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UNIT-II

Content

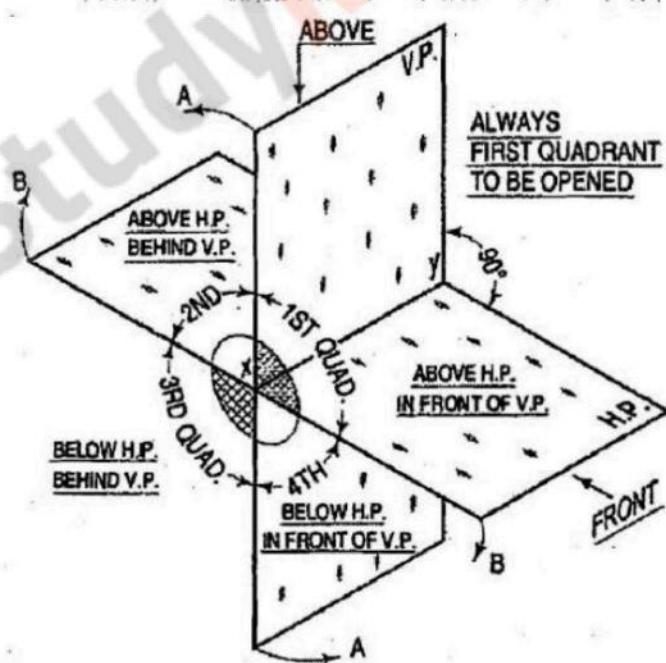
Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures.—Auxiliary Planes.

Unit-II

Orthographic Projections: When the projectors are parallel to each other and also perpendicular to the plane, the projection is called orthographic projection.

Planes of Projection: The two planes employed for the purpose of orthographic projections are called reference planes or principal planes of projection. They intersect each other at right angles. The vertical plane of projection (in front of the observer) is usually denoted by the letters V.P. It is often called the frontal plane and denoted by the letters F.P. The other plane is the horizontal plane of projection known as the H.P.

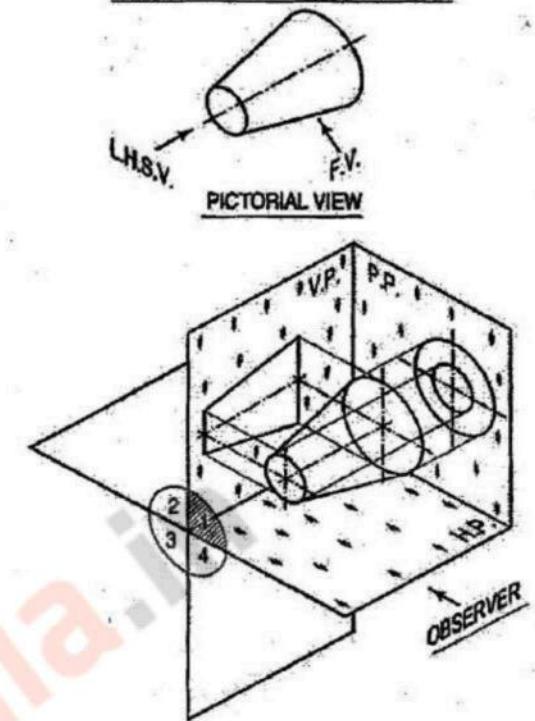
The line in which they intersect is termed the reference line and is denoted by the letters xy. The projection on the V.P. is called the front view or the elevation of the object. The projection on the H.P. is called the top view or the plan.



First-Angle Projection: We have assumed the object to be situated in front of the V.P. and above the H.P.i.e. in the first quadrant and then projected it on these planes. This method of projection is known as first-angle projection method. The object lies between the observer and the plane of projection.

In this method, when the views are drawn in their relative positions, the top view comes below the front view. In other words, the view seen from above is placed on the other side of (i.e. below) the front view. Each projection shows the view of that surface (of the object) which is remote from the plane on which it is projected and which is nearest to the observer.

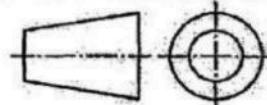
FIRST ANGLE PROJECTION METHOD



FIRST ANGLE PROJECTION



RELATION BETWEEN OBSERVER, OBJECT AND P.P.

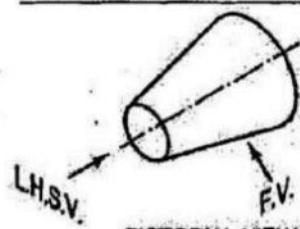


F.V. L.H.S.V.
IDENTIFYING GRAPHICAL SYMBOL OF
FIRST ANGLE PROJECTION

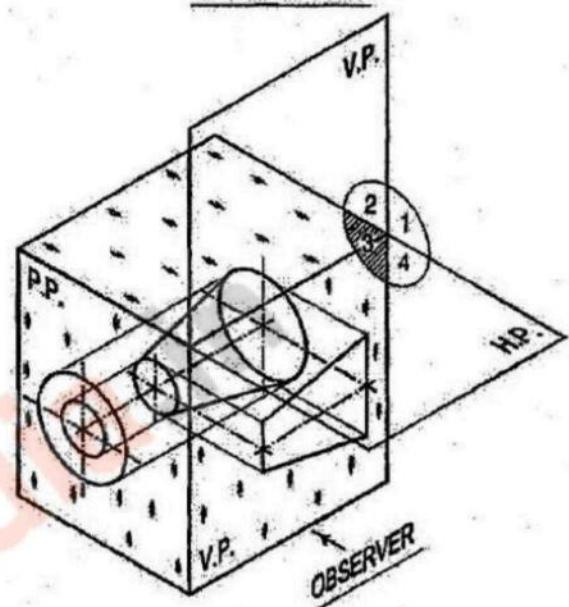
Third-Angle Projection: In this method of projection, the object is assumed to be situated in the third quadrant. The planes of projection are assumed to be transparent. They lie between the object and the observer. When the observer views the object from the front, the rays of sight intersect the V.P.

The figure formed by joining the points of intersection in correct sequence is the front view of the object. The topview is obtained in a similar manner by looking from above. When the two planes are brought in line with each other, the views will be seen as shown in fig. The top view in this case comes above the front view.

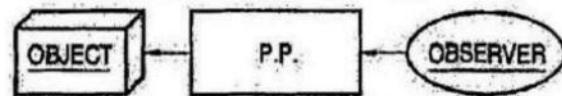
THIRD ANGLE PROJECTION METHOD



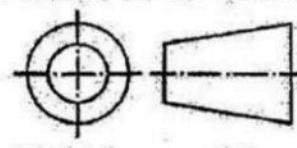
PICTORIAL VIEW



THIRD ANGLE PROJECTION



RELATION BETWEEN OBSERVER, OBJECT AND P.P.



IDENTIFYING GRAPHICAL SYMBOL OF THIRD ANGLE PROJECTION

Projections of Points:

A point may be situated, in space, in any one of the four quadrants formed by the two principal planes of projection or may lie in any one or both of them. Its projections are obtained by extending projectors perpendicular to the planes.

One of the planes is then rotated so that the first and third quadrants are opened out. The projections are shown on a flat surface in their respective positions either above or below or in xy.

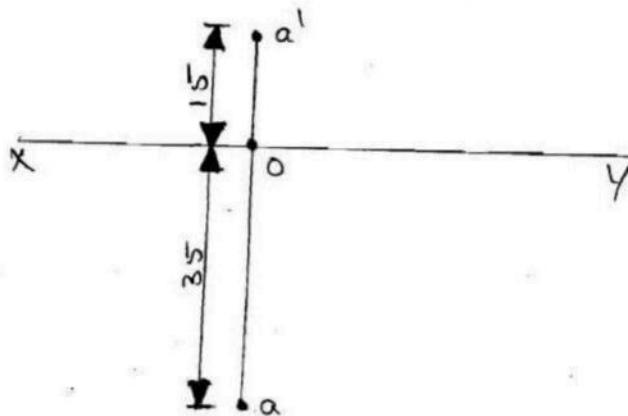
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ORTHOGRAPHIC PROJECTIONS

Projection of points:

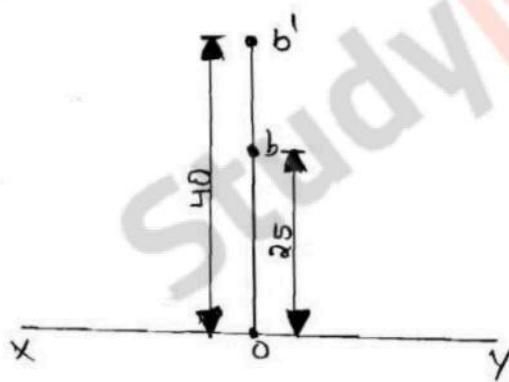
I) The Point A is 15mm above H.P, 35mm in front of V.P

A → 15mm above H.P
35mm in front V.P



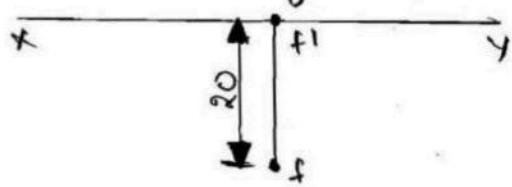
II) The Point B is 40mm above H.P, 25mm behind V.P.

B → 40mm above H.P
25mm behind V.P



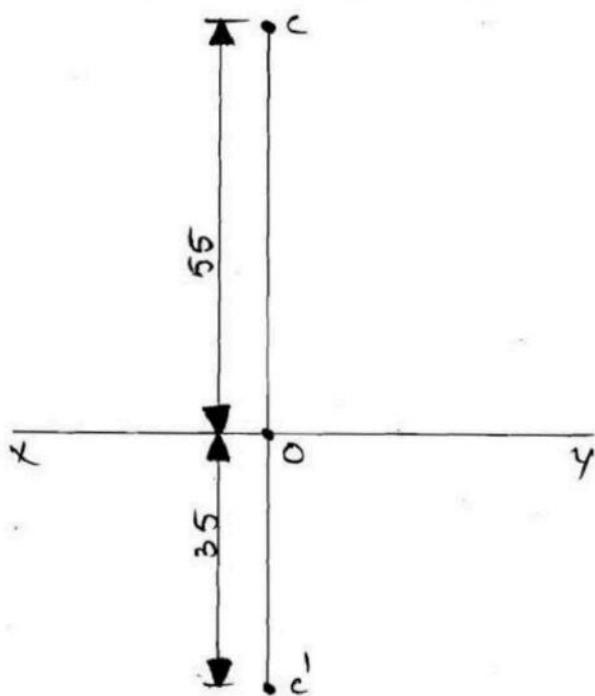
(III) The Point F is on the H.P and 20 mm in front of V.P.

F → F on the H.P
20mm in front V.P



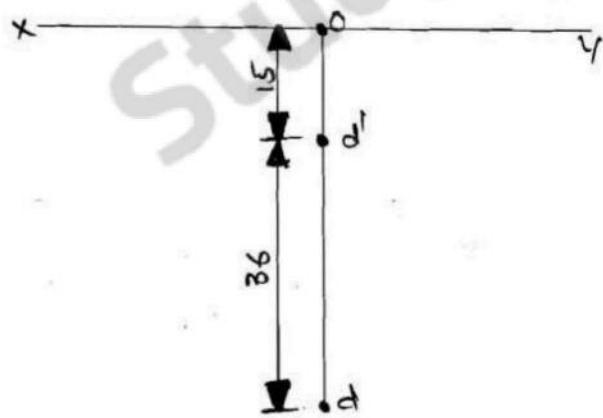
(III) The point 'c' is 35mm below H.P, 55mm behind V.P.

C → 35mm below H.P
55mm behind V.P



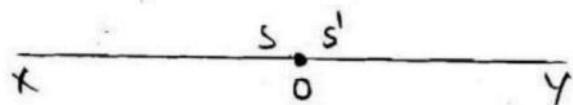
(IV) The point 'D' is 15mm below H.P, 36mm in front of V.P

D → 15mm below H.P
36mm in front V.P



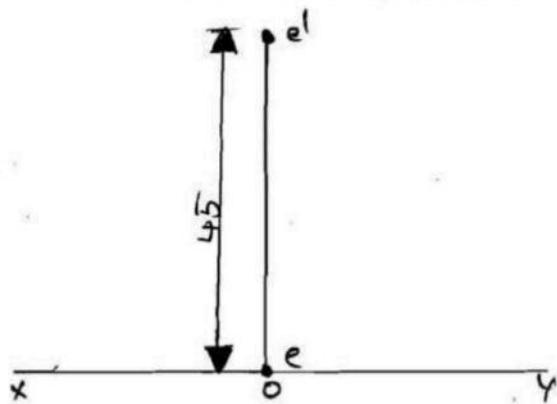
(V) The point 'S' both on the H.P and V.P.

S → on the H.P
on the V.P



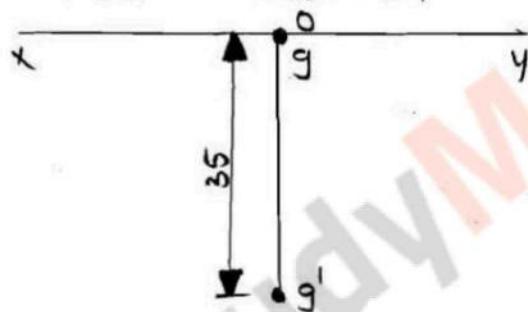
IV The point E' on the V.P and 45mm above H.P

E → Point on the V.P
45mm above H.P.



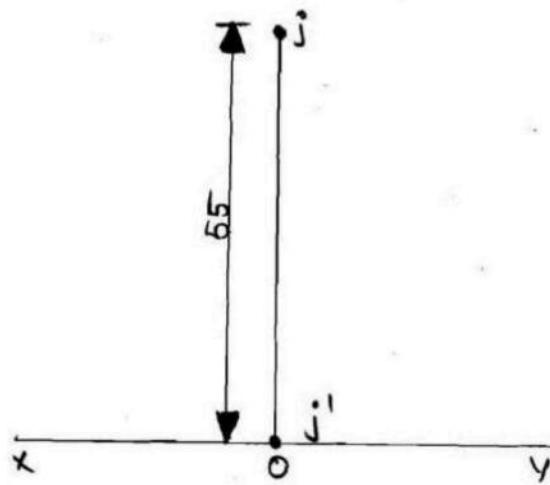
VII The point G' is on the V.P and 35mm below H.P

G → on the V.P
35mm below H.P.



VIII The point J on the H.P and 55mm behind V.P.

J → Point is on H.P
55mm behind V.P



1. State the quadrants in which the following points are situated.

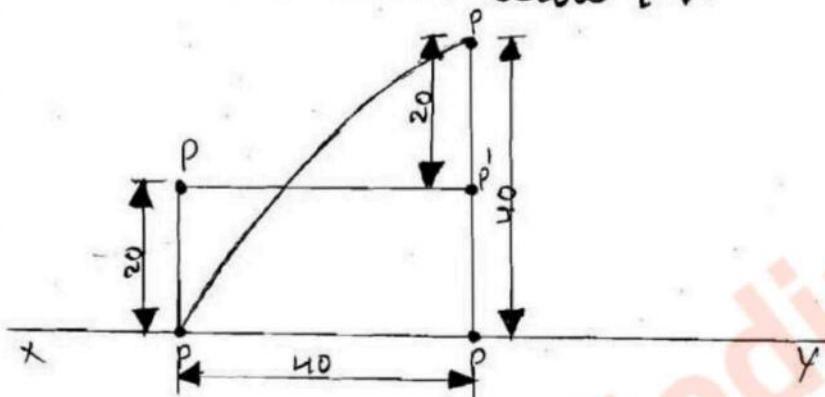
a) P' its top-view is 40mm above XY.

Frontview 20mm below the top-view.

b) The point Q' its projections coincide with each other
40mm below XY.

Ans. a) P \rightarrow T.V 40mm above XY

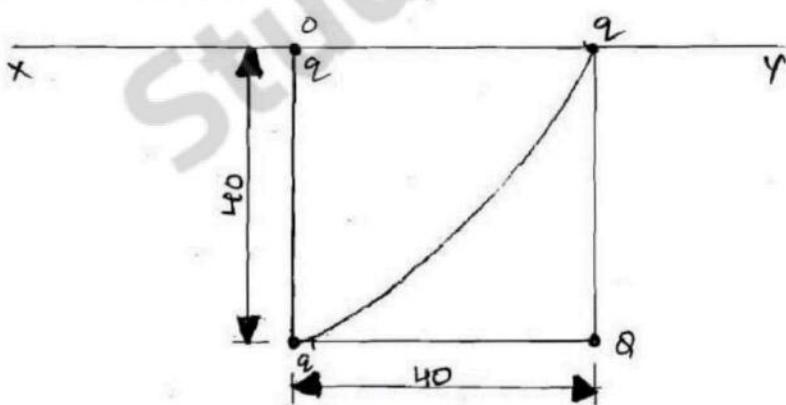
F.V 20mm below T.V.



P lies in second quadrant.

b) Q \rightarrow coincide with each other

40mm below XY



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A point 'P' is 15mm above H.P and 20mm in front of V.P. Another point 'Q' is 25mm behind V.P and 40mm below H.P. Draw the projections of P and Q keeping the distance between their projectors equal to 90 mm draw st. lines joining.

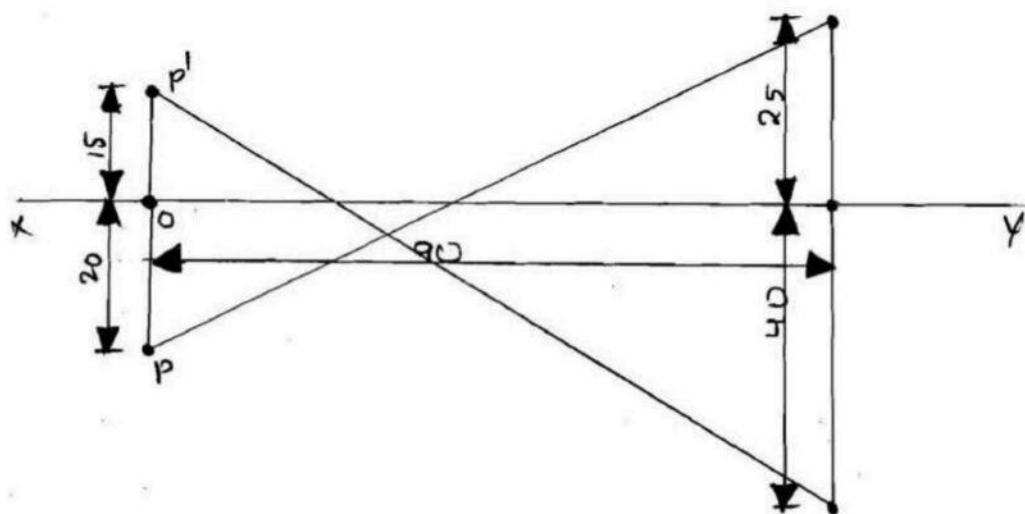
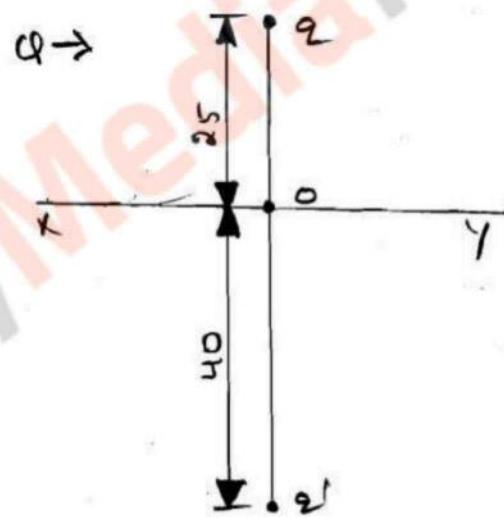
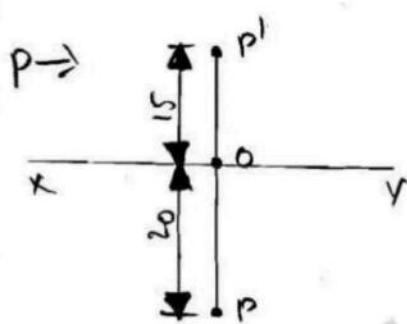
(i) Their top-views

(ii) Their front views.

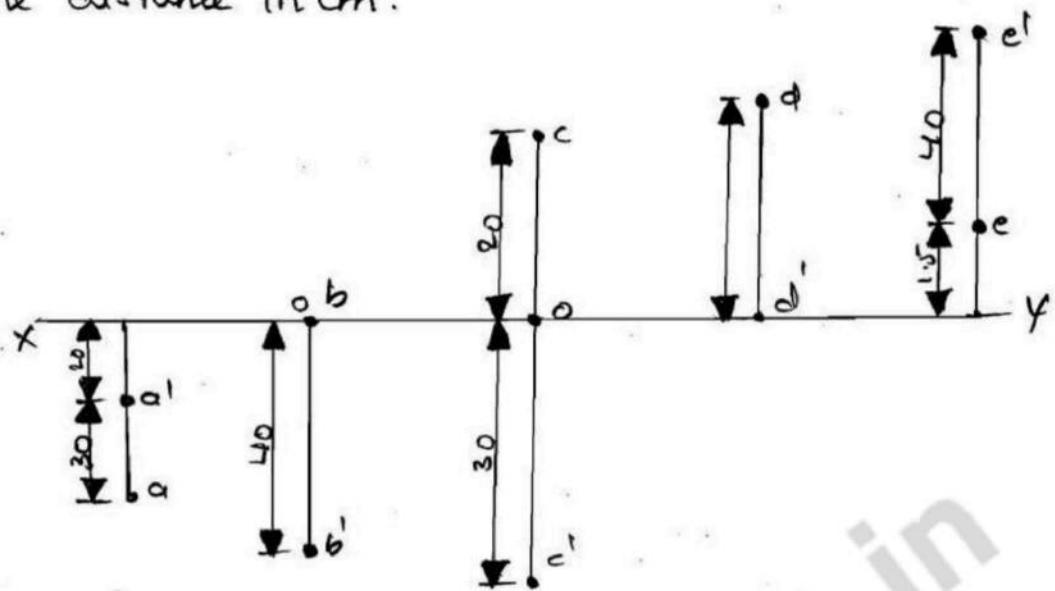
P → 15mm above H.P
20mm in front V.P

Q → 25mm behind V.P
40mm below H.P.

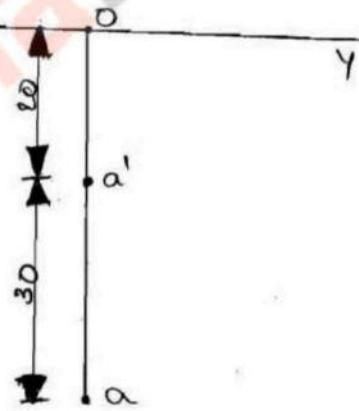
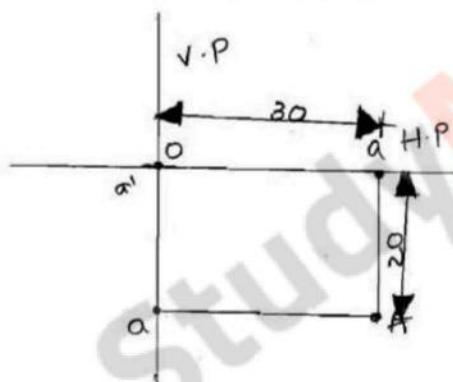
distance b/w their projectors is 90 mm.



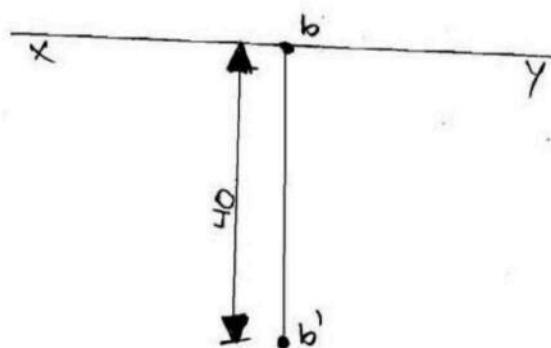
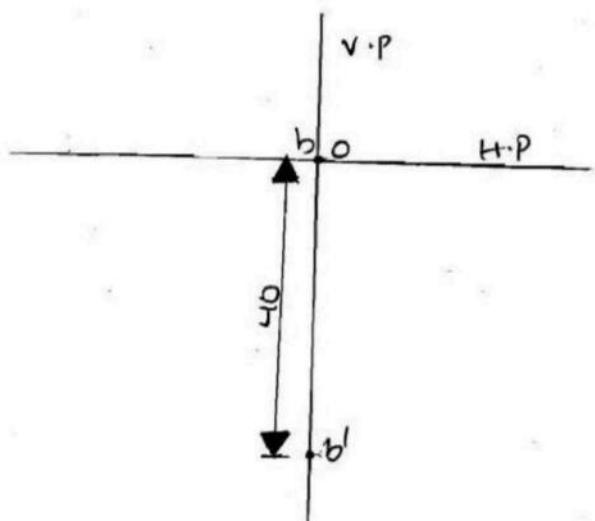
3. Projection of various points are given in the figure state the position of each point with respect to reference planes giving the distance in cm.



(i) A \rightarrow 30mm \rightarrow V.P
20mm \downarrow H.P.

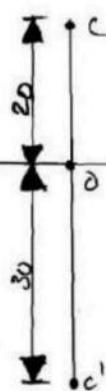
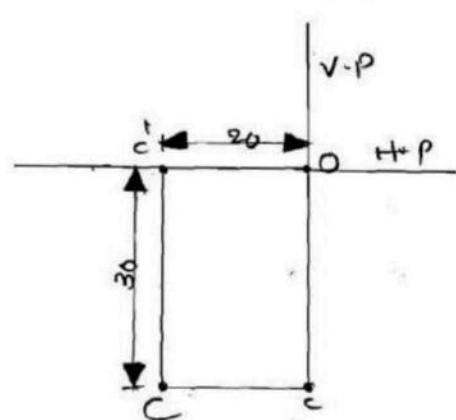


(ii) B \rightarrow on the V.P
40mm \downarrow H.P.



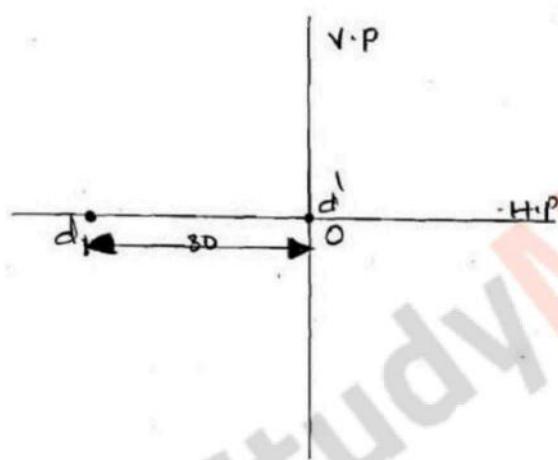
(iii)

C → 30 mm ↓ H.P.
20 mm ← V.P.



(iv)

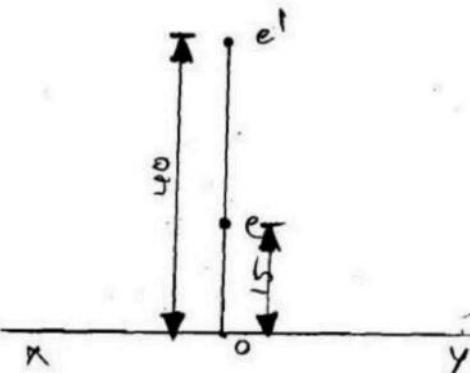
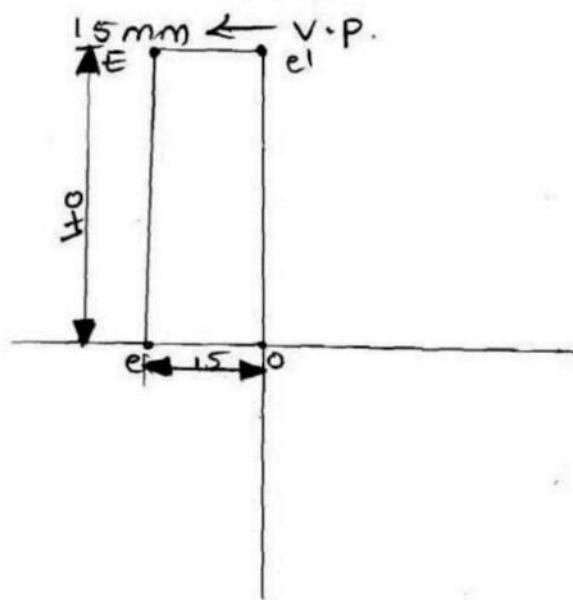
D → on the H.P.
30 mm ← V.P.



(v)

E → 40 mm ↑ H.P.

15 mm ← V.P.

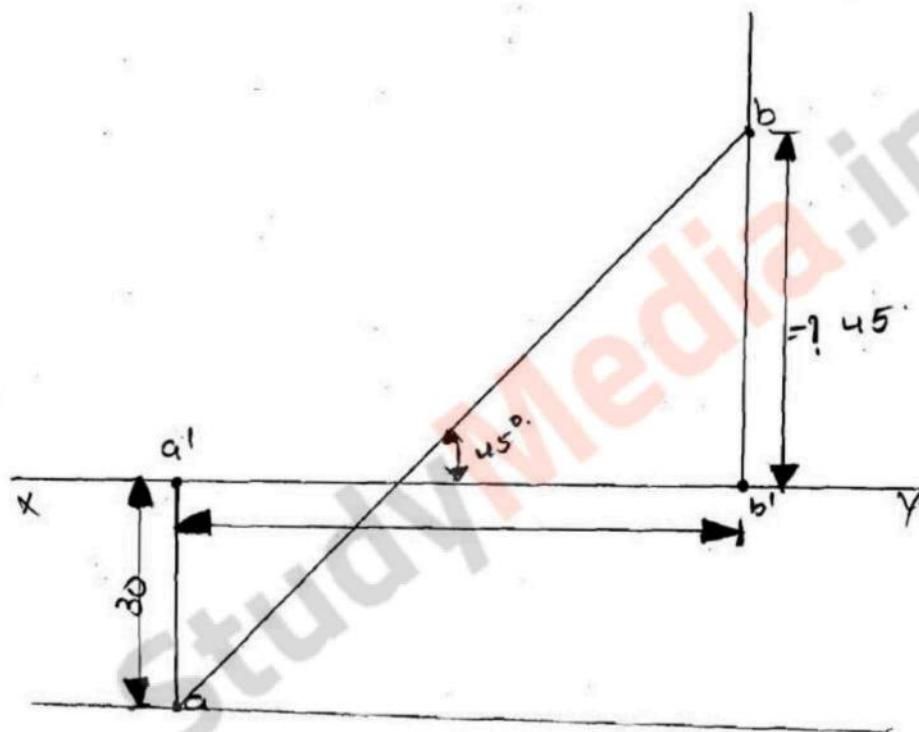


Q: Two points 'A' and 'B' are in the H.P. The Point 'A' is 30mm in front of V.P, while 'B' is behind the V.P -The distance b/w their projectors is 75mm and their line joining their top views makes an angle of 45° with XY. Find the distance of the Point 'B' from v.p.

Ans: A \rightarrow 30mm in front of v.p

B \rightarrow behind the v.p = ?

Distance b/w their projectors = 75mm.



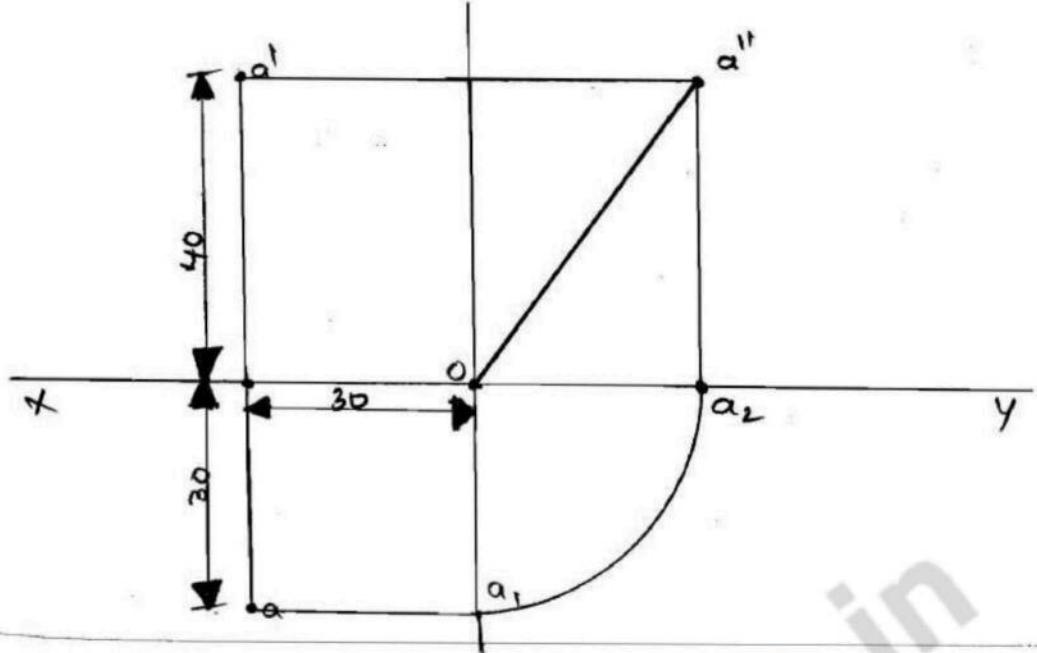
Q:- The Point 'Q' is situated in first quadrant -It is 40mm above H.P and 30 mm infront of v.p . Draw its projections and find its shortest distance from the intersection of H.P ,V.P and auxiliary plane .

Ans: Q \rightarrow in first quadrant

40mm \uparrow H.P

30mm \rightarrow V.P

auxiliary plane = ?



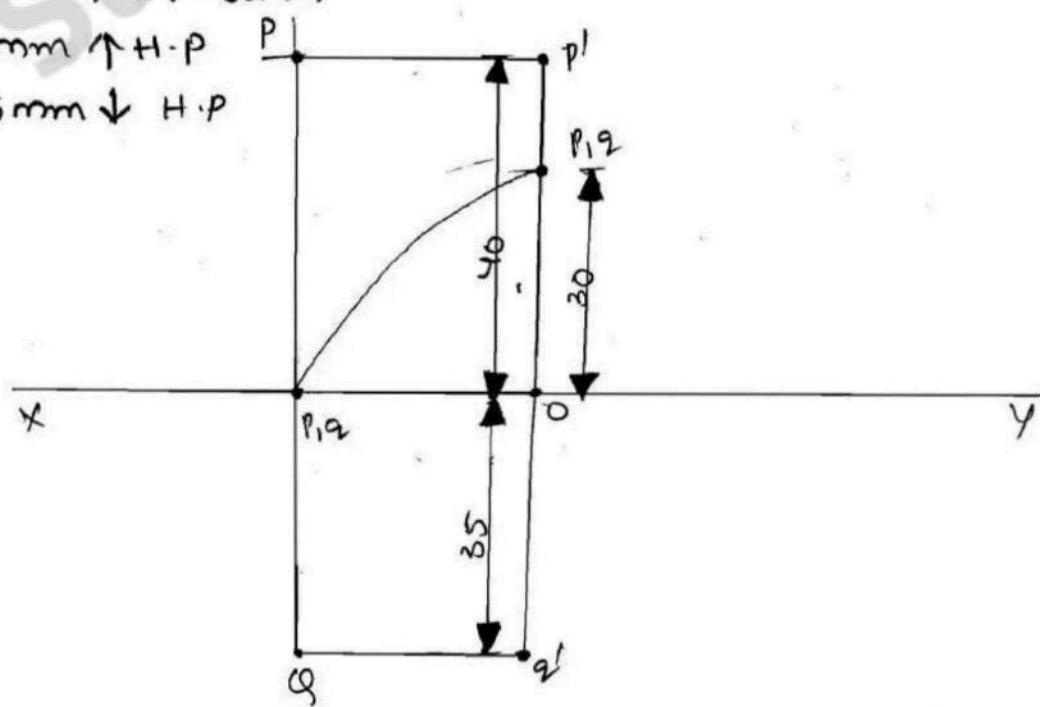
Q: A point 30 mm above XY line is the plan view (top view) of two Points P and Q. The elevation of P' is 45 mm above H.P., while that of the Point Q' is 35 mm below the H.P. Draw the projections of point and state their positions with reference to the Principle planes and the quadrant in which they lie.

Ans:

Both P and Q T.V = 30mm

P \rightarrow 45mm \uparrow H.P

Q \rightarrow 35mm \downarrow H.P



Projections of Straight Lines:

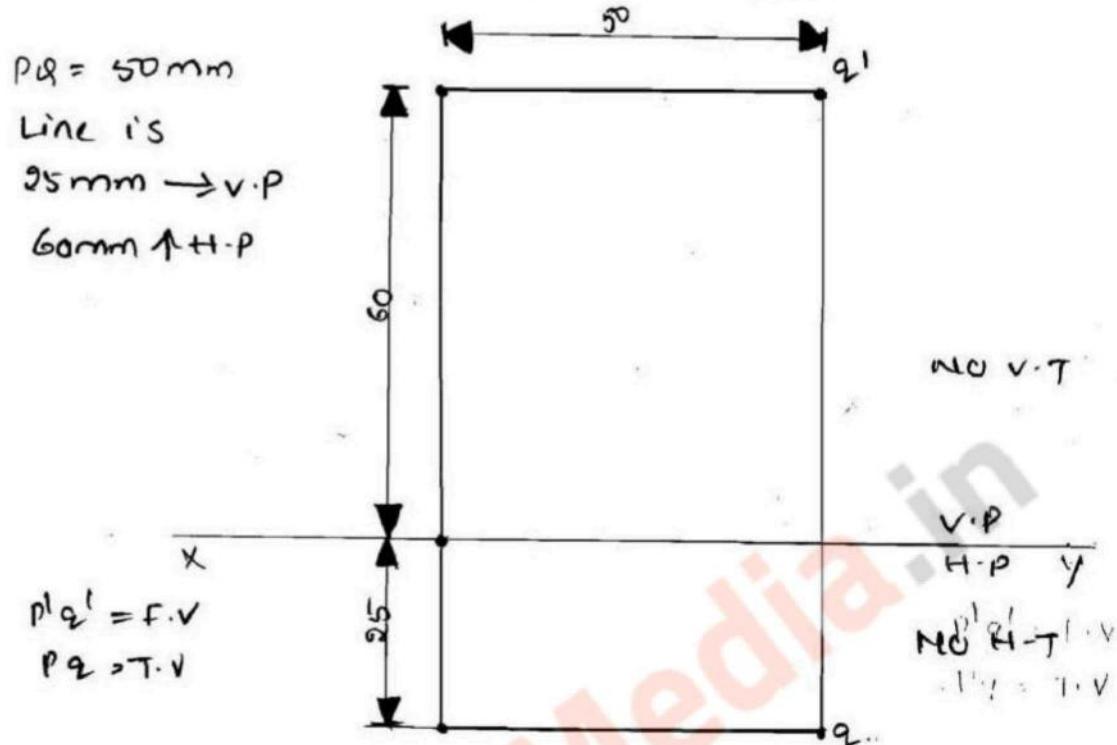
A straight line is the shortest distance between two points. Hence, the projections of a straight line may be drawn by joining the respective projections of its ends which are points.

The position of a straight line may also be described with respect to the two reference planes. It may be:

1. Parallel to one or both the planes.
2. Contained by one or both the planes.
3. Perpendicular to one of the planes.
4. Inclined to one plane and parallel to the other.
5. Inclined to both the planes.
6. Projections of lines inclined to both the planes.
7. Line contained by a plane perpendicular to both the reference planes.
8. True length of a straight line and its inclinations with the reference planes.
9. Traces of a line.
10. Methods of determining traces of a line.
11. Traces of a line, the projections of which are perpendicular to xy .
12. Positions of traces of a line.

PROJECTION OF LINES

Q1: A 50mm long line PQ' is parallel to both H.P and V.P it is 25mm in front of V.P and 60mm above H.P .Draw its projections and determine its traces.

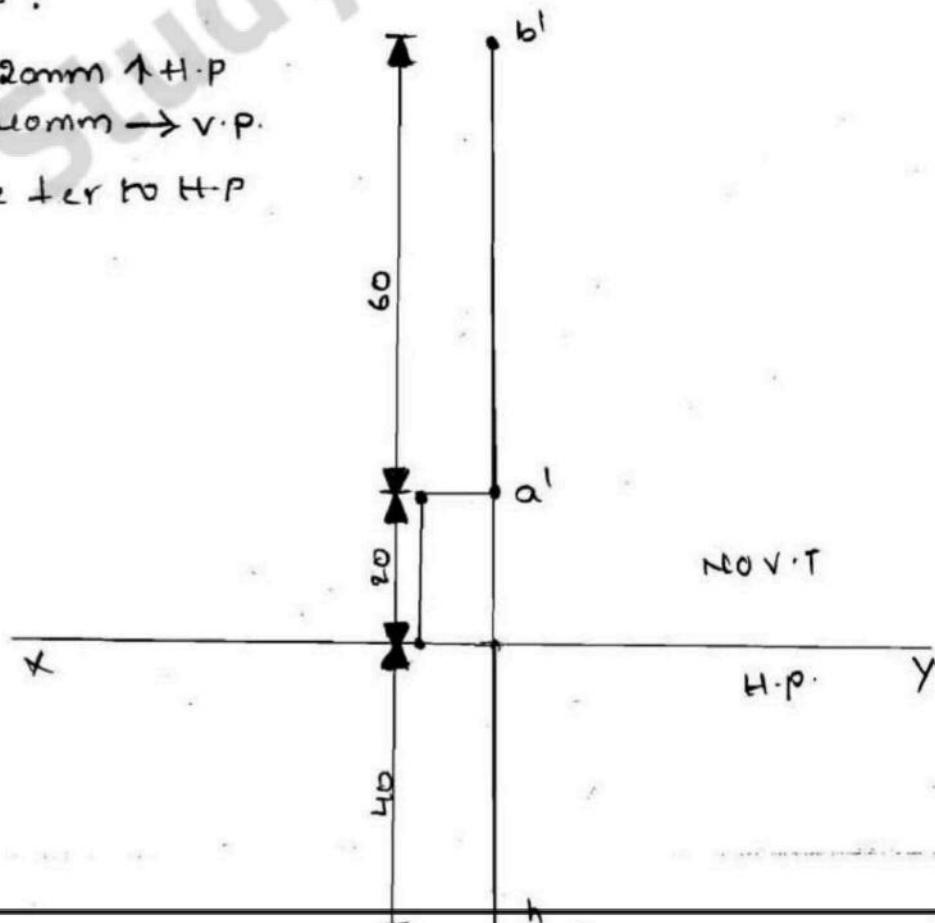


Q2: A 60mm long line AB has its end A' 20mm above H.P .The line is ter to H.P and 40mm infront of v.p . Draw its projections and Locate its traces ?

Ans.

$A \rightarrow 20\text{ mm} \uparrow H.P$
 $40\text{ mm} \rightarrow V.P$

The line ter to H.P

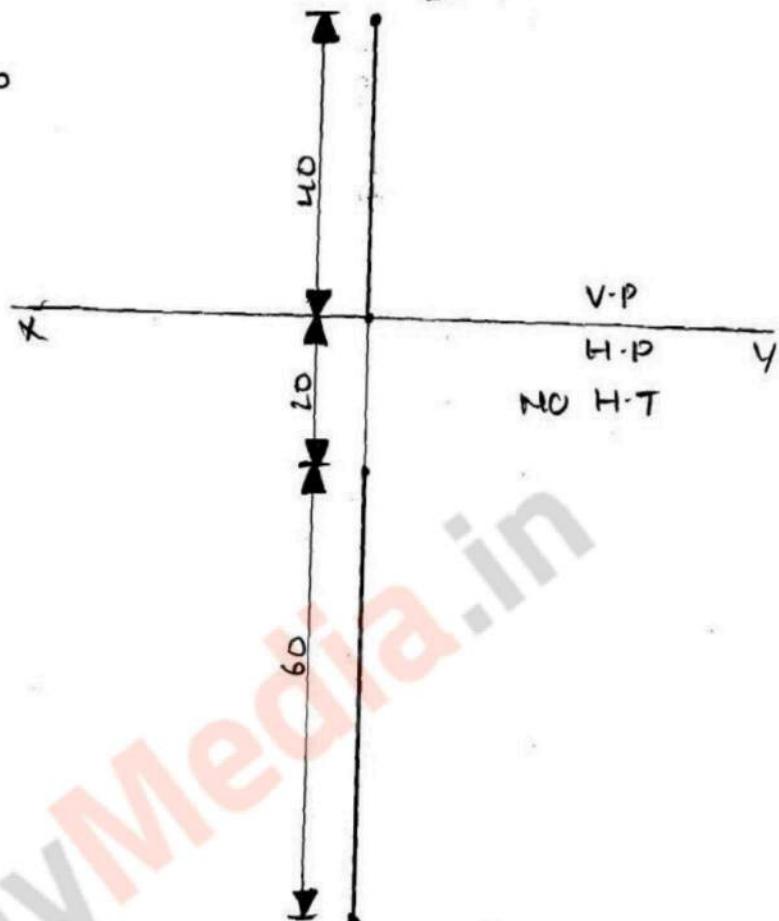


3. A 60mm long line AB has its end A' is 20 mm in front of V.P. The line is ter to V.P and 40 mm above the H.P. Draw its projections and Locate its traces. $v' b'(a')$

Ans:

$$AB = 60\text{mm}$$

$A \rightarrow 20\text{mm in front V.P}$
 $= 40\text{mm } \uparrow \text{H.P}$
 Line ter to V.P.



4. A 80mm long line AB has end A' at distance of 20mm above H.P and 40mm in front of V.P. The line is Inclined at 30° to H.P and is parallel to V.P. Draw the Projections of the line and determine its traces

Ans:

$$\alpha \rightarrow \text{H.P}$$

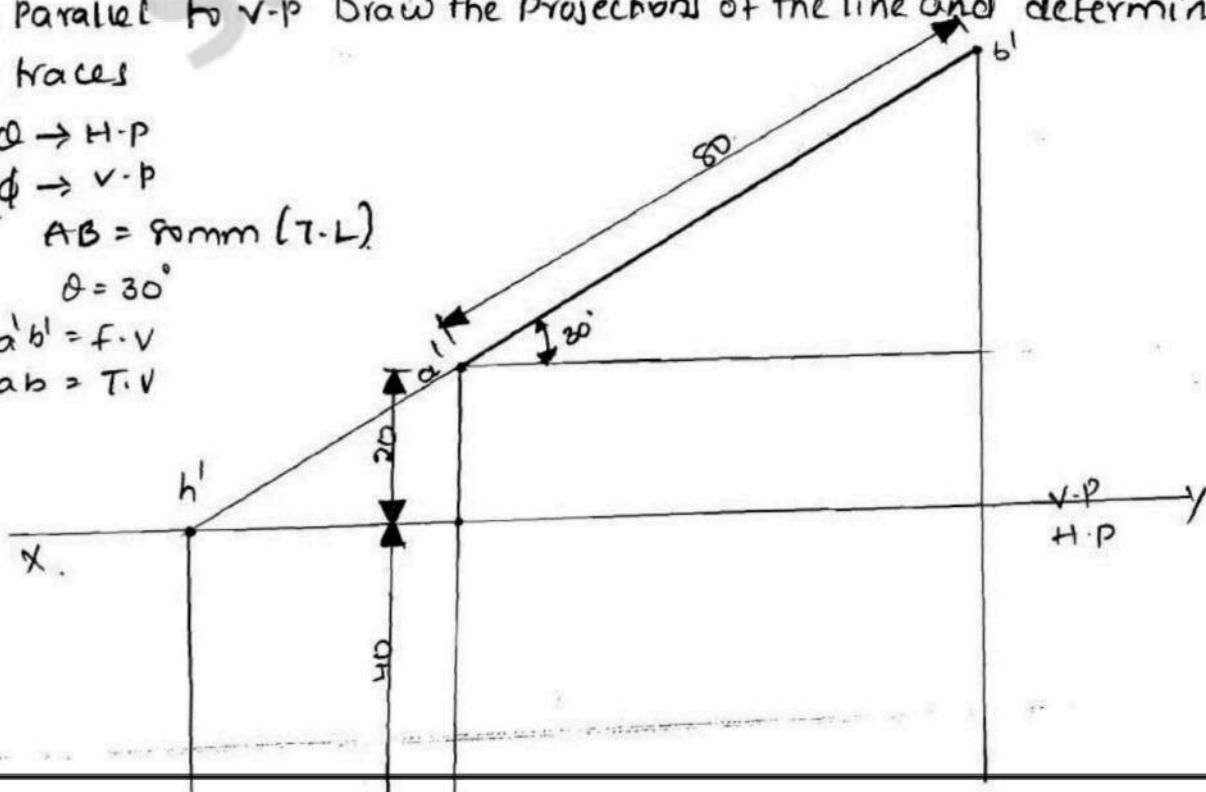
$$\phi \rightarrow \text{V.P}$$

$$AB = 80\text{mm (T.L.)}$$

$$\theta = 30^\circ$$

$$a'b' = f.v$$

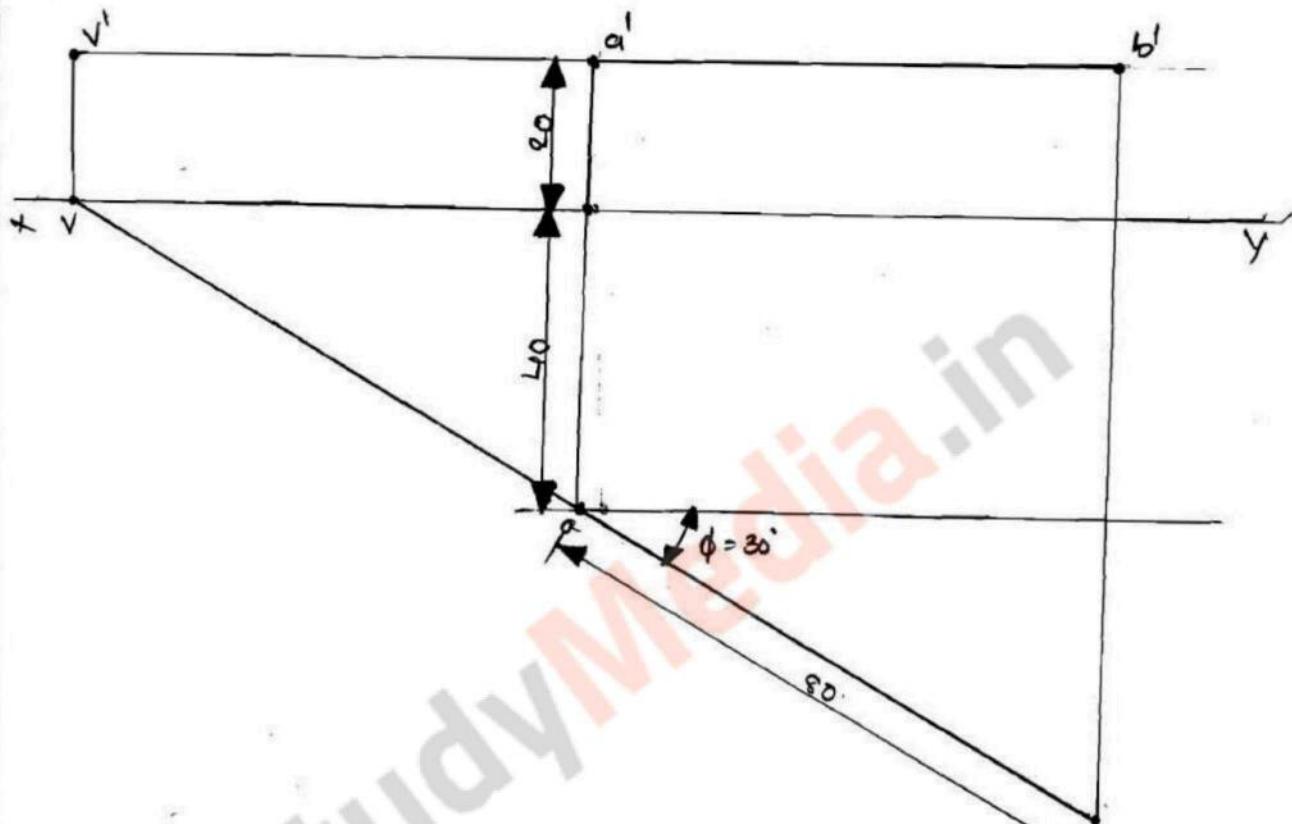
$$ab = t.v$$



5. A 80mm long line AB is inclined at 30° to V.P and parallel to H.P - The end 'A' of the line is 20 mm above the H.P and 40mm in front of the V.P . Draw the projections of the line and determine its traces.

$$AB = 80 \text{ mm}$$

$$A \rightarrow 20 \uparrow \text{H.P} \quad B \rightarrow 40 \rightarrow \text{V.P} \quad \phi = 30^\circ$$

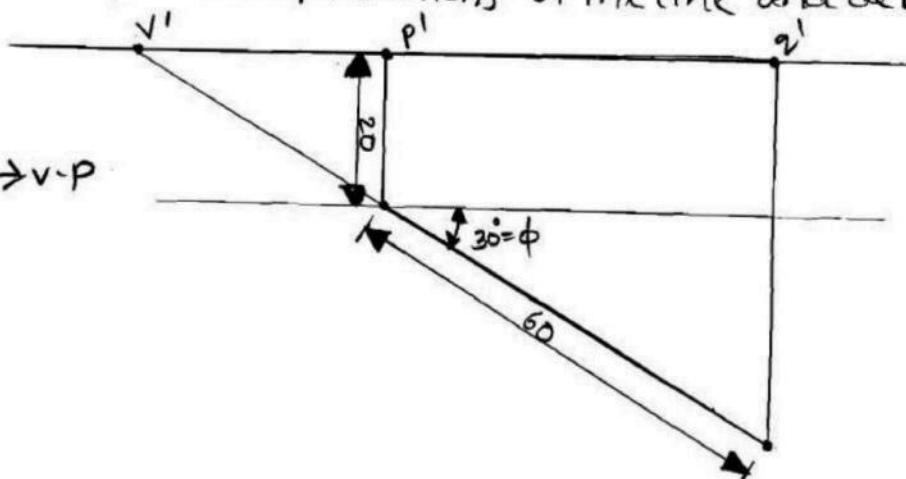


6. A 60mm long line PQ is situated in H.P and is inclined at 30° to V.P. The end 'P' of the line is situated 20mm in front of V.P. Draw the projections of the line and determine its trace.

$$PQ = 60 \text{ mm}$$

$$P \rightarrow 20 \text{ mm} \rightarrow \text{V.P}$$

$$\phi = 30^\circ$$

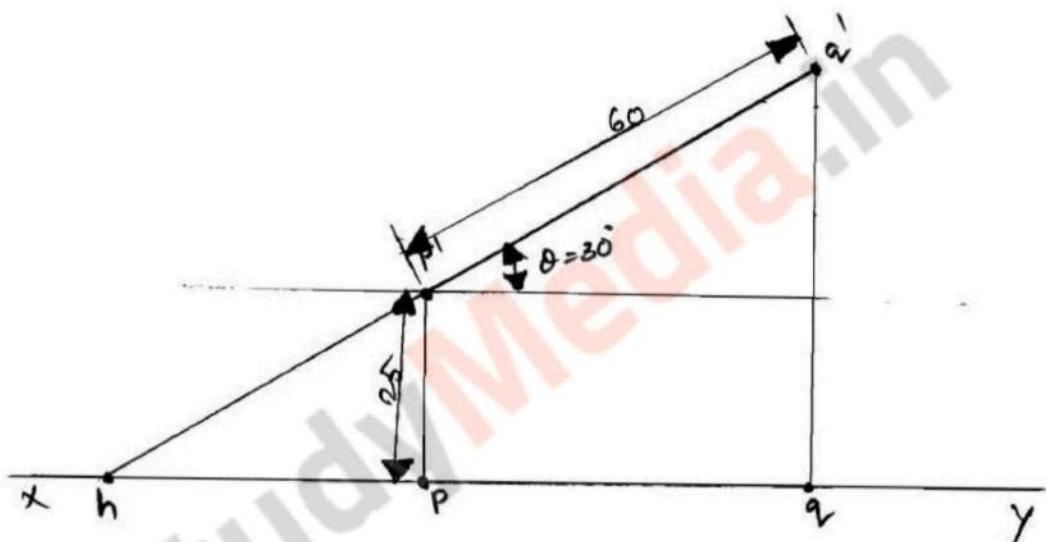


7. Draw the projections of a 60mm long line $p'q'$ if it is in the V.P and inclined at 30° to H.P. The end p' of the line is 25mm above the H.P. Also determine the traces of the line.

Ans $p'q' = 60 \text{ mm}$

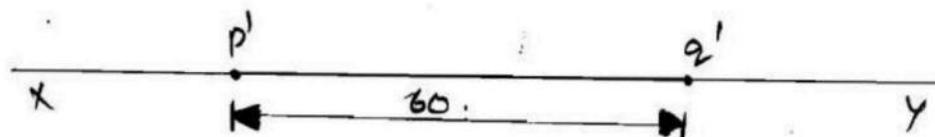
$P \rightarrow 25 \text{ mm } \uparrow \text{H.P}$

$\theta = 30^\circ$



8. Draw the projections of a 60mm Long Line PQ , which is situated in H.P and V.P both. Also determine the traces of the line.

Ans $PQ = 60 \text{ mm}$.



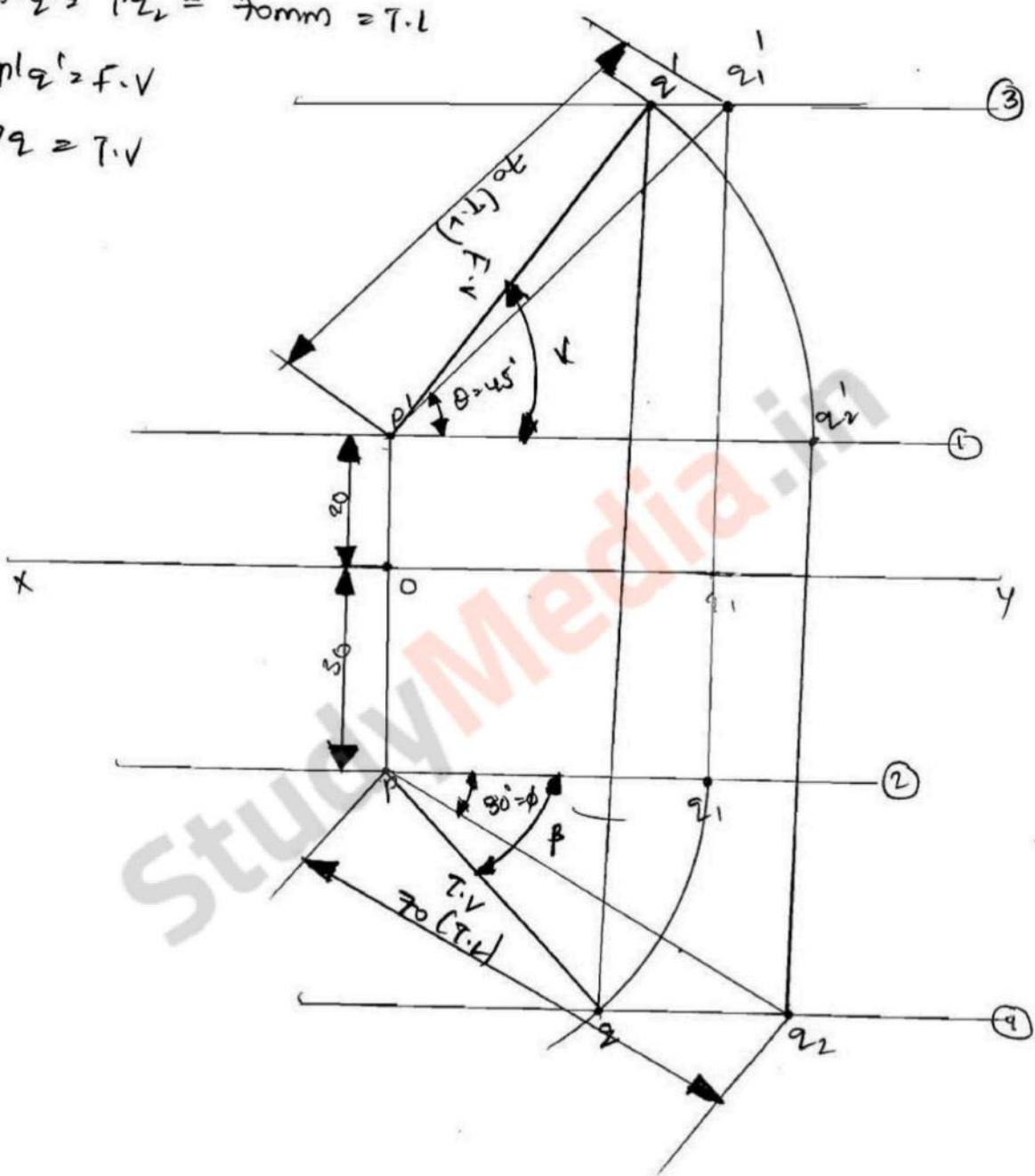
q. A 70mm longline PQ has its end 'P' is 20mm above H.P and 30mm in front of V.P - The line is inclined at 45° to H.P and 30° to V.P. Draw its projections.

Ans:-

$$P_1 Q_1 = P_2 Q_2 = 70\text{mm} = 7.1$$

$$P_1 Q_1 = f.v$$

$$P_2 Q_2 = t.v$$



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A straight line 'PQ' as its end 'P' is 20mm above H.P and 30 mm in front of V.P and the end 'Q' is 80mm above H.P and 70 mm in front of V.P. If the end projections are 60mm apart draw the projections of the line determine the true length (T.L) and True inclinations with reference planes.

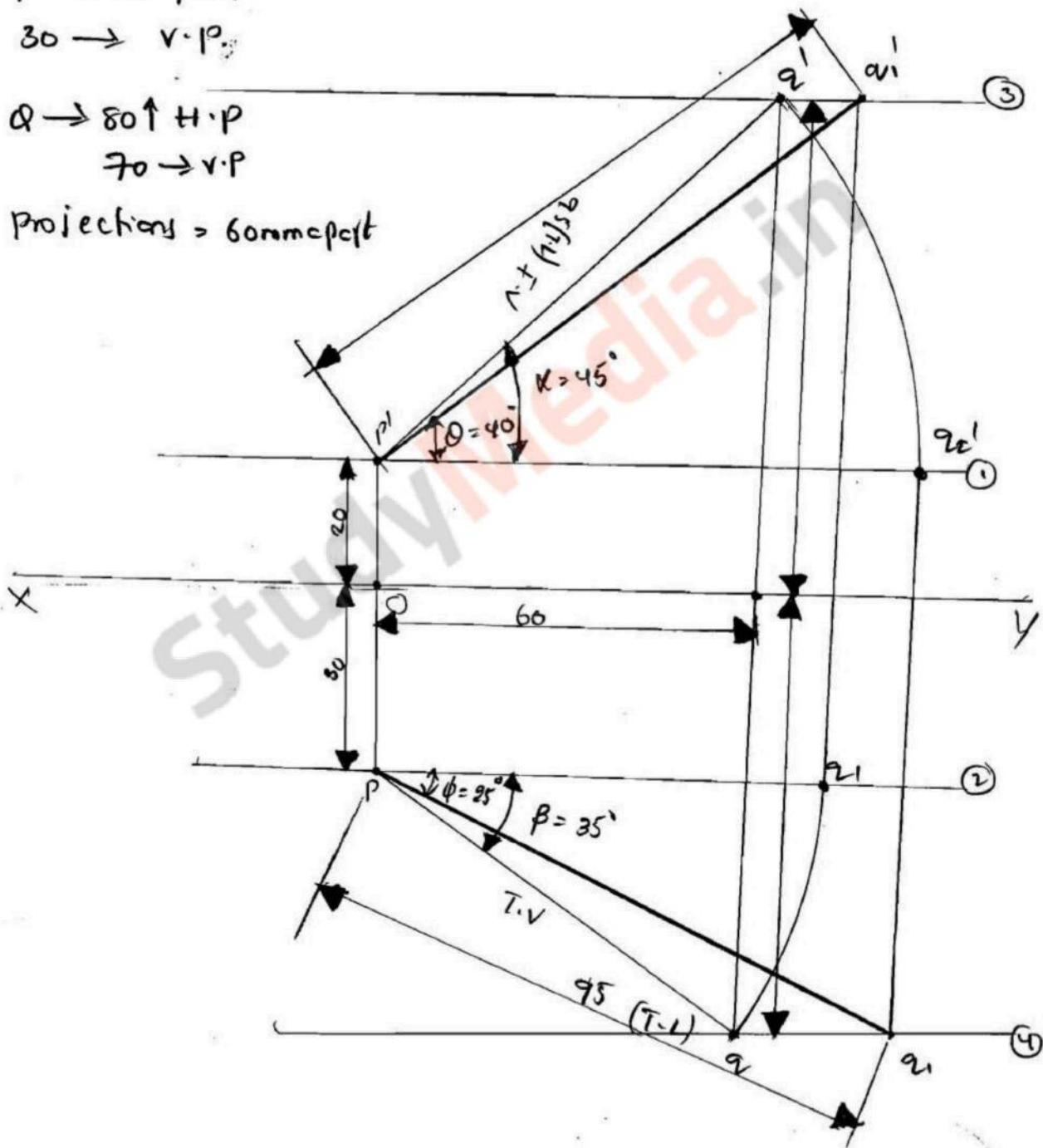
$$P \rightarrow 20 \uparrow H.P$$

$$30 \rightarrow V.P$$

$$Q \rightarrow 80 \uparrow H.P$$

$$70 \rightarrow V.P$$

Projections = 60mm apart

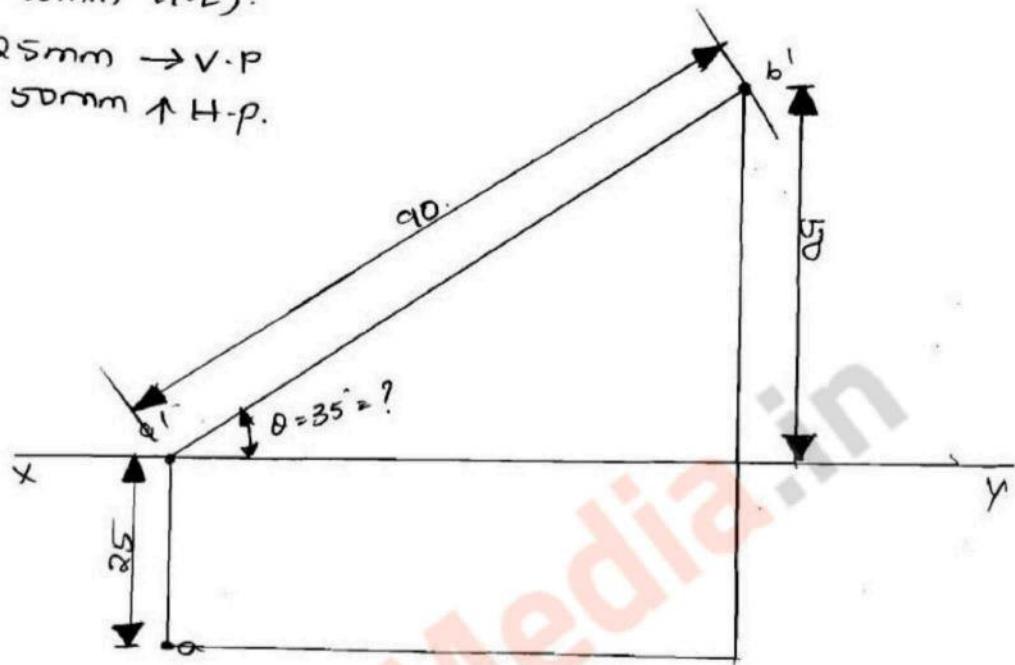


1. A 90mm long line is parallel to and 25mm in front of v.p. Its one end is in the H.P. while the other is 50mm above the H.P. Draw its projections and finds its inclination with the H.P.

Ans - $AB = 90\text{mm}$ (T.L.)

$25\text{mm} \rightarrow V.P$

$50\text{mm} \uparrow H.P.$

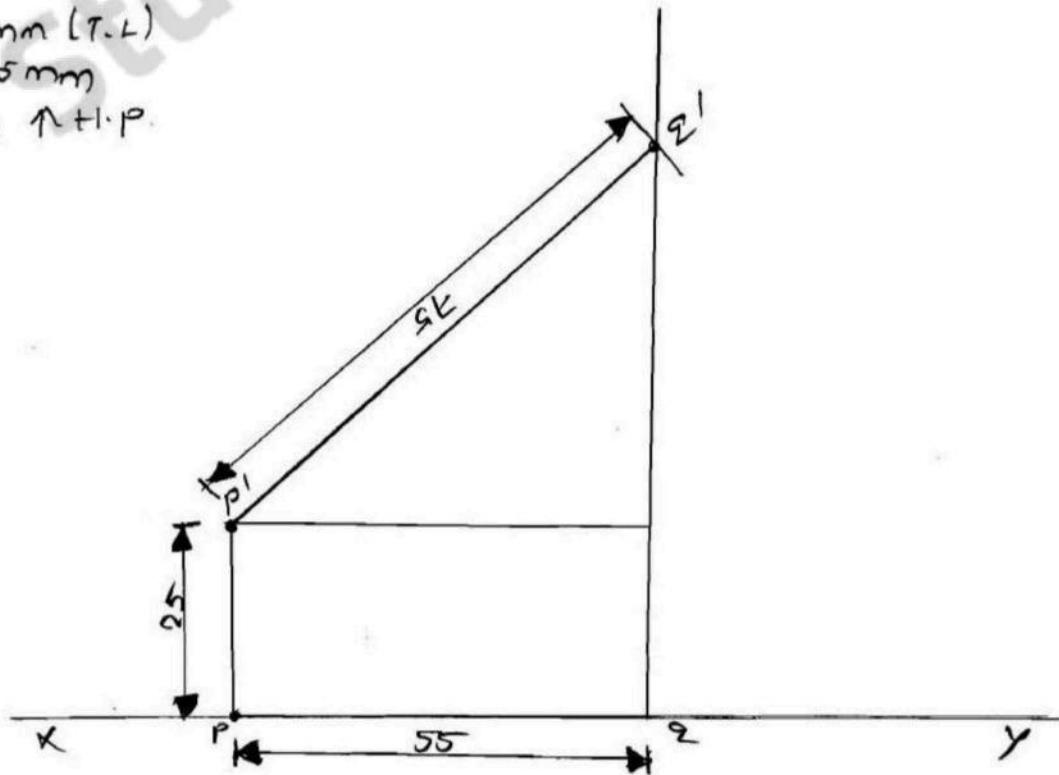


2. The topview of 75mm Long line measures 55mm. The line is in the v.p. , its one end is being 25mm above H.P. Draw its projections.

Ans $PQ = 75\text{mm}$ (T.L)

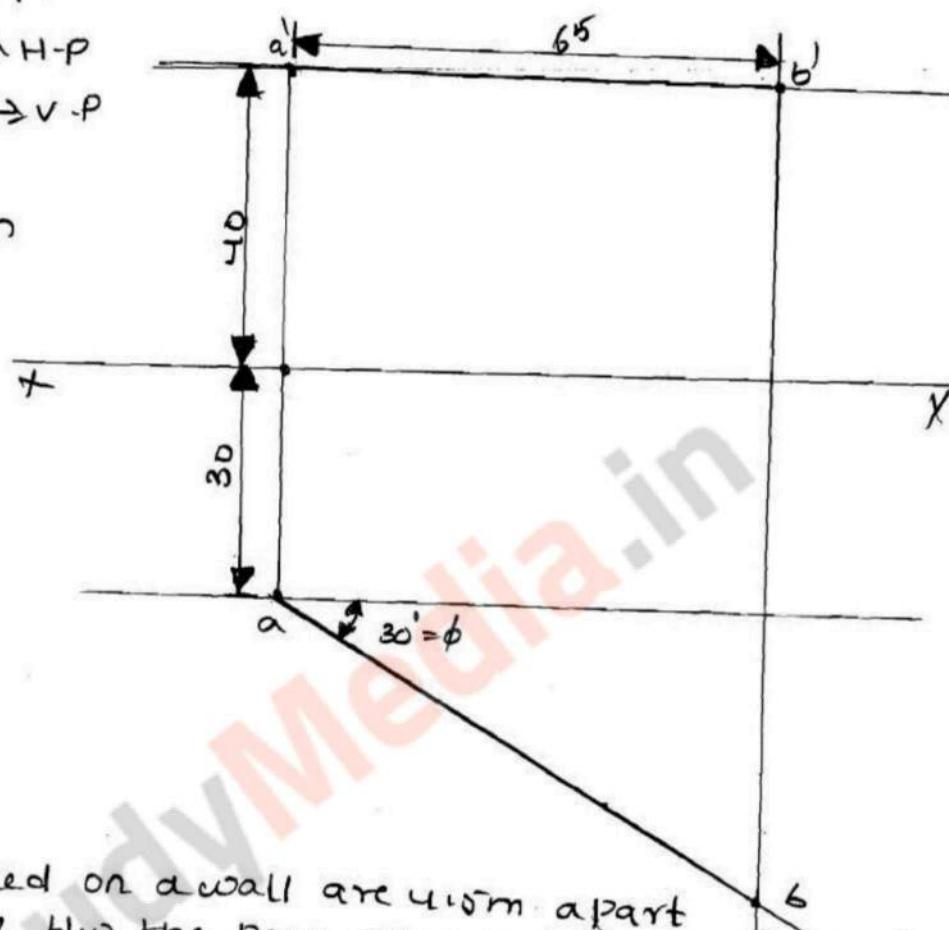
$T.V = 55\text{mm}$

$25\text{mm} \uparrow H.P.$



3. The front view of a long line inclined at 30° to v.p is 65mm long. Draw the projections of the line when it is parallel to and 40mm above the H.P. its one end being 30mm in front of v.p.

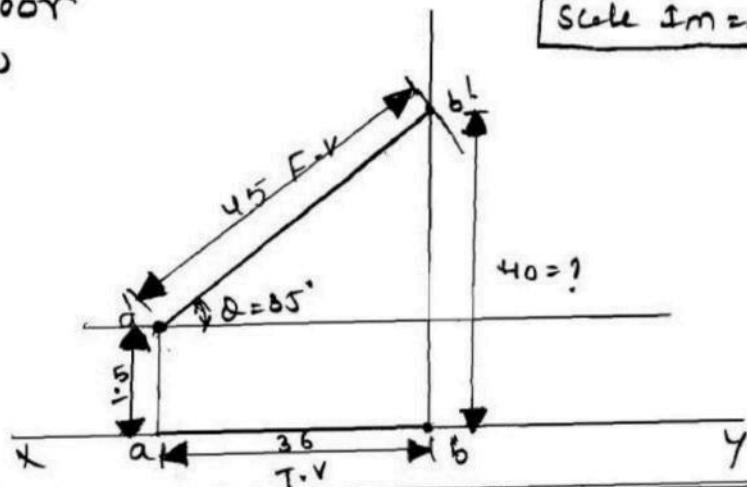
Ans: $A \rightarrow 40\text{ mm} \uparrow \text{H.P}$
 $30\text{ mm} \rightarrow \text{V.P}$
 $\phi = 30^\circ$
 $AB = 60\text{ mm}$



5. Two pegs fixed on a wall are 4.5m apart. The distance b/w the pegs measured parallel to the floor is 3.6m. If one peg is 1.5m above the floor, find the height of second peg and the inclination of the line joining the two pegs with the floor.

Distance b/w the two pegs = 3.6m = T.V.
 with respect to floor
 Actual distance b/w them = 4.5m

Scale 1m = 5cm



4. A vertical line AB, 75mm long has its end A in the H.P and 25mm in front of V.P. A line AC, 100mm long is in the H.P and parallel to the V.P. Draw the projections of the line joining B and C, determine inclination with the H.P

Ans.

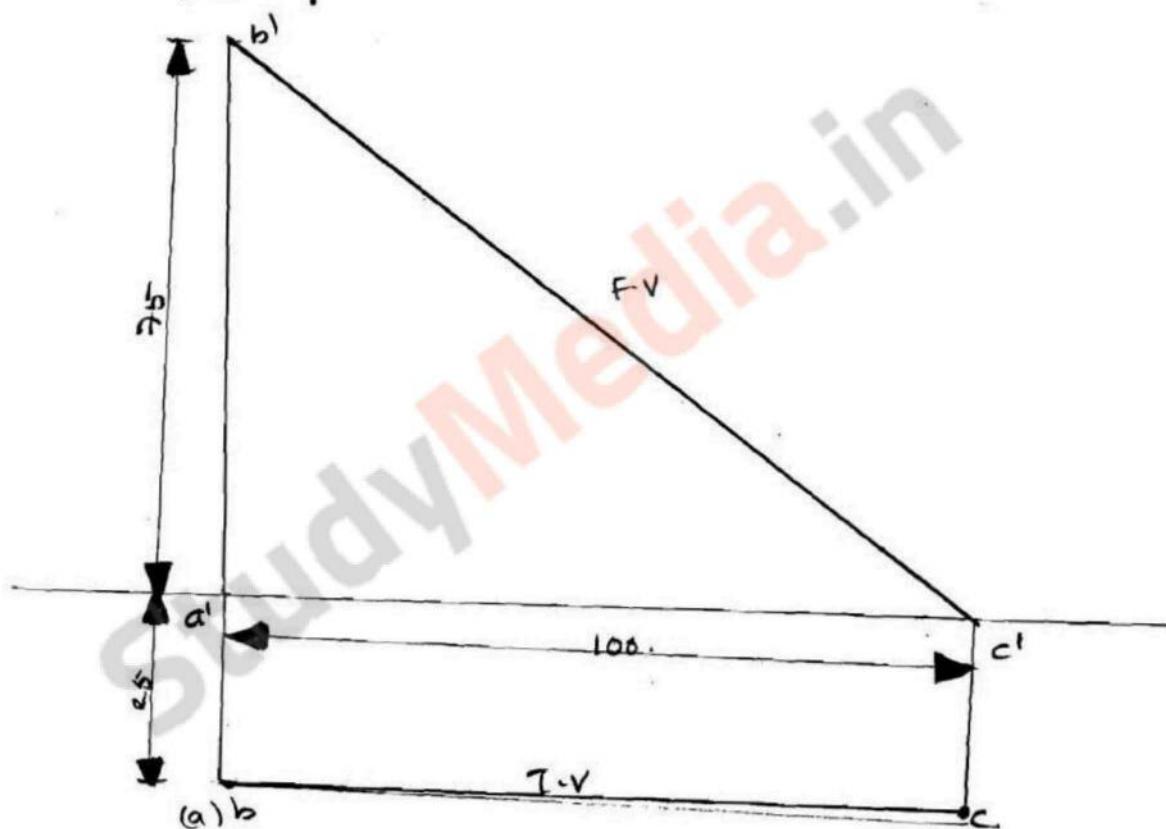
AB → Vertical line.

A → in the H.P

25mm → V.P

AC → 100mm → in the H.P 110 mm V.P.

BC length = ?



1. A line CD 80mm long is inclined at 45° to H.P and 30° to V.P its end 'C' is in the H.P and 40mm in front of V.P. Draw the projections. Locate traces.

Ans:

$$CD = T.L = 80\text{mm}$$

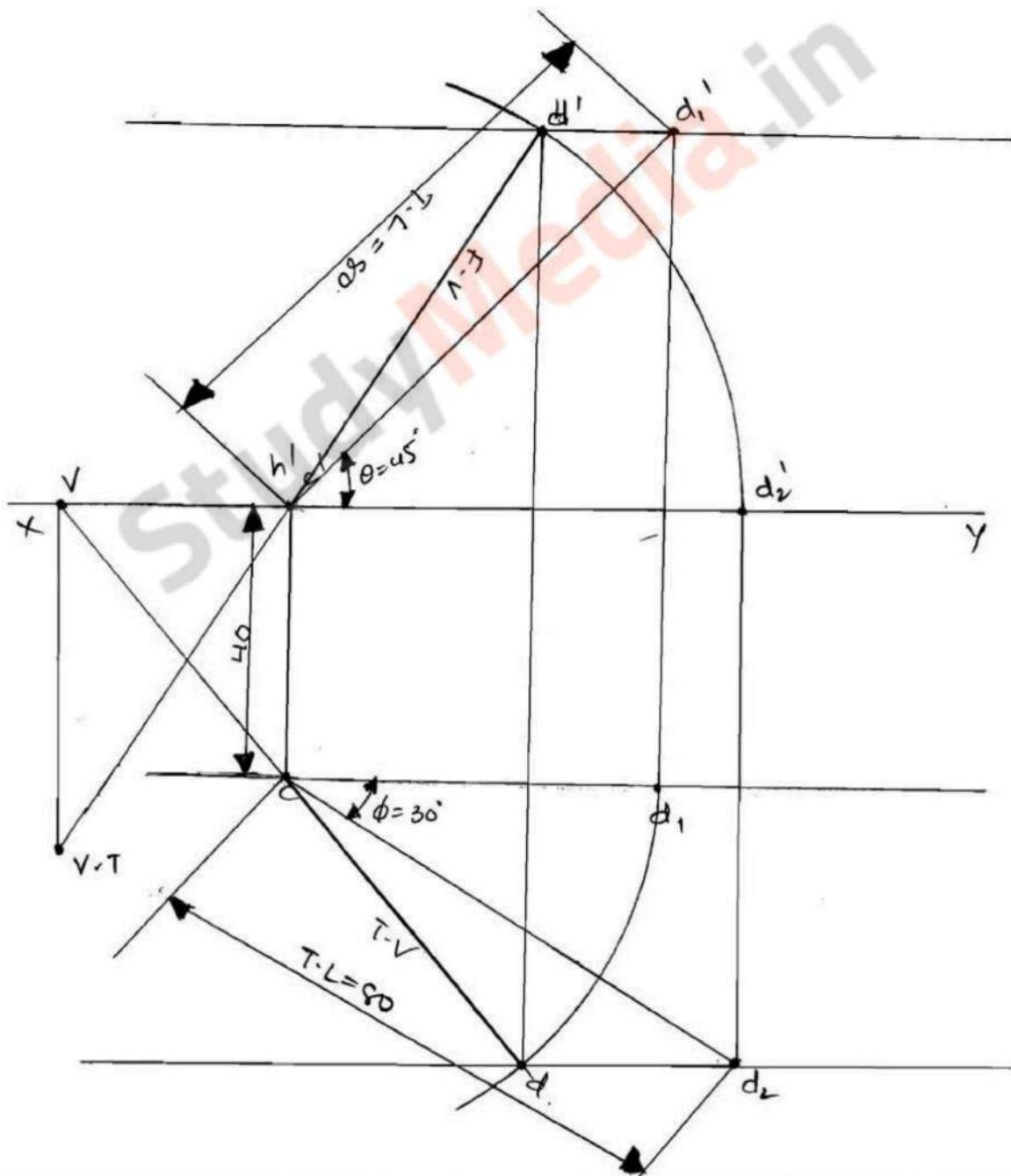
$$\theta = 45^\circ$$

$$\phi = 30^\circ$$

on the H.P and 40mm \rightarrow V.P

$$c'd' = F.V \quad cd = T.V$$

$$c'd'_1 = T.L = cd_2$$



2. A 100mm long line PQ is inclined at 30° to H.P and 45° to V.P. Its midpoint is 35mm above H.P and 50mm in front of V.P. Draw its projections. Locate traces.

Ans

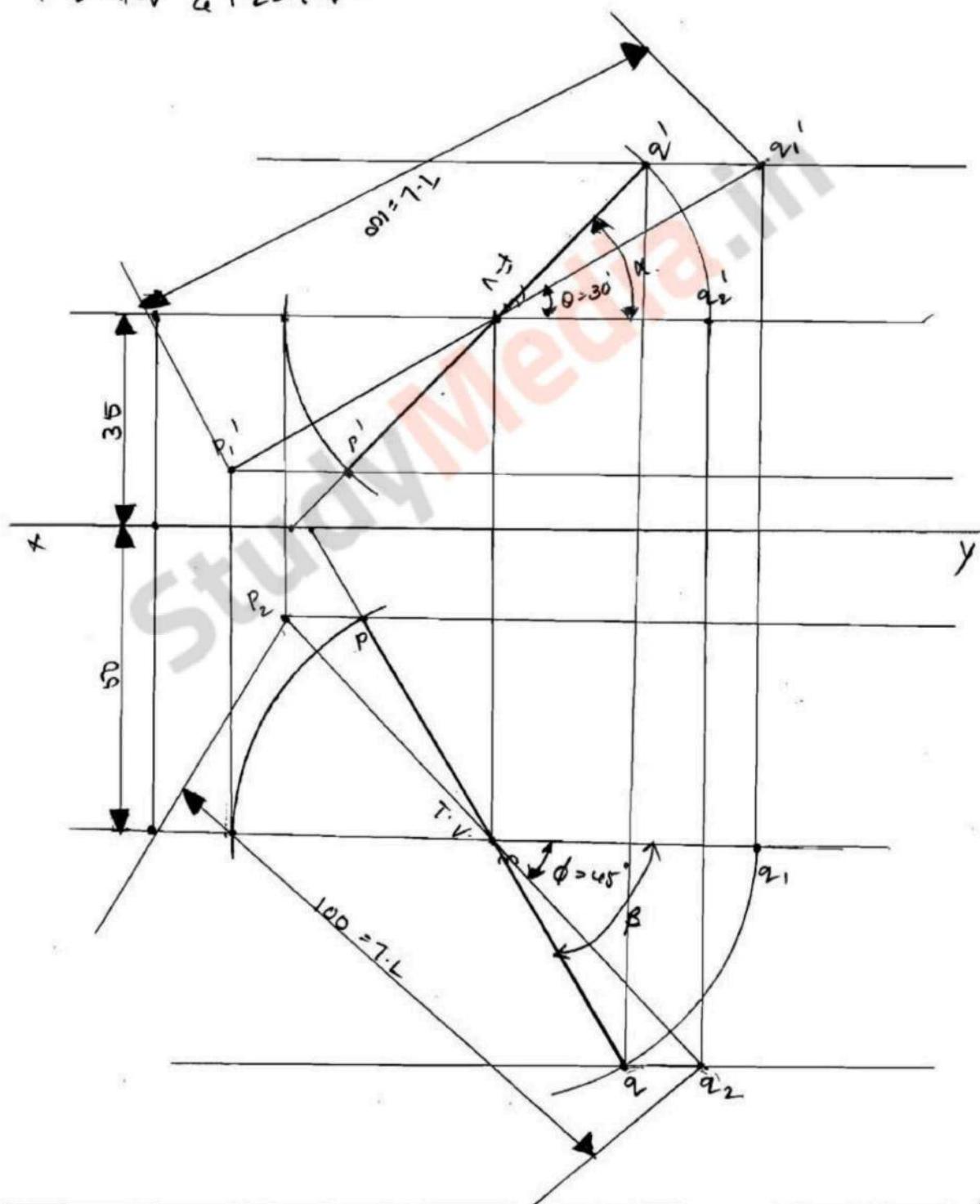
$$PQ = T.L = 100\text{mm}$$

$$\theta = 30^\circ$$

$$\phi = 45^\circ$$

35mm \uparrow H.P and 50mm \rightarrow V.P

$$PQ' = F.V \quad \& \quad PQ = T.V$$



3. Draw the projections and find out true length of a line AB with end B' on the H.P and 40mm in front of V.P. AB is inclined at 30° to H.P and 45° to V.P and its plan view measures 50 mm. Locate Traces.

Ans:

$$T.L = ?$$

B → in the H.P

$$40\text{mm} \rightarrow V.P$$

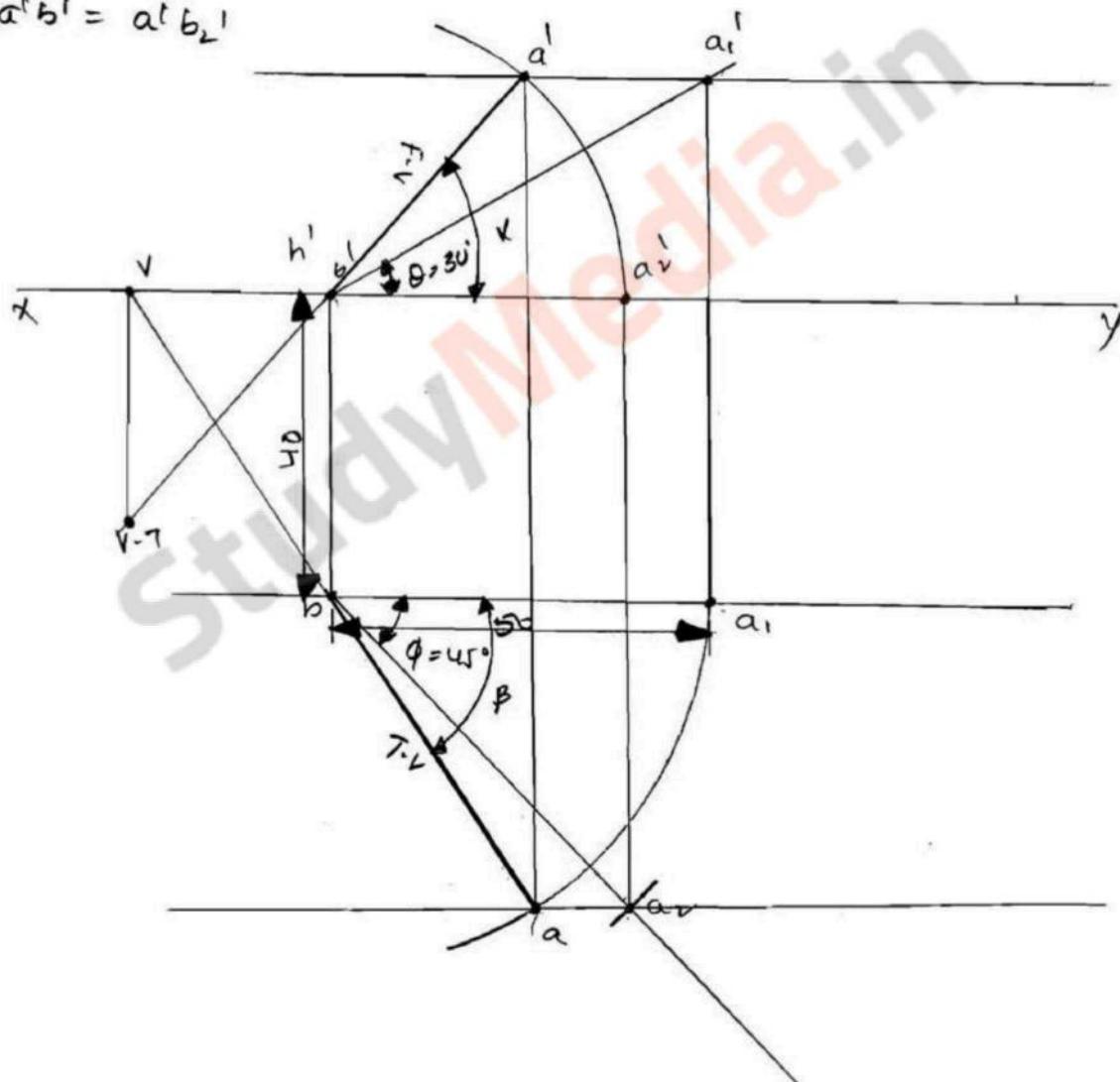
$$\theta = 30^\circ \text{ & } \phi = 45^\circ$$

$$T.V = 50\text{mm}$$

$$a'b_1' = T.L = ab_L$$

$$a'b_1' = F.V, ab = T.V$$

$$a'b_1' = a'b_2'$$



4. The top view of a 80mm long line PQ measures 65mm while the length of its frontview is 55mm its one end A' is in the H.P and 12mm in front of V.P. Draw the projections of A'B and determine its inclination with the H.P and V.P
Locate Traces.

$$T.V = 65 \text{ mm}$$

$$F.V = 55 \text{ mm}$$

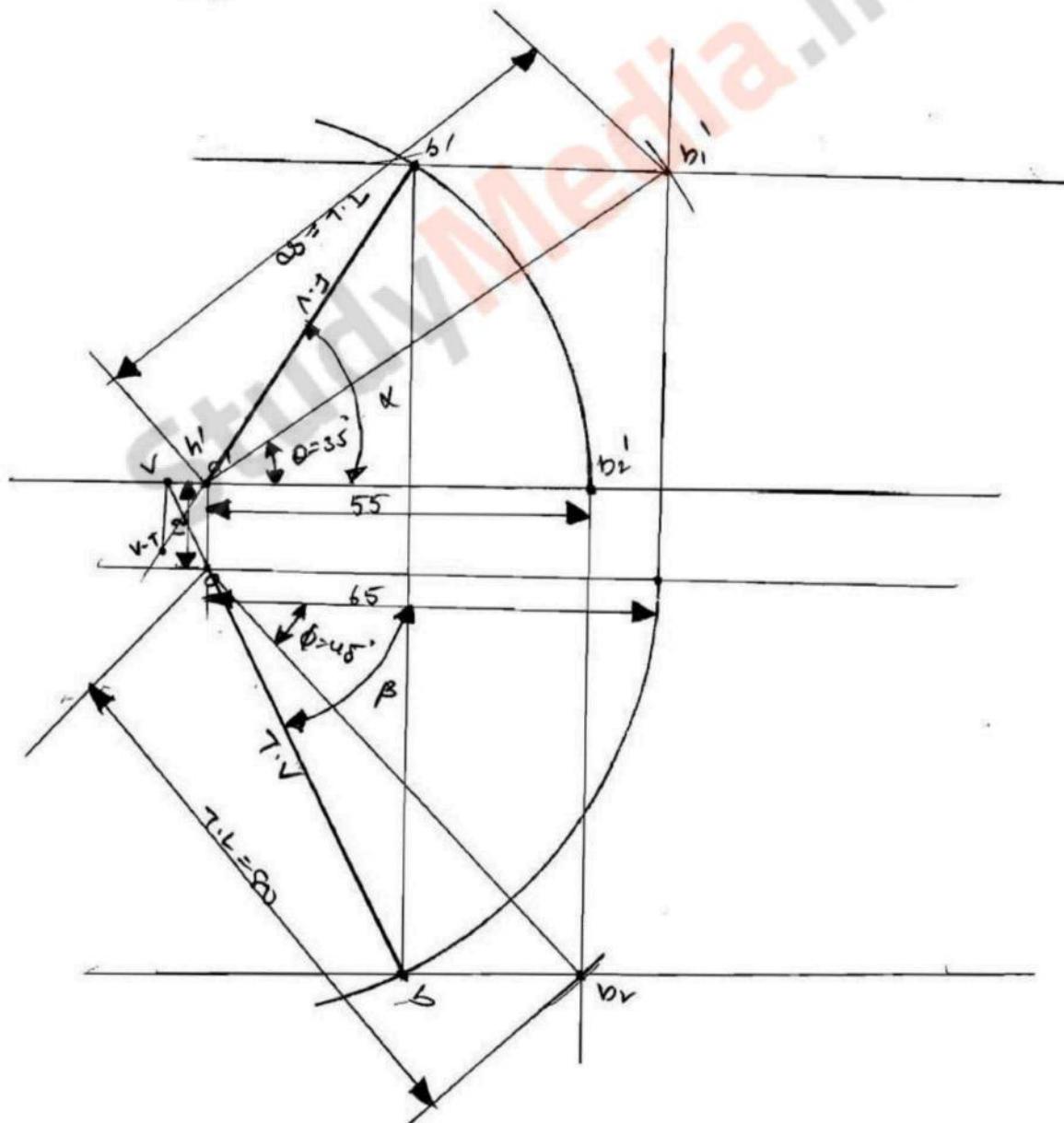
$$T.L = 80 \text{ mm}$$

A → in the H.P & 12mm → V.P

$$PQ_1' = T.L = PQ_2$$

$$PQ_1' = F.V, PQ_2 > T.V$$

$$PQ_1' = PQ_2'$$



5. A line AB 90mm long is inclined at 45° to H.P and its topview makes an angle of 60° with the V.P. - The end A is in the H.P and 12 mm in front of V.P draw its F.V and find its true Inclination with V.P - also locate traces.

Ans:

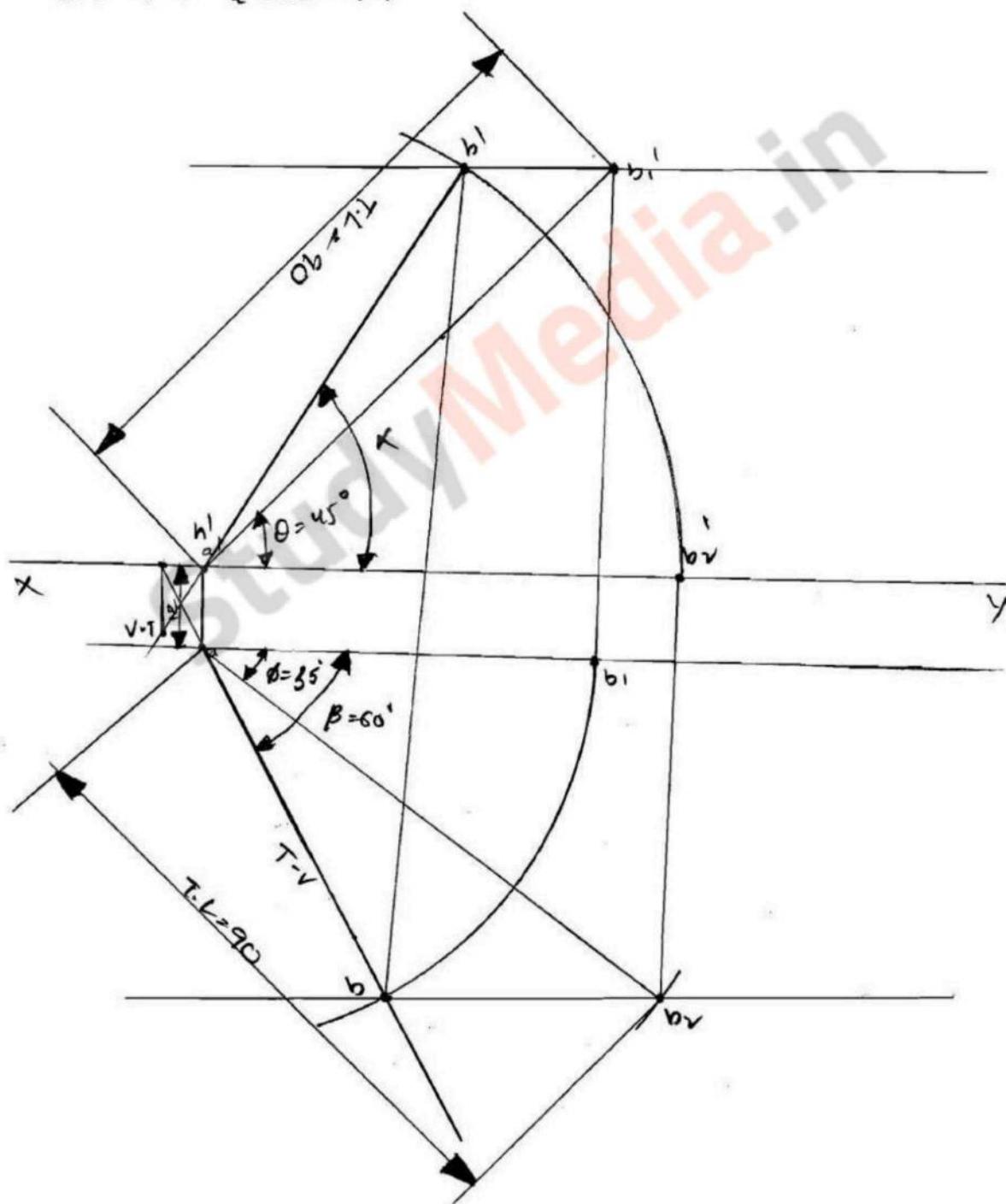
$$AB = 90\text{mm} \text{ C.T.L}$$

$$\theta = 45^\circ \quad \phi = ?$$

$$\beta = 60^\circ$$

A → on the H.P and 12mm → V.P

$$a'b' = f.v \quad \& \quad ab = t.v$$



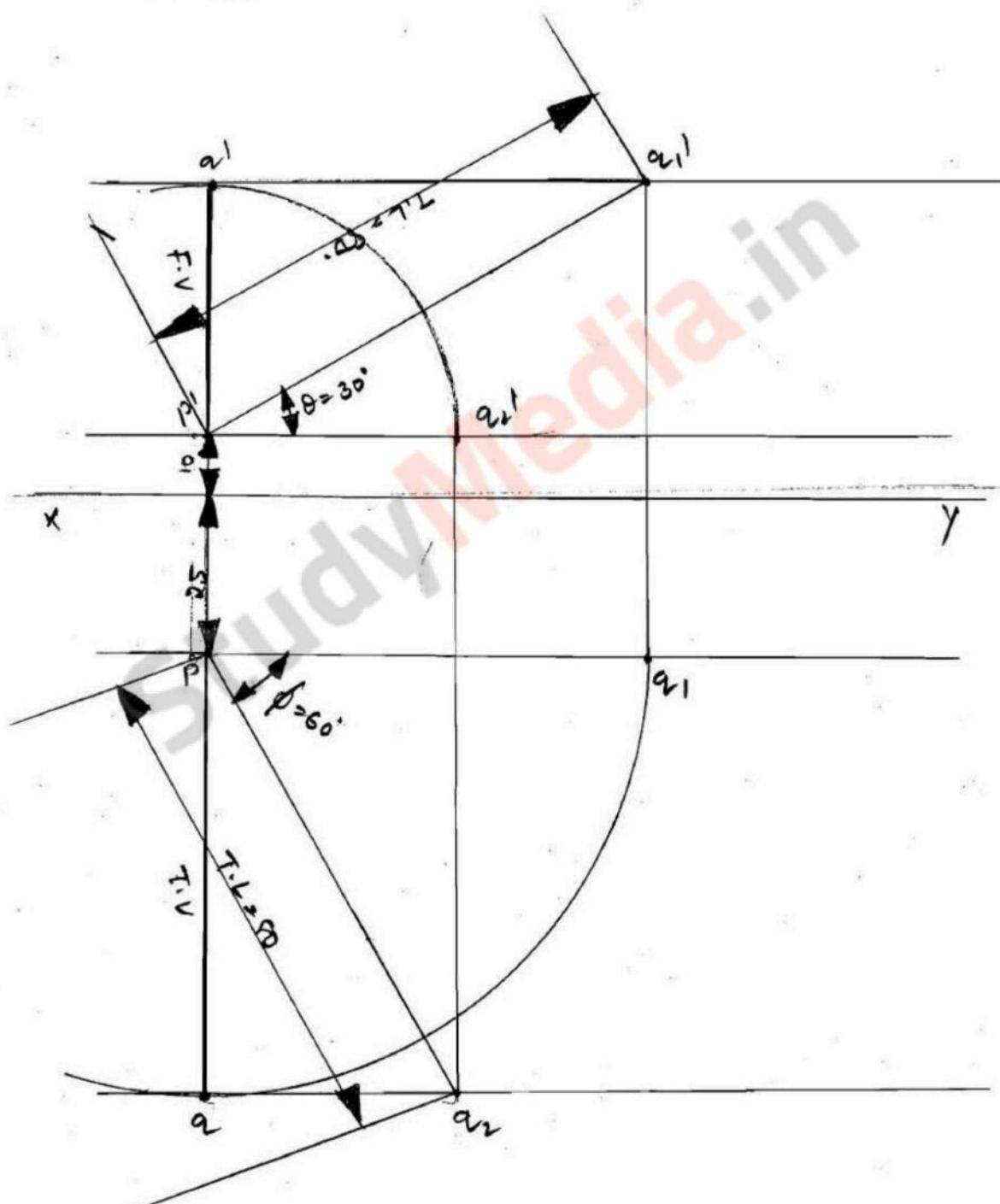
6. A 80 mm long line PQ as its end 'P' 10mm above H.P and 25mm in front v.p the line inclined at 30° to H.P and 60° to V.P . Draw its projections.

Ans:- $l_{pq} = 80 \text{ mm}$

$P \rightarrow 10 \text{ mm } \uparrow \text{H.P}$

$25 \text{ mm } \rightarrow \text{V.P}$

$\theta = 30^\circ, \phi = 60^\circ$



8. The front view of line $\bar{A}\bar{B}'$ makes an angle of 30° with XY line. The HT of the line is 45mm in front of V.P., while its VT is 30mm below the H.P. The end A' is 12mm above the H.P. and end B' is 105mm in front of V.P. Draw the projections of line and find its true length, inclination with H.P. and V.P.

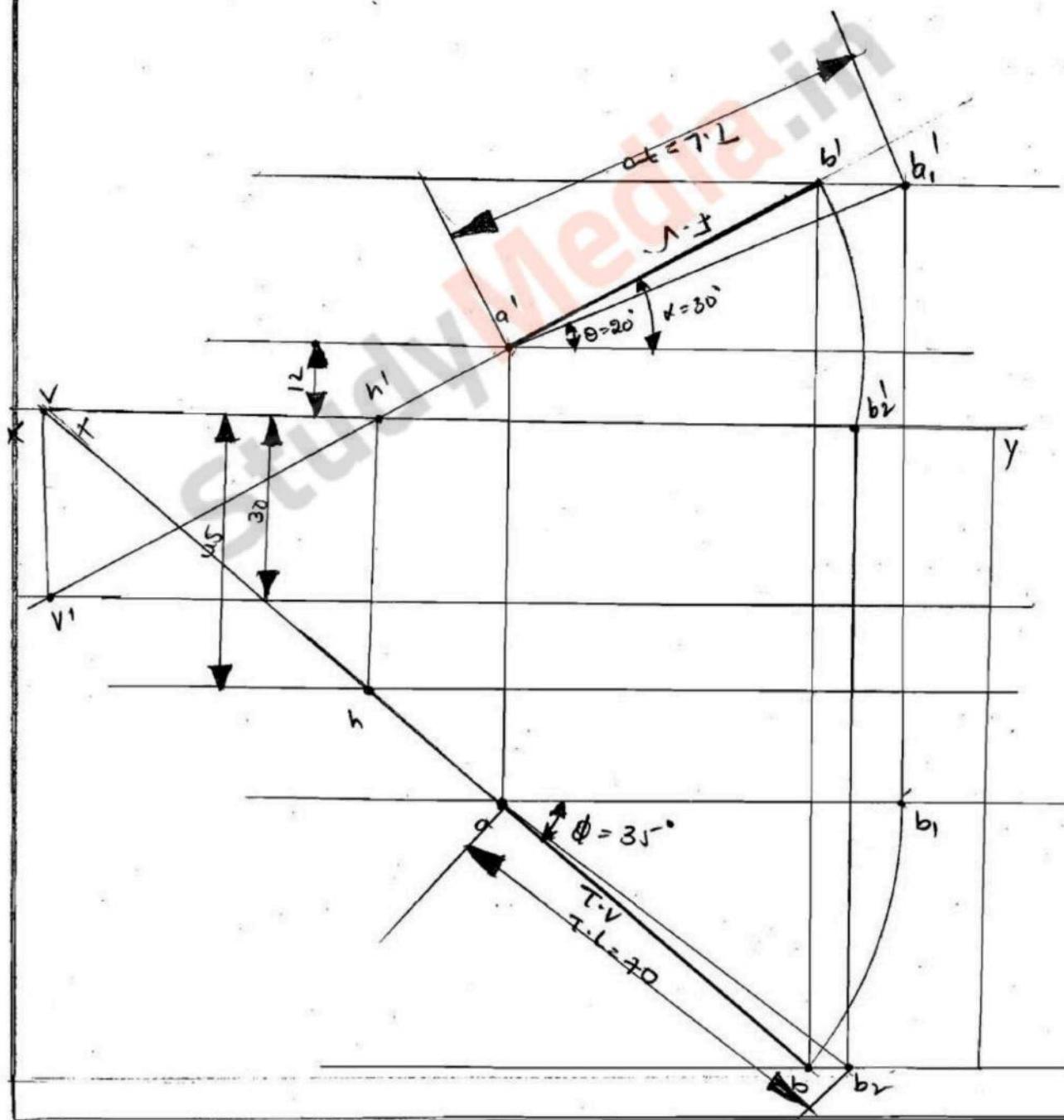
Ans:

$$a'b' = 30^\circ \text{ with } XY$$

$$H.T = 45\text{mm} \rightarrow \text{of V.P}$$

$$V.T = 30\text{mm } \downarrow \text{H.P}$$

$$A \rightarrow 12\text{mm } \uparrow \text{H.P.}$$



A 70mm long line PQ has its ends P and Q above the H.P
and 40mm in front of the V.P. The other end Q is 60mm above the H.P
and 10mm in front of the V.P. Draw the projections of PQ
and determine its inclinations with the reference planes.

P - 7.24

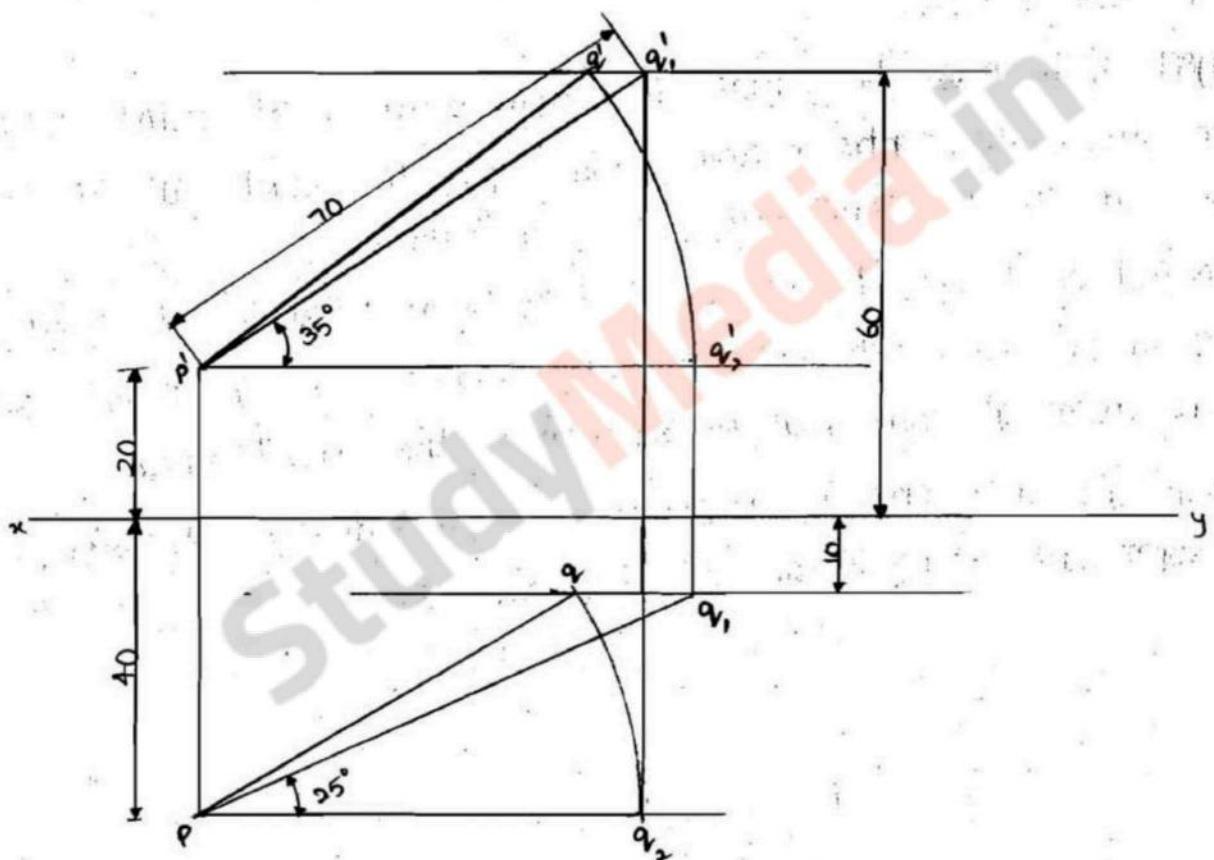
PQ = 70mm line

End P is 40mm in front of V.P

and 20mm above H.P

End Q is 60mm above the H.P

and 10mm in front of V.P



1. On a projector, mark point p' 20mm above xy and p 40mm below xy .
2. Draw a line ab parallel to and 60mm above xy as the locus of q' .
3. Draw another line cd parallel to and 10mm below xy as locus of q .
4. Draw an arc with centre p' and radius 70mm to meet ab at point q_1' . Join $p'q_1'$ to represent true inclination of line with the H.P. Here $\theta = 35^\circ$.
5. Draw an arc with centre p and radius 70mm to meet cd at point q_2 . Join pq_2 to represent true inclination of line with the V.P. Here $\phi = 25^\circ$.
6. Project q_1' to meet horizontal line from point p at point q_1 . Draw an arc with centre p and radius pq_1 , to meet cd at point q_1 . Join pq_1 to represent the top view.
7. Project q_2 to meet horizontal line from point p' at point q_2' . Draw an arc with centre p' and radius $p'q_2'$ to meet ab at point q_2' . Join $p'q_2'$ to represent the front view.
8. Join q_1q_2 and ensure that it is perpendicular to xy , representing projector of the end ϕ .

The front and top views of 75mm long line PQ measures 50 mm and 60 mm, respectively. If the end P of the line is 35 mm above the H.P. and lies in front of the V.P. draw its projections and locate the traces. Determine the true inclinations of the line PQ with the H.P. and the V.P.

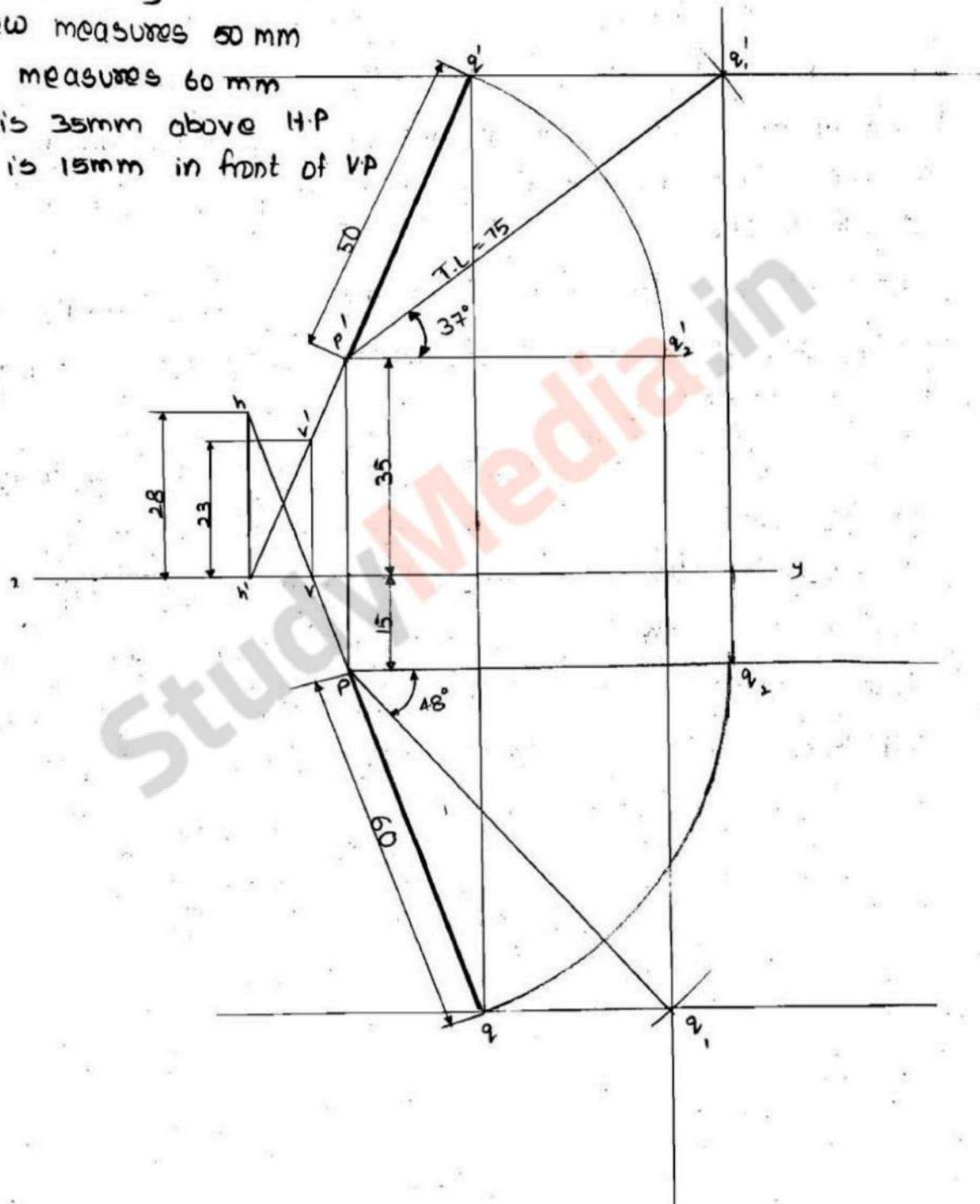
PQ is 75 mm long

front view measures 50 mm

Top view measures 60 mm

End P is 35 mm above H.P.

End P is 15 mm in front of V.P.



1. Draw reference line, mark P' 35mm above and 15mm below it is P .
2. Draw a 50mm long line $p'q_1'$ parallel to xy . Draw another 60mm long line pq , parallel to xy .
3. Draw an arc with centre P' and radius 75mm to meet projector of q_1 at point q_1 . Join $p'q_1'$ to represent true inclination of line with the H.P. Here $\theta = 37^\circ$.
4. Repeat above step same with V.P. Here $\phi = 48^\circ$.
5. Draw an arc with centre P' and radius $p'q_1'$ (50mm) to meet horizontal line from point q_1 at point q' . Join $p'q'$ to represent the front view.
6. Repeat above with centre P and radius 60mm. Join pq it is top view.
7. Join qq and ensure that it is perpendicular to xy , representing projector of end Q .
8. Produce $p'q'$ to meet xy at a point h' . Draw vertical projector through point h' to meet the pq produced at point h . The point h represents the H.T. Here h is 28mm above xy .
9. Produce pq to meet xy at a point v . Draw a vertical projector through point v to meet $p'q'$, produced at point v' . Point v' represents the V.T. Here, point v' is 23mm above xy .

Its mid-point is 35 above the H.P and 50mm in front of V.P
Draw its projections.

PQ = 100 mm line

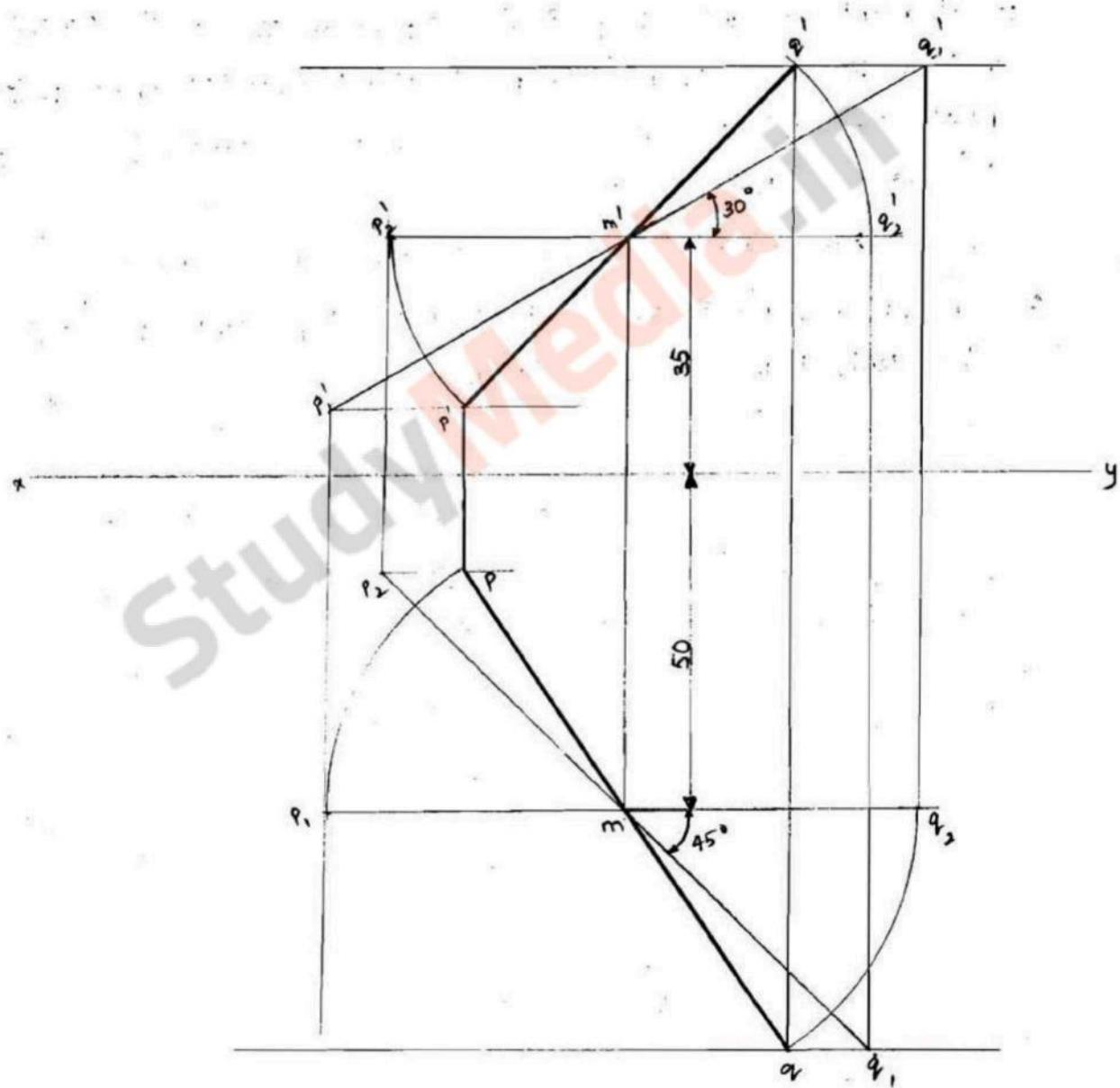
M is midpoint

M is 35 above H.P

and 50 in front of V.P

Line inclined 30° to H.P

45° to V.P



1. Draw a reference line xy . On a vertical projector make point m' 35mm above xy and point m 50 mm below xy .
2. Draw a 50mm long line $m'q'$ inclined at 30° to xy . Produce it such that $p_1q_1 = 100\text{mm}$.
3. Draw another 50mm line mq_2 inclined at 45° to xy . Produce it such that $P_2q_2 = 100\text{mm}$.
4. Project points p_1 and q_1 to meet horizontal line through point m at points p_1 and q_1 , respectively. Draw an arc with centre m and radius mp_1 or mq_1 to meet the horizontal lines from points P_2 and q_2 at points P and q , respectively. Join pmq to represent the top view.
5. Project remaining to represent front view ($p'm'q'$)
6. Join p_1p and q_1q to ensure that they represent projector of the ends P and Q respectively.

Fig. 9.29
 P₁ - 9.28

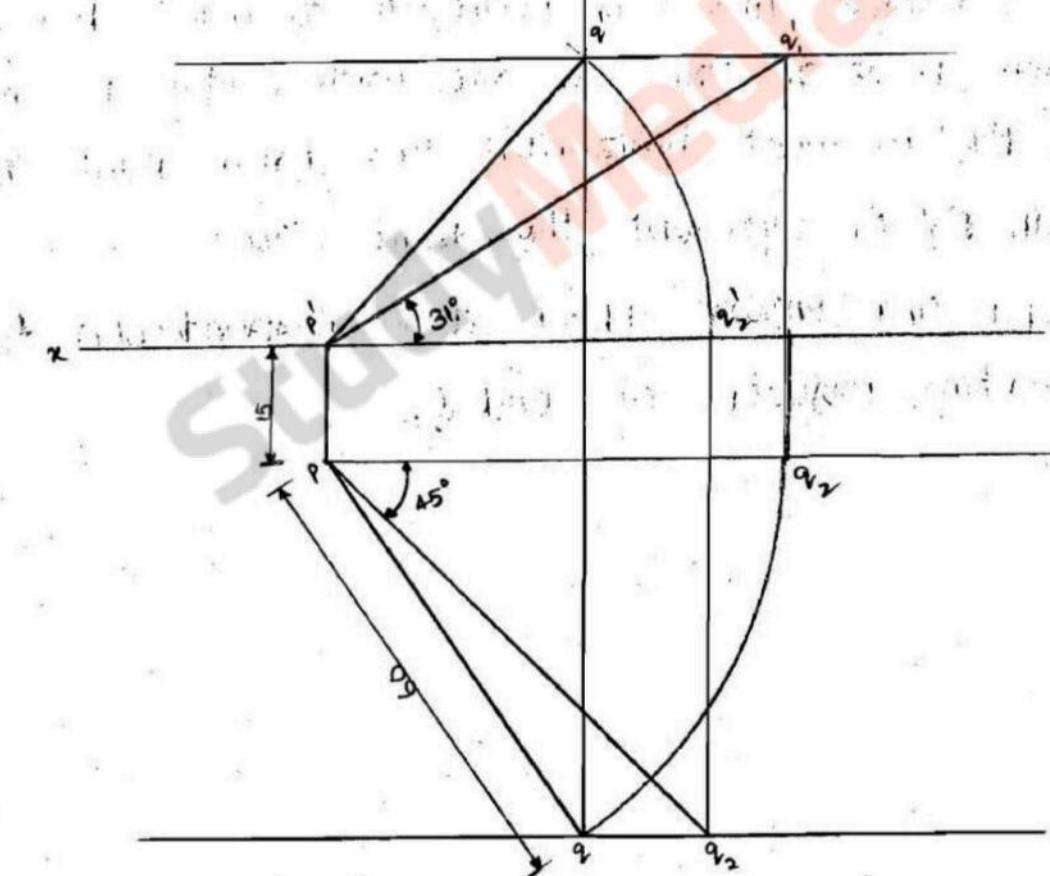
PQ is 70mm long line

line inclined at 45° to the V.P.

End P is on H.P.

End Q is 15mm in front of V.P.

Top View measures 60mm

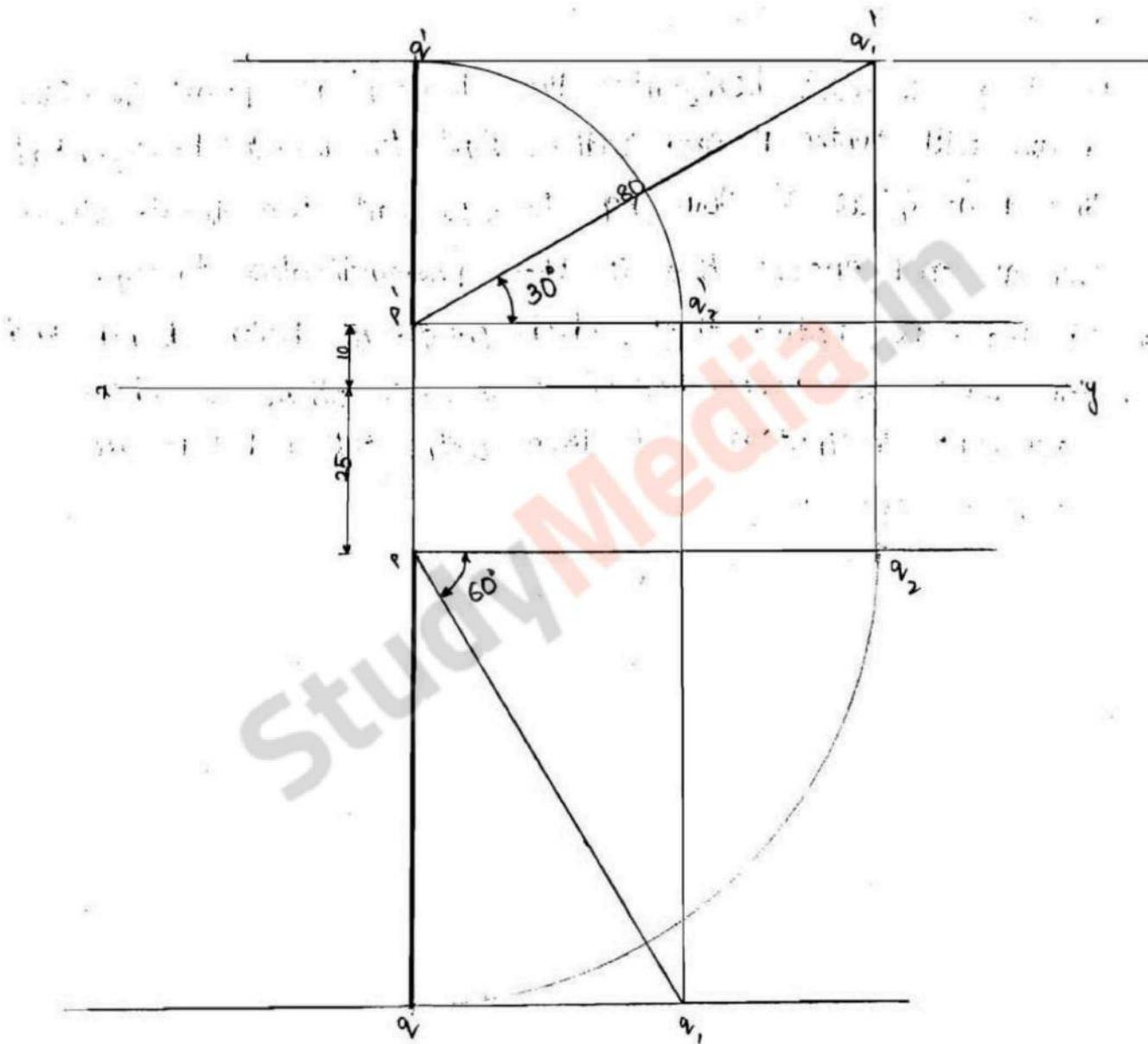


1. Draw the reference line xy . Make p' on xy and p 10mm below xy .
2. Draw a 70mm long line pq_2 inclined at $\theta=45^\circ$ to xy .
3. Draw an arc with centre P and radius 60mm to meet the horizontal line through point q_2 at point q . Join pq to represent top view.
4. Draw an arc with centre p and radius pq to meet the horizontal line from point p at point q_1 . Draw another arc with p' and radius 70mm to meet projector of q_1 at q'_1 . Join $p'q'_1$ to represent the base inclination of line with LTP. Here $\alpha=31^\circ$.
5. Draw a vertical line from point q_2 to meet horizontal line from p' at q_2' . Draw an arc with centre p' and radius $p'q_2'$ to meet horizontal line from point q'_1 at q' . Join $p'q'$ to represent the front view.
6. Join q'_1q and ensure that it is perpendicular to xy , representing projector of end Q .

180JECTIVE'S IN LINE WHERE $\psi = 10^\circ$

Q. 9.25

O. 9.25



1. Draw a reference line xy . Mark P 10mm above xy and p 25mm below xy .
2. Draw an 80mm long line $p'q_1'$ inclined at 30° to xy .
3. Draw another 80mm long line pq_2 inclined at 60° to xy .
4. Project q_1' to meet horizontal line from q at q_1 . Draw an arc with centre p and radius pq_1 , to meet horizontal line from q_2 at q_2 . Join pq_1 to represent top view.
5. Project q_2 to meet horizontal line from p' at point q_2' . Draw an arc with centre p' and radius $p'q_2'$ to meet horizontal line from q_1' at q_1' . Join $p'q_1'$ to represent the front view.
6. Join q_1q_2 and ensure that it is perpendicular to xy .
7. It may be noted that when $\theta + \phi = 90^\circ$, both front and top views are perpendicular to xy . In other words, apparent inclinations of line with H.P and V.P are 90° , i.e., $\alpha = \beta = 90^\circ$.

Line inclined to both reference planes where $\theta + \phi < 90^\circ$

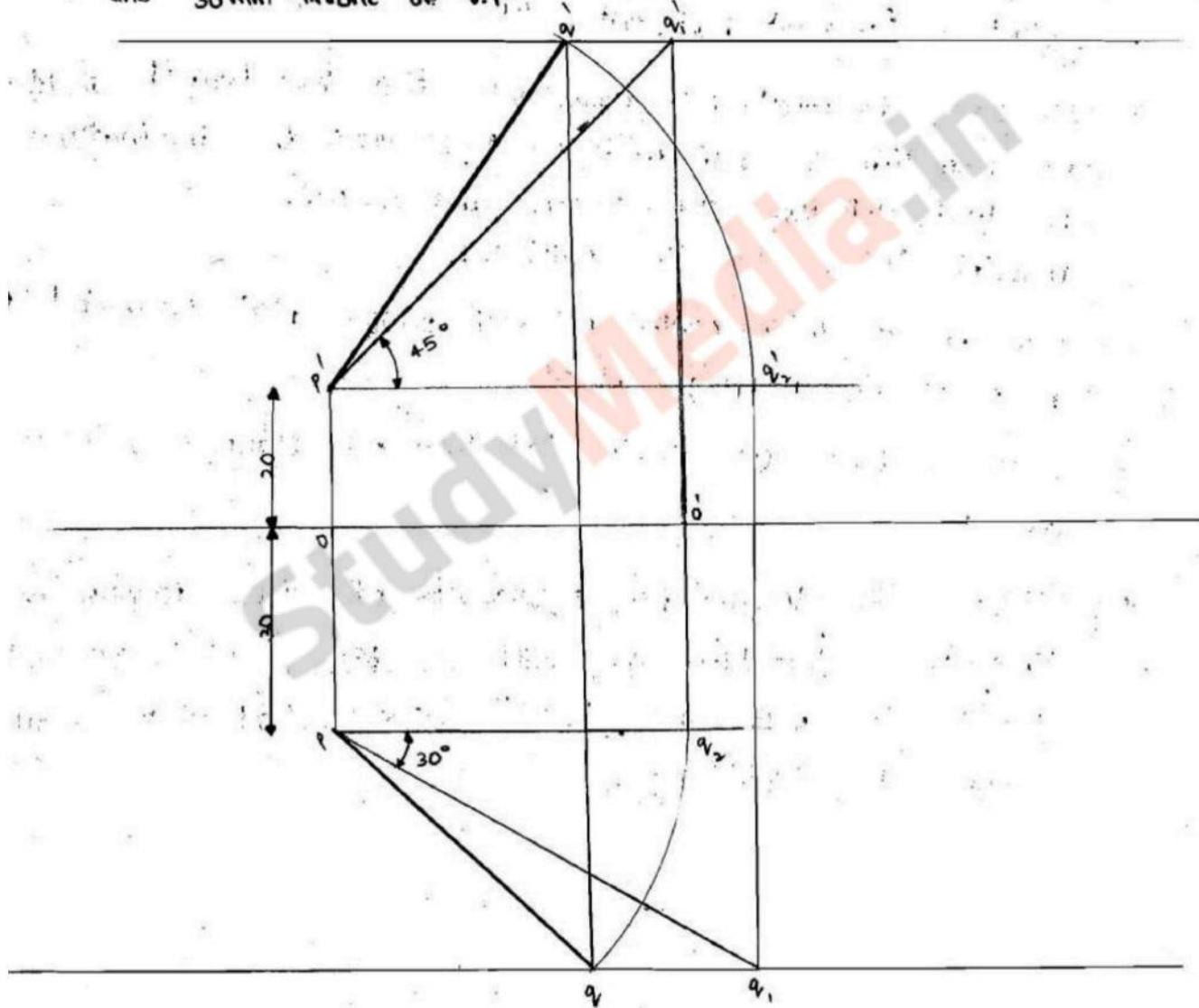
Line PQ = 70mm

$$\theta = 45^\circ$$

$$\phi = 30^\circ$$

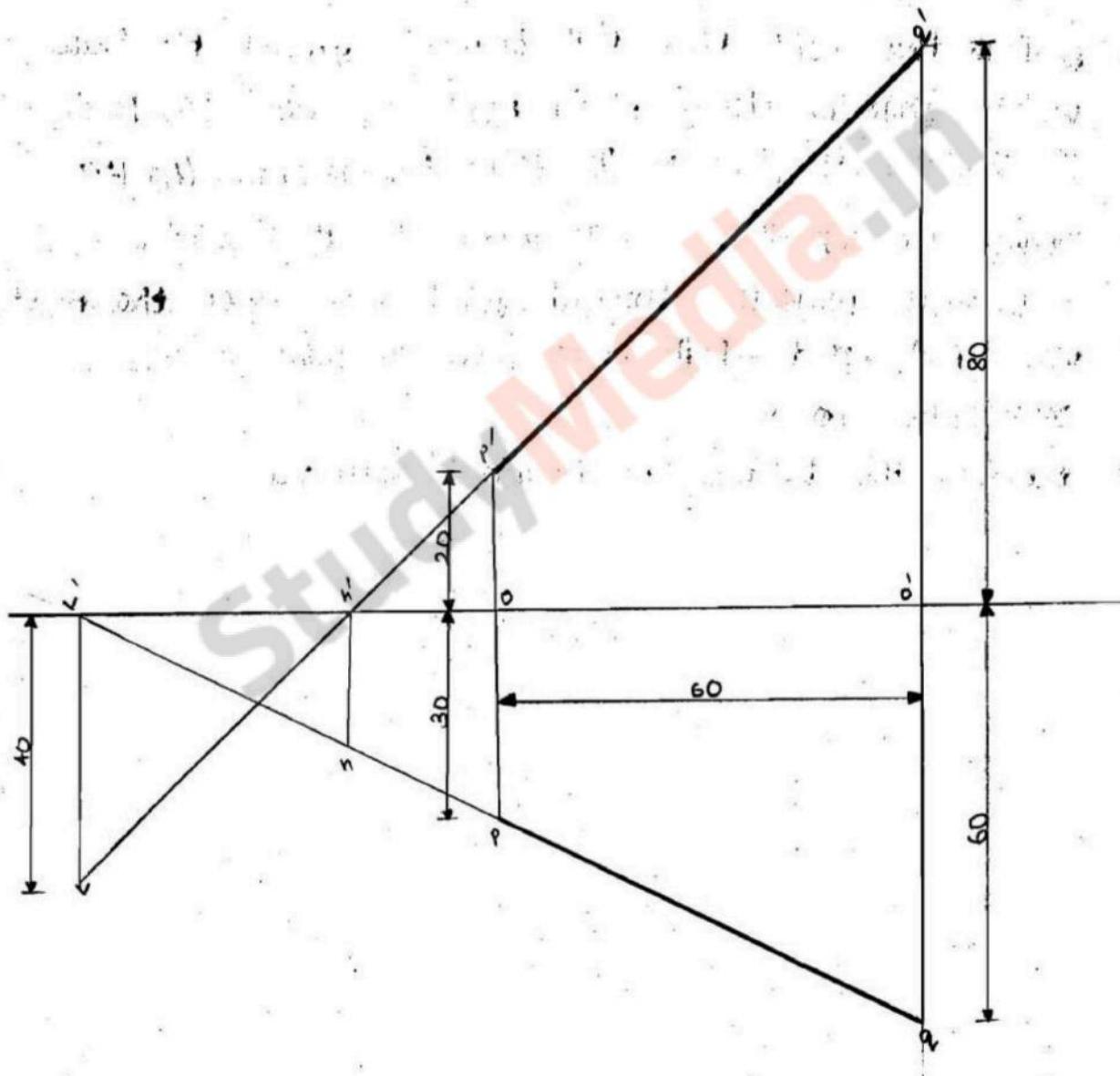
P end 20mm above the H.P

and 30mm in front of V.P



1. Mark O and O₁ on line such that they are 60mm apart.
2. On vertical projector through O, mark P¹ 20mm above xy and P₁ 30 below xy.
3. On the vertical projector through O₁, mark Q¹ 80mm above xy and Q₁ 70mm below xy.
4. Join P¹Q¹ and PQ₁ to represent front and top view of line respectively. Find the T.L and θ of line with H.P.
5. Draw an arc with centre P and radius PQ₁ to meet horizontal line from P at Q₁.
6. Project Q₁ to meet horizontal line ab through Q¹ at Q¹.
7. Join P¹Q¹. The length P¹Q¹ represents the true length of PQ. The inclination of P¹Q¹ with xy represents true inclination of PQ with H.P. Here, T.L = 94 mm and $\theta = 40^\circ$. Find E.L and ϕ of line with V.P.
8. Draw an arc with centre P¹ and radius P¹Q¹ to meet the horizontal line from P¹ at Q₂¹.
9. Project Q₂¹ to meet horizontal line cd through point Q at Q₂.
10. Join PQ₂. The length PQ₂ represents the true length of PQ. The inclination of PQ₂ with xy represents true inclination of PQ with V.P. Here, $\phi = 25^\circ$. Ensure that the length PQ₂ is equal to length P¹Q¹.

Traces of line $\theta + \phi < 90^\circ$



1. Draw a reference line xy . Mark O and O_1 on xy such that they are 60 mm apart.
2. On vertical projector through O , mark p' and p as the front and top views of p .
3. similarly, on vertical projector through O_1 , mark q' and q as the front and the top views of q .
4. Join $p'q'$ and pq to represent the front and top views of the line PQ .
5. Produce the front view $p'q'$ to meet xy at h' . Draw a vertical projector through h' to meet top view pq , produced if required, at point v . The point h represents the H.T
6. Produce the top view pq to meet xy at a point v . Draw a vertical projector through point v to meet the front view $p'q'$, produced if necessary, at point v' . The v' represents the V.T
7. Measure the distance of h and v' from xy .

Projections of Planes:

Plane figures or surfaces have only two dimensions, viz. length and breadth. They do not have thickness. A plane figure may be assumed to be contained by a plane, and its projections can be drawn, if the position of that plane with respect to the principal planes of projection is known.

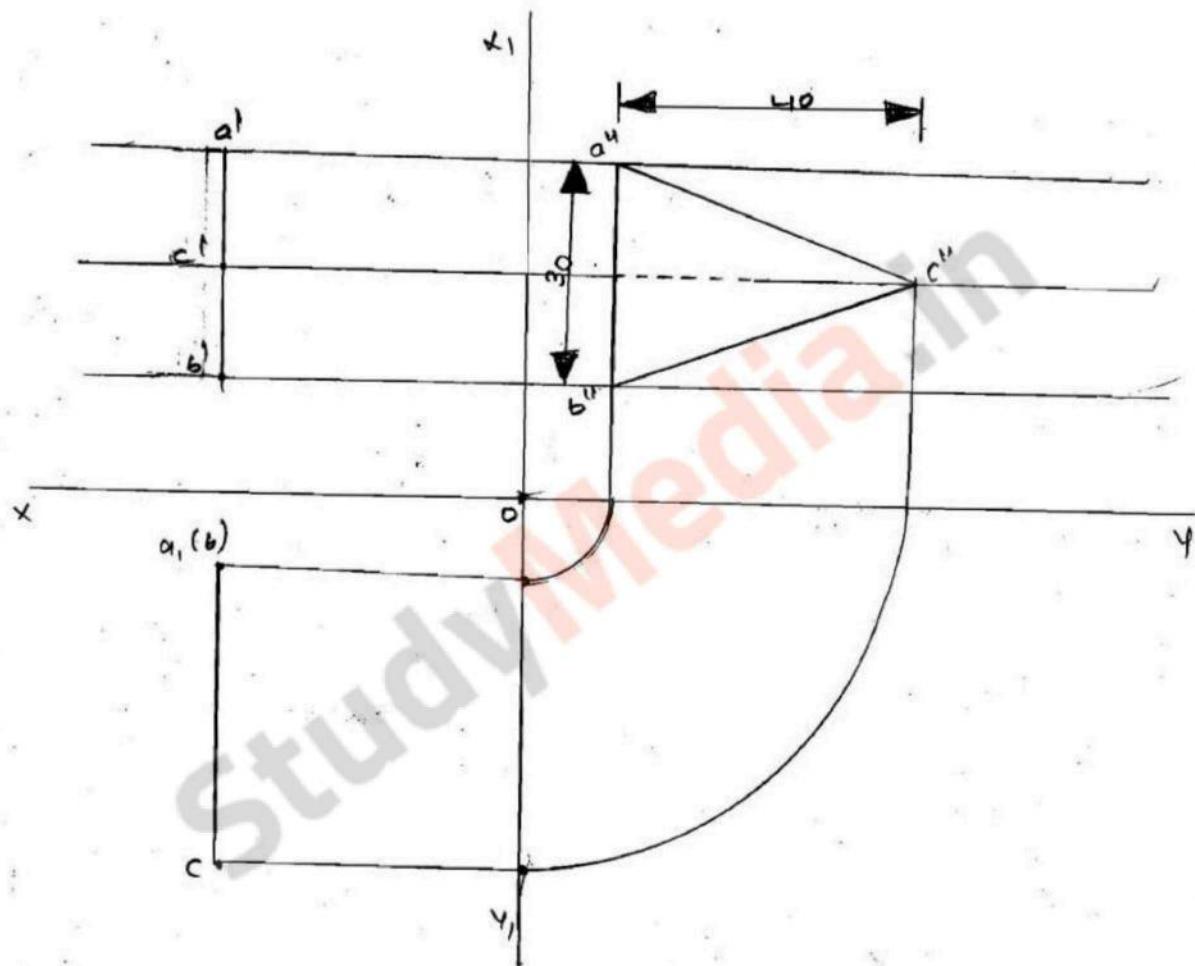
StudyMedia.in

1. A triangular Plane is in the form of Isosceles triangle of 30mm side base and 40mm long altitude. It is kept in the first quadrant such that the surface is perpendicular to both H.P. and V.P. Draw its projections when the base is parallel to V.P.

501

Base = 30mm

altitude = 40mm.



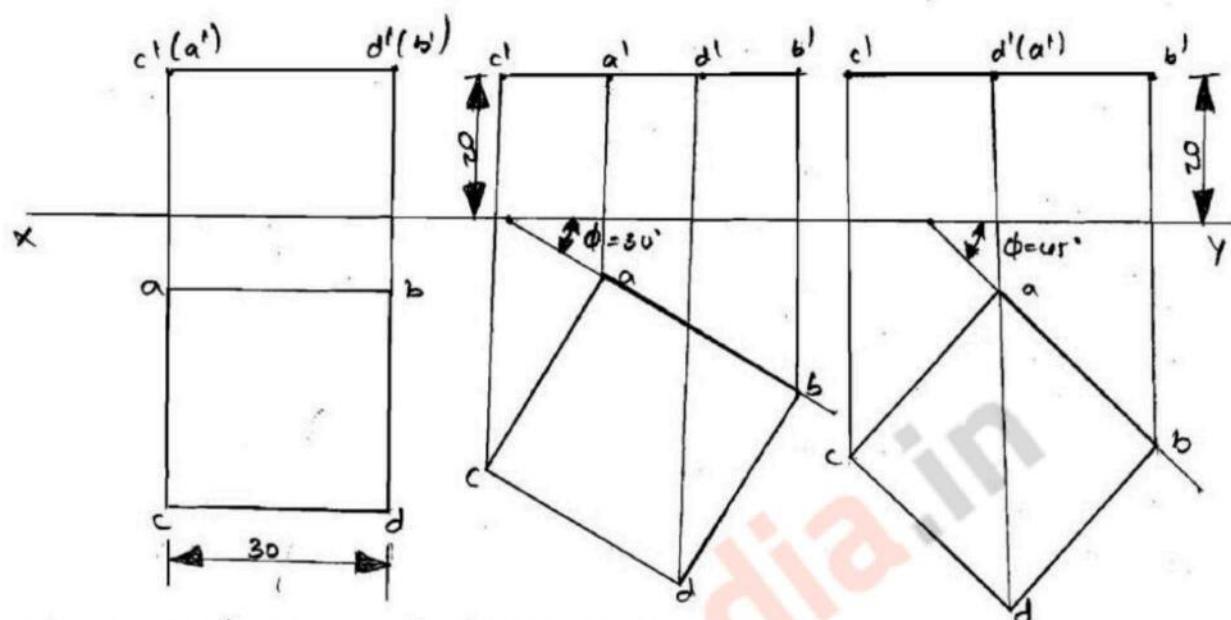
- ② A square plane A₁B₁C₁D₁ 30 mm side as its surface parallel to H.P and 20 mm away from it. Draw its projections of the plane when two of its sides are

 - Parallel to v.p
 - Inclined at 30° to v.p
 - All sides are equally inclined to v.p

Sol:

Side = 30mm

20mm away from it at 30°
and $\phi = 45^\circ$

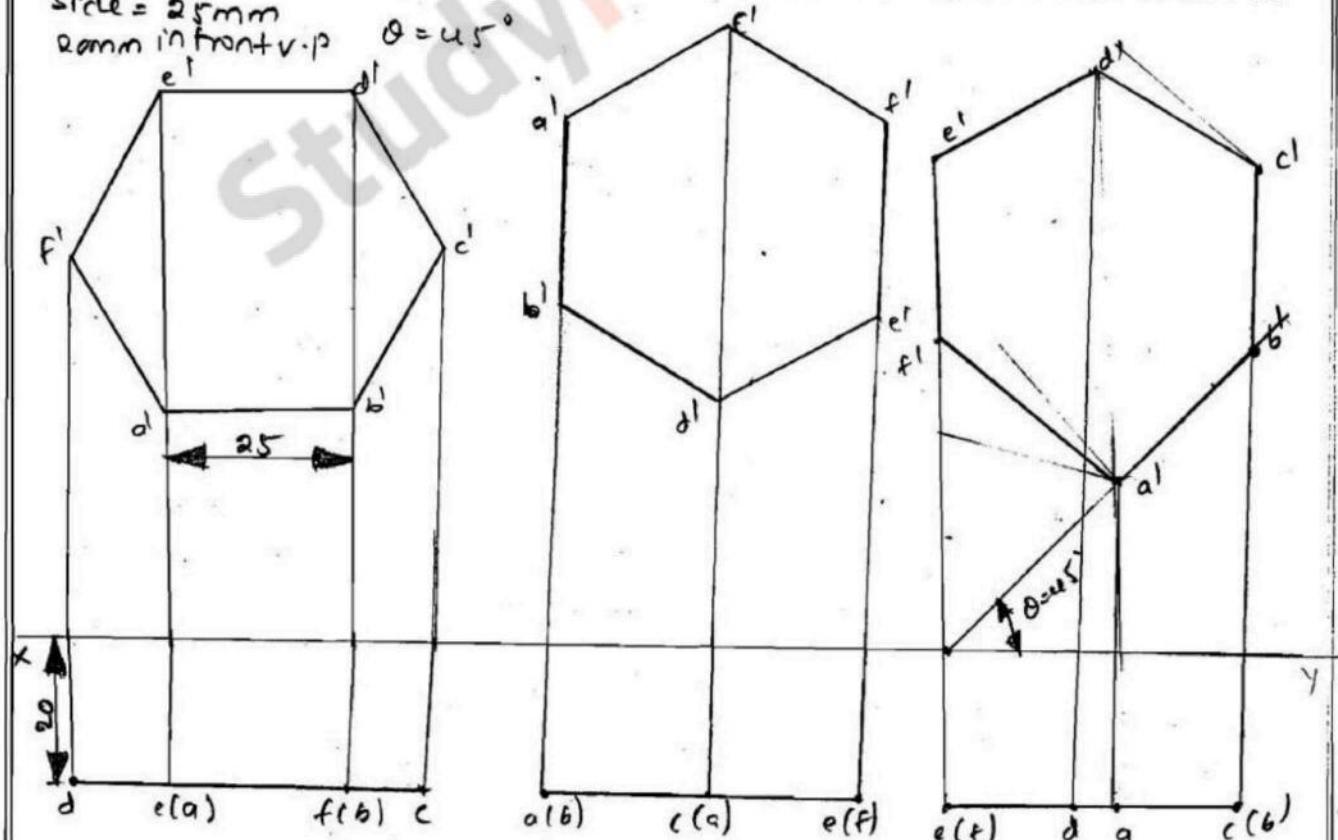


3. A hexagonal plane of 25mm side as its surface lies 20mm in front of V.P. Draw the projections of the plane when a side (i) Parallel to H.P (ii) Perp to H.P (iii) Inclined $\theta = 45^\circ$

Sol:

Side = 25mm

20mm in front v.p. $\theta = 45^\circ$



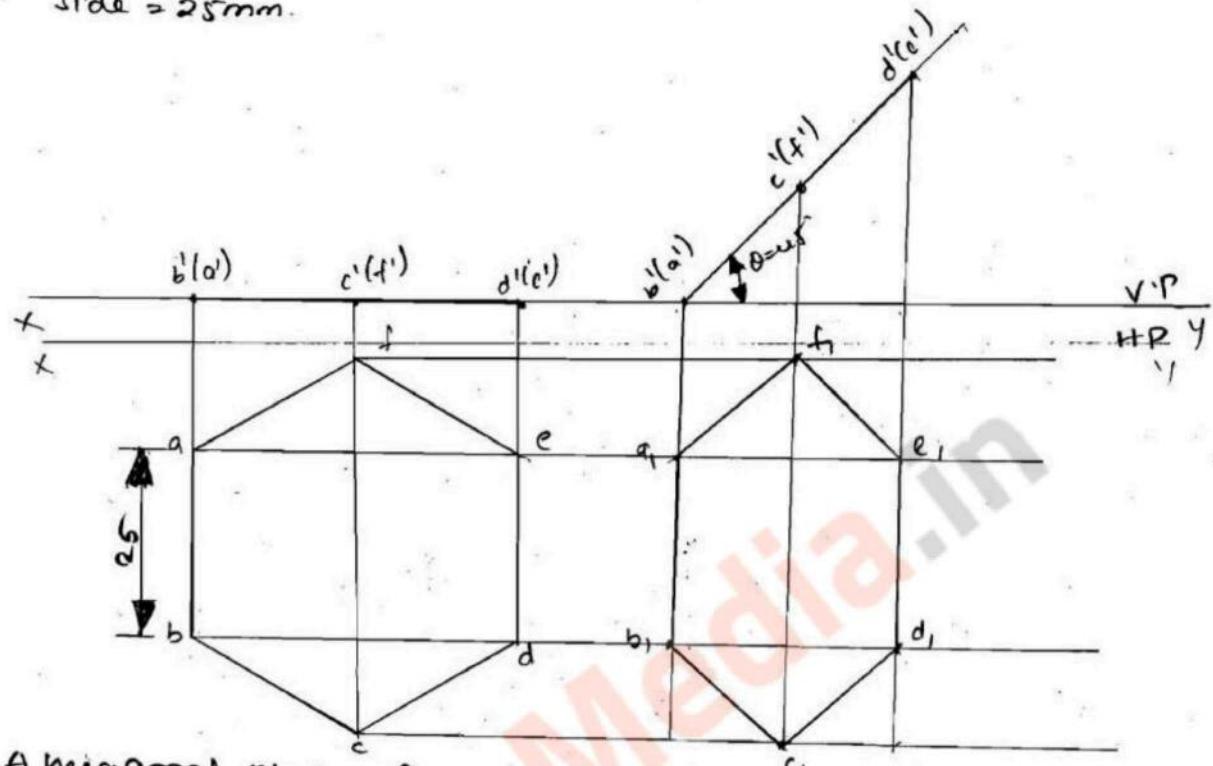
4. A hexagonal Plane of 25mm side as one side on the ground.

The surface of the Plane is inclined at 45° to H.P and 45° to V.P - Draw its Projections

$$\theta = 45^\circ$$

one of the sides on the ground

$$\text{side} = 25\text{mm}$$



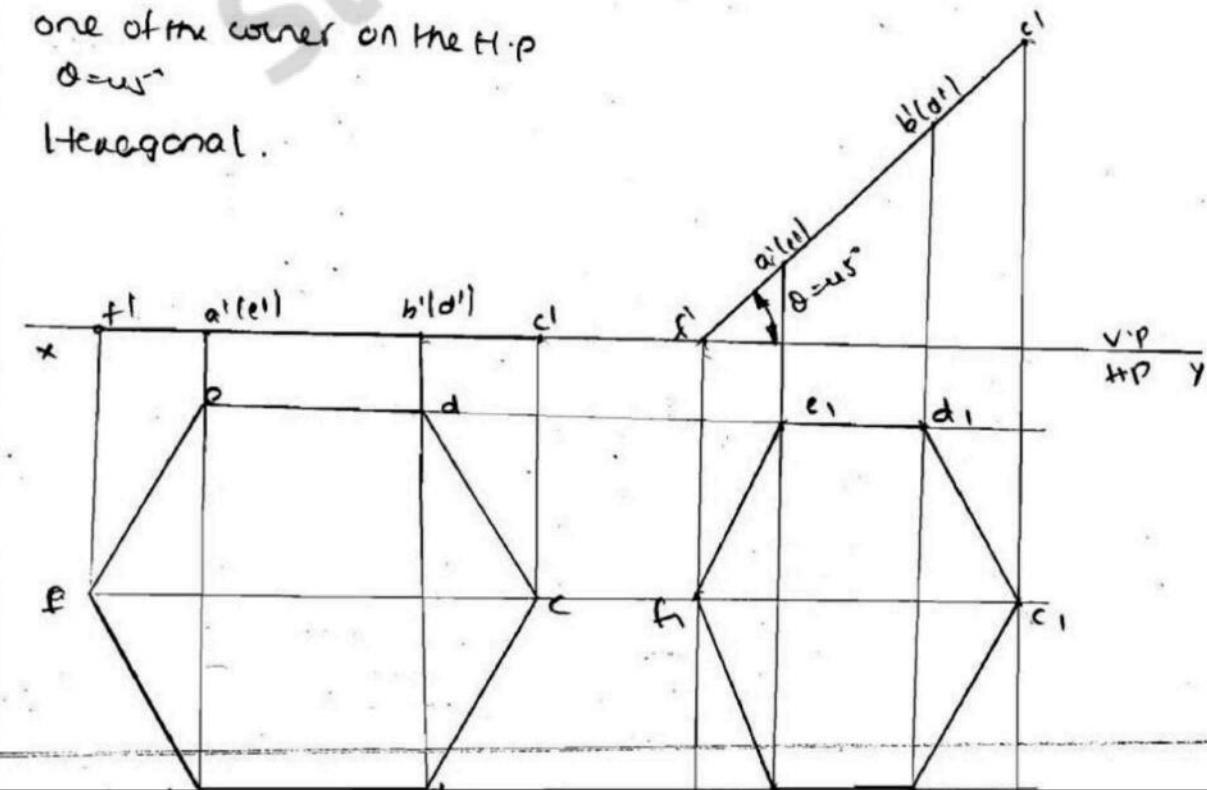
5. A hexagonal plate of 30mm side resting on one of its corners on the H.P. The plate is 45° to V.P and inclined at 45° to H.P - Draw its projections.

$$\text{side} = 30\text{mm}$$

one of the corner on the H.P

$$\theta = 45^\circ$$

Hexagonal.

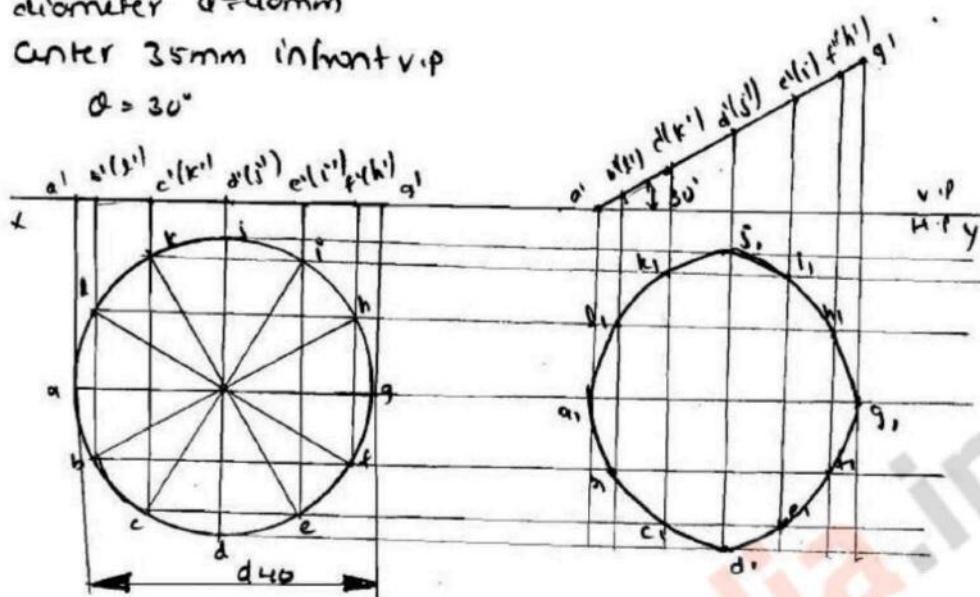


Q: Draw the projections of a circle of 40mm diameter resting on the H.P. on a point on the circumference. Its plane is inclined at 30° to H.P. and lies to V.P. Its center is 35mm in front of V.P.

Diameter $d = 40\text{mm}$

Center 35mm in front V.P.

$\theta = 30^\circ$

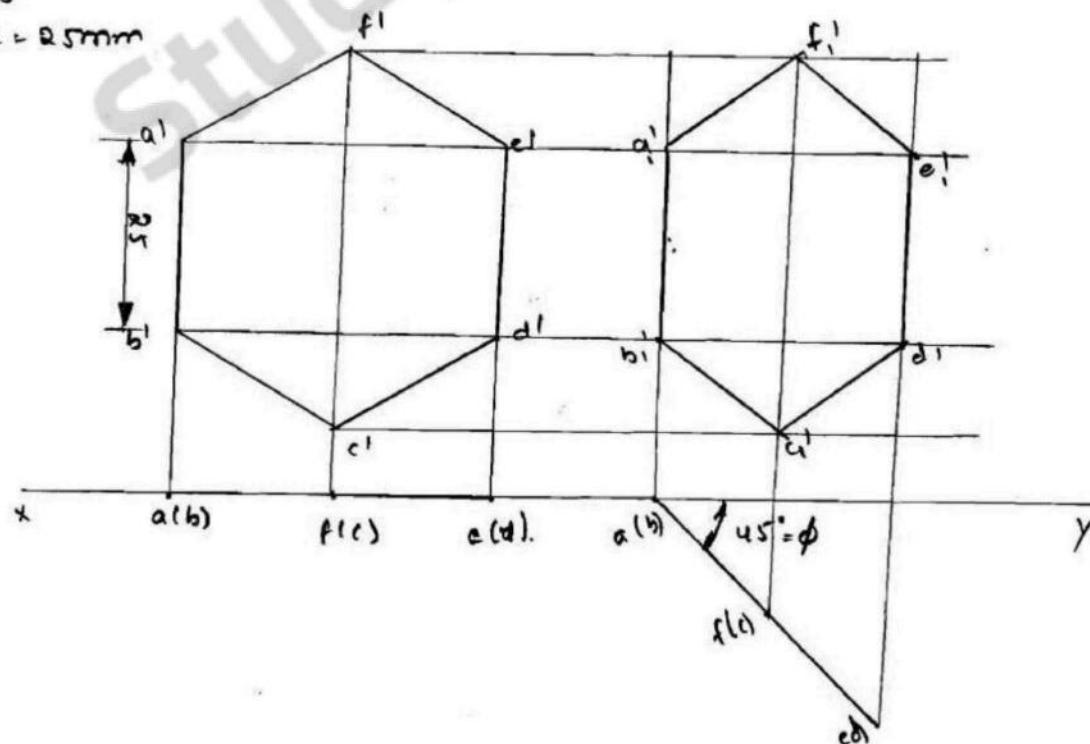


Q: A hexagonal plate of 25mm side and negligible thickness has one of its edges in the V.P. The surface of the plate is parallel to H.P. and inclined at 45° to V.P. Draw its projections.

Hexagonal

$\phi = 45^\circ$

Side = 25mm

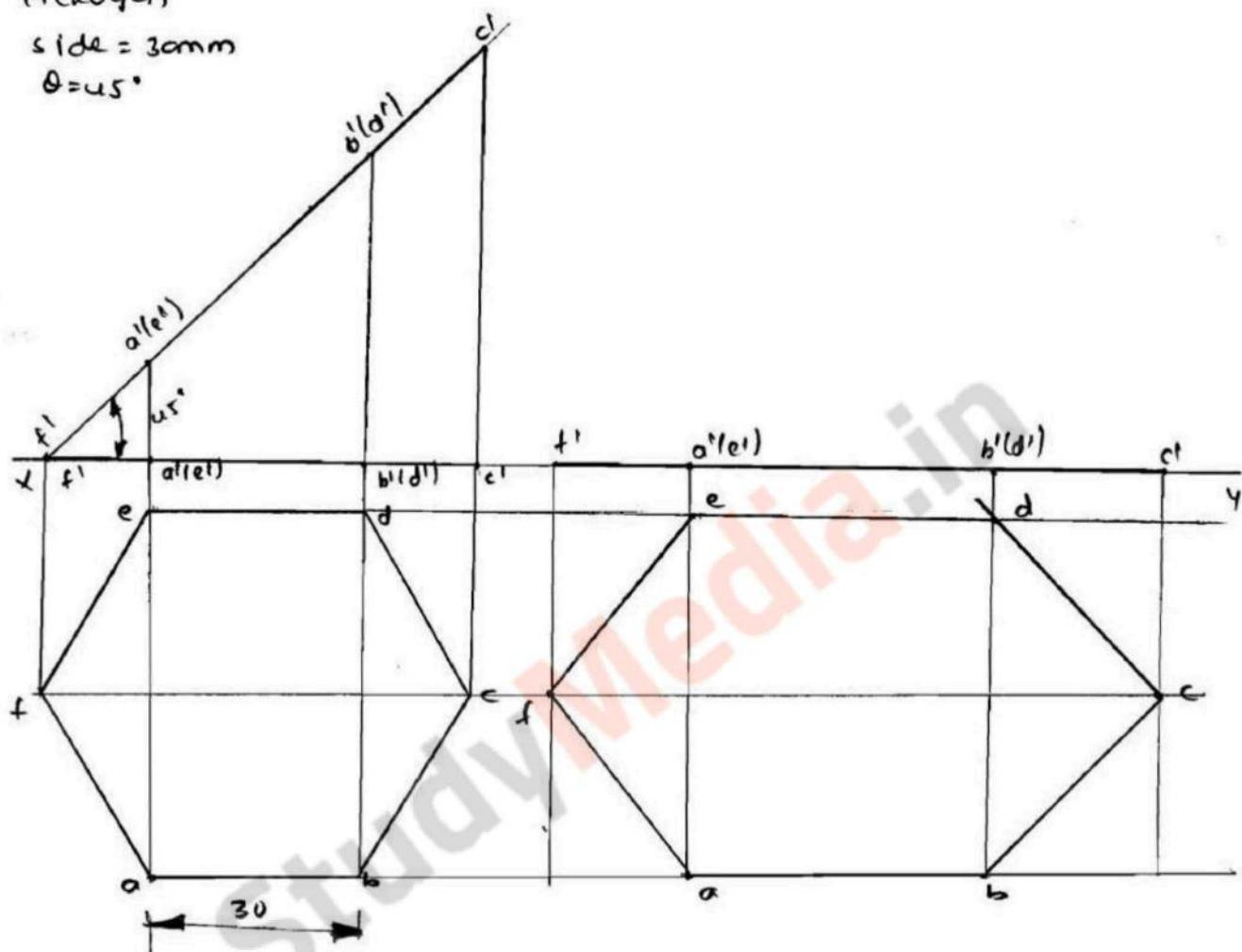


Q: The top view of a lamina whose surface is perp to v.p and inclined at 45° to h.p. appears as a regular hexagon of 30mm side, having a side parallel to the reference line. Draw the projections of the plane and obtain its true shape.

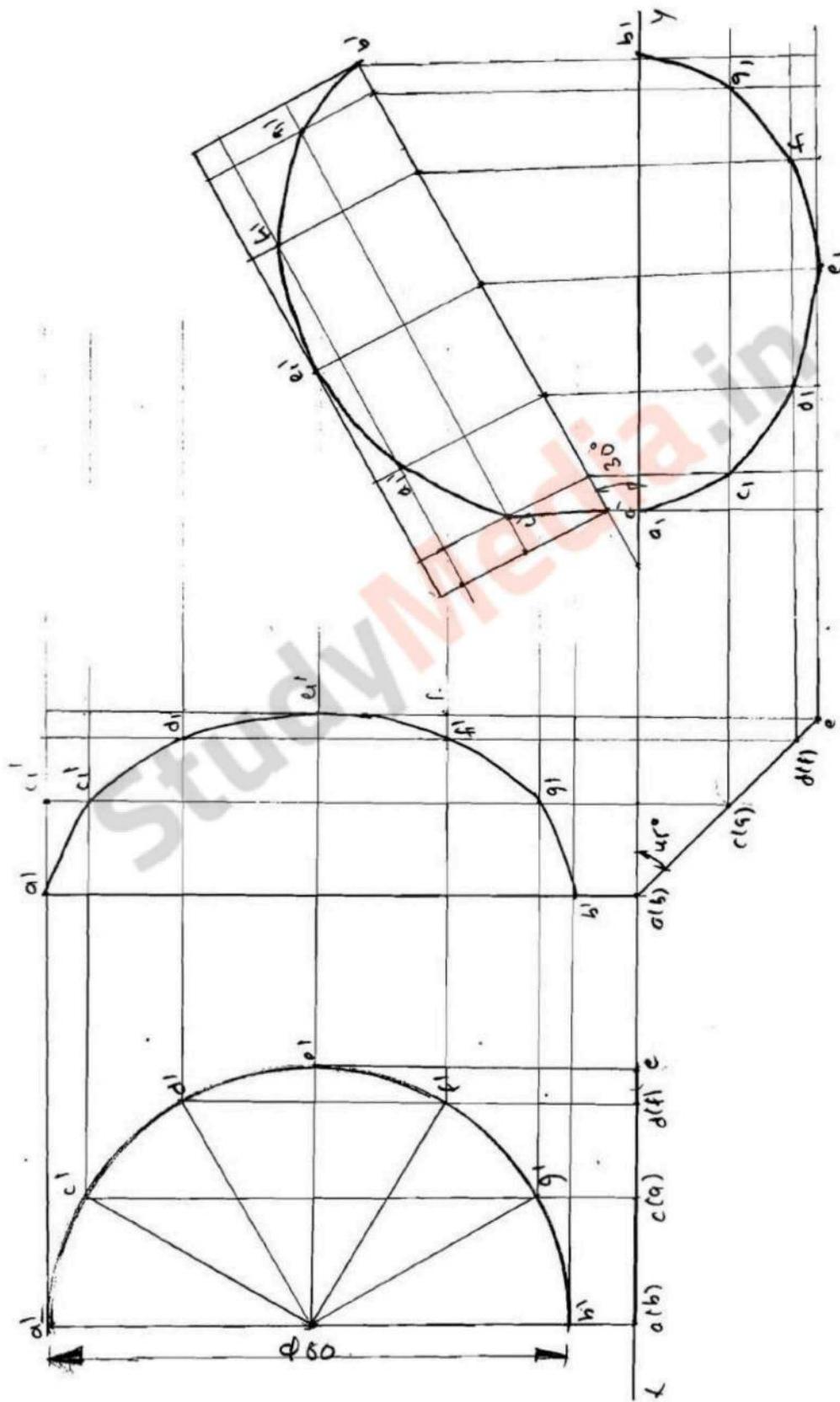
Hexagon

side = 30mm

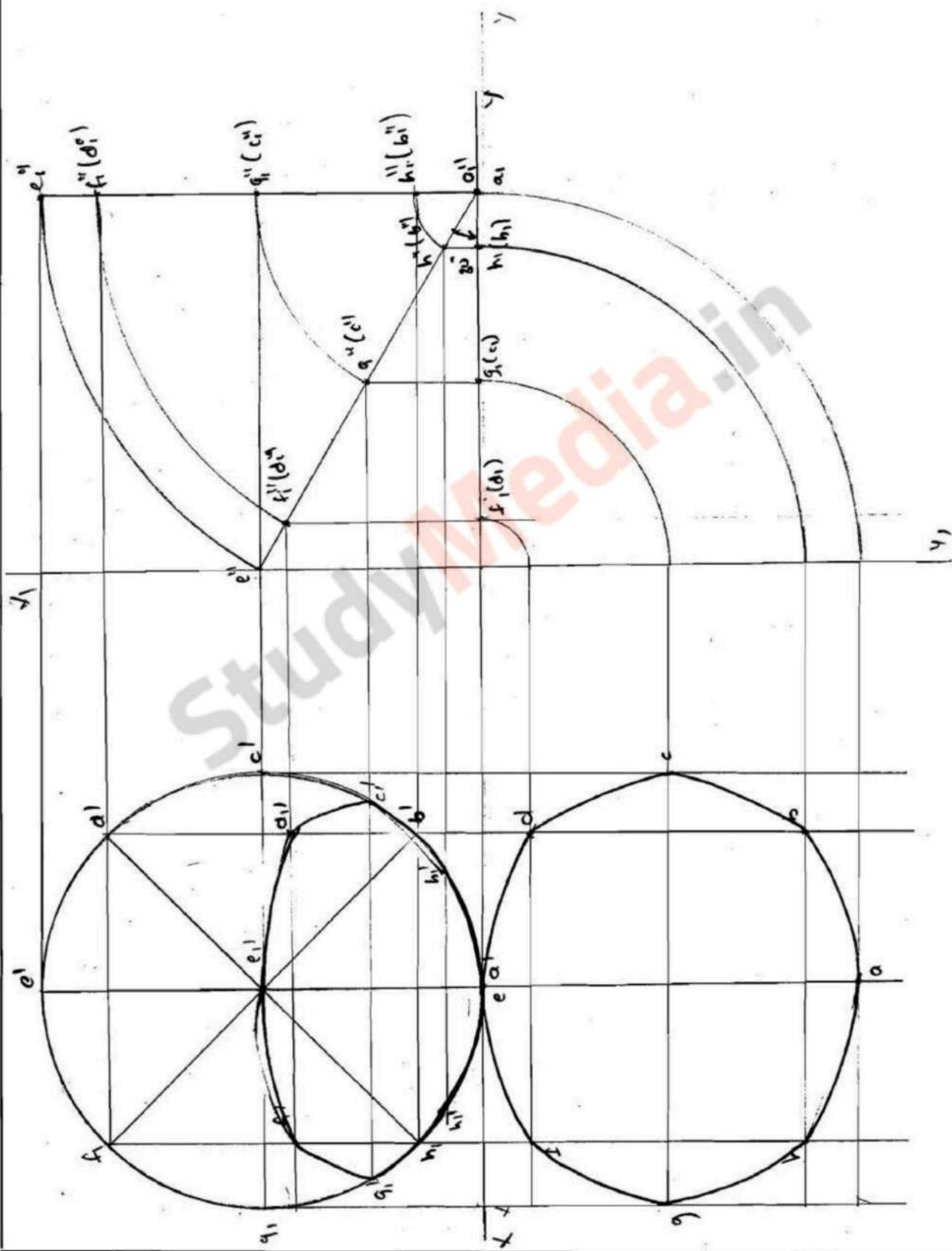
$\theta = 45^\circ$



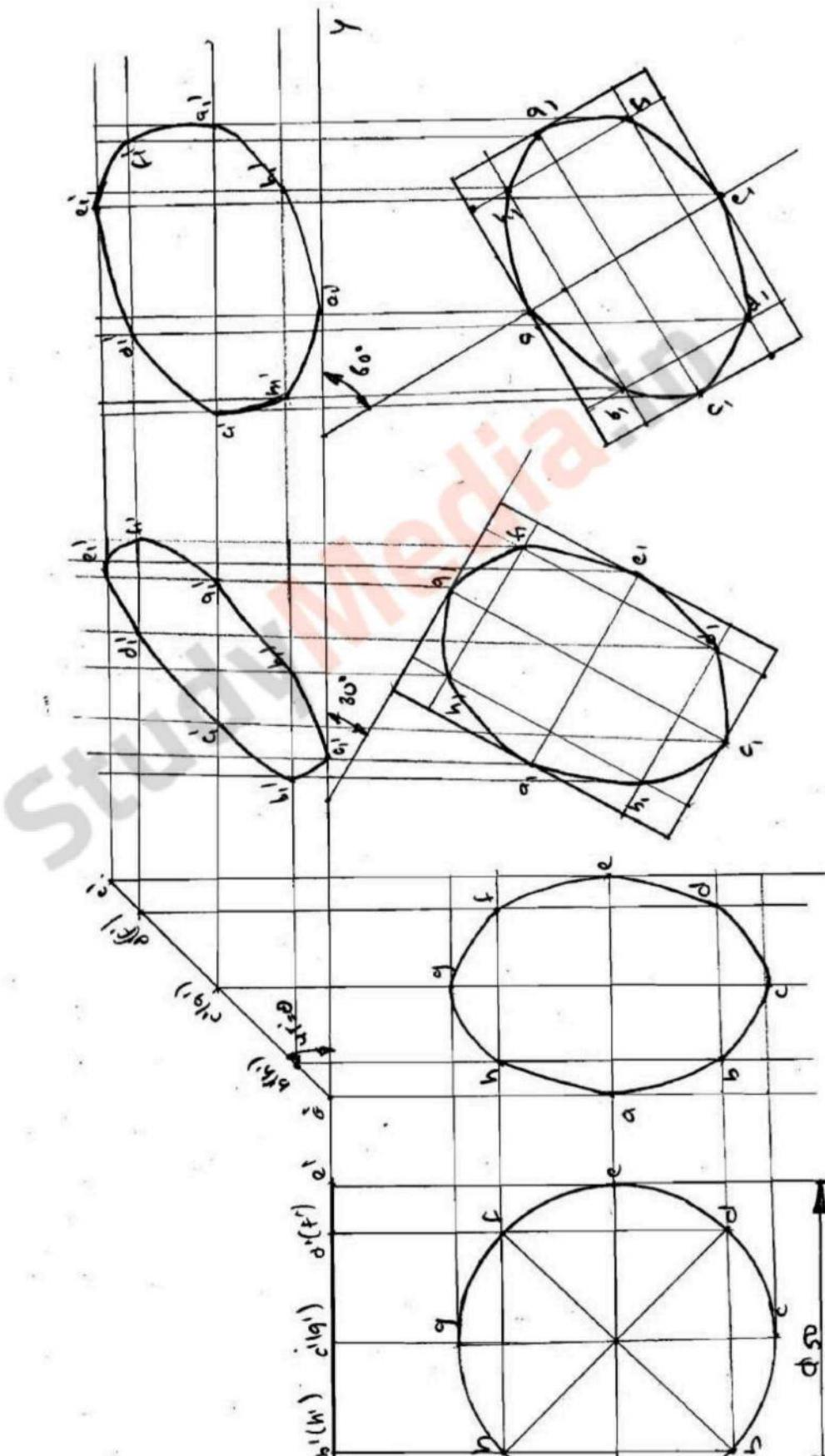
- d: A semi-circular plate of 80mm diameter has its straight edge on the V.P and inclined at 30° to H.P. while the surface of the plate is inclined at 45° to V.P. Draw the projections of the plate.



Q: A circular plane of 80mm diameter has one of the ends of the diameter in the H.P., while the other end is in the V.P. The plane is inclined 30° to the H.P. and 60° to V.P. draw its projections.



- O: Draw the projections of a circle of 50mm diameter resting in the H.P. on a point 'A' on the circumference its plane is inclined at 45° to H.P. and.
- The top-view of the diameter AG making 30° angle with the V.P.
 - The diameter AG making 30° angle with the V.P.



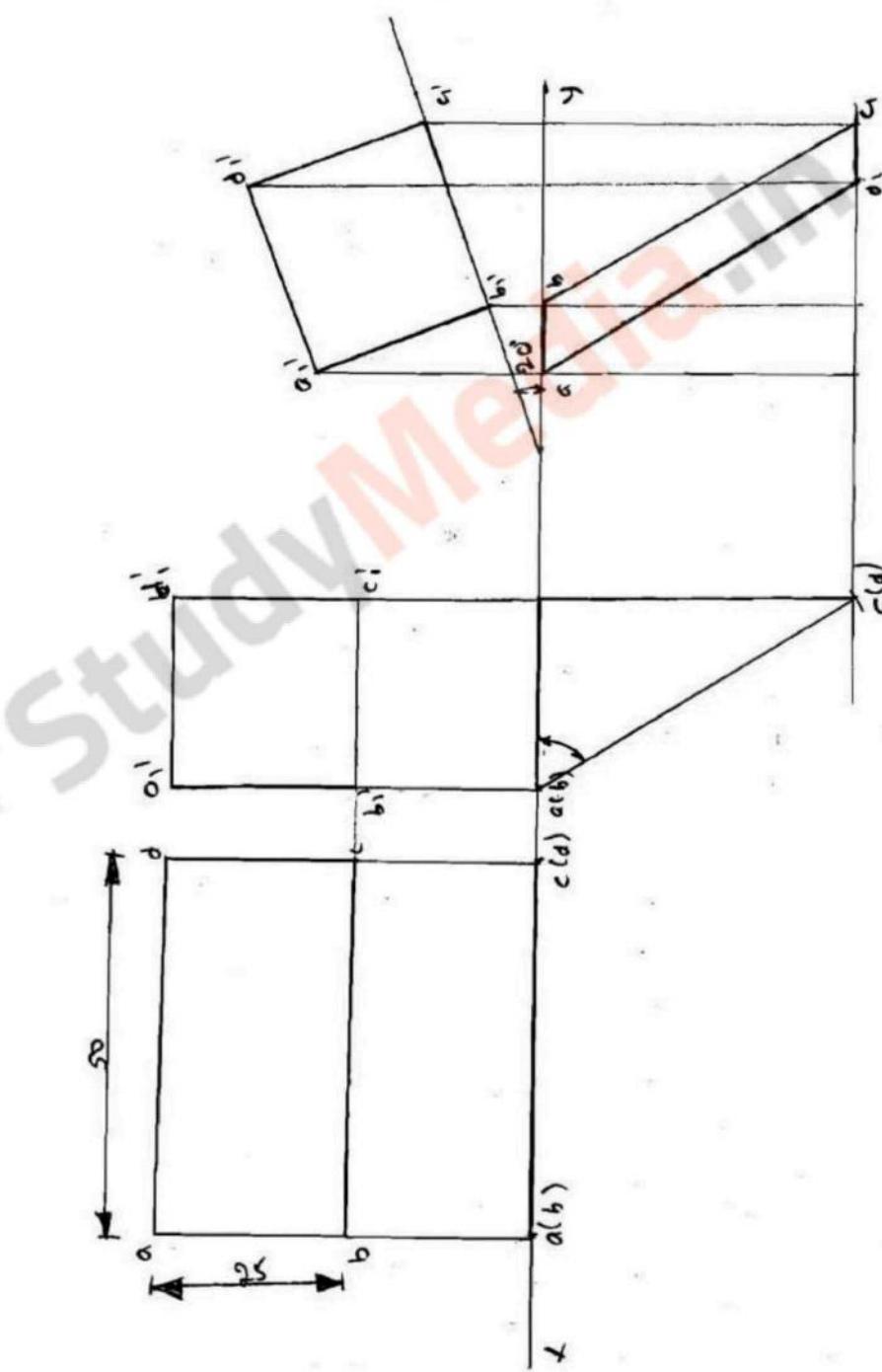
Q: An elevation of a rectangular lamina ABCD at 25mm & 50mm sides of is a square of 25mm when its side AB is in the V.P and the side AD' is making an angle of 30° to the H.P

Rectangular ABCD

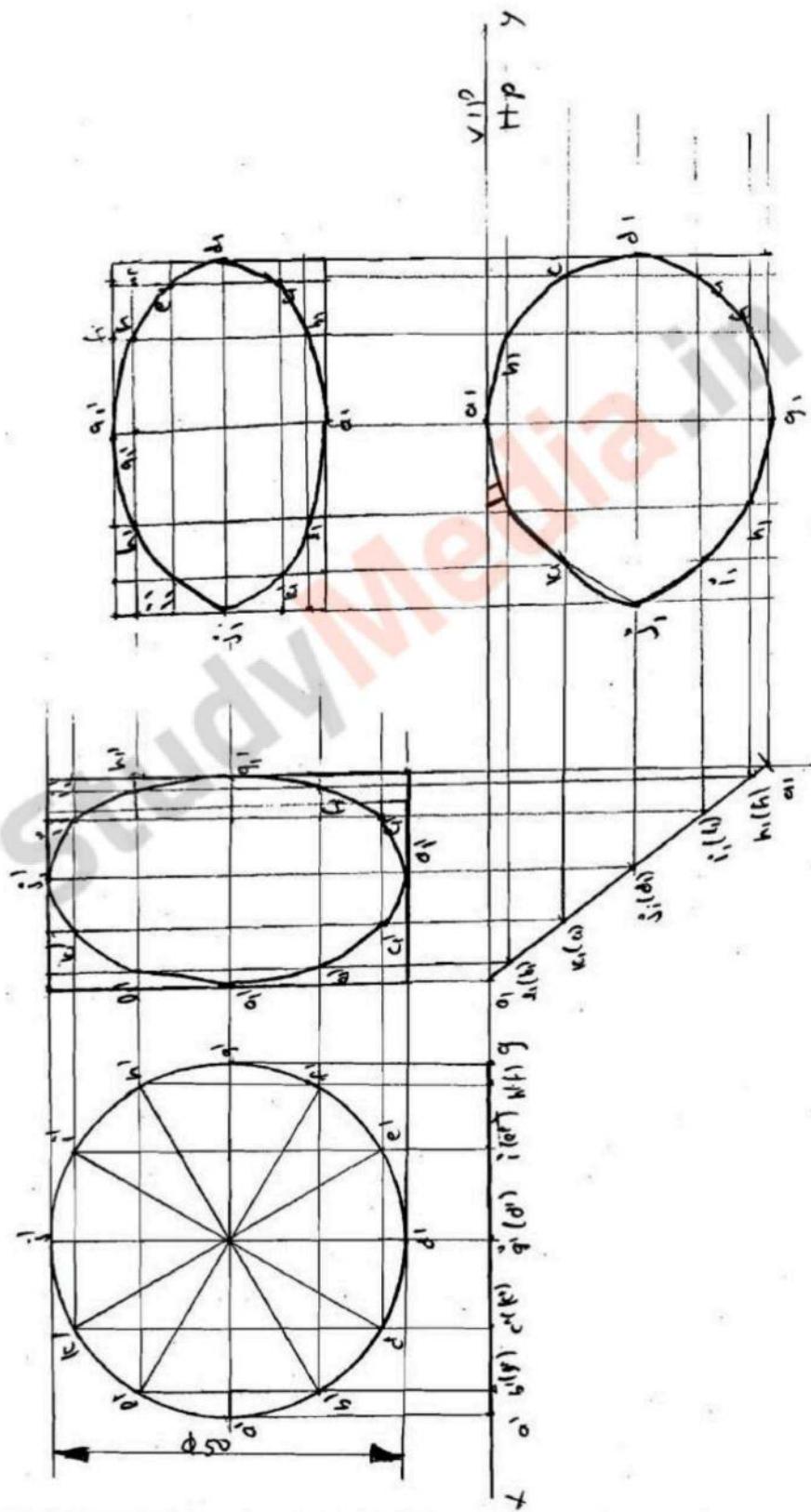
side = 25x50mm

square = 25mm

$\theta = 20^\circ$



- a: A circular plate of negligible thickness and 50mm diameter appears as an ellipse in the frontview, having major axis 50mm and minor axis 30mm long. Draw its Top view when the major axis of the ellipse is horizontal.



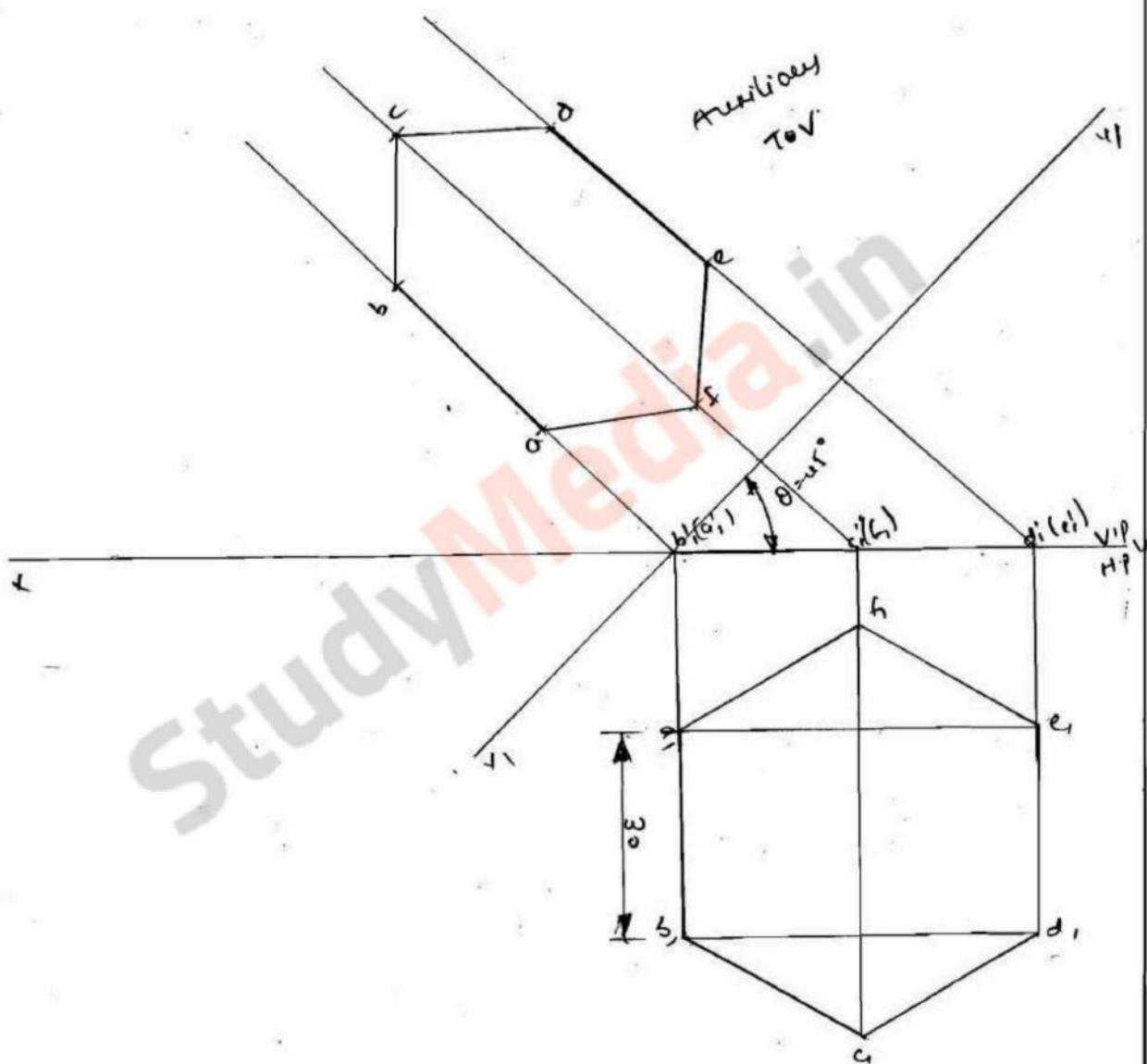
Auxiliary Plane method

1. A hexagonal Plane side 30mm has an edge on H.P. The surface is inclined at 45° to H.P and 60° to V.P. Draw its projections.

Hexagonal Plane.

Side = 30mm

$\theta = 45^\circ$



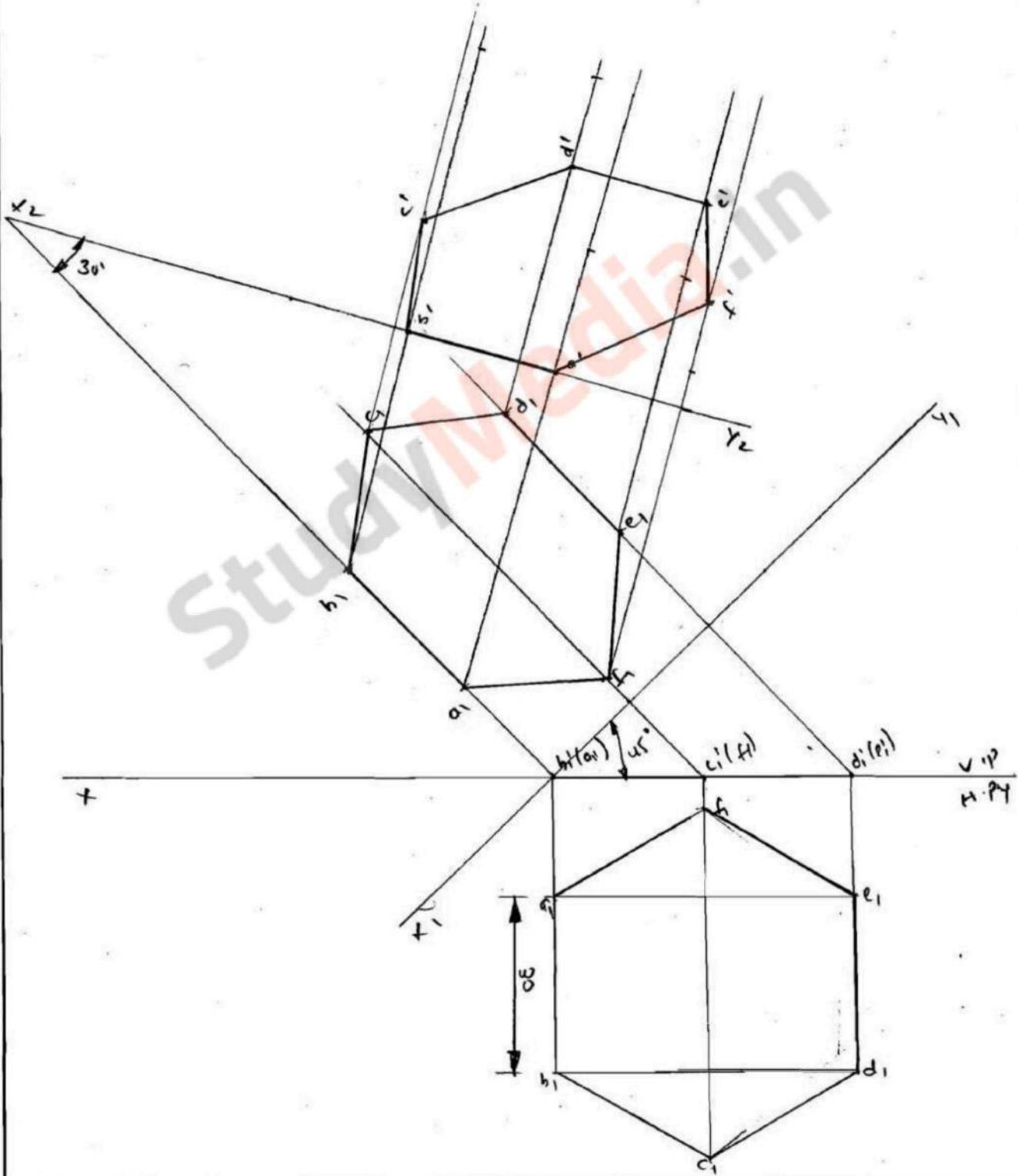
2.

A hexagonal Plane of side 30mm has an edge on the H.P. It's surface is inclined at 45° to H.P and the edge on which the plane rests is inclined at 30° to V.P. Draw its projections.

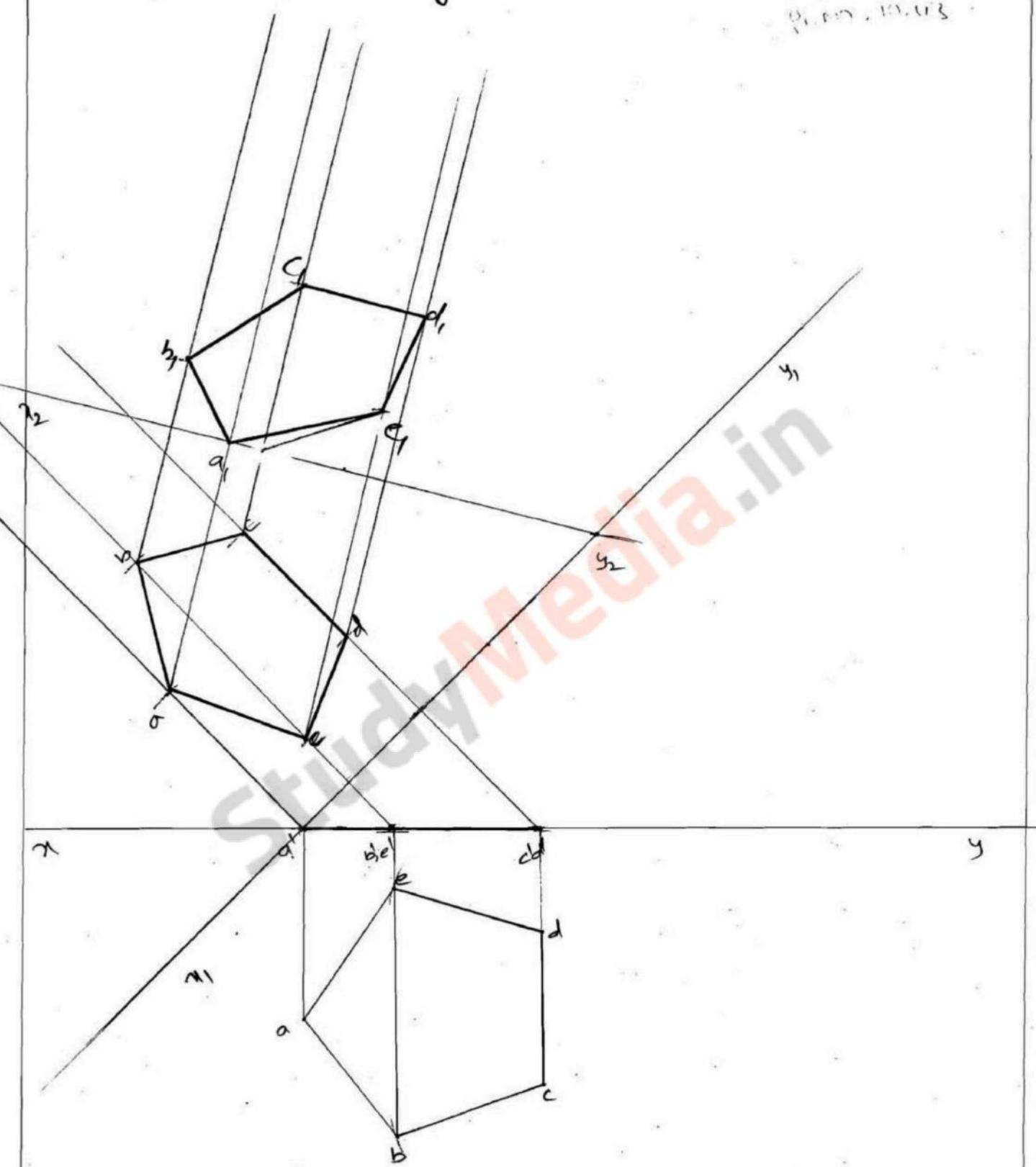
Hexagonal Plane.

Side = 30mm.

$\phi = 30^\circ$, $\theta = 45^\circ$



* Pentagonal Plane Auxiliary Views Inclined both the planes

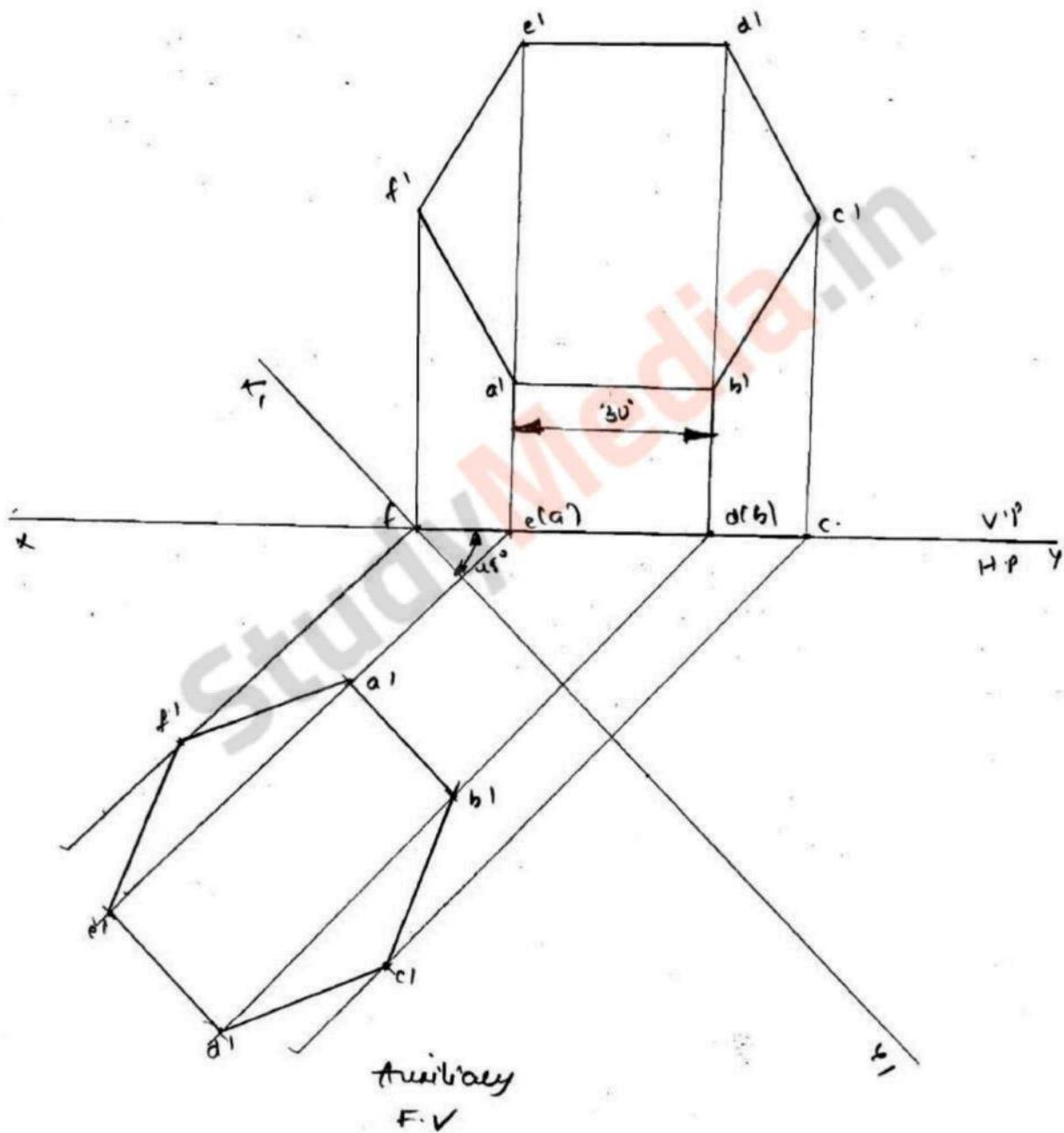


3. A hexagonal plane of side 30mm has a corner in the v.p. The surface of the plane is inclined at 45° to V.P and 45° to H.P. Draw its projections.

Hexagonal Plane

Side = 30mm

$\phi = 45^\circ$



4. A hexagonal plane of side 30mm has a corner in the V.P. The surface of the plane is inclined at 45° to V.P and 60° to H.P. The F.V. of the diagonal passing through that corner is inclined at 60° to H.P. Draw its projections.

Hexagonal plane

$$\theta = 60^\circ$$

Side = 30mm

$$\phi = 45^\circ$$

