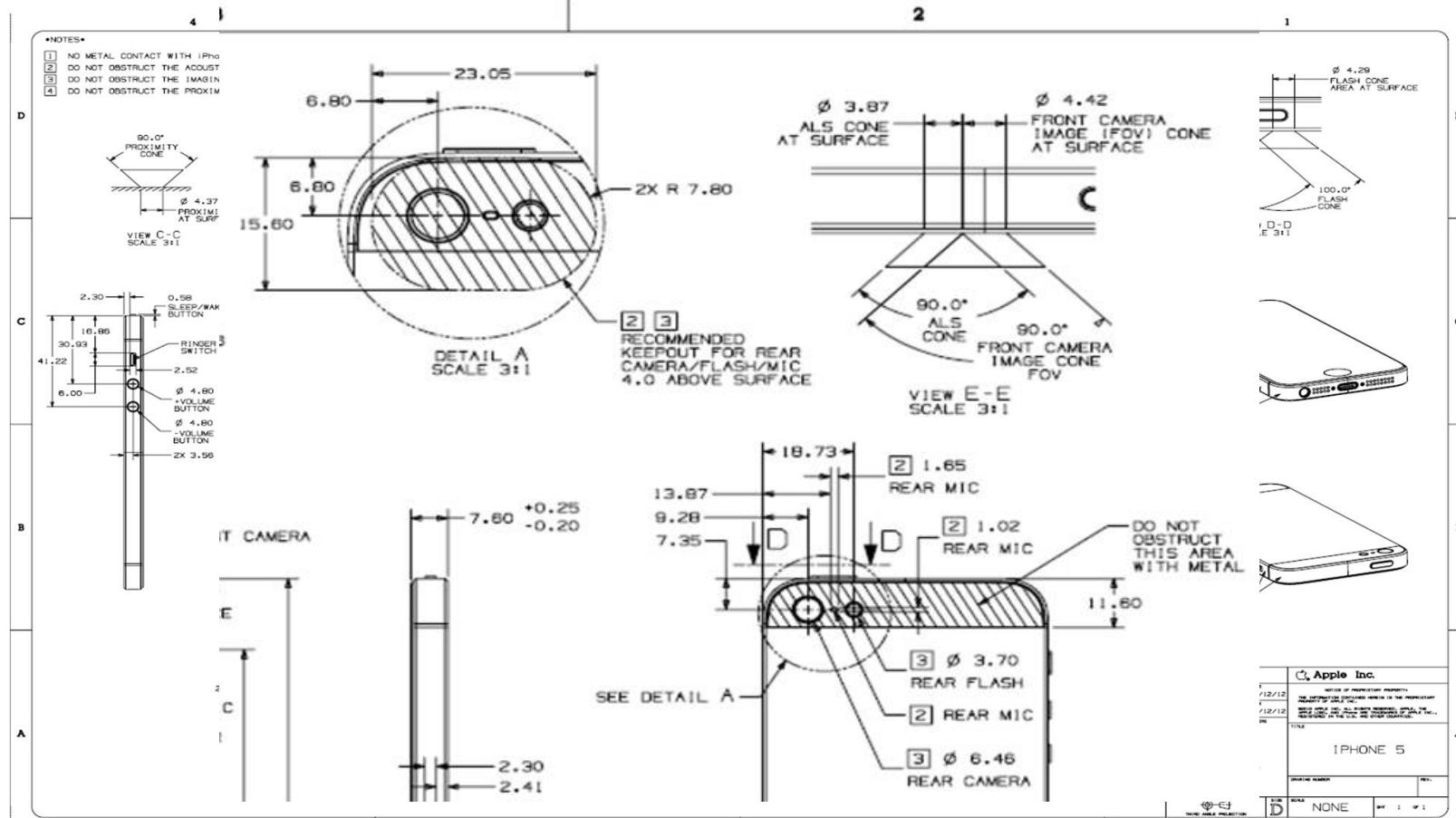
\*\*Except Broken-out and Revolved, only for Removed if optional cutting plane also shown

Conventions: Multiple, Aligned, Assembly

# DETAILS

## WHAT IS A DETAIL VIEW?

- Enlarged Scale to Show Detail
- Includes Dimensions or Other Clarifying Information for Construction/Fabrication/Assembly



# DIMENSIONING REFRESHER

**PURPOSE:** To provide a clear and complete description of an object.

- **Accuracy:** Correct values must be given
- **Clarity:** Dimensions must be placed in appropriate position to communicate the most important information (i.e., on the view of the face that describes the feature most clearly, the “characteristic view”)
- **Completeness:** Fully dimensioned, not over- or under-dimensioned.
- **Readability:** Correct format, appropriate linetype and line quality must be used for legibility and interpretation

# SOME BASIC DO'S & DONT'S OF DIMENSIONING

- Consciously Place Dimensions & Leader Notes w/ Enough Space to Avoid Overcrowding & Misinterpretation
- Add Another View or Drawing Sheet, if Necessary
- Stagger Dimensions Rather than Lining Them Up in a Row or on Top of One Another

# IN CLASS ACTIVITY: Dimensioning Exercises Packet

Continuation of the Packet Handed Out Today  
Exercises 1-7

REFER TO DIMENSIONING RESOURCES!

# HOMEWORK SUMMARY

- Finish Homework Packet

# RUBRICS SUMMARY

- EPICS 151 Week 8 Homework Packet Rubrics

\*Rubrics for each deliverable are available on Blackboard\*

# PRE-WORK FOR WEEK 11

- Prepare for Final Exam by Reviewing Weekly Content to Demonstrate Competencies
- Week 11 Plan
  - Turn in Homework Packet
  - Final Exam at Start of Class (60 minutes)
  - Working Drawings

# RESOURCES

- 10 Basic Dimensioning Rules (on Blackboard)
- Dimensioning Summary (on Blackboard)
- **UTA Office Hours**  
**4-8 PM M-F**  
**MT CTLM 129; W B60; R B56; F 152**
- Online Search (e.g., How to draw [topic])
- Email/Contact Professor