

Unit - I → Free hand sketching and Special curves.

Unit - II → points, lines and planes.

Unit - III → projection of solids.

Unit - IV → section of solids & development of surfaces.

Unit - V → perspective projection & Isometric projection

~~A Y P | B V P  
B M P | B V P~~

25 x 20 cmmarks

## GE8152 - Engineering graphics.

Unit - I:  
Plane curves and free hand sketching.

Types of objects:

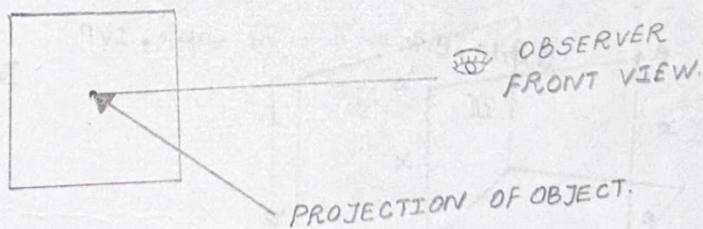
\* One dimensional objects. ( $\circ$ ,  $(\text{---})$  → 1d)

\* Two dimensional objects.  → 2d

\* Three dimensional objects  → 3d.

Plane of projection:

0.3  
0.3  
5mm.

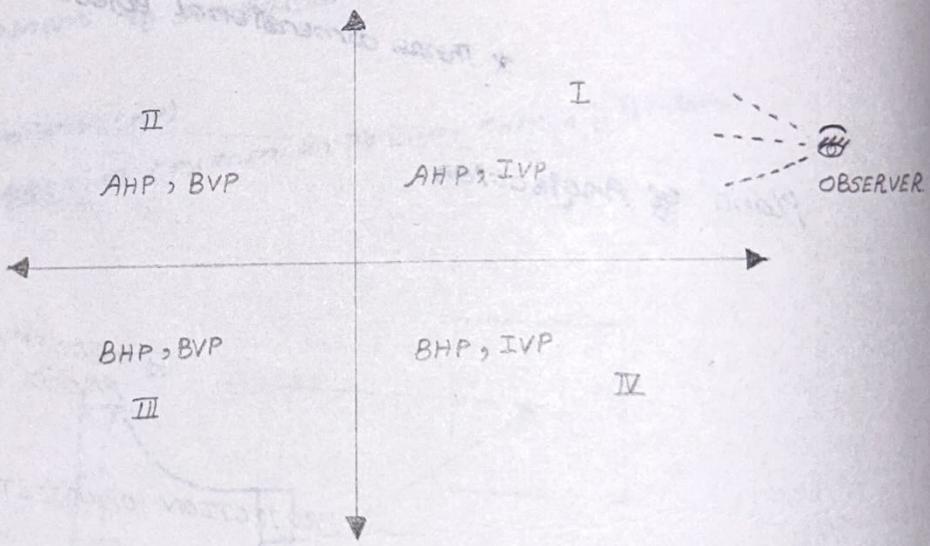


In Engineering graphics two principle planes are used. to get projection of object. projection is the combination of front view (Elevation) and topview (Plan view). \* vertical plane (VP) is always assumed to be placed vertically. The front view of the object is projected on this plane.

\* Horizontal plane (HP) is assumed to be placed horizontally. The top view of the object is projected on this plane.

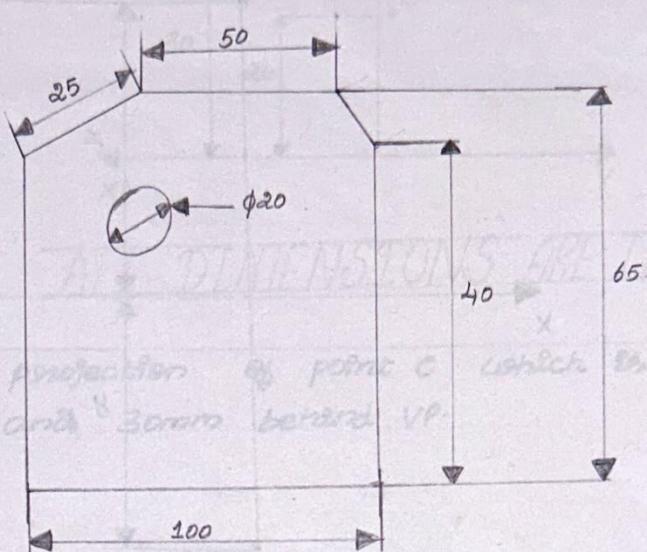
- \* These planes are known as reference planes. They are imaginary, transparent and dimensionless.
- \* Both planes (V.P and H.P) are perpendicular to each other.
- \* The intersecting line is known as reference line (or) (XY line).
- \* The reference planes V.P and H.P forming four quadrants namely I<sup>st</sup> quadrant - AHP, IVP  
II<sup>nd</sup> quadrant - AHP, BVP  
III<sup>rd</sup> quadrant - BHP, BVP  
IV<sup>th</sup> quadrant - BHP, IVP

AHP - Above HP  
IVP - In front of VP  
BHP - Below HP  
BVP - Behind VP.



#### Conventions followed:

- \* Top view and Front view represents small letters only.
- \* Top views are represented by  $a, b, c, d$  etc...
- \* Front views are represented by  $a', b', c'$



- Q) Draw the projection of point C which is 30mm above HP and 30mm behind VP.

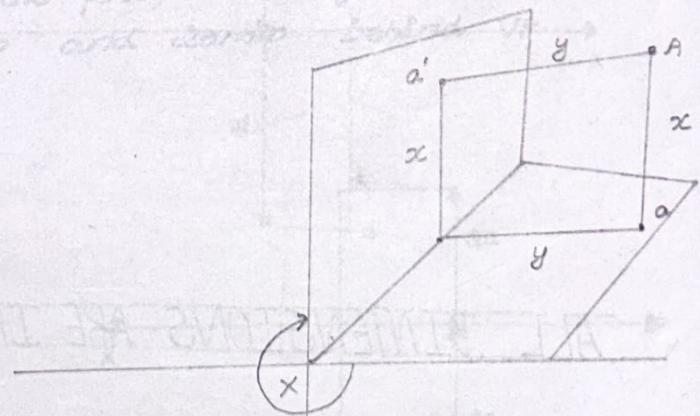
### Unit-II

#### Projection of points

Projection of points in I quadrant:

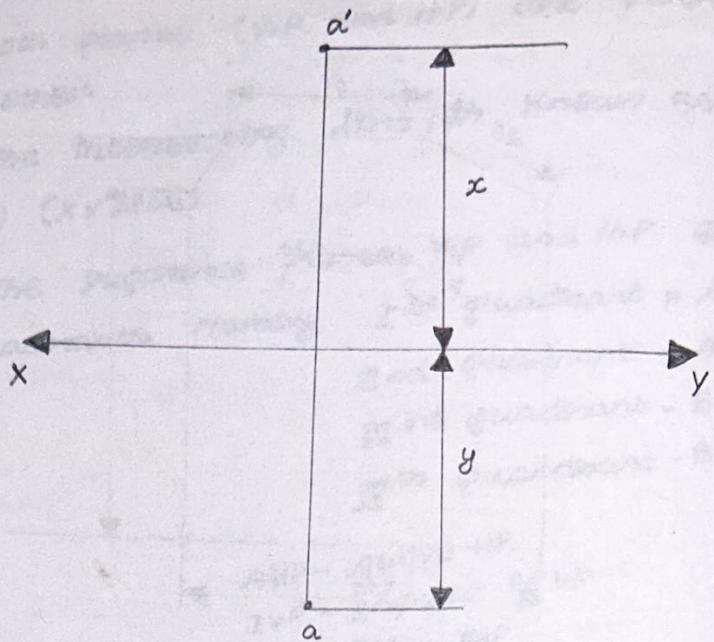
A point 'A' is 25 mm above H.P and 8 mm in front of V.P.

- Q) Draw the projection of point D which is 30mm below HP and 30mm behind VP.

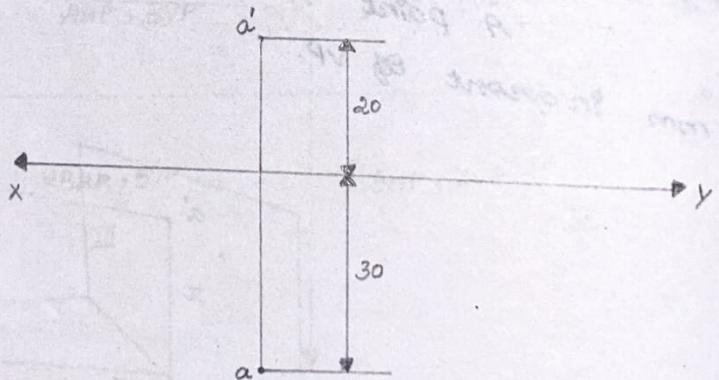


Point 'B' is 30 mm above H.P and 30 mm behind VP.

| S.C.  | a'b'c'd'  | a b c d         |
|---|-----------|-----------------|
| A point 'C' is 30mm above H.P and 30mm behind VP. | Above HP  | Behind VP       |
| Below H.P   | Below V.P | In front of V.P |

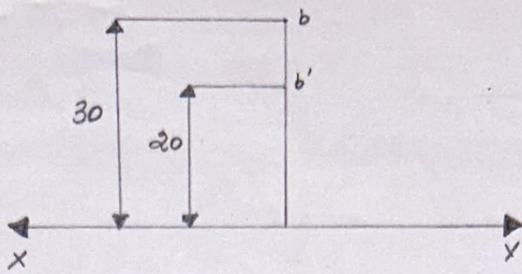


- 1) A point 'A' is 20mm above HP and 30mm in front of VP. draw its projections. (HP  $\rightarrow$  ' ) put dash at HP point.



ALL DIMENSIONS ARE IN mm

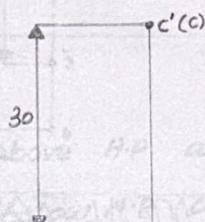
- 2) A point 'B' is 20mm above HP and 30mm behind VP. Draw its projections.



ALL DIMENSIONS ARE IN mm.

- 3) Draw the projection of point C which is 30mm above HP and 30mm behind VP.

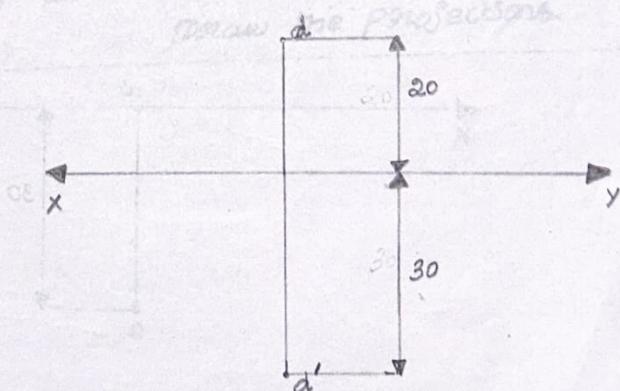
~~ALL DIMENSIONS ARE IN mm.~~



- 1) Point A is 35mm above HP and 25mm in front of VP.  
 2) Point B is 25mm above HP and 15mm behind VP.  
 3) Point C is 30mm above HP and 30mm in front of VP.  
 4) Point D is 25mm below HP and 20mm behind VP.

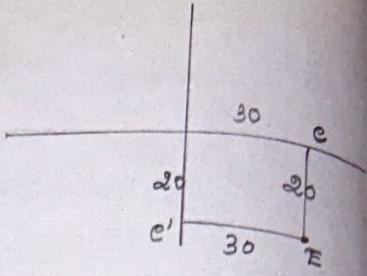
ALL DIMENSIONS ARE IN mm.

- 4) Draw the projection of point D which is 30mm below HP and 20mm behind VP.

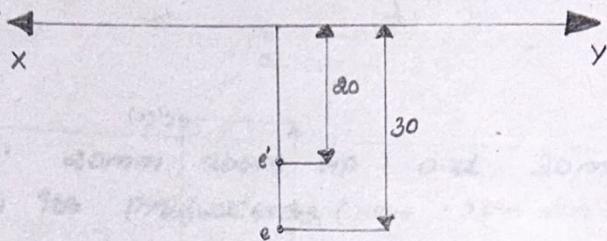


ALL DIMENSIONS ARE IN mm.

- 5) A point 'E' is 20mm below HP and 30mm in front of VP. Draw its projection.



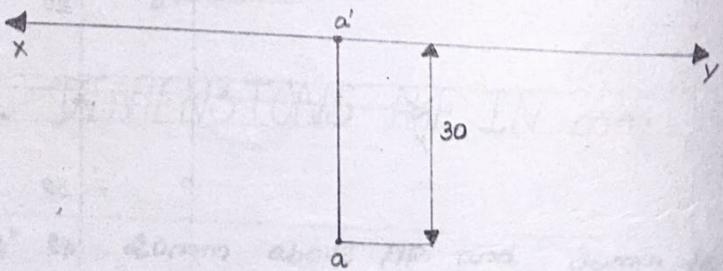
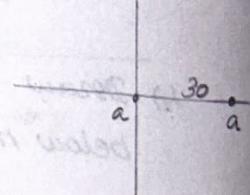
Example of solids having a vertical axis of revolution about its central axis.



- Q) A point 'A' is 30mm in front of VP and lies on HP.

ALL DIMENSIONS ARE IN mm

- 6) A point 'A' is 30mm in front of VP and lies on HP

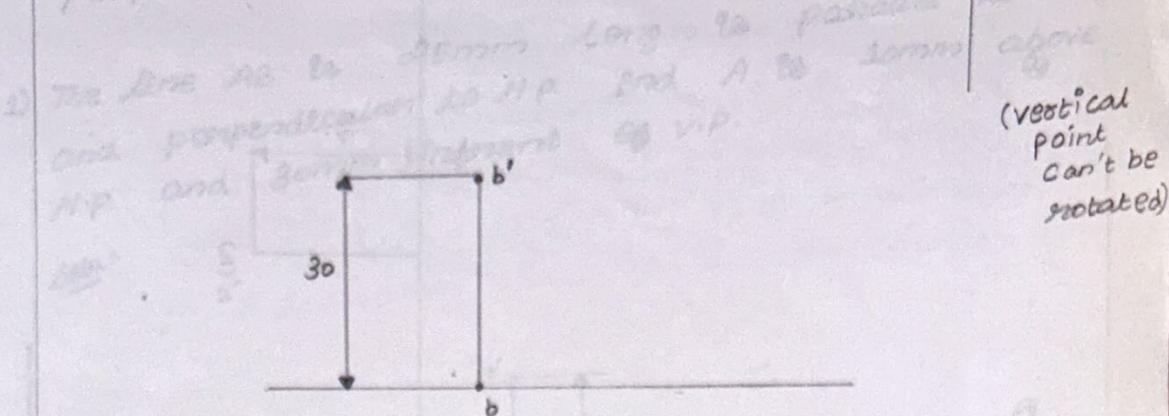


It lies on  
(HP lies on)

ALL DIMENSIONS ARE IN mm

- 7) A point 'B' is 30mm above HP and lies on VP.

Type 1: The line is parallel to V.P.  
perpendicular to H.P.

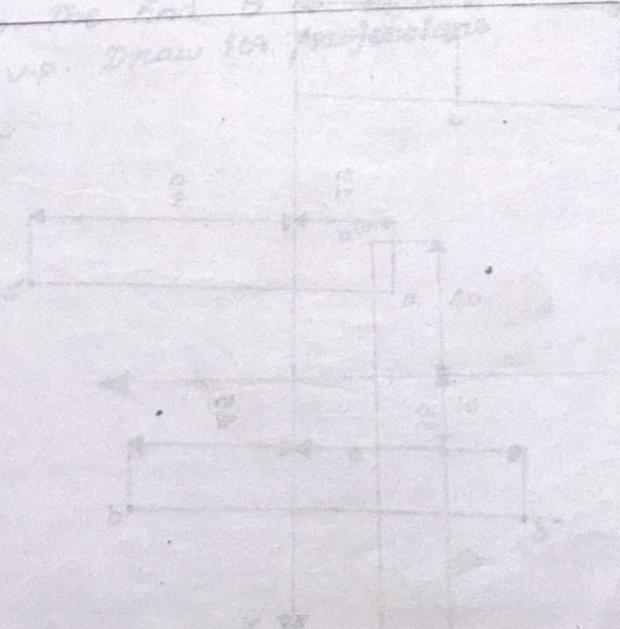


ALL DIMENSIONS ARE IN mm

14/8/19

- 1) Point A is 35mm above H.P. and 25mm in front of V.P.
  - 2) Point B is 40mm below H.P. and 15mm behind V.P.
  - 3) Point C is 50mm above H.P. and 25mm behind V.P.
  - 4) Point D is 45mm below H.P. and 20mm in front of V.P.
  - 5) Point E is 30mm behind V.P. and lies on H.P.
  - 6) Point F is 25mm below H.P. and lies on V.P.
  - 7) Point G is both H.P. and V.P.
  - 8) Point H is 25mm below H.P. and 25mm in front of V.P.
- Draw the projections.

1)



$$\frac{AHP}{BHP} / \frac{BVP}{TVP}$$

②

①

⑥

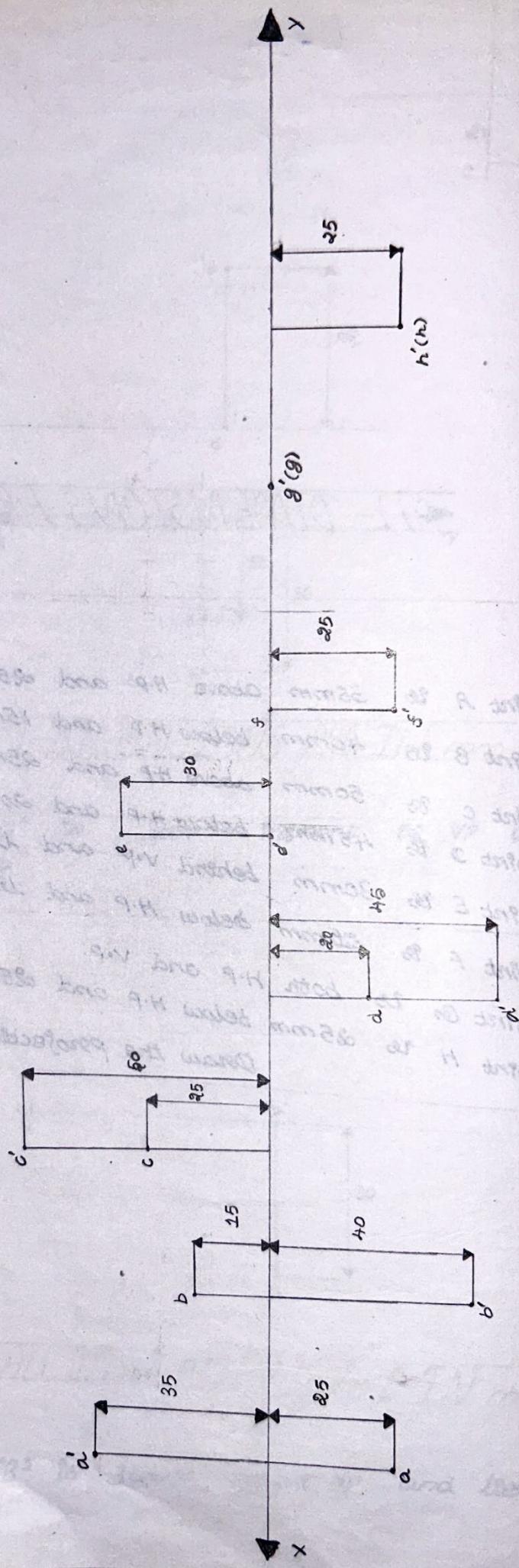
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④

③

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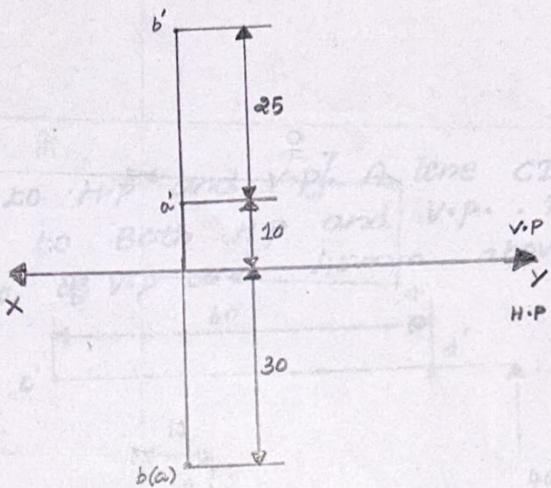


ALL DIMENSIONS ARE IN mm

## Projection of Lines

Type: 1: The line is parallel to V.P. and perpendicular to H.P.

- 1) The line AB is 25mm long is parallel to V.P. and perpendicular to H.P. End A is 10mm above H.P. and 30mm in front of V.P.  
Soln: V.E is 50mm below H.P & 10mm behind V.P.  
 V.P is 35mm below H.P & 40mm behind V.P.

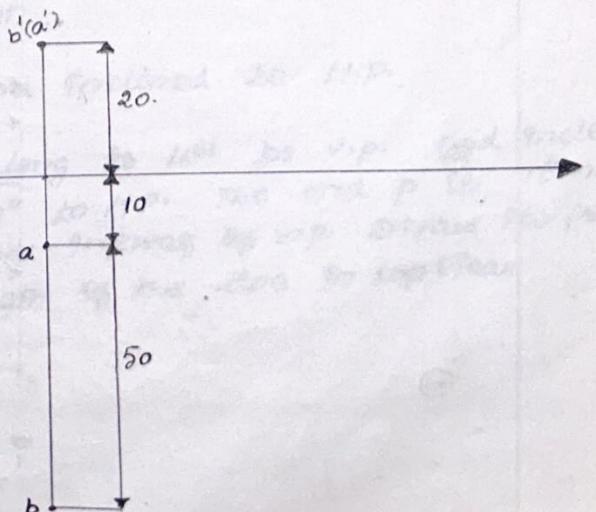


### Type: 2:

A line  $\parallel$  to H.P and  $\perp^r$  to V.P

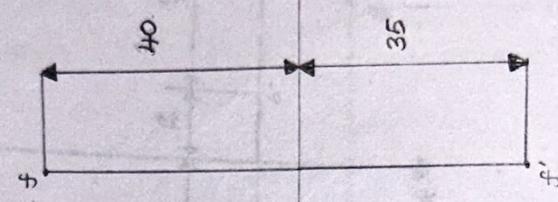
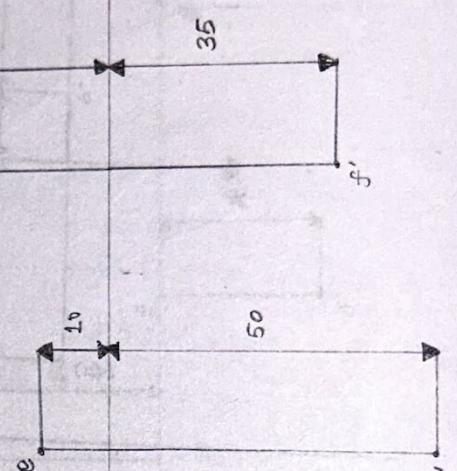
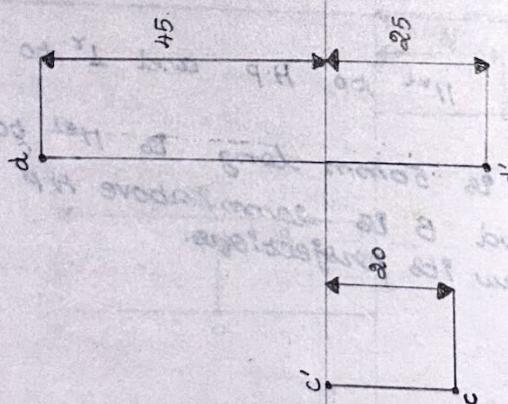
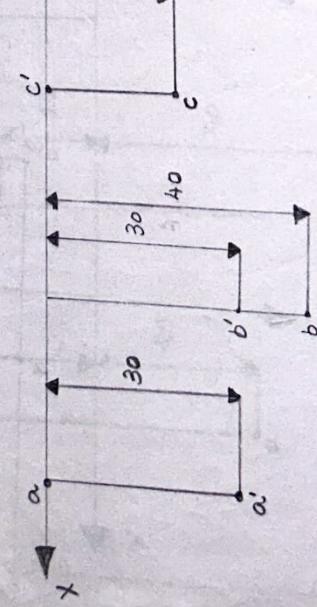
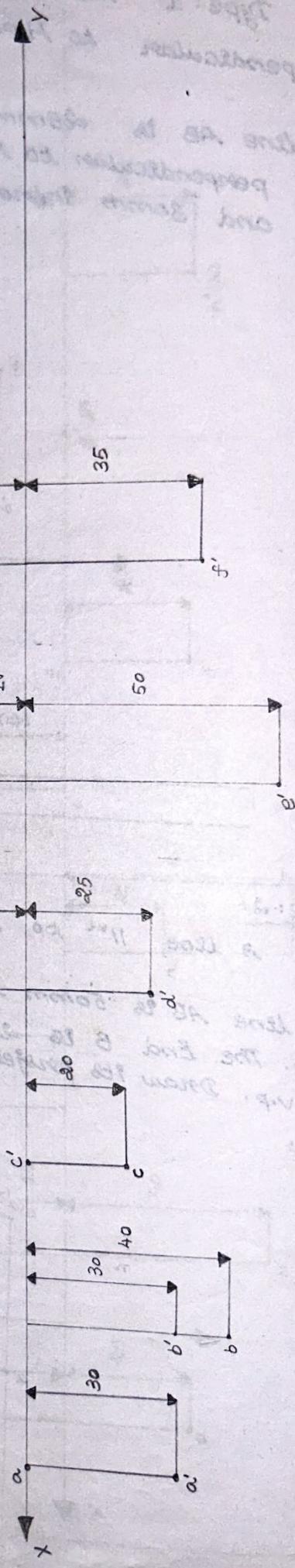
- 1) A line AB is 50mm long is  $\parallel$  to H.P and  $\perp^r$  to V.P. The End B is 20mm above H.P and 10mm in front of V.P. Draw its projections.

Soln:



ALL DIMENSIONS ARE IN mm

ALL DIMENSIONS ARE IN mm



⑤

⑥

②

③

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Draw the projection of points on a common reference line.

- verser line.

(i) point A is 30mm below HP & on VP

(ii) B is 30mm below HP & 40mm In front of VP

iii) C is 20mm In front of VP & lies on HP

iv) D is 25mm below HP & 45mm behind VP

v) E is 50mm below HP & 10mm behind VP

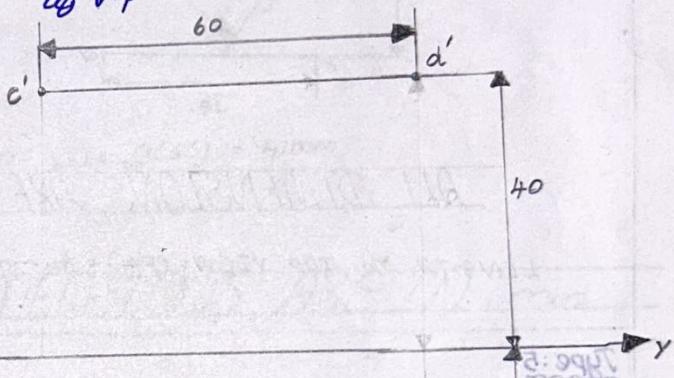
vi) F is 35mm below HP & 40mm behind VP.

300:

### Type:III

Type: III  
 [Lens parallel to H.P. and V.P.] A lens CD 80 mm long is parallel to both H.P. and V.P. The lens is 25 mm in front of V.P and 40 mm above H.P.

80M:



.9. V 02X ~~beach~~ drift bins q.H ed Jefferson 3 mi 25

A. The first group of birds was seen at 9:45 AM. They were flying over the water and were seen to be feeding on small fish. The second group of birds was seen at 10:15 AM. They were also flying over the water and were seen to be feeding on small fish.

ALL DIMENSIONS ARE IN mm

TYPE: 4

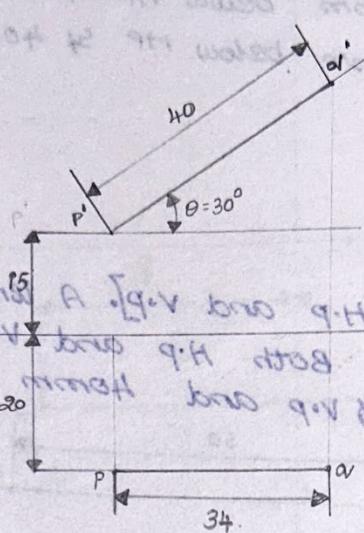
'Single Inclination'

Lens incl to V.P and inclined to H.P.

A line PQ 40mm long is inclined to V.P. and inclined at an angle of  $30^\circ$  to H.P. The end P is 15mm above H.P. and 20mm from the V.P. Draw its projection and find the length of the line in top view.

golu:

A line of 9H inclined at  $30^\circ$  to XY  
 has front view of length 8 (10)  
 inclined at  $30^\circ$  to XY  
 inclined at  $30^\circ$  to XY  
 inclined at  $30^\circ$  to XY  
 inclined at  $30^\circ$  to XY



III: 39/17

W.E.R.

ALL DIMENSIONS ARE IN mm

LENGTH OF TOP VIEW = (Pv) = 34 mm.

Type 5:

Line parallel to H.P. and inclined to V.P.

A line EF 50mm long is parallel to H.P. and inclined at an angle of  $35^\circ$  to V.P. The end E is 20mm above H.P. and 15mm in front of V.P. Draw the projection of the line and find its Front View Length.

Front view - (N.P.)  
Top view - (P)

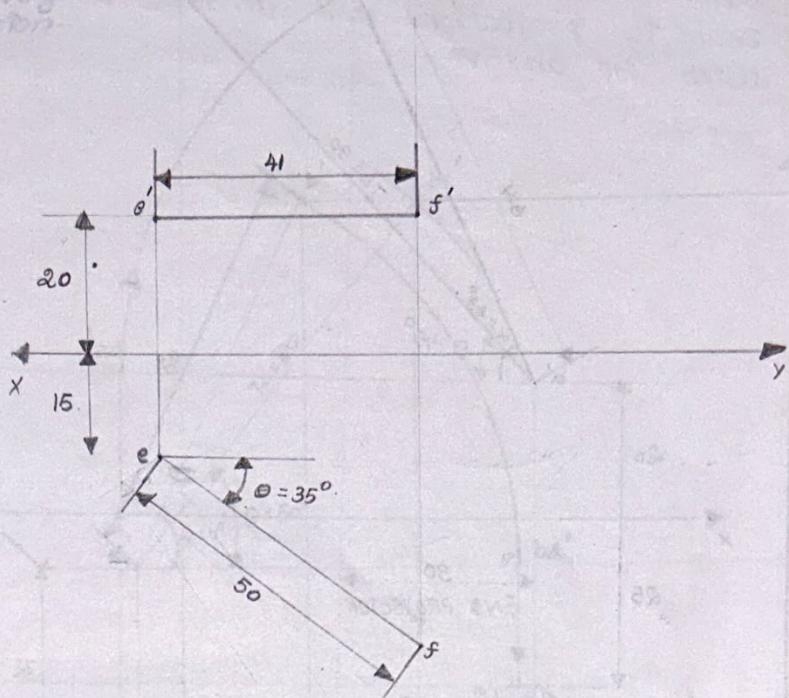
Solu.:

A line parallel to H.P. and inclined to V.P.  
 Line EF 50mm long is parallel to H.P. and inclined at  $35^\circ$  to V.P. The end E is 20mm above H.P. and 15mm in front of V.P. The front view length is 34 mm.

H: 39/17

W.E.R.

Given: A line AB 80mm long has its end A 20mm above H.P. and 30mm in front of V.P. The length of front view is 41mm. The line is inclined to both the planes. Draw its projections and find the zone of inclination.



LENGTH OF FRONT VIEW ( $e'f'$ ) = 41mm.

ALL DIMENSIONS ARE IN mm

Type : b:

"Double Inclination".

Type : 1:

Line inclined to both the planes.  
A line AB 80mm long has its end A 20mm above H.P. and 25mm in front of V.P. The line is inclined at  $45^\circ$  to H.P. and  $35^\circ$  to V.P. Draw its proj.

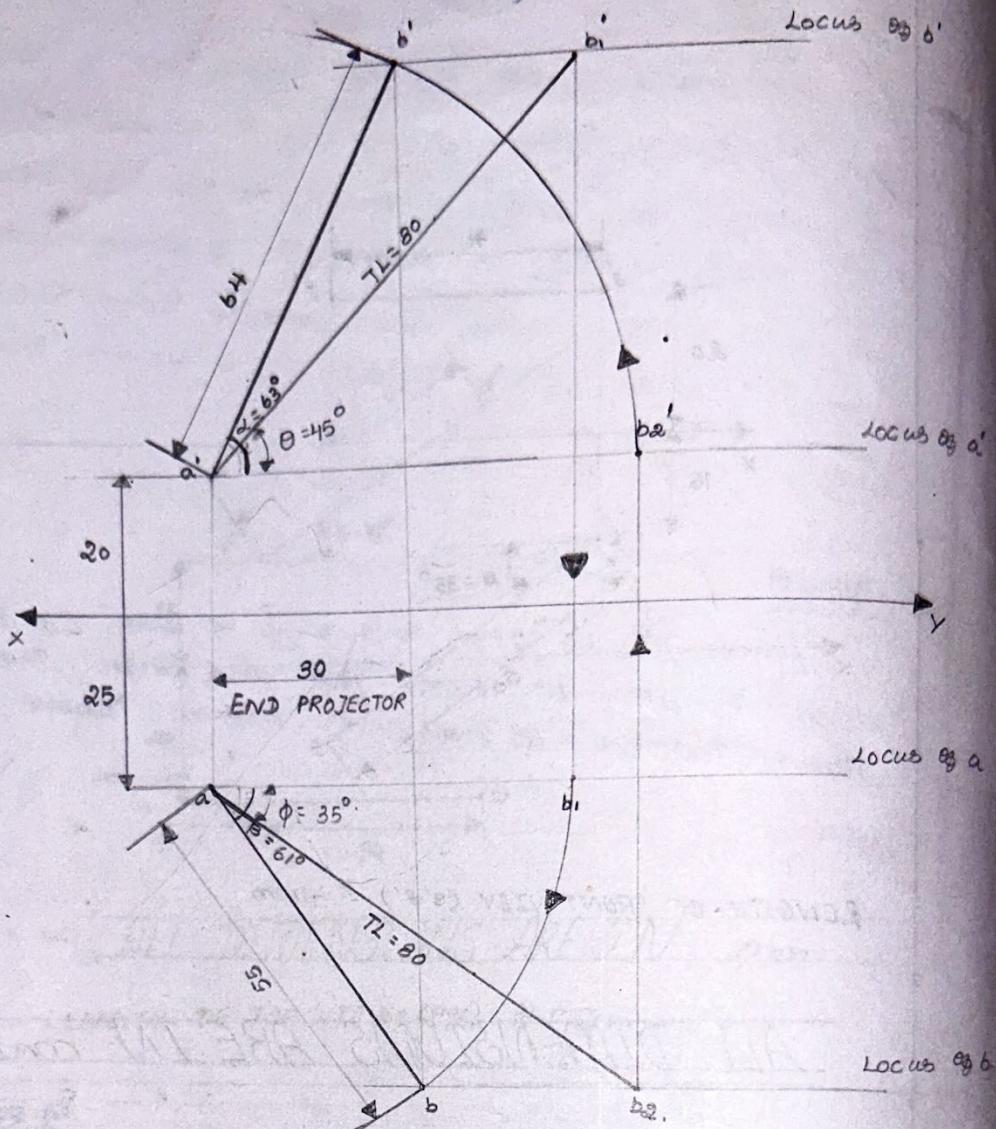
Soln:

$$AB = 80$$

$$A \rightarrow A_{HP} = 20, IVP = 25$$

$$HP(\theta) = 45^\circ, \frac{\uparrow}{\downarrow}$$

$$VP(\phi) = 35^\circ, \frac{\uparrow}{\downarrow}$$



ALL DIMENSIONS ARE IN mm

Resultant length of AB is 80 mm  
 Apparent length of AB in HP is 64 mm  
 Apparent length of AB in VP is 55 mm  
 True length of AB = 80 mm  
 True inclination of AB to VP = 35°

FRONT VIEW  $a'b' = 64$ .  $\theta_B = 8A$

TOP VIEW  $ab = 55$

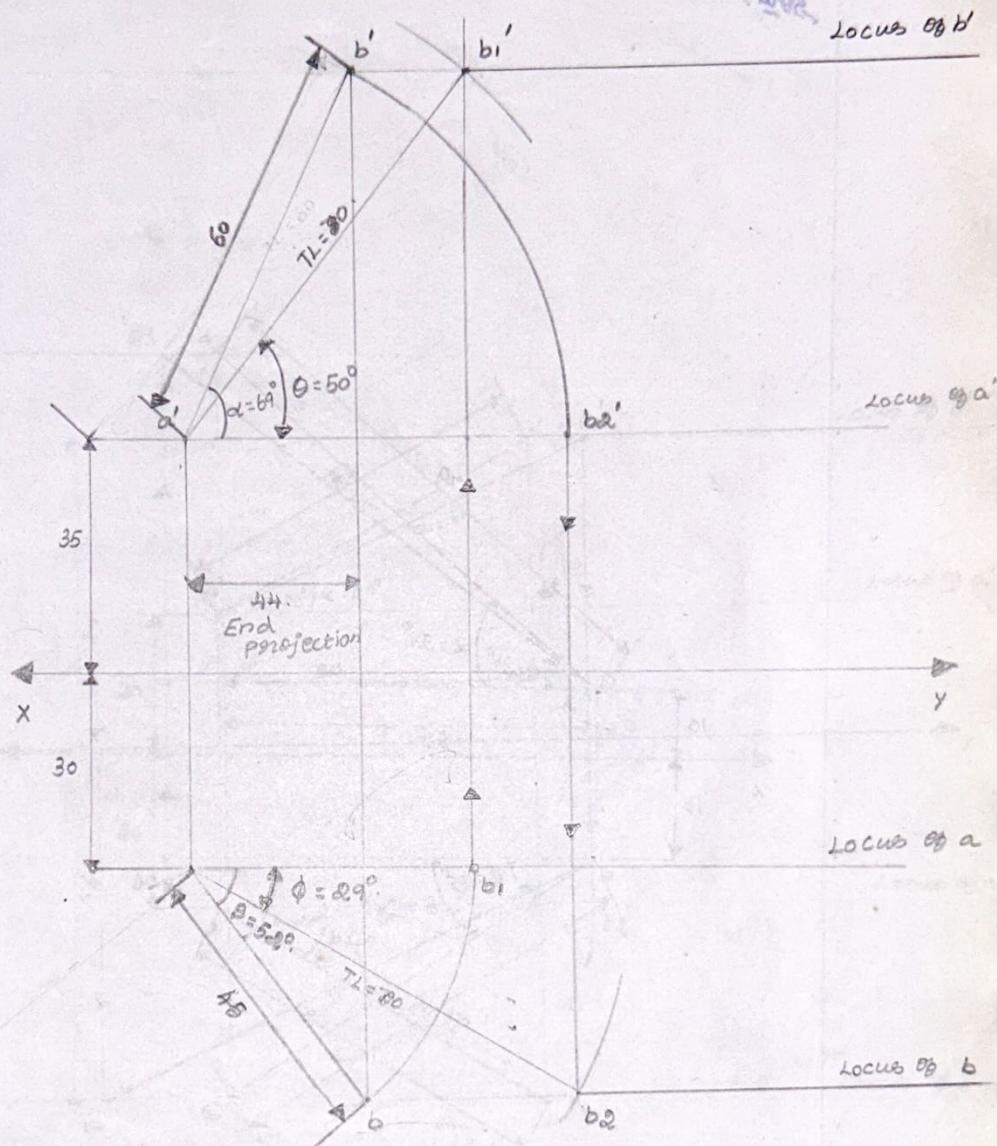
APPARENT INCLINATION  $HP(\alpha) = 63^\circ$   
 $VP(\beta) = 61^\circ$

END PROJECTOR = 30.

Type 2:

A line AB is 70mm long has its end A 35mm above H.P. and 30mm projection of V.P. The top view and front view has the length of 45mm and 60mm respectively. Draw its projections and find its true inclination.

Solu:



RESULT:

TRUE LENGTH:  $70 = a'b' = ab_2$

TRUE INCLINATION  $HP(\theta) = 50^\circ$

VP( $\phi$ ) :  $29^\circ$ .

FRONT VIEW  $a'b' = 60$   
TOP VIEW  $a'b = 45$

APPARENT INCLINATION HP ( $\alpha$ ) :  $69^\circ$   
VP( $\beta$ ) :  $52^\circ$ .

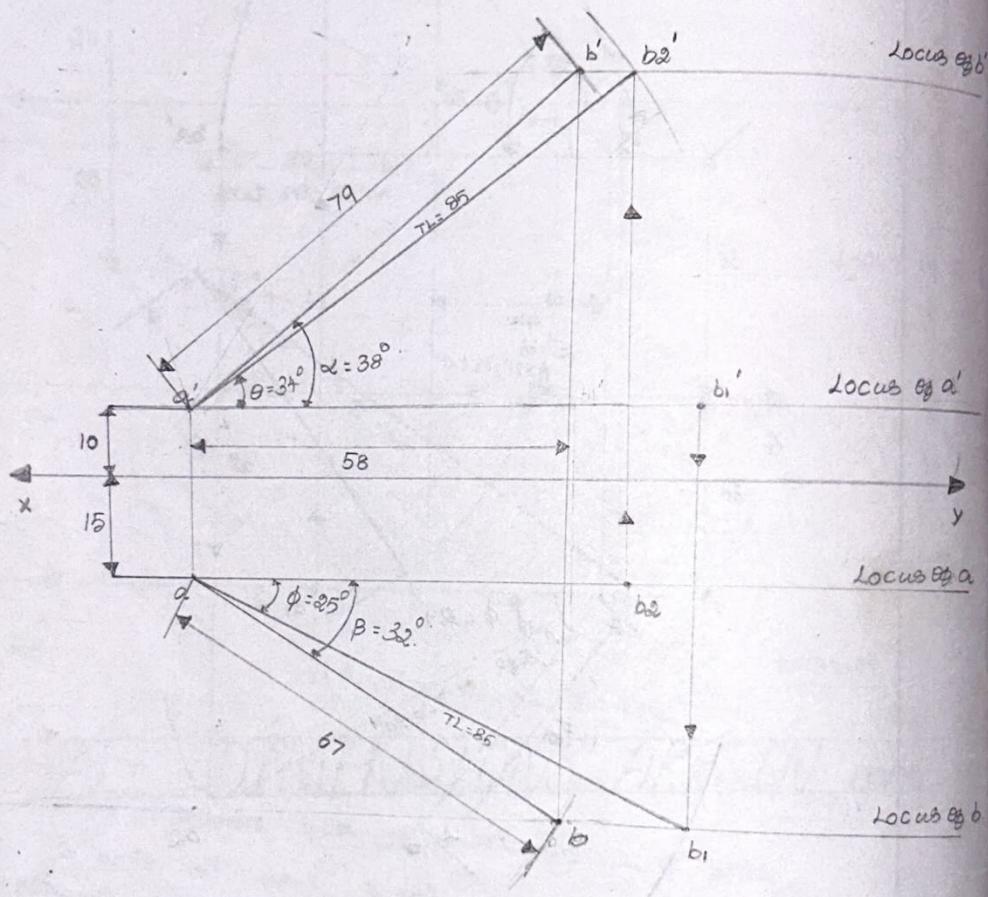
END PROJECTION = 44.

ALL DIMENSIONS ARE IN mm

Type 3:

A line AB is 85mm long has its end A, 10mm above HP and 15mm in front of V.P. The End B is 6mm above H.P. and 50mm in front of V.P. Draw its projections and find its true inclination with respect to HP and VP.

Soln:



Result:

TRUE LENGTH  $a'b_2$ ,  $a'b'_1 = 85$

TRUE INCLINATION HP ( $\theta$ ) =  $34^\circ$

VP ( $\phi$ ) =  $25^\circ$

FRONT VIEW  $ab' = 79$

TOP VIEW  $ab = 67$

APPARENT INCLINATION HP ( $\alpha$ ) =  $38^\circ$

VP ( $\beta$ ) =  $32^\circ$

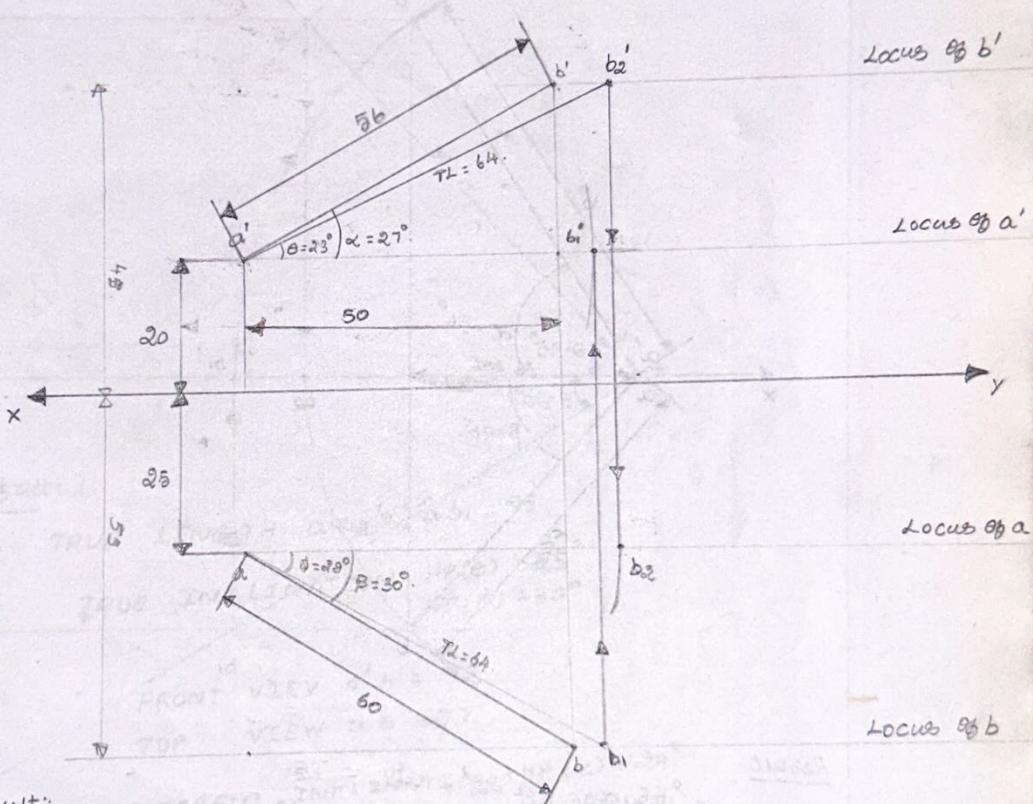
END PROJECTOR = 58

DIMENSIONS ARE IN mm

TYPE: 4:

A line AB has end A 20mm above HP and 25mm projectant to V.P. The other end B is 45mm above HP and 55mm projectant of V.P. The distance b/w end projector is 50mm. Draw its projections and find its true length and inclination with H.P and V.P.

SOLN:



Result:

TRUE LENGTH:  $a'b_2' \approx a'b_1' = 64$

TRUE INCLINATION HP ( $\theta$ ) =  $23^\circ$   
VP ( $\phi$ ) =  $28^\circ$

FRONT VIEW =  $a'b' = 56$

TOP VIEW =  $ab = 60$

APPARENT INCLINATION HP ( $\alpha$ ) =  $27^\circ$   
VP ( $\beta$ ) =  $30^\circ$ .

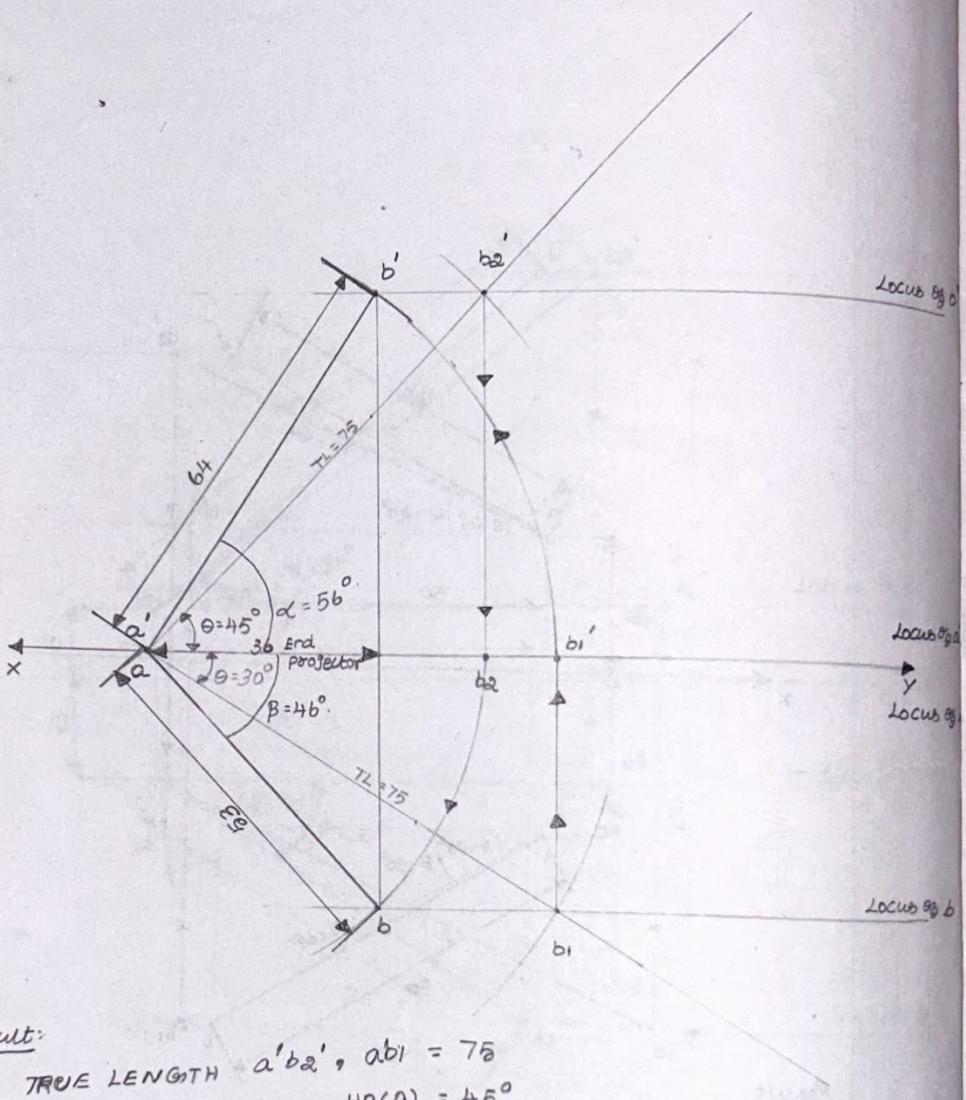
END PROJECTOR = 50.

ALL DIMENSIONS ARE IN mm

TYPE 5:

The line AB is 75mm long has its end A in both HP and VP. The line is most inclined at  $45^\circ$  to H.P. and  $30^\circ$  to V.P. Draw its projections.

Soln: A lies in both HP and VP,  $HP(\theta) = 45^\circ \uparrow$ ,  $VP(\phi) = 30^\circ \downarrow$   
 $TL AB = 75\text{mm}$

Result:TRUE LENGTH  $a'b' = 75$ TRUE INCLINATION  $HP(\theta) = 45^\circ$ APPARENT INCLINATION  $VP(\phi) = 30^\circ$ FRONT VIEW  $a'b' = 64$ TOP VIEW  $ab = 53$ .APPARENT INCLINATION  $HP(\alpha) = 56^\circ$  $VP(\beta) = 46^\circ$ 

END PROJECTOR = 36.

ALL DIMENSIONS ARE IN mm

Type 6:  
 A line AB is 85mm long as its end A is 60 mm above HP and 65 mm in front of VP. The end B is 25mm above HP and 20mm in front of VP. Draw proj.

Soln:

$$TL = AB = 85$$

$$A \text{ AHP} = 60 \uparrow \text{ IVP} = 65 \downarrow$$

$$B \text{ AHP} = 25 \uparrow, \text{ IVP} = 20 \downarrow$$

Result:

$$\text{TRUE LENGTH } a'b'_1, ab_1 = 85$$

$$\text{TRUE INCLINATION } \text{HP}(\theta) = 25^\circ \\ \text{VP}(\phi) = 30^\circ$$

$$\text{FRONT VIEW } a'b' = 72$$

$$\text{TOP VIEW } ab = 77$$

$$\text{APPARENT INCLINATION } \text{HP}(\alpha) = 29^\circ \\ \text{VP}(\beta) = 34^\circ$$

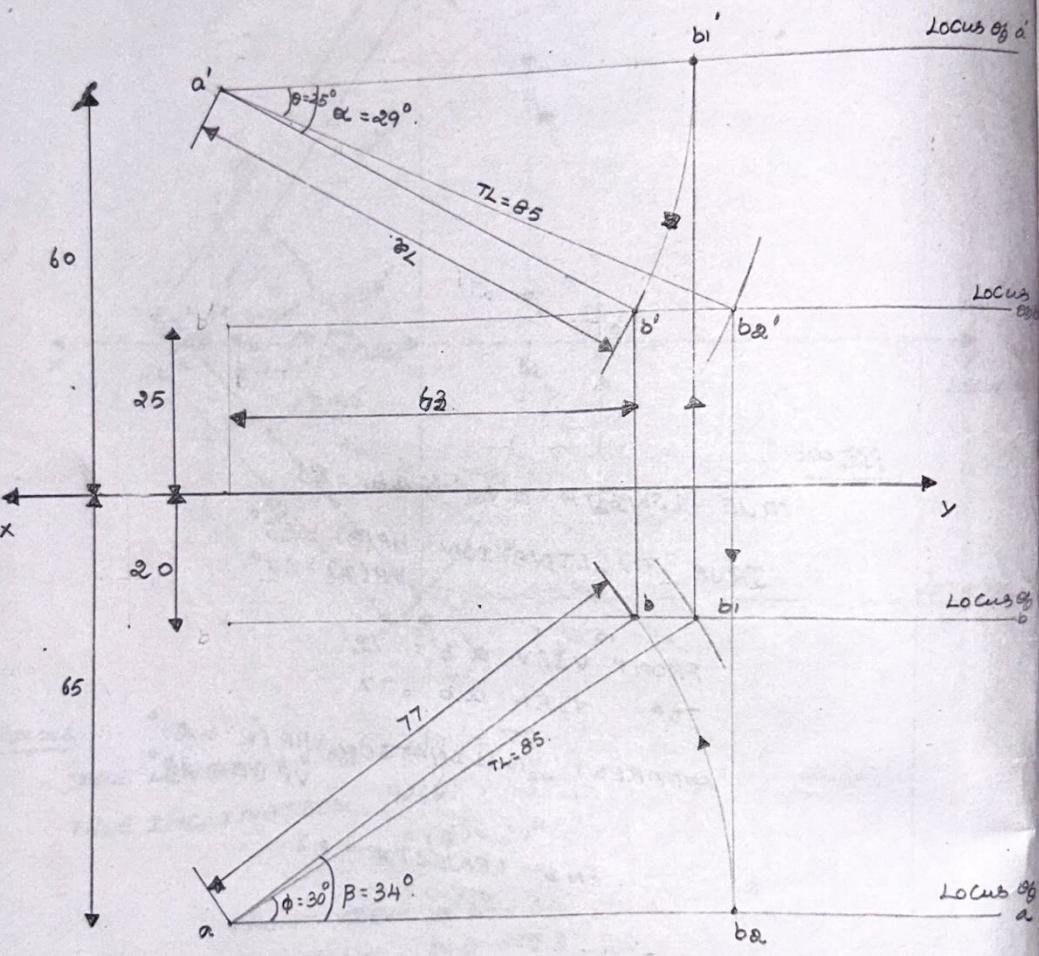
$$\therefore \text{END PROJECTOR} = 63$$

(Refer Fig)

ALL DIMENSIONS ARE IN mm

above H.P. 60 mm  
above V.P. 65 mm  
Front view 72 mm  
Top view 77 mm  
End projector 63 mm

W.E.



### Type: 7 (Special type).

A line AB is 65 mm long, has its end A 29 mm above HP and 15 mm in front of VP. The line is inclined at an angle of  $35^\circ$  to H.P. and  $55^\circ$  to V.P. Draw its projections.

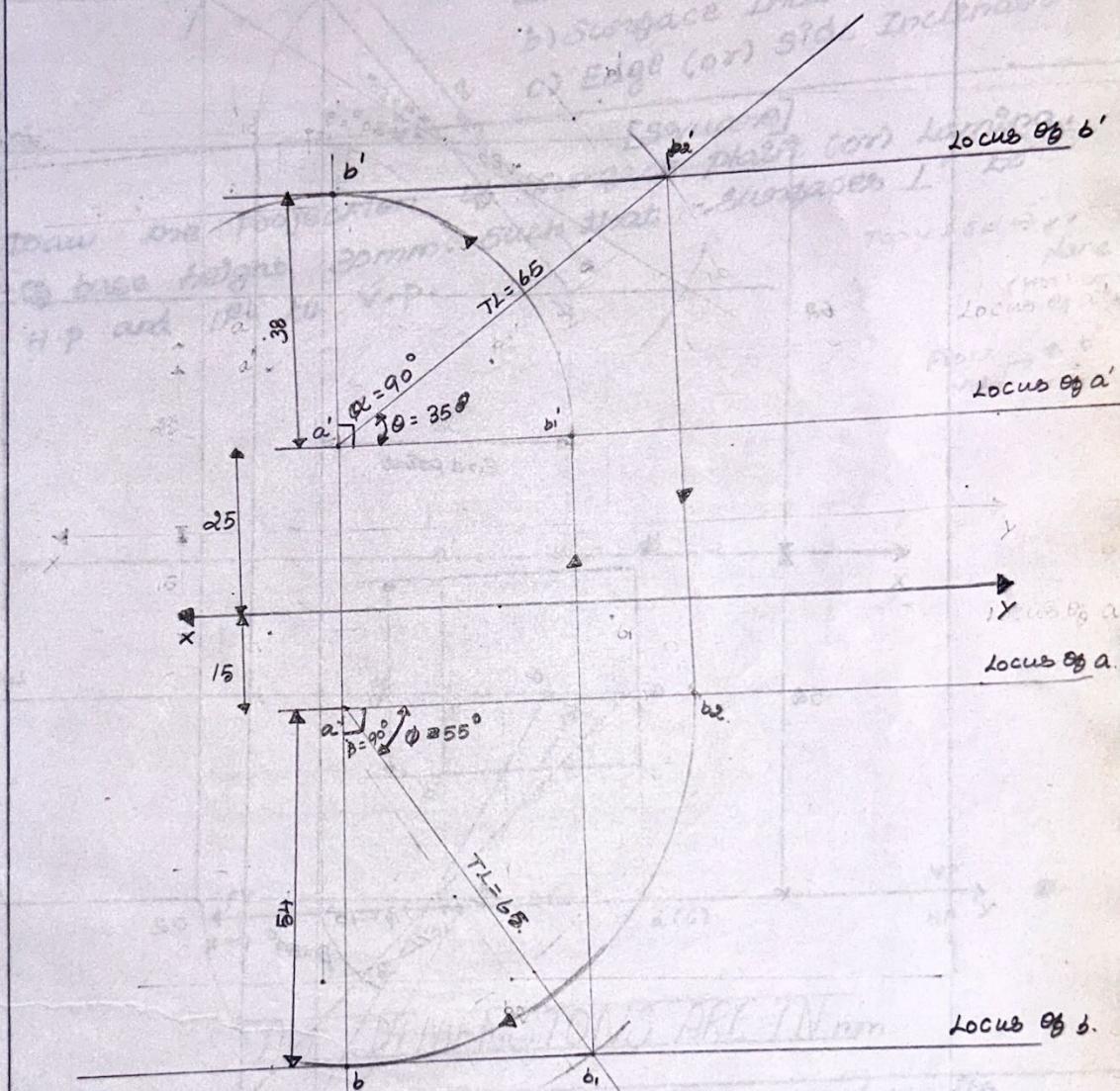
SOL:

9.4 at  $20^{\circ}\text{C}$  and 9.7 at  $40^{\circ}\text{C}$ . The  $\Delta H_f$  is  $10.5 \text{ kJ/mol}$

- a) Simple Piping
- b) Surface Inclination Ans.

Surface Delineation  
3rd Inc

Ex Edge (or) Side



Roscut

TRUE LENGTH  $a'b^2$ ,  $ab_1 = 85$

TRUE LENGTH & TRUE INCLINATION  $HP(\theta) = 35^\circ$   
 $VP(\theta) = 55^\circ$

FRONT VIEW  $a'b' = 38$   
 $a + b = 54$

$$ab = 54.$$

APPARENT INCLINATION  $HP(\alpha) = 90^\circ$   
 $VP(\alpha) = 90^\circ$ .

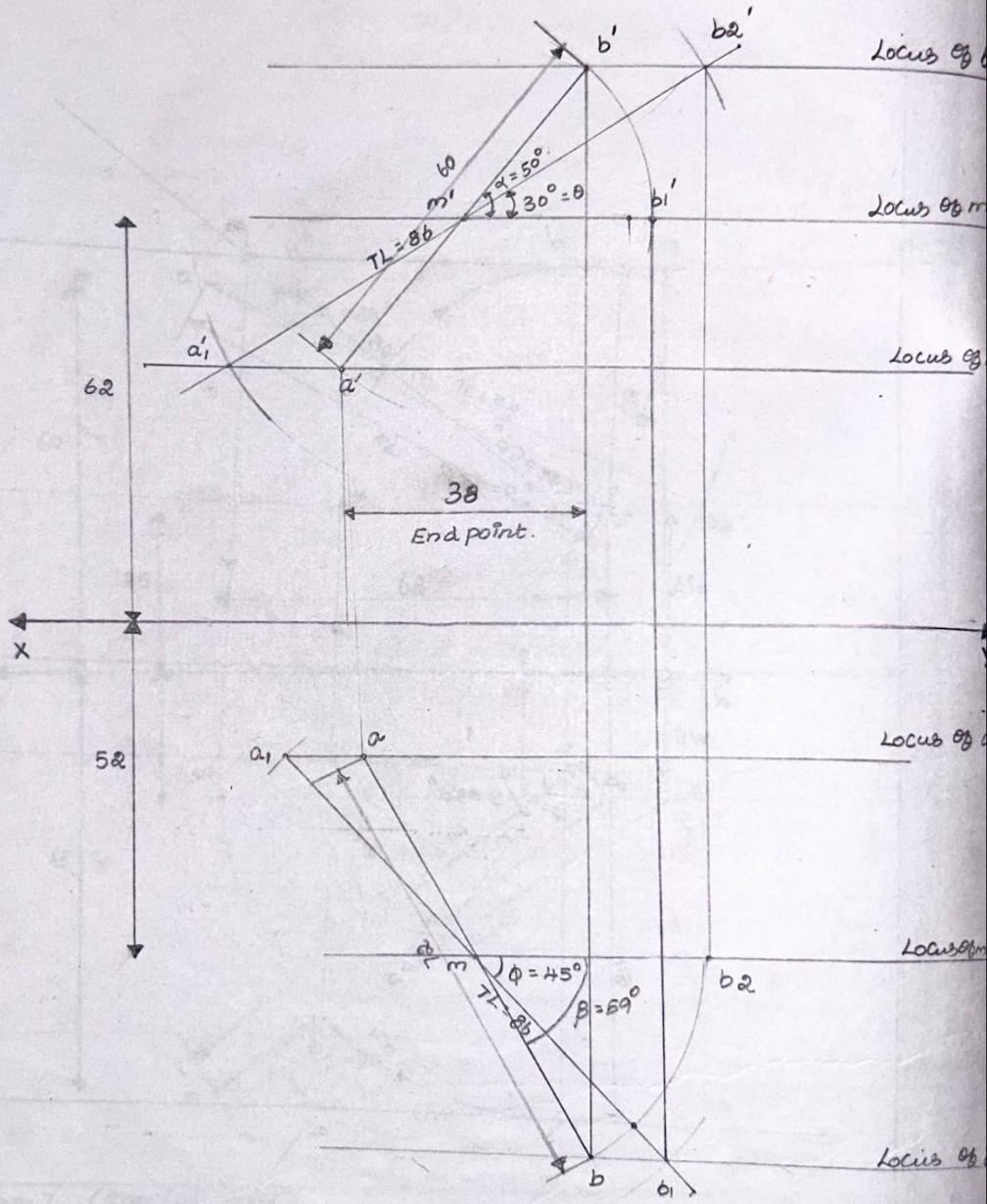
ALL DIMENSIONS ARE IN mm

Type:

(Special type: Midpoint).

A straight line AB of length 86mm is inclined at  $30^\circ$  to H.P. and  $45^\circ$  to V.P. Its midpoint is 62 mm above H.P. and 52mm projectant by V.P.

SOLN:



Result:

TRUE LENGTH  $a'b_1b_2'$ ,  $ab_1 = 86$ .

TRUE INCLINATION  $HP(\theta) = 30^\circ$   
 $VP(\phi) = 45^\circ$ .

Apparent Inclination  $HP(\alpha) = 50^\circ$   
 $VP(\beta) = 59^\circ$ .

FRONT VIEW  $a'b_1 = 60$

TOP VIEW  $ab = 72$ .

End projector = 38.

ALL DIMENSIONS ARE IN mm

# PROJECTION OF PLANE SURFACES

Type :-

T<sub>1</sub>

- 1) Single Stage
- a) Single Inclination
- b) Edge (or) Surface.
- 2) Double Stage.
- a) Simple position.
- b) Surface Inclination.

T<sub>2</sub>

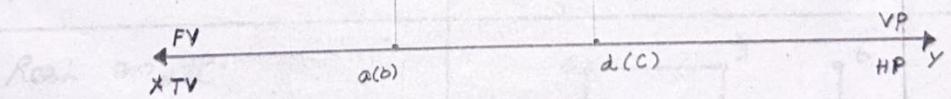
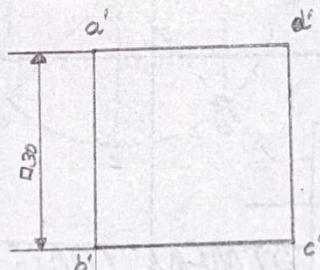
Double Inclination

- a) Simple position
- b) Surface Inclination
- c) Edge (or) side Inclination.

Draw the projection of surface plain. [Square] such that surfaces L<sup>r</sup> to base height 30mm. Such that surfaces L<sup>r</sup> to H.P and I<sub>rel</sub> to V.P.

TOP VIEW  $\rightarrow$  XY plane (HORL 20 mm)

Front view  $\rightarrow$  a' b'



ALL DIMENSIONS ARE IN mm

A circular plate of diameter 50 mm has its surface rel to H.P and 1<sup>r</sup> to V.P. Its centre is 20 mm above H.P and 30mm Infront of V.P.

Soln:-

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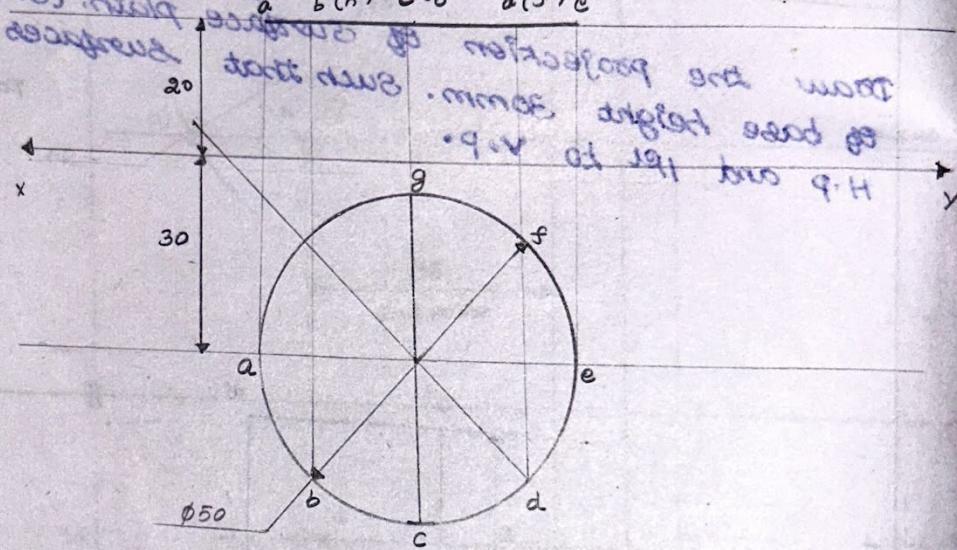
સુધી

- Significance of sample (1)
  - Significance of estimator (2)
  - Estimator (3)
  - Sample size (4)
  - Desirable properties of estimator (5)
  - Properties of estimator (6)
  - Sampling distribution (7)
  - Standard error of estimator (8)
  - Standard error of estimate (9)

87

- 15  
a) Edge (or) Shape Information  
b) Symmetric Information  
c) Single Bounding

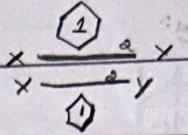
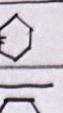
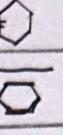
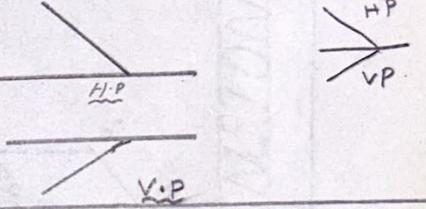
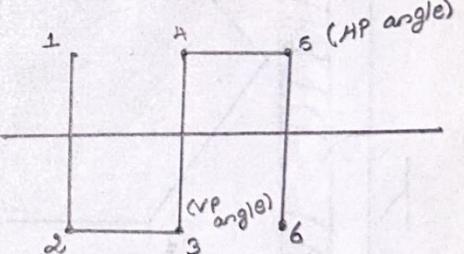
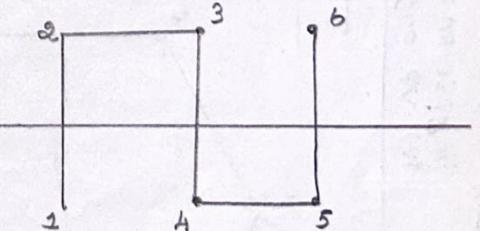
Definite (e.g.) exist, are  $a'(n)$   $b'(n')$   $c'(g')$   $d'(f')$   $e'$



ALL DIMENSIONS ARE IN mm

A camera block of shams  
perspective filter to Hg and 3 mm Interference  
shown space Hg and 3 mm Interference  
to Vp. To Vp. To Vp. To Vp.

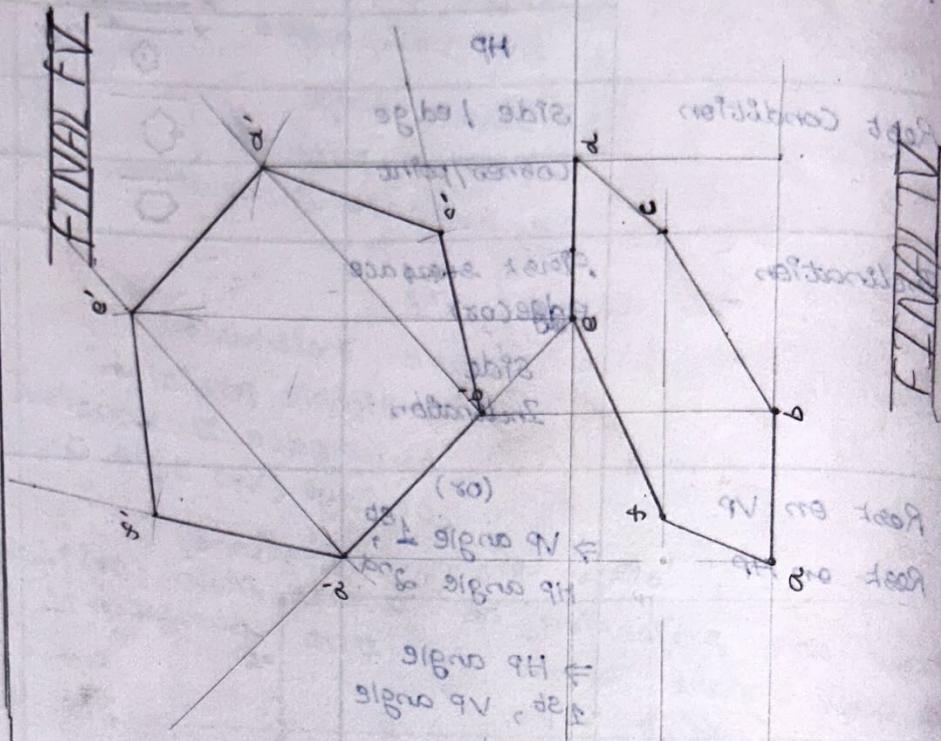
# Golden rules for planes

|    |                          |   |  |
|----|--------------------------|---|--|
| 1. | Rest on                  | VP  |    |
|    |                          | HP  |     |
| 2) | Rest condition           | side / edge<br>corner/point   |     |
| 3  | Inclination              | First surface<br>edge(or)<br>Side<br>Inclination  |  |
| 4) | Rest on VP<br>Rest on HP | (or)<br>⇒ VP angle $1^{\text{st}}$ ,<br>HP angle $2^{\text{nd}}$<br><br>⇒ HP angle<br>$1^{\text{st}}$ , VP angle<br>$2^{\text{nd}}$ |  |
| 5  | HP angle<br>VP angle     |   |  |
| 6  | Rest on VP.              |   |  |
| 7  | Rest on HP.              |   |  |
| 8  | Hexagon<br>Pentagon      | $\frac{360}{6} = 60^\circ$<br>$\frac{360}{5} = 72^\circ$  |  |

2418119  
 Ques. Write a prob. of a hexagonal lamina of side 30mm resting on its side on V.P. And inclined at  $45^\circ$  to H.P. and surface is inclined at  $35^\circ$  to V.P. Draw the progs.

Soln:

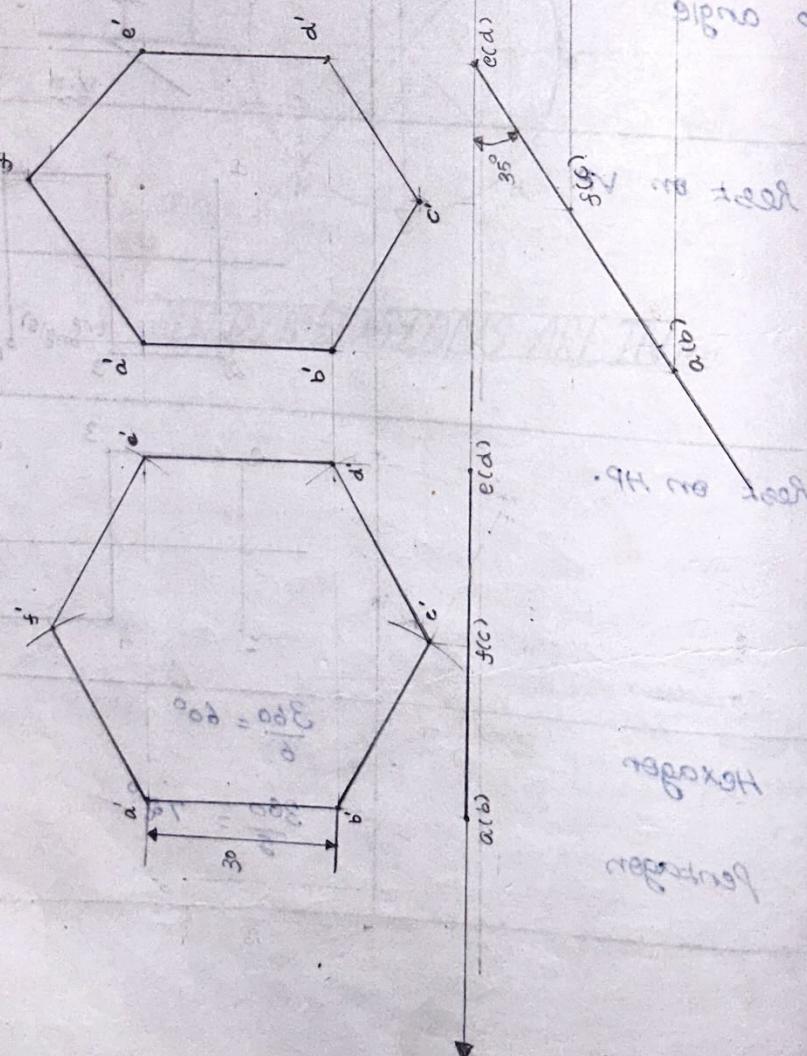
Put posterior part of  
 i) measure 6'  
 ii) measure 4'  
 and move  
 and move



v) HP angle

H.F.

- i) Hexagon,  $\equiv 60^\circ$
- ii) Resting on side on V.P.
- iii) Side on V.P.
- iv) VP angle

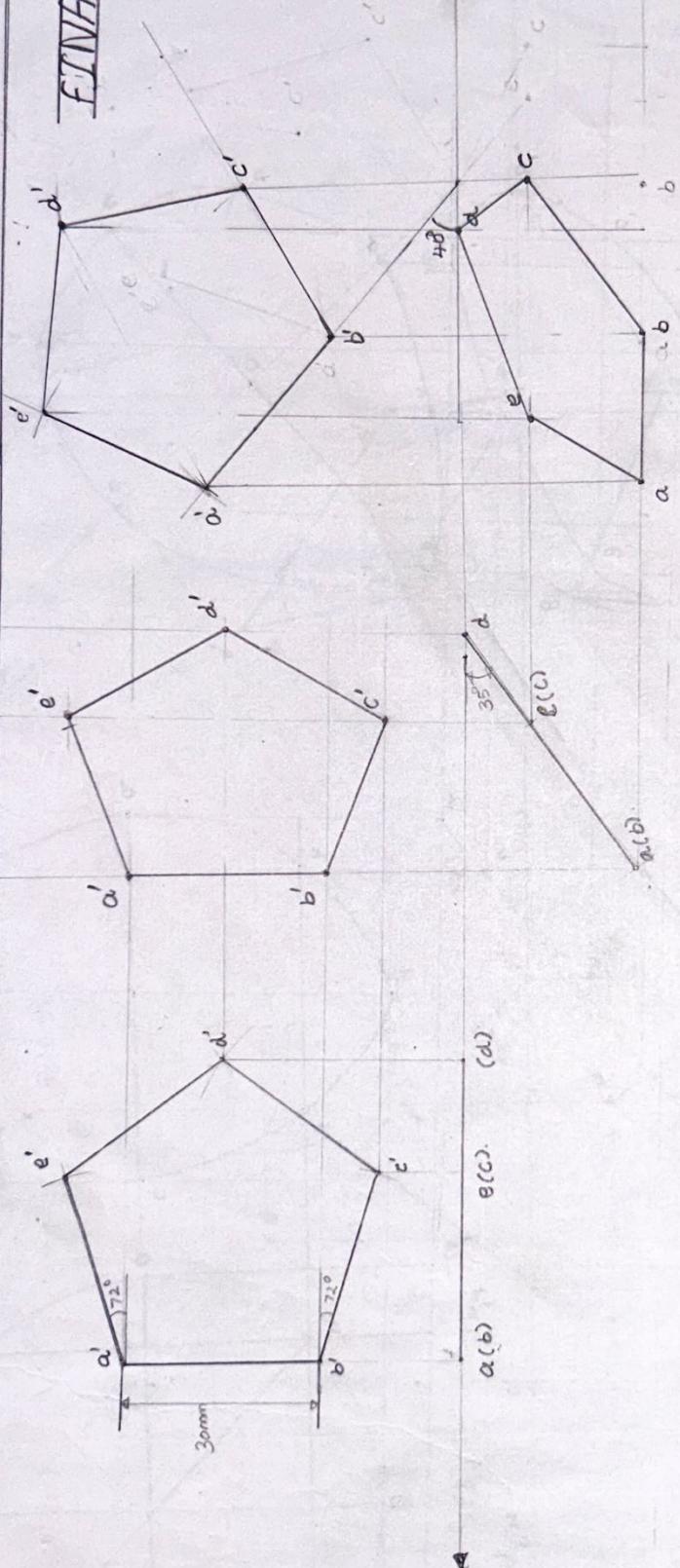


All Dimensions are in mm

1) A pentagon of side 30mm is resting on V.P. on its side on V.P. It is inclined at  $40^\circ$  to H.P. and surface is inclined at  $35^\circ$  to V.P. Proj.

Given:

FINAL F.F.



ELIMINATE

ALL DIMENSIONS ARE IN mm

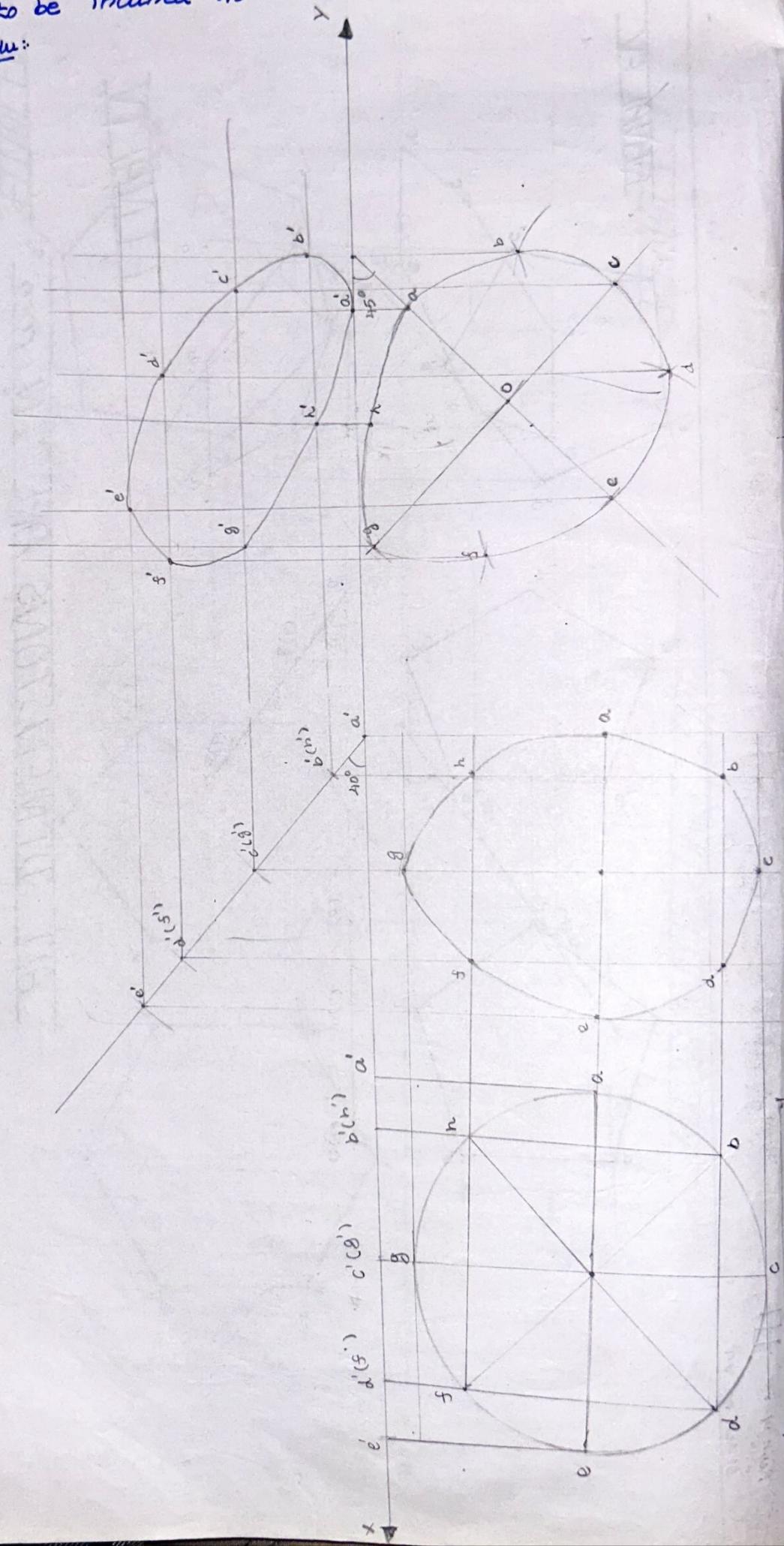
V.P. angle

Pentagon = 12  
Rest on V.P.  
Side on V.P.

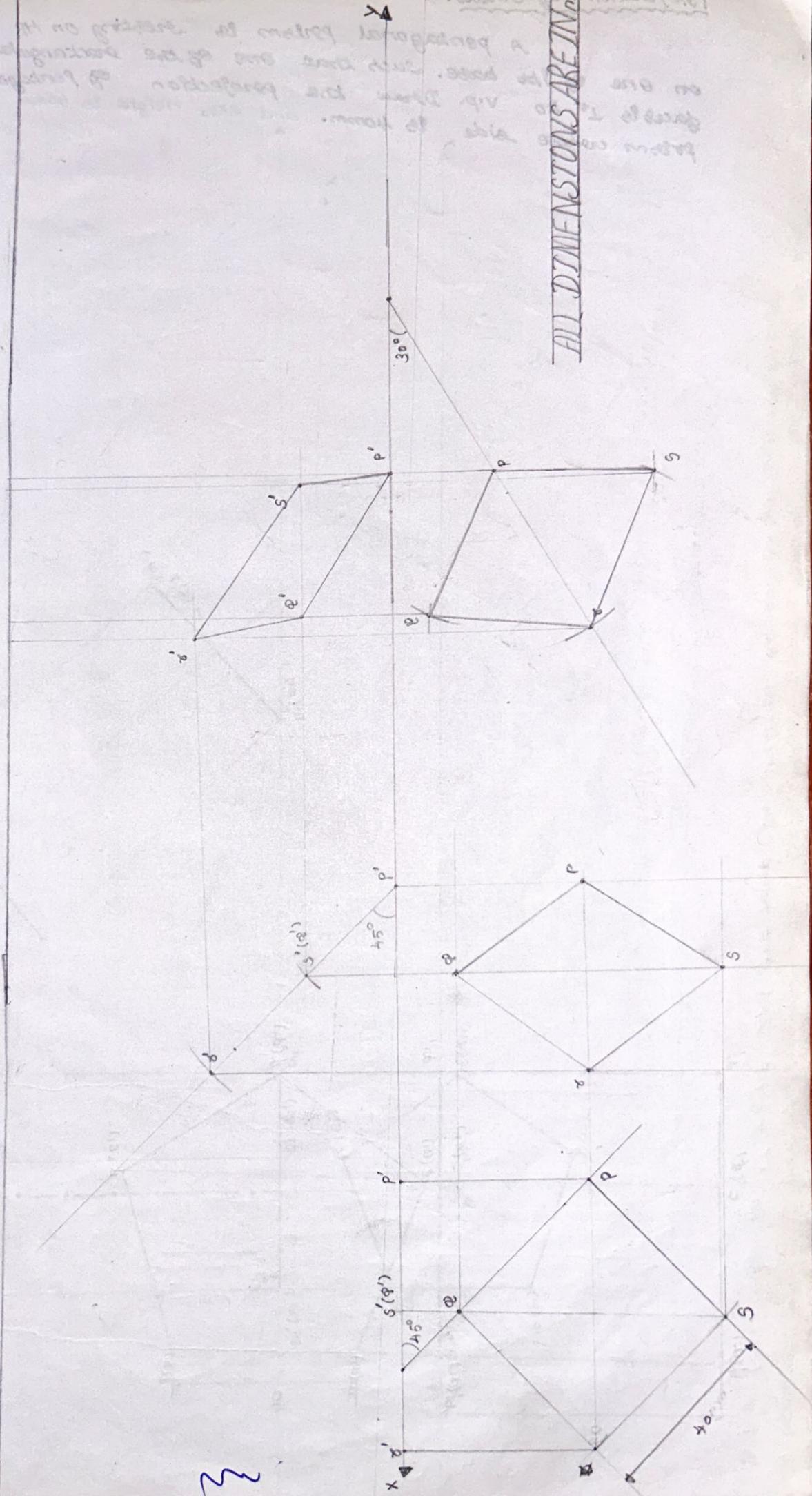
A circular plate of diameter 70mm has its end A of circumference AE in H.P. and the plane is inclined at  $40^\circ$  to H.P. draw its projection when AE appears to be inclined  $45^\circ$  to V.P.

Solu:

All dimensions are in mm

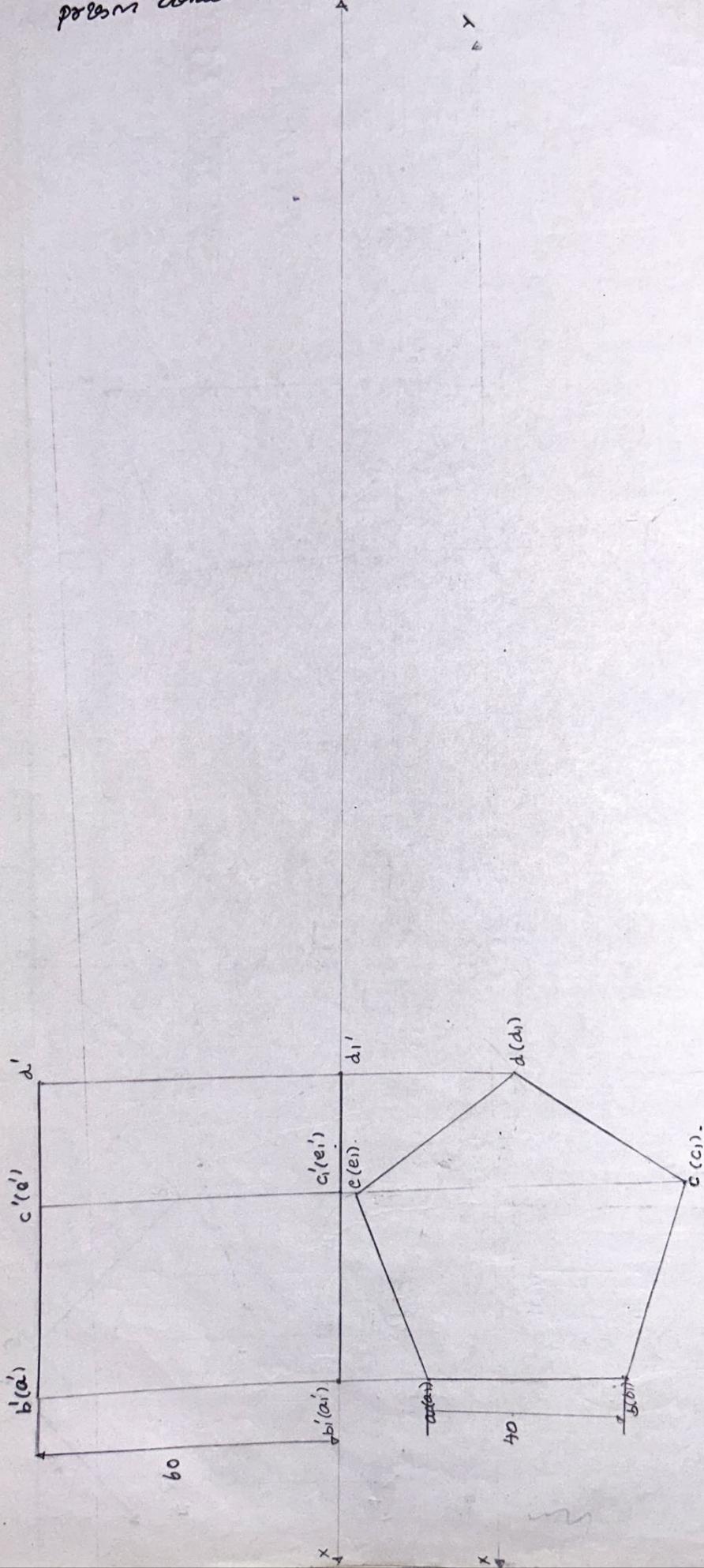


A square landa PPRS of side 40mm rested on the ground on its corner p'nt such a way that the diagonal PPRS is inclined at  $30^{\circ}$  to v.p. Draw persog.



Projection of Solids

A pentagonal prism is resting on H.P. on one of its base. such that one of the rectangular faces is  $\perp$  to V.P. Draw the projection of pentagonal prism whose side is 40mm. and axis height is 60mm.



A pentagonal prism of base side 40 mm and axis height 70 mm is resting on its base edge on H.P. D-S axis is inclined at  $50^\circ$  to H.P. and  $110^\circ$  to V.P. Draw its projections.