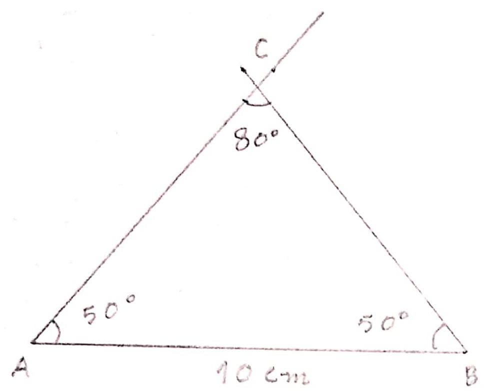
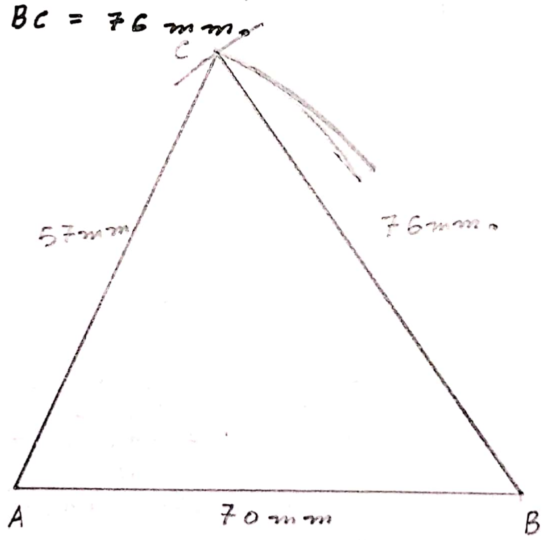
Q. Construct an isosceles Δ, with angles given as:
50°, 50° and 80°.



Construction:

1. Draw a line AB of length 10cm.
2. Measure 50° from A and sketch a line
3. Measure 50° from B and sketch another line
4. The intersection of these two lines would be the third vertex of Δ.

Q. Construct a Δ ABC, where
AB = 70 mm,
AC = 57 mm,
BC = 76 mm.



Construction

1. Draw a line AB of length 70mm.
2. Now, taking 'A' as the centre, mark a distance/arc of 57mm.
3. Assume B as the centre, and make an arc of 76mm.
4. The intersection of arcs gives us the vertex C.
5. Join AC and BC.

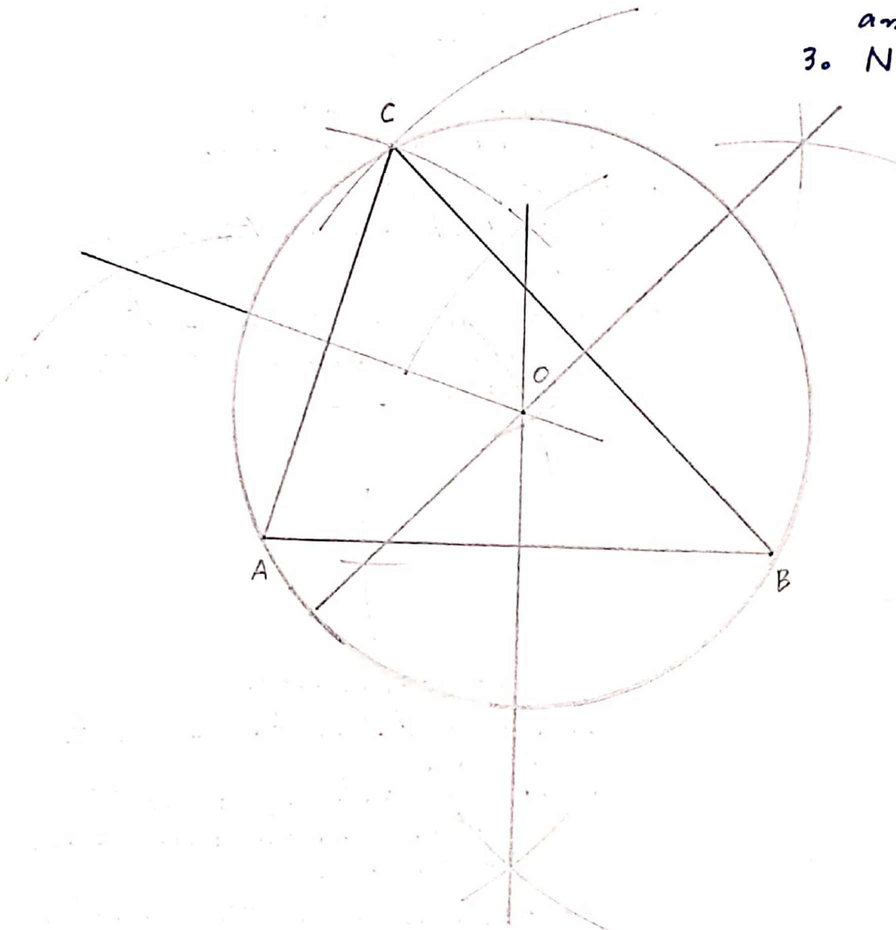
Q. Constructing circumcircle on the previous Δ.

Circumcenter → Point of Intersection of $\perp$ bisectors of side of Δ.

Construction:

1. Follow the previous steps to construct the ∠
2. Perpendicularly bisect AB and BC.
3. Now, joint thier $\perp$ bisectors.
4. Thier intersection point would give us 'O', the circumcenter of Δ ABC.
5. Now, centre as O, and radius 'OA', draw a circle.
6. All three vertices of Δ, would lie on this circle.

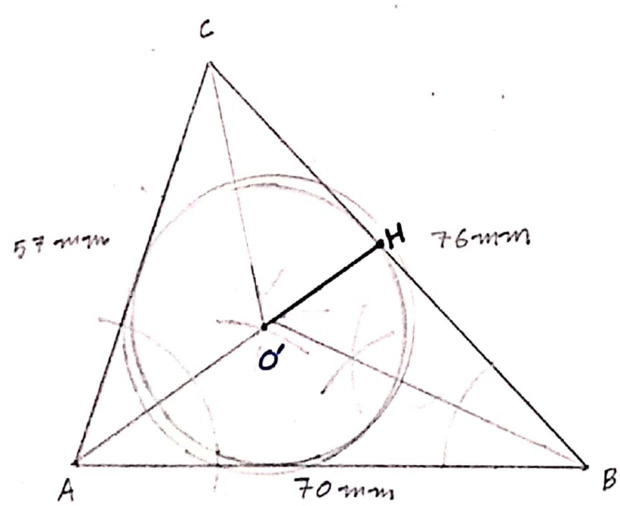
Hence, construction of circumcircle is complete.



Q. Constructing incircle on the previous Δ.

Construction:

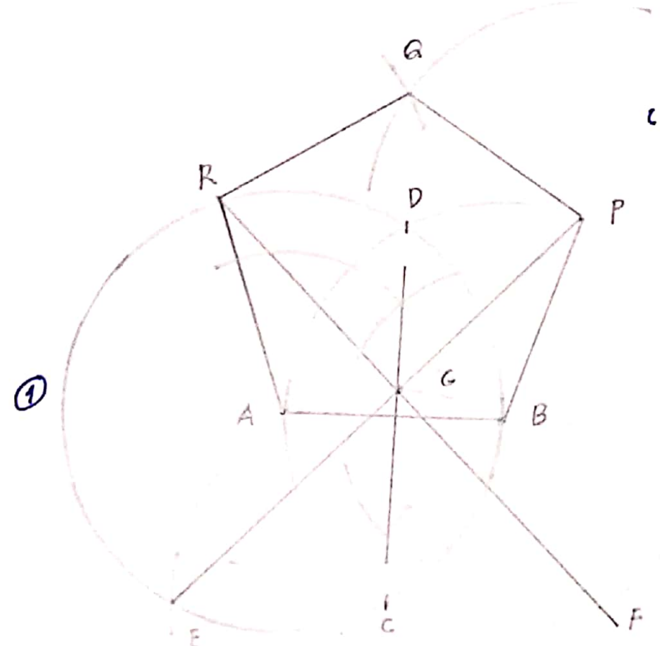
1. Follow the previous steps to construct the Δ.
2. Bisect ∠CAB and ∠ABC and ∠ACB.
3. Join these angle bisectors.
4. These angle bisectors's point of intersection (O') would be the incentre of Δ ABC.
5. Now, taking O' as centre and taking OH as radius. Construct a circle inside the Δ.



Incentre → Point of Intersection of angle bisectors of Δ.

Q. To construct a pentagon of given side AB = 3 cm.

Method 1:



Construction:

(i) Draw a line AB equal to the given length

(ii) With centre A and radius AB, describe circle 1.

(iii) With centre B and radius AB, describt circle 2.

(iv) These two circles would meet at C and D

(v) Join C and D

(vi) With centre C and radius AB, draw another circle intersecting CD at G. ②

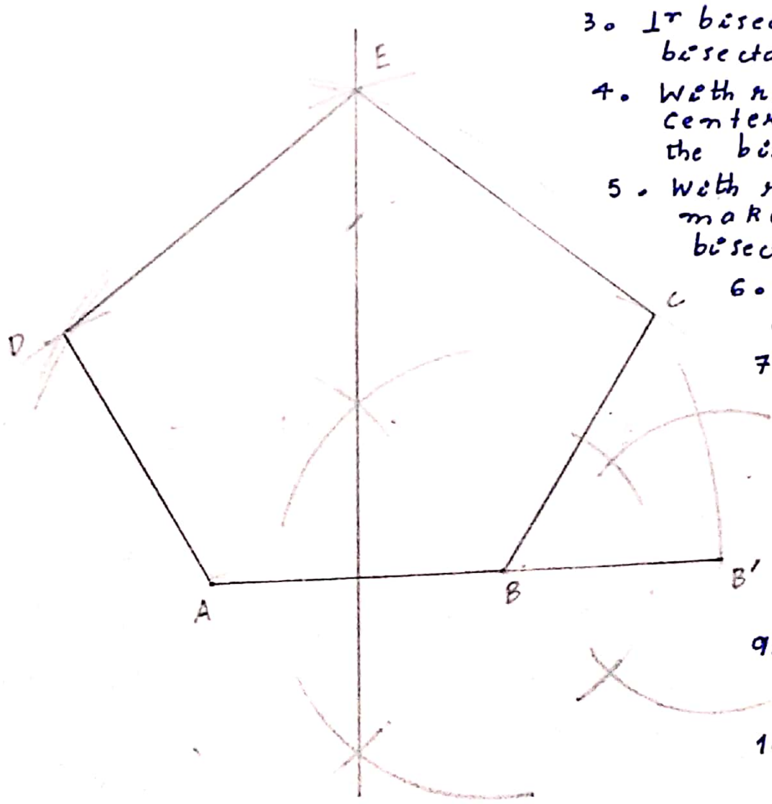
(vii) Now, the previous circle would meet circle 1 and 2 and E and F

(viii) Extend EG and EF meeting circle 1 and 2.

~~vii~~ (ix) With P and R as centres and AB as radius. Mark Q.

(x) Join BP, PQ, QR and RA.

Method 2:



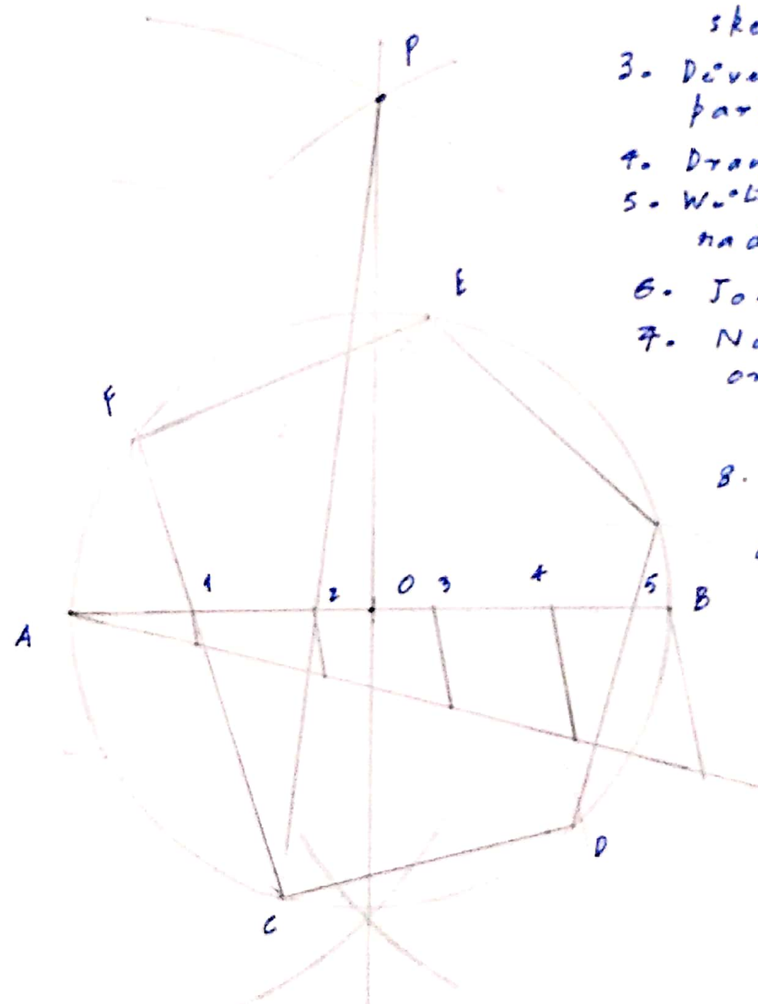
Construction:

1. Draw a line AB of given length 4cm.
2. Extend AB to B′ where AB > BB′ and BB′ = 3 cm.
3. ⊥r bisect AB and draw it's bisector
4. With radius ~~AF~~ AB′ and center A mark an arc on the bisector.
5. With radius AB′ and center B, make another arc on the bisector.
6. Name the point of intersection as E.
7. Now, with radius AB and center B. Make an arc on the left side of A
8. Now, with centre as A and radius AB. Make another arc and name the point of intersection as D.
9. Now with radius AB′ and centre A, mark an arc.
10. With radius AB and centre as B, mark another arc intersecting previous arc at C.
11. Join all the points.

Q. Inscribe a pentagon in a given circle.
Let Diameter of the given circle = 8 cm.

Construction

1. Draw a line of AB of 8cm.
2. Let O be the centre of AB. Now taking O as centre and OA as radius, sketch a circle.
3. Divide AB into 5 equal parts.
4. Draw a ⊥r to AB through O.
5. With centres A and B and radius AB. Mark P.
6. Join P2 extending it C.
7. Now making arc of 4cm on the circumference of circle
8. We obtain D, B, E and F
9. Join these.



Q. To construct a hexagon of a given side with general method.

Let the side of hexagon = 3 cm.

Construction:

(i) Draw a line AB of given side

(ii) Taking A as centre and A as centre radius = AB. Sketch a semicircle meeting extended AB at P.

(iii) Now making 6 equal divisions of semi-circle.

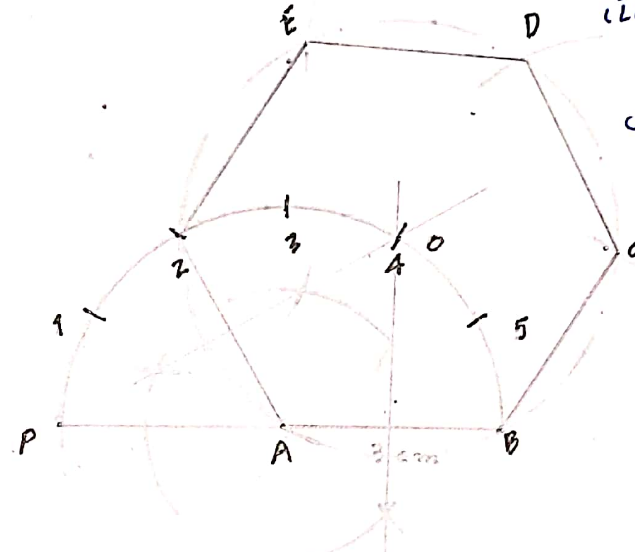
(iv) Now join A2 and draw ⊥r bisectors of AB and A2

(v) ⊥r bisectors meet at 'O'.

(vi) Now centre O and radius AO, sketch a circle.

(vii) Taking radius AB and centre B mark 'C'. Similarly get D and E.

(viii) Join these points.



Q. To construct a hexagon, of given side length.

Let the side of hexagon = 4 cm.

Construction:

(i) Draw line AB of length 4 cm

(ii) ⊥r bisect AB at name the intersection as 'O'.

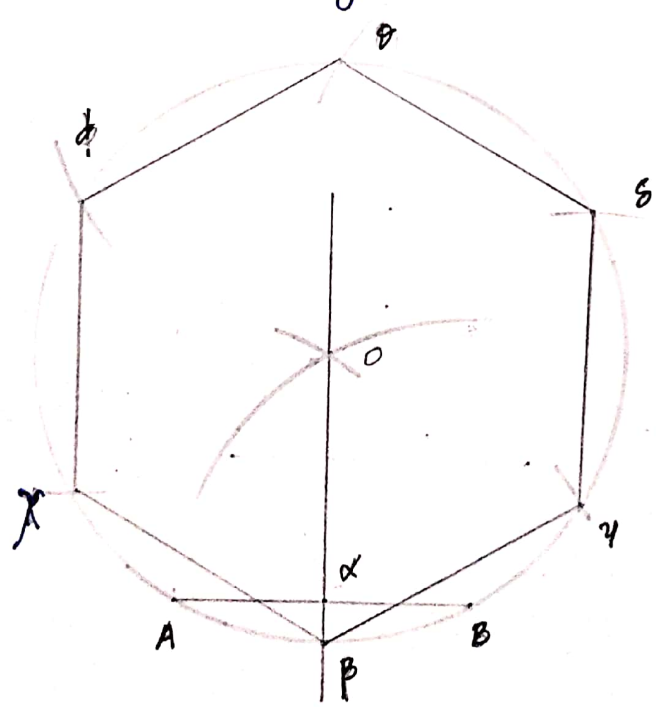
(iii) Now, take 'O' as centre and radius 'AB', sketch a circle

(iv) circle and ⊥r bisector meet at β

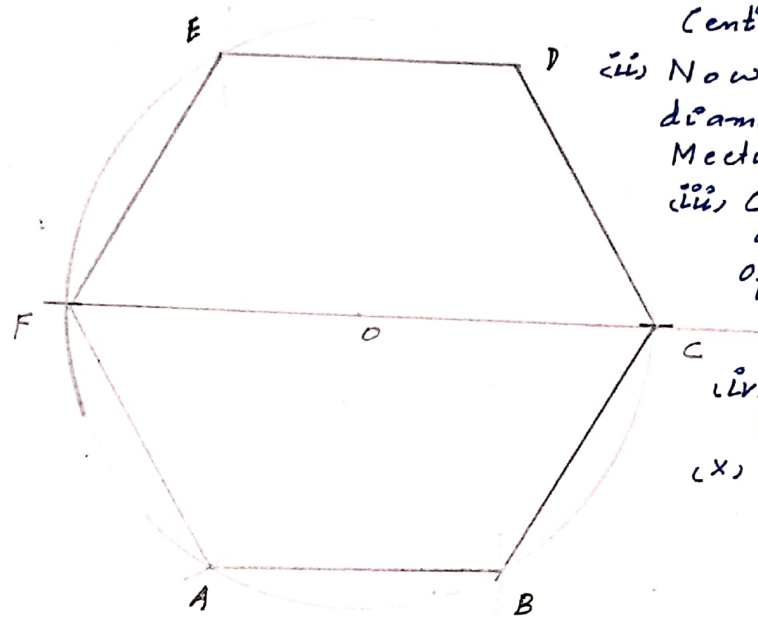
(v) Now makes arc of given side length at circumference.

We get γ, δ, θ, φ and χ.

Join these sides.



Alternative method :



(i) Draw a circle of same radius as of side length.
Centre → O

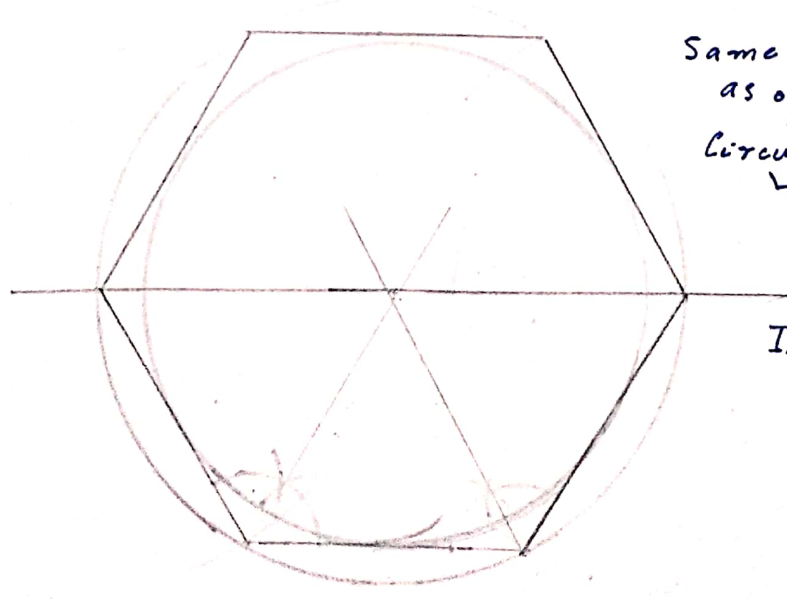
(ii) Now, make horizontal diameter.
Meeting circle at F and C

(iii) C as centre, make arc on circumcircle of given side length

(iv) We get A, B, D and E

(v) Join ~~these~~ sides.

Q. Circumscribing a hexagon.
Inscribing a hexagon.



Same procedure as of in Δ.

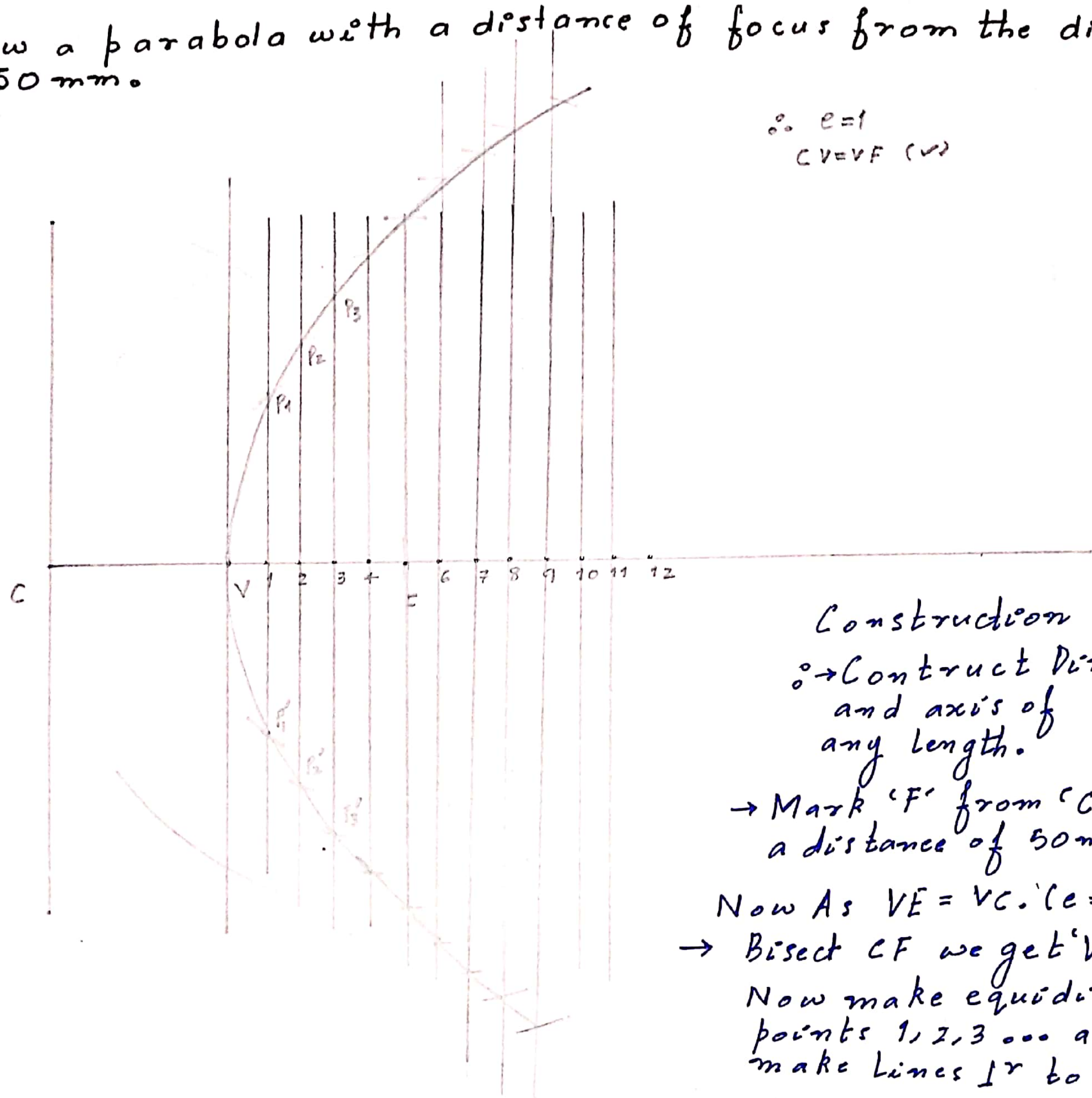
Circumcentre
→ ⊥r bisector of sides

Incentre
→ Angle bisector of polygon.

PARABOLA

Q. Draw a parabola with a distance of focus from the directrix is 50 mm.

∴ $e = 1$
$CV = VF$ (V)



Construction

∴ → Contruct Directrix and axis of any length.

→ Mark 'F' from 'C' at a distance of 50 mm.

Now As $VF = VC$. ($e = 1$)

→ Bisect CF we get 'V'.

Now make equidistant points 1, 2, 3 ... and make Lines ⊥r to axis.

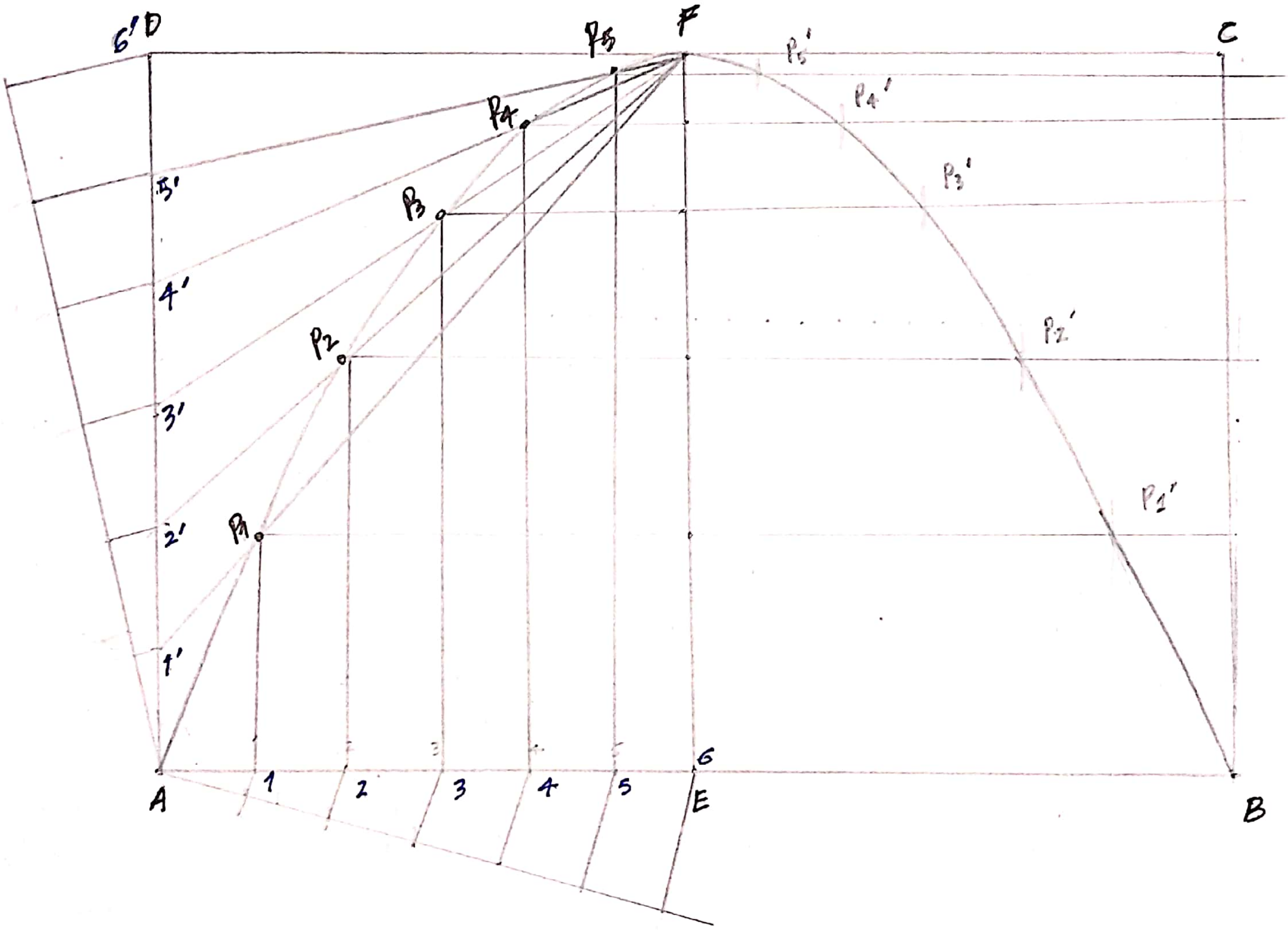
→ With centre F and distance C1, draw arcs cutting the ⊥r through 1 at P_1.

→ Similarly get P_2, P_3 and so on.

→ Free hand join these.

→ Constructing parabola through rectangle method

Dimensions = 150×100 mm.



Construction:

→ Construct rectangle of given dimensions.

→ Bisect AB at E and CD at F. Join EF.

→ Equally divide AE and AD. (Let's say into 6 parts)

→ Joint 1'F, 2'F, ... 6'F.

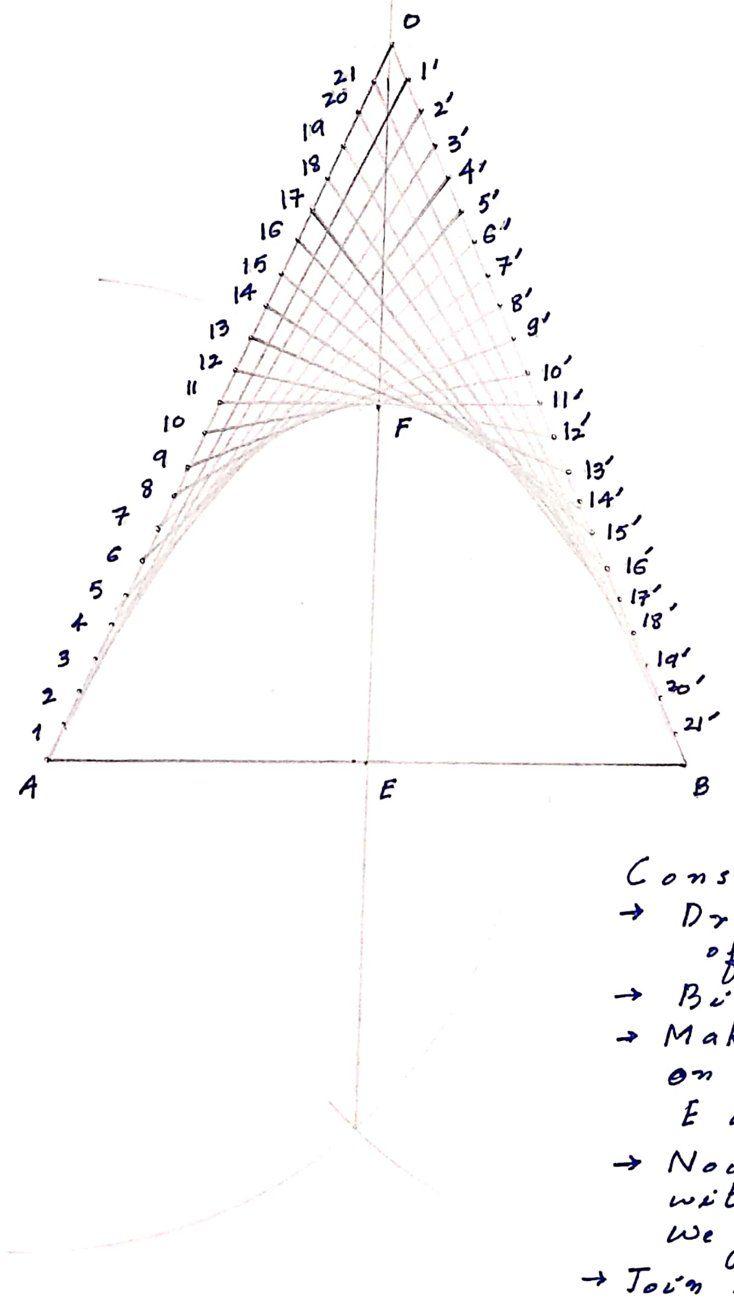
→ Now joint point 1 to line joint 1'F and we get P_1.

=> Similarly get P_2, P_3, P_4 and P_5

~~Freehand hand~~ Join these.

Q. Constructing parabola through tangent method.

AB = 90mm
EF = FO = 50mm

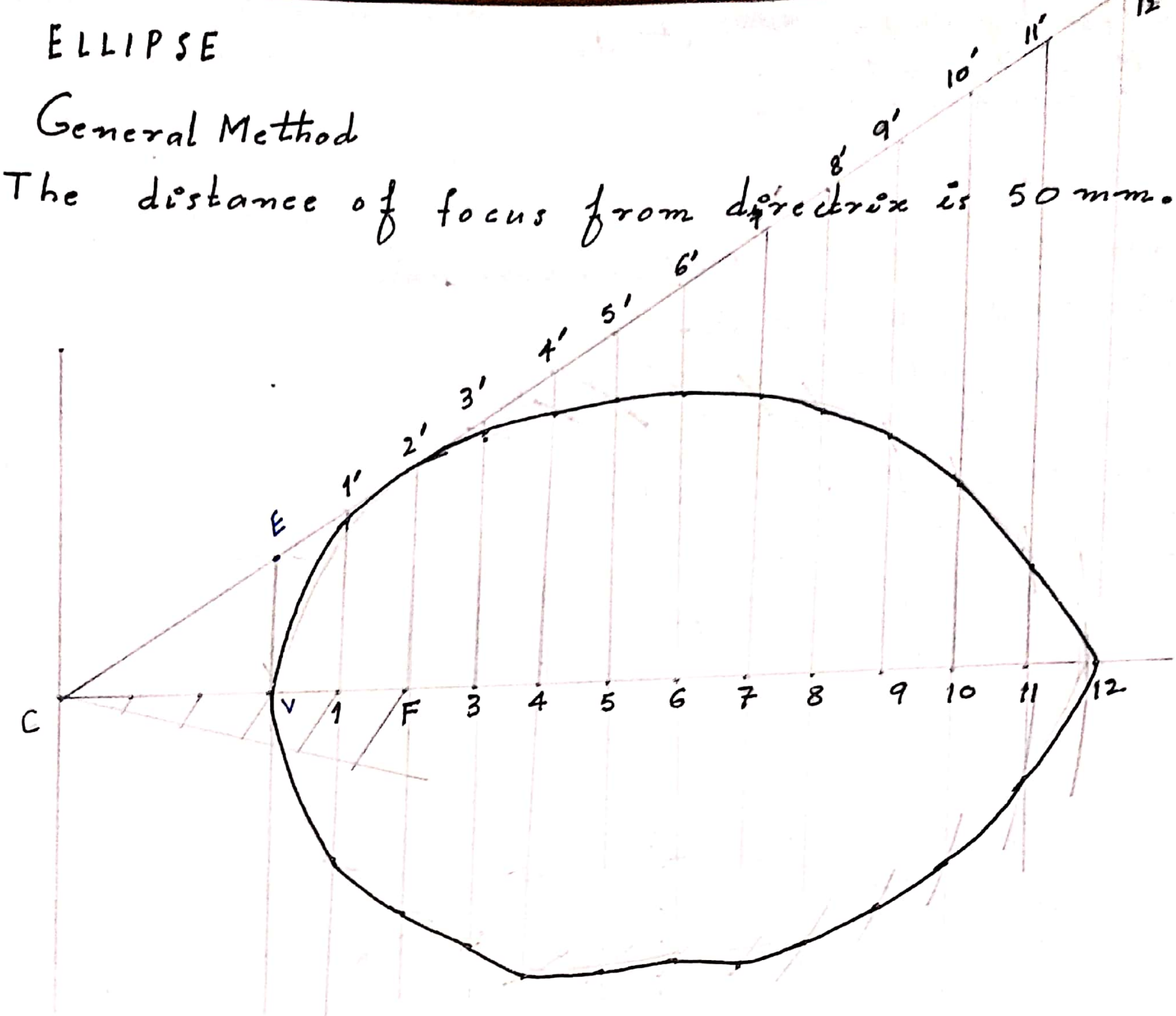


Construction
→ Draw a line AB of 90 mm.
→ Bisect AB at E
→ Make an arc of 50mm on bisector at F taking E as centre.
→ Now, make same arc with F as centre. we get O
→ Join AO and OB.
→ Make equal divisions on OA and OB.
→ Join 11', 22' and so on.

ELLIPSE

→ General Method

→ The distance of focus from directrix is 50 mm.



Construction:

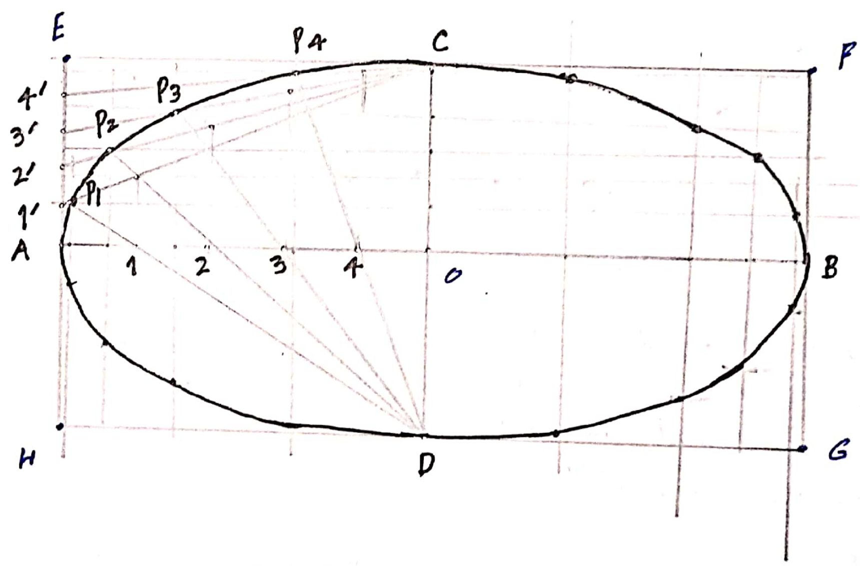
1. Draw directrix and axis
2. Mark F from 50 mm from C.
3. Make CF into 5 equal division
4. As, $e = \frac{2}{3}$, we get V on 2nd from F.
5. Now, VE = VF.
6. Join CE, extend it. Making ⊥r through 1, 2, 3, ... meeting CE at 1', 2', ...
7. Now, taking 11' as radius and 'F' as centre. Make an arc.
8. Similarly 22', 33' with centre F. We get P_1, P_2, ...
9. Join these points.

→ Ellipse by rectangle method.

Major Axis = 100 mm
Minor Axis = 50 mm

Construction:

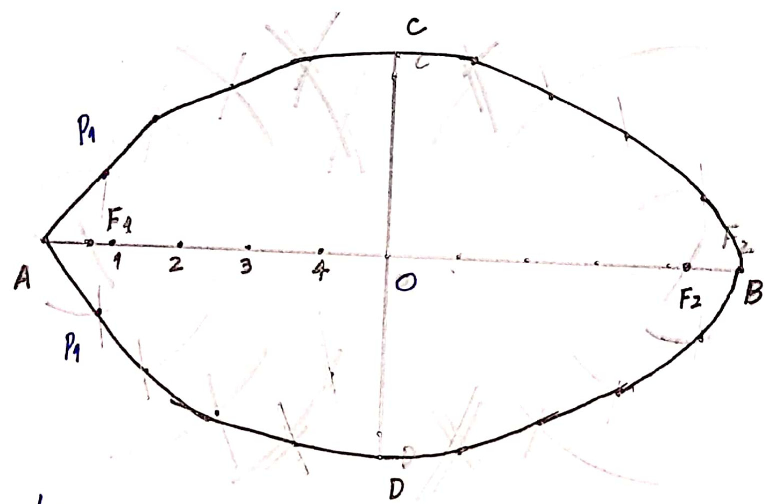
(i) Make AB (major) and CD (minor) axis.
(ii) Make rectangle EFGH.
(iii) Divide OA and AE, into equal 5 parts.
(iv) Join 1'C, 2'C, 3'C, 4'C.
(v) Join D to line 1'C, 2'C and so on.
We get P_1, P_2, P_3, P_4.
(vi) Join P_1, P_2 smoothly.



ELLIPSE

Circular Arc Method

Major Axis = 100 mm (AB)
Minor Axis = 50 mm (CD)



Construction :

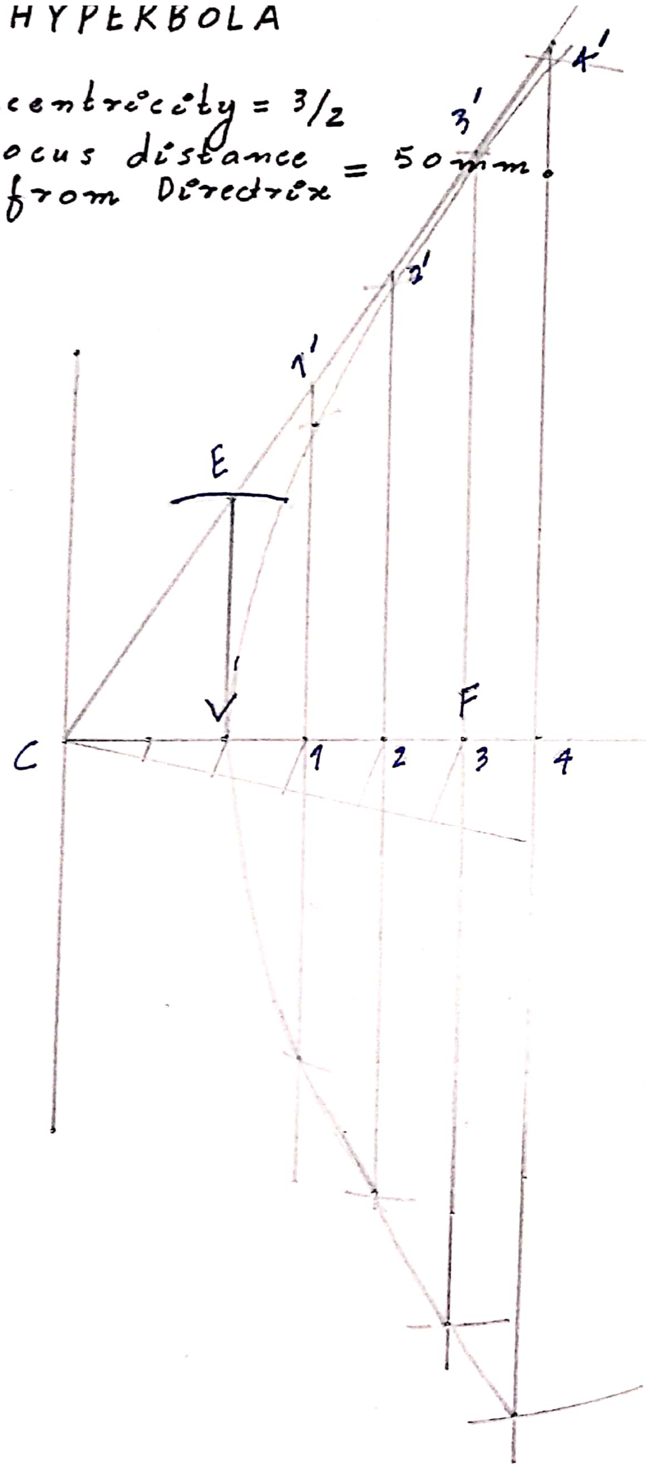
(i) Draw major axis AB and minor axis CD, their point of intersection O.
(ii) With centre C and radius OA mark F_1 and F_2.
(iii) Divide OA into 5 equal parts. (1, 2, 3 and 4)
(iv) With centres F_1 and F_2 and radius equal to A1, draw arcs on both sides of AB.
(v) With same centres and radius equal to B1, draw arcs intersecting the previous arcs at four points marked P_1.
(vi) Similarly, with radii A2 and B2, A3 and B3 etc. obtain more points.
(vii) Draw a smooth curve through these points.

HYPERBOLA

General Method.

Eccentricity = $3/2$

Focus distance from Directrix = 50 mm.



Construction

(i) Construct directrix and axis.

(ii) Mark 'F' from C at a distance 50 mm.

(iii) Mark V at at 3rd division. $\frac{CV}{VF} = \frac{2}{3}$ → $\frac{VF}{VC} = \frac{3}{2}$.

(iv) VF = VE

(v) Follow the same procedure as ellipse.

Arc Method

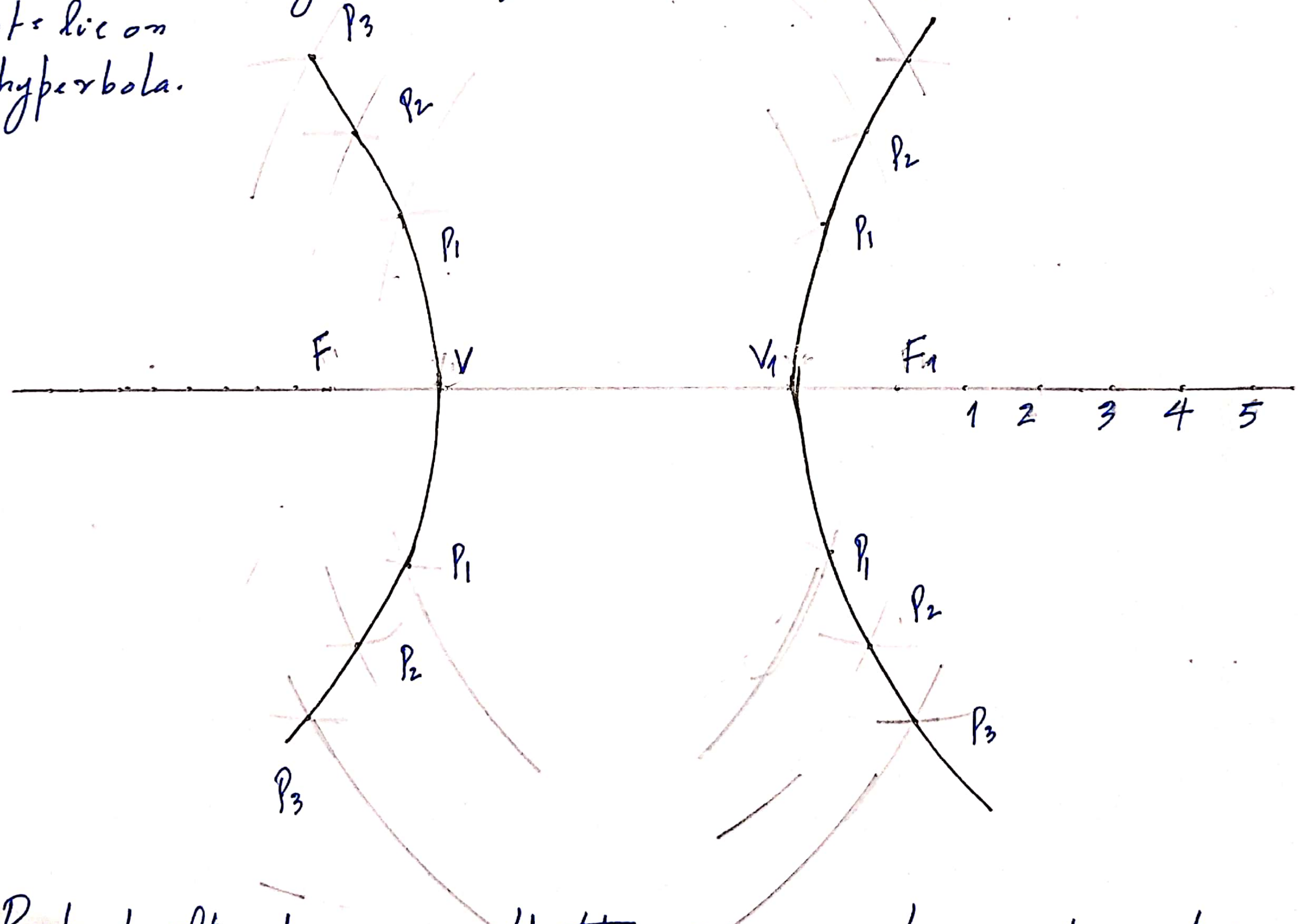
Distance between Focii $= F_1F_2 = 80$ mm.
$V_1V_2 = 50$ mm.

(i) Draw a horizontal line as axis and on it mark the given F and F_1, and vertices V and V_1.

(ii) Mark any number of points 1, 2, 3, etc to the right of F_1.

(iii) With F and F_1 as centres and radius, say V_2, draw four arcs.

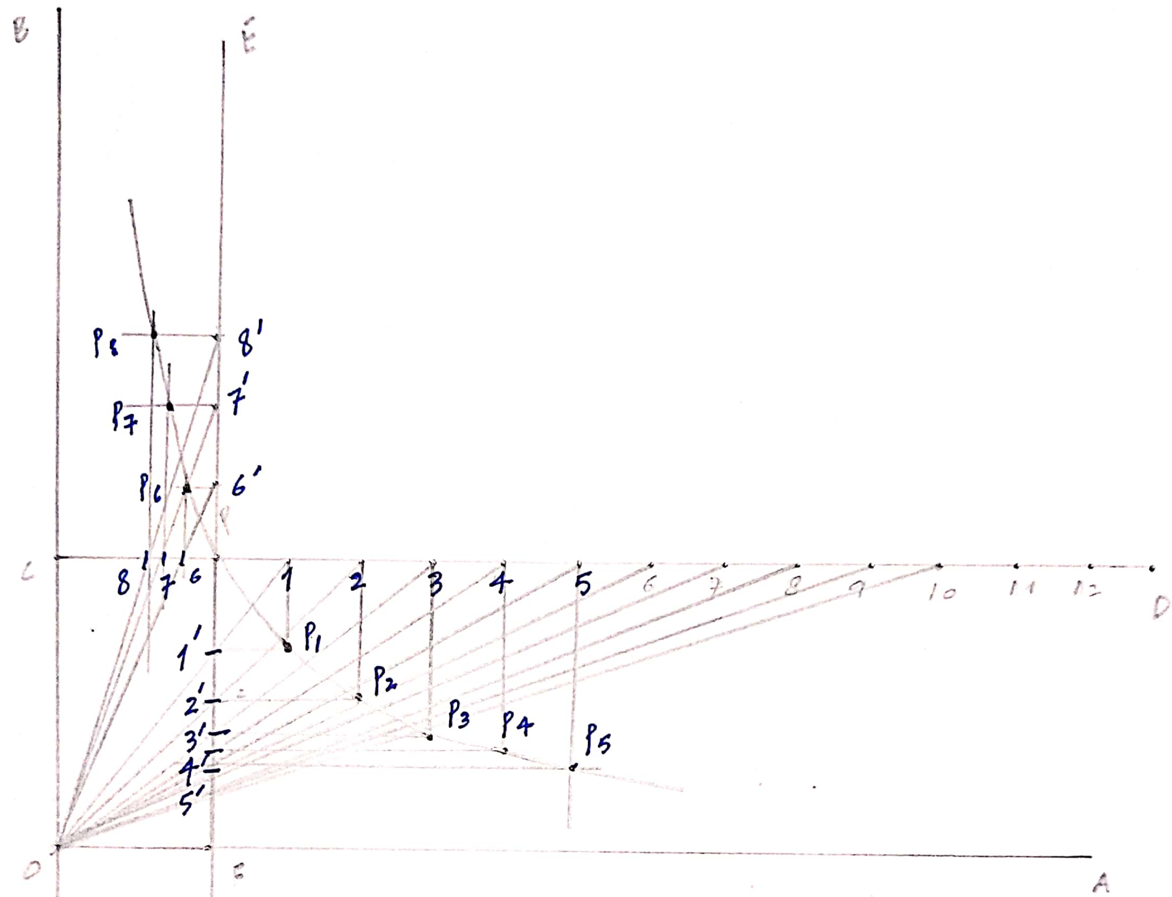
(iv) With the same centres and radius V_1 2, draw four more arcs intersecting the first arcs at points P_3, P_2. Then these points lie on the hyperbola.



(v) Repeat the process with the same centres and radii V_1 and $V_1$1, V3 and $V_1$3, etc. Draw the required hyperbola through the points thus obtained.

Asymptotes and Vertex Method

40 mm, 20 mm from asymptote.



Construction:

(i) Draw lines OA and OB at right angles to each other.

(ii) Mark the position of the point P.

(iii) Through P, draw lines CD and EF // to OA and OB respectively.

(iv) Along PD, mark a no. of 1, 2, 3, etc. not necessarily equidistant.

(v) Draw lines O1, O2, etc. cutting PF at points 1', 2', etc.

(vi) Through point 1, draw a line // to OB and through 1', draw a line // to OA, intersecting each other at a point P_1.

(vii) Obtain other points in the same manner.

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

→ Representative Factor:

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

→ Length of scale:

$$L_s = R.F \times \text{maximum length}$$

10 milimeter = 1 centimeter
10 centimeter = 1 decimeter
10 decimeter = 1 meter
10 meter = 1 decameter
10 decameter = 1 heptometer
10 heptometer = 1 kilometer

Graphical Scale
1. Plain scale
2. Diagonal scale
3. Vernier Scale
4. Comparitive Scale
5. Chord Scale

Plain Scale

R.F

Example: To construct a scale of 1:40 to read meters and decimeters and long enough to measure 6 m and mark on it a distance of 4.7 m.

$\therefore$ $R.F = \frac{1}{40}$

$L.S = R.F \times \text{Max Length} = \frac{1}{40} \times 6\text{ m} = \frac{1}{\cancel{40}} \times \overset{3}{\cancel{6}} \times \overset{5}{\cancel{10}} \times 1\cancel{0}\text{ cm} = 15\text{ cm}$

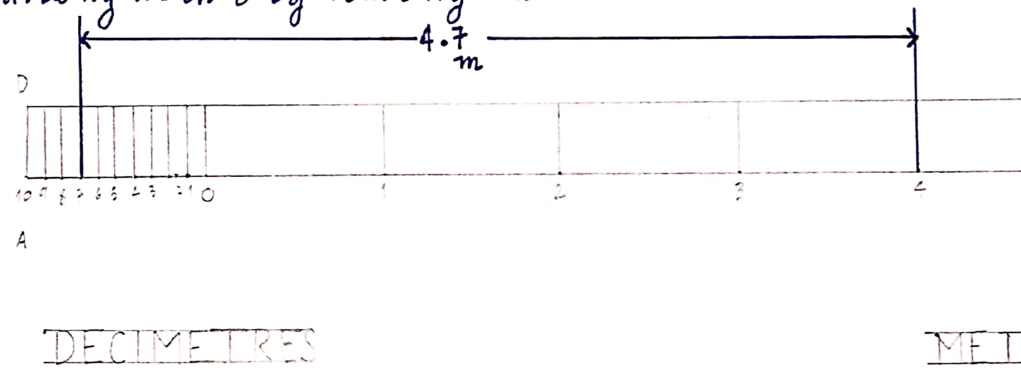
→ Steps for constructions:

Step 1: As, LS = 15 cm, firstly draw a line AB of length 15 cm i.e equal to LS.

Step 2: Now, draw AD and BC of length 1 cm each and complete the rectangle.

Step 3: After completing the rectangle, as the maximum length is given as 6 Km, divide AB into 6 equal parts.

Step 4: After dividing AB into 6 equal parts, number the divisions starting with 0 by leaving the first division.



Step 5: Make 10 equal division in the first block i.e AO, and number them

Step 6: As, we have to mark 4.7 m on the scale, therefore make an extensi line on the 4 meter mark and another on the 7 decimeter mark

Hence, we have successfully constructed a plaine scale and marked the distance of 4.7 m on it.

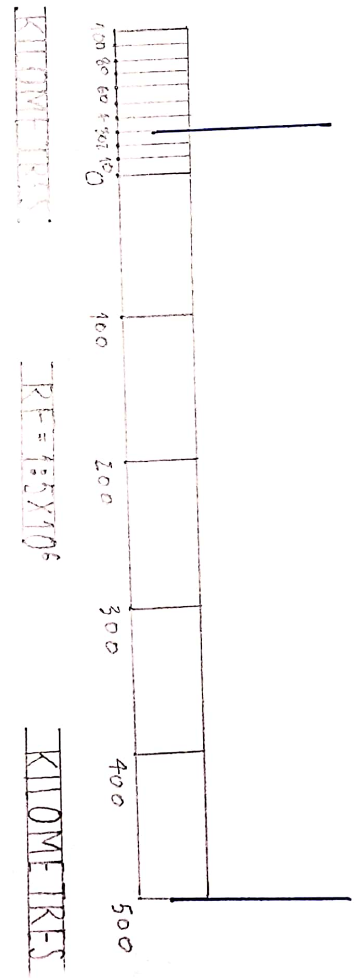
Example: The distance between two towns is 250 km and is represented by a line of length 50 mm on a map.

Construct a plaine scale to read 600 km and show the distance 530 km on it.

$$R.F = \frac{50\,mm}{250\,km} = \frac{50\times10^{-1}\,cm}{250\times10^{5}\,cm} = \frac{1}{5\times10^{6}}$$

$$\therefore \quad L.S = R.F \times \text{Maximum length}$$

$$= \frac{50\times10^{-1}}{250\times10^{5}}\times(600\,km) = \frac{5}{250\times10^{5}}\times 600\times10^{5} = 12\,cm$$



$\frac{12}{6} = 2$

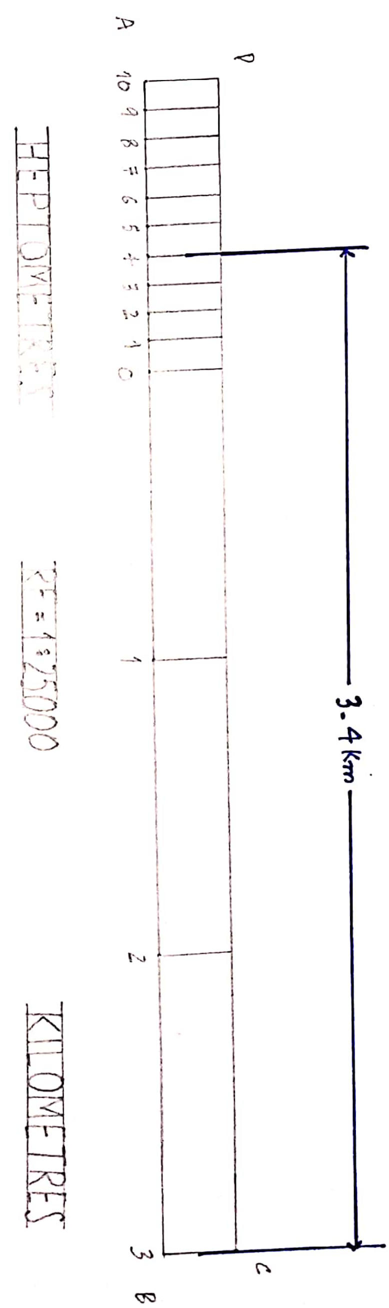
Example : Construct a scale of R.F equal to $\frac{1}{25000}$ to read kilometer and heptometer, long enough to measure 4 Km to mark the length of 3.4 km.

$$1\ km = 10^3\ m$$
$$1\ m = 10^2\ cm$$
$$\therefore 1\ km = 10^5\ cm$$

$$R.F = \frac{1}{25000}$$

$$L.S = R.F \times \text{Maximum length}$$

$$= \frac{1}{25 \times 10^3} \times 4\ km = \frac{1}{25 \times 10^3} \times 4 \times 10^5\ cm = \frac{4 \times 100}{25} = 16\ cm.$$



Diagonal Scale

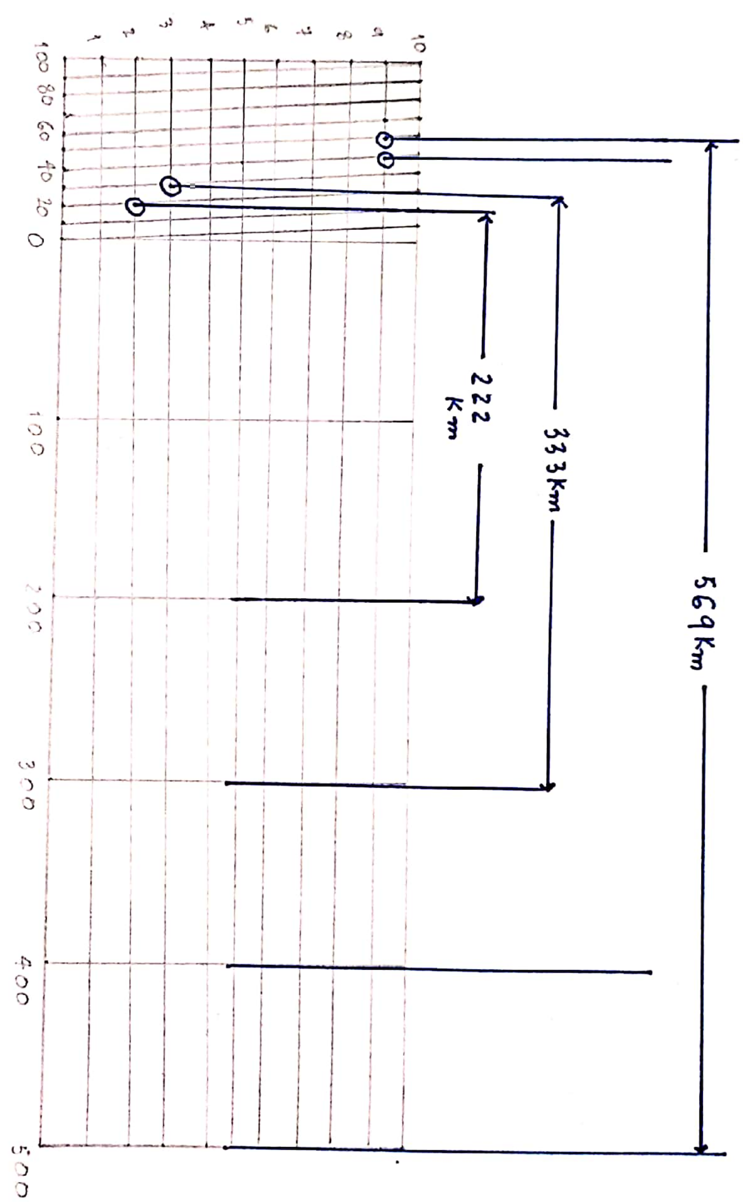
Example: The distance between Delhi and Agra is 200 km in a railway map it is represented by a line 5 cm long. Find it's RF and draw a diagonal scale to show a single km and measure upto 600 km.

(a) 222 Km
(b) 336 Km
(c) 459 Km
(d) 569 Km.

$$R.F = \frac{5}{200 \times 10^5} = \frac{1}{40 \times 10^5}$$

$$\therefore L.S = R.F \times \text{Maximum Length}$$

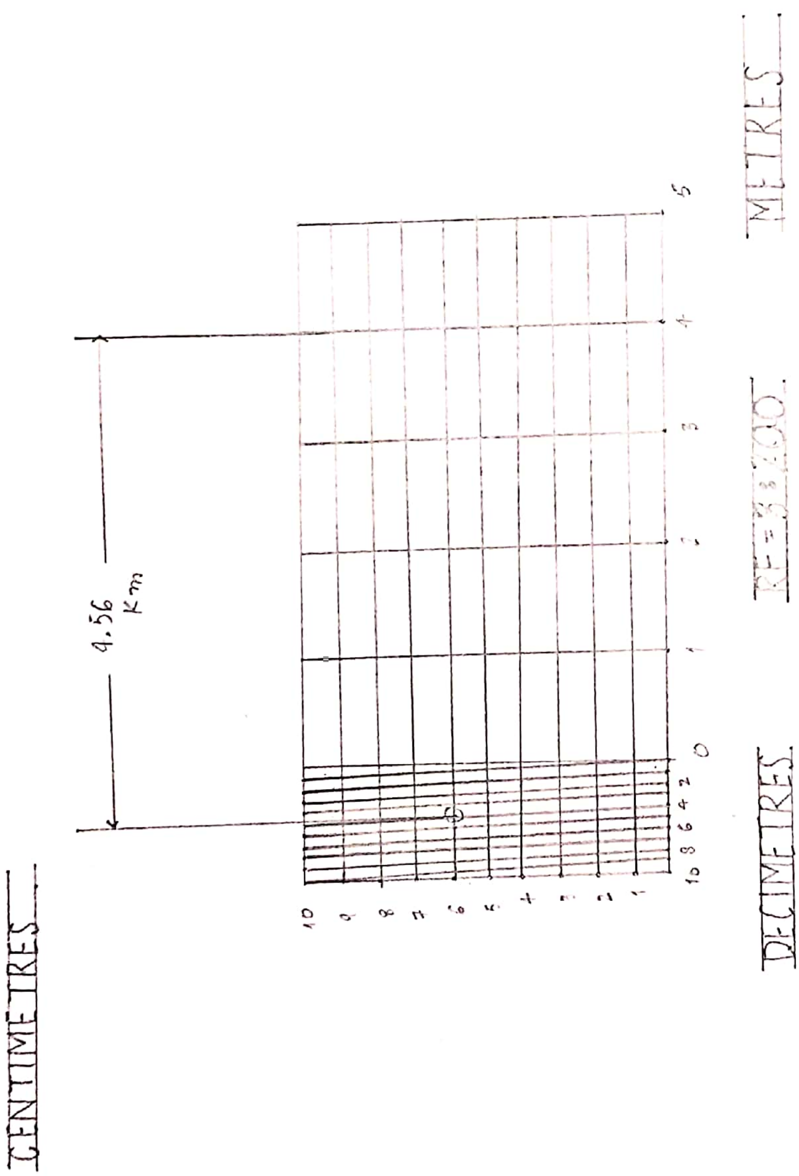
$$= \frac{1}{\cancel{4} \times 10^6} \times \cancel{600}\,{}^{300\ 150} \times 10^5 = 15\text{ cm}$$



Example: Construct a diagonal scale of $RF = \frac{3}{200}$ shown in meter, decimeter and centimeter. The scale measures upto 6m and show 4.56 m.

$$R.F = \frac{3}{200}$$

$$L.S = R.F \times \text{Maximum length}$$
$$= \frac{3}{200} \times 6 \times 10^2 = 9\ cm.$$



Vernier Scale.

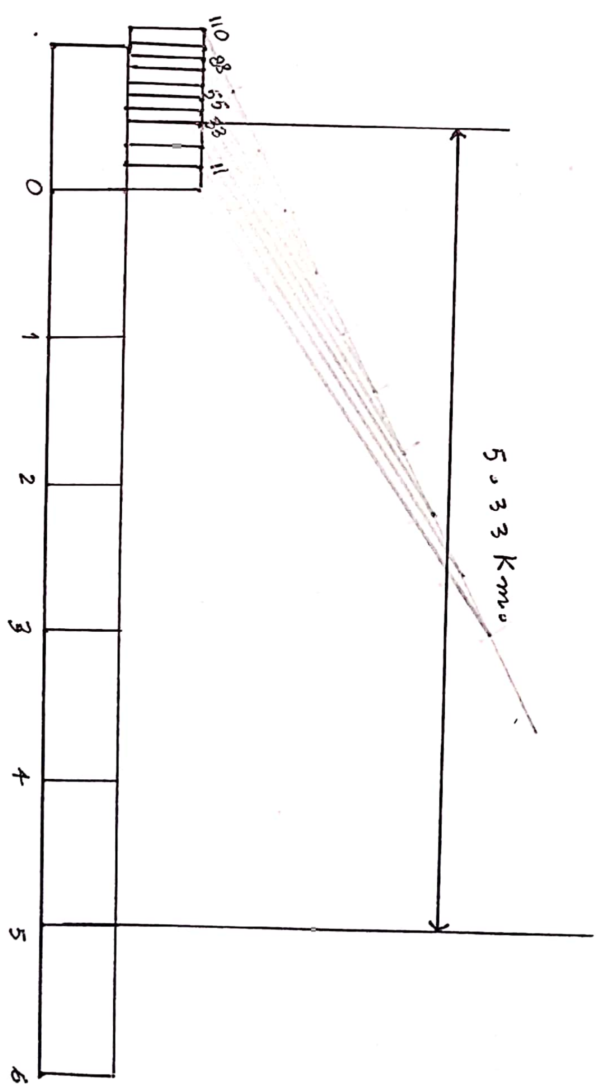
Q. A map of size 500x50 cm² represent an area of 6250 sq km.

Construct a vernier scale to measure km, hectometer, and decameter and long enough to measure 7 km. Mark 5.33 km on it.

$$\therefore RF = \frac{\text{Drawing Dimension}}{\text{Actual Dimension}} = \frac{500\times50}{6250\times10^{10}} \text{ cm}^2$$

$$= \frac{\sqrt{500\times50}}{\sqrt{6250}\times10^5} = \frac{158.113}{79.056\times10^5} = \frac{2}{10^5}$$

$$\therefore LS = R.F \times ML = \frac{2}{10^5}\times 7\times10^5 = 14 \text{ km.}$$

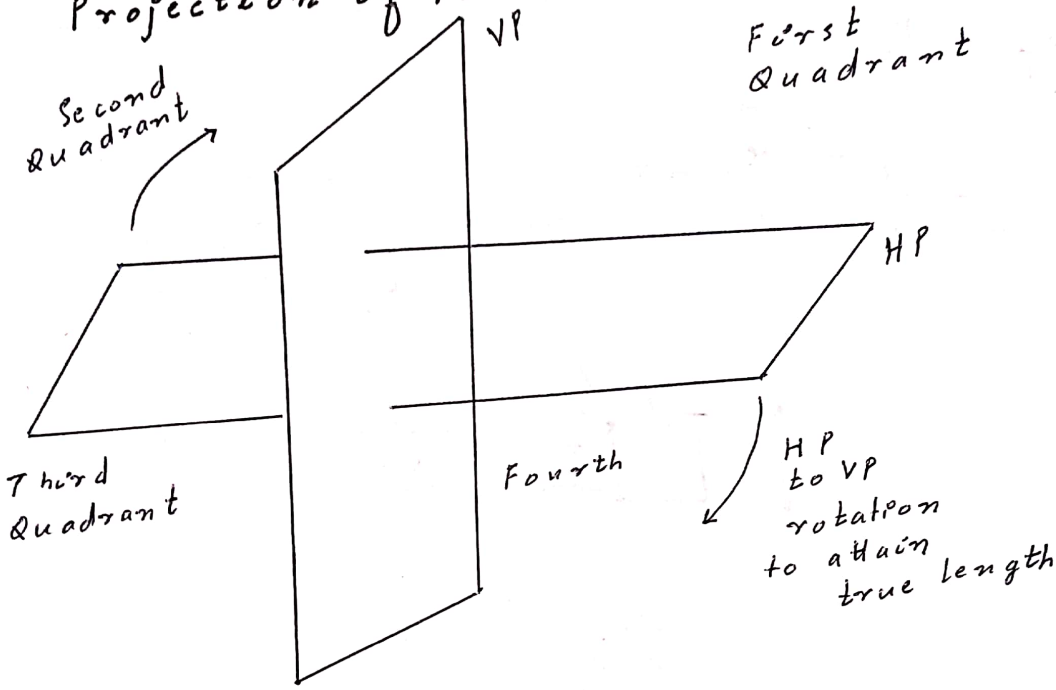


5.33
0.33
5 km

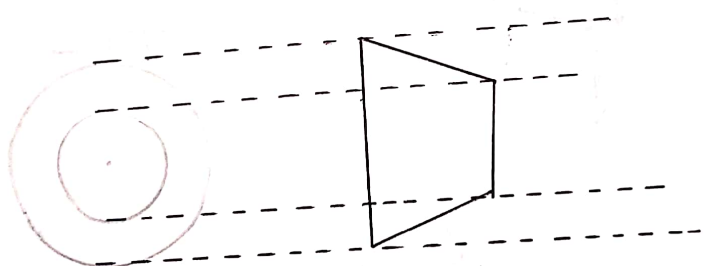
Q. 1

Projection of Points.

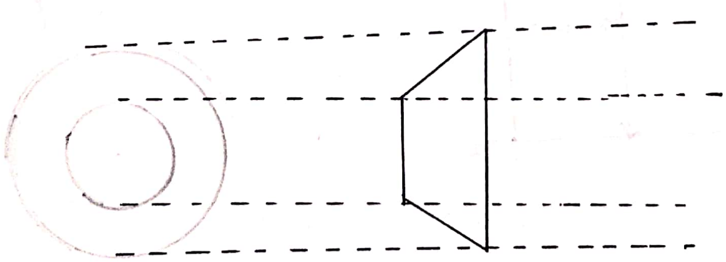
HP always rotates clockwise



Front View → Elevation View
Top View → Plane View

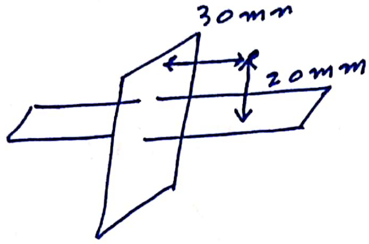


First angle projection.

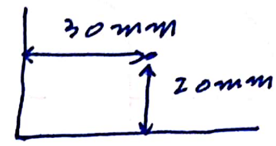


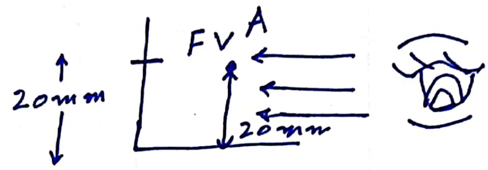
Third Angle Projection.

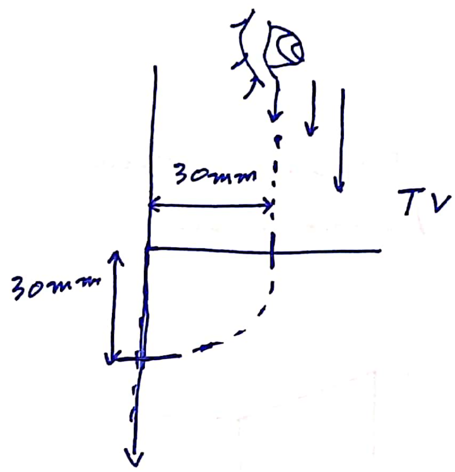
Q. A point is 20 mm above HP and 30 mm in front of VP.



=>





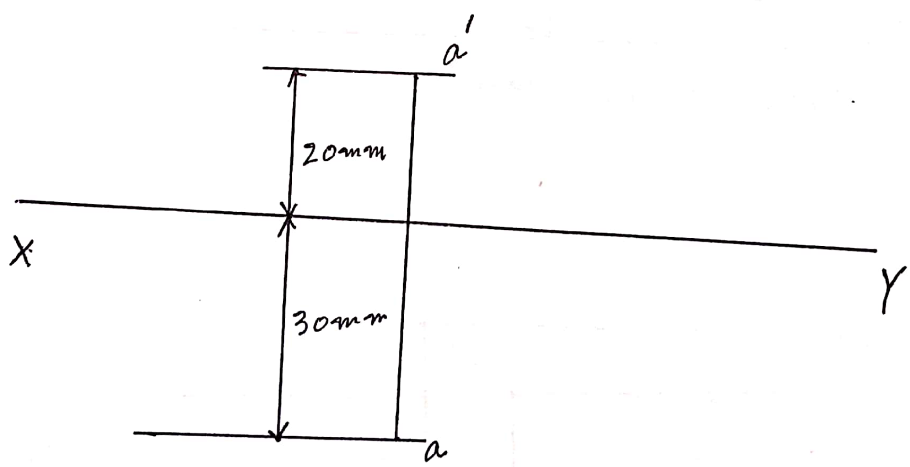


Point → A (capital)

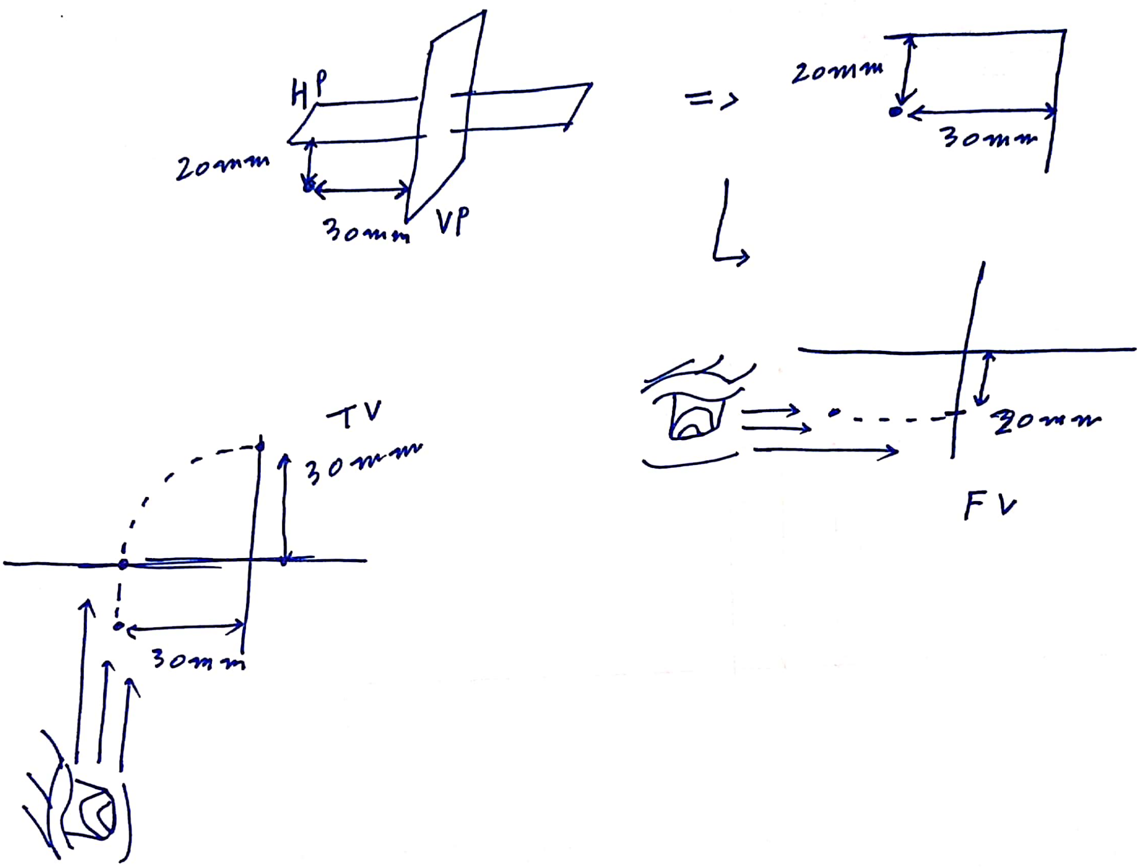
F.V → a' (small with dash)

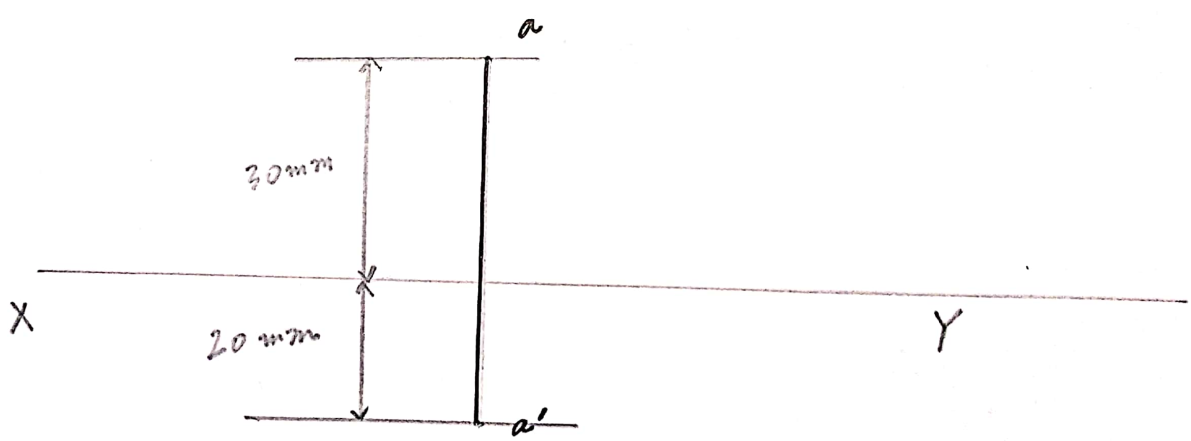
T.V → a (only small)

=>



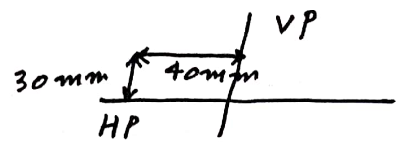
Q. A point A 20 mm below HP and 30 mm behind VP

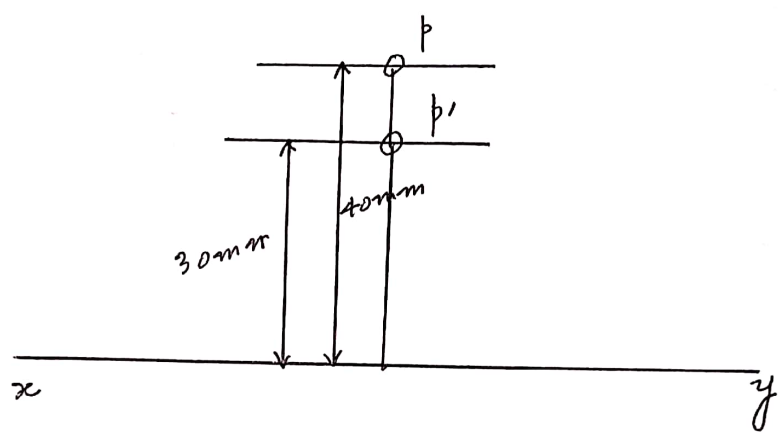




Q. A point P 30 mm above HP and 40 mm behind VP

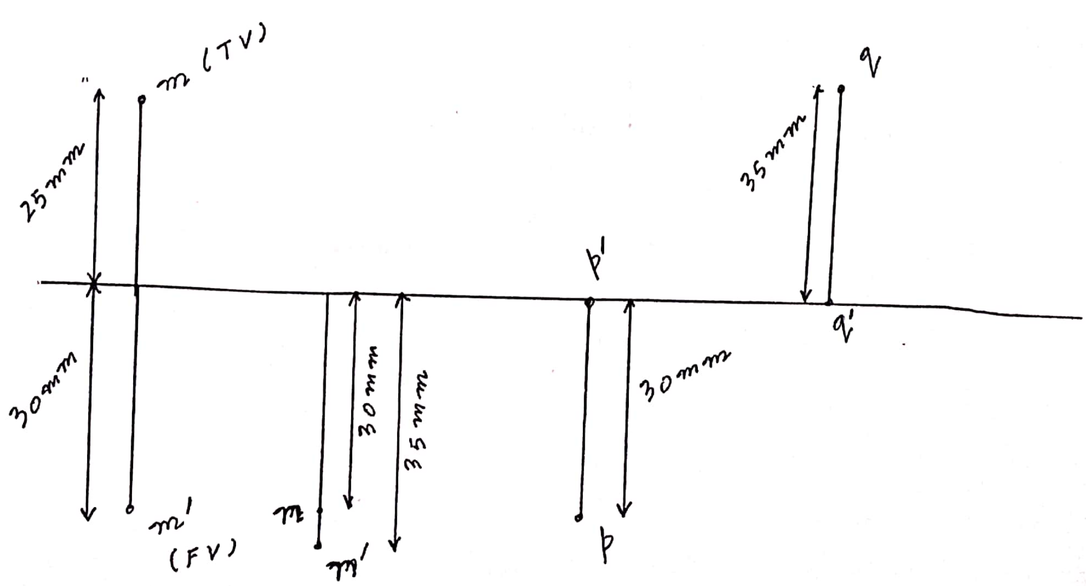
∴





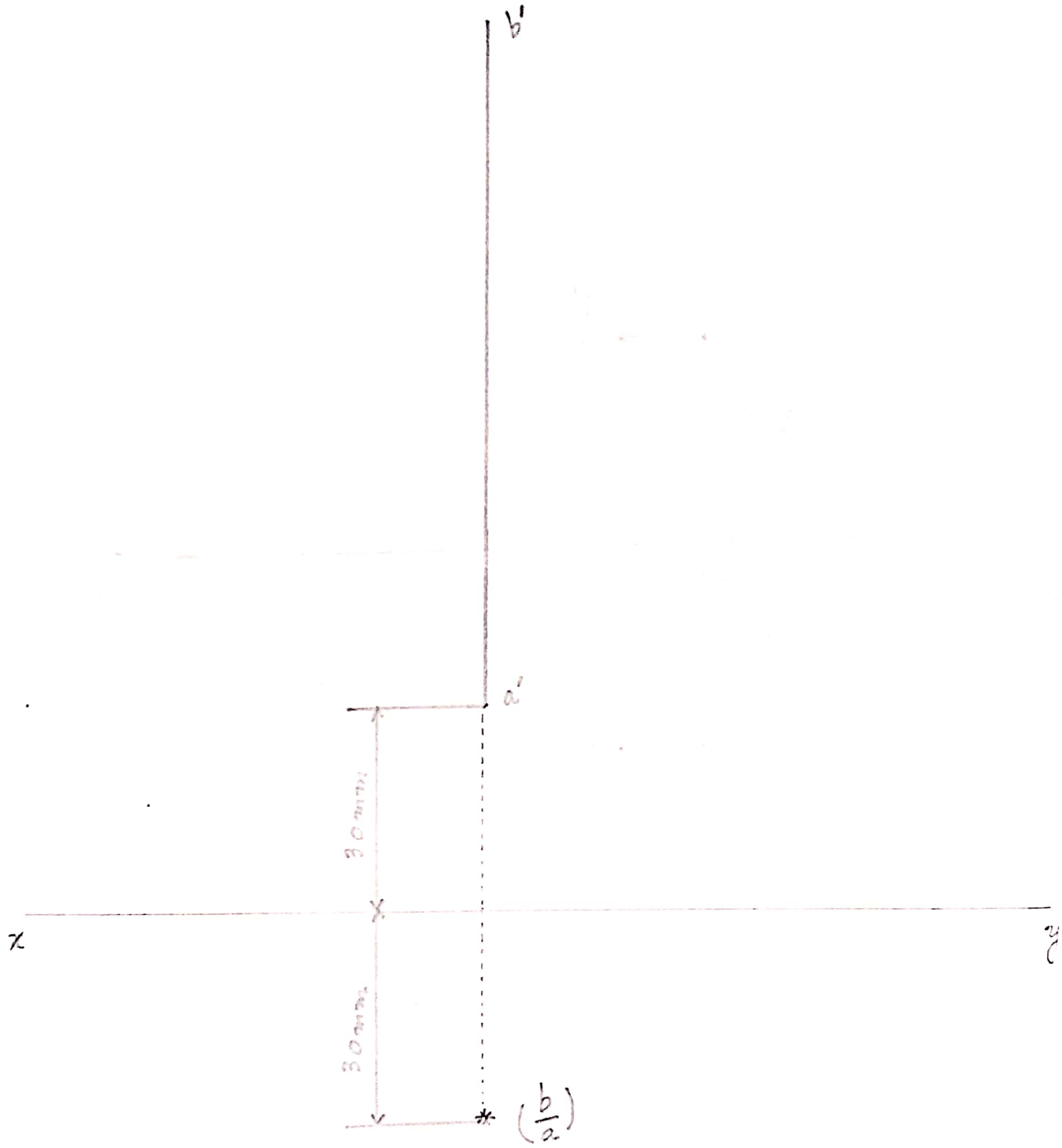
Q. Draw the projection of the following points on the same reference xy line, keeping convenient distances.

→ M → 30 mm below HP and 25 mm behind VP
→ N → 35 mm below HP and 30 mm in front of VP
→ P → On HP and 30 mm in front of VP
→ Q → On HP and 35 mm behind VP.

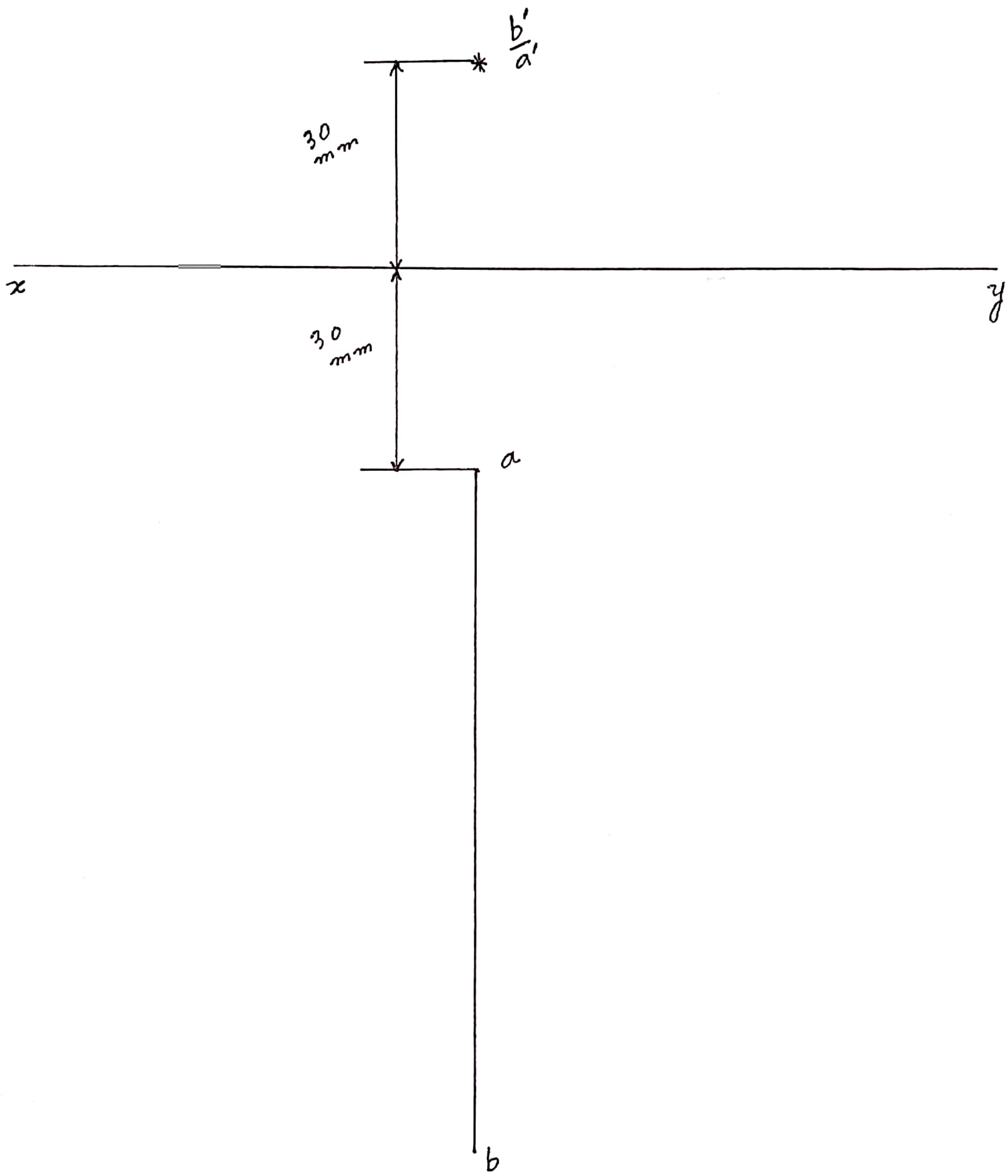


Projection of Lines

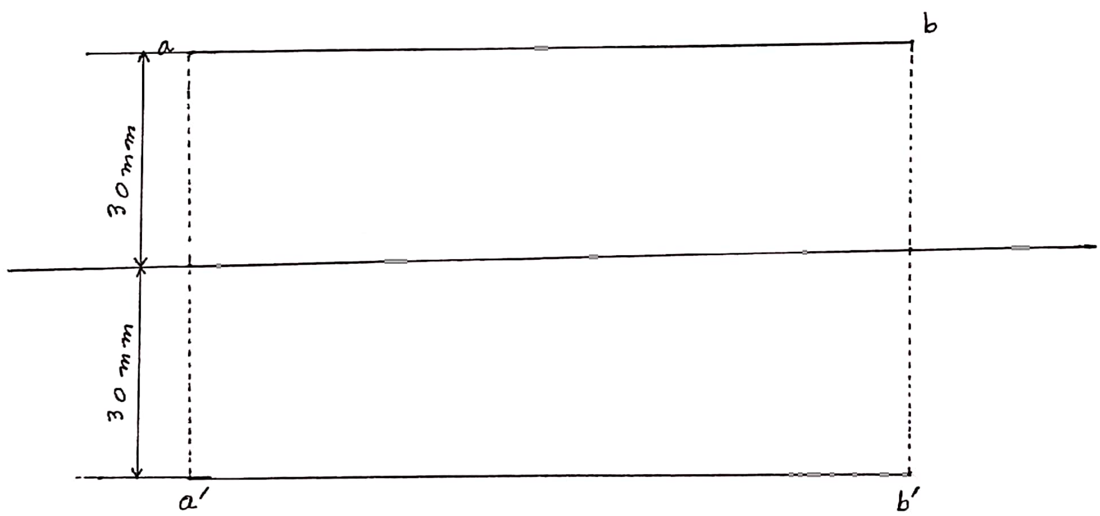
Q. A line AB 10 cm long and parallel to VP and ⊥r to HP and point 'A' is 30mm in front of VP and 30mm above HP.



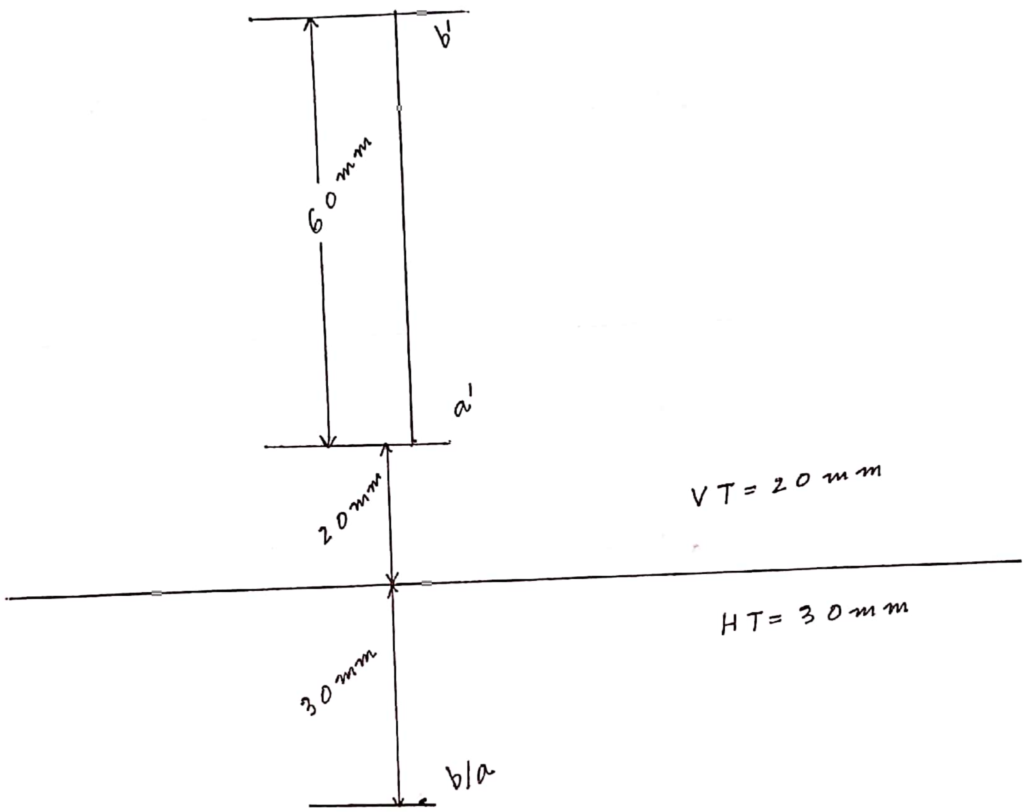
Q. A line AB 10 cm $\perp^r$ to VP and // to HP. Point A is 30 mm above HP and 30 mm in front of VP.



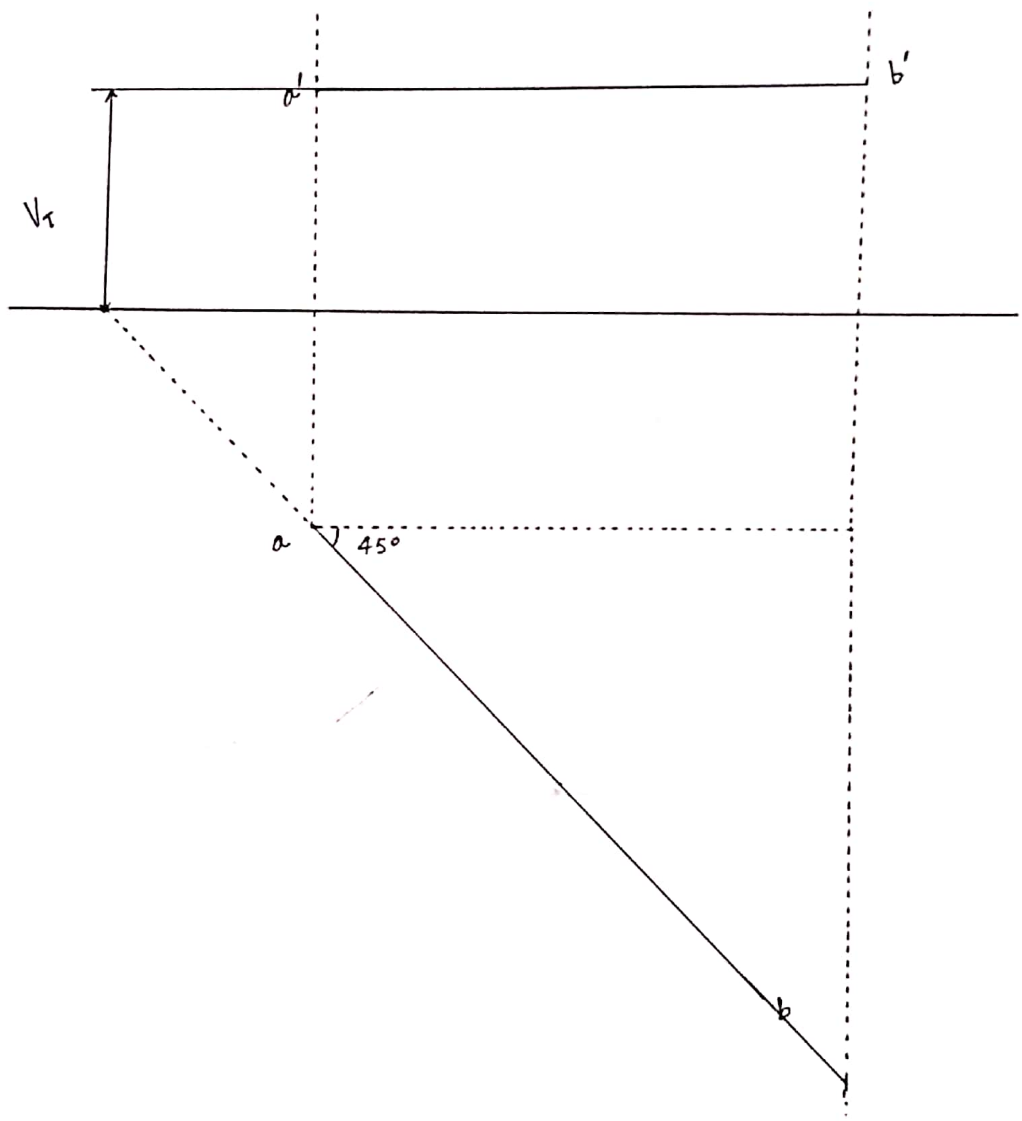
Q. A line AB, 10 cm long is ∥ to HP and ∥ to VP. Point A is 30 cm infront of VP and 30 cm above HP.



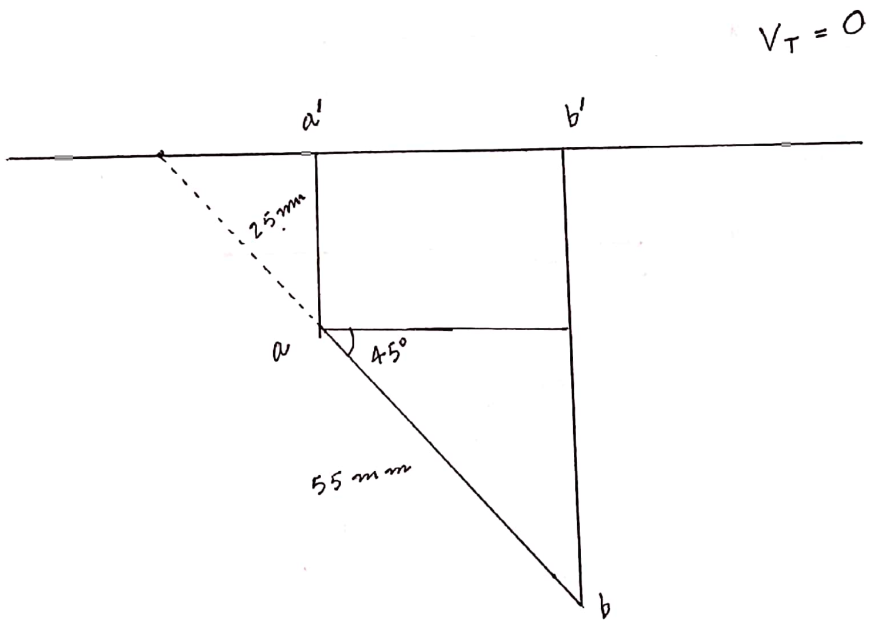
Q. A line AB 60mm long has its end 20mm above HP and 30mm infront VP ~~the~~ line cuts ⊥ to HP and ∥ to VP. Draw it's projection, mark the traces.



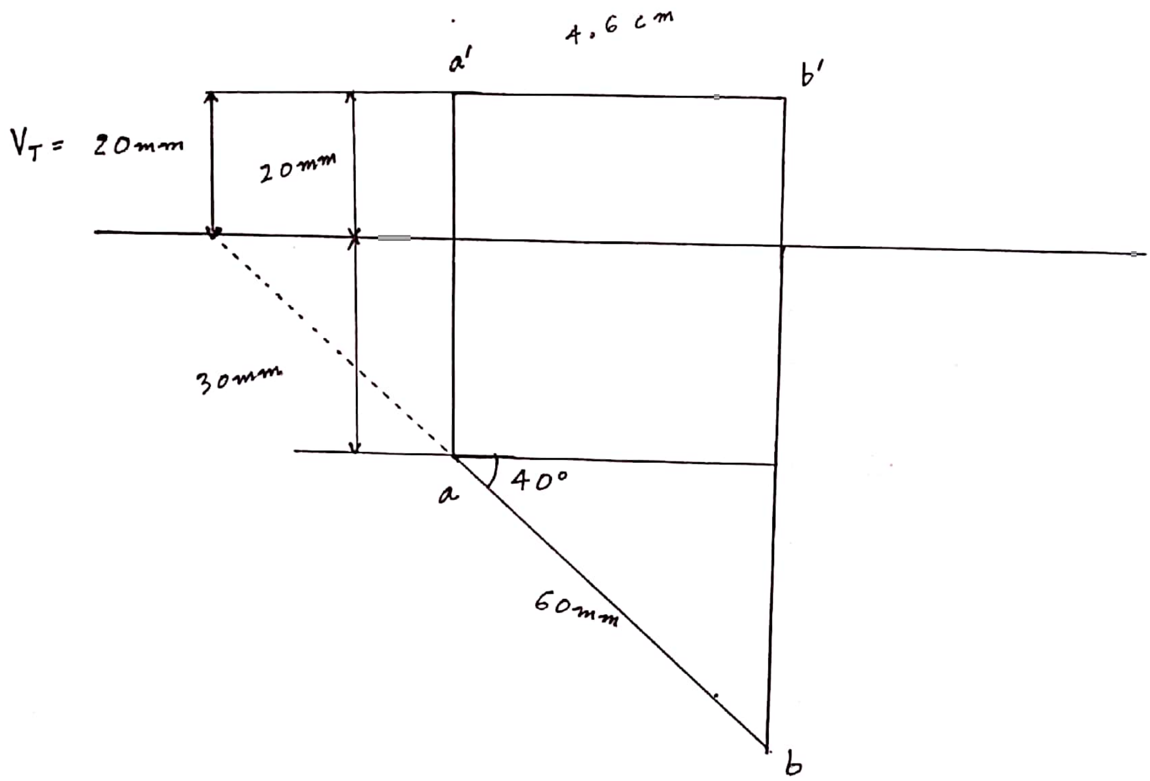
Q. A line AB // to HP and 45° inclined to VP. AB ... point A is 30 mm infront of VP and 30 mm above HP.



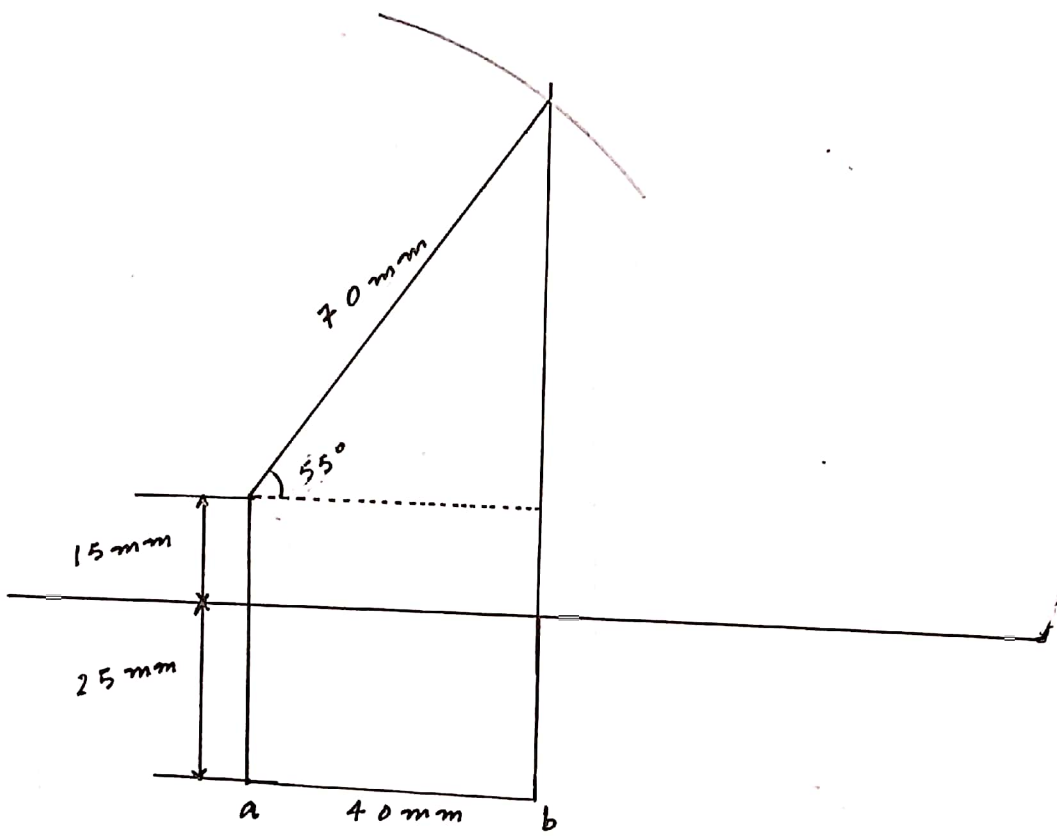
Q. A line AB 55 mm long has it's end 25 mm infront of VP and in HP. The line is inclined at 45° to VP. Draw it's projection.



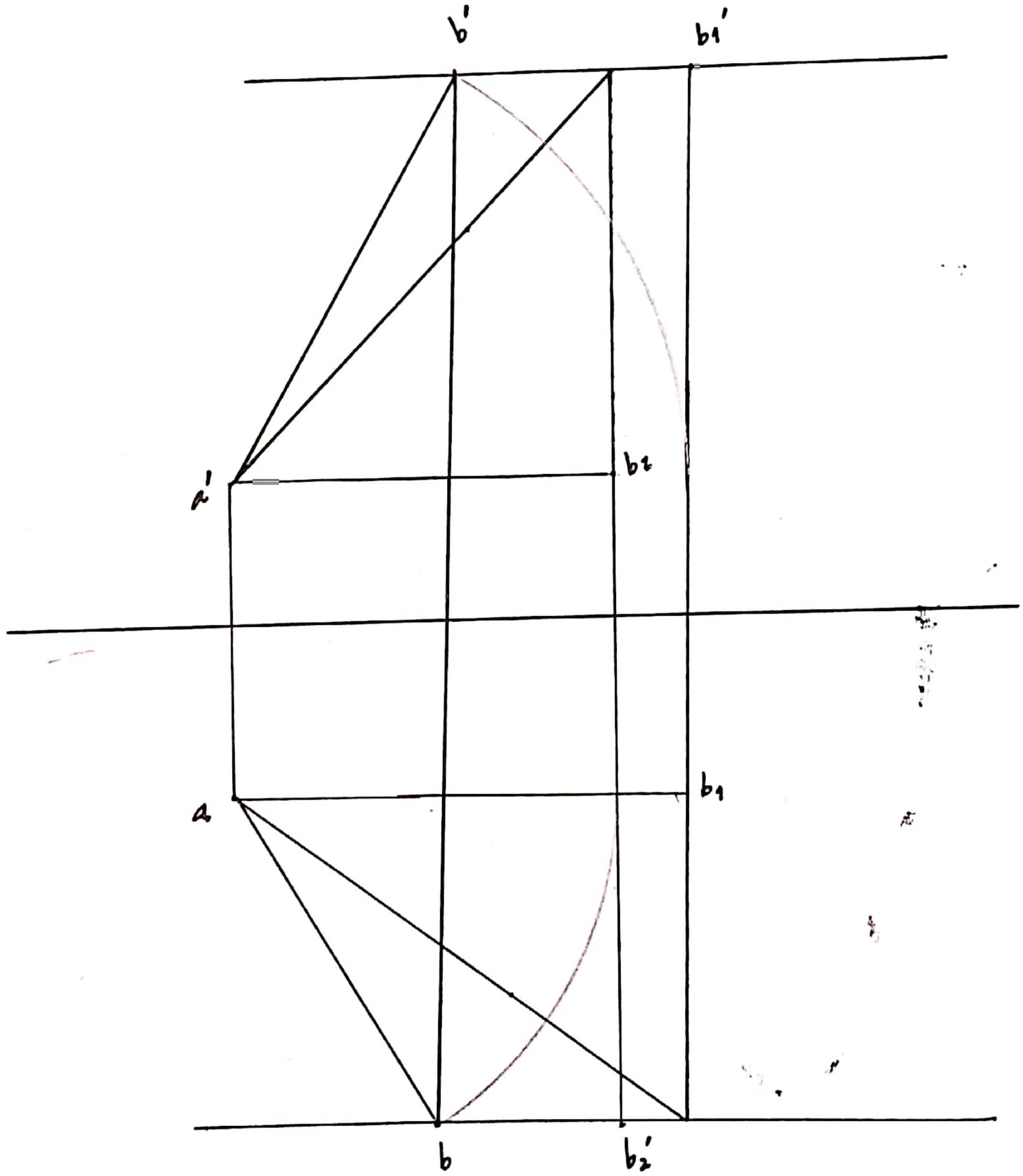
Q. A line AB 60mm long has its end 20mm above HP and 30 mm in front of VP. The line is inclined 40° to VP and // to HP.



Q. A line AB 70 mm long has it's and A 15 mm above HP and 25 mm in front of VP it's top view has a length 40 mm. Draw it's projection and inclination with HP.

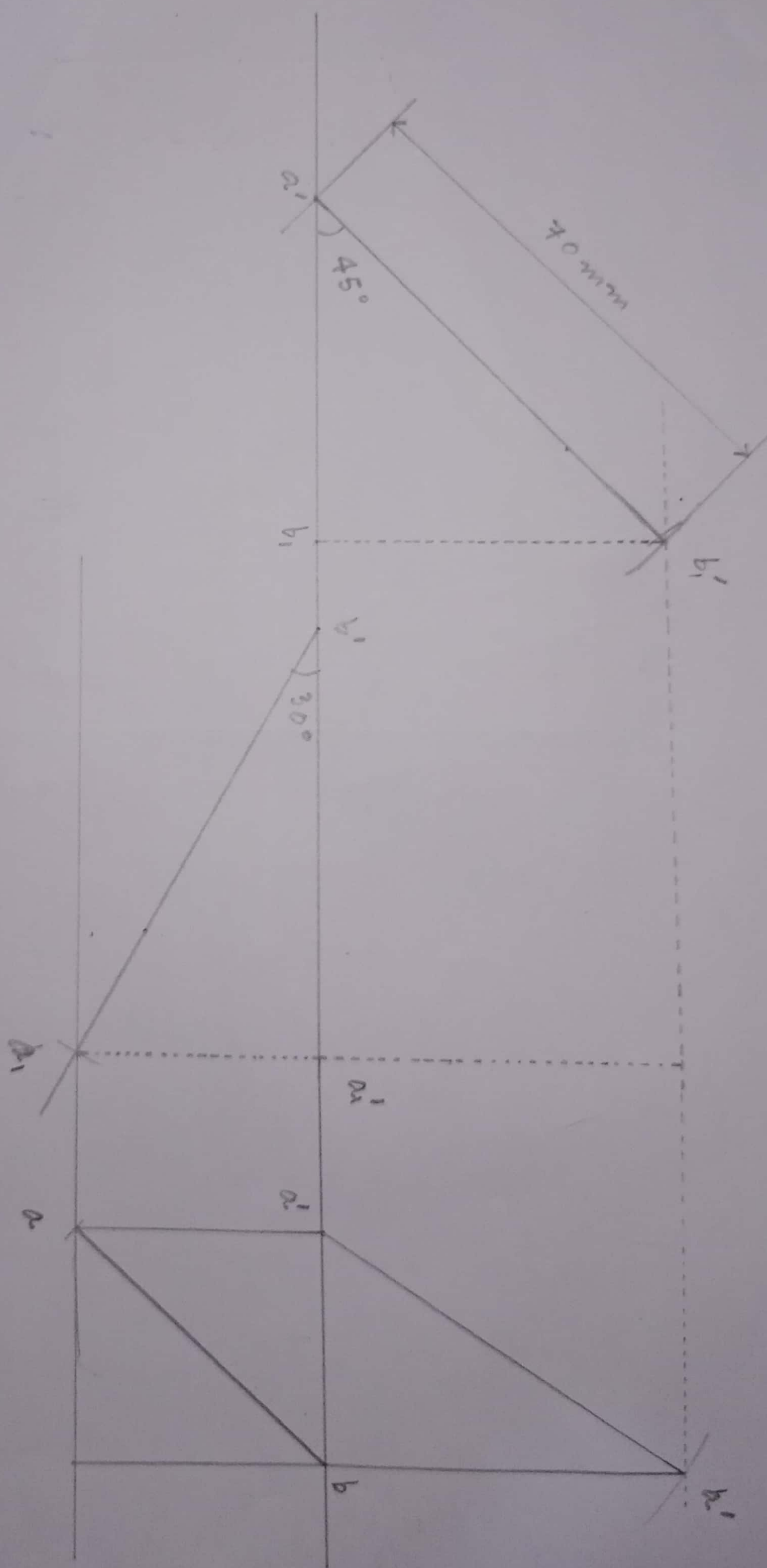


Q. A line AB 80mm long has it's end A 20mm above HP and 25mm in front of VP line is inclined to 45° to HP and 35° to VP.

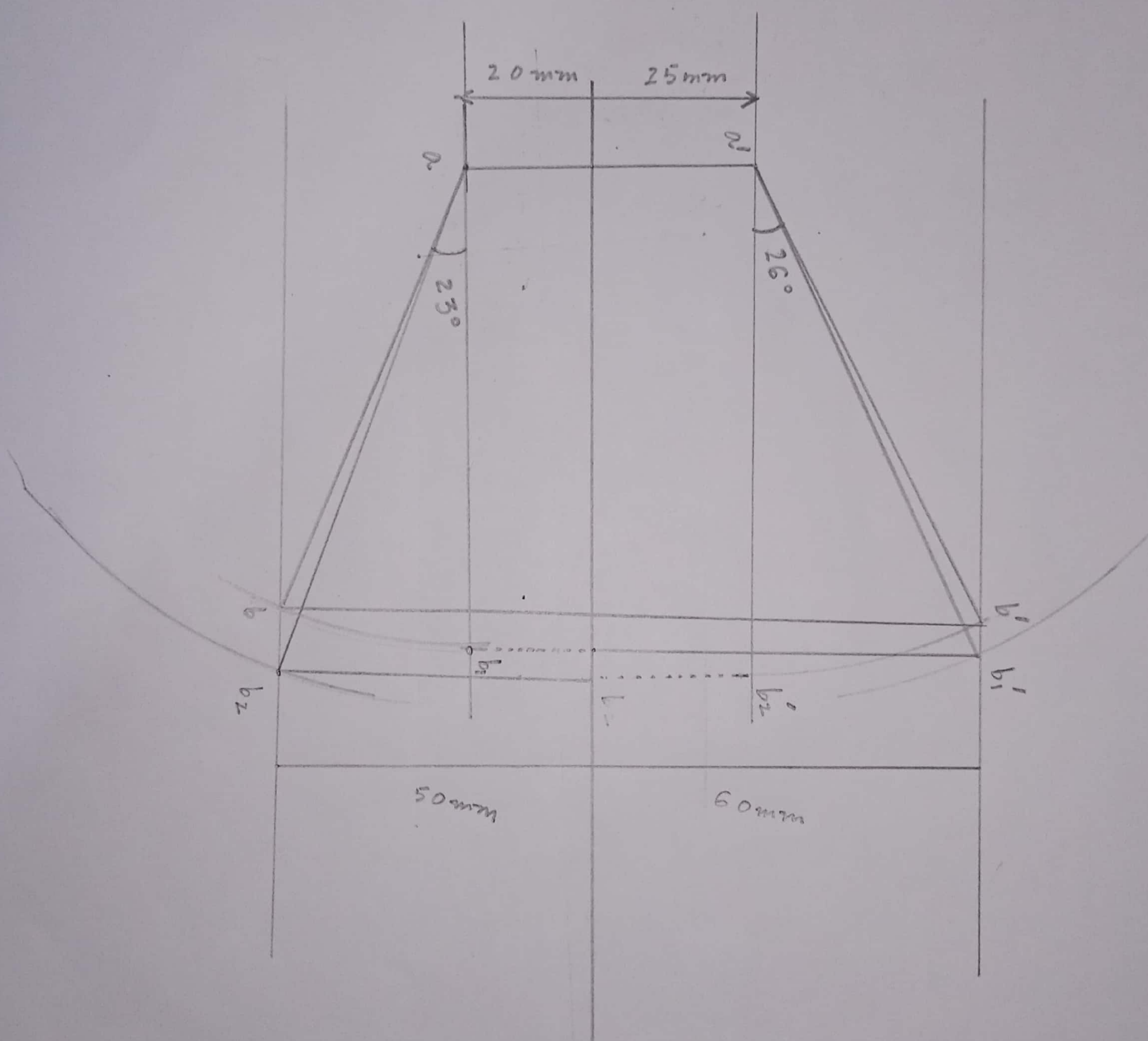


Q. A straight line AB is inclined 45° to HP and 30° to VP. The point A is in HP and the point B is in VP. The length of the line is 70mm. Draw the projection.

PROJECTION OF PLANE



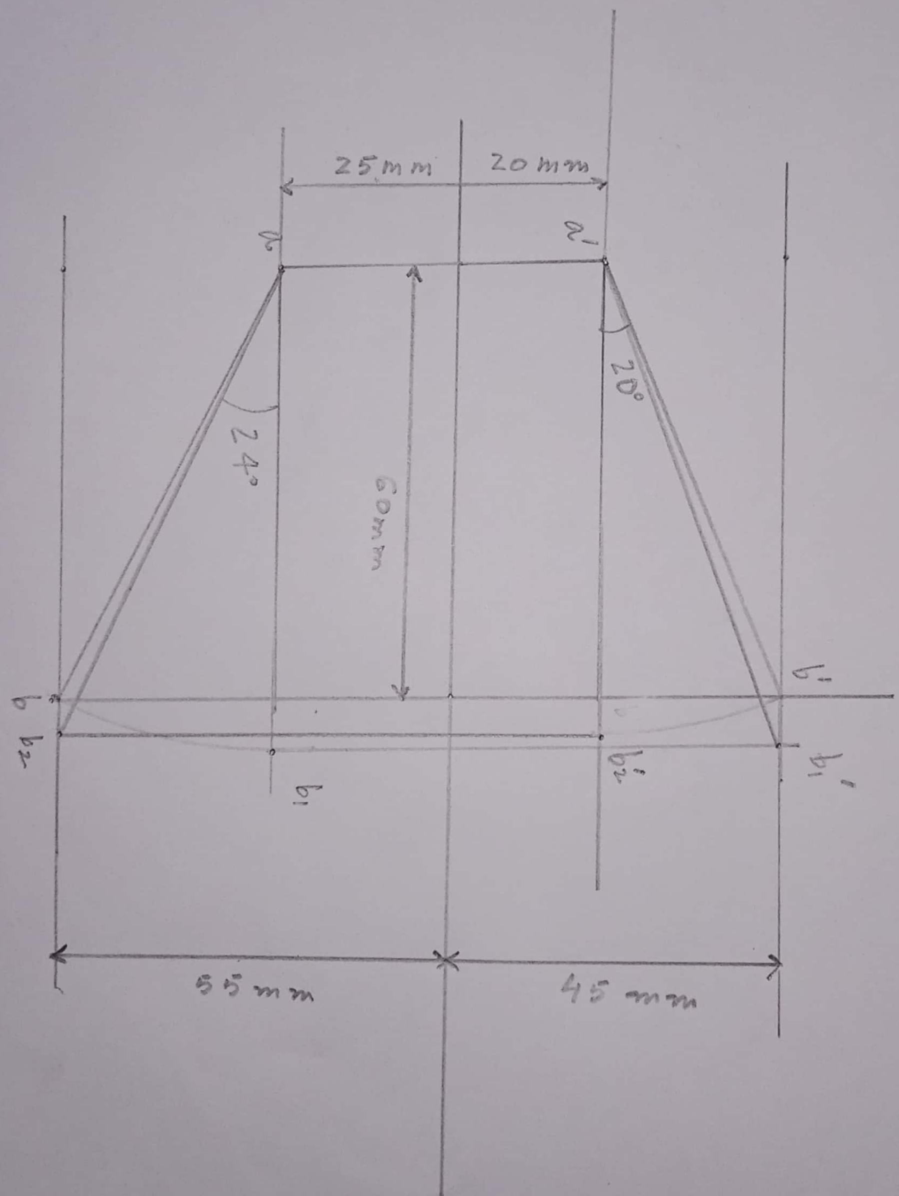
Q. A line AB 85 mm long it's end A 25 mm above the HP and 20 mm in front of VP the end B is 60 mm above HP and 50 mm in front of VP. Draw the projection and find the inclination angle with HP and VP.



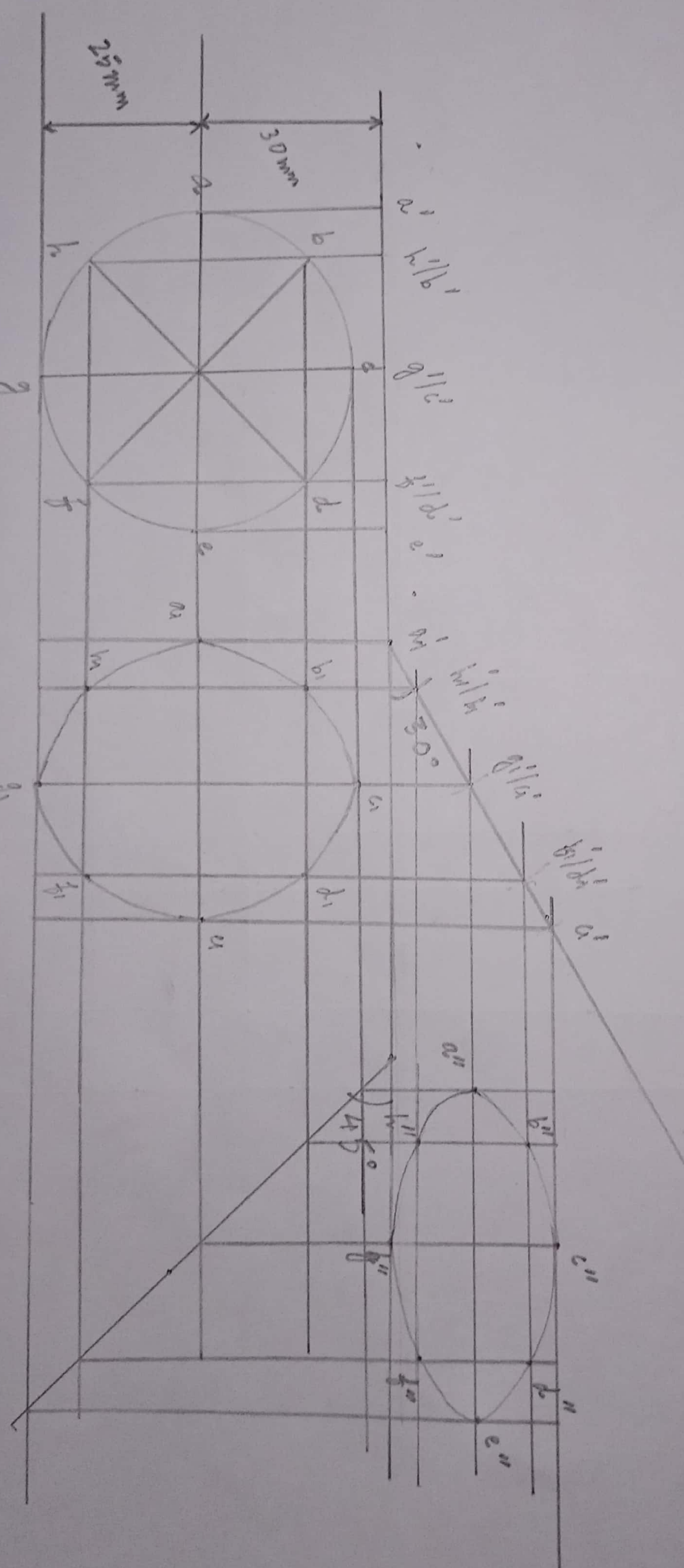
Q. A line AB has it's end A 20 mm above HP and 25 mm in front of VP.

The other end B is 45 mm above HP and 55 mm infront of VP.

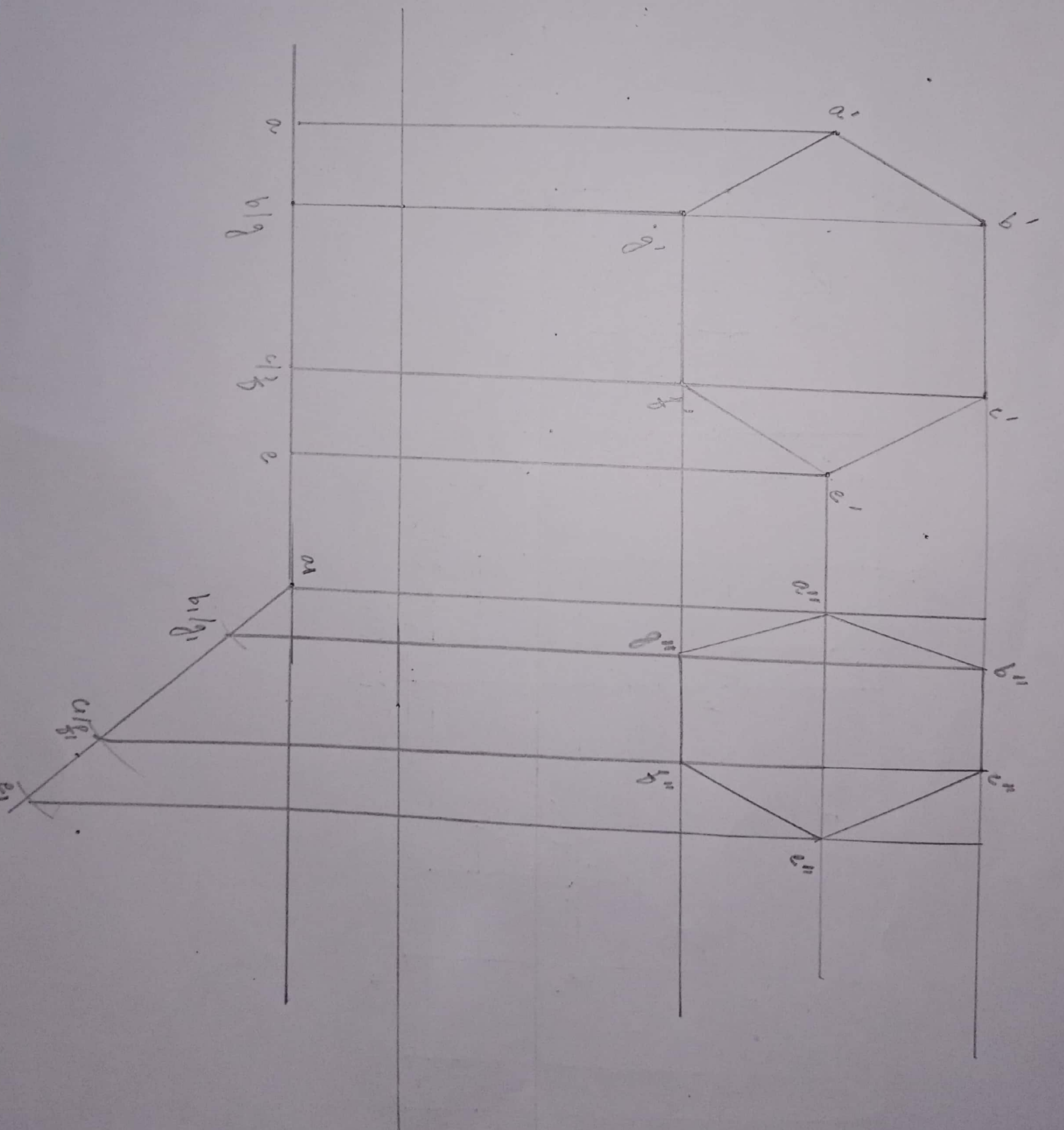
The distance between end projectors is 60mm draw the projection.



Q. A circle of diameter 50 mm inclined at 30° to HP and ⊥r to VP and the centre 30 mm in front of VP. Draw the projection of the lamina and the side view.

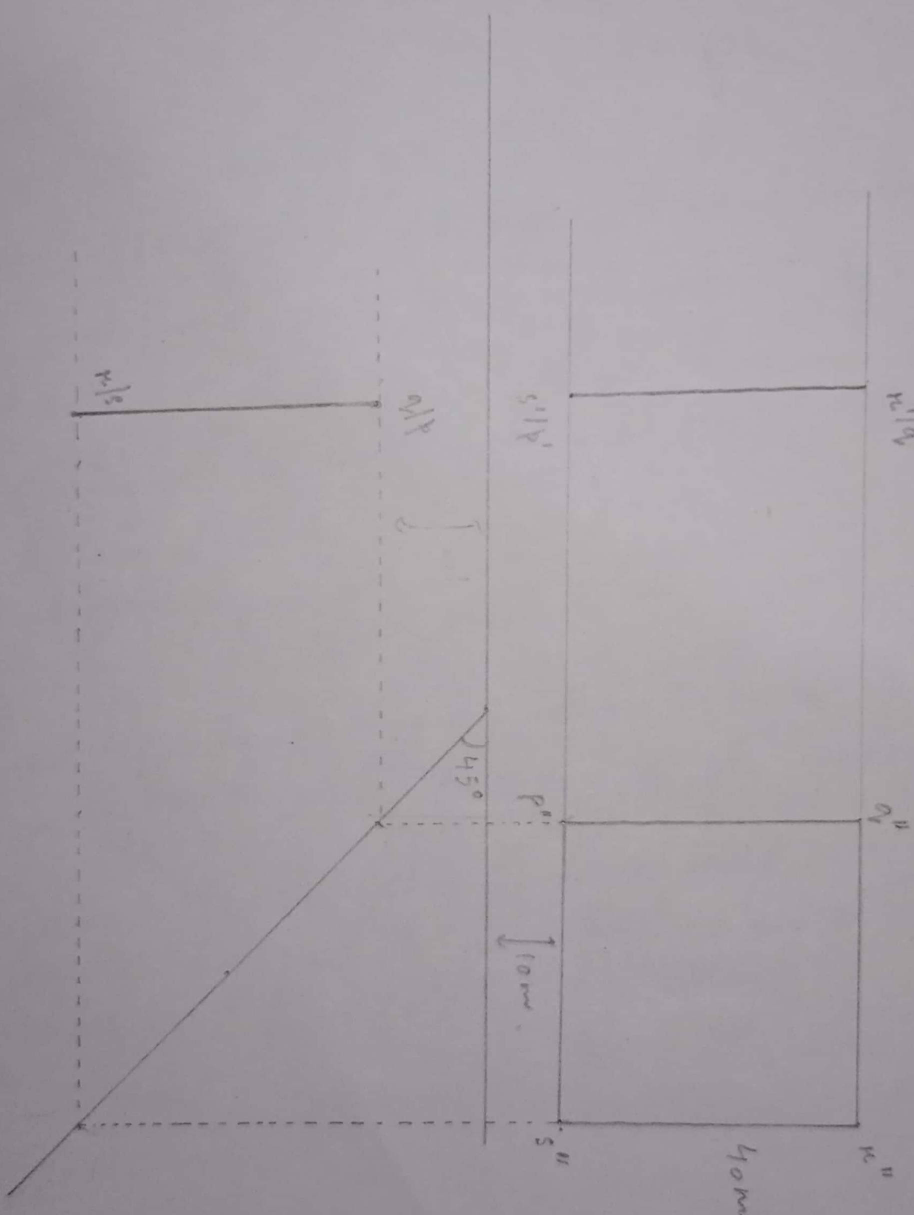


Q. A hexagonal plate of side 30 mm has a corner 20 mm from VP and 50 mm from HP it's surface is inclined at 50° to VP and $\perp^r$ to HP. Draw the projection.

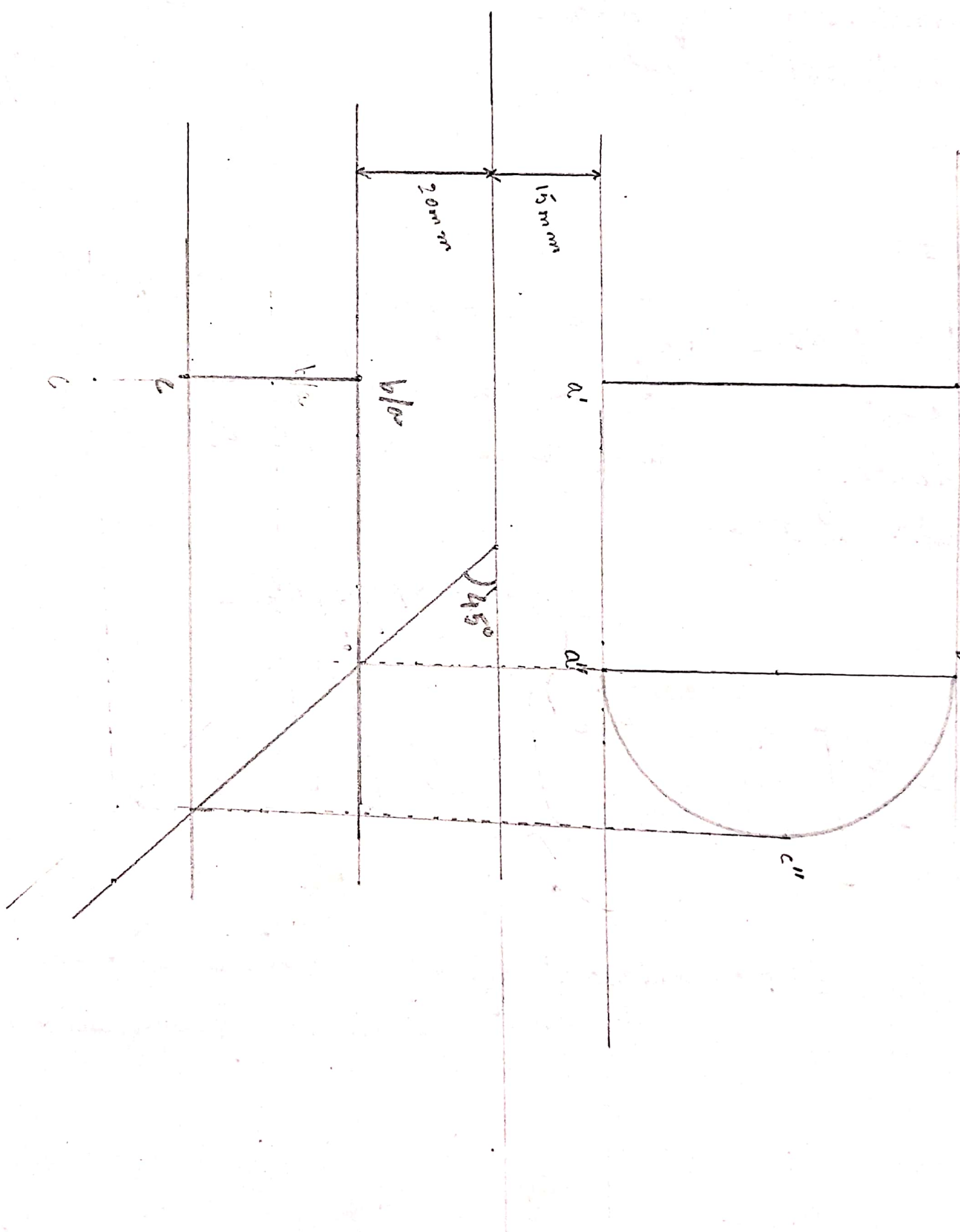


Surface ⊥r to both plane

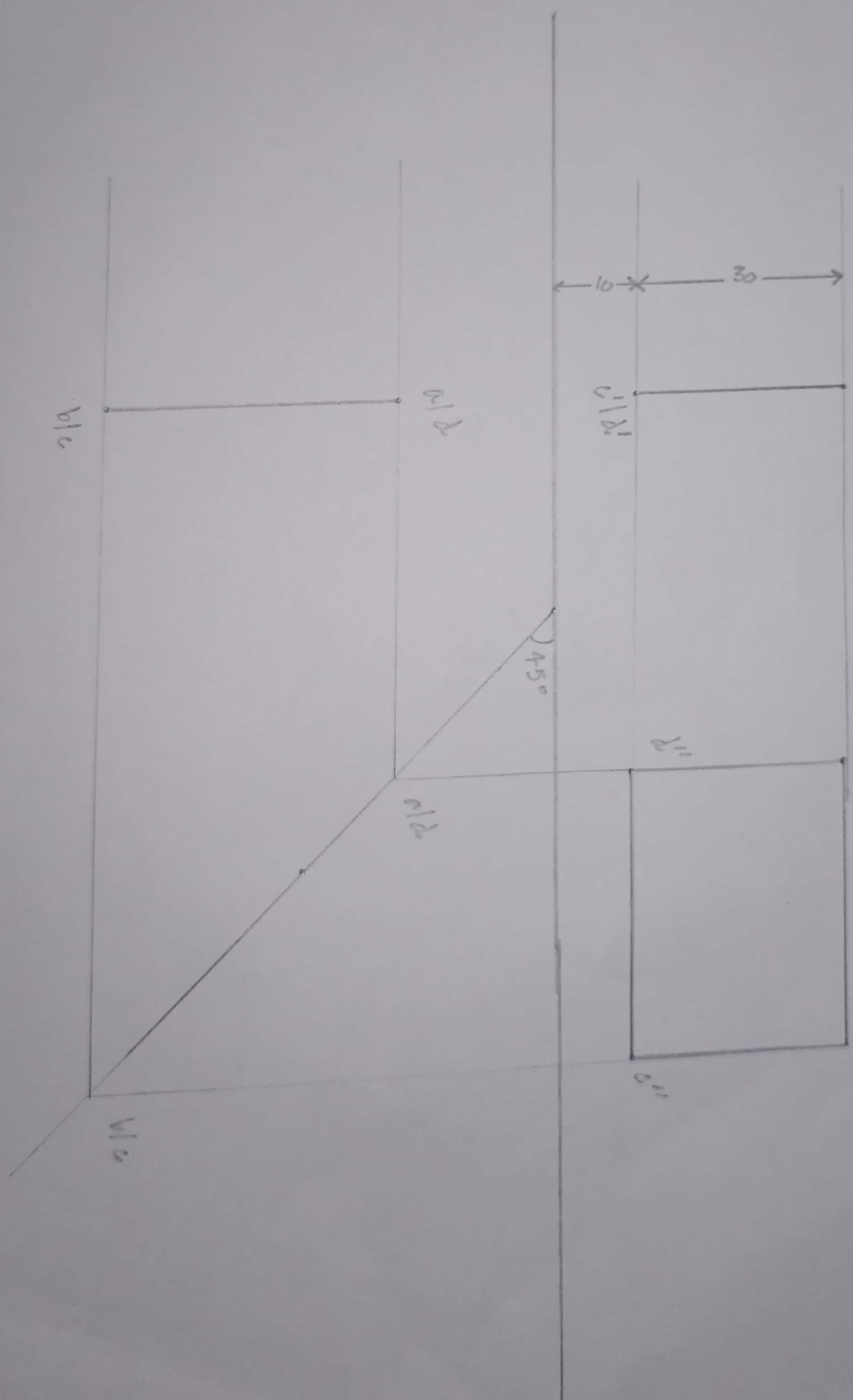
A square laminar side of 40mm ⊥r to both plane draw it's projection.



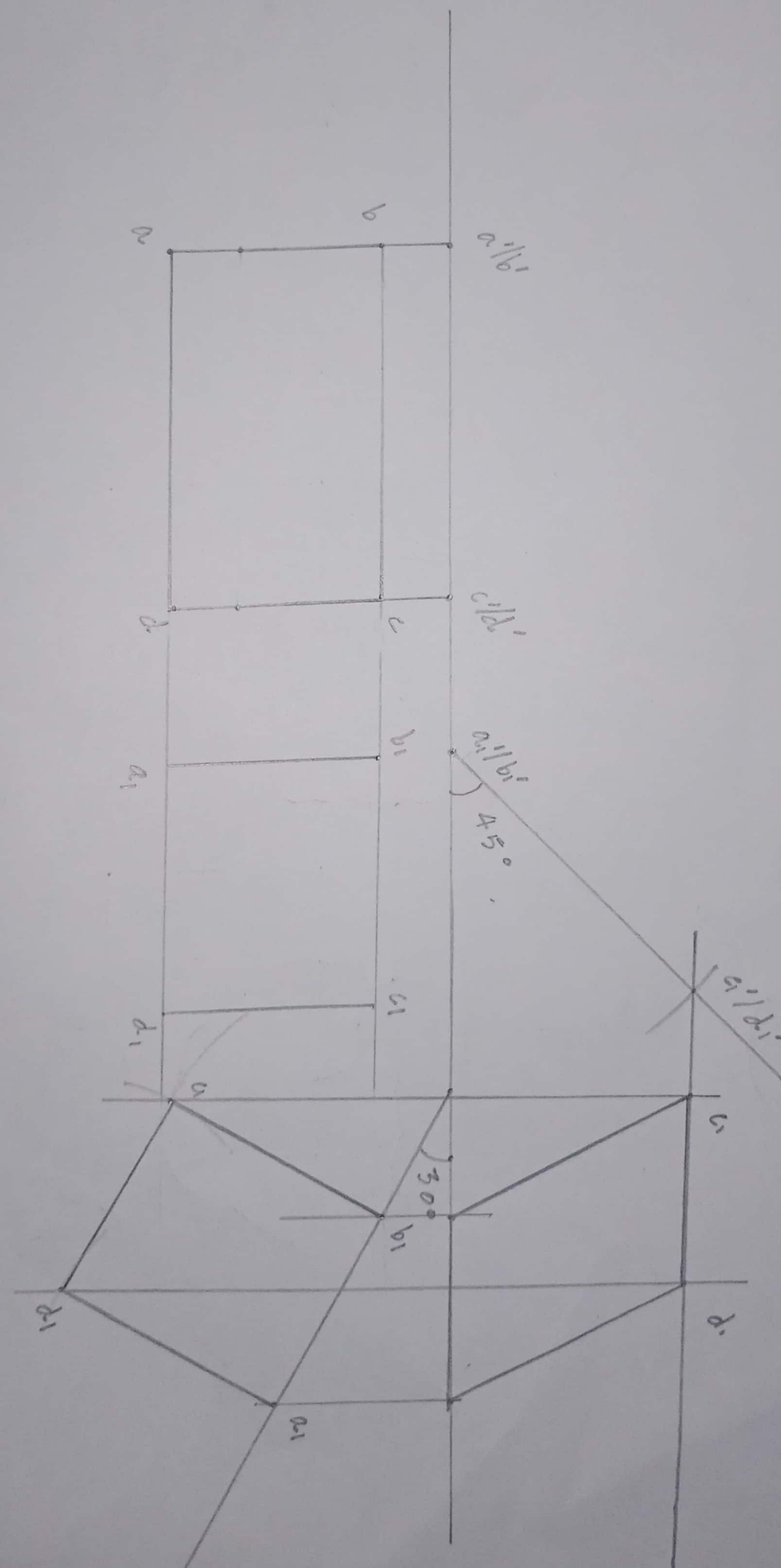
A semicircle plane of diameter 50 mm is kept in the first quadrant such that it's diameter is ⊥r to VP and HP. Draw it's projection when diameter is near VP distance from HP = 15 mm and VP = 20 mm.



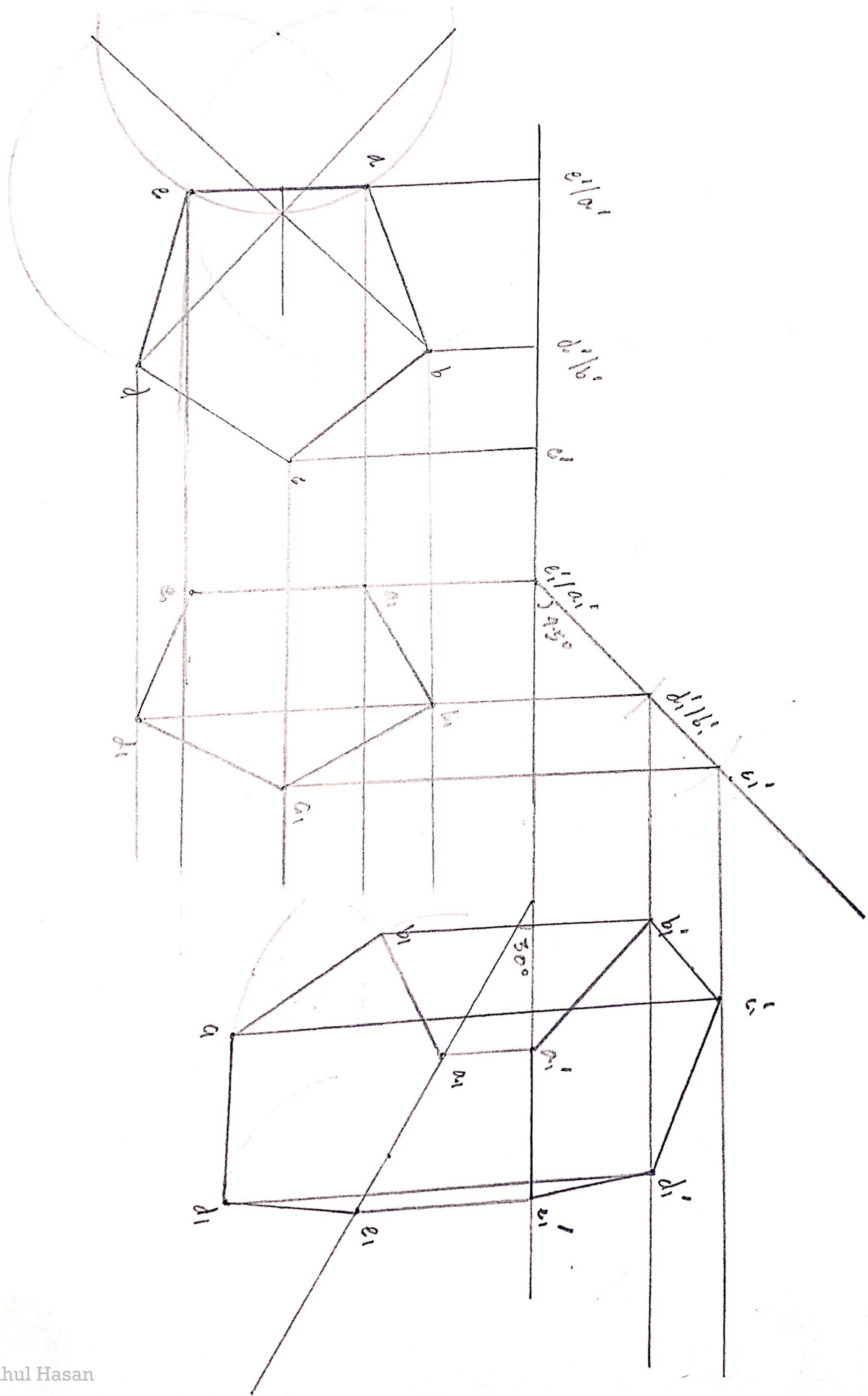
Q. A rectangular plate ABCD at side 40 X 30 is $\perp^r$ to V.P and HP. Draw it's projection. Shorter side is near to V.P



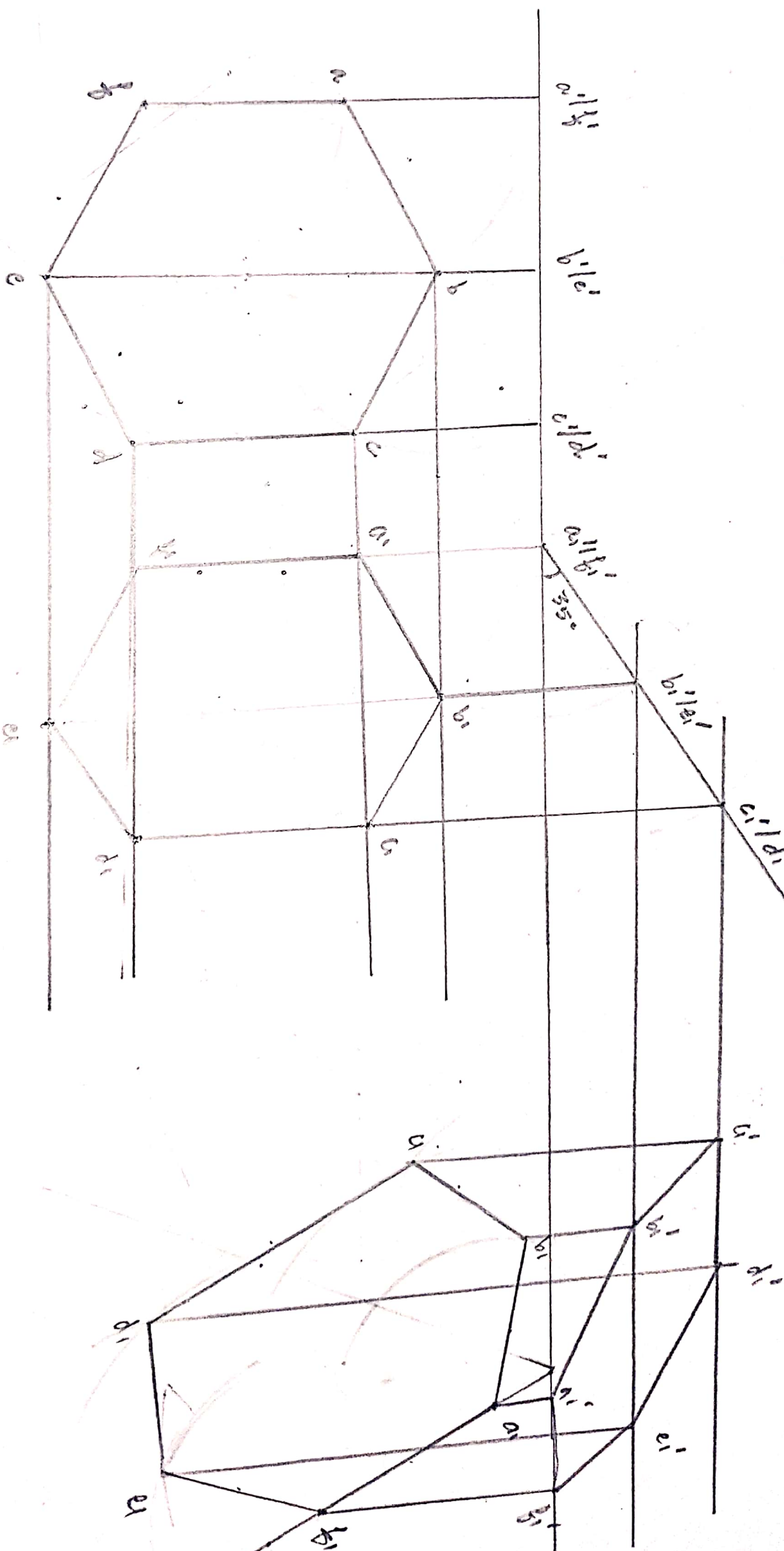
Q. A rectangular Lamina 30X50 side is resting on HP on one small side which is at 30° inclined to VP while the surface of the plane makes 45° inclination with HP.



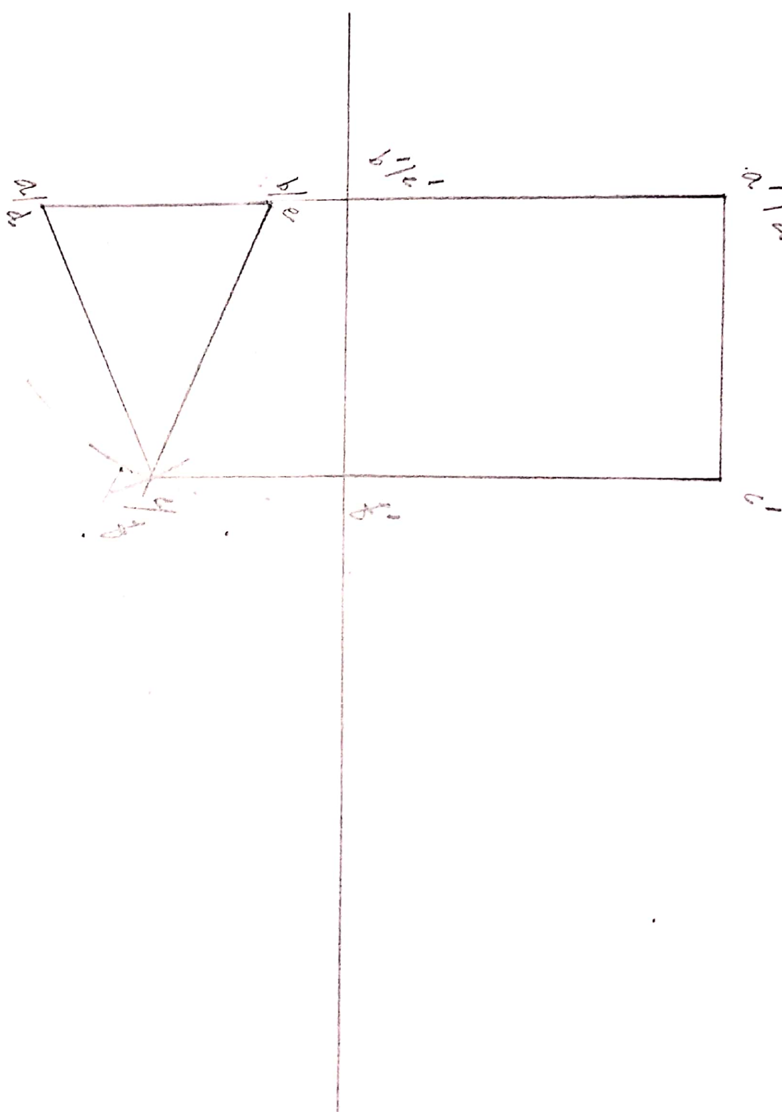
Q. A rectangular pentagon of 30 mm side is resting on HP on one of it's side with it's surface 45° inclined HP. Draw it's projection when the side in HP makes 30° angle with VP.



Q. Draw the projection of a hexagon side 30mm having it's side HP and top view inclined at 65° to VP and the surface inclined at 35° to HP.



Q. Ex 13.19 Draw projection of Δgular prism base 40 mm and axis 50 mm long resting on one of it's bases on the HP with a vertical face ⊥r to the V.P.



Q. Draw the projections of a pentagonal pyramid, base 30 mm edge and axis 50 mm long, having it's base on H.P. and an edge of the base parallel to the VP. Also draw it's side view.