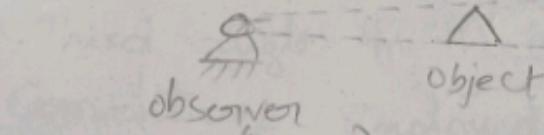


UNIT-2 ORTHOGRAPHIC PROJECTIONS

Projection : work to make objects to

and transfer its various 3D shape location
to 2D bottom to enlarged view

object



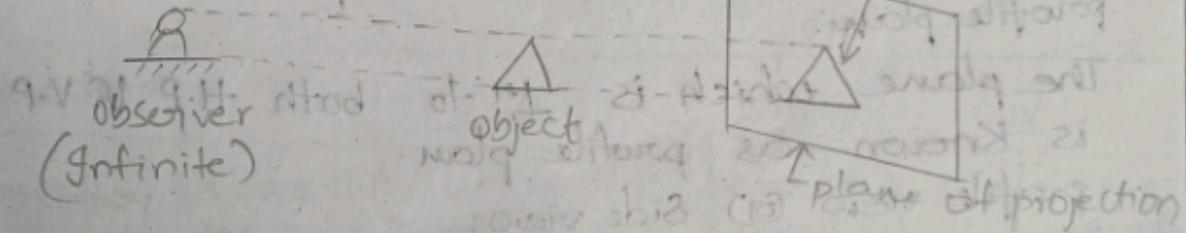
Orthographic projection : (1) Plane of projection

Ortho \Rightarrow right angle

Orthographic \Rightarrow Right angle drawing

Orthographic - it is based on to make out

• no (1) is same size



Definition : no (1) is same size

when the projectors are parallel to each other and also \perp to the plane of projection then the projection is called orthographic projection.

projector :

The rays (1) lines from the object to the plane are called projectors. (2H pencil)

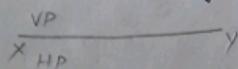
Reference planes (1) planes of projections:

The transparent planes on which the projections are drawn are known as reference planes

1. Vertical plane (V.P)
2. Horizontal plane (H.P)

reference line:

The line of intersection of horizontal plane and vertical plane is known as reference line and it is denoted by XY



Front view (FV) Elevation:

The projection of the object on the vertical plane is called front view.

Top view (TV) plan:

The projection of the object on the horizontal plane is called Top View (TV) plan.

The plane which is \perp to both H.P & V.P is known as profile plan.

profile view (SV) Side view:

The projection of the object on the profile plane is called profile view.

Four Quadrants (Q) divided into four angles:

II

above H.P, behind V.P

FV above XY

TV above XY

HP below XY

below H.P, behind V.P

FV below XY

TV above XY

HP below XY

above H.P, in front of V.P

FV above XY

TV below XY

HP below XY

below H.P, in front of V.P

FV below XY

TV below XY

HP below XY

III

below H.P, in front of V.P

FV below XY

TV above XY

HP below XY

IV

below H.P, in front of V.P

FV below XY

TV below XY

HP below XY

✓ First angle method of projection:

- 1) The object is kept in the first quadrant.
- 2) The front view is drawn above my and Top view below my.
- 3) The object lies in b/w plane and observer.

X Third angle method of projection:

Conventions Employed:

Actual points $\rightarrow A, B, C, D \dots$

Top view $\rightarrow a, b, c, d \dots$

front view $\rightarrow a', b', c', d' \dots$

Side view $\rightarrow a'', b'', c'', d'' \dots$

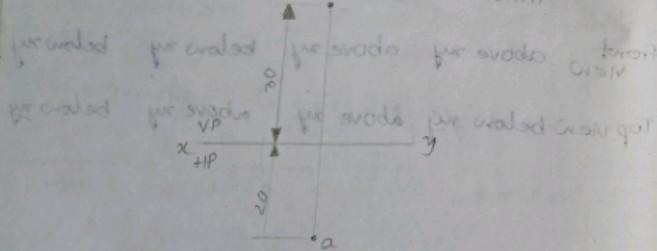
Quadrant	I	II	III	IV
Position	above H.P in front V.P	above H.P behind V.P	below H.P behind V.P	below H.P in front V.P
front view	above XY	above XY	below XY	below XY
Top view	below XY	above XY	above XY	below XY

Projections of Points in Space

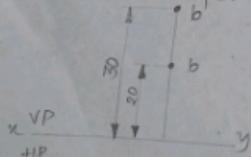
- The distance of the point from the horizontal plane (i.e., above H.P. or below H.P.) can be seen in front view.
- The distance of the point from the vertical plane (i.e., in front of V.P. or behind V.P.) can be seen in top view.

Point above H.P. → F.V. above my
 Point below H.P. → F.V. below my
 Point on the H.P. → F.V. on my
 Point in front V.P. → T.V. below my
 Point behind V.P. → T.V. above my
 Point on the V.P. → T.V. on my

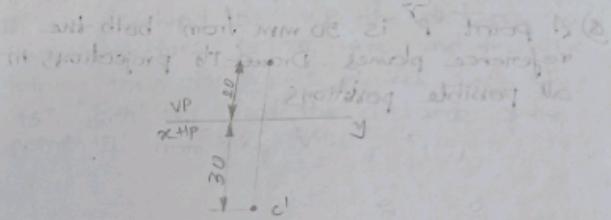
- A point 'A' is 30 mm above H.P. and 20 mm in front of V.P. draw its projections



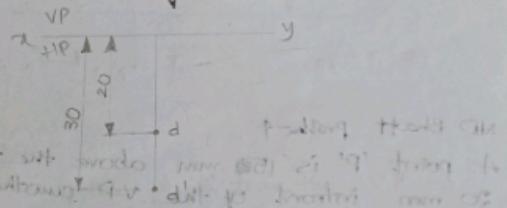
- A point 'P' is 30 mm above H.P. and 20 mm behind V.P. draw its projections



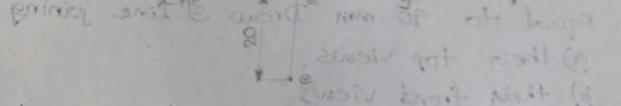
- A point 'P' is 30 mm below H.P. and 20 mm behind V.P. draw its projection.



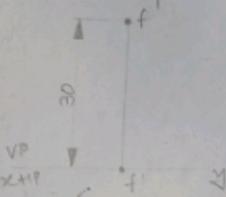
- A point 'T' is 30 mm below H.P. and 20 mm in front of V.P.



- A point 'E' is on the H.P. and 20 mm in front of V.P. draw its projections

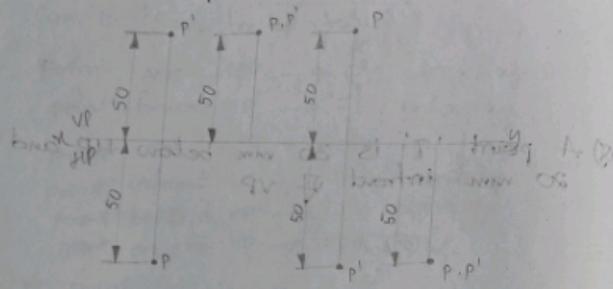


- A point 'F' is 30 mm above H.P. and in the V.P.



Q) A point 'G' is on both H.P and V.P
 position of G

Q) A point 'P' is 50 mm from both the reference planes. Draw its projections in all possible positions

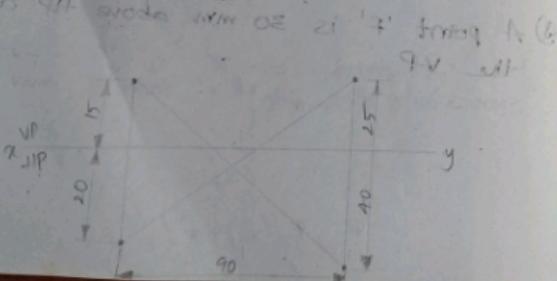


ND Bhatt problem 4

A point 'P' is 150 mm above the H.P and 20 mm in front of the V.P another point 'Q' is 25 mm behind the V.P if 40 mm below the H.P. Draw projections of P & Q keeping the distance b/w their projectors equal to 90 mm. Draw st. line joining

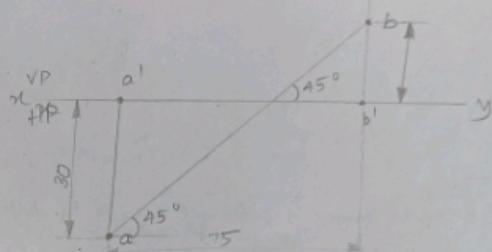
a) their top views

b) their front views



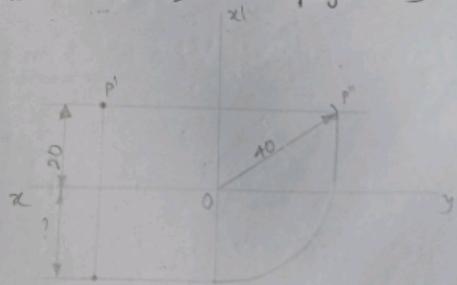
ND Bhatt prb -6

Two pts. A & B are in the H.P. the point 'A' is 30 mm in front of the V.P while 'B' is behind the V.P the distance b/w them projectors is 75 mm and the line joining their top views makes angle of 45° with xy find the distance of the point 'B' from the V.P



The distance of the pt 'B' from the V.P is

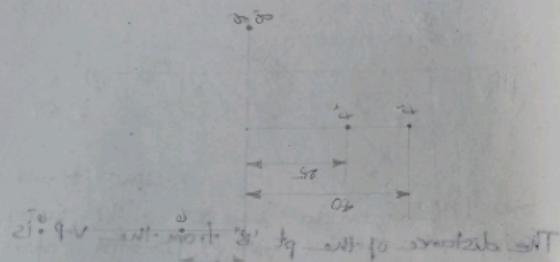
Q) A point 'P' is 20 mm above H.P and lies in the first quadrant, its shortest distance from xy is 10 mm. Draw its projections



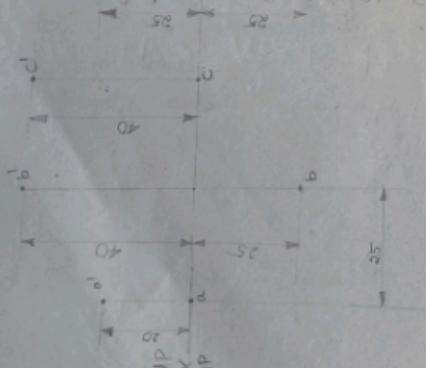
Sheet no - 3.1

problem (1 to 10) in ND Rhatt TB Ex-9

- (1) Draw the projections of the following pts on the same ground line keeping the projectors 25 mm apart:
 - A, in the H.P. & 20 mm behind V.P.
 - B, 40 mm above H.P. & 25 mm in front of V.P.
 - C, in the V.P. and 40 mm above the H.P.
 - D, 25 mm below the H.P. and 25 mm behind V.P.
 - E, 15 mm above the H.P. & 50 mm behind V.P.
 - F, 40 mm below the H.P. & 25 mm in front of V.P.
 - G, in both the H.P. & the V.P.

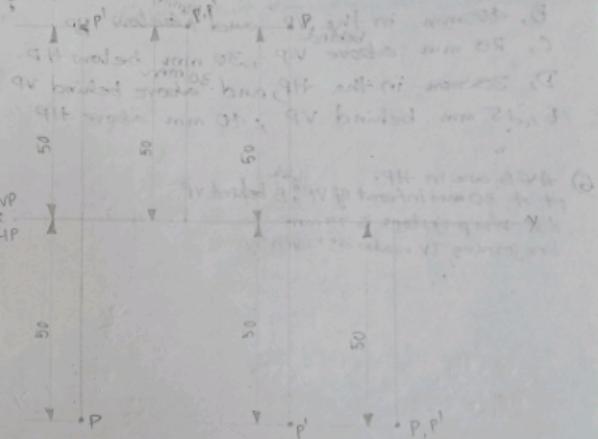


(if distance of 40 is given then 40 is to be taken as 20 mm from left of reference line)



A

- (2) A pt P is 50 mm from both the reference planes. Draw its projections in all possible positions.

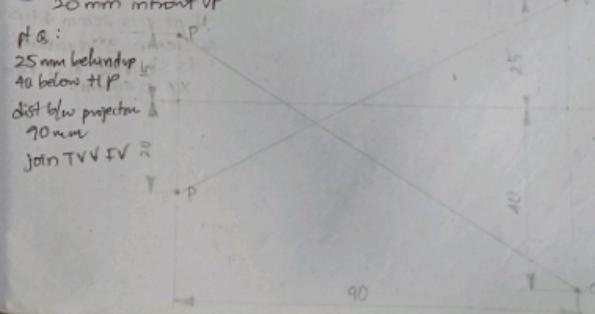


- (3) a) A pt P; its top view is 40 mm above XY, the front view, 20 mm below the top view.
b) A pt Q; its projections coincide with each other 40 mm below XY.

2ND QUADRANT

4TH QUADRANT

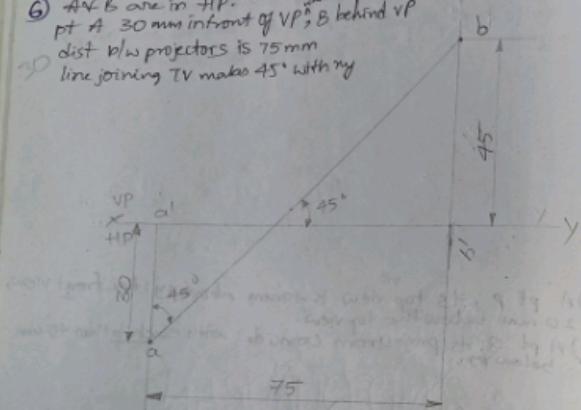
- P: P:
 ④ 15 mm H.P.
 20 mm in front VP
 Q: 25 mm behind VP
 40 below H.P.
 dist b/w projectn
 90 mm
 join TV & FV



Nisi

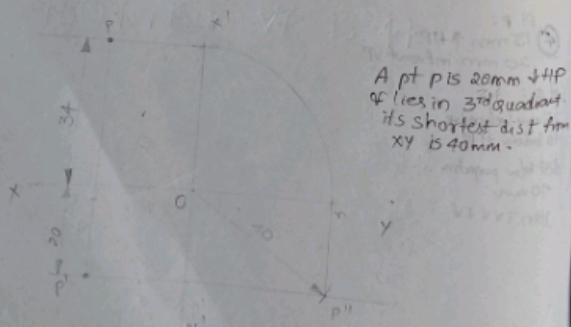
- 5) A, 20 mm below H.P., int 50 mm in front of V.P.
 B, ~~40 mm~~^{40mm} in the VP and ~~7~~⁷ below H.P.
 C, 20 mm above V.P., 30 mm below H.P.
 D, 30 mm in the H.P. and ~~above~~ behind V.P.
 E, 15 mm behind V.P.; 10 mm above H.P.

- 6) A & B are in H.P.
 pt A, 30 mm in front of VP; B behind VP
 dist b/w projectors is 75 mm
 line joining TV makes 45° with XY



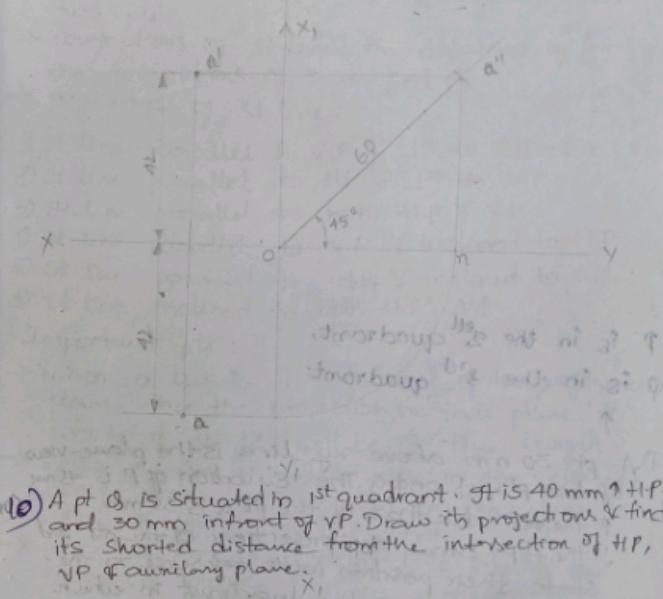
THE DISTANCE OF THE POINT B
 FROM V.P. IS ~~45~~ 45

7)

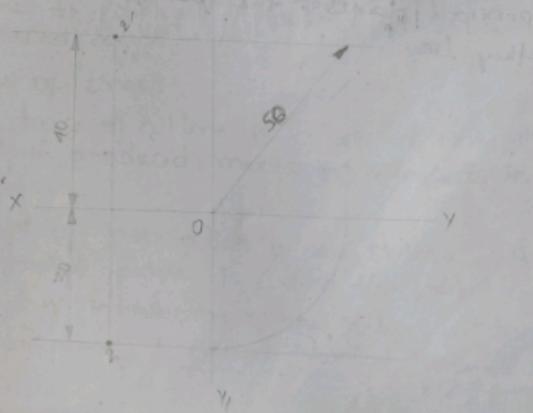


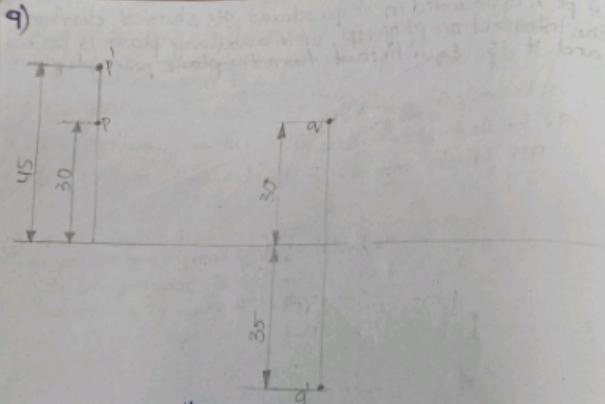
A pt P is 20mm \downarrow H.P.
 if lies in 3rd quadrant
 its shortest dist from
 XY is 40mm.

- 8) A pt A is situated in 1st quadrant. Its shortest dist from the intersection of H.P. VP & auxiliary plane is 60 mm and it is equidistant from the plane principle plane



- 9) A pt O is situated in 1st quadrant. It is 40 mm \uparrow H.P. and 30 mm in front of V.P. Draw its projections & find its shortest distance from the intersection of H.P., V.P. & auxiliary plane.





P is in the 2nd quadrant,
Q is in the 3rd quadrant

- ① A pt 30 mm above my line is the plane-view of two pts P and Q. The Elevation of P is 45 mm ↑ the H.P while that of the pt Q is 35 mm ↓ the V.P. Draw the projection of the pts and state their position with reference to the principal planes & the quadrant in which they lie.

PROJECTIONS OF ST. LINES

- A st-line is the shortest distance b/w any two pts of object
- projections of st-lines are obtained by joining the projections of their end pts.
- ⇒ positions of st-line:

- 1) St-line parallel to V.P & ⊥ to H.P
- 2) St-line parallel to H.P & ⊥ to V.P
- 3) St-line parallel to both H.P & V.P
- 4) St-line parallel to V.P & inclined to H.P.
- 5) St-line parallel to H.P & inclined to V.P.
- 6) St-line inclined to both H.P & V.P.

Important pts:

- when a line is \parallel to one of the reference plane then the projection on that plane to which it is \parallel will be its true length.
- When a line is \perp to one of the reference plane then the projection on that plane to which it is \perp is a point.
- when a line is inclined to one of the reference plane then the projection on that plane to which it is inclined will be its reduced length.

Traces of lines:

- 1) The trace of a line is a pt at which the line if produced meets (or) intersects the plane.
- 2) The pt of intersection of the st.line with horizontal plane is called "Horizontal trace"(H.T)
- 3) The pt of intersection of the st.line. with vertical plane is called "vertical trace"(V.T).

Position:

1) St. line \parallel to V.P & \perp to H.P will be A line \parallel to V.P \rightarrow True length in F.V and line \perp to H.P \rightarrow pt. in T.V to show its true position of points

q.t. at $H.P$ \perp to $V.P$ of L will be t_1

q.v. at $V.P$ \perp to $H.P$ of L will be t_2

q.v. of L inclined to $H.P$ will be t_3

2) St. line \parallel to H.P & \perp to V.P

line \parallel to H.P \rightarrow T.L in T.V

line \perp to V.P \rightarrow pt. in F.V

and for a and b of L it is north

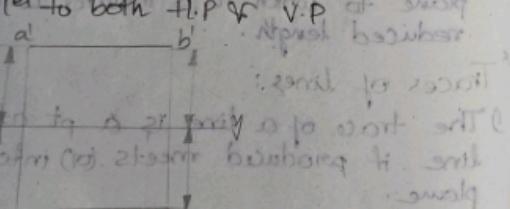
at 45° from $H.P$ with $south$

angle with $H.P$ is 45° and a is 100

and b is 100 and L is 100 below

and a is 100 and b is 100 and L is 100 below

3) St. line \parallel to both H.P & V.P of L



distances from $H.P$ are same as from $V.P$

and distances from $H.P$ and $V.P$ are same

and angle with $H.P$ and $V.P$ are same

and angle with $H.P$ and $V.P$ are same

and angle with $H.P$ and $V.P$ are same

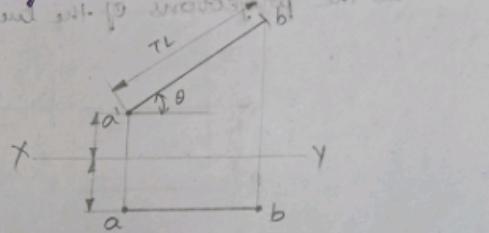
St. Line \parallel to V.P & inclined to H.P

line \parallel to V.P \rightarrow T.L in F.V

line inclined to H.P \rightarrow R.L in T.V

The inclination with H.P is denoted as ' θ ' and this angle ' θ ' will be seen in F.V.

and angle ' θ ' will be seen in T.V.



2) St. line \parallel to H.P & inclined to V.P

line \parallel to H.P \rightarrow T.L in T.V

line inclined to V.P \rightarrow R.L in F.V

The inclination with V.P is denoted as ' ϕ ' and this angle ' ϕ ' will be seen in T.V.

and angle ' ϕ ' will be seen in F.V.

and angle ' ϕ ' will be seen in F.V.

and angle ' ϕ ' will be seen in T.V.

and angle ' ϕ ' will be seen in T.V.

and angle ' ϕ ' will be seen in F.V.

and angle ' ϕ ' will be seen in F.V.

and angle ' ϕ ' will be seen in T.V.

and angle ' ϕ ' will be seen in T.V.

and angle ' ϕ ' will be seen in F.V.

and angle ' ϕ ' will be seen in F.V.

and angle ' ϕ ' will be seen in T.V.

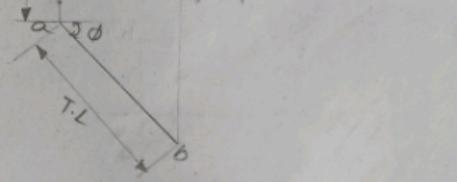
and angle ' ϕ ' will be seen in T.V.

and angle ' ϕ ' will be seen in F.V.

and angle ' ϕ ' will be seen in F.V.

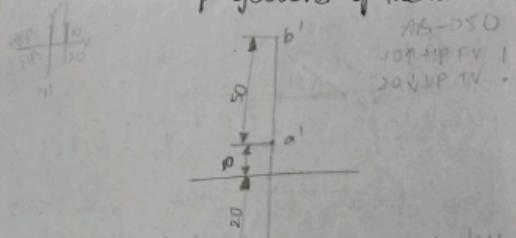
and angle ' ϕ ' will be seen in T.V.

and angle ' ϕ ' will be seen in T.V.

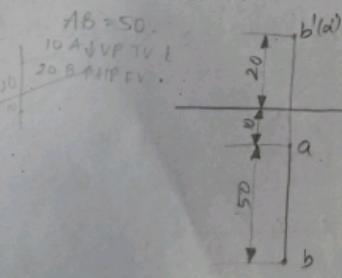


Problems:

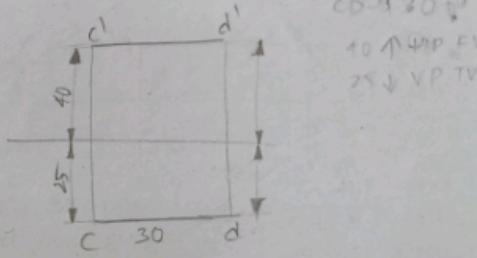
- 1) A line AB 50 mm long is \perp to V.P. and \parallel to H.P. point 'A' is 10 mm above H.P and the line is 20 mm in front of V.P. Draw the projections of the line AB.



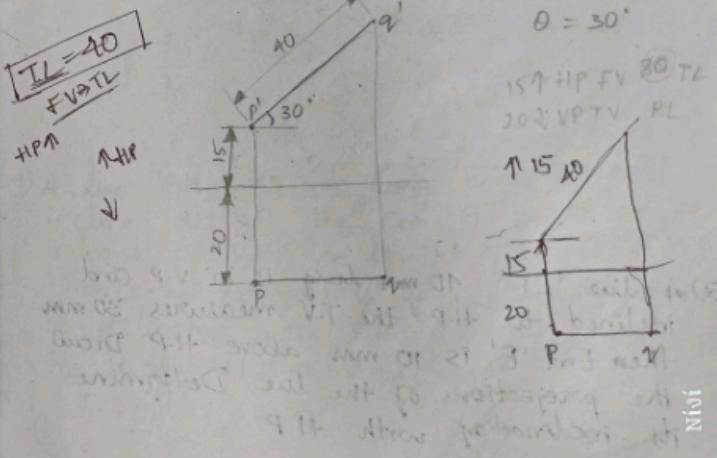
- 2) A line AB 50 mm long is \perp to V.P. and \parallel to H.P. its End 'A' is 10 mm in front of V.P and the line is 20 mm above H.P. Draw the projections of the line.



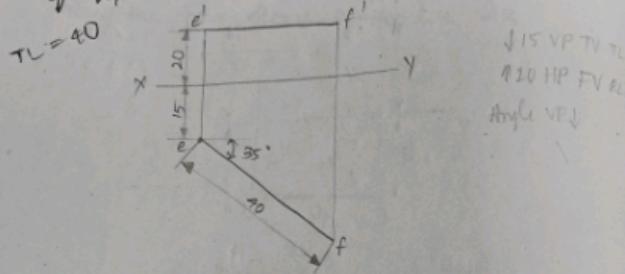
- 3) A line CD 30 mm long is \perp to both the planes. the line is 40 mm above H.P and 25 mm in front of V.P. Draw its projections.



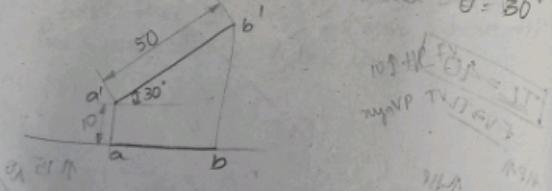
- 4) A line PQ 40 mm long is \perp to V.P and α inclined at an angle of 30° to H.P. the End 'P' is 15 mm above H.P and 20 mm in front of V.P. Draw the projections of the line.



5) Draw the projections of a line 'EF' 40 mm long inclined to H.P. and inclined at an angle of 35° to V.P. the End 'E' is 20 mm above H.P and 15 mm in front of V.P

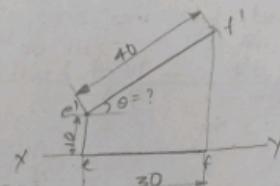


6) A line 'AB' 50 mm long is in V.P. and inclined at an angle of 35° to H.P. the End 'A' is 10 mm above H.P. Draw the projections. Line in the V.P. \rightarrow TV on my



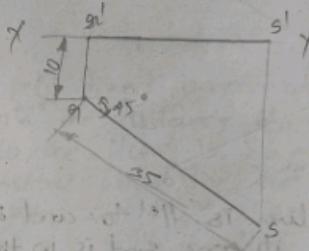
7) A line 'EF' 40 mm long is in V.P. and inclined to H.P. the T.V. measures 30 mm and the End 'E' is 10 mm above H.P. Draw the projections of the line. Determine its inclination with H.P.

Line in the VP \rightarrow TV on my
T.V.L (R.L) = 30, TL = 40



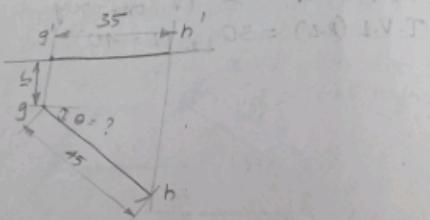
8) A line 'RS' 35 mm long is in H.P. and inclined at an angle of 45° to V.P. the End 'R' is 10 mm in front of V.P. Draw the projections. Line in H.P. \rightarrow FV on my

$$TL = 35 \quad \phi = 45^\circ$$

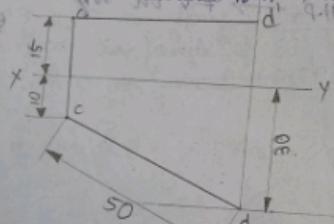


9) A line 'GH' 45 mm long is in H.P. and inclined to V.P. the End 'G' is 15 mm in front of V.P. the length of the F.V. is 35 mm. Draw the projections of the line. Determine its inclination with V.P.

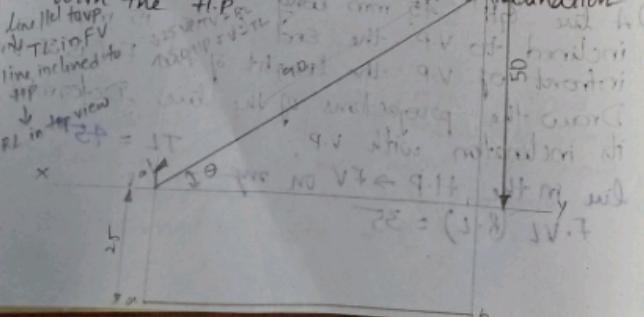
$$TL = 45^\circ \quad F.V.L (R.L) = 35 \quad 15 \downarrow VP$$



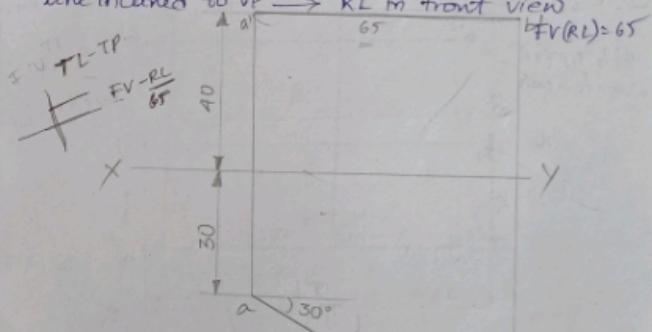
- 10) Draw the projections of a st-line 'CD' 50 mm long, \parallel to H.P and inclined to V.P. The End 'C' is 10 mm in front of V.P and 'D' is 30 mm in front of V.P the line is 15 mm above H.P. Line \parallel to H.P \rightarrow TL in TV
line inclined to VP \rightarrow reduced height in FV



- 11) A 90 mm long line is \parallel to and 25 mm in front of the V.P its one end is in the H.P while the other is 50 mm above the H.P. Draw its projections and find its inclination with the H.P.

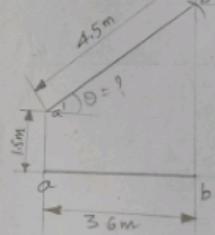


- 12) The FV of a line, inclined at 30° to the VP, is 65 mm long. Draw the projections of a line when it is \parallel to End 40 mm above the H.P, Its one End being in front of VP is line \parallel to H.P \rightarrow TL in TV
line inclined to VP \rightarrow RL in front view



- 13) Two pets fixed on a wall are 4.5 metres apart. The distance b/w the pets measured \parallel to the floor is 3.6 metres. If one pet is 1.5 metres above the floor, find the height of the 2nd pet and the inclination of the line joining the 2 pets with the floor.

$$\begin{aligned} 45m &= 4.5 \times 1000 \times \frac{1}{100} \\ &= 45mm \\ RL &= 3.6m \\ TL &= 45m \end{aligned}$$

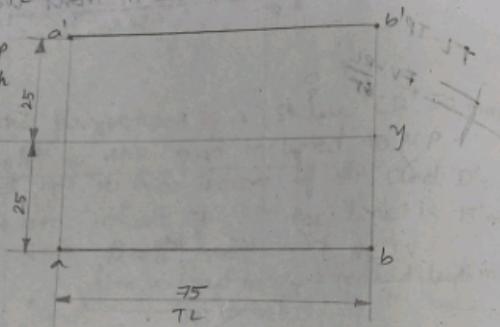


SCALE 1:100

Sheet NO - 3 & 2
problems Ex-10(a) ND Shattu problems 11/07
17-200

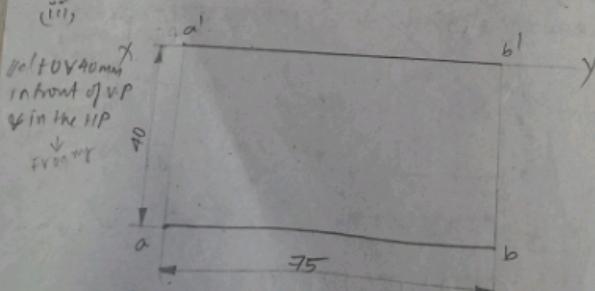
① a $\text{TL} = 75$ m 18 ← qv at bend in wall

20 = (19) NT
Help to tip VVP
+ 25 mm from each



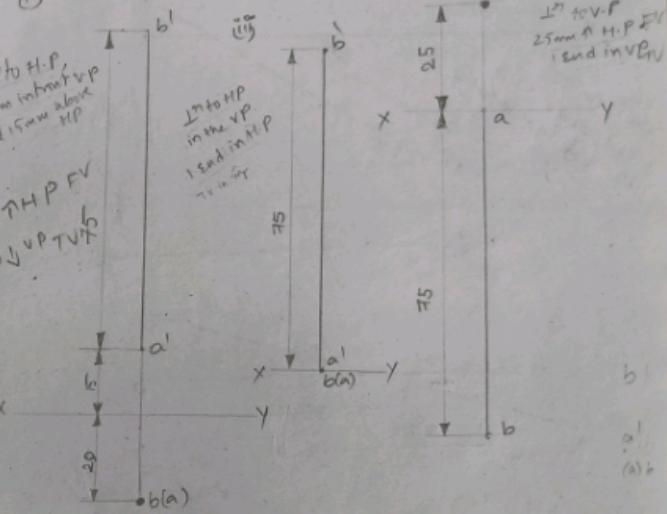
11/17/04 50 min drive from the station. Top show on the beach going out (e)
in the afternoon. ^{HP} with old smoothish sand. Waves
are very small. Currents are slow. Wind at 15-20
KPH. Tides are high & result with rocks. Currents C-1
at the end of the beach. ^a ~~water~~ ^b ~~water~~ ^c ~~water~~ ^d ~~water~~ ^e ~~water~~

(11)

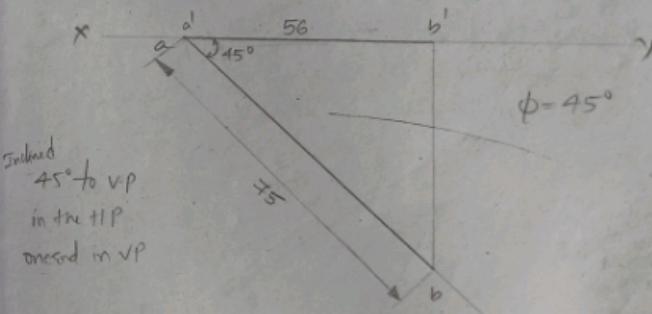


b) ⑤

into H.P.
20mm intravp
1 end, 15mm above
HP

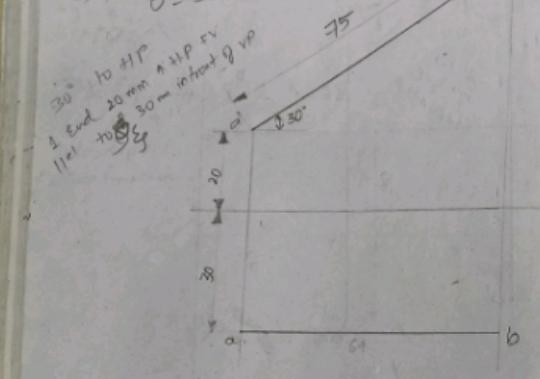


c) 5



The

(i) $\theta = 30^\circ$



(ii)

$\phi = 60^\circ$

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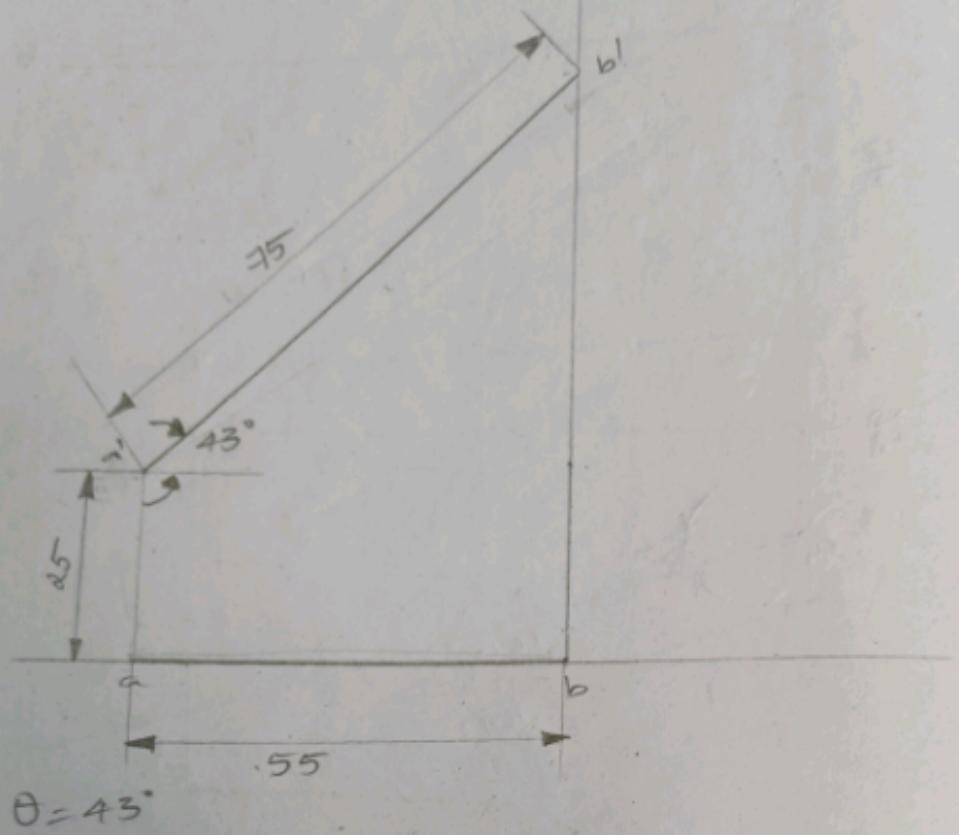
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(4)



$$T_L = 75 \quad R_L = 55$$

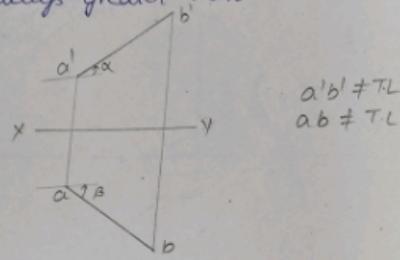
The top view of a 75 mm long line
measured 55 mm. The line is in the VP
its one end being 25 mm above the H.P

25 ↑ HP

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

→ when a line is inclined to both H.P. & V.P. its front view both $a'b'$ & Top view ab will not be True length and also they will not be True inclination.

→ α, β are called apparent inclination and are always greater than True inclination.



Steps to draw the orthographic projection when a line is inclined to Both H.P & V.P

1) Rotate the line AB about the end 'A' until it becomes \parallel to VP, keeping the inclination with H.P. Constant.

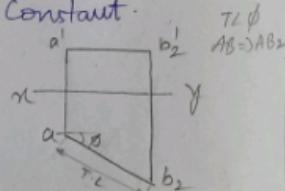
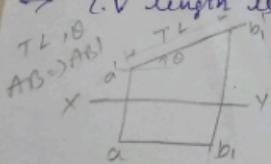
2) Rotate a line AB about the end 'a' until it becomes \parallel to H.P., keeping the inclination with VP Constant.

3) Locus of End 'B' in front view

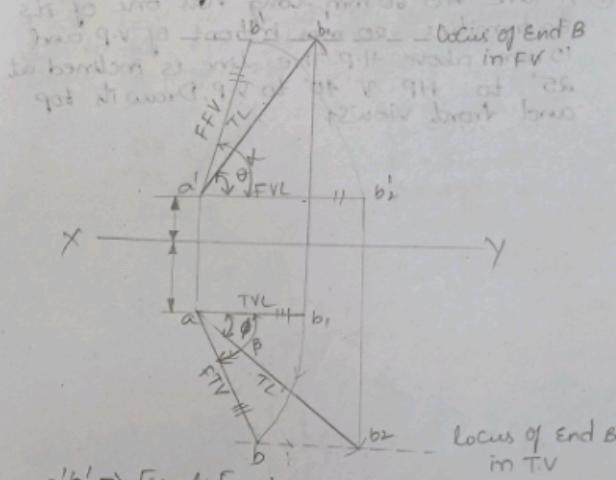
→ Locus of End 'B' in Top View

→ F.V length is always constant.

→ T.V length is always constant.



Combined diagram:



$a'b'$ ⇒ Final Front view

ab ⇒ Final Top view

$a'b' \Rightarrow a'b_1$ ⇒ Front view length

$ab \Rightarrow ab_1$ ⇒ Top view length

$a'b_1 \Rightarrow ab_2$ ⇒ True length

$\theta \neq \phi$ ⇒ True inclinations

$\alpha \neq \beta$ ⇒ Apparent inclination

$\alpha > \theta, \beta > \phi$

→ a' & a lie on the same projector

→ b' & b should lie on the same projector

→ distance b/w End projector means distance b/w a'

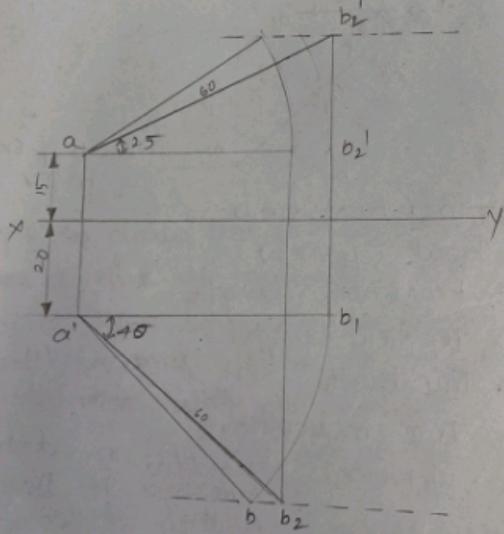
$a'b' \text{ & } ab \Rightarrow HB$

$a'b'_1, a'b_2, ab, ab_1 \Rightarrow H$

Remaining lines $\Rightarrow 2+1$

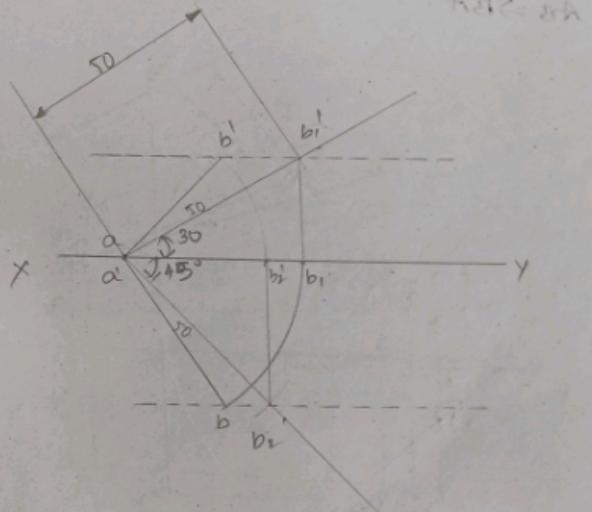
① A line AB 60 mm long has one of its Extremities 20 mm in front of V.P and 15 mm above H.P. The line is inclined at 25° to H.P and 40° to V.P. Draw its top and front views.

$$\begin{aligned} TL &= 60 \\ \theta &= 25^\circ \\ \phi &= 40^\circ \end{aligned}$$



② A line AB, 50 mm long has its end A in both H.P. & V.P. It is inclined at 30° to the H.P. and at 45° to the V.P. Draw its projections.

$$\begin{aligned} TL &= 50 \\ \theta &= 30^\circ = \alpha \\ \phi &= 45^\circ = \phi \\ \alpha_2 &= \phi \end{aligned}$$



3) A line AB, 75 mm long is inclined at 45° to the HP & 30° to the VP. Its end B is in the VP & 40 mm in front of the VP. Draw its projections.

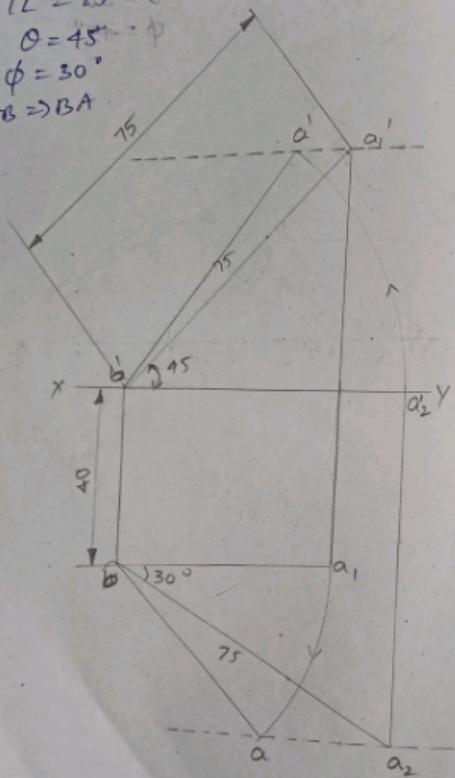
traces $\theta = 30^\circ$

$$TL = 75 - 0$$

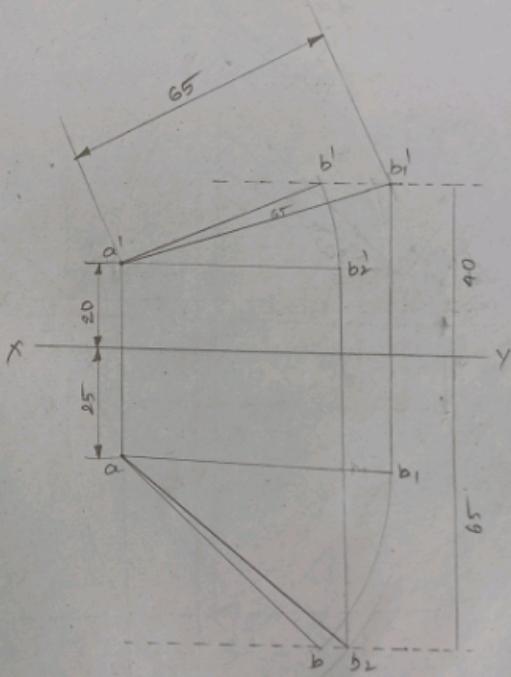
$$\theta = 45^\circ - \phi$$

$$\phi = 30^\circ$$

$$AB \Rightarrow BA$$



④ A line AB, 65 mm long has its end A 20 mm above the HP & 25 mm in front of VP. The End B is 40 mm above the VP & 65 mm in front of VP. Draw the projections of AB & show its inclinations with the HP & the VP.

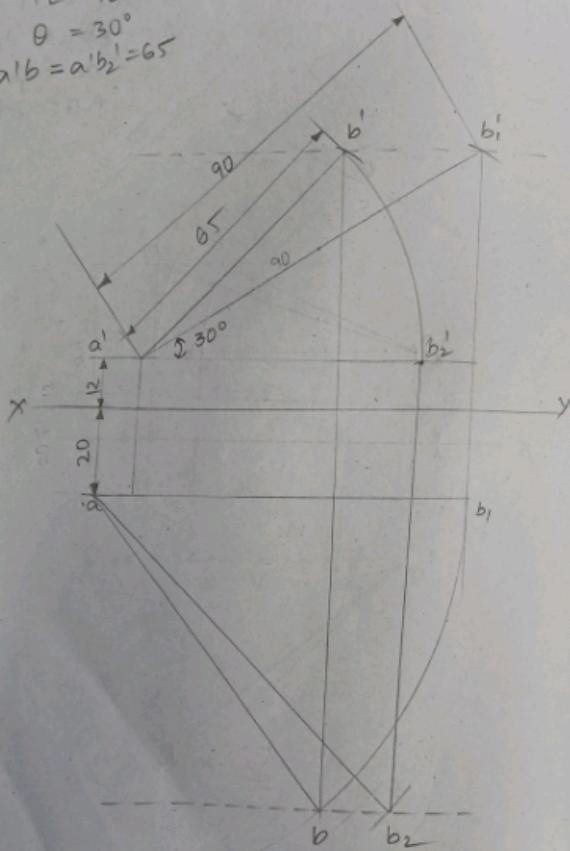


5) A line AB, 90 mm long is inclined at 30° to the H.P. Its end A is 12 mm above the H.P. and 20 mm in front of V.P. Its F.V. measured 65 mm. Draw the T.V. of AB, and determine its inclination with the V.P.

$$TL = 90 \text{ mm}$$

$$\theta = 30^\circ$$

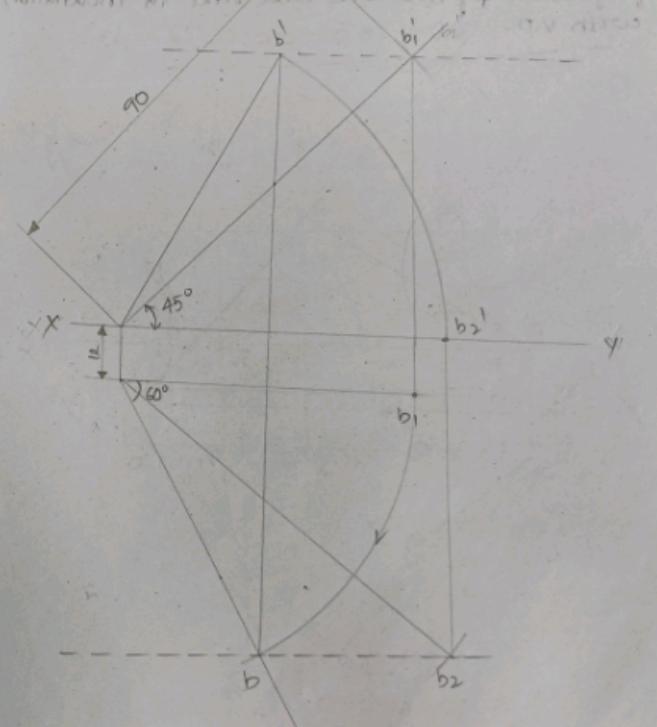
$$a'b = a'b_2' = 65$$



6) A line AB, 90 mm long, is inclined at 45° to the H.P. and its top view makes an angle of 60° with the V.P. The end A is in the H.P. and 12 mm in front of the V.P. Draw its front view and find its true inclination with the V.P.

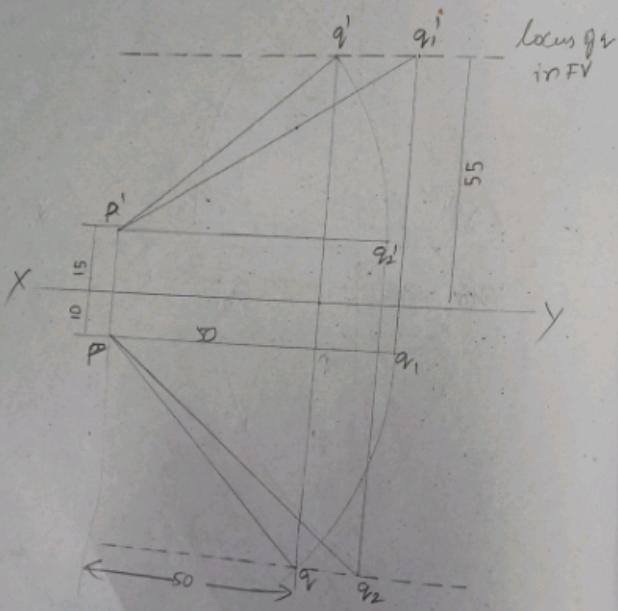
$$TL = 90 \text{ mm}$$

$$\theta = 45^\circ$$



7) A line PQ has its End P 15 mm above H.P and 10 mm in front of V.P. The End Q is 55 mm above H.P and the line is inclined at 30° to H.P. The distance g_1 as the End projector of the line when measured II^d to the line of intersection of the H.P & V.P is 50 mm. Draw the projections of the line and find its inclination with V.P.

$$\theta = 30^\circ$$

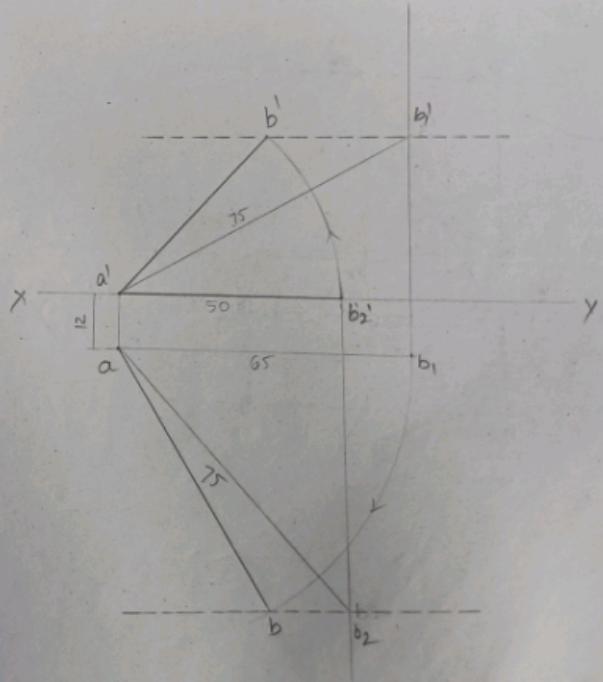


8) The Top view of a 75 mm long line AB measures 65 mm, while the length of its front view is 50 mm. Its one end A is in the H.P and 12 mm in front of the V.P. Draw the projections of AB and determine its inclinations with the H.P & the V.P.

$$TL = 75 \Rightarrow a'b'_1 = ab_2 = 75$$

$$FVL = 50 \Rightarrow a'b'_1 = a'b'_2 = 50$$

$$TVL = 65 \Rightarrow ab = ab_1 = 65$$



Q) A line AB, 65 mm long has its End A in the H.P. and 15 mm in front of V.P. the End B is in the 3rd quadrant. The line is inclined at 30° to the H.P. and 60° to the V.P. Draw its projections.

