Engineering Graphics and descriptive Geometry

Summer 2025/2026

Perpared By:

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Dr:

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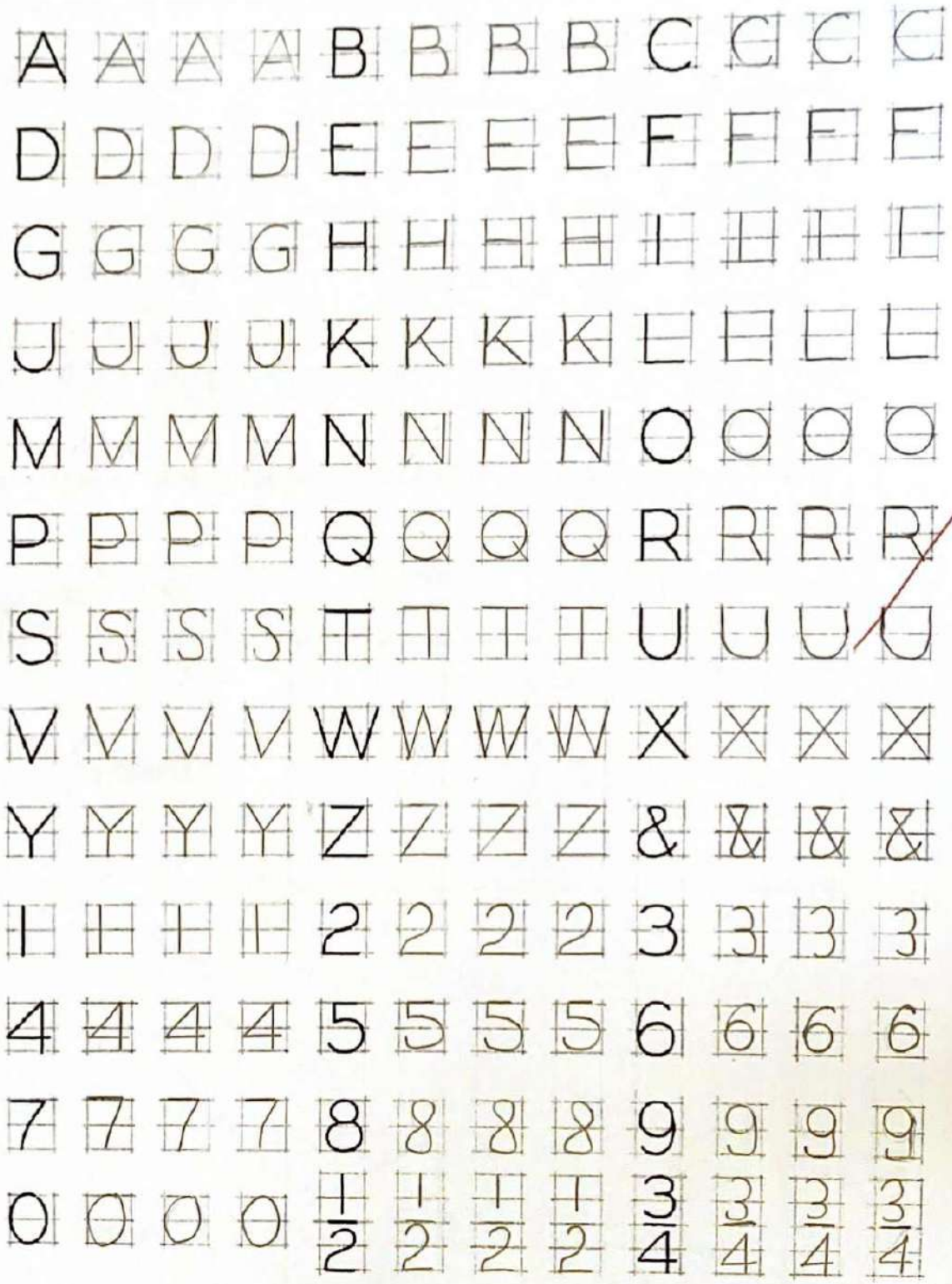
madarju.com

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: BAYAN ABU EL SAMEN	SECTION NO.: 5	2
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SCALING

Exercise (2):

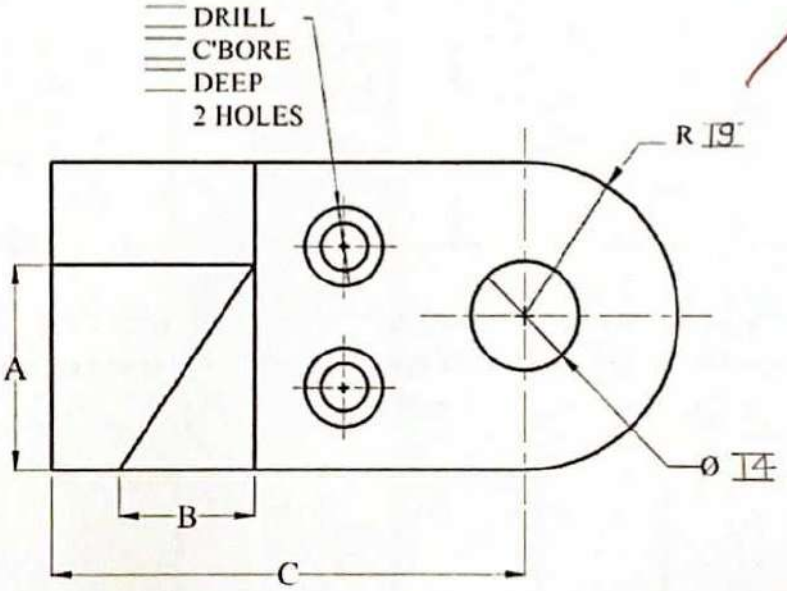
A: In the two views shown below, measure the dimensions to the nearest whole millimeter from **A** through **H**. Use the **metric** scale to calculate the actual dimensions. **Letter** the answer in the guidelines.

Scale	Actual Dimensions (mm)						
	A	B	C	E	F	G	H
1:1	25	17	60	30	17	13	26
1:5	125	85	300	150	85	65	130
1:50	1250	850	3000	1500	850	650	1300
1:200	5000	3400	12000	6000	3400	2600	5200
2:1	12.5	8.5	30	15	8.5	6.5	13
100:1	0.25	0.17	0.6	0.3	0.17	0.13	0.26

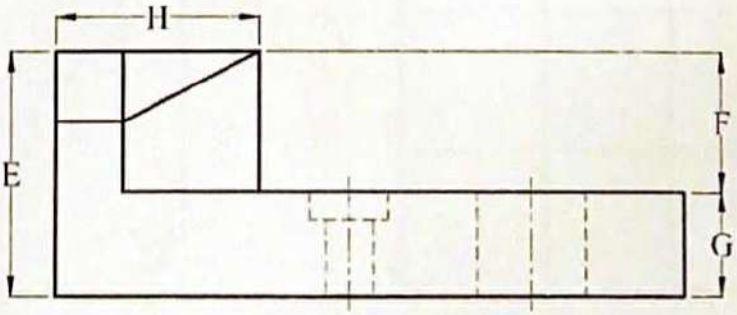
10

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

Top View



Front View



NAME: BAYAN ABU EL SAMEN	SECTION NO.: 5	3
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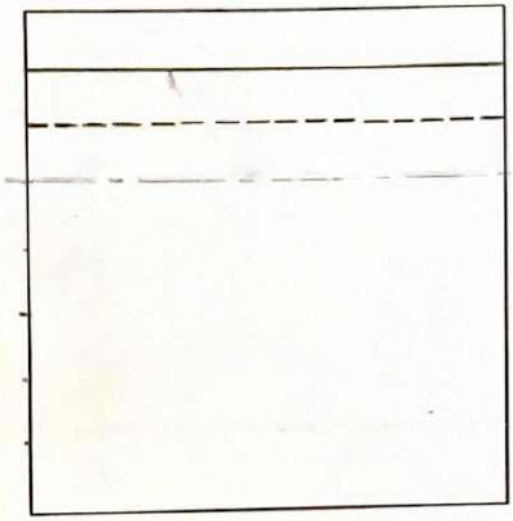
TYPES OF LINES

HIDDEN	3x spacing	(HB)
CENTERLINE	6x, x	(2H)
PHANTOM	6x, x, x	(HB)

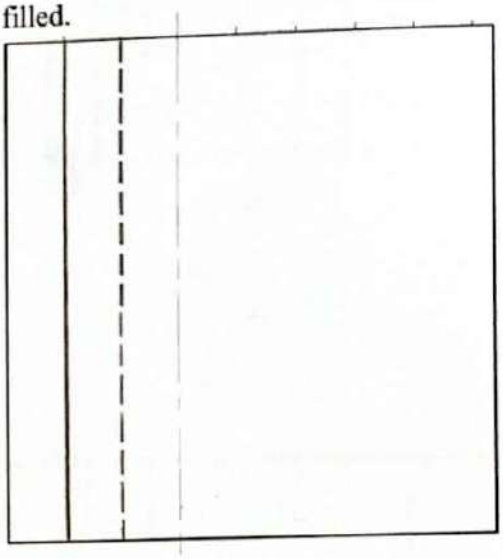
Exercise (3):

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.

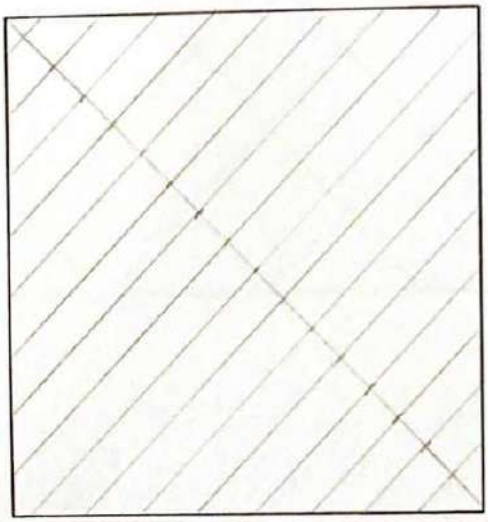


Good
10

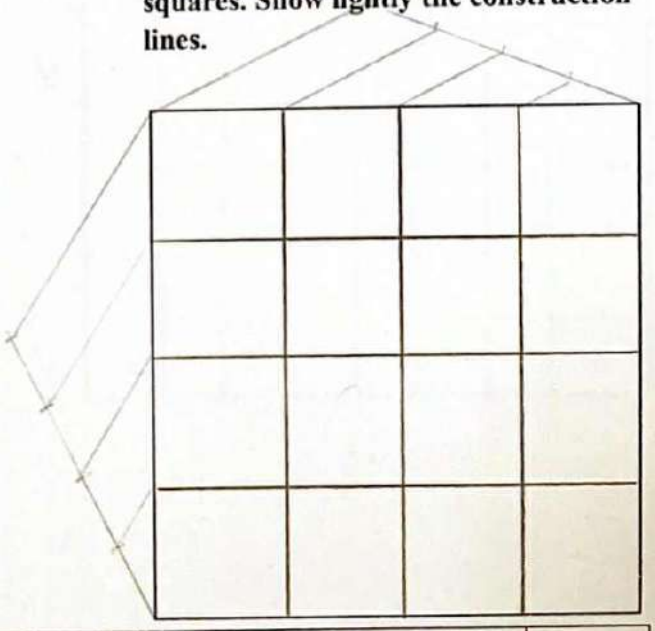
b. Draw vertical lines (8 mm apart) in the following order: **visible (HB), hidden (HB), and centerline (2H)**. Start from the left and repeat until the square is filled.



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



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



NAME: BAYAN ABU EL SAMEN	SECTION NO.: 5	4
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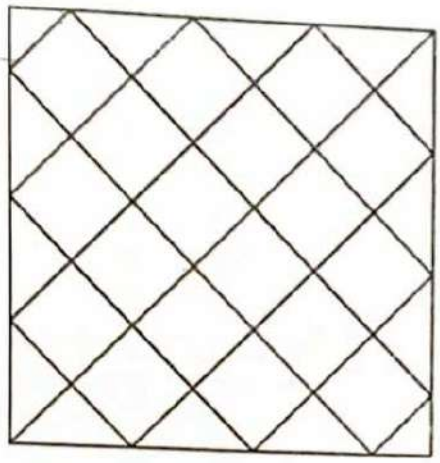
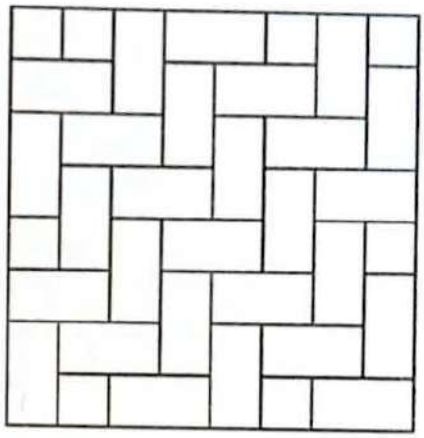
Exercise (4): Draw a copy for the given paving patterns using the two given squares using **Diagonal Line Technique**. Show the construction lines.

Diamond



(a)

Herrinbone



(b)

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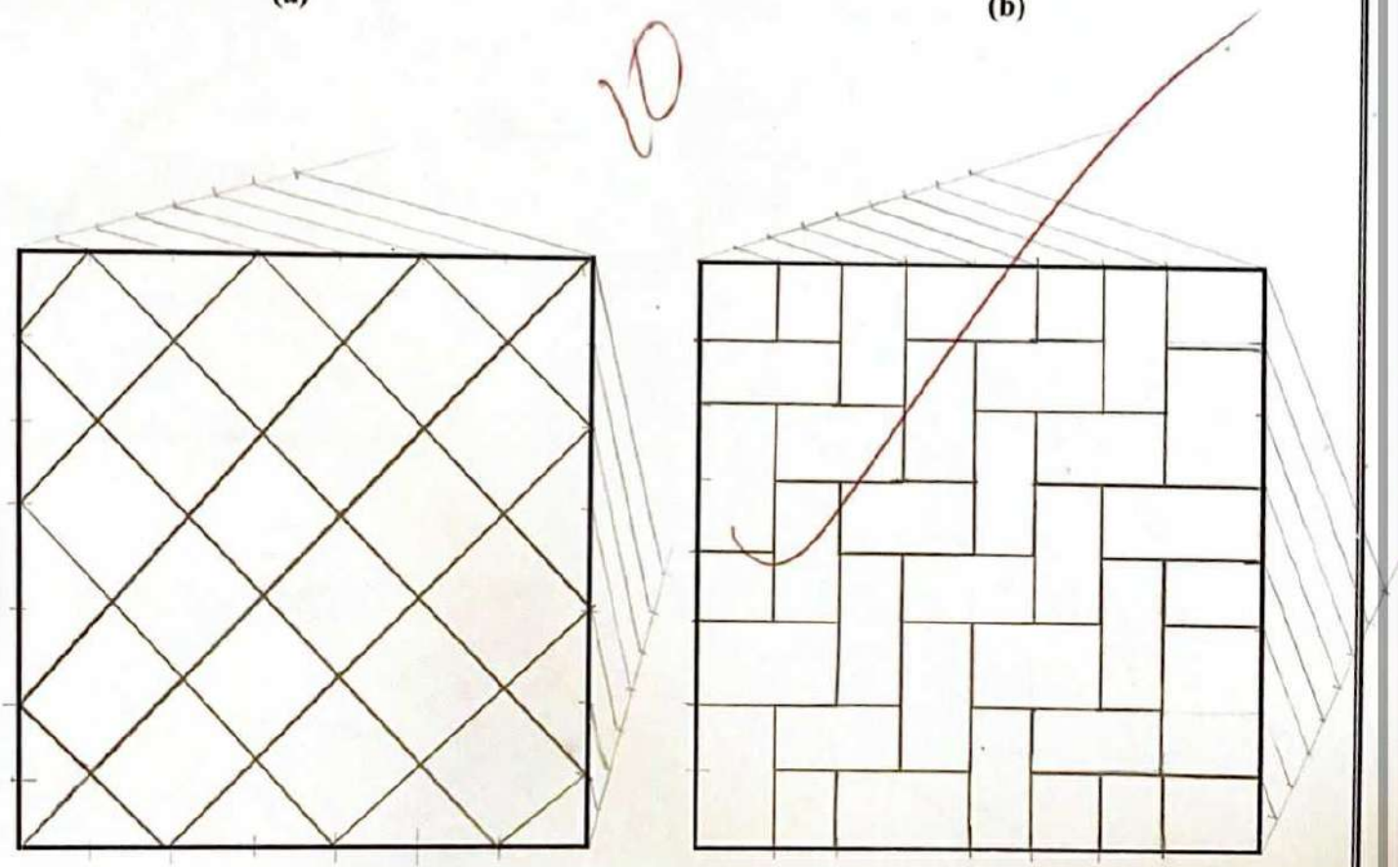

NAME: BAYAN ABO EL SAMEN	SECTION NO.: 5	5
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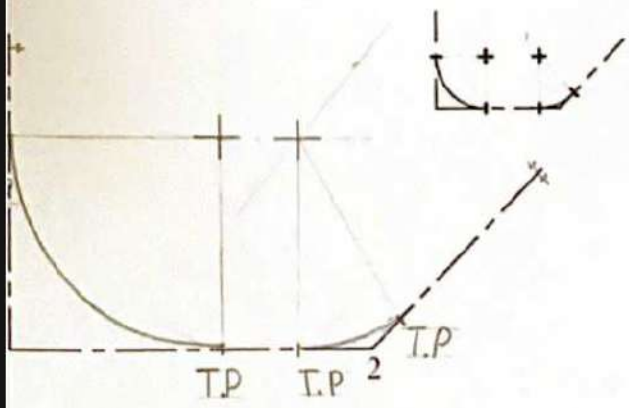
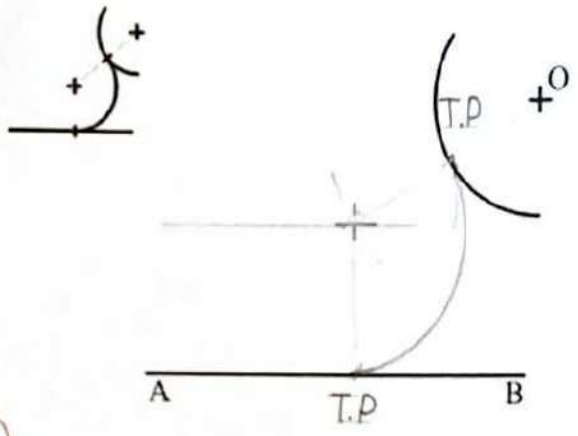
Draw the arcs as required in questions from (1) to (6). Mark tangent points and show lightly the construction lines.

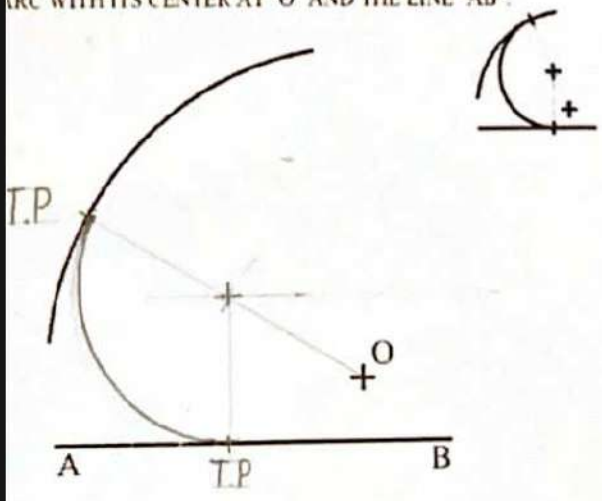
CONSTRUCT TWO ARCS OF 28 mm CENTERLINE RADIUS ANGENT TO ANGLES 1 AND 2 IN THE ROADWAY.



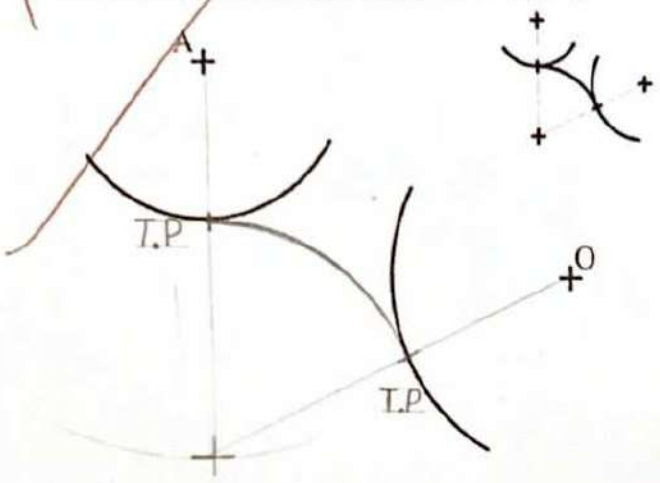
2: DRAW AN ARC OF 19 mm RADIUS TANGENT TO THE GIVEN ARC WITH ITS CENTER AT "O" AND THE STRAIGHT LINE "AB".



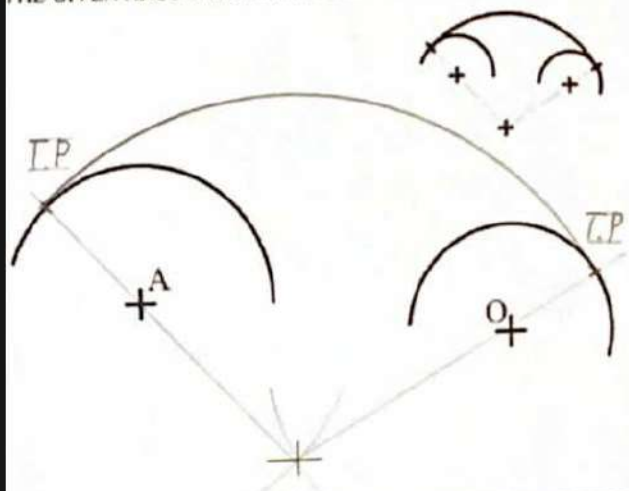
: DRAW AN ARC OF 20 mm RADIUS TANGENT TO THE GIVEN RC WITH ITS CENTER AT "O" AND THE LINE "AB".



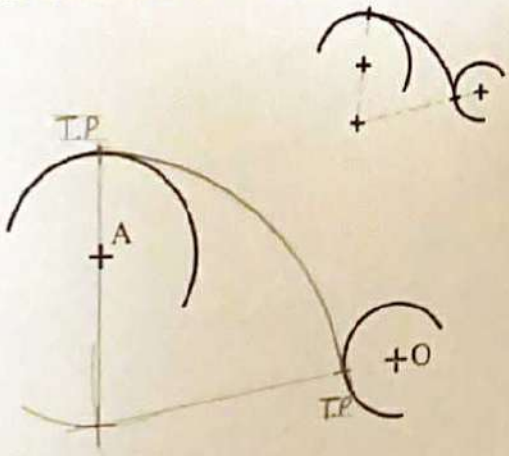
4: DRAW A CIRCULAR ARC OF 32 mm RADIUS TANGENT TO THE TWO GIVEN ARCS WITH CENTERS AT "A" AND "O".



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".



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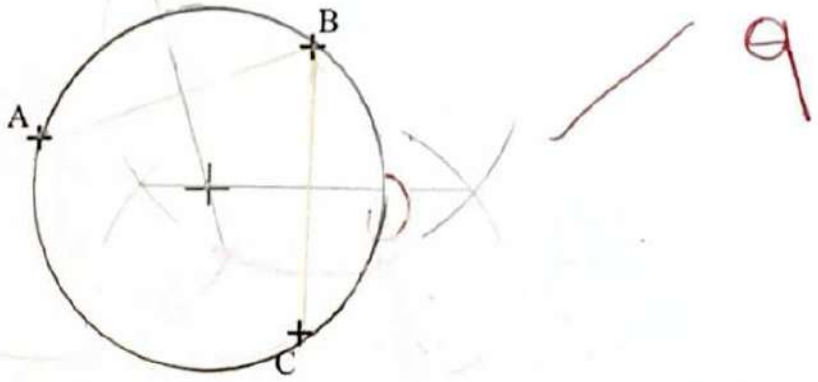
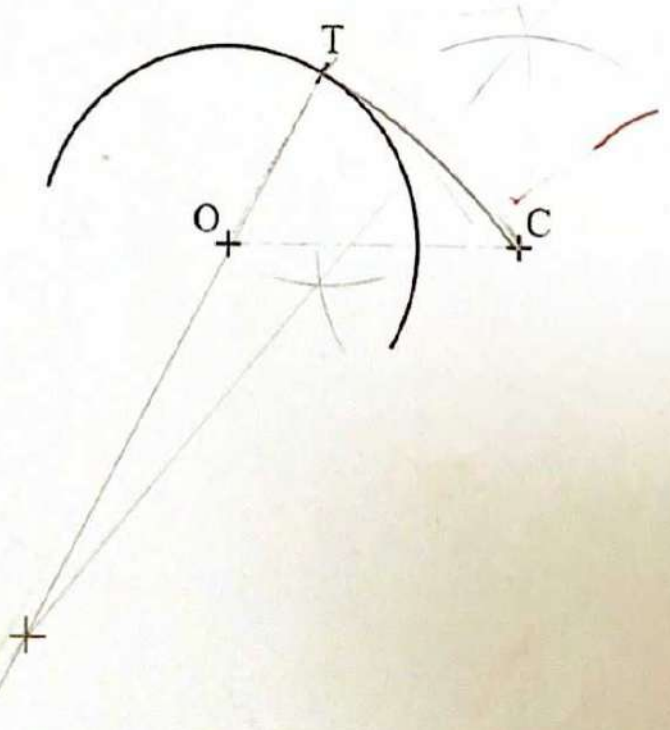
7: CONSTRUCT A CIRCLE THAT PASSES THROUGH POINTS "A", "B", AND "C". SHOW CONSTRUCTIONS.

R = 23 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 = 82 MM



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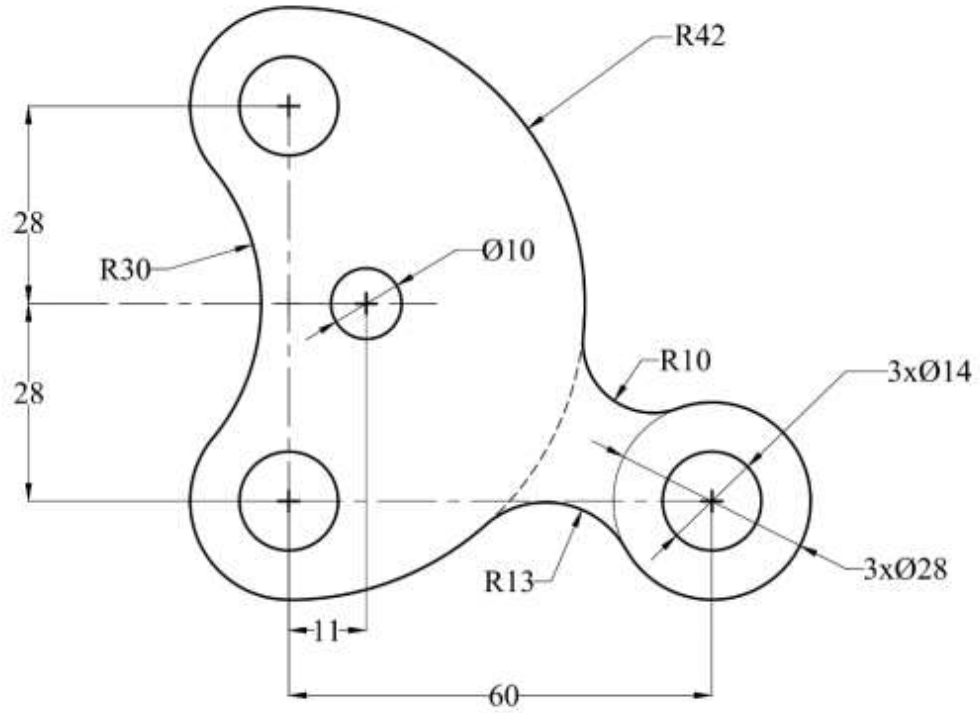
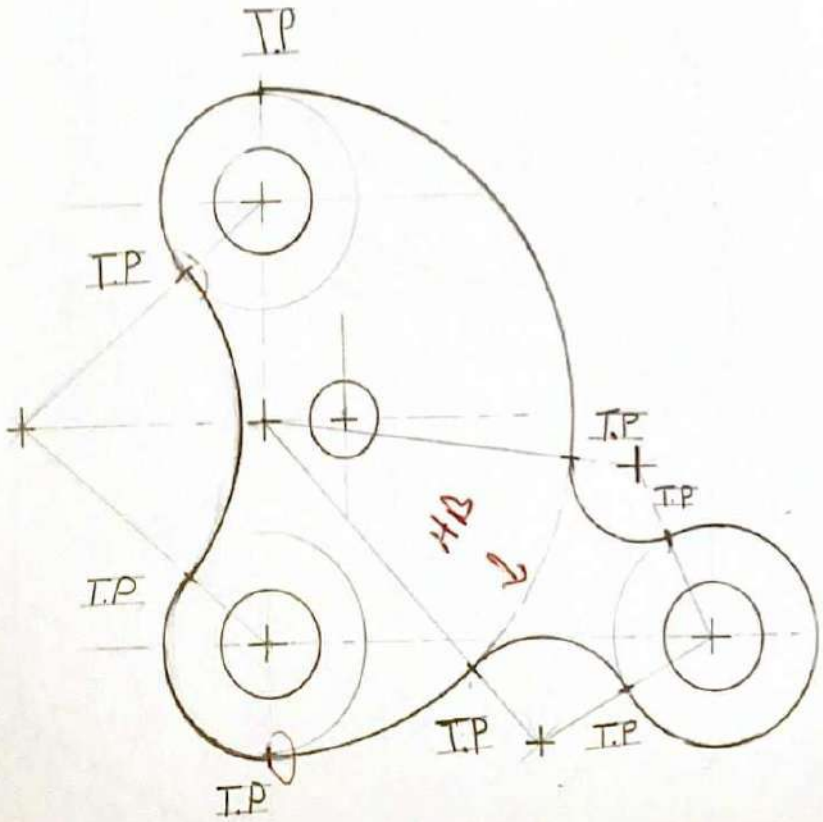
Prepare an instrumental drawing for the objects from **(a)** to **(d)** to the indicated scale. Show outlines in **HB** and construction lines in light and thin **2H**. Mark all tangent points with **3 mm dash HB**. **Do not erase construction lines**. Dimensions are in millimeters.

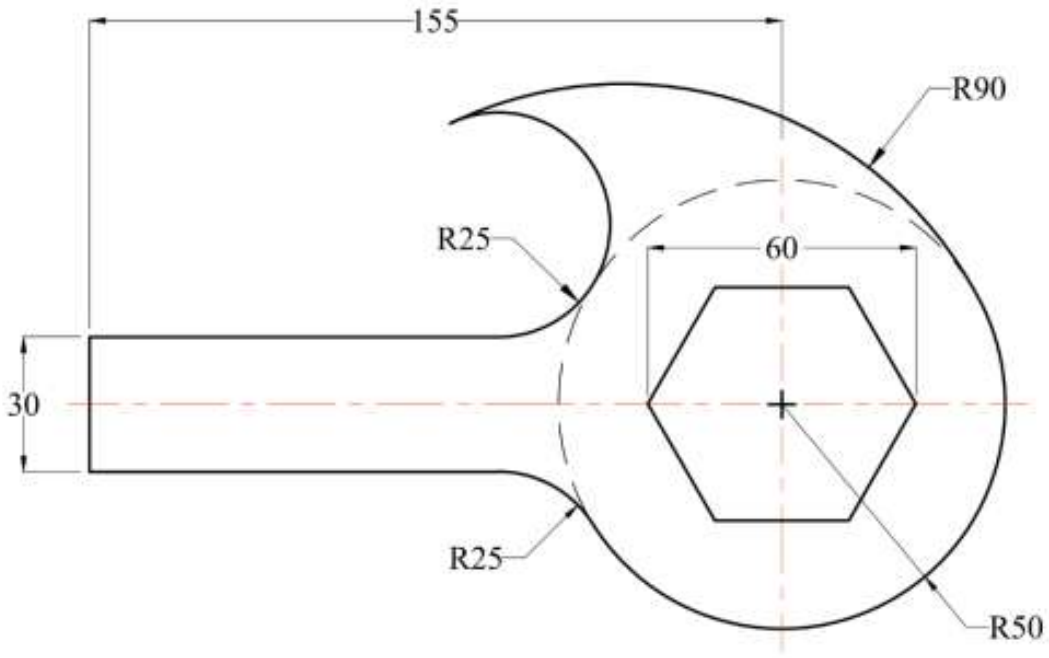


(a): Use Scale 1:1

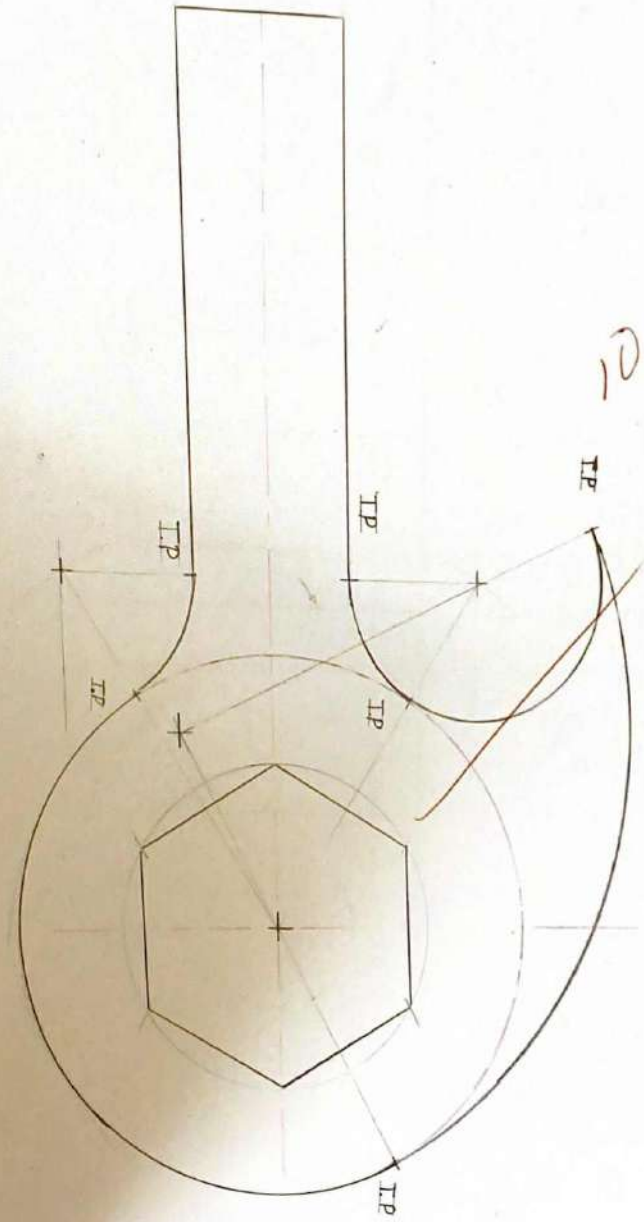
9



NAME: BAYAN ABU EL SAMEN	SECTION NO.: 5	82
FILE NO.: 37	DATE:	



(c): Use Scale 1:1



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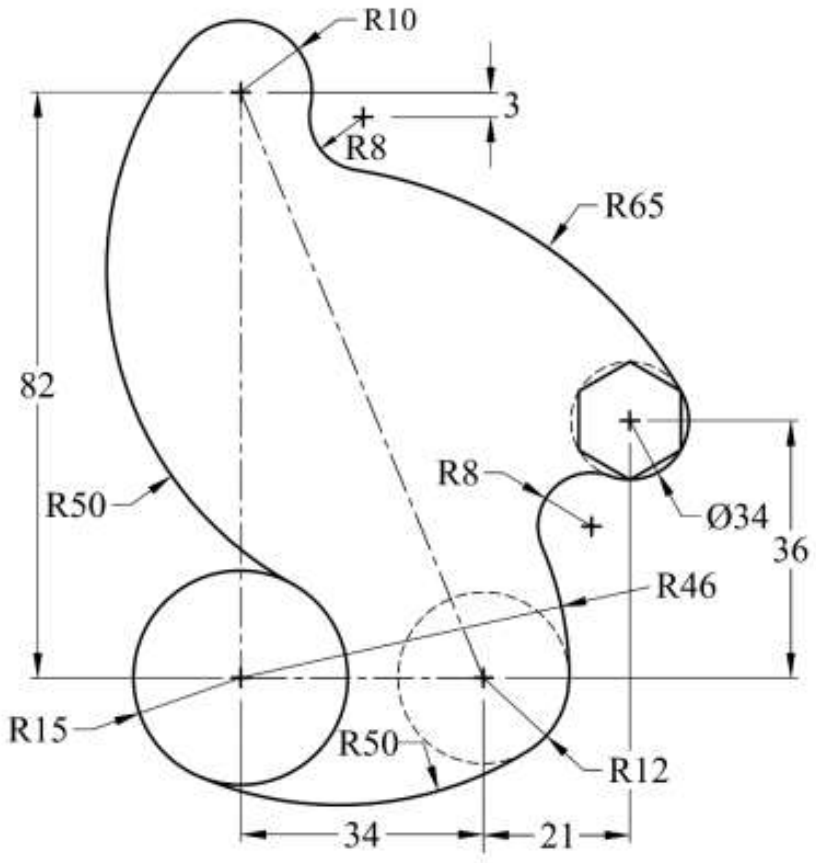
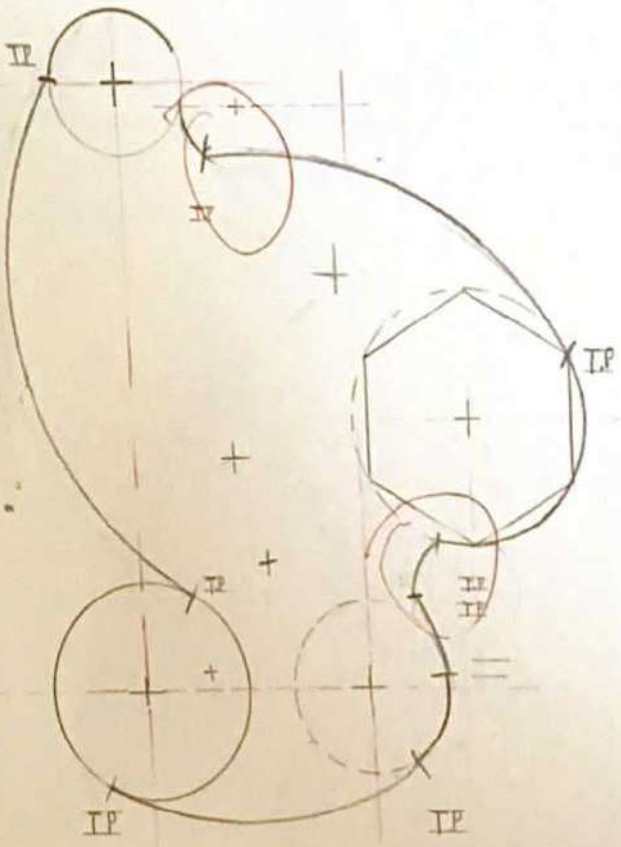
TANGENCY

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



8



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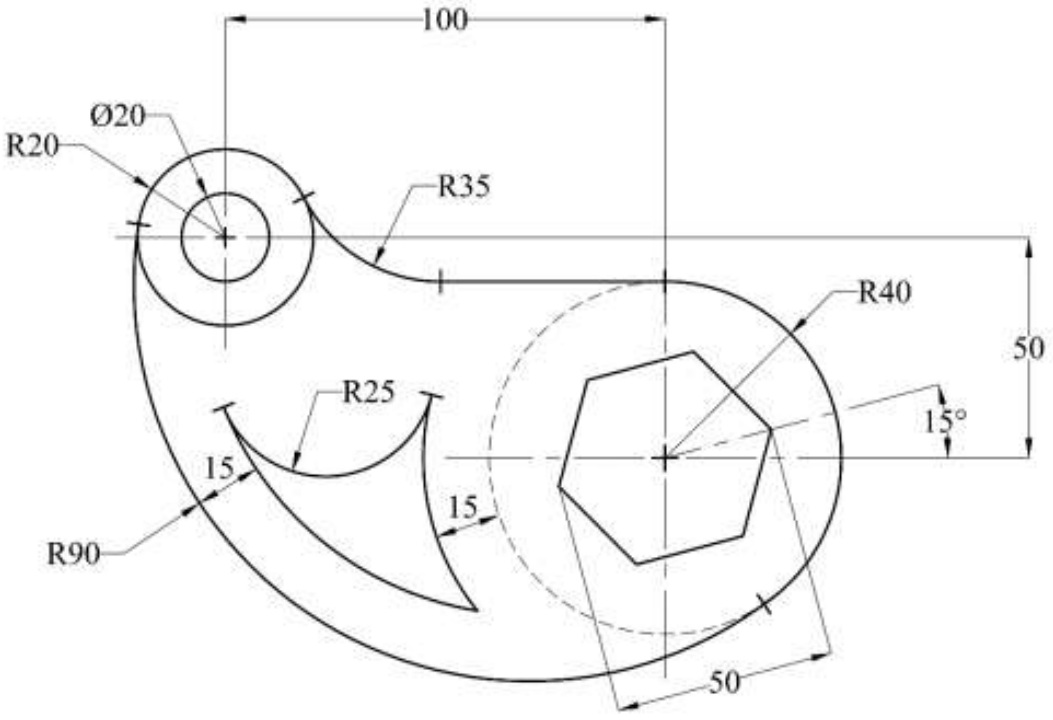
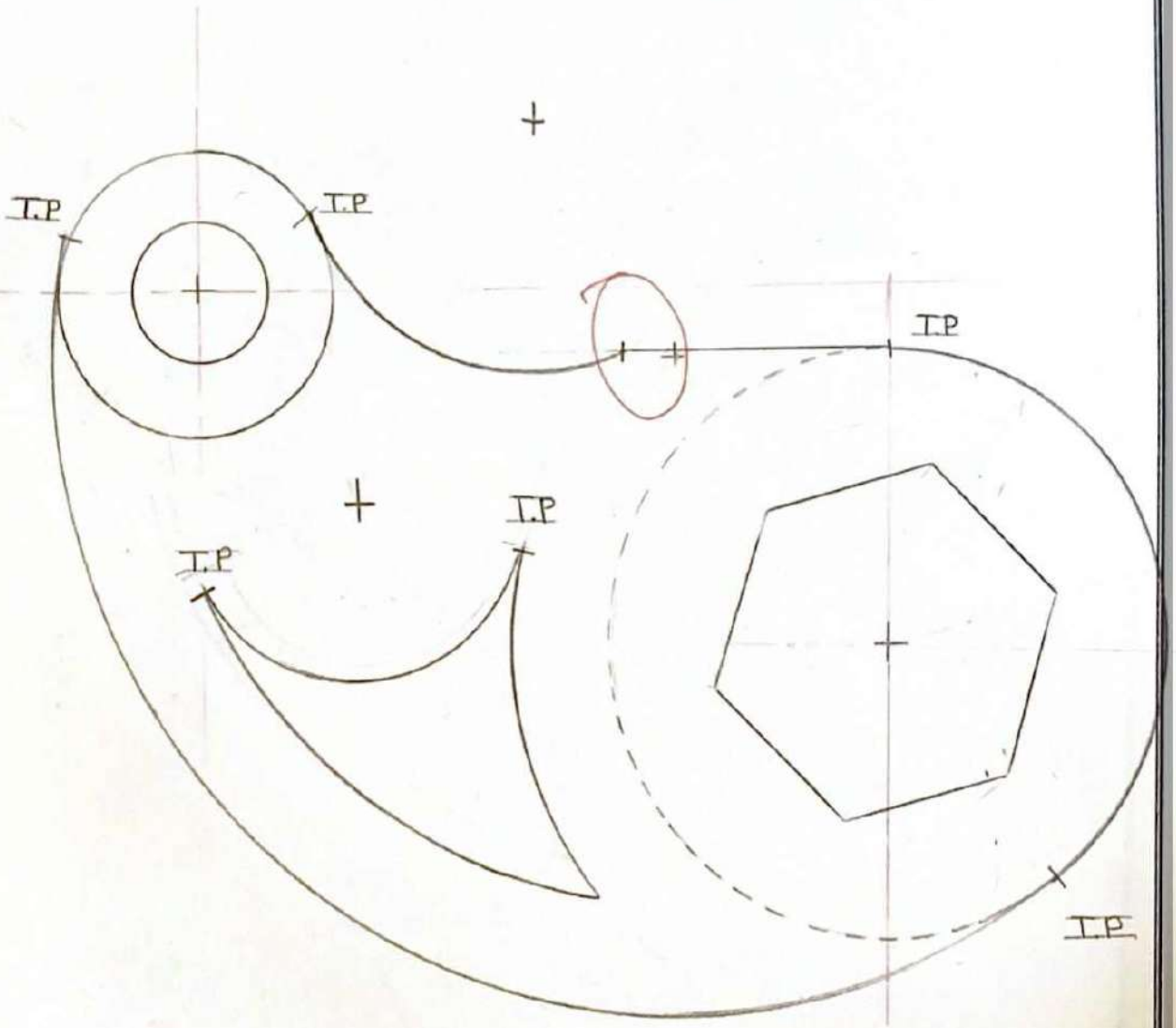
Exercise (3): Draw the given view. Show all constructions and mark all tangents.



9



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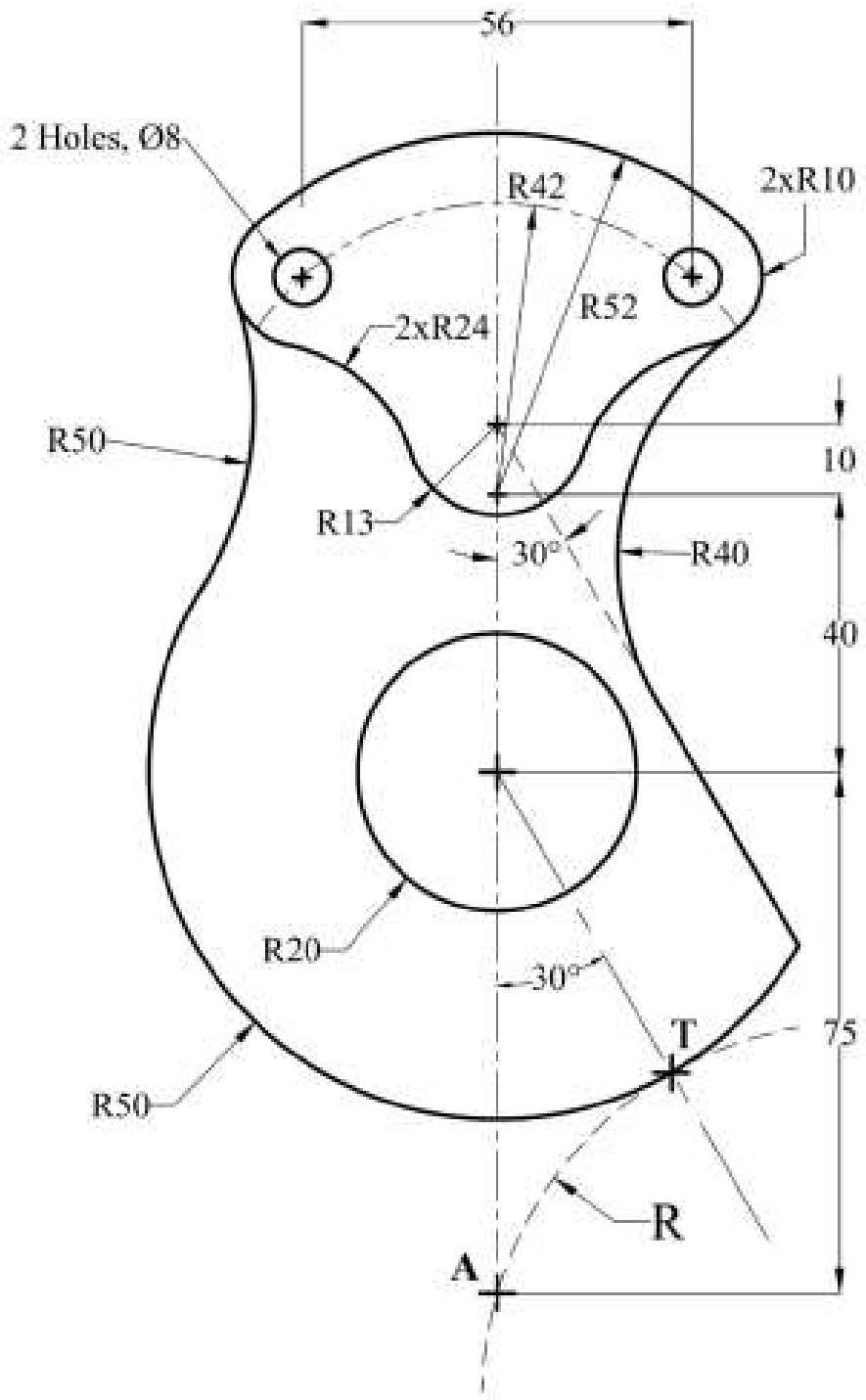
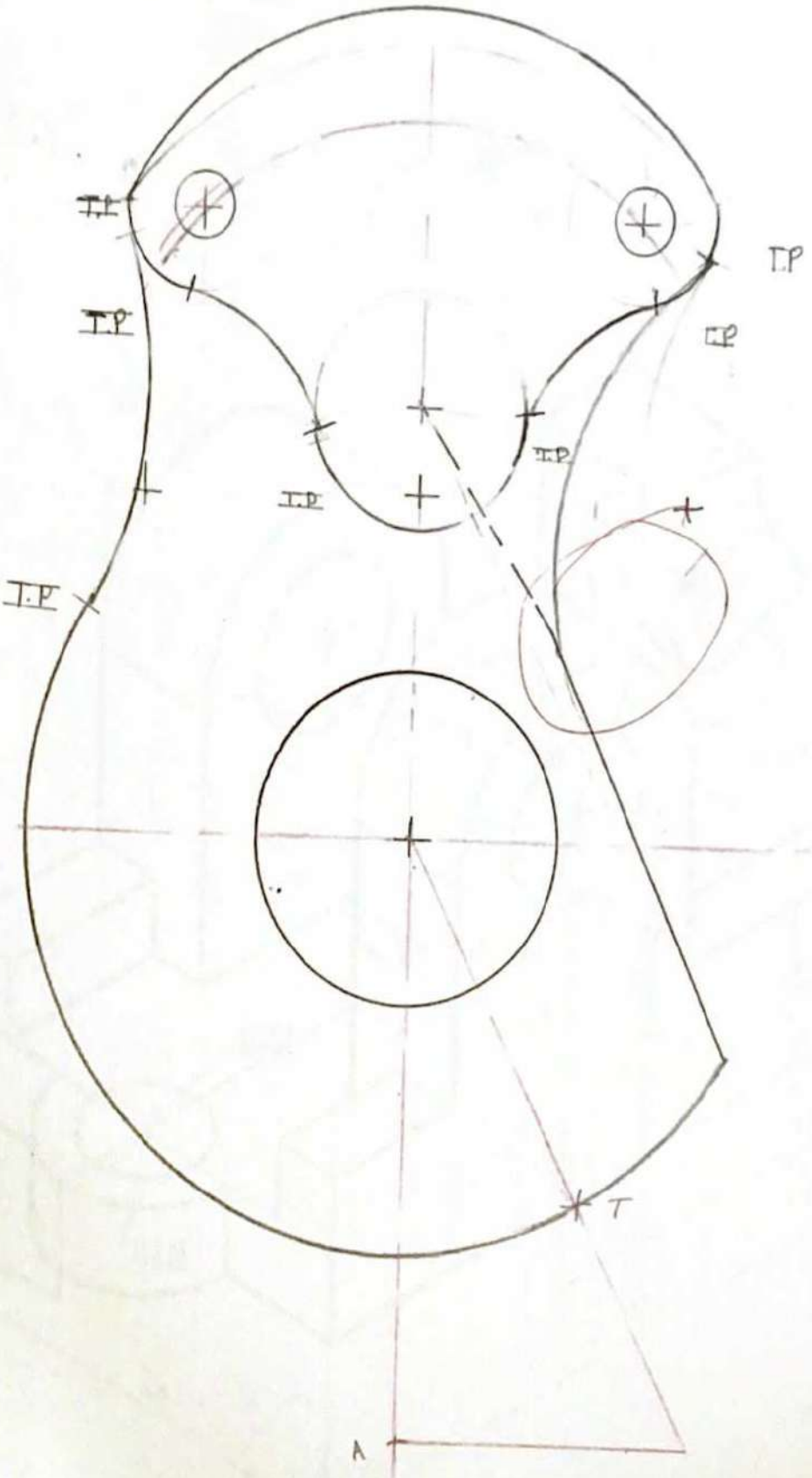
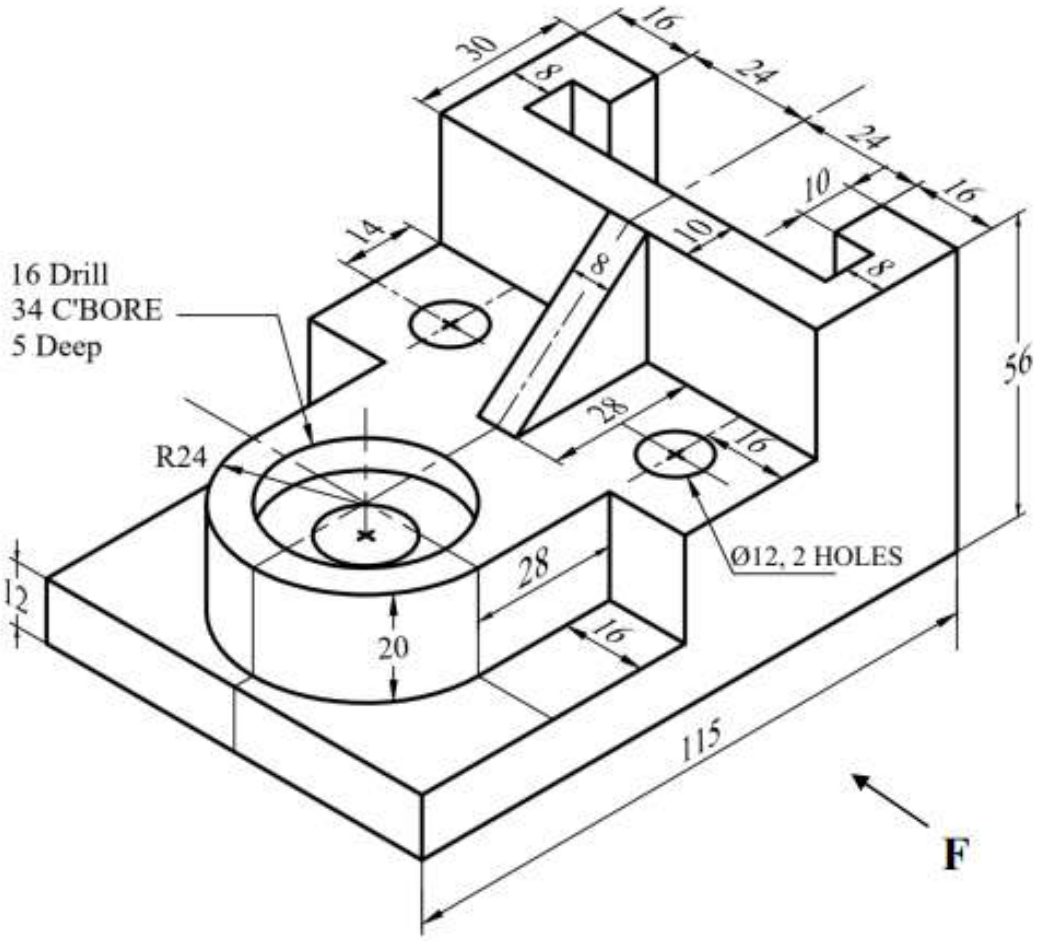
Exercise (6):

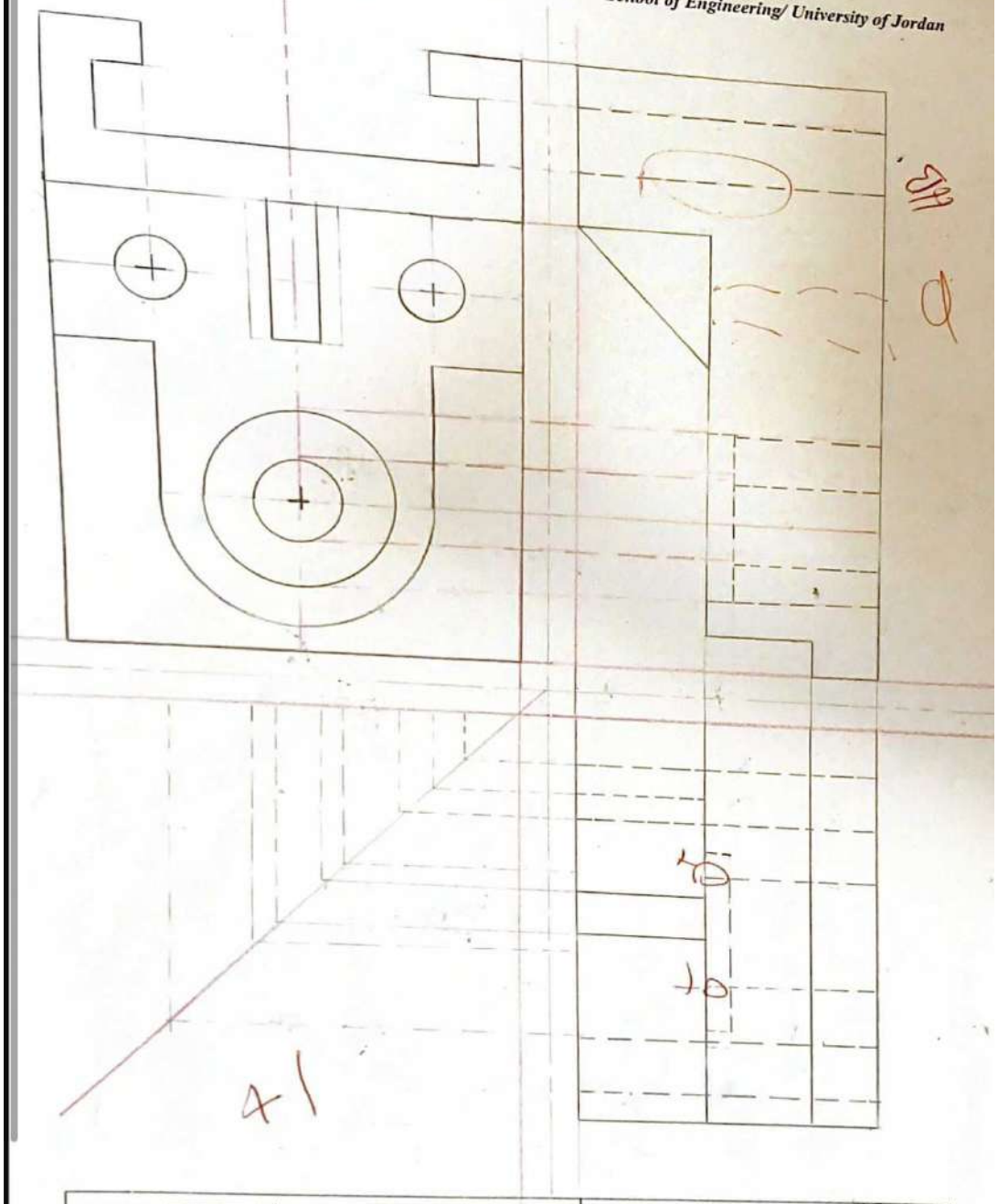
Draw the following, show the construction lines, and mark all tangent points. Then, Find the radius of the circle that passes through points (A) and tangent at point (T).




T.P
T.P
T.P
T.P
T.P
T.P
T
A

(B)


30
16
24
24
16
10
8
14
10
8
8
16 Drill
34 C'BORE
5 Deep
56
28
R24
16
Ø12, 2 HOLES
28
12
20
16
115
F



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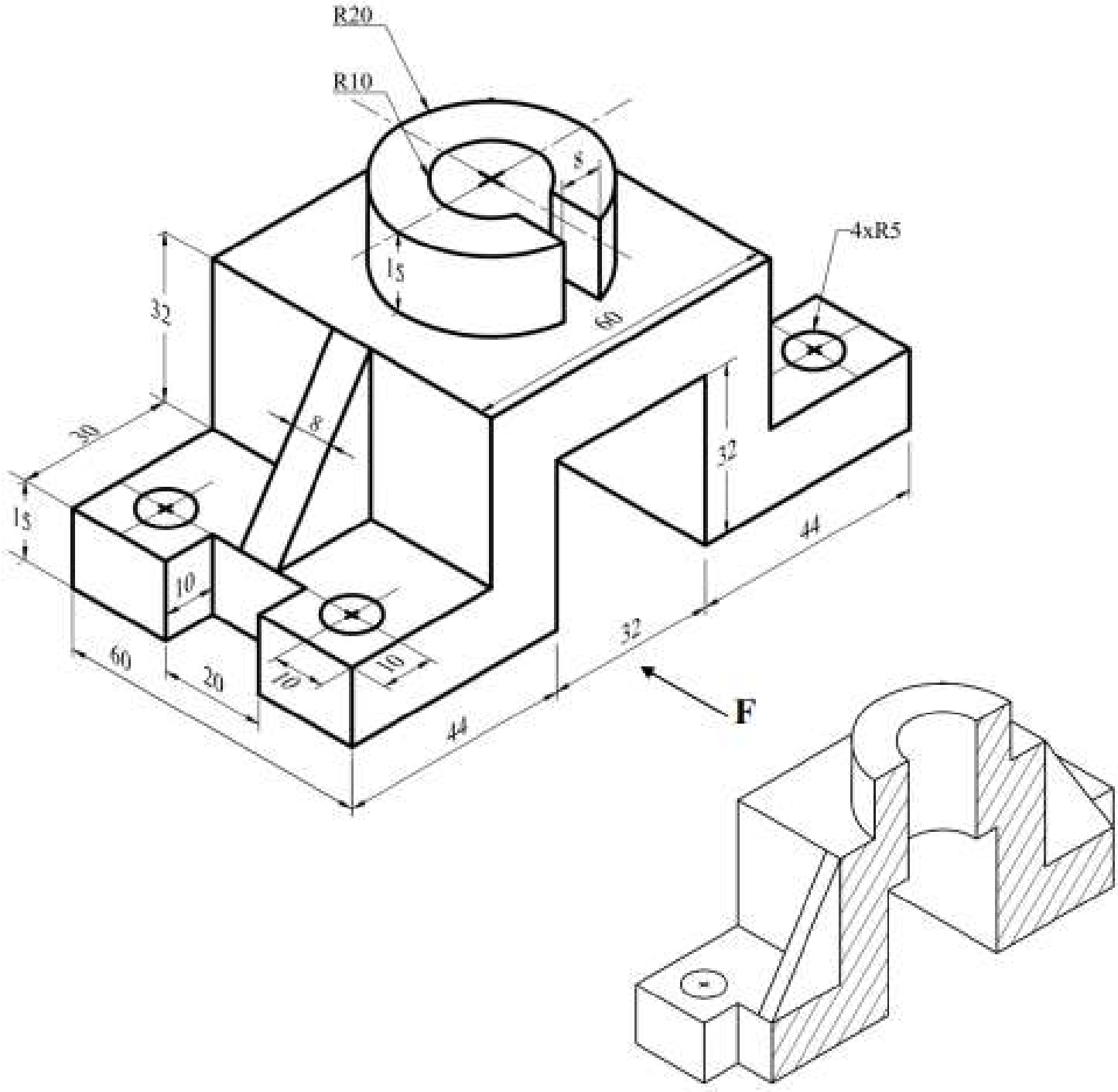
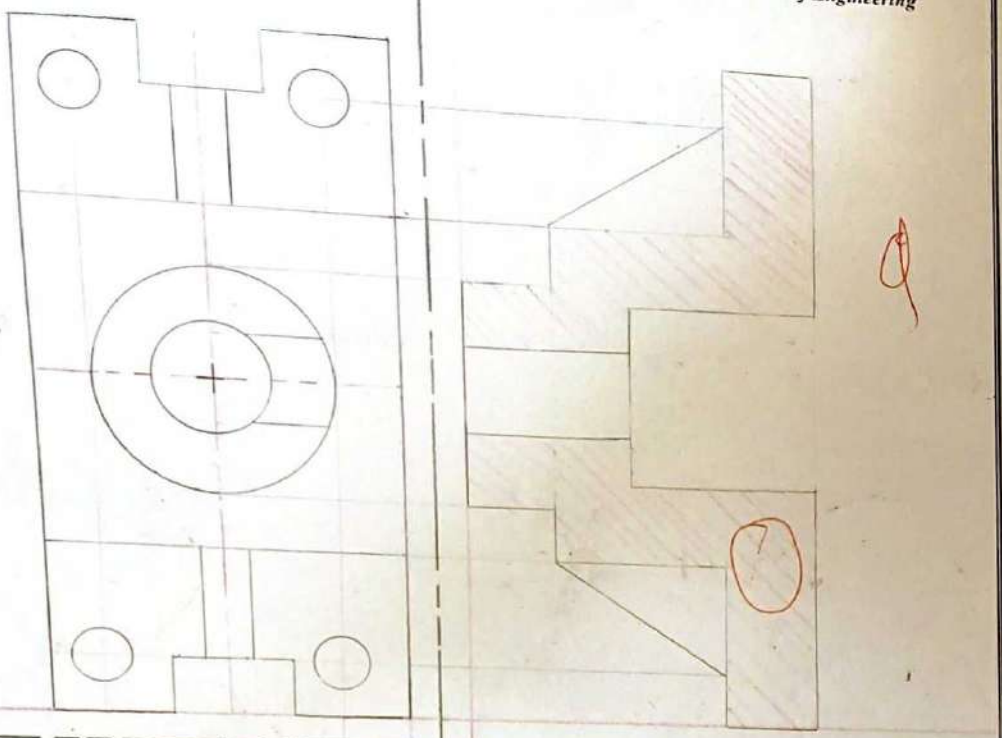
FILE NO.: 37	DATE:	

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

Note: All holes are through.





NAME: BAYAN SULTAN	SECTION NO.: 5	65
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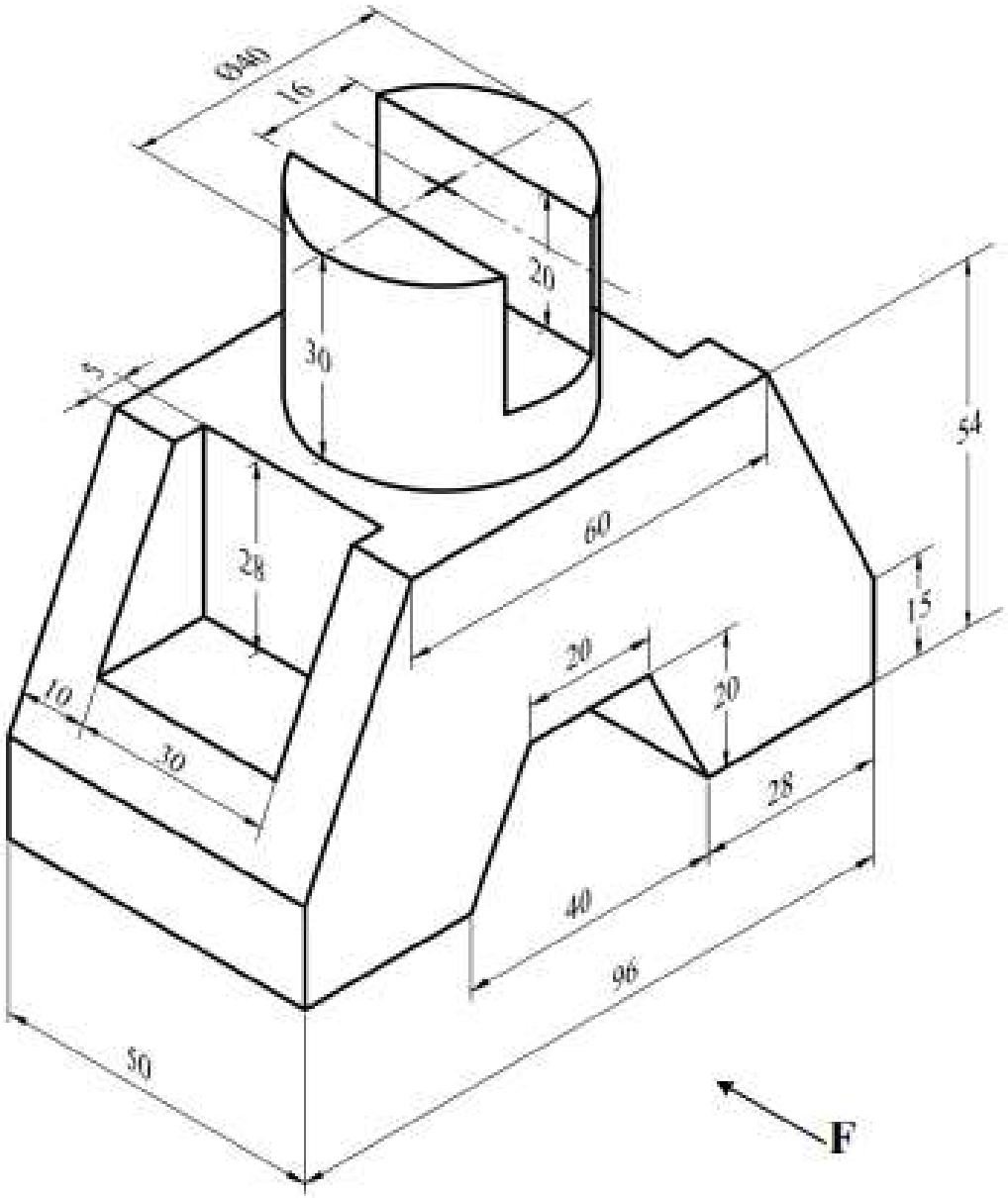
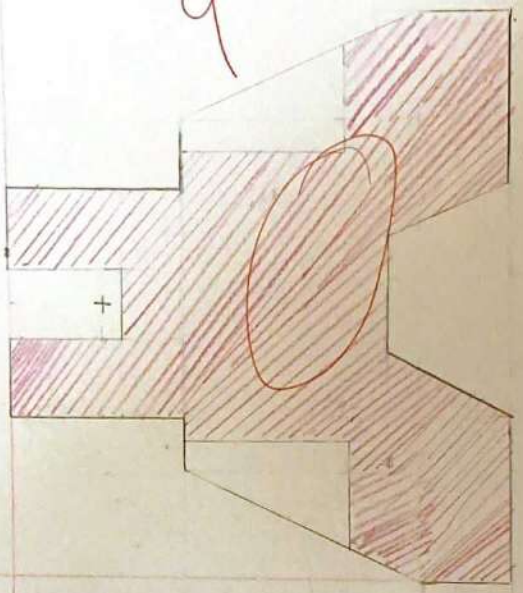
Exercise (4): For the given solid, draw the full sectional front view, top view, and the left side view.





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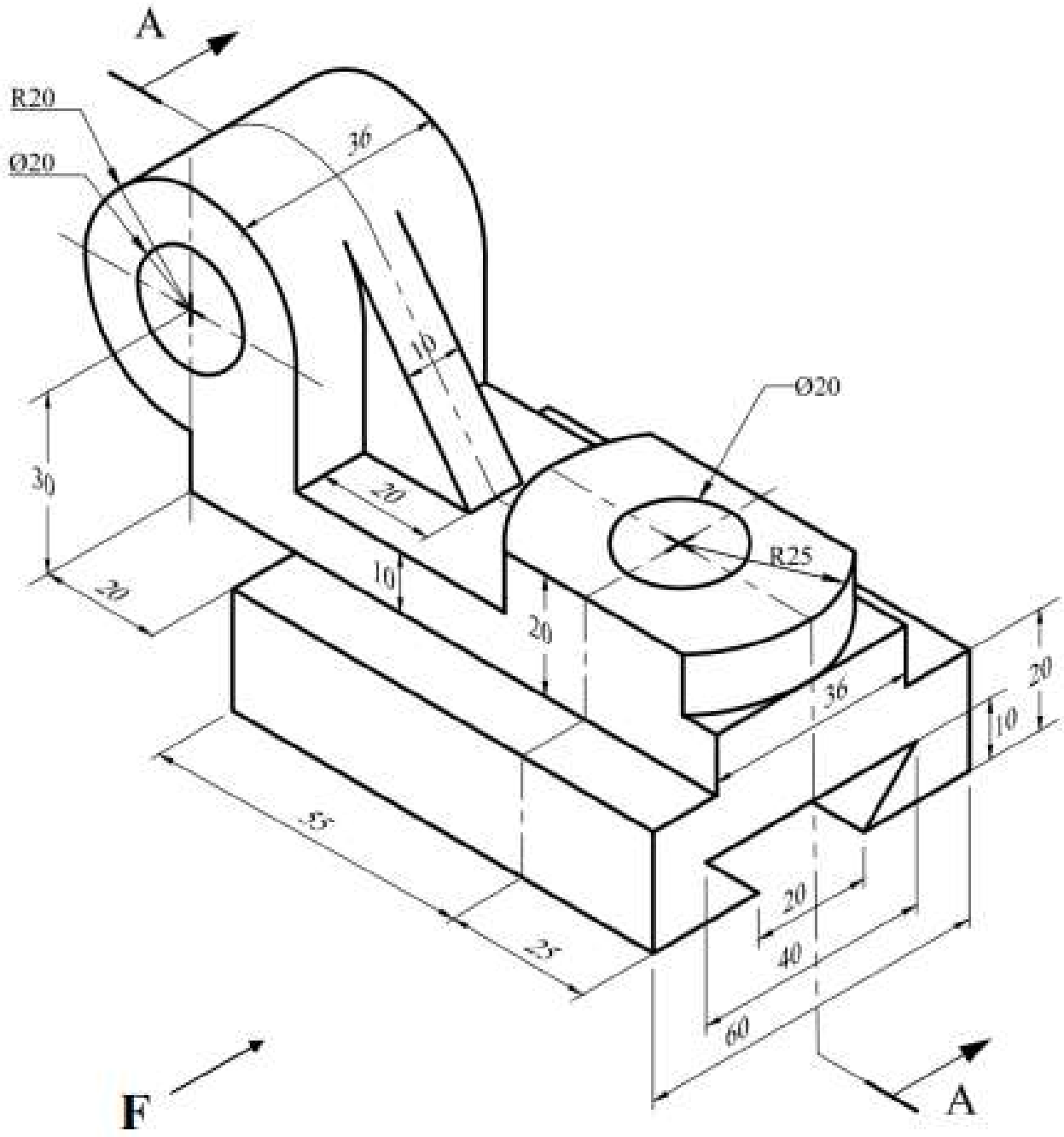
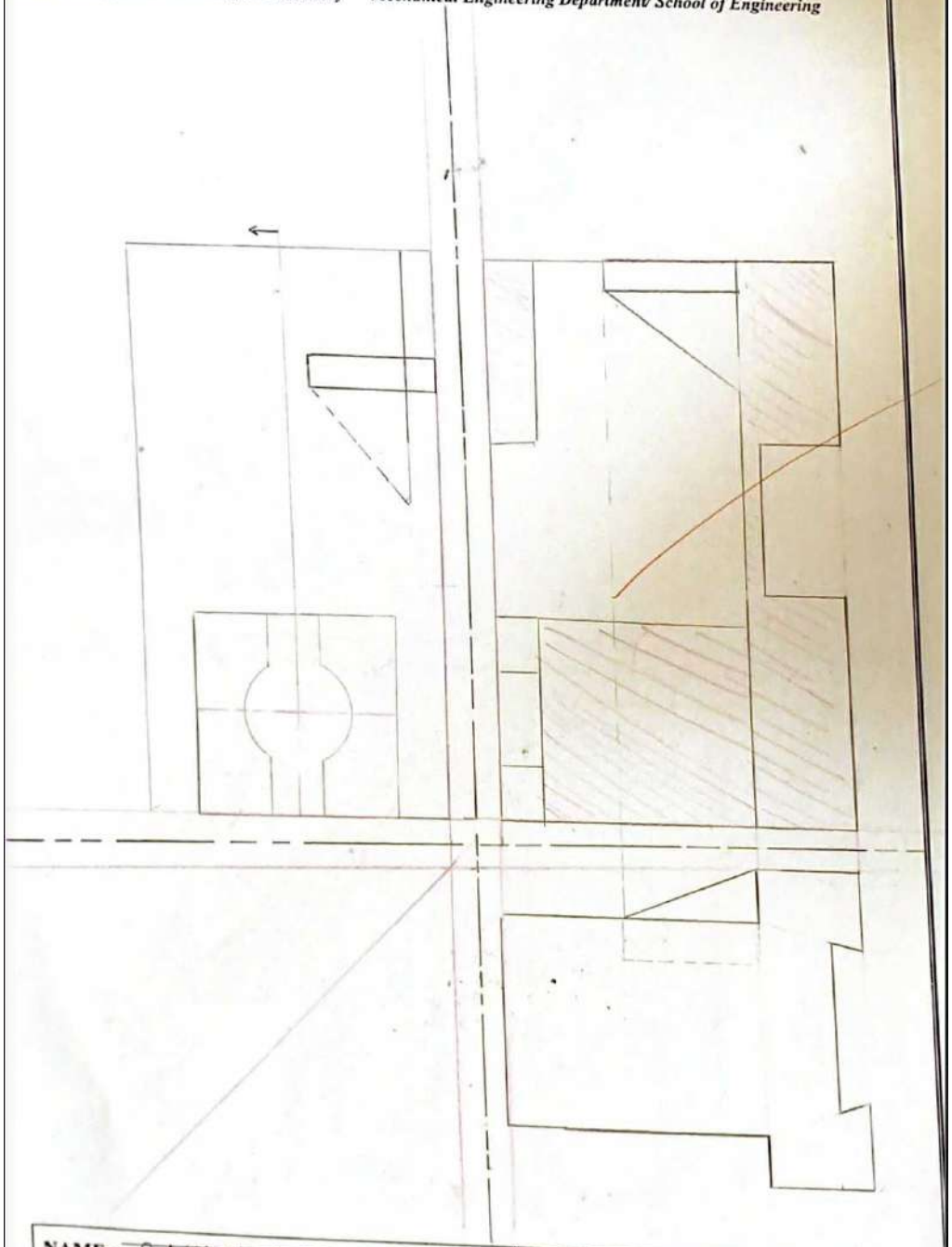
SECTION NO.: 5

DATE:

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

Note: All holes are through.





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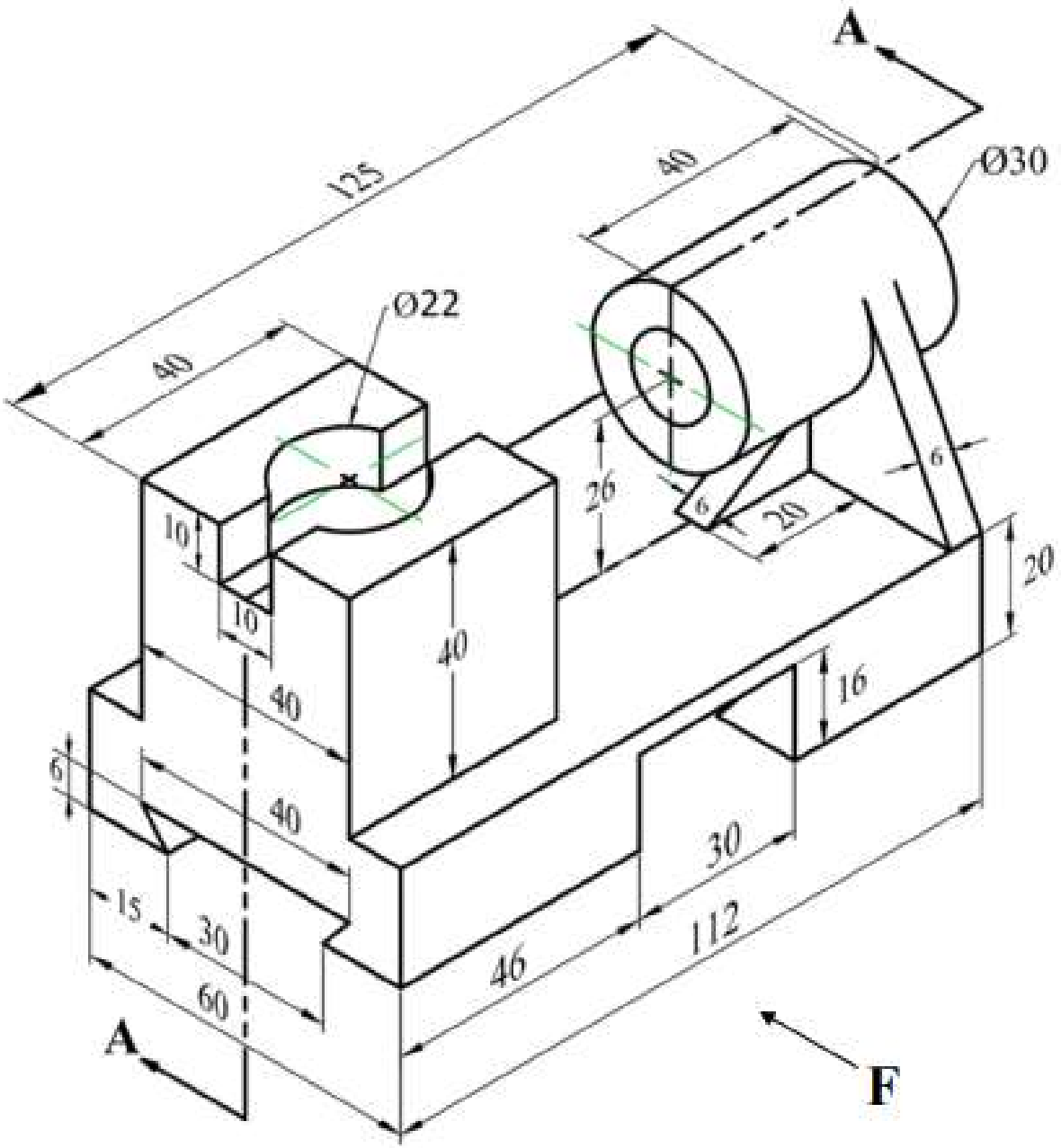
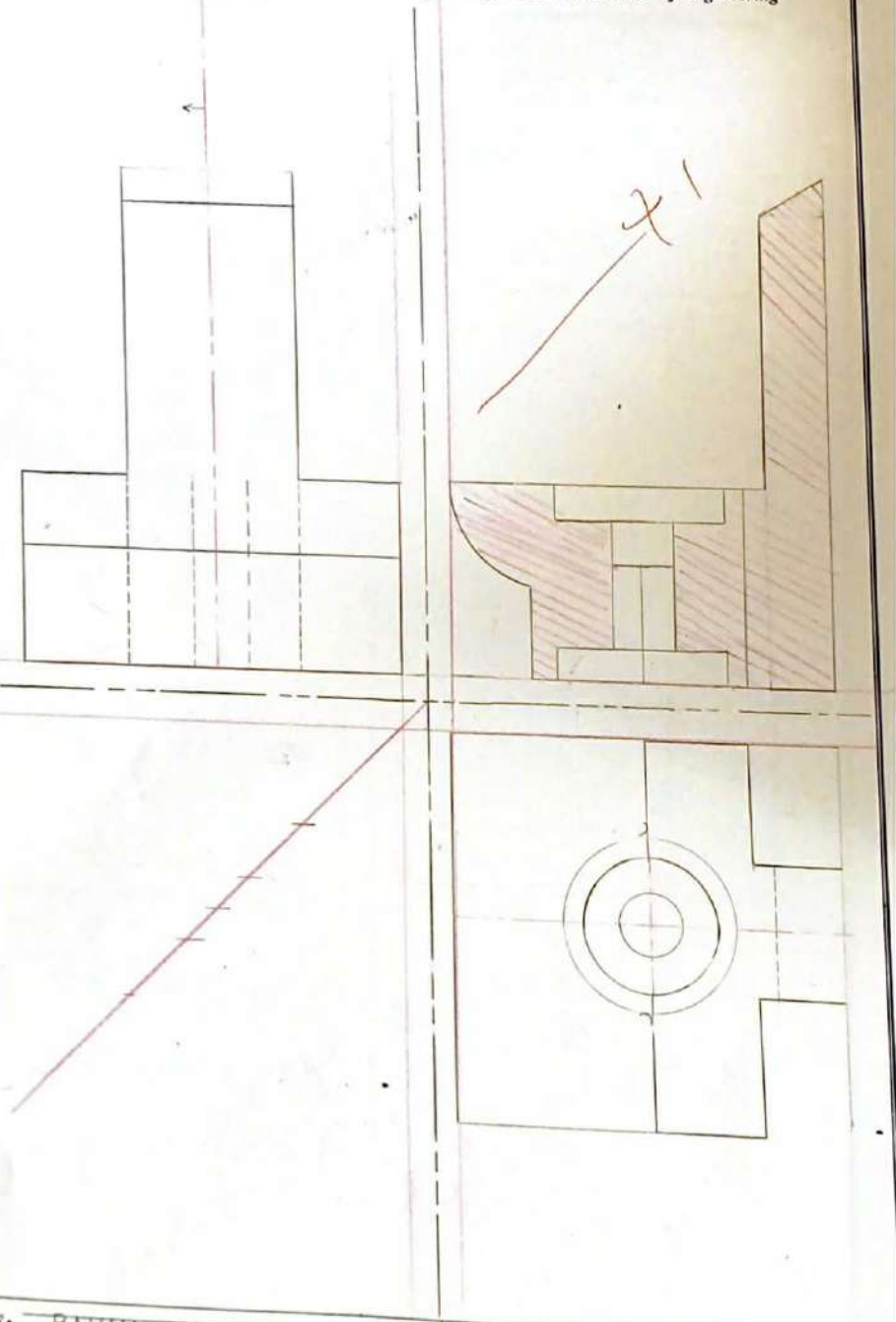
SECTION NO.: 5

DATE:

Exercise (3): Draw the full sectional front at A-A, top, and the left side views.

Note: All holes are through.





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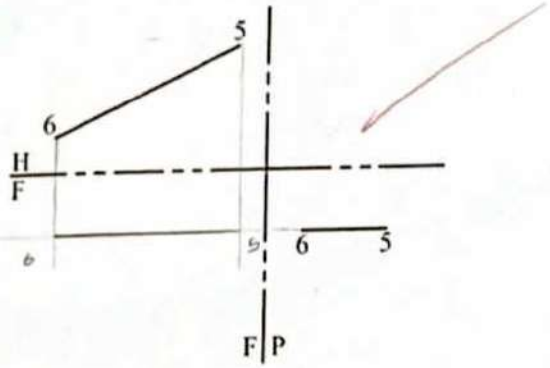
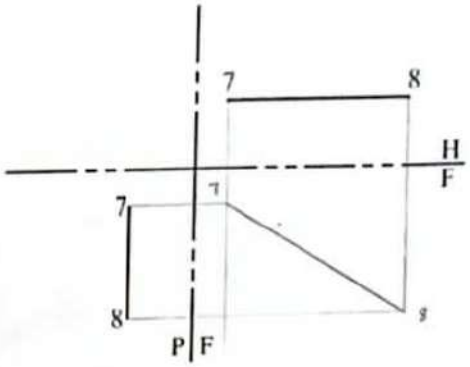
LINE PROJECTION

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

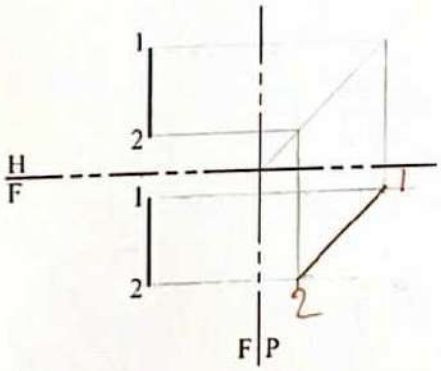
1 TYPE: H.L.



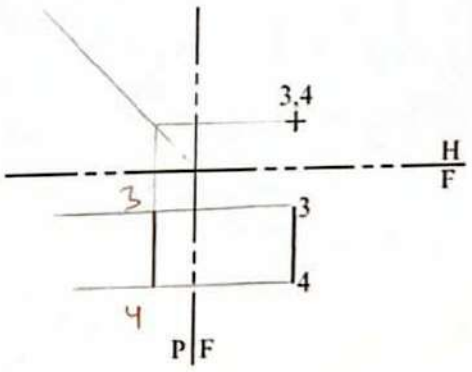
2 TYPE: F.L



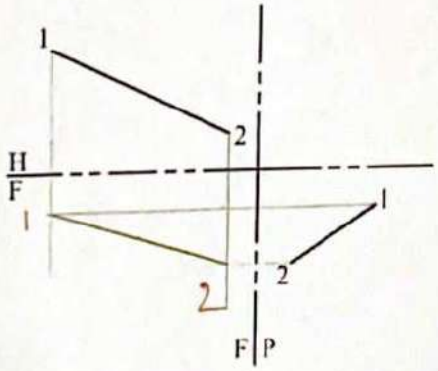
3 TYPE: P.L



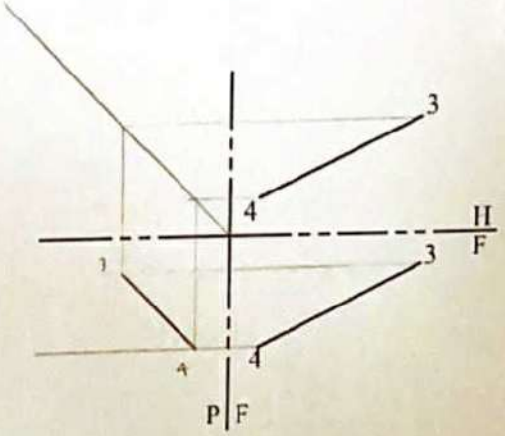
4 TYPE: F.P.L



5 TYPE: O.L



6 TYPE: O.L

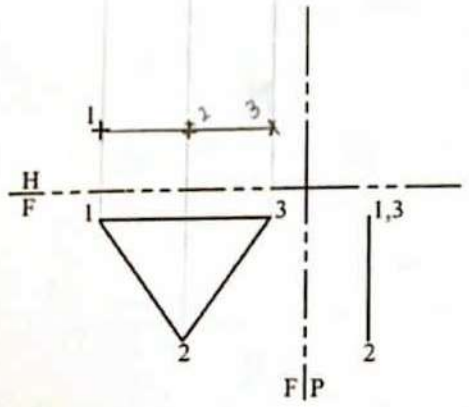


NAME: BAYAN SULTAN	SECTION NO.: 5	40
FILE NO.: 37	DATE:	

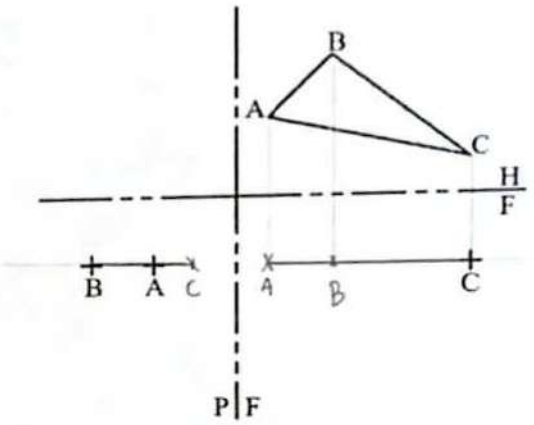
PLANE PROJECTION

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

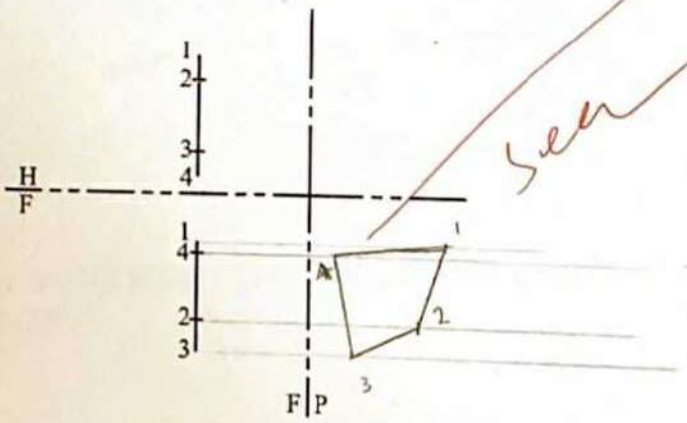
1 TYPE: E.P



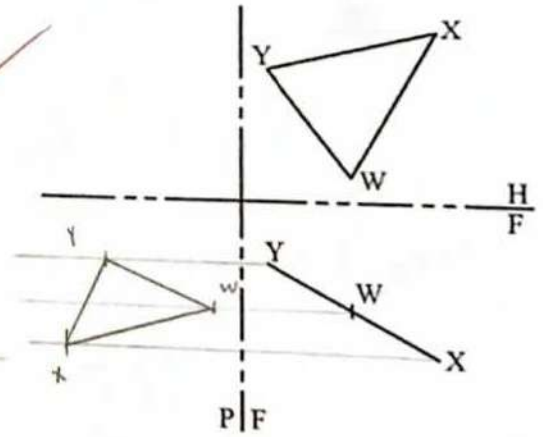
2 TYPE: H.P



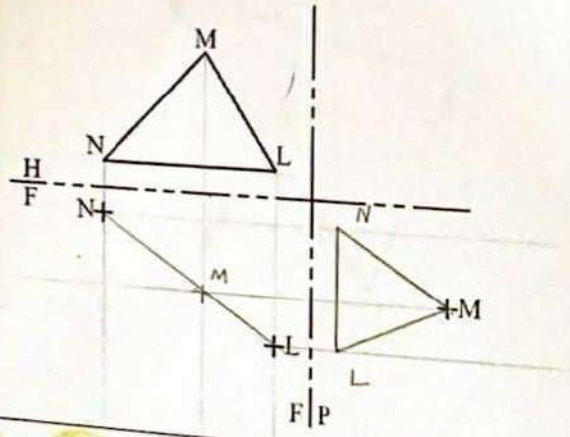
3 TYPE: P.P



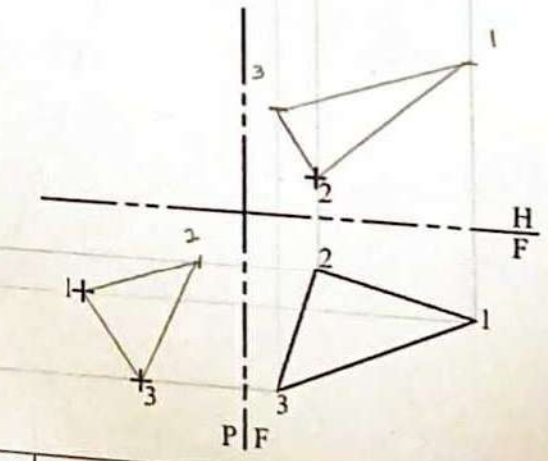
4 TYPE: INCLINED



5 TYPE: INCLINED



6 TYPE: O.P



NAME: BAYAN SULTAN

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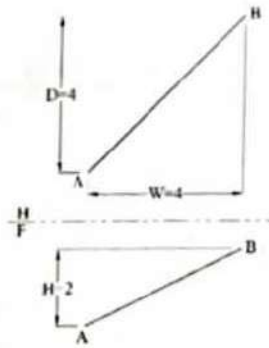
DATE:

TRUE LENGTH OF A LINE



W = WIDTH
D = DEPTH
H = HEIGHT

MATHEMATICAL EXAMPLE (PYTHAGOREAN THEORY)

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

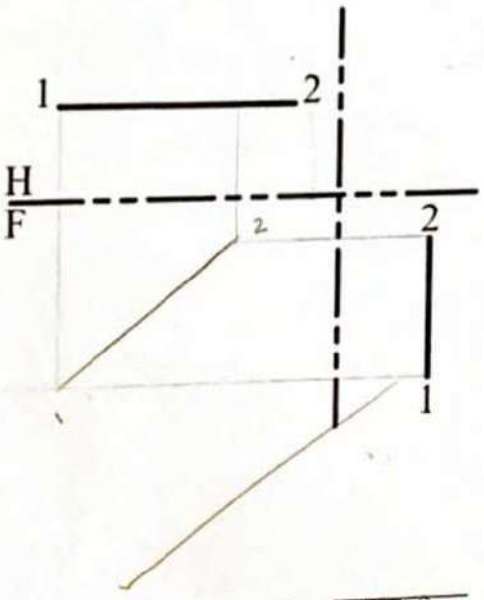
$W^2 = 16$

$D^2 = 16$

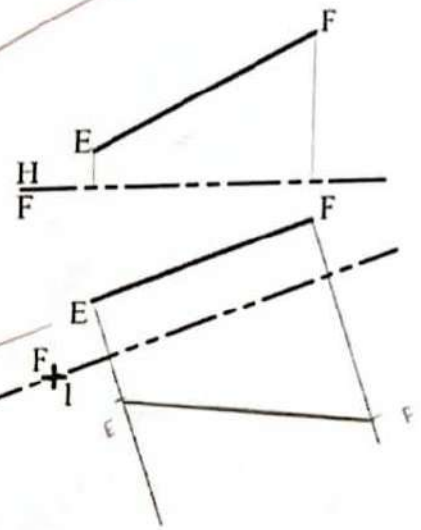
$H^2 = 4$

DETERMINE THE TRUE LENGTHS OF EACH LINE USING GRAPHICAL METHOD.

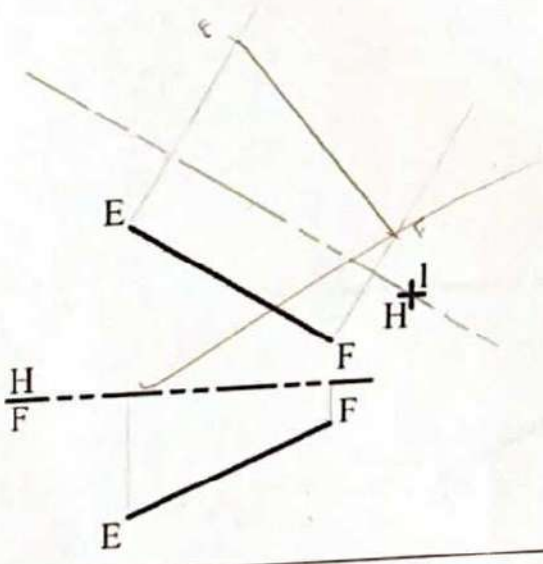
1 METRIC SCALE 1:600, TL = 17400



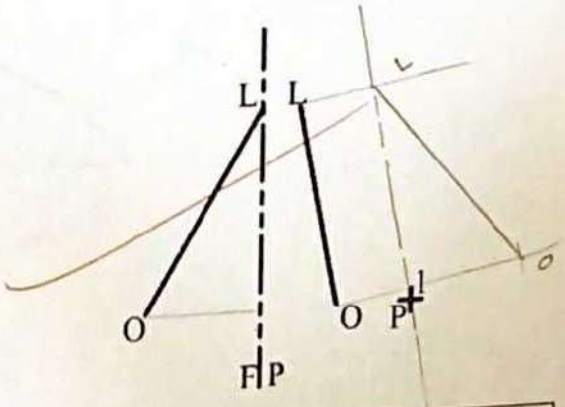
2 METRIC SCALE 1:30, TL = 960



3 METRIC SCALE 1:60, TL = 1920



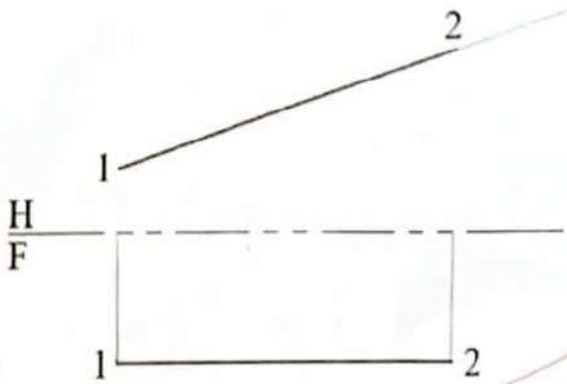
4 METRIC SCALE 1:40, TL = 1200



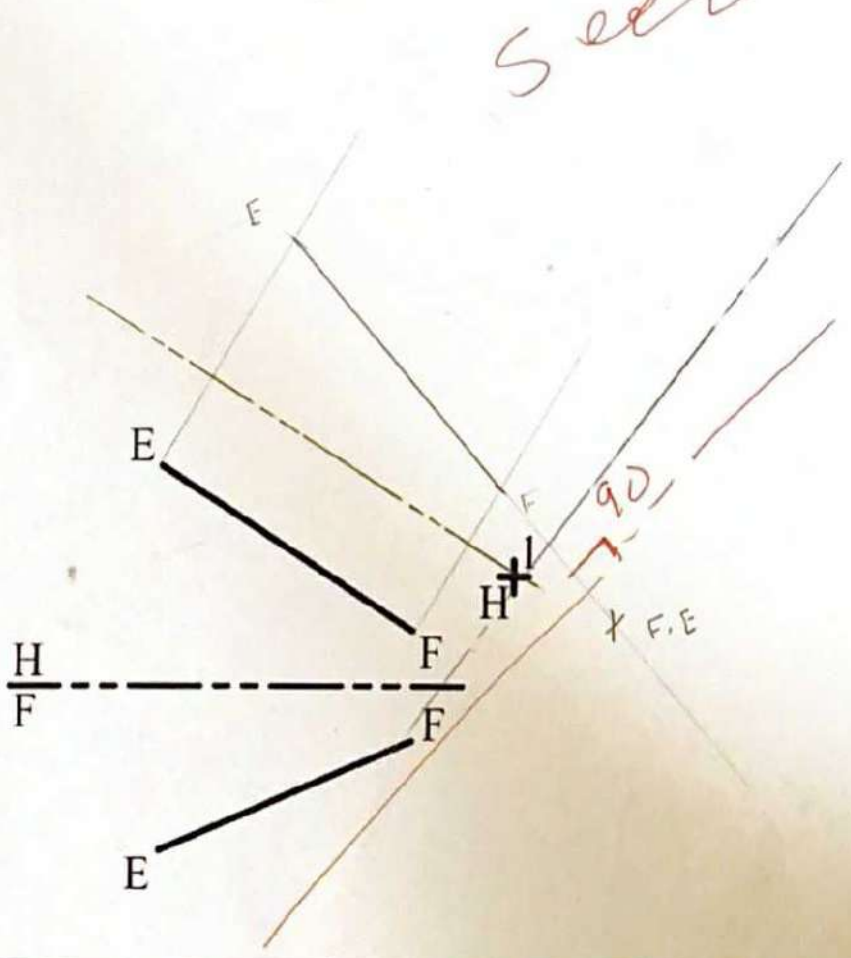
NAME: BAYAN SULTAN	SECTION NO.: 5	43
FILE NO.: 37	DATE:	

POINT VIEW

1 OBTAIN A POINT VIEW OF LINE 1-2.



2 OBTAIN A POINT VIEW OF LINE **(E-F)**.



NAME: BAYAN SULTAN	SECTION NO.: 5	44
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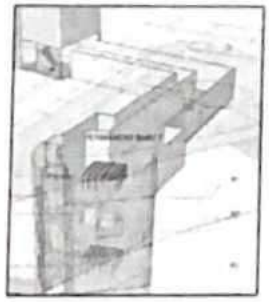
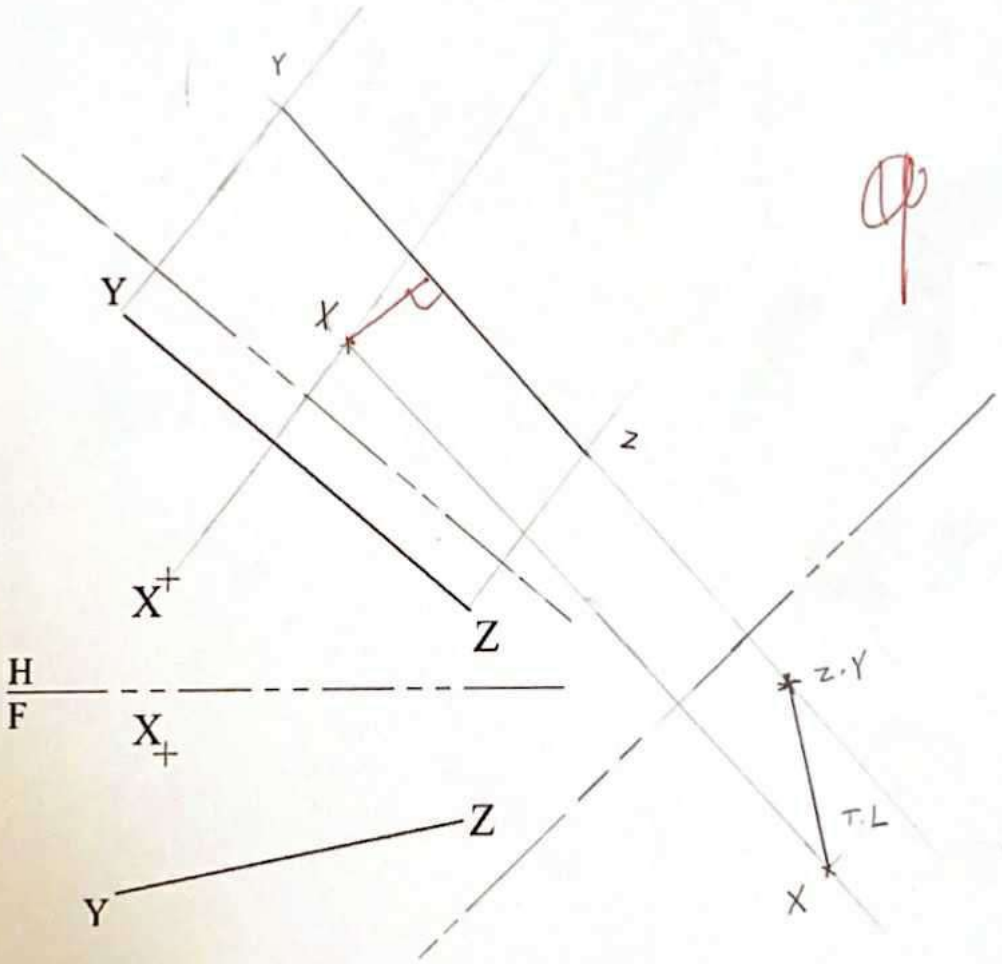
3 GIVEN HORIZONTAL AND FRONT VIEWS OF A TUNNEL, WHERE **YZ** IS THE CENTERLINE OF A TUNNEL AND **X** IS A POINT ON THE EARTH'S SURFACE.

FIND THE **TRUE LENGTH** OF THE **VENTILATION SHAFT** TO BE DUG FROM POINT **(X)** TO **(YZ)**. 25 mm

NOTE: START PROJECTION FROM **TOP**.





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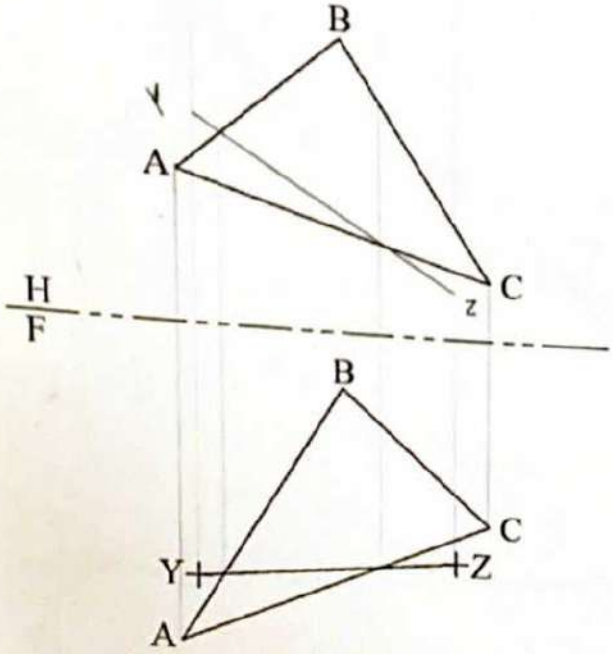
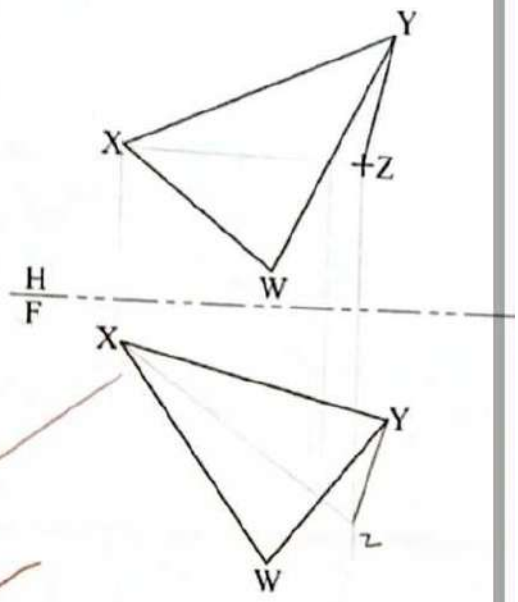
PROJECTION OF A LINE ONTO A PLANE

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

1

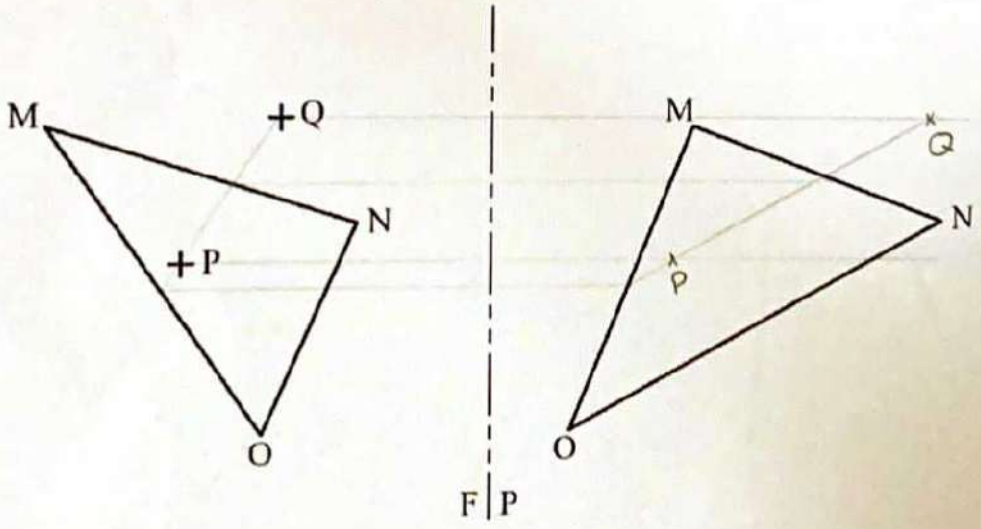


2



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

3

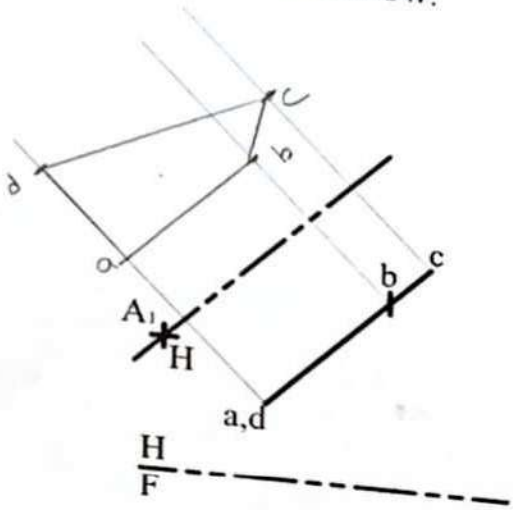


NAME: BAYAN SULTAN	SECTION NO.: 5	46
FILE NO.: 37	DATE:	

...SHAPE OF A PLANE

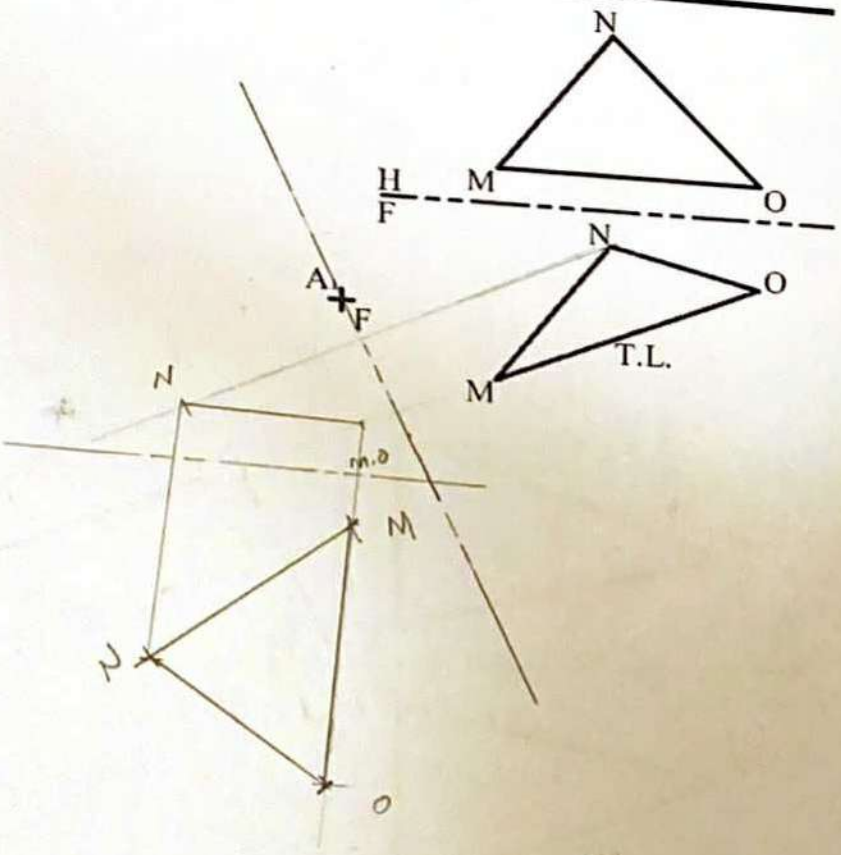
FIND THE TRUE SHAPE VIEWS OF THE PLANES OF ALL EXERCISES SHOWN BELOW.

1



10

2



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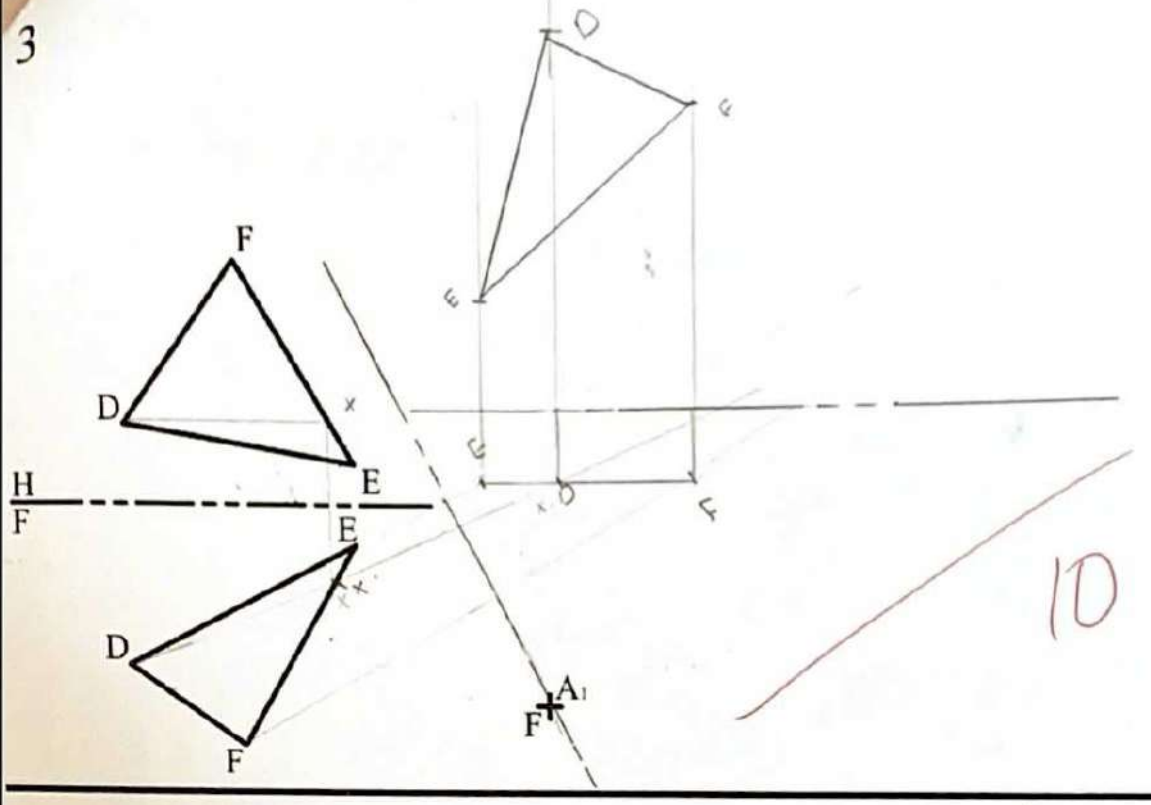
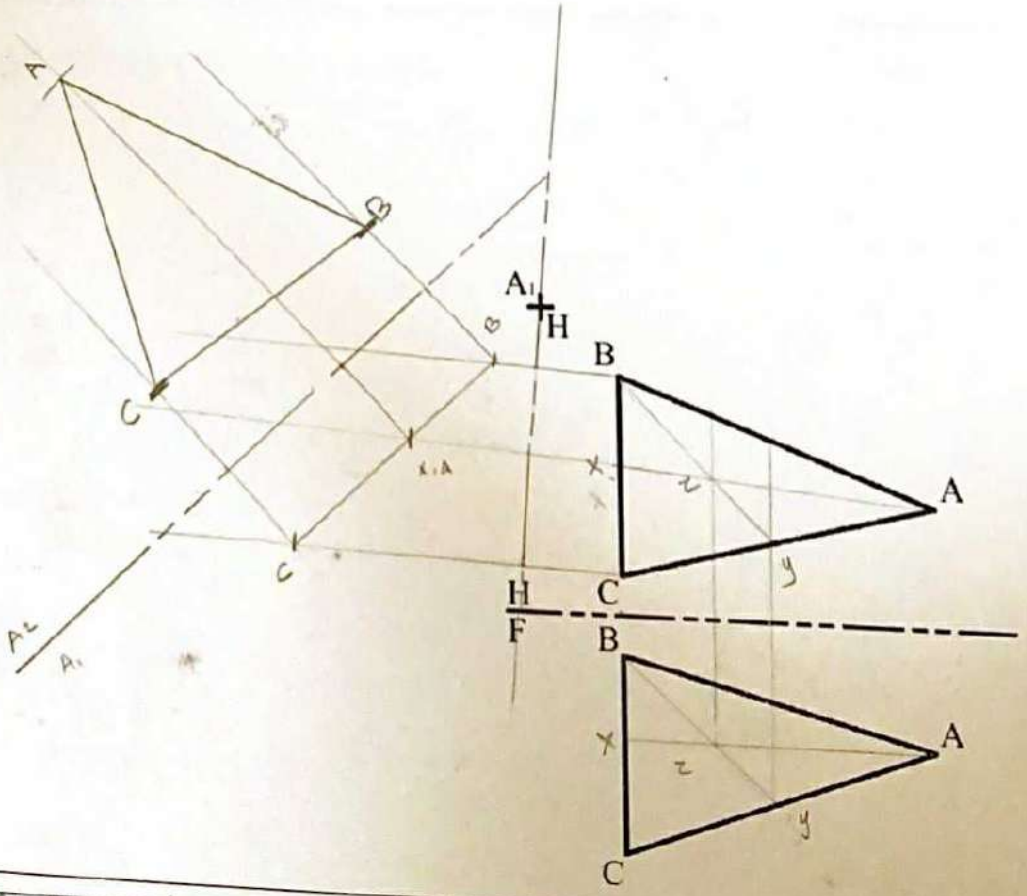
3



10

4



NAME: BAYAN SULTAN

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SECTION NO.: 5

DATE:

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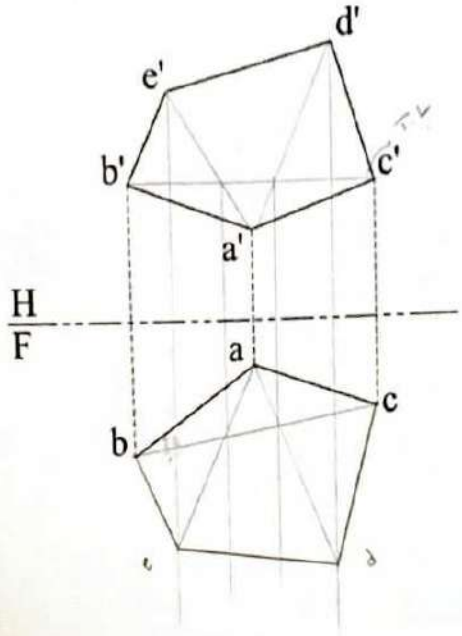
APPLICATIONS ON TRUE SHAPE OF A PLANE

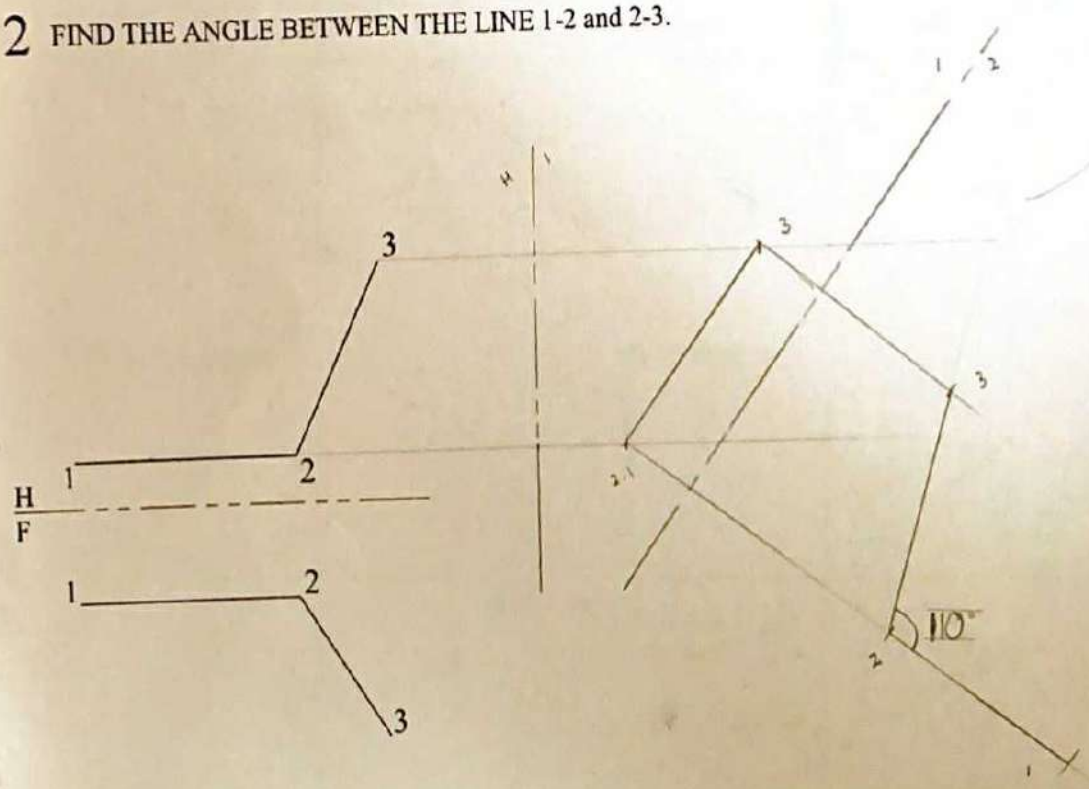
1 USING THE GIVEN HORIZONTAL AND FRONTAL PROJECTIONS **ONLY**, DETERMINE THE FRONTAL PROJECTION OF THE PLANE PENTAGON **(abcde).**



+1

10

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



NAME: BAYAN SULTAN	SECTION NO.: 5	49
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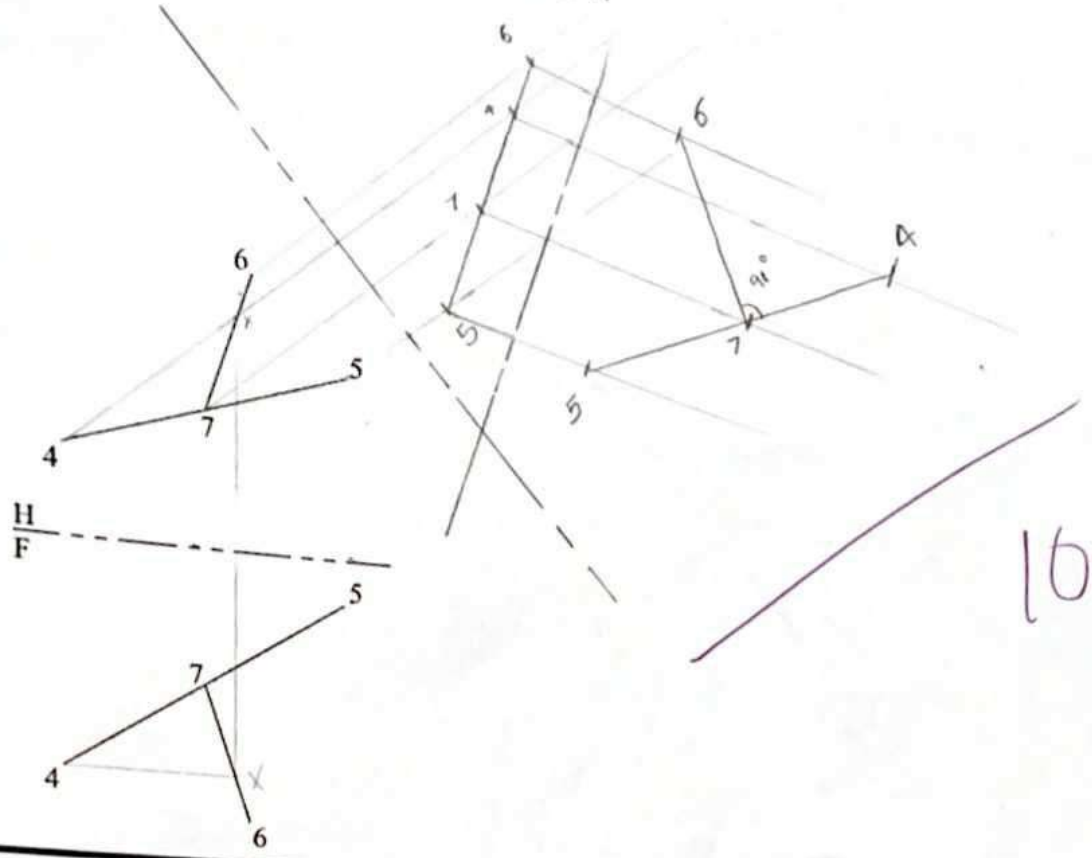
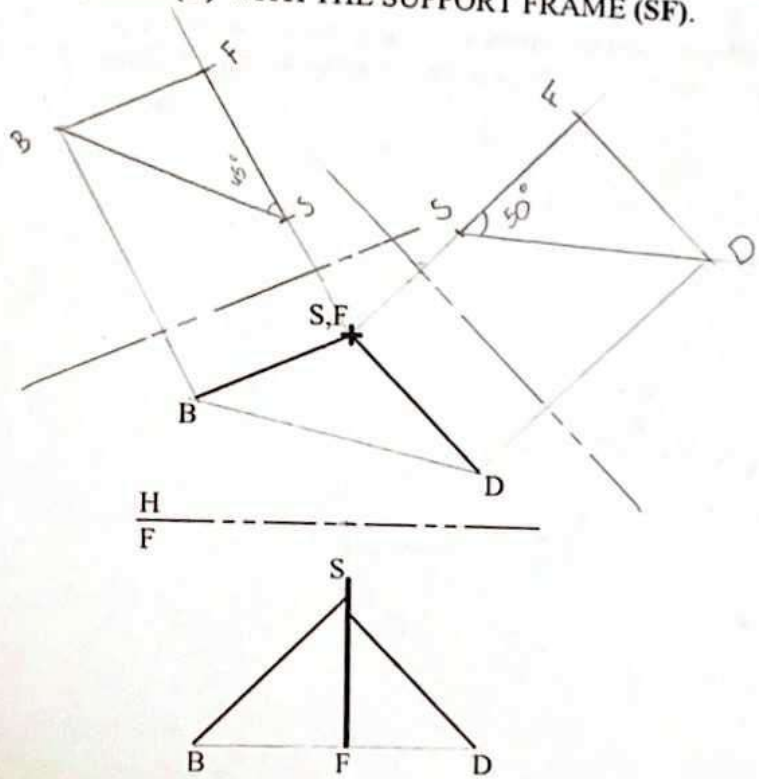
3 FIND THE ANGLE BETWEEN THE LINE 4-5 and 6-7.



16

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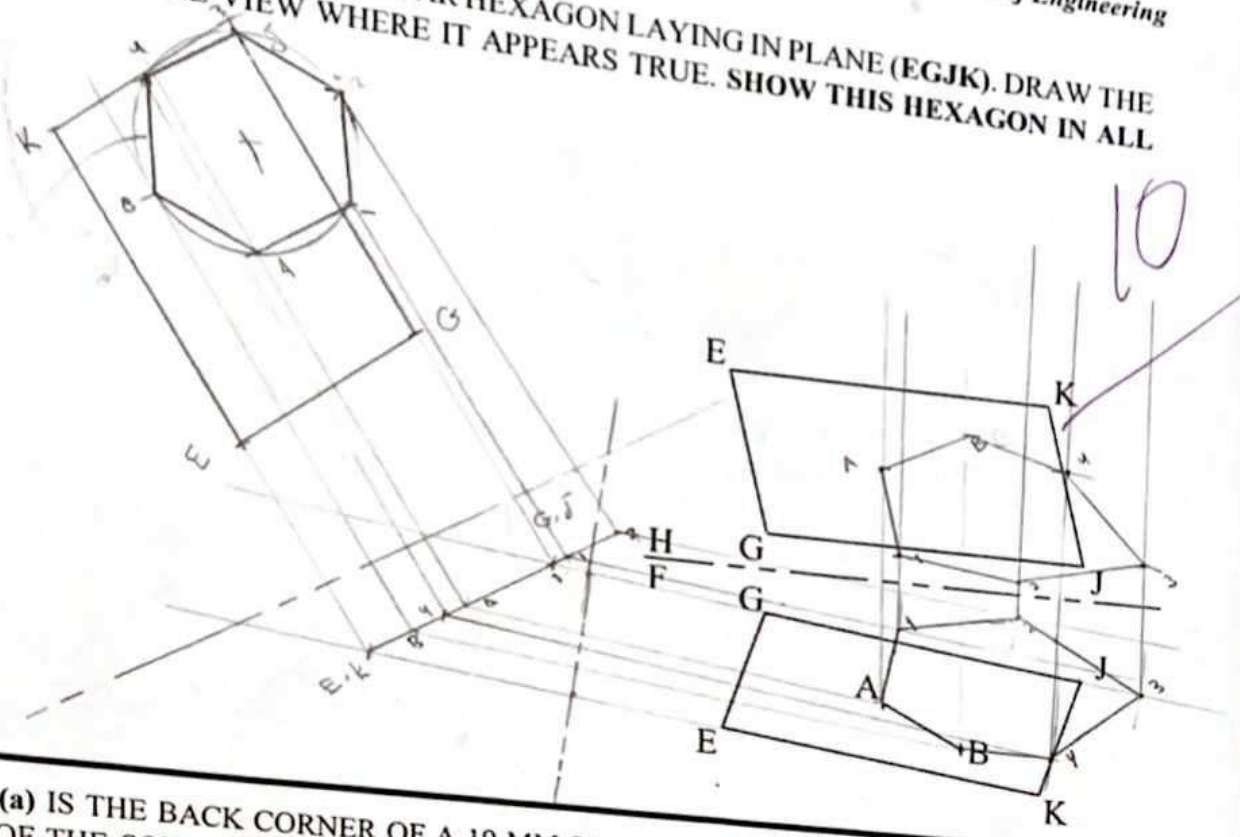
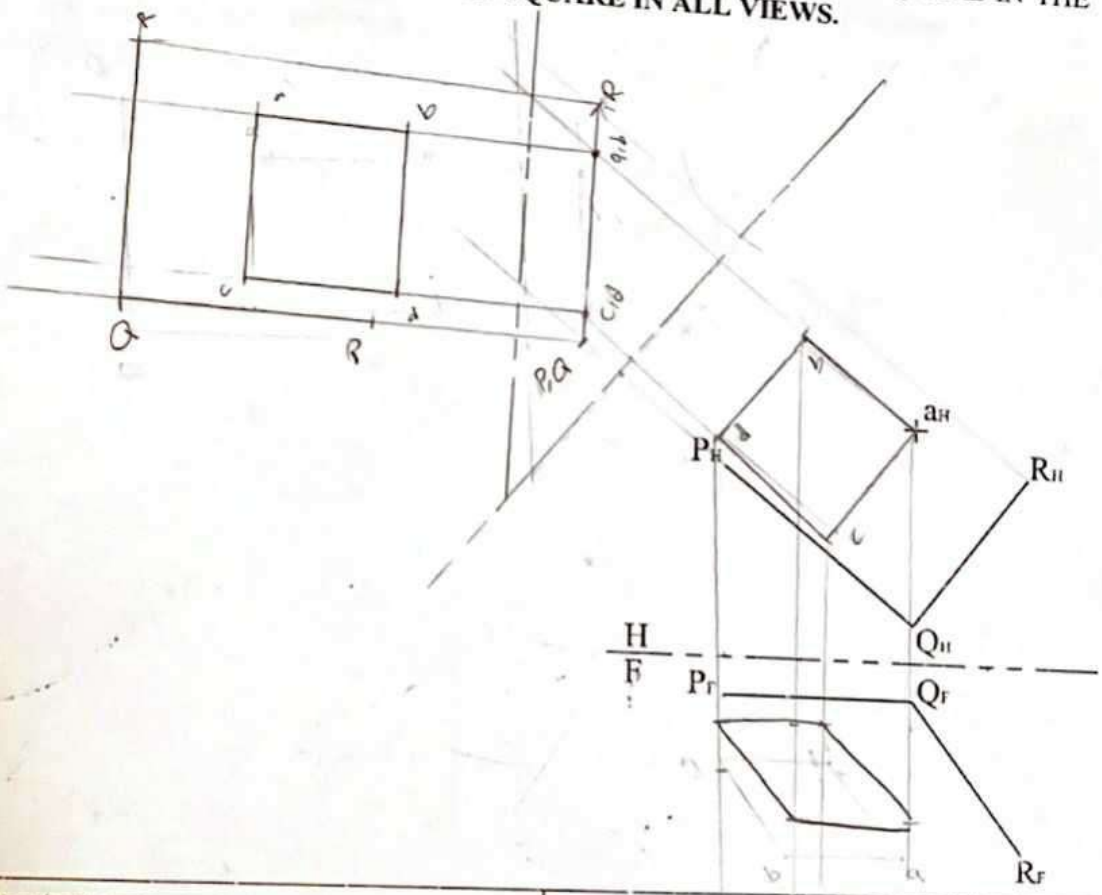
...(AB) IS ONE SIDE OF A REGULAR HEXAGON LAYING IN PLANE (**EGJK**). DRAW THE HEXAGONAL IN THE VIEW WHERE IT APPEARS TRUE. **SHOW THIS HEXAGON IN ALL VIEWS.**

10



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. **SHOW THIS SQUARE IN ALL VIEWS.**



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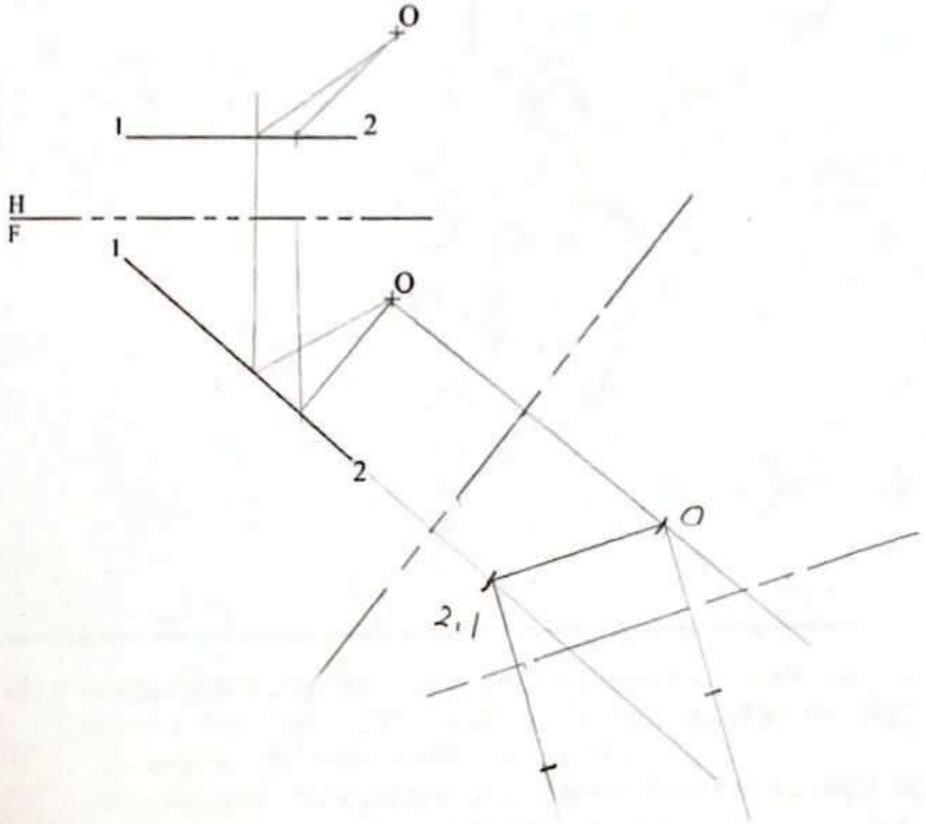
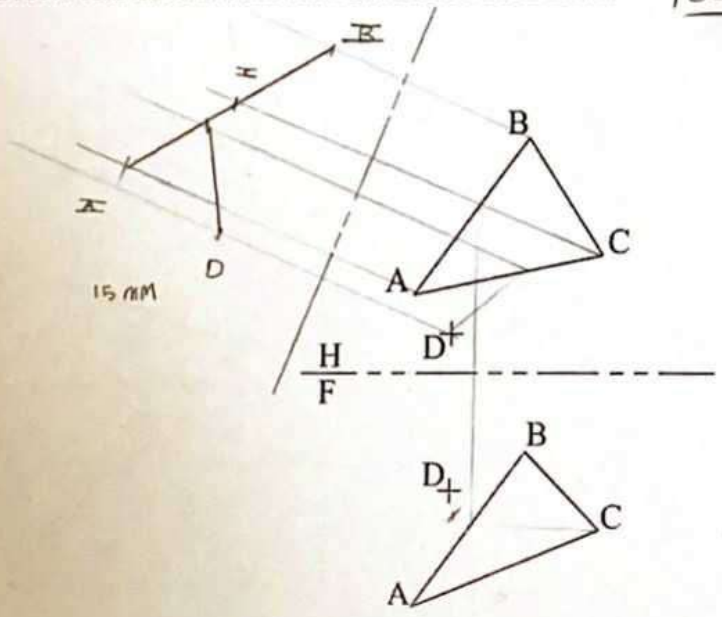
PERPENDICULARITY

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.** → 30 mm



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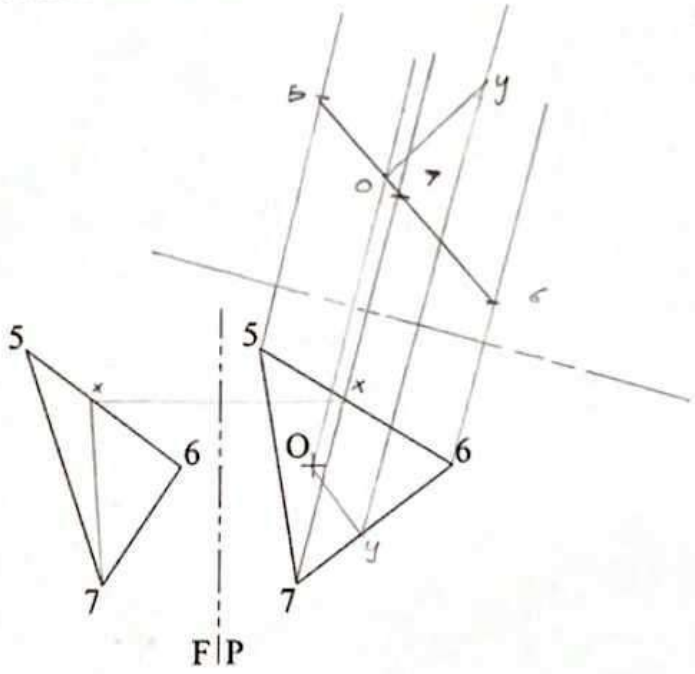
3 DRAW A LINE THAT IS **1-INCH** LONG FROM POINT **(O)** ON THE PLANE, PERPENDICULAR TO THE PLANE. SHOW THE LINE IN BOTH VIEWS.



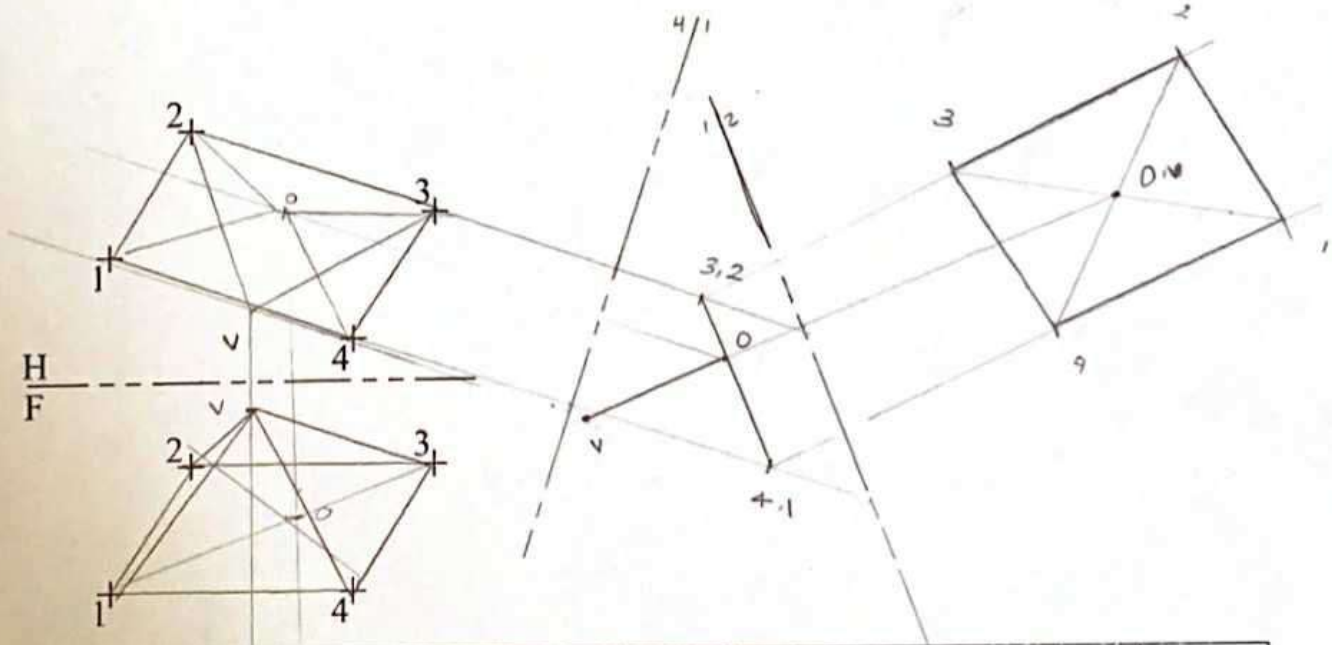
4 THE PLANE FORMED BY THE POINTS **(1-2-3-4)** IS THE BASE OF A RIGHT PYRAMID. THE VERTEX **(V)** HAS AN ALTITUDE OF **(0.8" ≈ 20mm)** ABOVE THE BASE AT ITS **MIDPOINT**.

a) **DRAW** THE PYRAMID IN ALL VIEWS.

b) FIND THE **TRUE SHAPE** OF THE BASE, AND THEN COMPUTE ITS **AREA**. $A = 32 \times 25 = 800\ mm^2$

c) WHAT IS THE **VOLUME** OF THE PYRAMID? $V = \frac{1}{3} \times 800 \times 20 = 5333.3\ mm^3$

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



NAME: _____	SECTION NO.: _____	55
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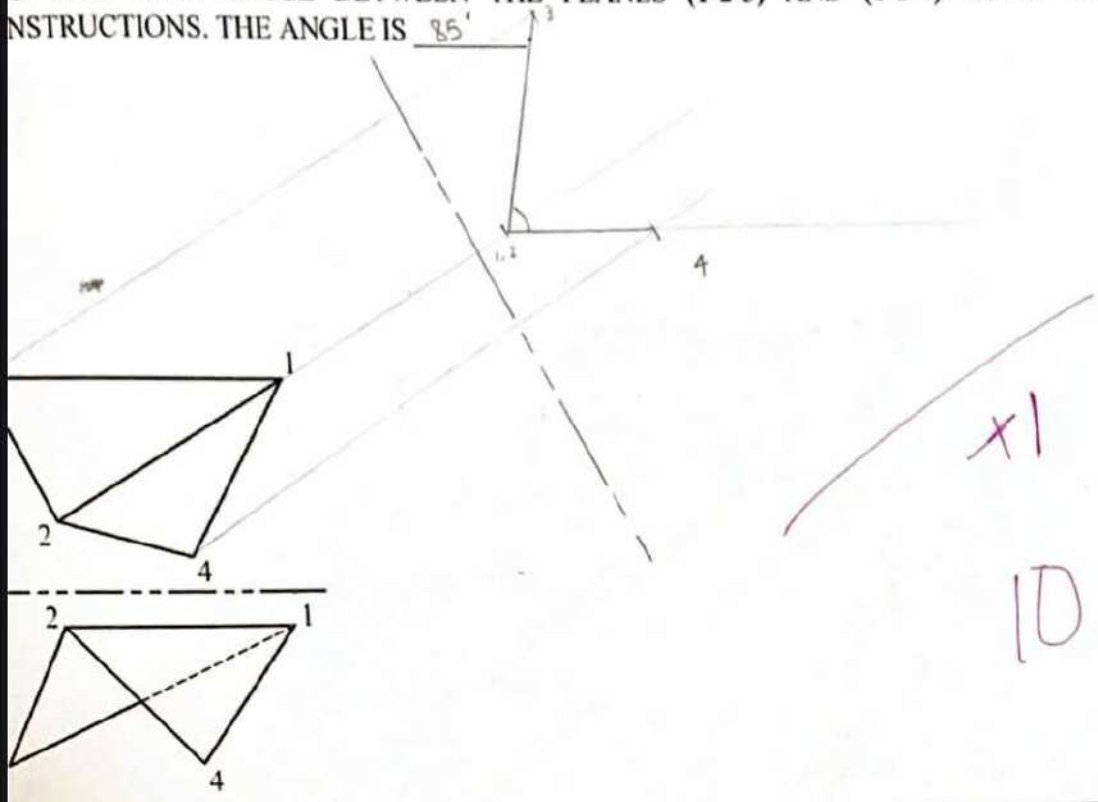
NGLE BETWEEN TWO INTERSECTED PLANES (DIHEDRAL ANGLE)

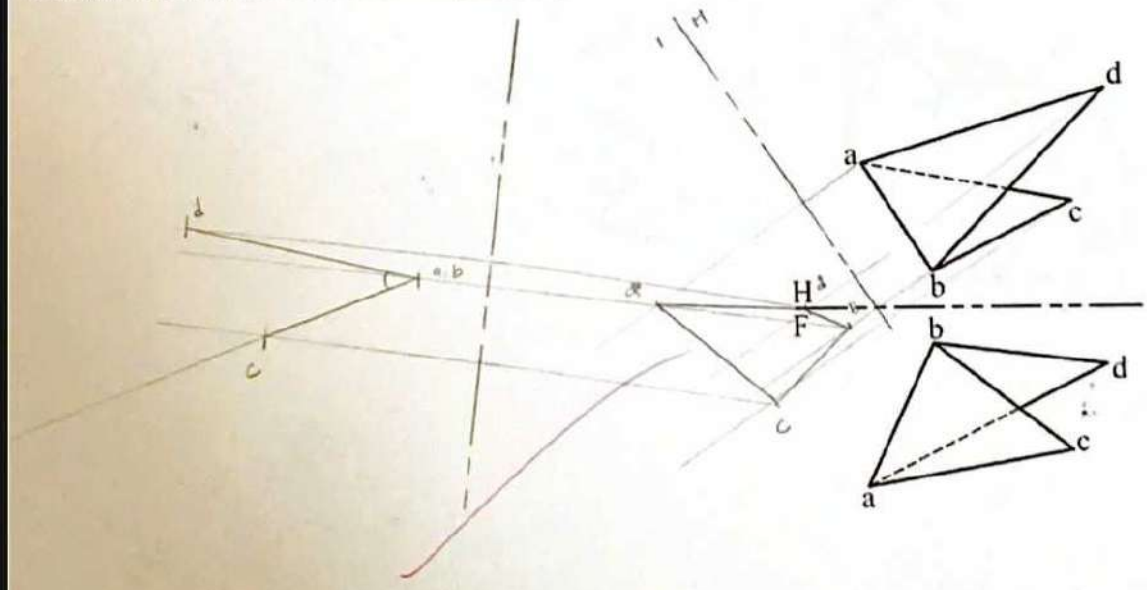
D THE TRUE ANGLE BETWEEN THE PLANES **(1-2-3)** AND **(1-2-4)**. SHOW ALL NSTRUCTIONS. THE ANGLE IS 85°



+1

10

DETERMINE THE ANGLE BETWEEN PLANES **(ABC)** AND **(ABD)**. SHOW ALL CONSTRUCTIONS. THE ANGLE IS 36°.



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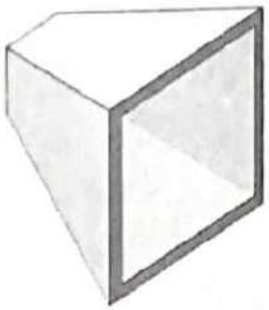
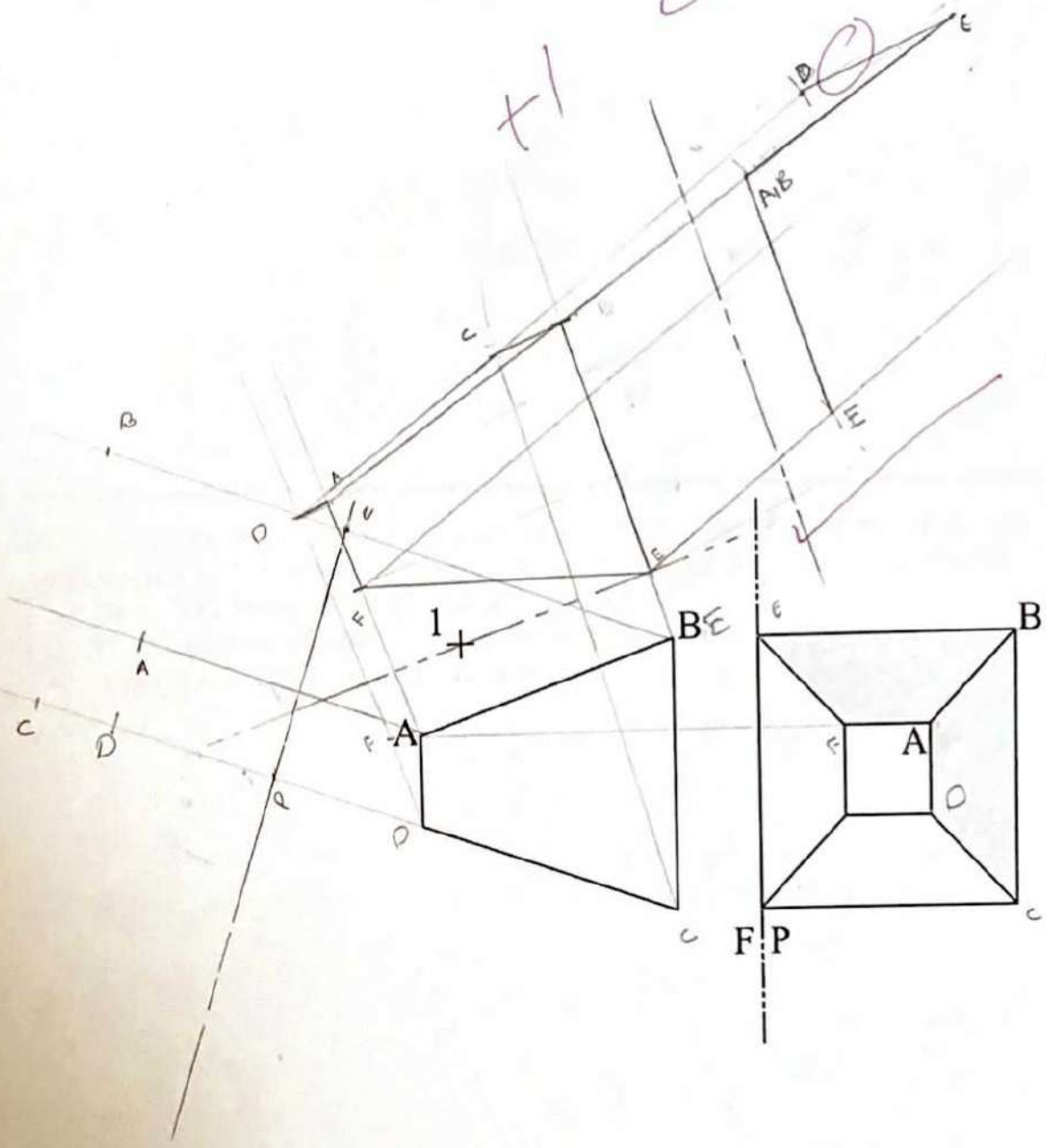
IN ORDER TO BUILD A **DIFFUSER SECTION** SIMILAR TO THE ONE IN THE FIGURE, THE DIHEDRAL ANGLE MUST BE KNOWN. USE **(AB)** AS THE LINE OF INTERSECTION.



THE ANGLE IS 102° .

8

+1



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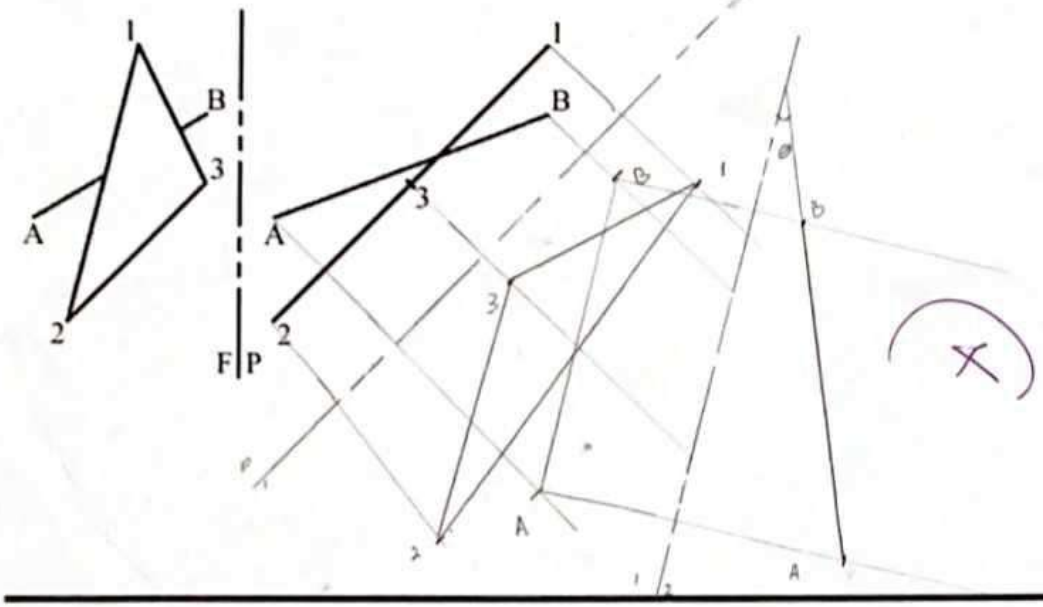
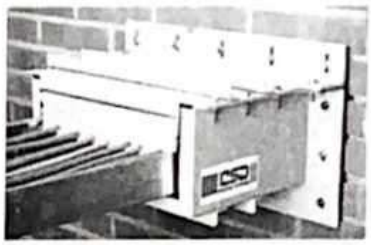
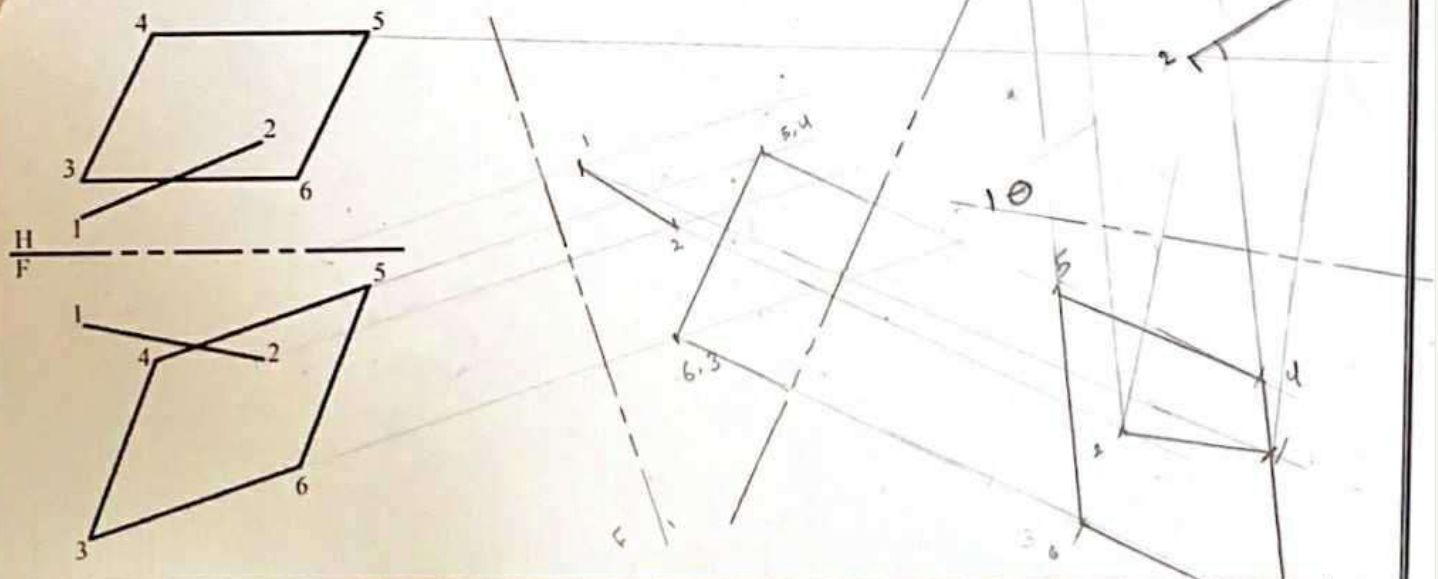
ANGLE BETWEEN A LINE AND A PLANE

1 FIND THE ANGLE BETWEEN THE LINE AND THE PLANE USING **THE PLANE METHOD**. THE ANGLE IS 24°.



2 FIND THE ANGLE BETWEEN CONTROL CABLE **(1-2)** AND BULKHEAD **(3-4-5-6)**. THE ANGLE IS 32°.





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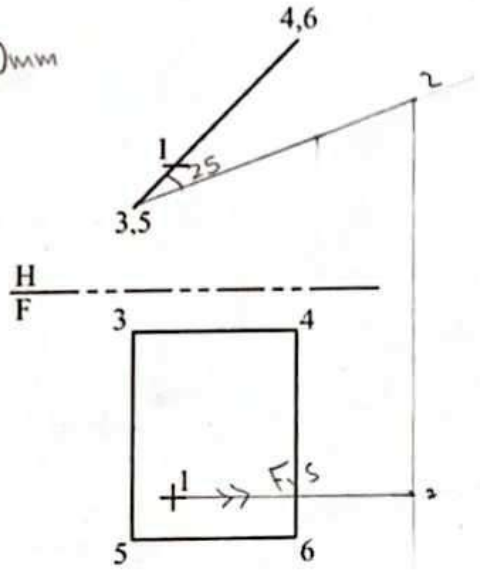
3 ESTABLISH THE VIEWS OF 1.5" LINE **(1-2)** SUCH THAT LINE **(1-2)** FORMS AN ANGLE OF 25° WITH THE GIVEN SURFACE **(3-4-5-6)**. SHOW LINE (1-2) IN ALL VIEWS.

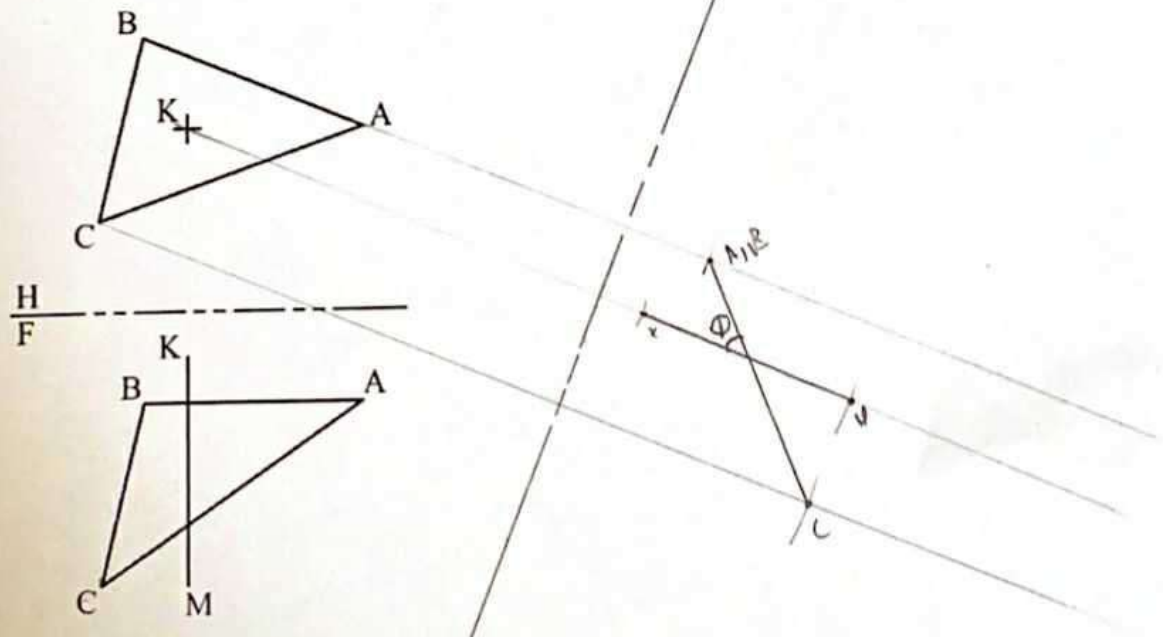
1.5in = 40 mm

≈3.9 cm ≈ 40mm



4 FIND THE ANGLE BETWEEN THE VERTICAL LINE **(MK)** AND PLANE **(ABC)**. THE ANGLE IS 46°.

10

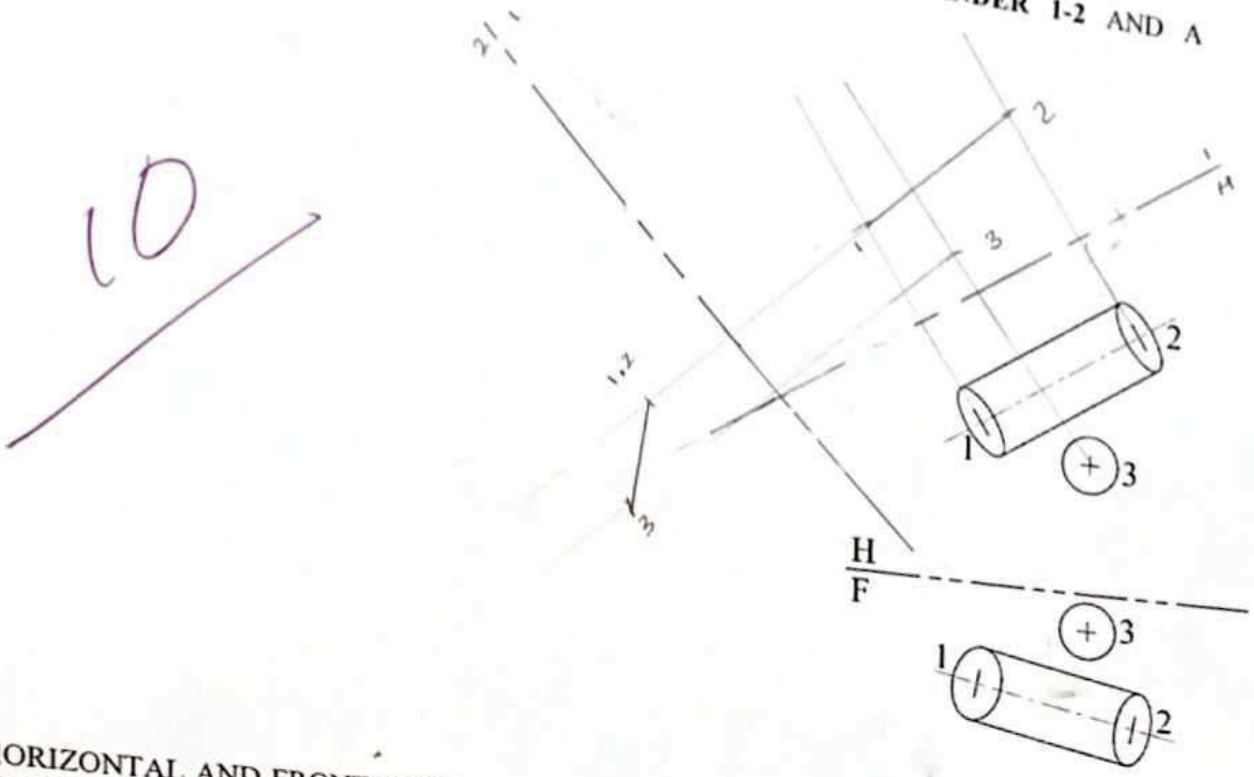


NAME: SHAIK'A	SECTION NO.: 5	57
FILE NO.: 14	DATE:	

METRY (AUXILIARY PROJECTION)

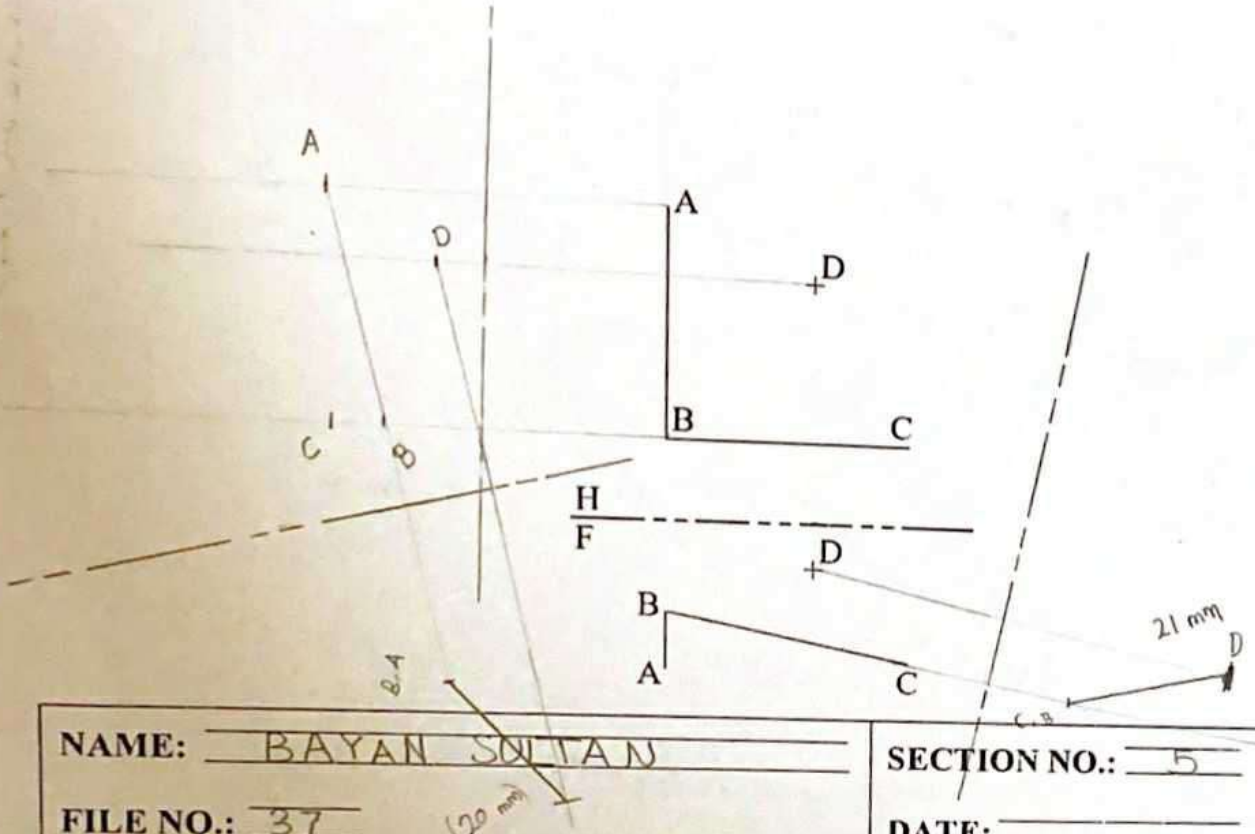
1 DETERMINE THE **CLEARANCE** (MINIMUM DISTANCE) BETWEEN **CYLINDER 1-2** AND A **SPHERICAL TANK 3**. =13 mm

10



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

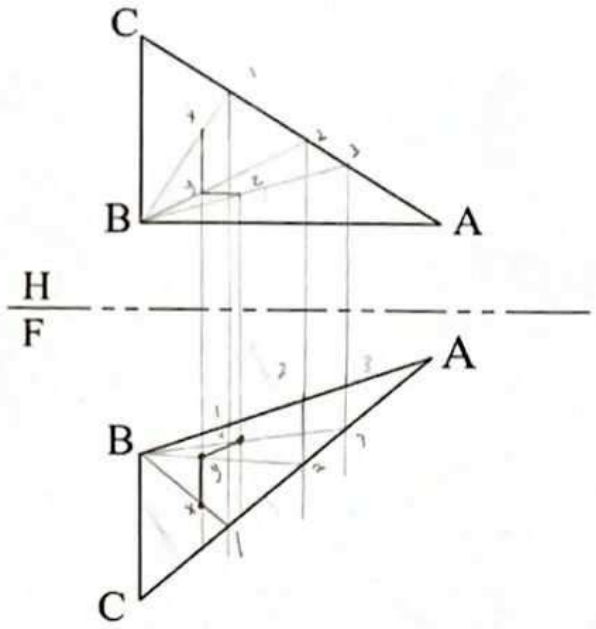
a. WHAT WOULD BE **THE LENGTH OF THE SHORTEST PIPE**? (FROM D TO AB **OR** FROM D TO BC).
b. WHAT WOULD BE THE **DISTANCES** BETWEEN THE WATER METER **(D)** AND THE WATER PIPES (AB AND BC)?



NAME: BAYAN SULTAN	**SECTION NO.:** 5	**103**
FILE NO.: 37	**DATE:**	

APPLICATIONS

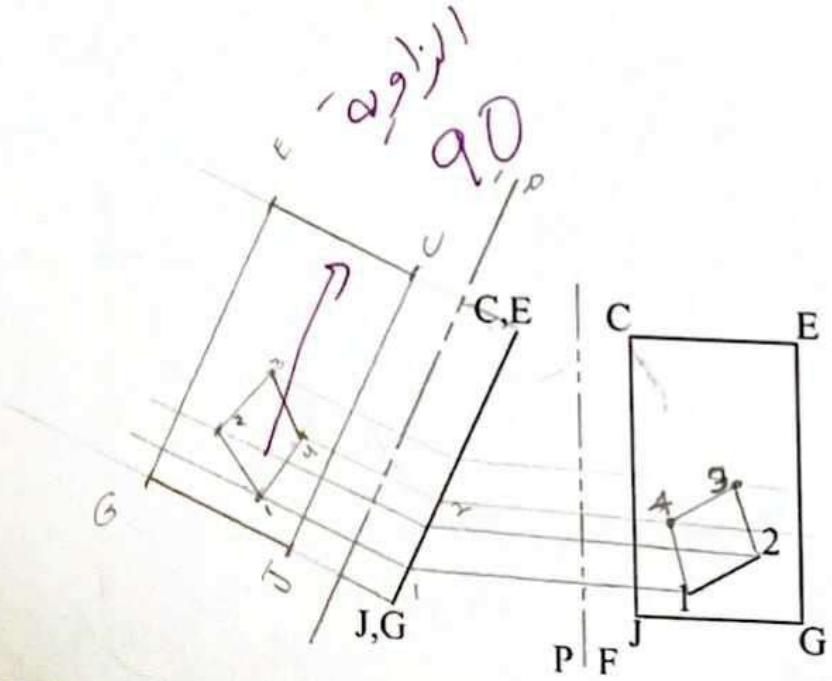
1 USE THE GIVEN TWO VIEWS **ONLY** TO COMPLETE THE MISSING VIEW OF LETTER **(L)**, WHICH LIES ON THE PLANE **(ABC)**.



+1

9

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



NAME: BAYAN SULTAN	SECTION NO.: 5	104
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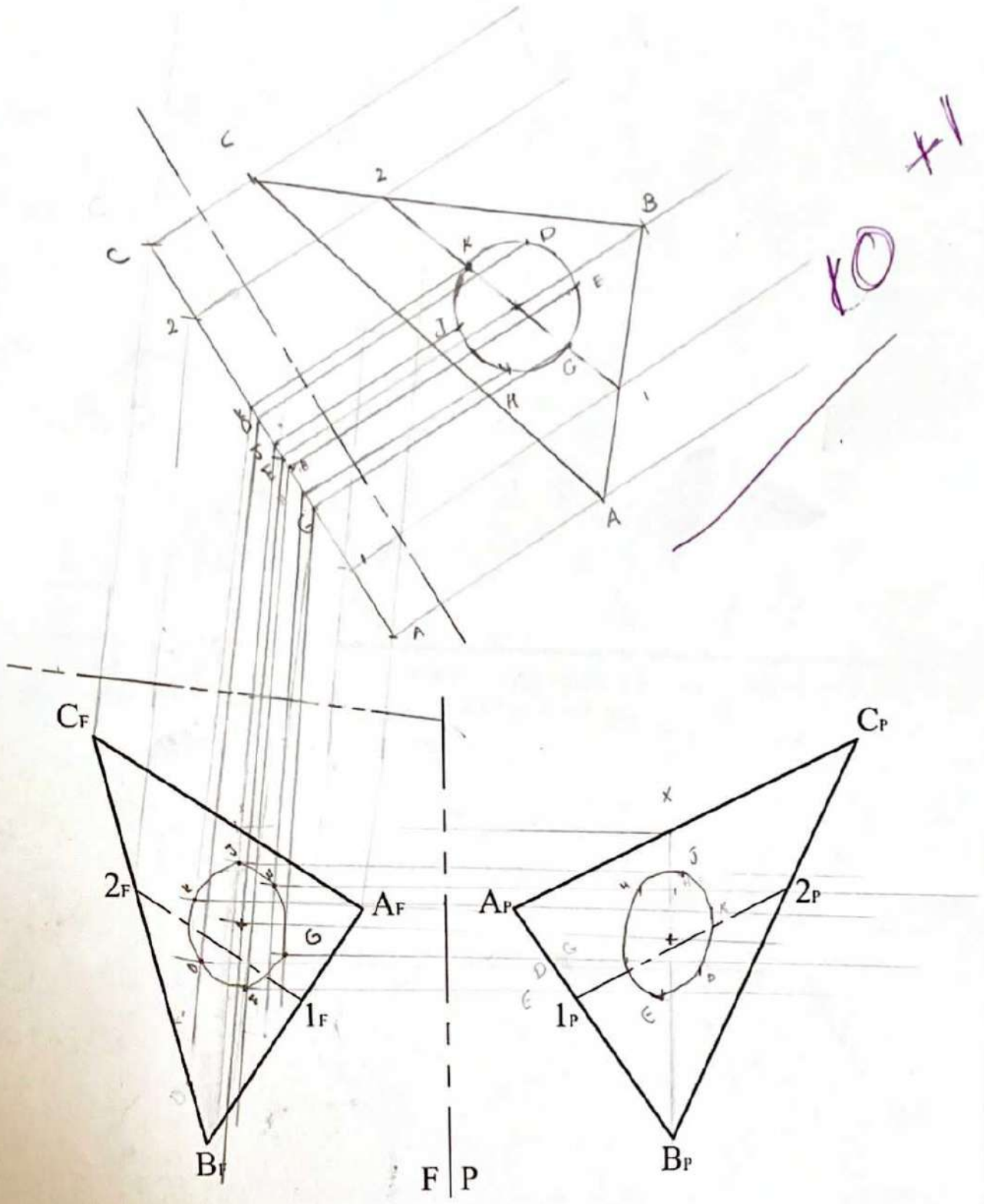
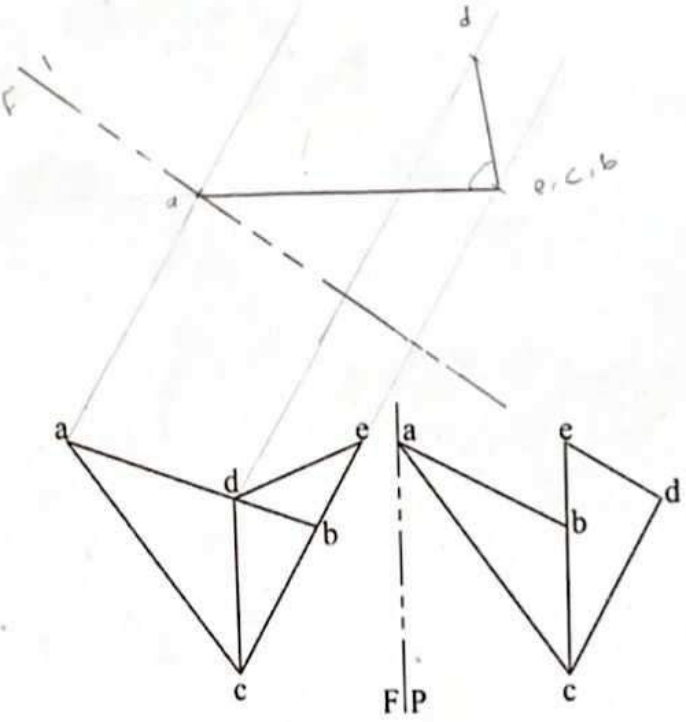
A CIRCULAR HOLE IS TO BE CUT IN SURFACE (**ABC**). THE CENTER OF THE HOLE LIES ON LINE (**1-2**) AND IS 25 MM FROM (**A**). COMPLETE THE FRONT AND RIGHT SIDE VIEWS OF HOLE. (HOLE DIAMETER IS 20 MM).



NAME: BAYAN SULTAN	SECTION NO.: 5	105
FILE NO.: 37	DATE:	

IND THE DIHEDRAL ANGLE BETWEEN THE TWO PLANES (ABC) AND (CDE).

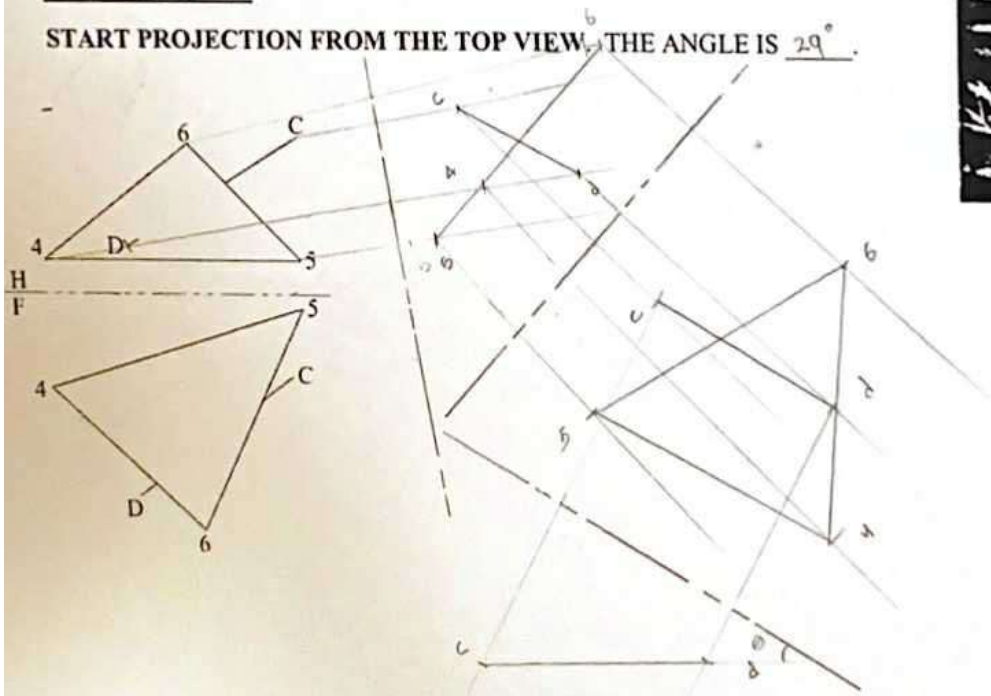
ANGLE IS 86°.



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.

Courtesy of Ryan Aeronautical Co.

START PROJECTION FROM THE TOP VIEW. THE ANGLE IS 29°.



NAME: BAYAN SULTAN	SECTION NO.: 5	106
FILE NO.: 37	DATE:	