Engineering Graphics

Lecture Notes

UNIT-I

Content

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid, Scales – Plain & Diagonal.

Basic Concepts

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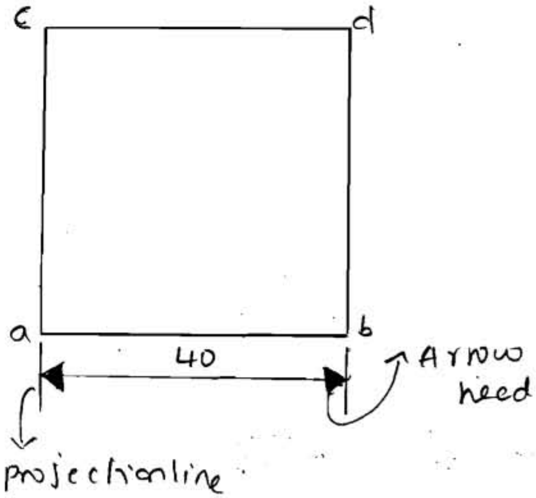
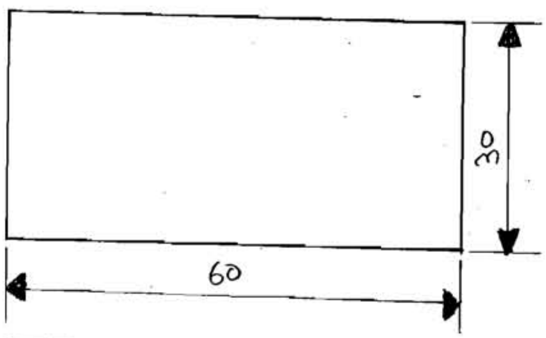
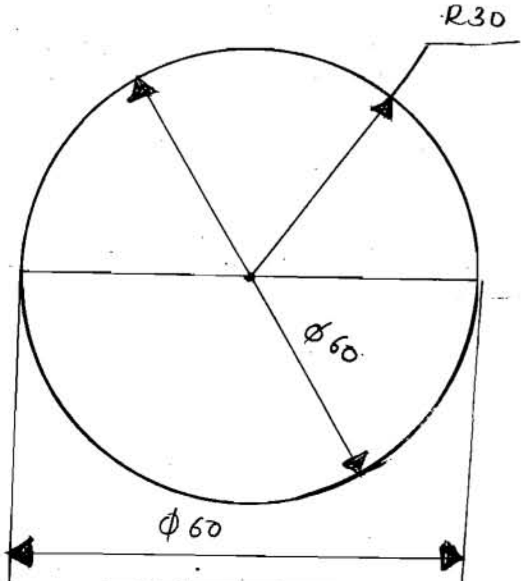


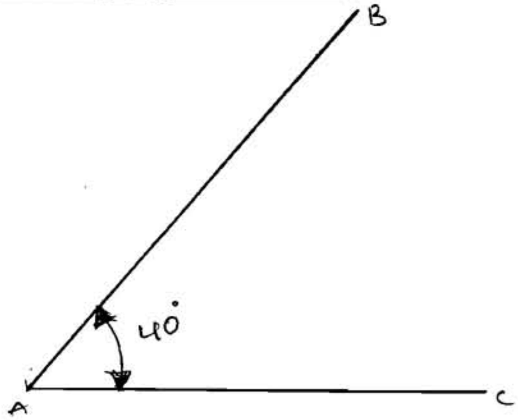
Square.



Rectangle



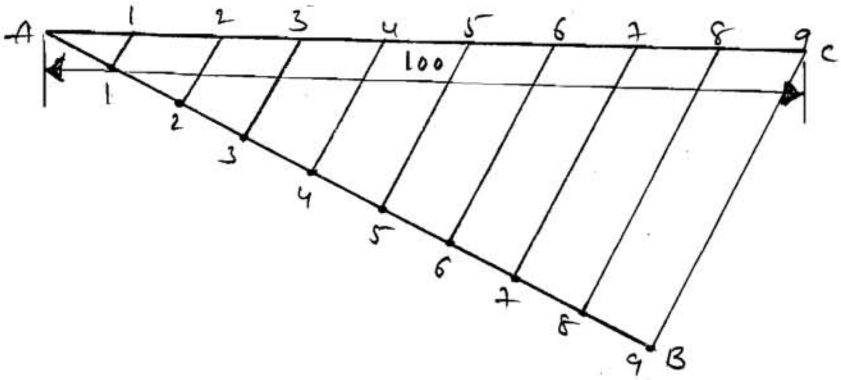
Circle.



Angle

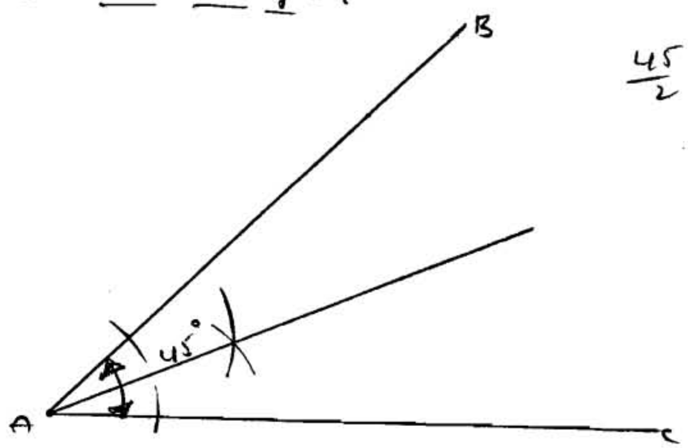
Divide a line into Number of equal parts

$n = 9$

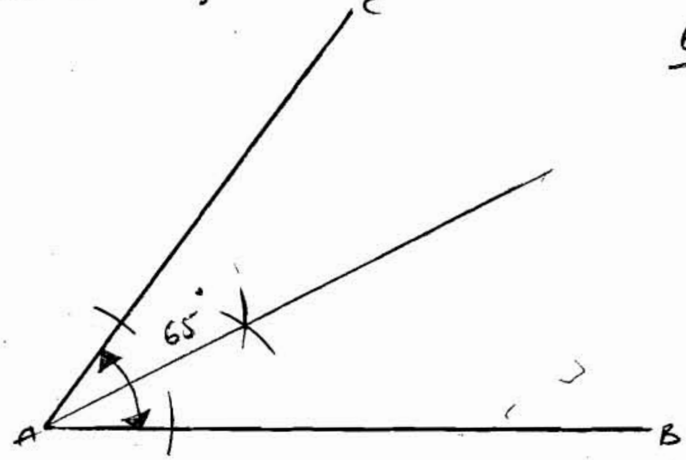


Bisecting an angle :-

$\frac{45}{2} = 22.5$

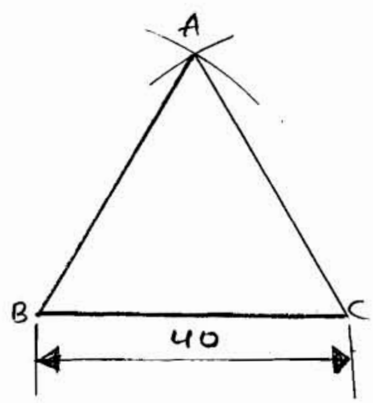


Bisect an angle of 65°



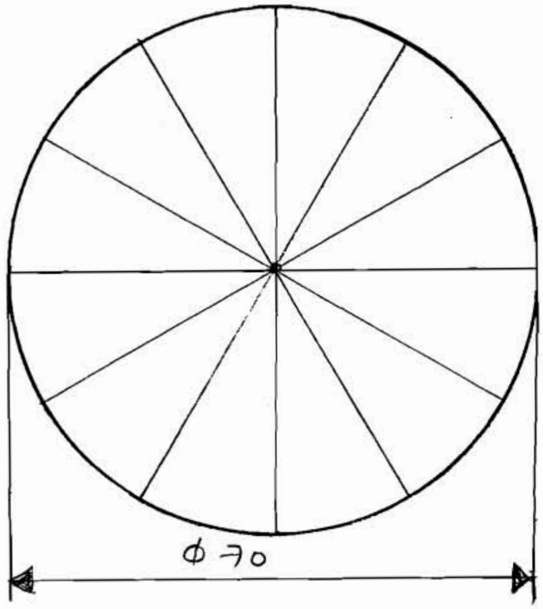
$\frac{65^\circ}{2} = 32.5^\circ$

Construct an equilateral triangle of side 40mm



Divide a circle of diameter 70mm into 12 equal Parts

n = 12 equal parts

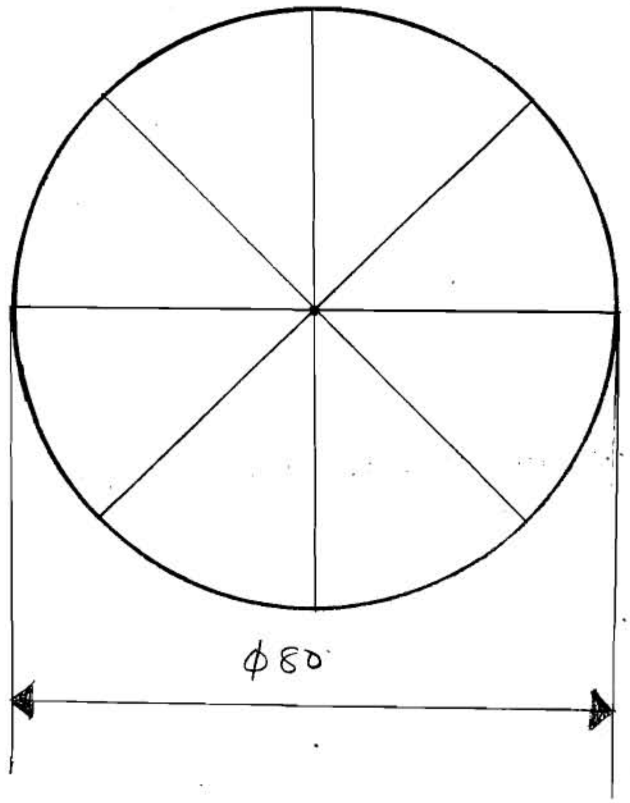


$\frac{360^\circ}{12} = 30^\circ$

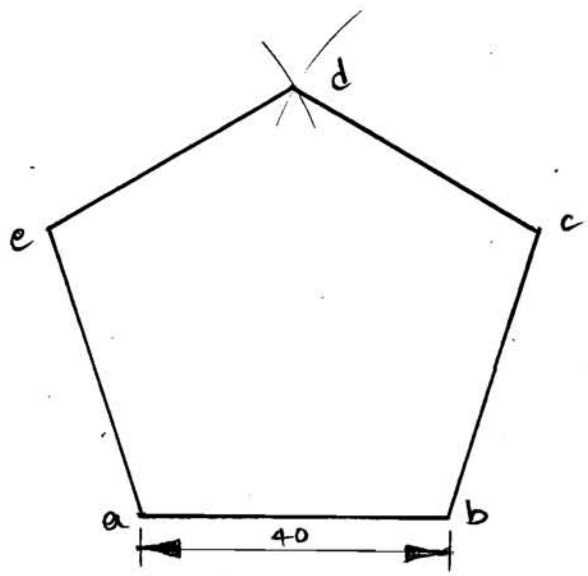
Divide a circle of diameter 80mm into 8 equal parts.

n = 8 equal parts

$$\frac{360^\circ}{8} = 45^\circ$$

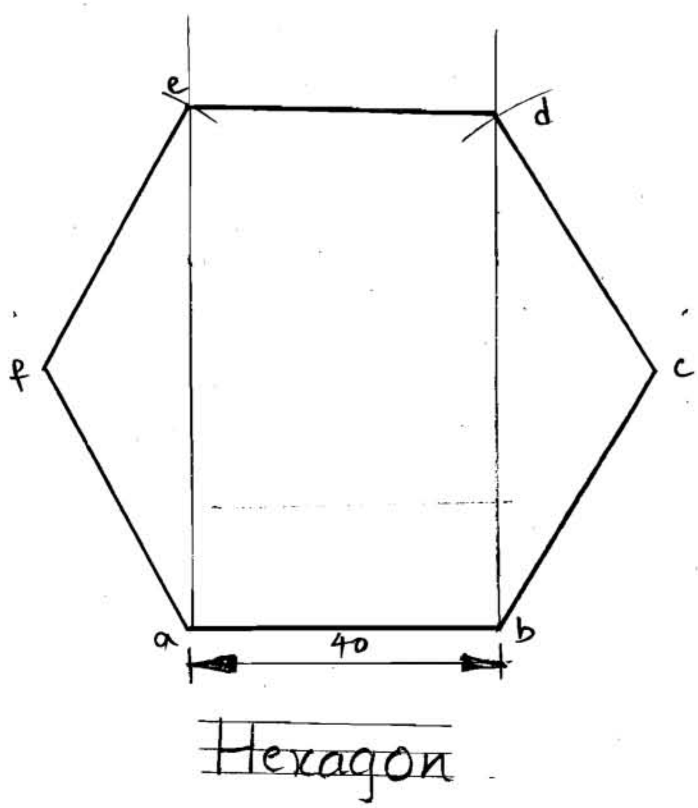


Construct a Pentagon of side 40mm



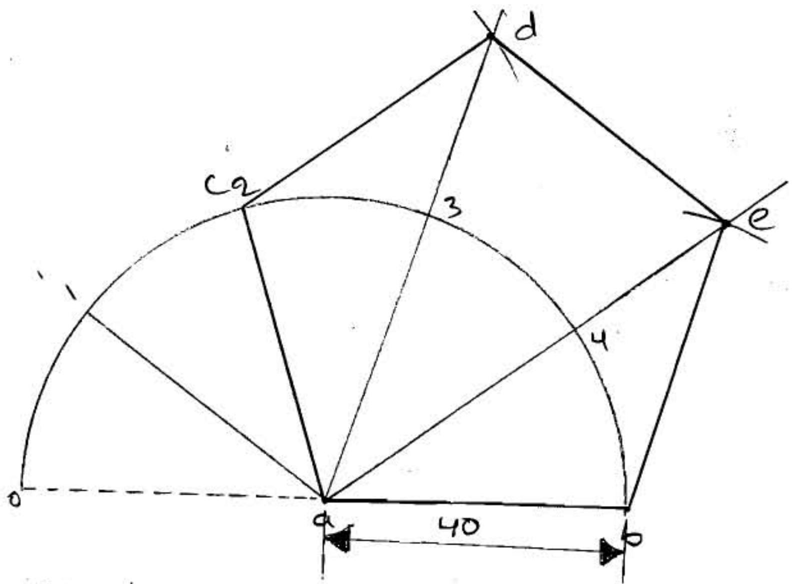
Pentagon

construct a Hexagon of side 40mm

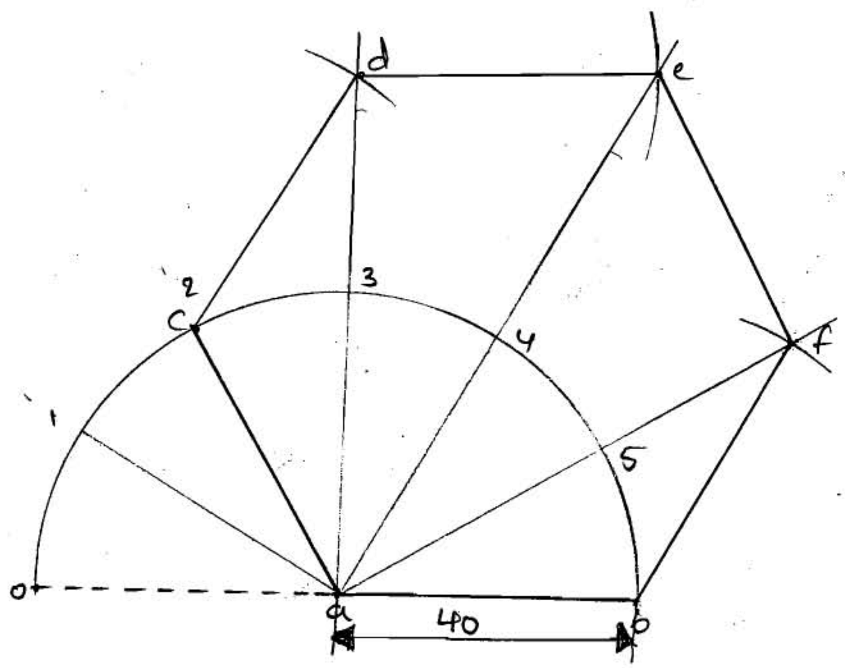


Hexagon

Draw a regular Pentagon and regular Hexagon having 40mm side Length

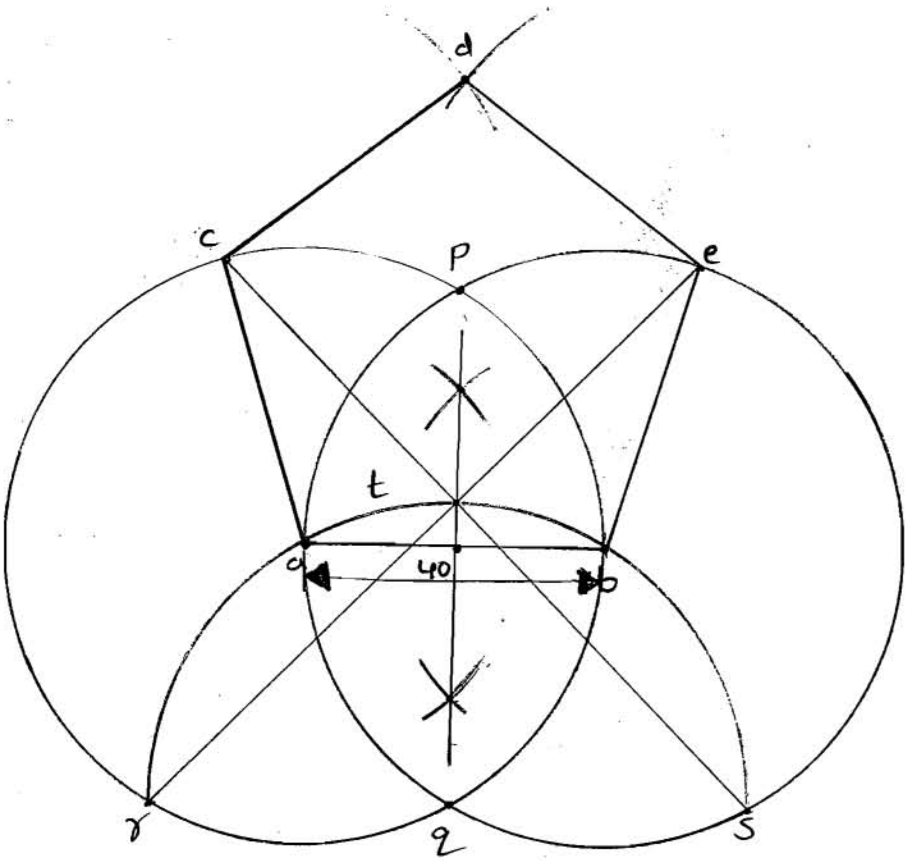


Pentagon

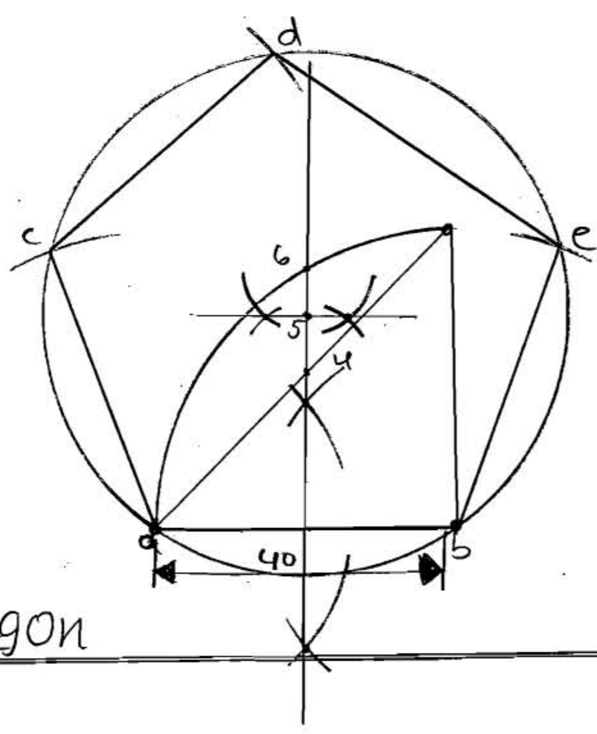


Hexagon.

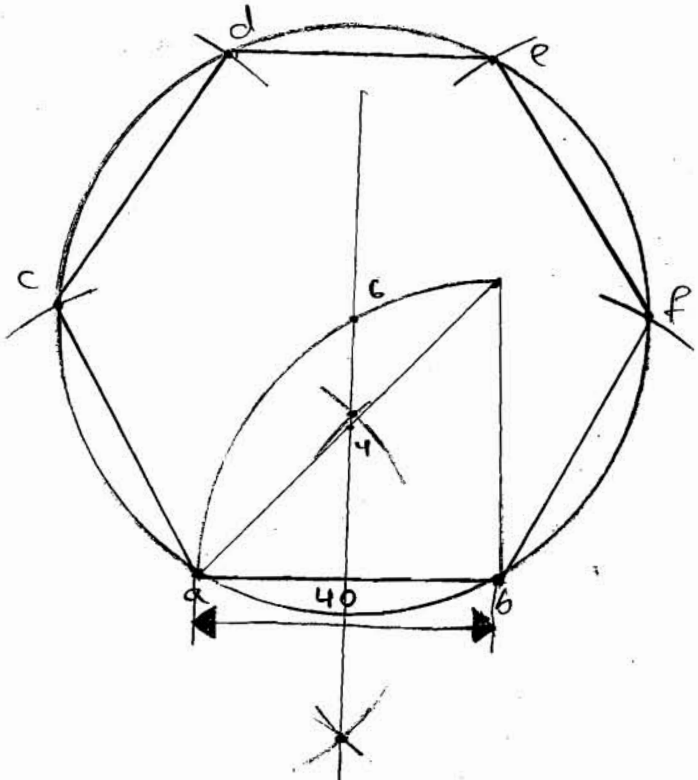
Q:- Draw a regular Pentagon of side 40mm by using arcs of circle method



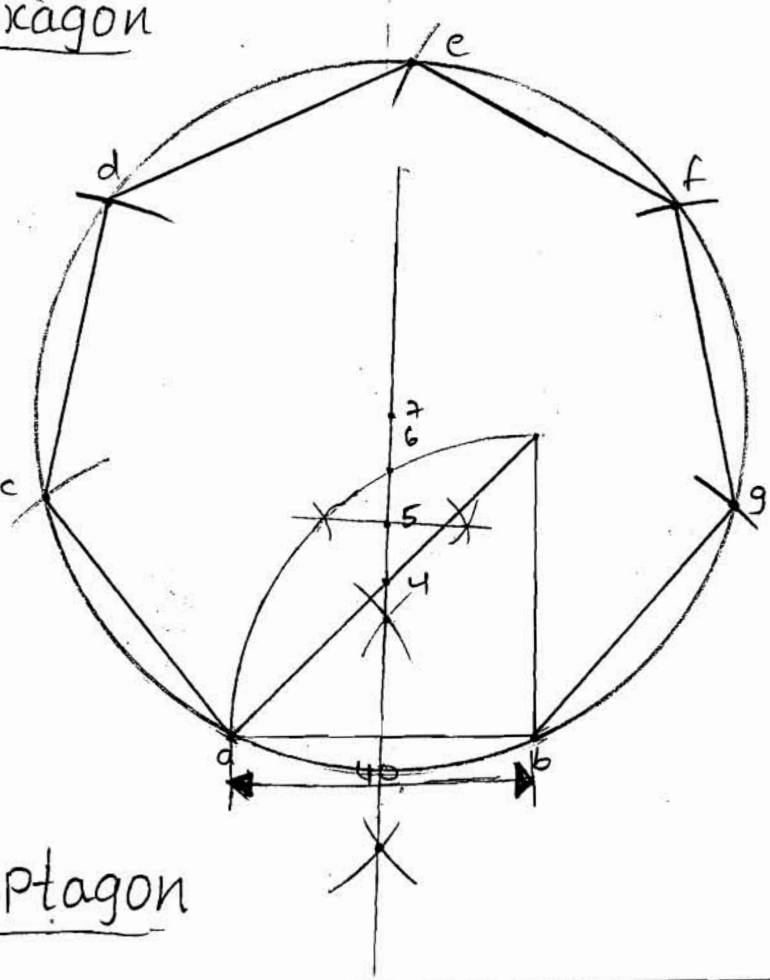
⇒ Special method of construction of any Polygon.



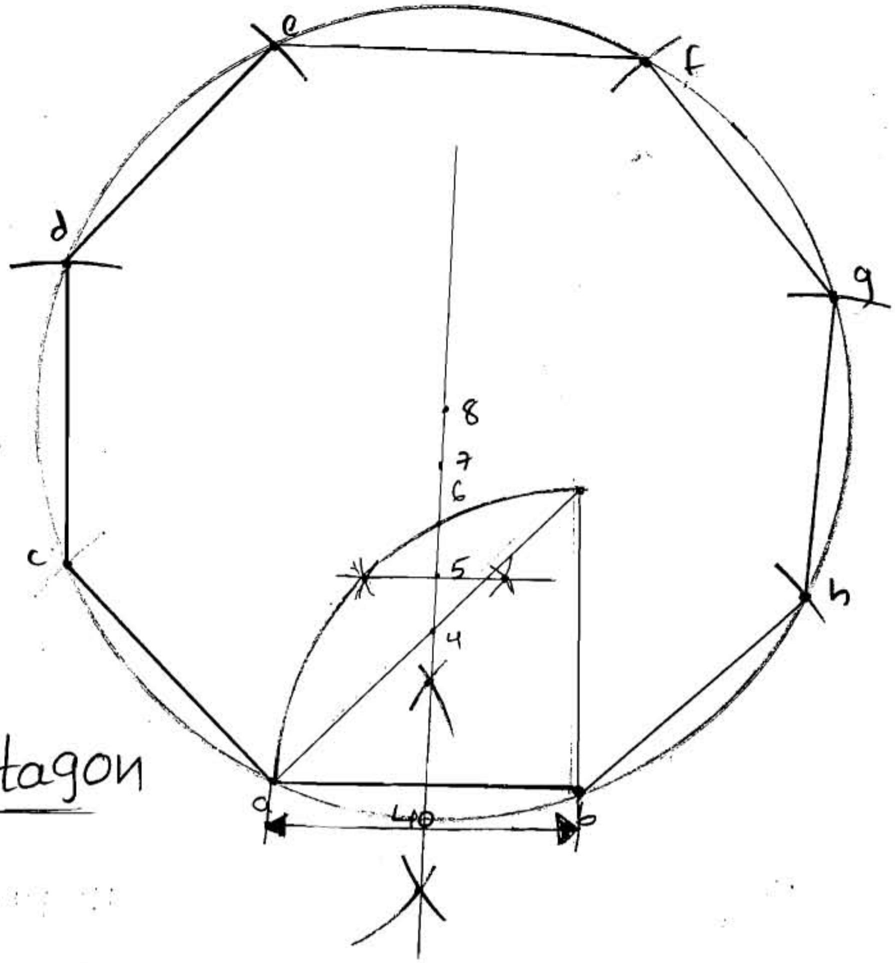
Pentagon



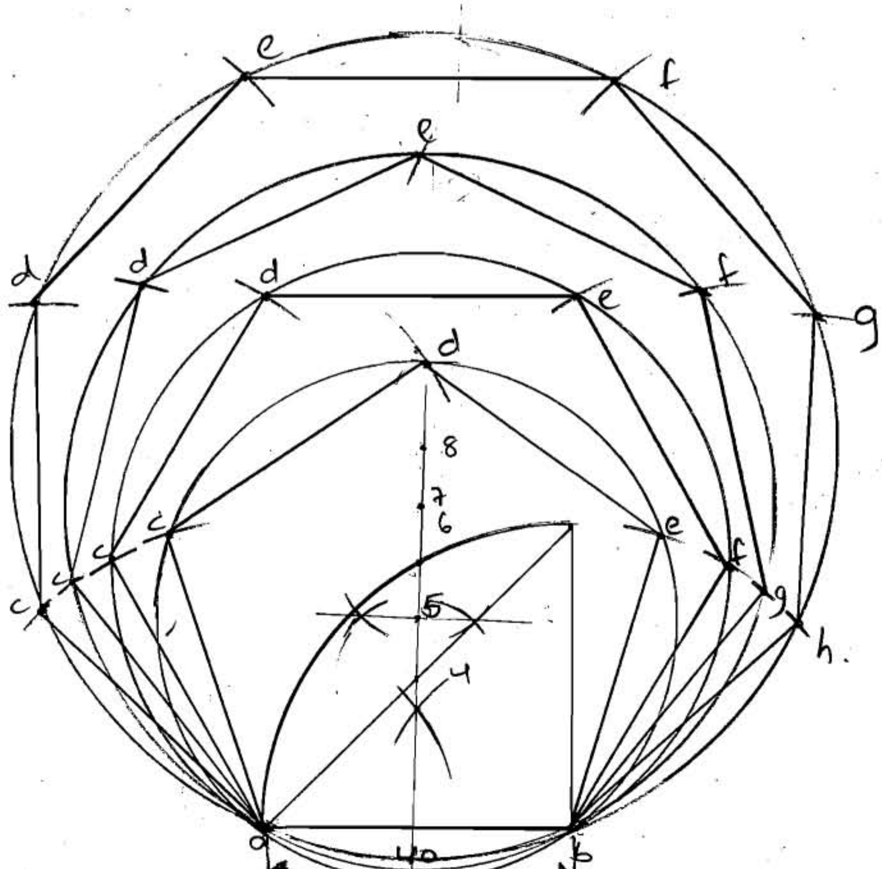
Hexagon



Septagon



Octagon



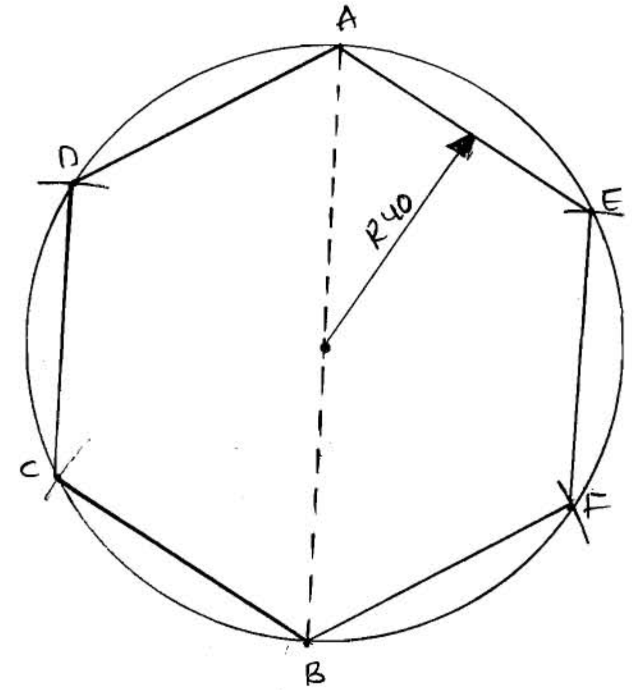
Polygon

Construct a Hexagon of side 40mm

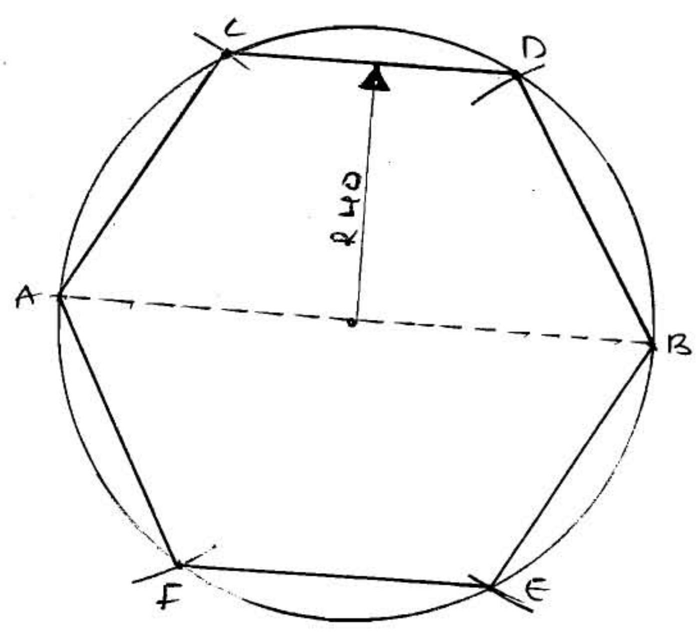
a) Side is vertical.

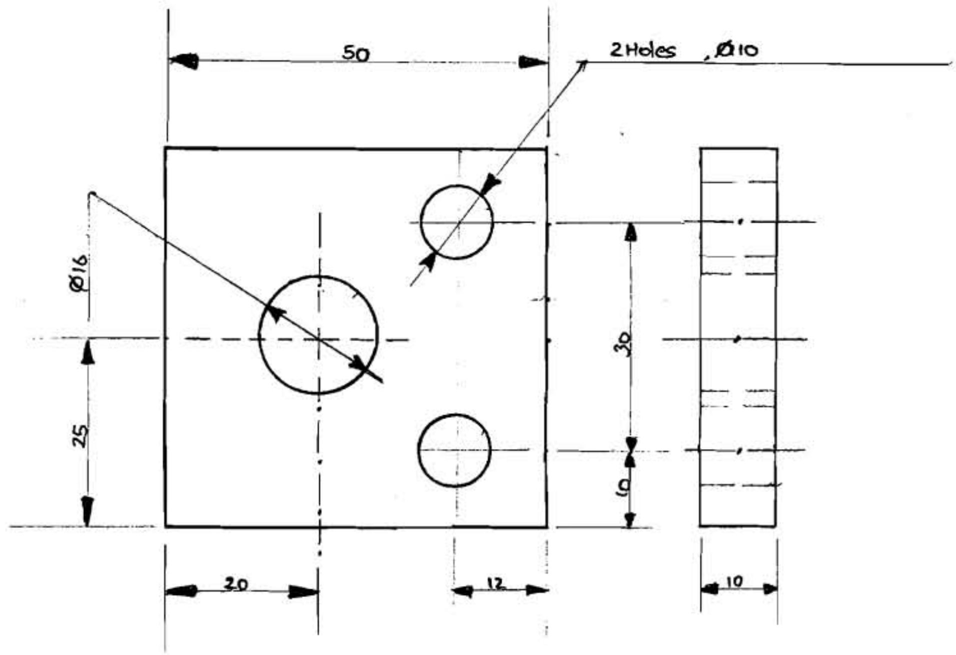
b) side is Horizontal.

a)

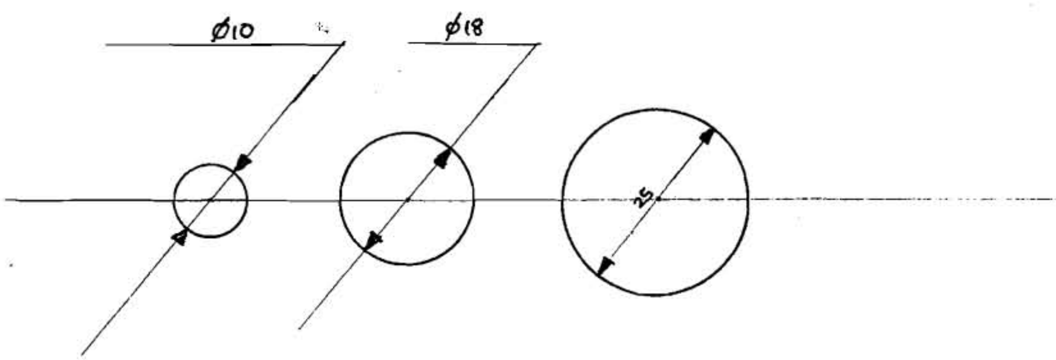


b)

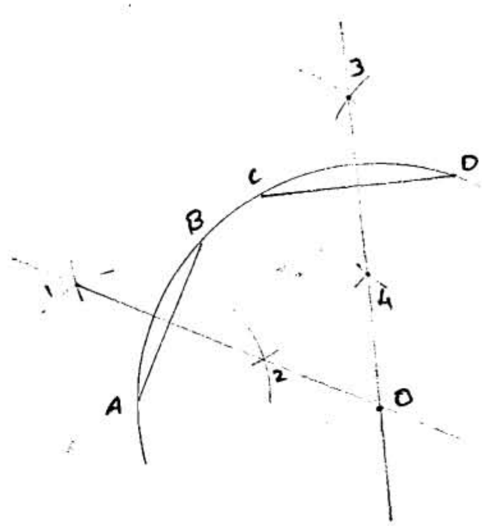




50
2 Holes ,Ø10
Ø16
30
25
10
20
12
10



Ø10
Ø18
25

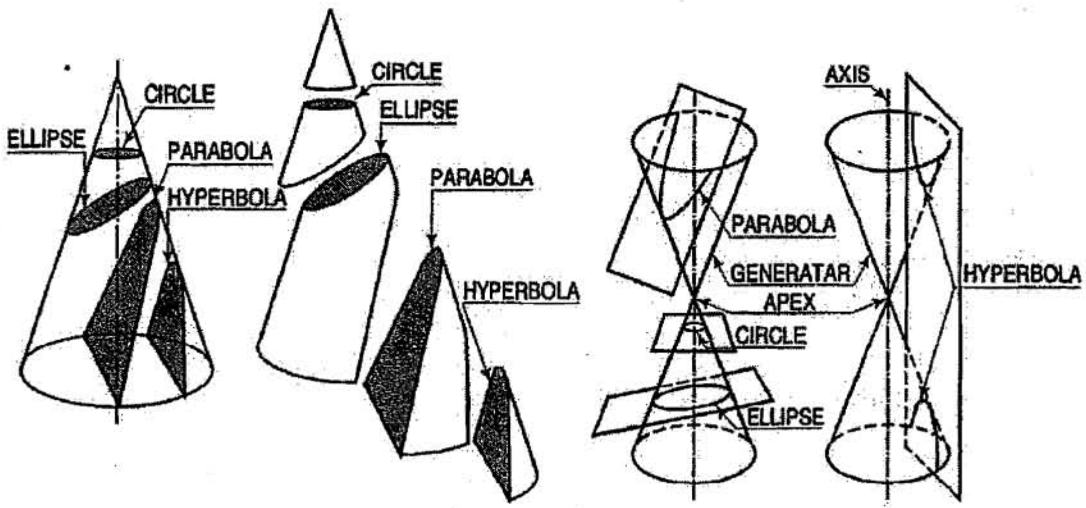


3
C
D
B
1
4
2
O
A

Unit-I

Conic Sections:

The section obtained by the intersection of a right circular cone by a plane in different positions relative to the axis of the cone are called conics.



Conic sections

(i) When the section plane is inclined to the axis and cuts all the generators onone side of the apex, the section is an ellipse

(ii) When the section plane is inclined to the axis and is parallel to one of thegenerators, the section is a parabola

(iii) A hyperbola is a plane curve having two separate parts or branches, formedwhen two cones that point towards one another are intersected by a planethat is parallel to the axes of the cones.

The conic may be defined as the locus of a point moving in a plane in such a waythat the ratio of its distances from a fixed point and a fixed straight line is alwaysconstant. The fixed point is called the focus and the fixed line, the directrix.

The ratio $\frac{\text{distance of the point from the focus}}{\text{distance of the point from the directrix}}$ is called eccentricity and isdenoted by e. It is always less than 1 for ellipse, equal to 1 for parabola and greaterthan 1 for hyperbola i.e.

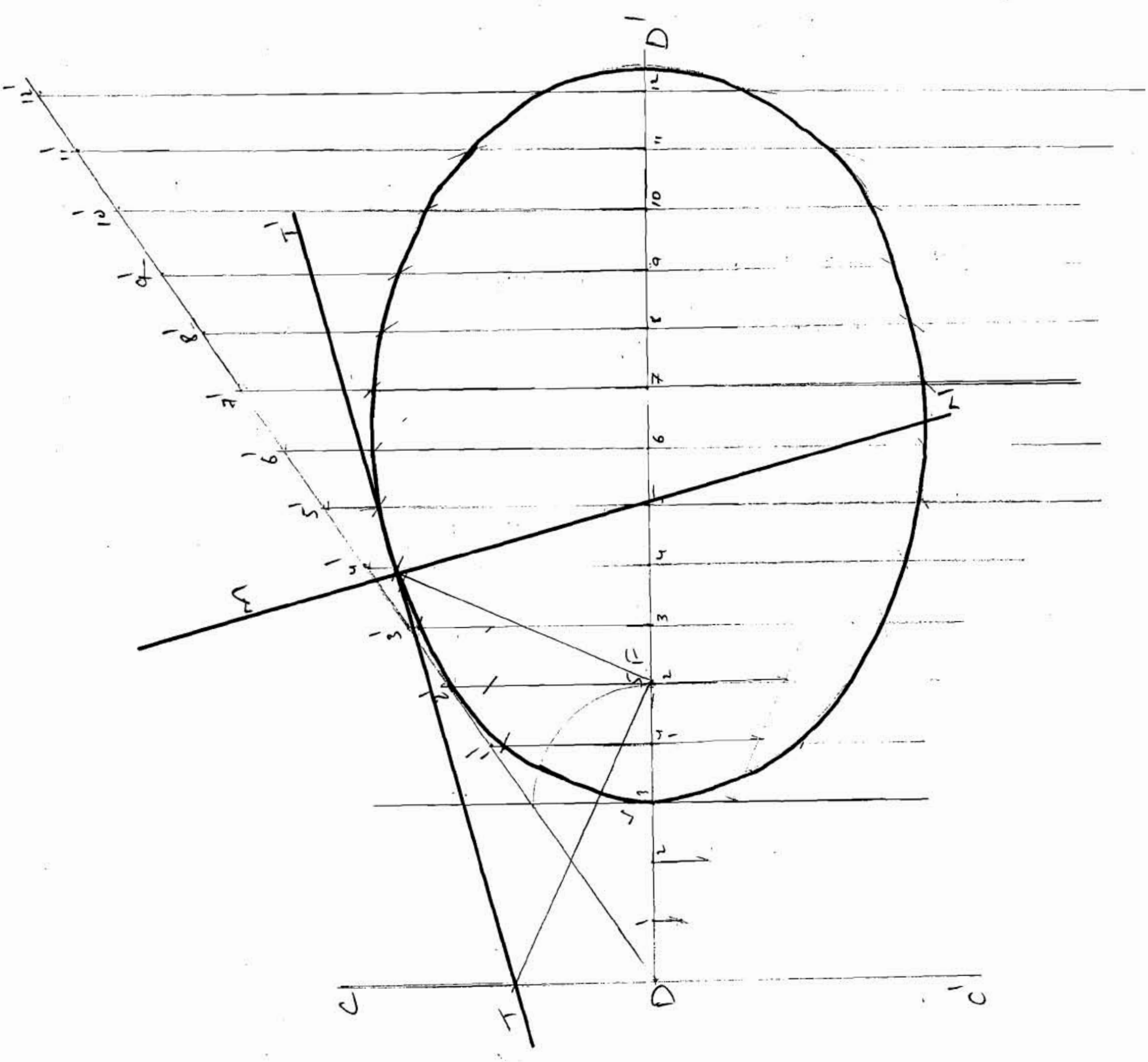
(i) ellipse :$e < 1$

(ii) parabola : $e = 1$

(iii) hyperbola : $e > 1$.

The line passing through the focus and perpendicular to the directrix is calledthe axis. The point at which the conic cuts its axis is called the vertex.

Draw a ellipse when the distance of its focus from its directrix is 50mm and eccentricity is 2/3 also, draw a tangent and a normal to the ellipse at point 70mm away from directrix.

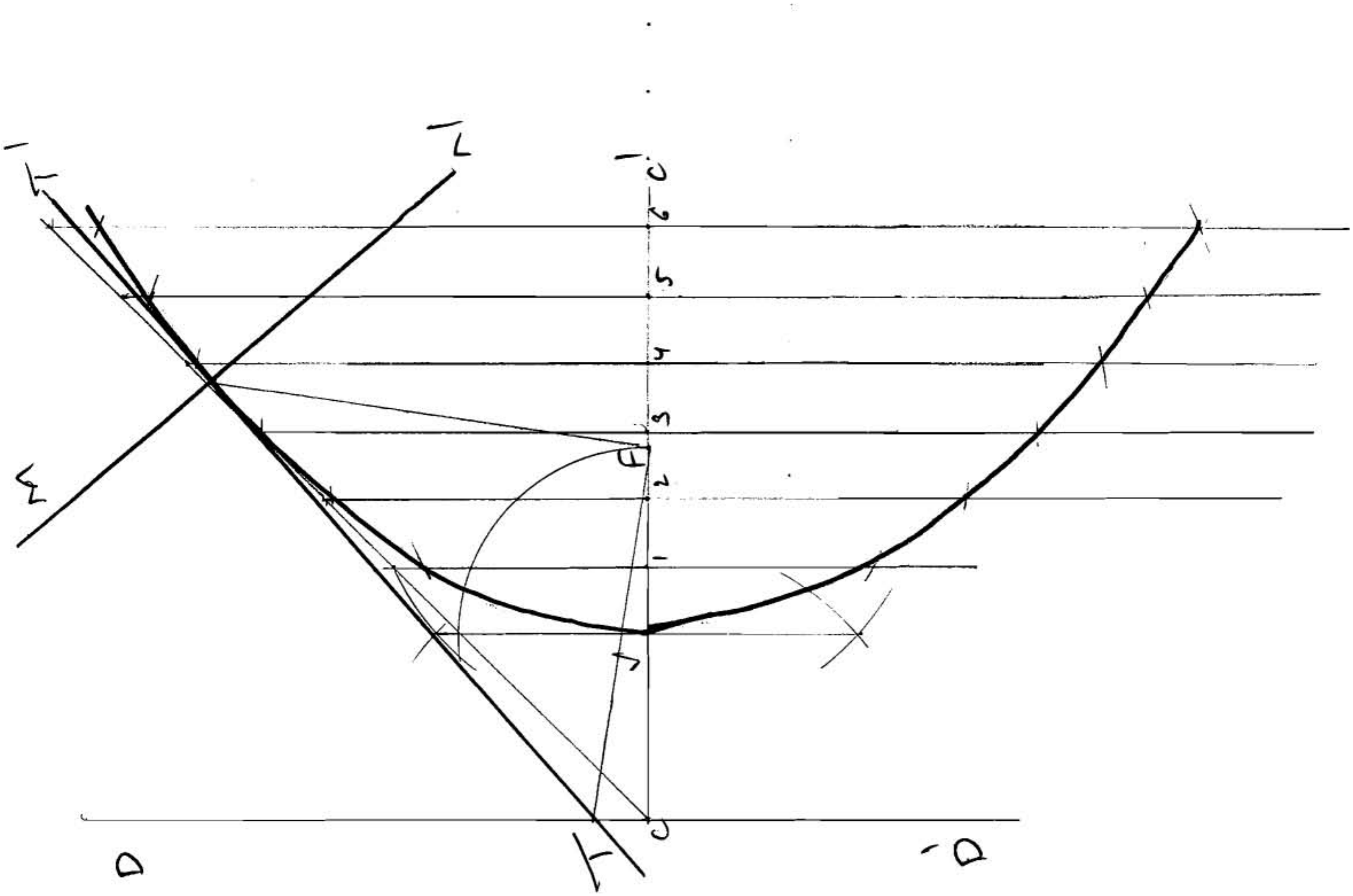


1. Draw focus F on axis AB such that AF = 50mm.
2. Divide AF in 5 equal parts. mark vertex V_1 on 3rd division from A. and Draw vertical line V_1E equal to V_1F. Join A to E and produce it to some distance.
3. Mark a point 1 anywhere on line AB (less than 1cm). Draw a perpendicular line through 1 and meet AE produced at point 1'.
4. with centre F and radius 1-1', draw arcs to intersect the perpendicular line 1-1' at points P_1 and P_1'. These are the loci points of ellipse
5. similarly, mark other point. These gives some more loci points of ellipse like; P_2 and P_2', P_3 and P_3', P_4 and P_4', etc.
6. Join all the loci points of ellipse and obtain the required ellipse. and the required ellipse

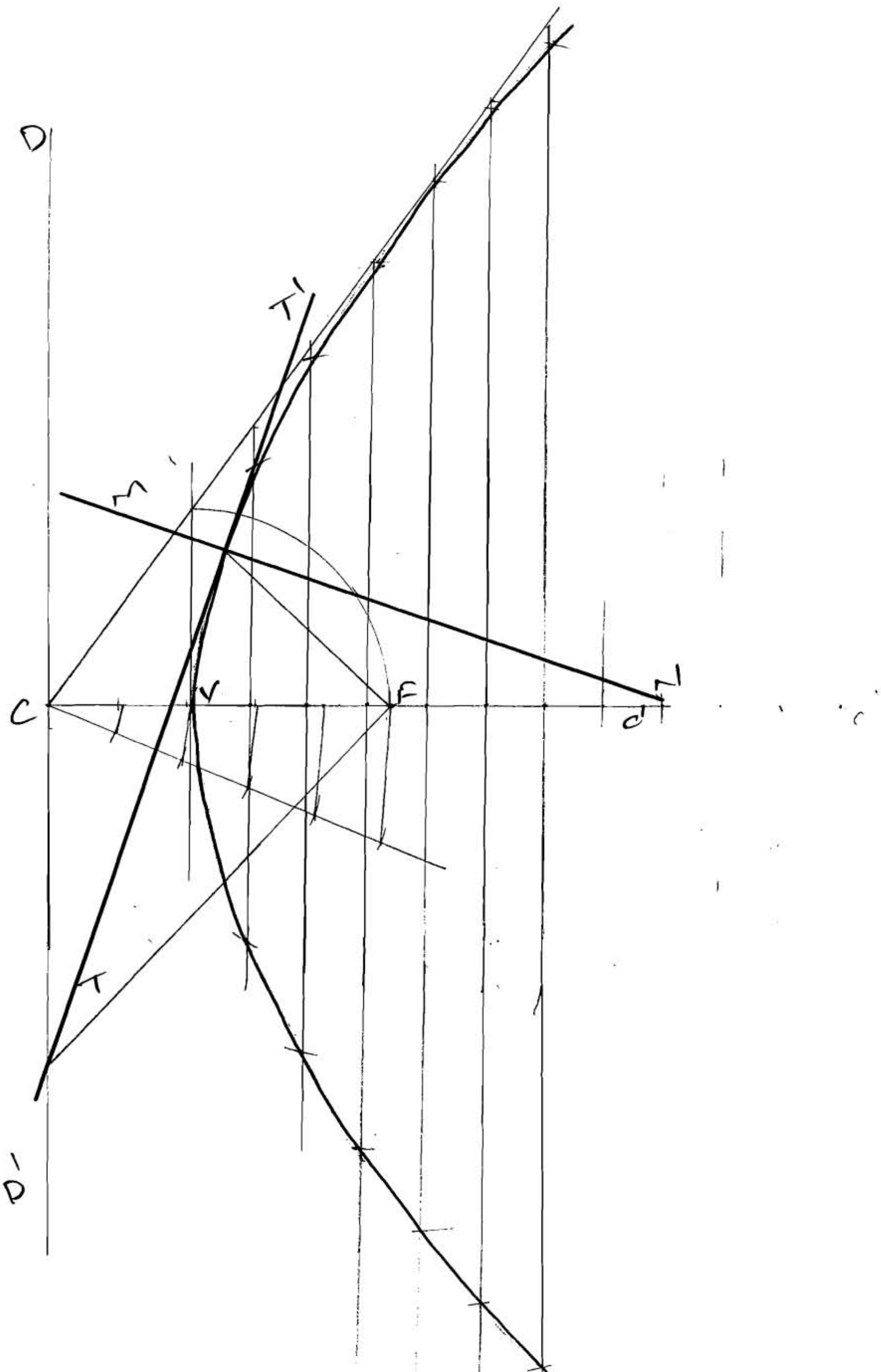
Tangent and normal to an ellipse.

1. Mark a point P on ellipse at 70mm from directrix and join PF.
2. Draw a line FT perpendicular to line PF to meet directrix DD' at point T.
3. Join TP and produce to some point T'. The line TT' is required tangent.
4. Through point P, draw a line NN' perpendicular to TT'. The line NN' is the required normal.

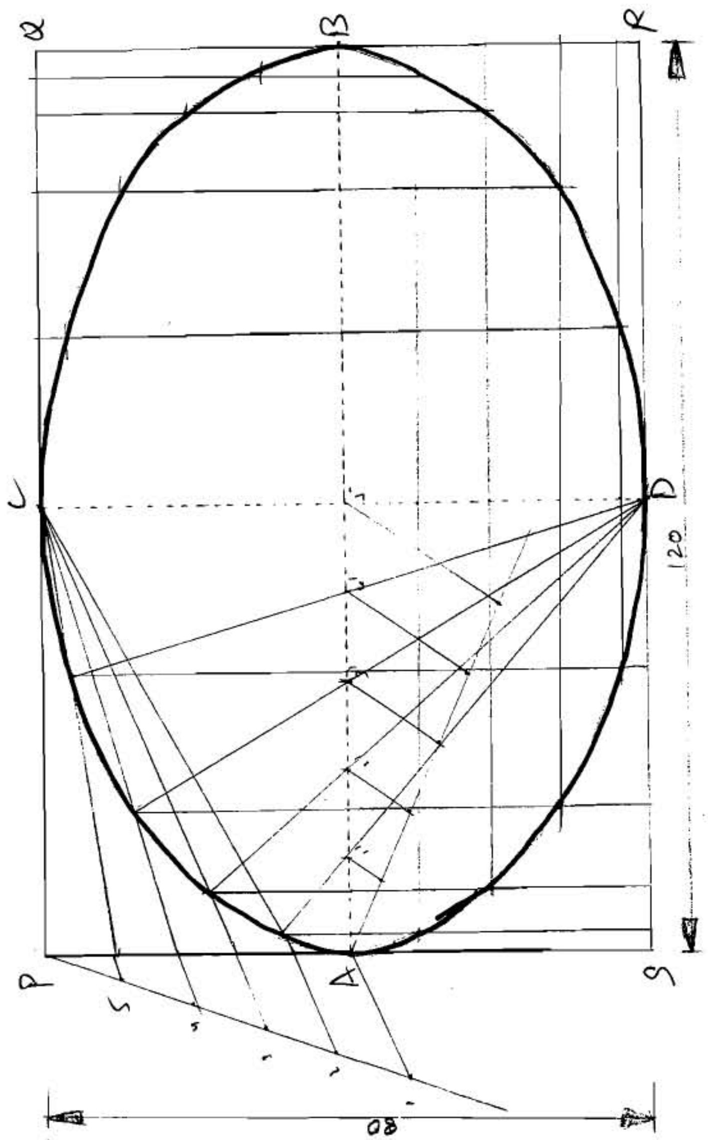
Draw parabola when the distance between its focus and directrix is 55 mm also a tangent and a normal at a point 65mm from directrix.



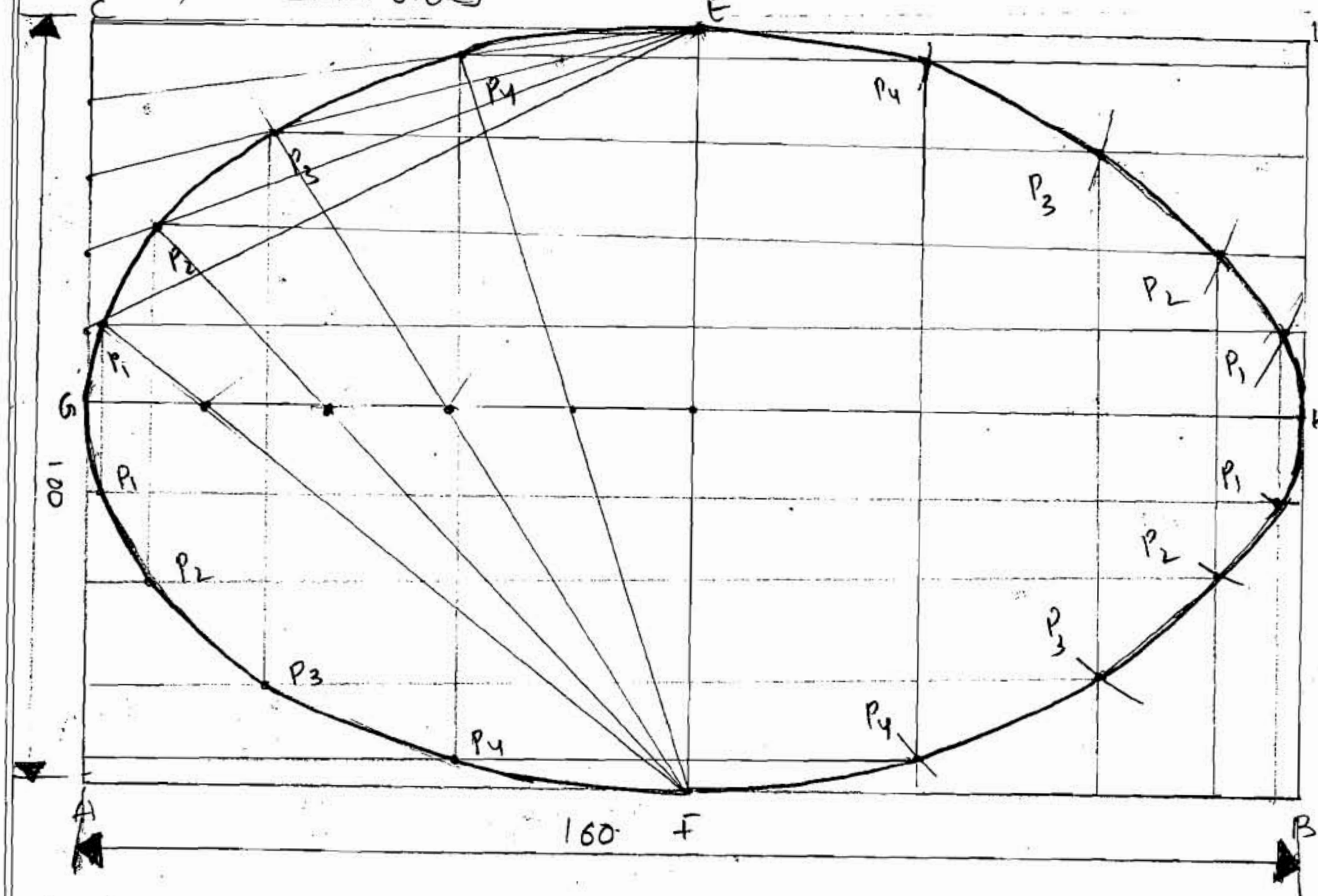
Draw a hyperbola when the distance of its focus from its directrix is 58mm and eccentricity is 3/2 also draw a tangent and a normal to the hyperbola at a point 30mm from the directrix.



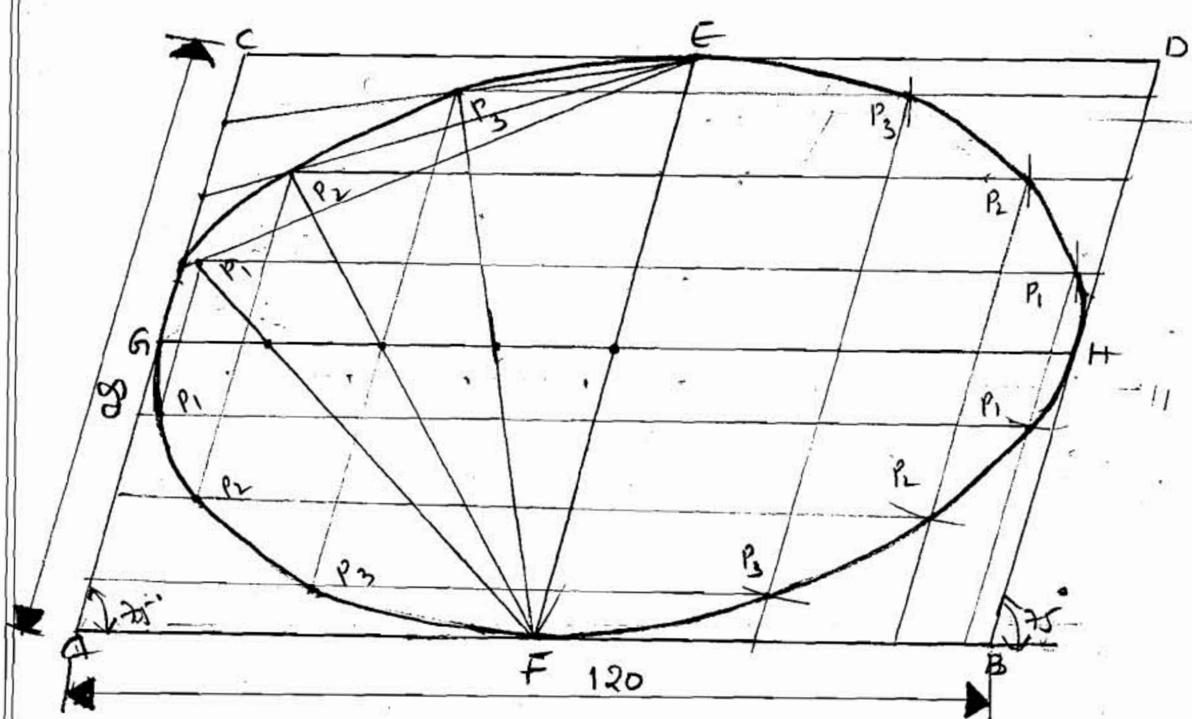
Draw an ellipse having 120mm long major axis and 80mm minor axis.



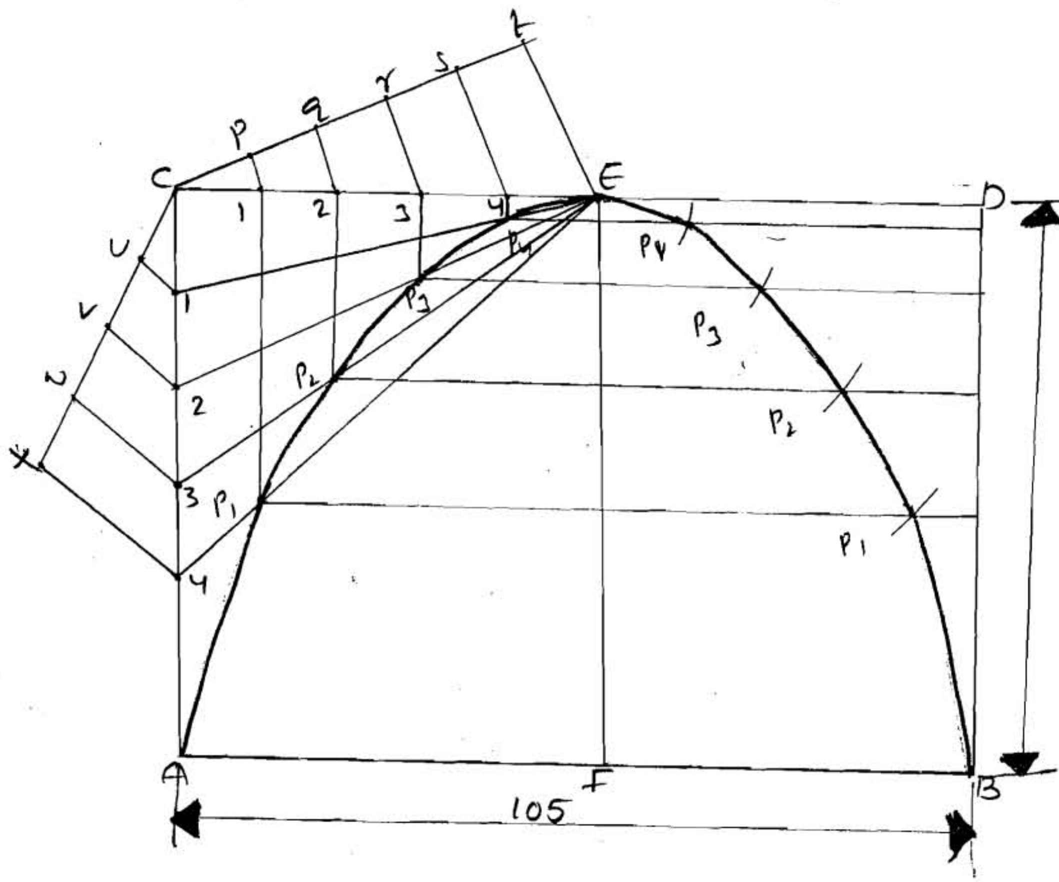
Q:- Inscribe the Largest Possible ellipse in a rectangle with 160mm x 100mm sides



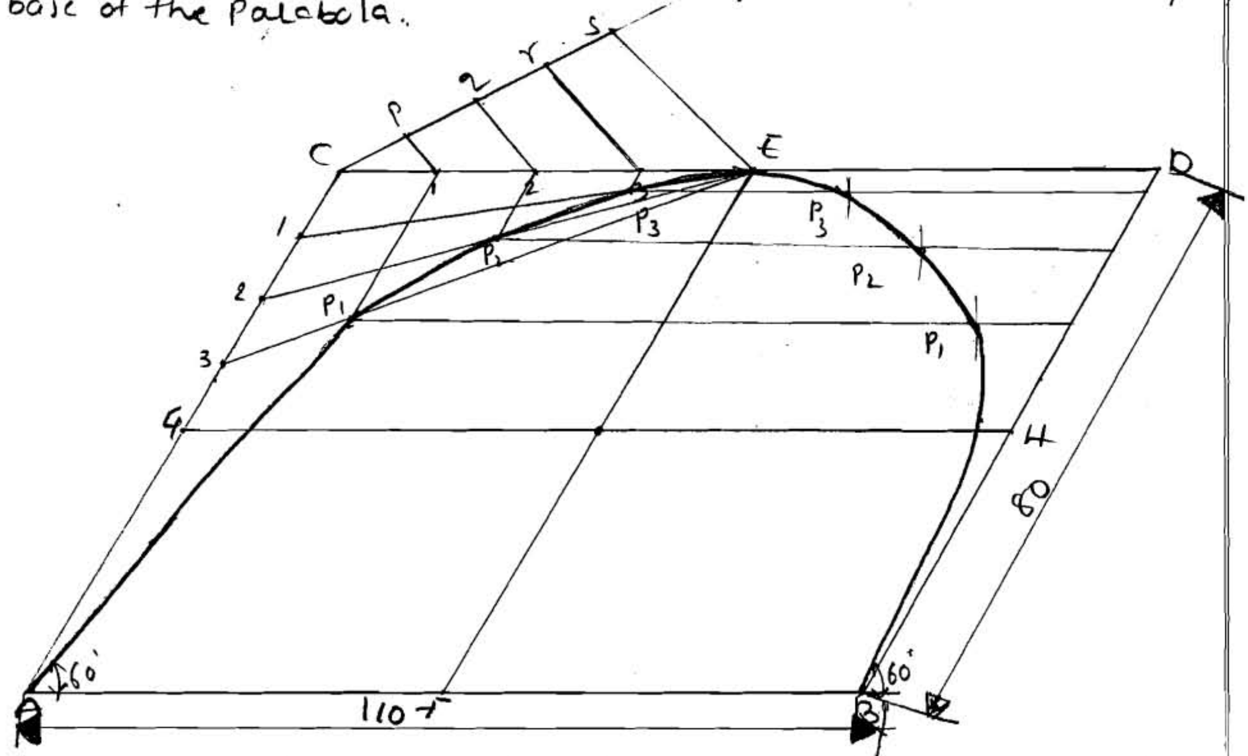
Q: The sides of a Parallelogram are 120mm x 80mm. The Included angle between them is 75°. Inscribe an ellipse. In the given llgram



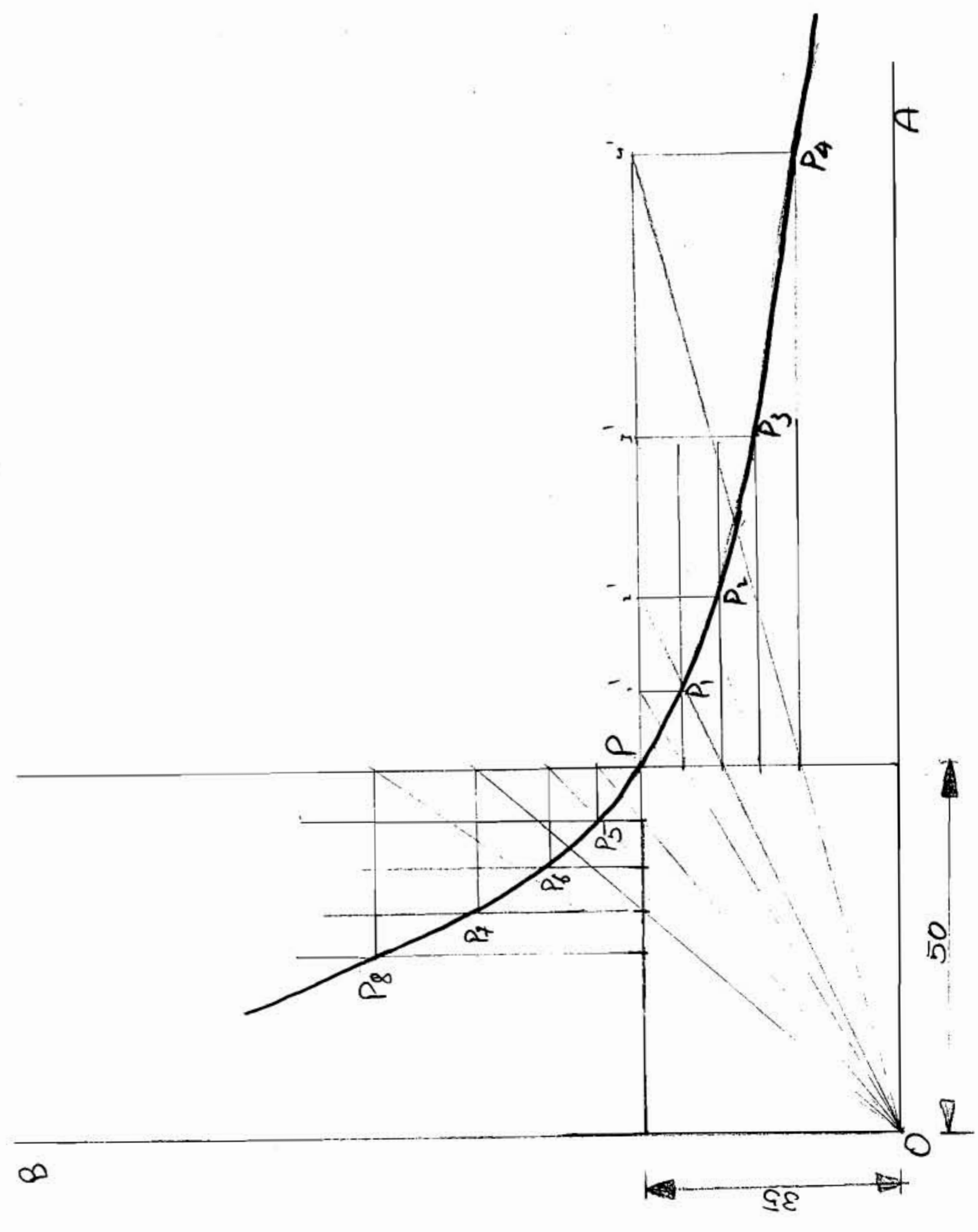
Q: Draw a parabola given the width and height of its enclosing rectangle as 105mm x 75mm respectively.



Q: Inscribe a parabola in a parallelogram of 110 x 80mm sides, The Included angle being 60°. consider the longer side of the parallelogram as base of the Parabola.

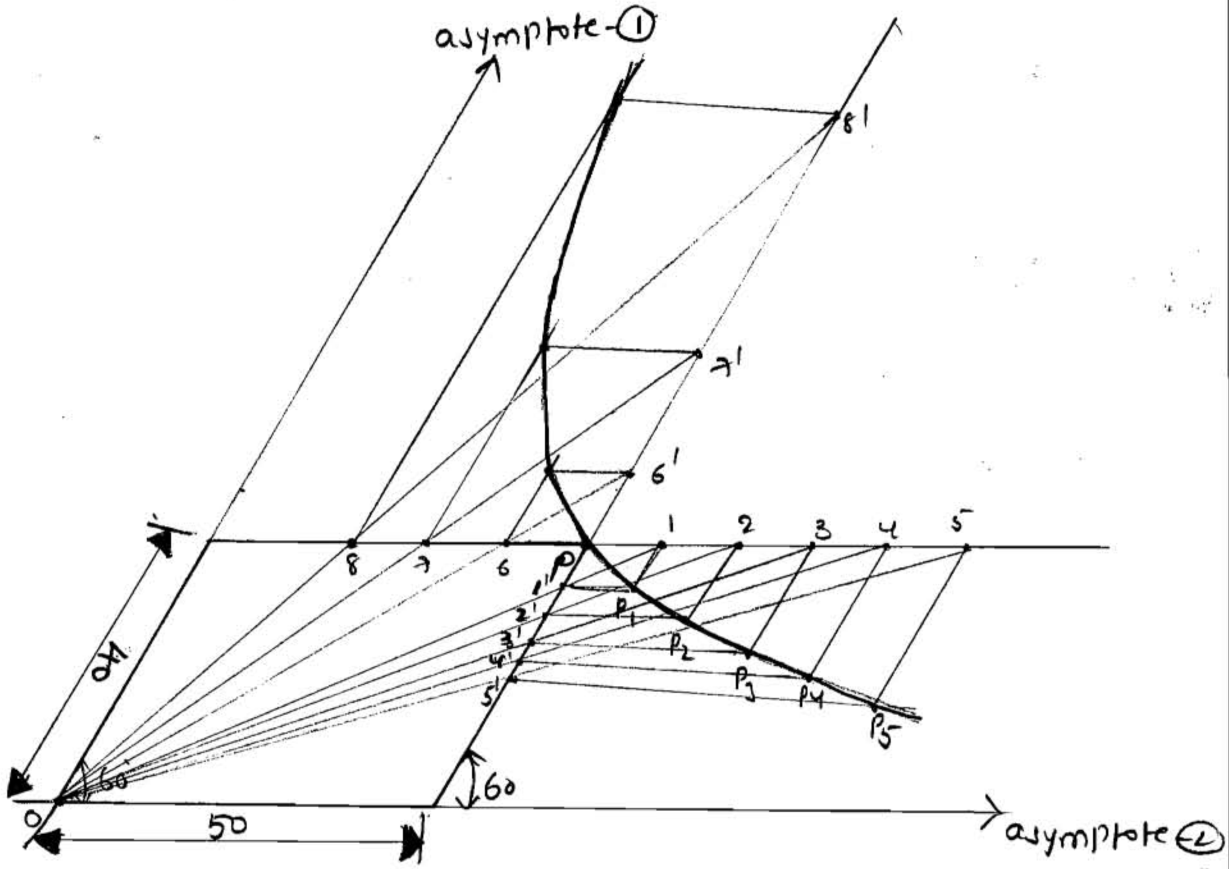


A point P of the hyperbola is situated at a distance of 35mm and 50mm from the pair of asymtodes. The asymtodes are perpendicular to each other. Draw hyperbola using orthogonal asymtodes method.



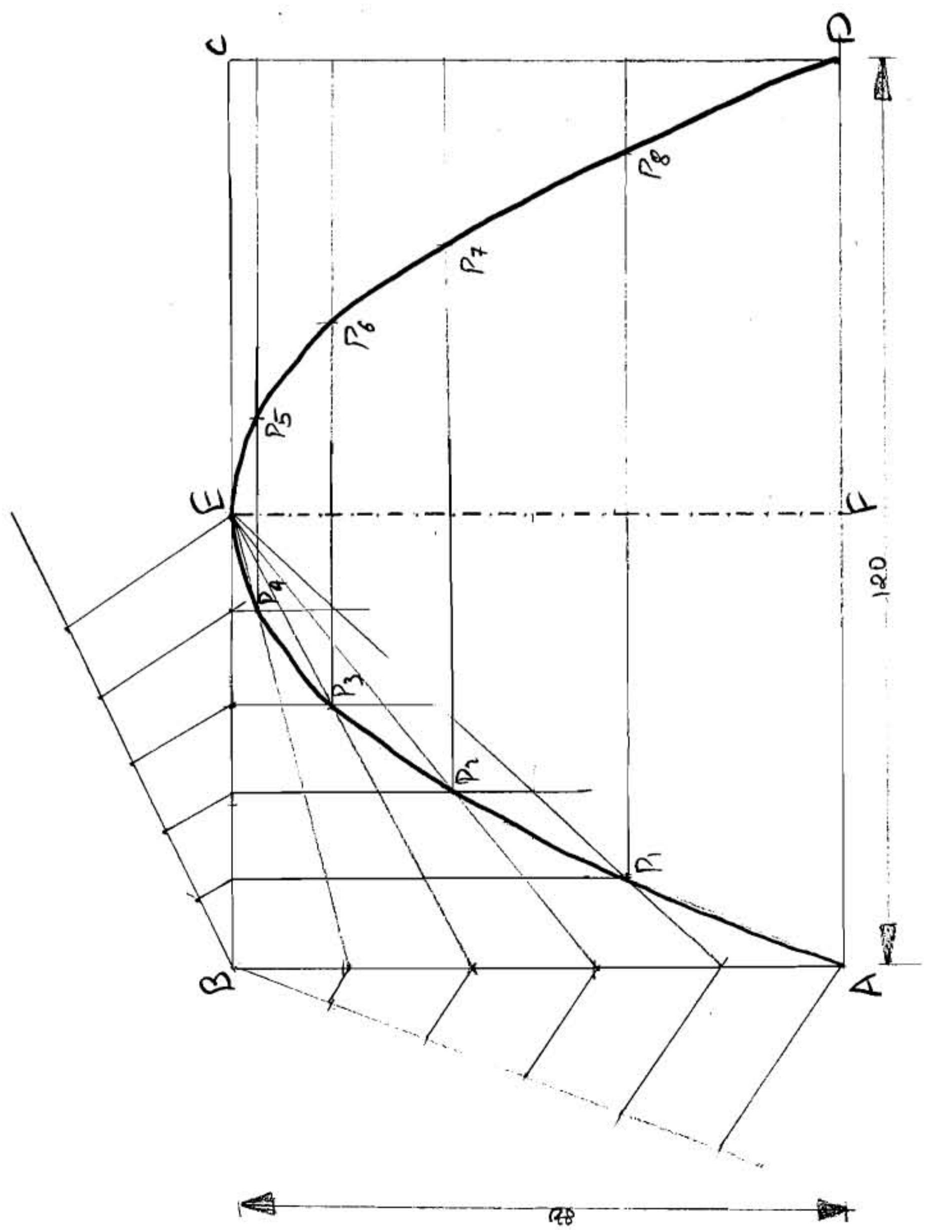
1. Draw asymptotes OA and OB perpendicular to each other.
2. Mark P such that OA = 35 mm and OB = 50 mm.
3. Draw CD, EF parallel to OA, OB respectively. pass through P.
4. Mark points 1, 2, 3, etc..., on PD at equal distance.
5. Join O1, O2, O3 etc.., to intersect the line EP at 1', 2', 3' etc.
6. Draw lines from points 1, 2, 3, etc.., parallel to OB to interest lines drawn from points 1', 2', 3' parallel to OA at points P_1, P_2, P_3 - etc.
7. Mark point 5, 6, 7 etc.., on CP at equal distance.
8. Repeat step 5, 6 with 5, 6, 7.. etc points. you will get
9. P_5, P_6, P_7..., etc
9. Draw a smooth curve passing through P_1, P_2, P_3, P_5, P_6, P_7... etc.., to get required rectangular hyperbola.

Q:- Draw a hyperbola when its asymptotes are Inclined at 60° to each other and it passes through a point 'p'. At a distance of 40mm and 50mm from the Asymptotes.



Hyperbola

Draw a parabola of base 120mm and axis 80mm by rectangular method.



1. Draw a rectangle ABCD taking A = 120 mm and AD = 80mm

2. Mark E and F as the midpoints of AB and CD respectively. Join EF to represent the axis.

3. Divide FD and DA, into equal number of parts, say 4. mark division of side DA as 1, 2, 3 and divisions of FD as 1', 2', 3'. Now join F with points 1, 2, 3.

4. Through 1', 2', 3' draw lines parallel to axis EF to meet F1, F2, F3 at P_1, P_2, P_3 respectively.

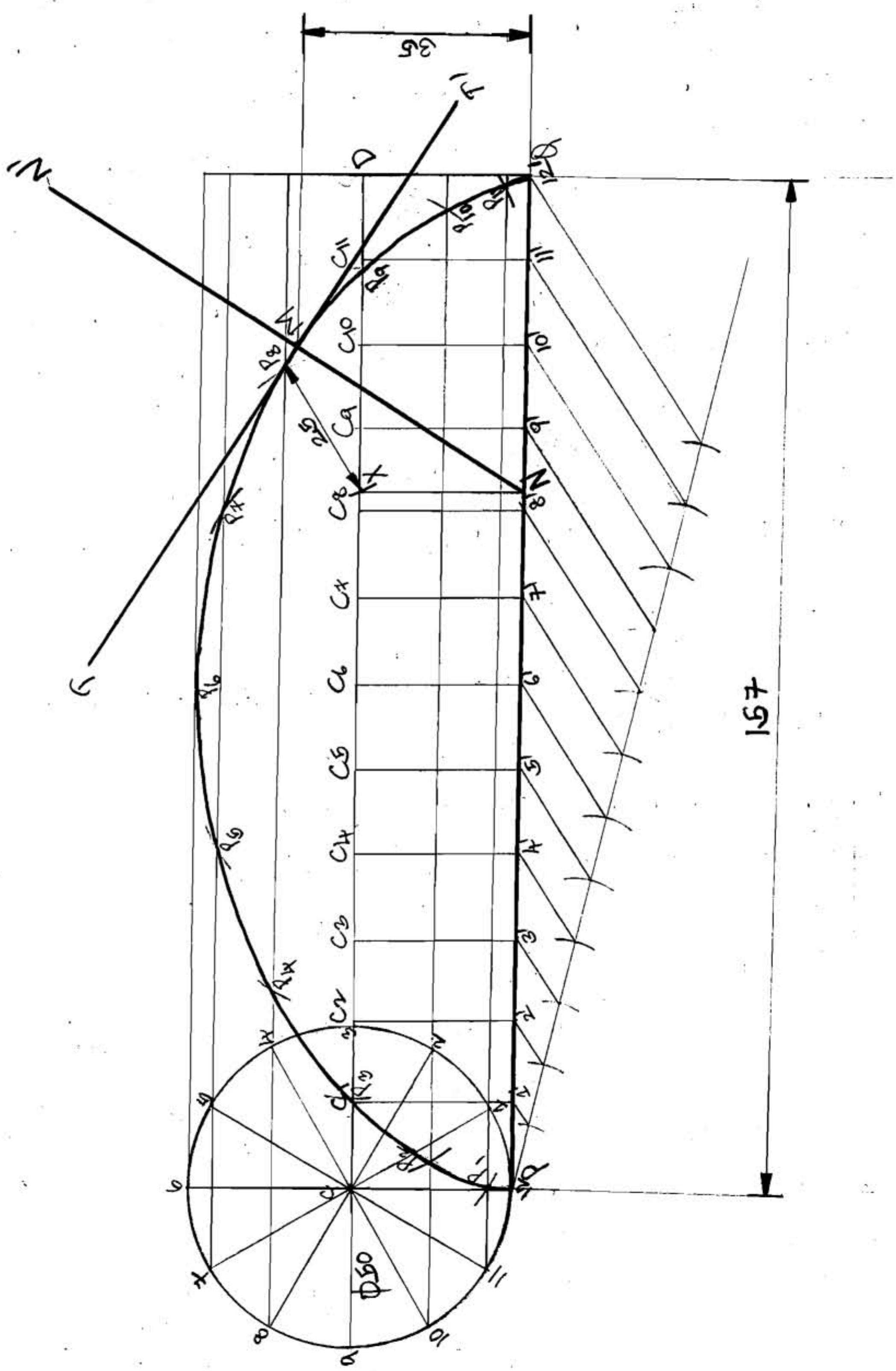
5. As the curve is symmetric about axis, obtain points P_1', P_2', P_3' of the curve by drawing horizontal lines through points P_1, P_2, P_3 and making them equal on both side of axis EF.

6. Draw a smooth curve passing through $A, P_3, P_2, P_1, F, P_1', P_2'$, P_3' and B to get the required parabola.

Cycloids:

These curves are generated by a fixed point on the circumference of a circle, whichrolls without slipping along a fixed straight line or a circle. The rolling circle iscalled generating circle and the fixed straight line or circle is termed directing lineor directing circle. Cycloidal curves are used in tooth profile of gears of a dial gauge.

Draw a cycloid of a circle of diameter 50mm for one revolution also draw a tangent and a normal to the curve at a point 35mm above base line.



1. Draw a circle of diameter 50mm with centre c.

2. Draw the directing line $PQ = \pi D = 157$mm long, horizontal and tangential to the circle.

3. Divide the circle into 12 equal parts and mark the divisions as 1, 2, 3 etc. Draw lines through points 1, 2, 3, etc., parallel to PQ.

4. Divide PQ into 12 equal parts and mark the divisions as 1', 2', 3', etc.

5. Erect vertical lines from points 1', 2', 3' etc. to meet the centre line CO at C_1, C_2, C_3, etc. When the circle rolls through $1/12^{th}$ rotation, point 1 of the circle will coincide with 1' centre c will move to c_1. The point P will move to new position P_1 lying on the horizontal line through point 1 at a distance of 25 mm from C_1.

6. Draw an arc with centre C_1 and radius 25mm to intersect the horizontal line through point 1 at point P_1.

7. Similarly, draw arc with centre C_2, C_3, C_4 etc.

8. Draw a smooth curve passing through P_1, P_2, P_3, P_4 etc. to get the required cycloid.

Tangent and normal to the cycloid:

1. Mark a point M on the cycloid 35mm above PQ.

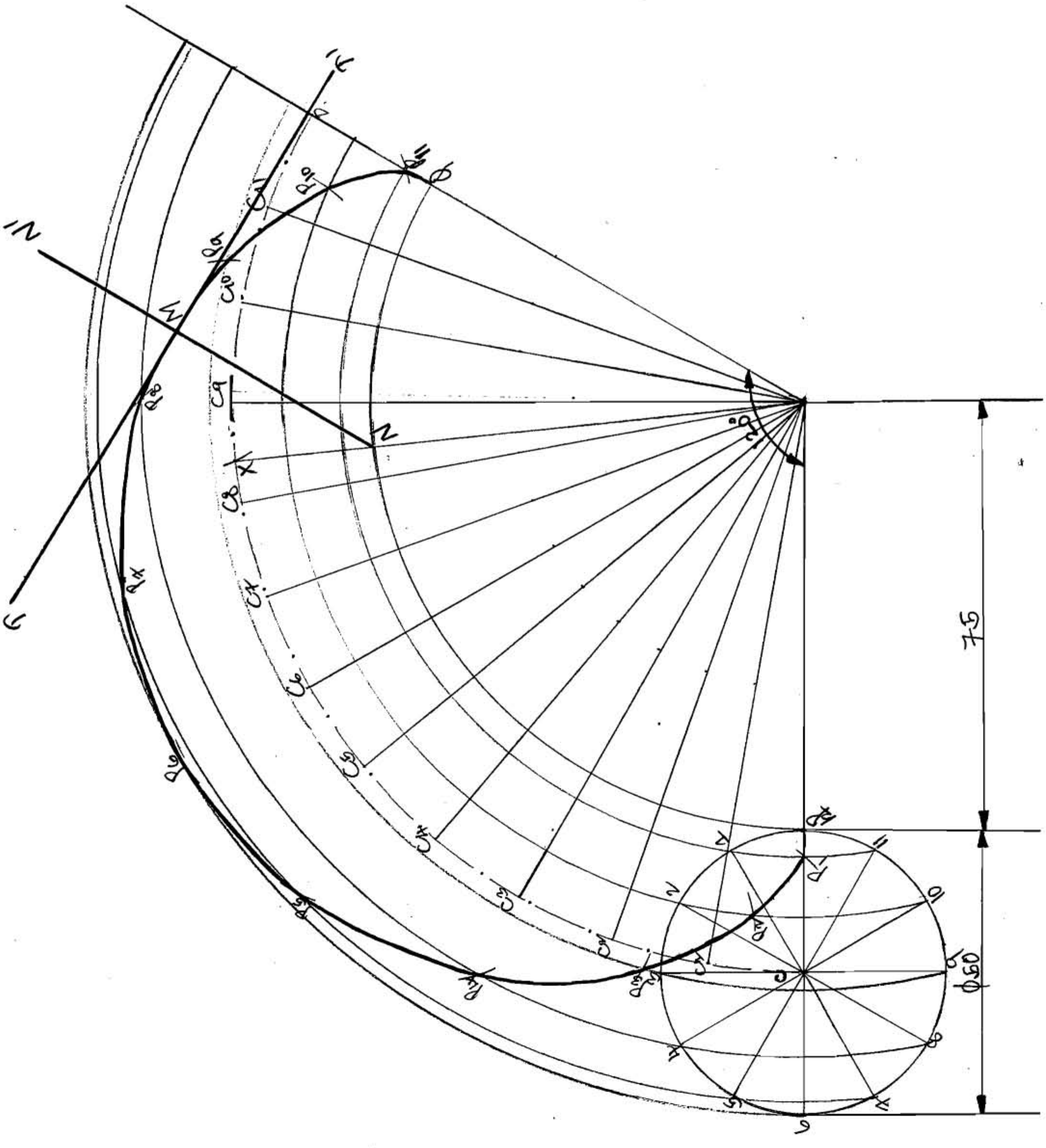
2. Draw an arc with centre M and radius 25mm, to intersect the centre line at X.

3. Draw a vertical line from X to meet PQ at N.

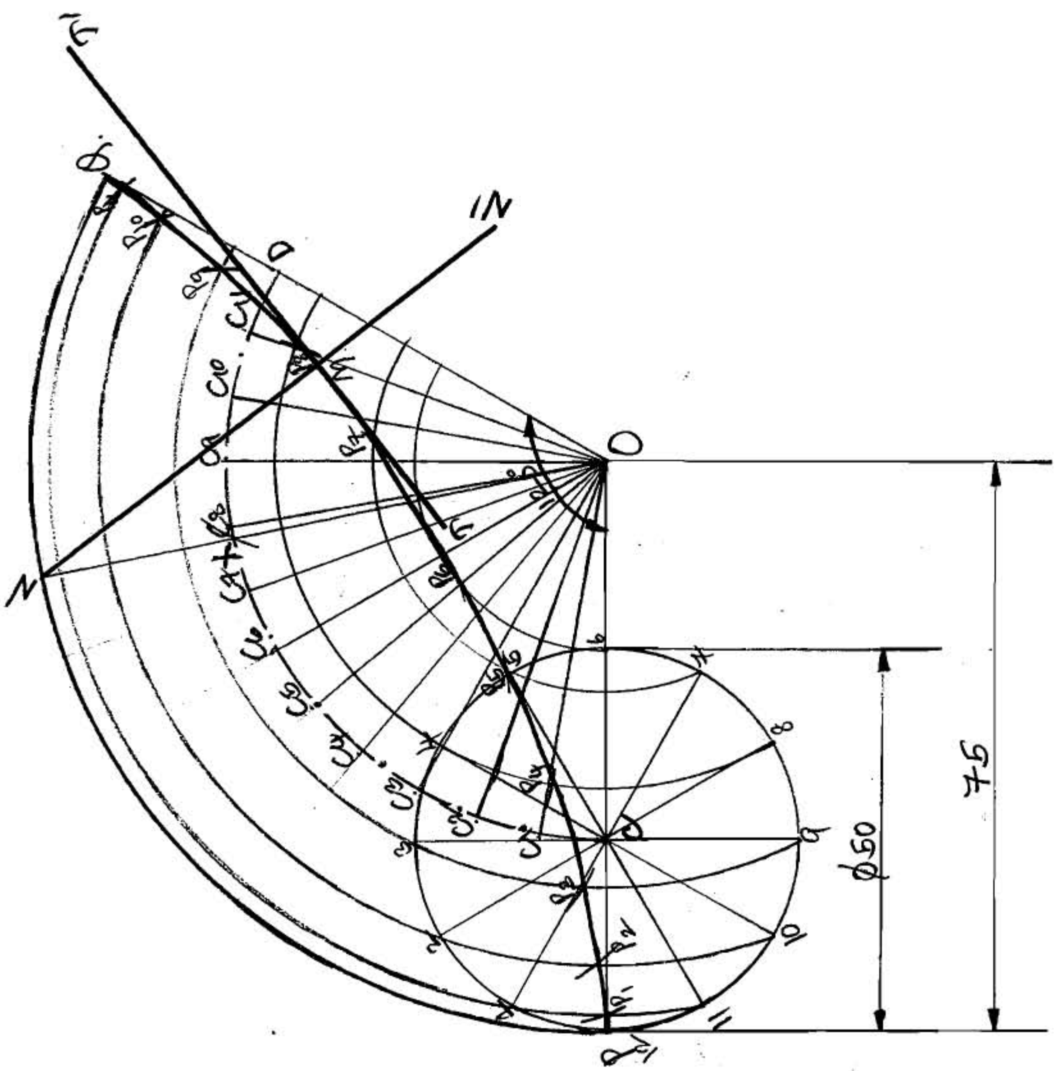
4. Join NM and produce to N'. This line NN' is the required normal.

5. Through point M draw a line TT' perpendicular to NN'. This line TT' is the required tangent

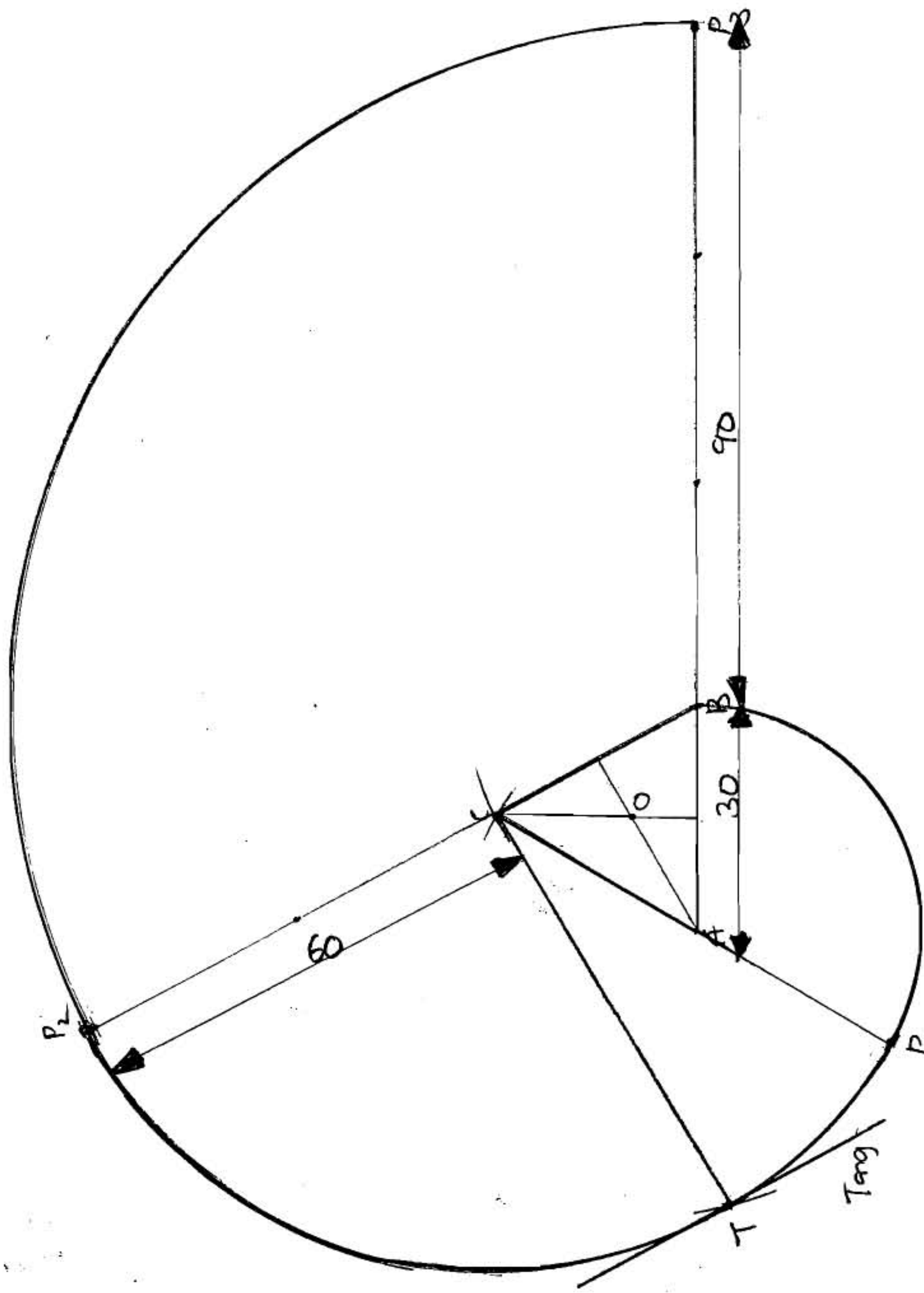
Draw an epicycloid of a circle of diameter 50mm which rolls outside a circle of diameter 150mm for one revolution also draw a tangent and normal to epicycloid at a point 110mm from the centre of directrix circle.



Draw a hypocycloid of a circle of diameter 50mm which rolls inside a circle of diameter on 50mm for one revolution also draw a tangent and normal to hypocycloid at a point 40mm from the centre of the directrix circle.

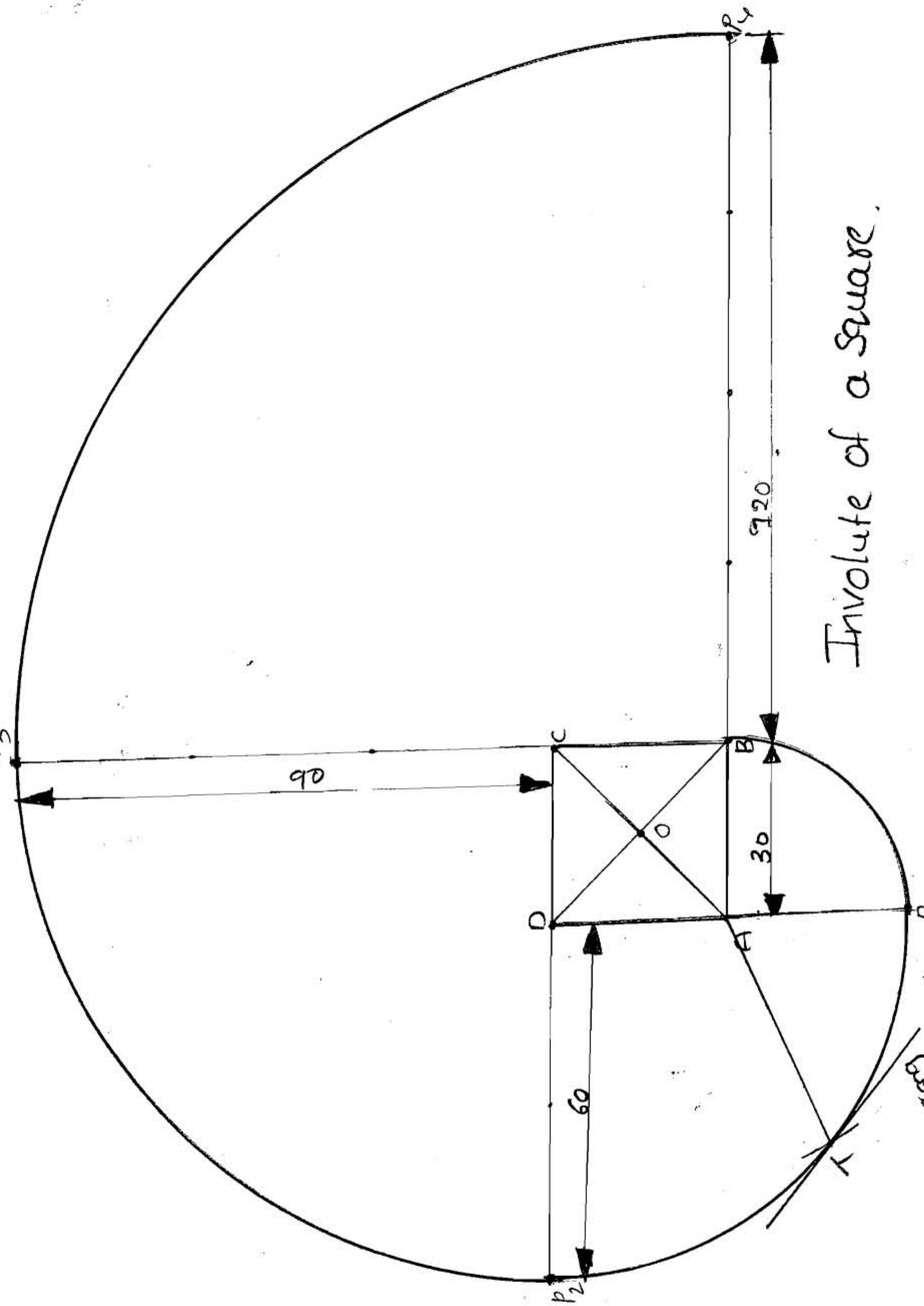


Draw an Involute for a triangular plane of side Length 30mm and also draw tangent and Normal at a Point 55mm from the center of the triangle.



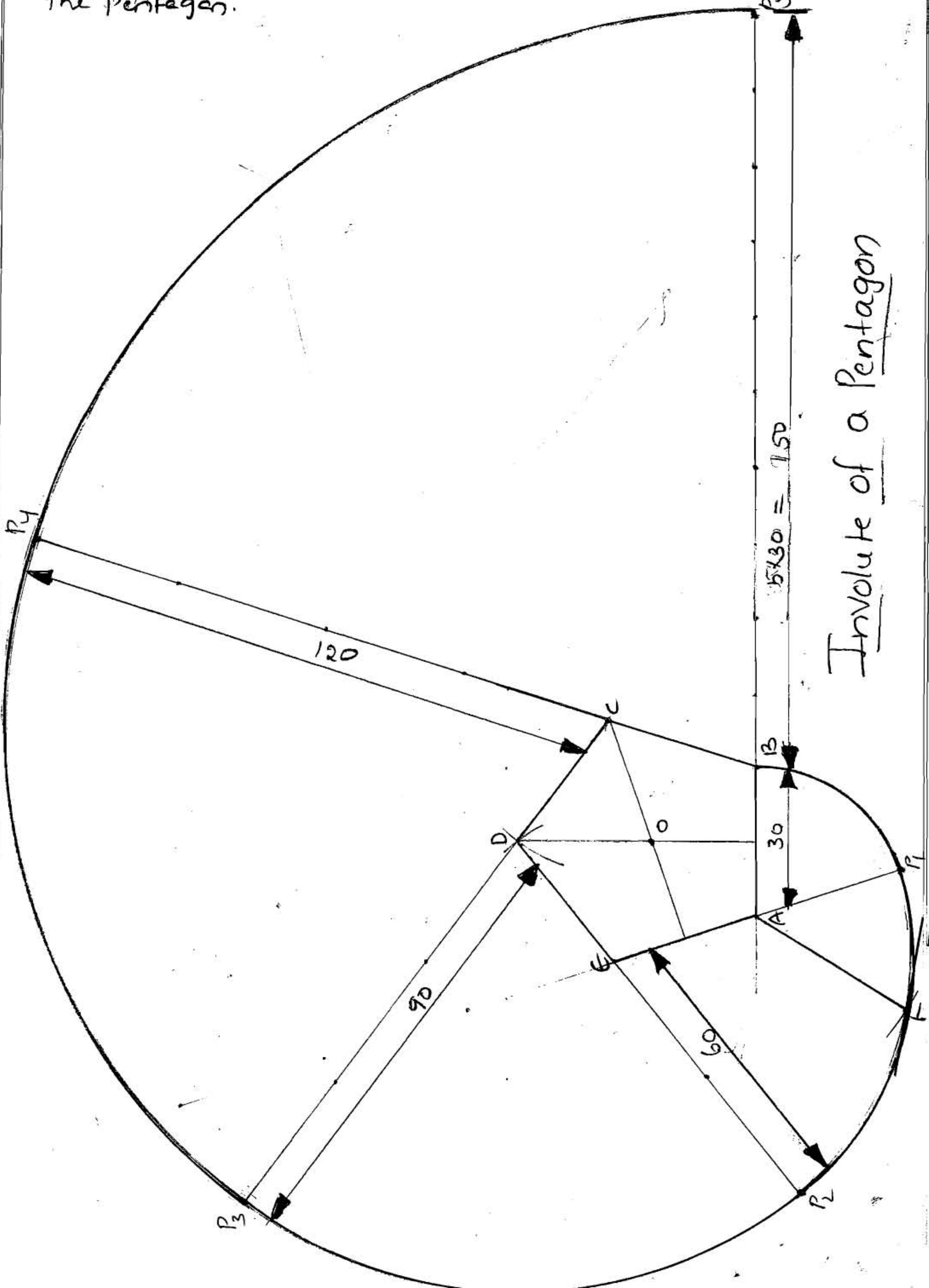
Involute of a triangle

construct an Involute curve for a square of side 30 mm and also draw tangent and Normal at a distance of 60 mm from the center of the square.

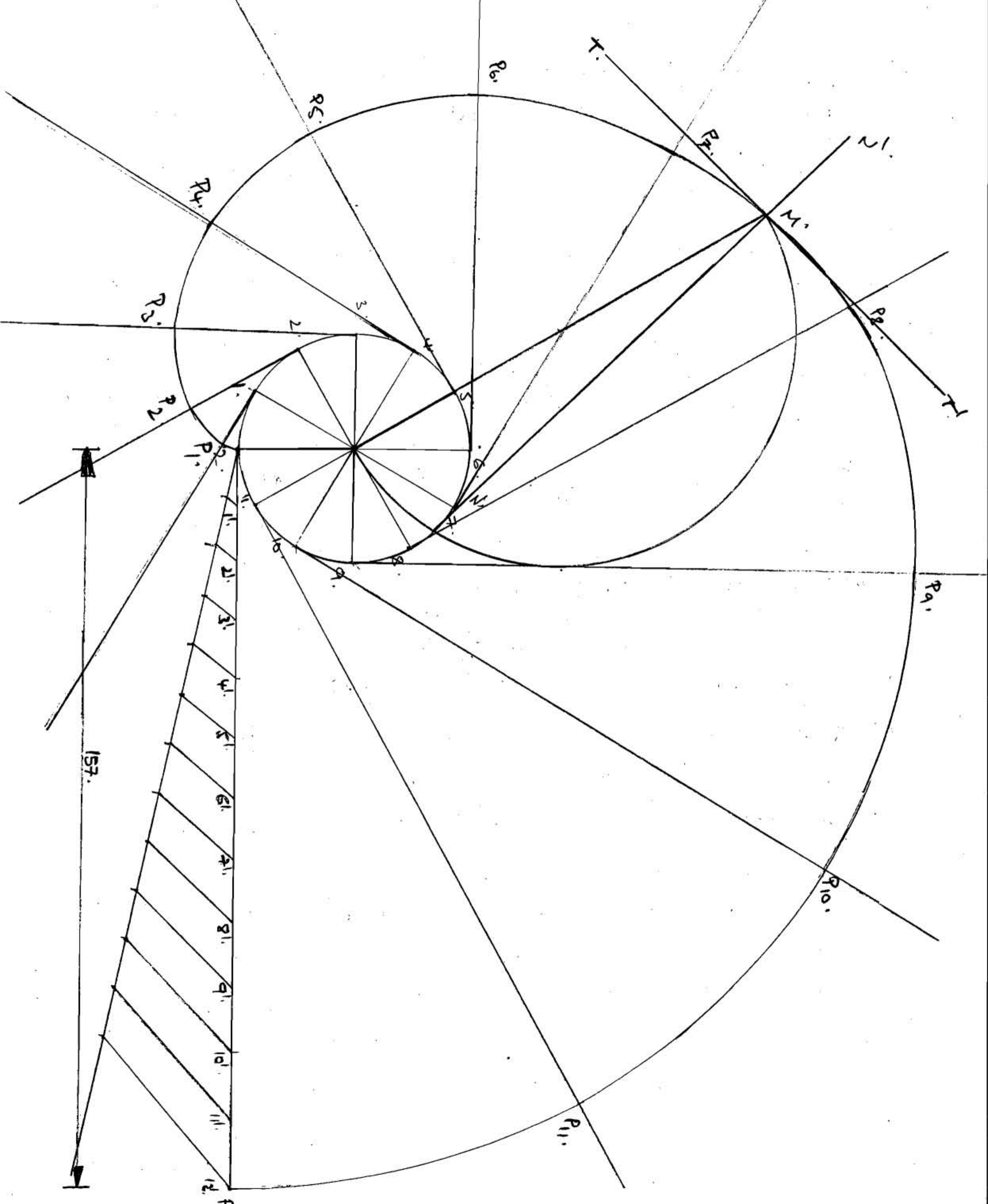


Involute of a Square.

Q: Draw an Involute curve for Pentagon of side 30 mm and also draw tangent and Normal at a distance of 60 mm from the centre of the pentagon.



Draw an involute of circle of diameter 50mm also draw normal and tangent at a point 100mm from the centre of circle.



1. Draw a circle of diameter 50mm and divide it into 12 parts and mark them as 1, 2, 3.., etc.

2. Draw line $PQ = \pi D = 157mm$. divide it into 12 equal parts. mark them as 1', 2', 3'..., etc.

3. Draw tangents to circle at 1, 2, 3 etc.

4. Draw an arc with centre 1 and radius P1' to intersect the tangent point 1 at P_1.

5. Draw an arc with centre 2 and radius P2' to intersect the tangent line through point 2 at P_2.

6. Similarly, draw arc with centres 3, 4, 5 etc and radii P3', P4', P5' etc.., respectively to intersect the tangent line through points 3, 4, 5 etc., at points P_3, P_4, P_5 etc., respectively.

7. Draw a smooth curve to pass through P_1, P_2, P_3 ..etc., and obtain required involute.

Tangent and normal to involute:

1. Mark a point M on involute at radial distance 100m from O.
2. Join OM and mark O_1 as its mid point.
3. Draw a semi-circle in clockwise direction with O_1 as centre and diameter OM to intersect the base circle at N.
4. Join MN and produce it to N'. The line NN' is the required normal.
5. Through point M, draw a line TT' perpendicular to NN' The line TT' is required tangent.

Scales:

Drawings of small objects can be prepared of the same size as theobjects theyrepresent. A 150 mm long pencil may be shown by a drawing of 150 mm length.Drawings drawn of the same size as the objects, are called full-size drawings. Theordinary full-size scales are used for such drawings.

A scale is defined as the ratio of the linear dimensions of element of the objectas represented in a drawing to the actual dimensions of the same element of theobject itself.

Representative fraction: The ratio of the length of the object representedon drawing to the actual length of the object represented is called the RepresentativeFraction (i.e. R.F.).

$$\text{R.F.} = \frac{\text{Length of the drawing}}{\text{Actual length of object}}$$

Types of scales

The scales used in practice are classified as under:

(1) Plain scales

(2) Diagonal scales

(3) Vernier scales

Plain Scale

1. A 1cm length of the drawing represents 5m length of the object. Then find R.F value.

Sol:
$$R.F = \frac{\text{Length of the object in drawing}}{\text{Actual length of object}}$$

$$R.F = \frac{1\,cm}{5\,m}$$

$$= \frac{1\,\cancel{cm}}{500\,\cancel{cm}}$$

$$\therefore \boxed{R.F = \frac{1}{500} = 1:500}$$

2. A 5cm long line represents 3 km length of a Road find the R.F value.

Sol:
$$R.F = \frac{\text{Length of the object in drawing}}{\text{Actual length of object}}$$

$$= \frac{5\,cm}{3\,km}$$

$$R.F = \frac{5\,\cancel{cm}}{3 \times 10^5\,\cancel{cm}}$$

$$\therefore \boxed{R.F = \frac{5}{3 \times 10^5}}$$

$[\because 1\,km = 10\,hm$
$= 10 \times 10\,Dm$
$= 10 \times 10 \times 10\,m$
$= 10 \times 10 \times 10 \times 10\,dm$
$= 10 \times 10 \times 10 \times 10 \times 10\,cm$
$1\,km = 10^5\,cm]$.

3. Find the R.F value of a 1cm = 1m

$$R.F = \frac{\text{Length of the object in drawing}}{\text{Actual length of object}}$$

$$= \frac{1\,cm}{1\,m}$$

$$R.F = \frac{1\,\cancel{cm}}{1 \times 100\,\cancel{cm}}$$

$$\therefore \boxed{R.F = \frac{1}{100} = 1:100}$$

4. In a map of India, a distance of 36 km between two localities is shown by a line of 45 cm long calculate its R.F.

$$R.F = \frac{\text{Length of the object in drawing}}{\text{Actual Length of the object}}$$

$$R.F = \frac{45cm}{36\ km}$$

$$R.F = \frac{\overset{5}{\cancel{45}}\ \cancel{cm}}{\underset{4}{\cancel{36}} \times 10^5 \cancel{cm}}$$

$$\therefore \boxed{R.F = \frac{5}{4 \times 10^5}}$$

5. A Rectangular Plot of $100\ km^2$ is represented by a rectangular area of 4 sq cm. Find the R.F.

Rectangular Plot = $100 km^2$

Area of Drawing = $4 cm^2$.

$$R.F = \sqrt{\frac{L.O.I.D}{A.L.O}}$$

$$R.F = \sqrt{\frac{\text{Area of O.I.D}}{\text{Actual Area of O}}}$$

$$R.F = \sqrt{\frac{4cm^2}{100\ km^2}}$$

$$R.F = \frac{2cm}{10km} = \frac{\cancel{2}\ \cancel{cm}}{\underset{5}{\cancel{10}} \times 10^5 \cancel{cm}} = \frac{1}{5 \times 10^5}.$$

6. A cube of 5 cm side represents a tank of 8000 cu m volume. Find the R.F

Cube side Length = 5cm

Tank volume = $8000\ m^3$

$$R.F = \sqrt[3]{\frac{\text{volume of O.I.D}}{\text{actual Vol. of O}}}$$

$$= \sqrt[3]{\frac{5^3\ cm^3}{8000\ m^3}} = \frac{5\ cm}{20 m} = \frac{\cancel{5}\ \cancel{cm}}{\cancel{20}_{4} \times 100\ \cancel{cm}}$$

$$\therefore R.F = \frac{1}{400}.$$

7. The area of a field is $50{,}000\ m^2$ the length and breadth of the field on the map is 15cm and 8cm respectively. Find the value of R.F.

$$R.F = \sqrt{\frac{15^2 \times 8^2\ cm^2}{50{,}000\ m^2}}$$

$$R.F = \sqrt{\frac{3}{1250}} \times \frac{cm}{m}$$

$$R.F = \frac{1}{5}\sqrt{\frac{3}{50}} \times \frac{\cancel{cm}}{100\ \cancel{cm}} = \frac{1}{500}\sqrt{3/50}$$

$$\therefore R.F = \frac{1}{500}\sqrt{3/50}.$$

8. A Room of $1728 m^3$ volume is shown by a cube of 4cm side. Find the R.f.

A: $$R.f = \sqrt[3]{\frac{4^3 cm^3}{1728\ m^3}}$$

$$= \sqrt[3]{\frac{\cancel{4^3}\ cm^3}{3^3 \times \cancel{4^3} m^3}}$$

$$= \frac{1\ cm}{3\ m}$$

$$= \frac{1\ \cancel{cm}}{3 \times 100\ \cancel{cm}}$$

$$\therefore R.F = \frac{1}{300}.$$

$$\therefore \boxed{R.f = 1:300}$$

PLAIN SCALES

Plain scale :

(1) Construct a scale of 1:60 to show meters and decimeters and long enough to measure upto 6m. Mark on it a distance of 4.7m, 3.6m.

Ans: $R \cdot F = 1/60$

Long enough to measure upto 6m

Mark a distance = 4.7m, 3.6m.

$$R \cdot F = \frac{L \cdot O \cdot I \cdot D}{A \cdot L\ o\ (or)\ \text{Max length of object}}$$

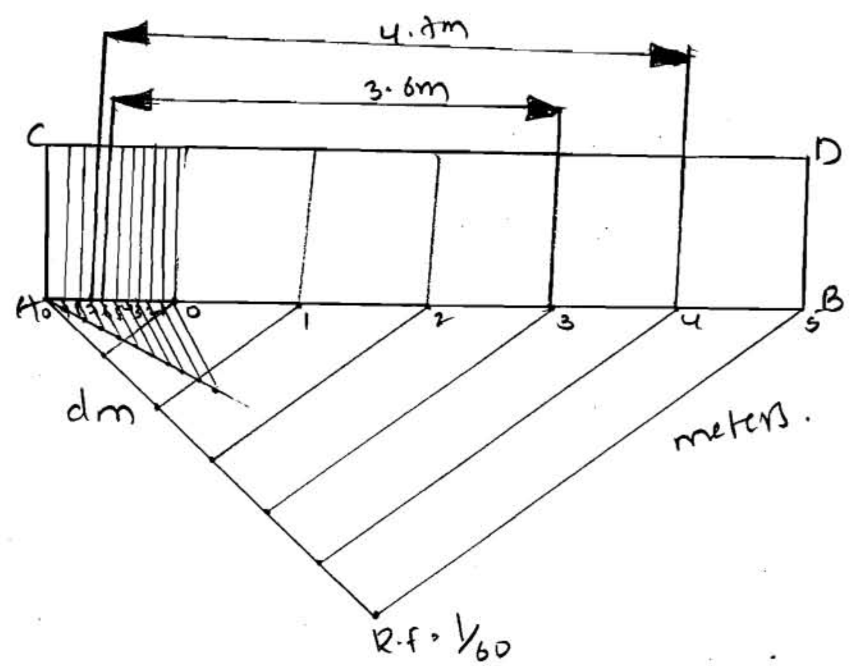
$$\frac{1}{60} = \frac{L \cdot O \cdot I \cdot D}{6m}$$

$$\frac{6m}{60} = L \cdot O \cdot I \cdot D$$

$$1/10 = L \cdot O \cdot I \cdot D$$

$$L \cdot O \cdot I \cdot D = 1/10\,m = 10\,cm$$

$$\boxed{L \cdot O \cdot I \cdot D = 100mm}$$



2. Construct a scale of 1 cm = 1 m to read meters and decimeters and long enough to measure upto 14m. Show a distance of 12.4m.

A:- 1 cm = 1 meter.

Max Length = 14m

Marking distance = 12.4 m

$$R.F = \frac{\text{Length of the object in drawing}}{\text{Actual length of object}}$$

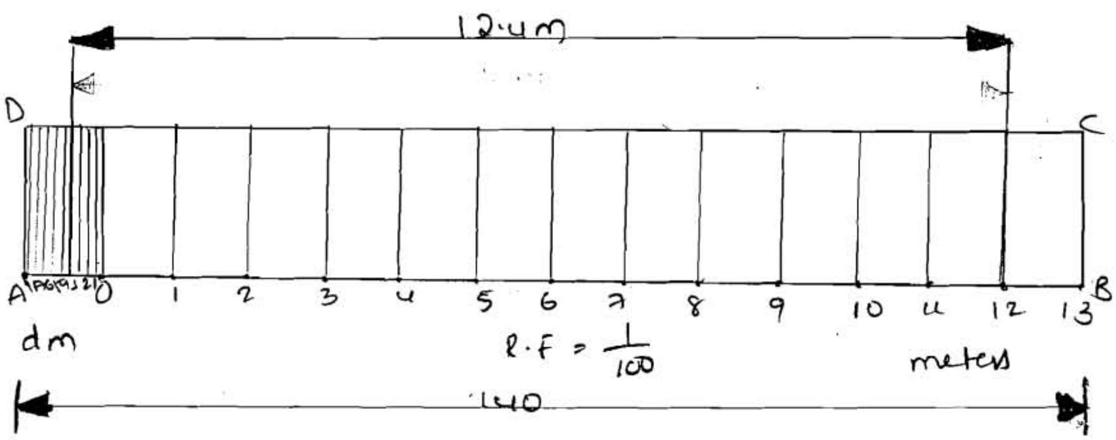
$$R.F = \frac{1cm}{1m} = \frac{1\cancel{cm}}{100\cancel{cm}} = \frac{1}{100}$$

$$\frac{1}{100} = \frac{L.O.I.D}{14m}$$

$$\frac{14m}{100} = L.O.I.D$$

$$L.O.I.D = \frac{14 \times 100cm}{100} = 14cm$$

$$L.O.I.D = 140mm.$$



3. A length of 1 decameter (Dm) is represented by 5cm. Find the R.F and construct a plain scale to measure upto 2.5 Dm and mark a distance of 19m on it.

A: R.F = ?

$1\ Dm = 5cm$

$$R.F = \frac{\text{Length of object in drawing}}{\text{Actual length of object}}$$

$$R.F = \frac{5cm}{1Dm} = \frac{5}{1000}$$

$$\therefore R.F = \frac{1}{200}$$

$$\frac{1}{200} = \frac{L.O.I.D}{2.5Dm}$$

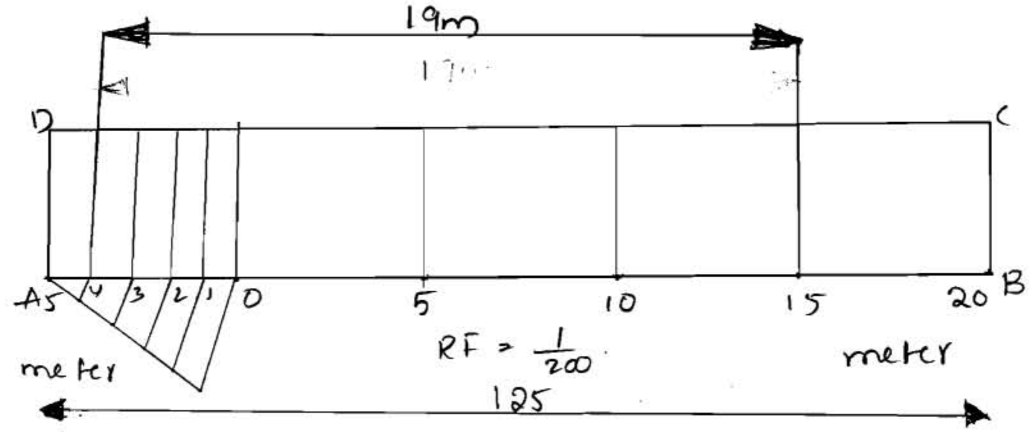
$$L.O.I.D = \frac{2.5Dm}{200}$$

$$= \frac{2.5 \times \cancel{1000}^{5}cm}{\cancel{200}}$$

$L.O.I.D = 12.5cm$ (or) $125mm$

max length $= 2.5Dm$

marking distance $= 19m$.



4. A rectangular plot of $100\ km^2$ is represented by a rectangular area of $4\ cm^2$. Draw a scale to show 50 km and mark a distance of 41 km on it.

A: $R.F = \sqrt{\dfrac{4\ cm^2}{100\ km^2}}$

$R.F = \dfrac{2\ cm}{10\ km}$

$= \dfrac{2\ cm}{10 \times 10^5\ cm} = \dfrac{1}{5 \times 10^5}$

Max length = 50 km

marking distance = 41 km.

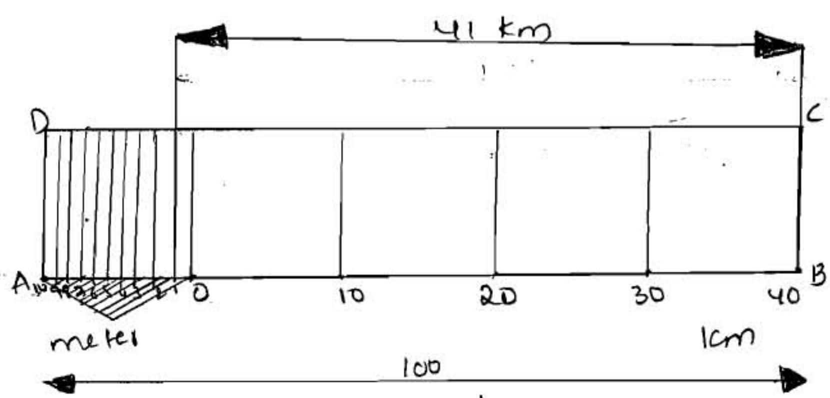
$R.F = \dfrac{\text{length of object in drawing}}{\text{Actual Length of object}}$

$\dfrac{1}{5 \times 10^5} = \dfrac{L.O.I.D}{50\ km}$

$L.O.I.D = \dfrac{50 \times 10^5\ cm}{5 \times 10^5}$

$= 10\ cm$

$\boxed{L.O.I.D = 100\ mm}$



$RF = \dfrac{1}{5 \times 10^5}$

5- construct a scale of 1:14 . to read feet and inches and long enough to measure 7 feet. show a distance of 5ft and 10 inches on it .

A: $R \cdot F = \frac{1}{14}$

$R \cdot F = \frac{\text{Length of object in drawing}}{\text{Actual length of object}}$

$\frac{1}{14} = \frac{L \cdot O \cdot I \cdot D}{7\ \text{feet}}$

$\frac{7 \times \cancel{12}^{6} \times 2.54\ cm}{1\cancel{4}_{2}} = L \cdot O \cdot I \cdot D$

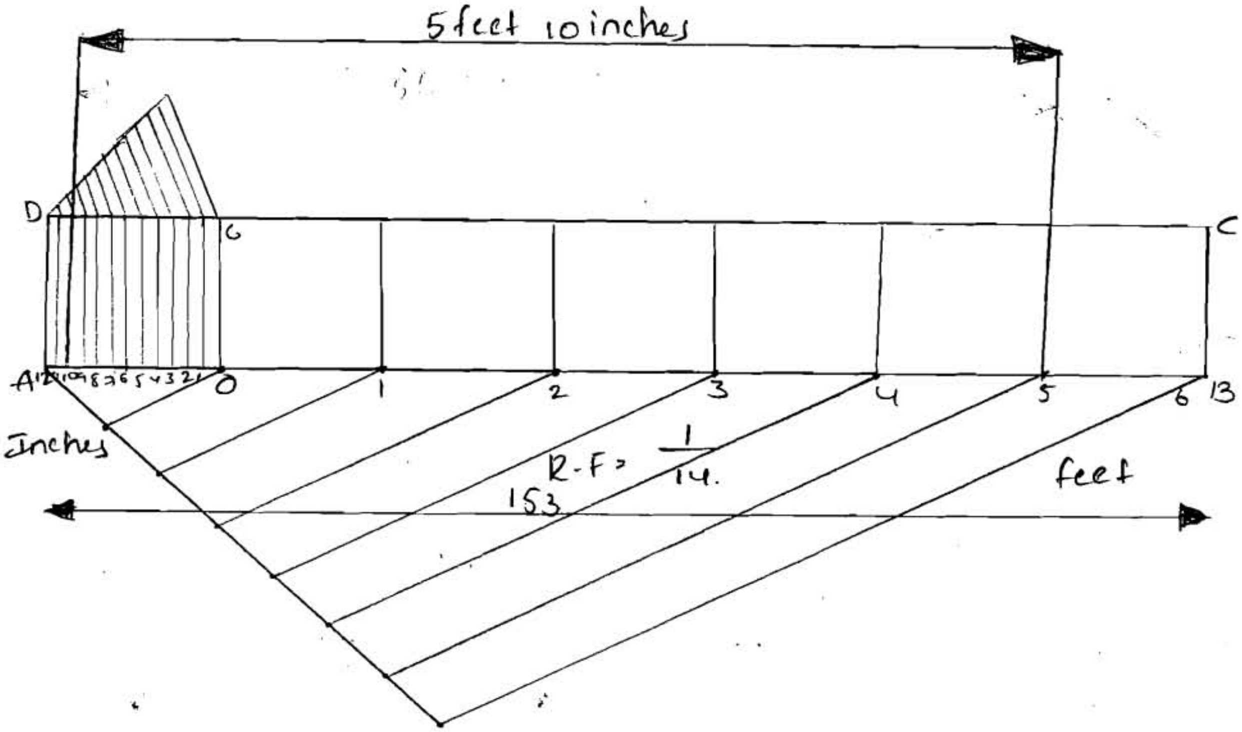
$L \cdot O \cdot I \cdot D = 15.24\,cm$

$\cong 15.3\ cm$

$L \cdot O \cdot I \cdot D = 153\ mm.$

marking distance = 5 feet 10 inches

Max length = 7 feet



6. Construct a scale of 1:54 to show yards and feet and long enough to measure 9 yards. Mark a distance of 6 yard 2 feet.

A:- $R.F = \frac{1}{54}$

$R.F = \frac{\text{Length of object in drawing}}{\text{Actual Length of object}}$

$\frac{1}{54} = \frac{L.O.I.D}{9 \text{ yards}}$

$\frac{9 \text{ yards}}{54} = L.O.I.D$

$\frac{9 \times 3 \times \cancel{12}^{6} \times 2.54cm}{\cancel{54}\ \cancel{6}\ 2} = L.O.I.D$

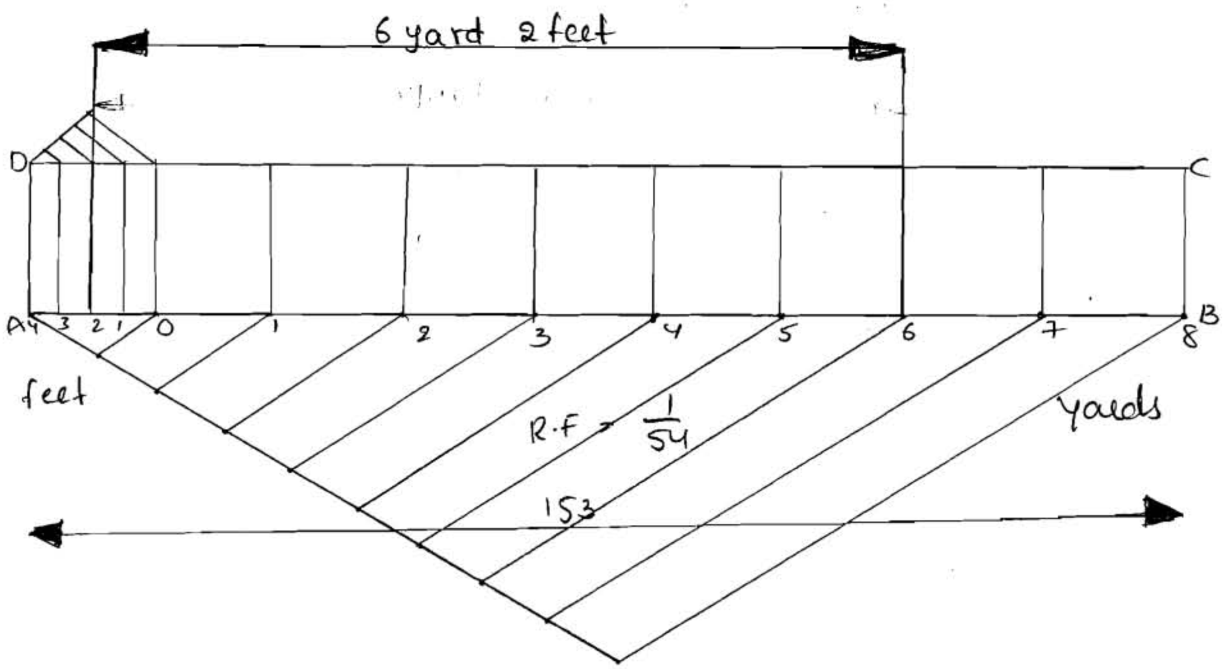
$L.O.I.D = 15.24cm$

$\simeq 15.3cm$

$L.O.I.D = 153 mm$

∴ max length = 9 yards

∴ marking distance = 6 yard and 2 feet.



7. A cube of 5cm side represents a tank of $8000\ m^3$. Find R-f and Construct a scale to measure upto 60 m and mark adistance of 47m

A: $R\cdot F = \sqrt[3]{\dfrac{5^3 cm^3}{8000\ m3}}$

$R\cdot F = \dfrac{\cancel{5}\ cm}{\cancel{20}_4\ m}$ $\therefore$ max Length = 60 m.

$= \dfrac{1\ cm}{400\ cm}$

$R\cdot F = 1/400$

$R\cdot f = \dfrac{\text{Length of object in drawing}}{\text{Actual Length of object}}$

$\dfrac{1}{400} = \dfrac{L\cdot O\cdot I\cdot D}{60\ m}$

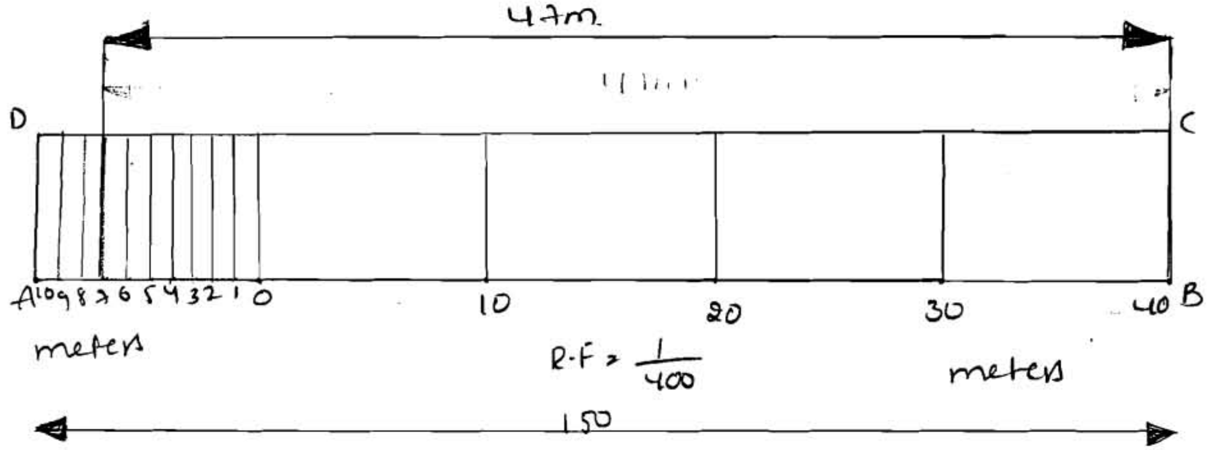
$\dfrac{60\ m}{400} = L\cdot O\cdot I\cdot D$

$L\cdot O\cdot I\cdot D = \dfrac{\cancel{6000}^{15}\ cm}{\cancel{400}}$

$L\cdot O\cdot I\cdot D = 15 cm$

$= 150\ mm$

marking distance = 47m



Diagonal scale

1. A map is to be drawn with R.F 1:40 · construct a scale to read in meters, dm and cm and long enough to measure upto 6m. show on it a distance of 3·84m

A: Scale → m, dm, cm

$R.f = \frac{1}{40}$

max length of object = 6m

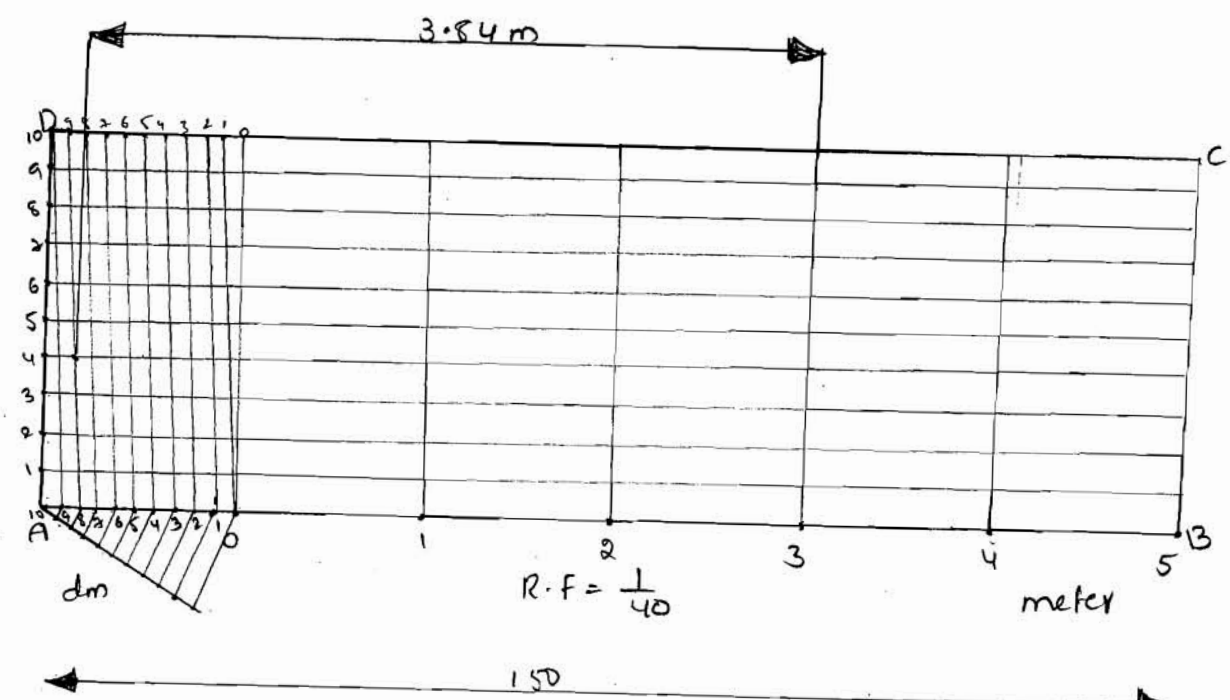
Marking distance = 3·84m

$R.f = \frac{\text{Length of object in drawing}}{\text{Actual Length of object}}$

$\frac{1}{40} = \frac{L.O.I.D}{6m}$

$L.O.I.D = \frac{6m}{40} = \frac{\cancel{6}^{3} \times \cancel{100}^{5}\,cm}{\cancel{40}_{2}} = 15cm$

$L.O.I.D = 150\,mm$



2. Construct a diagonal scale showing km, Hm, Dm in which 2cm long Line represents 1 km, and the scale is long enough to measure upto 7 km. Find the R.f and marking distance of 4.53 km on it.

A: Scale → km, hm, dm

$$R.f = \frac{2\,cm}{1\times10^5\,cm}$$

$$R.f = \frac{1}{5\times10^4}$$

$$R.f = \frac{\text{Length of object in drawing}}{\text{Actual Length of object}}$$

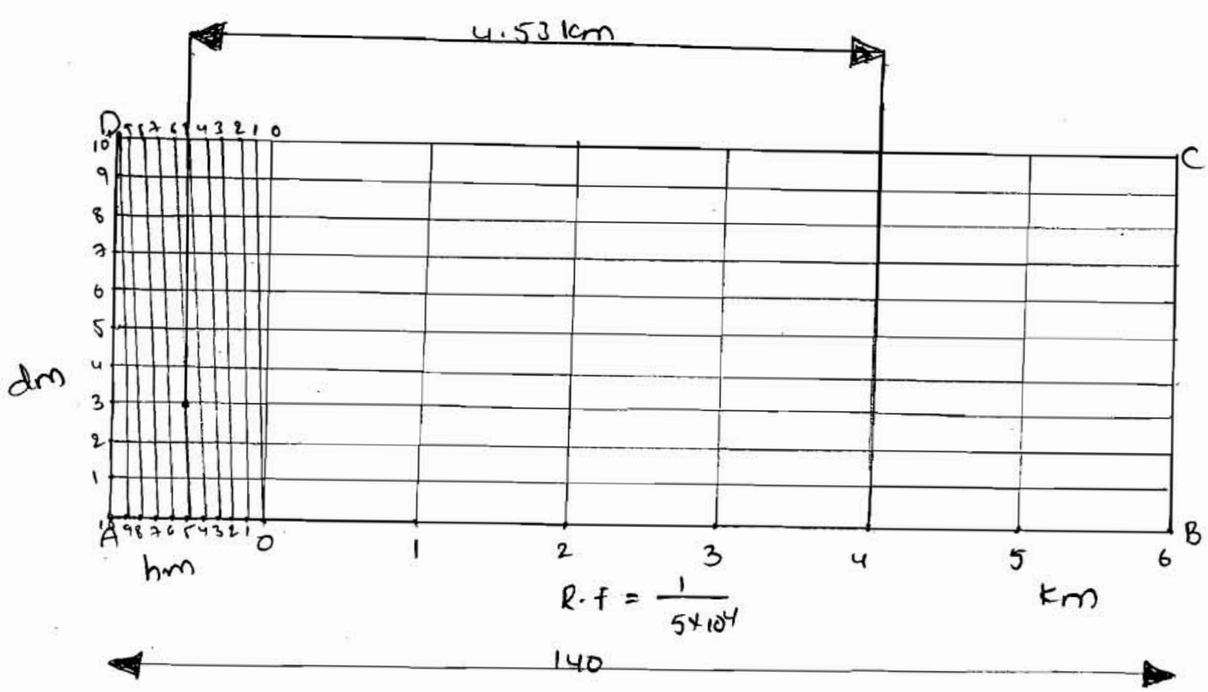
$$\frac{1}{5\times10^4} = \frac{L.O.I.D}{7\,km}$$

$$\frac{7\times10^5\,cm}{5\times10^4} = L.O.I.D$$

L.O.I.D = 14 cm (or) 140 mm

max length = 7 km

marking distance = 4.53 km.



3. Draw a diagonal scale of R.F 3:100 showing in meters, dm and cm and measure upto 5m. Mark a length of 3.69 m.

A:- $R.F = \frac{3}{100}$ scale → meters, dm, cm

$R.F = \frac{\text{Length of object in drawing}}{\text{Actual length of object}}$

$\frac{3}{100} = \frac{L.O.I.D}{5m}$

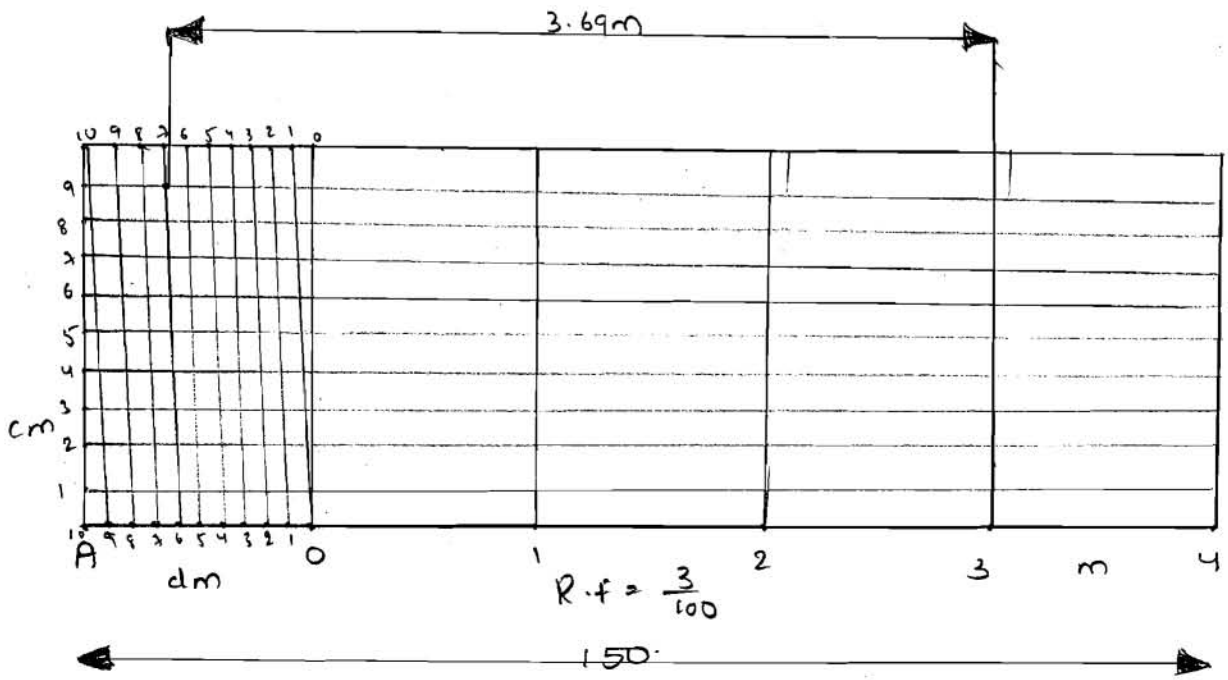
$\frac{3 \times 5 \times 100\,cm}{100} = L.O.I.D$

L.O.I.D = 15cm.

L.O.I.D = 150mm.

max length = 5m

marking distance = 3m 6dm and 9cm (3.69m).



4. The distance between two cities 'A' and 'B' is 300 km. Its equivalent distance on the map measures only 6cm. what is R.F? Draw a diagonal scale show 100's of km, Ten's km and km indicate on the scale the following distances.

(i) 525 km, (ii) 313 km and 258 km.

A: Distance b/w two cities = 300 km (A.L)

distance on the map = 6cm (L.O.I.D).

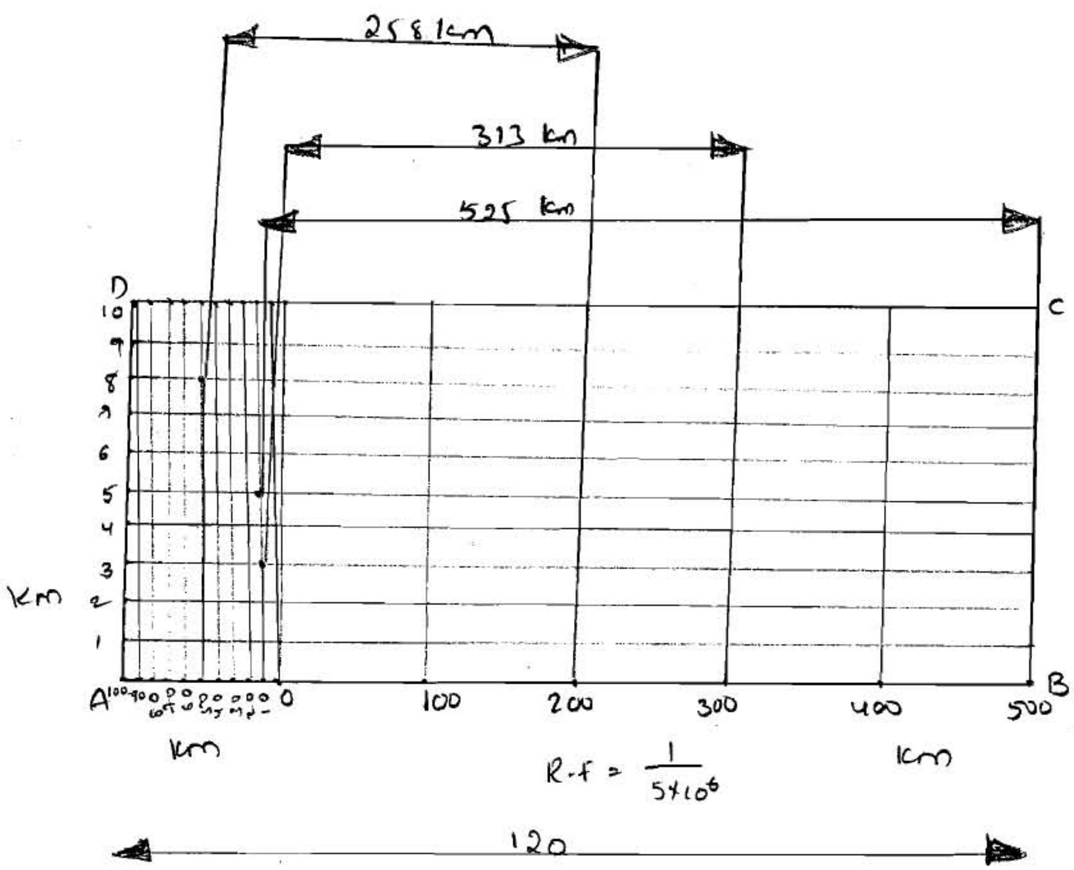
$$R.F = \frac{6cm}{300km} = \frac{6cm}{300\times10^5cm} = \frac{1}{5\times10^6}$$

max length = 600 km (∵ max marking distance is 525 km)

$$R.F = \frac{\text{Length of object in drawing}}{\text{Actual length of object}} = \frac{1}{5\times10^6} = \frac{L.O.I.D}{600km}$$

$$L.O.I.D = \frac{600\times10^5cm}{5\times10^6} = 12cm$$

$$L.O.I.D = 120\ mm.$$



5. On a map the actual distance of 5m is represented by a line of 25mm long. Calculate the R.F. Construct a diagonal scale long enough to measure upto 25m and make a distance of 19m and 11 m.

A: Max Length = 25m

$$R.F = \frac{\text{Length of object in Drawing}}{\text{Actual Length of object}}$$

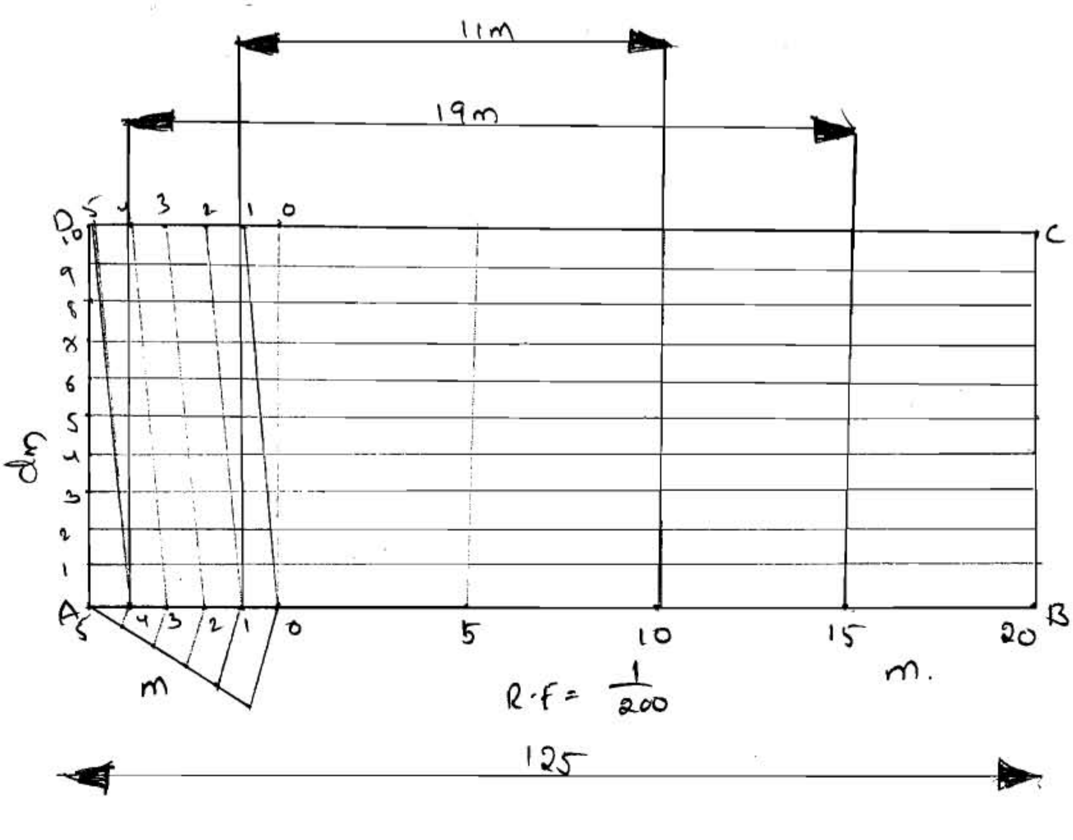
$$= \frac{25mm}{5m} = \frac{25mm}{5\times10^3 mm} = \frac{1}{200}$$

$$R.F = \frac{1}{200}$$

$$\frac{1}{200} = \frac{L.O.I.D}{25m}$$

$$\frac{25 \times 100\,cm}{200} = L.O.I.D$$

L.O.I.D = 12.5cm or 125mm.



6. Construct a diagonal scale showing yards, feets and inches. In which 2 inches long line represents 1.25 yards and it is long enough to measure upto 5 yards, marking distance as 3 yards 2 Feets and 10 inches.

Sol: 2 inches = 1.25 yards

$$R \cdot F = \frac{2\,\text{inches}}{1.25\,\text{yards}} = \frac{2\,\text{inches}}{1.25 \times 3 \times 12\,\text{inches}}$$

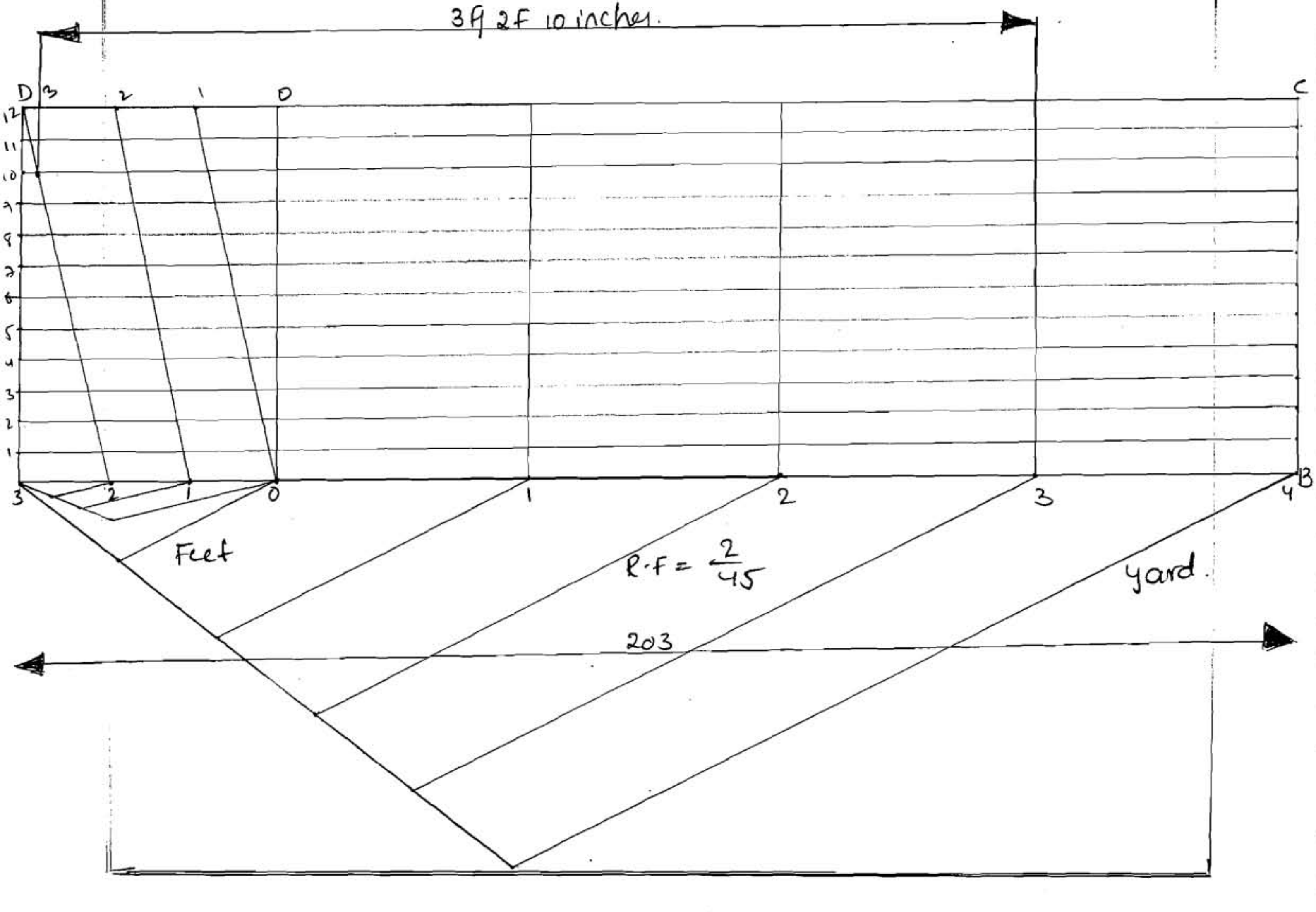
$$R \cdot F = \frac{\cancel{100}\ 2}{\cancel{2250}\ 45} = \frac{2}{45}$$

max length = 5 yards

$$R \cdot F = \frac{\text{Length of object in drawing}}{\text{Actual Length of object}}$$

$$\frac{2}{45} = \frac{L \cdot O \cdot I \cdot D}{5\,\text{yards}} = 5 \times 3 \times 12 \times 2.54\,\text{cm} \times \frac{2}{45} = L \cdot O \cdot I \cdot D.$$

$L \cdot O \cdot I \cdot D = 20.32\,\text{cm} \simeq 20.3\,\text{cm}$ (or) 203 m



7. A rectangular plots of land measuring 1.28 hectares is showing on a map by a similar rectangle of $8 cm^2$ calculate R.F of the scale. Draw a diagonal scale two read 1m and long enough to measure 600m. show a distance of 438m on it.

Sol:

$$R.F = \frac{8 cm^2}{1.28 \times 10^4 m^2}$$

$$= \sqrt{\frac{8 cm^2}{1.28 \times 10^4 m^2}} = \sqrt{\frac{\cancel{8}^{1}}{\cancel{128}_{16} \times 10^2}} \times \frac{cm}{m}$$

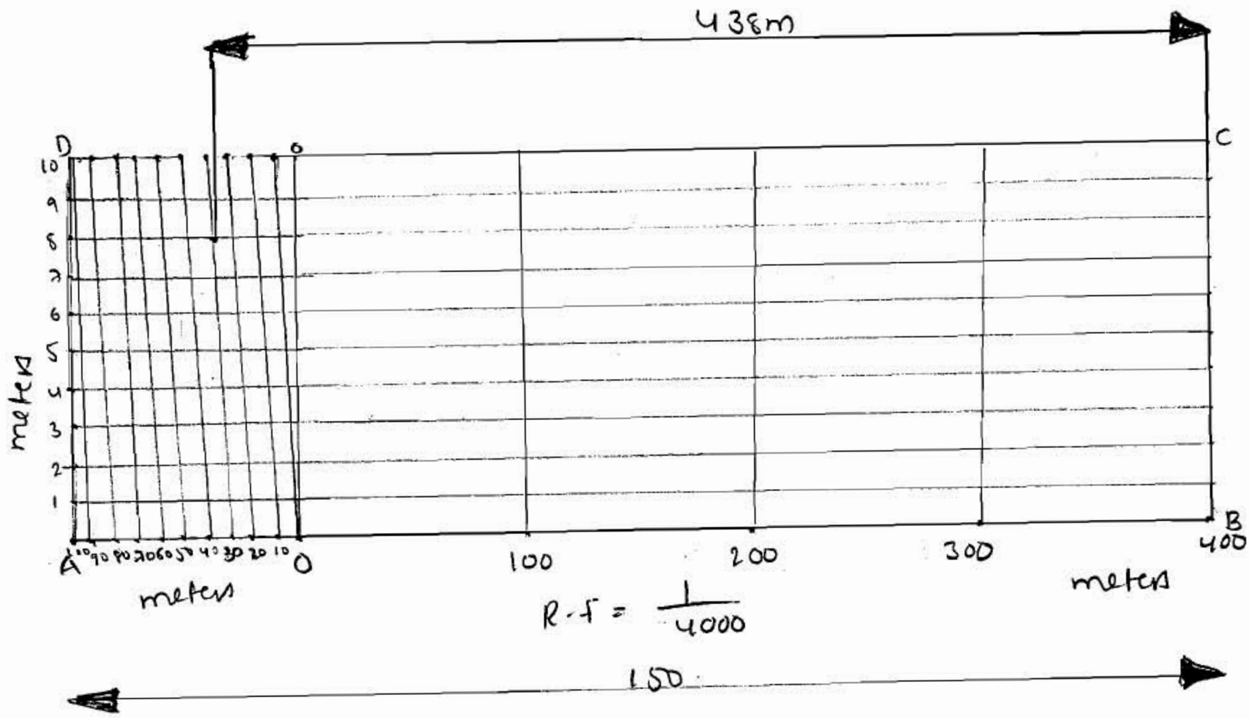
$$\therefore R.F = \frac{1}{4 \times 10} \times \frac{\cancel{cm}}{100 \cancel{cm}} = \frac{1}{4000}$$

$$R.F = \frac{\text{Length of the object in drawing}}{\text{Actual Length of object.}}$$

$$\frac{1}{4000} = \frac{L.O.I.D}{600m} \Rightarrow \frac{\cancel{600}^{15} \times \cancel{100}}{\cancel{4000}} = 15cm \text{ (or) } 150mm$$

$\therefore$ max Length = 600 m

marking distance = 438 m.



8. The distance between two stations is 100 km and on a map It is shown by 30 cm. Draw a diagonal scale and indicate 46.8 km and 32.4 km.

Sol: $R.F = \frac{30\,cm}{100\,km} = \frac{3\cancel{0}\,\cancel{cm}}{10\cancel{0} \times 10^5\,\cancel{cm}} = \frac{3}{10^6}$

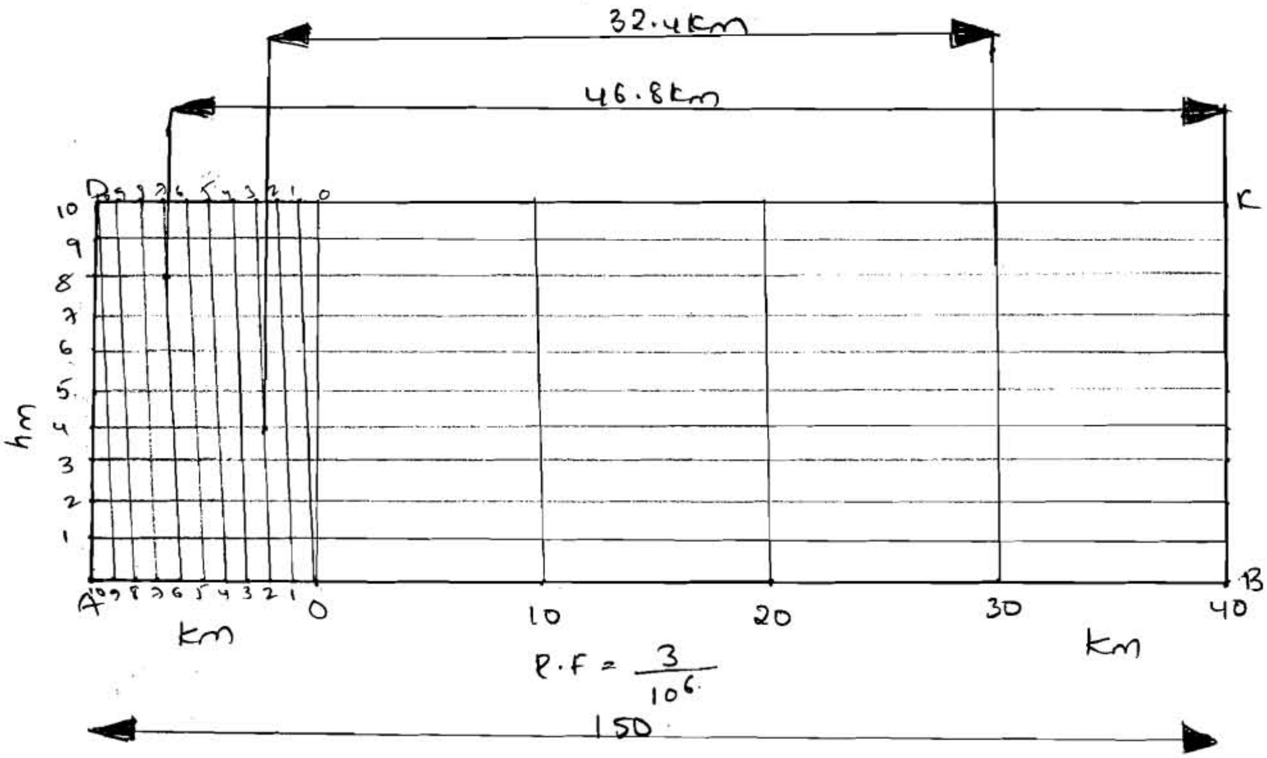
$R.F = \frac{\text{Length of object in drawing}}{\text{Actual Length of object}}$

Max Length = 50 km ($\because$ max marking is 46.8 km).

$\frac{3}{10^6} = \frac{L.O.I.D}{50\,km}$

$L.O.I.D = \frac{5\cancel{0} \times 10^{\cancel{8}} \times 3\,cm}{1\cancel{0}\cancel{6}} = 15\,cm$ or 150 mm

marking distance = 46.8 km and 32.4 km



9. Construct a scale to measure km, $\frac{1}{8}$ km and $\frac{1}{40}$ km, in which 1 km is showing by 4 cm. Mark on the scale at a distance of 2.775 km.

Sol.

$$R.F = \frac{4\,cm}{1\,km} = \frac{4\,cm}{1\times10^5\,cm} = \frac{1}{25\times10^3}$$

$$\therefore R.F = \frac{1}{25\times10^3}$$

$$R.F = \frac{\text{Length of the object in drawing}}{\text{Actual Length of object}}$$

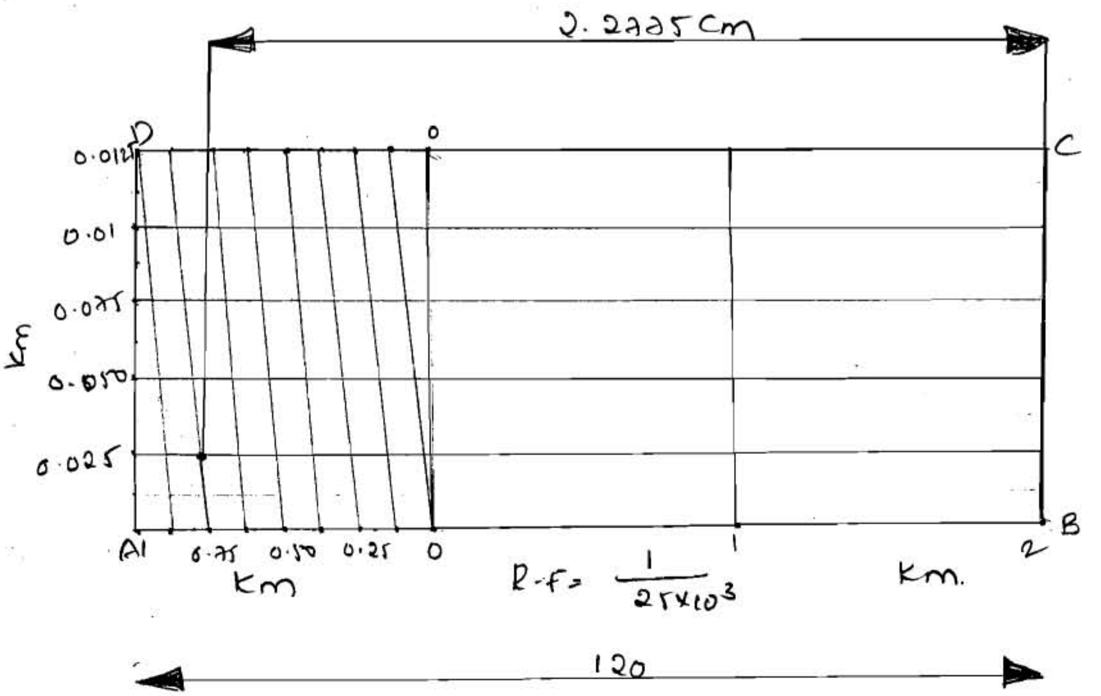
max Length = 3 km (∵ max marking is 2.775 km).

$$\frac{1}{25\times10^3} = \frac{L.O.I.D}{3\,km}$$

$$L.O.I.D = \frac{3\times10^5\,cm}{25\times10^3} = 3\times4\,cm = 12\,cm$$

$\therefore$ L.O.I.D = 120 mm

Marking distance = 2.775 km.



1-Q:- Construct a scale of R.F = 2.5 to show m, dm, cm and long enough to measure upto 4m.

Sol:

$R.F = 2.5$

$R.F = \frac{25}{10} = \frac{5}{2}$

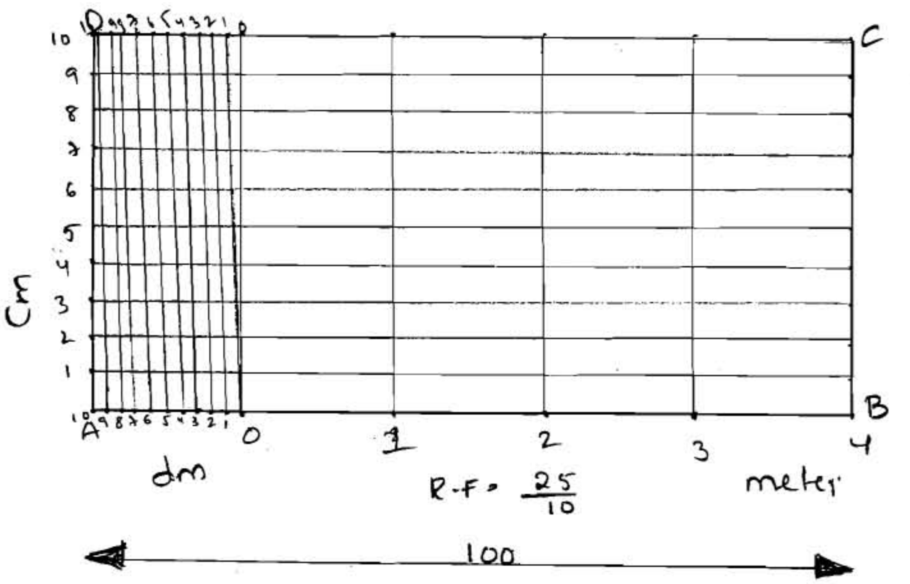
$R.F = \frac{\text{Length of } \cancel{\text{ob}}\text{ject in drawing}}{\text{Actual length of object}}$

$\therefore$ max length = 4m

$\frac{5}{2} = \frac{L.O.I.D}{4m}$

$\frac{5}{\cancel{2}} \times \cancel{4}^{2} \times 100 = L.O.I.D$

$L.O.I.D = 1000cm$ (or) $10,000mm$.



Scale : 1:100

2. Q:- Draw a diagonal scale of R.F = 4 to read cm, $\frac{1}{5}$cm, $\frac{1}{25}$cm and to measure upto 5cm. Mark on the scale distance of 3.36 cm.

Sol: R.F = 4

$$R.F = \frac{\text{Length of object in drawing}}{\text{Actual Length of object}}$$

max Length = 5cm

$$\frac{4}{1} = \frac{L.O.I.D}{5cm}$$

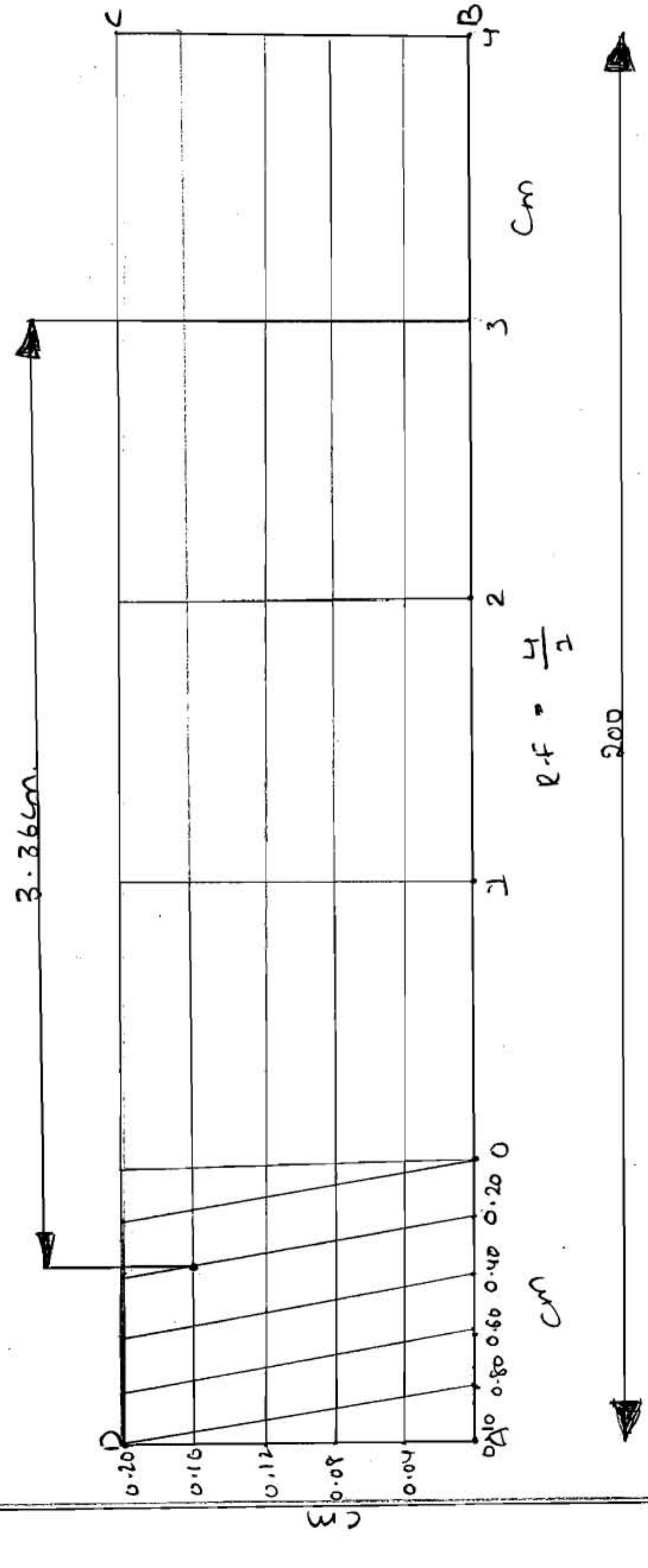
$4 \times 5cm = L.O.I.D$

L.O.I.D = 20cm (or)

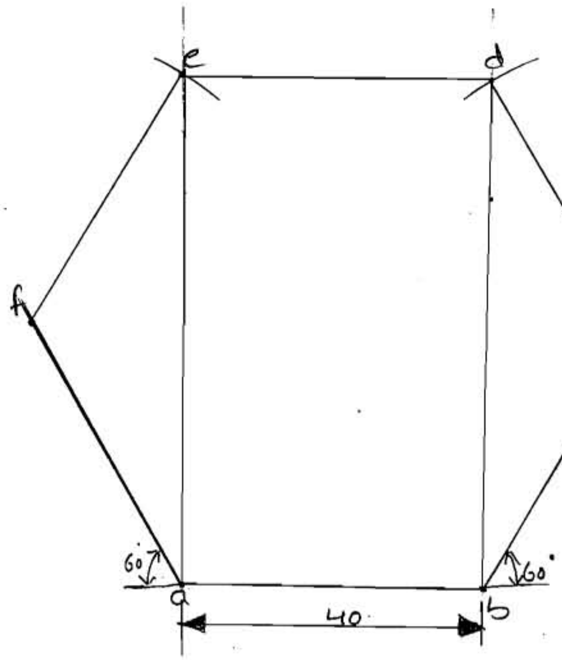
200 mm

Marking distance.

= 3.36 cm.



3\. Q:- a) Draw a regular hexagon of 40mm side using general method.



Hexagon

b) The distance between two points on a map is 15 cm. The real distance b/w them is 20 km. Draw a diagonal scale to measure upto 25 km and show a distance of 18.6 km on it.

Sol.

$$R \cdot F = \frac{15\,\cancel{cm}}{20 \times 10^5\,\cancel{cm}} = \frac{3}{4 \times 10^5}$$

$$R \cdot F = \frac{\text{Length of object in drawing}}{\text{Actual Length of object}}$$

max Length = 25 km

$$\frac{3}{4 \times 10^5} = \frac{L \cdot O \cdot I \cdot D}{25\,km}$$

$$L \cdot O \cdot I \cdot D = \frac{25 \times \cancel{10^5} \times 3\,cm}{4 \times \cancel{10^5}}$$

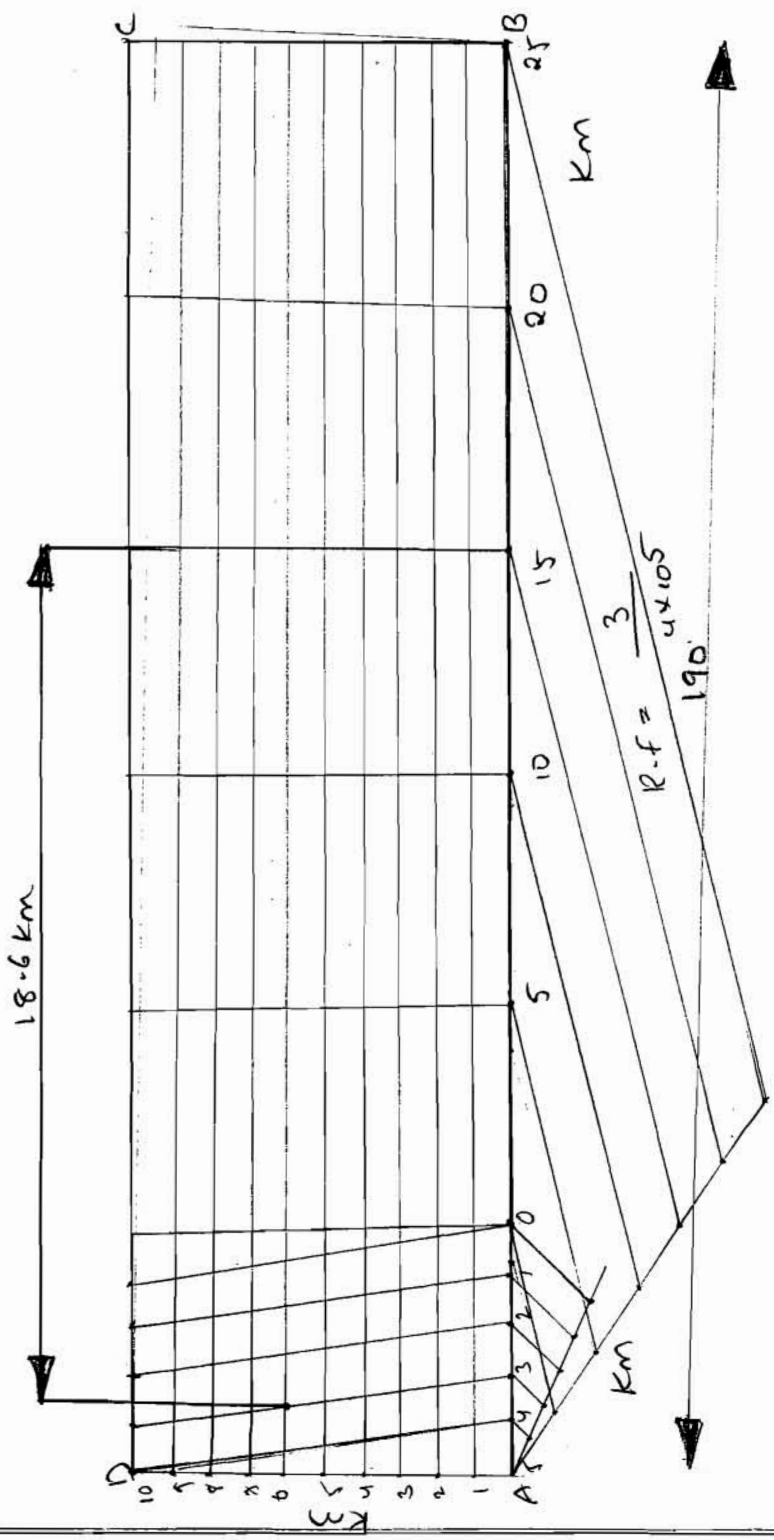
$= \frac{75}{4}$ cm

$= 18.75$ cm

≈ 19 cm

L.O.I.D = 19cm (or) 190 mm

Marking distance is 18.6 km.



Vernier scale

1. Construct a vernier scale of 1:40 to read meters, dm and cm and long enough to measure upto 6m and mark distance of 5.76m on it.

Sol: $R.F = \frac{1}{40}$

$R.F = \frac{\text{Length of object in drawing}}{\text{Actual Length of object}}$

$\therefore$ max length $= 6m$

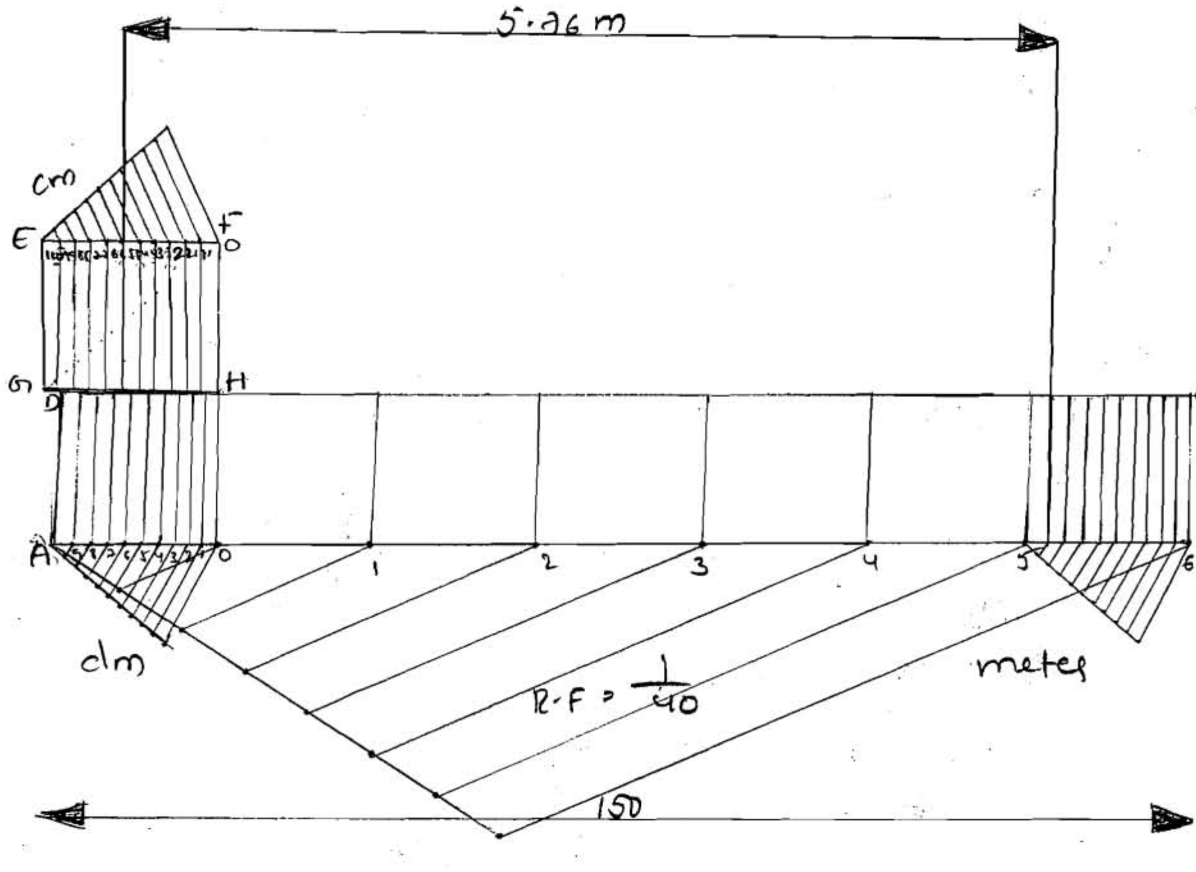
$\frac{1}{40} = \frac{L.O.I.D}{A.L.O}$

$\frac{1}{40} = \frac{L.O.I.D}{6m}$

$\frac{6 \times 100cm}{40} = L.O.I.D$

$\therefore L.O.I.D = 15cm$ (or) $150mm$

$\therefore$ Marking distance $= 5.76m$



2. If 1cm long line on a map represents a real distance of 4m. calculate the R.F. Draw a vernier scale long enough to measure upto 50m. show a distance of 44.5m on it.

Sol: $R.F = \frac{1cm}{4m} = \frac{1\cancel{cm}}{4\times100\cancel{cm}}$

$R.F = \frac{1}{400}$

$\therefore$ max Length = 50 m

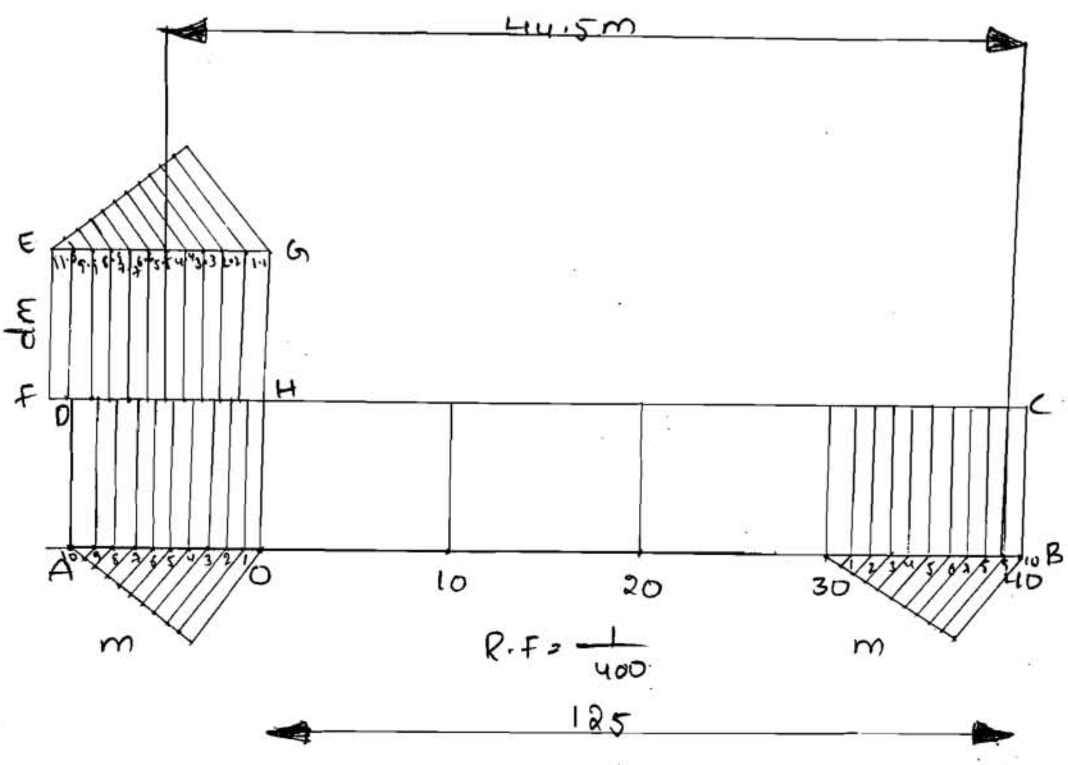
$R.F = \frac{\text{Length of object in drawing}}{\text{Actual length of object}}$

$\frac{1}{400} = \frac{L.O.I.D}{50m}$

$\frac{50\times100cm}{400} = L.O.I.D$

L.O.I.D = 12.5cm or 125mm

marking distance = 44.5 m.



Vernier Scale

3. A real Length of 10m is represented by a line of 5cm on a drawing. Find the R.F and Construct a vernier scale such that Least count is 2dm and measure upto 25m mark a distance of 19.4m on it.

Sol

$$R.F = \frac{5cm}{10m}$$

$$R.f = \frac{5\cancel{cm}}{10\times100\cancel{cm}} = \frac{1}{200}$$

max length = 25m

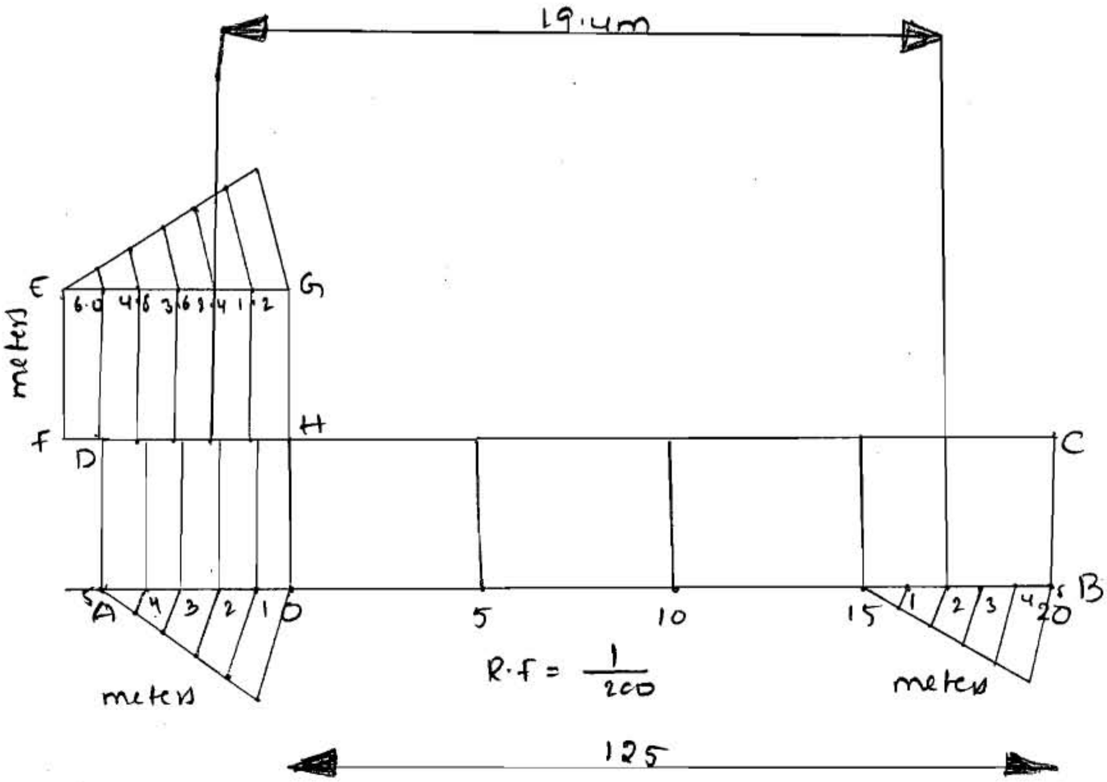
$$R.F = \frac{\text{Length of object in drawing}}{\text{Actual Length of object}}$$

$$\frac{1}{200} = \frac{L.O.I.D}{25m}$$

$$\frac{25\times 1\cancel{00}\ cm}{2\cancel{00}} = L.O.I.D$$

L.O.I.D = 12.5 cm or 125mm

∴ marking distance = 19.4m.



Vernier scale

4. On a map rectangle of 125cm × 200cm represents area of 6250 Km^2. Draw a vernier scale to show Dm, and long enough to measure upto 7 Km. show a distance of 6.43 km on it.

Sol: $R.F = \sqrt{\dfrac{125 \times 200 cm^2}{6250 km^2}}$

$= \sqrt{\dfrac{2500\cancel{0}}{625\cancel{0}} \times \dfrac{cm}{km}} = \sqrt{\dfrac{2500}{625} \times \dfrac{cm}{10^5 cm}}$

$= \dfrac{50}{25 \times 10^5} = \dfrac{2}{10^5} = \dfrac{1}{5 \times 10^4}$

$\therefore R.f = \dfrac{1}{5 \times 10^4}$

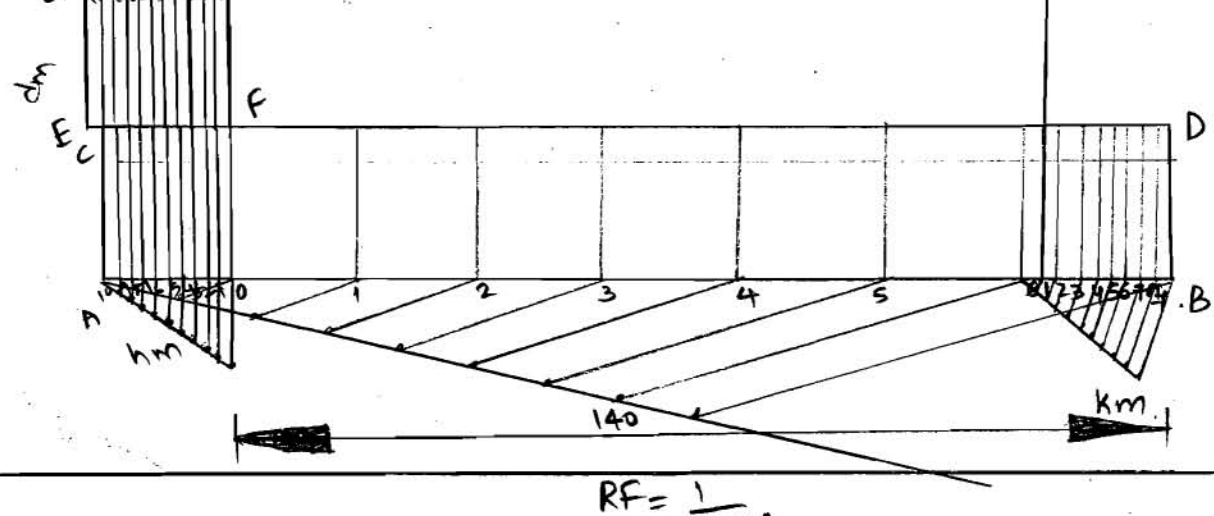
R - max length = 7 km

$\therefore R.F = \dfrac{\text{Length of object in drawing}}{\text{Actual length of object}}$

$\dfrac{1}{5 \times 10^4} = \dfrac{L.O.I.D}{7 \, km}$

$L.O.I.D = \dfrac{7 \times 10^5 cm}{5 \times 10^4} = 14 cm$ or 140mm

marking distance = 6.43 km



$RF = \dfrac{1}{5 \times 10^4}$

5. Construct a full size vernier scale of inches and show on it length of 4.67 inches.

Sol: Full size scale ratio = 1 : 1

$R.F = \frac{1}{1}$

max length = 5 inches (max marking is 4.67).

$R.F = \frac{\text{Length of object in drawing}}{\text{Actual Length of object}}$

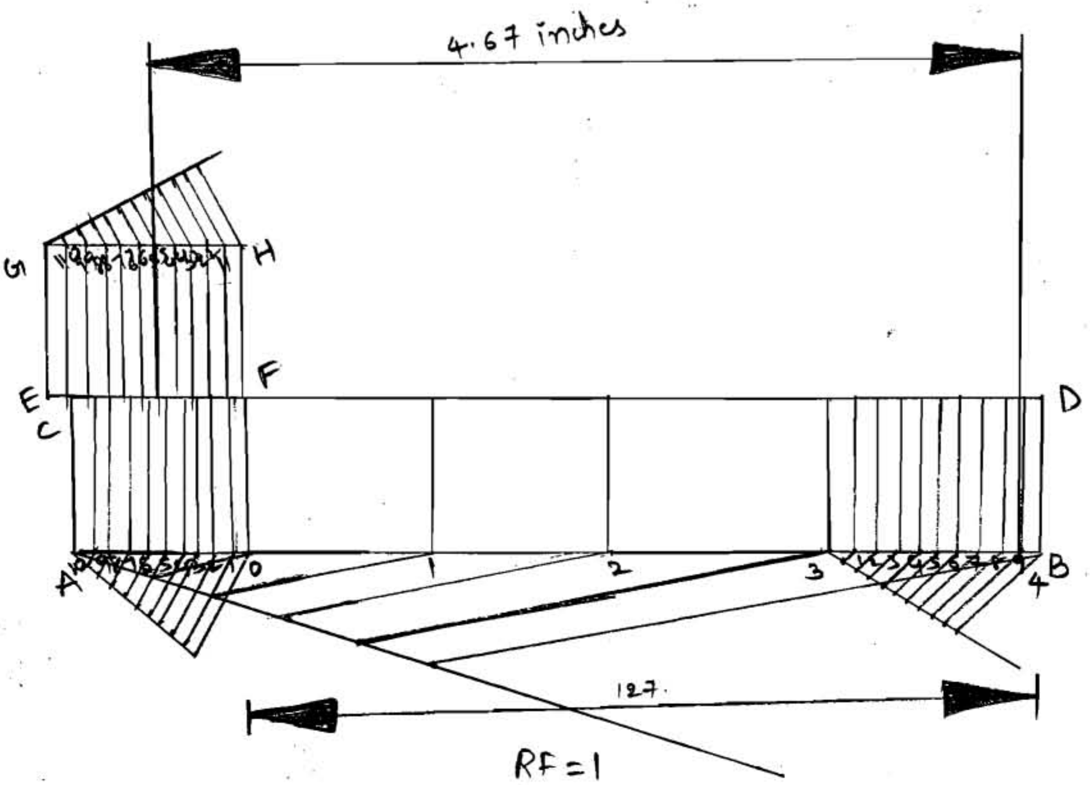
$\frac{1}{1} = \frac{L.O.I.D}{5 \text{ inches}}$

$L.O.I.D = 5 \times 2.54 \text{ cm}$

$= 12.7 \text{ cm}$

$= 127 \text{ mm}$

marking distance = 4.67 inches.



UNIT-II

Content

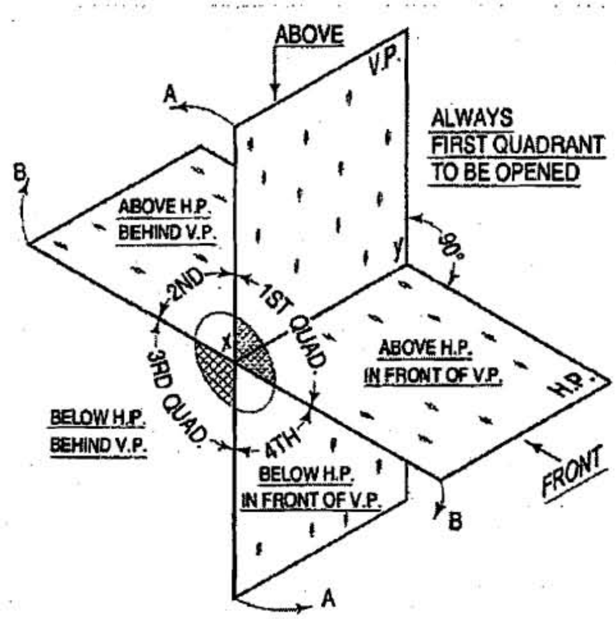
Orthographic Projections: Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures.—Auxiliary Planes.

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 calledreference planes or principal planes of projection. They intersect each other at rightangles. The vertical plane of projection (in front of the observer) is usually denotedby 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.

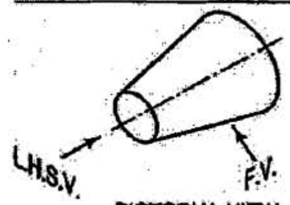
The linein which they intersect is termed the reference line and is denoted by the letters xy. The projection on the V.P. is called the front view or the elevation of the object.The projection on the H.P. is called the top view or the plan.



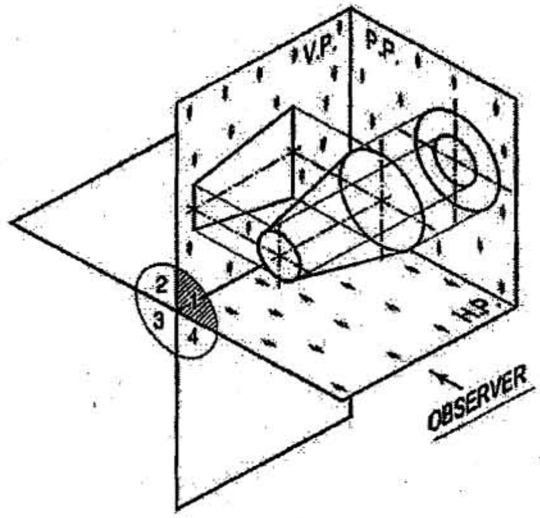
First-Angle Projection: We have assumed the object to be situated in front of the V.P. and above the H.P.i.e. in the first quadrant and then projected it on these planes. This method of projection is known as first-angle projection method. The object lies between the observer and the plane of projection.

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

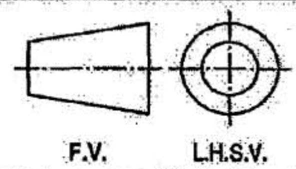


PICTORIAL VIEW



FIRST ANGLE PROJECTION

RELATION BETWEEN OBSERVER, OBJECT AND P.P.

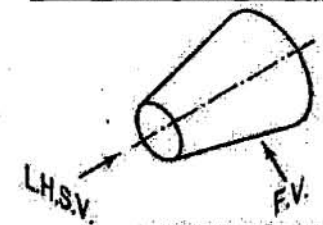


IDENTIFYING GRAPHICAL SYMBOL OF FIRST ANGLE PROJECTION

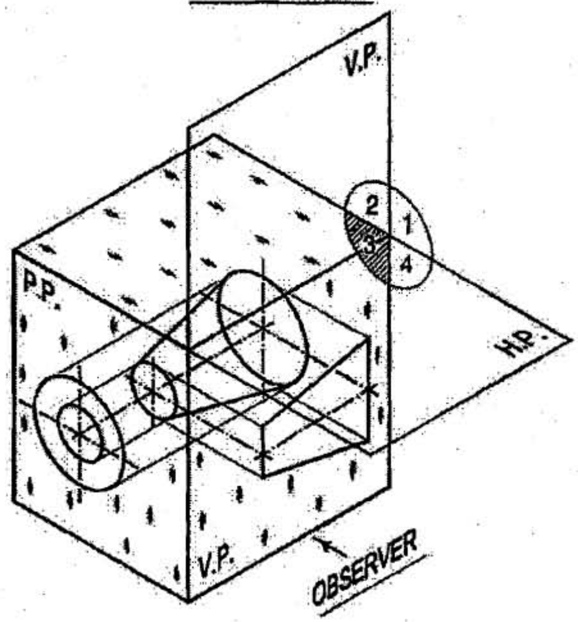
Third-Angle Projection: In this method of projection, the object is assumed to be situated in the third quadrant The planes of projection are assumed to be transparent. They lie between the object and the observer. When the observer views the object from the front, the rays of sight intersect the V.P.

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.

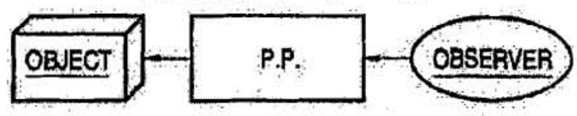
THIRD ANGLE PROJECTION METHOD



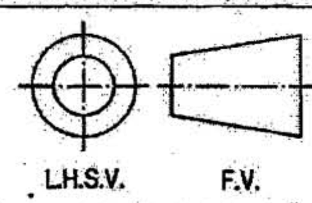
PICTORIAL VIEW



THIRD ANGLE PROJECTION



RELATION BETWEEN OBSERVER, OBJECT AND P.P.



IDENTIFYING GRAPHICAL SYMBOL OF THIRD ANGLE PROJECTION

Projections of Points:

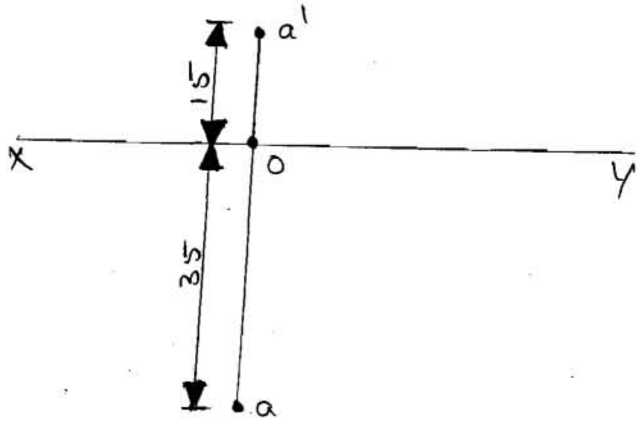
A point may be situated, in space,in any one of the four quadrants formed by the two principal planes of projection or may lie in any one or both of them. Its projections are obtained by extending projectors perpendicular to the planes.

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.

Projection of points :

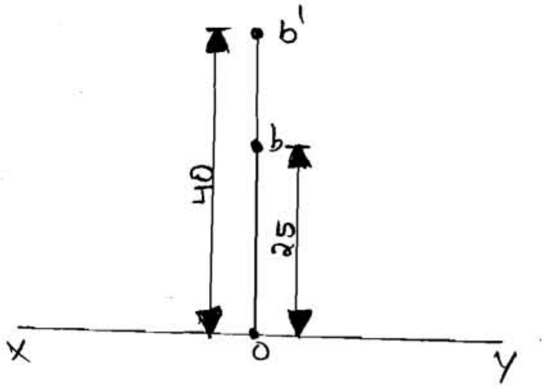
I. The Point 'A' is 15mm above H.P, 35mm infront of V.P

A → 15mm above H.P
35mm infront V.P



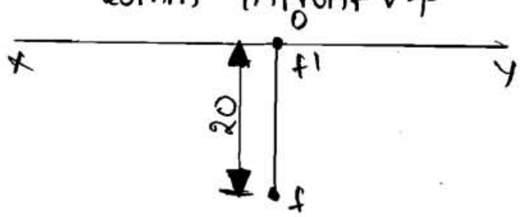
II) The Point 'B' is 40mm above H.P, 25mm behind V.P.

B → 40mm above H.P
25mm behind V.P



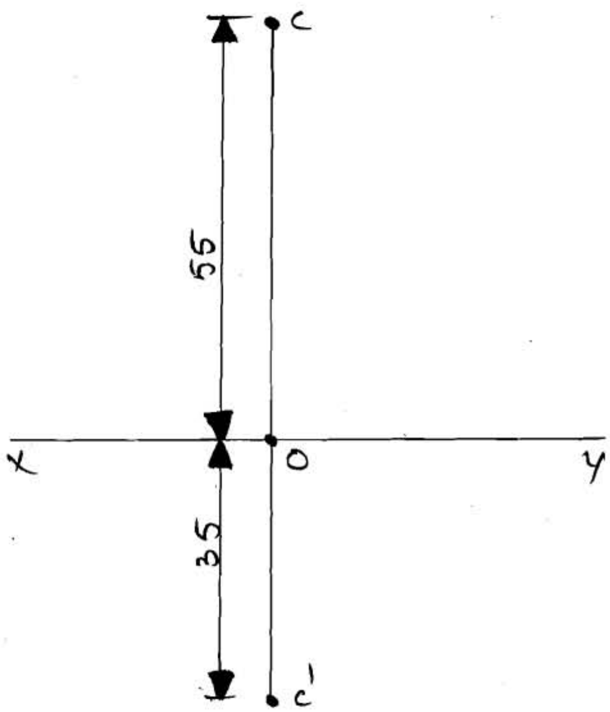
(VI) The Point 'F' is on the H.P and 20 mm infront of V.P.

F → F on the H.P
20mm infront V.P



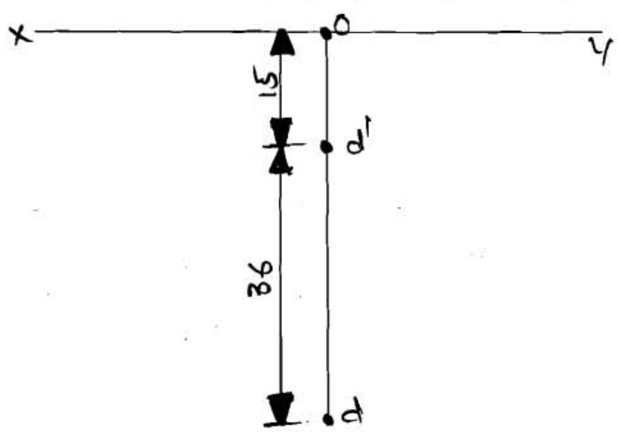
III) The Point 'c' is 35mm below H.P, 55mm behind V.P.

c → 35mm below H.P
55mm behind V.P



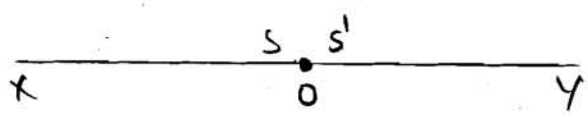
(IV) The point 'D' is 15mm below H.P, 36mm infront of V.P

D → 15mm below H.P
36mm infront V.P.



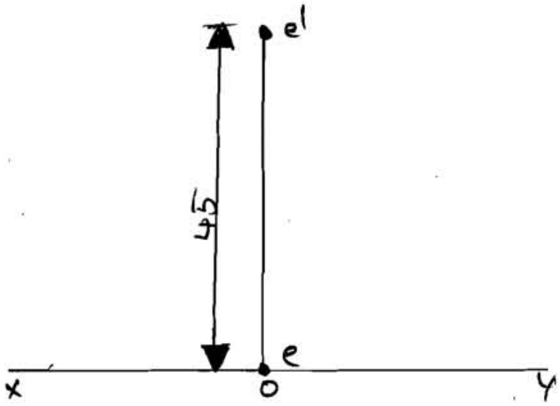
(IX) The point 's' both on the H.P and V.P.

s → on the H.P
on the V.P



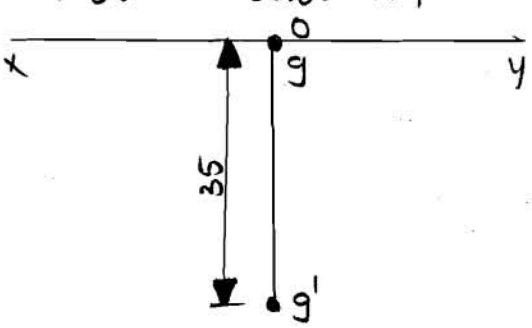
V The Point E' on the V.P and 45mm above H.P

E → Point on the V.P
45mm above H.P.



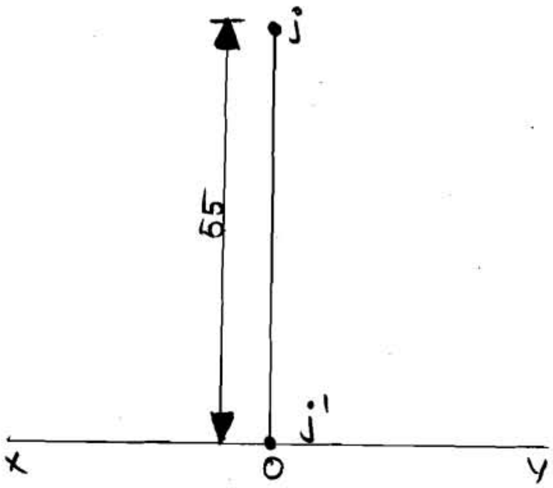
(VII) The point G' is on the V.P and 35mm below H.P

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

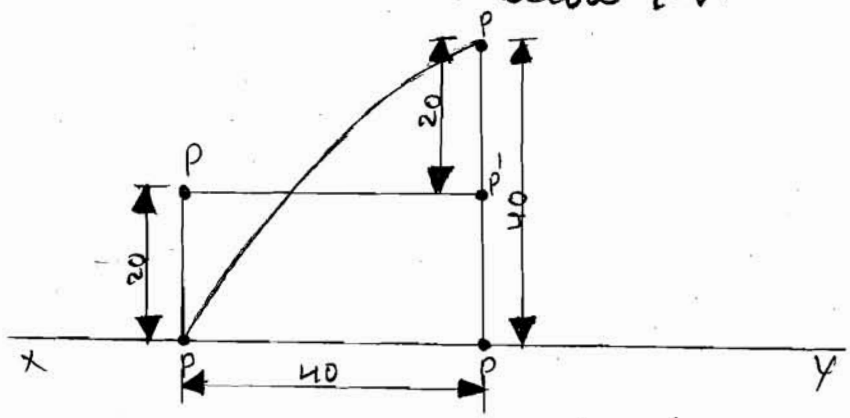


1. State the quadrants in which the following points are situated.

a) 'p' its top-view is 40mm above xy.
Front view 20mm below the top-view.

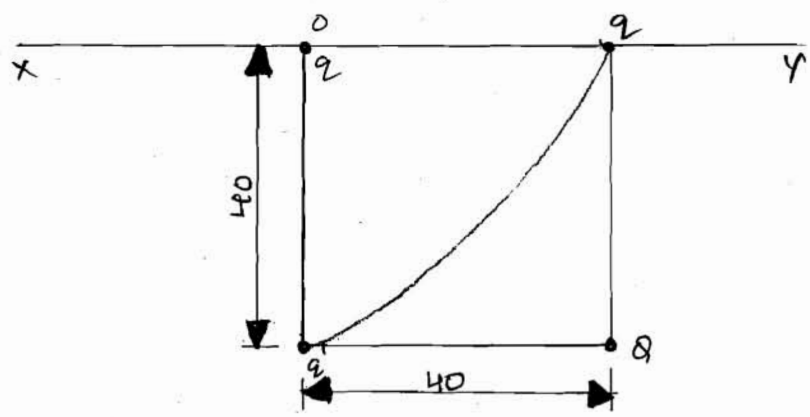
b) The point 'Q' its projections coincide with eachother 40mm below xy.

Ans. a) P ⟶ T.V 40mm above xy
F.V 20mm below t.v.



'p' lies in second quadrant.

b) Q ⟶ coincide with each other
40mm below xy



21 A point 'p' is 15mm above H.P and 20mm infront 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 90mm. Draw st.lines joining.

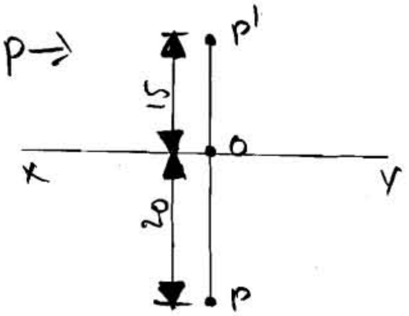
(i) Their top-views
(ii) Their front views.

P → 15mm above H.P
20mm infront V.P

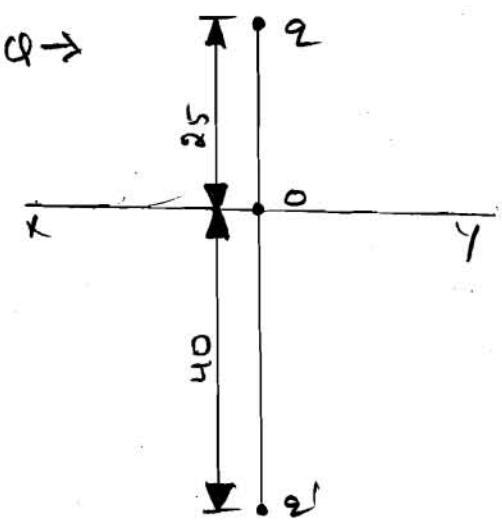
Q → 25mm behind V.P
40mm below H.P.

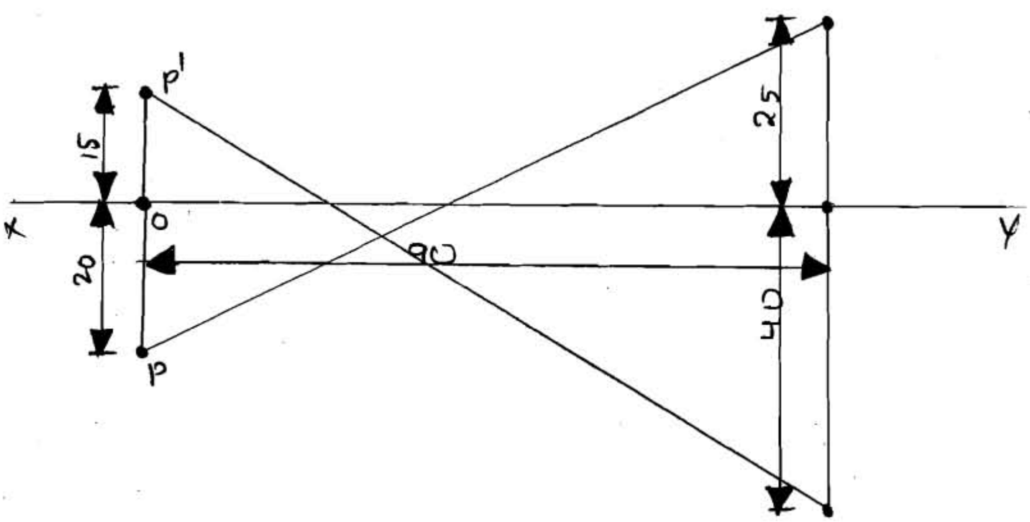
distance b/w their projections is 90mm.

P →

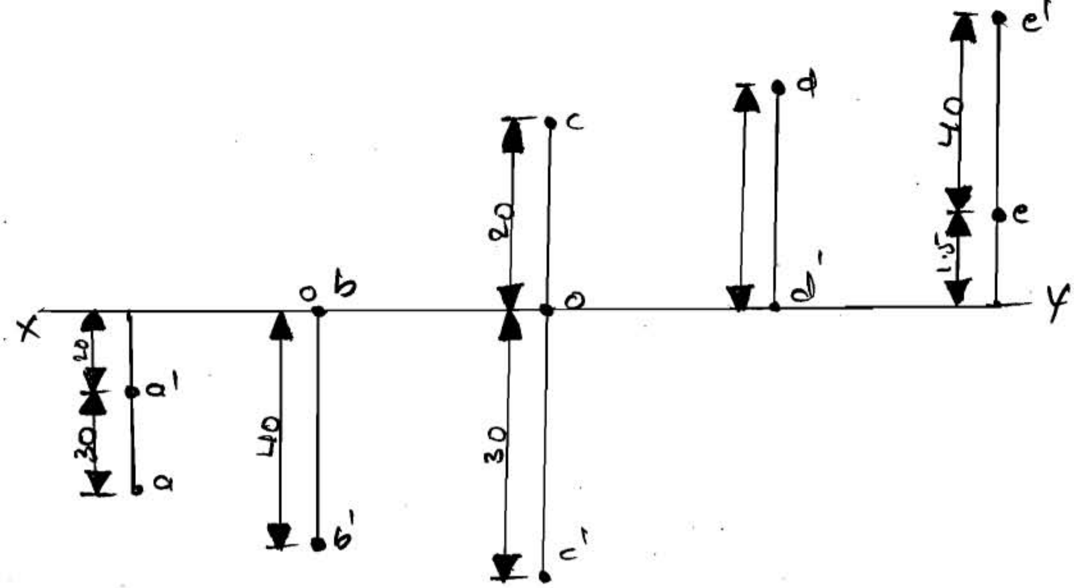


Q →

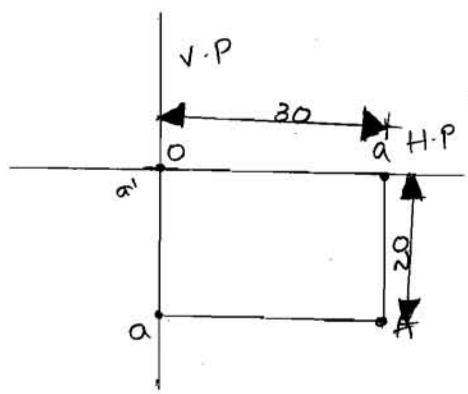


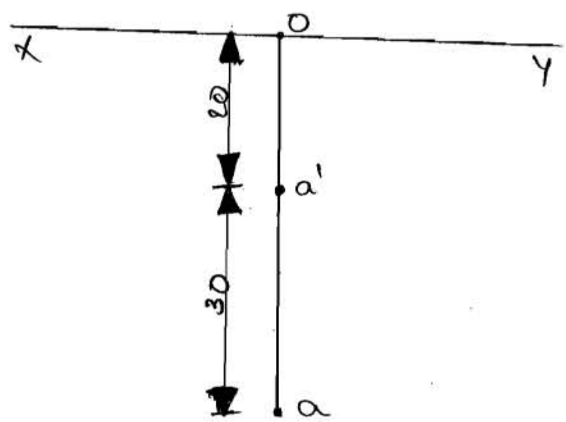


3. projection of various points are given in the figure state the position of each point with respect to reference planes giving the distance in cm.

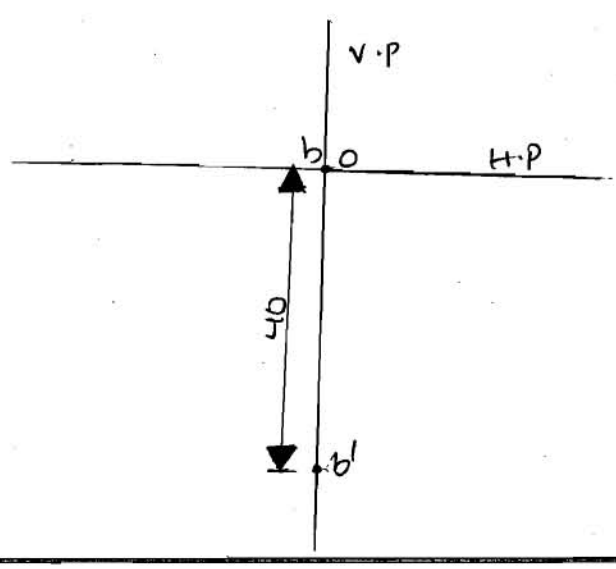


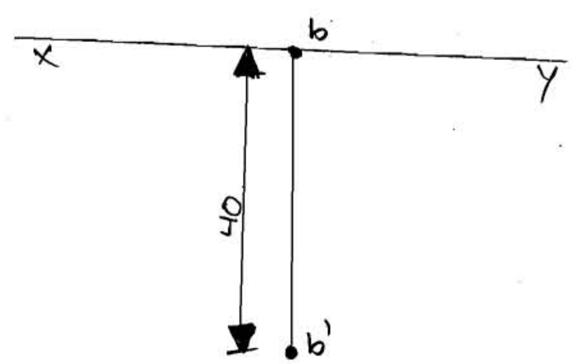
(i) A → 30mm → V.P
20mm ↓ H.P



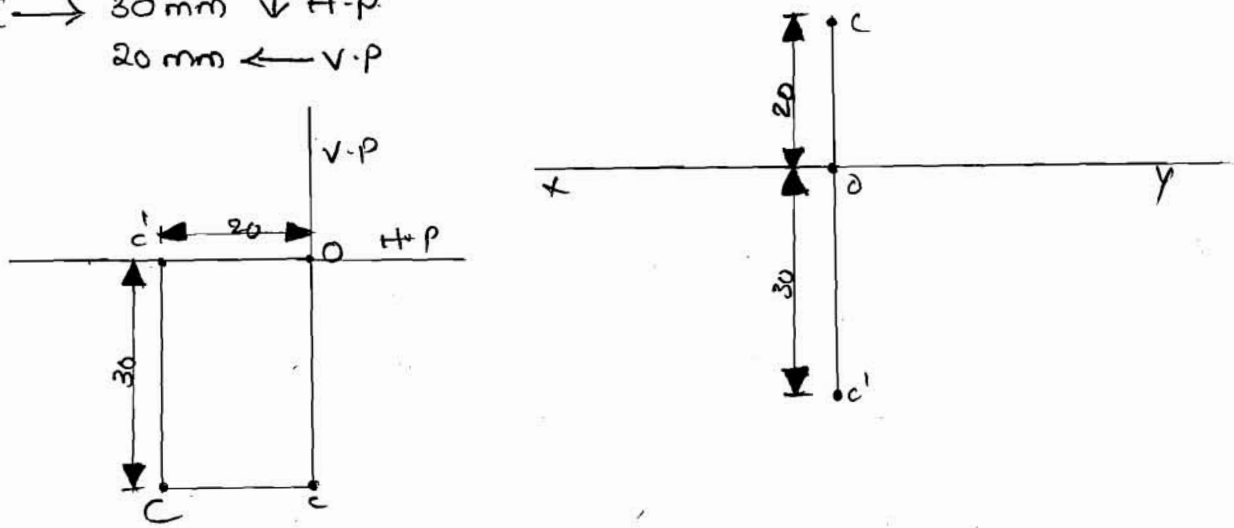


(ii) B → on the V-P
40mm ↓ H.P

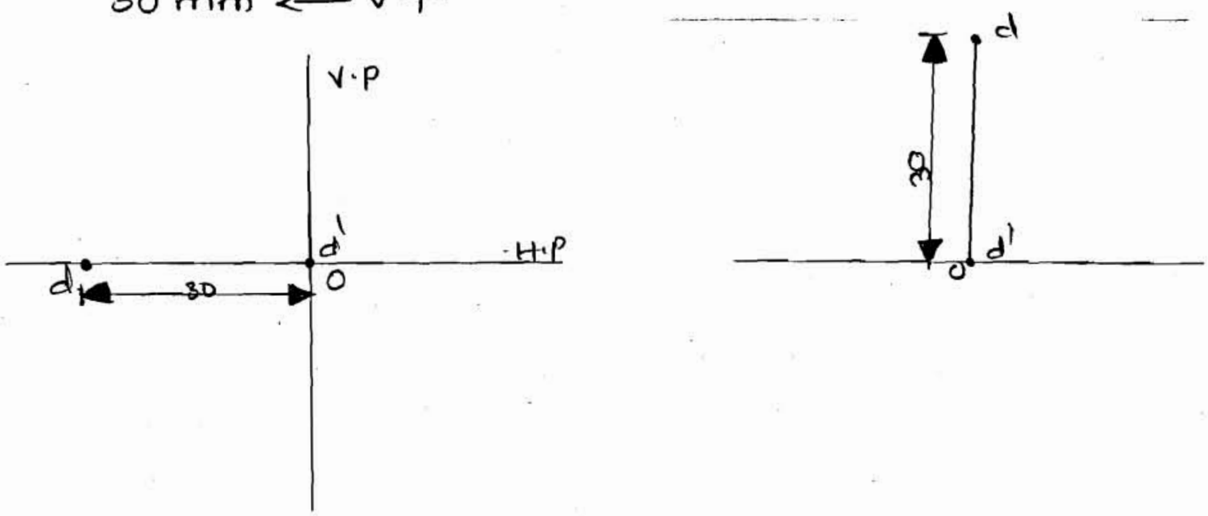




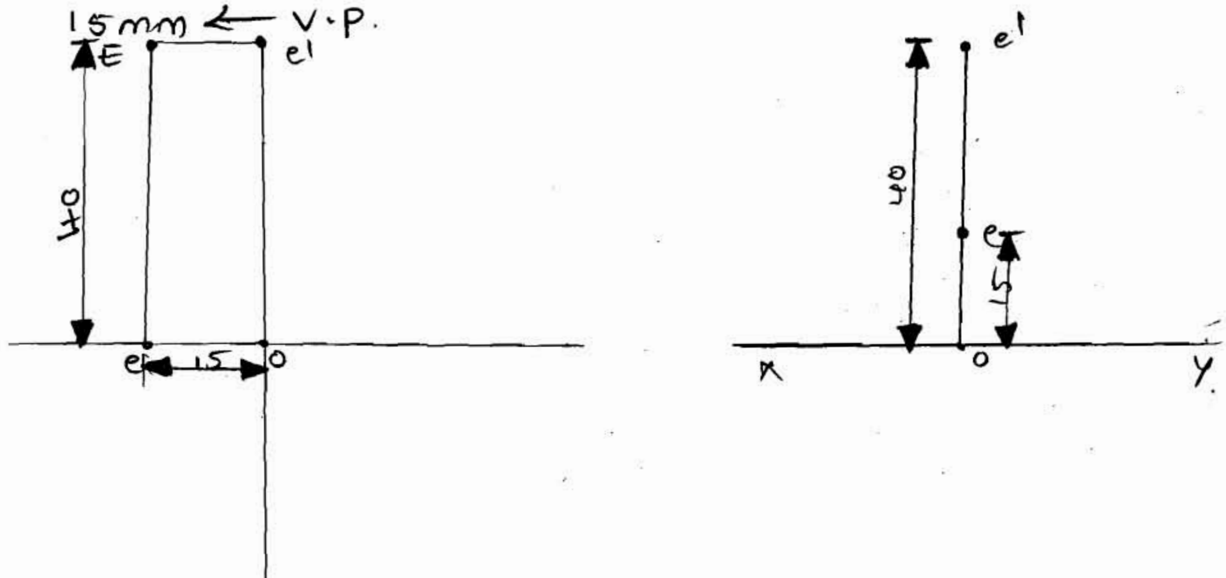
(iii) C ⟶ 30 mm ↓ H.P.
20 mm ⟵ V.P



(iv) D ⟶ on the H.P.
30 mm ⟵ V.P.



(V) E ⟶ 40mm ↑ H.P.
15mm ⟵ V.P.

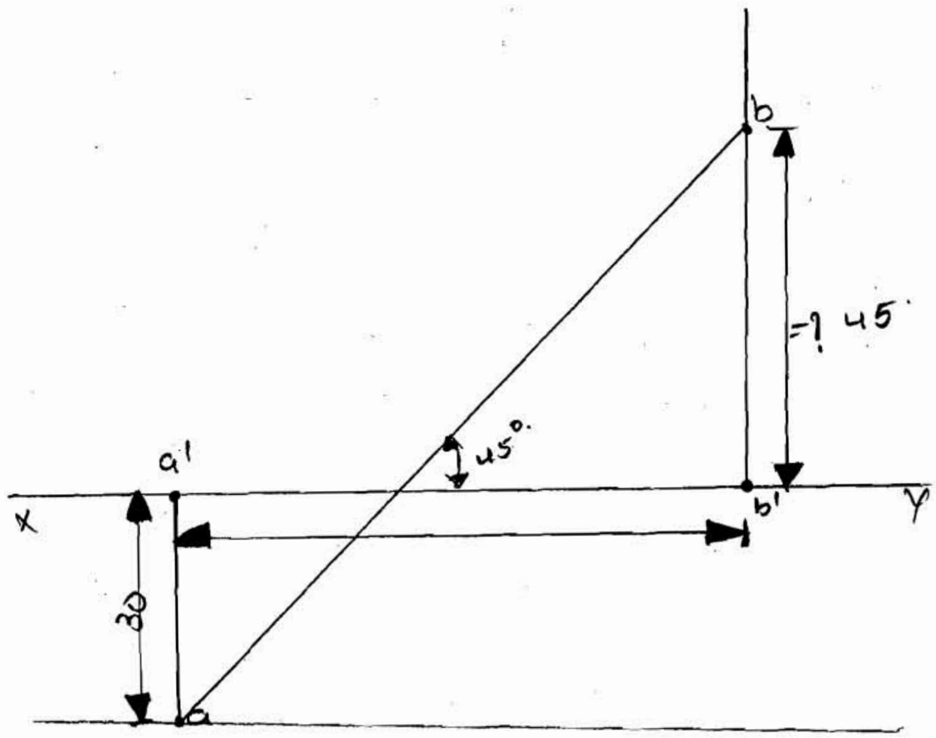


Q: Two points 'A' and 'B' are in the H.P. The point 'A' is 30 mm infront of V.P, while 'B' is behind the V.P. The distance b/w their projectors is 75mm and their line joining their top views makes an angle of 45° with xy. Find the distance of the point 'B' from V.P.

Ans: A → 30mm infront of V.P

B → behind the V.P = ?

Distance b/w their projectors = 75mm.



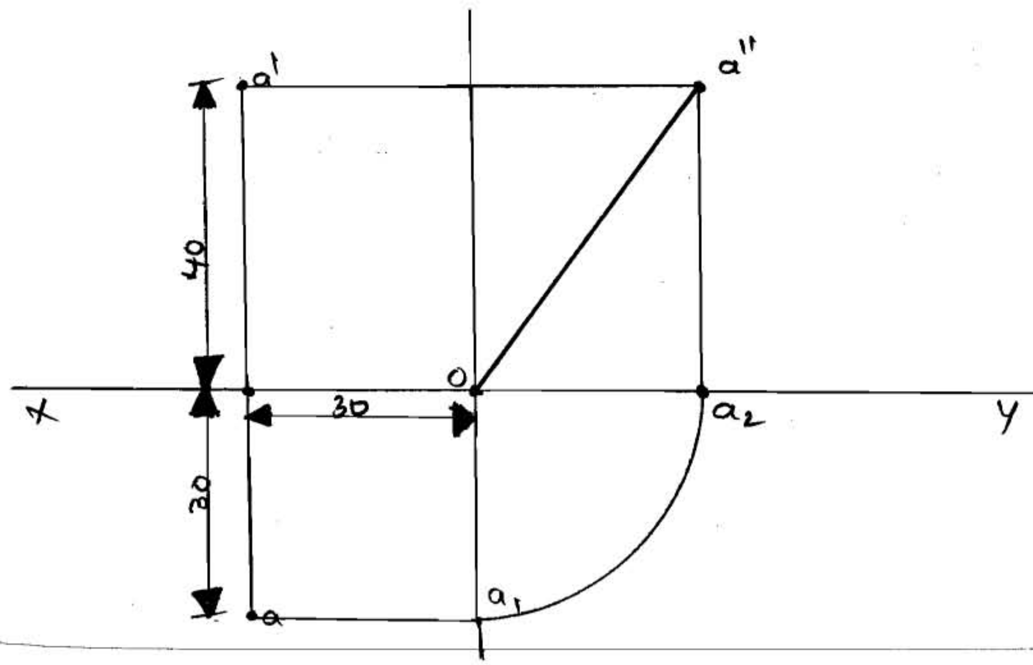
Q:- The point 'Q' is situated in first quadrant - It is 40mm above H.P and 30 mm infront of V.P. Draw its projections and find its shortest distance from the intersection of H.P, V.P and auxillary plane.

Ans: Q → in first quadrant

40mm ↑ H.P

30mm → V.P.

auxillary plane = ?

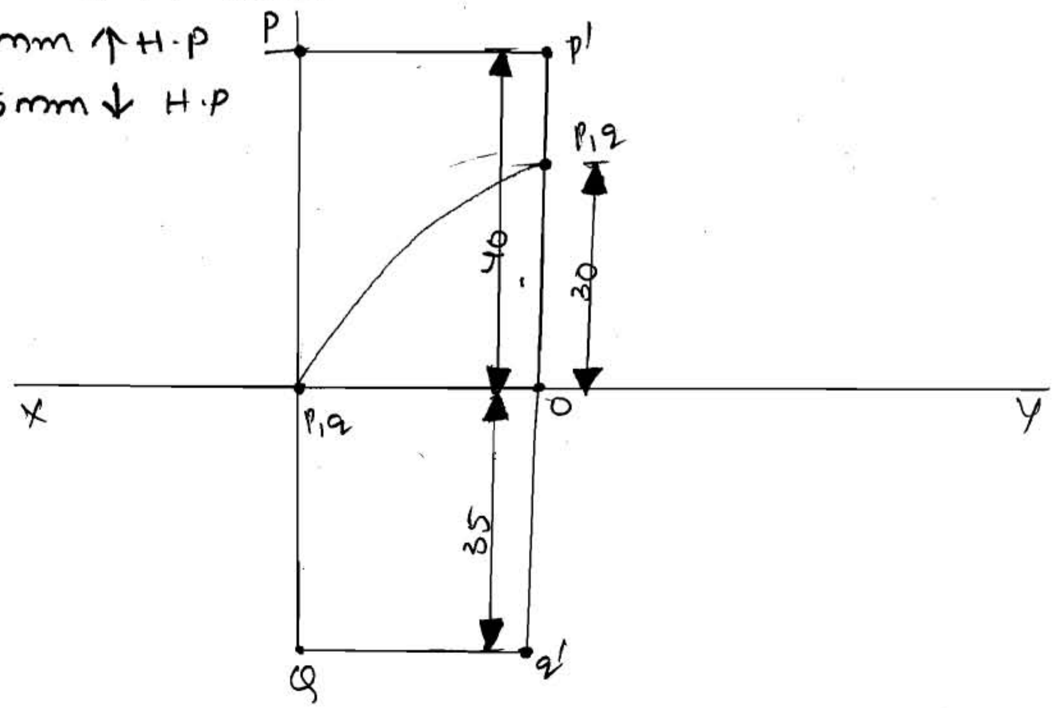


Q: A point 30 mm above xy line is the plan view (top view) of two points p and q. The elevation of p' is 45mm above H.P, while that of the point q' is 35mm below the H.P. Draw the projections of point and state their positions with reference to the principle planes and the quadrant in which they lie.

Ans: Both P and Q T.V = 30mm

P → 45mm ↑ H.P

Q → 35mm ↓ H.P



Projections of Straight Lines:

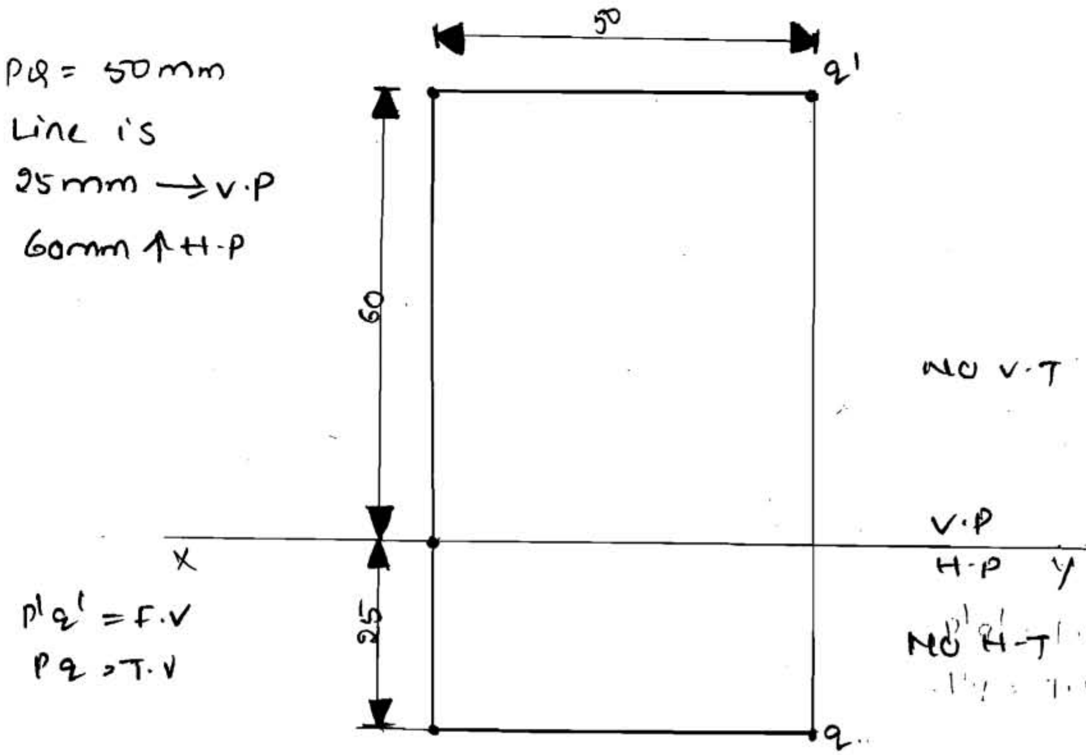
A straight line is the shortest distance between two points. Hence, the projectionsof a straight line may be drawn by joining the respective projections of its endswhich are points.

The position of a straight line may also be described with respect to the tworeference 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

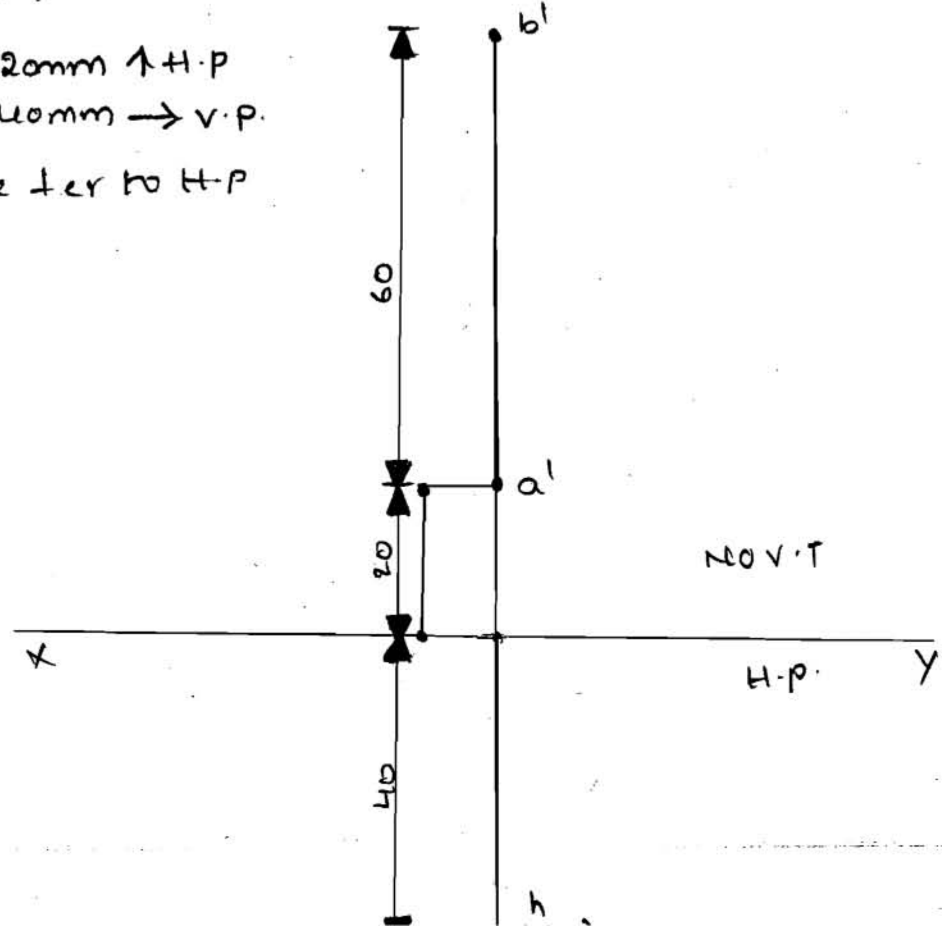
1Q:- A 50mm long line PQ' is parallel to both H.P and V.P it is 25mm infront of V.P and 60mm above H.P. Draw its projections and determine its traces.



2Q:- A 60mm long line AB has its end A' 20mm above H.P. The line is ⊥er to H.P and 40mm infront of V.P. Draw its projections and locate it traces?

Ans. A → 20mm ↑ H.P
40mm → V.P.

The line ⊥er to H.P



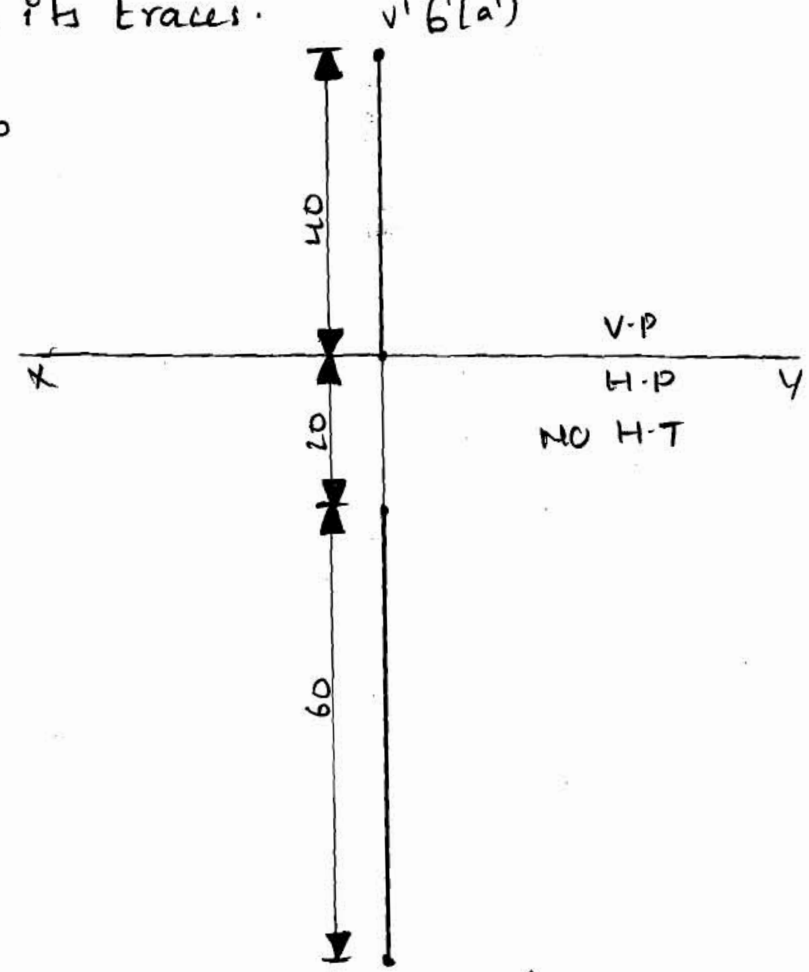
3. A 60mm Long Line. AB has its end 'A' is 20 mm infront of V.P. The line is ⊥er to V.P and 40 mm above the H.P. Draw its projections and Locate its traces.

An: AB = 60mm

A → 20mm infront V.P

= 40mm ↑ H.P

Line ⊥er to V.P.



4. A 80mm long line AB has end 'A' at distance of 20mm above H.P and 40mm infront 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 it traces

An. $\theta \rightarrow$ H.P

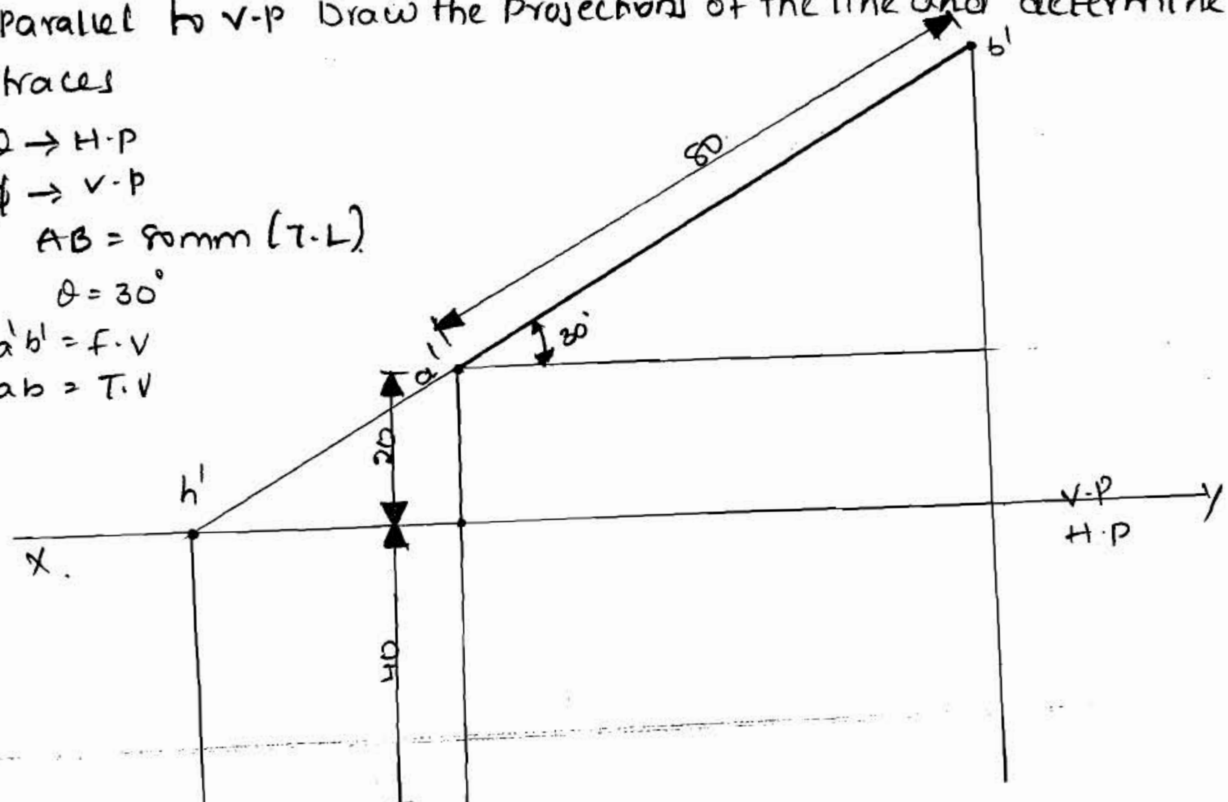
$\phi \rightarrow$ V.P

AB = 80mm (T.L)

$\theta = 30^\circ$

a'b' = F.V

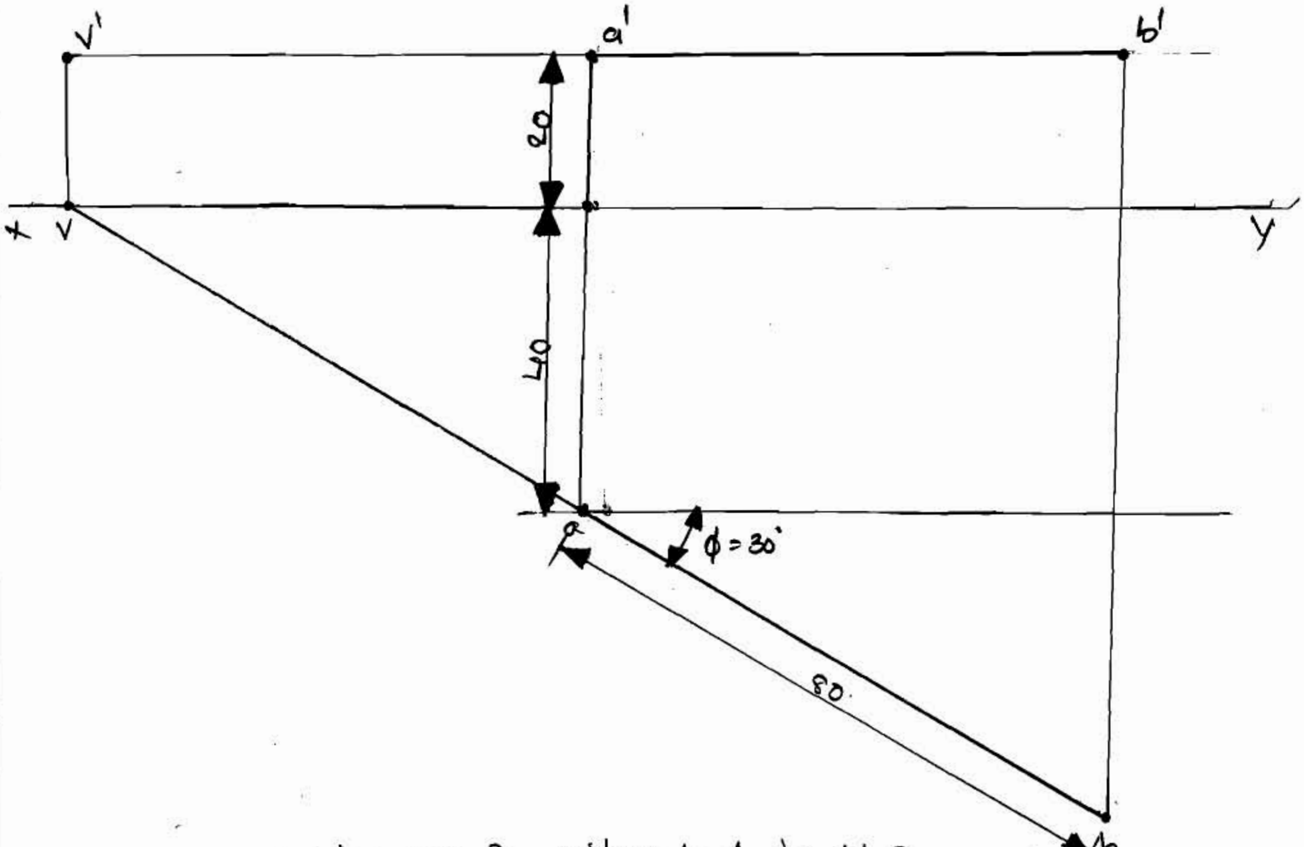
ab = T.V



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 20mm above the H.P and 40mm infront of the V.P. Draw the projections of the line and determine it traces.

AB = 80mm

A → 20 ↑ H.P   B → 40 → V.P $\phi = 30°$

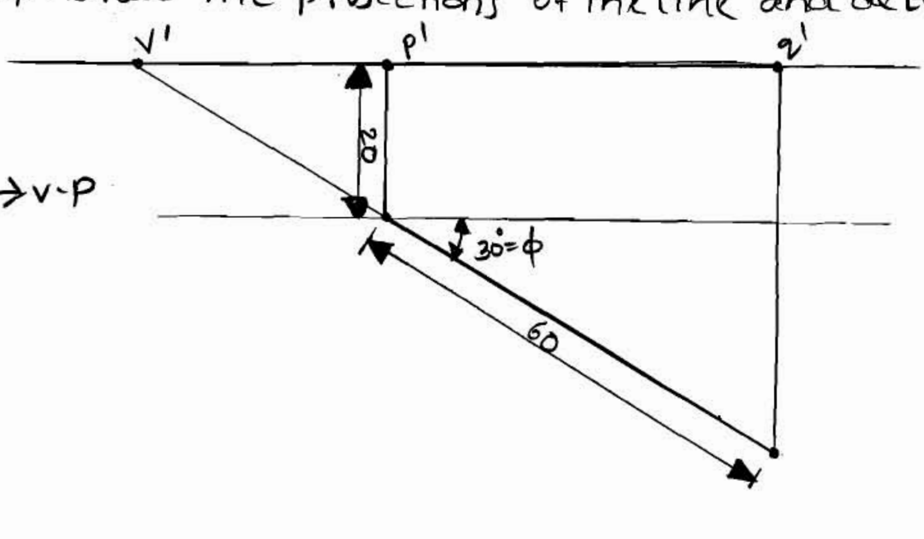


6. A 60mm long line PQ is situated in H.P and is inclined at 30° to V.P. The end 'p' of the Line is situated 20mm infront of V.P. Draw the projections of the line and determine it trace.

PQ = 60mm

P → 20mm → V.P

$\phi = 30°$

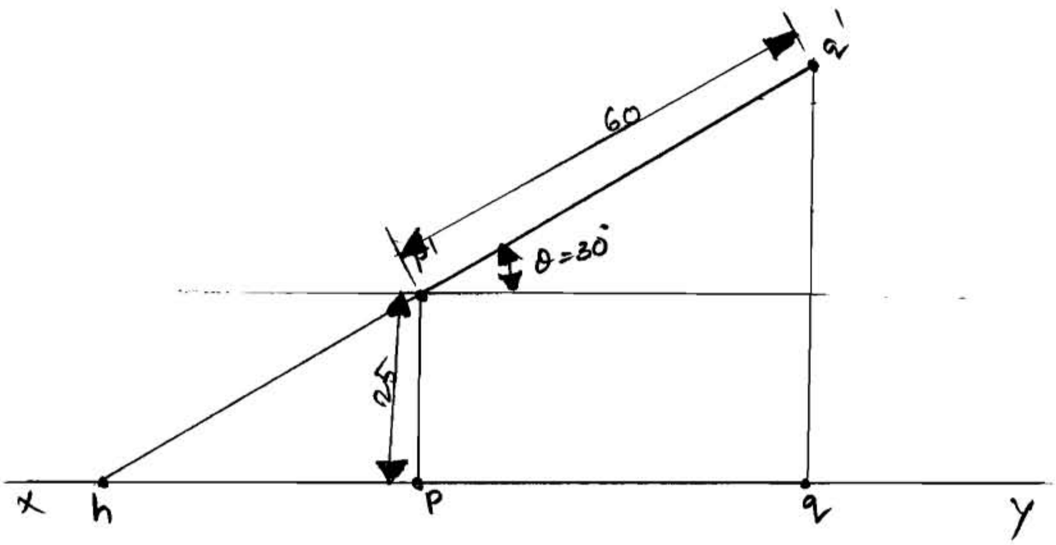


7. Draw the projections of a 60mm long line p'q' is in the V.P and inclined at 30° to H.P. The end p' of the Line is 25mm above the H.P. Also determine the traces of the line.

Ans $p'q' = 60$ mm

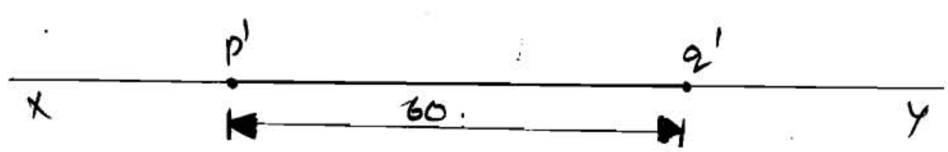
$P \rightarrow 25$mm ↑ H.P

$\theta = 30°$



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 = 60mm.

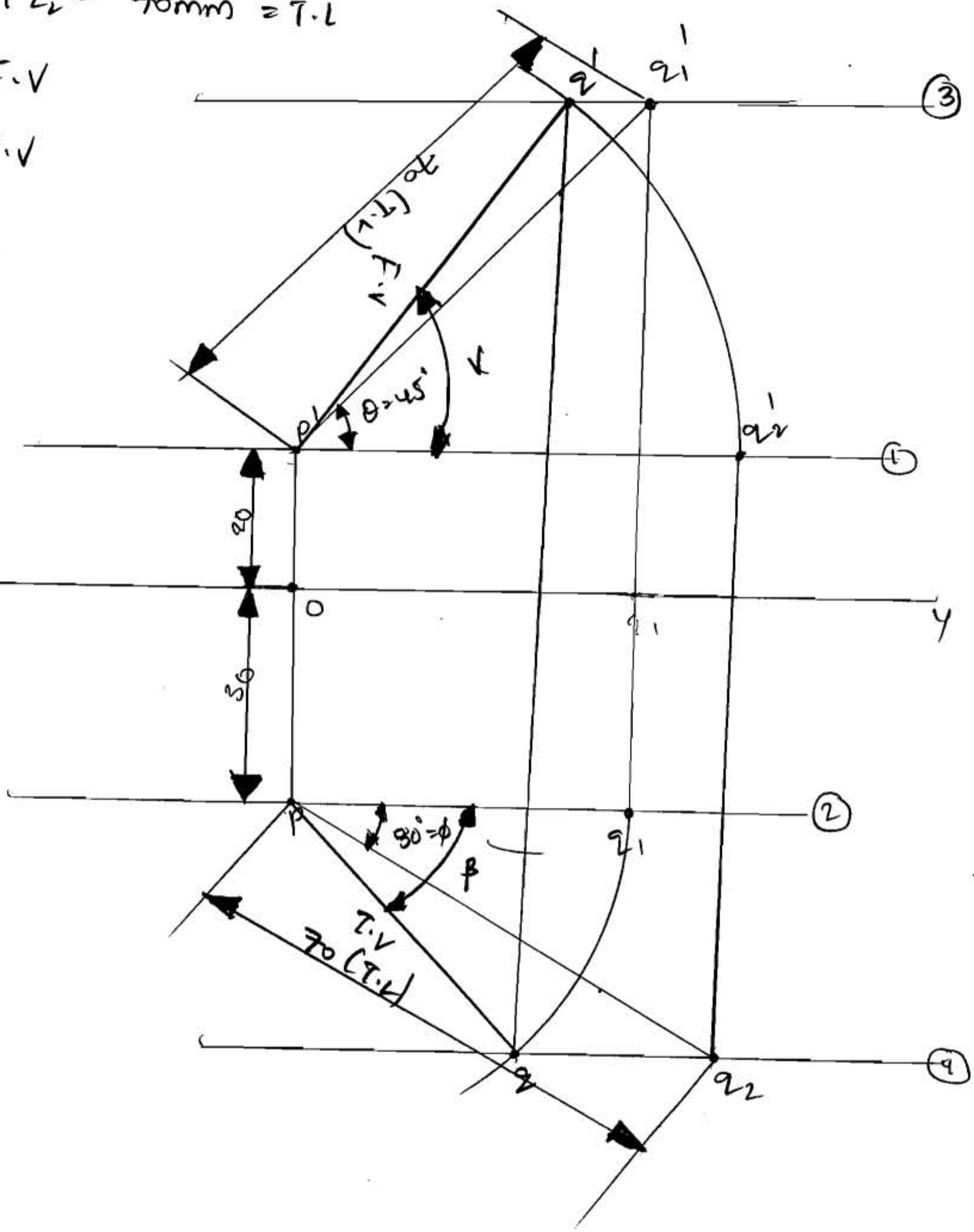


9. A 70mm long line PQ has its end 'p' is 20mm above H.P and 30mm infront of V.P - The line is inclined at 45° to H.P and 30° to V.P. Draw its projections.

Ans:- $p'q' = pq_2 = 70mm = T.L$

$p'q' = F.V$

$pq = T.V$

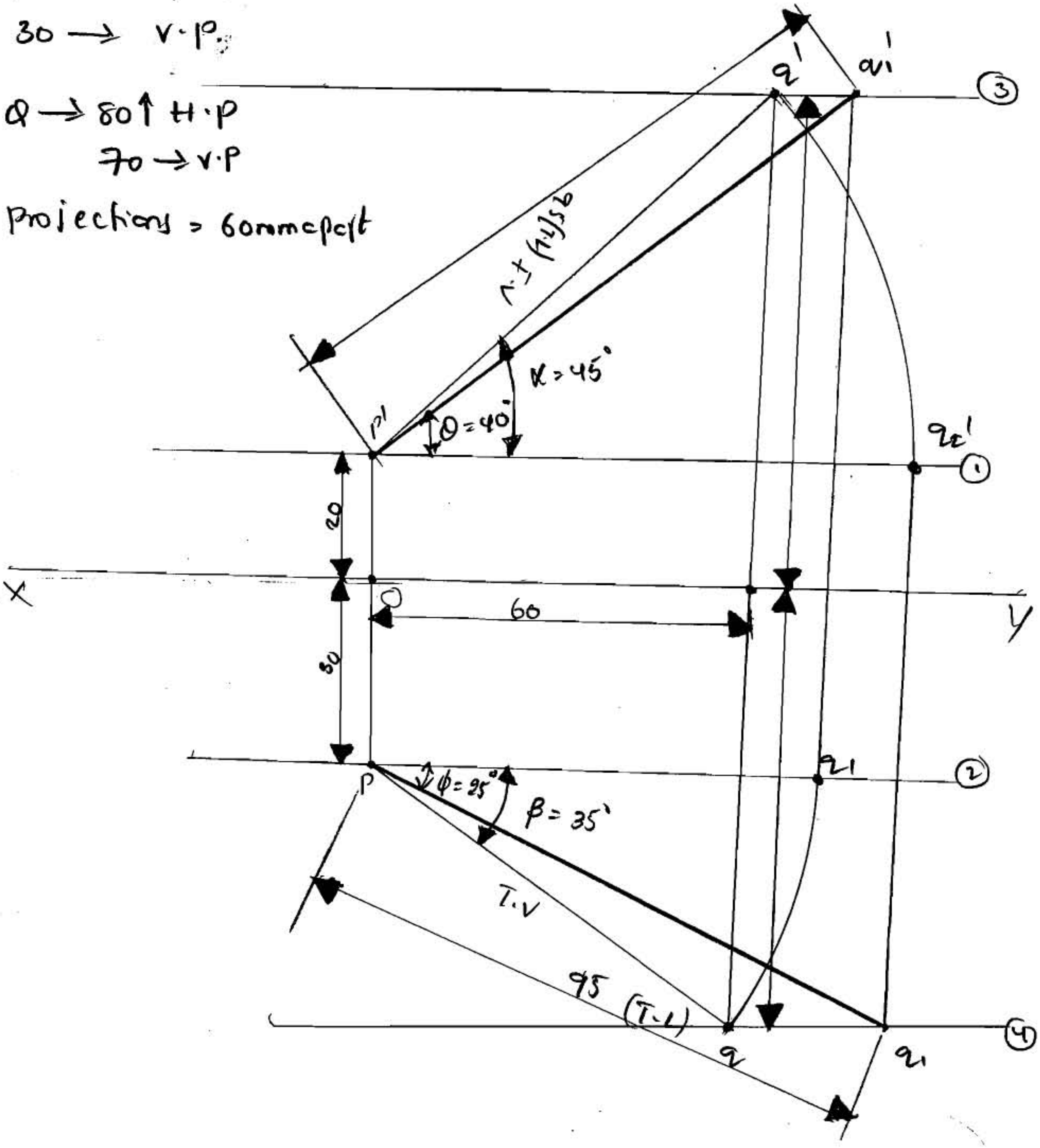


104 A Straight Line 'pq' as its end 'p' is 20mm above H.P and 30mm infront of V.P and The end 'q' is 80mm above H.P and 70mm infront of V.P. If the end projectors are 60mm apart draw the projections of the line determine the true length (T.L) and True inclinations with reference Planes

P → 20 ↑ H.P
30 → V.P.

Q → 80 ↑ H.P
70 → V.P

Projections = 60mm apart

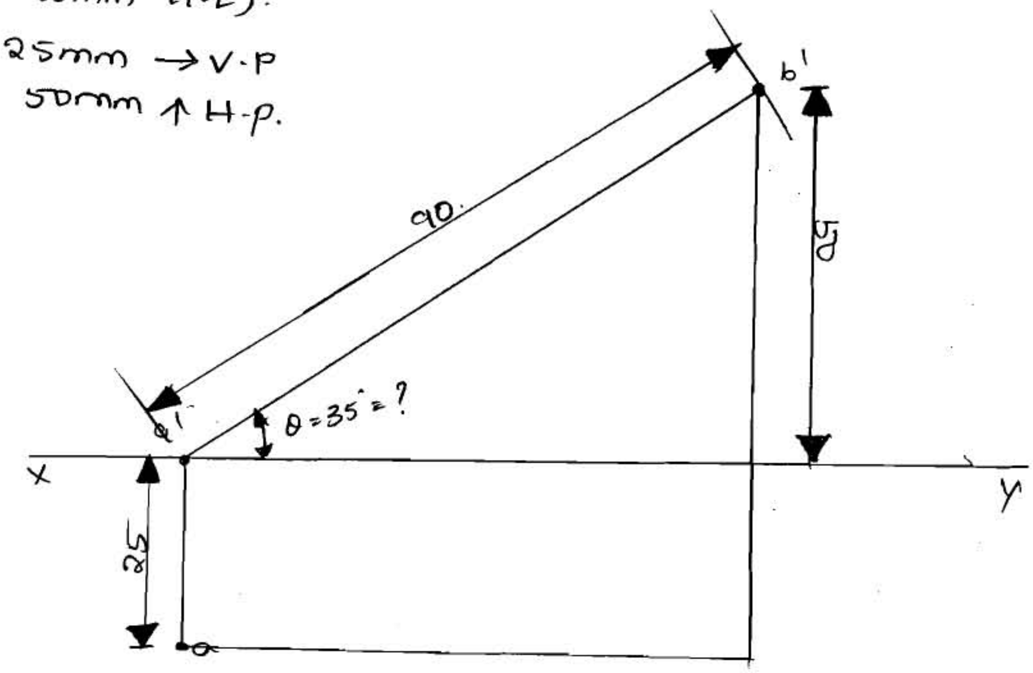


1\. A 90mm long line is parallel to and 25mm in front of V.P. Its one end is in the H.P while the other is 50mm above the H.P. Draw its projections and finds its inclination with the H.P.

Ans:- AB = 90mm (T.L).

25mm → V.P

50mm ↑ H.P.

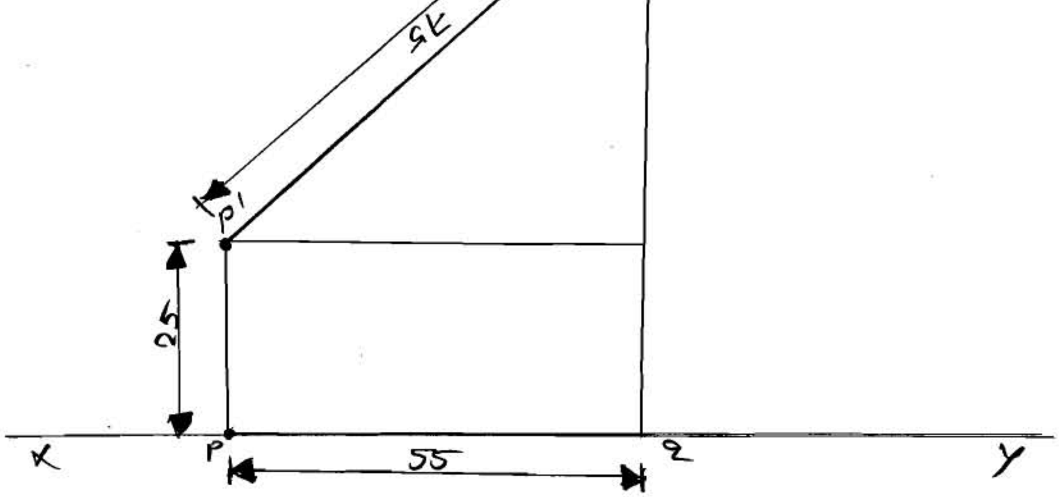


2\. The topview of 75mm Long Line measures 55mm. The line in the V.P. Its one end is being 25mm above H.P. Draw its projections.

Ans PQ = 70mm (T.L)

T.V = 55mm

25mm ↑ H.P.



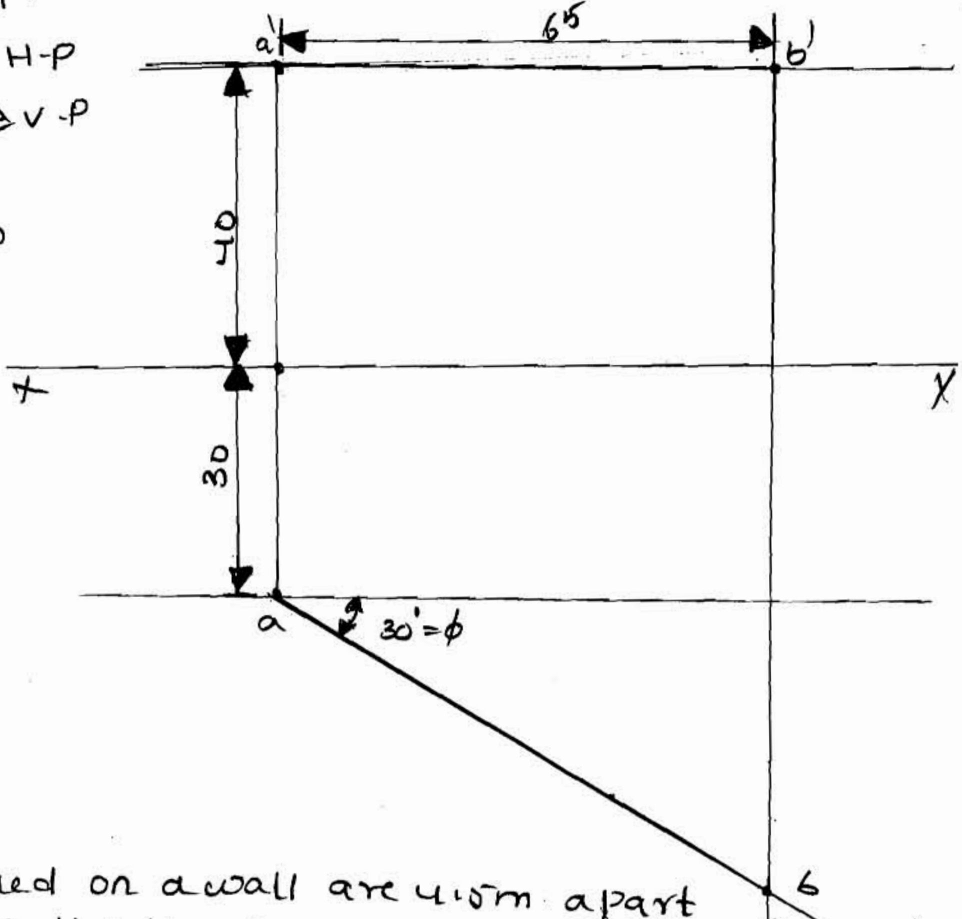
3. The front view of a long line Inclined at 30° to v.p is 65mm long. Draw the projections of the line when it is parallel to and 40mm above the H-p. its one end being 30mm infront of v-p.

Ans: A → 40mm ↑ H-P

30mm → V.P

$\phi = 30°$

AB = 60mm



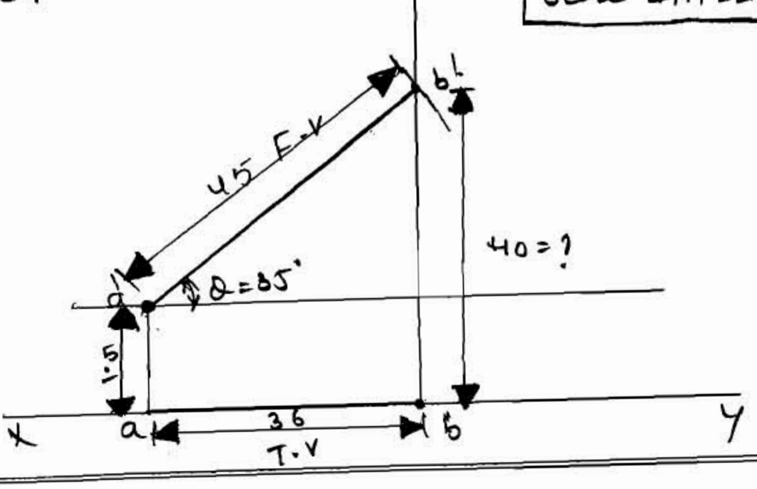
5. Two pegs fixed on a wall are 4.5m apart The distance b/w the pegs measured parallel to the floor is 3.6m. if one peg is 1.5m above the floor, find the height of second peg and the inclination of the line joining the two pegs with the floor,

Ans: Distance b/w the two pegs = 3.6m = T.V.

with respect to floor

Actual distance b/w them = 4.5m

Scale 1m = 1cm



4. A vertical line AB, 75mm long has its end 'A' in the H.P and 25mm infront 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

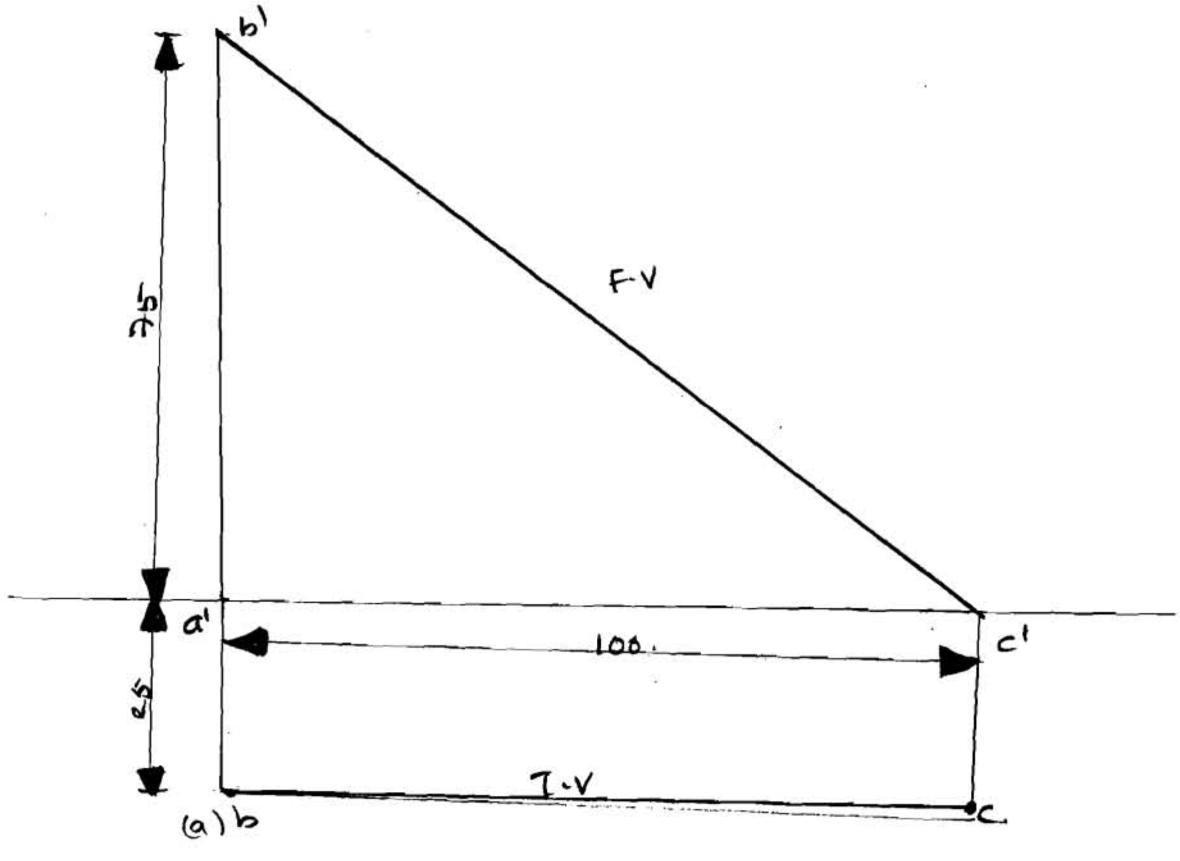
Ans. AB → vertical line.

A → in the H.P

25mm → V.P

AC → 100mm → in the H.P llel to V.P.

BC length = ?



1. A line CD 80mm long is Inclined at 45° to H.P and 30° to V.P its one 'c' is in the H.P and 40mm infront of V.P. Draw the projections. Locate Traces.

Ans:

$CD = T.L = 80mm$

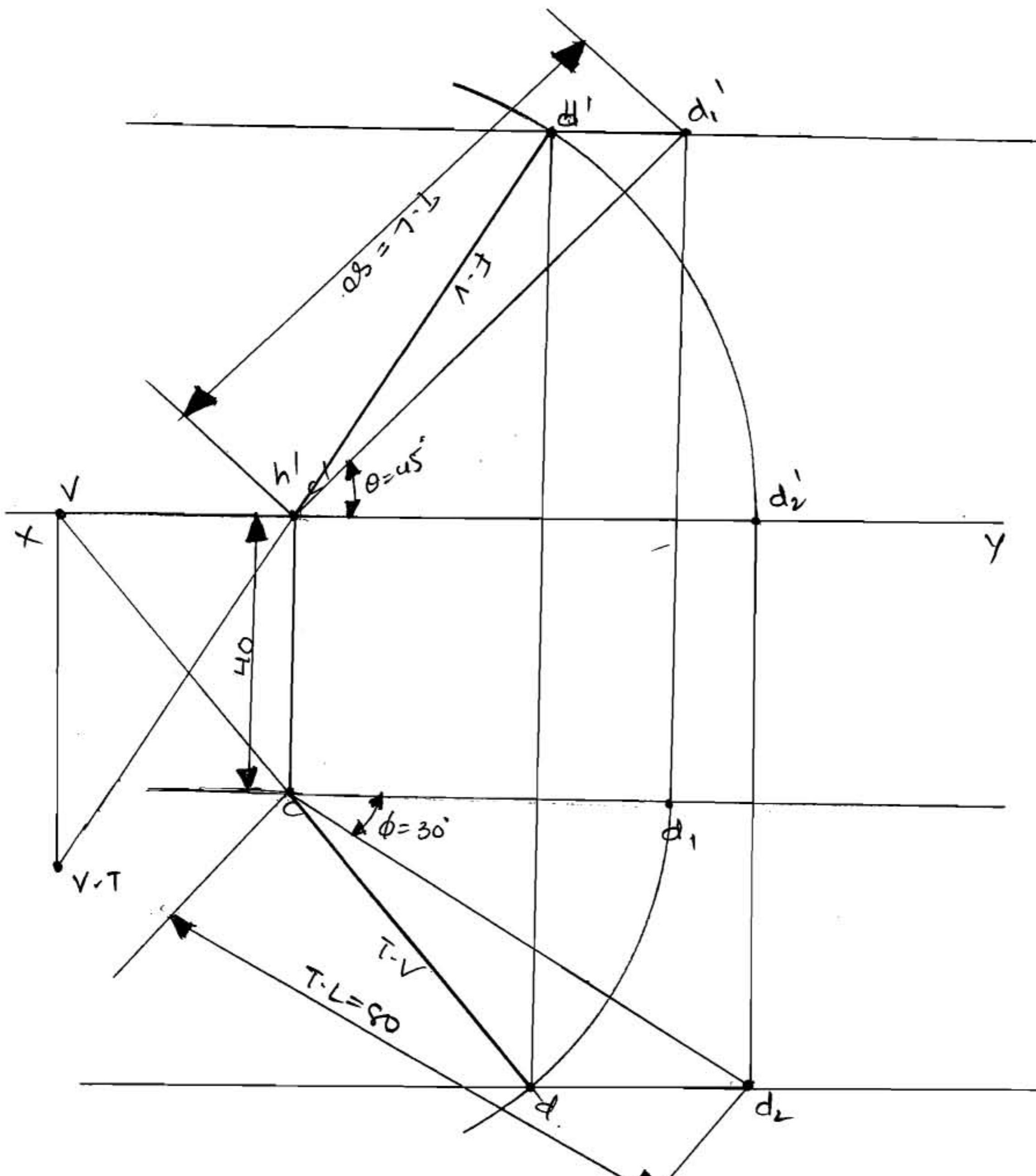
$\theta = 45°$

$\phi = 30°$

on the H.P and 40mm → V.P

$c'd' = F.V$, $cd = T.V$

$c'd_1' = T.L = cd_2$.



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 infront of V.P. Draw its projections Locate Traces.

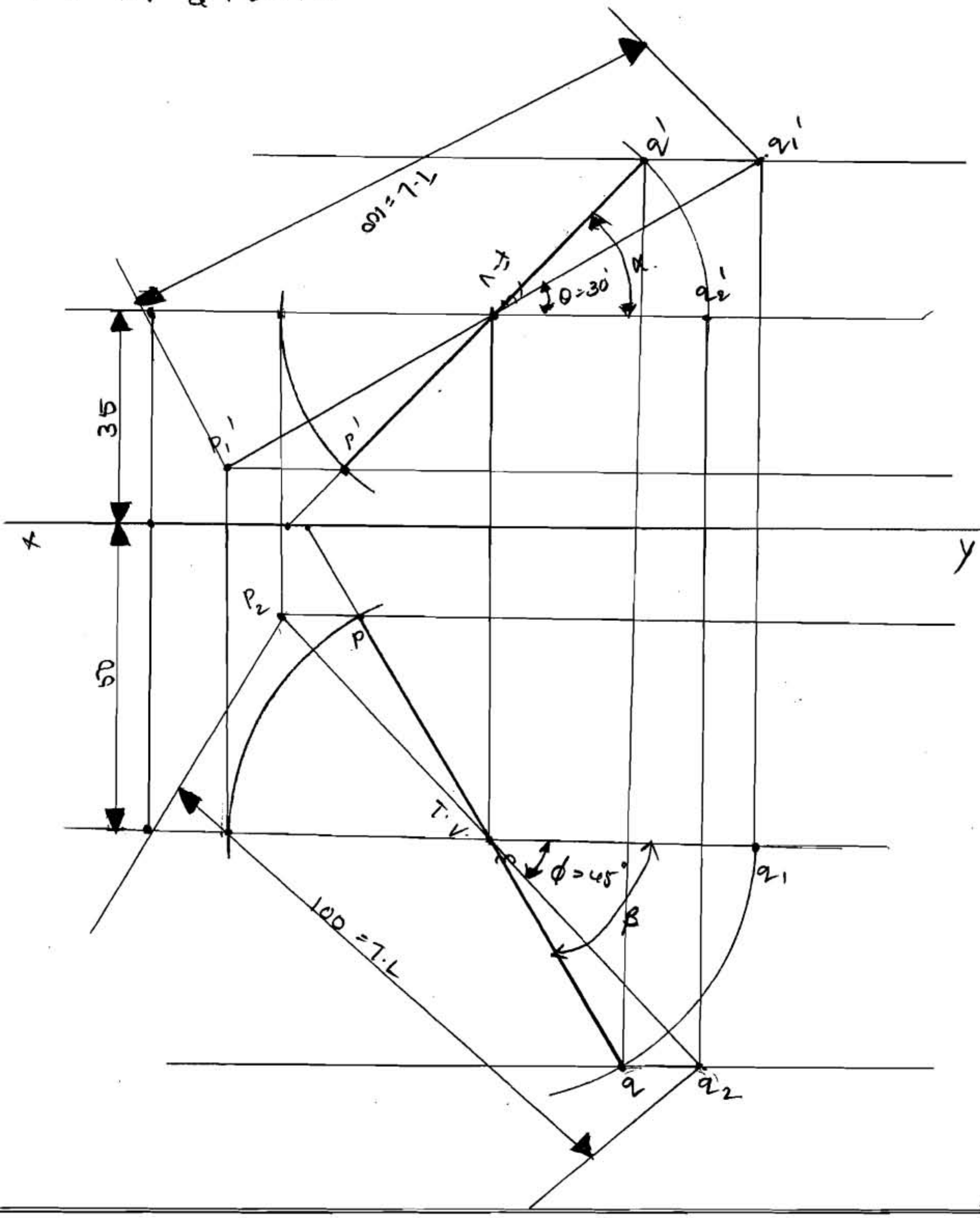
An PQ = T.L = 100mm

$\theta = 30°$

$\phi = 45°$

35mm ↑ H.P and 50mm ⇸ V.P

$p'q'$ = F.V & 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

40mm → V.P

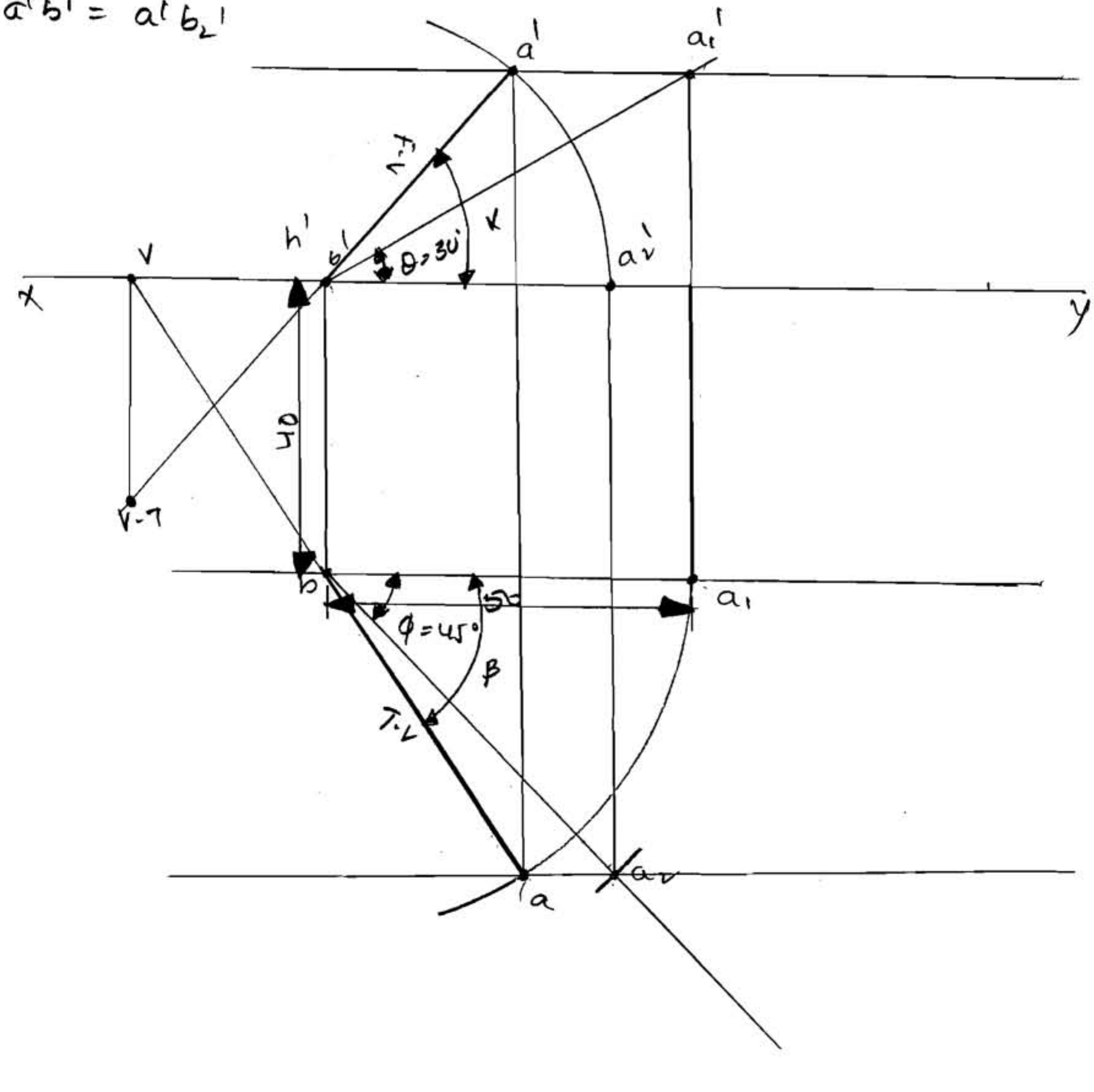
$\theta = 30°$ & $\phi = 45°$

T.V = 50mm

$a'b_1' = T.L = ab_2$

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

$a'b' = a'b_2'$



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

Ans: T.V = 65 mm

F.V = 55 mm

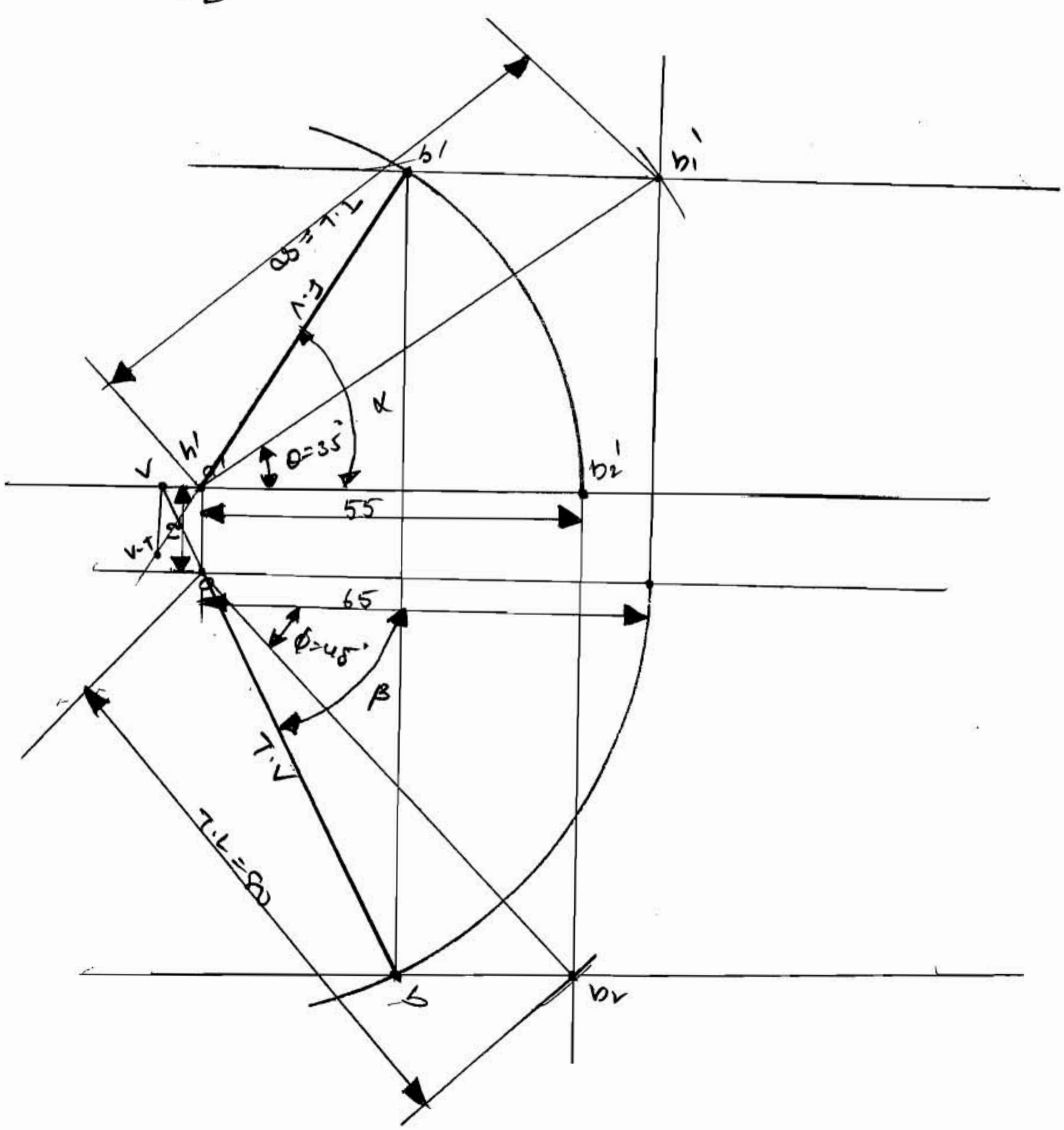
T.L = 80mm

A → in the H.P & 12mm → V.P

$p^1q_1{}' = T.L = pq_2$

$p^1q^1 = F.V$, $pq = T.V$

$p^1q^1 = p^1q_2{}'$



5. A line AB 90mm long is inclined at 45° to 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 infront of V.P. Draw its F.V and find its true inclination with V.P. also locate Traces.

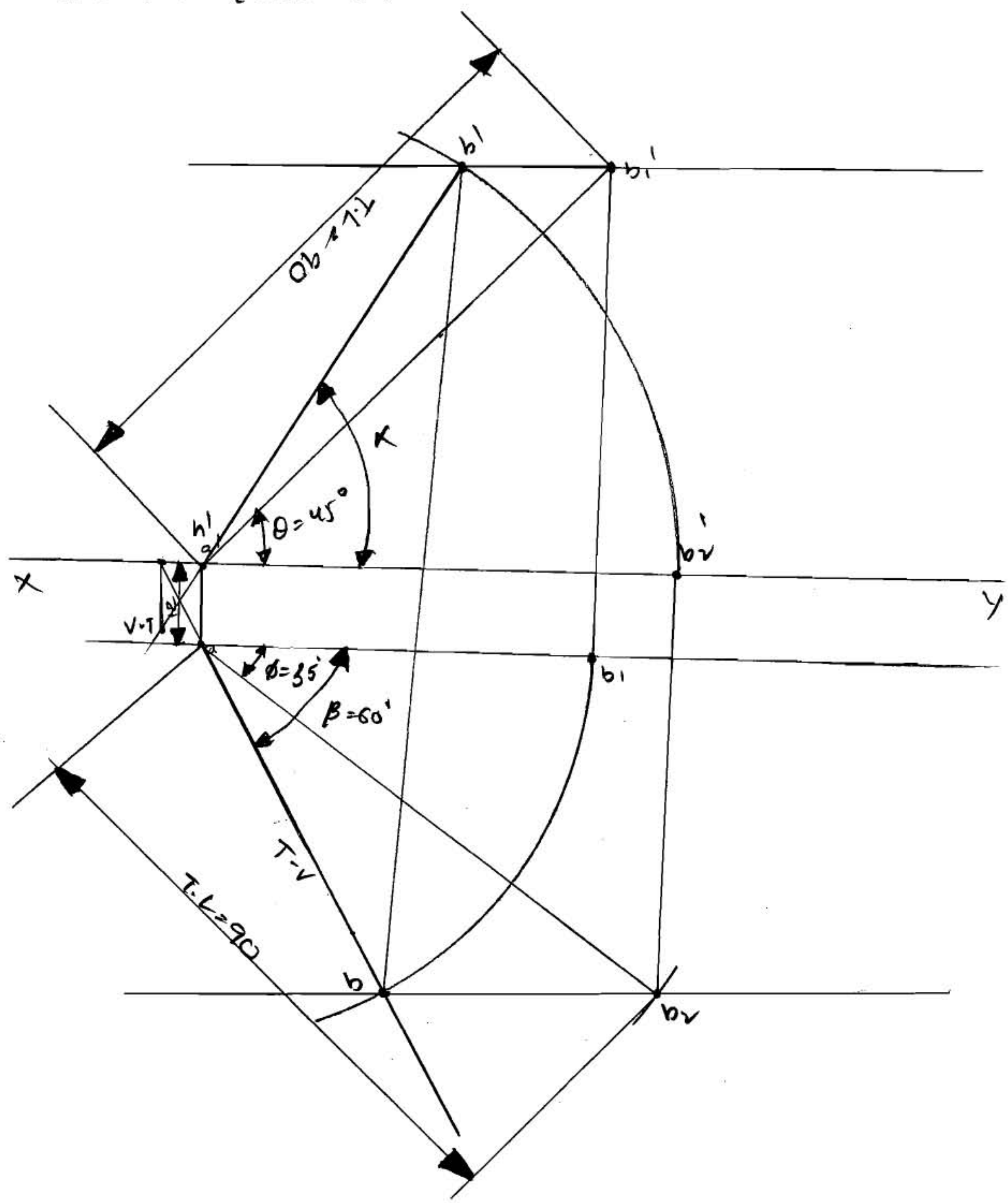
Ans: AB = 90mm = T.L

$\theta = 45°$ $\phi = ?$

$\beta = 60°$

A → on the H.P and 12mm → V.P

$a'b'$ = F.V & ab = T.V



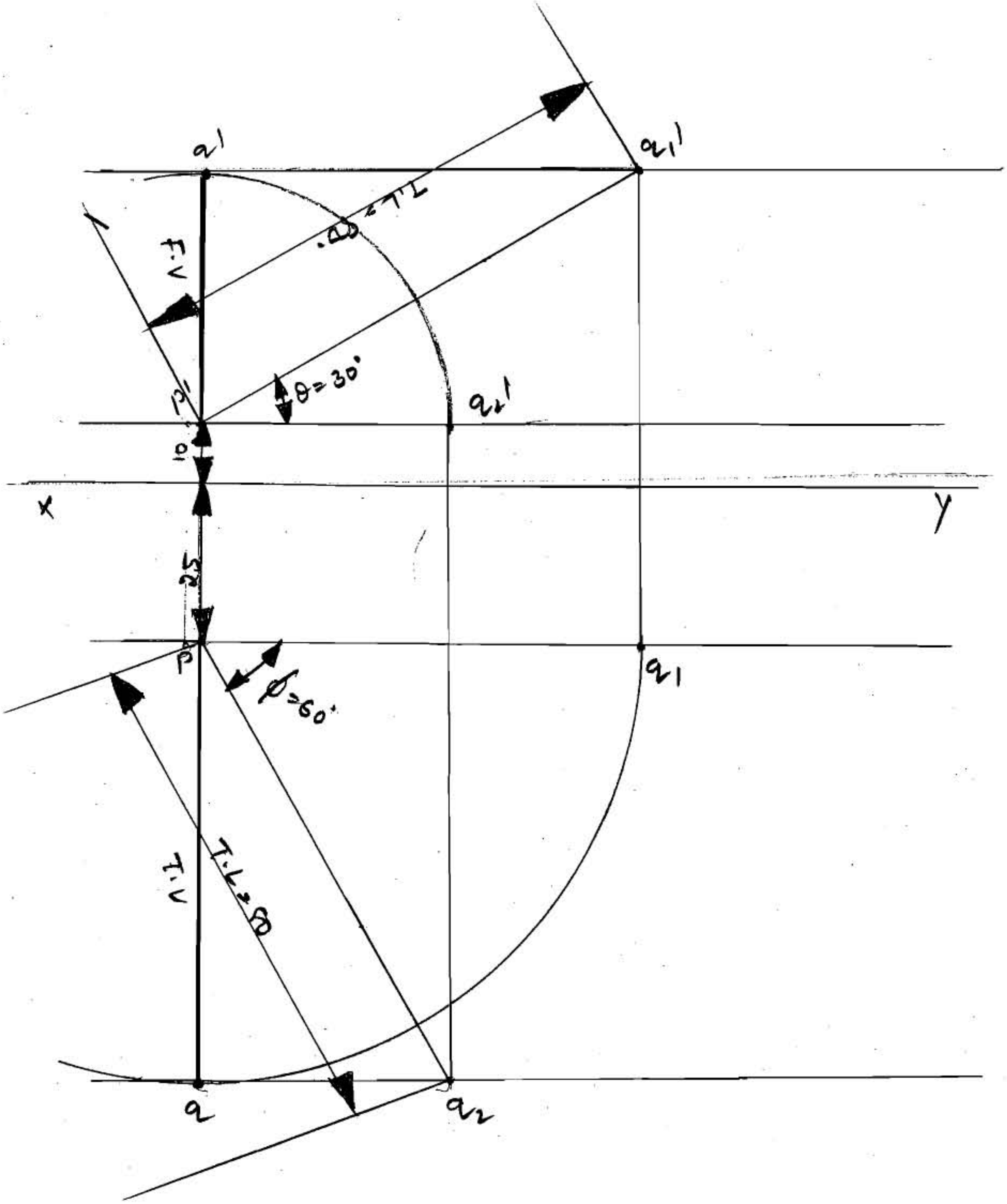
6. A 80 mm long line PQ as its end 'p' 10mm above H.P and 25mm in front v.p the line inclined at 30° to H.P and 60° to v.p . Draw its projections.

Ans:- PQ = 80 mm

P → 10mm ↑ H.P

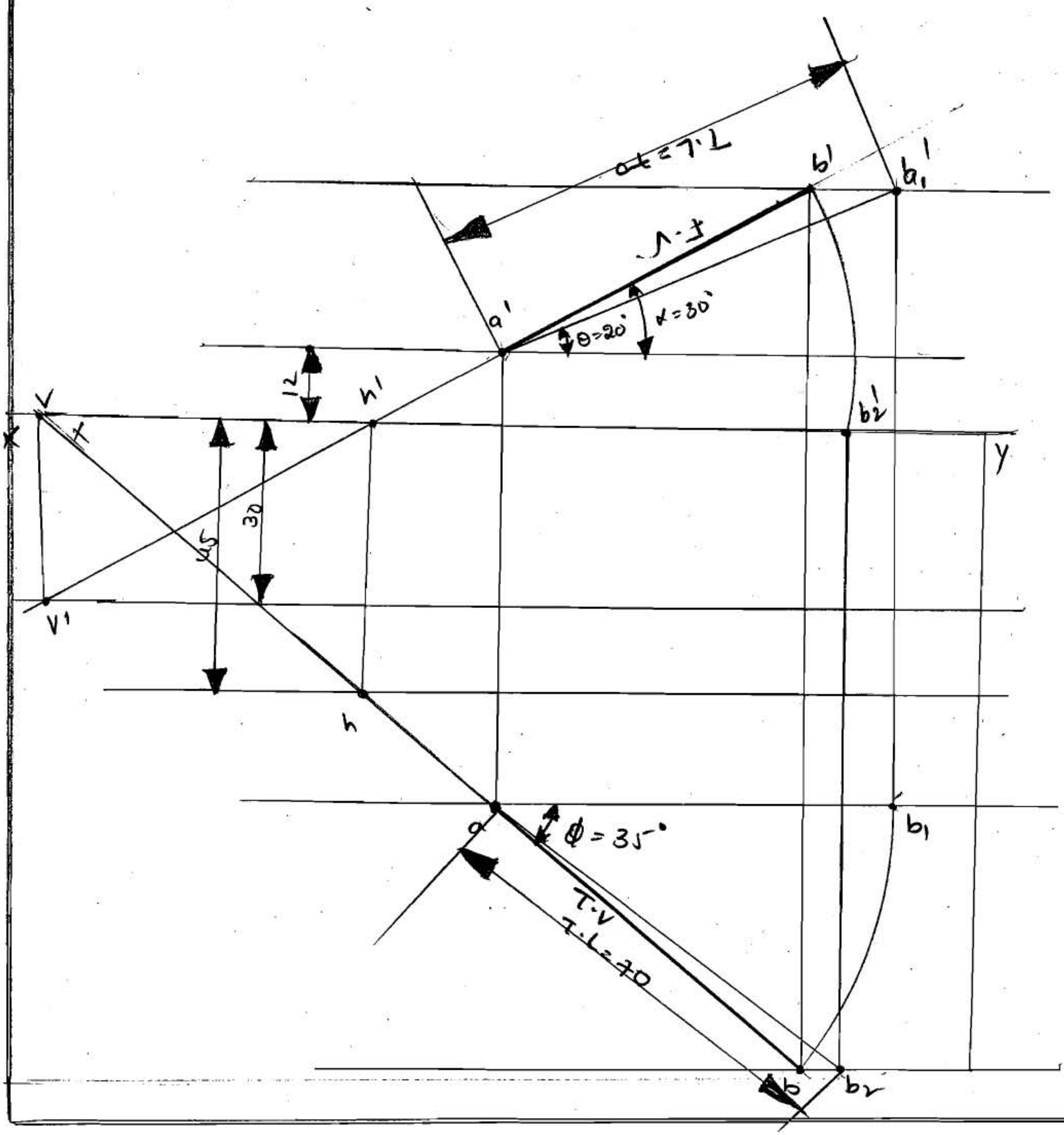
25 mm → v.p

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



8. The front view of line A'B' makes an angle of 30° with xy line. The H·T of the line is 45mm infront of v·p, while its V·T is 30mm below the H·P. The end A' is 12mm above the H·P and end B' is 105mm infront of V·P. Draw the projections of line and find it true length inclination with H·P and V·P.

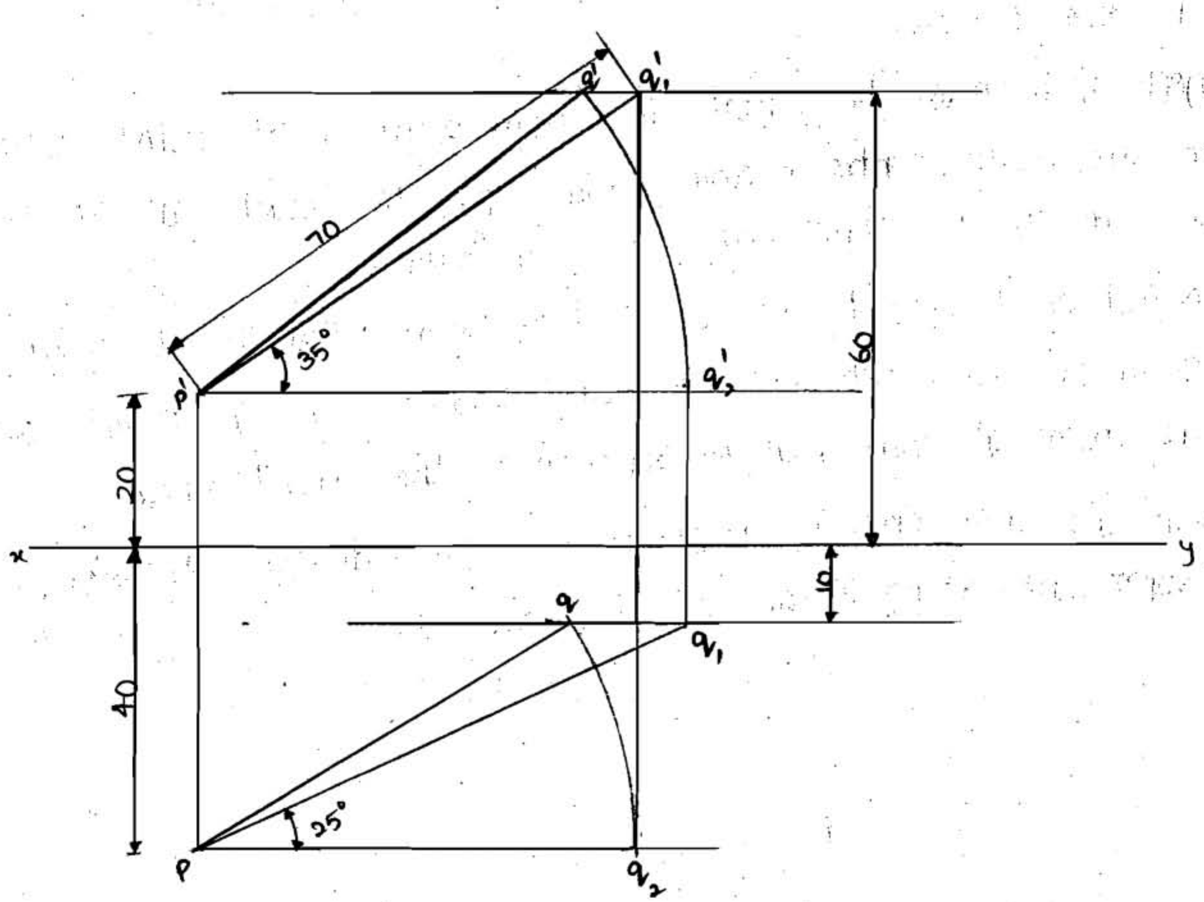
Ans:
$a'b' = 30°$ with xy
$H \cdot T = 45mm \rightarrow$ of v·p
$V \cdot T = 30mm \downarrow H \cdot P$
$A \rightarrow 12mm \uparrow H \cdot P$.



A 70mm long line PQ has its end P 20mm above the H.P and 40mm in front of the V.P. The other end Q is 60 mm above the H.P and 10mm in front of the V.P. Draw the projections of PQ and determine its inclinations whith the reference planes.

P - 7.24

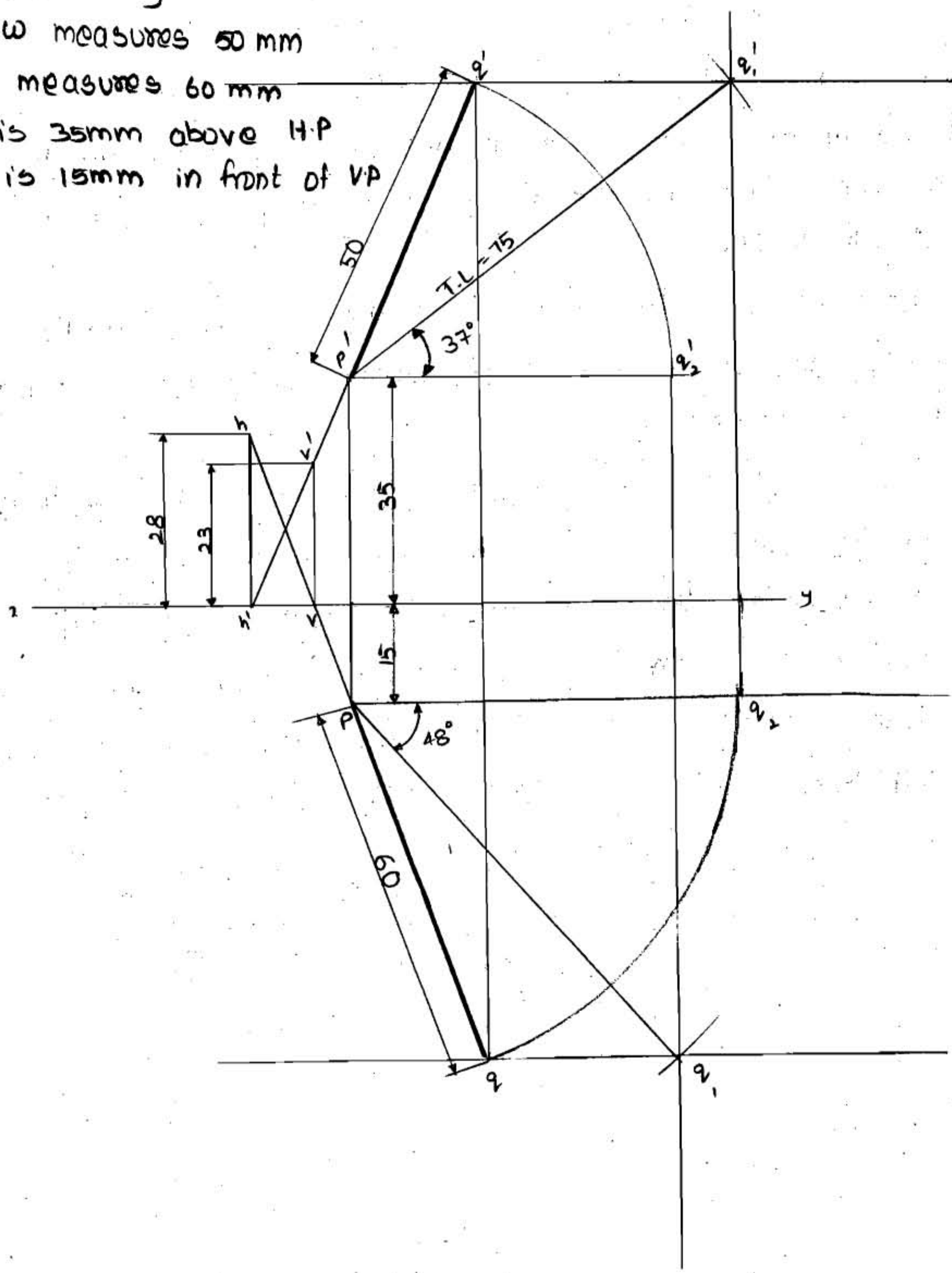
PQ = 70mm line
End P is 40mm infront of V.P
and 20mm above H.P
End q is 60mm above, the H.P
and 10mm infront of V.P



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 $\theta = 35°$.
5. Draw an arc with centre p and radius 70 mm to meet cd at point q_2. Join pq_2 to represent true inclination of line with the V.P. Here $\phi = 25°$.
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. Join pq 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'. Join p'q' to represent the front view.
8. Join q'q and ensure that it is perpendicular to xy, representing projector of the end Q.

The front and top views of 75mm long line PQ measures 50mm and 60mm, respectively. If the end P of the line is 35mm above the H.P. and 15 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.

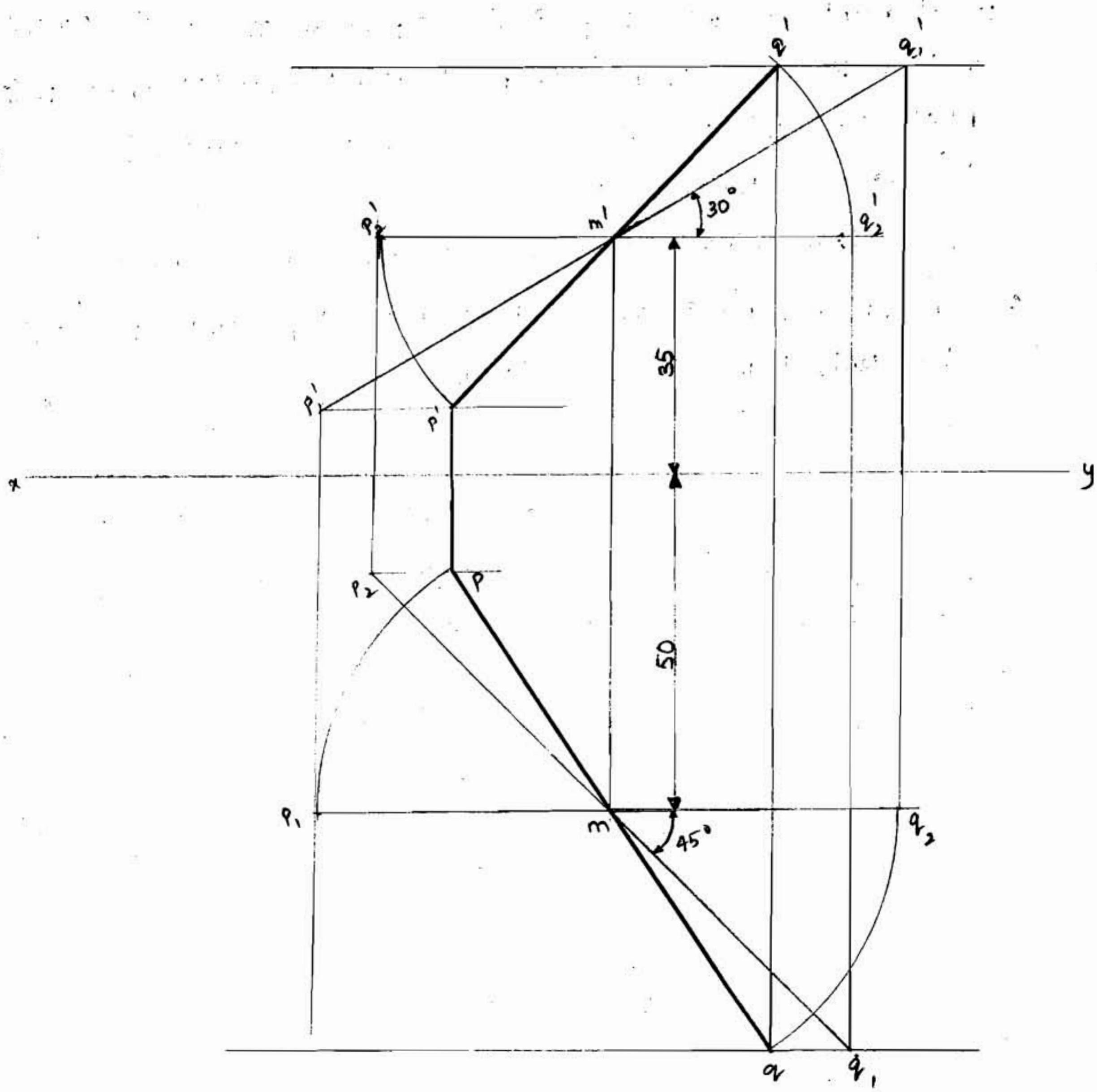
PQ is 75 mm long
front view measures 50 mm
Top view measures 60 mm
End P is 35mm above H.P
End P is 15mm in front of V.P



1. Draw reference line, mark p' 35mm above and 15mm below it is p.
2. Draw a 50mm long line $p'q_2'$ parallel to xy. Draw another 60mm long line pq_1 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 $\theta = 37°$.
4. Repeat above step same with V.P. Here $\phi = 48°$.
5. Draw an arc with centre p' and radius $p'q_2'$ (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 q'q 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 projects.

PQ = 100mm line
M is midpoint
M is 35 above H.P
and 50 infront of V.P
line inclined 30° to H.P
45° to V.P



1. Draw a reference line xy. On a vertical projector mark point m' 35mm above xy and point m 50 mm below xy.
2. Draw a 50mm long line $m'q_1'$ inclined at 30° to xy. Produce it such that $p_1'q_1'$ = 100mm.
3. Draw another 50mm line mq_2 inclined at 45° to xy. Produce it such that p_2q_2 = 100mm.
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'p and q'q to ensure that they represent projector of the ends P and Q respectively.

fig: 9.29

P_1 - 9.28

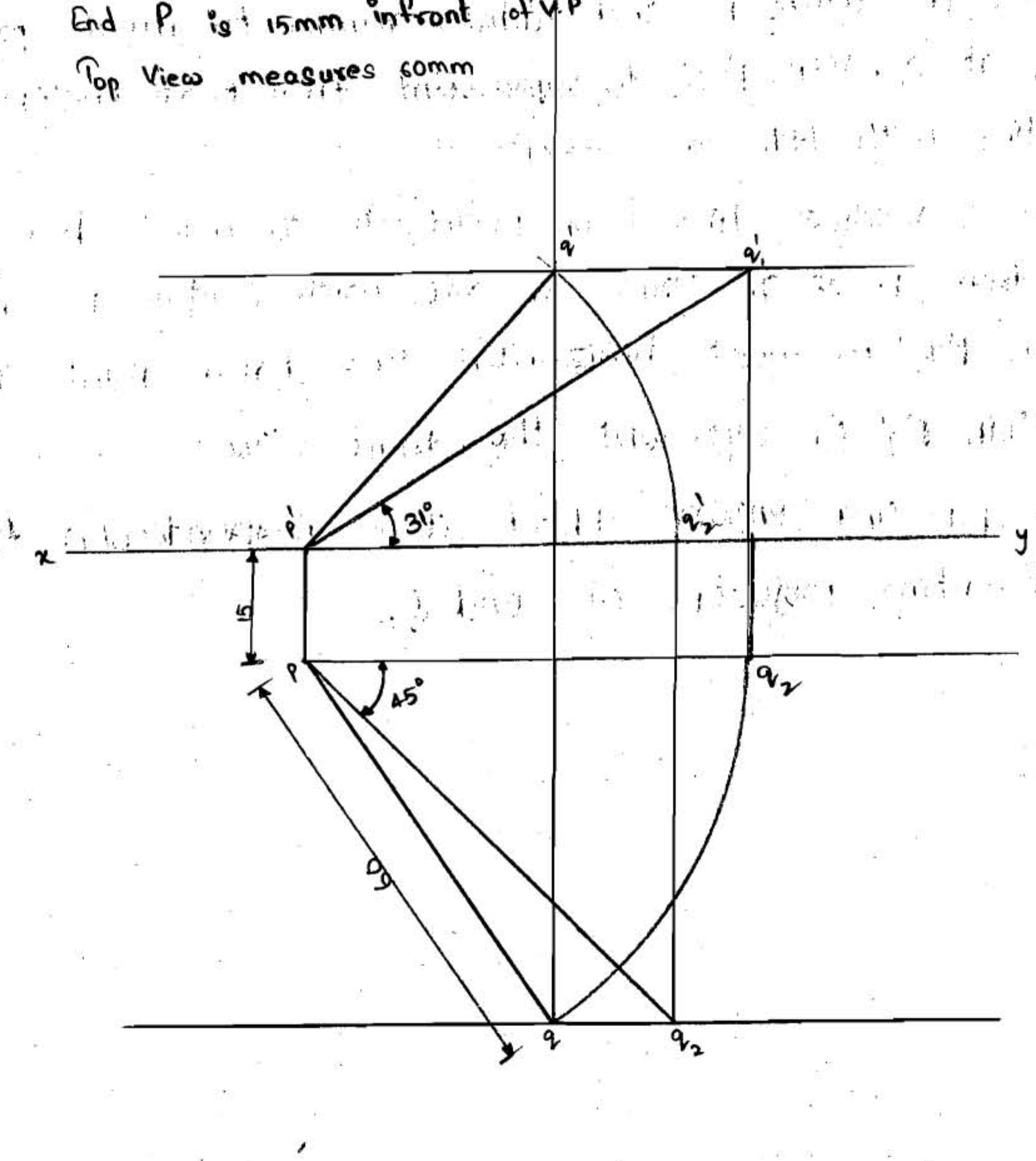
PQ is 70mm long line

line inclined at 45° to the V.P

End P is on H.P

End P_1 is 15mm infront of V.P

Top View measures 60mm



1. Draw the reference line xy. Mark p' on xy and p 15mm below xy.

2. Draw a 70mm long line pq_2 inclined at $\phi=45^\circ$ to xy.

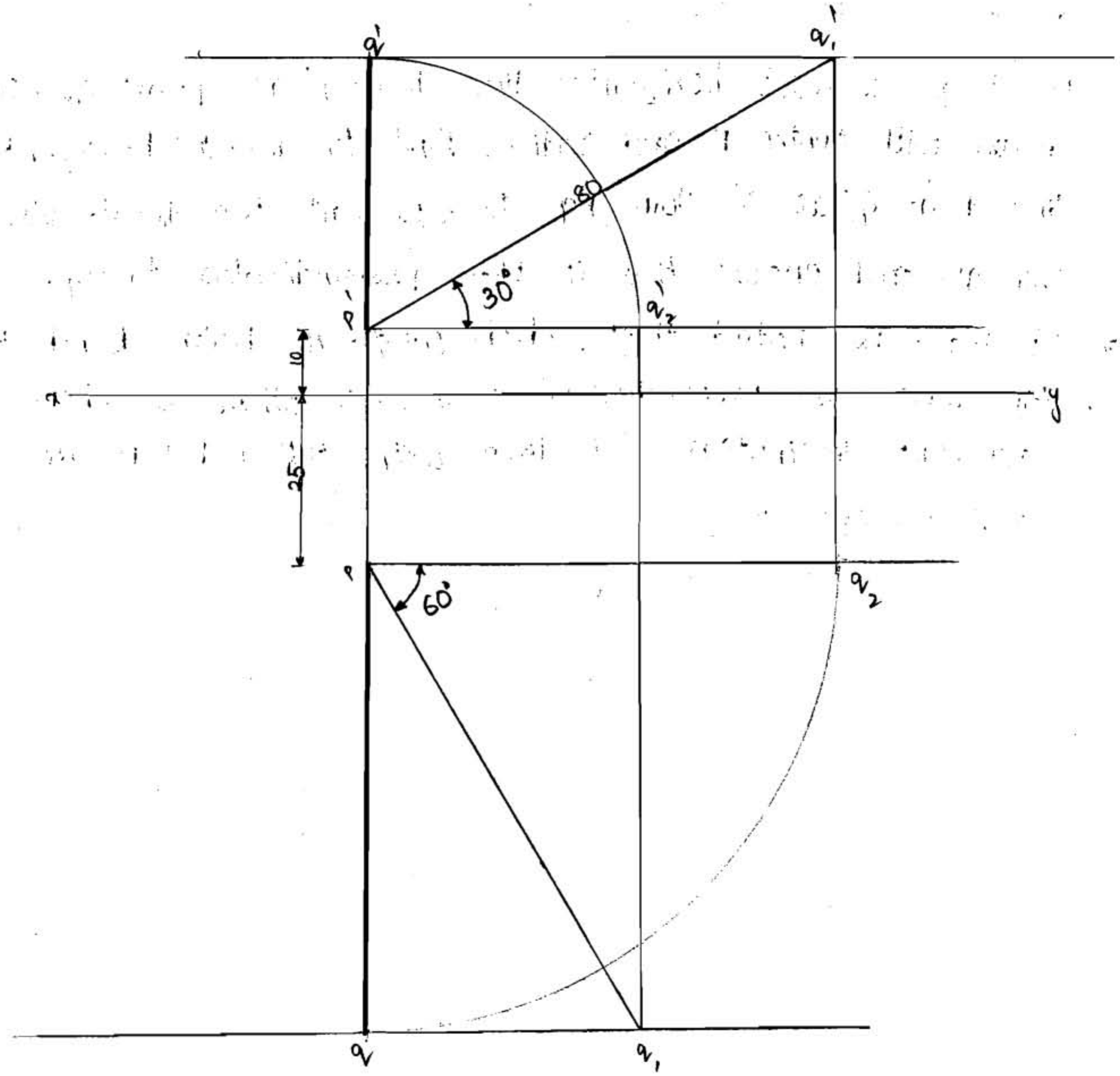
3. Draw an arc with centre p and radius 60mm to meet the horizontal line through point q_2 at point q. Join pq to represent top view.

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 true inclination of line with HP. Here $\theta=31^\circ$.

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'q and ensure that it is perpendicular to xy, representing projector of end Q.

Projections of Line where $\theta+\phi=90$



1. Draw a reference line xy. Mark p' 10mm above xy and p 25mm below
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. Join pq 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'. Join p'q' to represent the front view.
6. Join q'q and ensure that it ~~th~~ is perpendicular to xy.
7. It may be noted that when $\theta + \phi = 90°$, 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., $\alpha = \beta = 90°$.

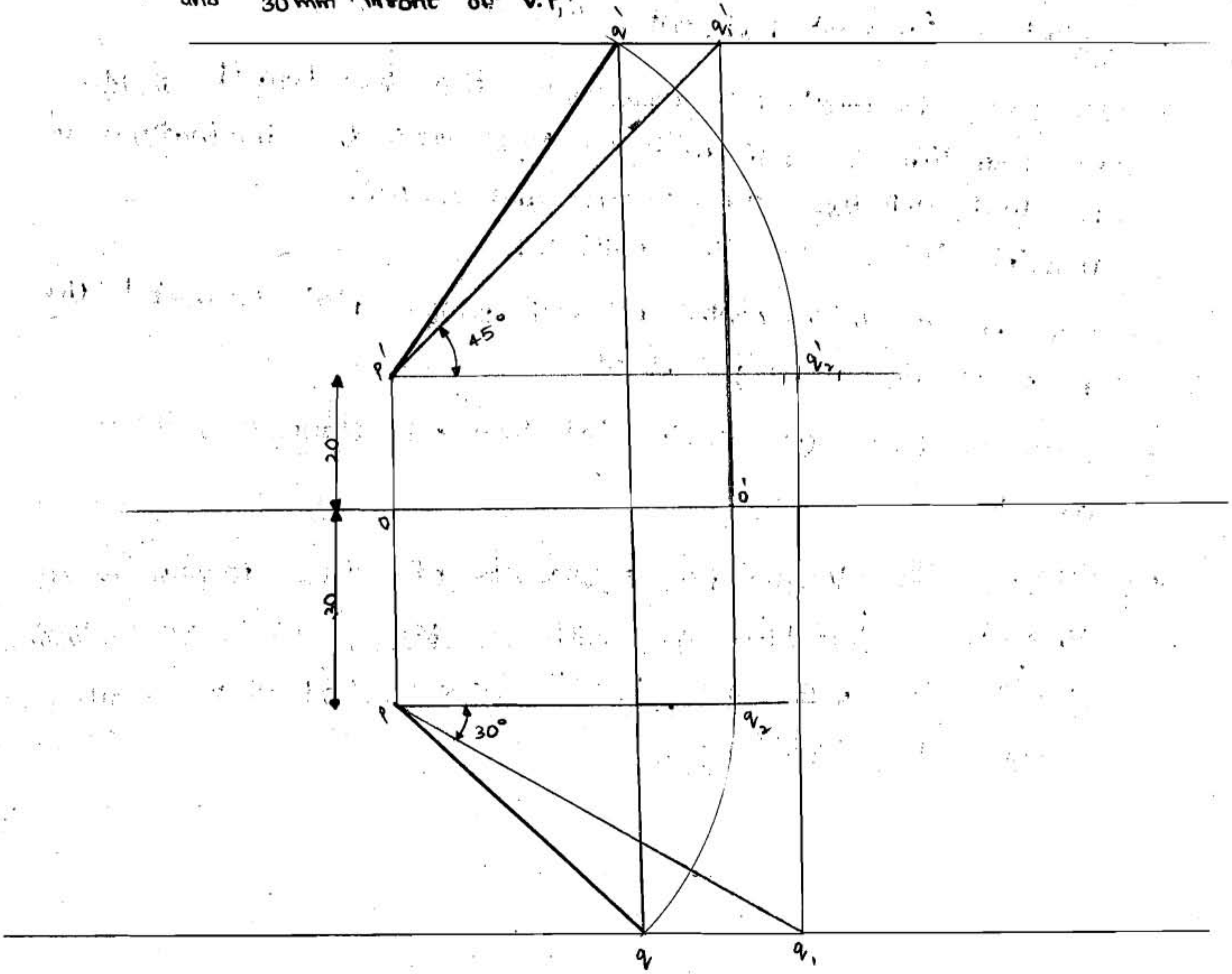
Line inclined to both reference Planes where $\theta+\phi < 90^\circ$

Line PQ = 70 mm

$\theta = 45^\circ$

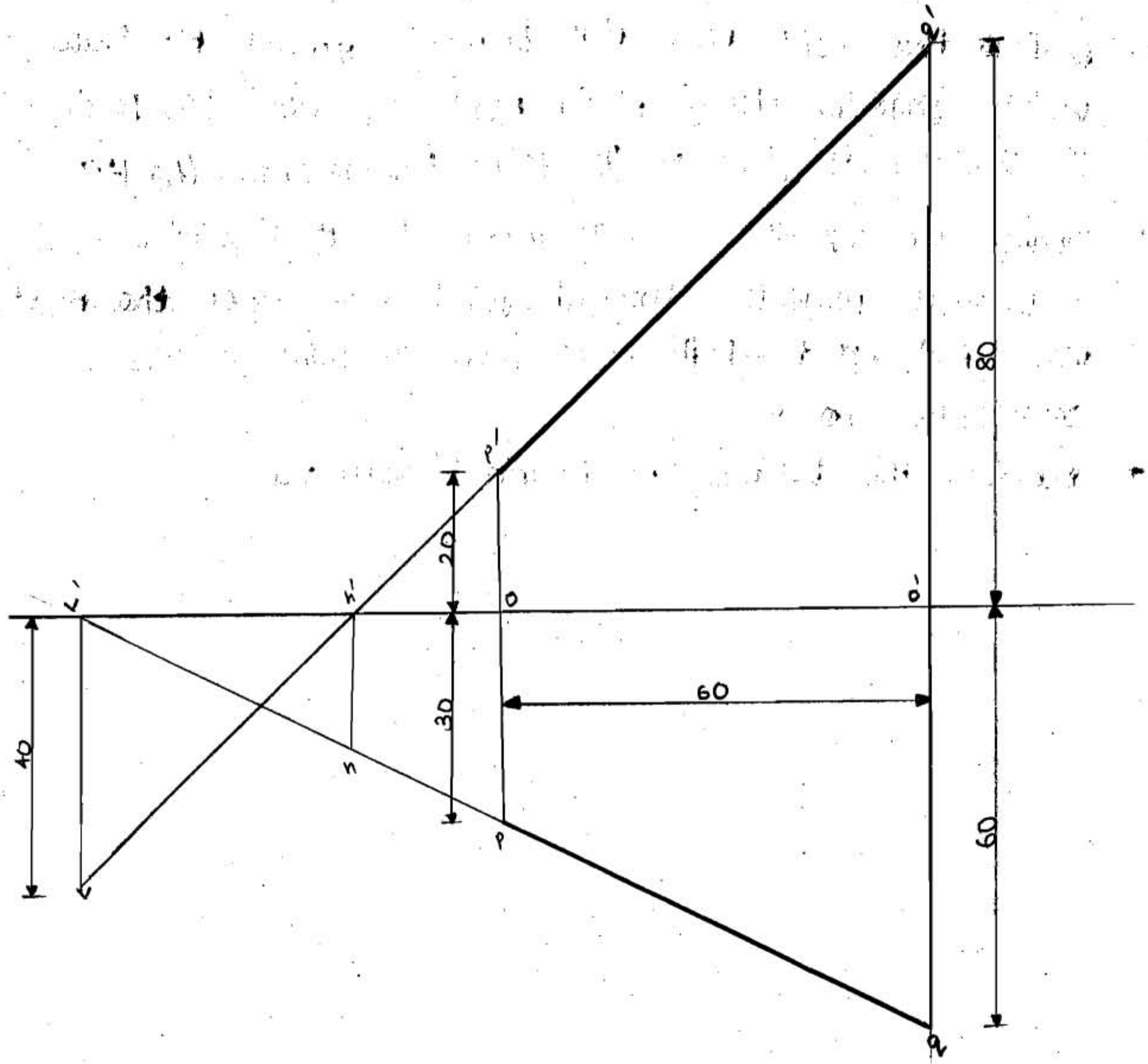
$\phi = 30^\circ$

P end 20mm above the H.P and 30 mm infront of V.P.



1. Mark o and o_1 on line such that they are 60mm apart
2. On vertical projector through o, mark p' 20mm above xy and p 30 below xy.
3. On the vertical projector through o_1, mark q' 80 mm above xy and q 70 mm below xy.
4. Join $p'q'$ and pq to represent front and top view of line. respectively. Find the TL and (θ) of line with H.P
5. Draw an arc with centre p and radius pq to meet horizontal line from p at q_1.
6. Project q_1 to meet horizontal line ab through q' at q_1'
7. Join $p'q_1'$. The length $p'q_1'$ represents the true length of PQ. The inclination of $p'q_1'$ with xy represents true inclination of PQ with H.P Here, T.L = 94mm and $\theta = 40°$.
   Find TL and ϕ of line with V.P.
8. Draw an arc with centre p' and radius $p'q'$ to meet the horizontal line from p' at q_2'.
9. Project q_2' to meet horizontal line cd through point q at q_2.
10. Join pq_2. The length pq_2 represents the true length of PQ. The inclination of pq_2 with xy represents. True inclination of PQ with V.P. Here, $\phi = 25°$. Ensure that the length pq_2 is equal to length $p'q_1'$

Traces of line $\theta + \phi < 90°$



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 neccessary, at point v'. The v' represents the V.T.

7. Measure the distance of h and v' from xy.

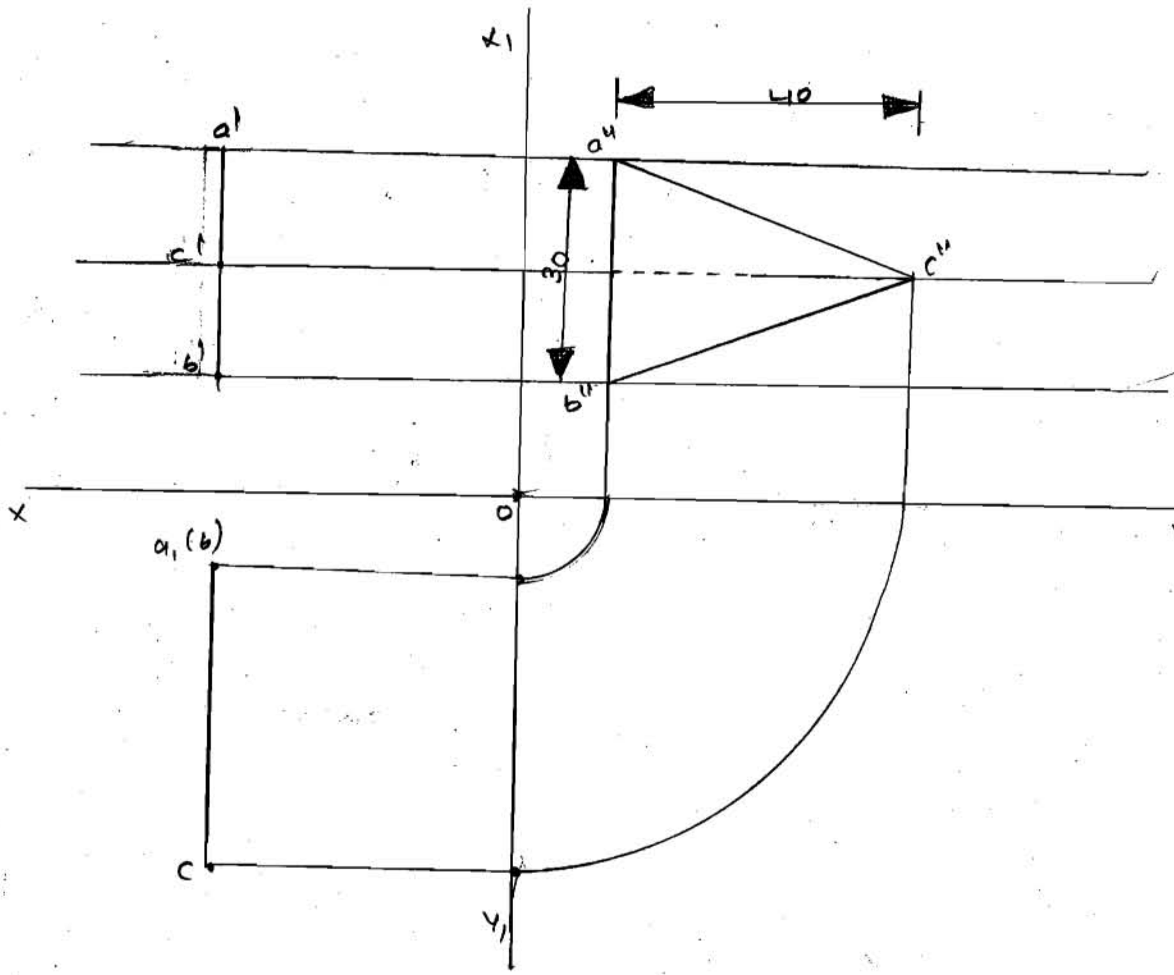
Projections of Planes:

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.

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 $\perp$er to both H.P and V.P. Draw its projections when the base is parallel to V.P.

Sol: Base = 30mm

altitude = 40mm.



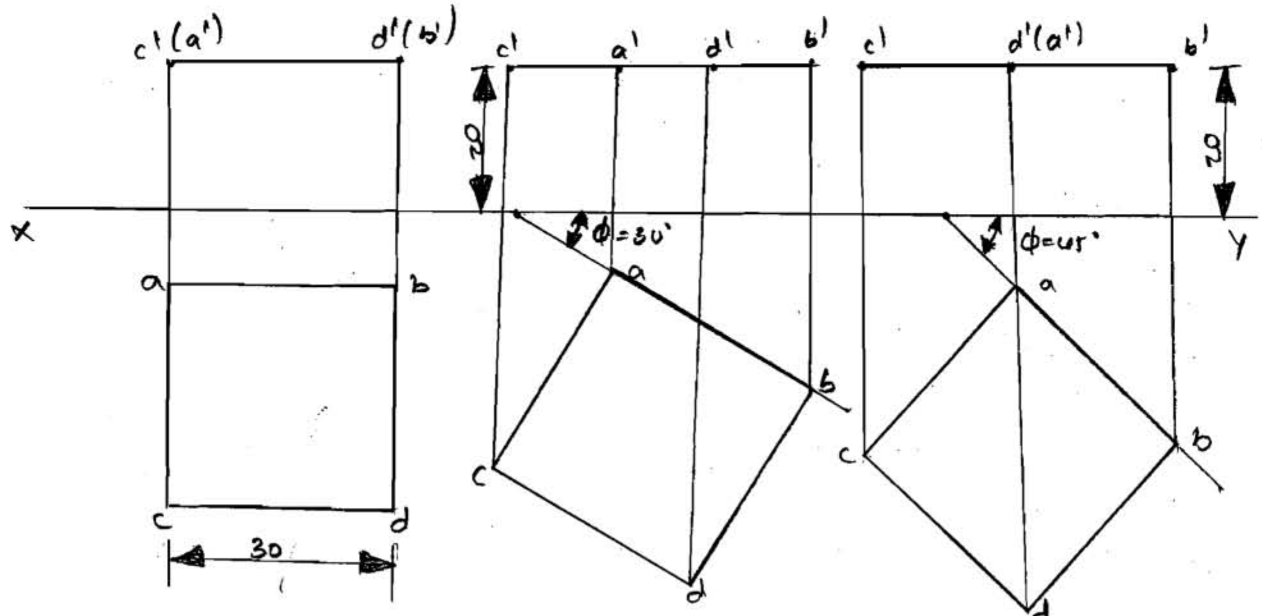
(2) A square plane $A_1B_1C_1D$ 30 mm side as its surface parallel to H.P and 20mm away from it. Draw its projections of the plane when two of its sides are

(i) Parallel to V.P

(ii) Inclined at 30° to V.P

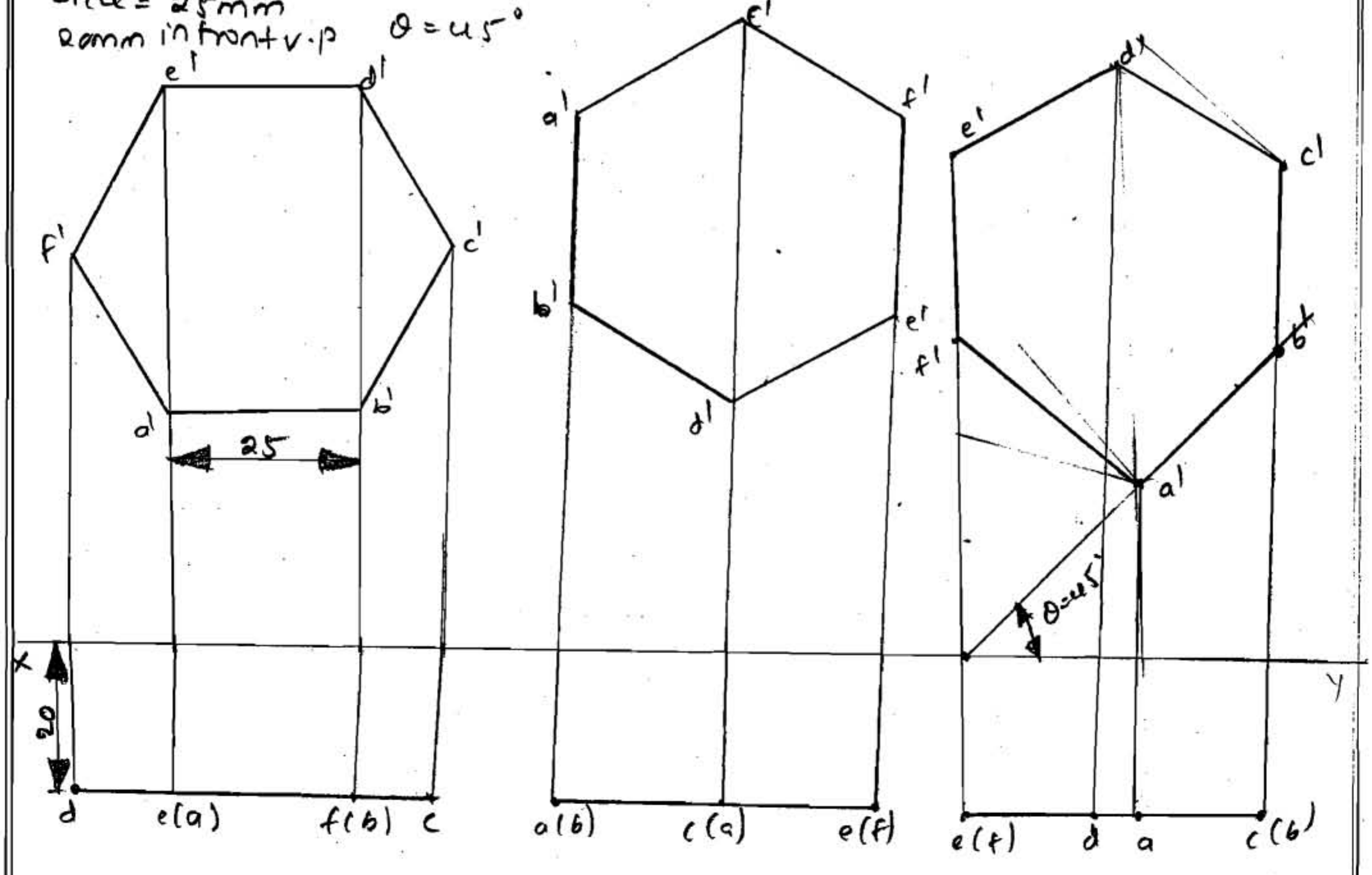
(iii) all sides are equally inclined to V.P

Sol: Side = 30mm
20mm away from it ∢ 30°
and $\phi = 45°$



3. A hexagonal plane of 25mm side as its surface ||el to and 20mm infront of V.P. Draw the projections of the plane when a side (i) Parallel to H.P (ii) ⊥er to H.P (iii) Inclined $\theta = 45°$

Sol: Side = 25mm
20mm infront V.P $\theta = 45°$

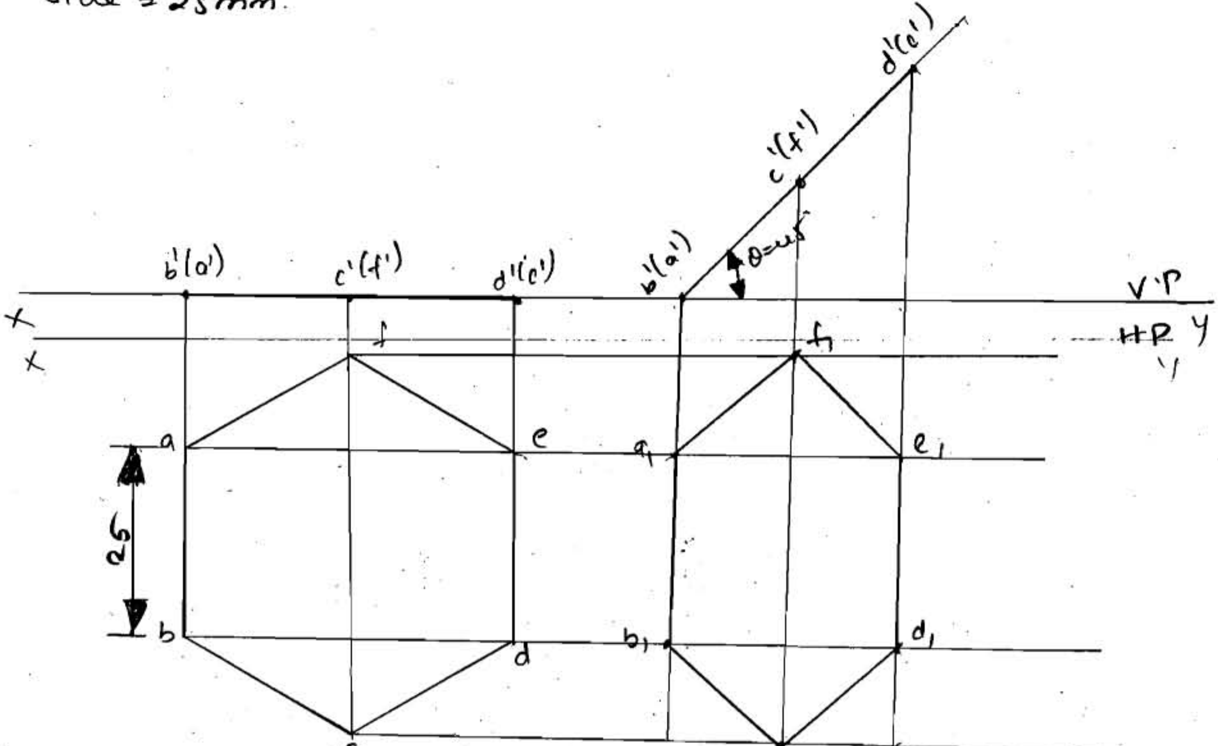


4. A hexagonal Plane of 25mm side as one side on the ground. The surface of the Plane is Inclined at 45° to H.P and ter to V.P. Draw it Projections

Sol: $\theta = 45°$

one of the side on the ground

side = 25mm.



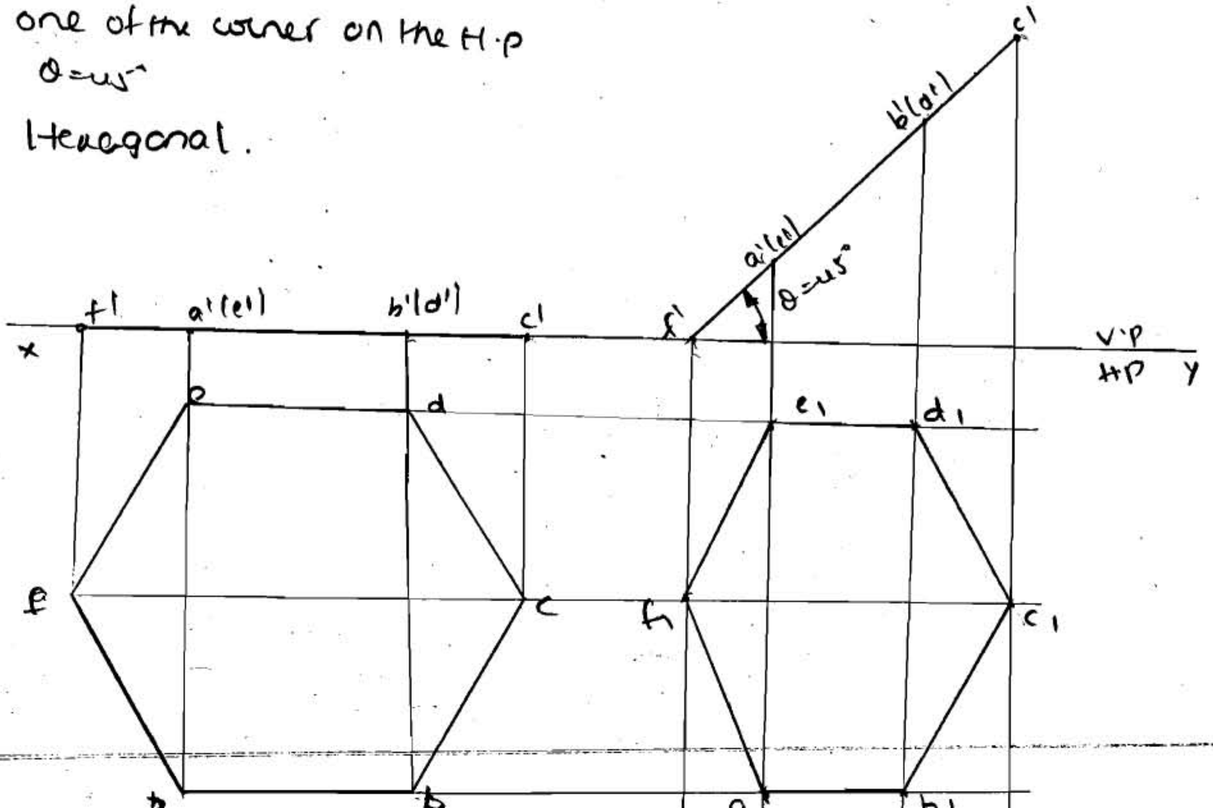
5. A hexagonal plate of 30mm side resting on one of its corner on the H.P. The plate is ter to V.P and inclined at 45° to H.P. Draw its projections.

side = 30mm

one of the corner on the H.P

$\theta = 45°$

Hexagonal.

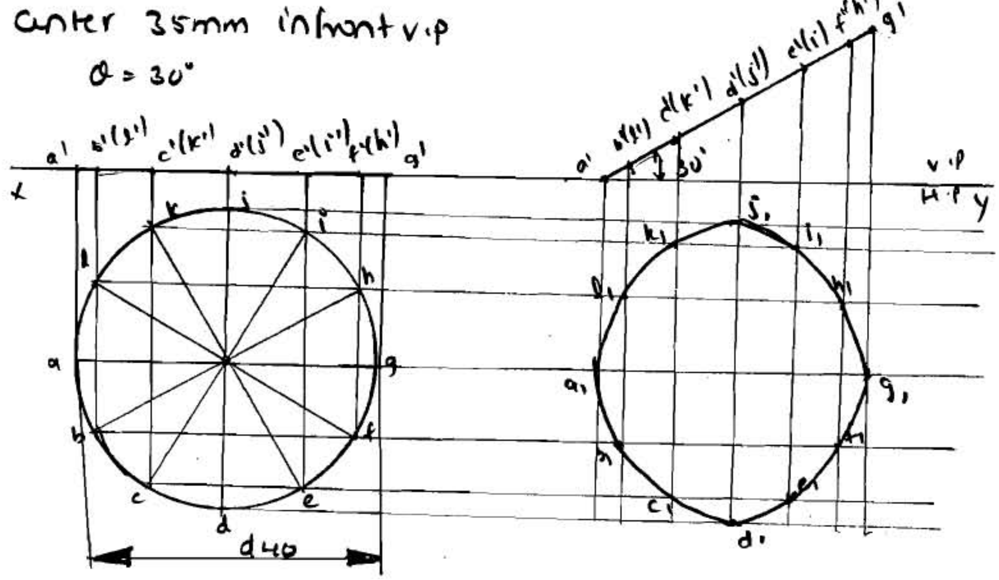


Q: Draw the projections of a circle of 40mm diameter resting on the H.P on a point on the circumference. its plane is inclined at 30° to H.P and ⊥er to V.P. its center is 35mm in front of V.P.

diameter $d = 40mm$

center 35mm infront V.P

$\theta = 30°$

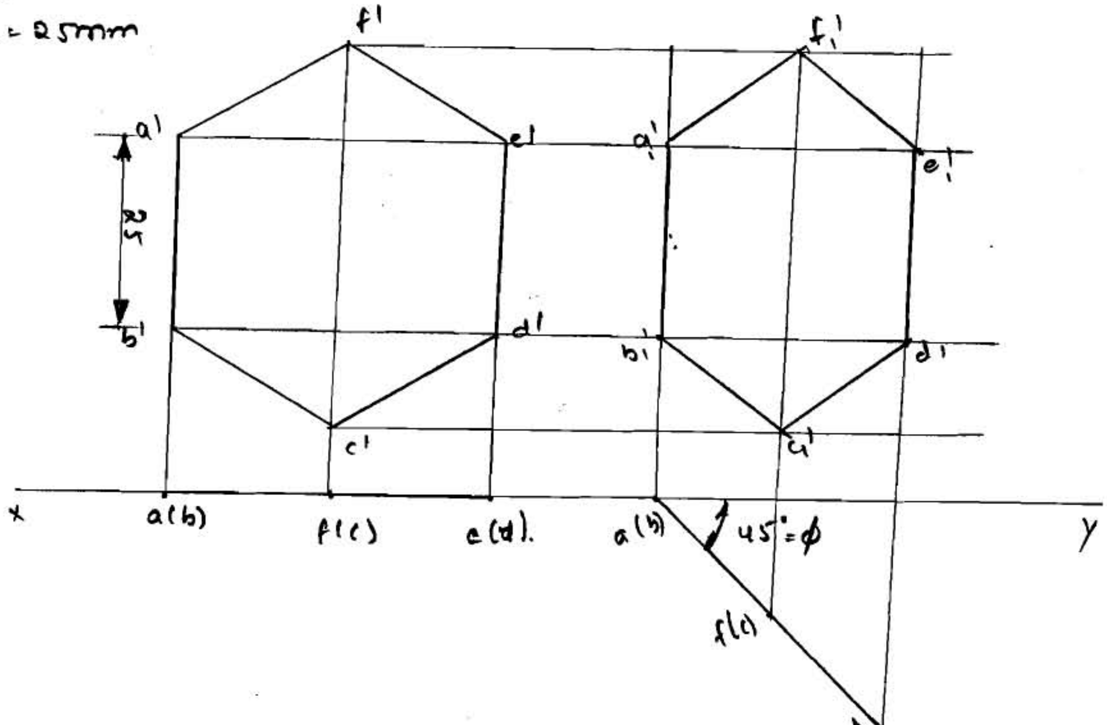


Q:- A hexagonal plate of 25mm side and negligible thickness have one of its edges in the V.P. The surface of the plate is ⊥er to H.P and inclined at 45° V.P. Draw its projections.

Hexagonal

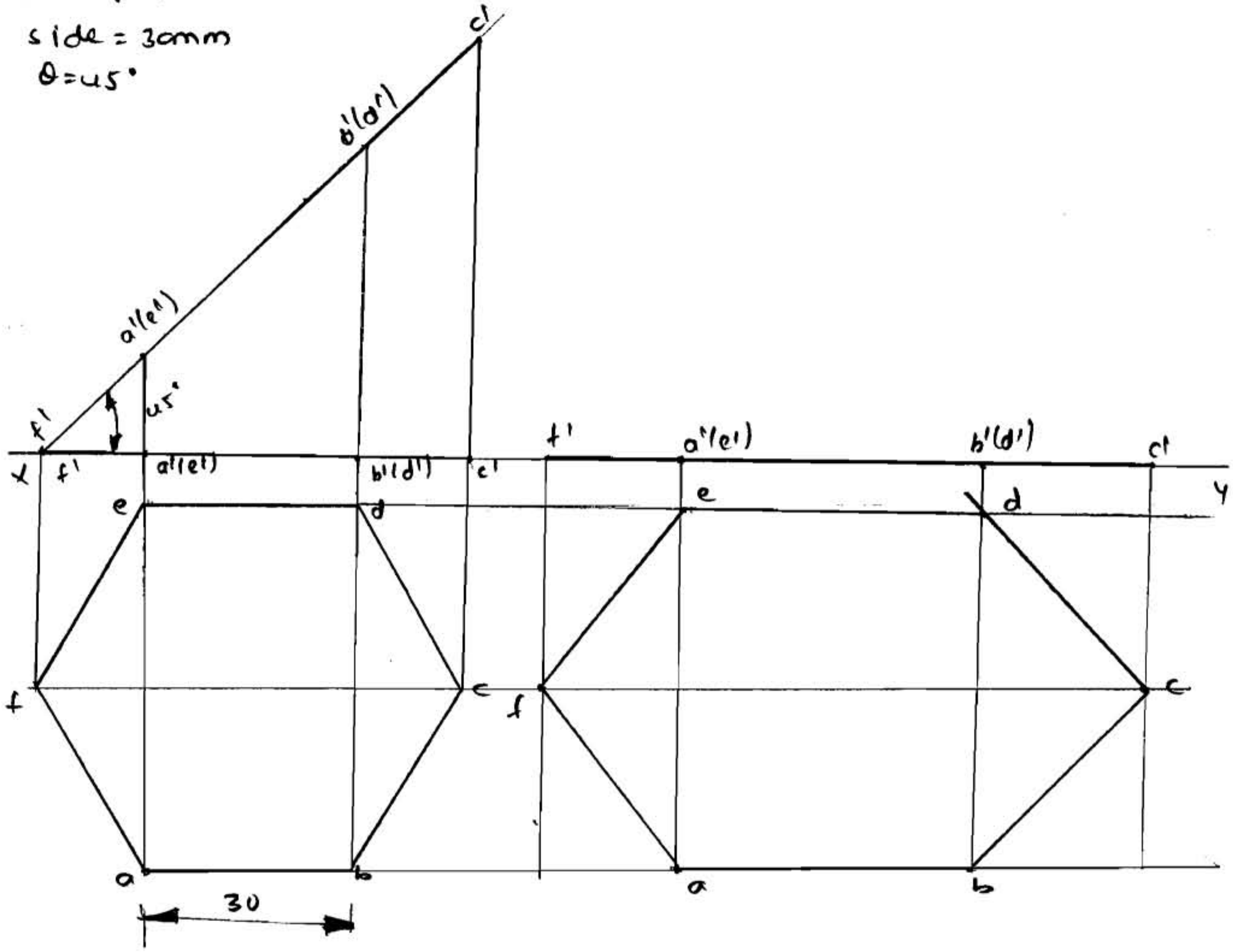
$\phi = 45°$

side = 25mm

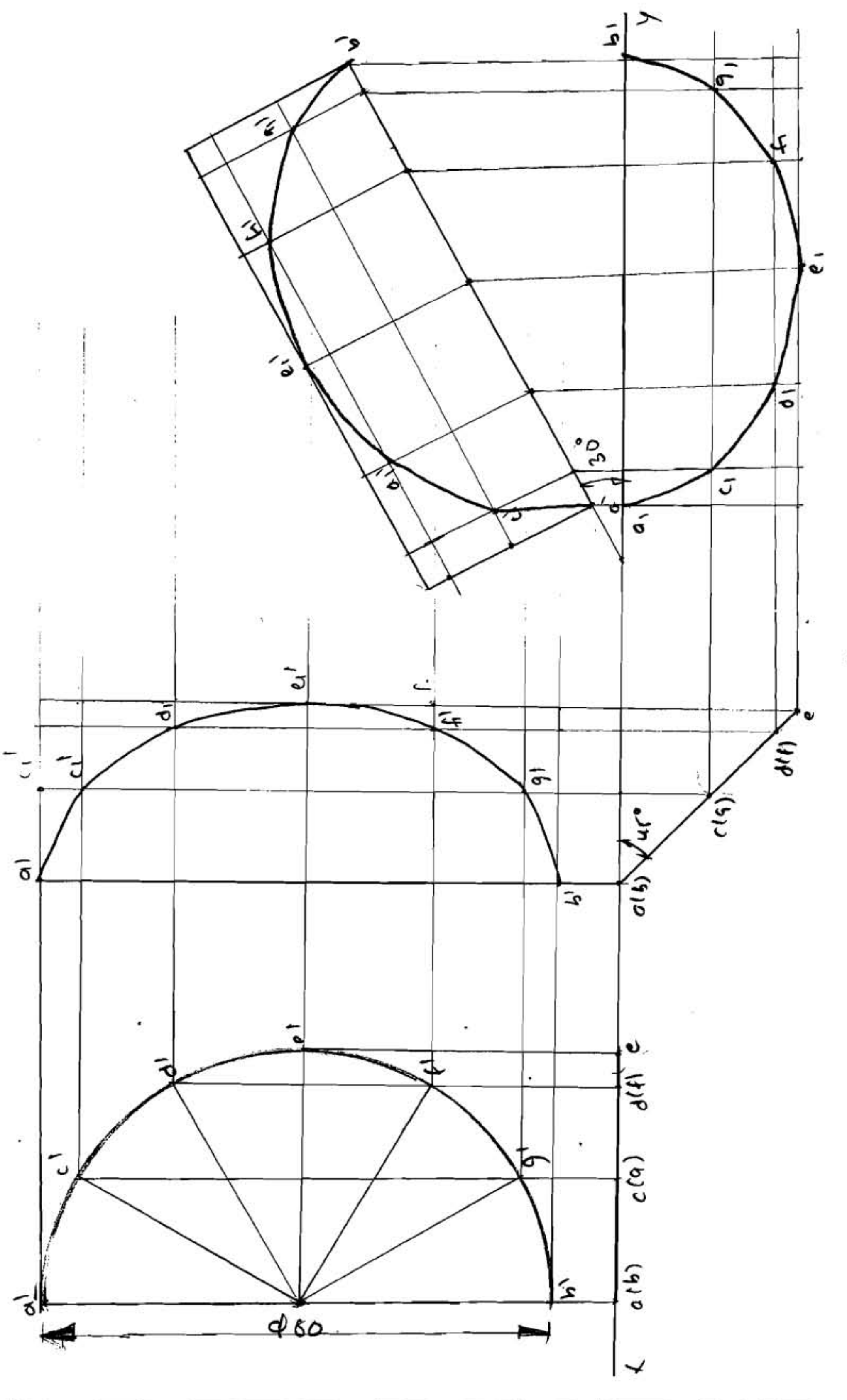


Q: The top view of a lamina whose surface is per to v.p and inclined at 45° to H.P. appears as a regular hexagon of 30mm side, Having a side parallel to the reference line. Draw the projections of the plane and obtain its true shape.

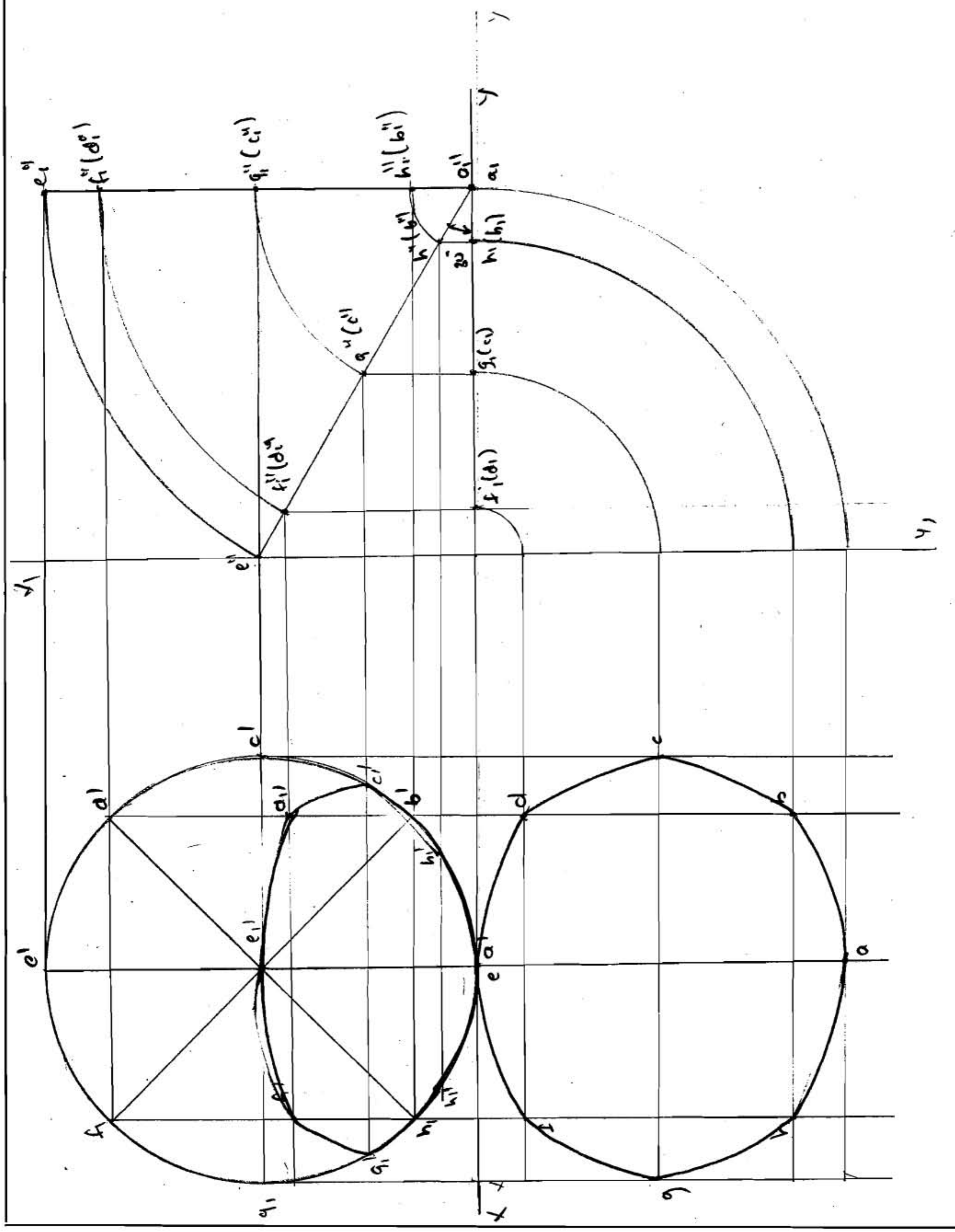
Hexagon
side = 30mm
$\theta = 45°$



Q: 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.



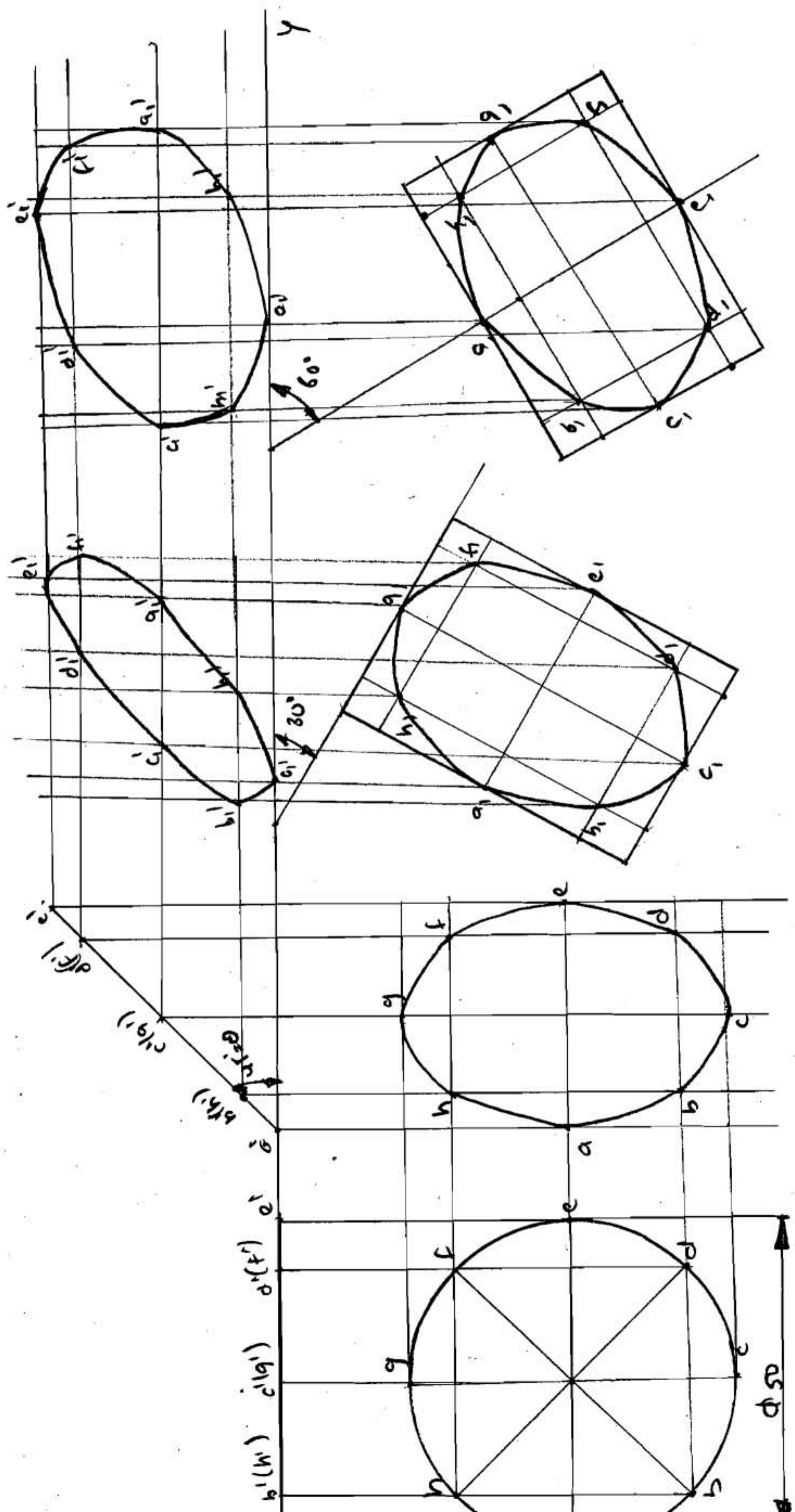
Q: A circular plane of 80mm diameter hase one of the ends of the diameter in the H.P. while the other end in the V.P. The plane is inclined 30° to the H.P and 60 to V.P Draw its Projection.



Q: 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.

a) The top-view of the diameter 'AC' making 30° angle with the V.P

b) The diameter 'AC' making 30° angle with the V.P



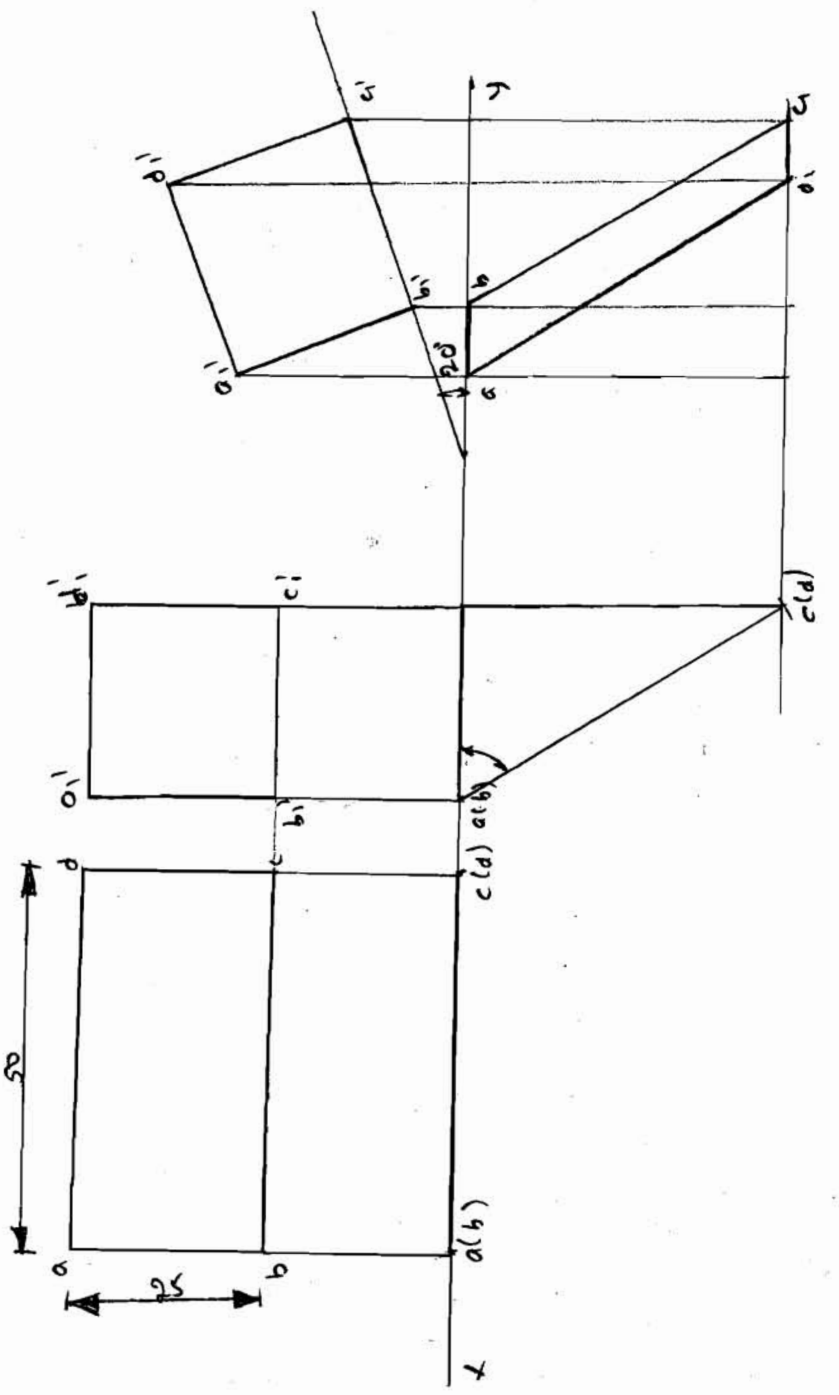
Q: An elevation of a rectangular lamina ABCD of 25mm & 50mm sides of is a square of 25mm when its side AB is in the V.P and the side AD is making an angle of 30° to the H.P

Rectangular ABCD

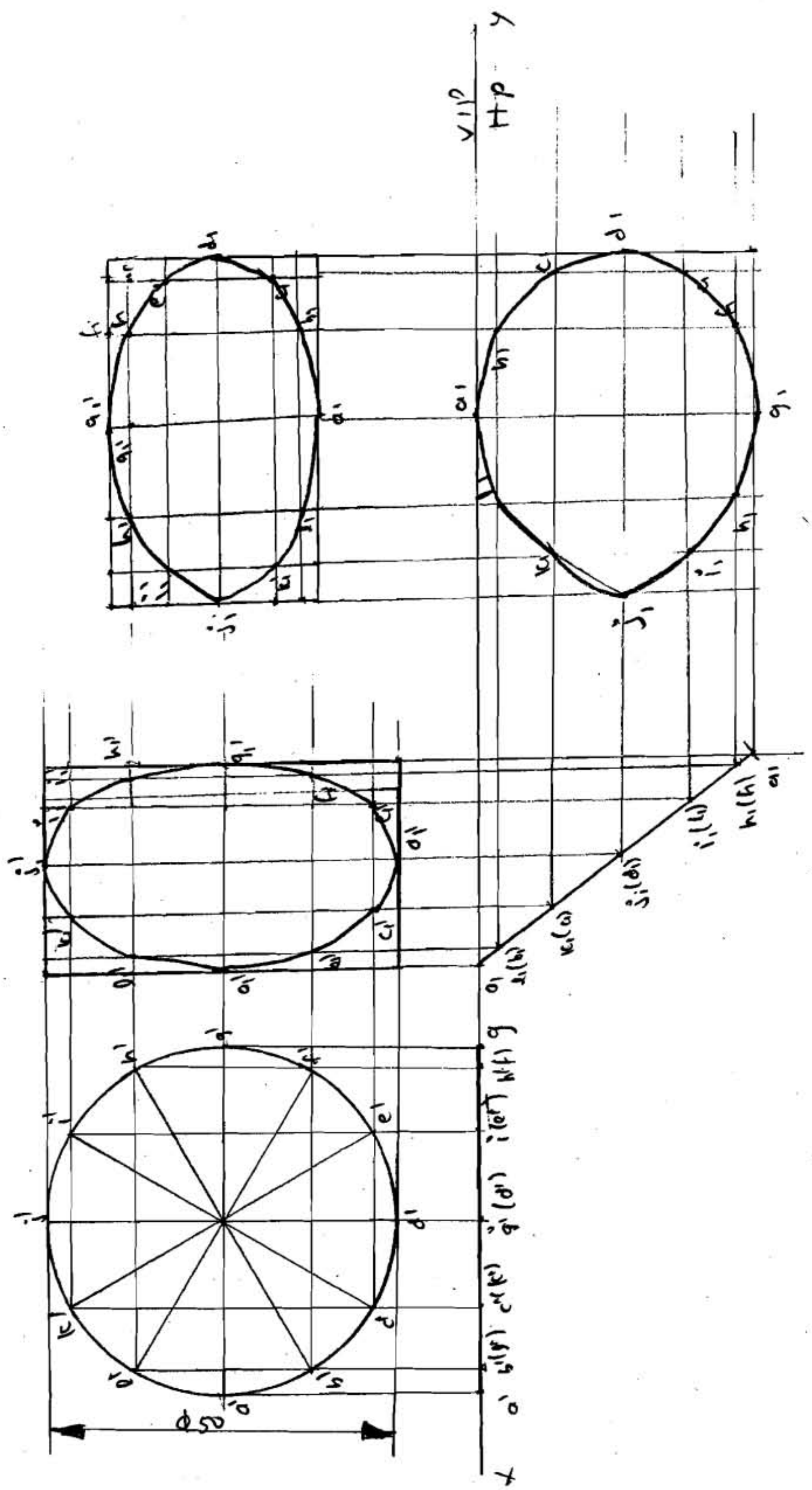
side = 25 × 50mm

square = 25mm

$\theta = 20°$



Q: A cirular 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.



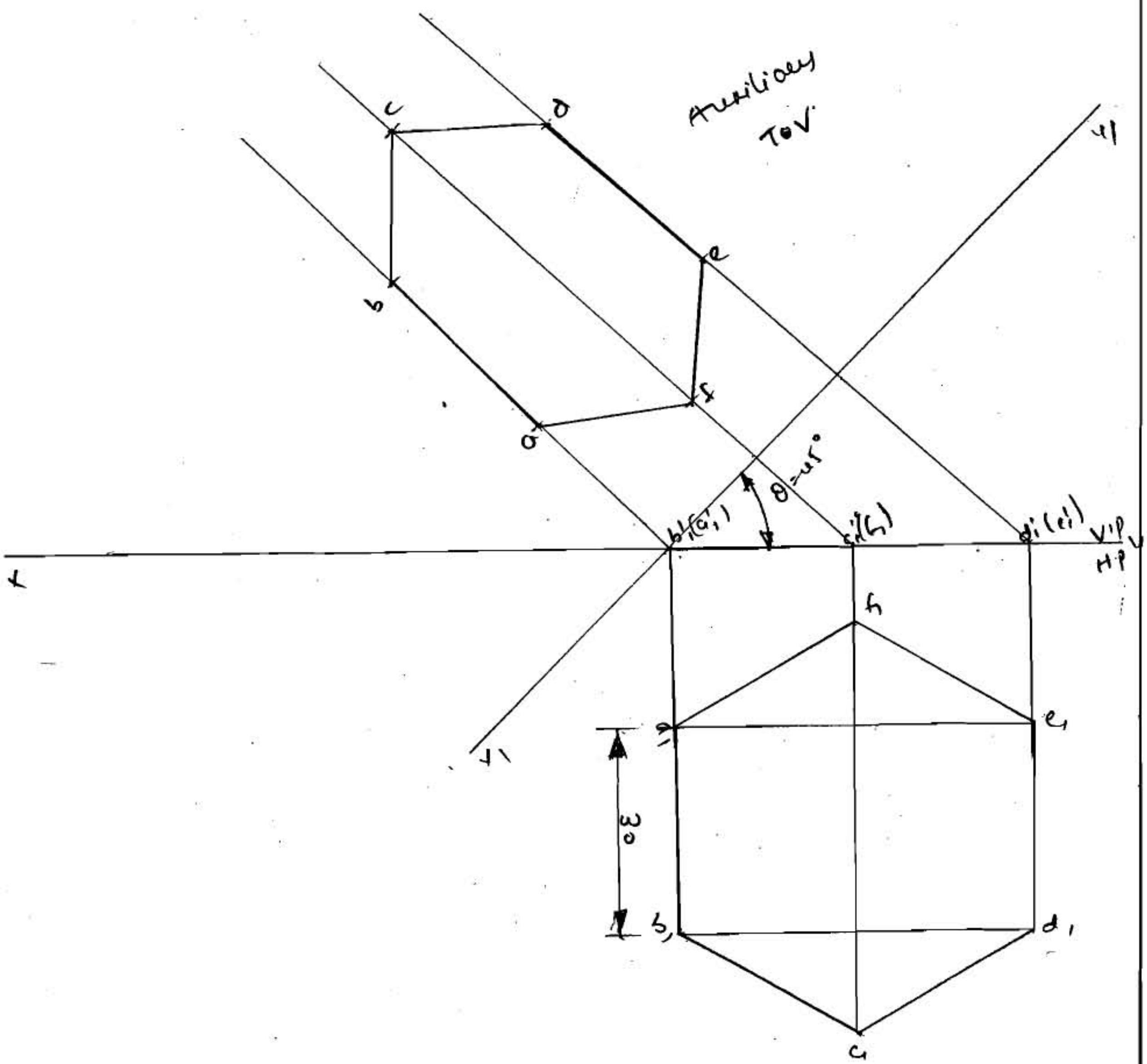
Auxiliary Plane method

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

Hexagonal Plane.

Side = 30mm

$\theta = 45^\circ$

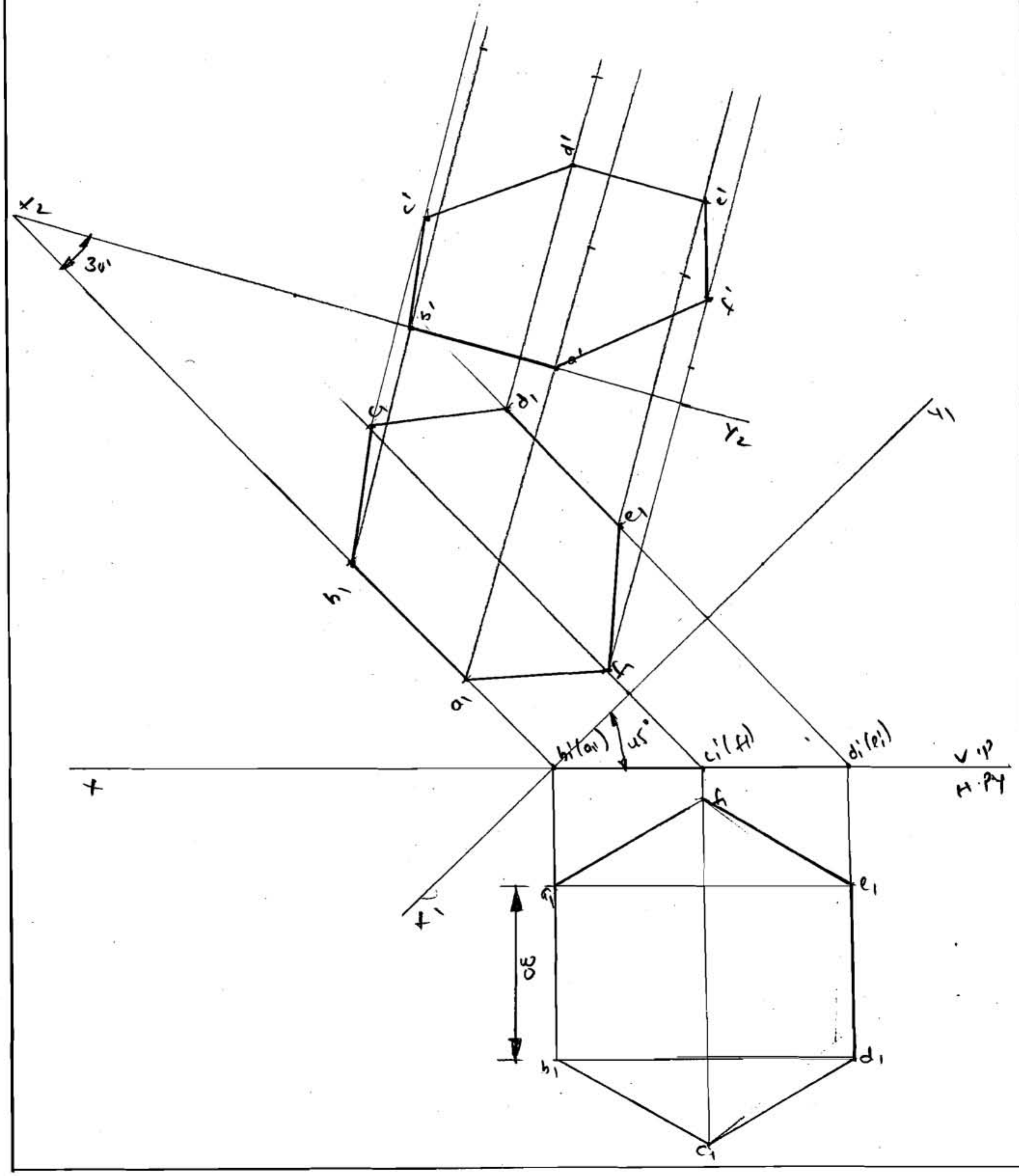


2. A hexagonal plane of side 30mm has an edge on the H.P. Its surface is inclined at 45° to H.P and the edge on which the plane rest is inclined at 30° to V.P. Draw its projections.

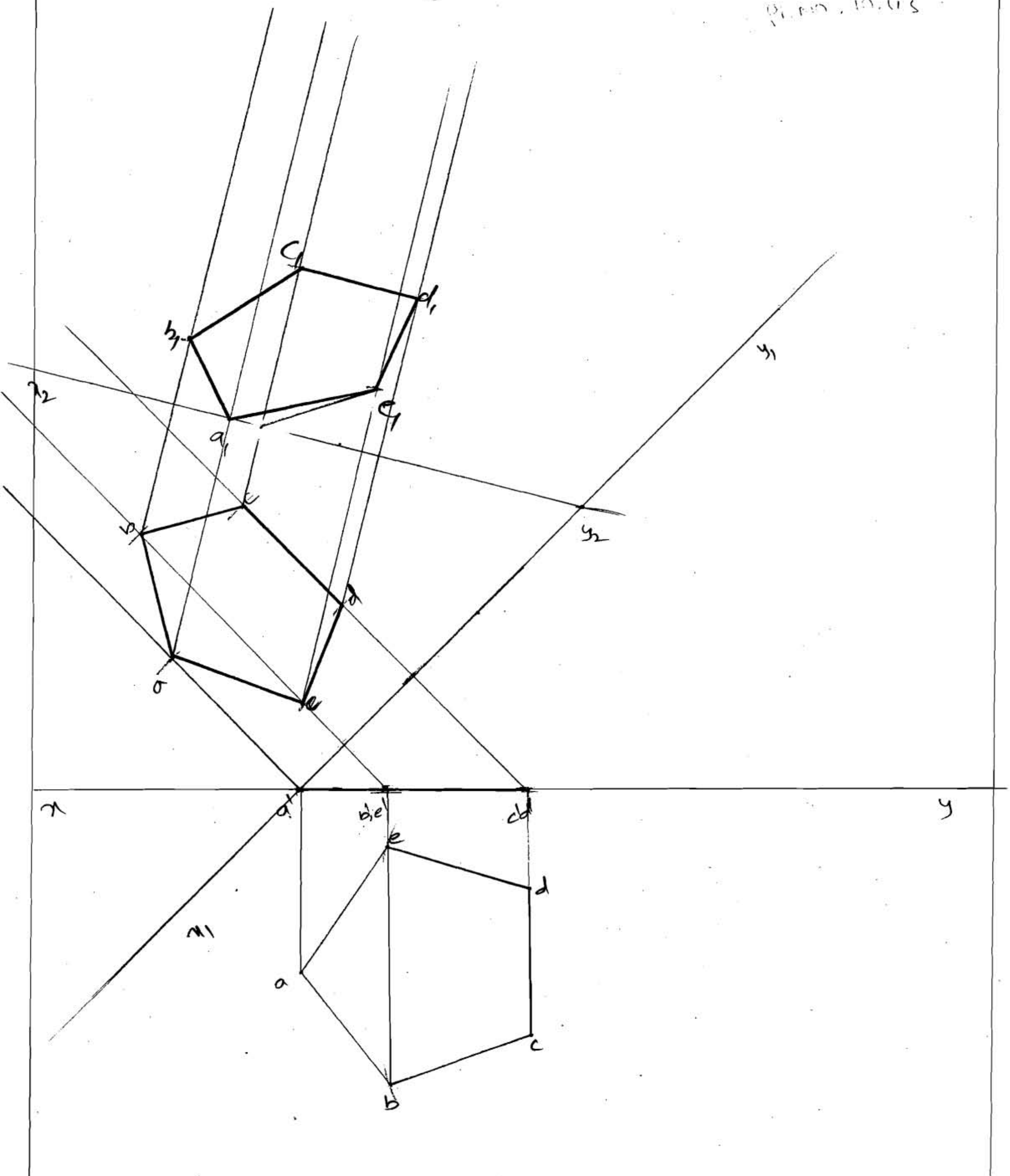
Hexagonal plane.

Side = 30mm.

$\phi = 30$, $\theta = 45°$



* Pentagonal Plane Auxiliary Views Inclined both the planes

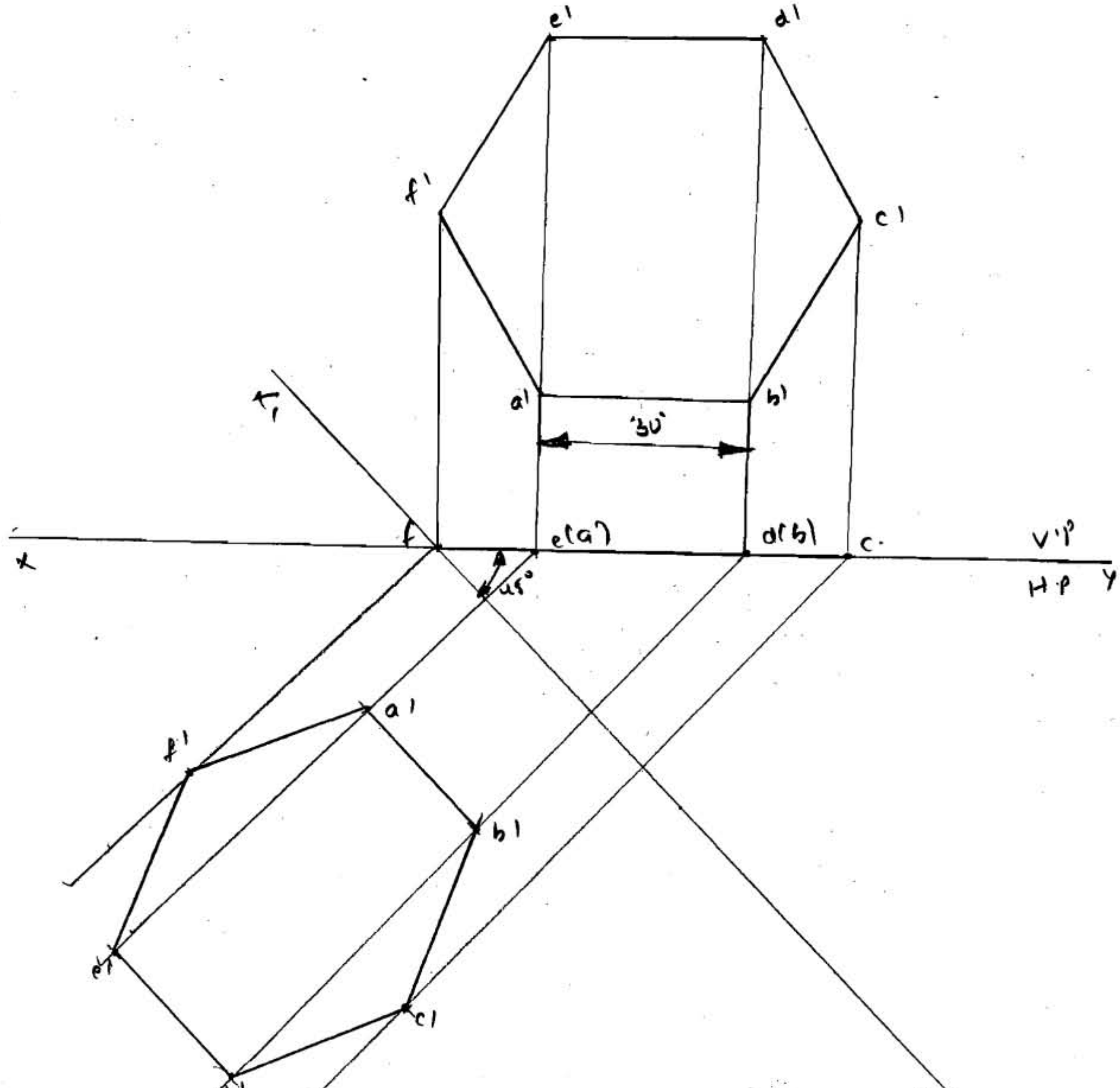


3. A hexagonal plane of side 30mm has a corner in the v.p. The surface of the plane is inclined at 45° to v.p and per to H.P. Draw its projections.

Hexagonal Plane

Side = 30mm

$\phi = 45°$



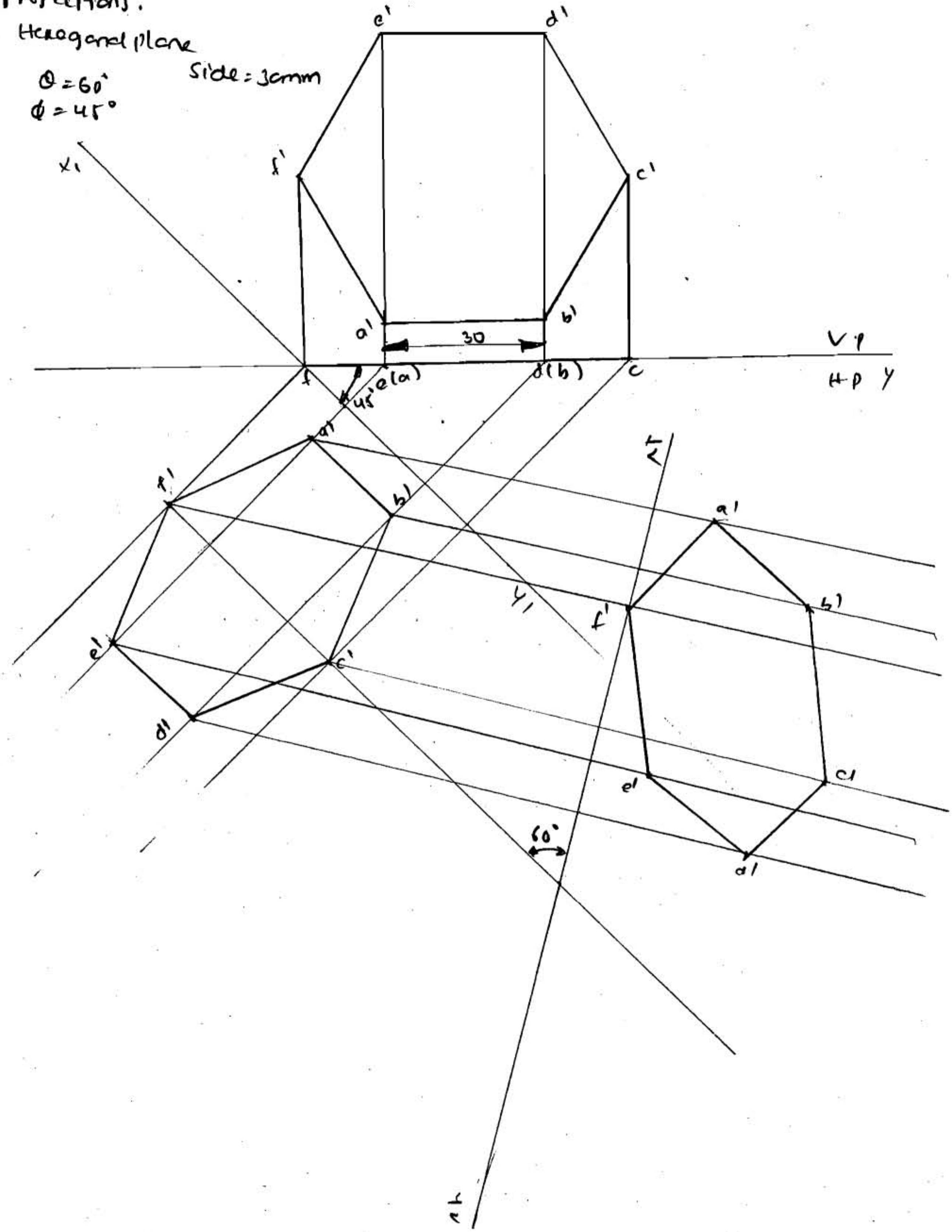
Auxiliary F.V

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 per 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

$\theta = 60°$
$\phi = 45°$

Side = 30mm



UNIT-III

Content

Projections of Regular Solids – Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views – Sections of Sphere

Unit-III

Projections of Solids:

A solid has three dimensions, viz. length, breadth and thickness. Torepresent a solid on a flat surface having only length and breadth, at least two orthographic views are necessary. Sometimes, additional views projected on auxiliary planes become necessary to make the description of a solid complete.

This chapter deals with the following topics:

1. Types of solids.
2. Projections of solids in simple positions.
(a) Axis perpendicular to the H.P.
(b) Axis perpendicular to the V.P.
(c) Axis parallel to both the H.P. and the V.P.
3. Projections of solids with axes inclined to one of the reference planes and parallel to the other.
(a) Axis inclined to the V.P. and parallel to the H.P.
(b) Axis inclined to the H.P. and parallel to the V.P.
4. Projections of solids with axes inclined to both the H.P. and the V.P.
5. Projections of spheres.

3. PROJECTION OF SOLIDS

1. A square pyramid side of base 40mm and axis 60mm is resting on its base on the H-P. Draw its projections when

a) A side of the base is parallel to V-P

b) A side of the base is inclined at 30° to V-P

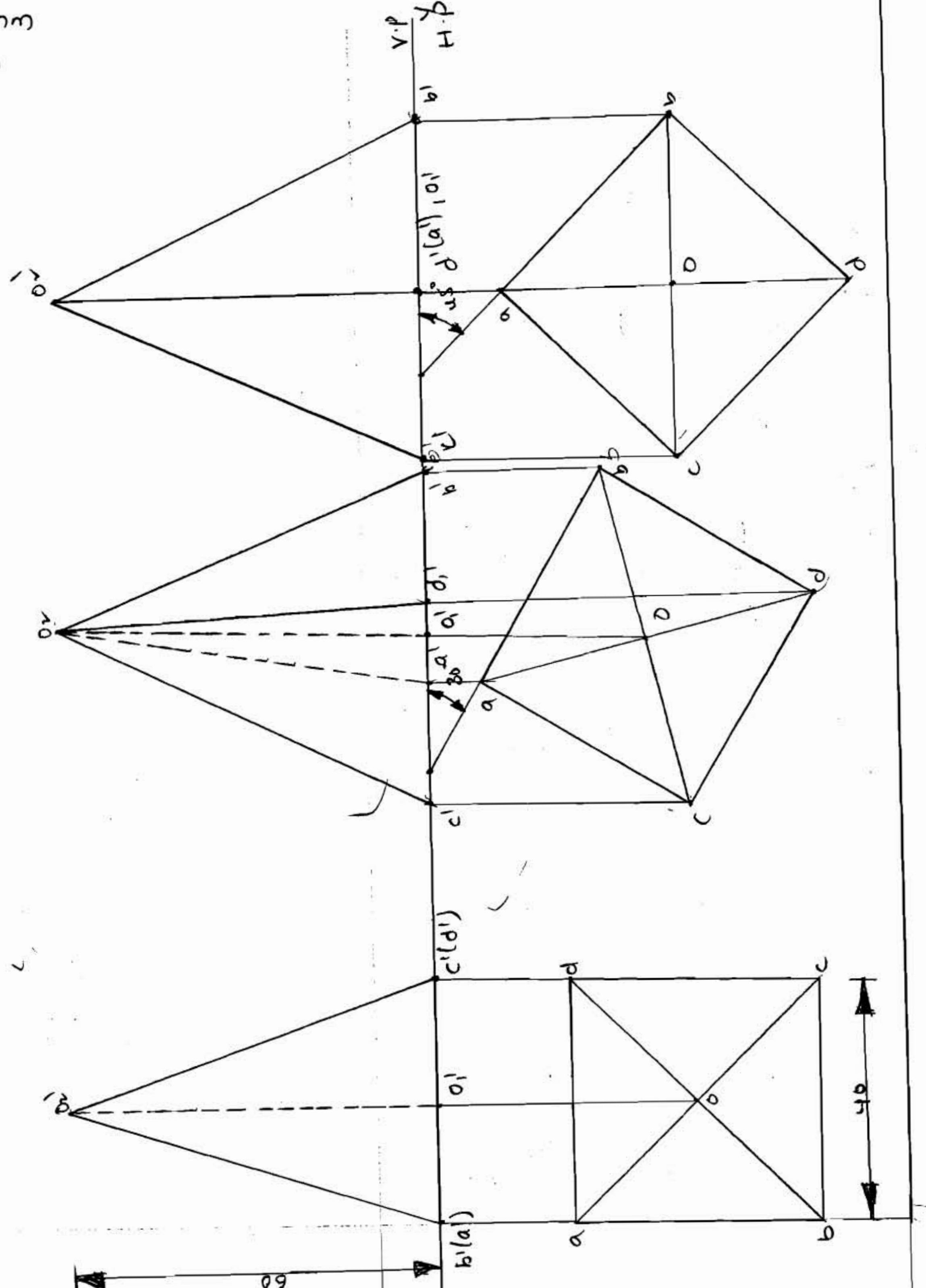
c) All sides of the base are equally inclined to V-P.

Sol: Square pyramide

Base = 40mm

Axis = 60mm

$\phi = 30^{\circ}$



2. A square prism of 40mm above edges and 60mm long axis is resting on its base on the ground. Draw its Projections when

a) A face is Perpendicular to v.p

b) A face is inclined at 30° to v.p

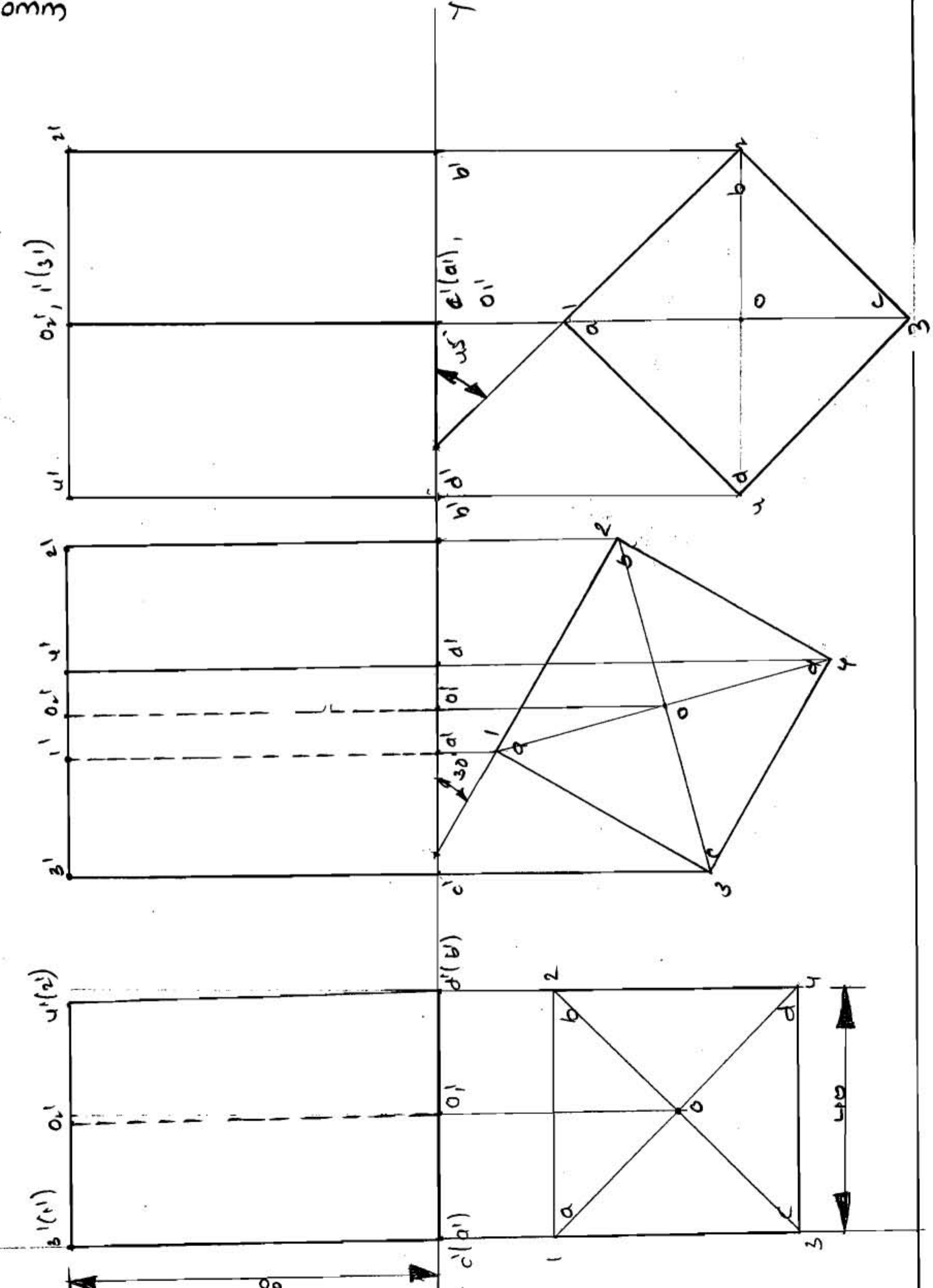
c) All the faces are equally inclined.

Ans: square prism.

Base = 40mm

Axis = 60mm

$\phi = 30°$



3. A Pentagonal Prism of 30mm base edges and 60mm Long axis has one of its bases in the v.p. Draw its Projections when

a) A rectangular face is Parallel to and 15mm above H.p

b) A face is ⊥er to H.p

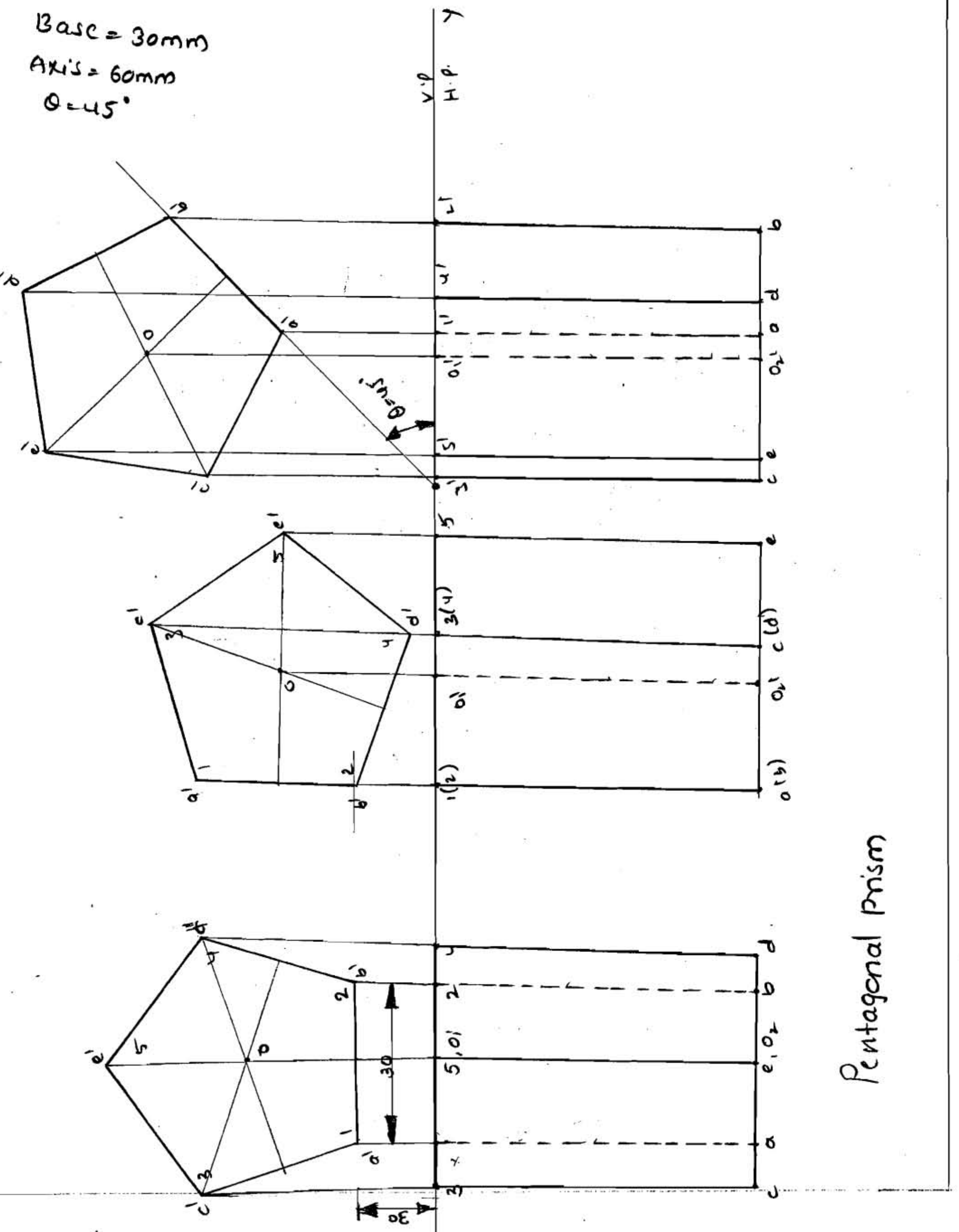
c) A face is inclined at 45° to H.p.

Sol:- Pentagonal Prism.

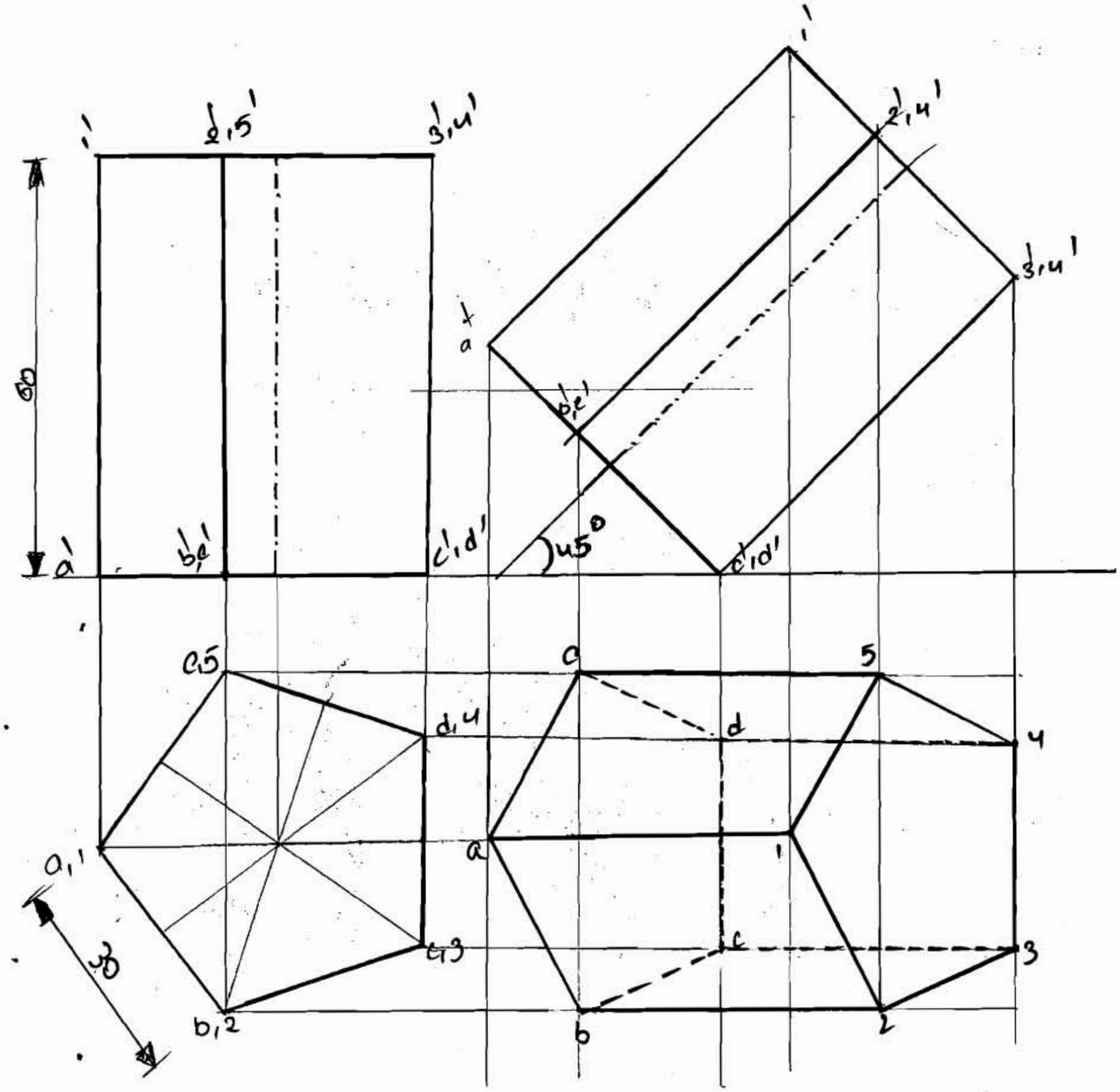
Base = 30mm

Axis = 60mm

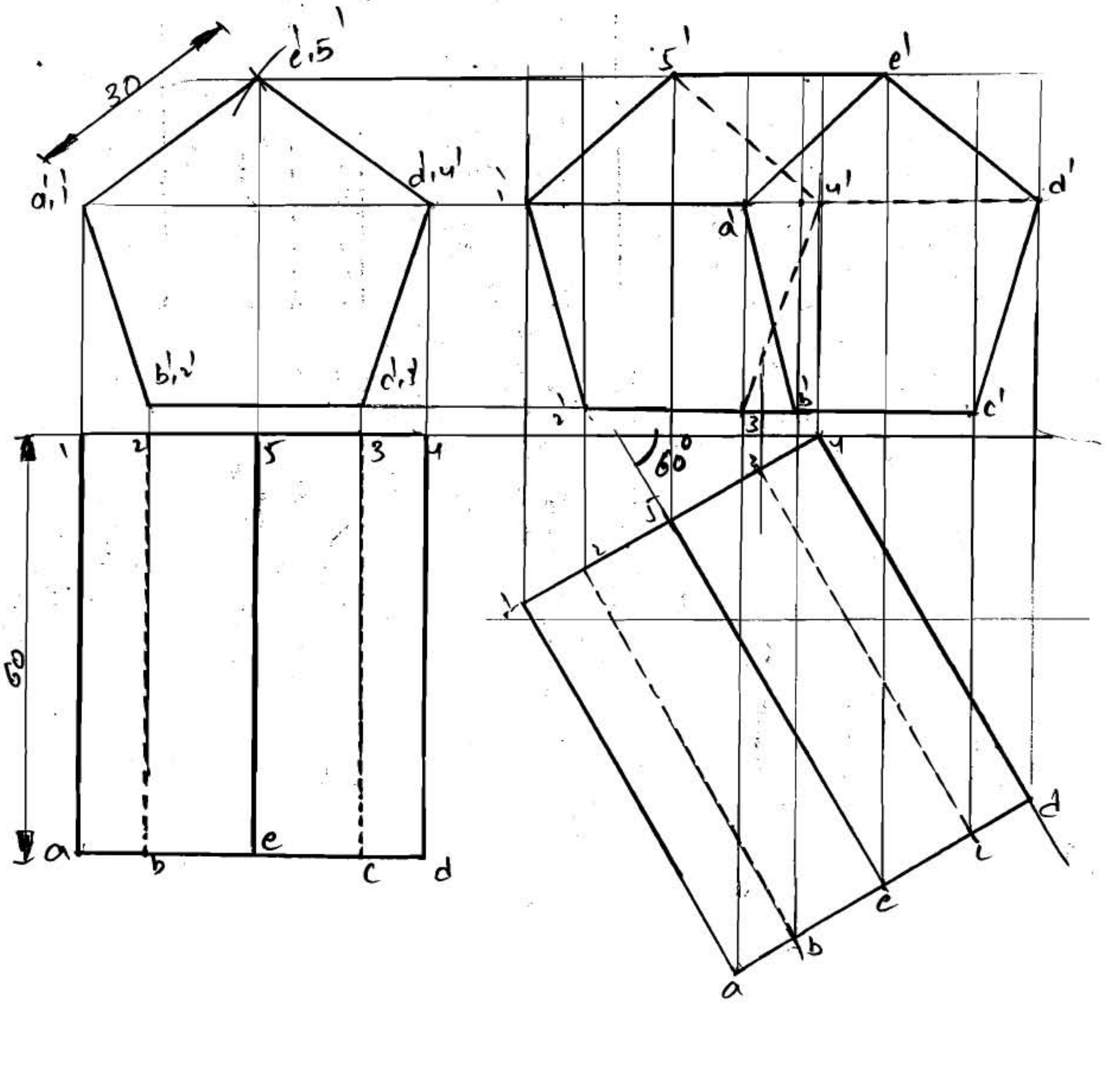
θ = 45°



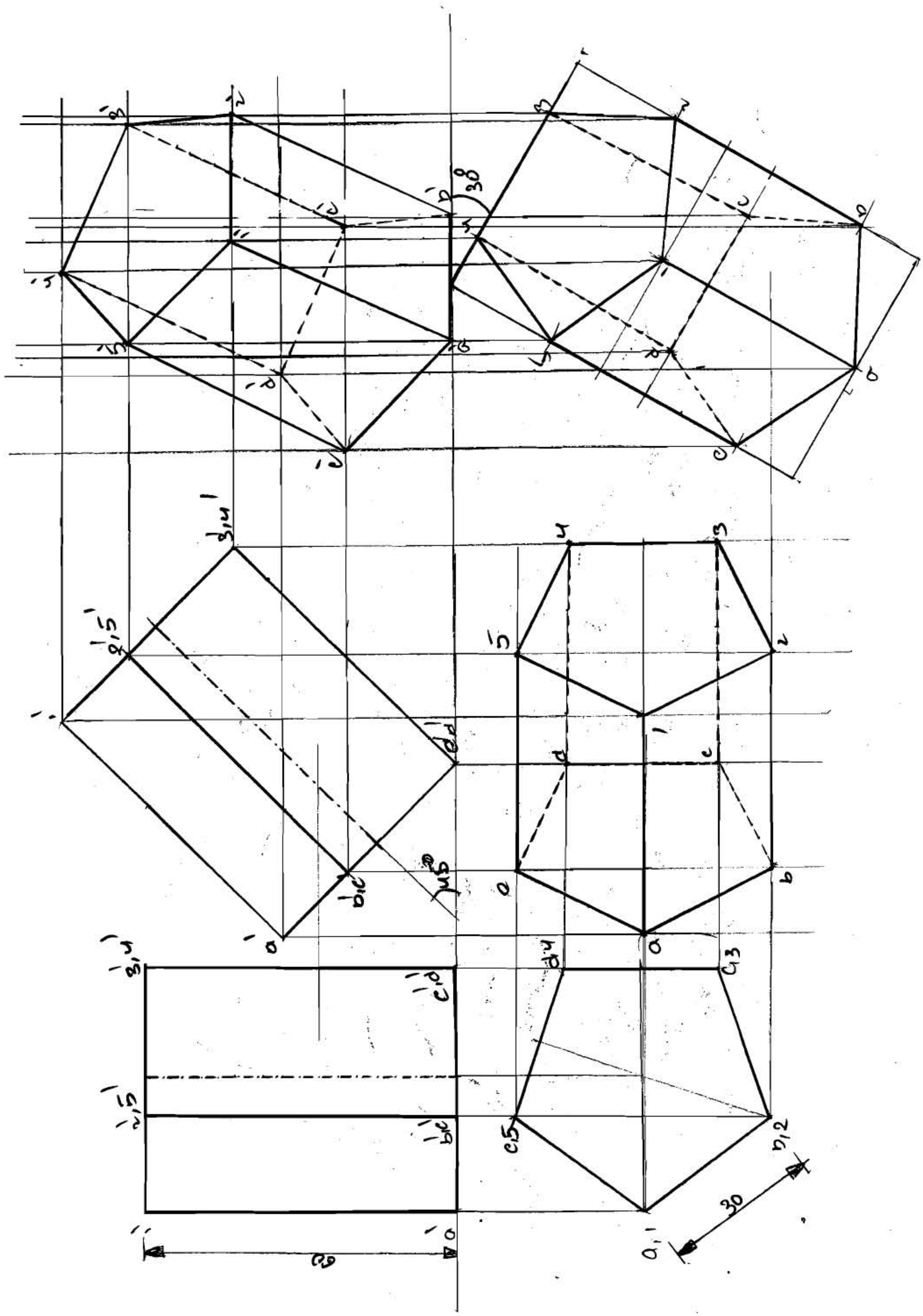
* Pentagonal Prism Inclined to H.P



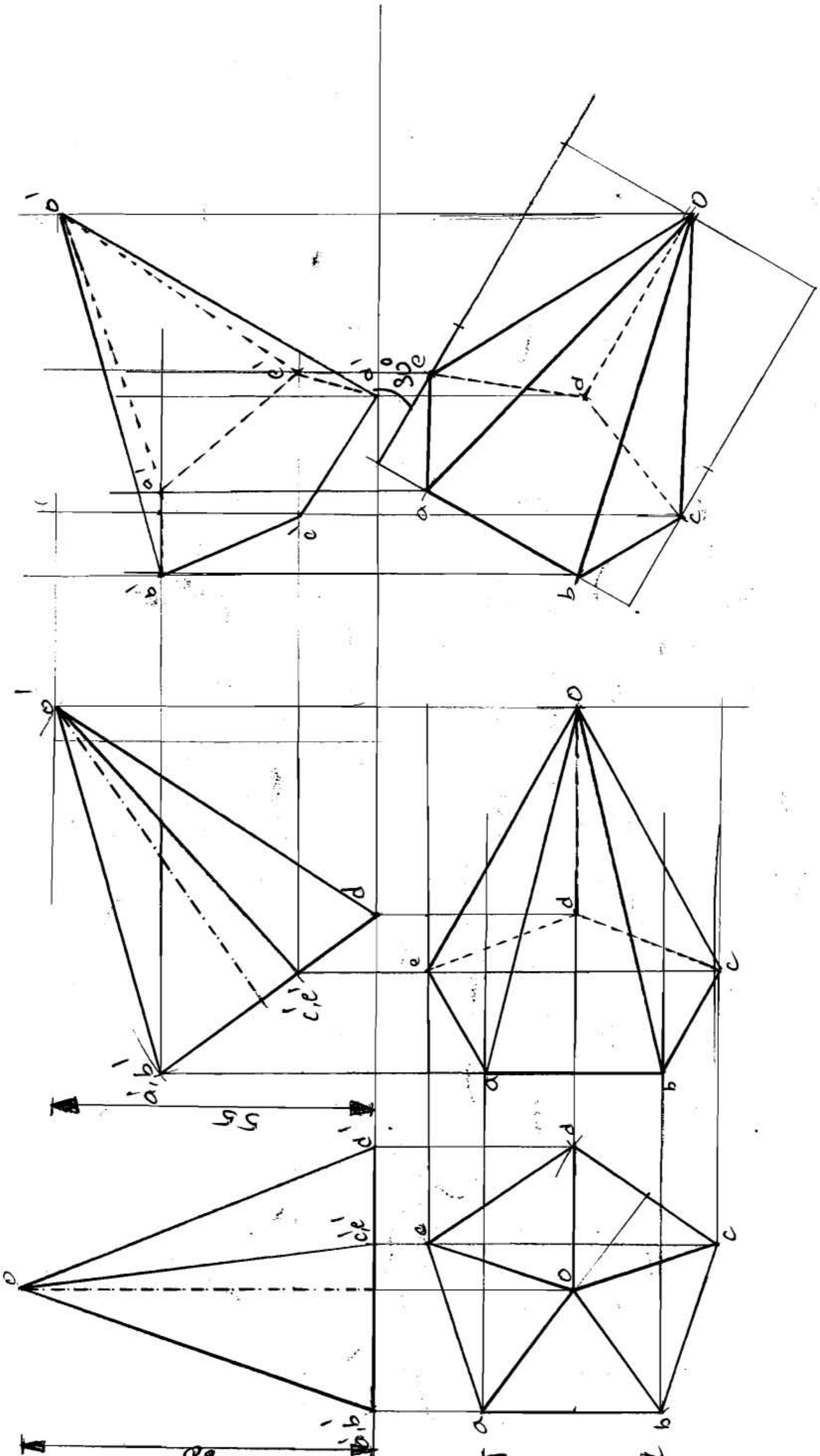
* Pentagonal Prism Inclined to V.P



* Pentagonal Prism Axis inclined to both the plane V.P & H.P



Pentagonal Pyramid Axis Inclined both the plane H.P & V.P

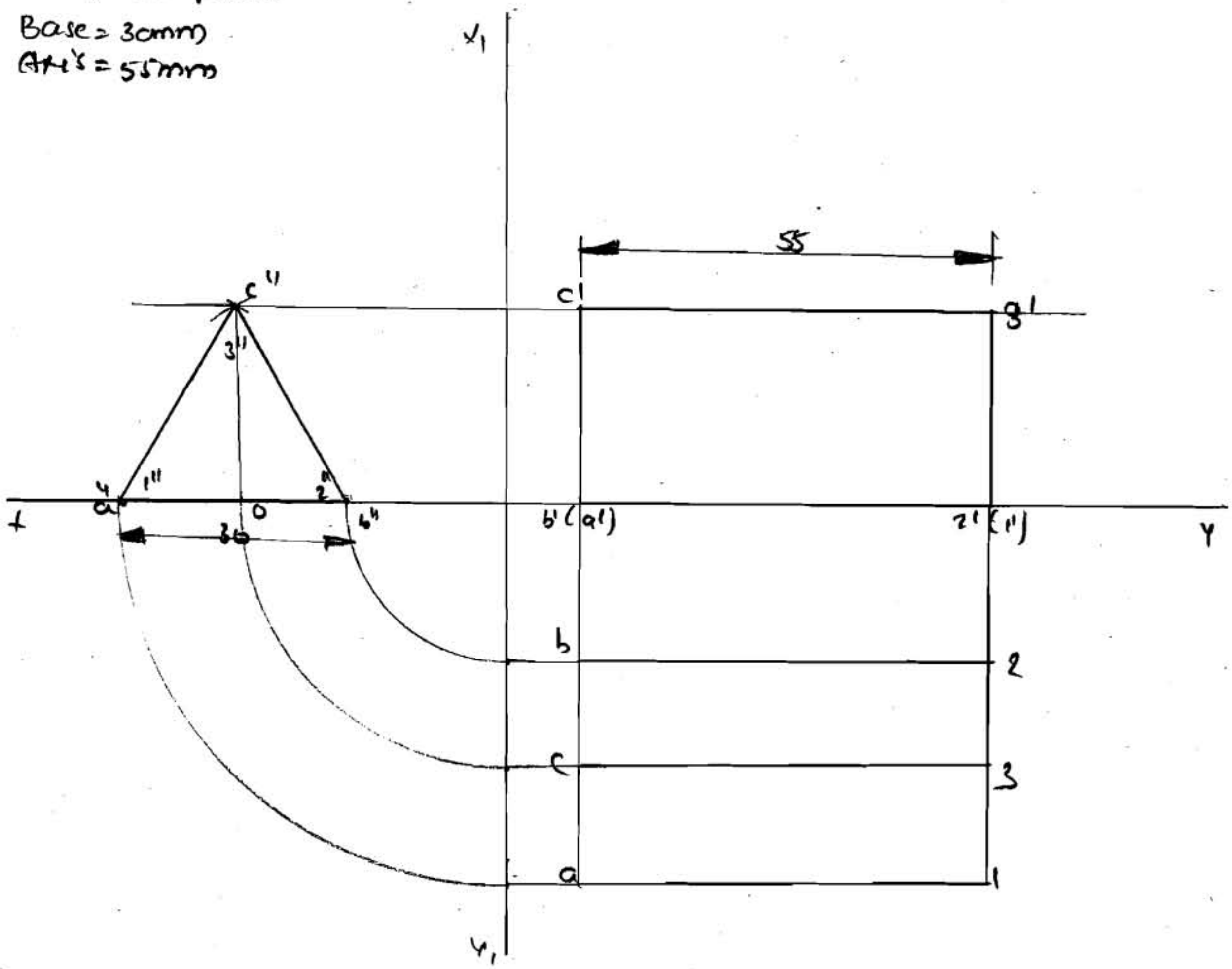


2. A triangular prism of base 30mm and axis 55mm long lies on its rectangular face in H.P. with its axis parallel to V.P. Draw the three views of the prism.

Triangular prism

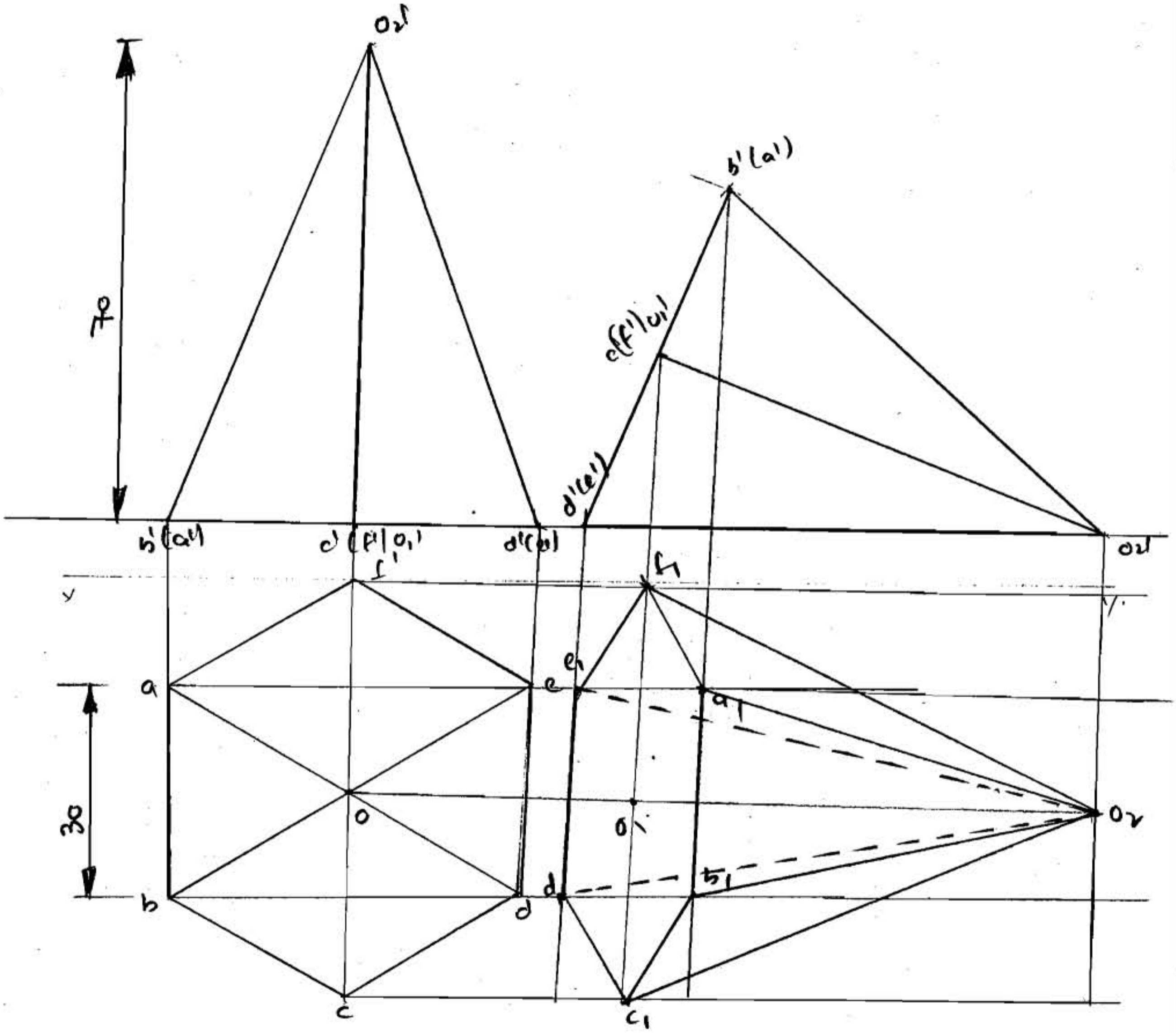
Base = 30mm

Axis = 55mm



Q:- A Hexagonal pyramid with 30mm base edge and 70mm Long axis as a triangular face on the ground. and the axis parallel to the v.p. Draw its projections

Hexagonal Pyramid
Base = 30mm
Axis = 70 mm.



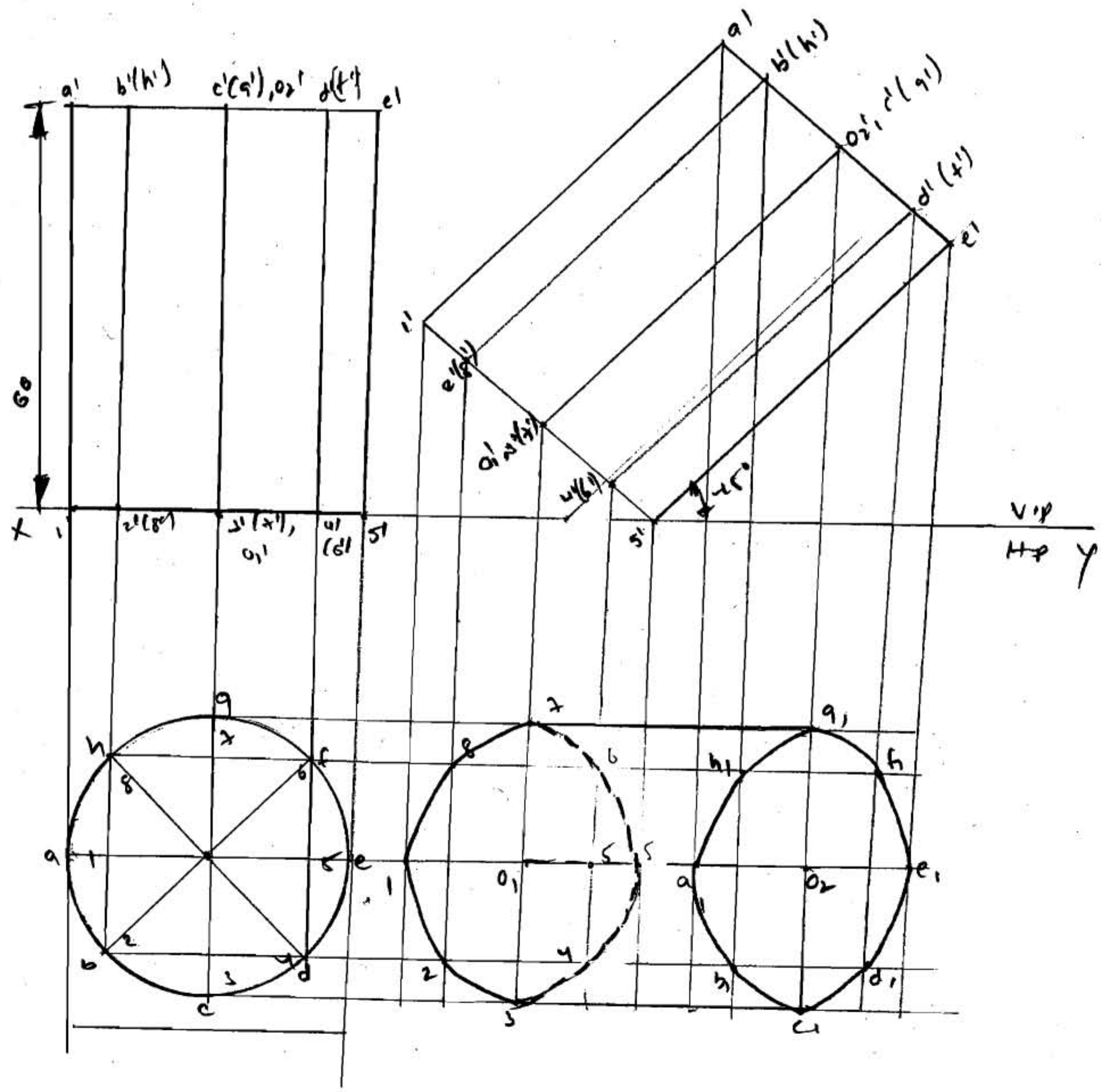
Q: Draw the projections of a cylinder of 40mm diameter and 60mm long axis. when it is lying on the H.P. with axis inclined at 45° to H.P and parallel to V.P

cylinder

diameter (ϕ) = 40mm

Axis = 60mm

θ = 45° / lel to V.P

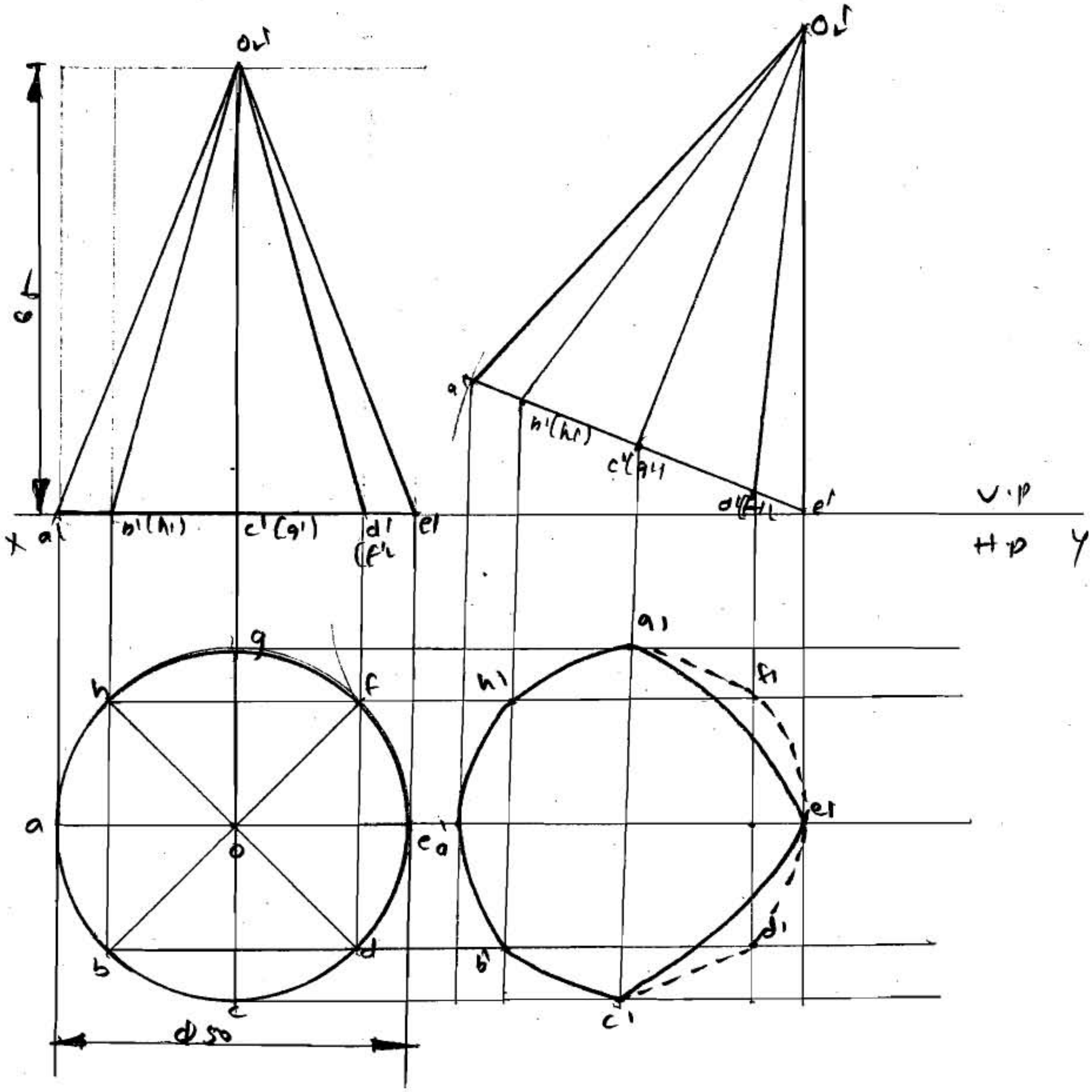


a: A right circular cone with 50mm diameter base and 65mm long axis rest on its base rim on the H.P. with its axis parallel to V.P and one of the generator ⊥er to H.P. Draw the projections of the cone.

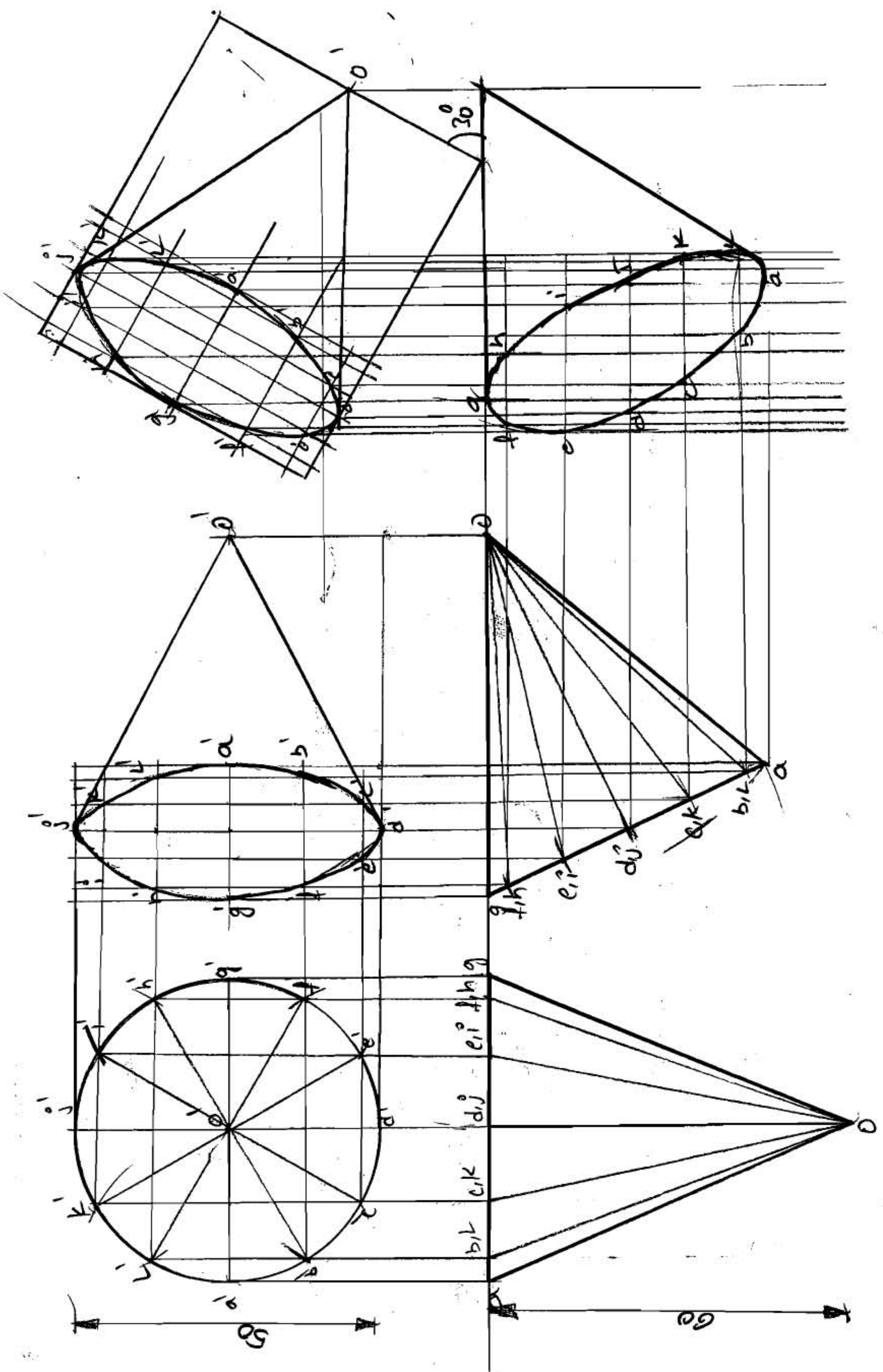
Cone

diameter = ϕ 50mm

Axis = 65mm



* Cone Axis Inclined the both plane V.P & H.P

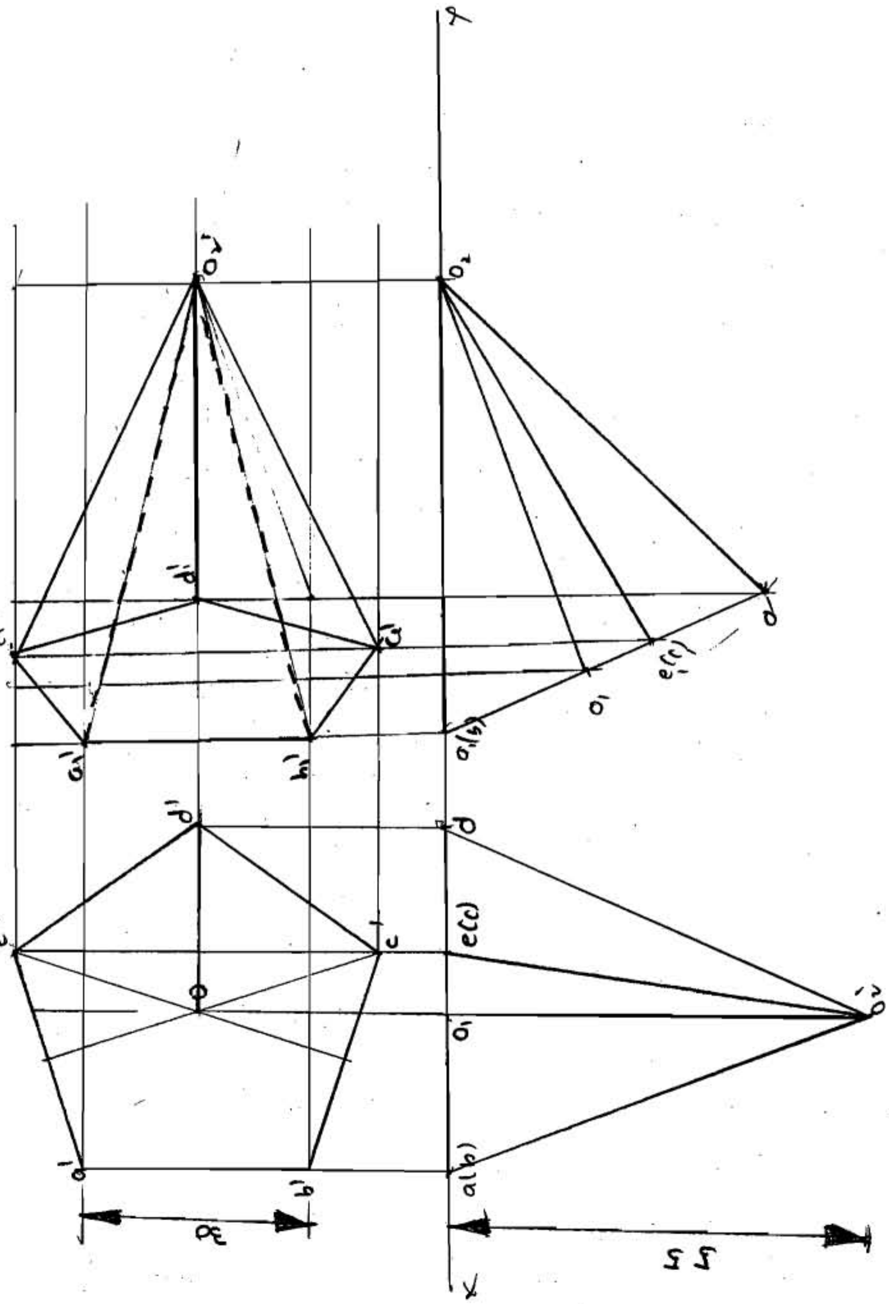


Q: A Pentagonal Pyramid base side 30mm and axis 55mm Long, has a triangular face in the v.p and axis parallel to H.P. Draw its projections

Pentagonal Pyramid

Base = 30mm

Axis = 55mm



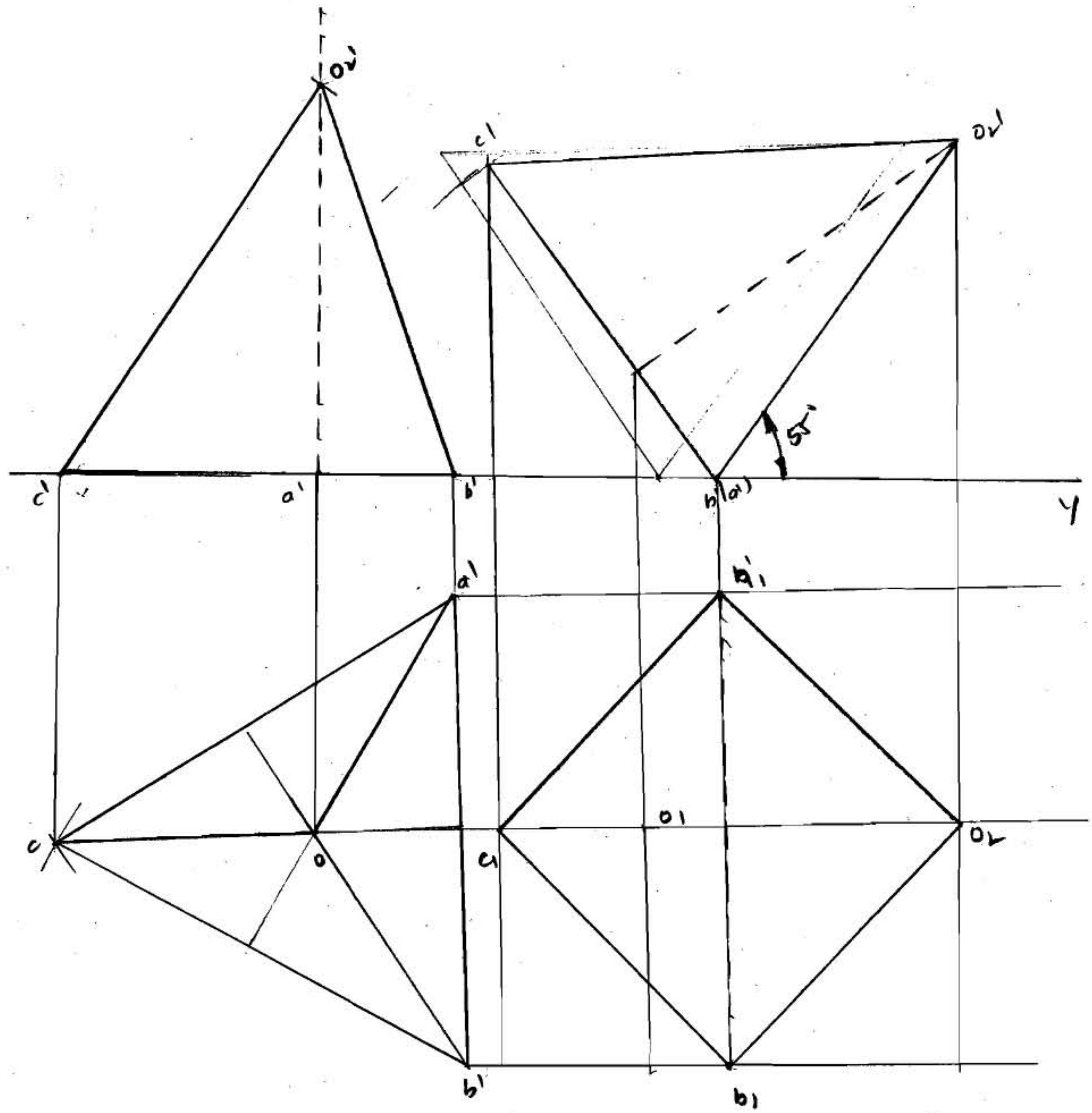
Q: A tetrahedron of 70mm long edge on the ground and the faces containing that edge are equally inclined to the H.P. Draw its projection when the edge lying on the ground per to V.P

Tetrahedron

side = 70mm

Long edge on H.P

$\theta = 55°$



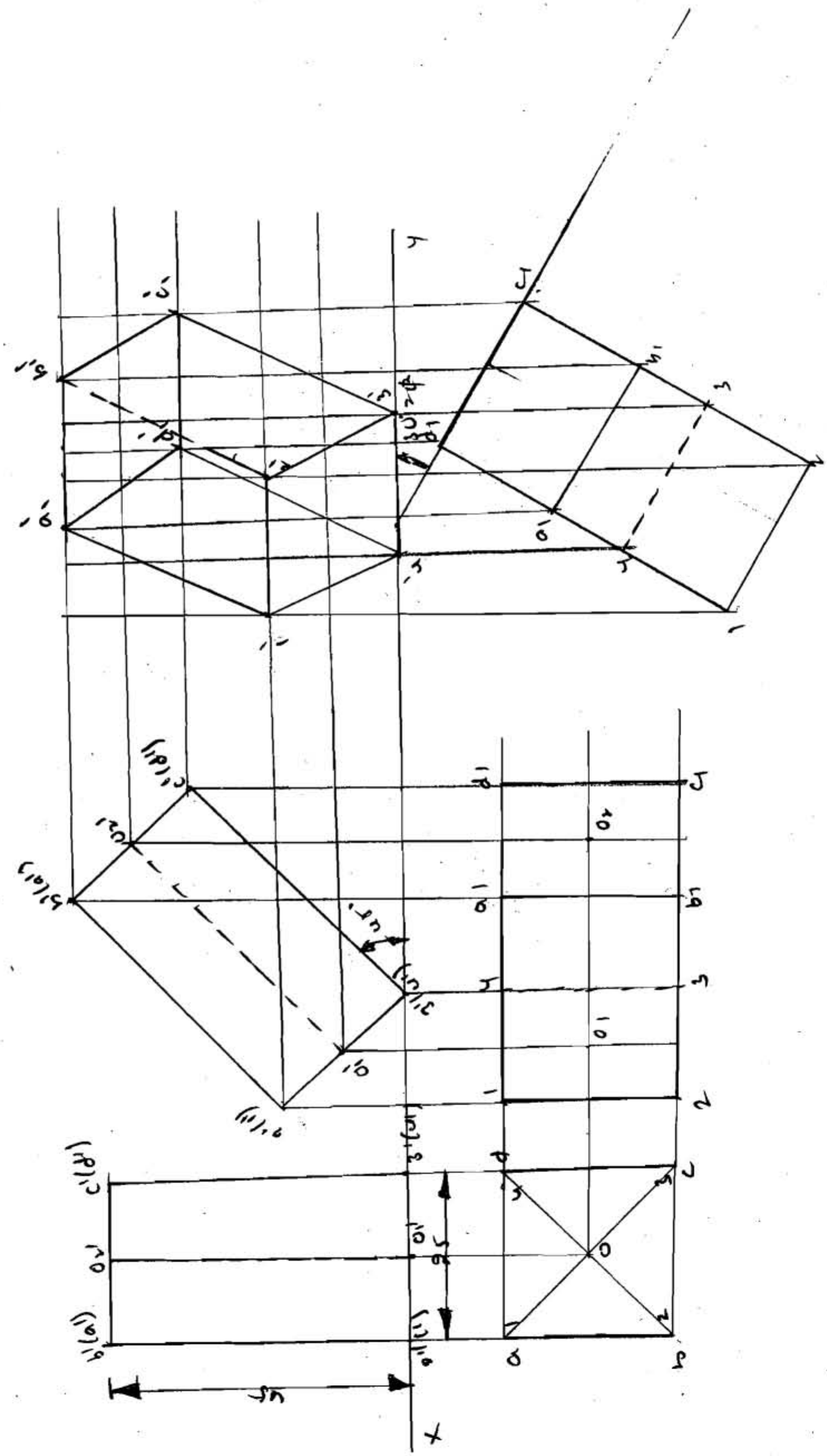
Q: A square prism 25mm edge base and 45mm long axis has its axis inclined at 45° to HP and edge of its base on which the prism rest is inclined at 30° to VP. Draw its projections

Square prism

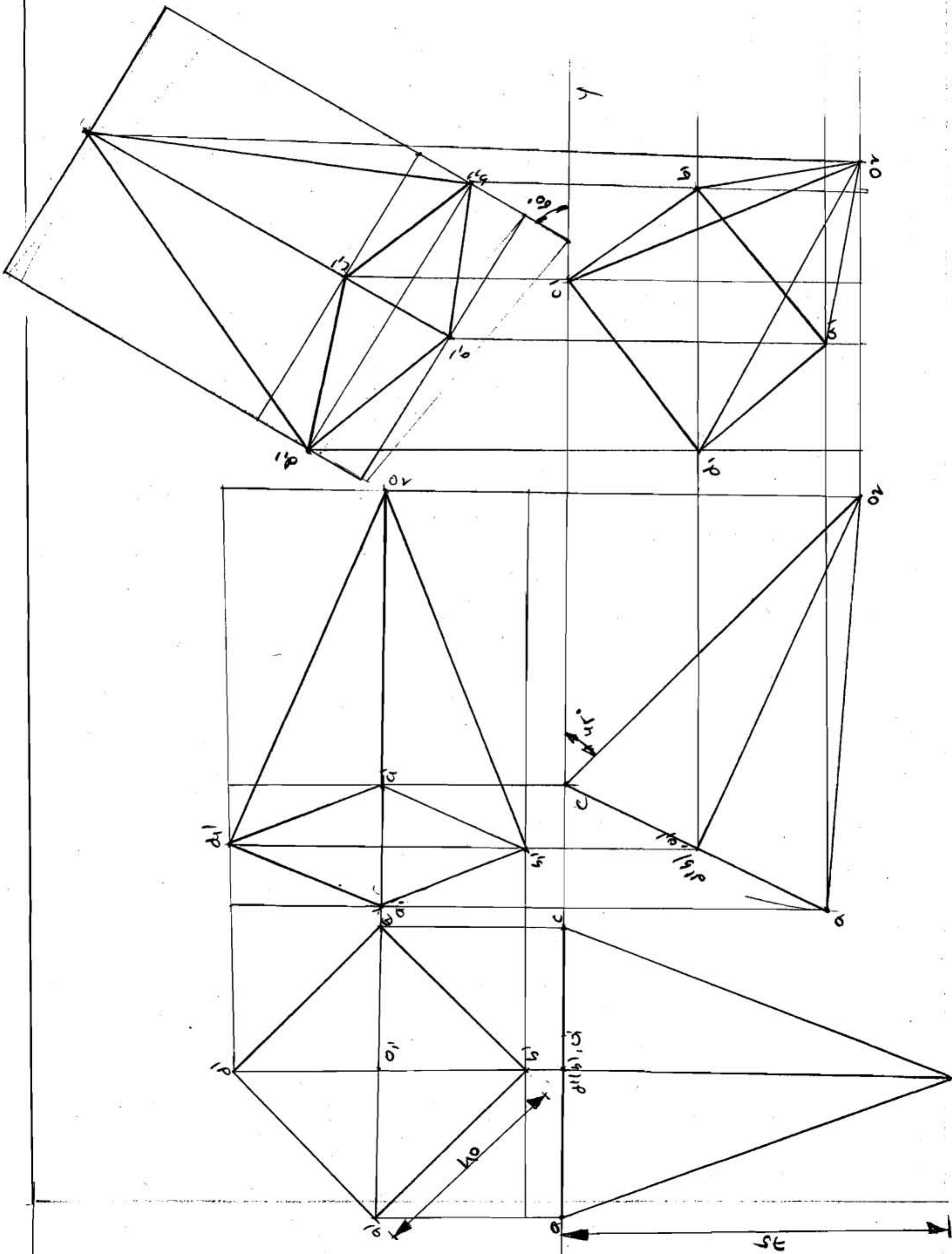
Base = 25mm

Axis = 45mm

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



Q: A square pyramid of 40mm base side and 75mm long axis has a corner of its base on the v.p. The slant edge contained by that corner is inclined at 45° to v.p. and the plane containing the slant edge and the axis is inclined at 60° to H.P. Draw its projections



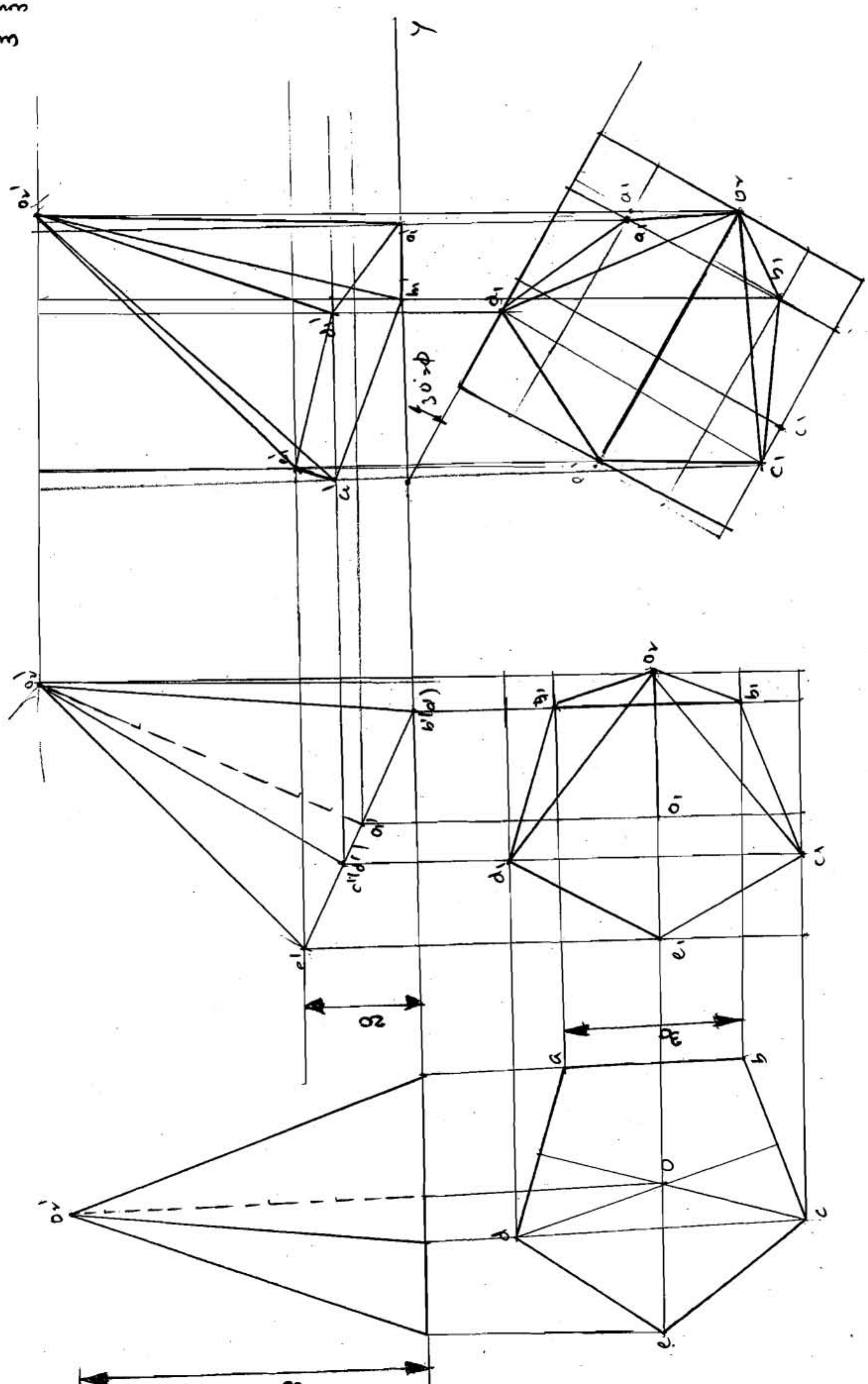
2. A Pentagonal pyramid of 30mm base side and 60mm long axis rest on an edge of its base on the ground so that the highest point on the base is 20mm above the ground. Draw its Projections if the vertical plane containing the axis is inclined at 30° to V.P

Pentagonal Pyramid

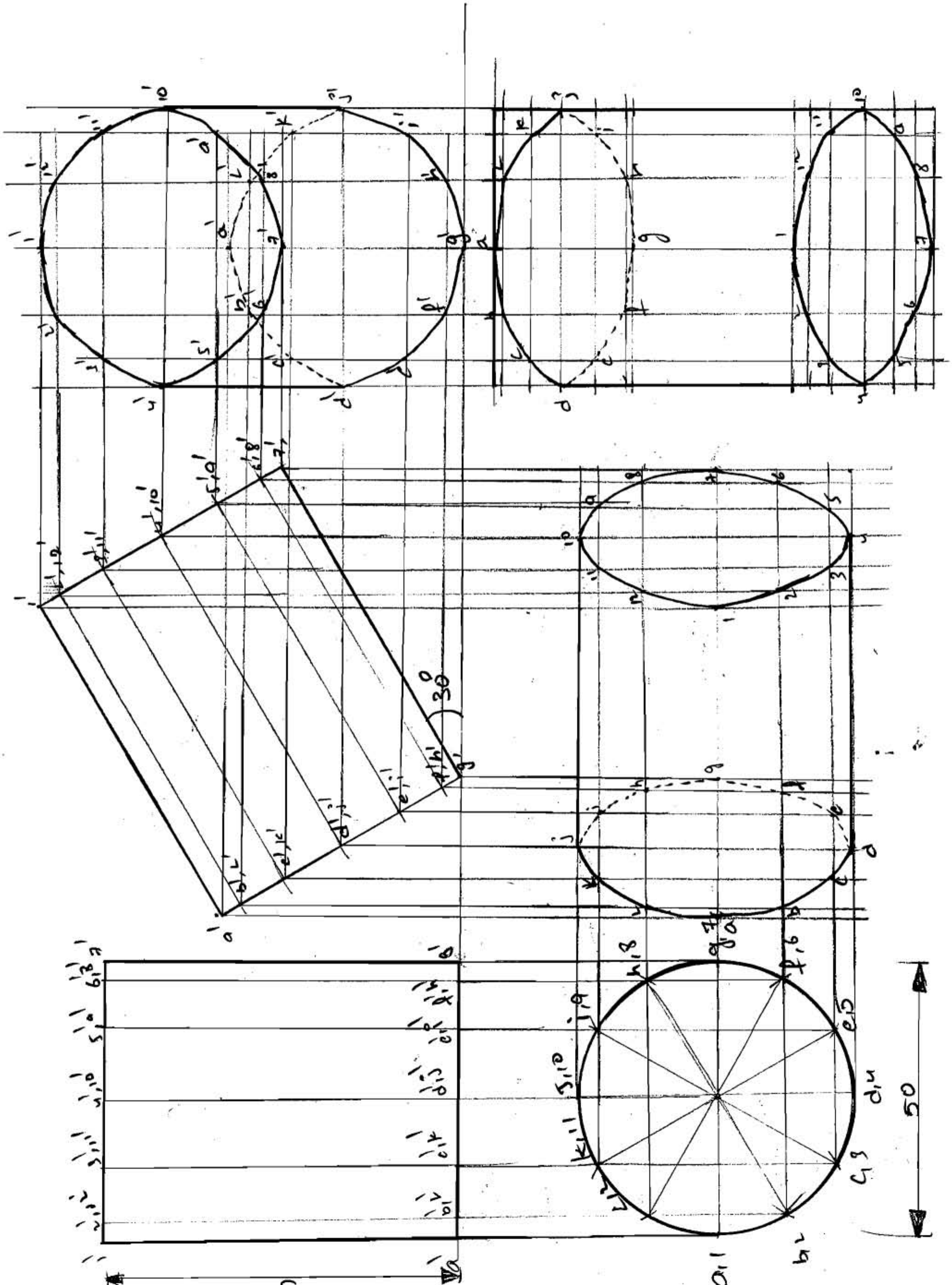
B = 30mm

A = 60mm

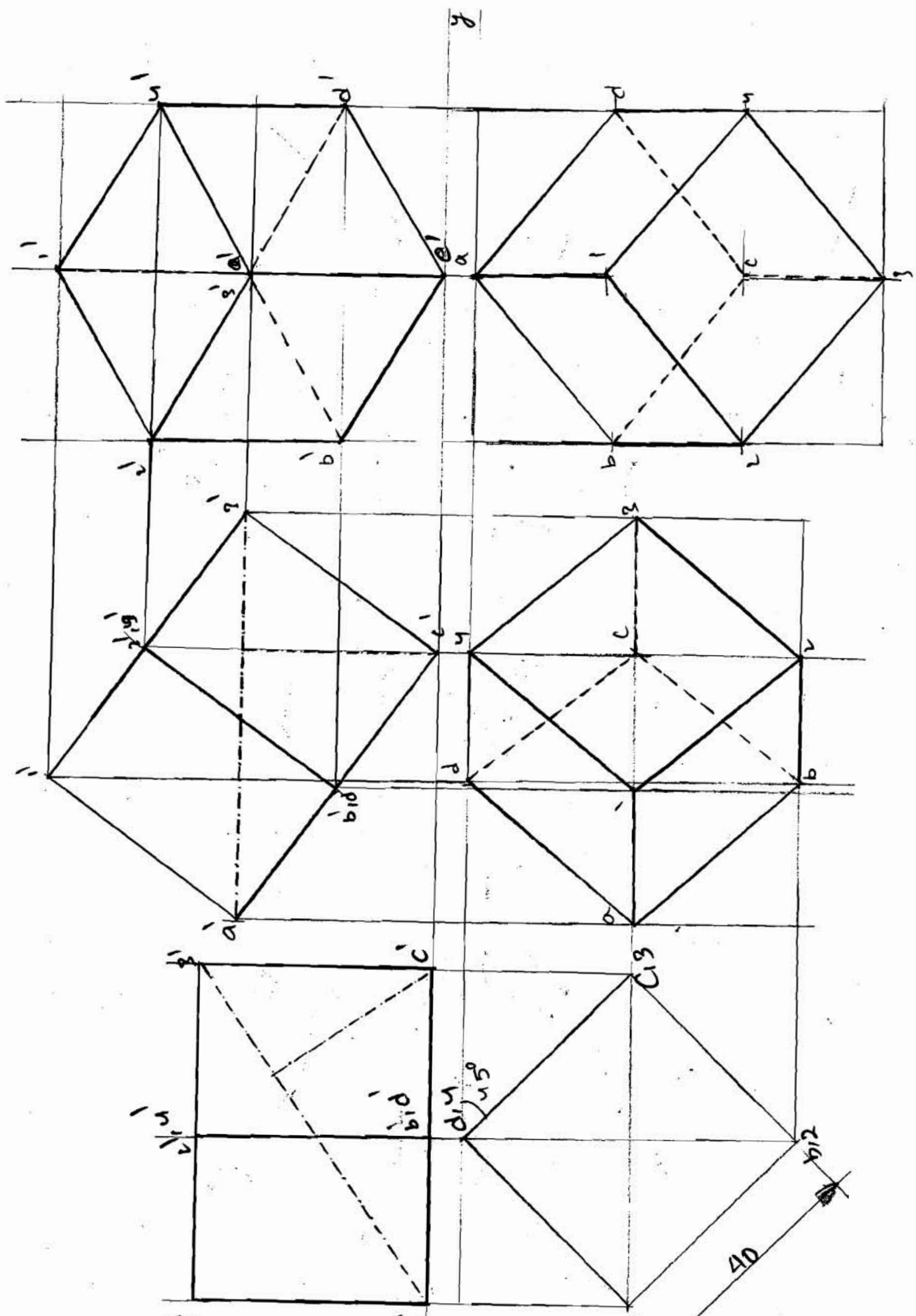
ϕ = 30°



* Cylinder Inclined both the plane V.P & H.P



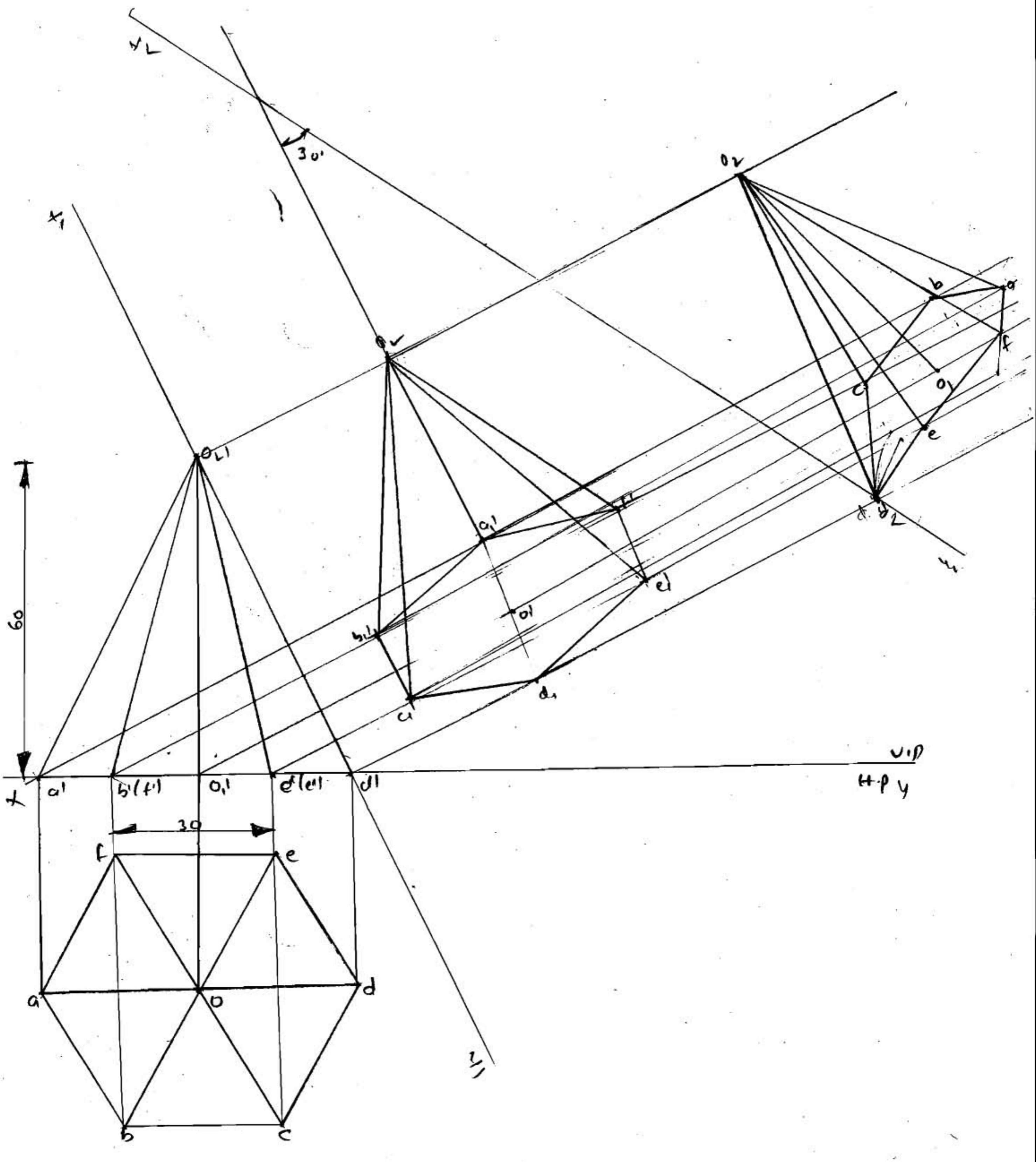
* Cube Diagonal Parallel to the H.P (Inclined both H.P & V.P)



A Hexagonal Pyramid of base side 30mm and axis 60mm have one of its slant edges on the H.P and inclined at 30° to the V.P. Draw its projections when the base is visible.

B = 30mm   Hexagonal Pyramid.

Axis = 60mm

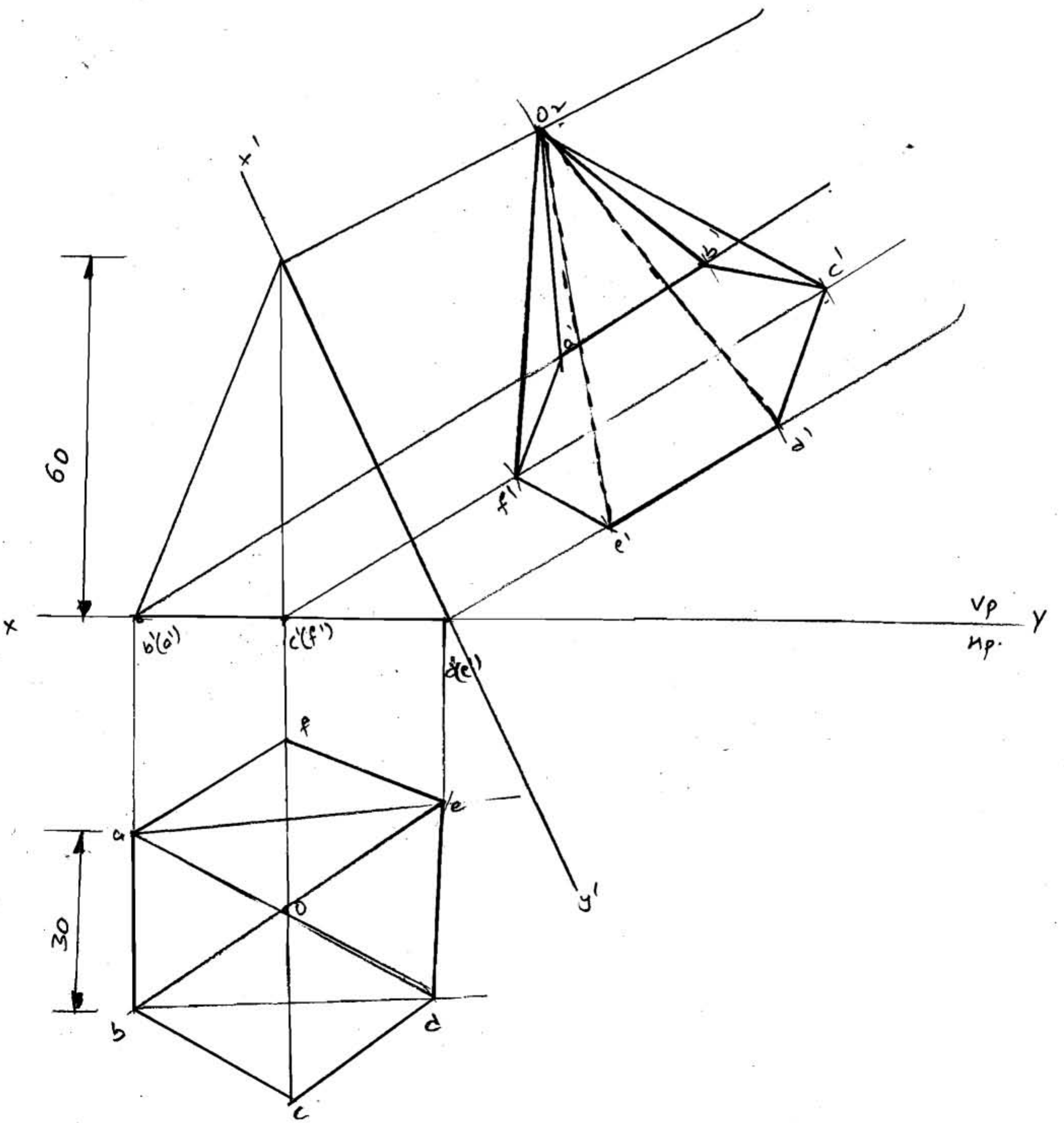


1. A Hexagonal Pyramid base side 30mm and axis 60mm as a triangular face on the ground and the axis parallel to V.P. Draw its projections

Pyramid

B = 30mm

A = 60mm



Sections of solids:

Invisible features of an object are shown by dotted lines in their projected views. But when such features are too many, these lines make the views more complicated and difficult to interpret. In such cases, it is customary to imagine the object as being cut through or sectioned by planes. The part of the object between the cutting plane and the observer is assumed to be removed and the view is then shown in section.

The imaginary plane is called a section plane or a cutting plane. The surface produced by cutting the object by the section plane is called the section. It is indicated by thin section lines uniformly spaced and inclined at 45°.

The projection of the section along with the remaining portion of the object is called a sectional view. Sometimes, only the word section is also used to denote a sectional view.

Section planes: Section planes are generally perpendicular planes. They may be perpendicular to one of thereference planes and either perpendicular, parallel or inclined to the other plane. They are usually described by their traces. It is important to remember that the projection of a section plane, on the plane to which it is perpendicular, is a straight line. This line will be parallel, perpendicular or inclined to xy, depending upon the section plane being parallel, per-pendicular or inclined respectively to the other reference plane.

Sections: The projection of the section on the reference plane to which the section plane is perpendicular, will be a straight line coinciding with the trace of the section plane on it. Its projection on the other plane to which it is inclined is called apparent section. This is obtained by

(i) Projecting on the other plane, the points at which the trace of the section plane intersects the edges of the solid and

(ii) Drawing lines joining these points in roper sequence.

True shape of a section: The projection of the section on a planeparallelto the section plane will show the true shape of the section. Thus, when the sectionplane is parallel to the H.P. or the ground, the true shape of the section will beseen in sectional top view. When it is parallel to the V.P., the true shape will bevisible in the sectional front view.But when the section plane is inclined, the section has to be projected on anauxiliary plane parallel to the section plane, to obtain its true shape. When thesection plane is perpendicular to both the reference planes, the sectional side viewwill show the true shape of the section.

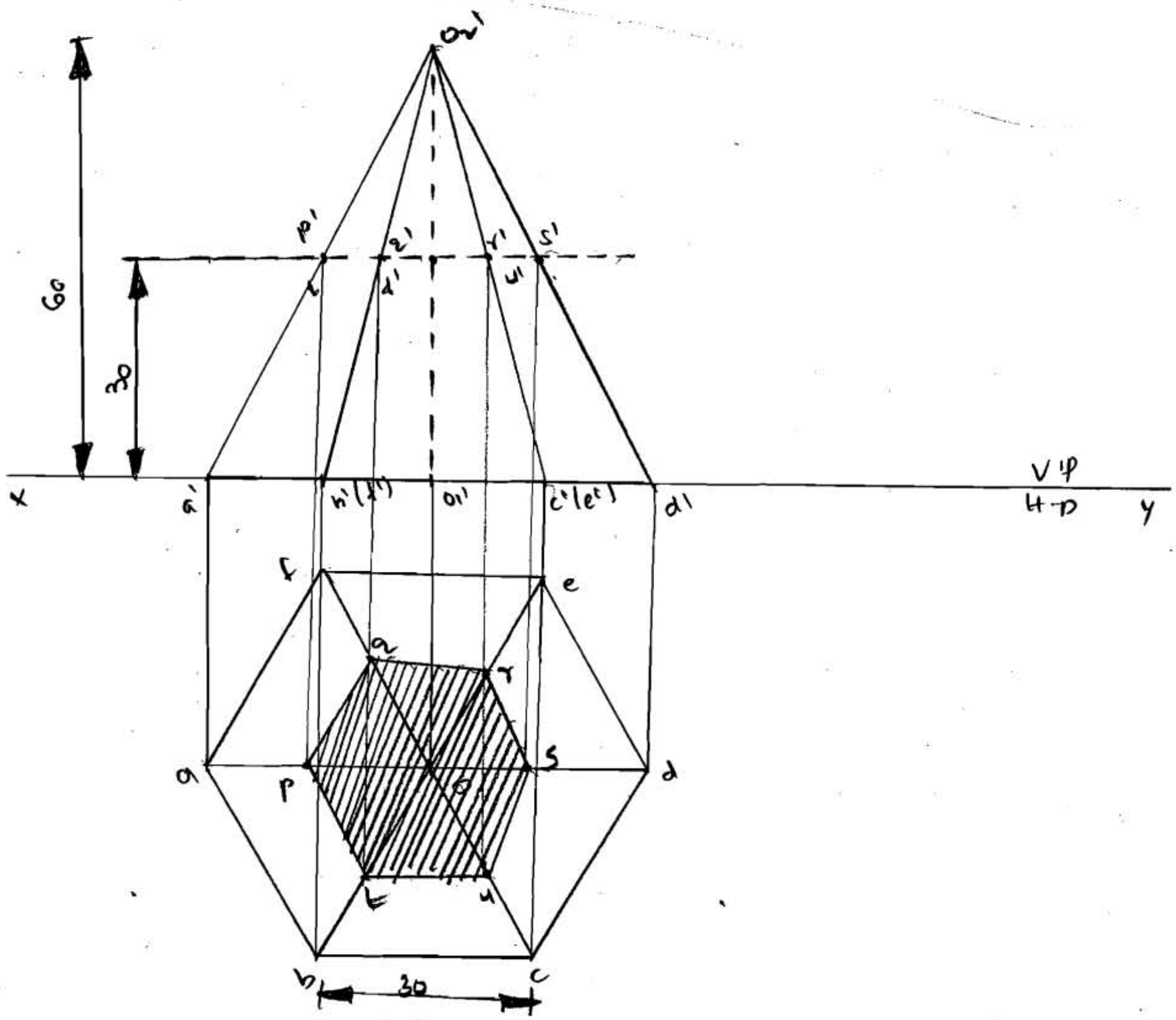
Section of solids.

1. A hexagonal pyramid of 30mm base side and 60mm long axis rest with its base on H.p. and one of the edges of the base is llel to v.p. It is cut by a horizontal section plane at a distance of 30mm above the base. Draw the F.V and sectional T.V

Hexagonal Pyramid.

B = 30mm

A = 60mm

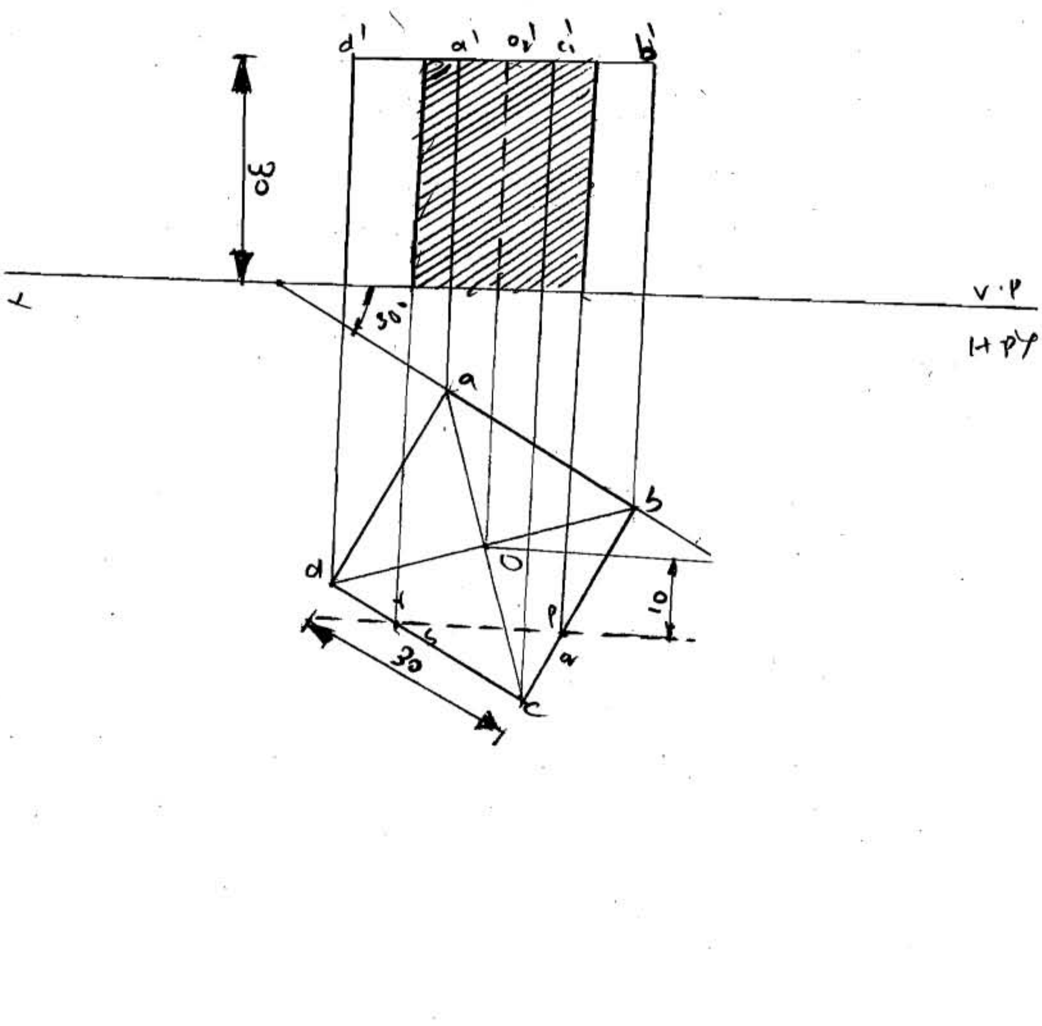


A cube of 30mm long edges is resting on the H.P on one of its faces with a vertical face inclined at 30° to the V.P. It is cut by a sectional plane parallel to the V.P and 10mm away from the axis and further away from the V.P. Draw the sectional front view and top-view of the cube.

Cube .

base = 30mm

$\phi = 30^{\circ}$



3. A triangular prism of 30mm base side and 50mm long axis is lying on the H.P on one of its rectangular faces with its axis inclined at 30° to V.P. It is cut by a horizontal section plane at a distance of 12mm above the ground. Draw its F.V and sectional Top view.

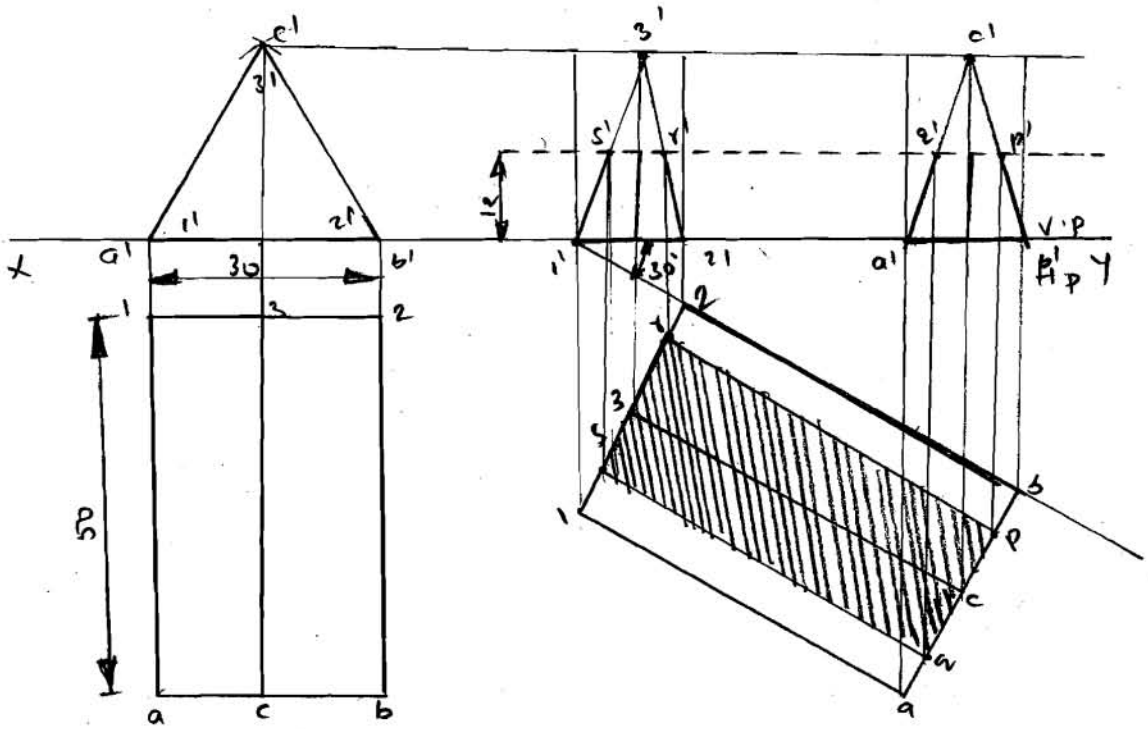
Triangular prism

Base = 30mm

Axis = 50mm

ϕ = 30°

Horizontal sectional plane = 12mm ↑ ground.



Q: A Hexagonal Prism of 20mm base and 60mm height is resting on one of its corners on the ground. with the base making 60° with the ground. The axis is Parallel to V.P. A sectional plane parallel to H.P and ⊥er to V.P cuts the objects such that it is 15mm from the base as measured along the axis. Draw it's sectional view from the above and the view from the front.

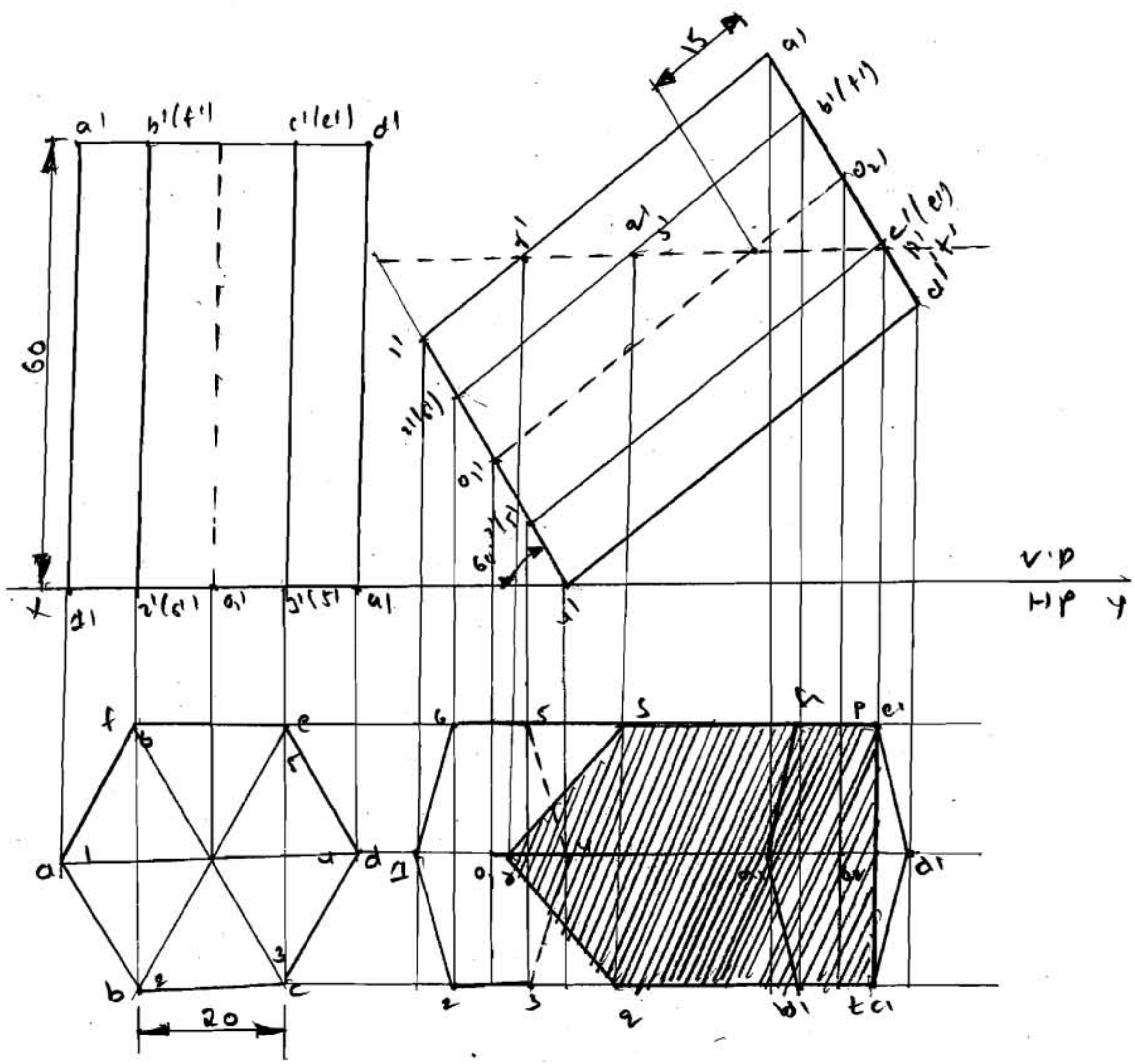
Hexagonal prism

$\theta = 60°$

Height = 60mm

Base = 20mm

H.O.S.P = 15mm



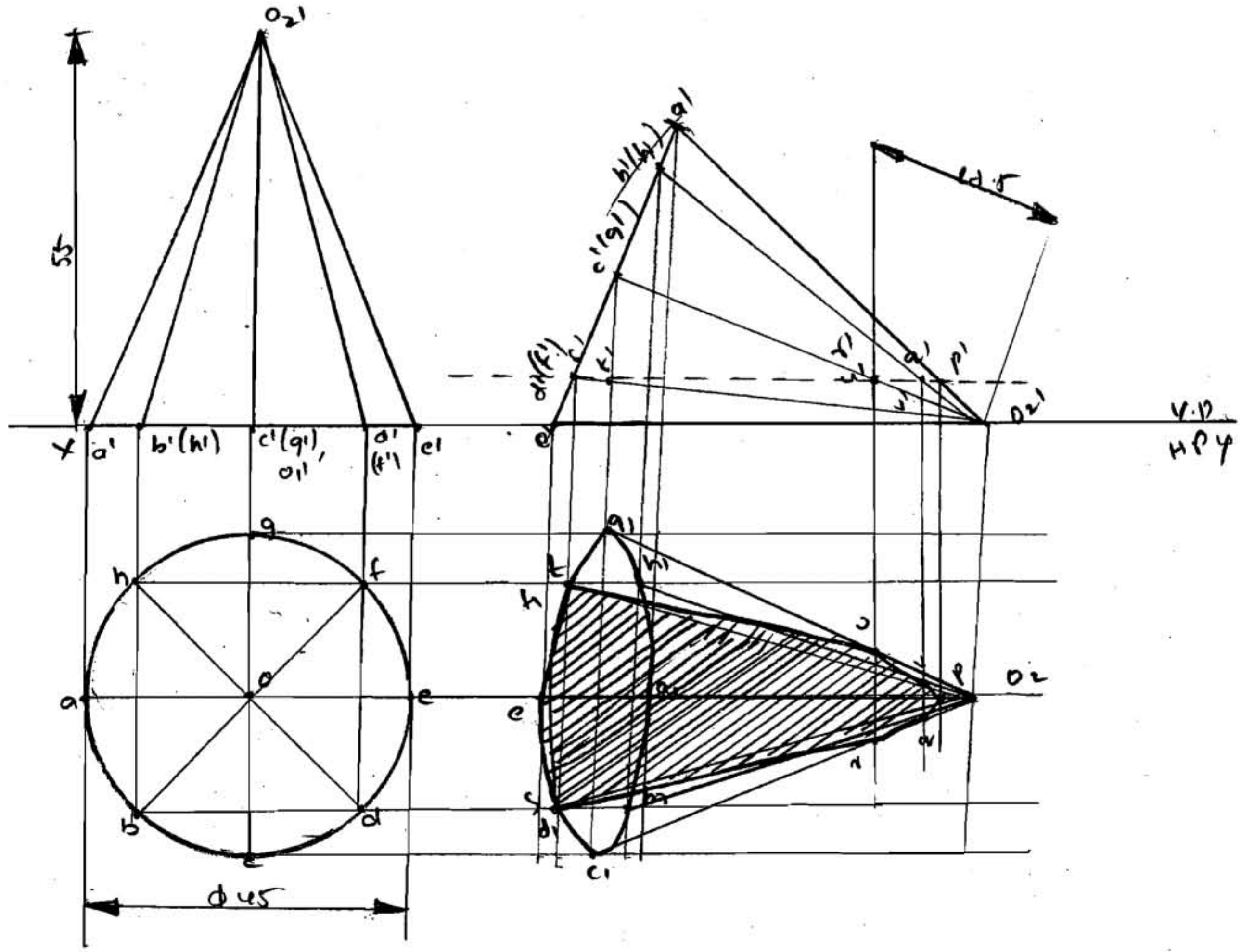
5. A right circular cone of the 45mm base diameter and 55mm axis long is lying on the one of its generator on the H.P. It is cut by a horizontal sectional Plane Passing through the midpoint of axis. Draw the projections of the cone and its true section.

Cone

$\phi = 45mm$

axis = 55mm

H.O.S.P passing through midpoint



Q:- A square pyramid base side 40mm and axis 60mm is resting on the base on the H.P with a side of base ||el to V.P. Draw its sectional view and the sphere of the section, if it is cut by a sectional plane ter to V.P, bisecting the axis

a) ||el to H.P b) Inclined at 45° to H.P

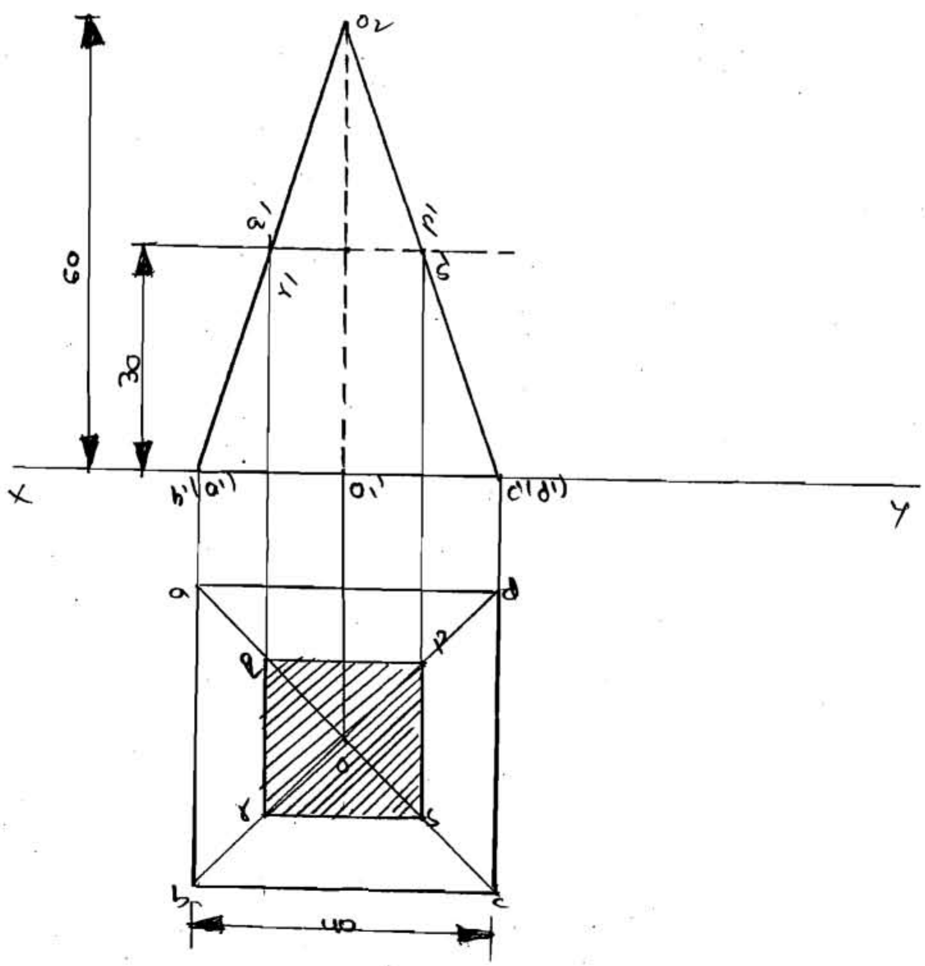
c) Inclined at 60° to H.P

(a) Parallel to H.P

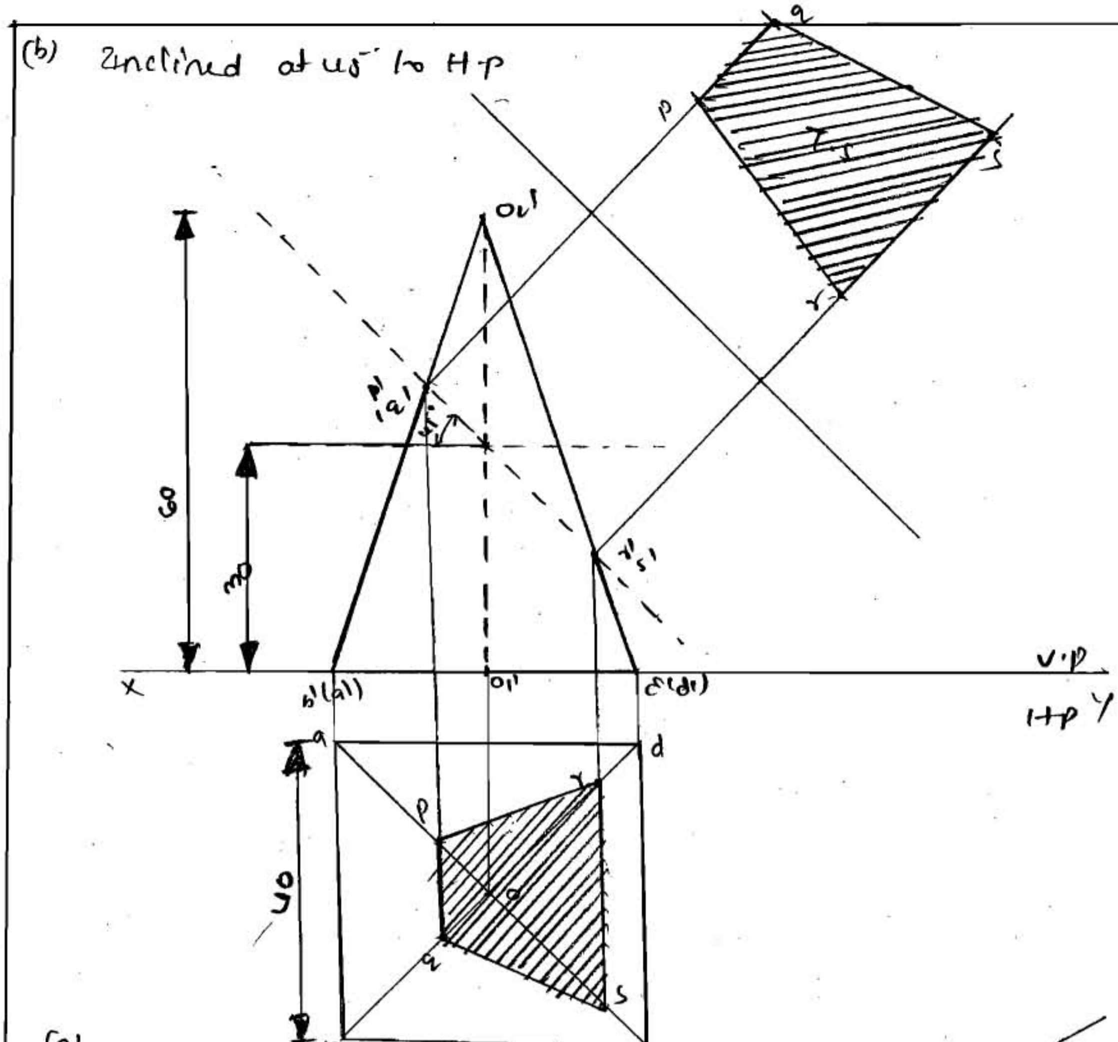
Square Pyramid

Base = 40mm

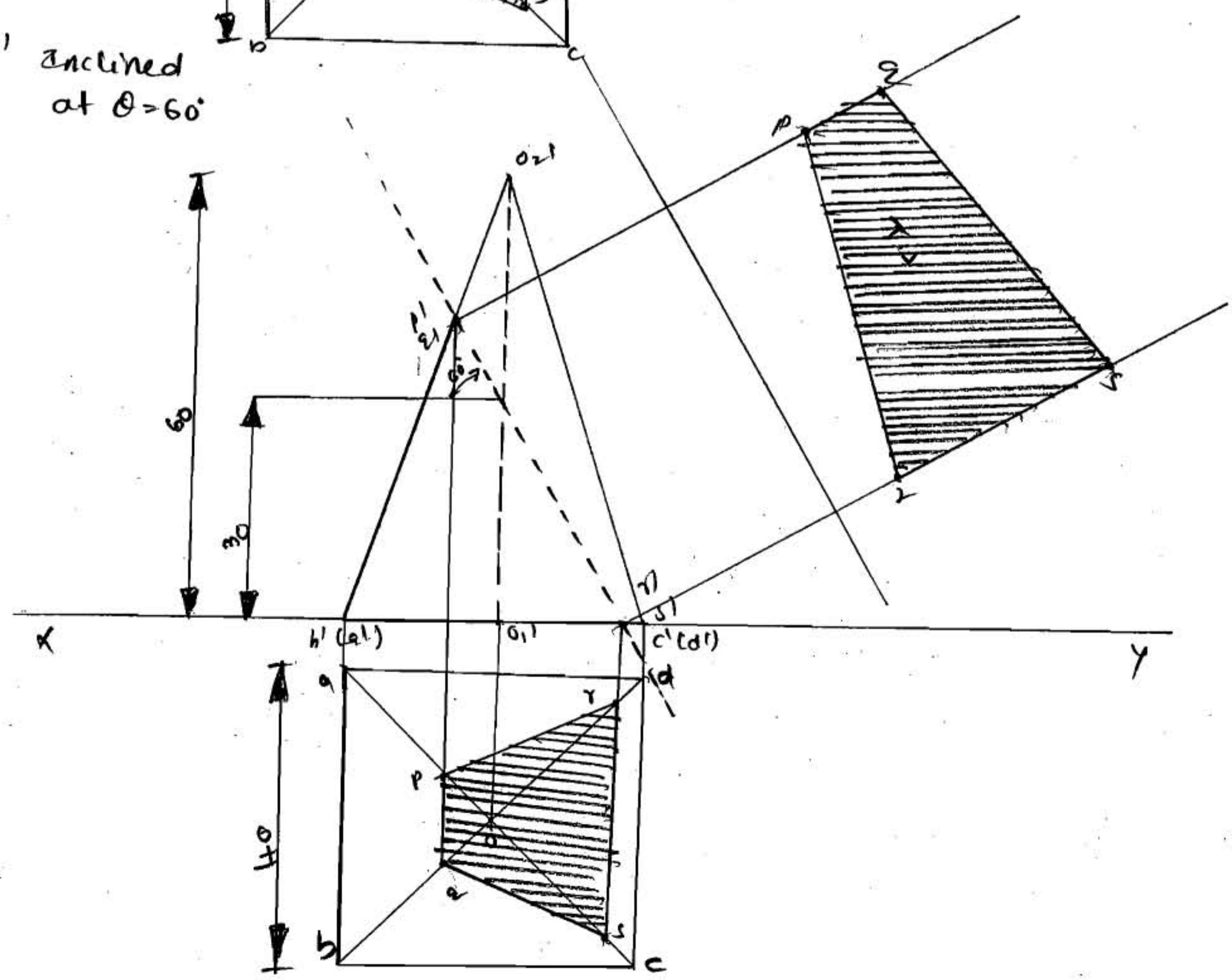
Axis = 60mm



(b) Inclined at 45° to H.P



(c) Inclined at θ=60°



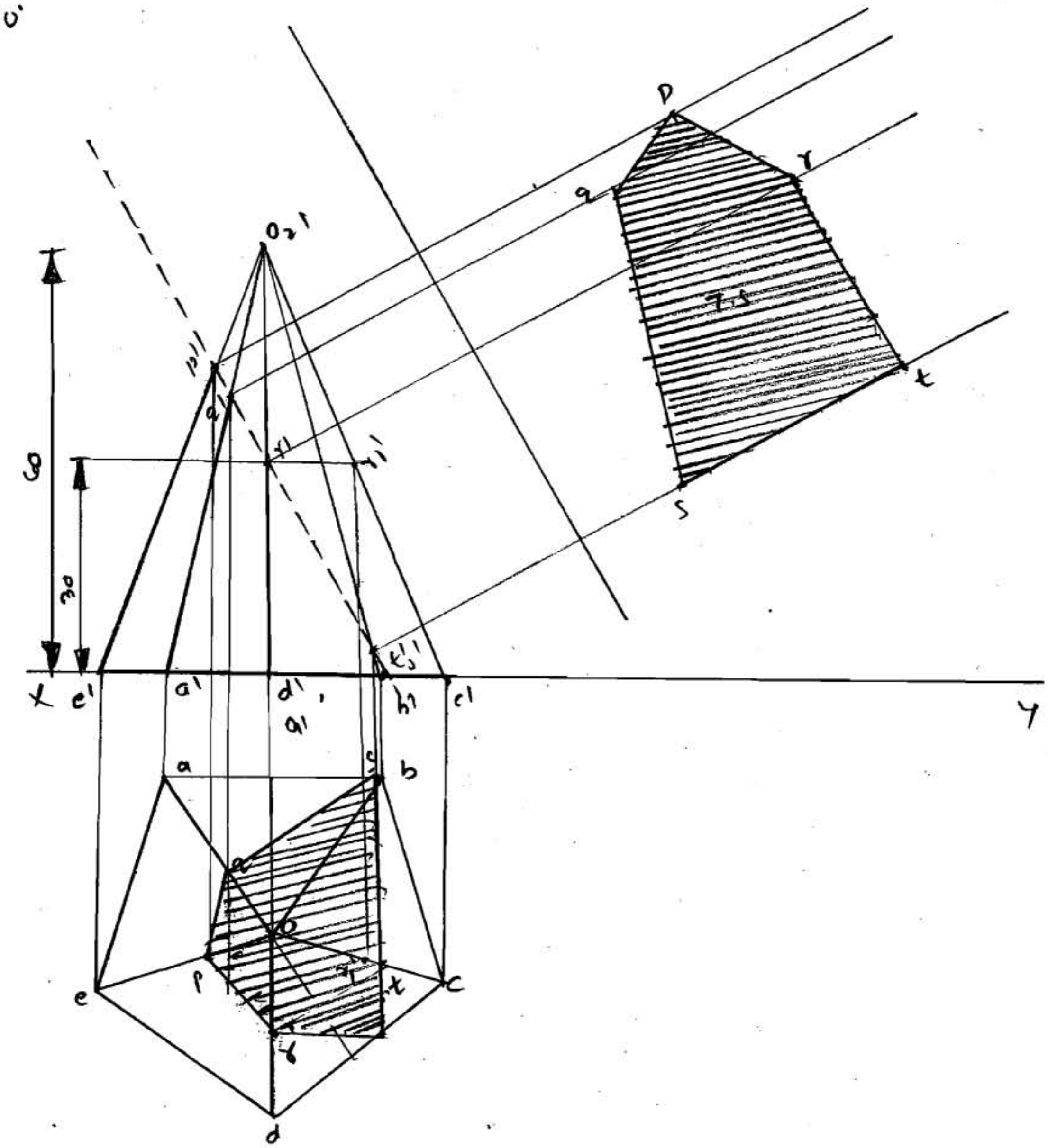
2. A Pentagonal Pyramid base side 30mm and axis 60mm is resting on its base on the H.P with an edge of its base parallel to V.P. It is cut by a sectional plane ⊥er to V.P, inclined at 60° to H.P and bisecting the axis. Draw its front view and sectional T.V and True Shape of the section.

Pentagonal Pyramid

Base = 30mm

Axis = 60mm

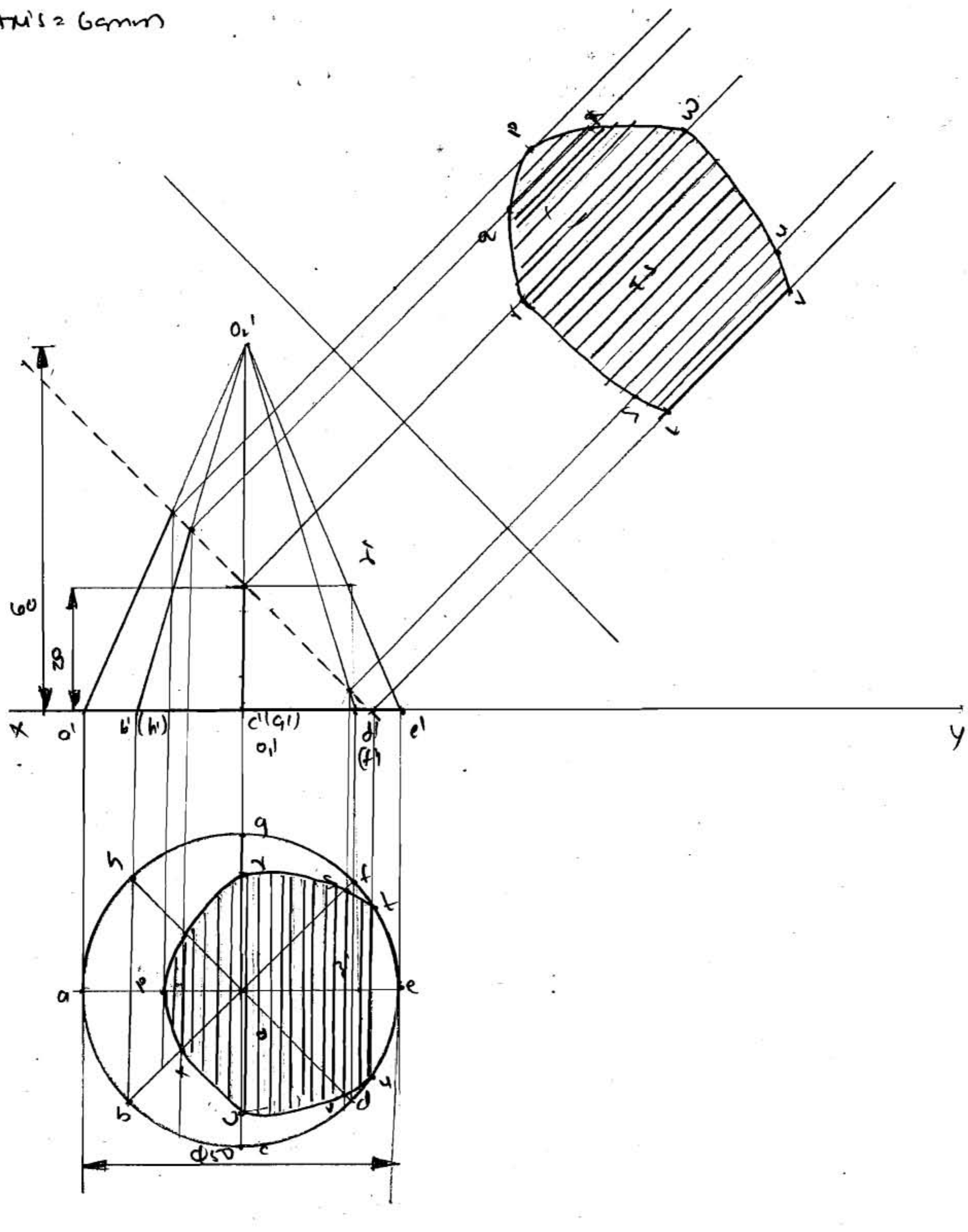
$\theta = 60°$



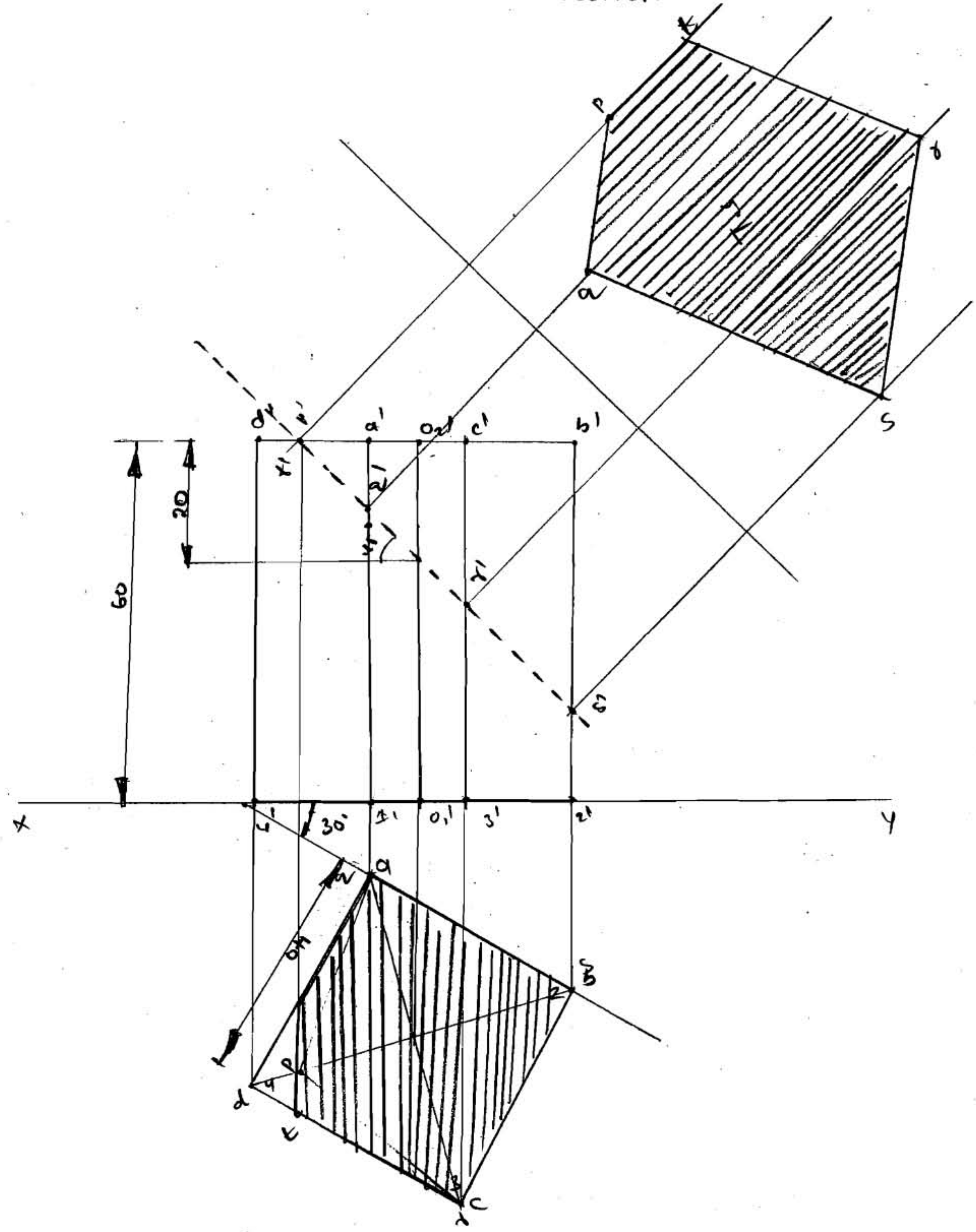
A cone of base diameter 50mm and axis 60mm is resting on its base on the H.P. It is cut by an A.I.P inclined at 45° to H.P and passing through a point on the axis, 20mm above the base. Draw its sectional T.V and obtain the true shape of the section.

diameter d = 50mm

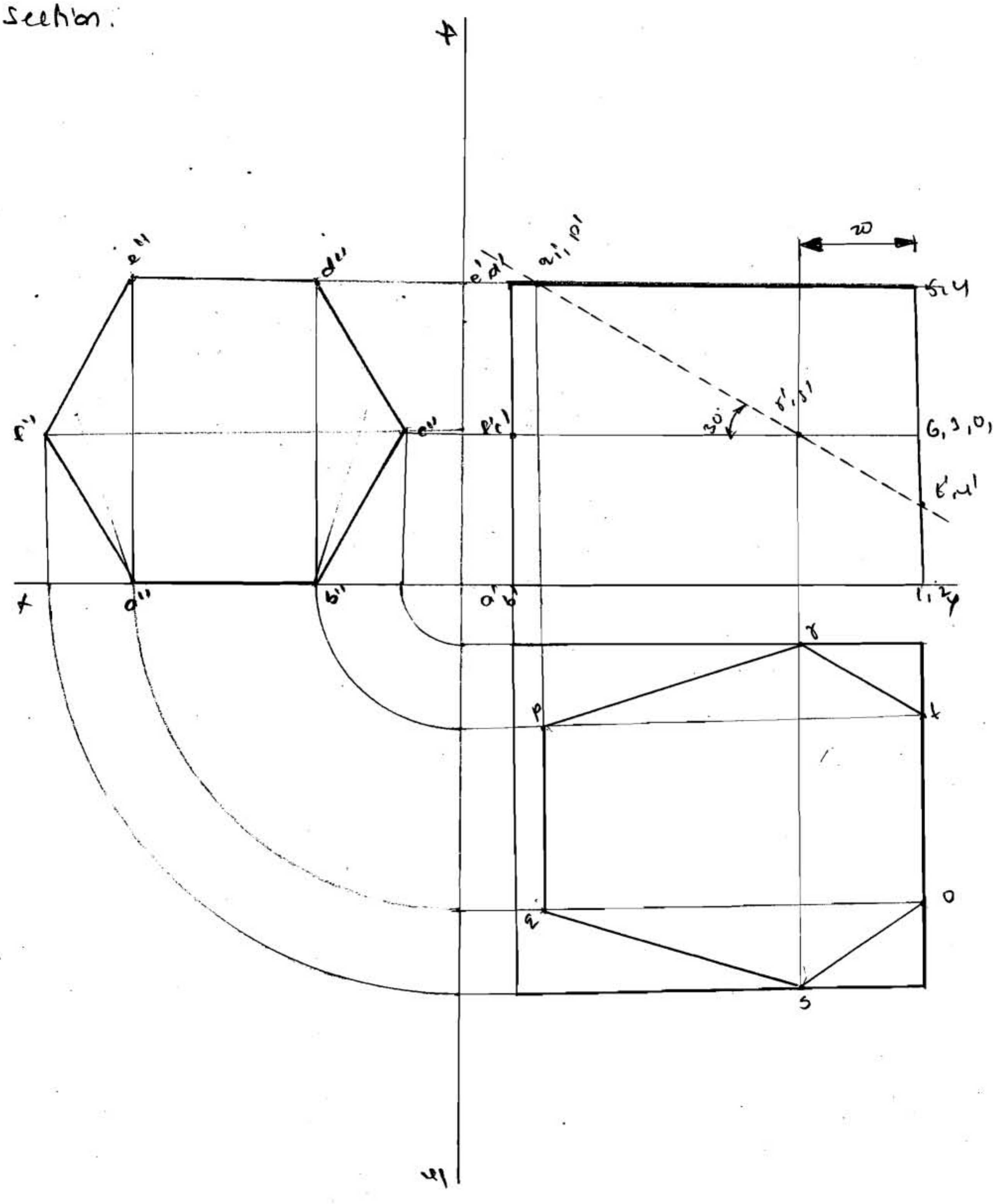
Axis = 60mm



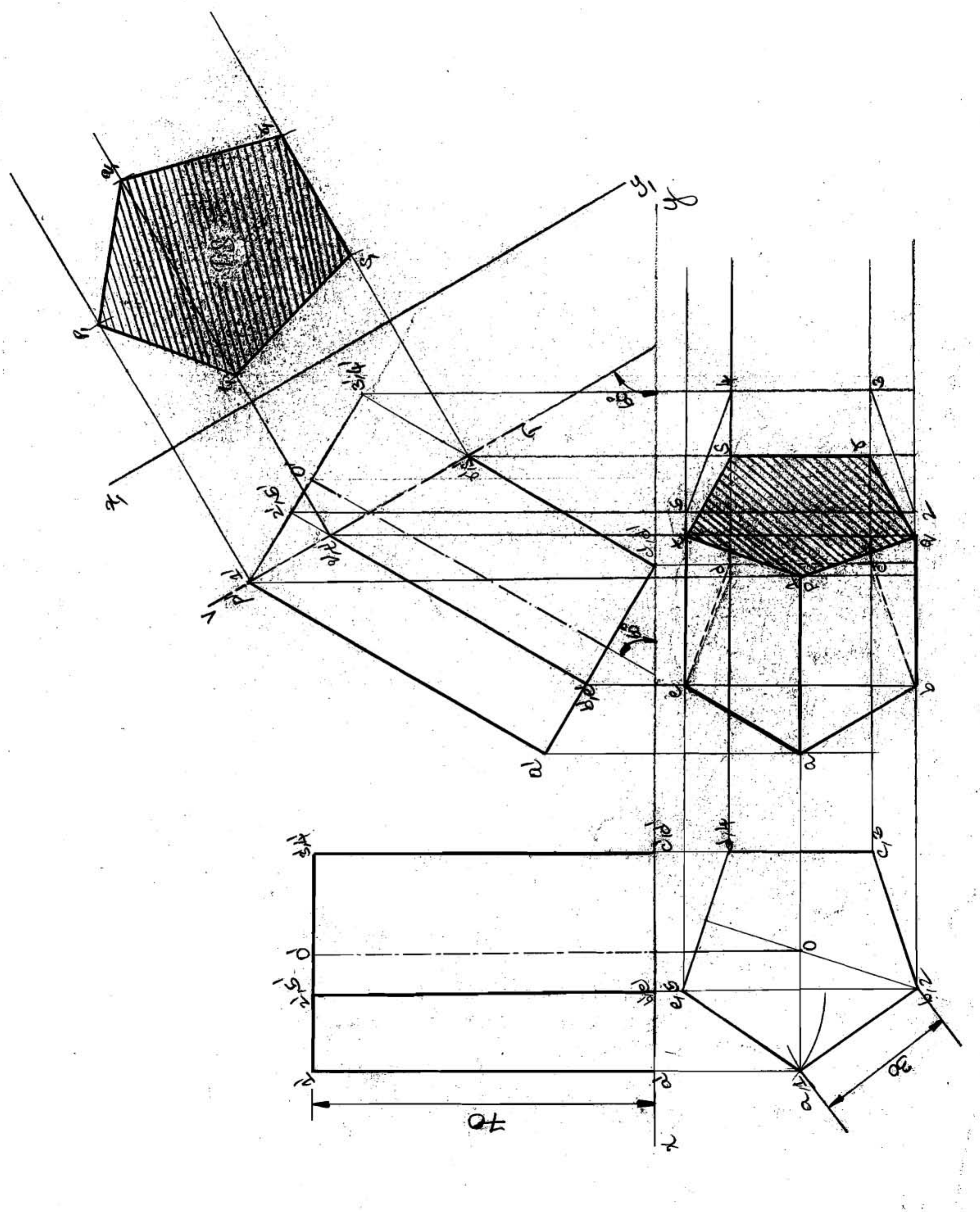
A Square Prism of base side 40mm and axis 60mm rest on its base on the H.P. such that one of the V.T inclined at 30° to V.P. A sectional Plane ter to V.P, inclined at 45° to H.P. Passing through the axis at a Point 20mm from its top end cuts the prism Draw its f.V sectional T.V and True shape of the section



A Hexagonal Prism of base side 30mm and axis 70mm is resting on a face on the H-P. with the axis ||el to the V-P. It is cut by a Plane whose V.T. is inclined at 30° to the reference line. and Passes through a Point on the axis 20mm from one of its ends. Draw its sectional Top view and obtain the true shape of the section.

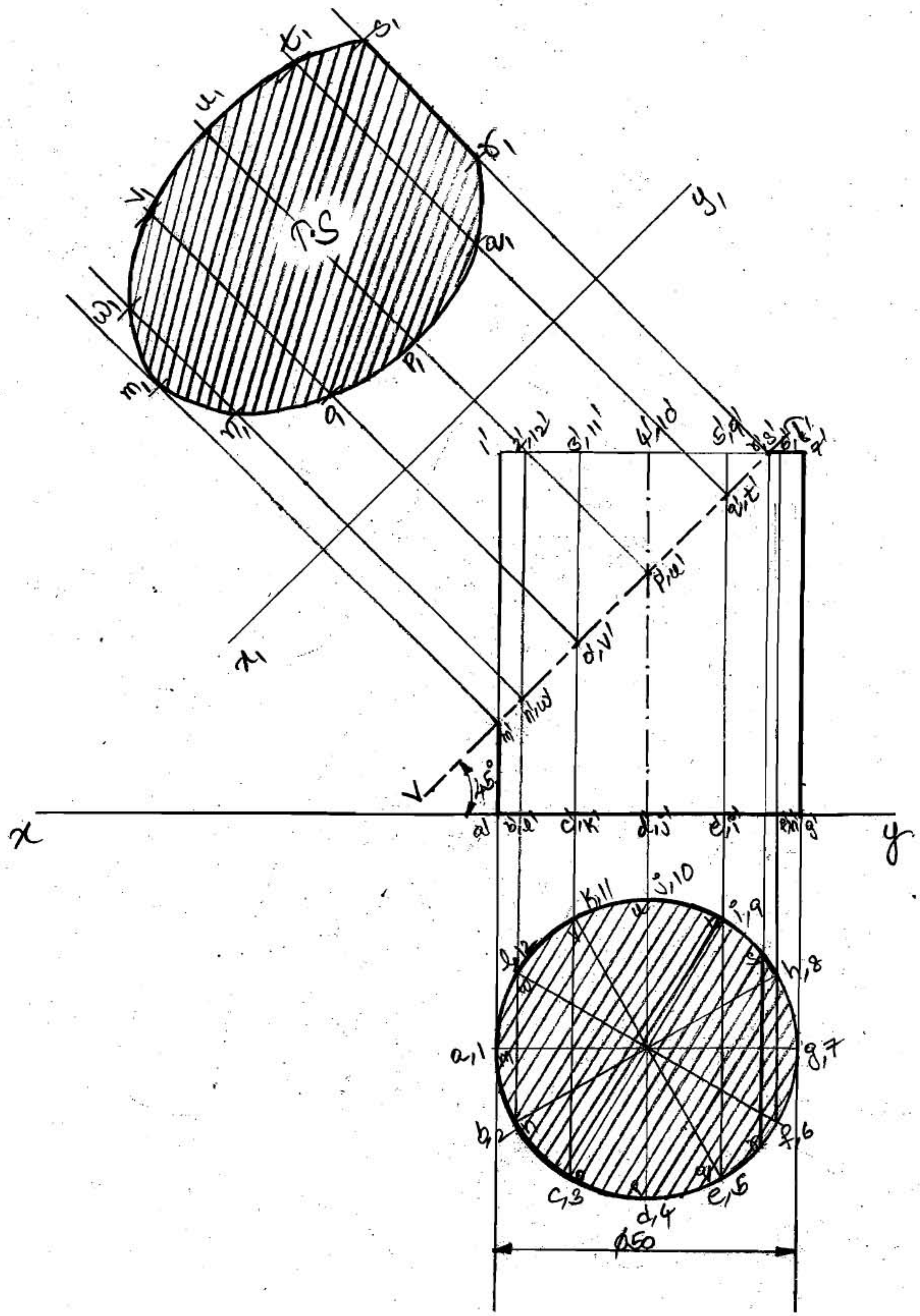


* Pentagonal Prism Inclined to one plane & Sectional View

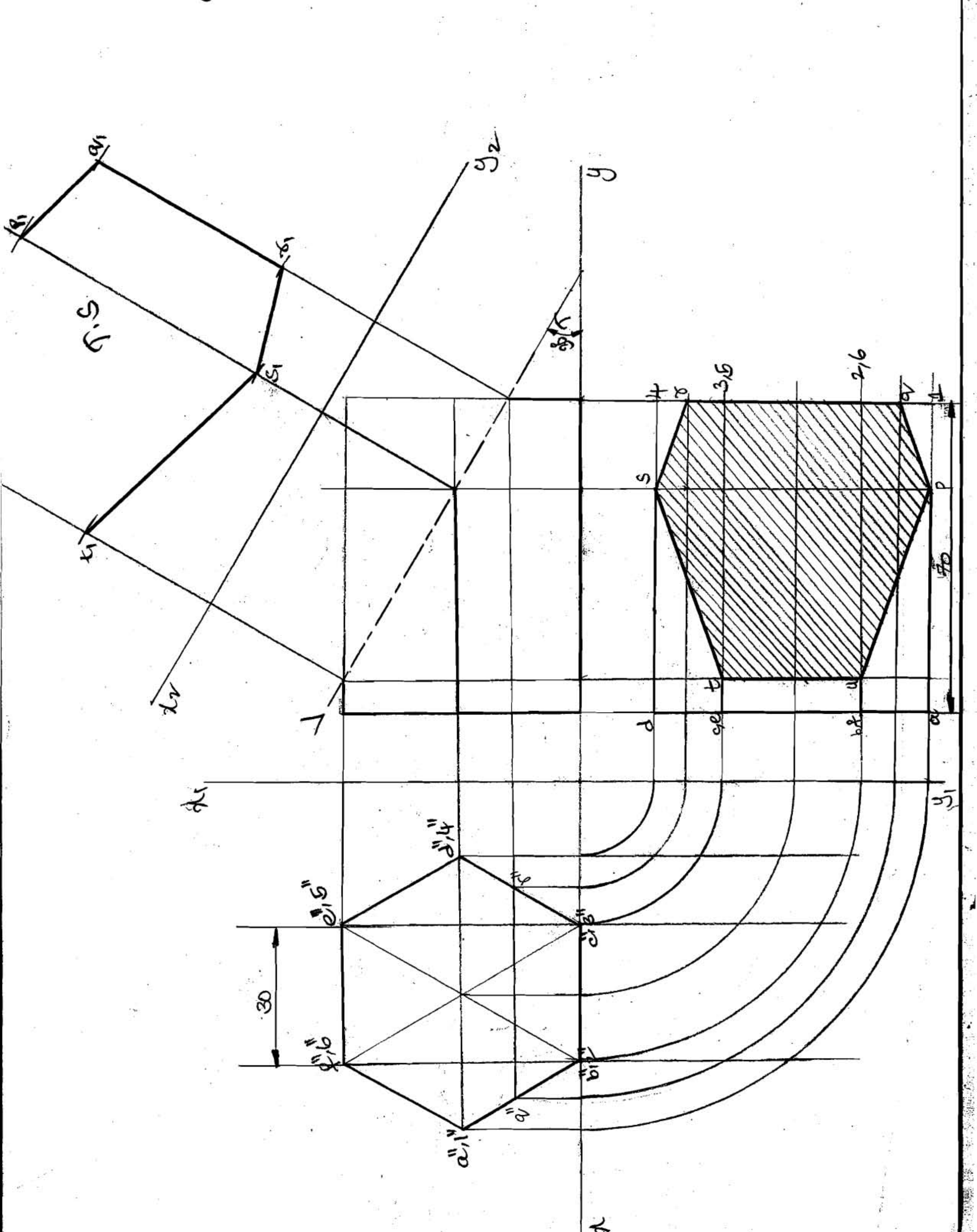


* Cylinder Sectional View

12-



* Hexagonal Prism sectional view



UNIT-IV

Content

Development of Surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone

Intersection of Solids: Intersection of – Prism vs Prism- Cylinder Vs Cylinder

Unit-IV

Development of Surfaces of Right Regular Solids:

Imagine that a solid is enclosed in a wrapper of thin material, such as paper. If this covering is opened out and laid on a flat plane, the flattened-out paper is the development of the solid. Thus, when surfaces of a solid are laid out on a plane, the figure obtained is called its development.

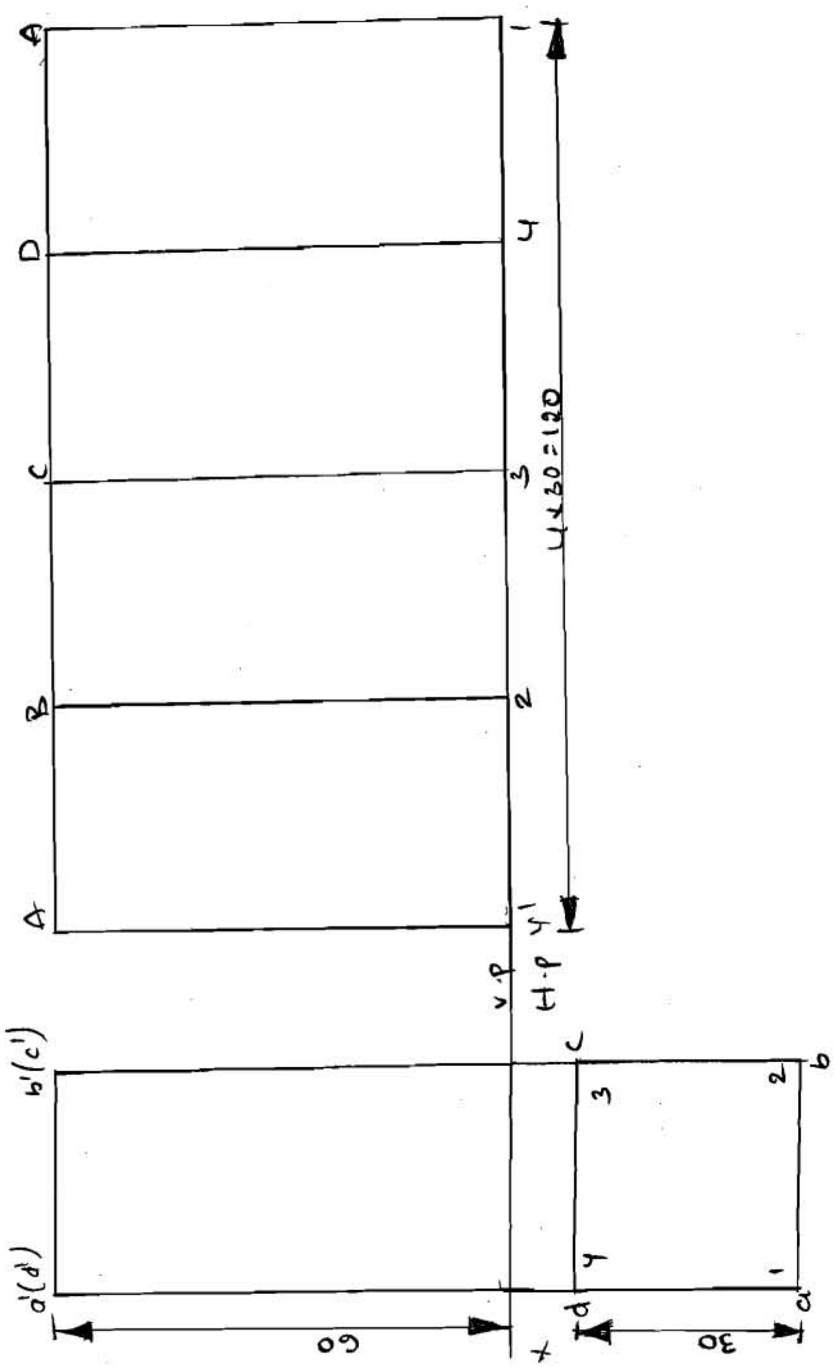
Intersection of Solids:

The intersecting surfaces may be two plane surfaces or two curved surfaces of solids. The lateral surface of every solid taken as a whole is a curved surface. This surface may be made of only curved surface as in case of cylinders, cones etc. or of plane surfaces as in case of prisms, pyramids etc. In the former case, the problem is said to be on the intersection of surfaces and in the latter case, it is commonly known as the problem on interpenetration of solids. It may, however, be noted that when two solids meet or join or interpenetrate, it is the curved surfaces of the two that intersect each other. The latter problem also is, therefore, on the intersection of surfaces.

1. A square prism of base side 30mm and axis 60mm is resting on its base on the H.P. with a rectangular face ||el to V.P develope the surface of the prism.

Base = 30mm , Square prism

Axis = 60mm.

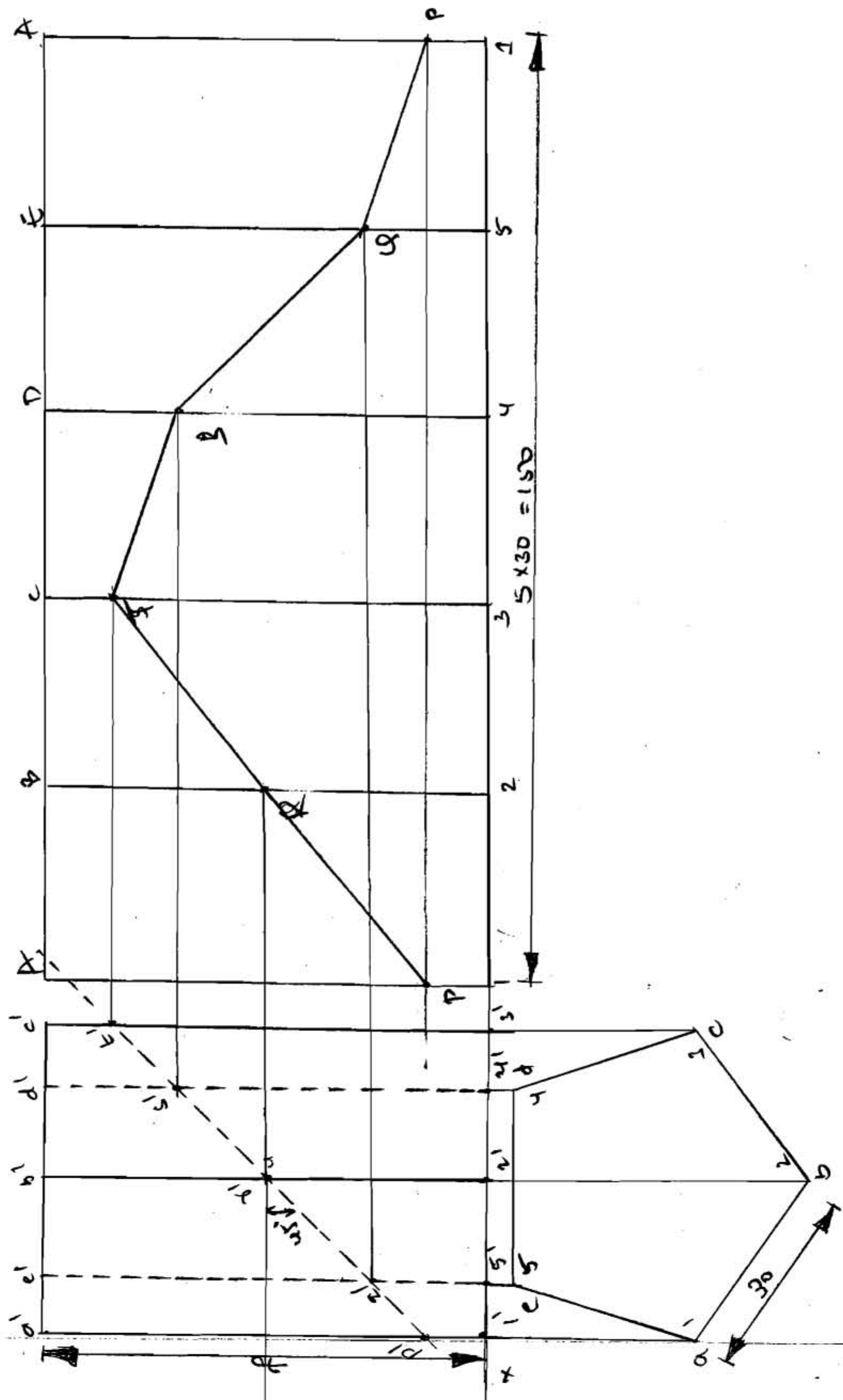


Q: A Pentagonal Prism base side 30mm and axis 70mm is resting on its base on the H.P. with rectangular face ||el to the V.P it is cut by a A.I.P. whose V.T is inclined at 45° to the Reference line and Passes through the midpoint of the axis. Draw the development of lateral surface of Truncated prism.

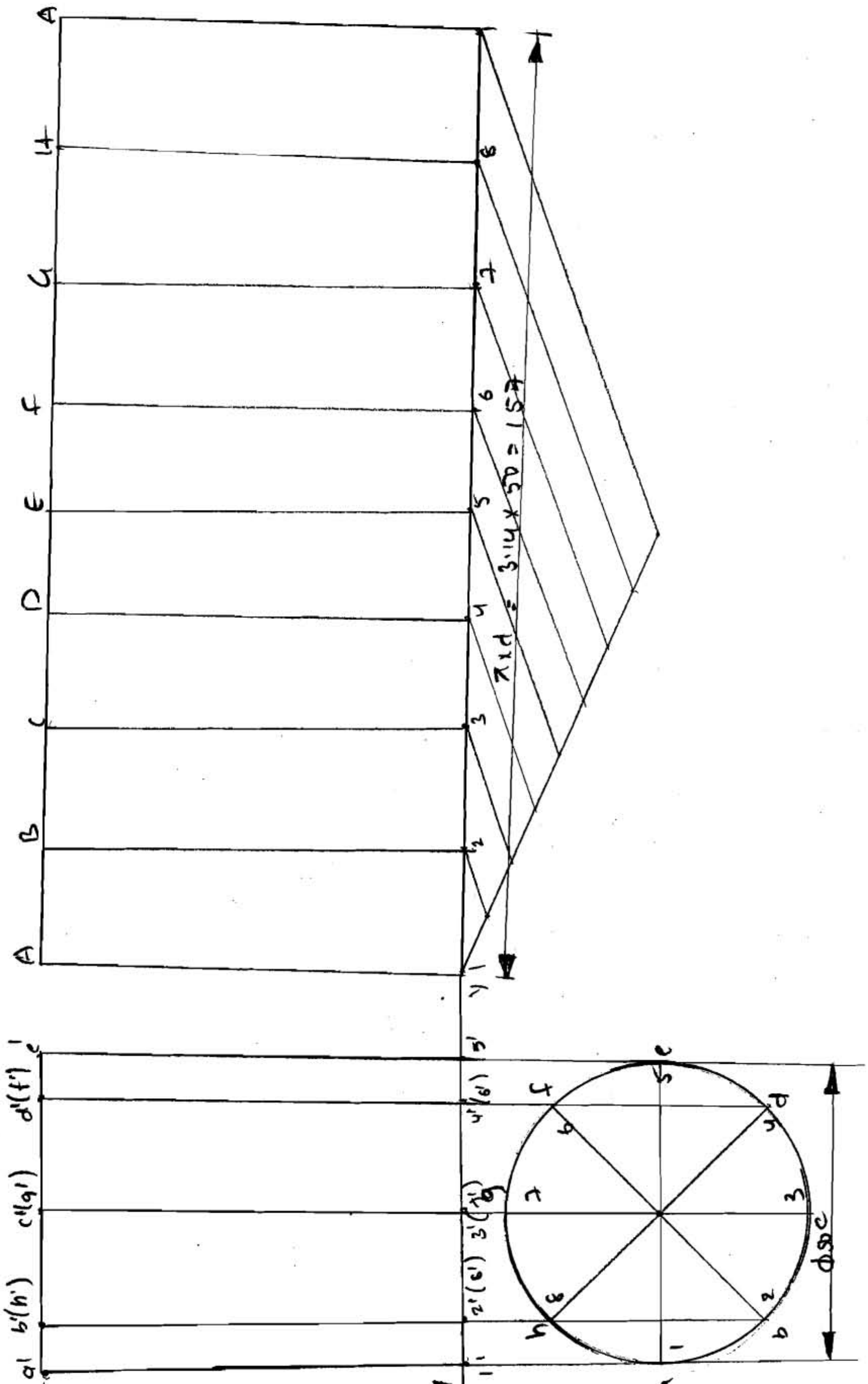
Pentagonal Prism

Base = 30mm

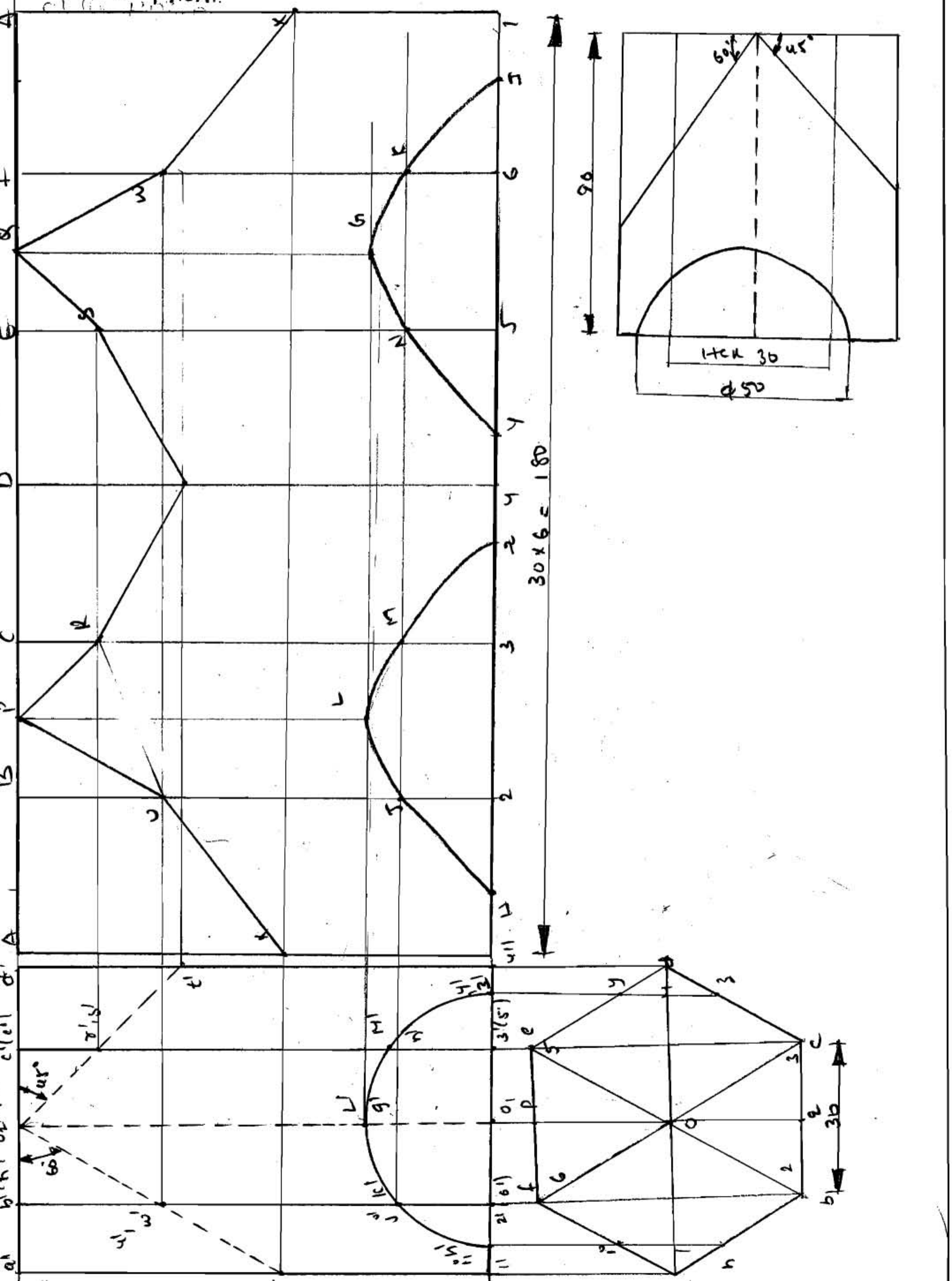
Axis = 70mm



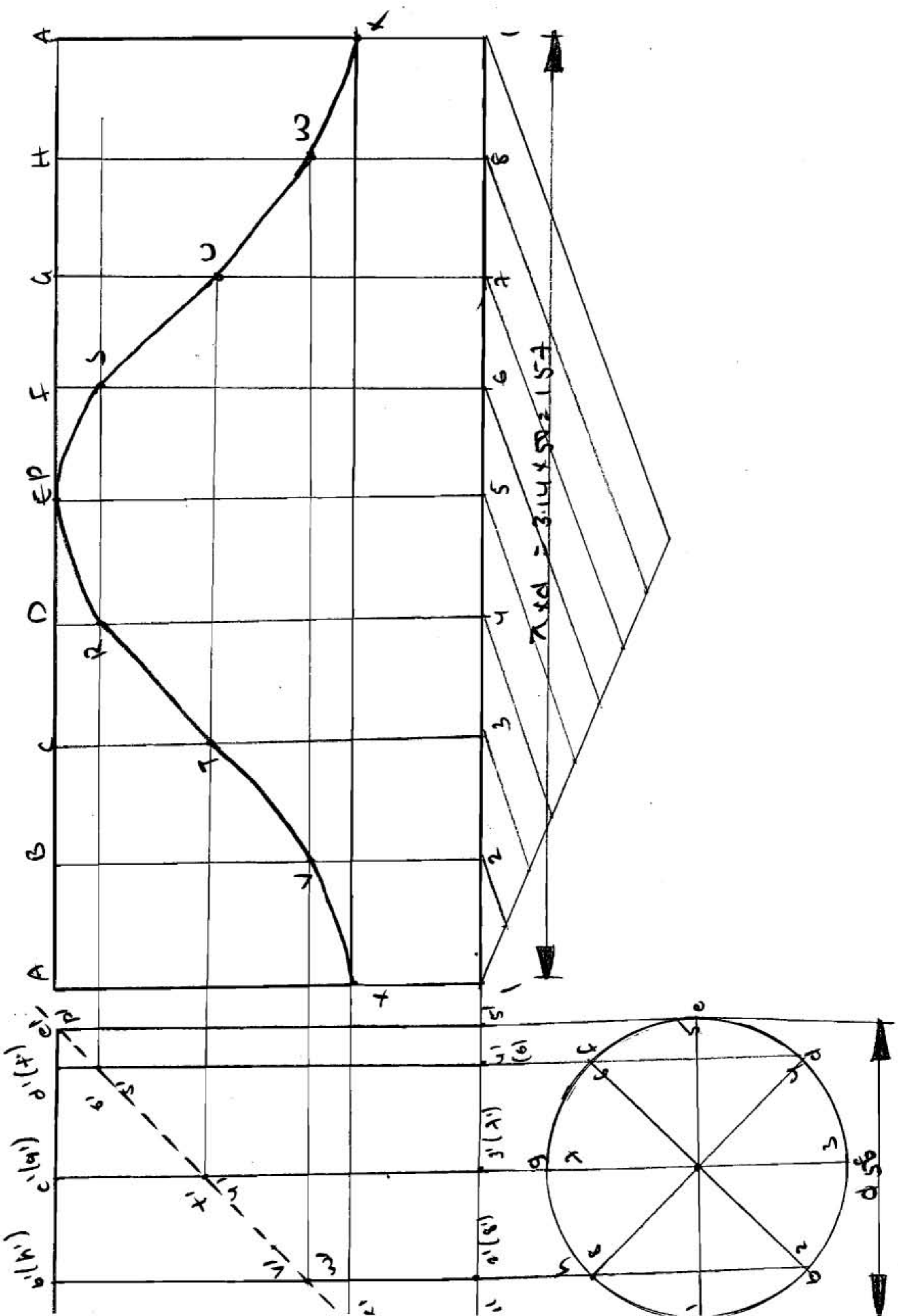
3. A cylinder of base diameter 50mm and axis 70mm is resting on the ground with its axis vertical. Draw the development of Lateeal sueface of cylinder.



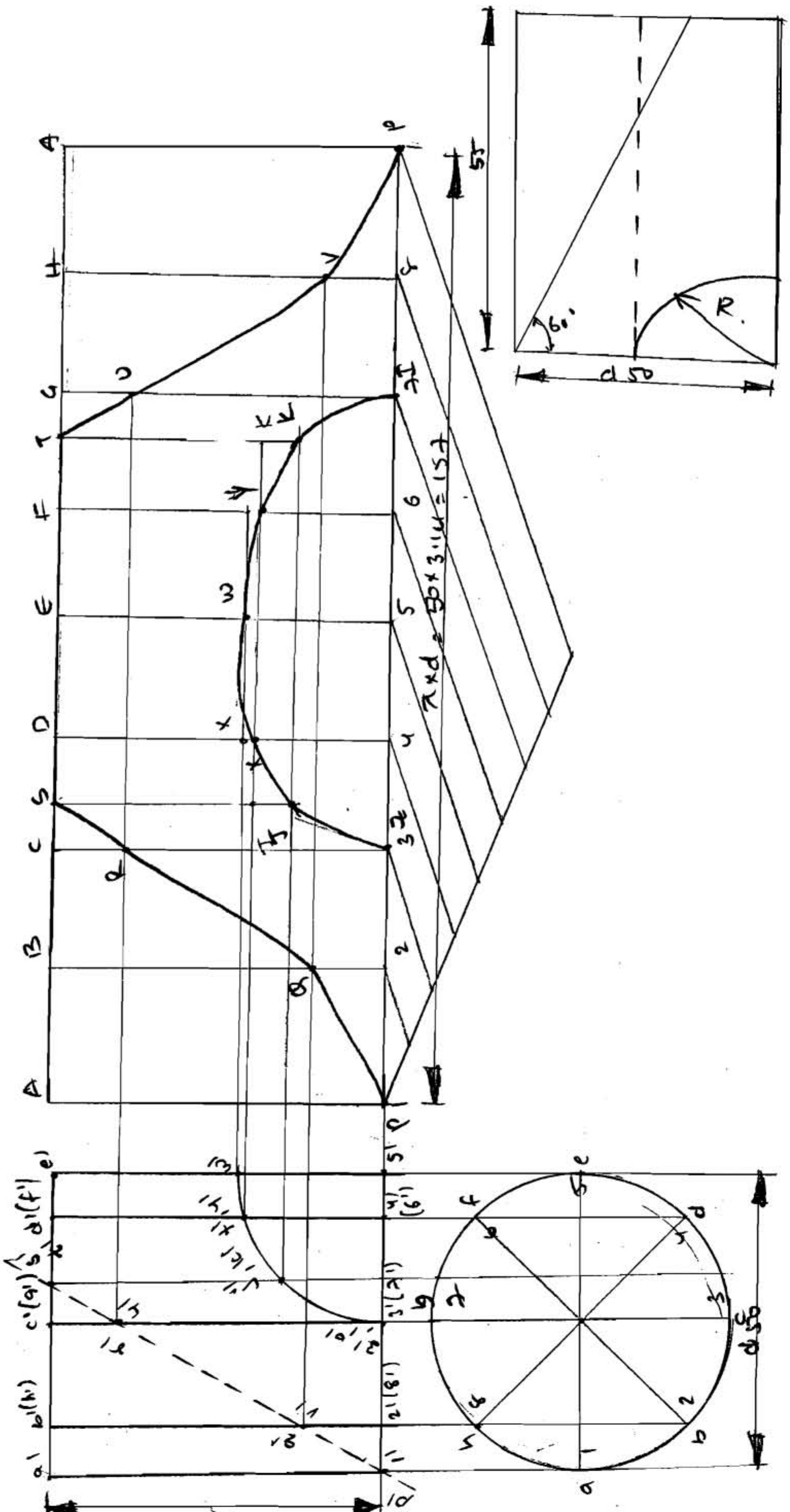
Q:- The figure shows the f.v of a truncated hexagonal Prism of base side 30mm and axis 90mm. The prism is resting on the H.P with the base side parallel to v.p. Develope the Lateral surface of the Prism.



Q: A cylinder of base diameter 50mm and axis 70mm is resting on the ground with its axis vertical. It is cut by a sectional plane per to V.P. inclined at 45° to the H.P, passing through the top of a generator and cuts the all the generators. Draw the development of its lateral surface.



Q:- Figure shows the F.v of a truncated cylinder of diameter 50mm resting on its base on the H.P. Draw the development of its lateral surfaces.

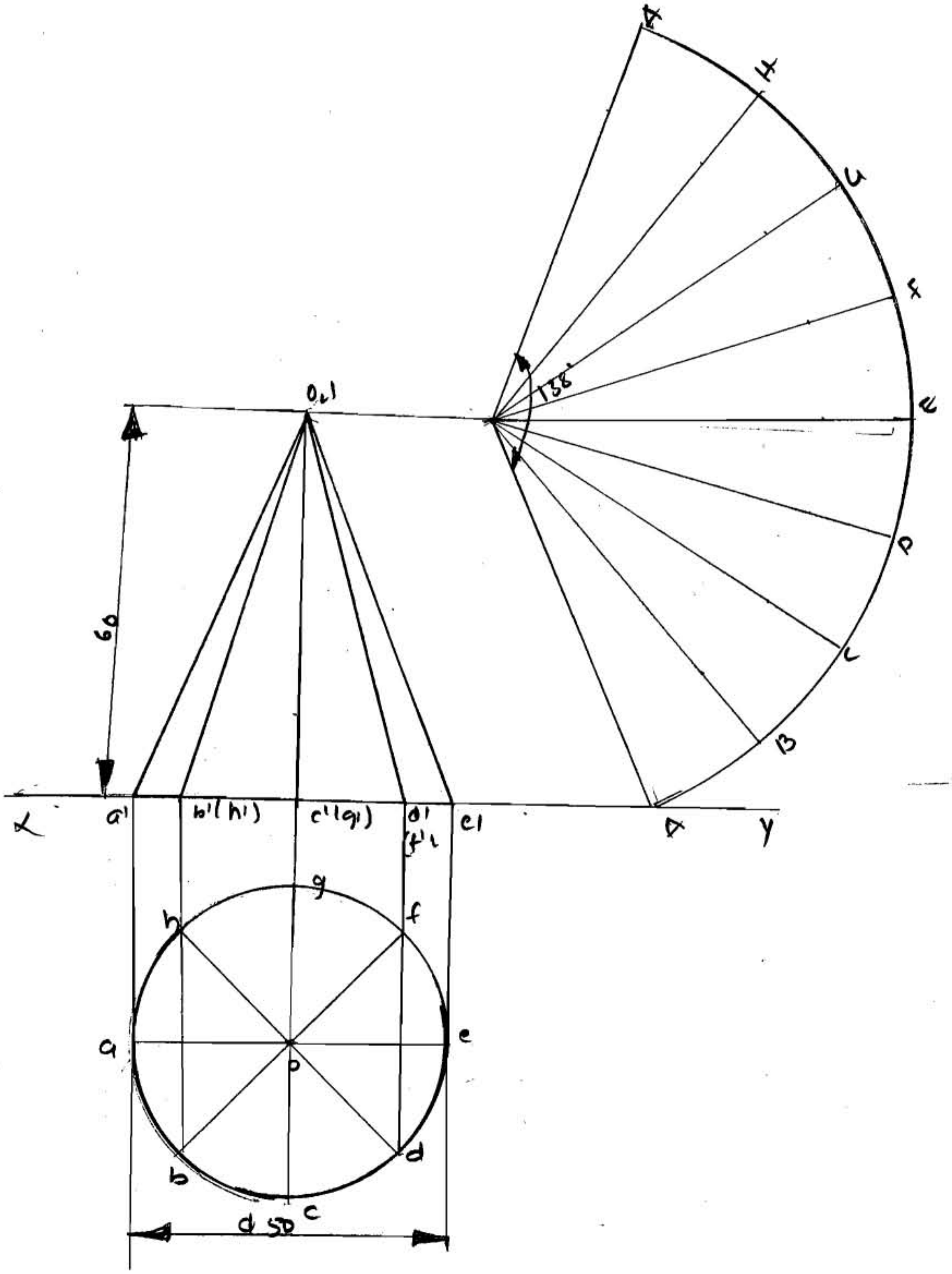


Q. A cone of base diameter 50mm and axis 60mm is resting on it's base on the H.P. Draw the development of it's lateral surface.

Base diameter $\phi = 50mm$

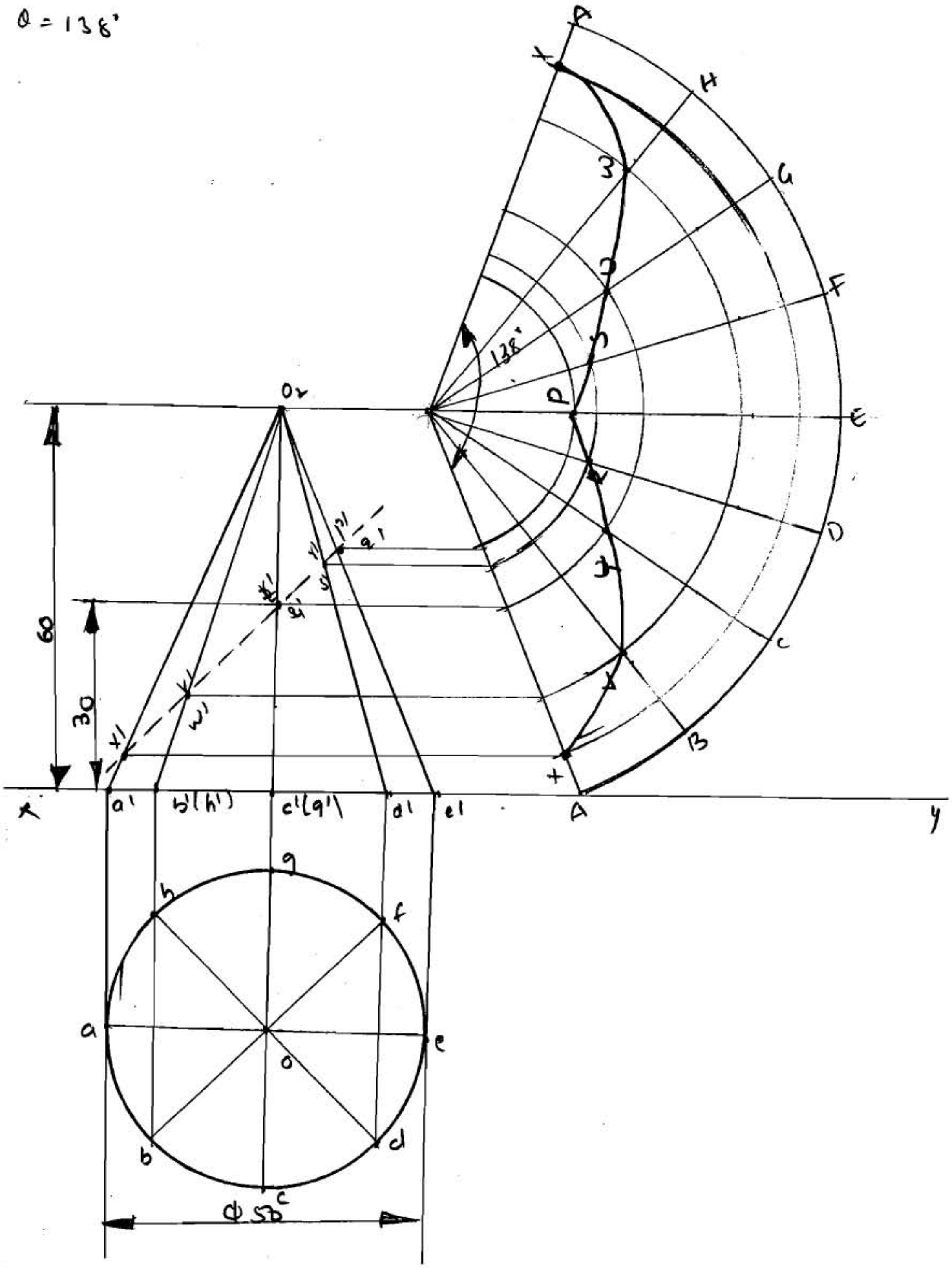
Axis = 60mm

$\theta = 138°$



Q A cone of base diameter 50mm and axis 60mm is resting on its base on the H.P, a sectional Plane ⊥r to V.P and inclined at 45° to H.P bisecting the axis of the cone draw the developement

Cone
base diameter $\phi = 50mm$
Axis = 60mm
$\theta = 138°$

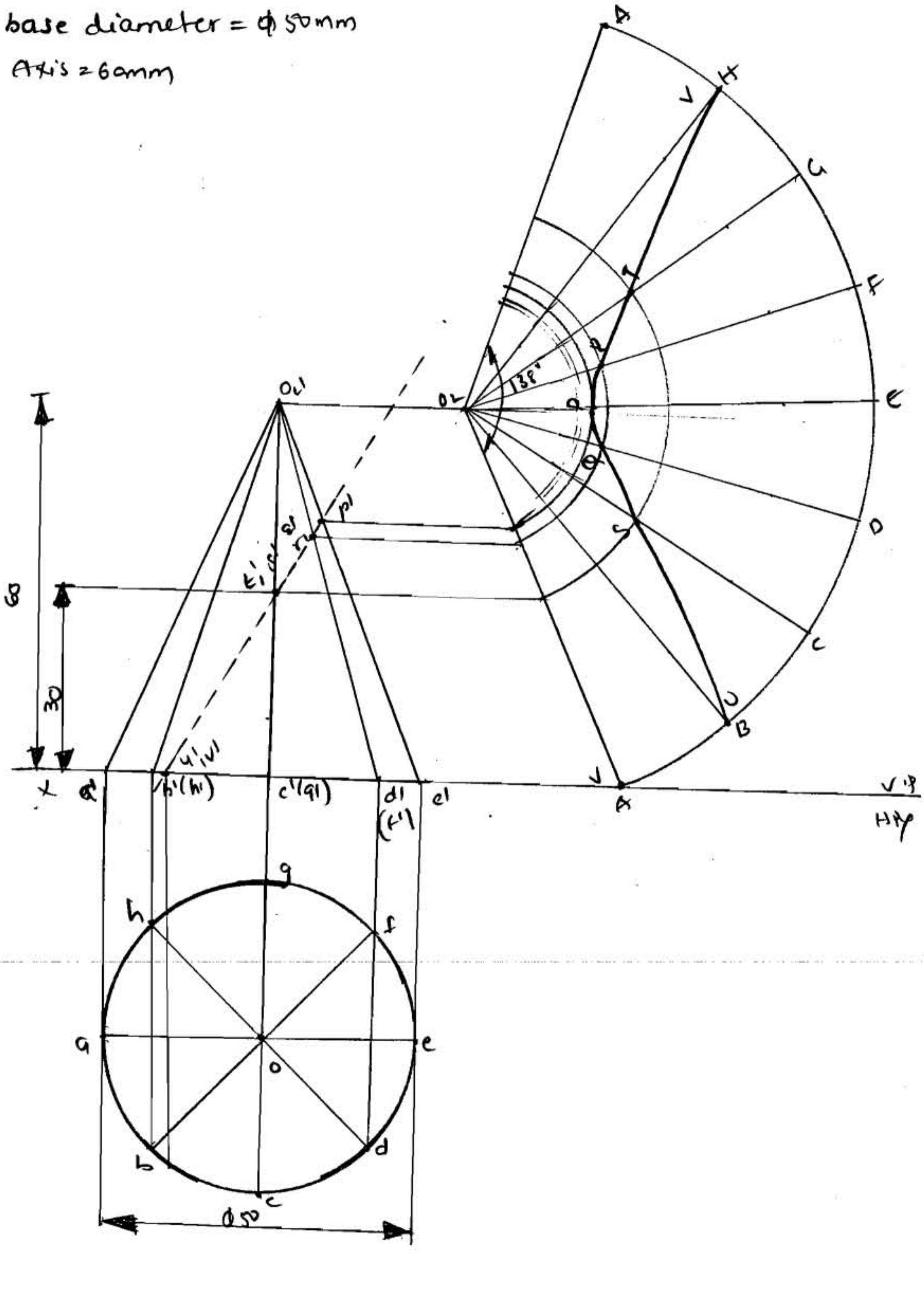


Q: A cone of base diameter 50mm and axis 60mm is resting on its base on the H.P. sectional plane per to V.P and inclined at 60° to H.P. bisecting the axis of the cone draw the development of lateral surface of cone

cone

base diameter = ϕ 50mm

Axis = 60mm



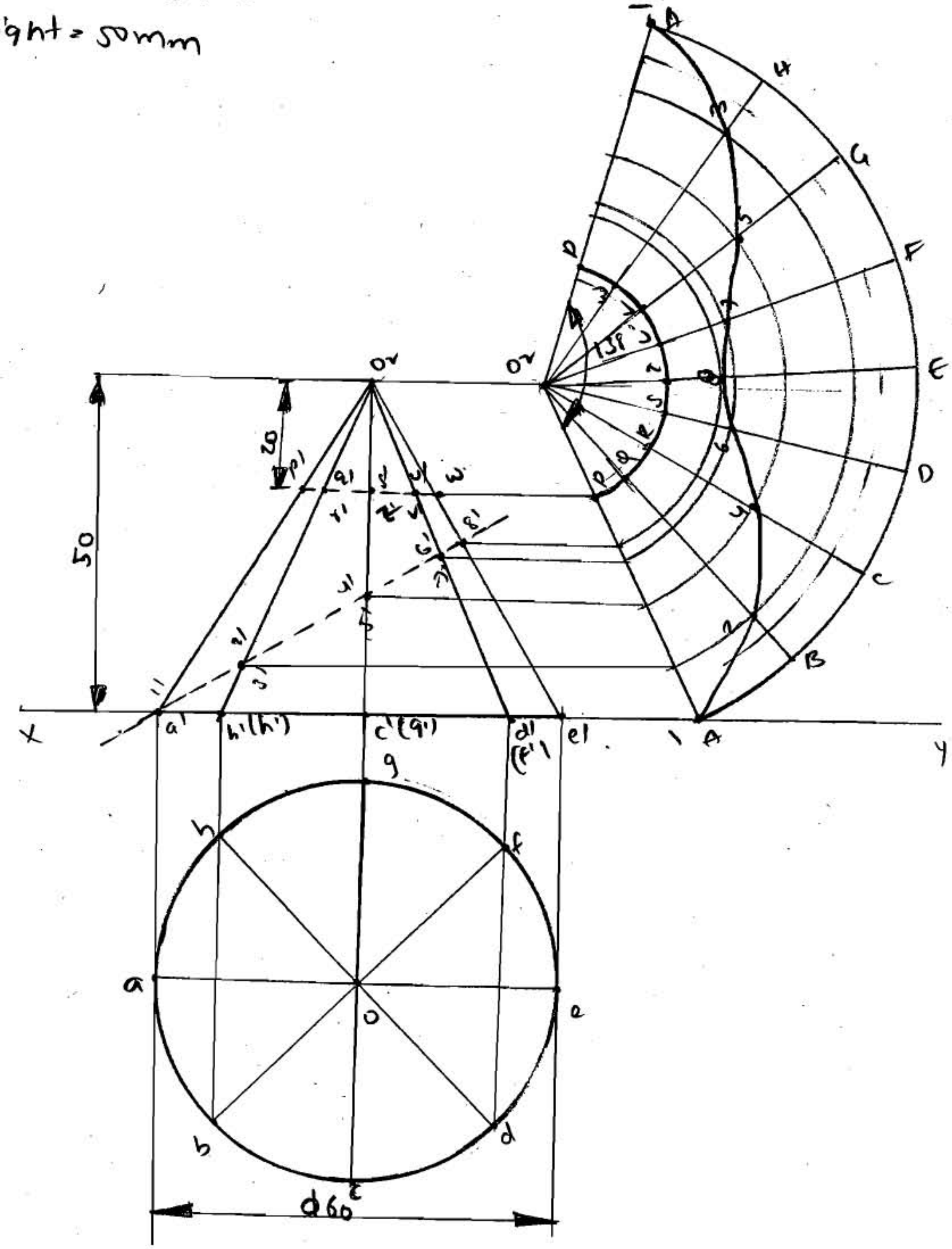
Q: The frustrum of the cone of base diameter 60mm Top diameter 20mm and height of the 50mm is resting on the base H.P. It is cut by A.I.P and inclined at 30° to the H.P. The H.T of which is tangential to the base circle. Draw the development of the lateral surface of the retained frustrum.

Cone

base diameter (ϕ) = 60mm

Top diameter (ϕ) = 20mm

height = 50mm



Q:- Draw the development of lateral surface of square pyramid of base side 40mm and axis 60mm is resting on its base on the H.P. such that

a) all sides of the base are equally inclined to the V.P

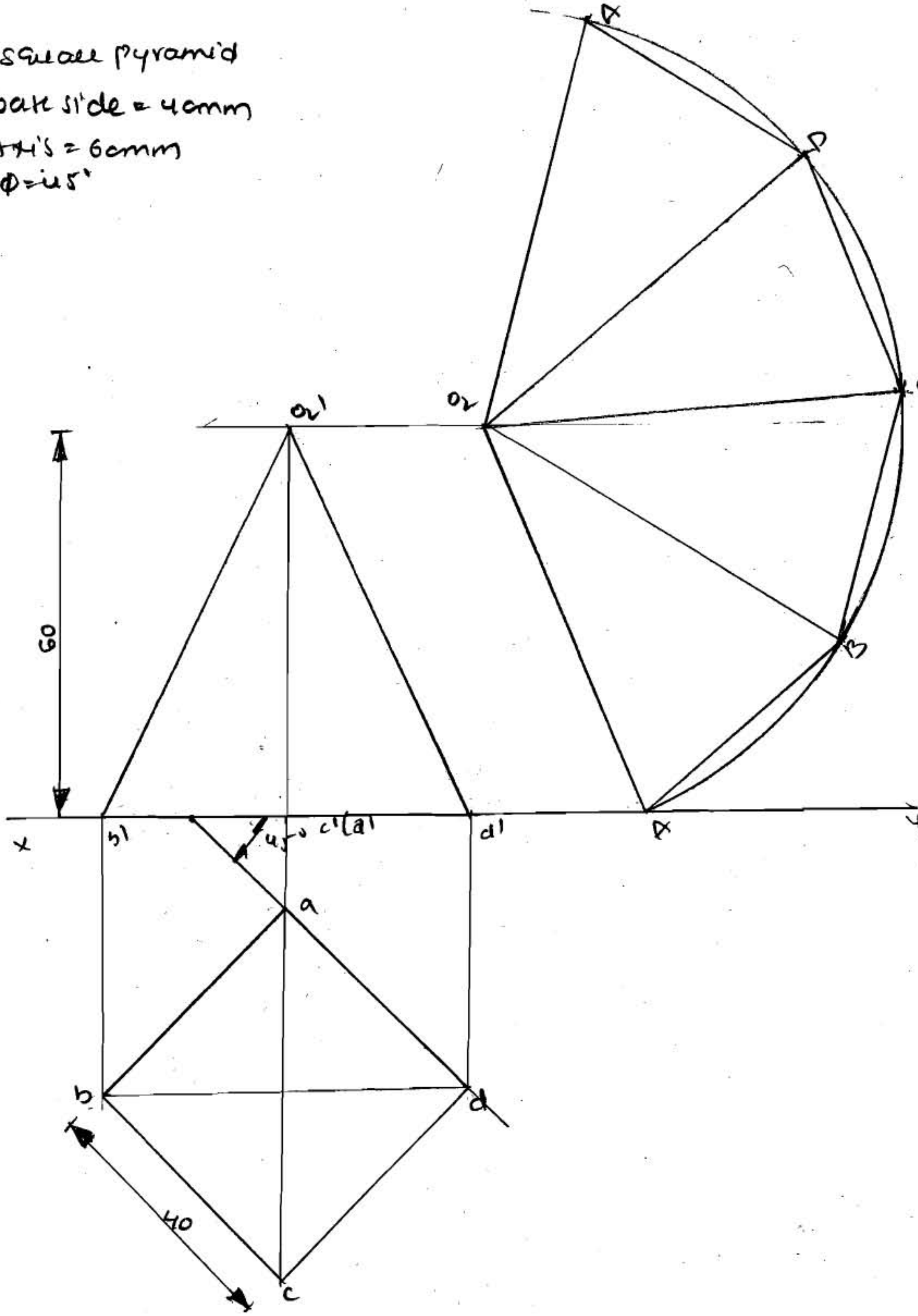
b) A side of the base is parallel to V.P

(a) square pyramid

base side = 40mm

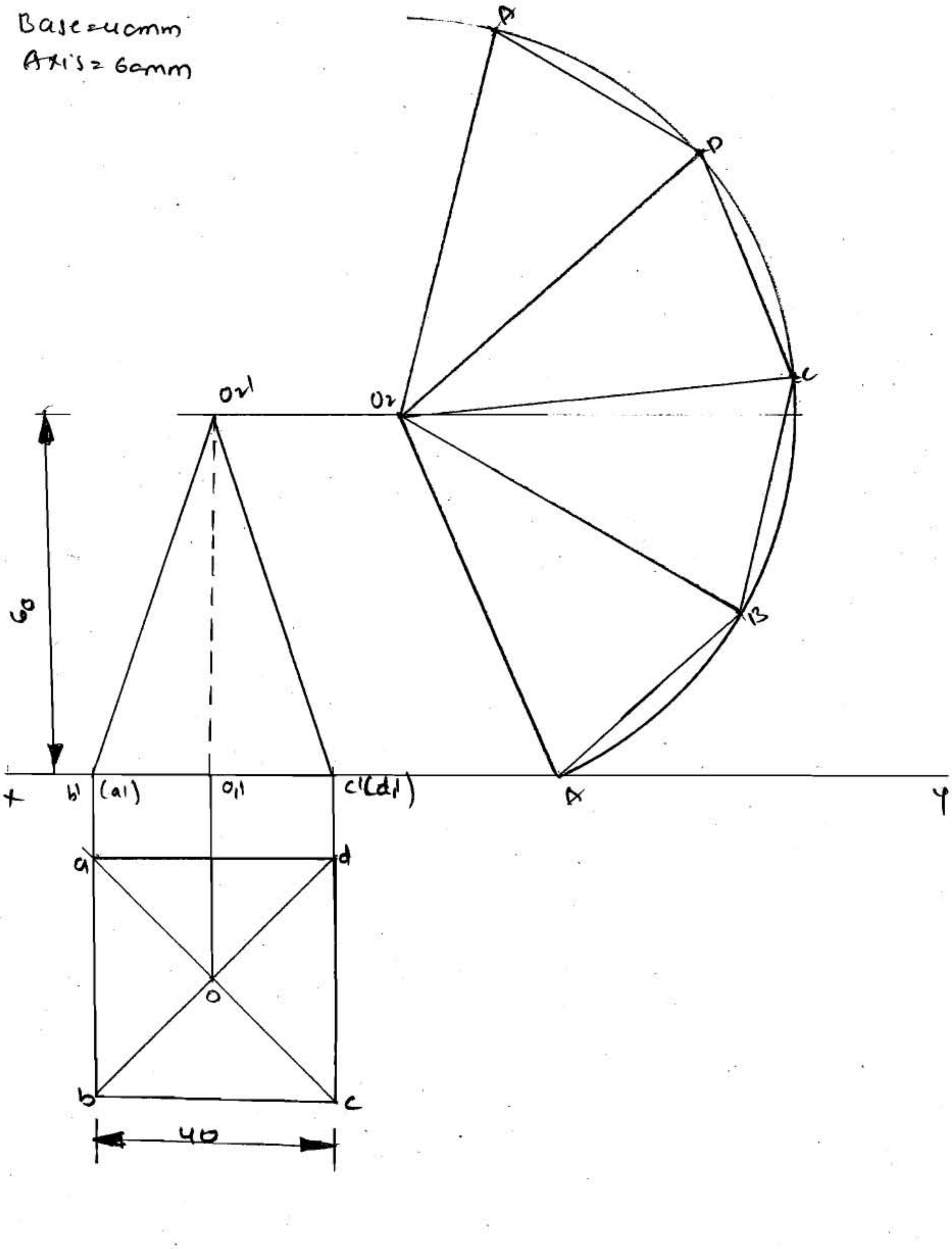
Axis = 60mm

$\phi = 45°$

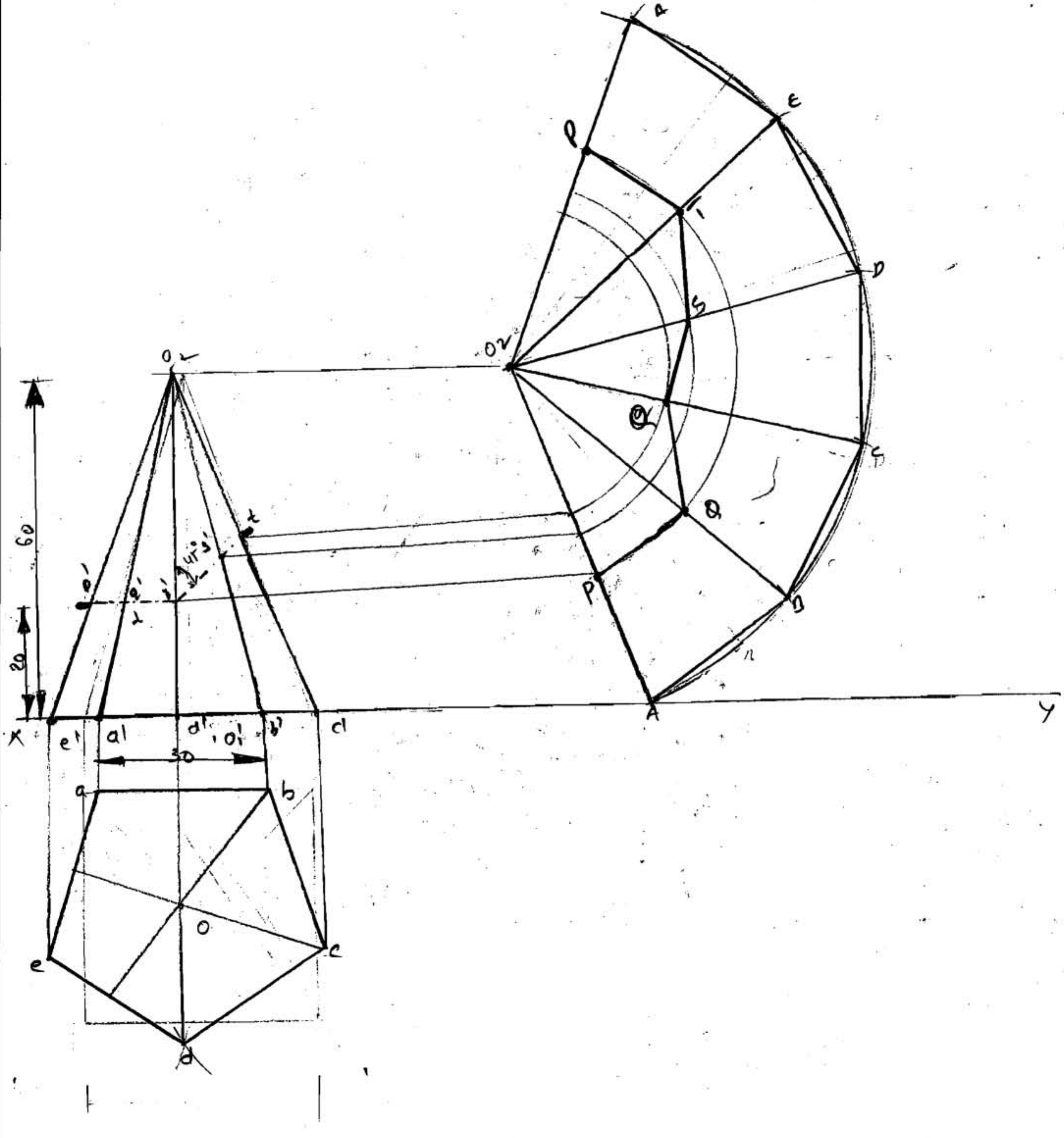


(b) Base is parallel to v.p

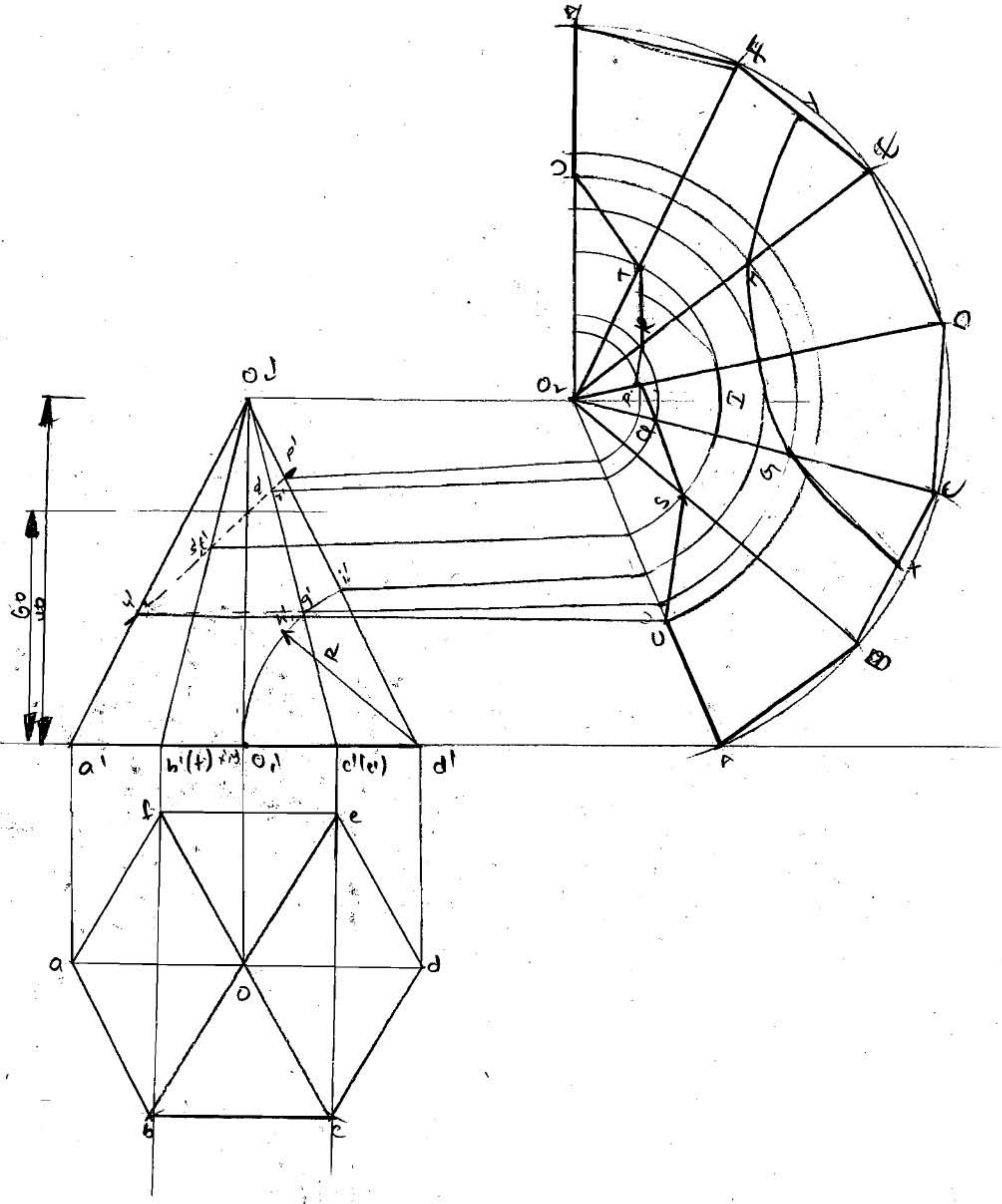
Base=40mm
Axis= 60mm



Q. A Pentagonal Pyramid Base side 30mm and axis 60mm - rest on its base on the H.P. with the side of the base is ||el to V.P. It is cut by two sectional planes meet at a height of 20mm from the base one of the sectional plane is horizontal while the other is an auxiliary inclined plane. whose V.T at 45° to H.P. Draw the development of lateral surface of solid when Apex is removed.



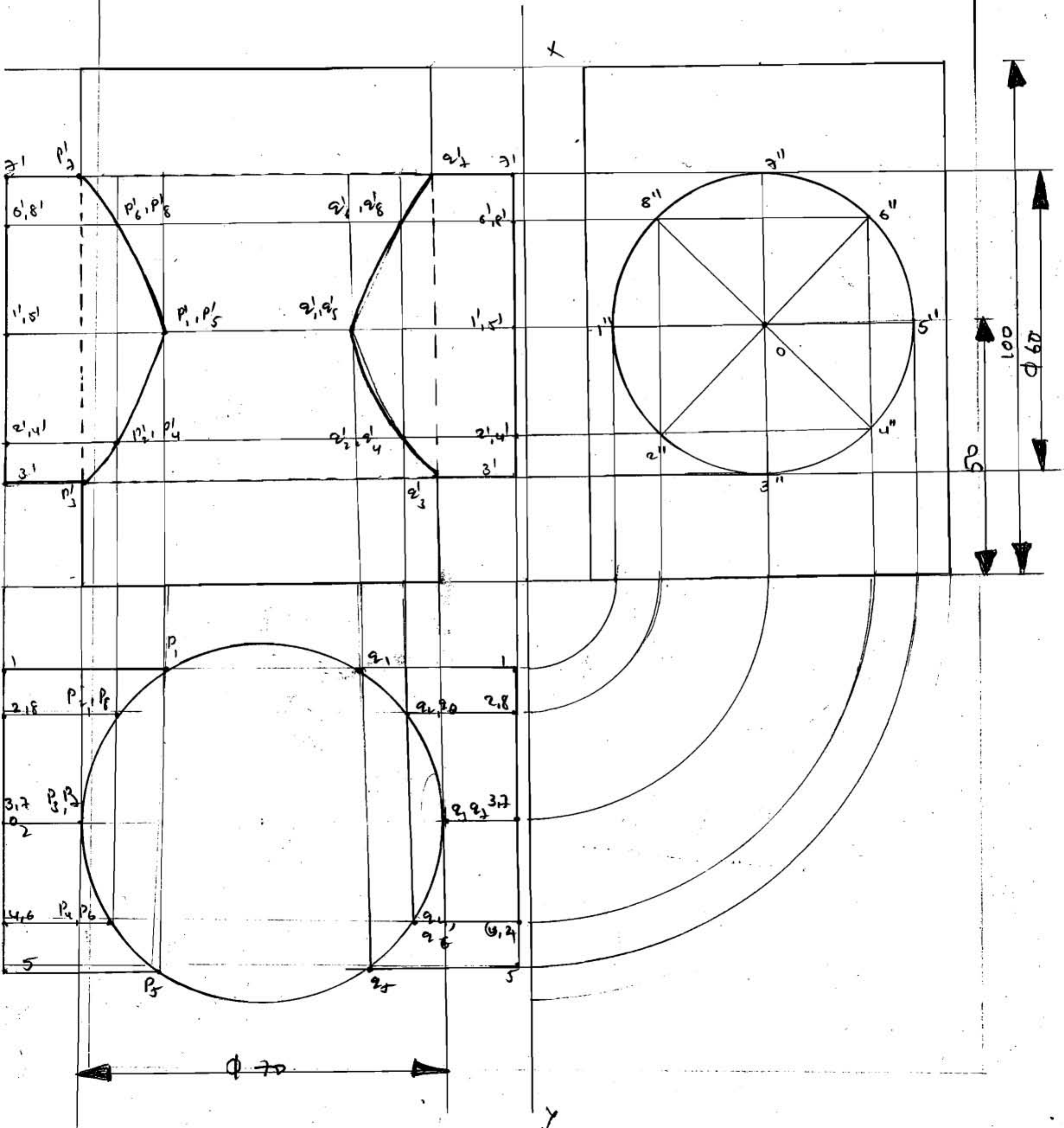
on it's base on the H.P with the side of the base parallel to V.P. It is cut by a planes per to V.P. To obtain the front view as shown in figure. Draw the development of lateral surface of the retained solid.



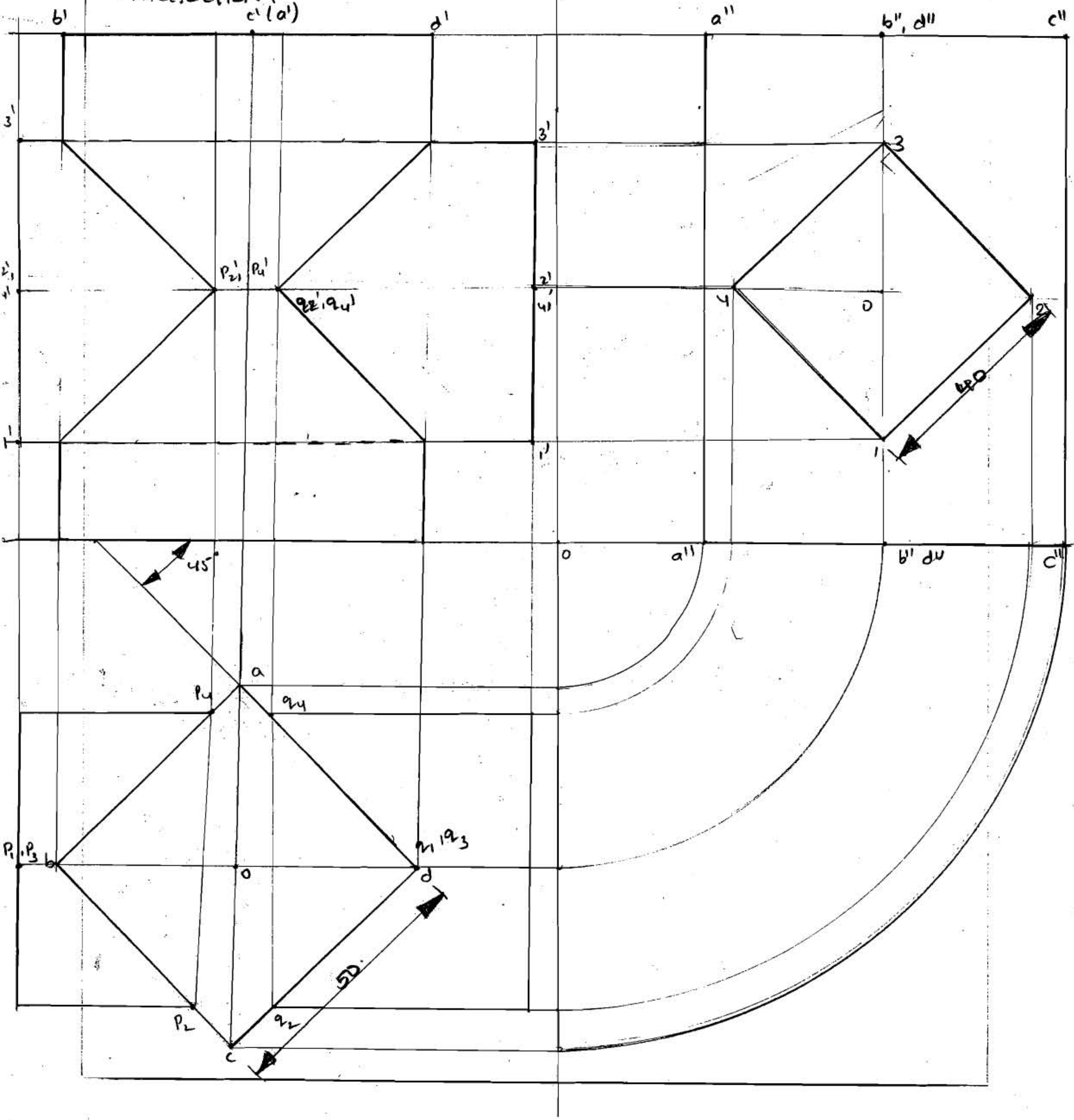
4. INTERSECTION OF SOLIDS

1. A cylinder of base diameter 70mm is resting on its base on the H.P. It is penetrated by another cylinder of base diameter 60mm such that their axis intersect each other at right angles. Draw the projections of the combination and show the curves of intersection.

Sol. Assume both cylinder height = 100mm



A square prism base side 50mm, is resting on its base on the H.P. It is completely penetrated by another square prism of base side 40mm. such that the axis of both prisms intersect eachother at right-angles and faces of both prisms are equally inclined to V.P. Draw the projections of the combination and show the lines of intersection.



UNIT-V

Content

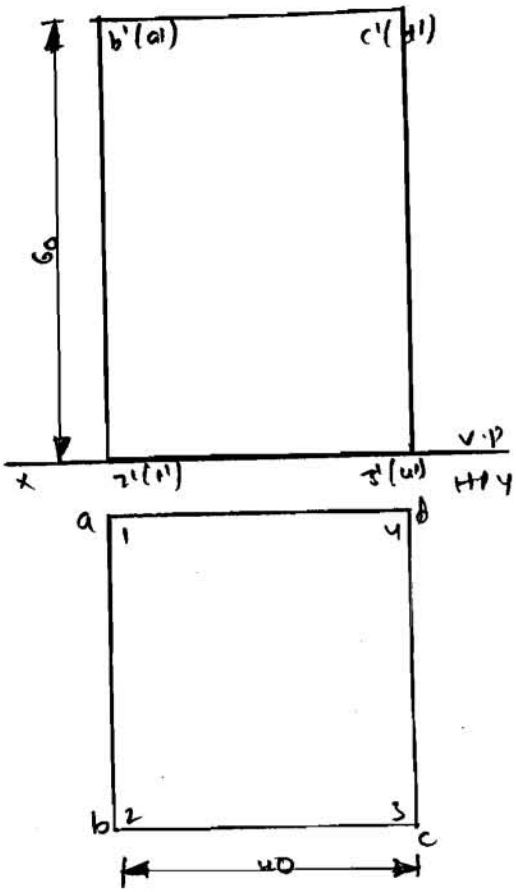
Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts.

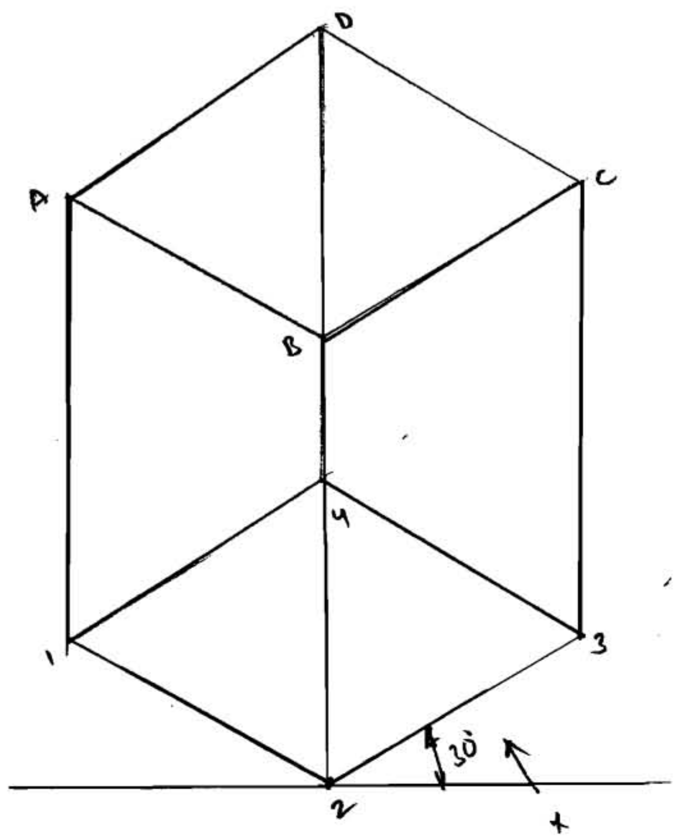
Conversion of Isometric Views to Orthographic Views and Vice-versa –Conventions

Isometric Projections and isometric views-

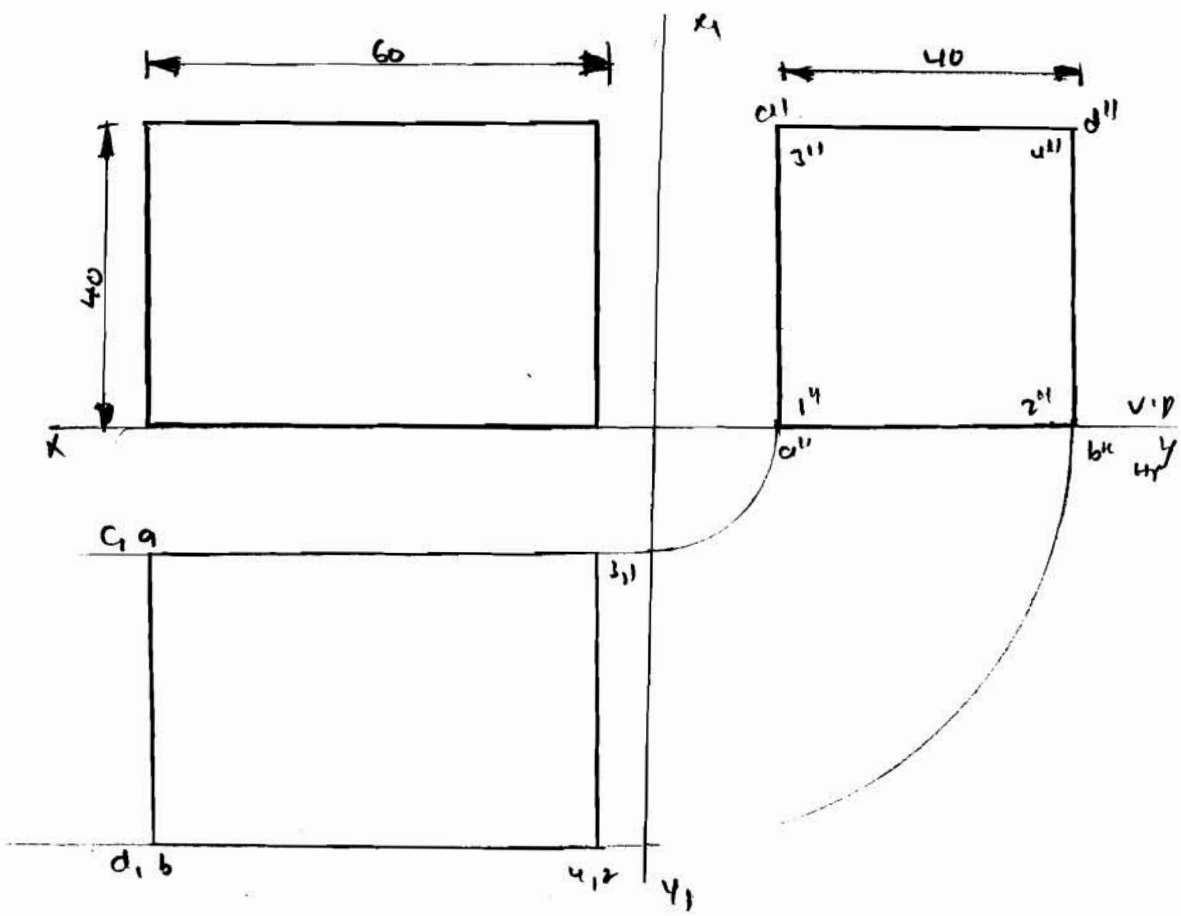
1) Draw an isometric view of a square prism, base side 40mm and axis 60mm long resting on the H.P

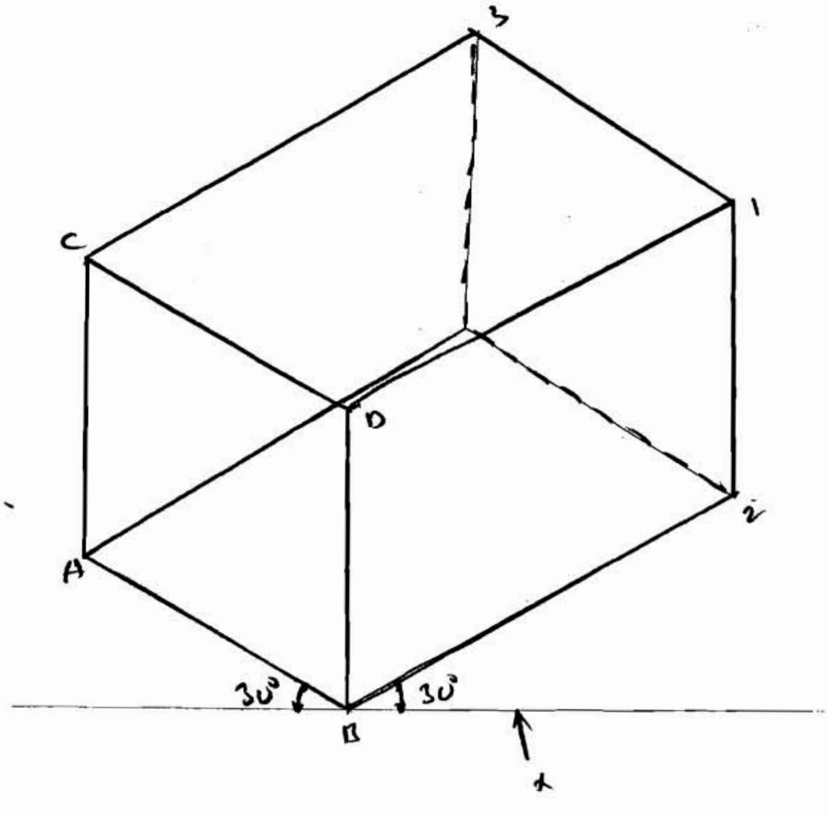
a) on its base with axis ⊥er to the H.P



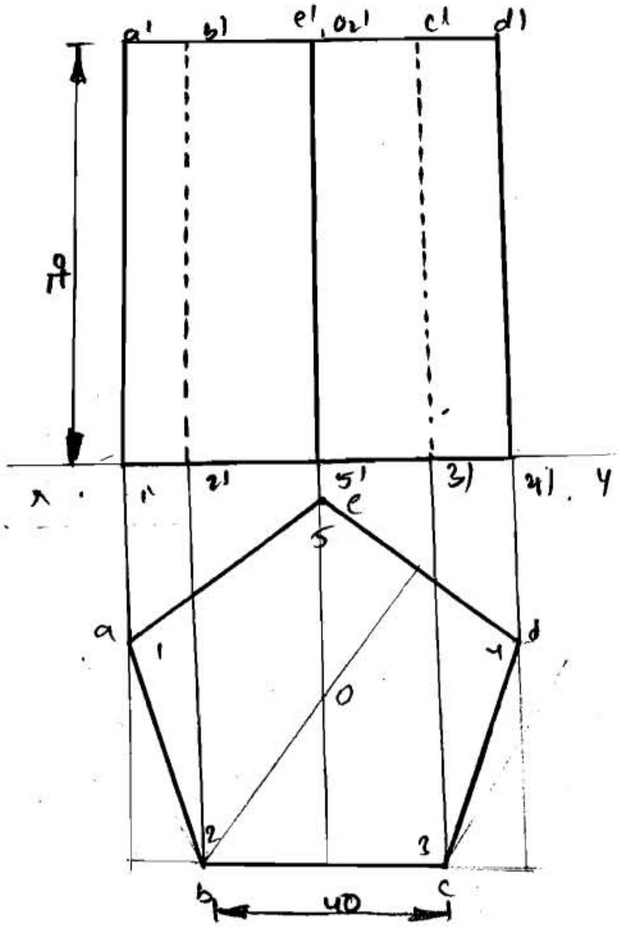


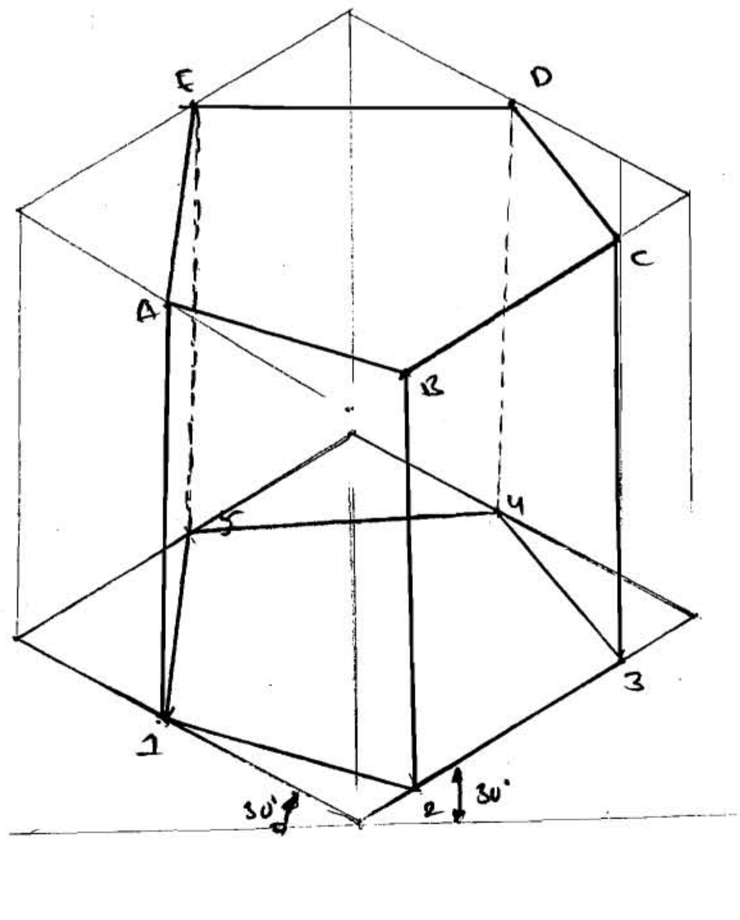
c) on its rectangular face with axis ⊥ to V.P



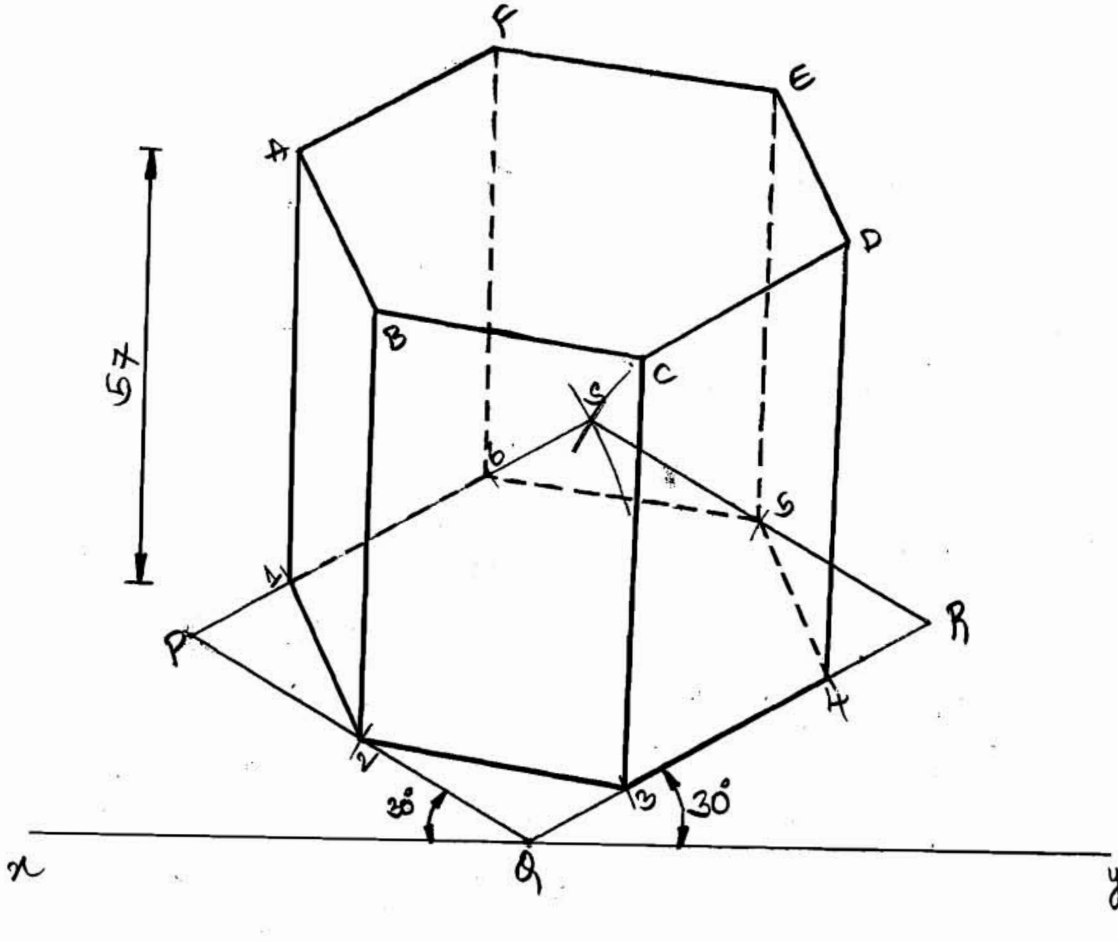


long axis resting on its base on the H.P. with an edge of the base is ||el to V.P

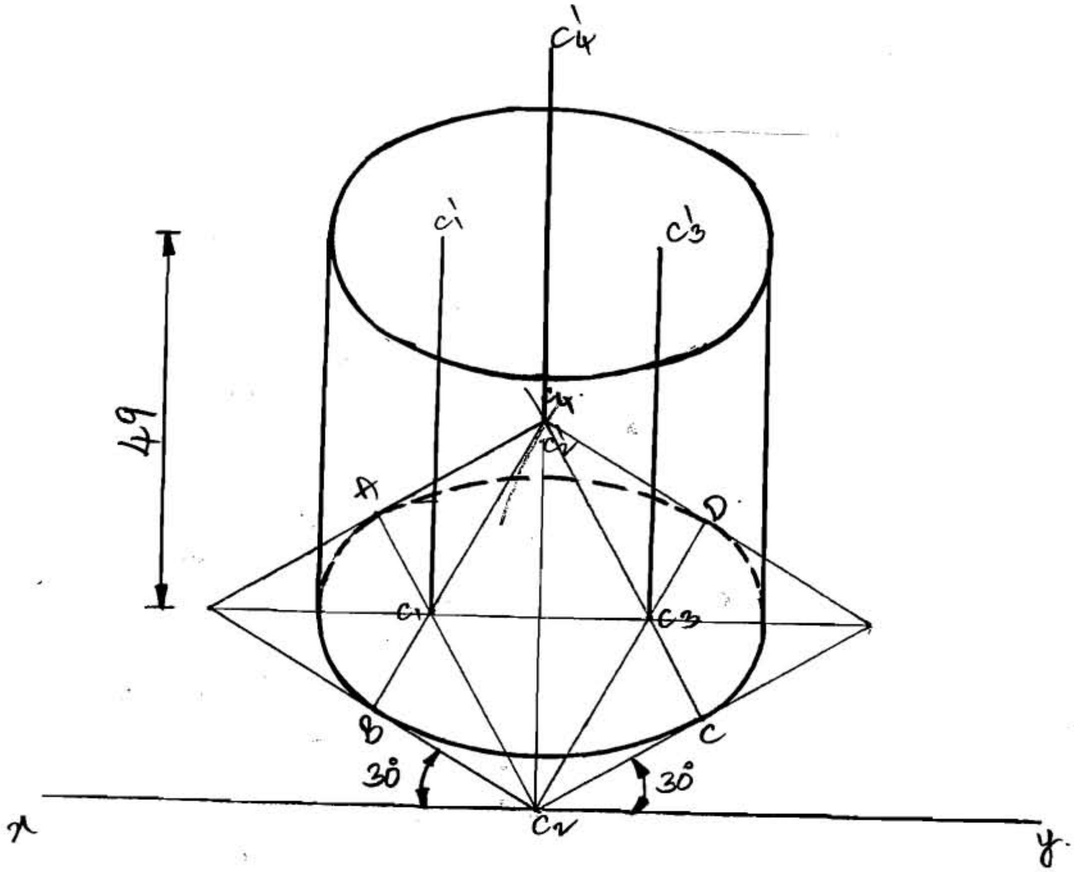




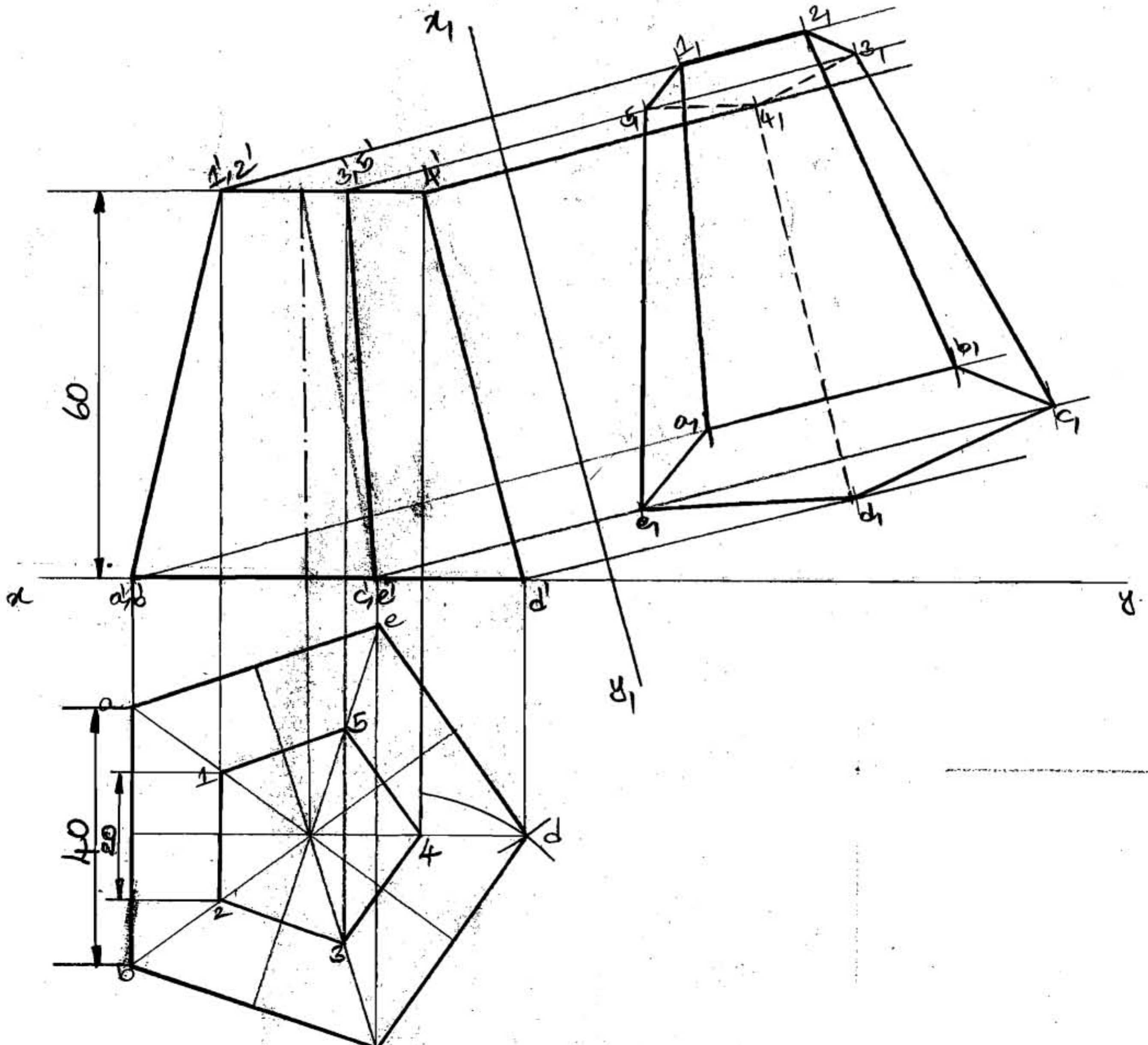
* Isometric View (Hexagonal Prism)



Isometric View (Cylinder)

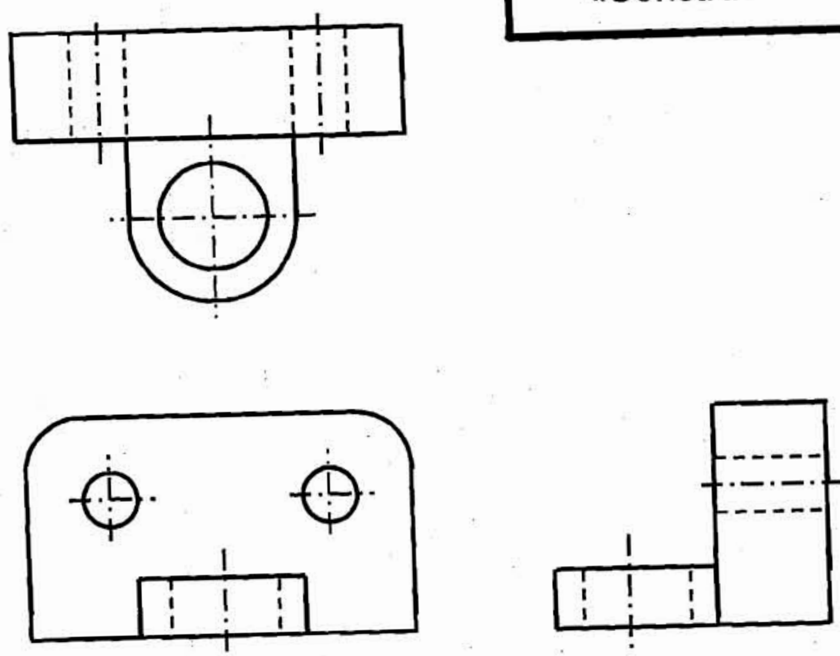


\# Isometric View (Pentagonal Frustum)

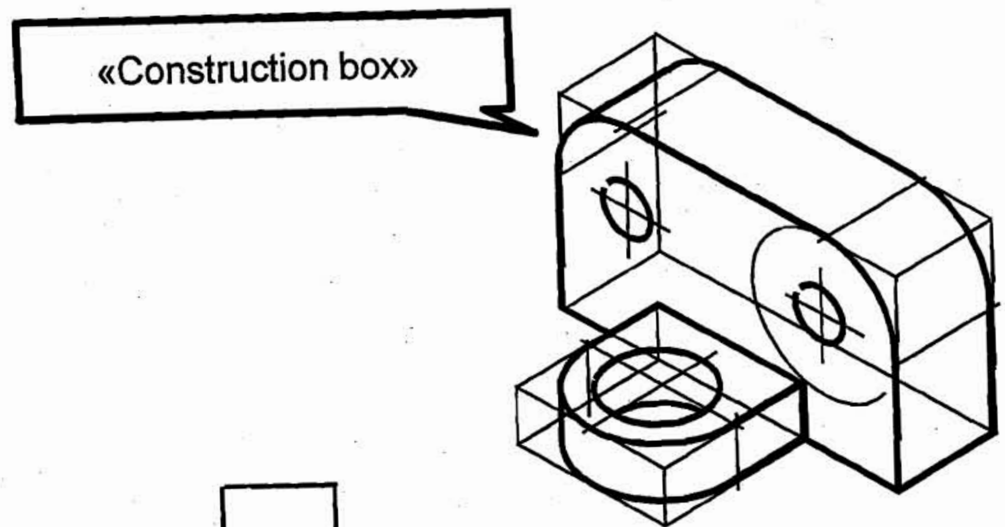


Isometric drawing

How to draw an object containing rounded parts

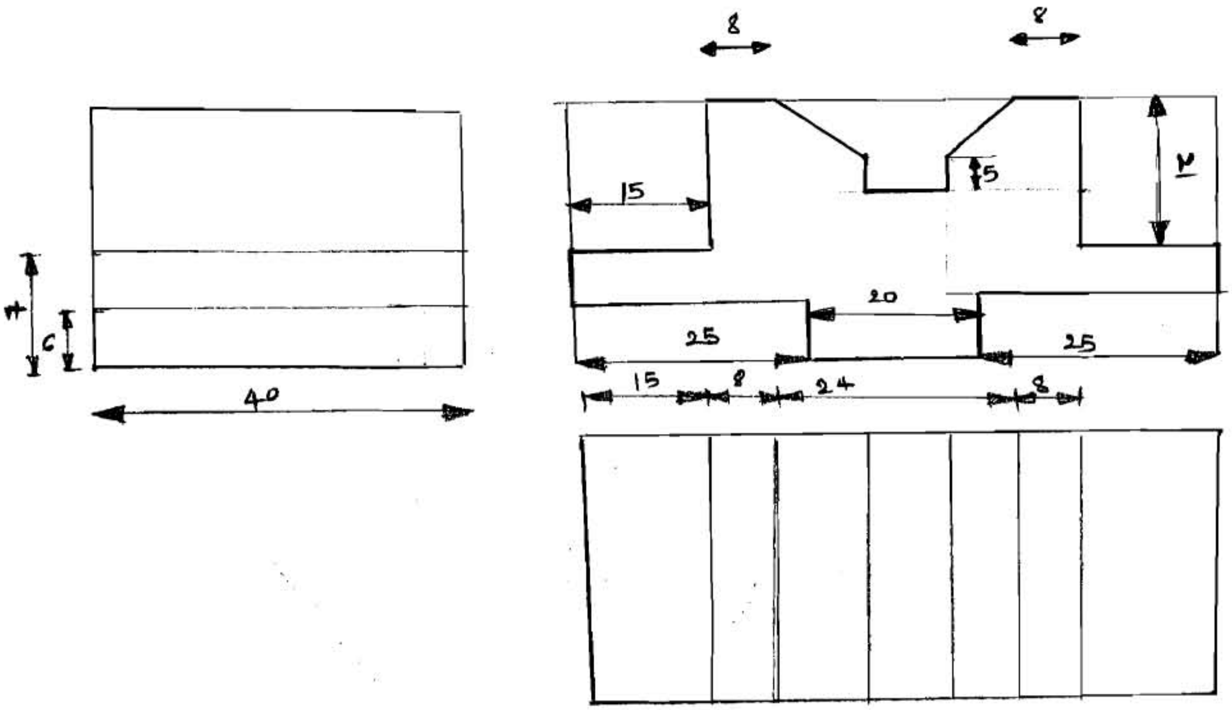


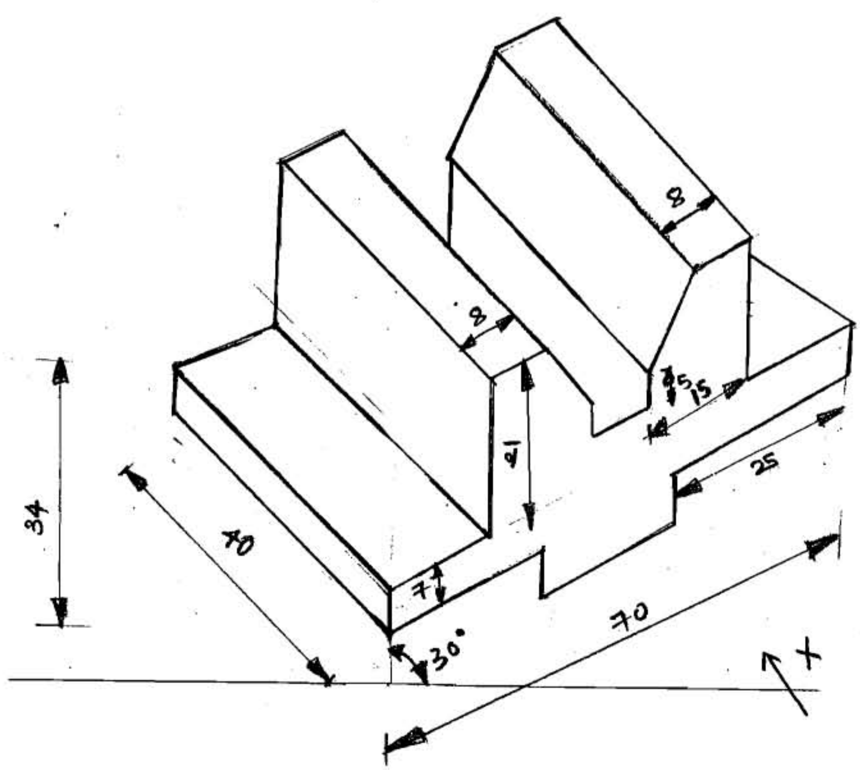
ORTHOGRAPHIC MULTI-VIEW PROJECTION



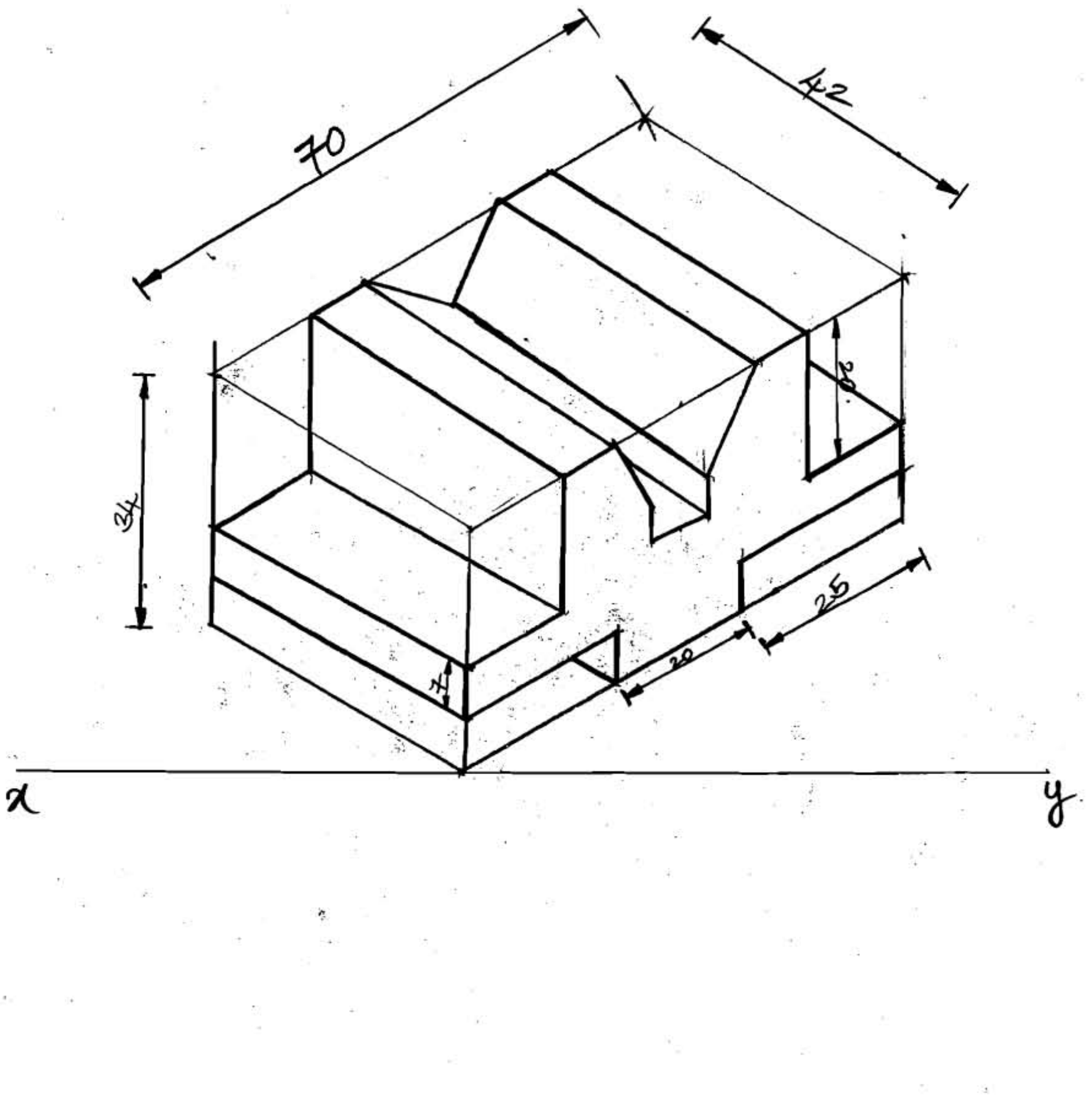
ISOMETRIC PROJECTION

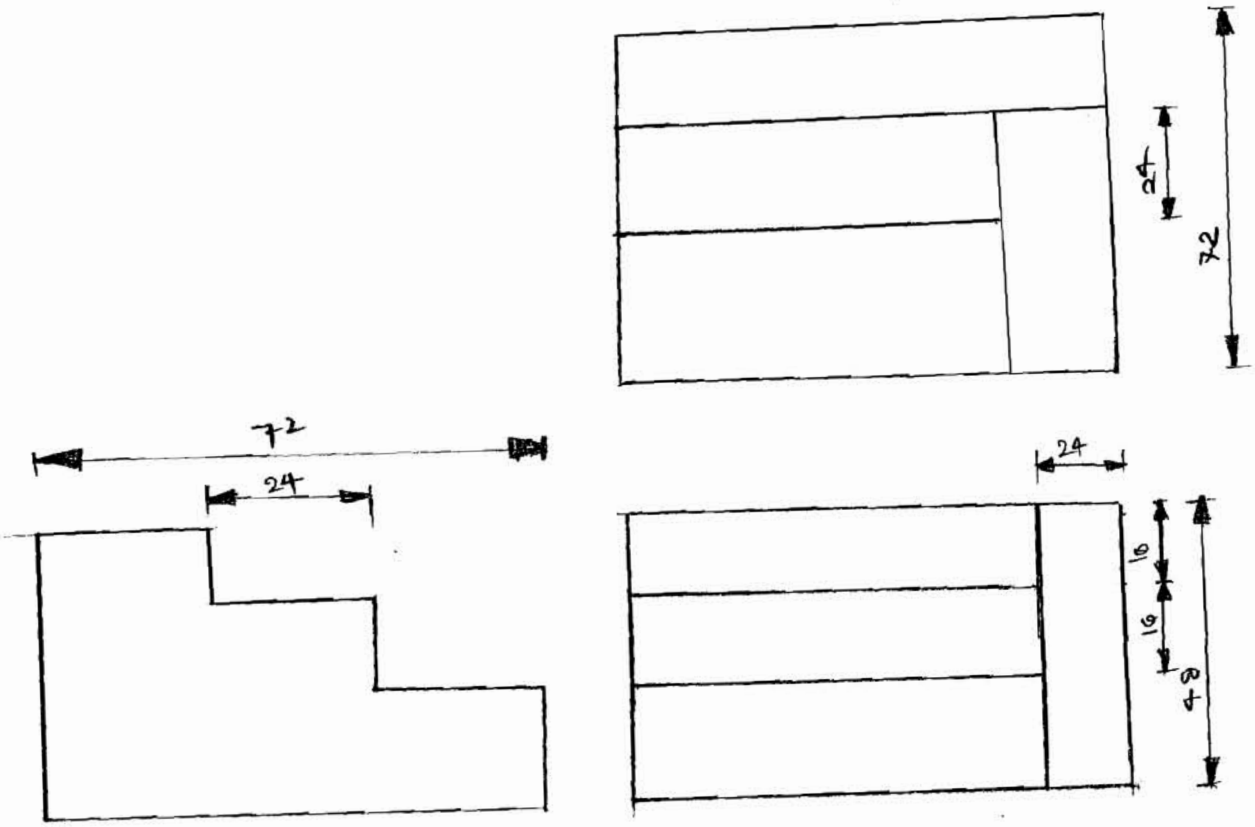
orthographic





Isometric View





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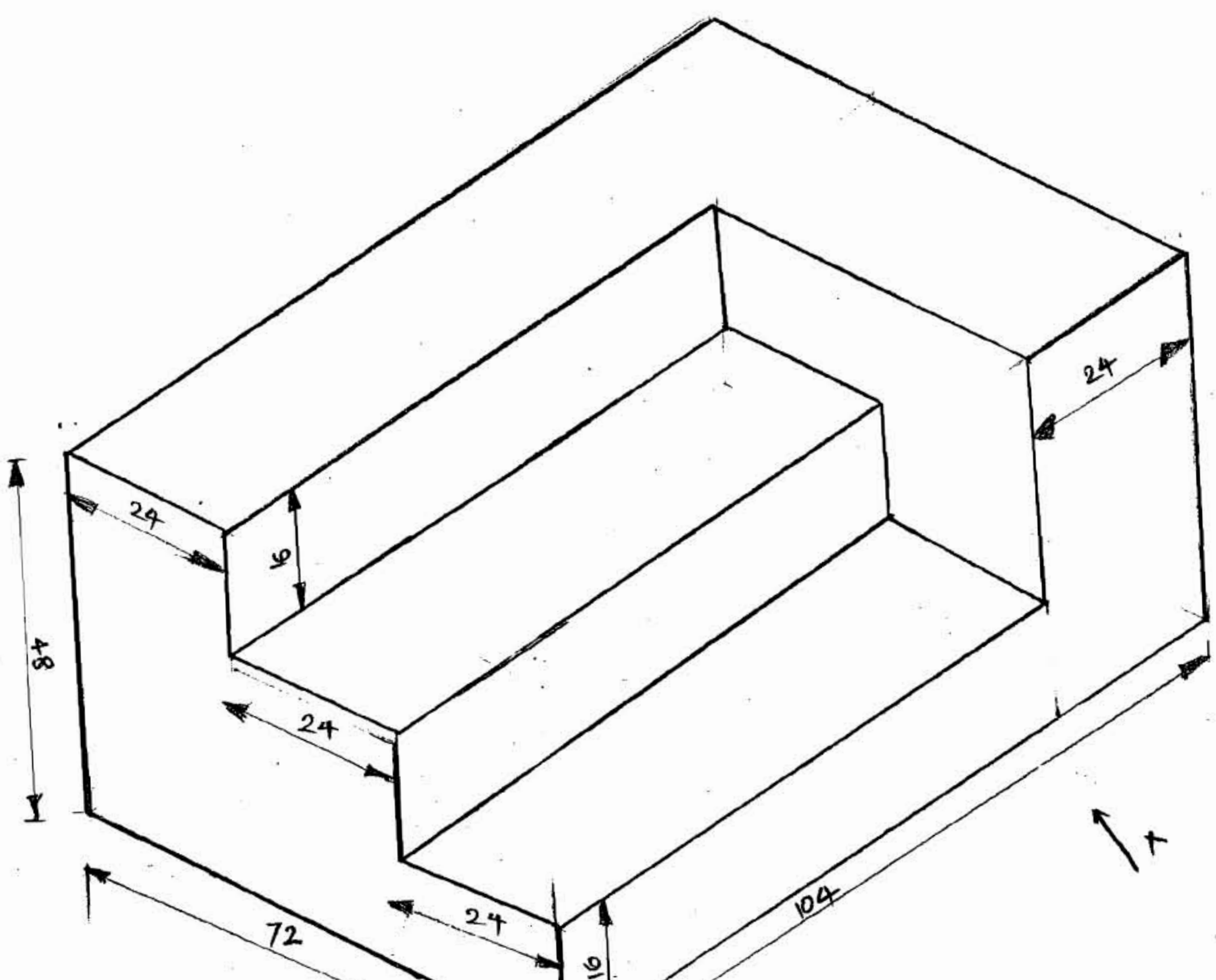

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X

Steps to draw projections

- Identify surfaces perpendicular or inclined to the view
- Surfaces parallel to the view would not be visible in that view.
- First draw horizontal and vertical reference planes (easily identifiable on drawing)
- Start drawing from the reference planes.

Example 1

Draw the orthographic projections of Fig. 1

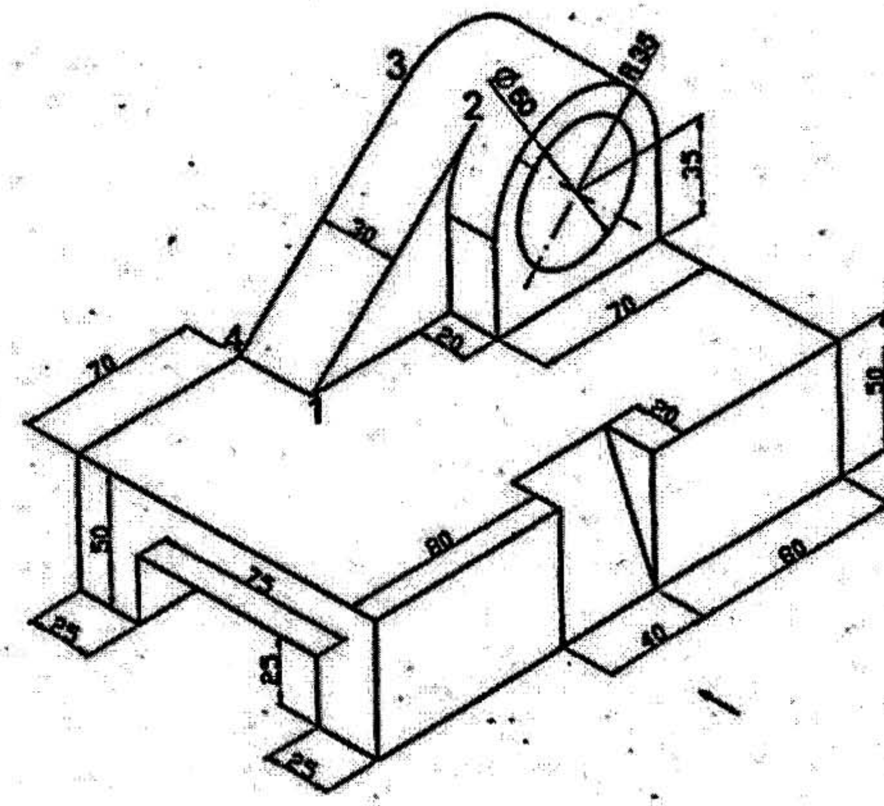
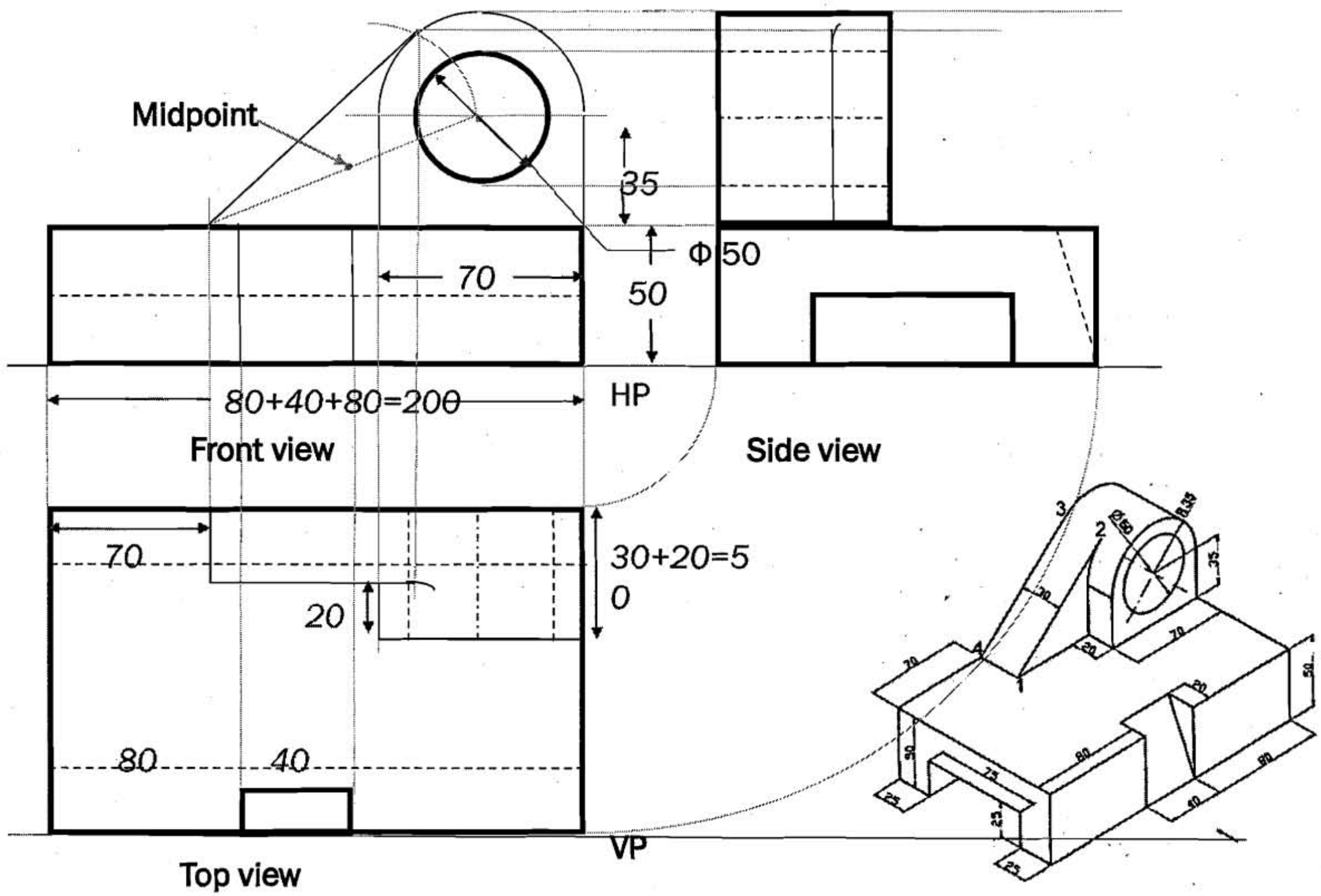
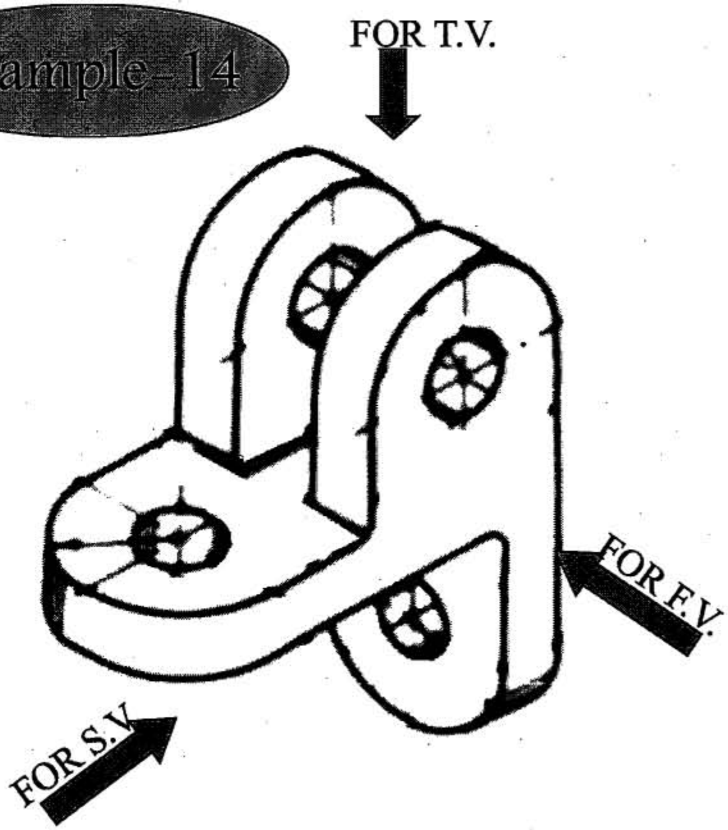


Fig. 1

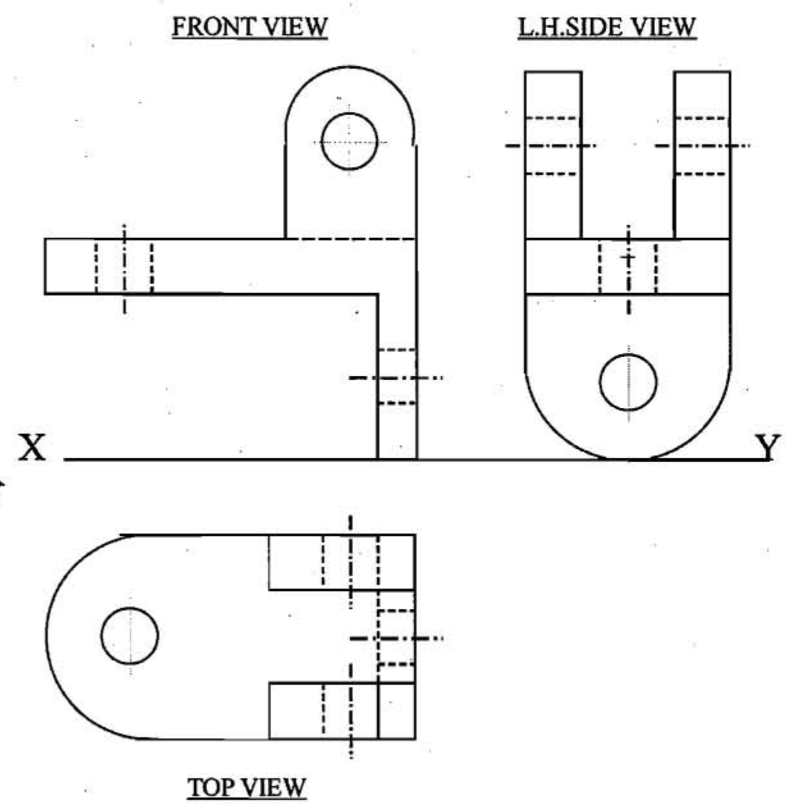


Midpoint
35
Φ 50
70
50
80+40+80=200
HP
Front view
Side view
70
30+20=5
0
20
80
40
VP
Top view

Example- 14



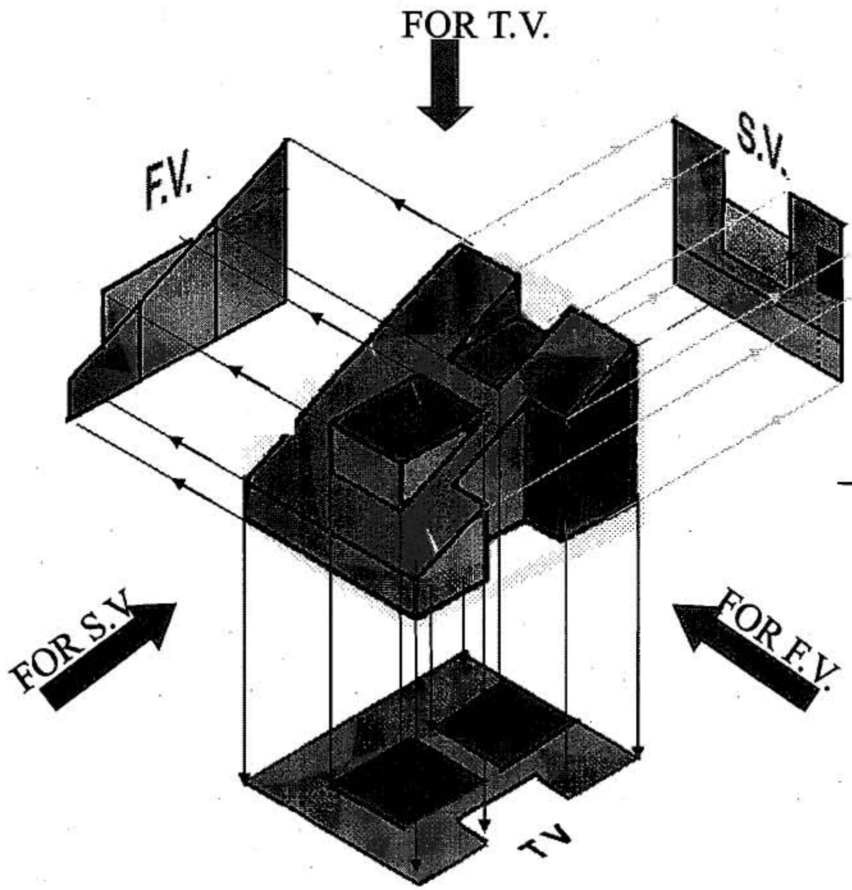
ORTHOGRAPHIC PROJECTIONS



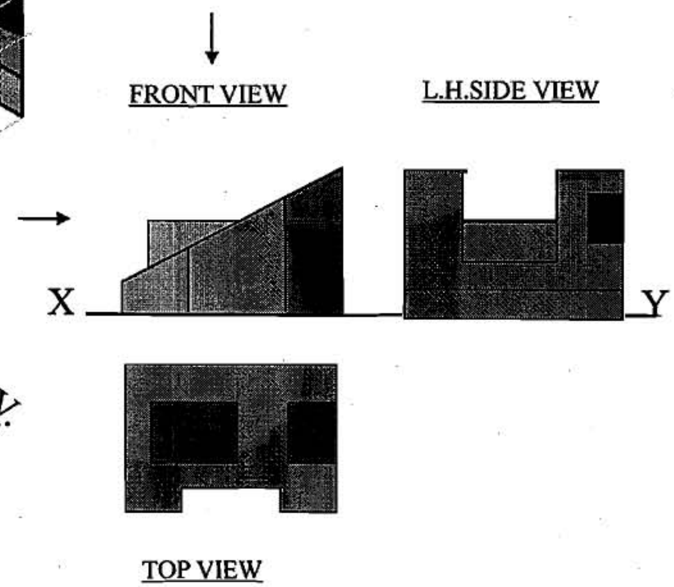
PICTORIAL PRESENTATION IS GIVEN

DRAW THREE VIEWS OF THIS OBJECT
BY FIRST ANGLE PROJECTION METHOD

Example-3



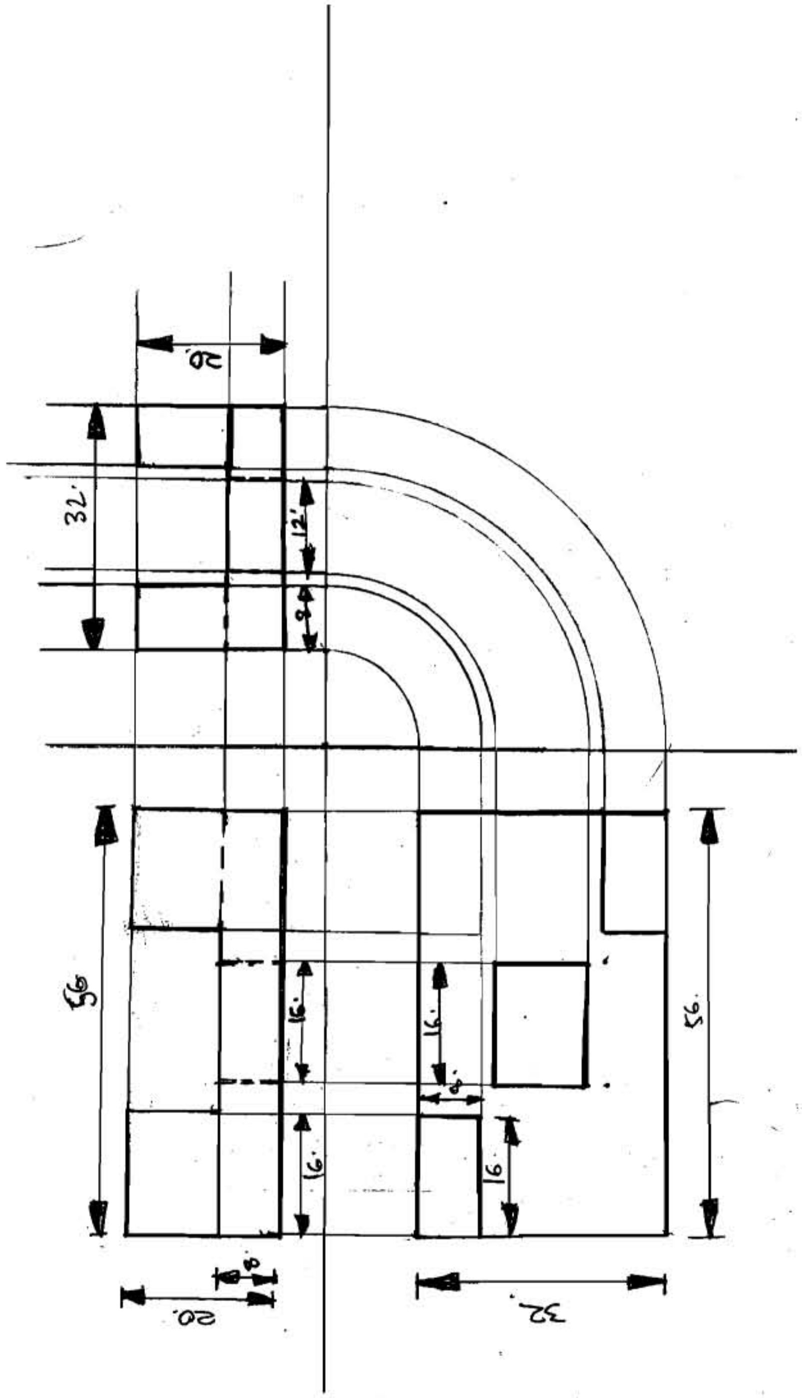
ORTHOGRAPHIC PROJECTIONS



PICTORIAL PRESENTATION IS GIVEN

DRAW THREE VIEWS OF THIS OBJECT
BY FIRST ANGLE PROJECTION METHOD

* Orthographics Views (First Angle Projection)



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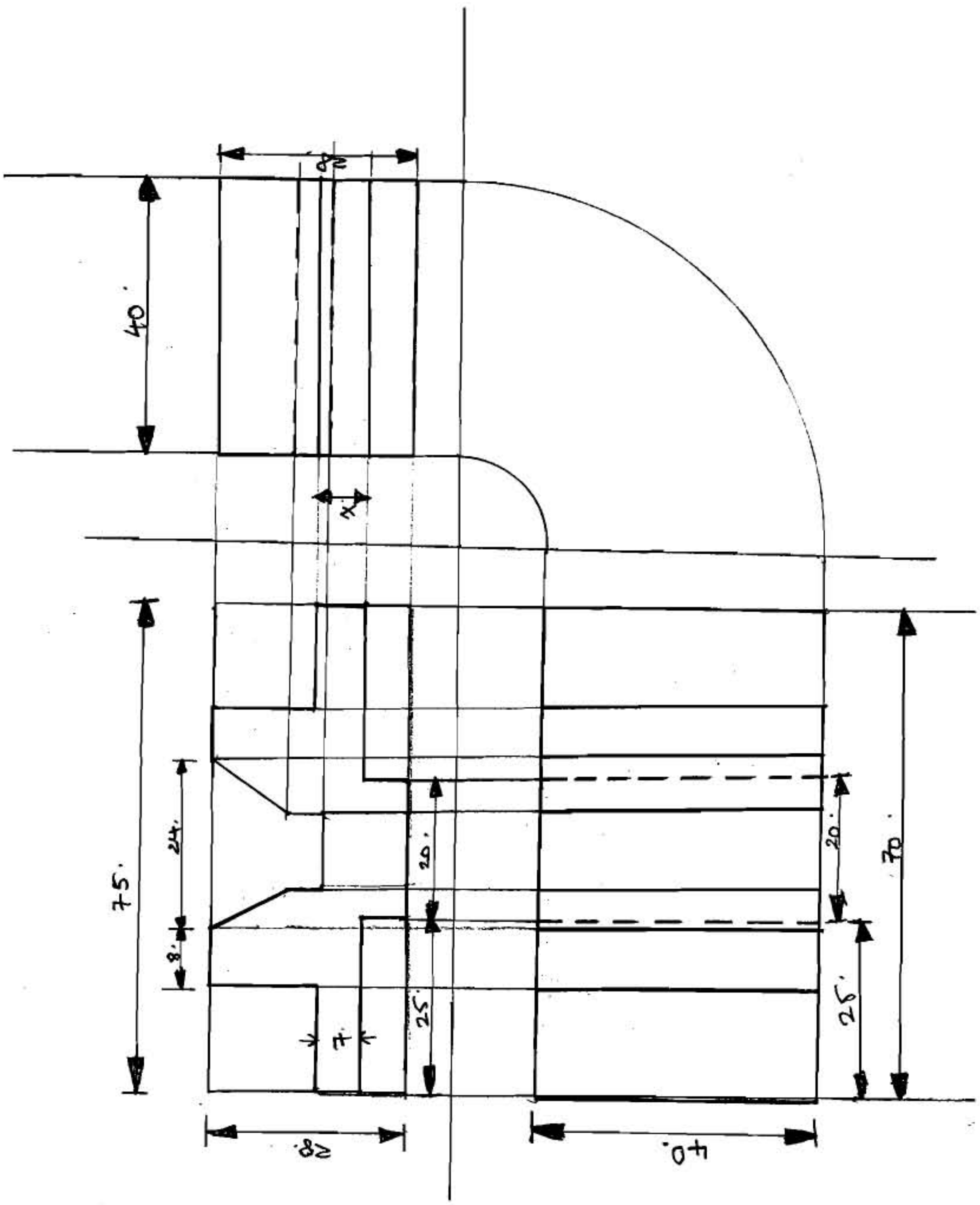
* Orthographic Views (First Angle Projection)



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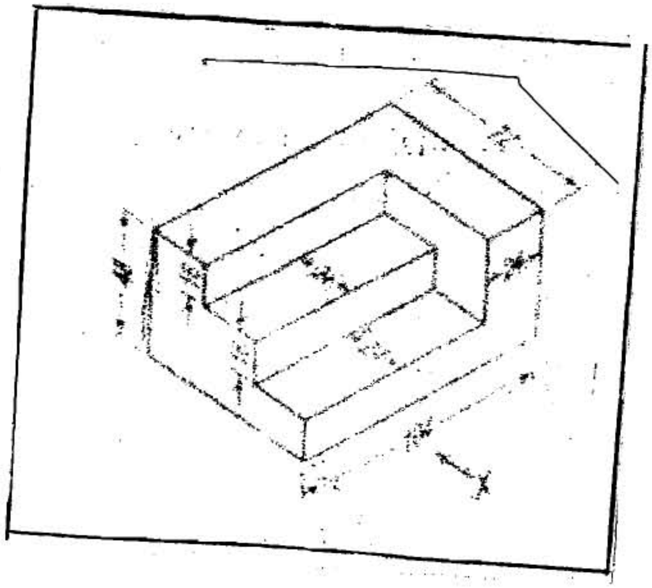

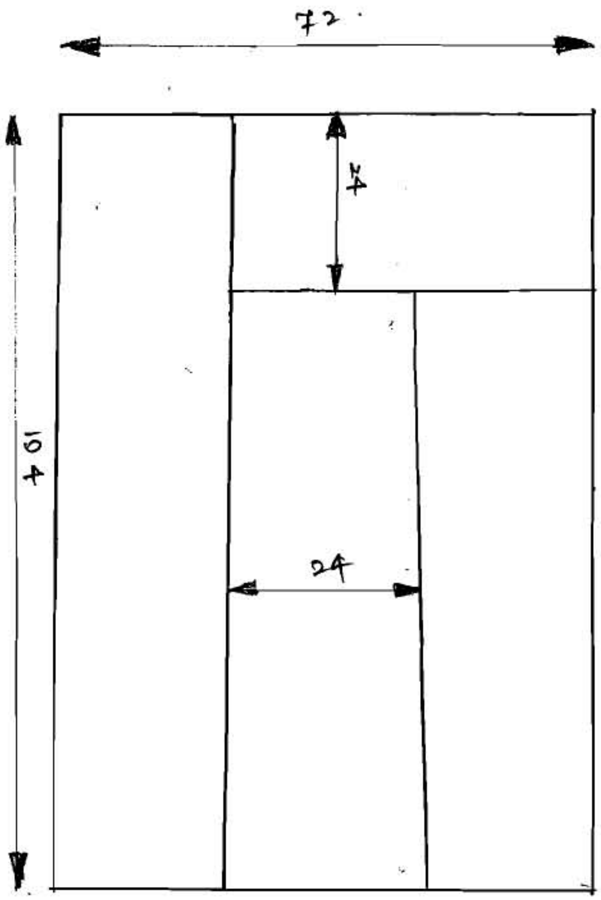
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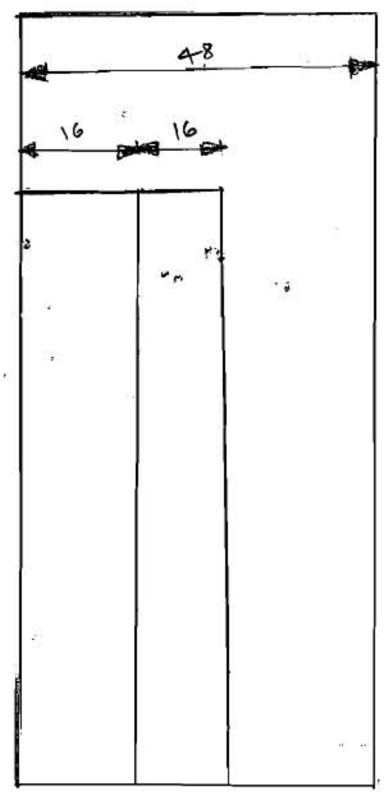
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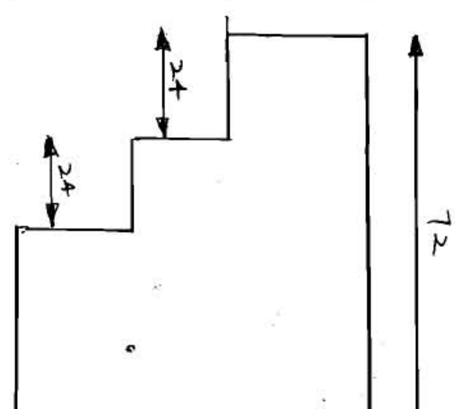
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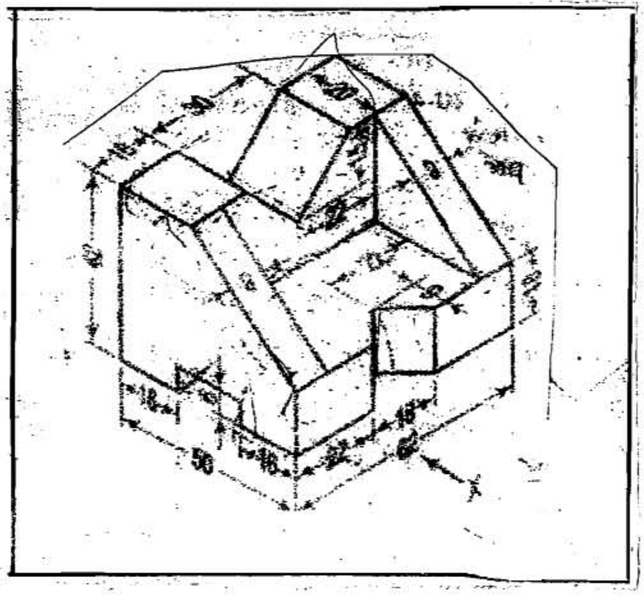

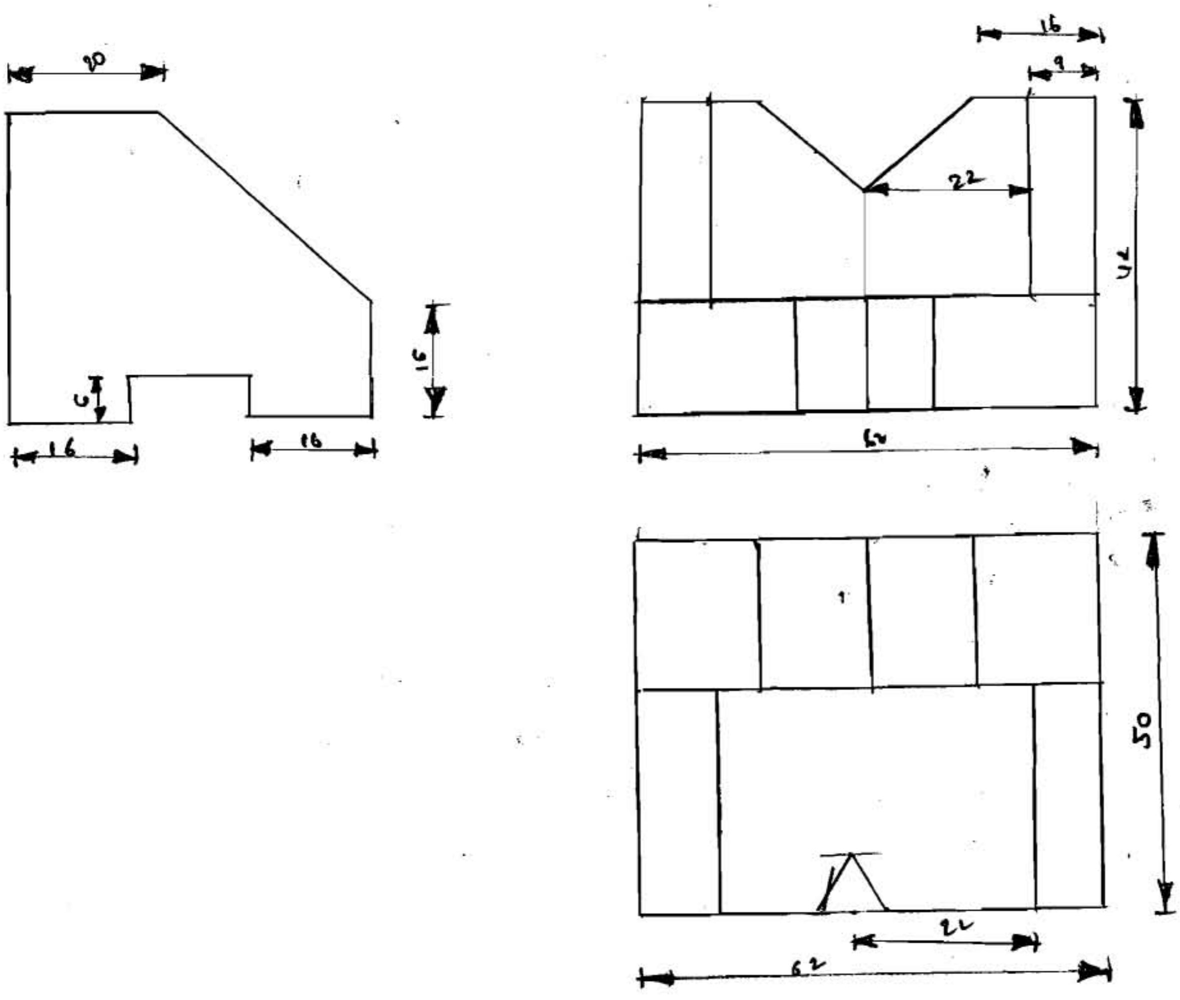
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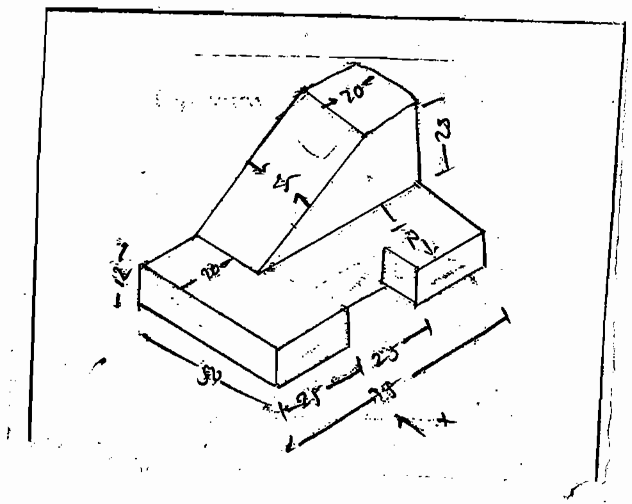

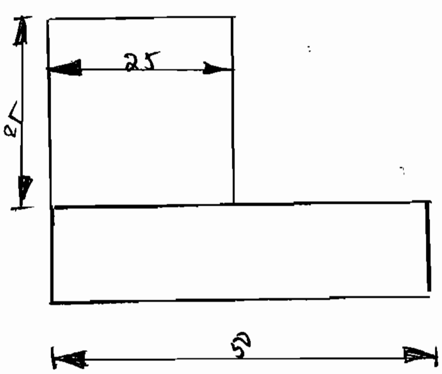
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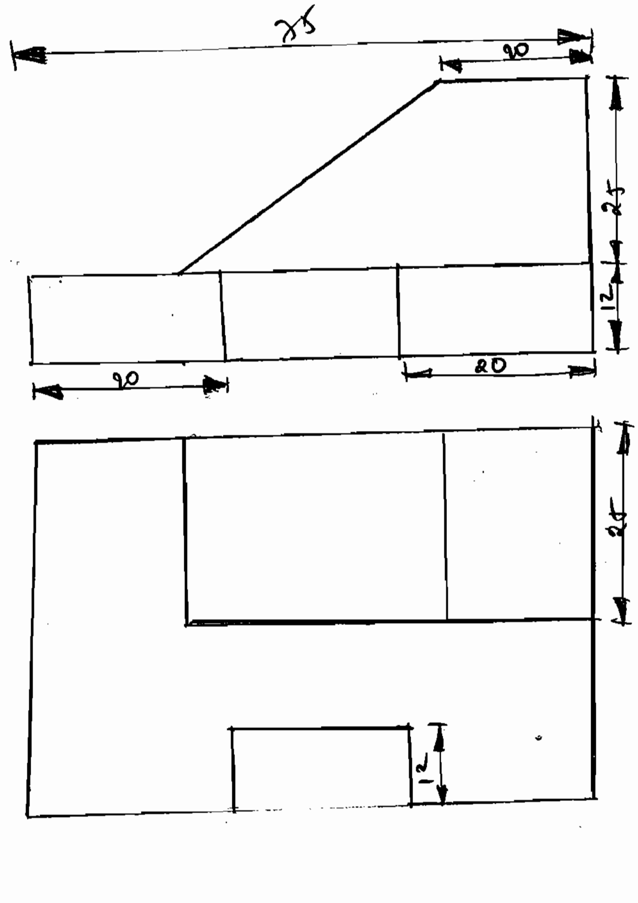
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