THE UNIVERSITY OF JORDAN

SCHOOL OF ENGINEERING

MECHANICAL ENGINEERING DEPARTMENT

Engineering Drawing Course

0904131

Practice Sheets

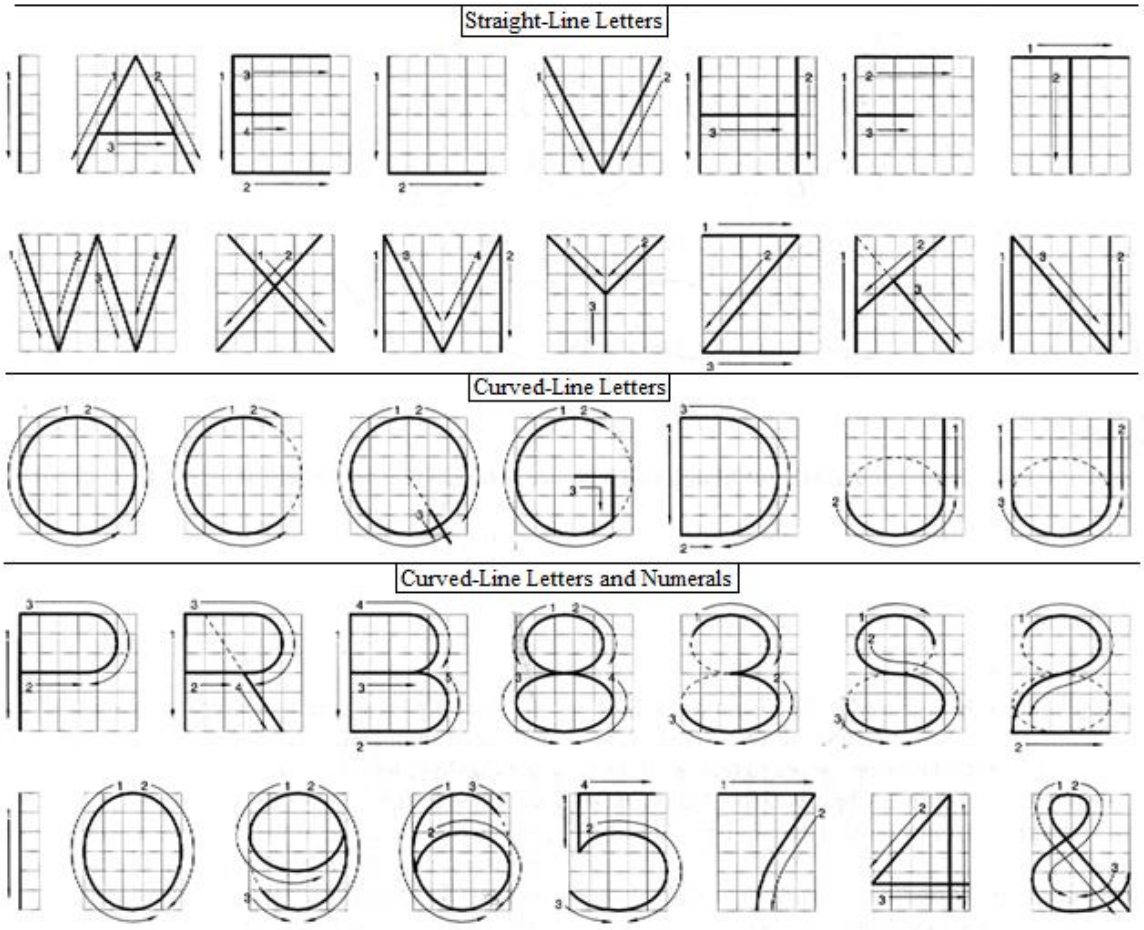
Fall 2022/2023

Topic One: Introduction to Engineering Graphics

ENGINEERING LETTERING

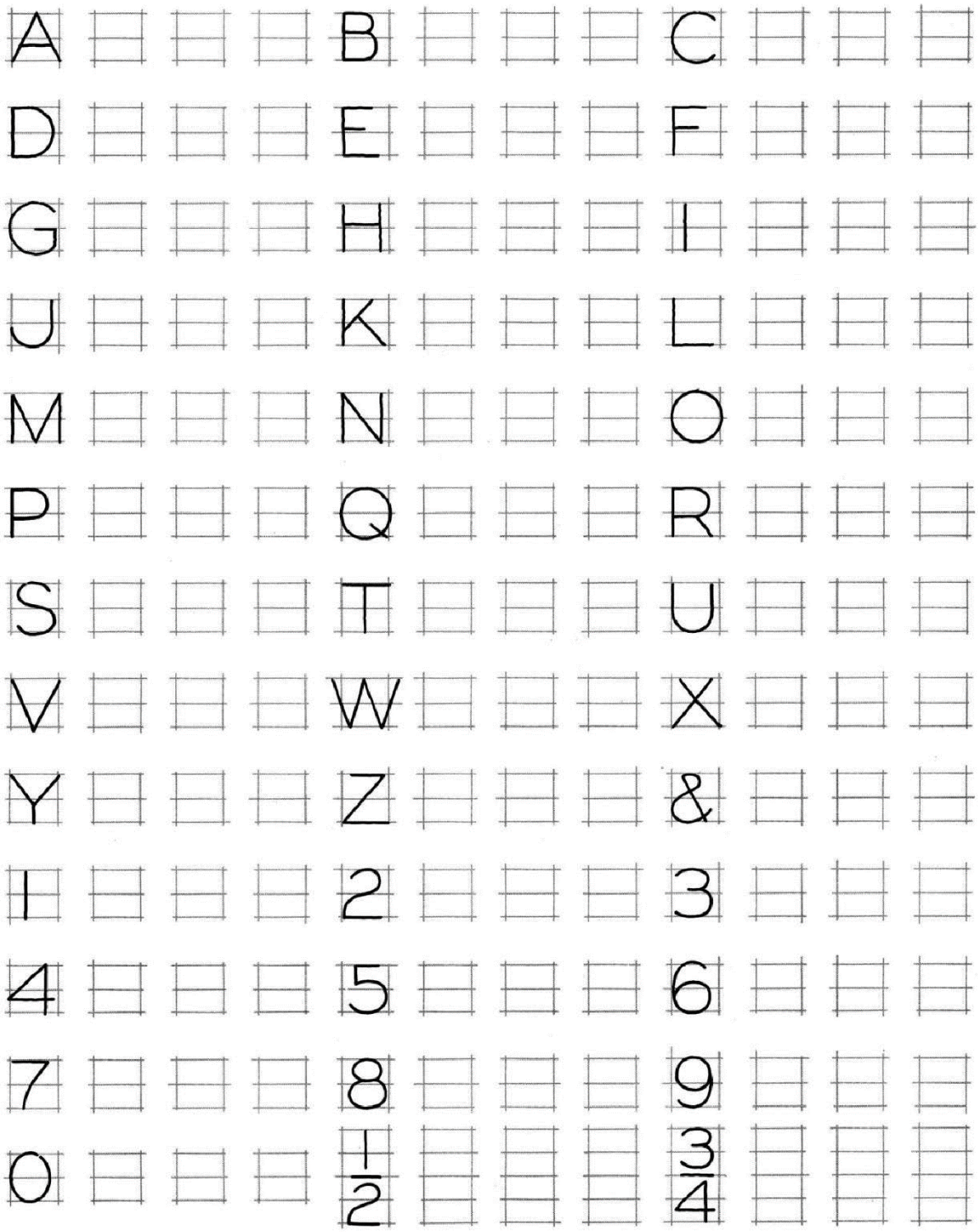
ESSENTIALS OF HAND LETTERING

1. USE THE SINGLE-STROKE, VERTICAL, GOTHIC STYLE OF LETTERING.
2. USE UPPER CASE (CAPITAL) LETTERS ONLY.
3. ALWAYS USE VERY LIGHT GUIDELINES.
4. NORMAL LETTERING IS MADE 3 MM HIGH.
5. TITLES SHOULD BE LETTERED 6 MM HIGH.
6. FRACTIONS ARE LETTERED TWICE THE HEIGHT OF NORMAL LETTERS.
7. FRACTION BARS ALWAYS DRAWN HORIZONTAL.
8. USE MEDIUM (B, HB, OR H) LEAD FOR NORMAL LETTERING.
9. USE A HARD (4H TO 9H) LEAD FOR DRAWING GUIDELINES.



NAME: _____	**SECTION NO.:** _____	**1**
FILE NO.: _____	**DATE:** _____	

Exercise (1): Using **HB** pencil with a slightly rounded point, construct each letter in the spaces provided. Observe the form and the proportion of each letter in order for you to improve your lettering when done smaller.



NAME: _____	**SECTION NO.:** _____	**2**
FILE NO.: _____	**DATE:** _____	

SCALING

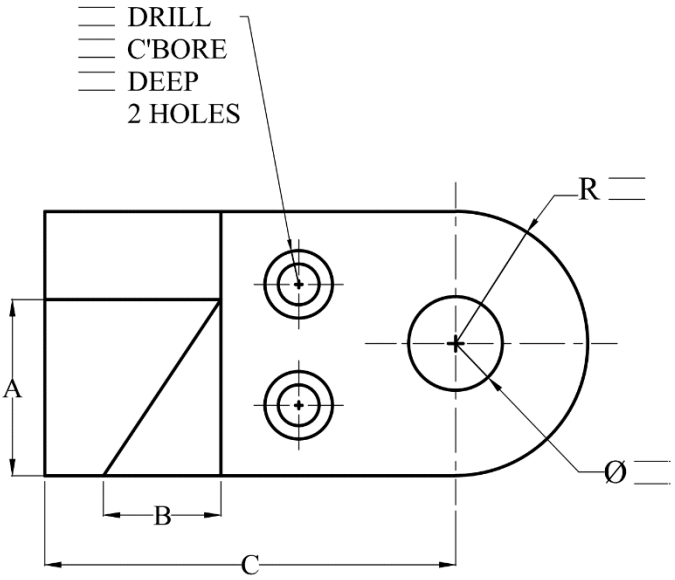
Exercise (2):

A: In the two views shown below, measure the dimensions to the nearest whole millimeter from **A** through **H**. Use the **metric** scale to calculate the actual dimensions. **Letter** the answer in the guidelines provided for the unit indicated.

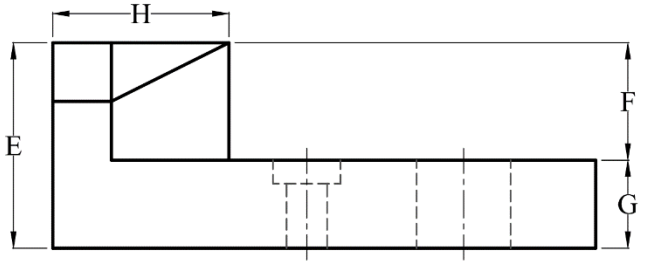
Scale	Dimensions (mm)						
	A	**B**	**C**	**E**	**F**	**G**	**H**
1:1							
1:5							
1:50							
1:200							
2:1							
100:1							

B: Measure the missing dimensions to the nearest whole millimeter. **(Scale 1:1)**

Top View



Front View



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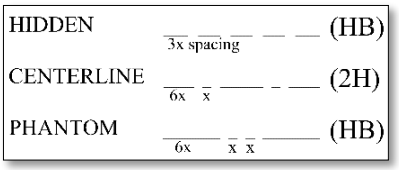
FILE NO.: _____	**DATE:** _____	

TYPES OF LINES



Exercise (3):

a. Draw horizontal lines (8 mm apart) in the following order: **visible (HB), hidden (HB), and centerline (2H)**. Start from the top and repeat until the square is filled.

b. Draw vertical lines (8 mm apart) in the following order: **visible (HB), hidden (HB), and centerline (2H)**. Start from the left and repeat until the square is filled.

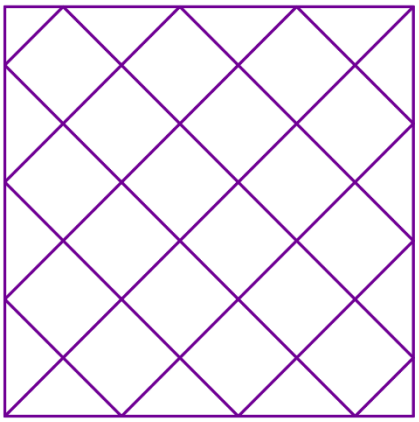
c. Draw **hatch lines (2H)** at (45º) until the square is filled (Space 3mm – 5mm).

d. Divide the given square into **16 equal squares. Show the construction lines.**

NAME: _____	**SECTION NO.:** _____	**4**
FILE NO.: _____	**DATE:** _____	

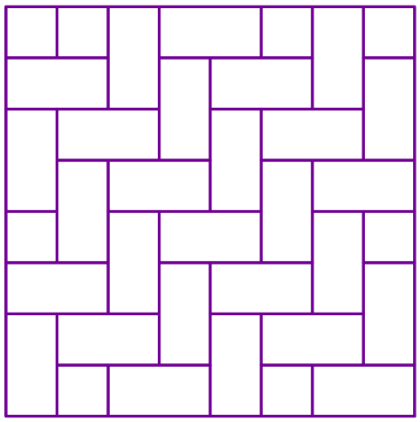
Exercise (4): Draw a copy for the given paving patterns using the two given squares using **Diagonal Line Technique**. Show the construction lines.

Diamond



(a)

Herrinbone



(b)

NAME: _____ **FILE NO.:** _____	**SECTION NO.:** _____ **DATE:** _____	**5**

Topic Two: Basic Drawing Skills

DRAWING GEOMETERY

1. Constructing a perpendicular bisector for a given line.
2. Dividing a given line into **(n)** equal parts.
3. Drawing a line parallel to a given line at a certain distance.
4. Cases of Tangency:

   Drawing an arc or circle with a given radius **(R)** that is:

   a. Passing through three points.

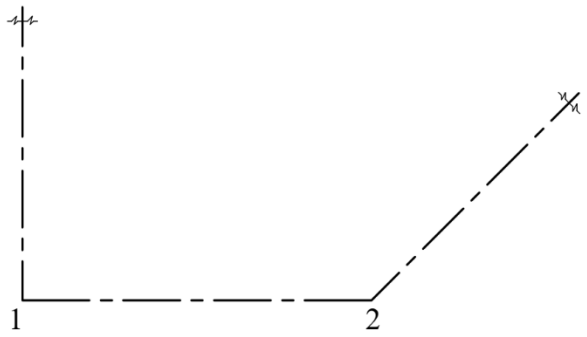
   b. Tangent to two given lines.

   c. Tangent to an arc and a line (concave and convex).

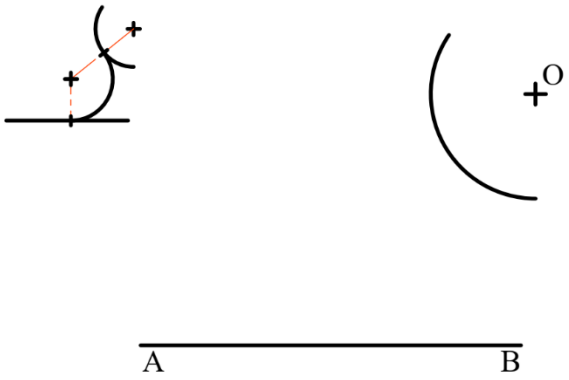
   d. Tangent to two arcs (concave and convex).
5. Constructing a regular, **Polygon** (inscribed in a circle and circumscribed about circle).

Draw the arcs as required in questions from (1) to (6). Mark tangent points and show constructions.

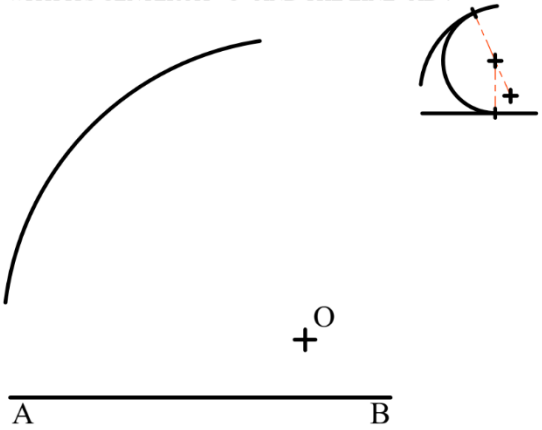
1: CONSTRUCT TWO ARCS OF 28 mm CENTERLINE RADIUS TANGENT TO ANGLES **1** AND **2** IN THE ROADWAY.



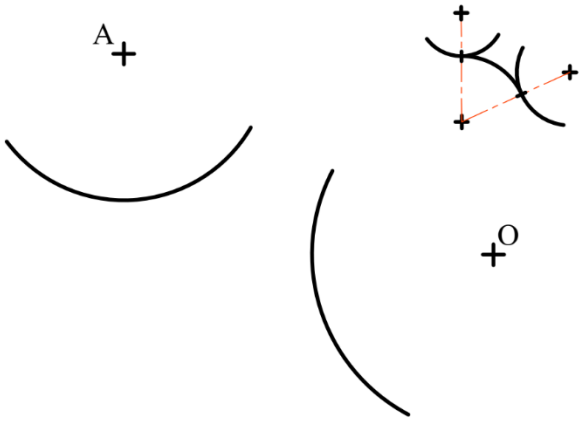
2: DRAW AN ARC OF 19 mm RADIUS TANGENT TO THE GIVEN ARC WITH ITS CENTER AT "O" AND THE STRAIGHT LINE "AB".



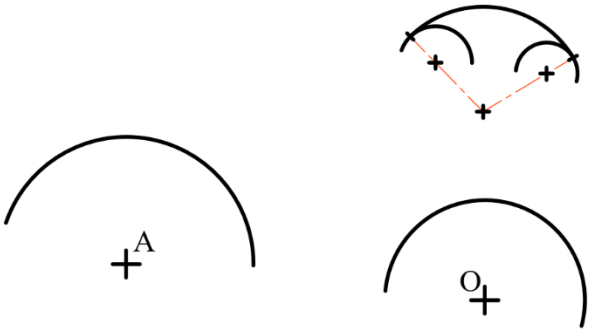
3: DRAW AN ARC OF 20 mm RADIUS TANGENT TO THE GIVEN ARC WITH ITS CENTER AT "O" AND THE LINE "AB".



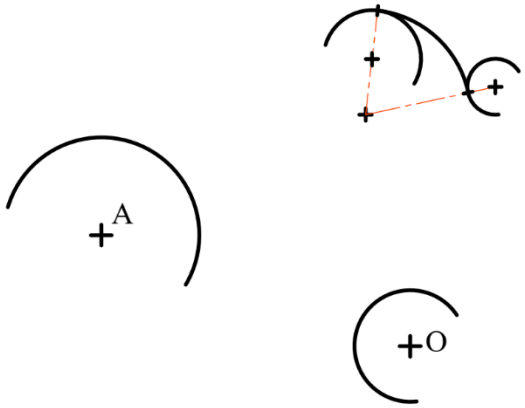
4: DRAW A CIRCULAR ARC OF 32 mm RADIUS TANGENT TO THE TWO GIVEN ARCS WITH CENTERS AT "A" AND "O".



5: DRAW AN ARC OF 48 mm RADIUS THAT IS TANGENT TO THE GIVEN ARCS WITH CENTERS AT "A" AND "O".



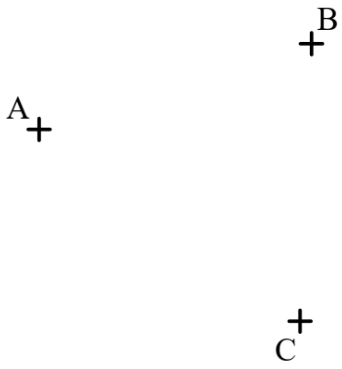
6: DRAW AN ARC OF 37 mm RADIUS THAT IS TANGENT TO THE GIVEN ARCS WITH CENTERS AT "A" AND "O".



NAME: _____	**SECTION NO.:** _____	**7**
FILE NO.: _____	**DATE:** _____	

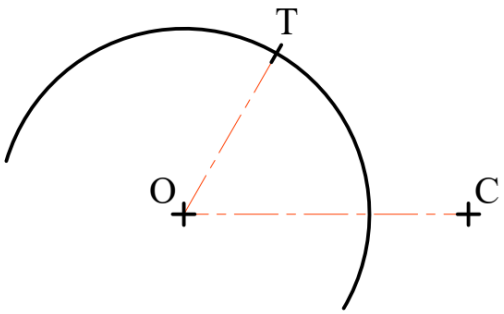
7: CONSTRUCT A CIRCLE THAT PASSES THROUGH POINTS "A", "B", AND "C". SHOW CONSTRUCTIONS.

R = _____ MM



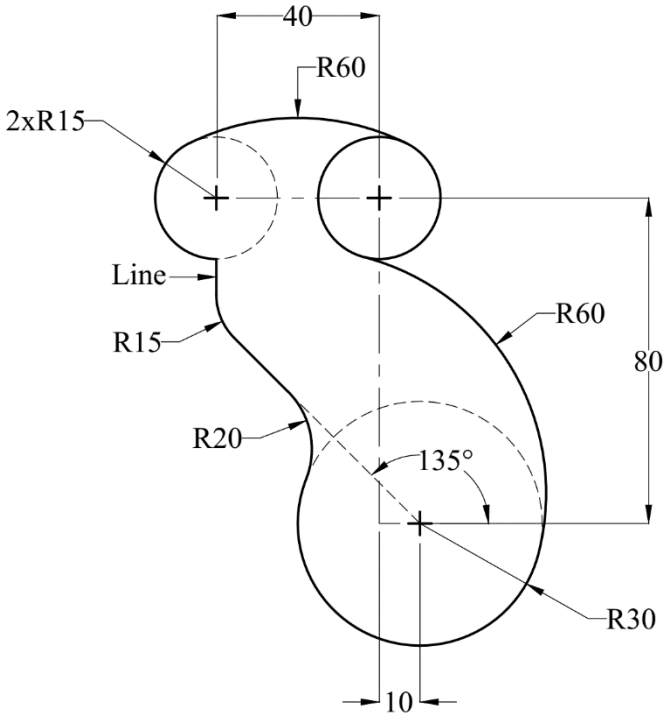
8: FIND THE RADIUS OF THE ARC (TC) THAT PASSES THROUGH POINT (C) AND TANGENT TO THE CIRCLE AT THE POINT (T). DRAW THE TANGENT ARC (TC). SHOW CONSTRUCTIONS.

R = _____ MM

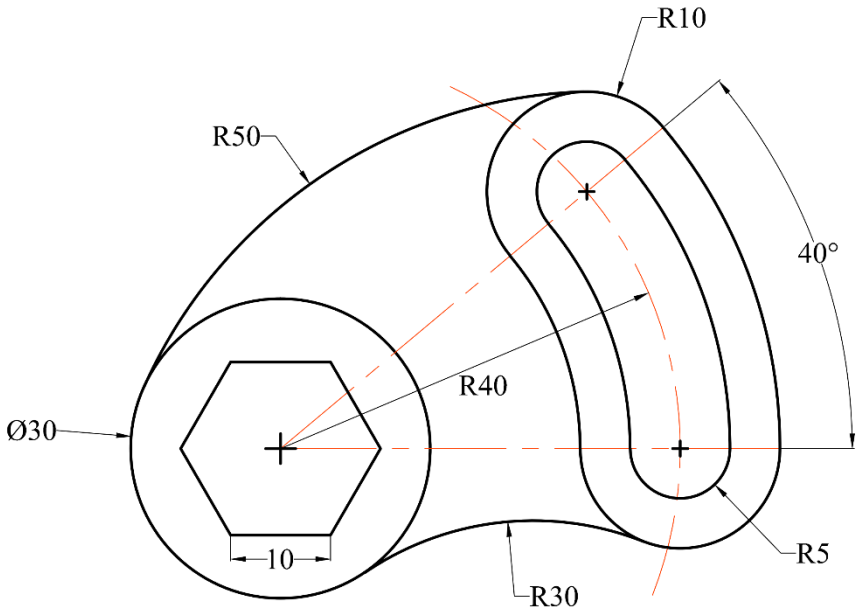


NAME: _____	**SECTION NO.:** _____	**8**
FILE NO.: _____	**DATE:** _____	

Prepare an instrumental drawing for the objects from **(a)** to **(d)** to the indicated scale. Show outlines in **HB** and construction lines in light and thin **2H**. Mark all tangent points with **3 mm dash HB**. **Do not erase construction lines**. Dimensions are in millimeters.



(a): Use Scale 1:1



(b): Use Scale 2:1 (Double size).

Note: The angle does not change by scale

NAME: _____	**SECTION NO.:** _____	**9**
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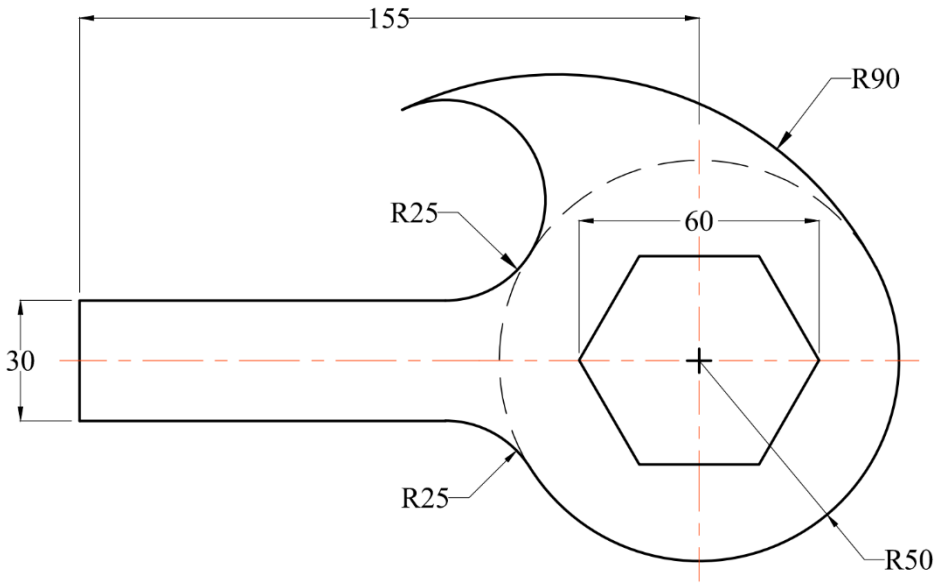
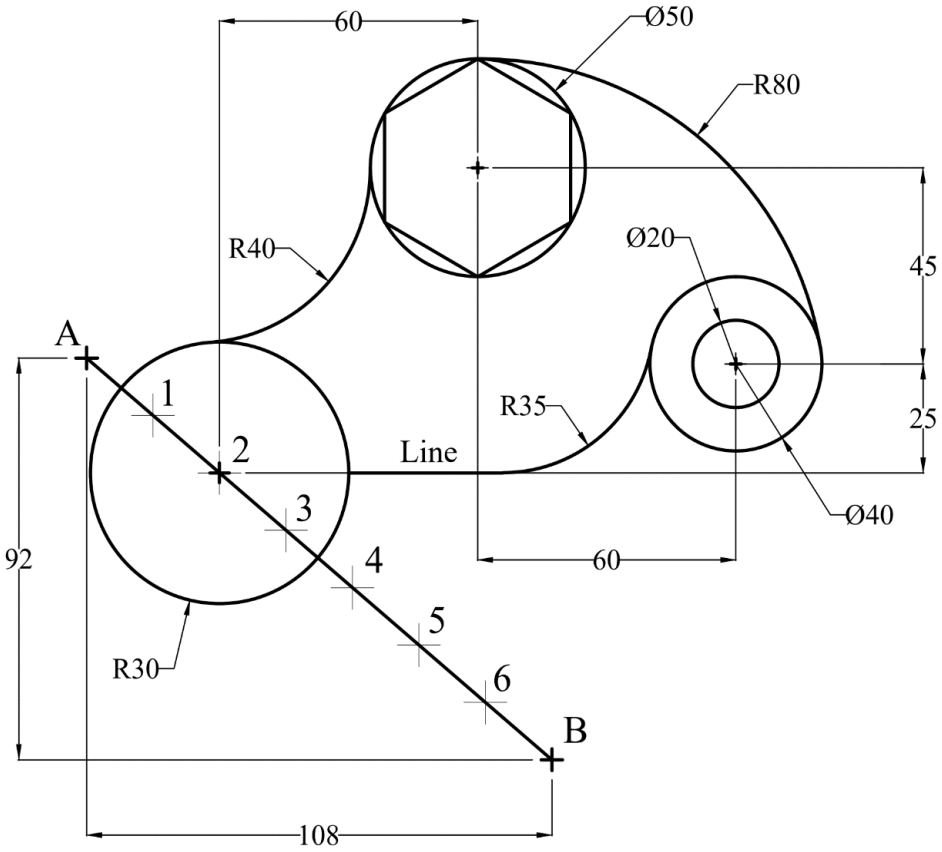


(c): Use Scale 1:1

(d): From point (A) and divide the given line (AB) into 7 equal parts, using **Diagonal Line Technique**. Use point (2) to start drawing the given shape.



(d): Use Scale 1:1

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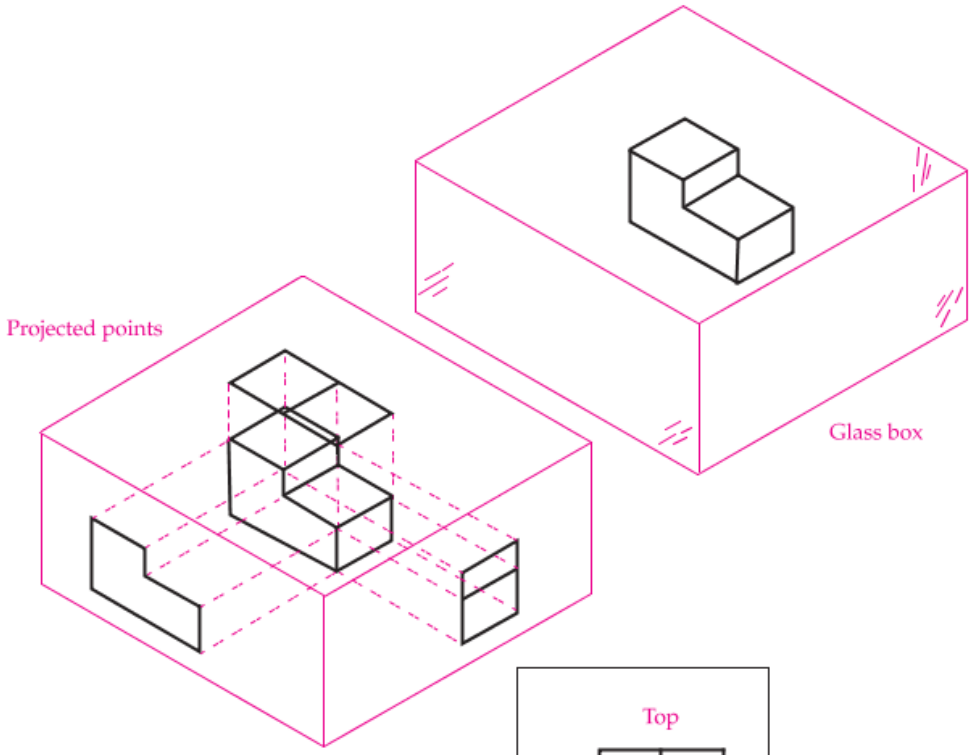
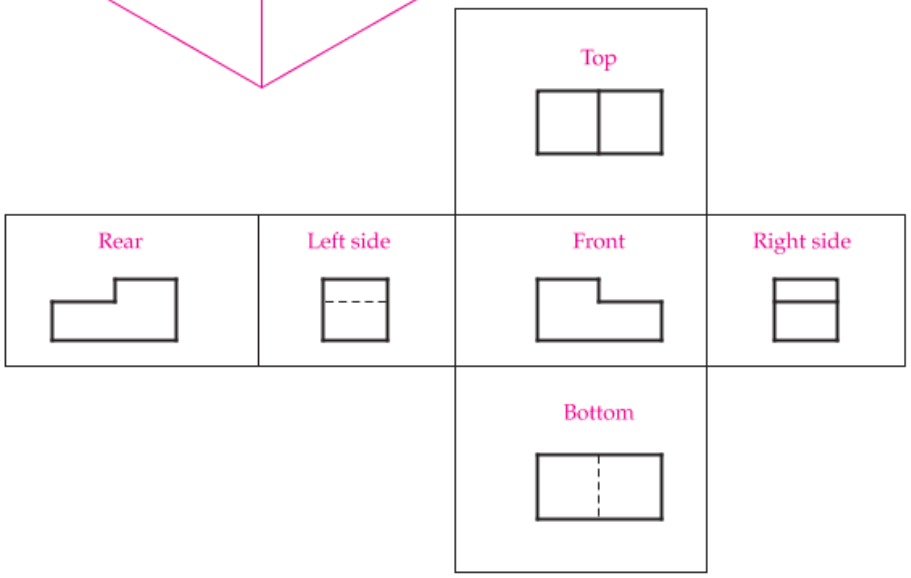
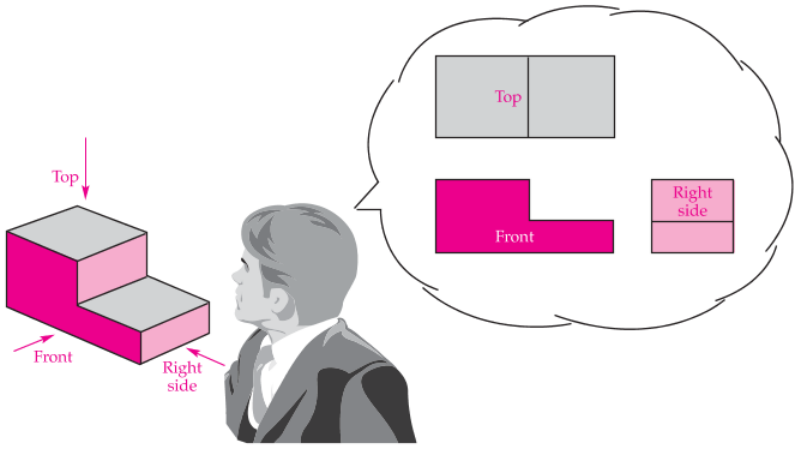
FILE NO.: _____	**DATE:** _____	

Topic Three: Multi-view Orthographic Projection







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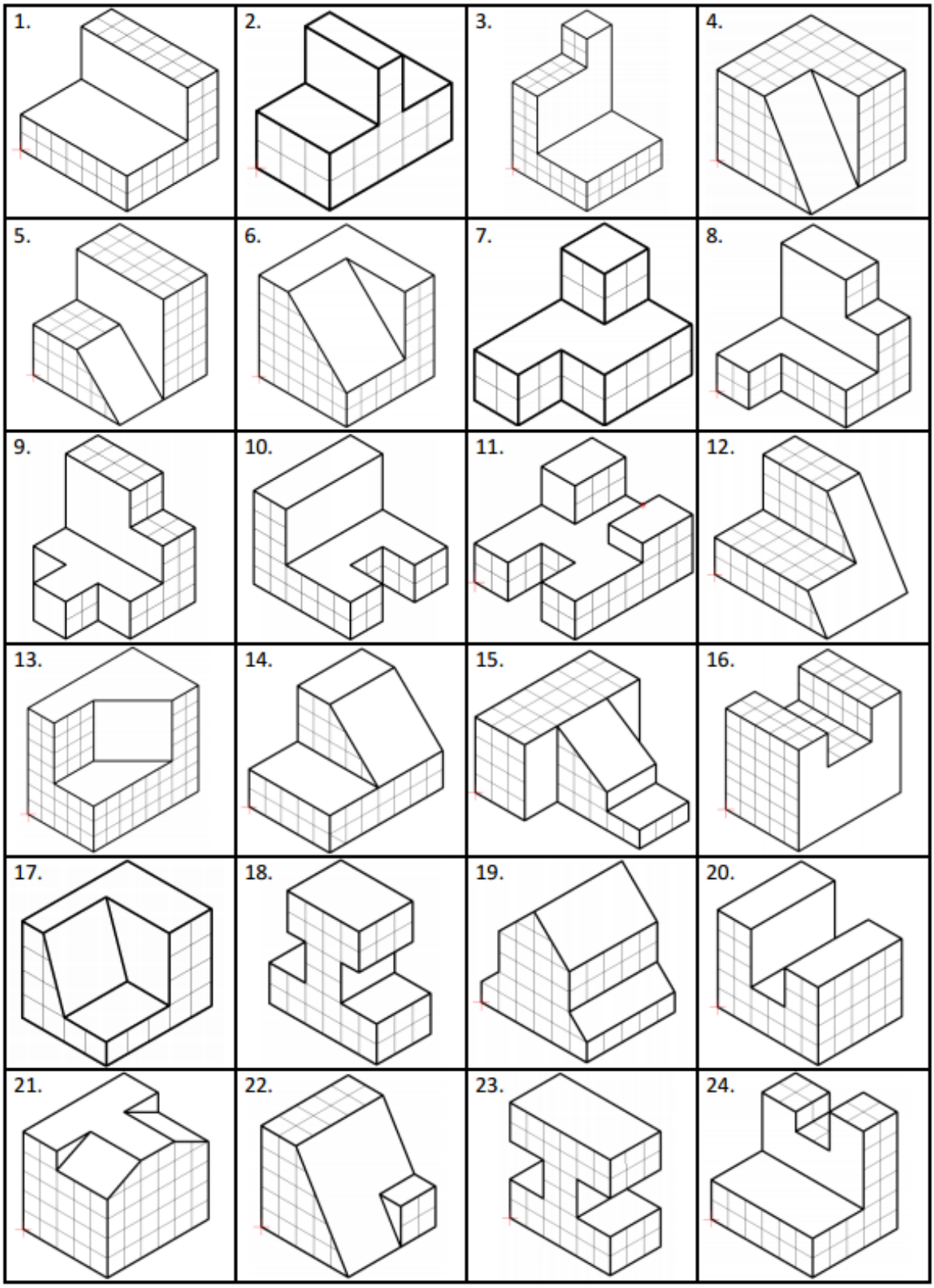
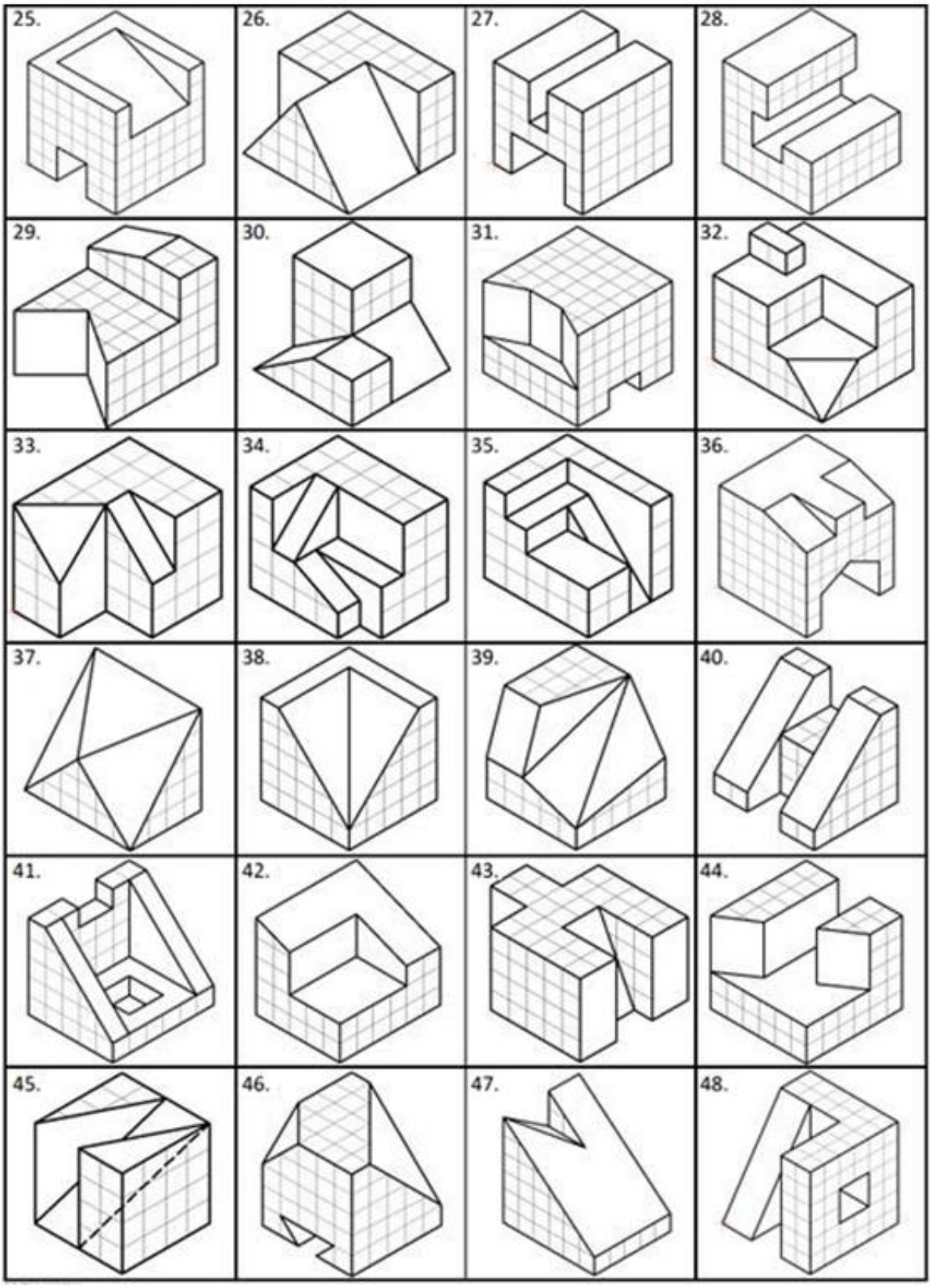
FILE NO.: _____	**DATE:** _____	

Exercise (1): Sketch using freehand, the orthographic projections for all solids.

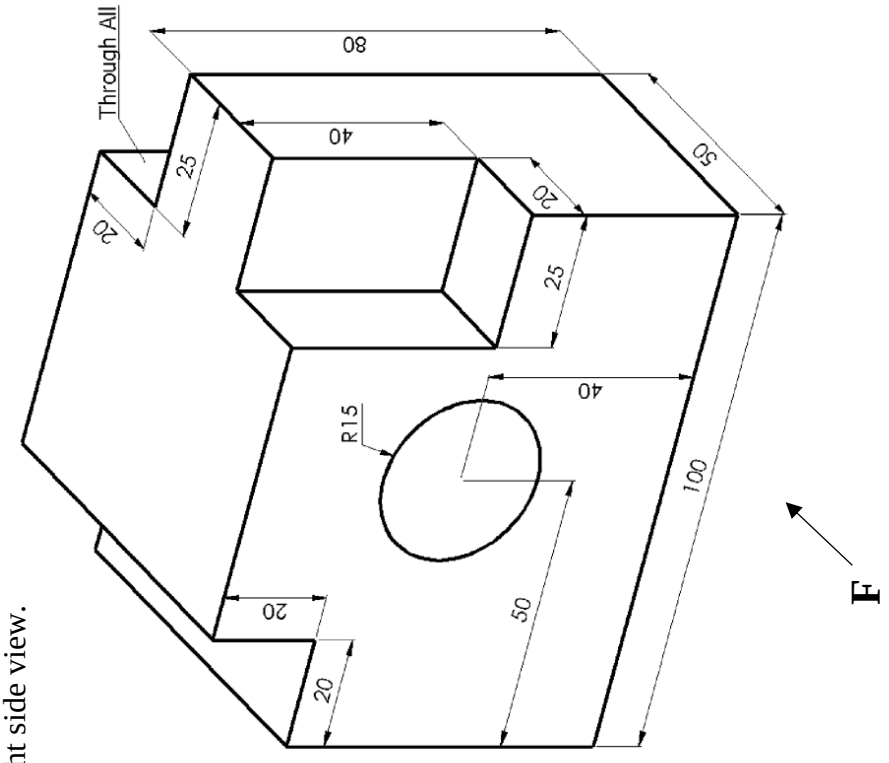


NAME: _____ **FILE NO.:** _____	**SECTION NO.:** _____ **DATE:** _____	**12**

Exercise (2): Sketch using freehand, the orthographic projections for all solids.



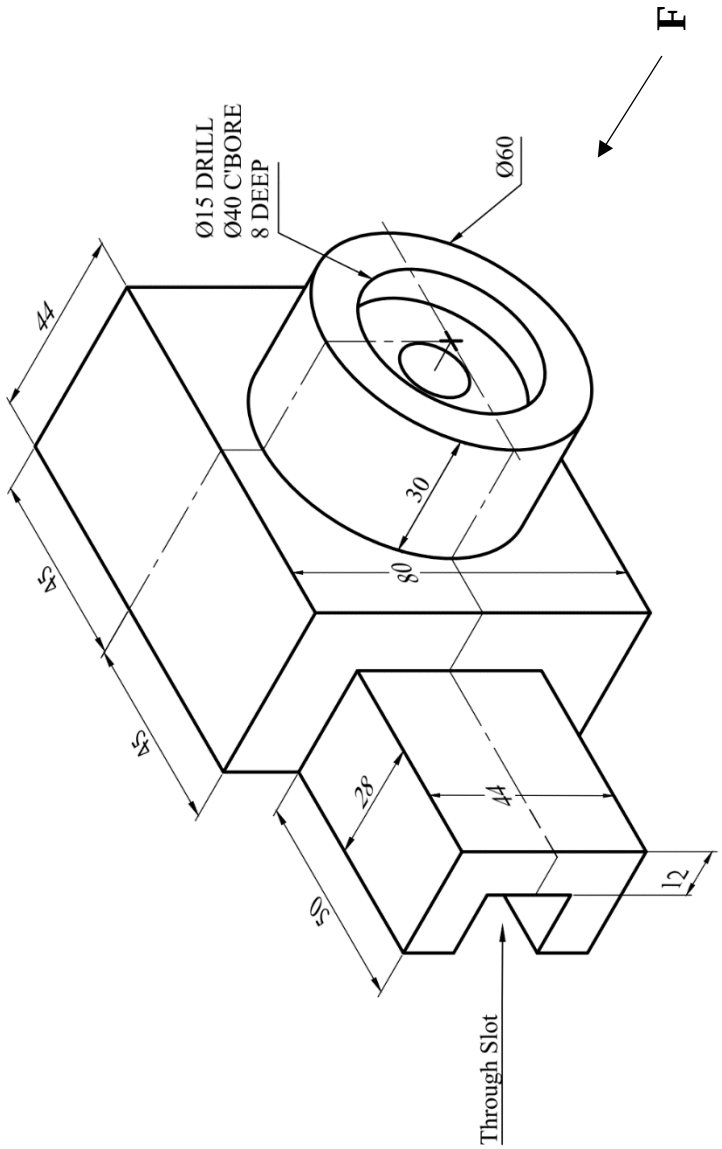
NAME: _____	**SECTION NO.:** _____	**13**
FILE NO.: _____	**DATE:** _____	



Exercise (3): For the given solid, draw the top view, front, and right side view.

NAME: _____	**SECTION NO.:** _____	**14**
FILE NO.: _____	**DATE:** _____	

Exercise (4): For the given solid, draw the top view, front, and left side view.

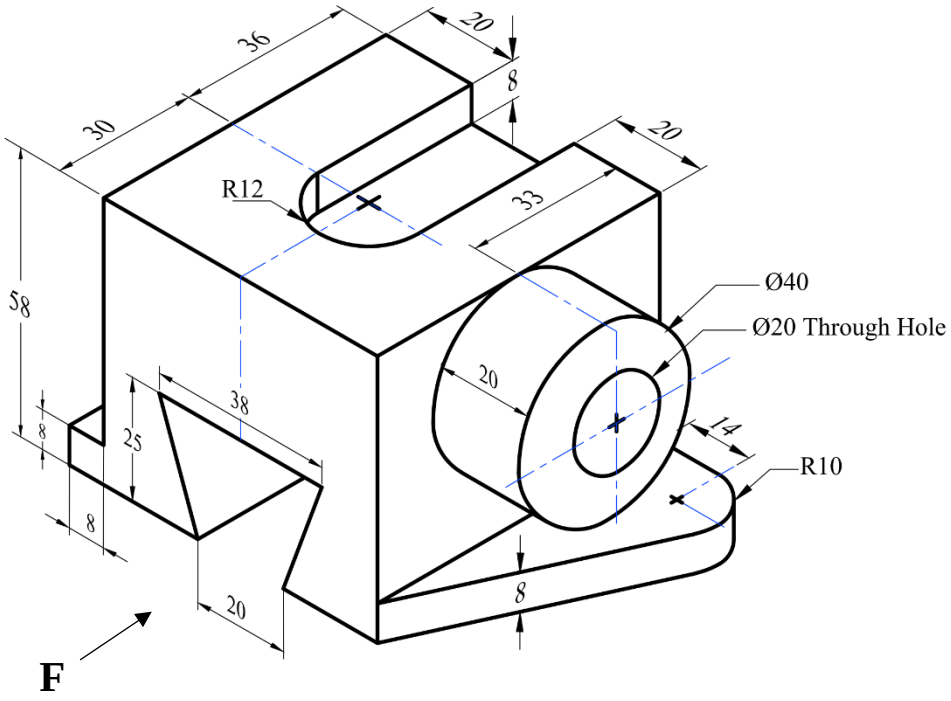


NAME: _____	**SECTION NO.:** _____	**15**
FILE NO.: _____	**DATE:** _____	

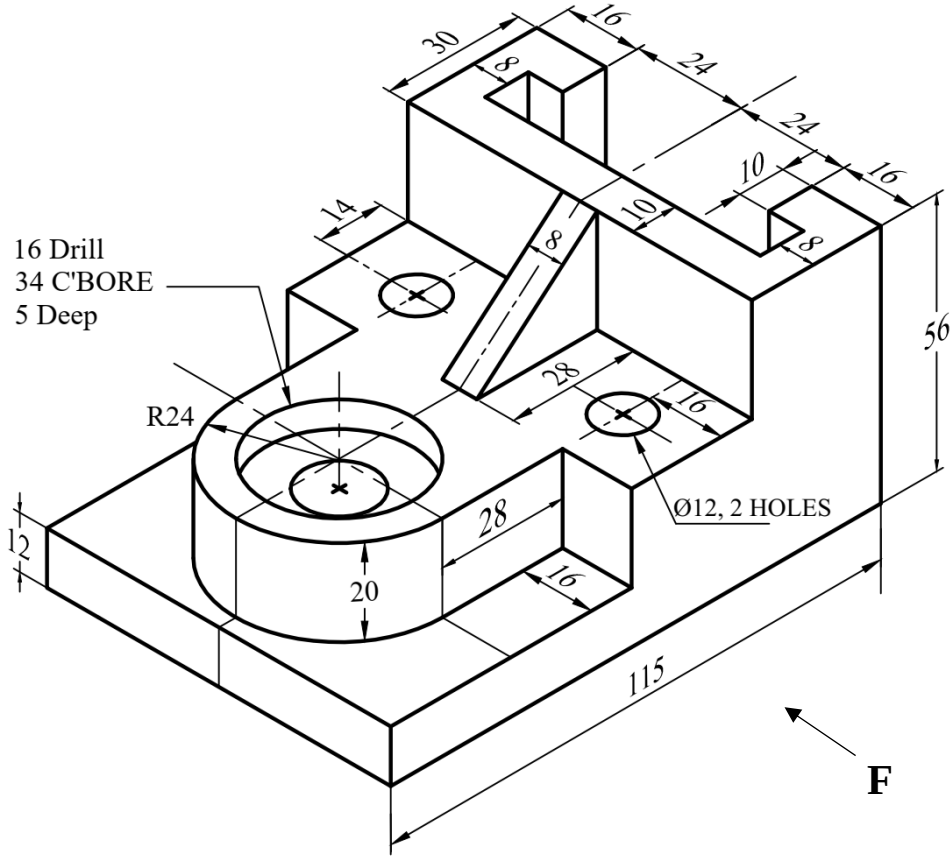
Exercise (5): For the given solids, draw the top view, front, and the side views.

Note: All holes are through.

(A)



(B)



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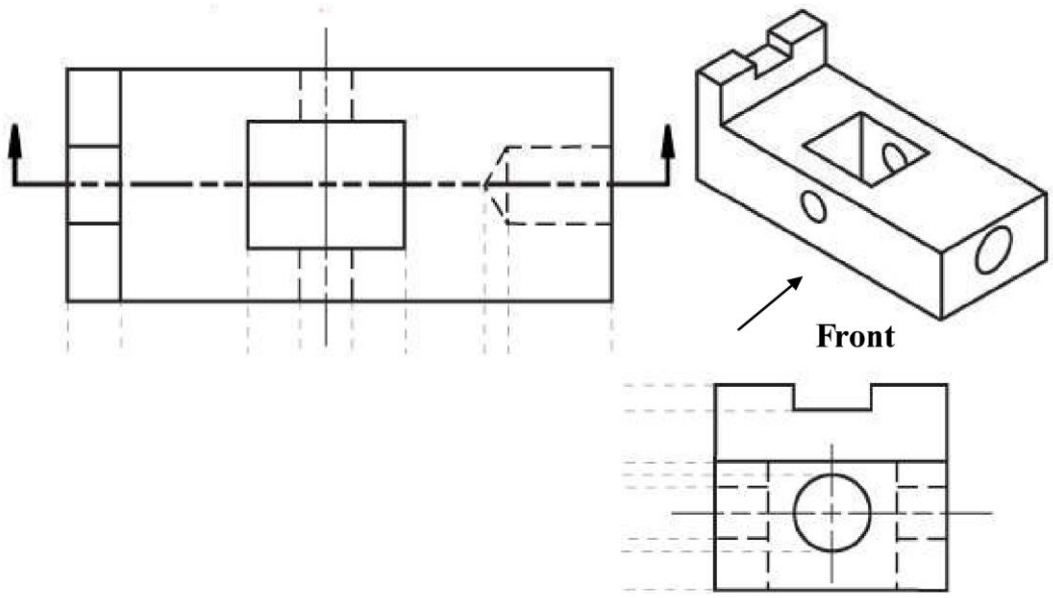
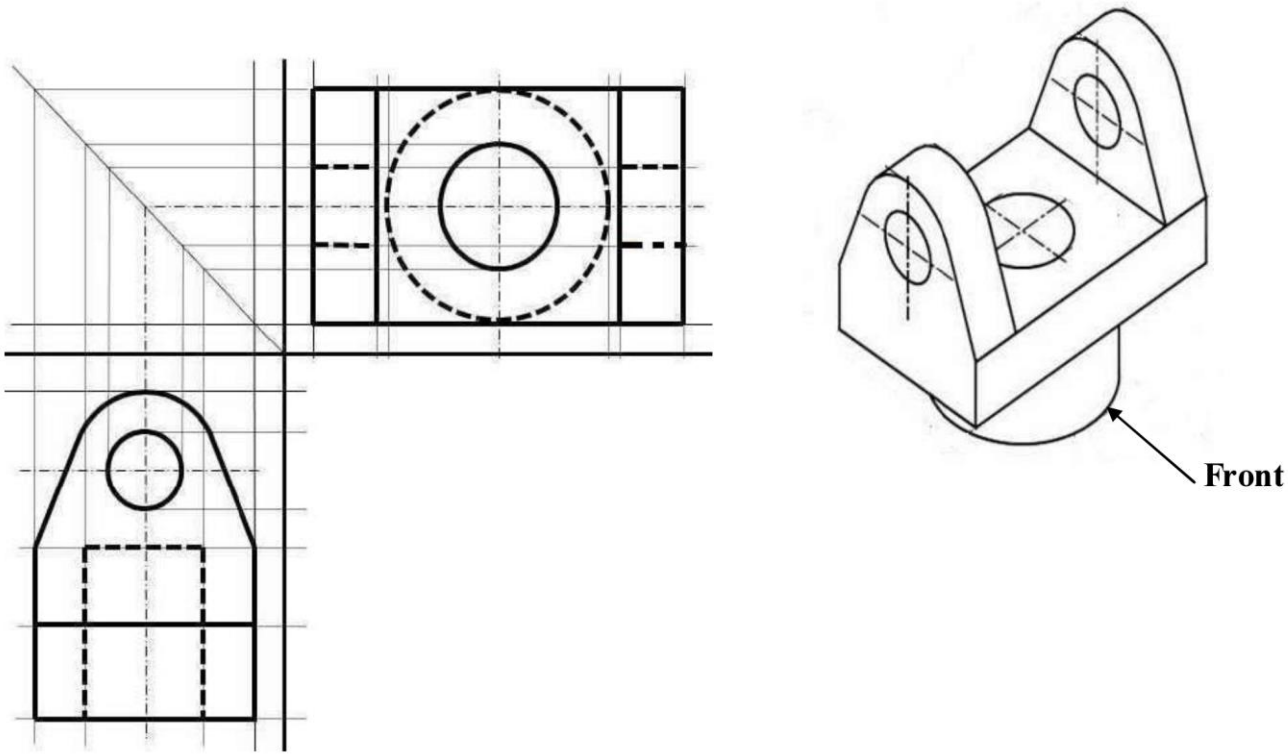
FILE NO.: _____	**DATE:** _____	

Topic Four: Sectioning in Engineering Drawing

Exercise (1): Given the top and the side views, sketch the front view as a full section. Noting that the solid material is mild steel.



(a)

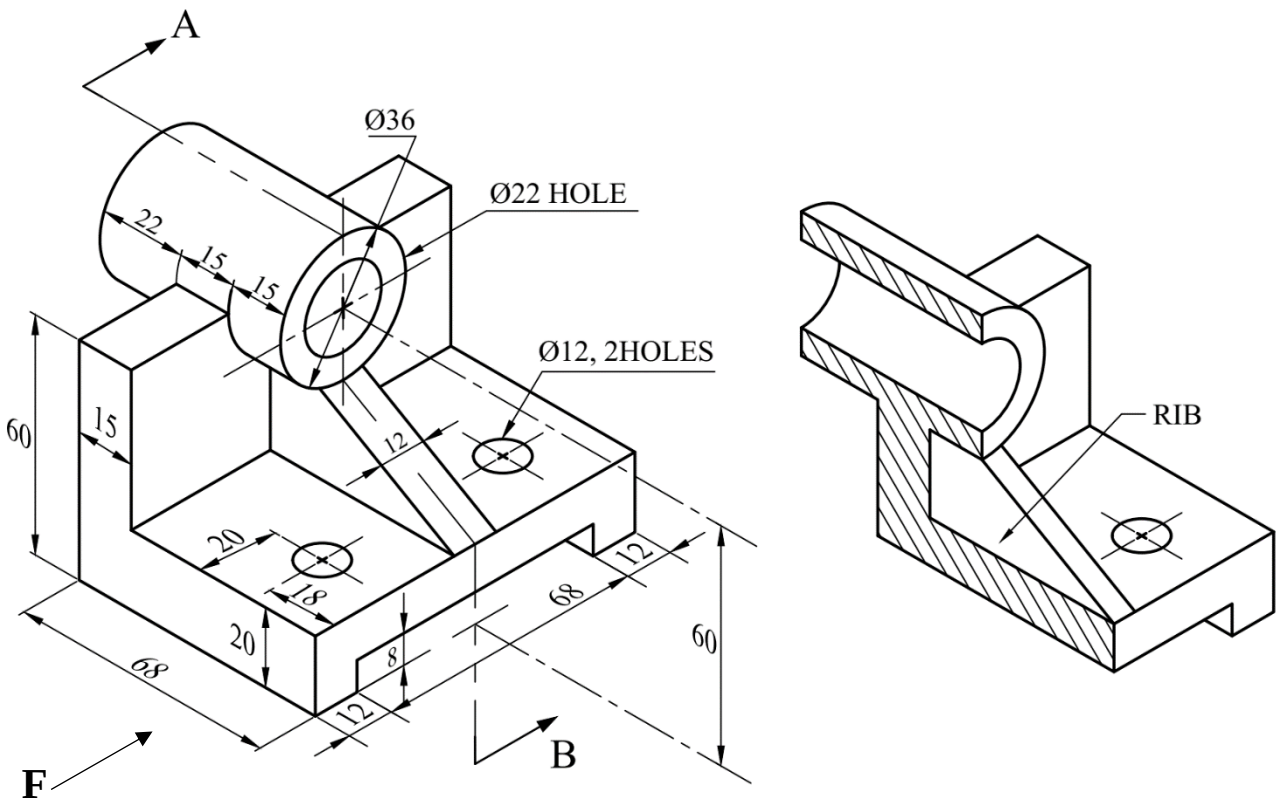


(b)

NAME: _____	**SECTION NO.:** _____	**17**
FILE NO.: _____	**DATE:** _____	

Exercise (2): Draw the full sectional front view at **A-B**, top view, and the right side view.

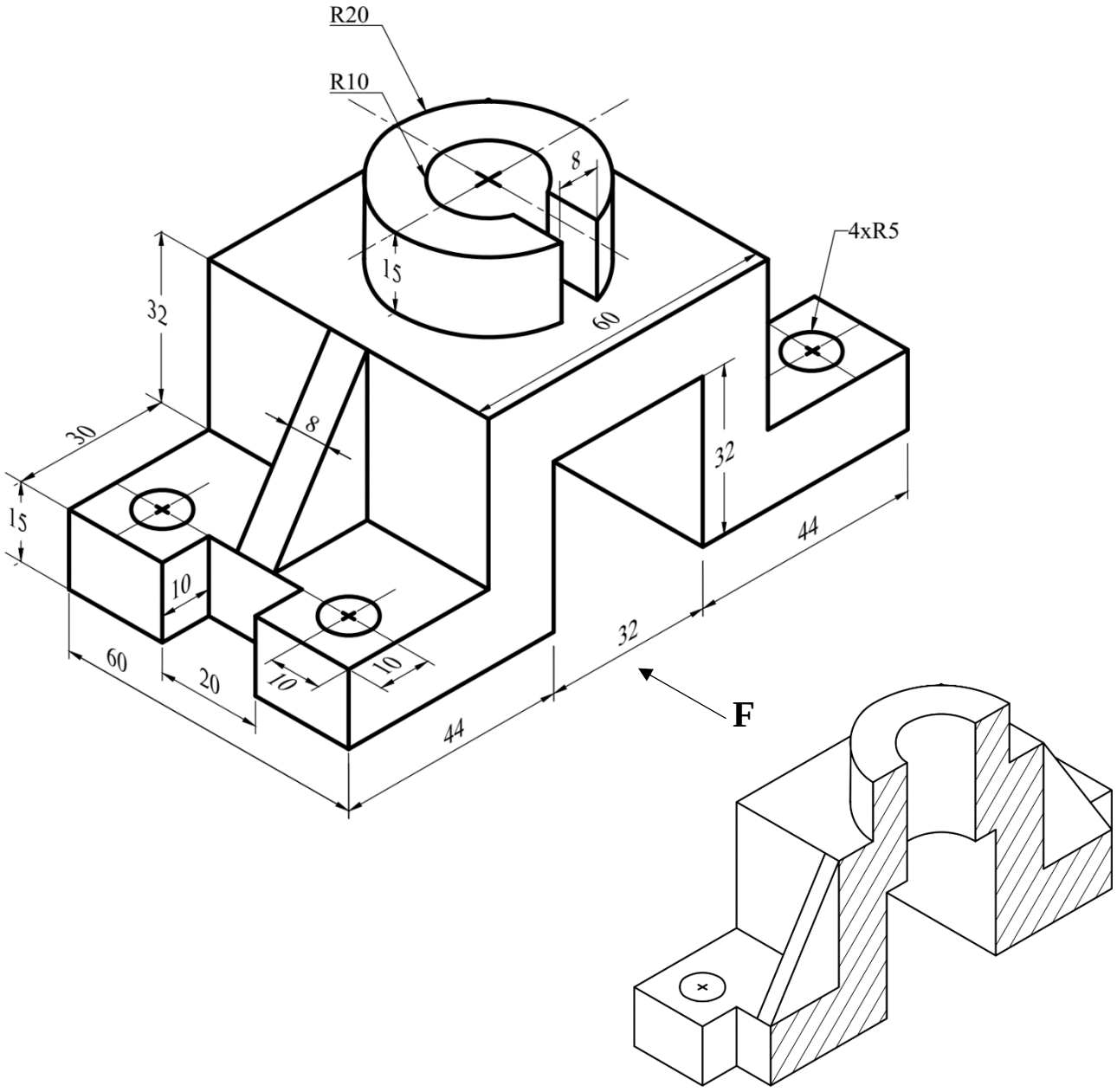
Note: All holes are through.



NAME: _____	**SECTION NO.:** _____	**18**
FILE NO.: _____	**DATE:** _____	

Exercise (3): For the given solid, draw the full sectional front view, top view, and the left side view.

Note: All holes are through.



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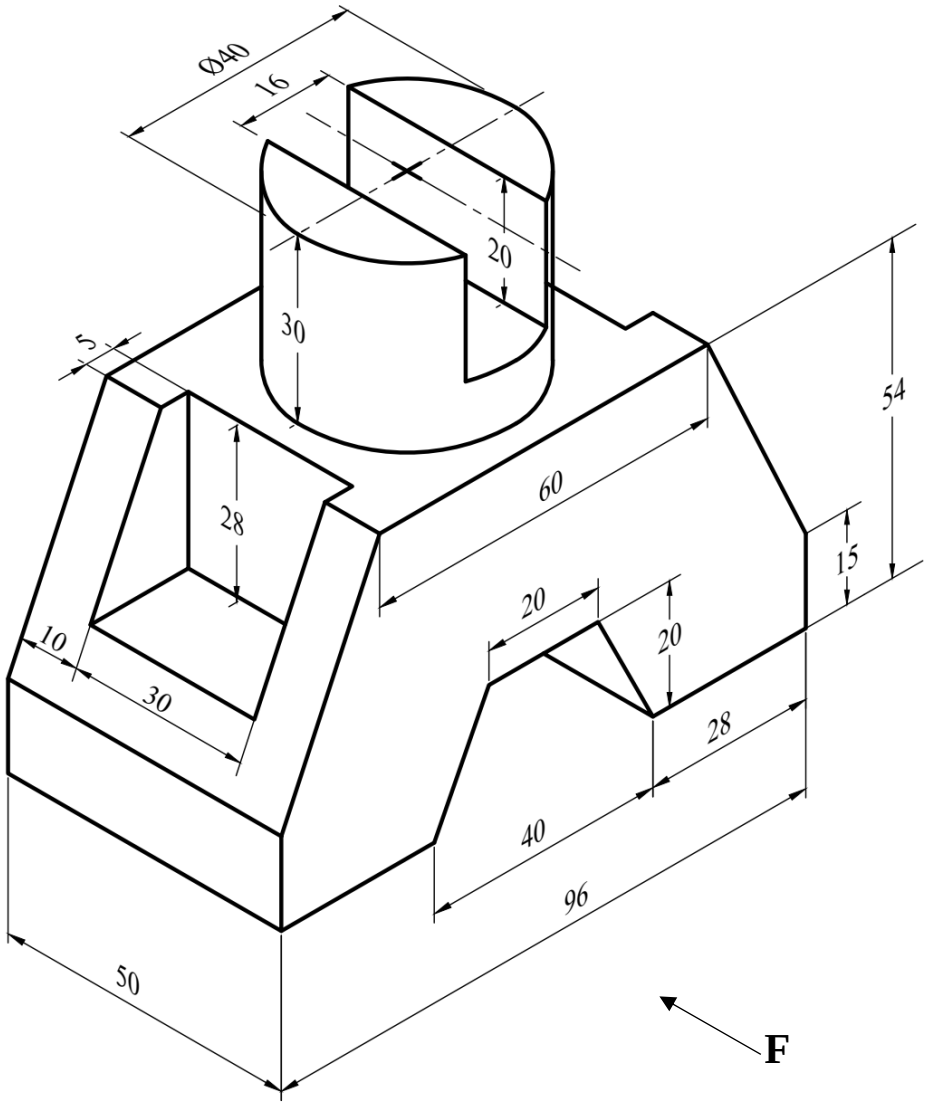
FILE NO.: _____	**DATE:** _____	

Exercise (4): For the given solid, draw the full sectional front view, top view, and the left side view.



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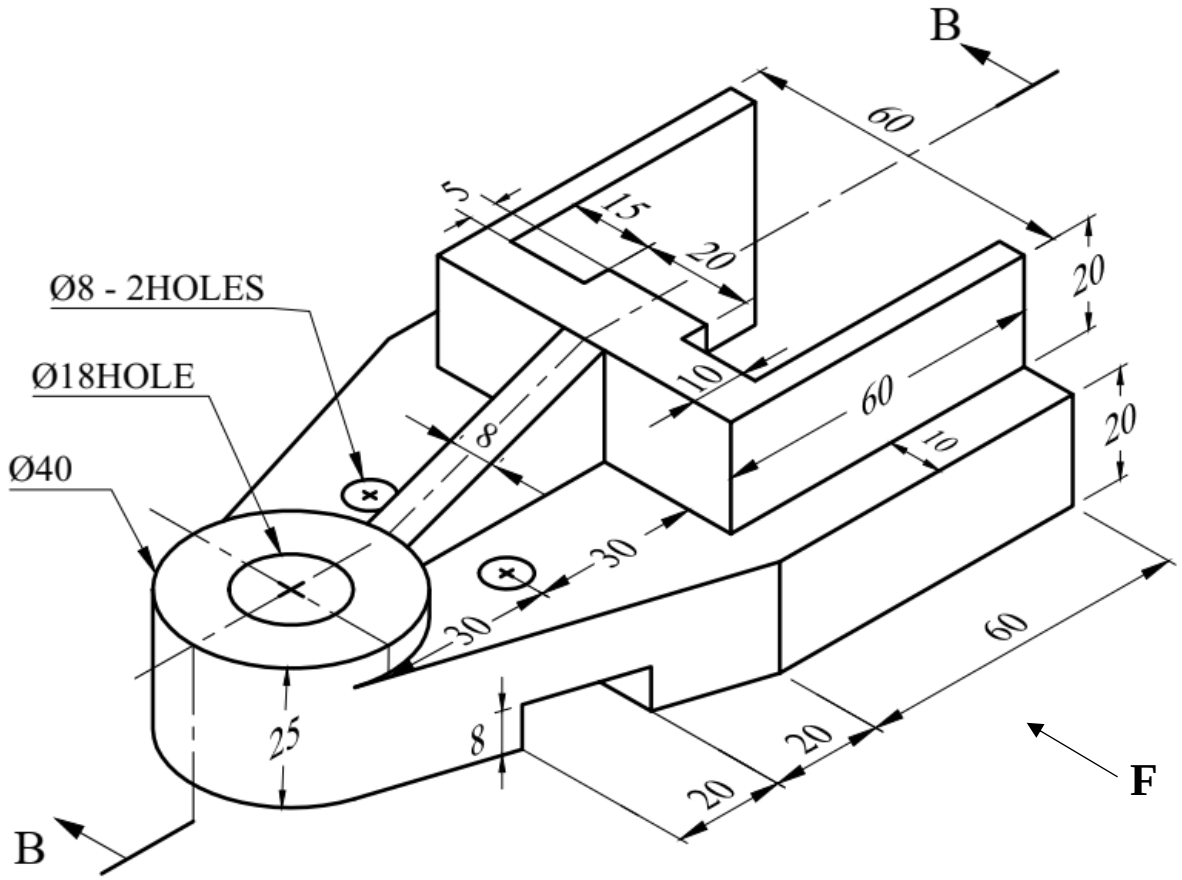
FILE NO.: _____	**DATE:** _____	

Exercise (5): Draw the full sectional front view at **B-B**, top view, and the left side view.

Note: All holes are through.



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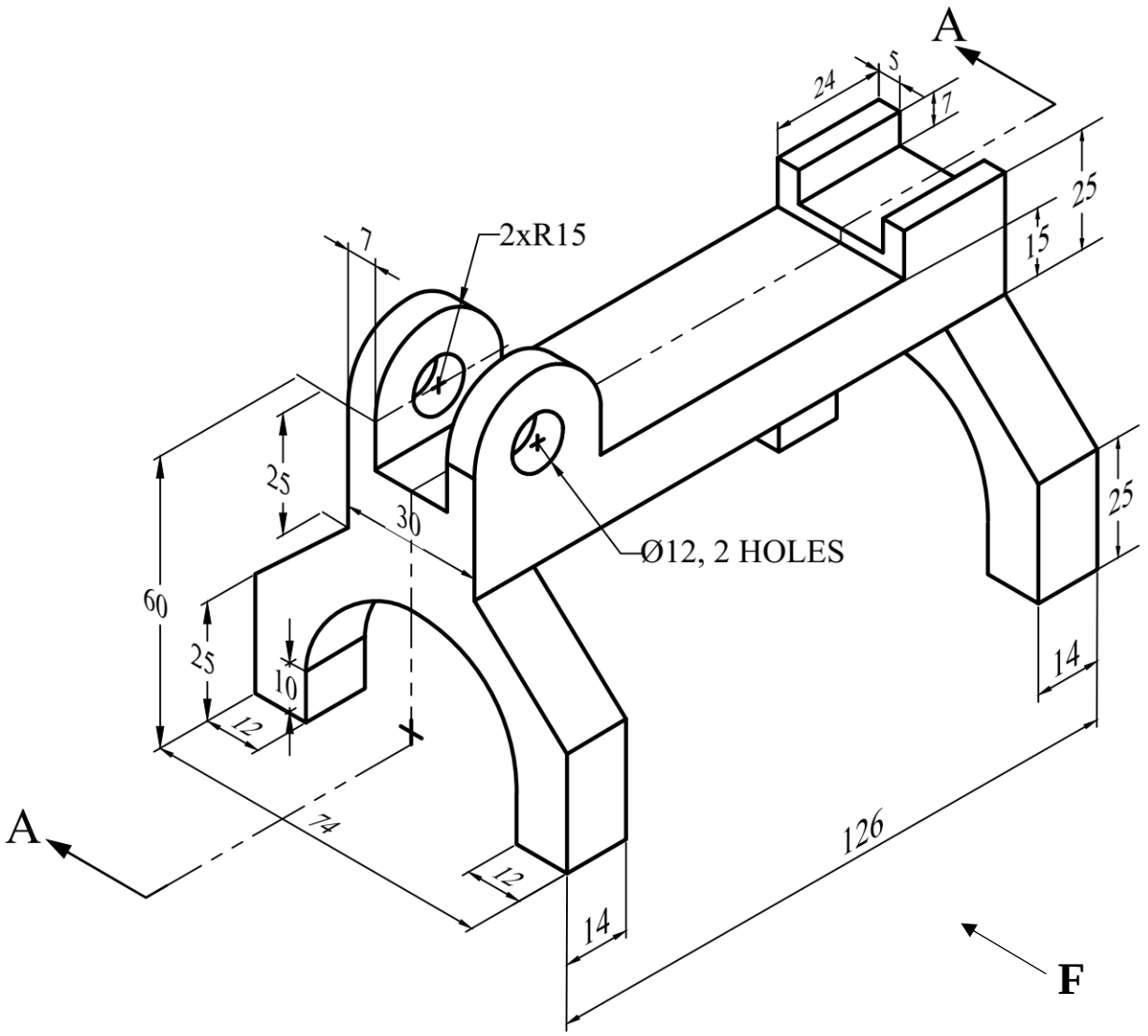
FILE NO.: _____	**DATE:** _____	

Exercise (6): Draw the full sectional front view at **A-A**, top view, and the left side view.

Note: All holes are through.



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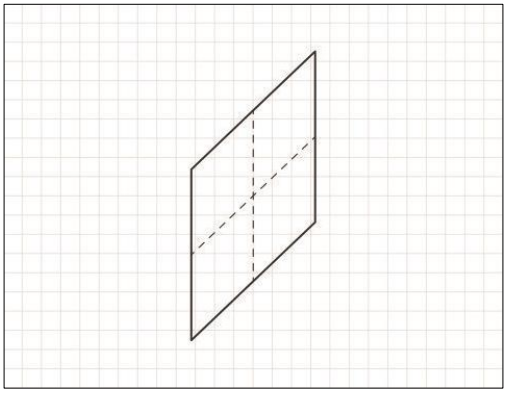
FILE NO.: _____	**DATE:** _____	

Topic Five: Pictorial Drawing (Oblique and Isometric)

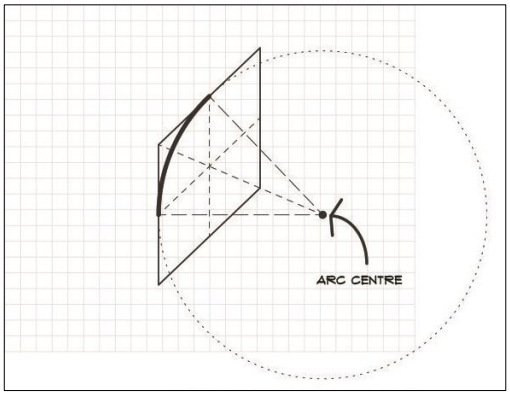
HOW TO DRAW A CIRCLE IN OBLIQUE AND ISOMETRIC VIEWS USING "FOUR CENTER" METHOD

OBLIQUE CIRCLE *

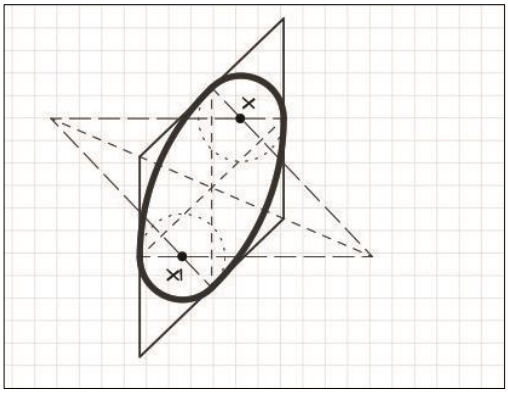
Step 1: Draw an oblique square with the sides equal to the diameter of the circle.



Step 2: Find adjacent side midpoints and construct intersecting perpendiculars. Repeat the process on the opposite side.



Step 3: using points (x) and (x_1) complete the smaller arcs to accomplish the total circle.



* Reference: https://archilibs.org/how-to-construct-a-paraline-circle-at-45/.

NAME: _____	**SECTION NO.:** _____	**23**
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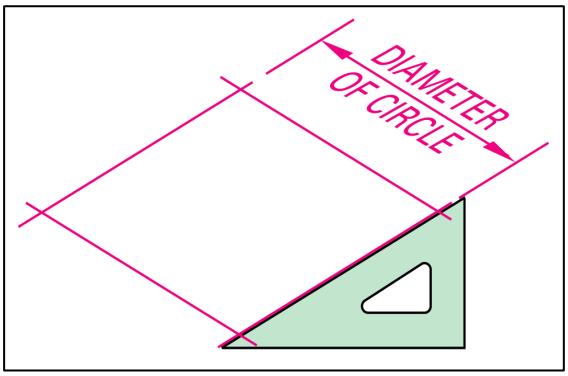
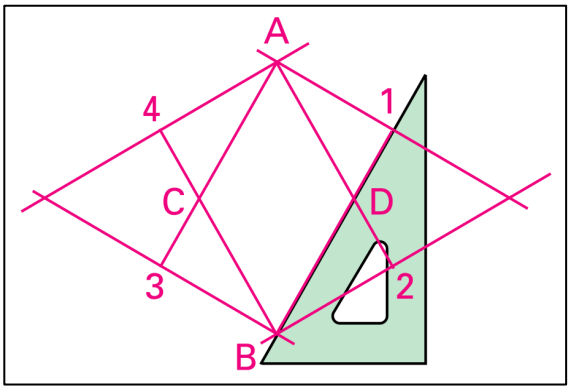
ISOMETRIC CIRCLE *

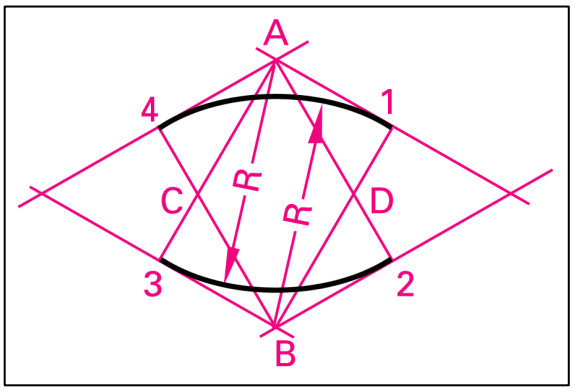
Step 1: Draw an isometric square with the sides equal to the diameter of the circle.



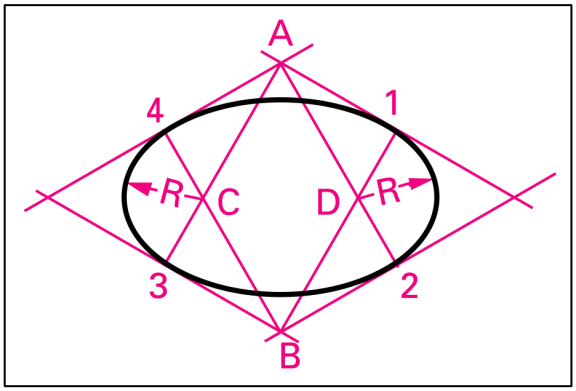
Step 2: Use a 30°-60° triangle to locate points (A), (B), (C), (D), and (1), (2), (3), (4).



Step 3: With (A) and (B) as centers and a radius equal to (A2) draw arcs as shown.



Step 4: With (C) and (D) as centers and a radius equal to (C4), draw arcs to complete the isometric circle (ellipse).



* Reference: Glencoe/McGraw-Hill (2003).

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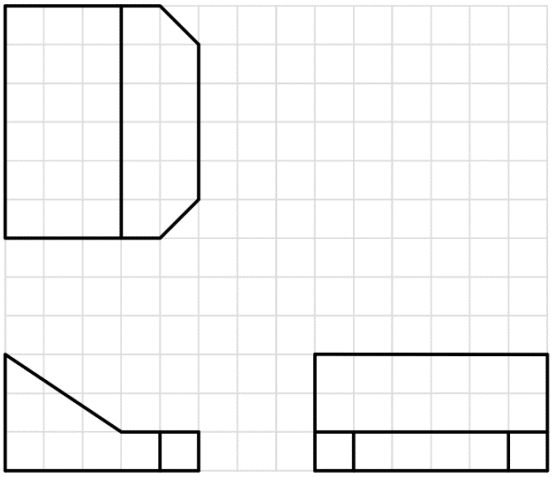
FILE NO.: _____	**DATE:** _____	

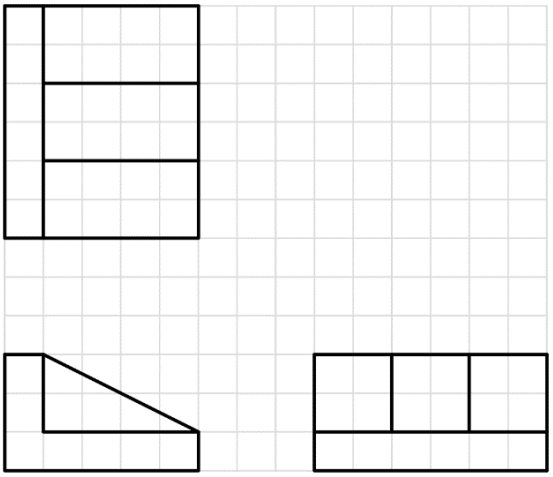
OBLIQUE DRAWINGS

Exercise (1): Using freehand sketch, make an oblique drawing for the following views.

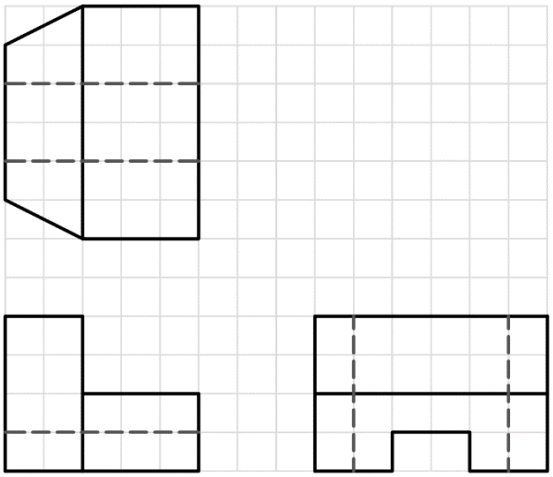
(A)



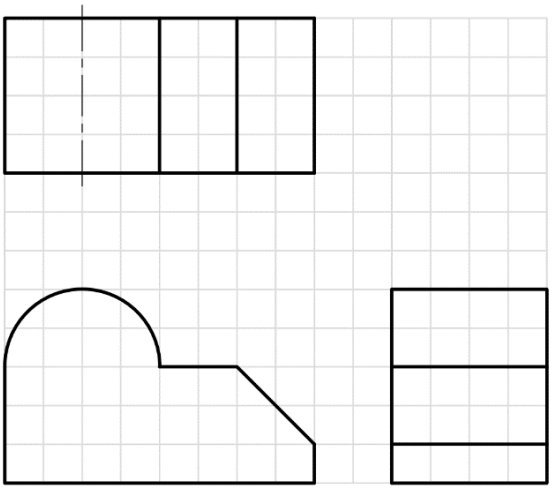
(B)



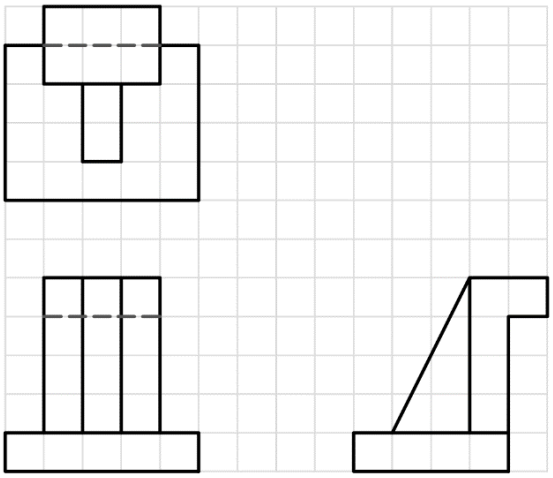
(C)



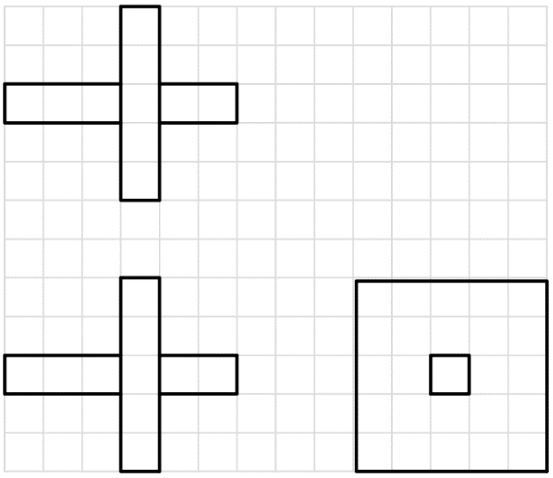
(D)



(E)



(F)



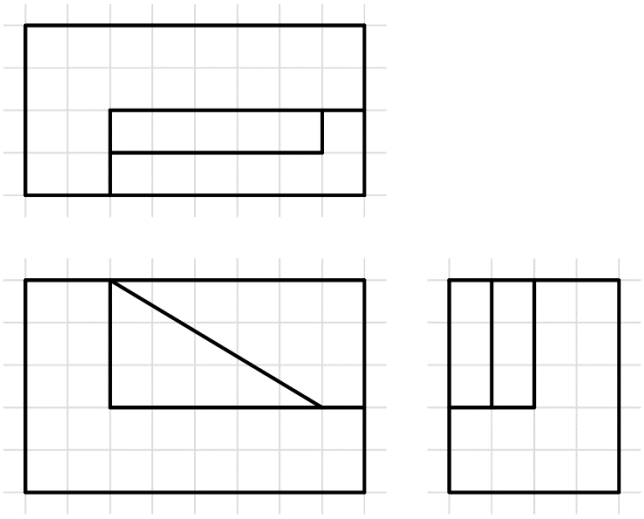
NAME: _____	**SECTION NO.:** _____	**25**
FILE NO.: _____	**DATE:** _____	

Oblique Grid Paper (Answer of Exercise 1):

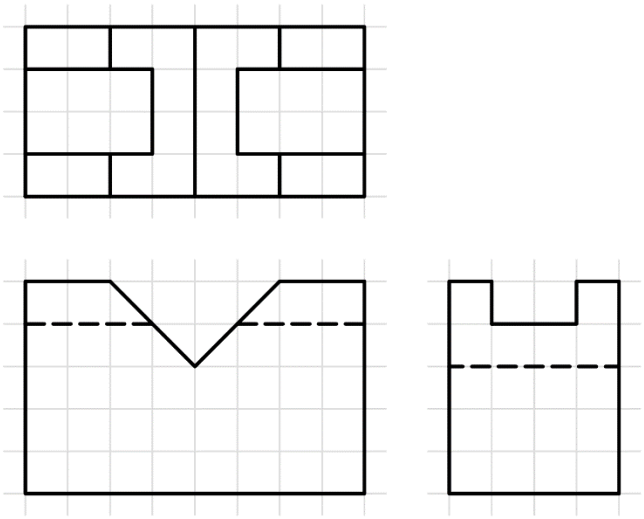
NAME: _____	**SECTION NO.:** _____	**26**
FILE NO.: _____	**DATE:** _____	

Exercise (2): Using freehand sketch, make an oblique drawing for the following views.

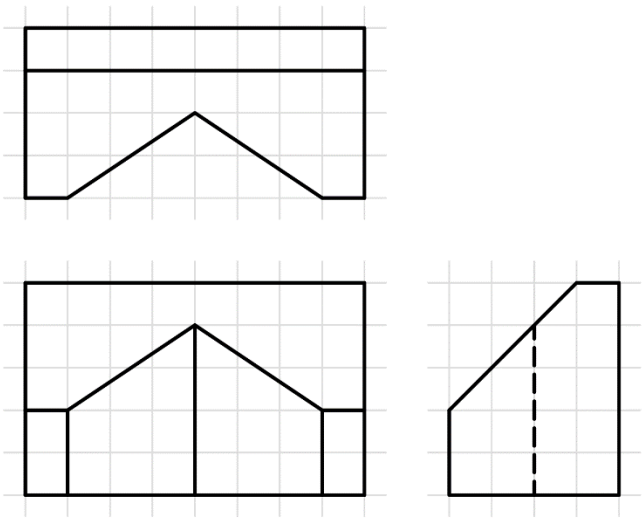
(A)



(B)



(C)

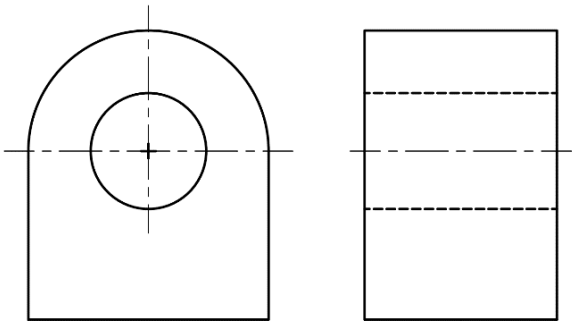


NAME: _____	**SECTION NO.:** _____	**27**
FILE NO.: _____	**DATE:** _____	

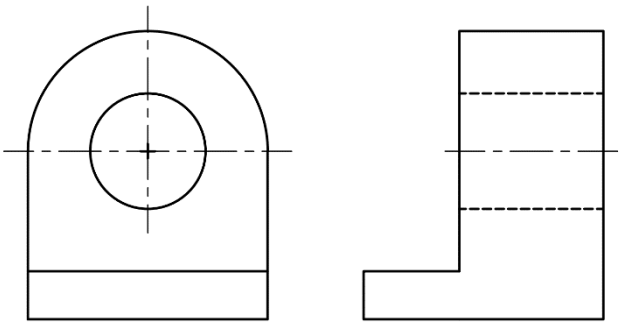
OBLIQUE DRAWINGS: CAVALIER AND CABINET

NOTE: CAVALIER IS THE FULL DEPTH AND CABINET IS THE HALF DEPTH.

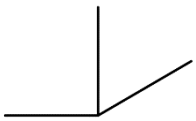
Exercise (3): For the given orthographic views, draw cavalier and cabinet oblique drawings.



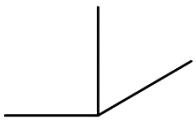
Front



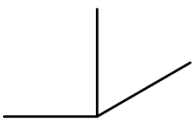
Front



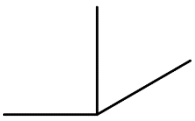
CAVALIER



CAVALIER



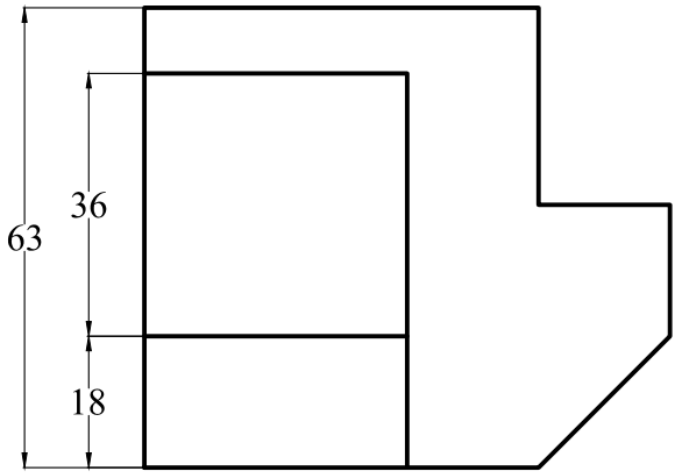
CABINET



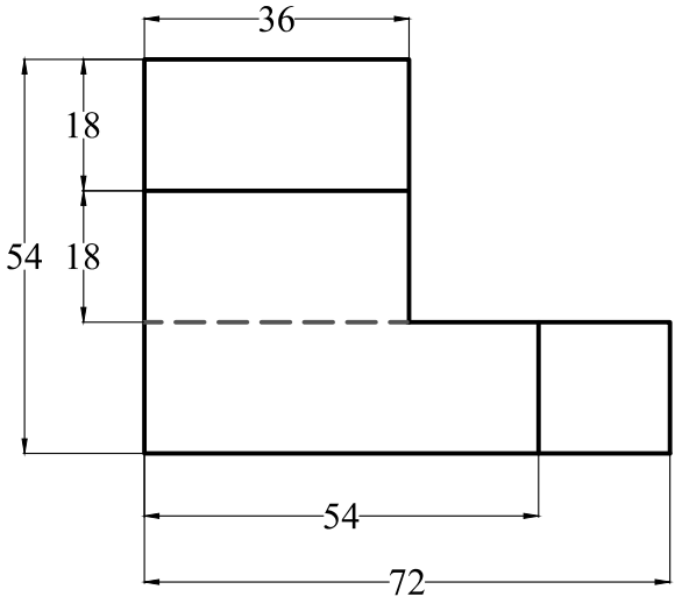
CABINET

NAME: _____	**SECTION NO.:** _____	**28**
FILE NO.: _____	**DATE:** _____	

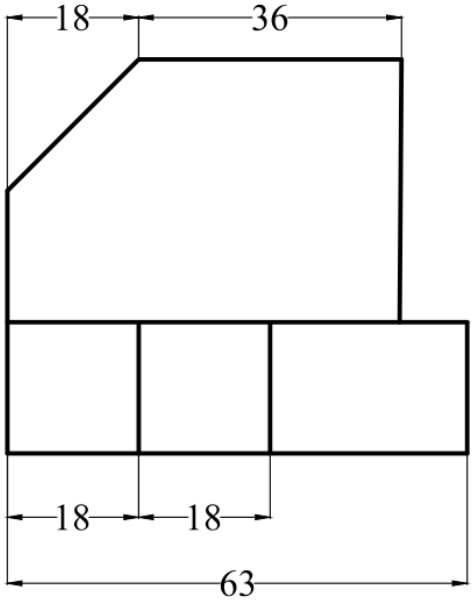
Exercise (4): For the given orthographic views, draw the corresponding Oblique drawing.



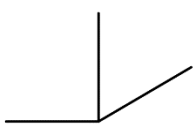
Top View



Front View

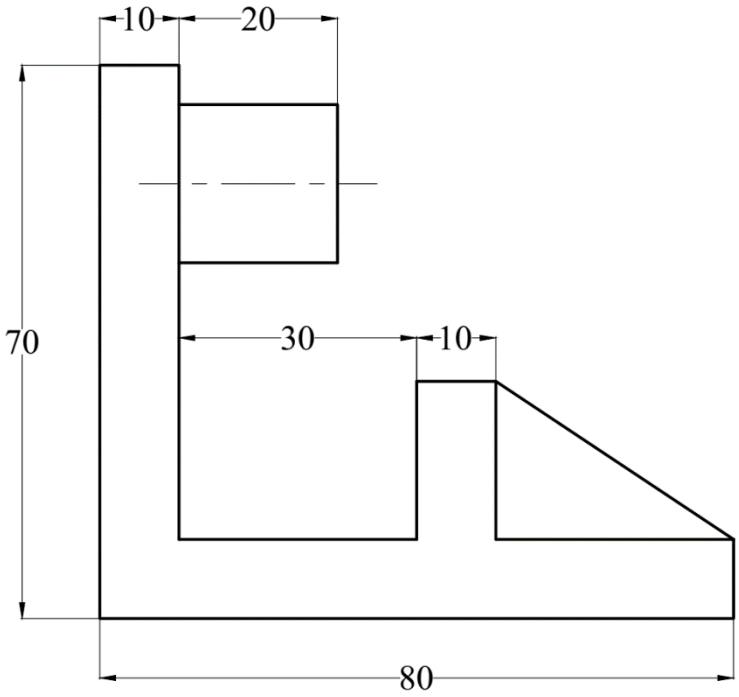


Right Side View

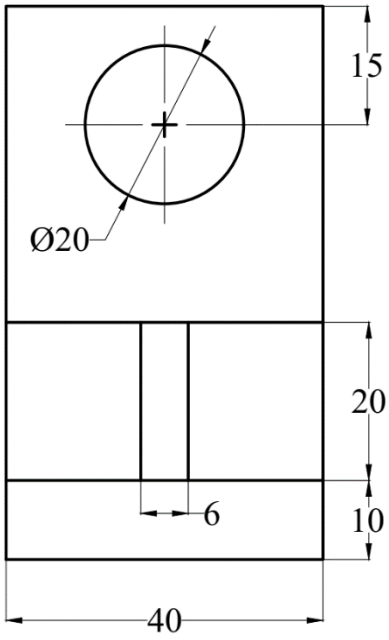


NAME: _____	**SECTION NO.:** _____	**29**
FILE NO.: _____	**DATE:** _____	

Exercise (5): For the given orthographic views, draw the corresponding Oblique drawing.



Left Side View



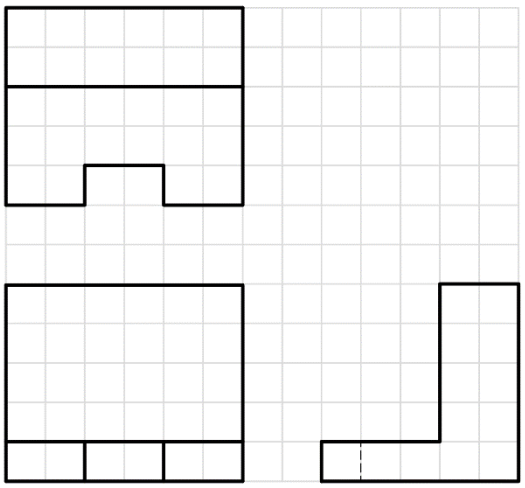
Front View

NAME: _____	**SECTION NO.:** _____	**30**
FILE NO.: _____	**DATE:** _____	

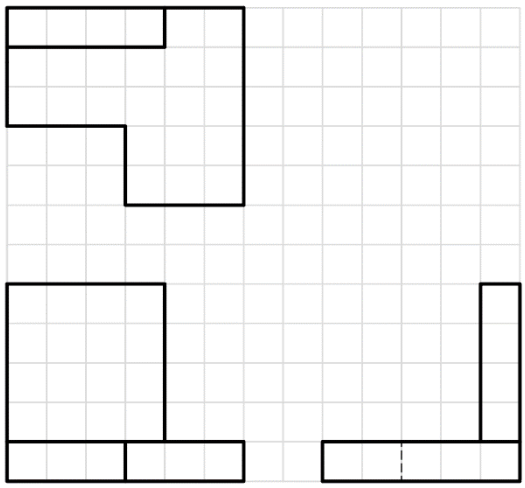
ISOMETRIC DRAWINGS

Exercise (1): Using freehand sketch, make an isometric drawing for the following views.

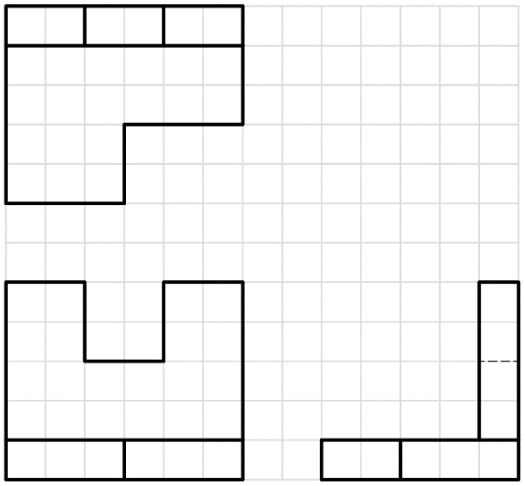
(A)



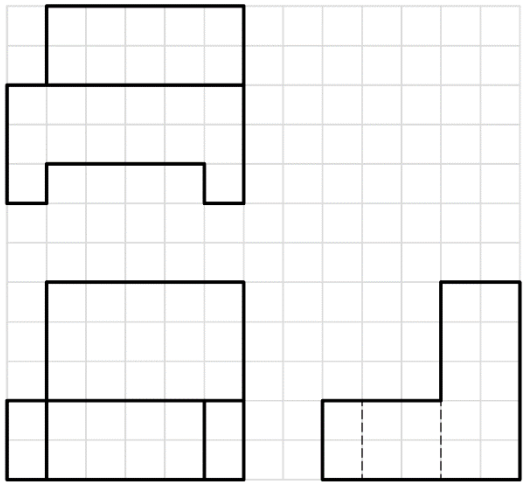
(B)



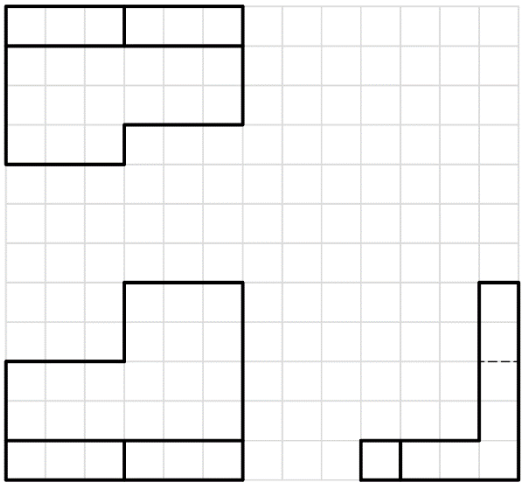
(C)



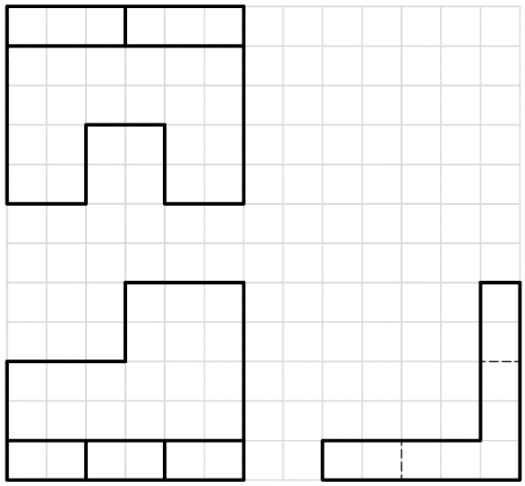
(D)



(E)



(F)



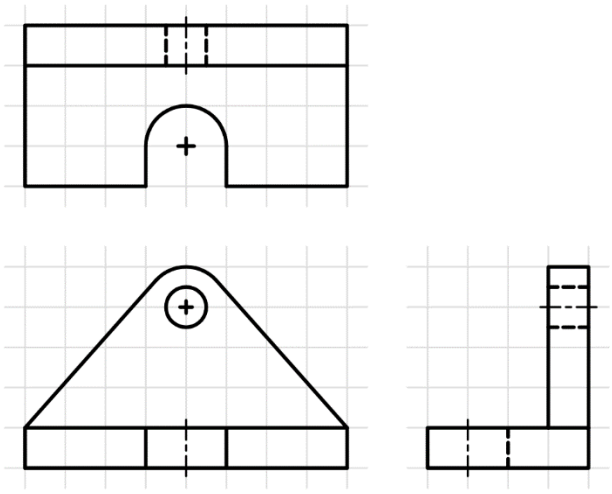
NAME: _____	**SECTION NO.:** _____	**31**
FILE NO.: _____	**DATE:** _____	

Isometric Grid Paper (Answer of Exercise 1):

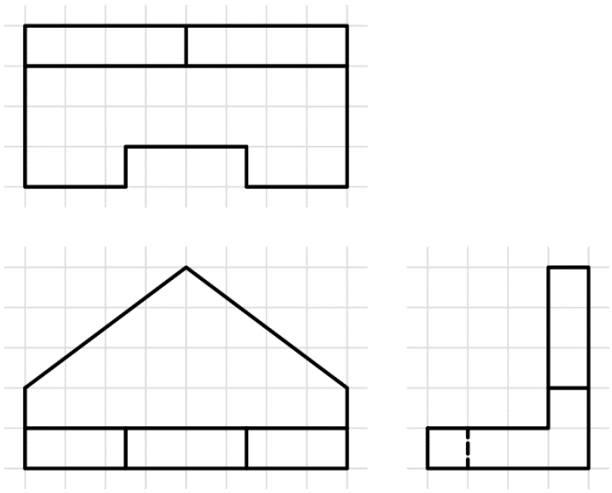
NAME: _____	**SECTION NO.:** _____	**32**
FILE NO.: _____	**DATE:** _____	

Exercise (2): Using freehand sketch, make an isometric drawing for the following views.

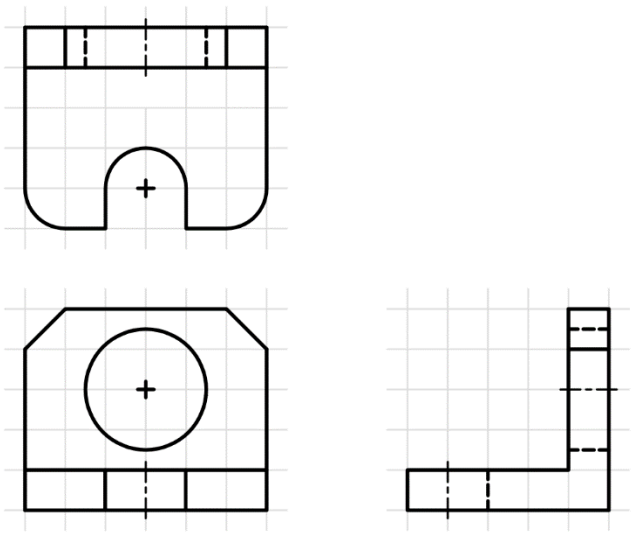
(A)



(B)

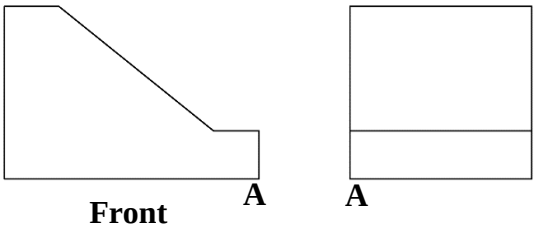


(C)

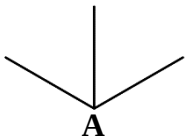


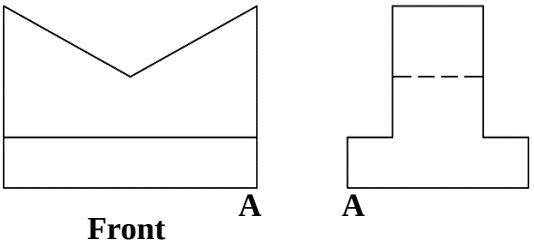
NAME: _____	**SECTION NO.:** _____	**33**
FILE NO.: _____	**DATE:** _____	

Exercise (3): For the given orthographic views, draw isometric drawings. **Double the dimensions**.

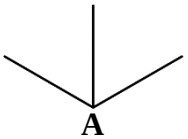


Front



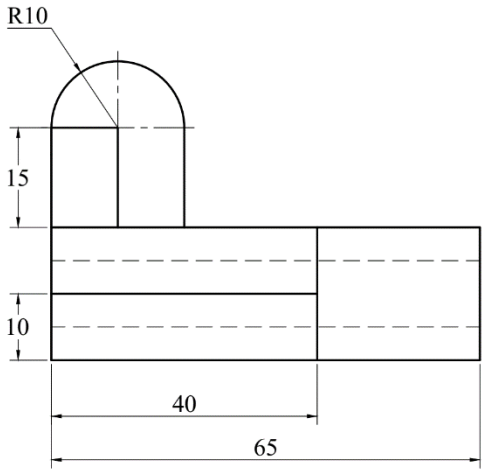


Front

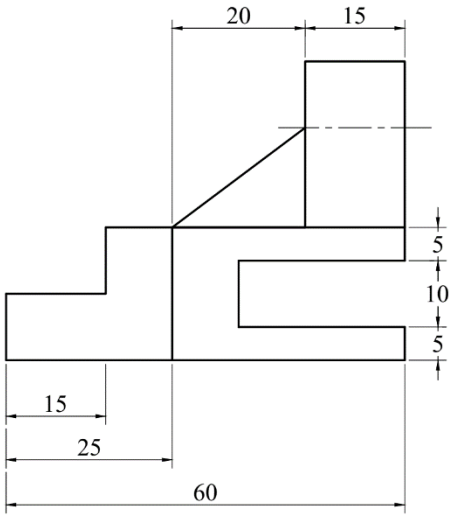


NAME: _____	**SECTION NO.:** _____	**34**
FILE NO.: _____	**DATE:** _____	

Exercise (4): For the given orthographic views, draw an isometric drawing.

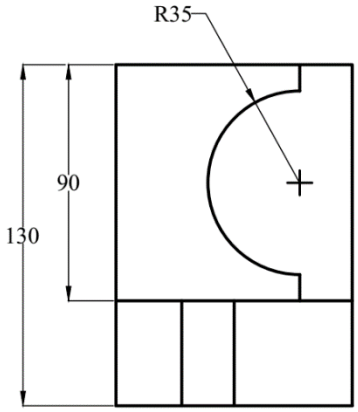


Front View

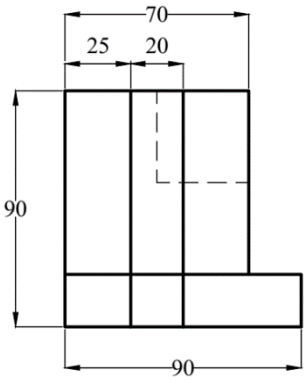


Right Side View

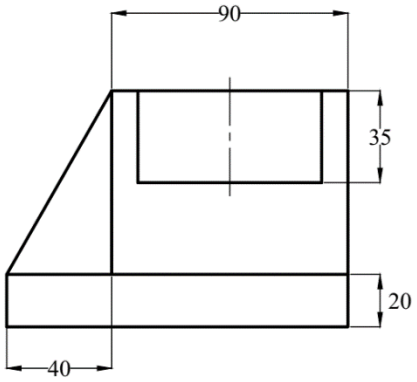
Exercise (5): For the given orthographic views, draw an isometric drawing.



Top View



Front View



Right Side View

NAME: _____	**SECTION NO.:** _____	**35**
FILE NO.: _____	**DATE:** _____	

Topic Six: Basic Dimensioning

DIMENSIONING RULES

A. Dimension Placement

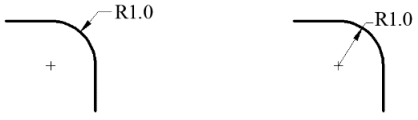
- Place dimensions on the most descriptive views.
- Take dimensions from visible lines not from hidden lines.
- Organize and align dimensions for ease of reading.
- The dimensions are normally positioned to maintain a minimum of 3/8" (9.52mm) open space around the object.
- Do not repeat dimensions.
- Dimensions should not cross other lines (unless necessary).
- Extension lines may cross other extension lines or object lines if necessary.
- Arrowheads are long and narrow (3 to 1 ratio).
- Do not place dimensions within views (unless necessary).
- Give an overall dimension and omit one of the chain dimensions.
- Shorter dimensions are placed inside longer ones.
- Angles may be dimensioned either by coordinates or angular measurements in degrees.
- Place angular dimensions outside the angle.
- Dimension cylinders in their rectangualr views with diameter.

B. Dimensioning for Holes

- Dimension holes in the circular view.

C. Dimensioning for Fillets, Rounds, and Arcs

- **Rounds** are dimensioned either by a leader pointing toward the center of the arc or the arrow may be placed inside (if space permits).



- A very slightly rounded corners may be denoted by: Break Corner.
- **Fillets** (inside rounded corners) are dimensioned by the same rules as rounds.
- If all fillets and rounds haveequal radii, the note "All Fillets and Rounds 1.0R" may be used instead of dimensioning each sperately.
- **Arcs** are dimensioned with a radius. Small arcs are dimensioned as they were fillets and rounds.

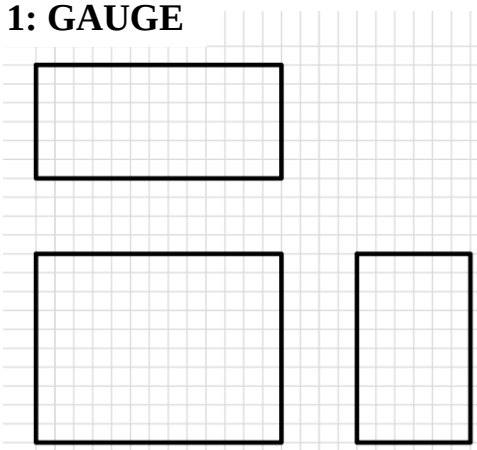
BASIC DIMENSIONING: FREEHAND

FOLLOW INSTRUCTIONS **A** OR **B** AS ASSIGNED. COUNT THE GRID TO DETERMINE DIMENSIONS. SCALE: FULL SIZE.

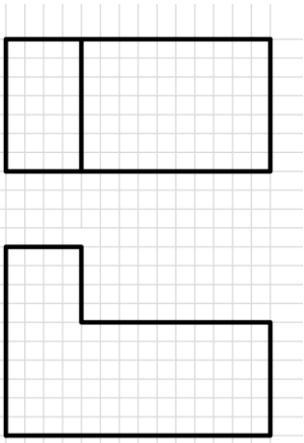
A: DIMENSION COMPLETELY OMITTING NUMERALS.

B: DIMENSION COMPLETELY WITH NUMERALS.

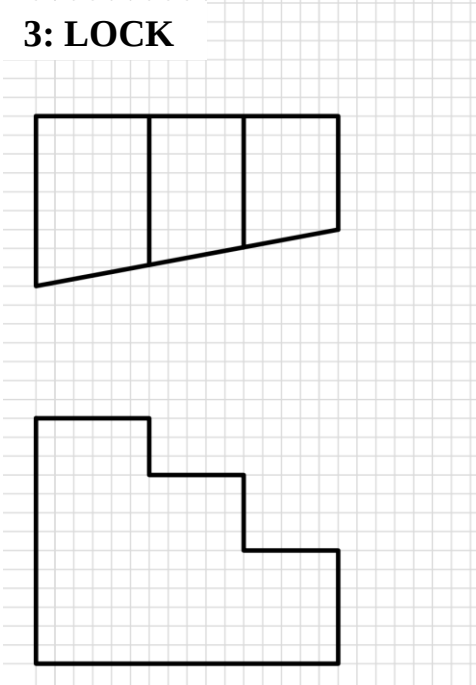
1: GAUGE



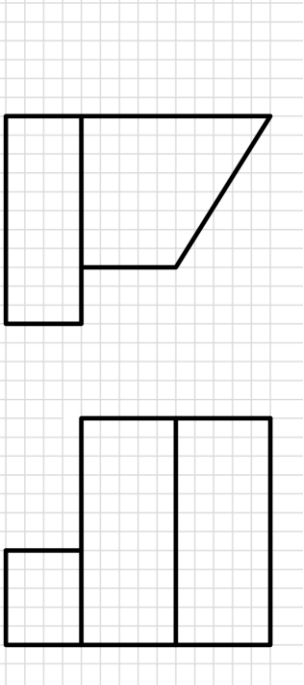
2: STOP



3: LOCK

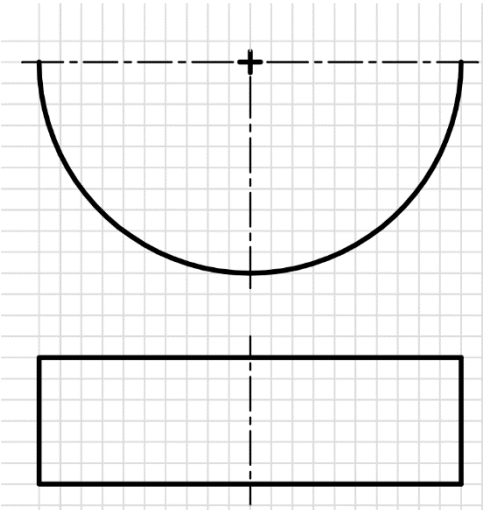


4: MOUNT

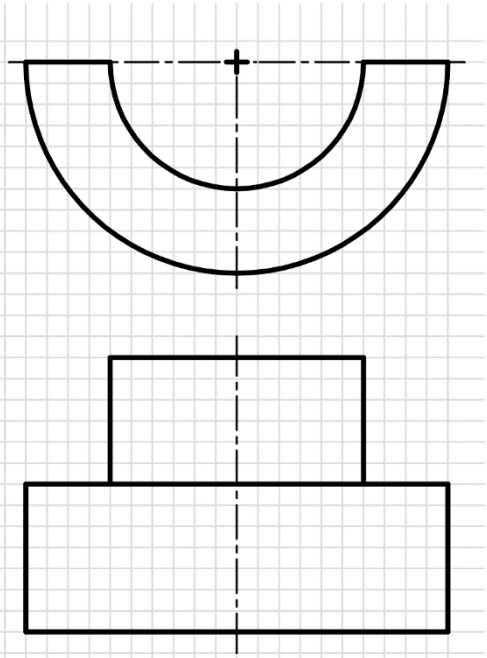


NAME: _____	**SECTION NO.:** _____	**37**
FILE NO.: _____	**DATE:** _____	

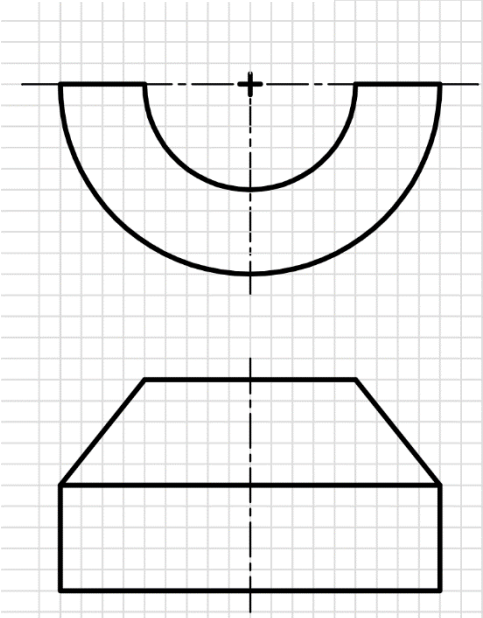
5: SPACER



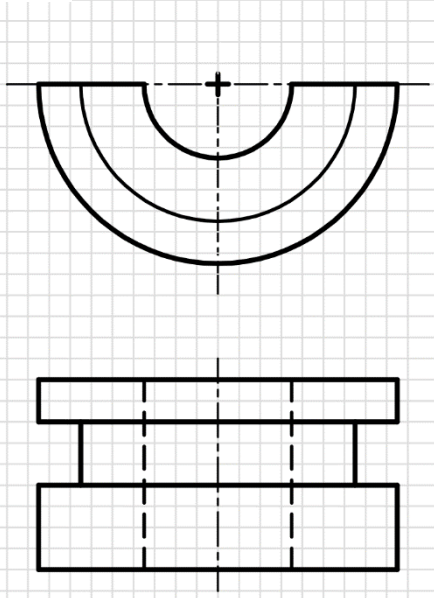
6: PULLEY BLANK



7: DUST GUARD

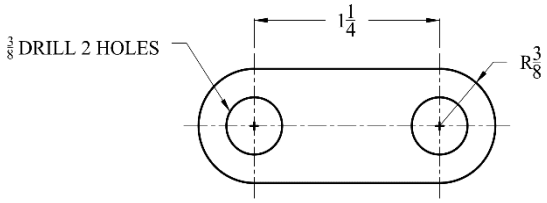


8: SLEEVE



NAME: _____	**SECTION NO.:** _____	**38**
FILE NO.: _____	**DATE:** _____	

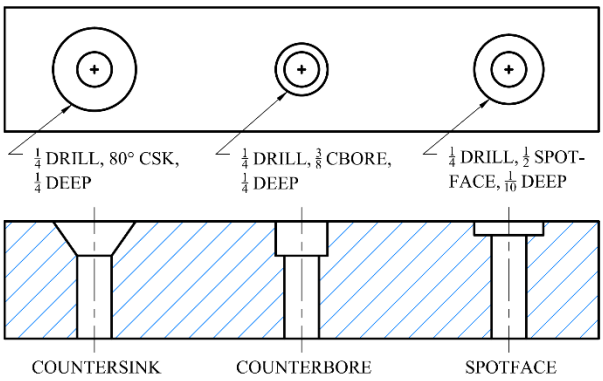
DIMENSIONING: NOTES FOR HOLES



HOLE NOTES:

CYLINDRICAL HOLES ARE USUALLY DIMENSIONED BY NOTES SPECIFYING THE MACHINE OPERATION WITH A LEADER IN THE CIRCULAR VIEW.

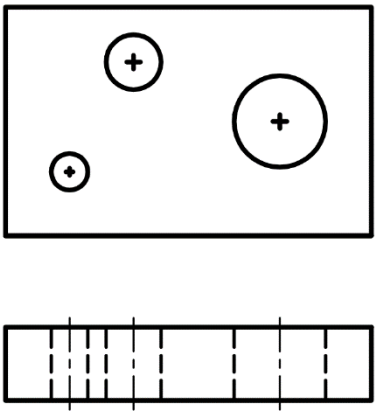
NOTE: THE LINK ABOVE NEEDS NO OVERALL DIMENSION SINCE OBJECT HAS CIRCULAR ENDS.



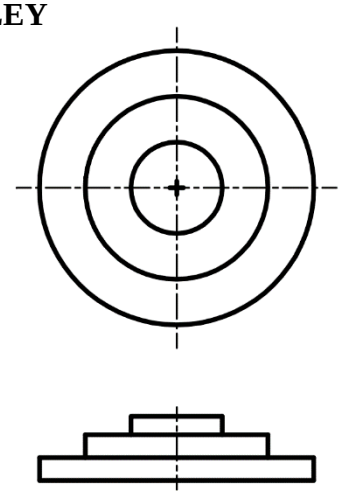
THE NOTES ABOVE ARE TYPICAL TO THE MORE COMMON TYPES OF MACHINED HOLES. LEADERS POINT TOWARD THE CENTERS OF THE HOLES. LEADERS ARE DRAWN IN THE CIRCULAR VIEWS.

DIMENSION THE OBJECTS BELOW SCALE: FULL SIZE.

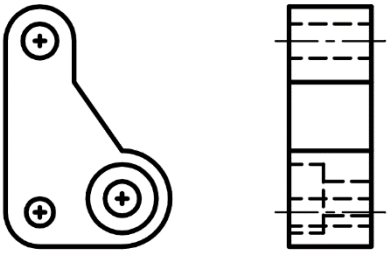
1: DRILL FIXTURE



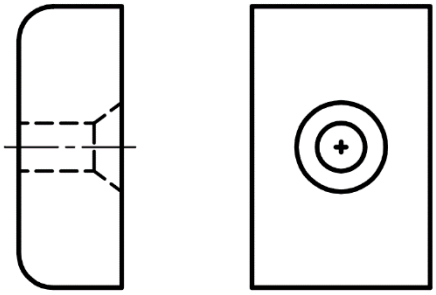
2: PULLEY



3: LEVER LINK



4: CLAMP



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FILE NO.: _____	**DATE:** _____	

Topic Seven: Descriptive Geometry (Auxiliary Projection)

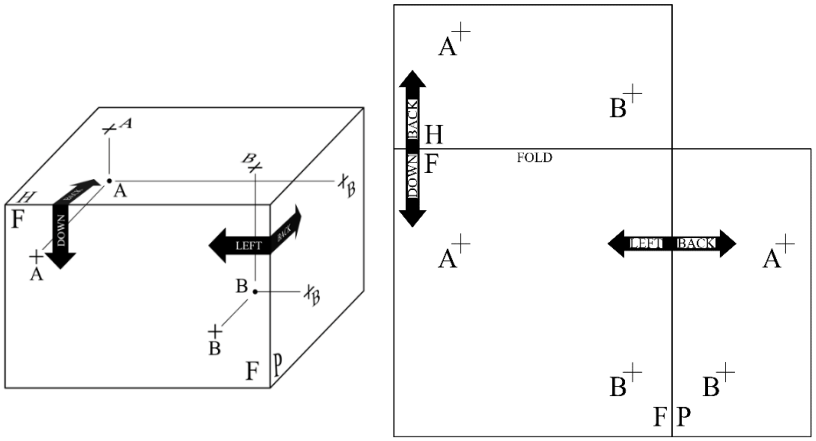
TOPICS

1. Tracing of points, lines and planes.
2. True Length.
3. True Shape.
4. Constructing the **Shortest Distance (Perpendicularity):**
    a. From a point to a given line.
    b. From a point to a given plane.
5. The true **Angle** of intersection using plane method:
    a. Between two lines.
    b. Between line and plane.
    c. Between two planes **(The Dihedral Angle)**.

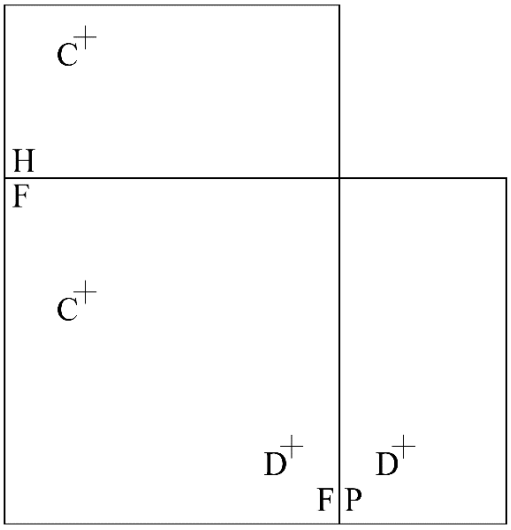
POINT

THE EXAMPLES AT THE RIGHT SHOW THE OBLIQUE AND ORTHOGRAPHIC PROJECTIONS OF POINTS A AND B.

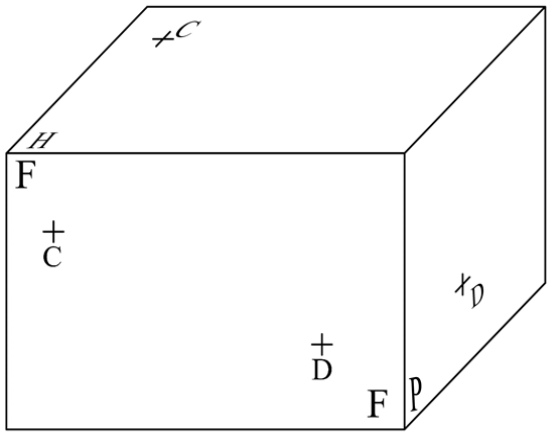
IT SHOW THE DIRECTIONAL RELATIONSHIPS AS WELL. CUT OUT THE ORTHOGRAPHIC DRAWING AND FOLD AS INDICATED TO PRODUCE A MODEL.



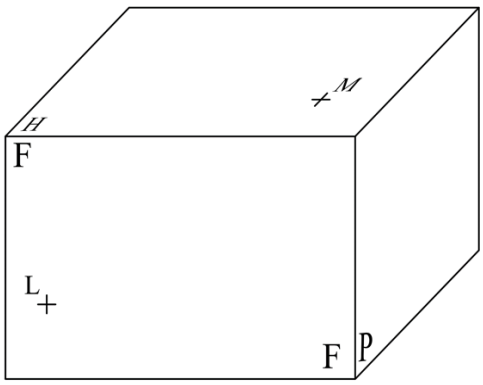
1. DRAW THE MISSING ORTHOGRAPHIC PROJECTIONS OF POINTS **C** AND **D**.



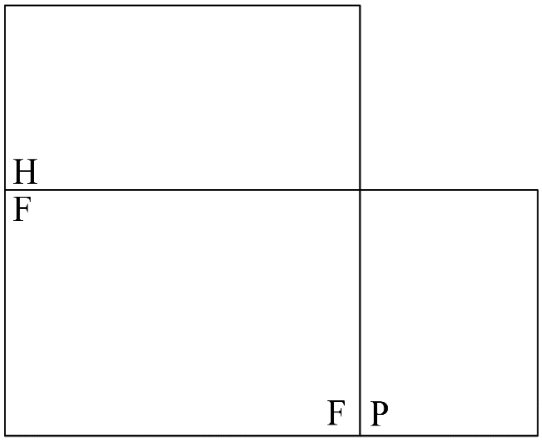
2. DRAW THE OBLIQUE PROJECTIONS OF POINTS **C** AND **D**. DRAW THE POSITIONS OF THESE IN SPACE.



3. POSITION **L** IS 20mm BEHIND THE FRONTAL PLANE AND POINT **M** IS 13mm BELOW THE HORIZONTAL PLANE. DRAW THE OBLIQUE PROJECTIONS OF POINTS **L** AND **M** AND THEIR POSITION IN SPACE.



4. DRAW THE OBLIQUE PROJECTIONS OF POINTS **L** AND **M** AS LOCATED IN PROBLEM (3).



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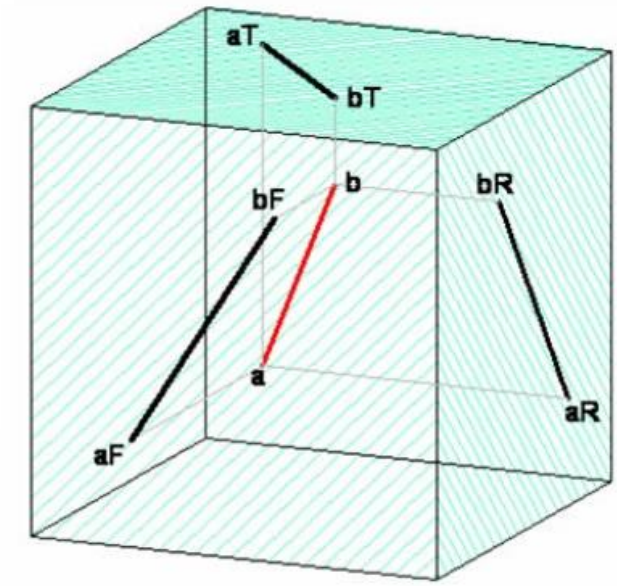
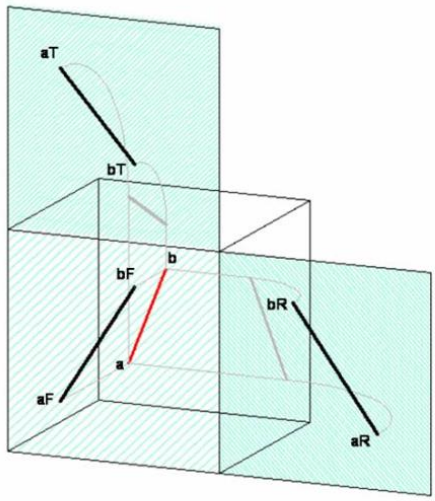
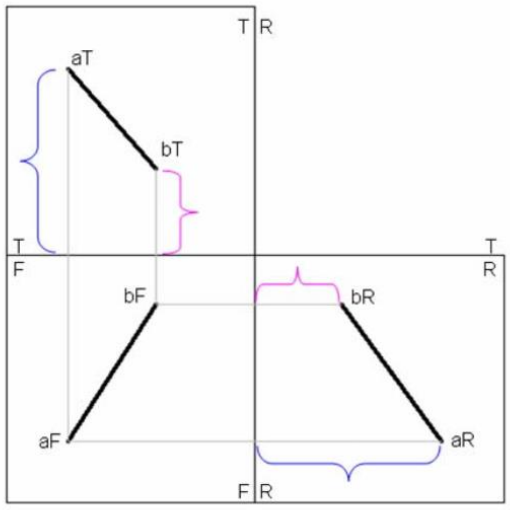
LINE PROJECTION







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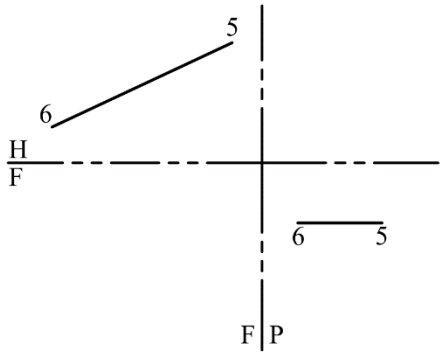
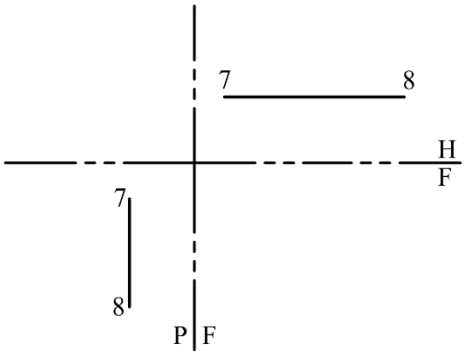
LINE PROJECTION

DRAW THE MISSING VIEWS OF EACH LINE AND INDICATE WHAT TYPE OF LINE EACH IS. LABEL TRUE LENGTH LINES **TL**.

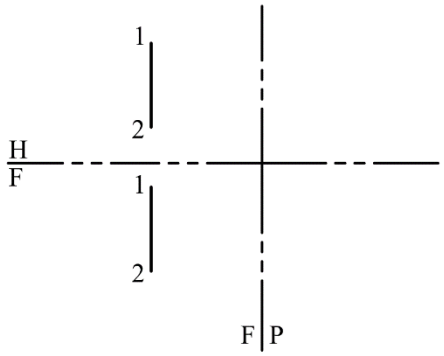
1 TYPE:_____



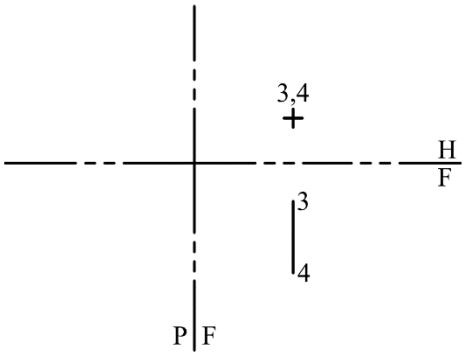
2 TYPE:_____



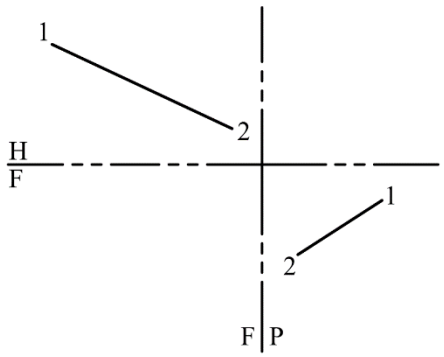
3 TYPE:_____



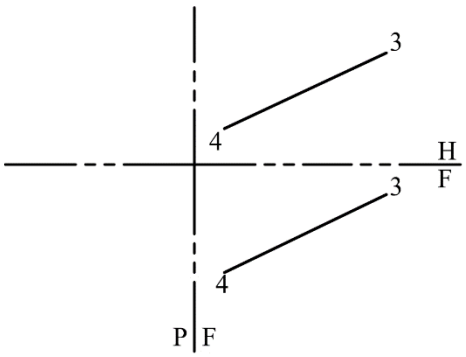
4 TYPE:_____



5 TYPE:_____



6 TYPE:_____



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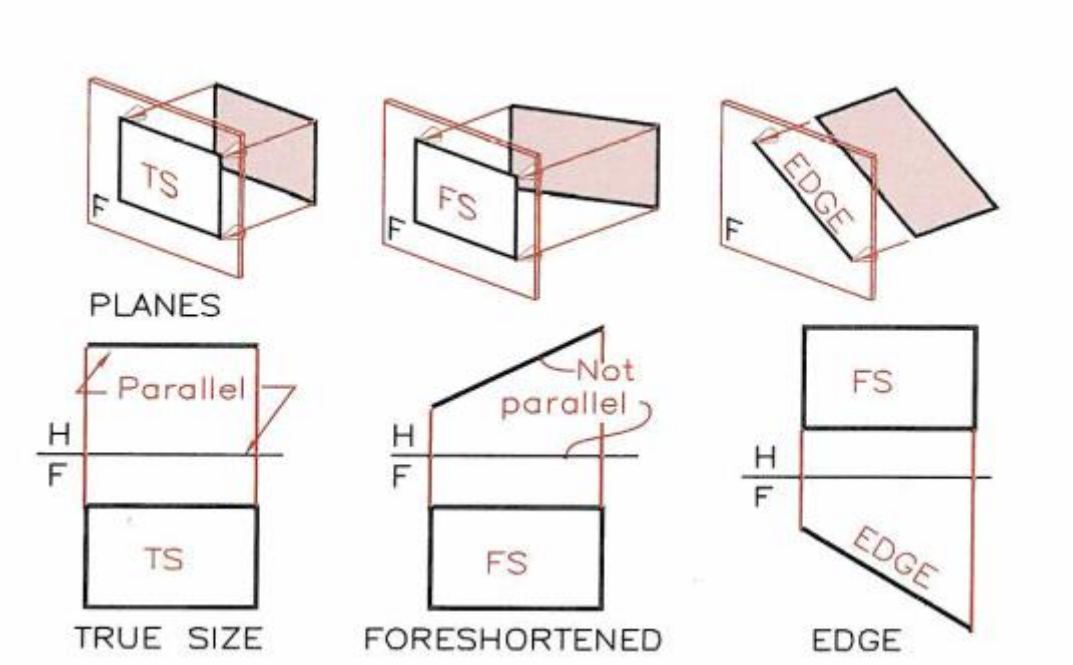
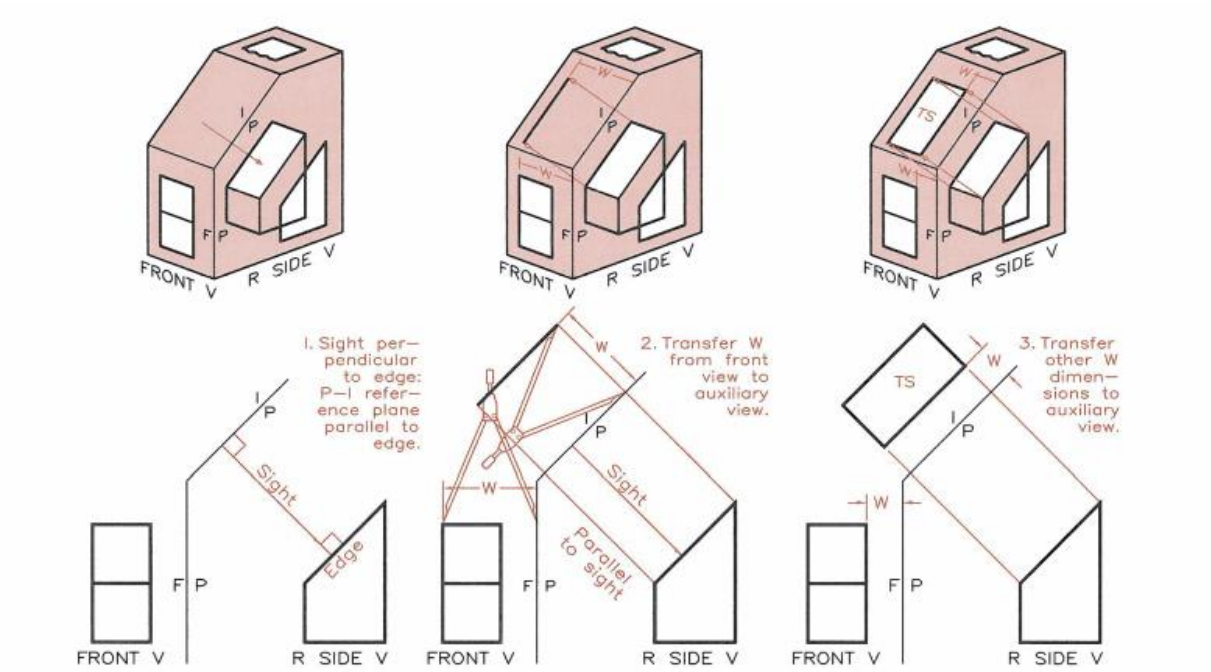
PLANE PROJECTION





15.22 From the side: Folding-line method:

Step 1 Draw a line of sight perpendicular to the edge of the inclined surface. Draw the P-1 fold line parallel to the edge view, and draw the F-P fold line between the given views.

Step 2 Project the corners of the edge view parallel to the line of sight. Transfer the width dimensions (W) from the front view to locate a line in the auxiliary view.

Step 3 Find the other corners of the inclined surface by projecting to the auxiliary view. Locate the points by transferring the width dimensions (W) from the front view to the auxiliary view.

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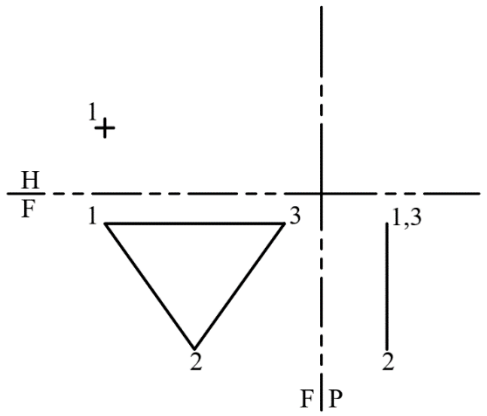
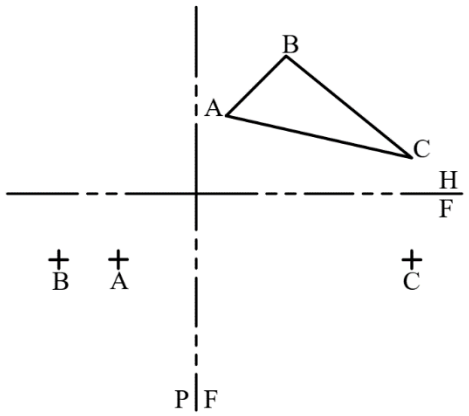
PLANE PROJECTION

DRAW THE MISSING VIEWS OF EACH PLANE. SPECIFY THE TYPE OF PLANE AND WHERE THE PLANE APPEARS TRUE SHAPE. LABEL THAT VIEW AS **TS**.

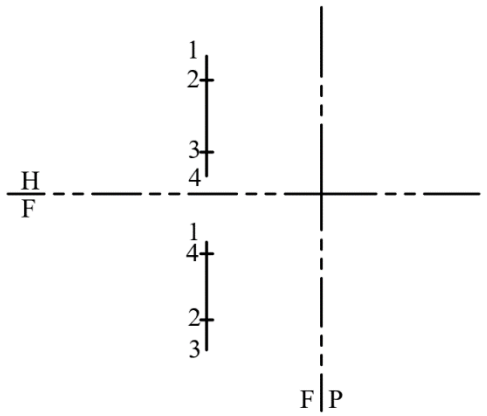
1 TYPE:_____



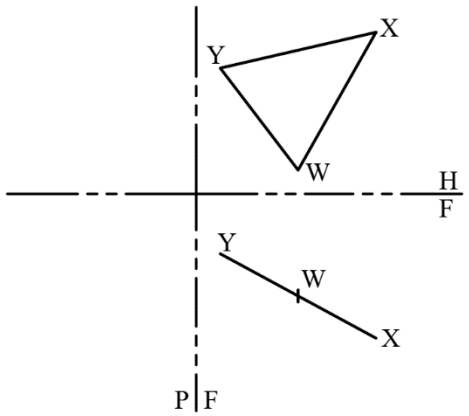
2 TYPE:_____



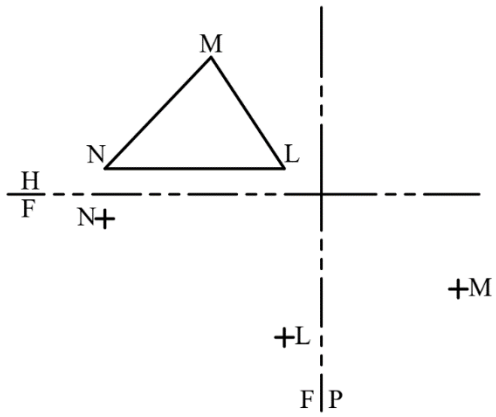
3 TYPE:_____



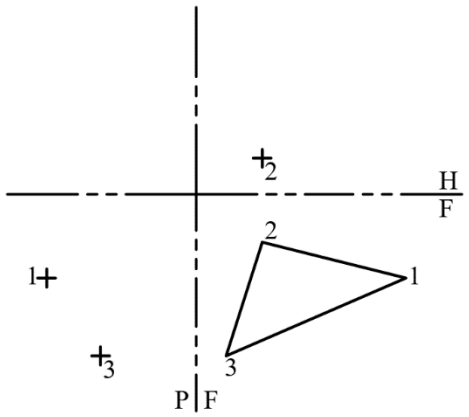
4 TYPE:_____



5 TYPE:_____



6 TYPE:_____



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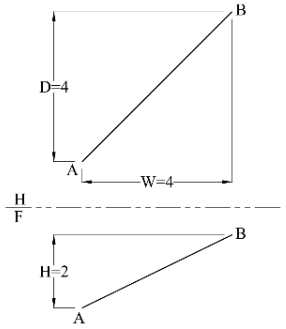
TRUE LENGTH OF A LINE

W = WIDTH

D = DEPTH

H = HEIGHT



MATHEMATICAL EXAMPLE (PYTHAGOREAN THEORY)

$TL = \sqrt{W^2 + D^2 + H^2}$

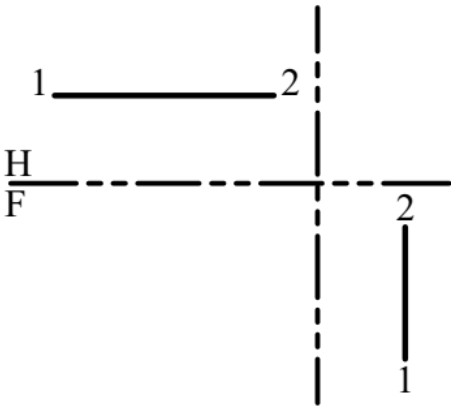
$W^2 = 16$

$D^2 = 16$

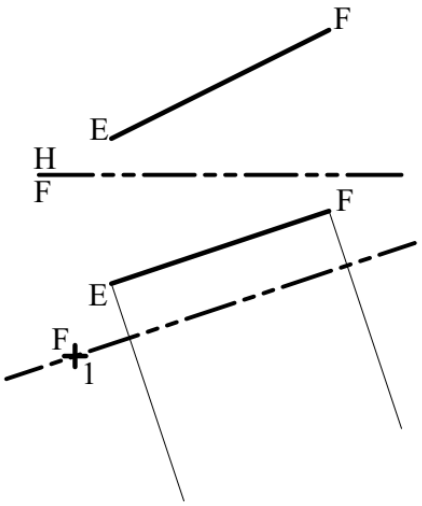
$H^2 = 4$

REDRAW THE FOLLOWING EXERCISES ON THE GIVEN **"GRID PAPER"**, THEN DETERMINE THE TRUE LENGTHS OF EACH LINE USING GRAPHICAL METHOD.

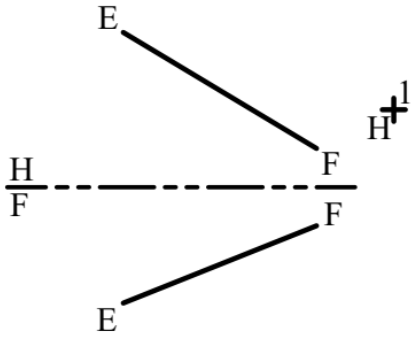
1 METRIC SCALE 1:600, **TL** = _____



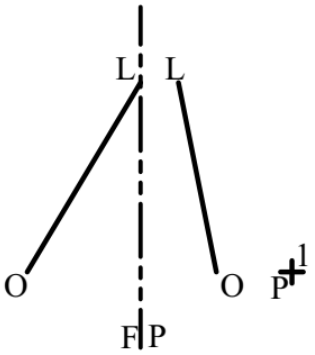
2 METRIC SCALE 1:30, **TL** = _____



3 METRIC SCALE 1:60, **TL** = _____



4 METRIC SCALE 1:40, **TL** = _____



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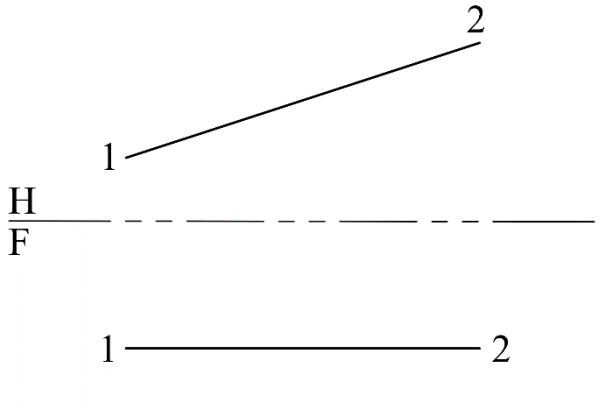
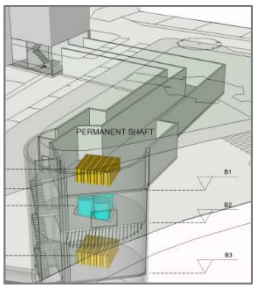
POINT VIEW

1 OBTAIN A POINT VIEW OF LINE 1-2.



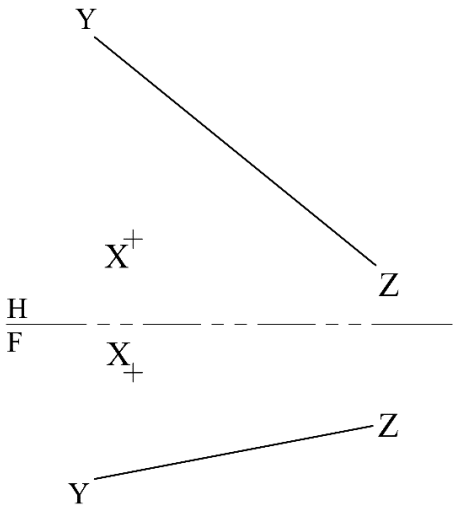
2 GIVEN HORIZONTAL AND FRONT VIEWS OF A TUNNEL, WHERE **YZ** IS THE CENTERLINE OF A TUNNEL AND **X** IS A POINT ON THE EARTH'S SURFACE.



A. DETERMINE THE **SHORTEST DISTANCE** FOR A VENTILATION SHAFT TO BE DUG FROM POINT **(X)** TO **(YZ)**.

B. FIND THE **TRUE LENGTH** OF THE **VENTILATION SHAFT** FROM POINT **(X)** TO **(YZ)**.

NOTE: START PROJECTION FROM **TOP**.



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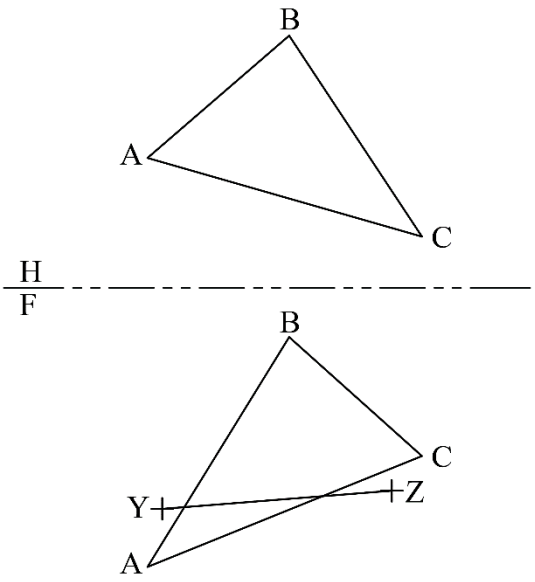
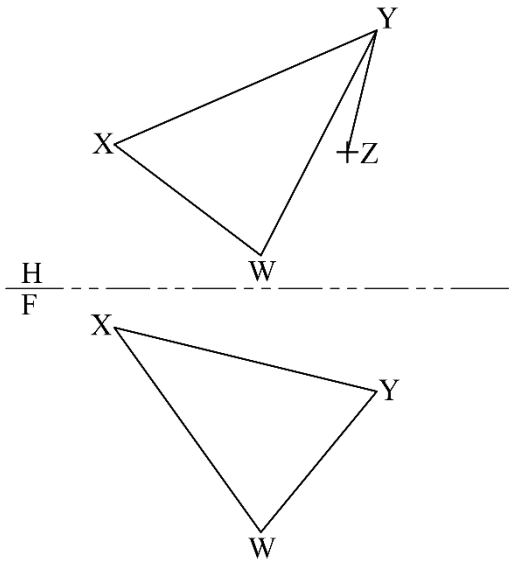
PROJECTION OF A LINE ONTO A PLANE

IN PROBLEMS 1 AND 2, DRAW THE MISSING PROJECTION OF LINE **YZ**, WHICH LIES IN THE PLANE IN EACH PROBLEM.

1

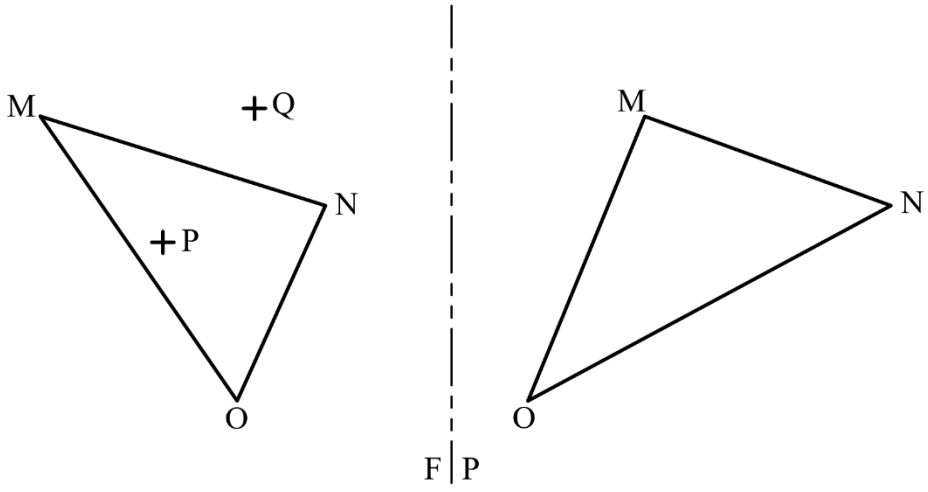


2



DRAW THE RIGHT SIDE PROJECTIONS OF POINTS **P** AND **Q**, WHICH LIE IN THE PLANE BELOW.

3



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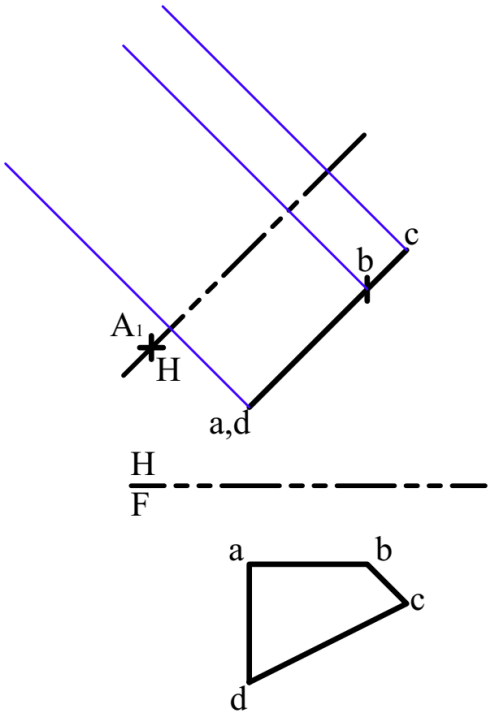
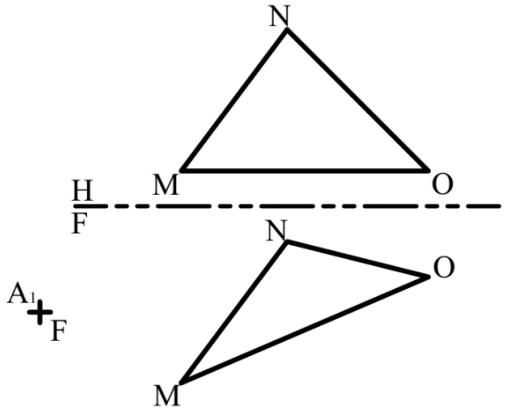
TRUE SHAPE OF A PLANE

FIND THE TRUE SHAPE VIEWS OF THE PLANES OF ALL EXERCISES SHOWN BELOW.

1



2



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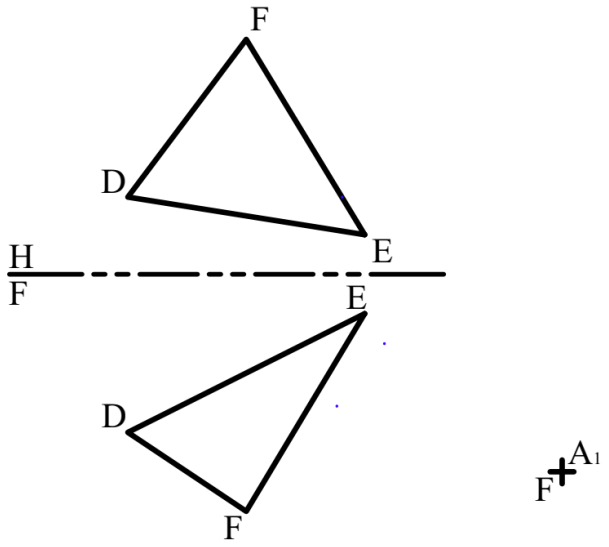
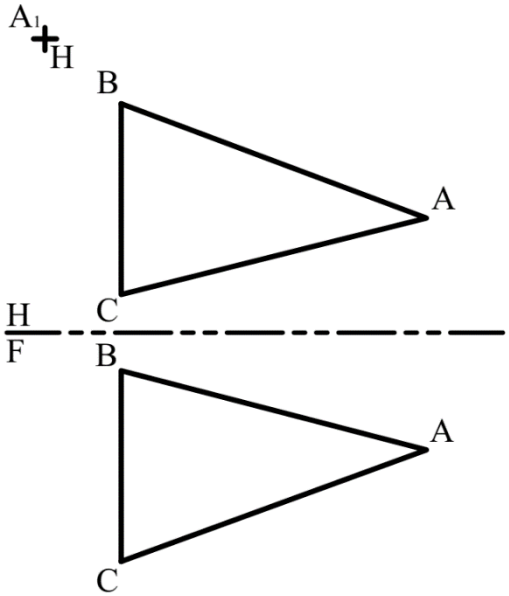
3



4



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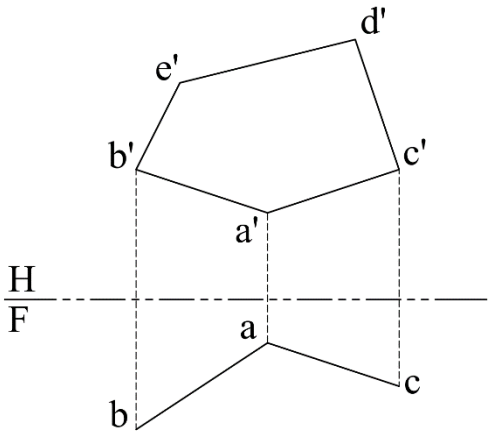
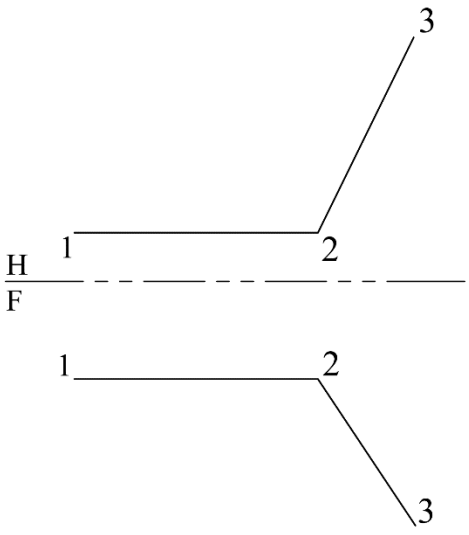
APPLICATIONS ON TRUE SHAPE OF A PLANE

1 USING THE GIVEN HORIZONTAL AND FRONTAL PROJECTIONS **ONLY**, DETERMINE THE FRONTAL PROJECTION OF THE PLANE PENTAGON **(abcde).**



2 FIND THE ANGLE BETWEEN THE LINE 1-2 and 2-3.



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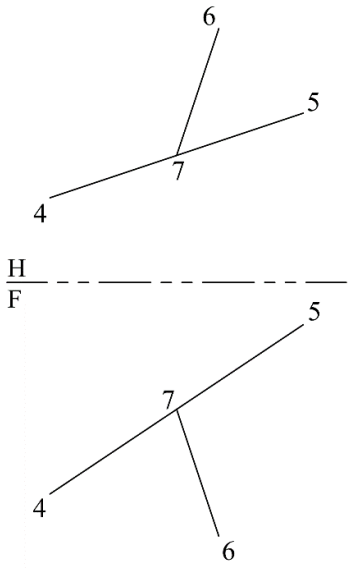
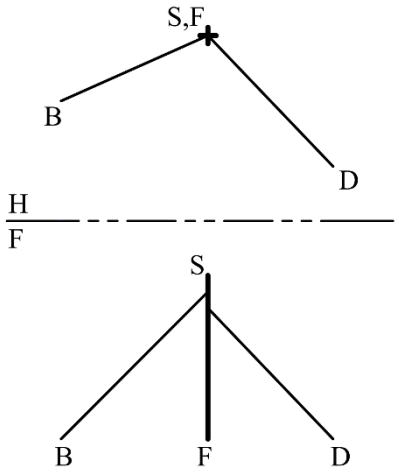
3 FIND THE ANGLE BETWEEN THE LINE 4-5 and 6-7.



4 GIVEN THE HORIZONTAL AND FRONTAL VIEWS OF A CONSTRUCTION ELEVATOR SUPPORT FRAME **(SF)** WITH TWO WIRES ATTACHED AS SHOWN BELOW. FIND THE "**ANGLES**" OF WIRES **(B)** AND **(D)** WITH THE SUPPORT FRAME **(SF)**.



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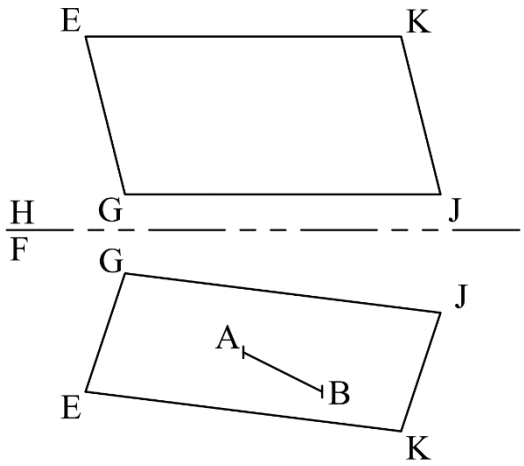
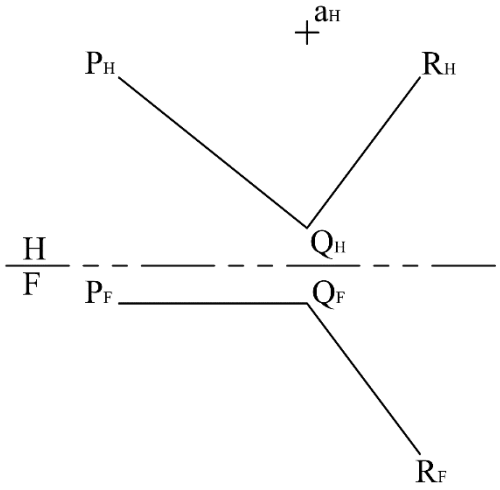
5 LINE **(AB)** IS ONE SIDE OF A REGULAR HEXAGON LAYING IN PLANE (**EGJK)**. DRAW THE HEXAGONAL IN THE VIEW WHERE IT APPEARS TRUE.



6 POINT **(a)** IS THE BACK CORNER OF A 19 MM SQUARE LAYING IN A PLANE (**PQR)**. TWO SIDES OF THE SQUARE ARE PARALLEL TO LINE (**PQ)**. COMPLETE THE SQUARE IN THE VIEW WHERE IT APPEARS TRUE.



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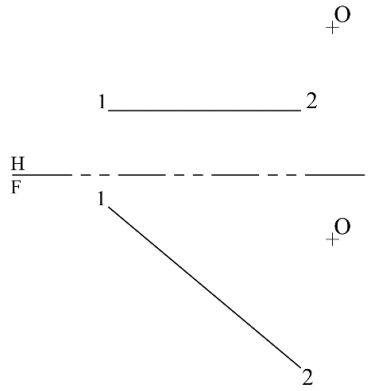
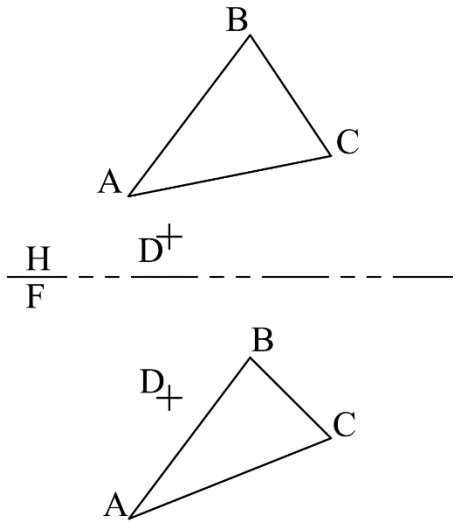
PERPENDICULARITY

1 DRAW A **PERPENDICULAR** LINE FROM POINT **(O)** TO THE GIVEN LINE (1-2). THEN FIND THE TRUE LENGTH OF THIS LINE.



2 MEASURE THE TRUE LENGTH OF THE SHORTEST LINE FROM POINT **(D)** TO THE PLANE **(ABC)**. DRAW THE LINE IN ALL VIEWS. **METRIC SCALE 1:2**.



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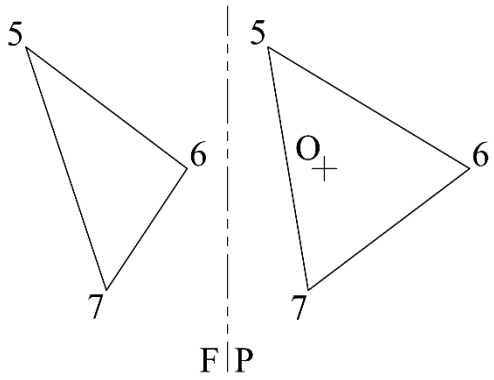
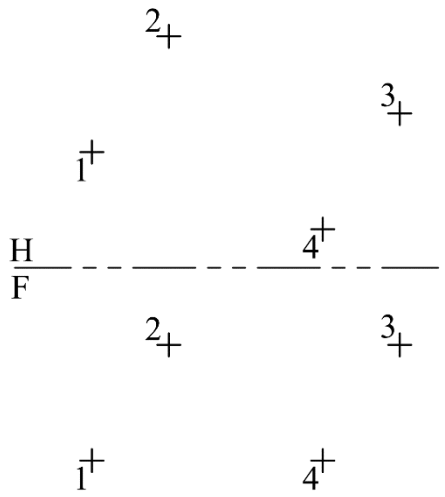
3 DRAW A LINE THAT IS **1-INCH** LONG FROM POINT **(O)** ON THE PLANE, PERPENDICULAR TO THE PLANE. SHOW THE LINE IN BOTH VIEWS.



4 THE PLANE FORMED BY THE POINTS **(1-2-3-4)** IS THE BASE OF A RIGHT PYRAMID. THE VERTEX **(V)** HAS AN ALTITUDE OF **(1")** ABOVE THE BASE AT ITS **MIDPOINT**.

a) **DRAW** THE PYRAMID IN ALL VIEWS.
b) FIND THE **TRUE SHAPE** OF THE BASE, AND THEN COMPUTE ITS **AREA**.
c) WHAT IS THE **VOLUME** OF THE PYRAMID?

(NOTE: VOLUME = $\frac{1}{3}$ AH)



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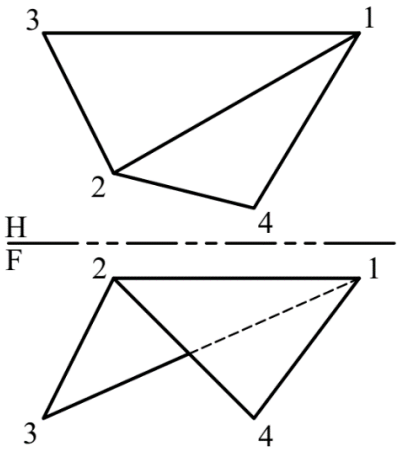
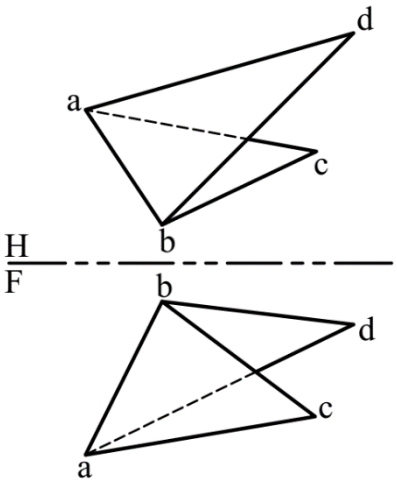
ANGLE BETWEEN TWO INTERSECTED PLANES (DIHEDRAL ANGLE)

1 FIND THE TRUE ANGLE BETWEEN THE PLANES **(1-2-3)** AND **(1-2-4)**. SHOW ALL CONSTRUCTIONS. THE ANGLE IS _____.



2 DETERMINE THE ANGLE BETWEEN PLANES **(ABC)** AND **(ABD)**. SHOW ALL CONSTRUCTIONS. THE ANGLE IS _____.



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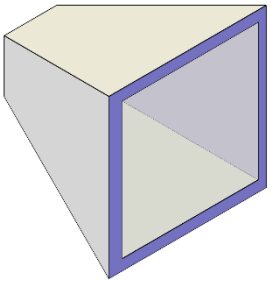
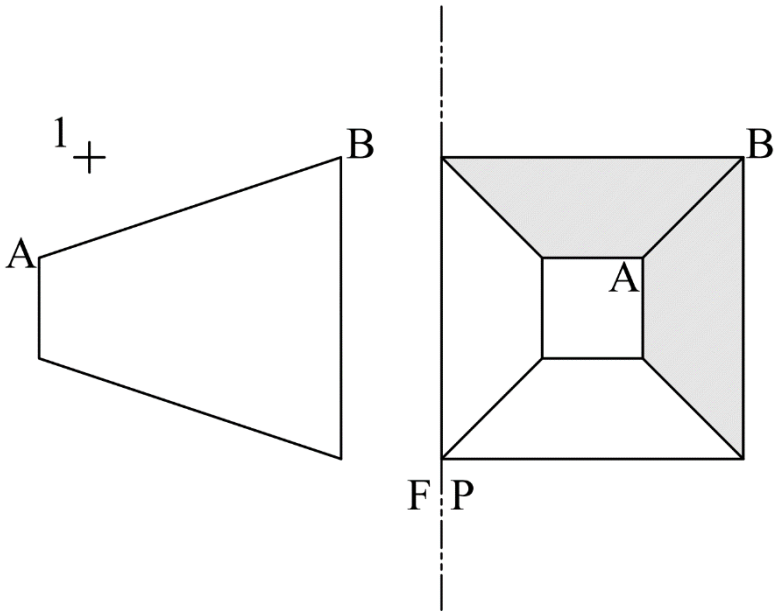
3 IN ORDER TO BUILD A **DIFFUSER SECTION** SIMILAR TO THE ONE IN THE FIGURE, THE DIHEDRAL ANGLE MUST BE KNOWN. USE **(AB)** AS THE OF INTERSECTION.

THE ANGLE IS _____.





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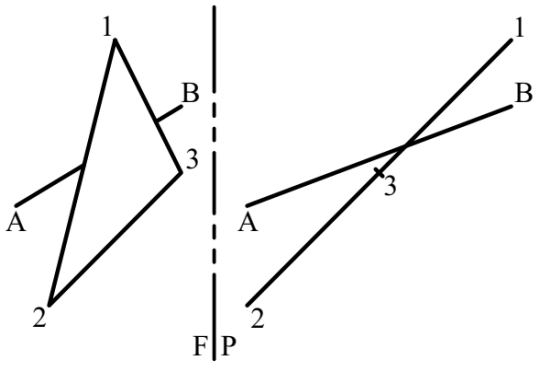
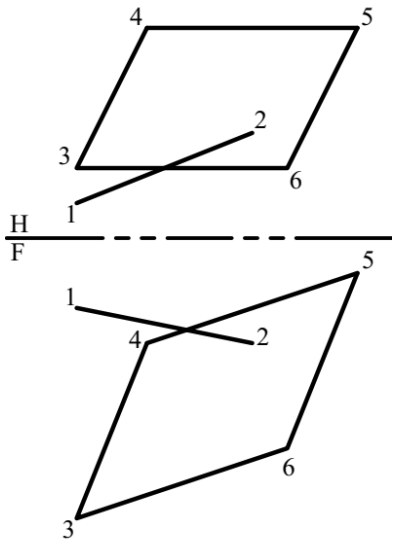
ANGLE BETWEEN A LINE AND A PLANE

1 FIND THE ANGLE BETWEEN THE LINE AND THE PLANE USING **THE PLANE METHOD**. THE ANGLE IS _____.



---

2 FIND THE ANGLE BETWEEN CONTROL CABLE (**1-2**) AND BULKHEAD **(3-4-5-6)**. THE ANGLE IS _____.



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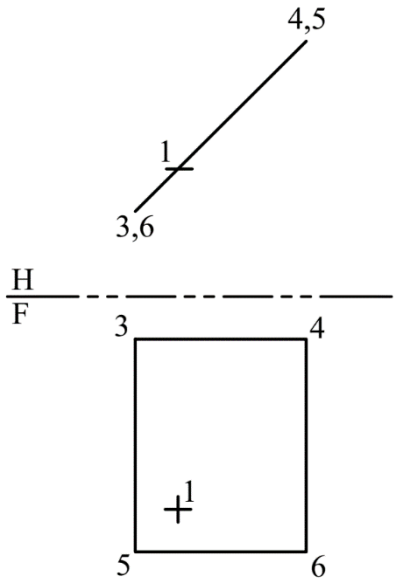
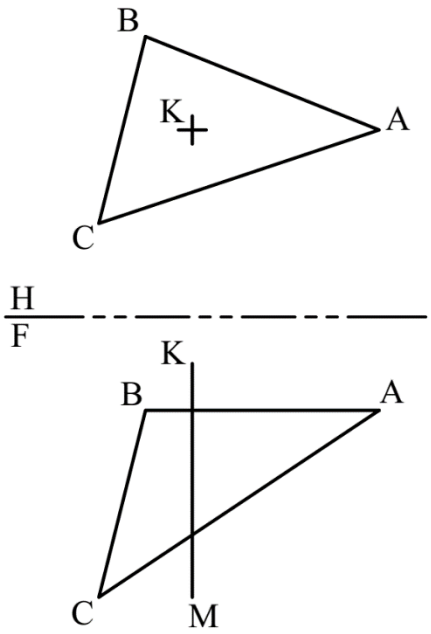
3 ESTABLISH THE VIEWS OF 1.5" LINE **(1-2)** SUCH THAT LINE **(1-2)** FORMS AN ANGLE OF 25º WITH THE GIVEN SURFACE **(3-4-5-6)**. SHOW LINE (1-2) IN ALL VIEWS.



4 FIND THE ANGLE BETWEEN THE VERTICAL LINE **(MK)** AND PLANE **(ABC)**. THE ANGLE IS _____.



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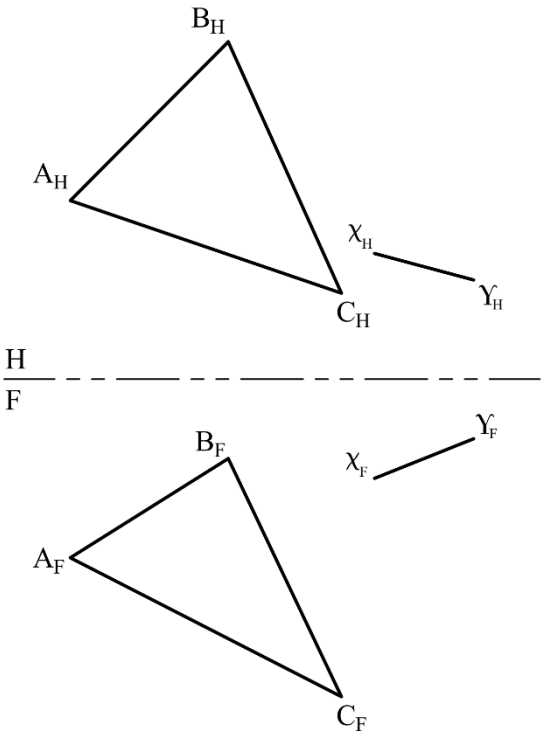
5 GIVEN THE HORIZONTAL AND FRONTAL VIEWS:

A. FIND THE TRUE LINE OF THE EXTENSION LINE **(XY)** TO THE PLANE (ABC). SHOW THE EXTENSION IN ALL VIEWS.

B. FIND THE ANGLE BETWEEN THE LINE **(XY)** AND THE PLANE **(ABC)**. THE ANGLE IS _____.



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NAME: _____	**SECTION NO.:** _____	**62**
FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**63**
FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**64**
FILE NO.: _____	**DATE:** _____	

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FILE NO.: _____	**DATE:** _____	

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FILE NO.: _____	**DATE:** _____	

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FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**68**
FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**69**
FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**70**
FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**71**
FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**72**
FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**73**
FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**74**
FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**75**
FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**76**
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FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**81**
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NAME: _____	**SECTION NO.:** _____	**82**
FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**83**
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NAME: _____	**SECTION NO.:** _____	**84**
FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**85**
FILE NO.: _____	**DATE:** _____	

NAME: _____	**SECTION NO.:** _____	**86**
FILE NO.: _____	**DATE:** _____	

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Extra Exercises

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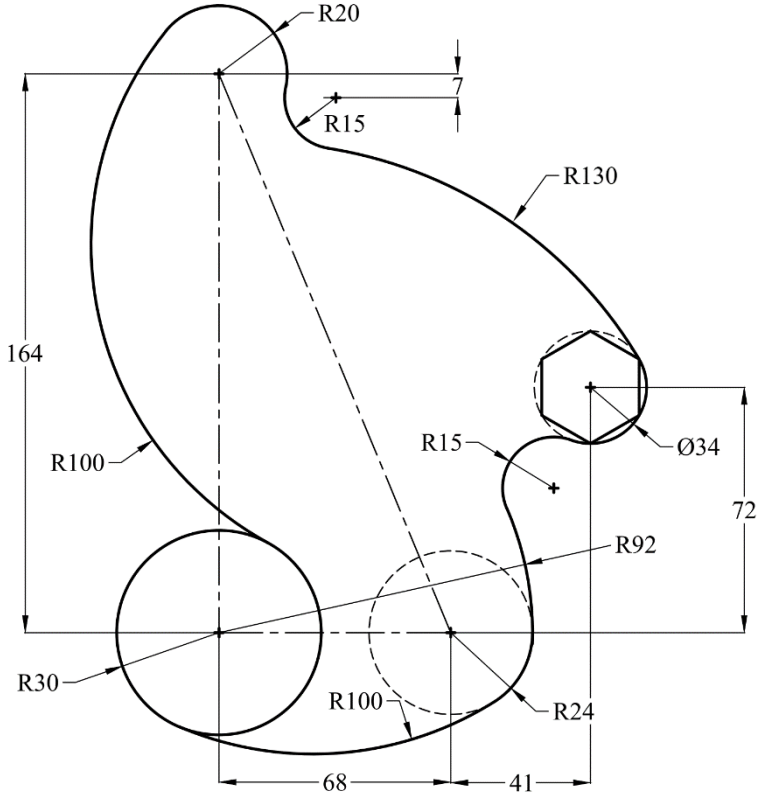
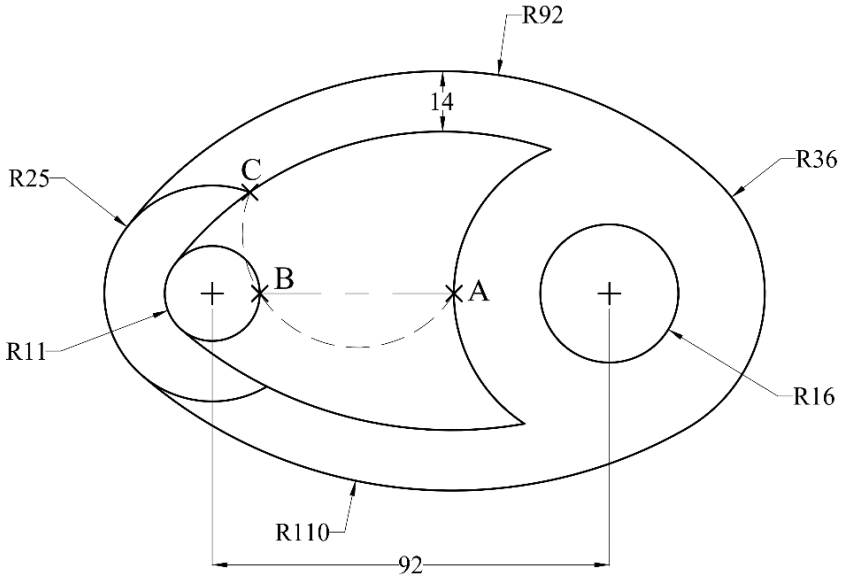
TANGENCY

Exercise (1): Draw the given view. Show all constructions and mark all tangents.



Exercise (2):

1. Draw the given view. Show all constructions and mark all tangents.
2. Find the radius of the arc that passes through points (A), (B), and (C).



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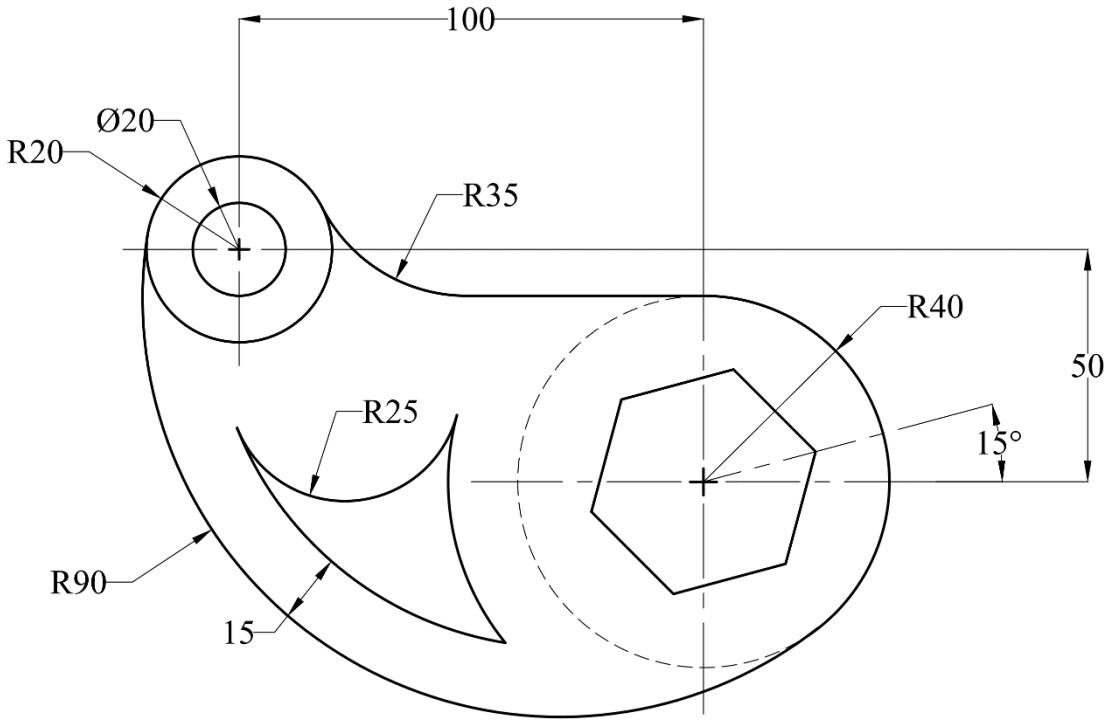
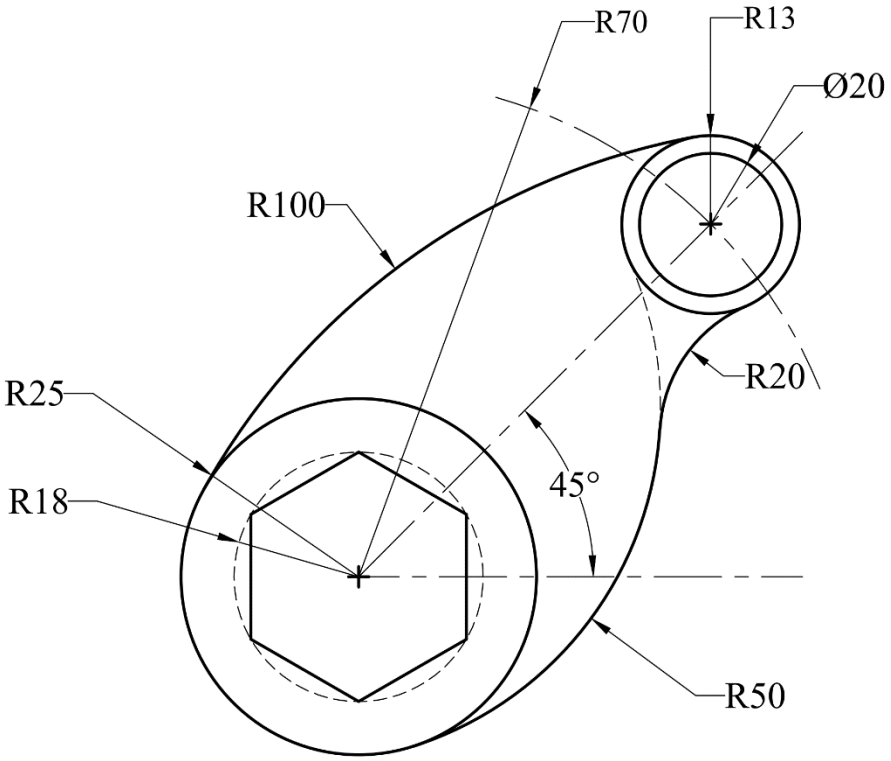
Exercise (3): Draw the given view. Show all constructions and mark all tangents.



Exercise (4): Prepare an instrumental drawing for the shown object. Show lightly all construction lines and Mark all tangent points.



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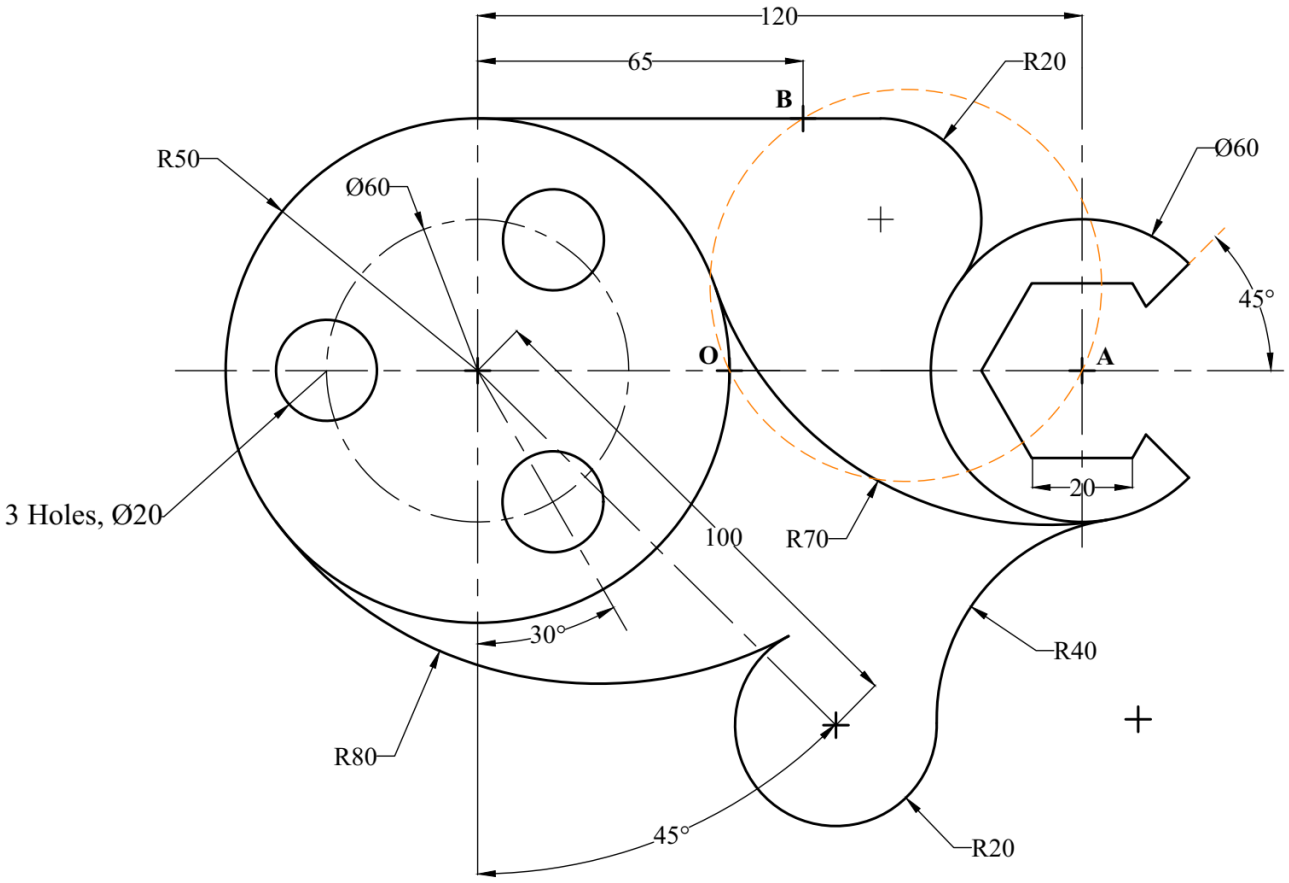
Exercise (5):

1. Draw the following, show the construction lines, and mark all tangent points.
2. Find the radius of the circle that passes through points (A), (B), and (O).



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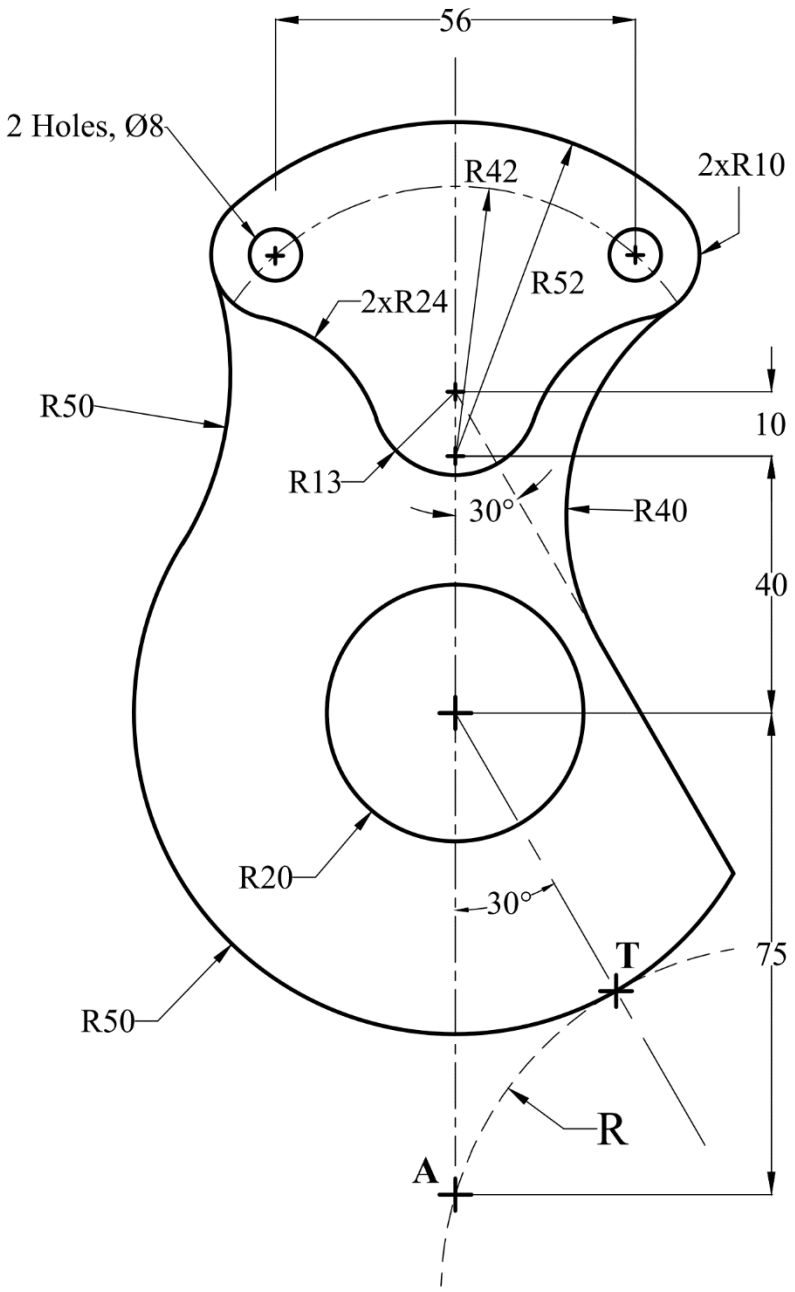
Exercise (6):

Draw the following, show the construction lines, and mark all tangent points. Then, Find the radius of the circle that passes through points (A) and tangent at point (T).



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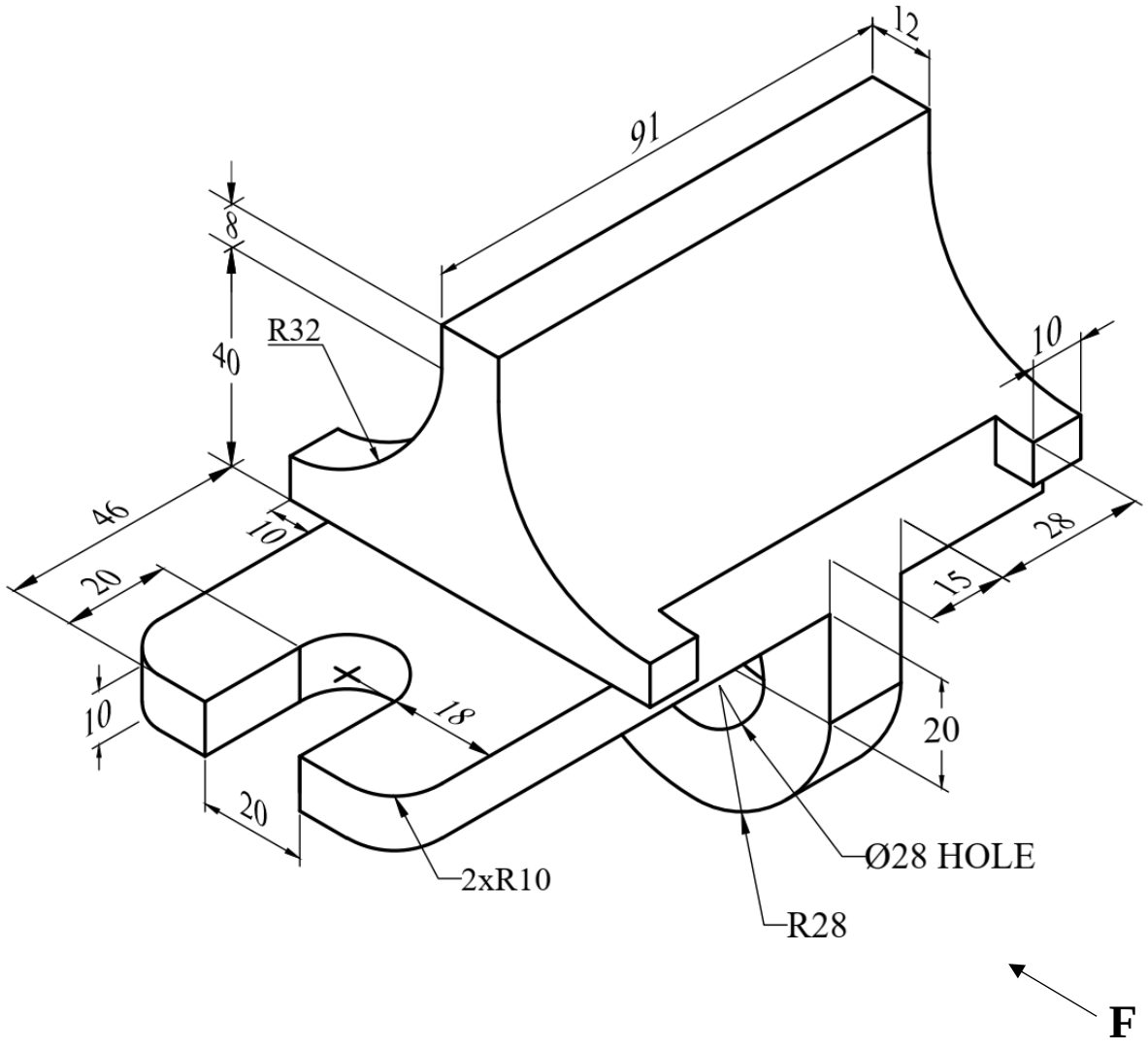
SECTIONING

Exercise (1): Draw the full sectional front view, top view, and the left side view.

Note: All holes are through.



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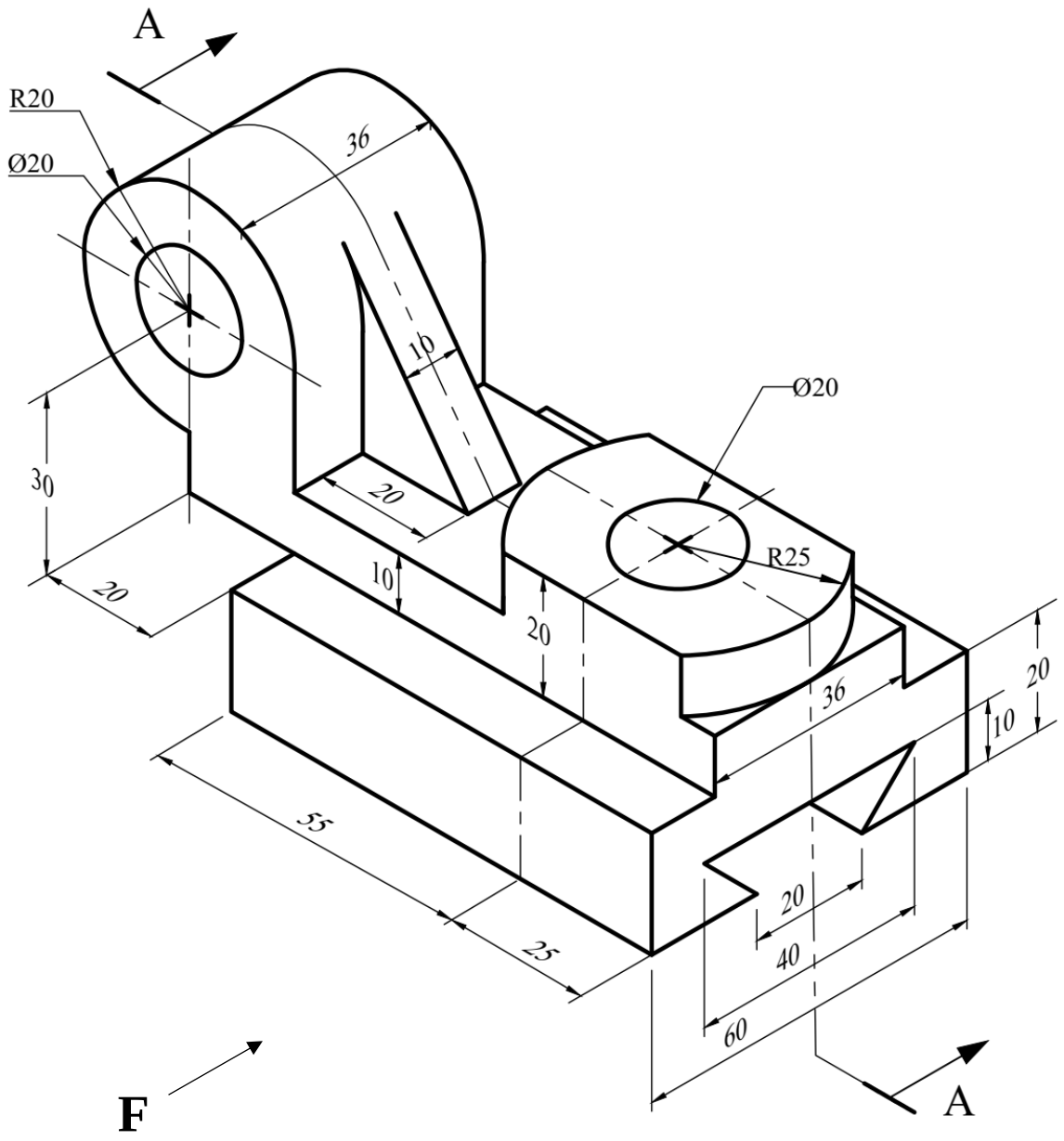
Exercise (2): For the given solid, draw the full sectional front view, top view, and the right side view.

Note: All holes are through.



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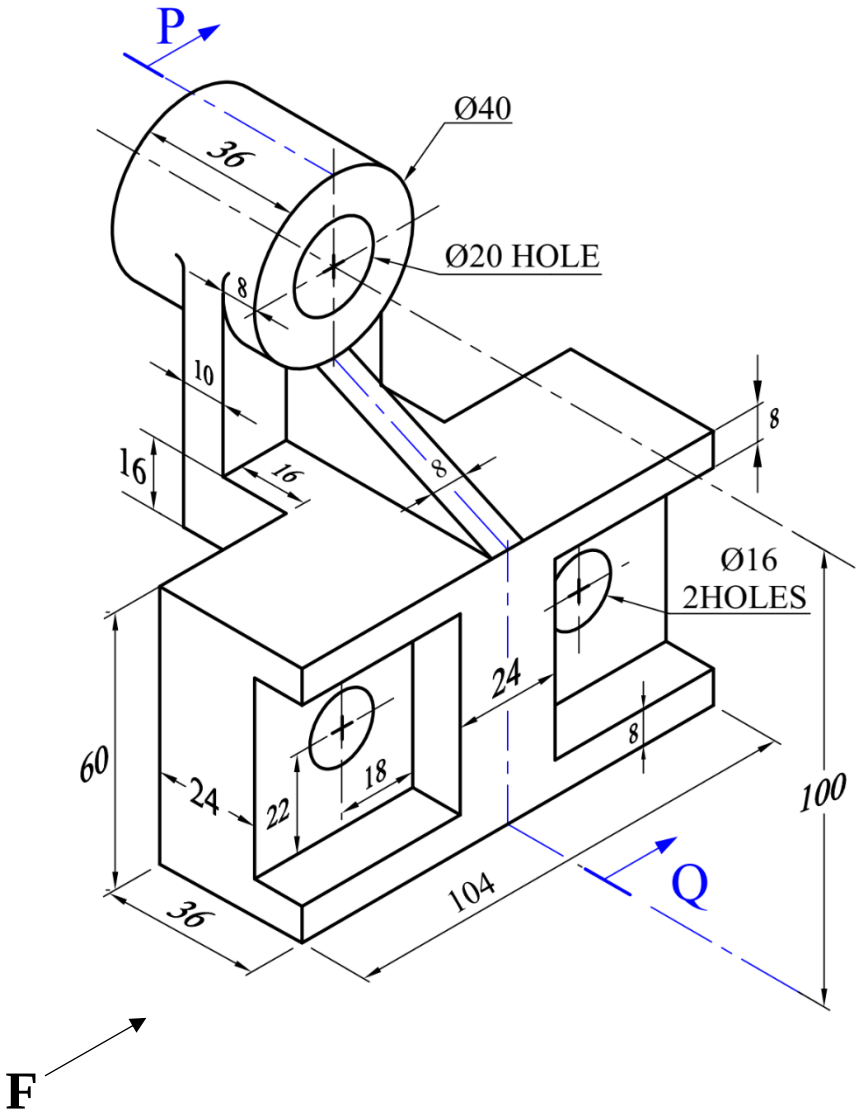
Exercise (3): For the given solid, draw the full sectional front view at **P-Q**, top view, and the right side view.

Note: All holes are through.



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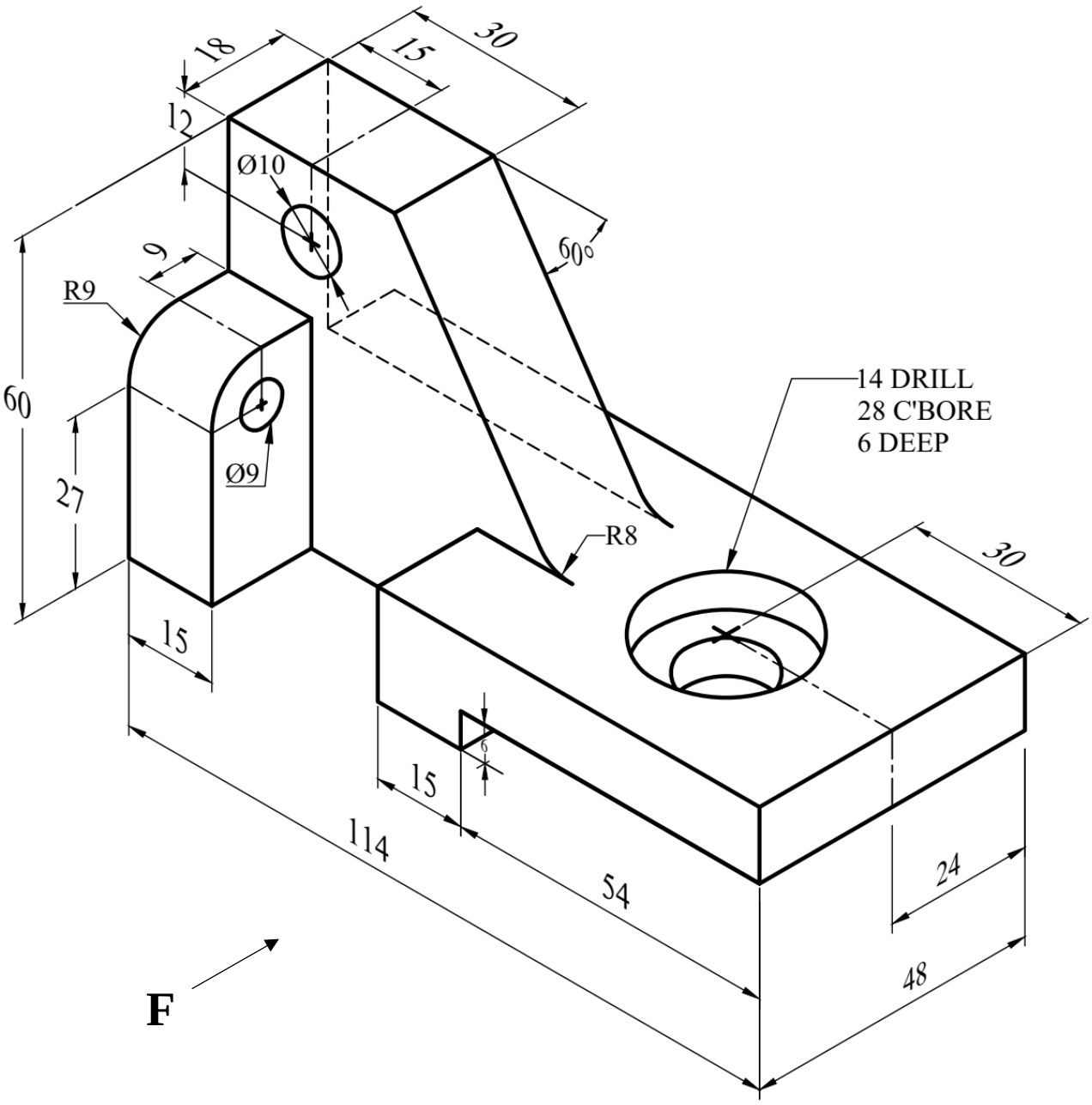
Exercise (4): For the given Roller Rest Bracket, draw the full sectional front view, top view, and the left side view.

Note: All holes are through.



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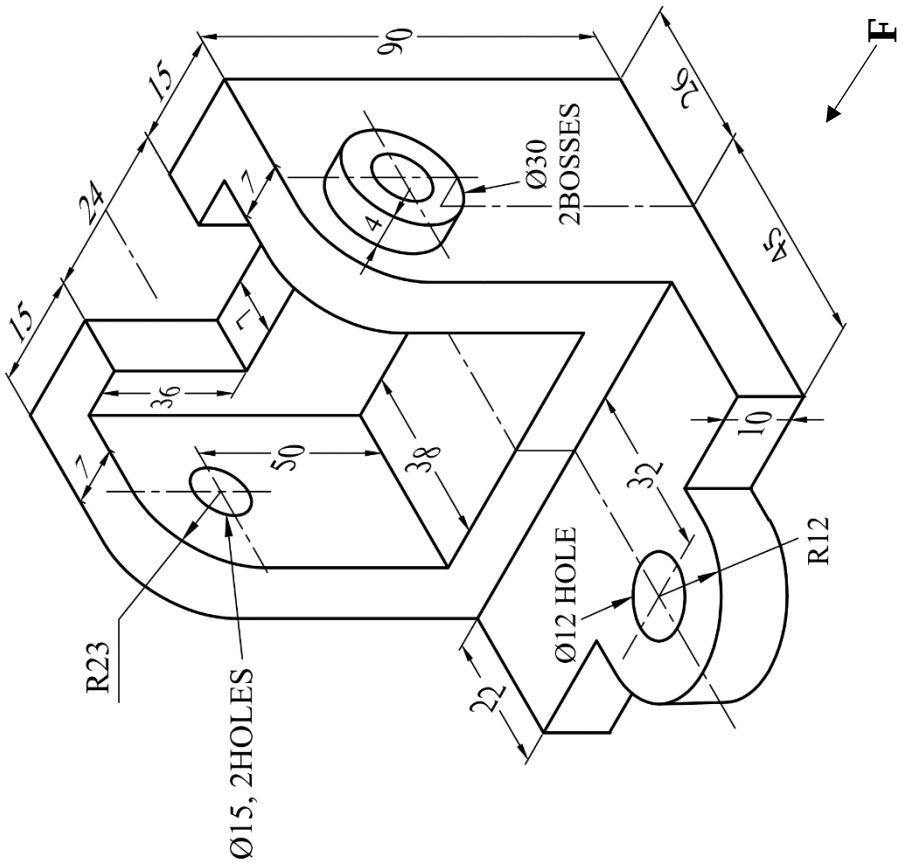
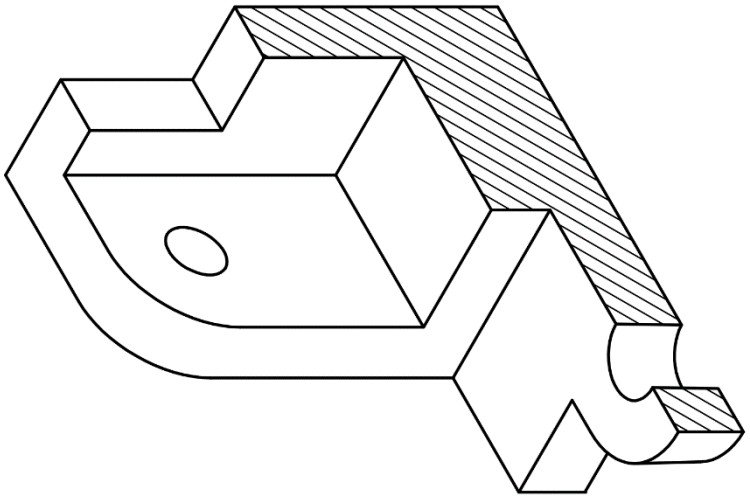


Exercise (5): Draw the full sectional front, top, and the left side views.

Note: All holes are through.



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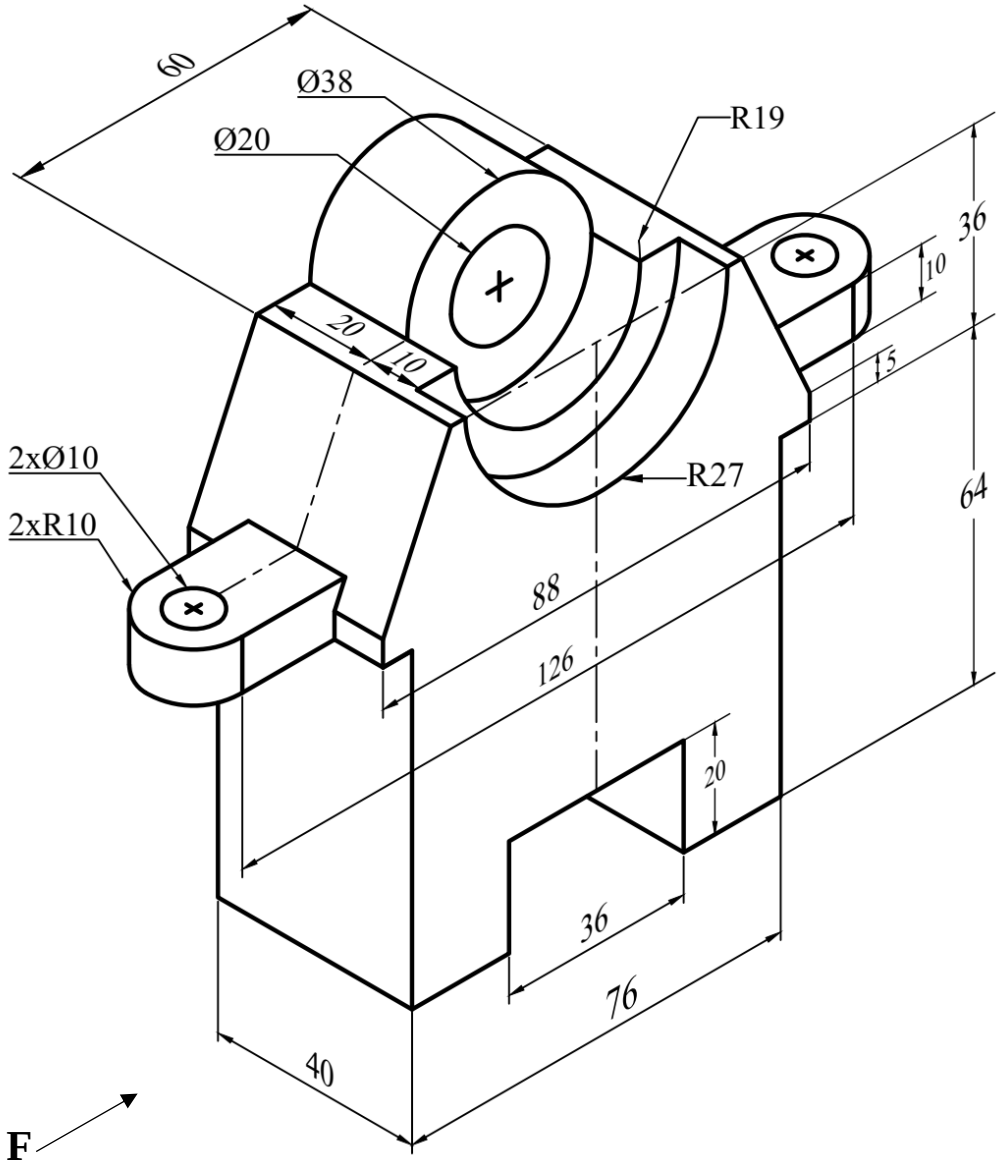
Exercise (6): For the given solid, draw the full sectional front view, top view, and the left side view.

Note: All holes are through.



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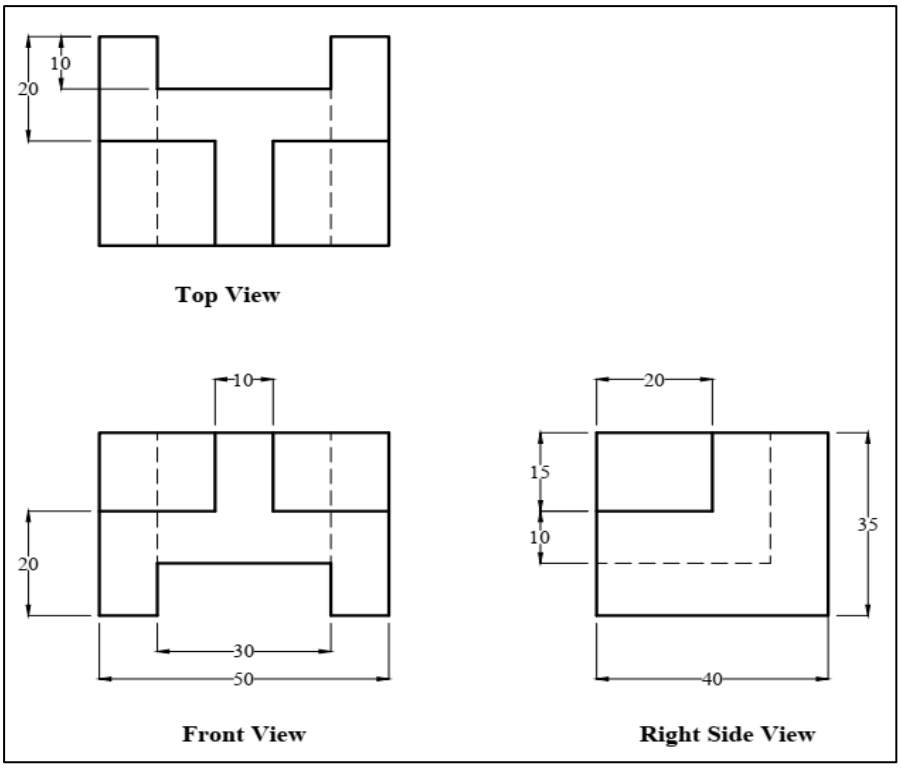
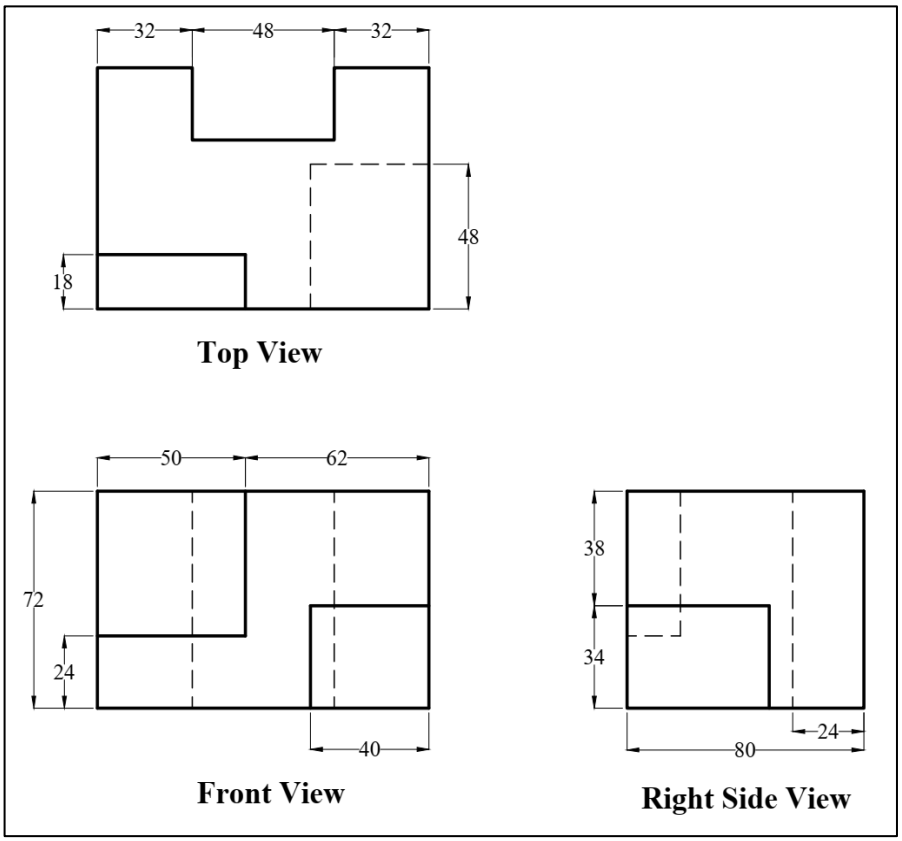
OBLIQUE DRAWING

Exercise 1: Draw the corresponding **Oblique drawings** using the given projections.

(A)



(B)



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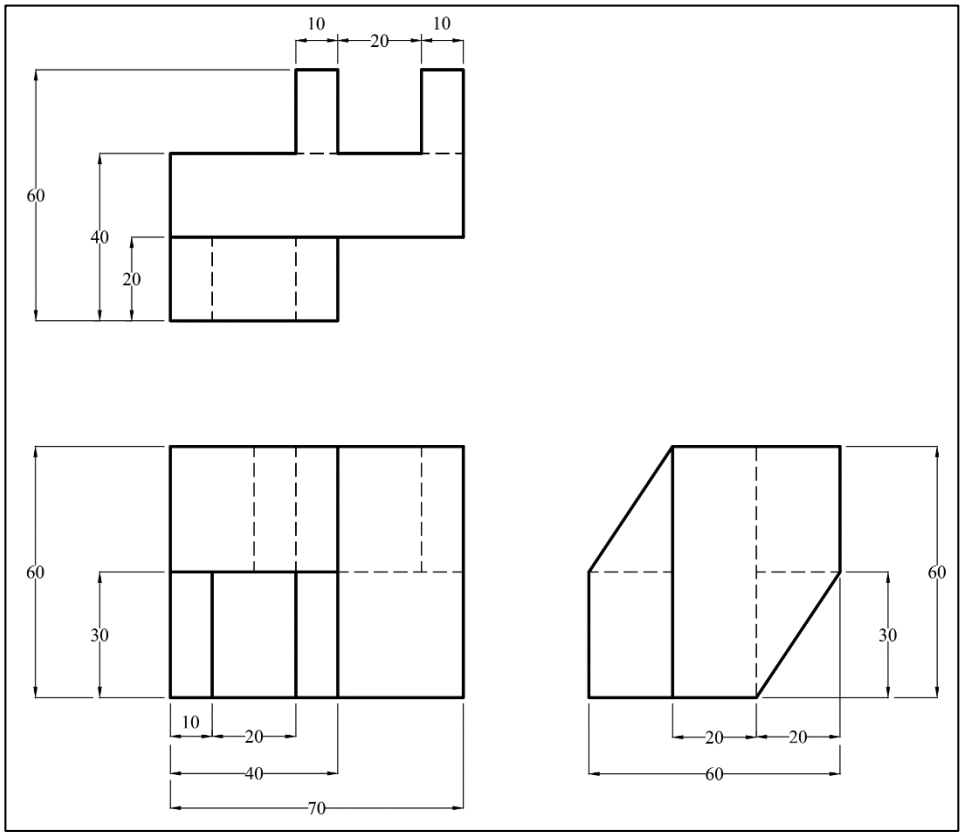
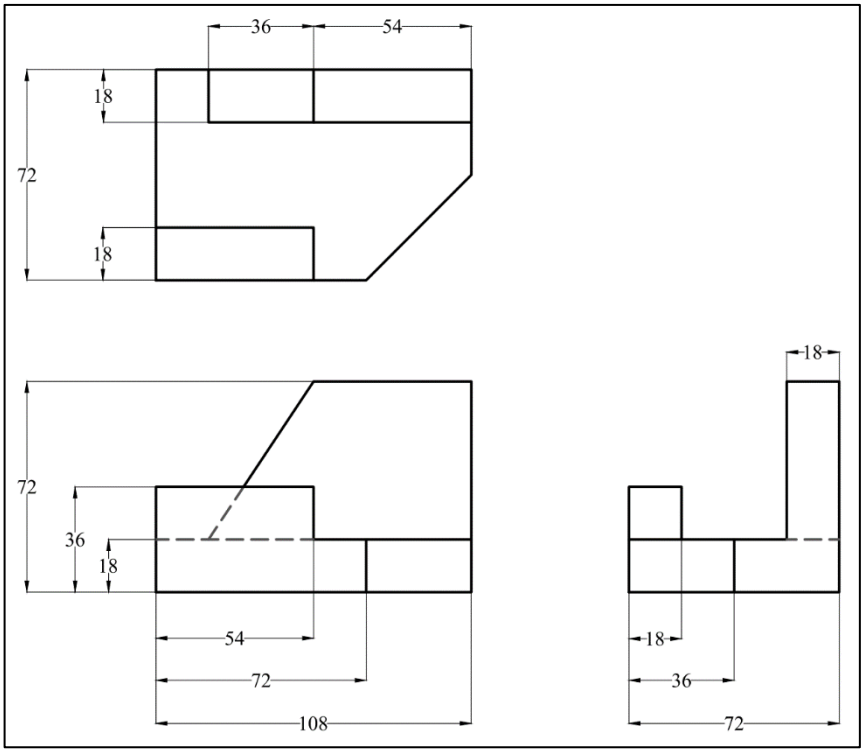
ISOMETRIC DRAWING

Exercise 1: For the given orthographic views, draw the corresponding **Isometric drawing**.

(A)



(B)



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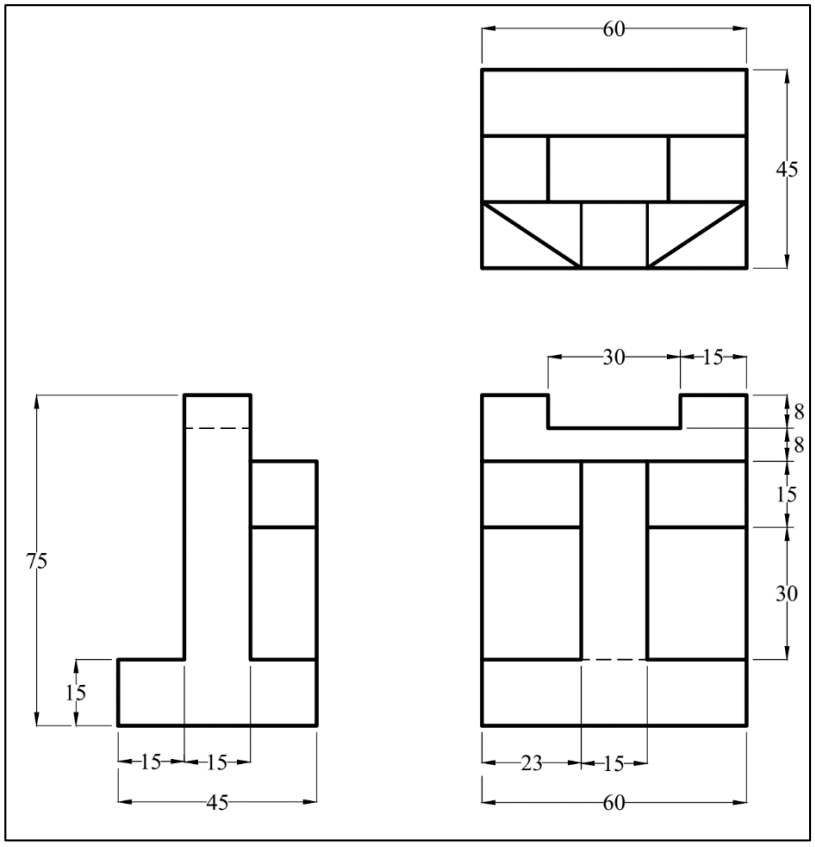
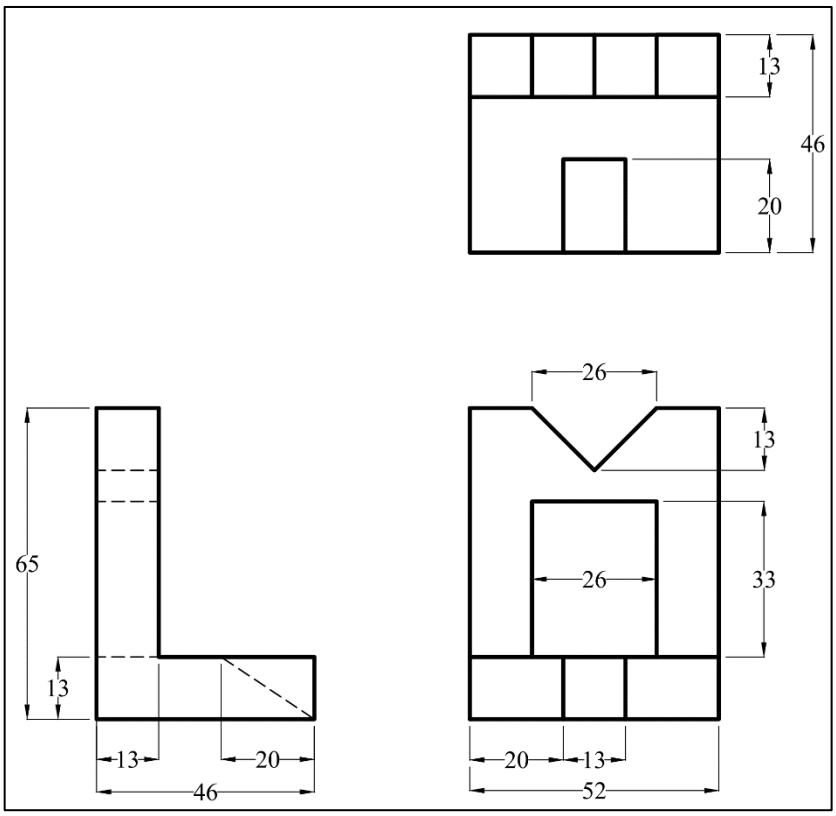
(C)



(D)



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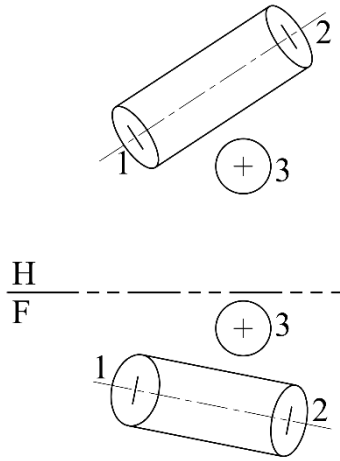
DESCRIPTIVE GEOMETRY (AUXILIARY PROJECTION)

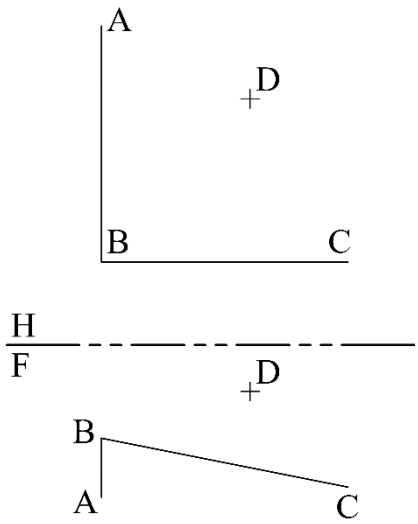
1 DETERMINE THE **CLEARANCE** (MINIMUM DISTANCE) BETWEEN **CYLINDER 1-2** AND A **SPHERICAL TANK 3**.



2 GIVEN HORIZONTAL AND FRONT VIEWS OF TWO PIPES, INTERSECT AT POINT **(B)** IN A RESIDENTIAL AREA. **AB AND BC** ARE THE CENTERLINES OF WATER PIPES **(AB AND BC)**. **D** IS THE LOCATION OF A WATER METER AT THE RESIDENTIAL AREA.

a. WHAT WOULD BE THE **DISTANCES** BETWEEN THE WATER METER **(D)** AND THE WATER PIPES (AB AND BC)?

b. WHAT WOULD BE **THE LENGTH OF THE SHORTEST PIPE**? (FROM D TO AB OR FROM D TO BC).



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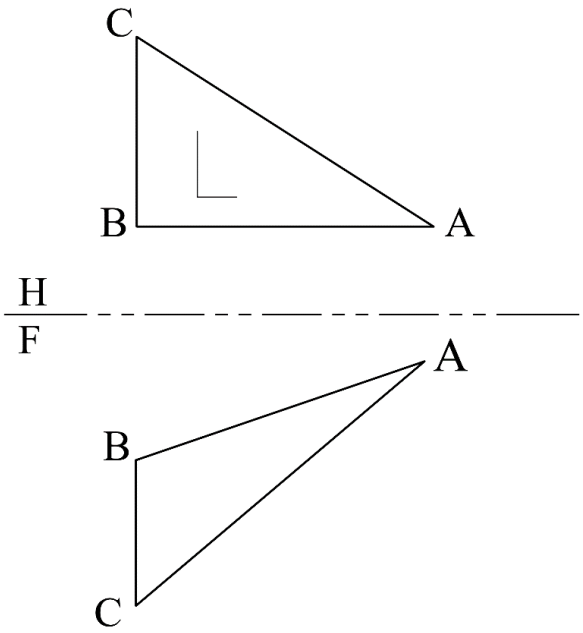
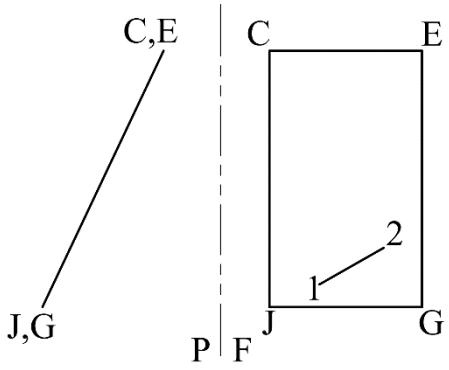
APPLICATIONS

1 USE THE GIVEN TWO VIEWS **ONLY** TO COMPLETE THE MISSING VIEW OF LETTER **(L)**, WHICH LIES ON THE PLANE **(ABC)**.



2 LINE **1-2** IS ONE SIDE OF SQUARE, WHICH LIES ON THE PLANE **(CEGJ)**. SHOW THIS SQUARE IN ALL VIEWS.



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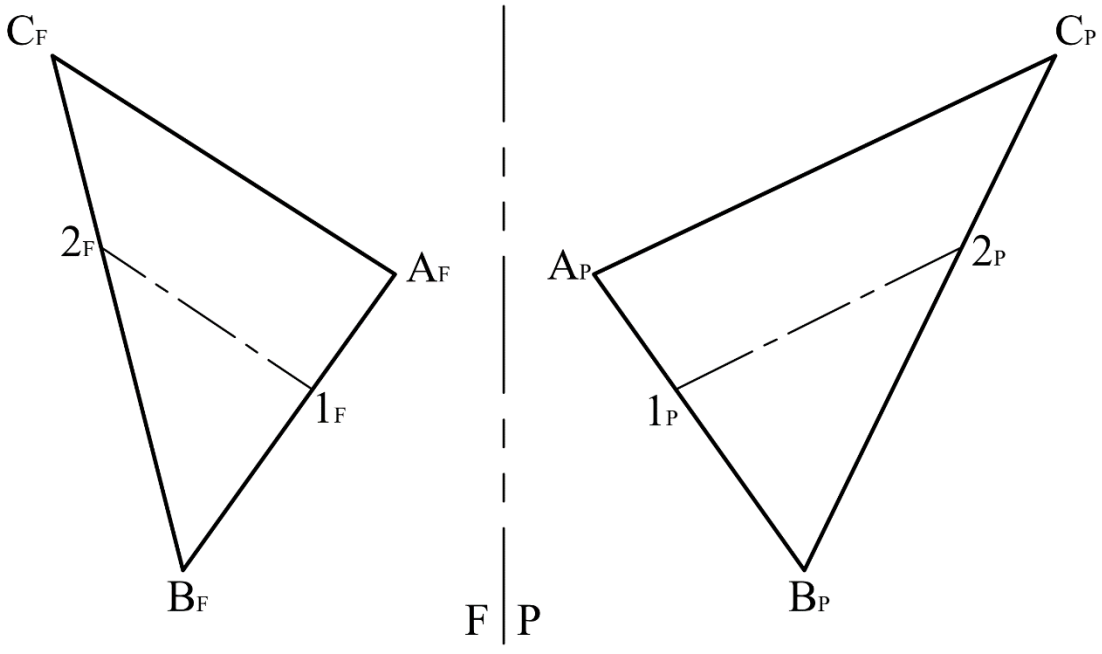
3 A CIRCULAR HOLE IS TO BE CUT IN SURFACE (**ABC)**. THE CENTER OF THE HOLE LIES ON LINE (**1-2)** AND IS 20 MM FROM **(A)**. COMPLETE THE FRONT AND RIGHT SIDE VIEWS OF HOLE. (HOLE DIAMETER IS 20 MM).



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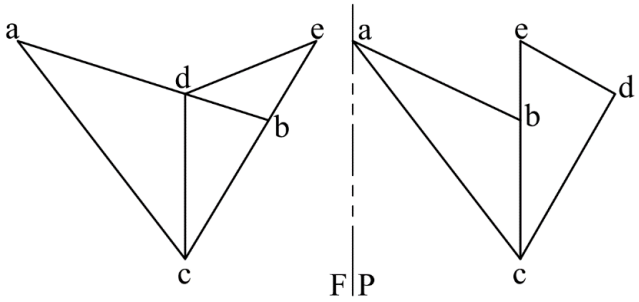
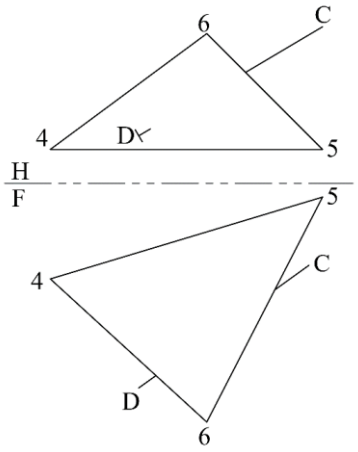
4 FIND THE DIHEDRAL ANGLE BETWEEN THE TWO PLANES (**ABC)** AND (**CDE)**.
THE ANGLE IS _____.



5 AN ASTRONAUT'S LINE OF SIGHT IS ALONG LINE **(DC)**, WHICH INTERSECTS THE TRIANGULAR WINDOW OF A SPACECRAFT. DETERMINE THE ANGLE BETWEEN THE LINE AND THE PLANE BY **THE PLANE METHOD**.

START PROJECTION FROM THE TOP VIEW. THE ANGLE IS _____.


Courtesy of Ryan Aeronautical Co.



NAME: _____	**SECTION NO.:** _____	**108**
FILE NO.: _____	**DATE:** _____	