Engeering Graphics (BT105)

23|Sep|24 - Mond

Syllabus Divided into two parts
① Manual drafting
② Computer Aided Design (CAD)

1. Manual drafting – UNIT-I – Engineering Curves

Topic ① Conic section
② Cycloidal Curves
③ Involute

CONIC SECTION

Circle | Ellipse | Parabola | Hyperbola

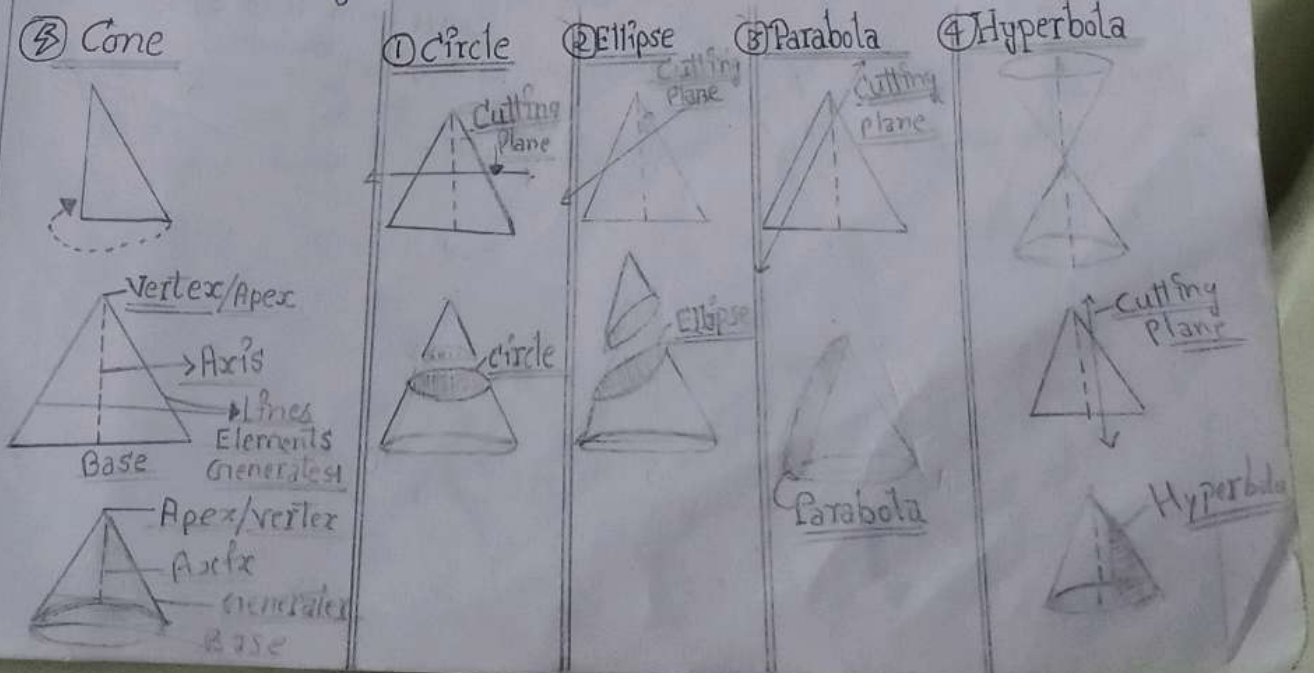
② Conic Section :– A Conic Section is a curve obtained by the Intersection of a right circular Cone by a plane in different position relative to the axis of Cone are called Conics

① Circle :– When the cutting plane is parallel with the base and perpendicular to the axis of Cone, the Intersection obtained is a circle

② Ellipse :– When the cutting plane is Inclined to the axis and cutting all the elements/generates on one side of apex, In that Case we optain ellipse.

③ Parabola :– When the cutting plane is inclined to the axis and is parallel to one of the generation, In that Case we obtain parabola

④ Hyperbola :– A Hyperbola is a plane curve having in seperate parts formed when two Cones point towards one another are Intersected by a plane that is parallel to the axis of the Cones.



Methods of Solving:-

Ellipse	Parabola	Hyperbola
1. Concentric circle Method	1. General Method	1. General Method
2. Rectangular Method	2. Rectangular Method	2. Rectangular Method.
3. Arc of circle Method	3. Tangent Method.	
4. General Method Directrix Focus Method		

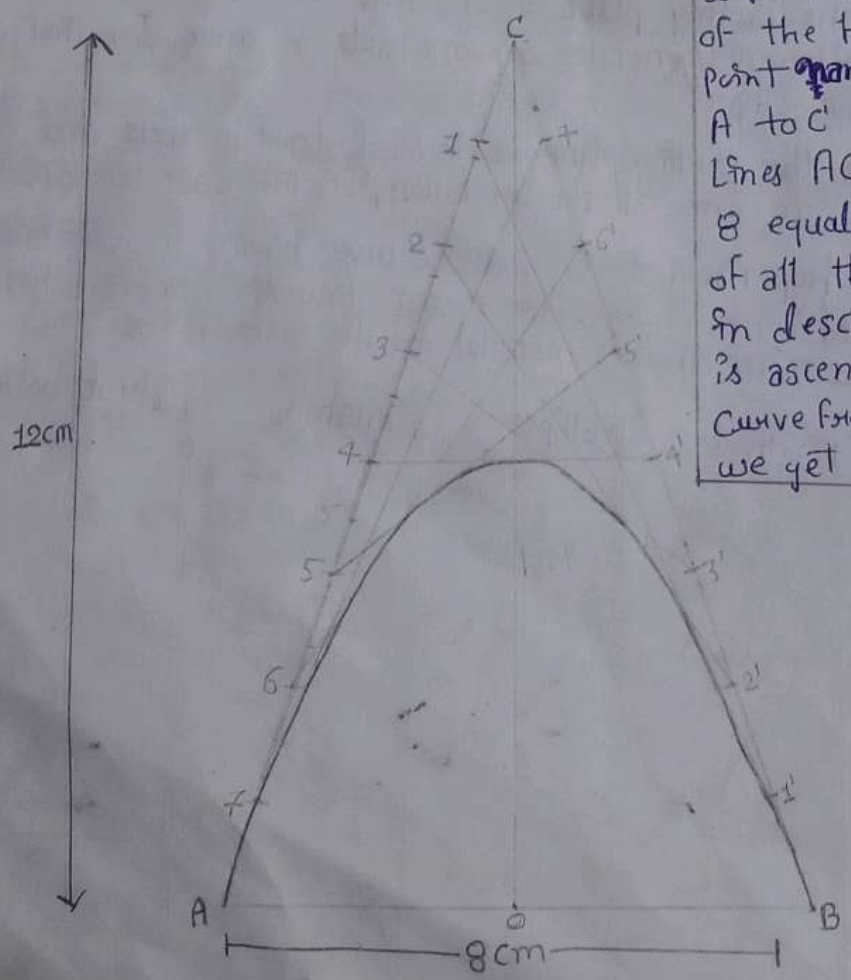
① Tangent Method for Parabola

Q.1 A ball is thrown up into the air while it reaches the maximum height of 6m and travel a horizontal distance of 8m. Draw the curve by tangent method trace out by path of the curve.

Solve ⇒ Given,

Base = 8M H = 6 × 2 = 12M (∵ Height twise for tangent Method)

1m = 1cm

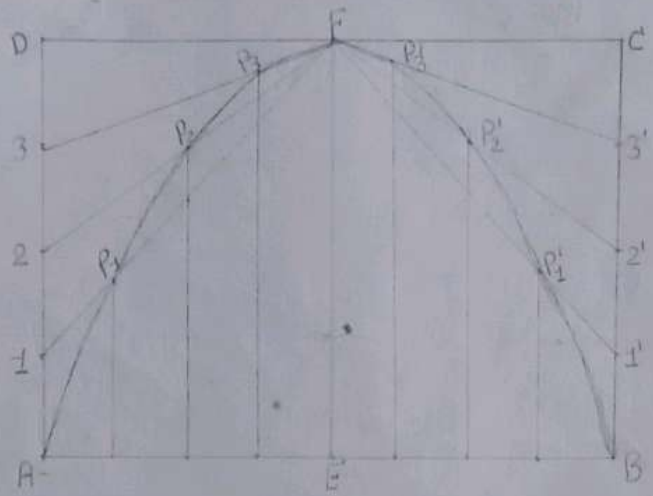


Method:- Firstly we draw a horizontal straight Line of 8cm, then draw a vertical line of 12cm from centre of the horizontal line and all three point naming A, B, C, then joint A to C and B to C. Both side Lines AC and BC we break in 8 equal parts, then numbering of all the point from A to C in descending order. And B to C is ascending order. Draw a Curve from A to B, In this Case we get parabola.

2:- By Rectangular Method :—

Solve
Method :—

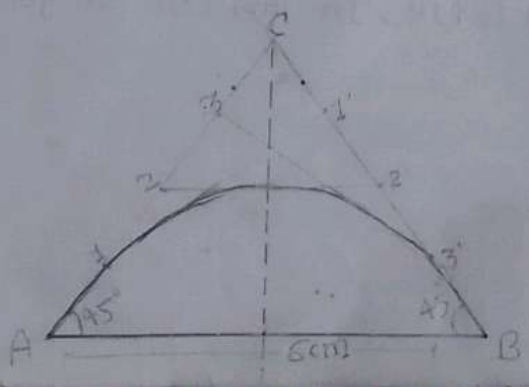
(1) Draw a base of 8cm (AB)
(2) At its mid point E draw the axis EF ⊥ AB of 6cm
(3) Construct a rectangle ABCD
(4) Divide AE and AD into same no. of equal parts
(5) Draw lines joining F with points 1, 2 and 3. through 1', 2' and 3'.
(6) Draw a lines ⊥ to AB Intersecting at point P_1, P_2 and P_3 same as P_1', P_2' and P_3' respectively.



Q.2:- A fountain jet discharge water at an angle of 45° water travels a distance of 6m. draw the curve trace out by the ~~part~~ path of water.

Sol^n :- Given, Horizontal distance = 6m
Jet discharge water at an angle of 45°
By Tangen Method —

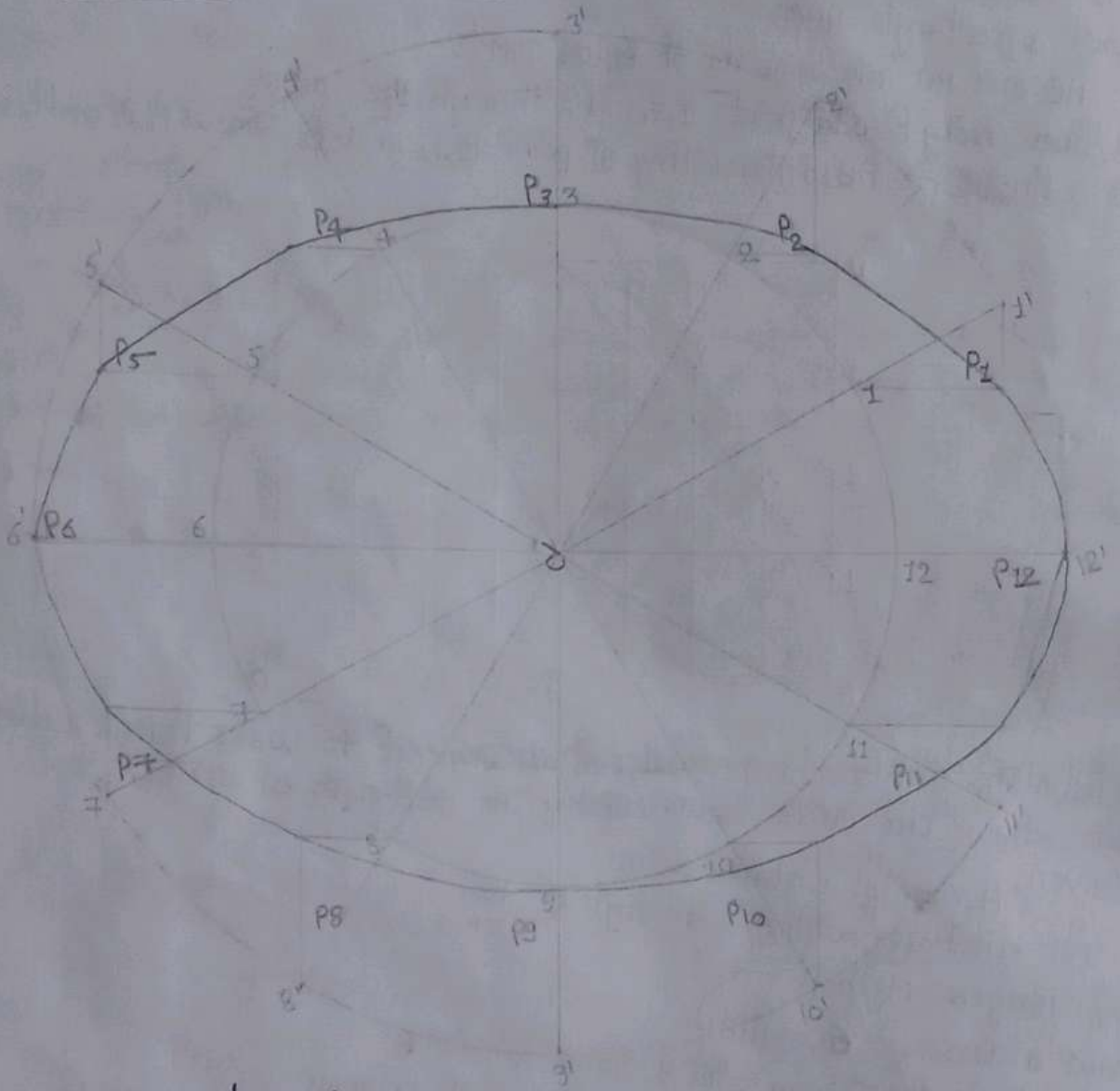
(1) Draw a Base of 6cm (AB)
(2) Mark an angle of 45° from point A. Same as point B.
(3) Combine all three point A BC and we get triangle.
(4) Divide AC and BC into same equal parts.
(5) Naming the point of AC in ascending order and BC in descending order
(6) Joint AC point with BC point as same as order.
(7) Draw curve from A to B on the intersection points, In this case we get Parabola.



Q1 The major axis of an ellipse is 150mm long minor 100mm Drawn the ellipse by Concentric circle method.

Sol major axis = 150mm , minor axis = 100mm

R = 7.5cm , R = 5cm



Concentric circle method —

(1) Draw a circle of 5cm Radius at the point O and the origin drawn second circle of 7.5cm Radius.

(2) Divide the circle into same equal parts and naming the minor circle point of 1 to 12 and major circle point 1' to 12'.

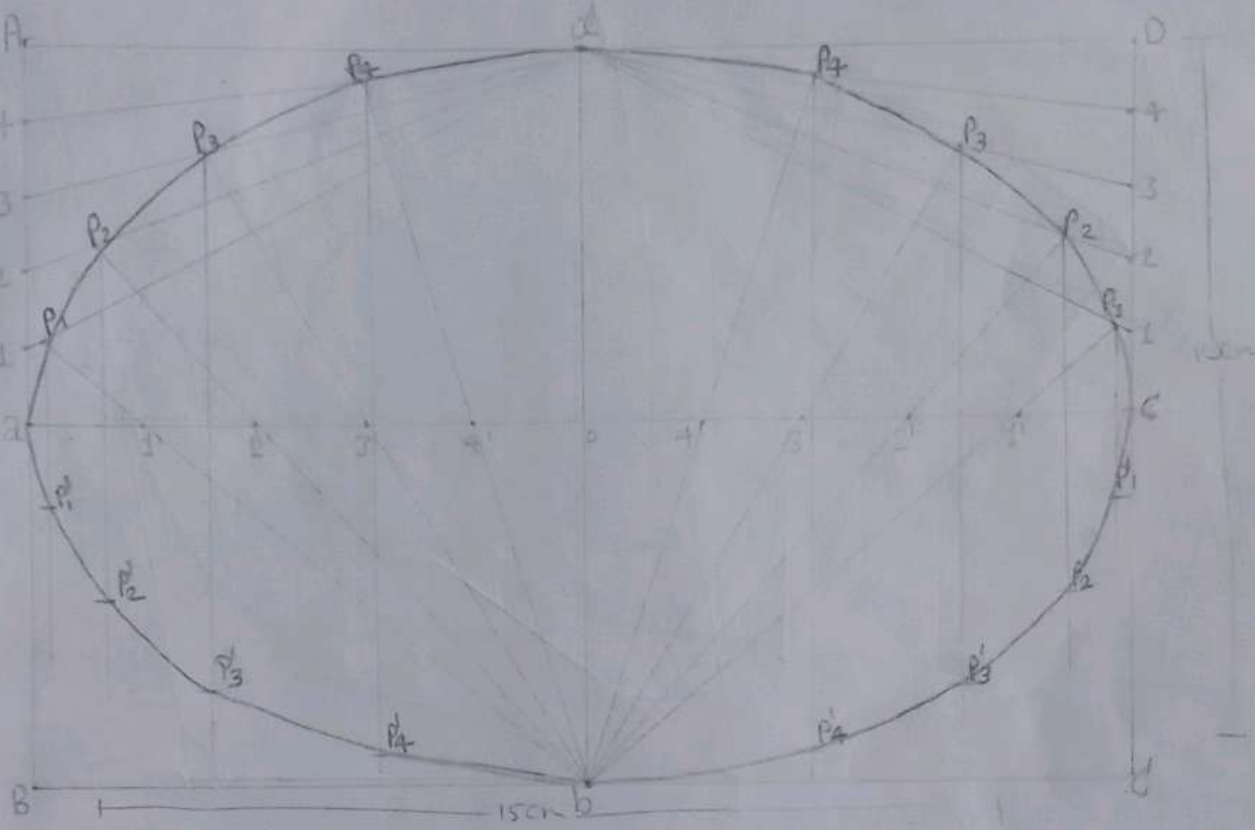
(3) Draw small perpendicular lines to the 1' to 12' and joint to the base of 1 to 12. then we get the points, naming P1 to P12.

(4) Joint all the points from P1 to P12. In this case we get ellipse.

Q.4: The major axis of an ellipse is 150mm long, minor axis is 100mm long. Draw the ellipse by rectangular method.

Sol^m: Given, Major axis = 150mm, minor axis = 100mm

10mm = 1cm R = 7.5cm R = 5cm



Rectangular Method :—

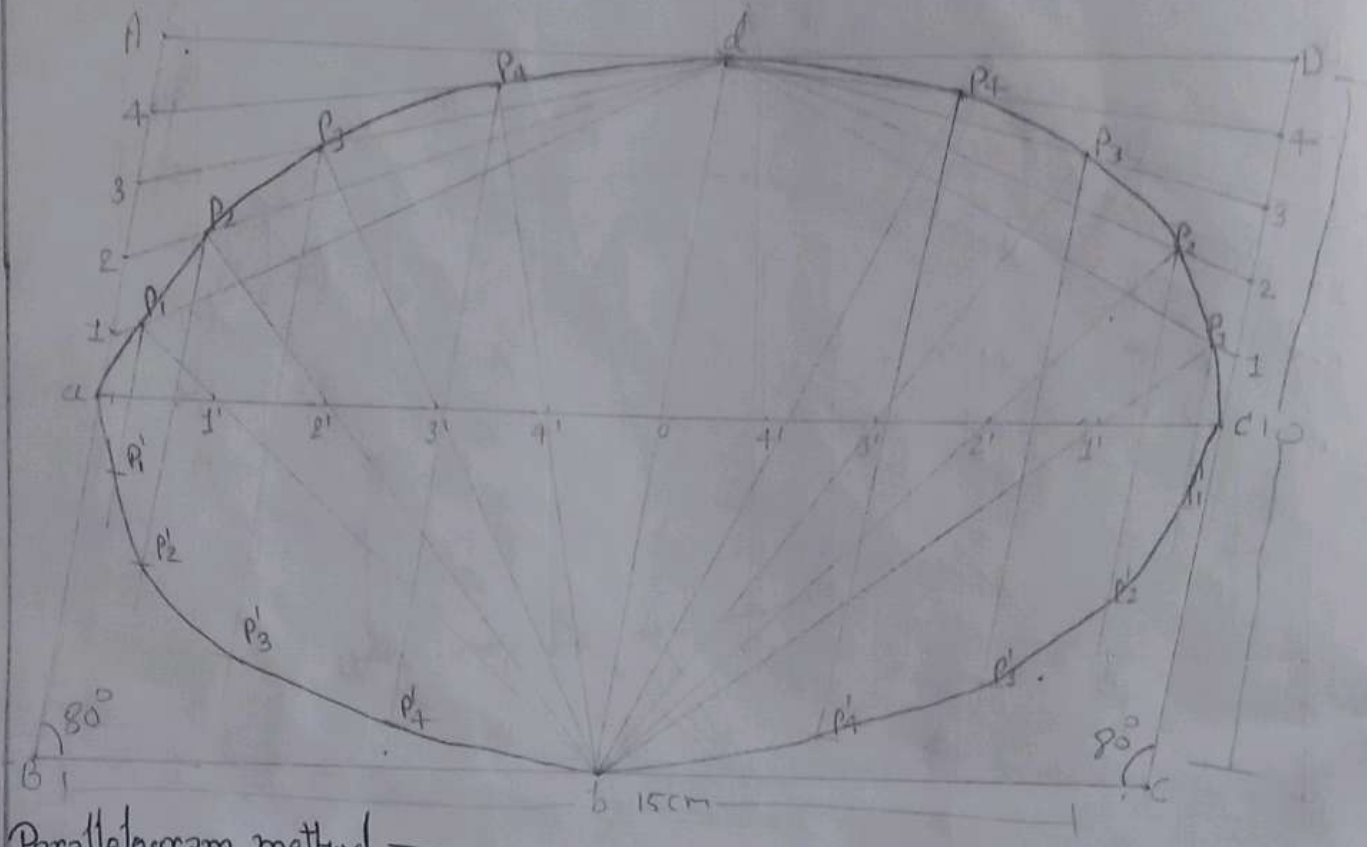
1. Draw a base of 15cm (BC)
2. Draw a ⊥ line at the ∠ B and same as C, naming A, D. Perpendicular line 10cm.
3. Join all points A, B, C and D. we get Rectangle.
4. Know Divide Rectangle into 4 equal part. then show the cordinates a, b, c, d.
5. divide (a) to origin (o) in equal parts and also a to A, C to D, origin (o) to C.
6. Draw a lines joining d with 1, 2, 3, 4 and b with 1', 2', 3', 4'.
7. Draw a ⊥ line from P_1 to, P_2, P_3 and P_4 to the base.
8. take the distance from Base line to P_1 in Rounder and the Downward. Same as P_2, P_3, P_4, we yet P_1', P_2', P_3' and P_4'.
9. Joint all the P_1 to P_4 and P_1' to P_4'. In this Case we get ellipse by Rectangular method.

Ans:- The major axis of an ellipse is 150mm long while minor axis is 100mm long. Draw the ellipse of Parallelogram method. Take the interior angle 80°

Soln:- Given,

Major axis = 150mm = 15cm

Minor axis = 100mm = 10cm



Parallelogram method —

(1) ~~Draw a base of major axis 15cm~~.

(1) Draw a parallelogram with a width of 15cm and a height of 10cm.

(2) Divide the width and height of the parallelogram in half to get the center points, which will be the endpoints of the major and minor axes.

(3) Divide the width line from a to origin(o) in equal parts and same as a to A, and also origin to C and C to B.

(4) Joint the lines d with 1, 2, 3, 4 and

(5) Draw lines b to 1, 2, 3, 4 with the intersection of the point 1', 2', 3', 4' Same as another side. naming P_1, P_2, P_3 and P_4

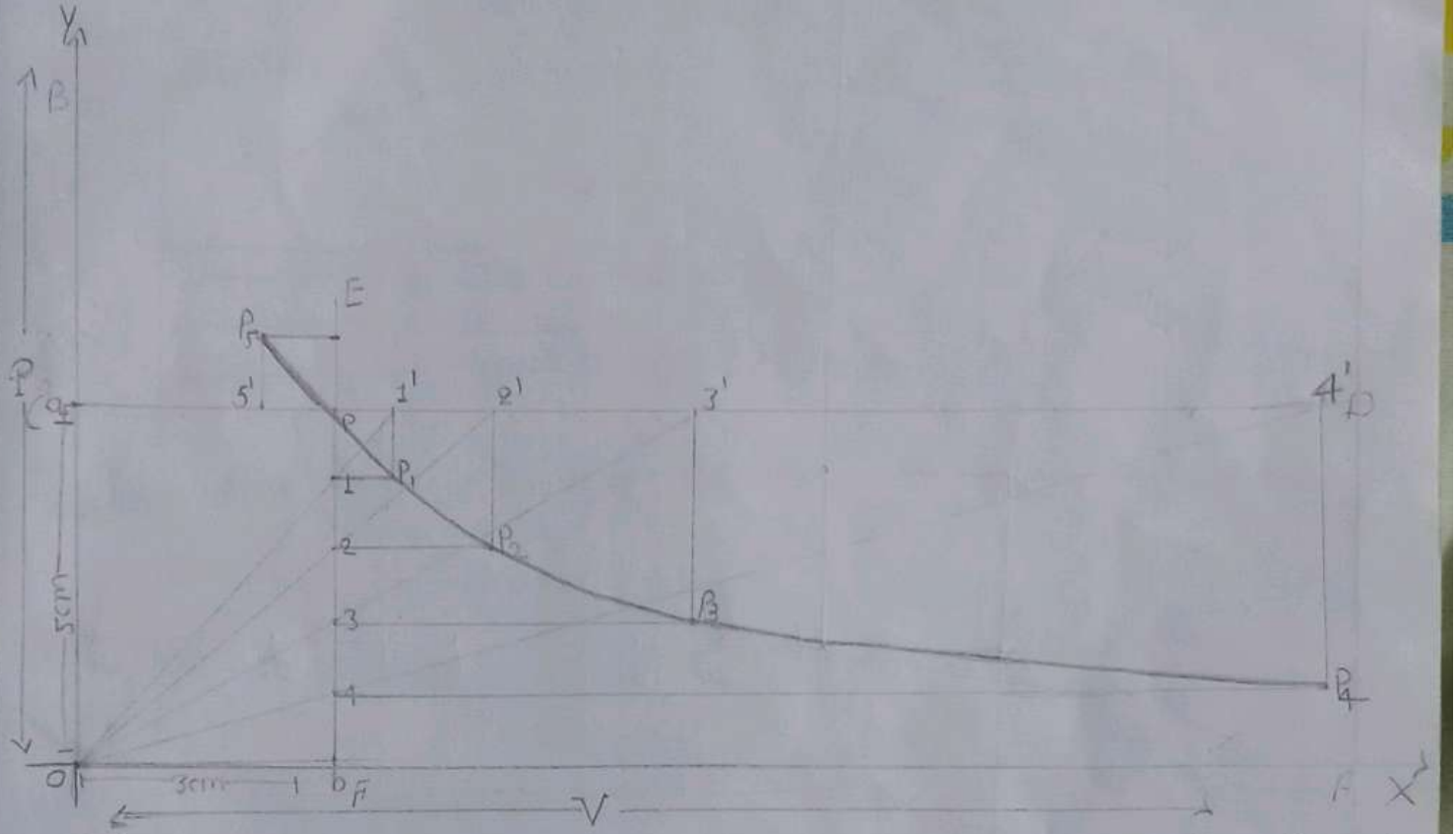
(6) Draw ⊥ lines from P_1, P_2, P_3 and P_4 to Downward. and measure the distance from width line to P_1, P_2, P_3 and P_4 and mark to the Downward.

(7) naming the ~~remain~~ new point P'_1, P'_2, P'_3, P'_4 and joint all the intersection point. In this case we get ellipse by parallelogram method.

Q.G:- Draw the Pressure volume (P.V.) for the pressure of 50 bar and volume of $35cm^3$ using rectangular method of hyperbola. [1 bar = 1mm] [$1cm^3$ = 1mm]

Sol:- Given:- Pressure ~~volum (P.V.)~~ = 50 bar = 50mm = 5cm

Volume = $35cm^3$ = 35mm = 3.5cm.

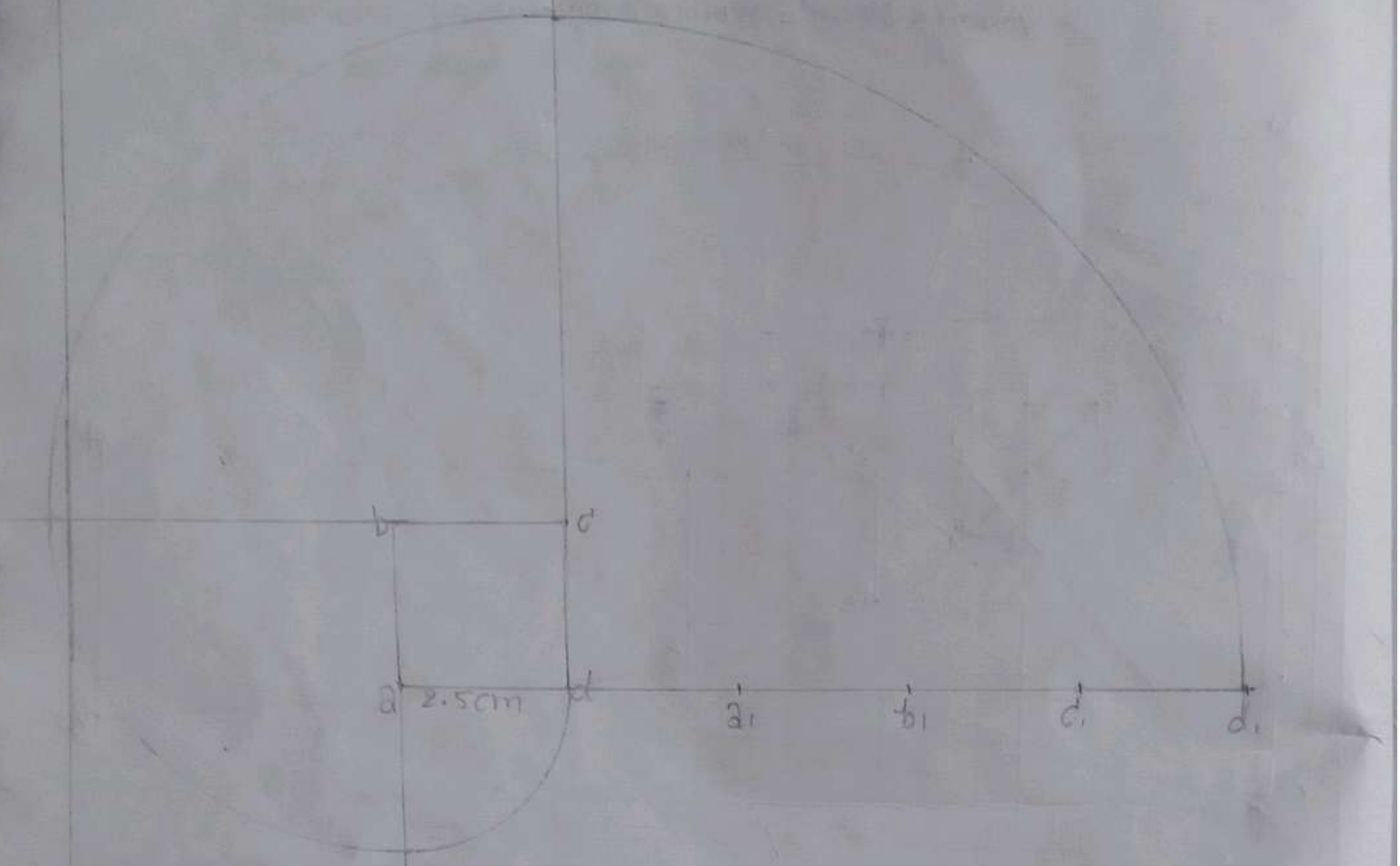


Method —

1. Draw a rectangular hyperbola given asymptotes as OX and OY are at right angles and a point P on the curve.
2. Draw the lines CD and EF passing through P and parallel to OA and OB respectively.
3. Locate number of points 1, 2, 3 etc. (not necessarily equidistant) along the line CD.
4. Join 1, 2, 3, 4 to O and extend if necessary till these lines meet the line EF at points 1', 2', 3' etc.
5. Draw vertical lines through 1, 2, 3 etc. parallel to EF and through 1', 2', 3' etc. parallel to CD to intersect at P_1, P_2, P_3 etc.
6. A smooth curve passing through P_1, P_2, P_3 etc. is the required rectangular hyperbola

Q.1 ⇒ Draw the involute by a square of 25mm.

Soln ⇒ Given, Square of 25mm = 2.5cm



Method :- (1) Draw a Square of 2.5cm.

(2) At the base of Square point(d) draw a line of 4a ⇒ 4×2.5 = 10cm

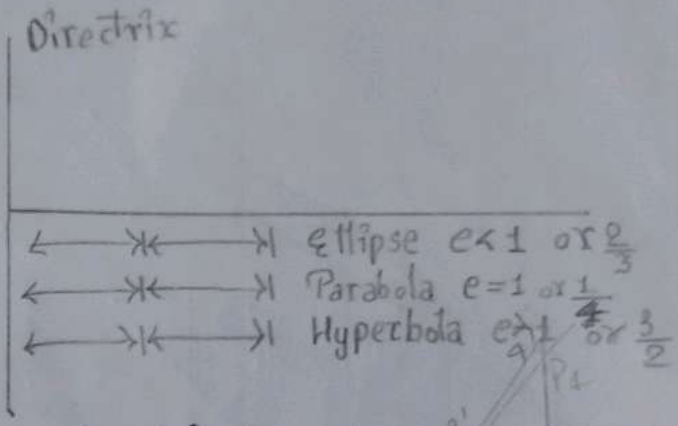
(3) Measure the distance between d to d_1, cut the same distance of the 1 to the d.

(4) At the point C ~~measure~~ measure ~~the~~ the distance from C to cut point and cut the another point on the left side

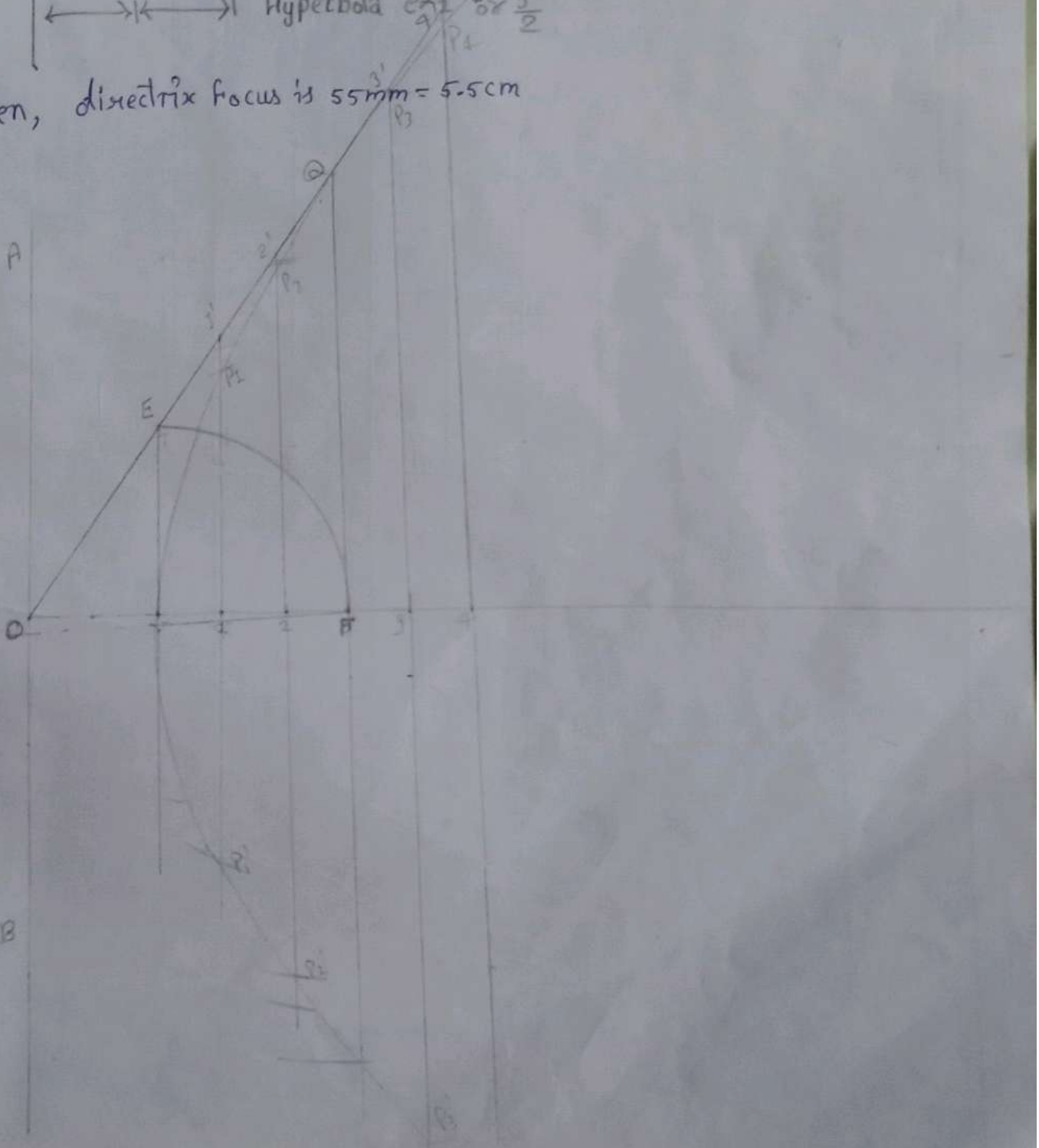
(5) And measure distance between b to second cut point, cut Down ward to b point and same to a.

Distance from directrix focus is 55mm. Draw the Hyperbola. by the general method of Eccentricity 'e.'

$$e = \frac{\text{distance from focus to vertex}}{\text{distance from verter to directrix}} = \frac{VF}{VD}$$



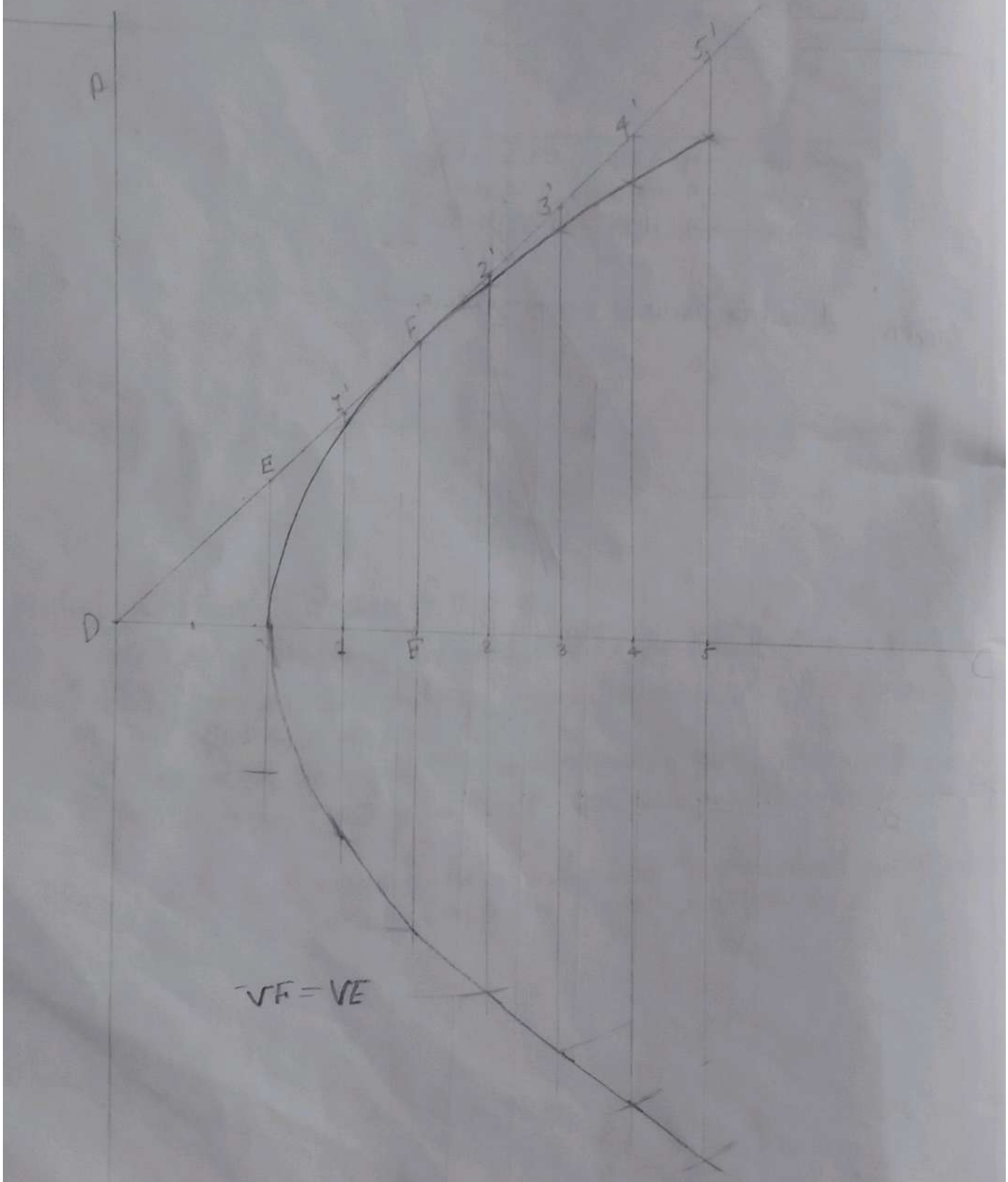
Given, directrix focus is 55mm = 5.5cm



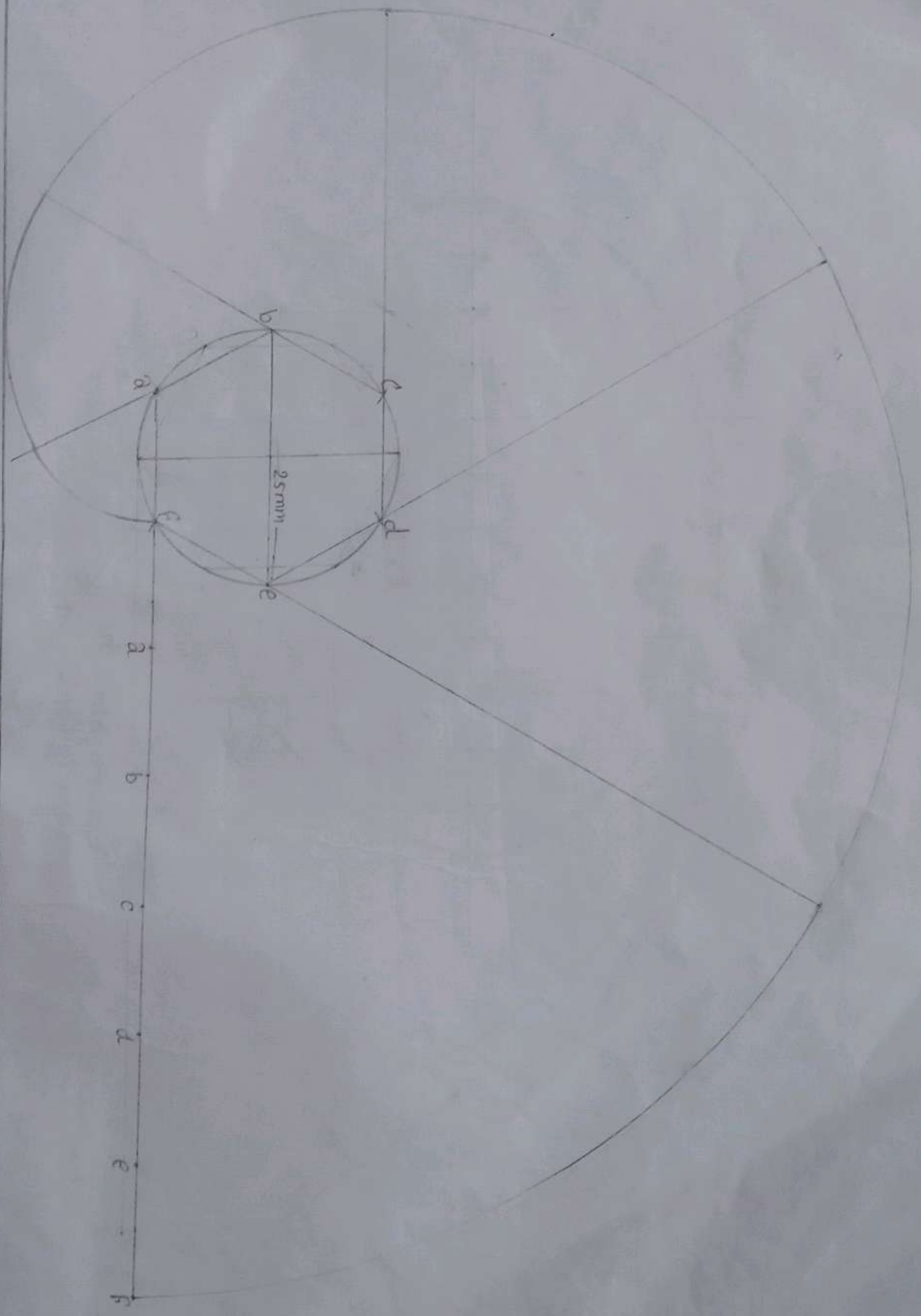
Distance from directrix focus is 55mm Draw the Parabola by the general method of Eccentricity 'e'.

Solution:- Eccentricity 'e' = $\frac{1}{4} = \frac{5.5}{4}$ D.F = 55mm = 5.5cm

e = $\frac{\text{Distance from focus to vertex}}{\text{Distance from vertex to directric}} = \frac{VF}{VD} = \frac{2.75cm}{2.75cm}$

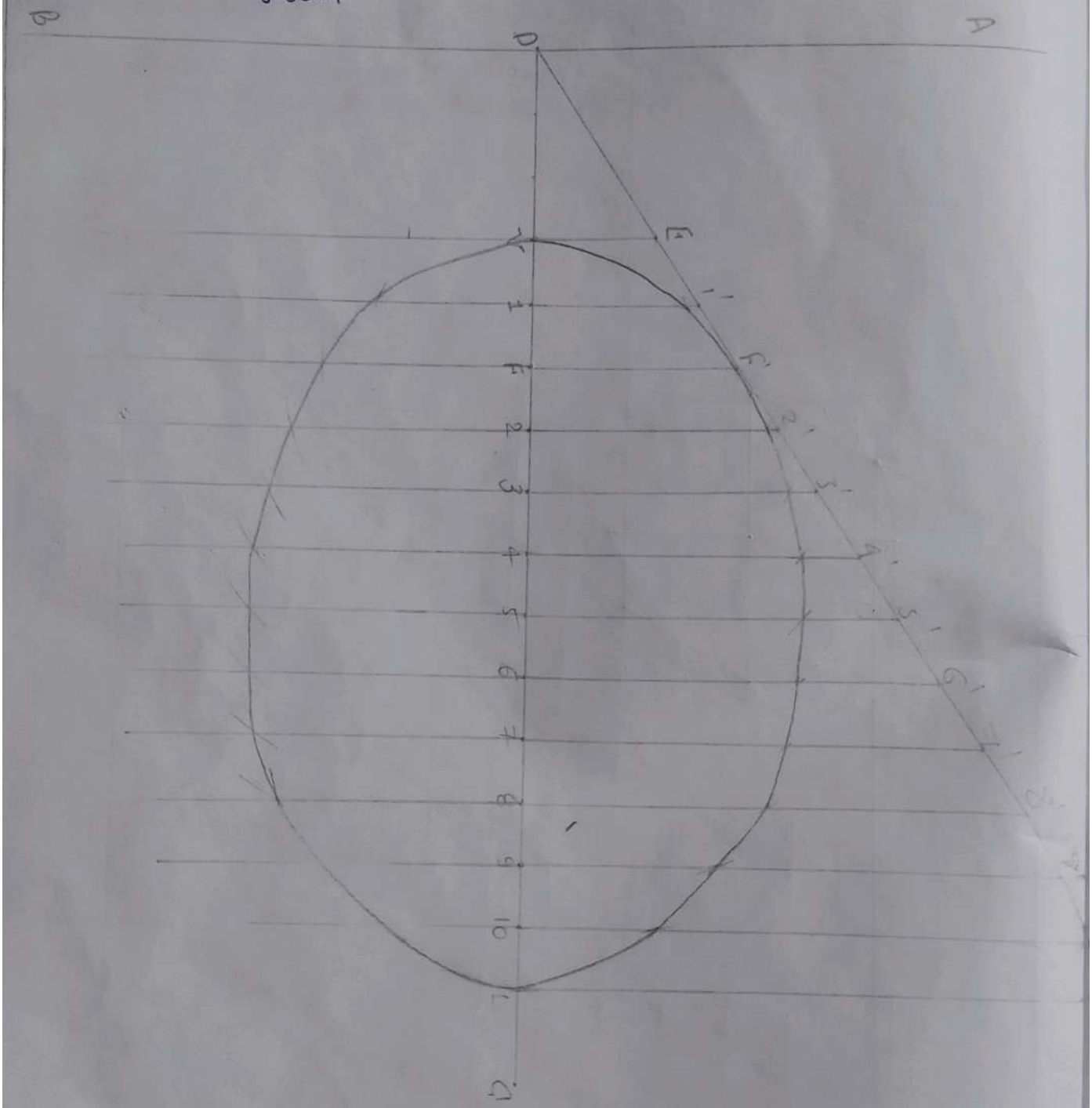


Q10 Draw the involute by a regular hexagon of 25mm

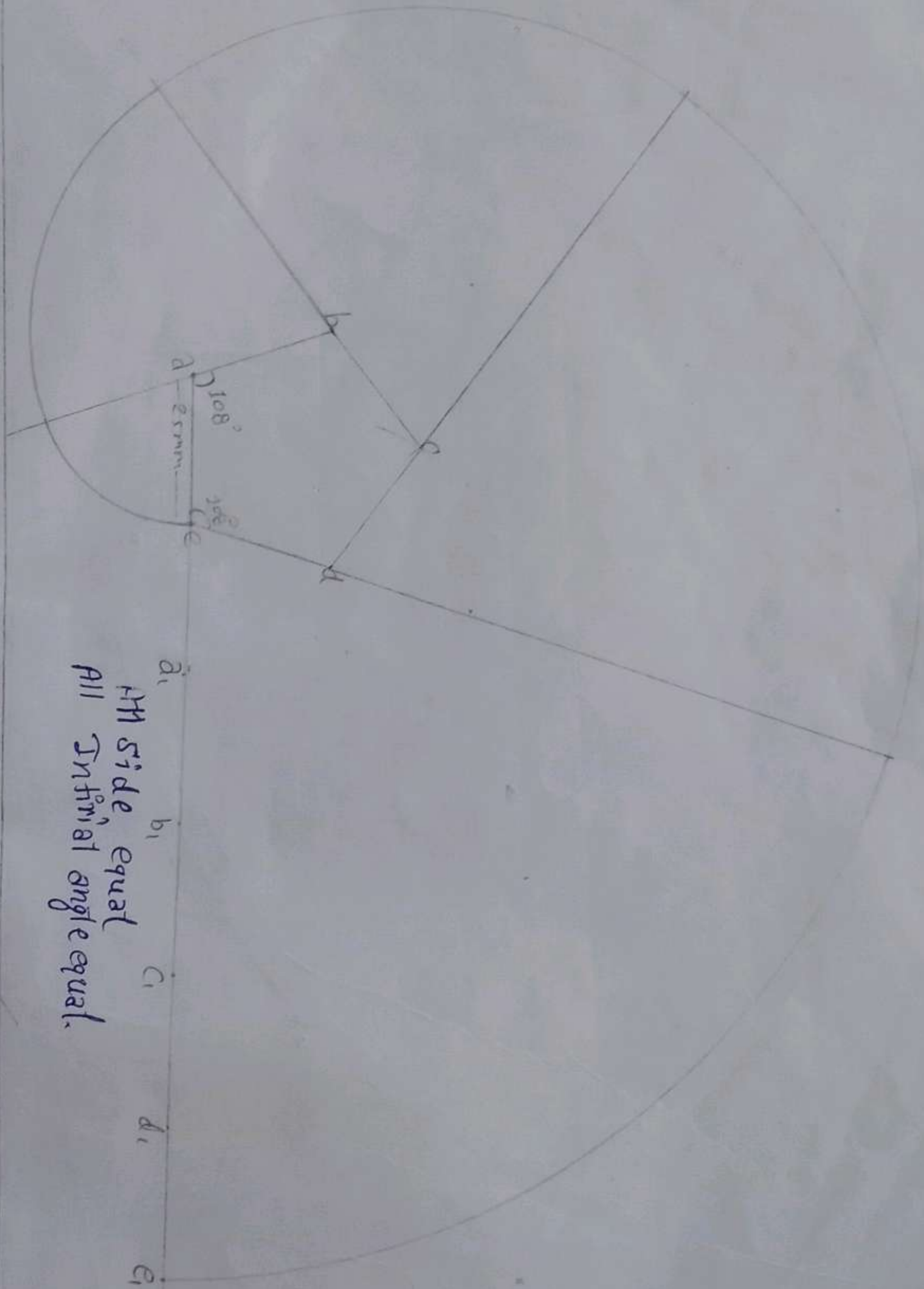


Distance from directrix focus is 55mm. Draw the Ellipse by general method of Eccentricity 'e'

Solution: D.F = 55mm → 5.5cm Eccentricity 'e' = $\frac{2.2}{3.3}$



Q.12 Draw the Involute by a regular pentagon of 25 mm.

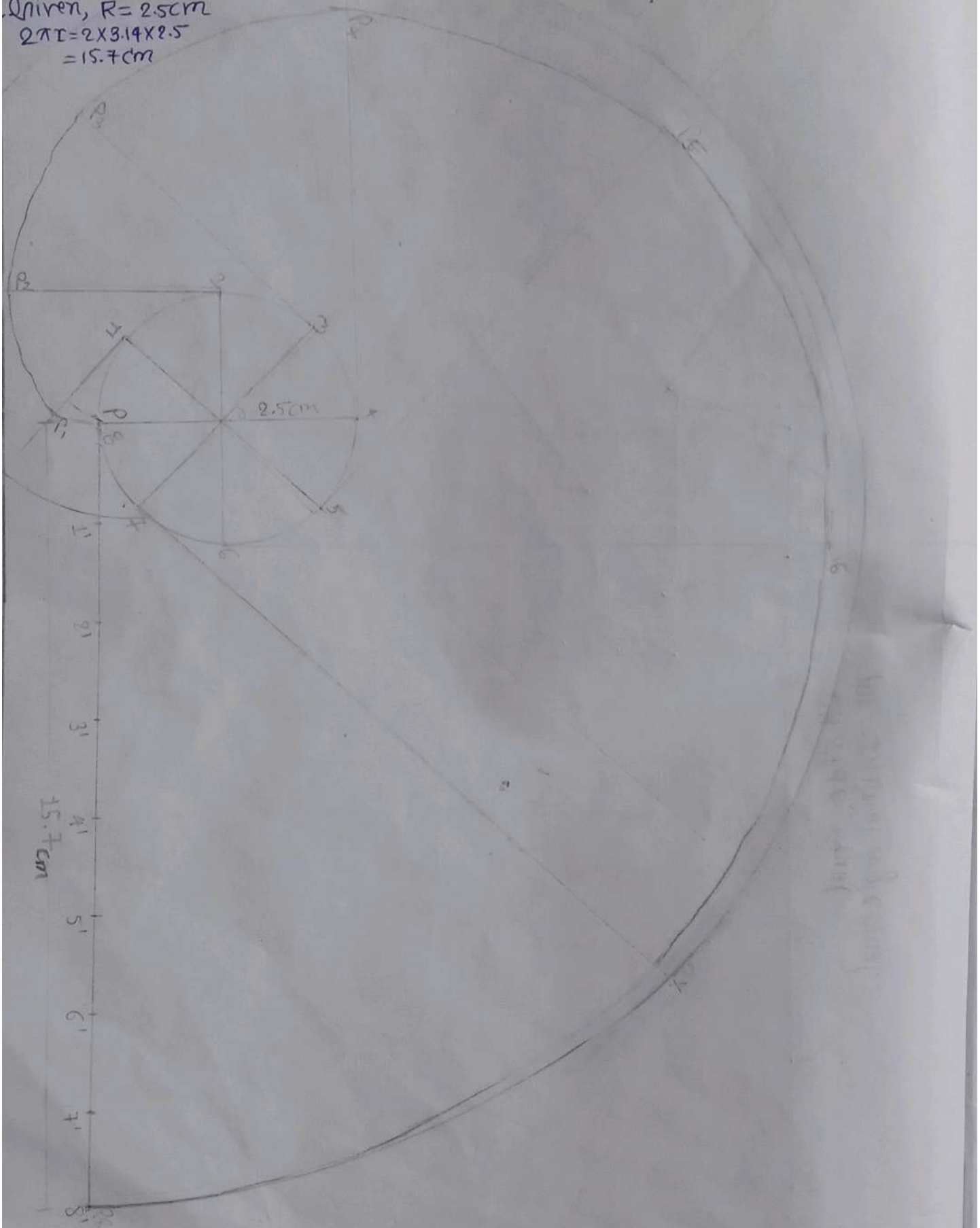


Draw the involute curve from a circle of 50mm diameter

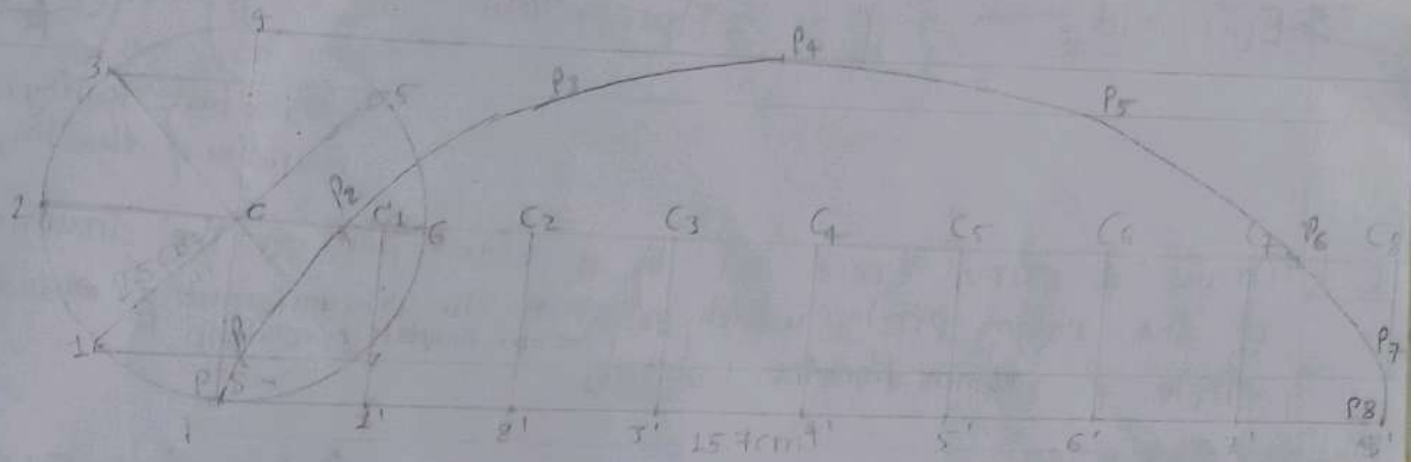
Given, R = 2.5cm

$2\pi r = 2 \times 3.14 \times 2.5$

$= 15.7\text{cm}$



Q14 → Draw the curve trace out by a fixed point on the circumference of a circle of 150mm diameter which roles along a straight line for one complete revolution.



Defination of Cycloidal Curve :-

Cycloidal is a curve trace out by a fixed point on the circumference of a rolling circle which roles along a straight line from one complete revolution & without slipping.

Epicycloid :-

Hypercycloid :-

$$\theta = \frac{r}{R} \times 360^\circ$$

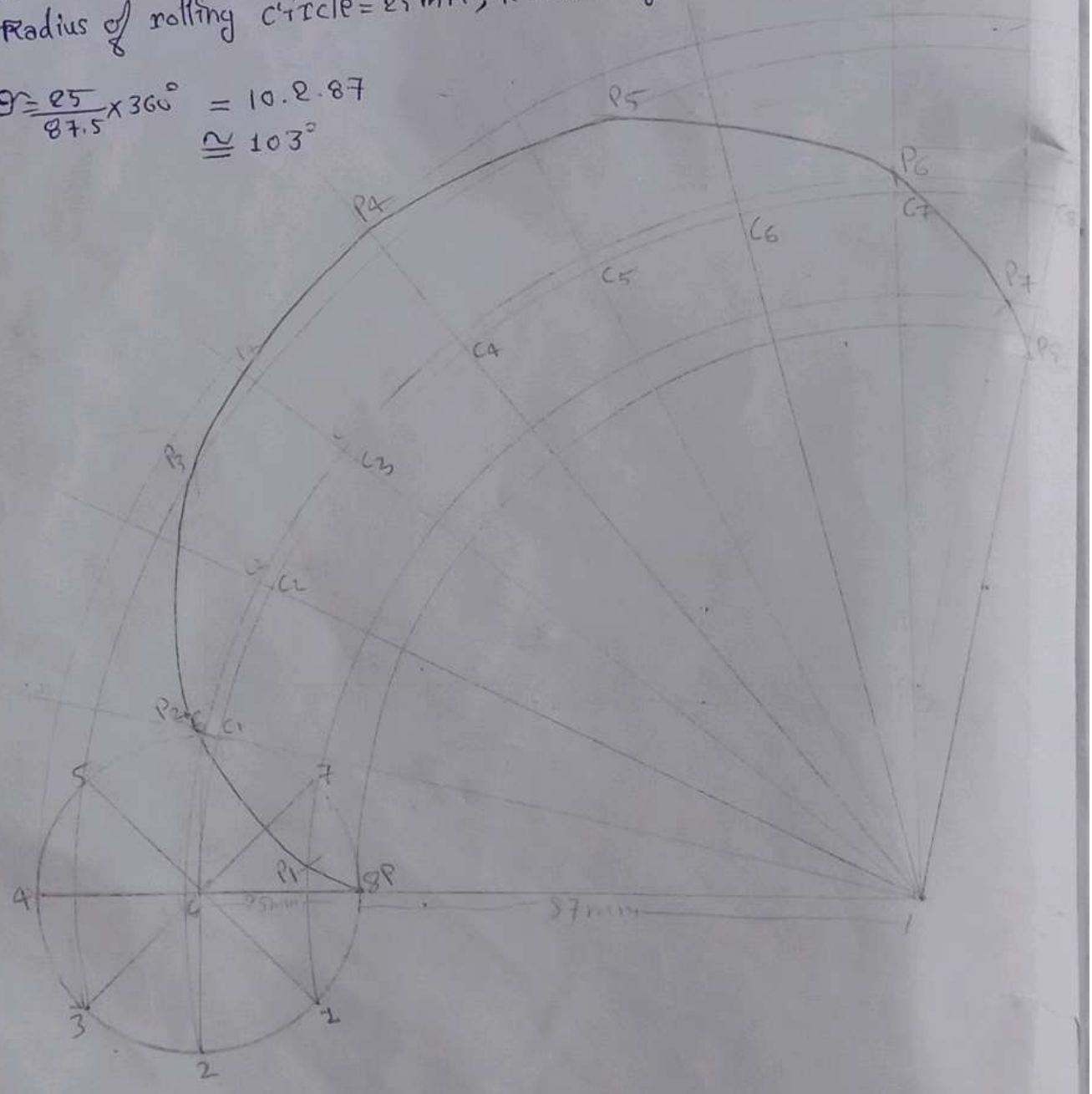
r = radius of Rolling circle
R = radius of directing circle

Q.1 Draw a curve trace out by a fixed point on the circumference of another circle of 175mm diametre. which rolles on the circumference of ~~an~~ outsides (For one complete revolution)

Sol^n => $\theta = \frac{r}{R} \times 360^\circ$

r = Radius of rolling circle = 25mm, R = Radius of directing circle = 87.5mm

$$\theta = \frac{25}{87.5} \times 360^\circ = 10.2.87$$
$$\cong 103^\circ$$



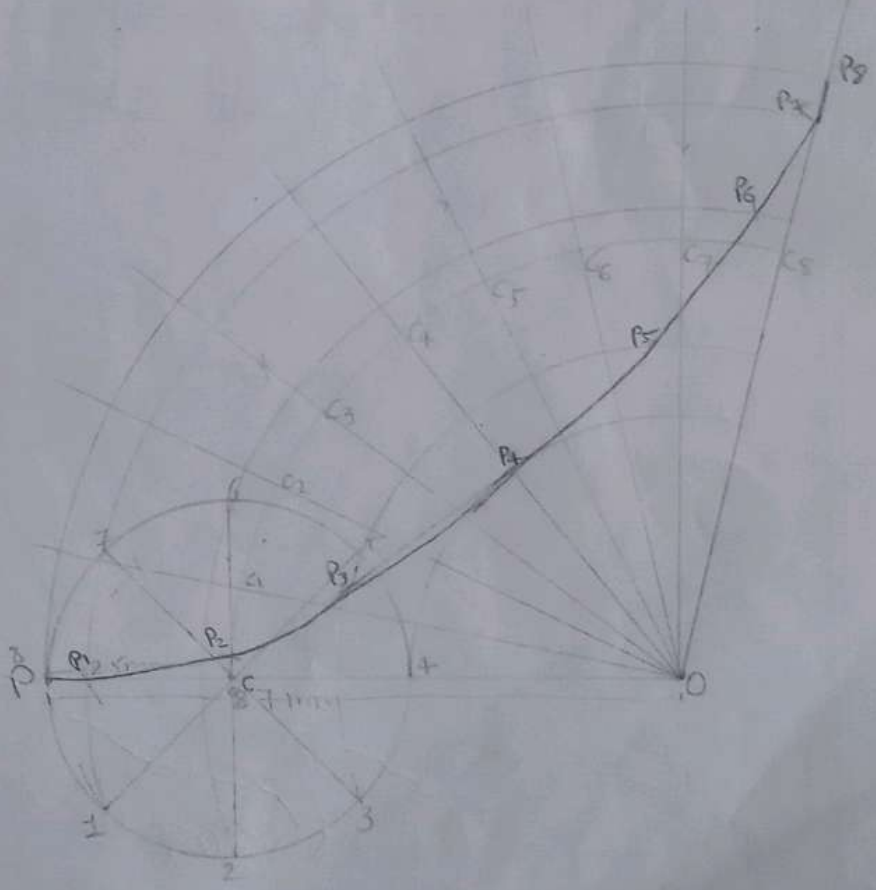
Q.2 Draw a curve trace out by a fixed point on the circumference of the rolling circle which ~~rolls~~ rolles for one complete revolution on the circumference of another circle of 175mm diametre.

Sol^n => $\theta = \frac{r}{R} \times 360^\circ$

r = Radius of rolling circle = 25mm, R = Radius of directing circle = 87.5mm

$\theta = \frac{25}{87.5} \times 360^\circ = 10.2.87$

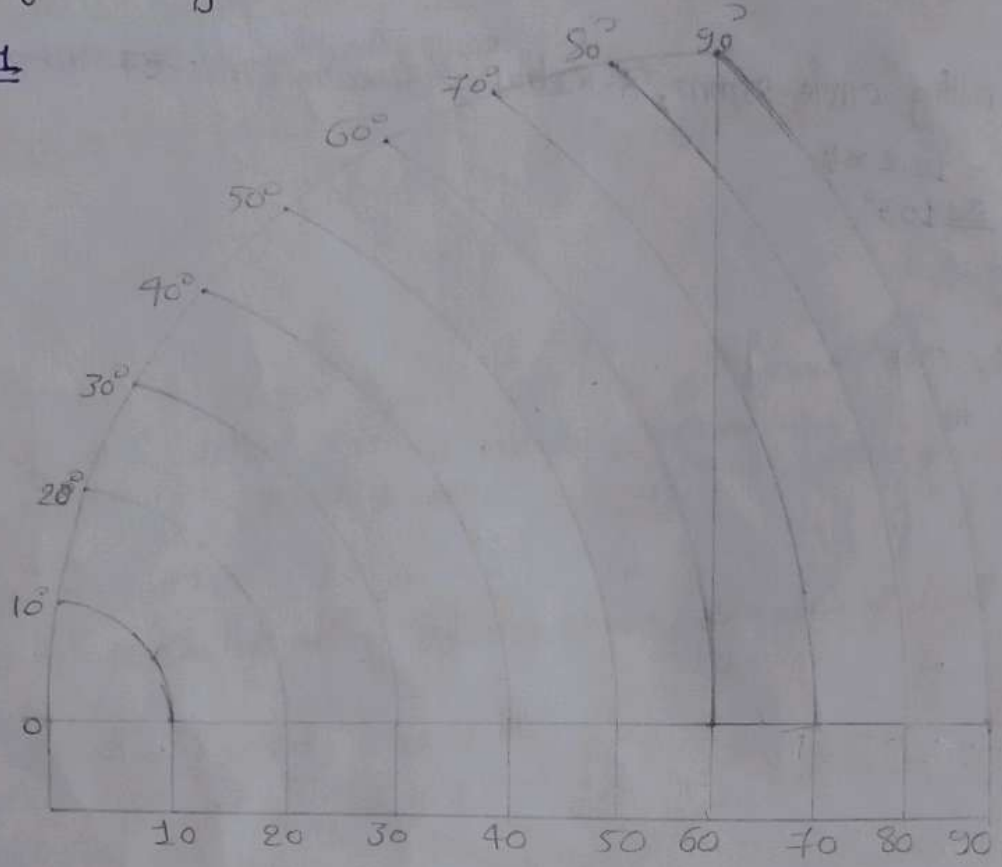
$\cong 103^\circ$

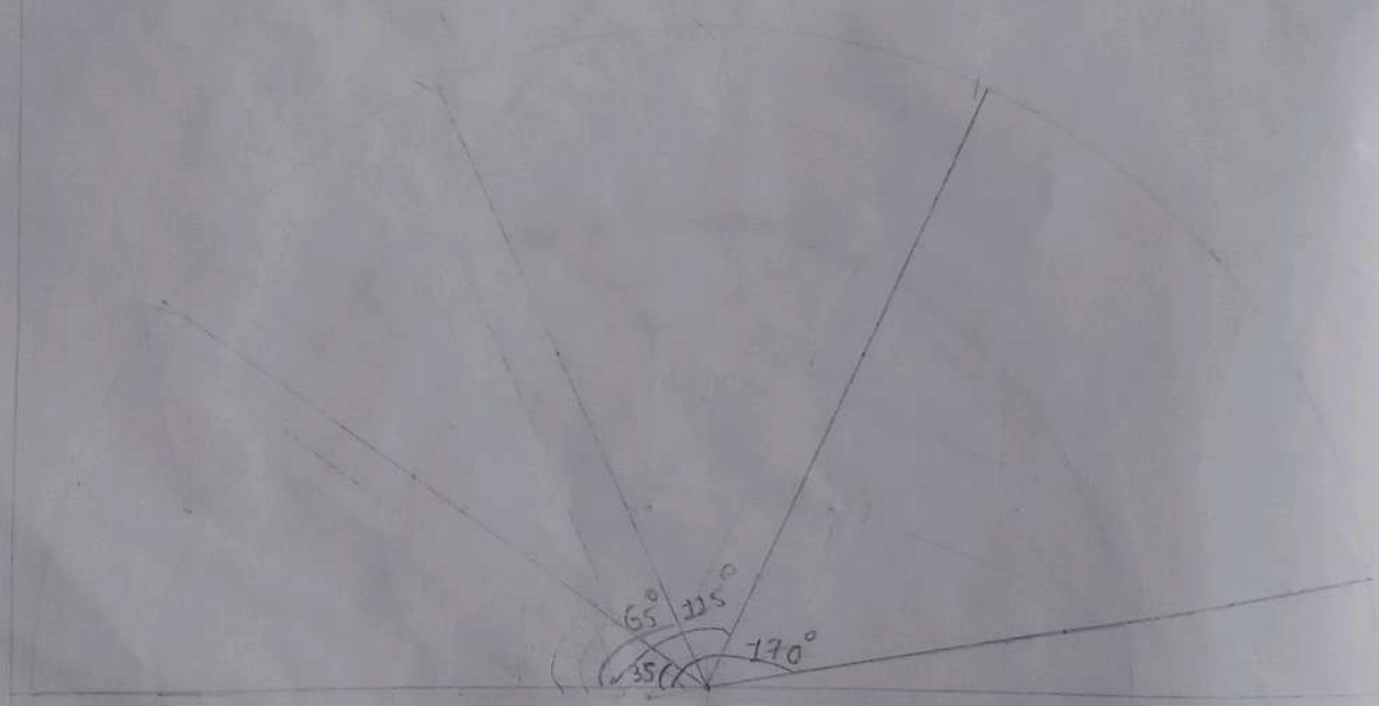


Q.1 Draw the Scale of chrods and messure following angle $35^\circ, 65^\circ, 115^\circ, 170^\circ$.

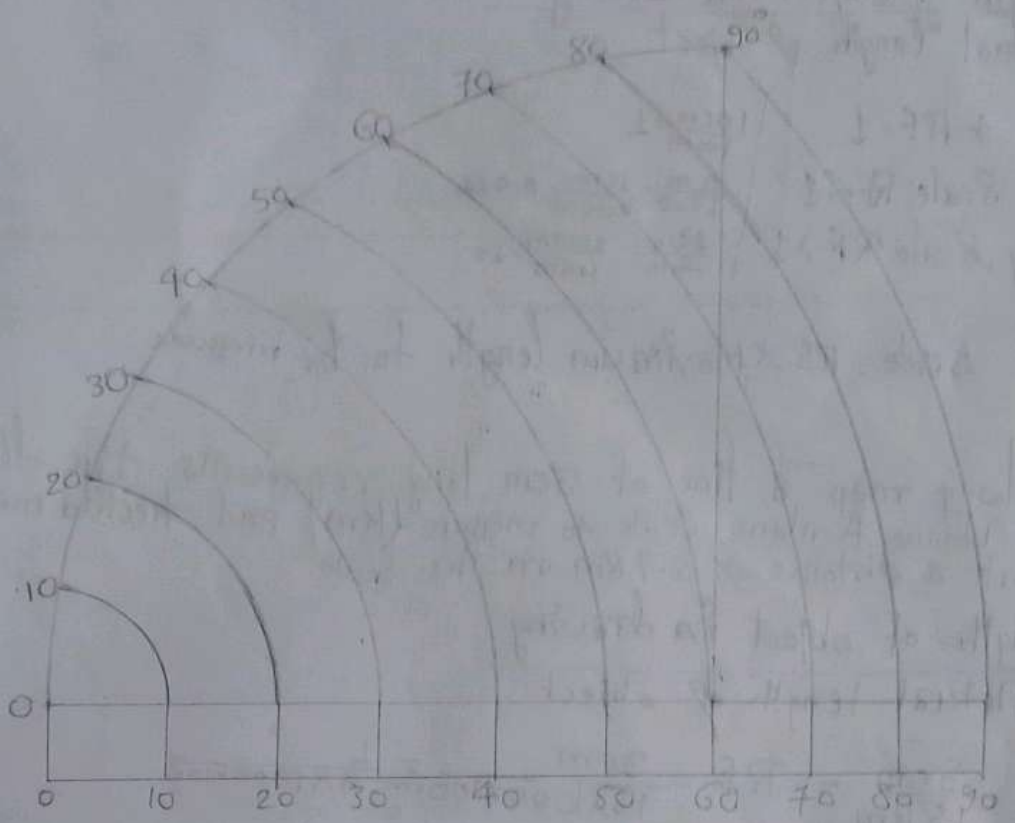
Q.2 Draw A triangle of Side length 9cm, 7cm, 6cm and messure intirial angles using Scale of chrods.

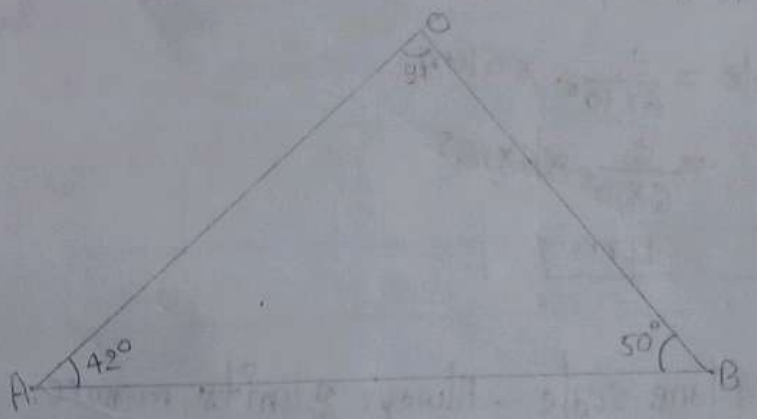
Soln 01





8.M.02





14/Oct/24

R.F :— Representative fraction

R.F = Unit less
1 Km = 10 Hm

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

Full Scale ⇒ RF = 1	$\frac{10cm}{10cm} = 1$
Reducing Scale RF < 1	$\frac{1cm}{1\,foot} = \frac{1cm}{30cm} = 0.033$
Enlarging Scale RF > 1	$\frac{1cm}{1mm} = \frac{10mm}{1mm} = 10$

Length of Scale = RF × Maximum length to be measure.

Q.1:— In a railway map a line of 3cm long represents the distance of 18km. Draw A plane Scale to measure (Km) and Hectkta meter and mark a distance of 5.7 Km. on the Scale.

Sol:—

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

$$R.F = \frac{3cm}{18Km} \Rightarrow R.F. = \frac{3cm}{18 \times 1000 \times 100 cm} = \frac{1}{6 \times 1000 \times 100}$$

length of Scale = R.F × Maximum length to be measure.

5.7 Km = 5 Km 7 Hm

Assuming Maxm length to measure = 6 Km

length of Scale = value always find in cm.

$$\text{length of Scale} = \frac{1}{6 \times 10^5} \times 6Km$$

$$LOS = \frac{1}{6 \times 10^5} \times 6 \times 10^5$$

$$\boxed{LOS = 1cm}$$

B ⇒ Types of Scale :— ① Plane scale – Always 2 units measure.
② Diagonal Scale – 3 units measure

① Plane S.
② Diagonal S. } Linear measurment
③ Vernier Sc
Scale of choord – Angular

Q.2 1 cm = 0.5 Km

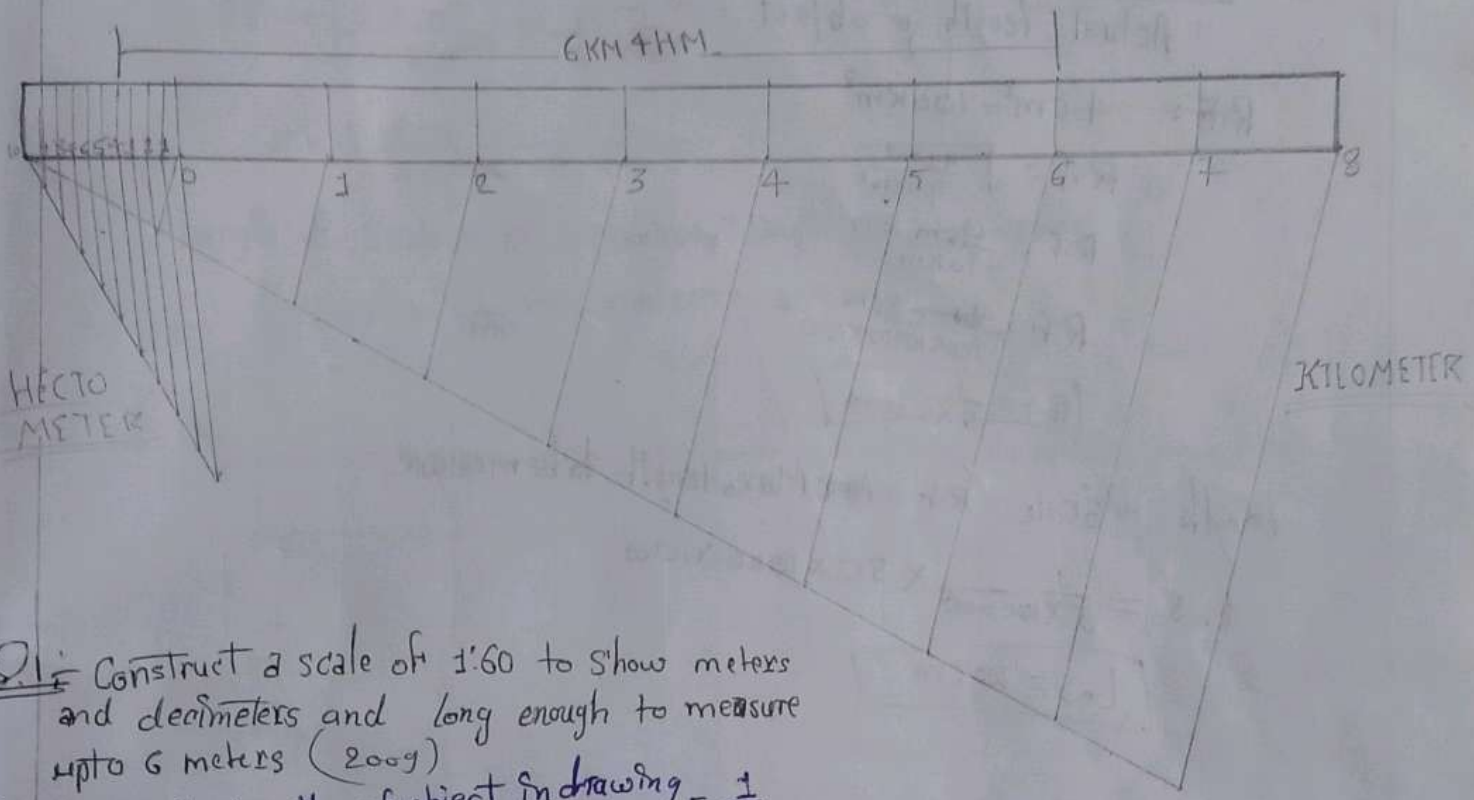
$$R.F = \frac{1}{50000}$$

LOS = RF × Max. length to be M

$$LOS = \frac{1}{50000} \times 900000$$

$$\boxed{LOS = 18cm}$$

Q2: Construct a plan scale of 1cm = 0.5Km, to red Kilometer and long enough to measure up to 9 Kilometers. Find its R.F. and measure distance of 6Km and 4 Hectometers on the Scale.



Q1: Construct a scale of 1:60 to show meters and decimeters and long enough to measure upto 6 meters (2009)

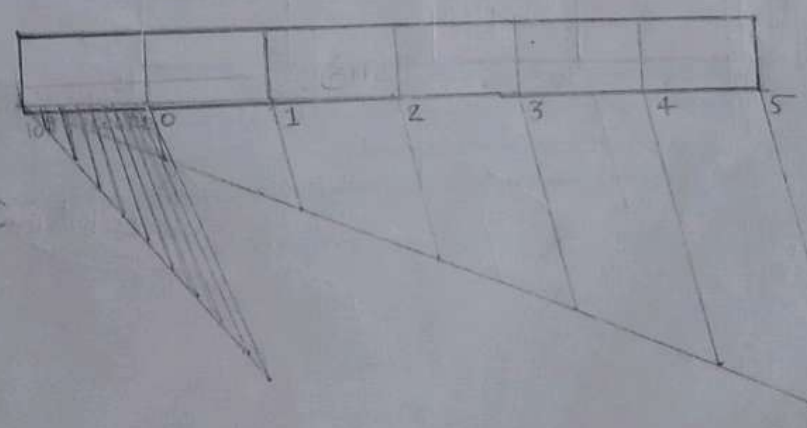
Soln $R.F = \frac{\text{length of object in drawing}}{\text{Actual length of object}} = \frac{1}{60}$

Length of Scale = R.F. × Maximum length to be measure

$LoS = \frac{1}{60cm} \times 6m$

$LoS = \frac{1}{60cm} \times 6 \times 100$

$LoS = 10cm$



$\frac{10}{6} = 1.666$

Q3:- A rectangular plot of 100square Kilometer is represented on a cetain map by a rectangular area of 4 Square centimeters. Draw a scale to show 50km and mark a distance of 41km on it (R.G.P.V JUNE 2008)

Sol:- R.F = Representative fraction

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

$4\,cm^2 = 100\,Km^2$

$$R.f = \sqrt{\frac{4\,cm^2}{100\,Km^2}}$$

$$R.f = \frac{2\,cm}{10\,Km}$$

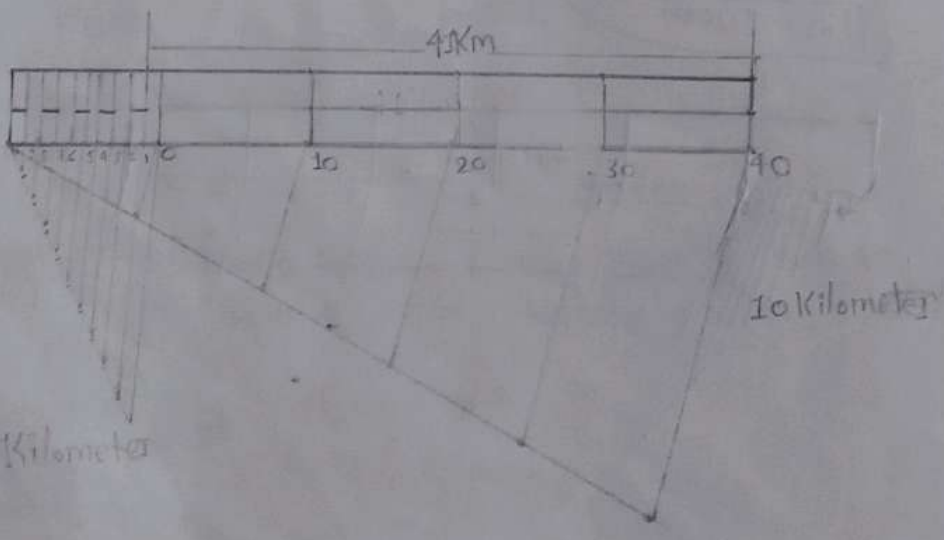
$$R.f = \frac{2\,cm}{10 \times 1000 \times 100}$$

$$\boxed{R.f = \frac{1}{5 \times 100000}}$$

Length of Scale = R.f × Max. length to be measure.

$$l.s = \frac{1}{5 \times 100000} \times 50 \times 1000 \times 100$$

$$\boxed{l.s = 10\,cm}$$



Q.4:- A cube of 5cm. side represent a tank of 8000 cubic meter volume. Find the R.F. and construct a scale to measure up to 60m and mark on it a distance of 47m. Indicate R.F. of the Scale (2008)

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

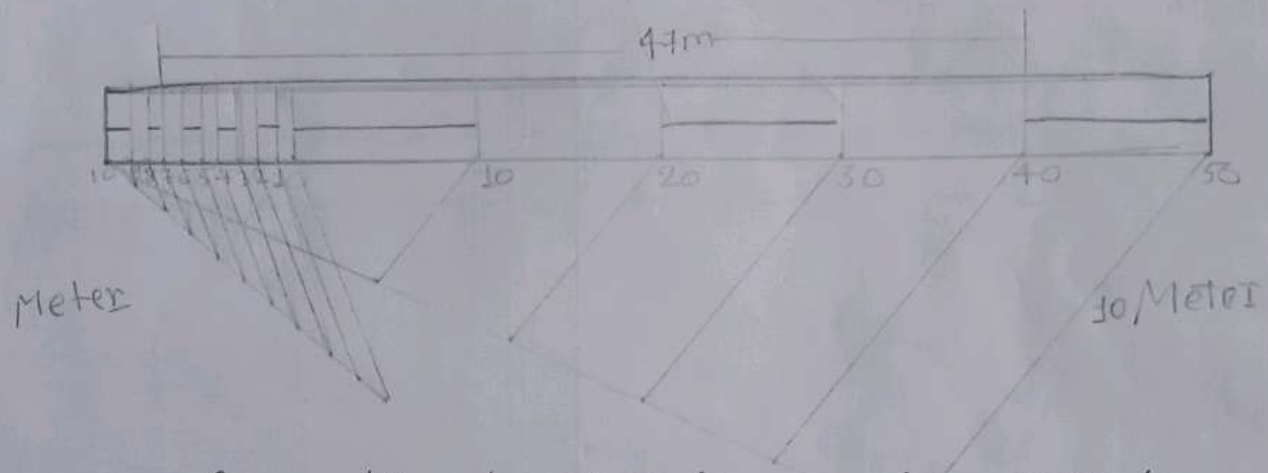
$125cm^3 = 8000m^3$

$R.F = \sqrt{\frac{125cm^3}{8000m^2}} = \frac{5cm}{20m}$

$R.F = \frac{5cm}{20 \times 100cm} = \frac{1}{400}$

Length of Scale = R.F. × Maximum length to be Measure

$LoS = \frac{1}{400} \times 60 \times 100cm = 15cm$

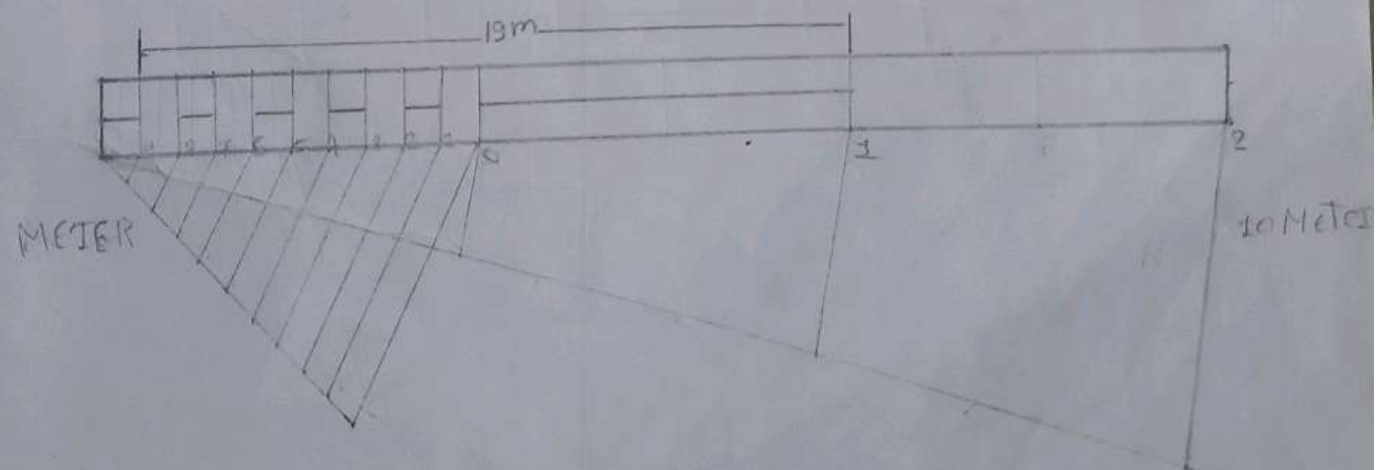


Q.5:- A container of 1000 cubic meter volume is represented by a block of 125 cubic Centimeter volume. Find R.f. and construct a scale to measure up to 30m. Measure a distance of 19m on the scale.

Sol:- $R.F = \frac{\text{length of object in drawing}}{\text{Actual length of object}} = \sqrt{\frac{125cm^3}{1000m^3}} = \frac{5cm}{10m} = \frac{5cm}{10 \times 100cm} = \frac{1}{200cm}$

length of Scale = R.F × Maximum length to be measure

$LoS = \frac{1}{200} \times 30 \times 100cm = 15cm$



Q.6- A 3.2cm. long line represent a length of 4m. Extends this line to measure lengths up to 25m. and show on it units of meter and 5 meters. Show the length of 17m. on this scale.

Sol^n

$3.2cm = 4m$

$R.F. = \frac{3.2cm}{4m}$

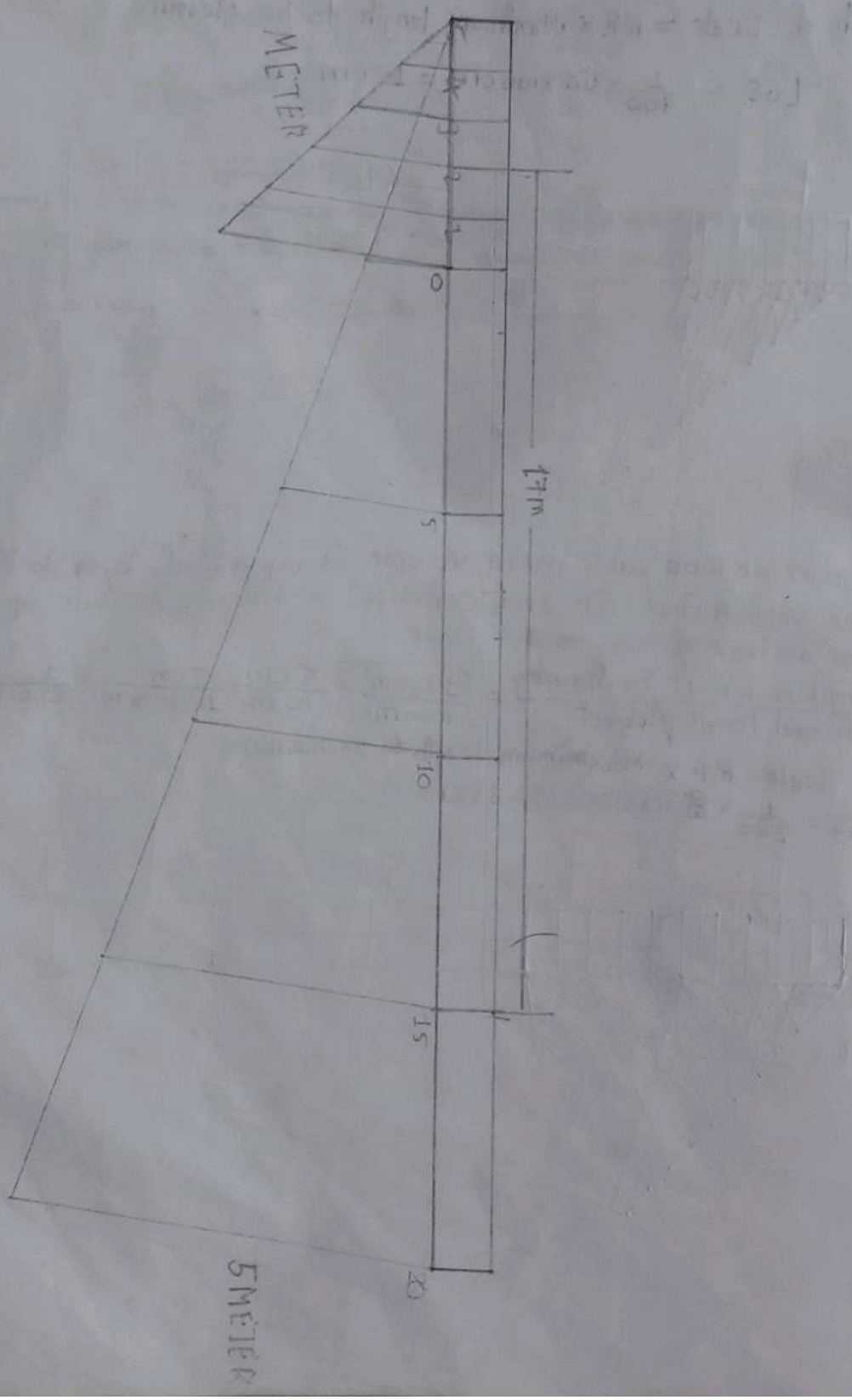
$R.F. = \frac{3.2cm}{400cm}$

$R.F. = \frac{32}{400}$

length of scale = R.F. × length to be Maximum

$Los = \frac{3.2}{400} \times 25 \times 100 cm$

$\boxed{Los = 20cm}$



Q.10 C

Q7 Construct a scale of $1\frac{3}{8}$" = 1 mile to measure up to 4 miles and mark a distance of 3 miles and 5 furlong on the scale.

Sol^{n} :-

R.F. = $\frac{1\frac{3}{8}"}{1 \text{ mile}}$

$\frac{11"}{8} = 1 \text{ mile}$

R.F. = $\frac{11"/8}{1 \text{ mile}}$

R.F. = $\frac{11 \text{ inch}}{8 \times 1 \text{ mile}}$

R.F. = $\frac{11 \text{ inch}}{8 \times 8 \times 220 \times 3 \times 12 \text{ inch}}$

$LOS = R.F \times Max^{m}$

$LOS = \frac{11}{8 \times 8 \times 220 \times 3 \times 12} \times 4 \text{ mile}$

$LOS = \frac{11}{8 \times 8 \times 220 \times 3 \times 12} \times 4 \times 8 \times 220 \times 3 \times 12 \times 2.54$

$LOS = \frac{11 \times 2.54}{2}$

$LOS = 13.97 \cong 14 \text{ cm}$

Q.10 (b) :- Scale of $\frac{3}{4}$" = 1 yard, to measure upto 10 yards and showing yards and feet.

Sol^{m} :-> $\frac{3"}{4}$ = 1 yard

$$R.f = \frac{\frac{3\ inch}{4}}{1\ yard}$$

$$R.f = \frac{3\ inch}{4 \times 3 \times 12\ inch}$$

$$R.f = \frac{3}{4 \times 1 \times 3 \times 12}$$

Max^{m} = 10 yard

LOS = R.F × Max^{m}

$$LOS = \frac{3}{4 \times 1 \times 3 \times 12} \times 10 \times 3 \times 12 \times 2.54$$

LOS = 19.05 cm $\simeq$ 19 cm

Q10 (a) Scale of $1\frac{1}{4}" = 1$ Foot, to measure upto 5 feet and showing feet and inches.

Solⁿ:

$1\frac{1}{4}" = 1$ Foot

$R.F = \frac{\frac{5}{4}\text{ inch}}{1\text{ Foot}}$

$R.F = \frac{5\text{ inch}}{4 \times 12\text{ inch}}$

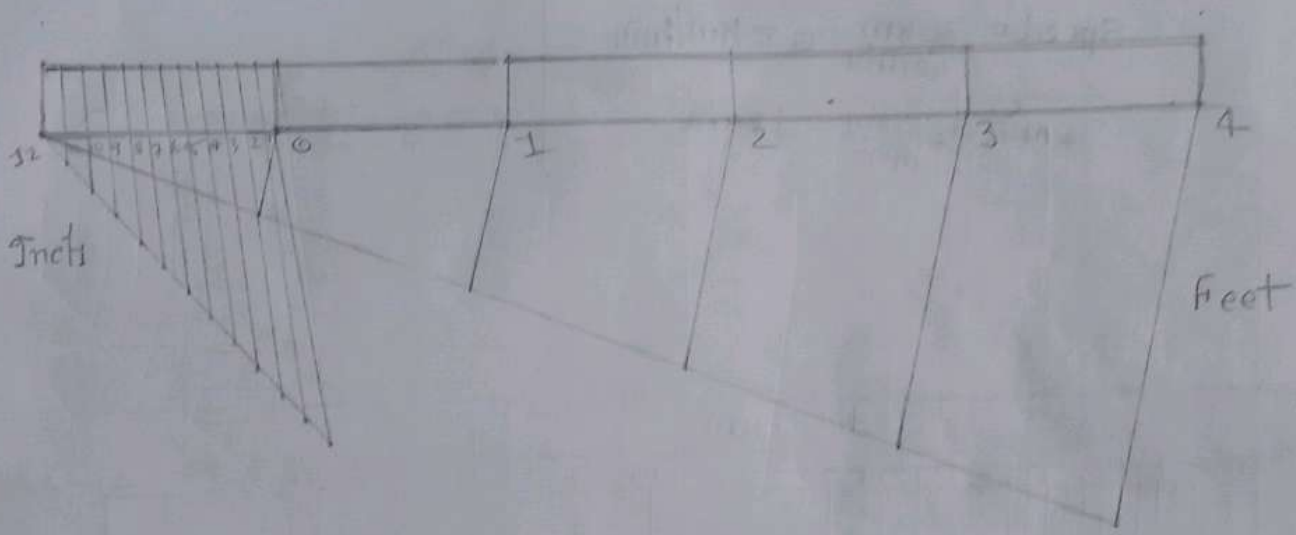
$\boxed{R.F = \frac{5}{48}}$

$LoS = R.F \times Max^m$

$LoS = \frac{5}{48} \times 5\text{ feet}$

$LoS = \frac{5}{48} \times 5 \times 12 \times 2.54$

$\boxed{LoS = 15.87\text{cm}} \cong 16\text{cm}$



2.9 → The distance between Two towns is 120km. A passenger train covers this distance in 4 hours. Construct a scale to measure off the distance covered by the train in a single minute and up to 1 hour. The R.F. of the scale is 1:200000. Show the distance covered by the train in 36 minutes.

Sol:

A ——— 120Km / 4hour ——— B

LOS = R.F × Max^m

LOS = $\frac{1}{200000}$ × 30 × 1000 × 100 cm

LOS = 15CM

Distance coverd in 36 min

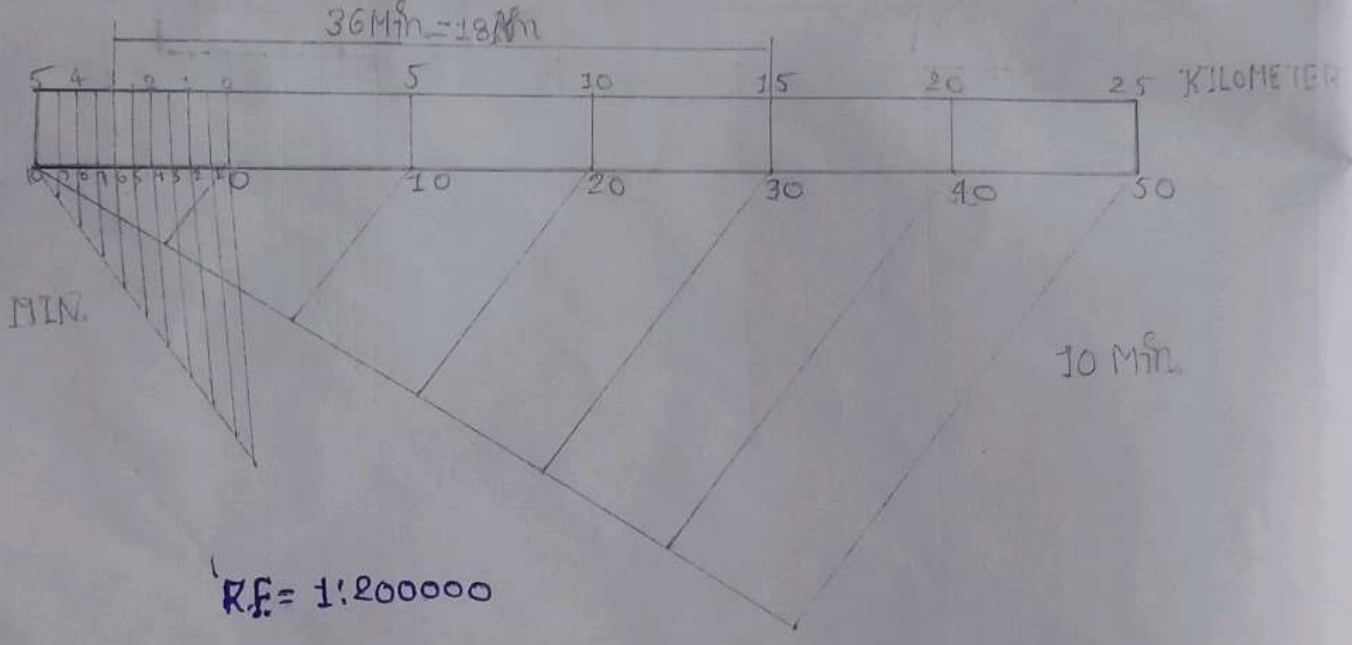
Speed = $\frac{\text{Distance Traveled}}{\text{Time Taken}}$

Speed = $\frac{120\text{Km}}{4\text{hr}}$

Speed = 30 Km/H

Speed = $\frac{30\text{Km}}{60\text{min}}$ = 0.5 Km/min

36 min × $\frac{0.5\text{Km}}{\text{min}}$ = 18Km



R.F. = 1:200000

Q.1 Construct a diagonal scale of R.F. = 1/32 to read meters, Decimeters and centimeters and long enough to read up to 4 meters. show on this scale a distance of 2.46 meters

Sol:

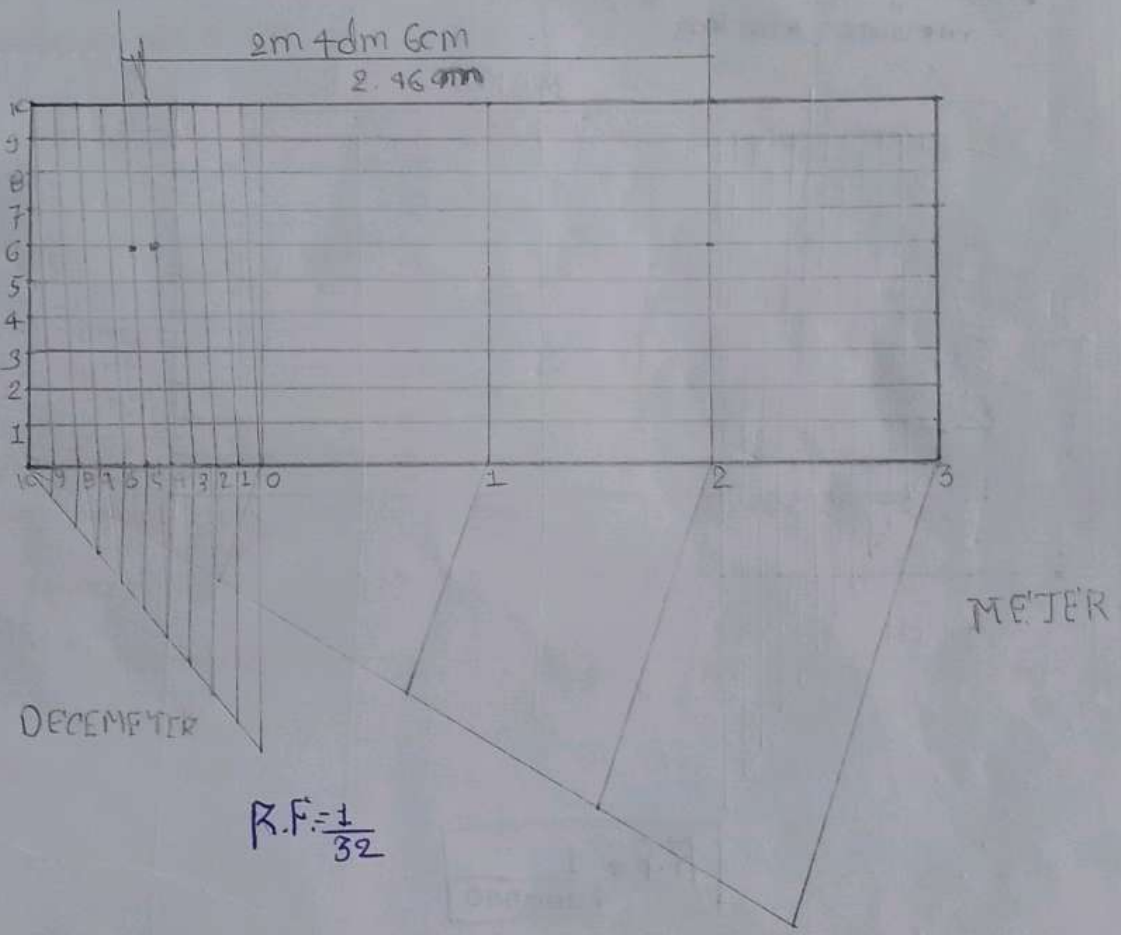
$R.f. = \frac{1}{32}$

Max^m length = 4m

LoS = R.f × max^m length to be messure

$LoS = \frac{1}{32} \times 4 \times 100$

$LoS = 12.5\,cm$



R.F. = 1/32

Q12 Distance between two railway stations is 600km. It is repreresented on a railway map by a line 15cm. long construct a diagonal scale to measures up to a kilometer. Find its R.F. and indicate a distance of 346km. on this scale.

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

$RF = \frac{15cm}{600km}$

$R.f = \frac{15cm}{600 \times 1000 \times 100}$

1Km = 1000m

1m = 100cm

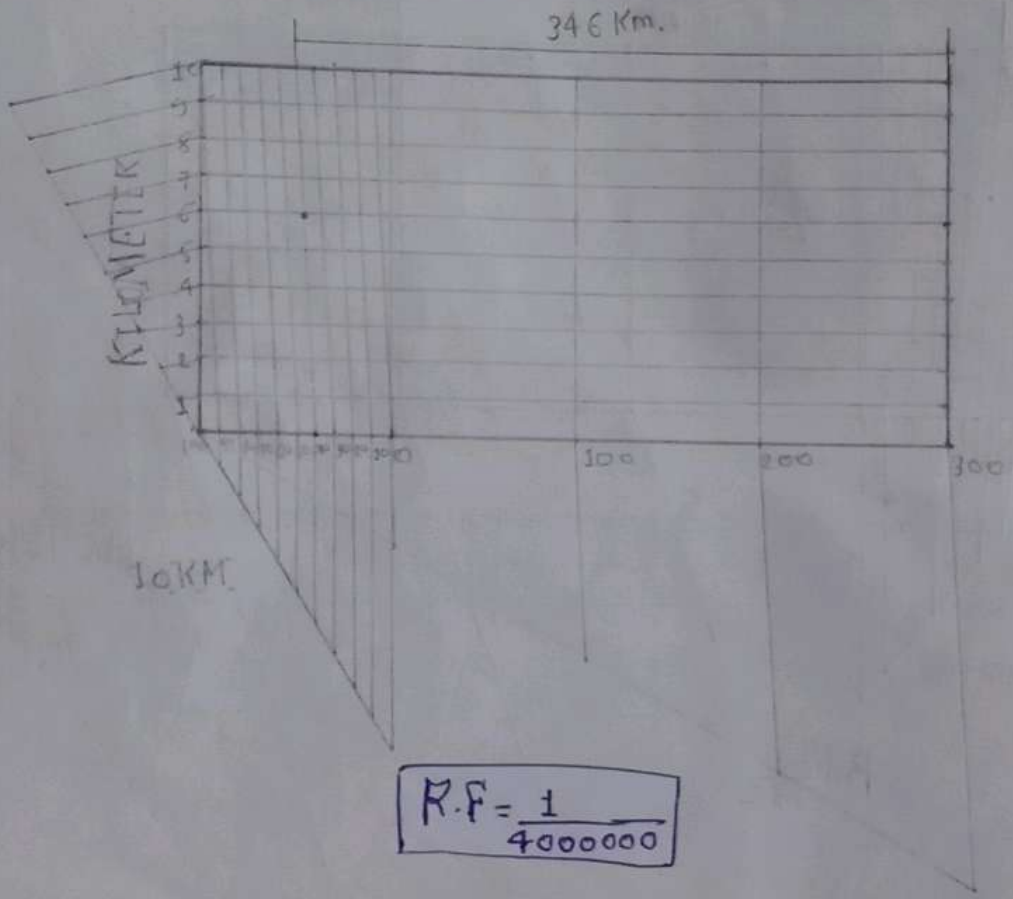
$\boxed{R.F = \frac{1}{4000000}}$

Assuming maximum length to be messure = 400 Km

$LoS = R.F \times Max^m \text{ length to be messure}$

$LoS = \frac{1}{4000000} \times 400 \times 1000 \times 100 cm$

$\boxed{LoS = 10cm}$



$\boxed{R.F = \frac{1}{4000000}}$

Q.15) Distance between two cities A and B is 300 kilometers, its equivalent distance on the map measures only 6cm. What is the R.F. & Draw a diagonal scale to show hundreds of kilometers, tens of kilometers and kilometers. Indicate on the scale, The following distance- 525 kilometers, 313 kilometers and 258 kilometers.

Sol'n ⇒ $R.F. = \frac{\text{length of object in drawing}}{\text{Actual length of object}}$

$R.F = \frac{6cm}{300km}$ 1km = 1000m, 1m = 100cm

$R.F = \frac{6cm}{300 \times 1000 \times 100}$

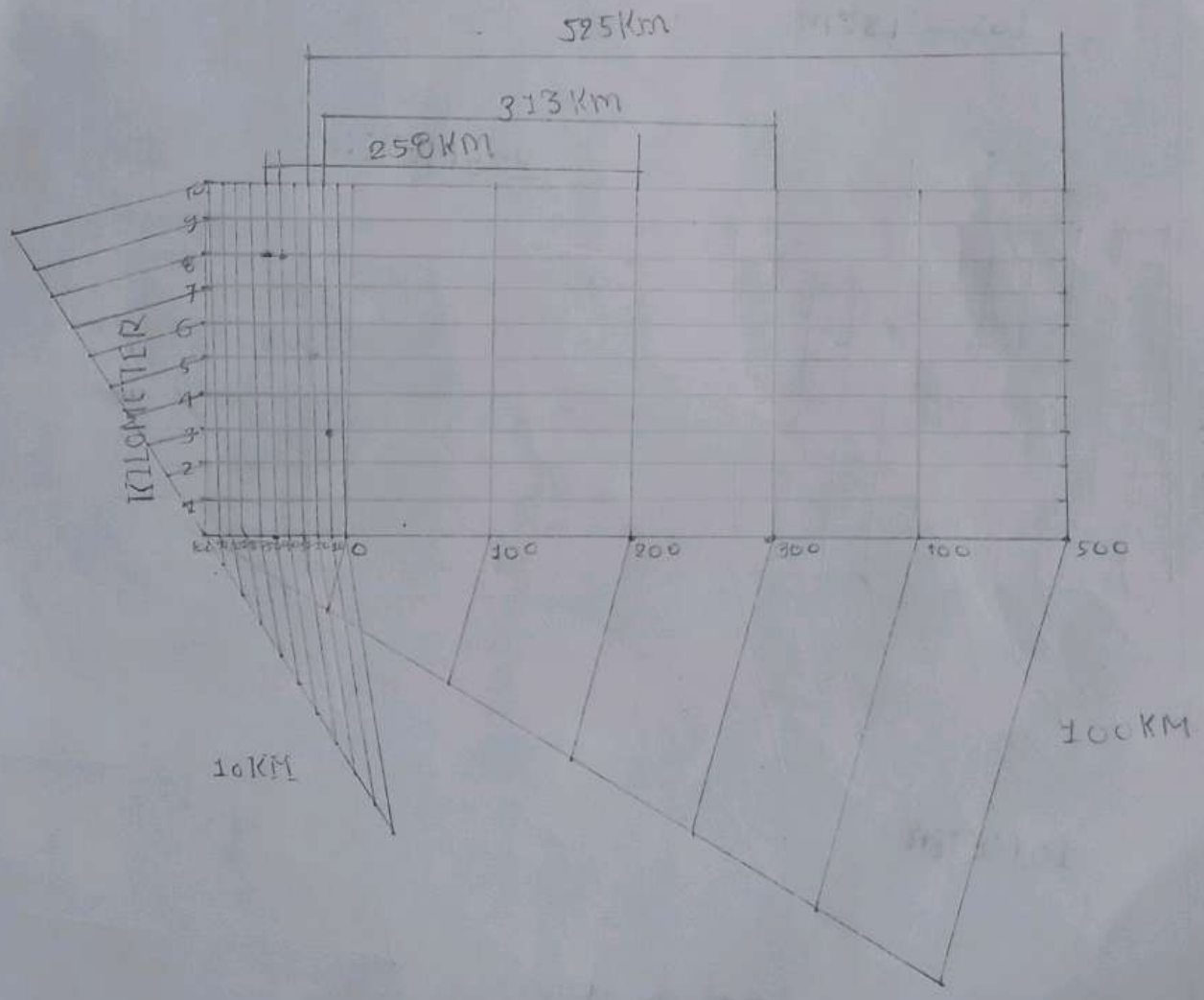
$R.F = \frac{1}{5000000}$

Assuming maximum length to be Measure = 600 km

$LoS = R.F. \times Max^m$

$LoS = \frac{1}{5000000} \times 600 \times 1000 \times 100 cm$

$LoS = 12 cm$



Q18 An area of a field is 50000 square meter. The length and the breadth of the field, on the map is 10cm. and 18cm. respectively. Construct a diagonal scale which can read upto single meter. Mark a length of 235 meters on the scale. What is the R.F. of the scale?

Sol^n ⇒ $10cm \times 18cm = 50000m^2$

$180cm^2 = 50000m^2$

$\sqrt{\frac{180cm^2}{50000m^2}} \times 300 \times 100$

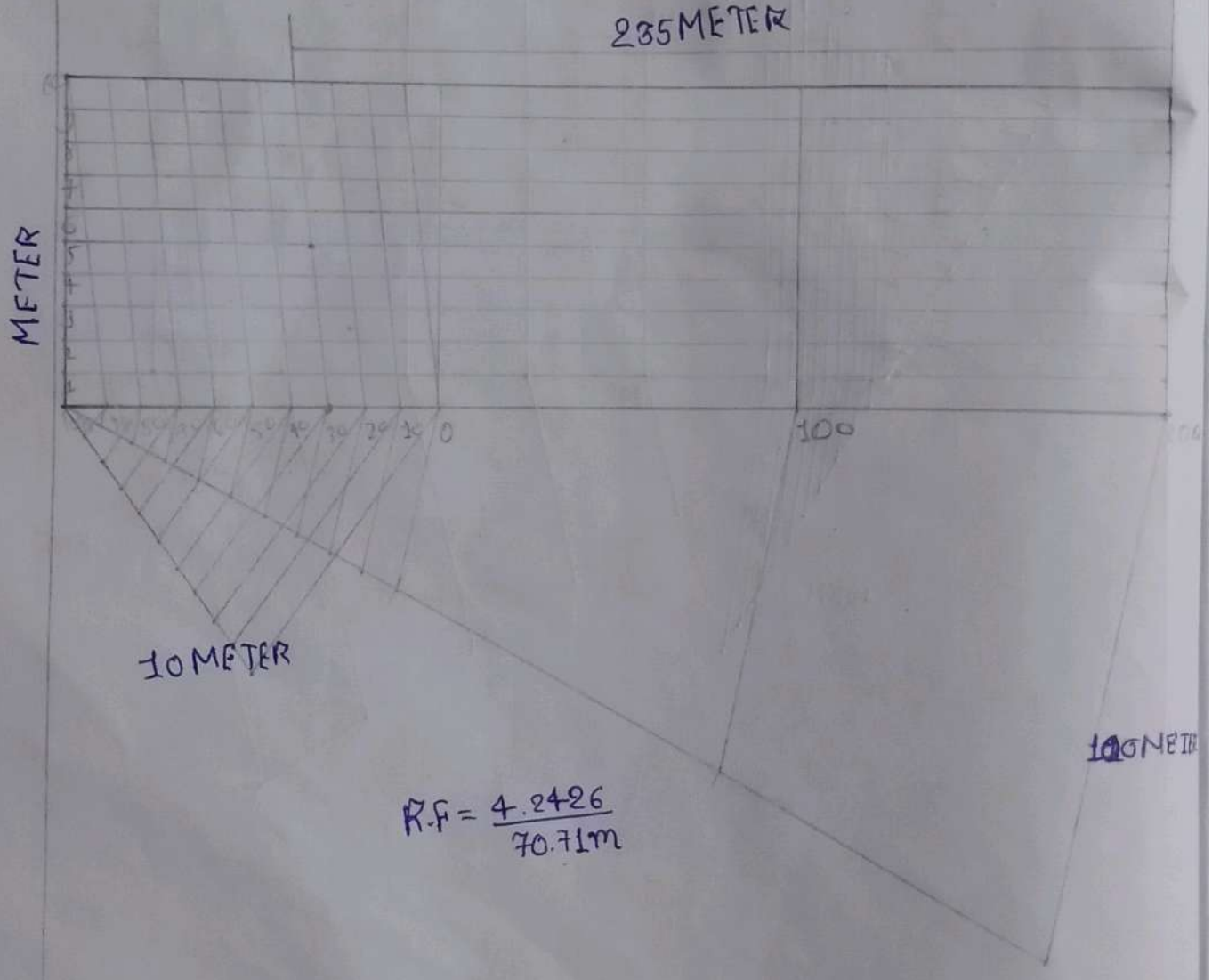
$LOS = \frac{\sqrt{18cm^2}}{\sqrt{5000m^2}} \times 300 \times 100$

$LOS = \frac{4.2426}{70.71m} \times 300 \times 100$

$LOS = \frac{4.2426}{7071} \times 300 \times 100$

$LOS = 0.0006 \times 300 \times 100$

$LOS = 18cm$



$R.F = \frac{4.2426}{70.71m}$

5.16 A rectangular plot of land area 0.45 hectare is represented on a map by a similar rectangle of 5 square cm, calculate the R.F. of the scale of the map. Also draw a scale to read upto single meters from from map. The map should be long enough to measure up to 400 meters.

Sol^n

1 Hectare = $100 cm^2$

$5 cm^2 = 0.45$ Hectare

$5 cm^2 = 0.45 \times 10000 m^2$

$$R.F = \sqrt{\frac{5 cm^2}{0.45 \times 10000 m^2}}$$

$$R.f = \frac{2.2360 cm}{67.08203 m}$$

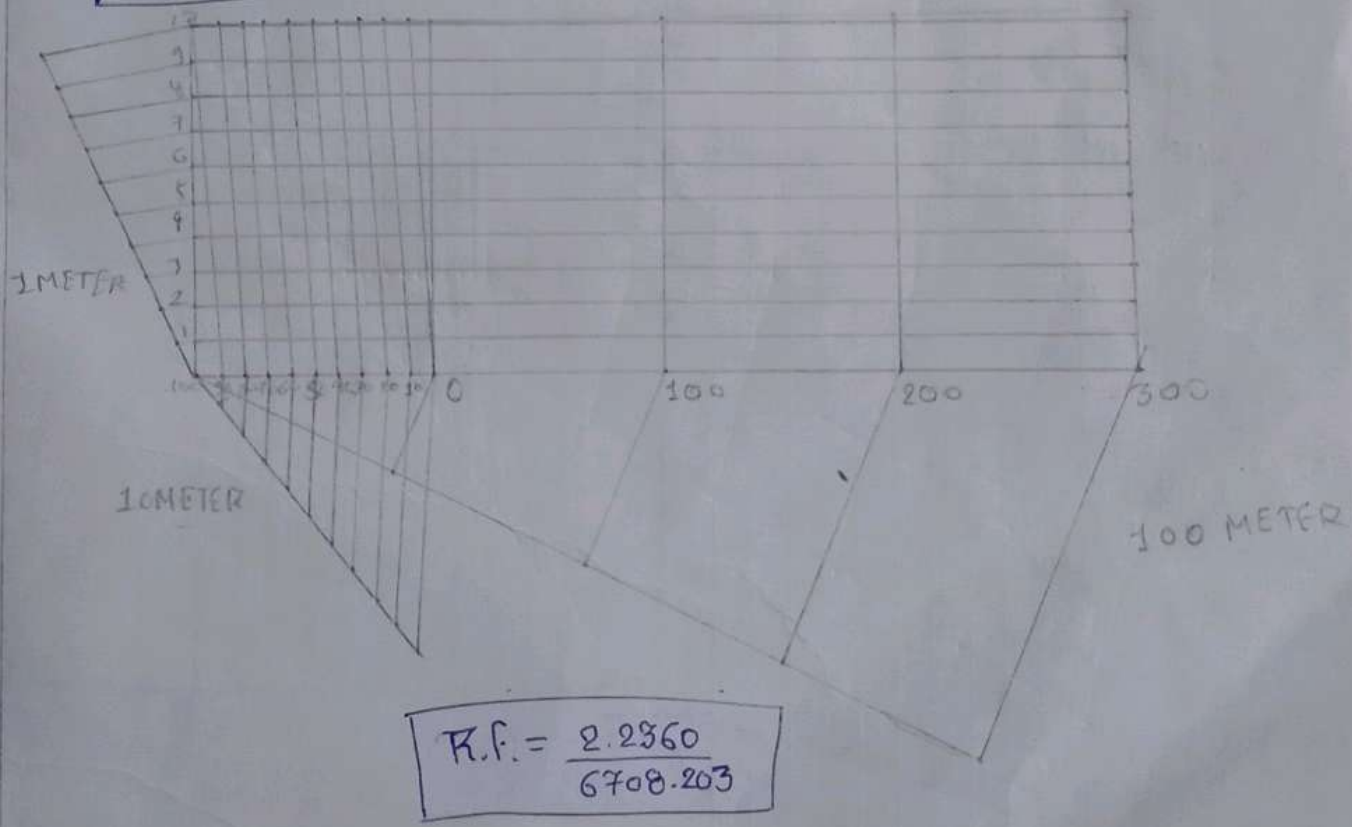
$$R.f = \frac{2.2360 cm}{6708.203 cm}$$

$LoS = R.f \times Max^M$

$$LoS = \frac{2.2360}{6708.203} \times 400 m$$

$$LoS = \frac{2.2360}{6708.203} \times 400 \times 100 cm$$

$\boxed{LoS = 13.33}$



$$\boxed{R.f. = \frac{2.2360}{6708.203}}$$

Q.17 An area of 144 square cm. on a map represented an area of 36 sq. Km. on the field the R.F of the scale for this map and draw a diagonal scale to show km, hectametre and decameter so as to measure up to 10 Km. Show a distance of 7.54 Km. on it.

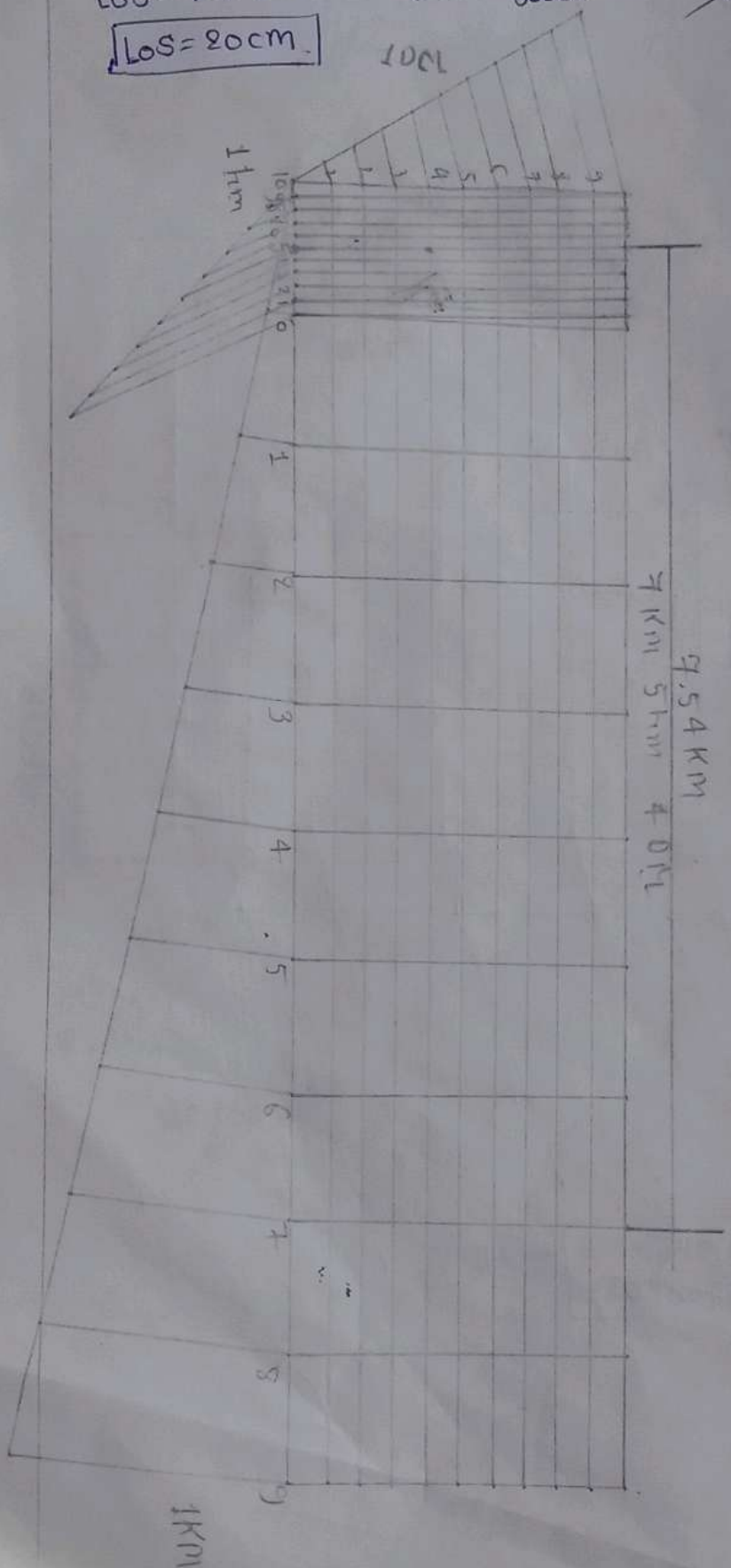
Soln

$144\ cm^2 = 36\ km^2$

$R.F = \frac{\text{length of drawing}}{\text{Actual length of object}} = \sqrt{\frac{144\ cm^2}{36\ km^2}} = \frac{12\ cm}{6 \times 1000 \times 100\ cm} = \frac{1}{50000}$

$LOS = R.F \times Max^m \Rightarrow LOS = \frac{1}{50000} \times 10\ km \Rightarrow \frac{1}{50000} \times 10 \times 1000 \times 100\ cm$

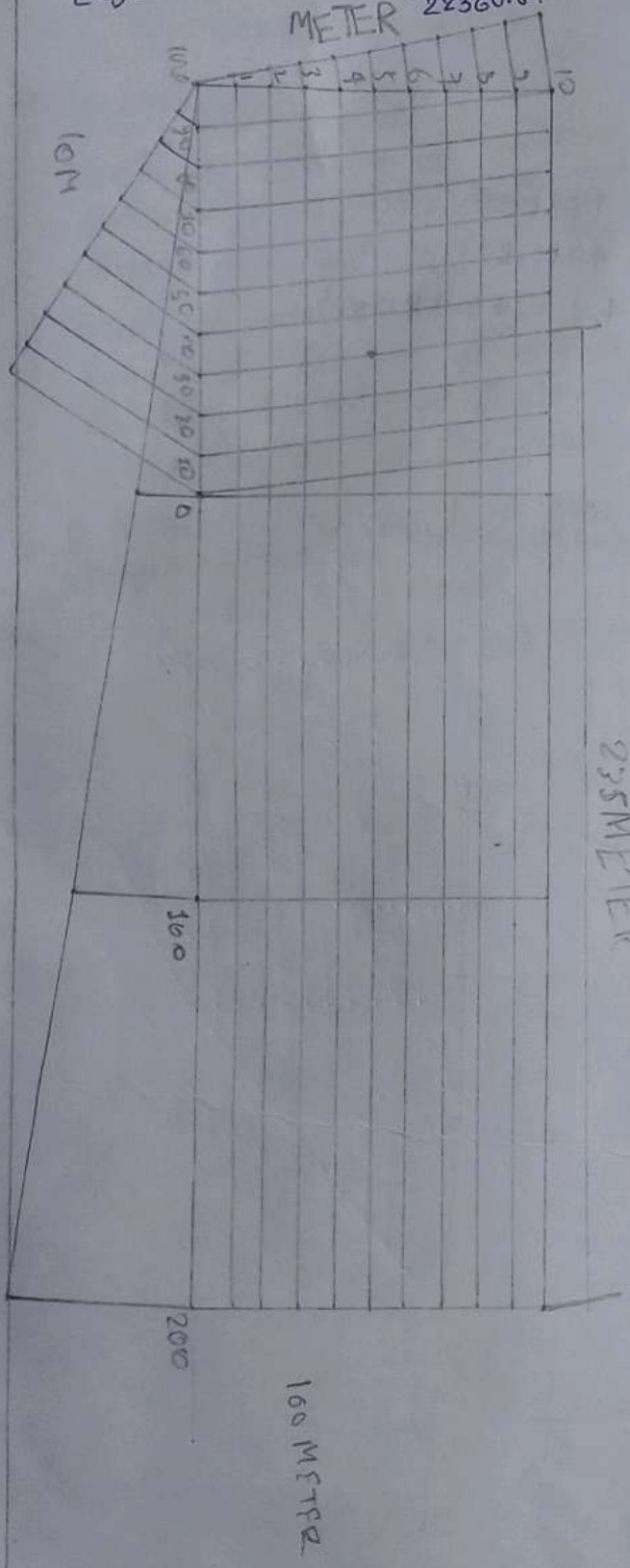
LOS = 20 cm



18 An area of a field is 50000 m^2. The length and the breadth of the field, on the map is 10cm and 18cm. represented, Construct a diagonal scale which can read upto single meter. Mark a length of 235 Meters on the scale. What is the R.f. of the scale?

Soln $R = \frac{\text{length of drawing}}{\text{Actual length of obj.}} = \frac{18cm^2}{50000m^2} = \sqrt{\frac{18cm^2}{50000m^2}} = \frac{13.41cm}{223.607m} = \frac{1341cm}{22360.67cm}$

$LOS = R.F \times Maxm \Rightarrow \frac{13.41}{22360.67} \times 300m \Rightarrow \frac{13.41}{22360.67} \times 300 \times 100cm \Rightarrow LOS = 17.97 \cong 18cm$



Q. A aeroplane is flying at a speed of 360 Km/hr. Draw a diagonal scale to represent 6Km. by 1cm and to show distance up to 60Km. Find the R.F of the scale and find from the scale distance covered by the aeroplane in

(i) 3 minutes 22 seconds (ii) 7 minutes 49 seconds.

Soln 360Km/h

$$\text{Speed} = \frac{360\text{Km}}{60\text{ min}} = 6\text{Km/min}$$

$$\text{In second} = \frac{6\text{ Km}}{60\text{ sec}} = 0.1\text{Km/sec}$$

(i) = 3 minutes 22 sec

$3 \times 6 + 0.1 \times 22$

$18 + 2.2 = 20.2\text{Km}$

(ii) = 7 min 49 sec

$= 7 \times 6 + 49 \times 0.1$

$= 42 + 4.9 = 46.9\text{Km}$

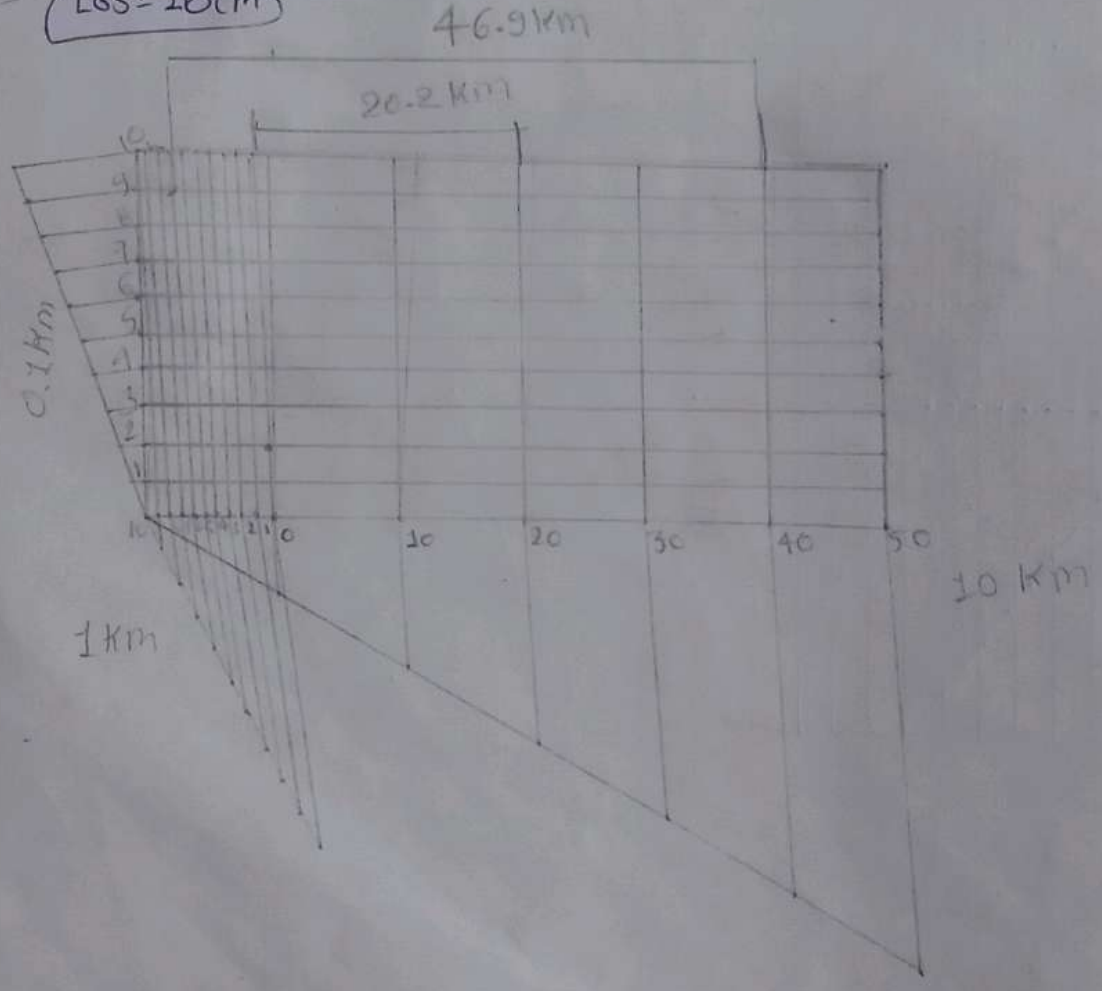
1cm = 6Km

$$\text{R.F} = \frac{1\text{ cm}}{6 \times 1000 \times 100\text{ cm}}$$

LOS = R.F x max^m

$$\text{LOS} = \frac{1}{6 \times 1000 \times 100} \times 60\text{Km} = \frac{1}{6 \times 1000 \times 100} \times 60 \times 1000 \times 100\text{ cm}$$

LOS = 10cm



05/Nov/24

Vernier scale

- Linear vernier scale
  - Forward vernier scale
  - Backward vernier scale
- circular vernier scale

Forward vernier scale

Length of division of vernier scale is smaller than the length of division of primary scale. Divisions are marked in the same direction with the main scale.

Backward vernier scale

Length of division of vernier scale is greater than length of each division of primary scale. numbering is done in the opposite direction as of in primary scale.

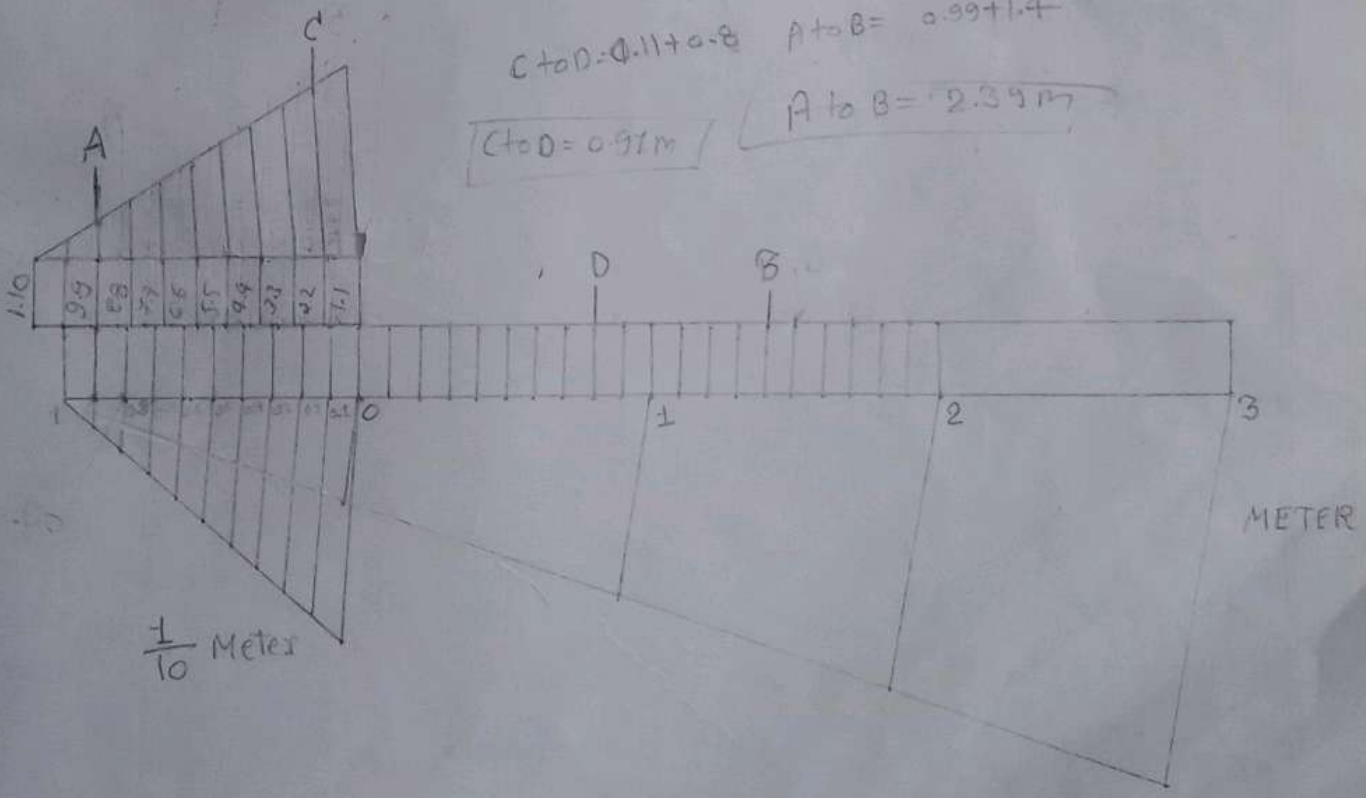
Q.1 Draw the vernier scale of R.F. 1/25 to read cm up to 4 m. and show on it a length of 2.39 m and 0.91m

Soln LOS = R.F × Max^m

LOS = $\frac{1}{25} \times 4\,m$ ⇒ LOS = $\frac{1}{25} \times 4 \times \frac{4}{100}$ ⇒ LOS = 16cm

C to D = 0.11 + 0.8 A to B = 0.99 + 1.4

C to D = 0.91m A to B = 2.39m



2B. Construct a full-size vernier scale of inches and show on it lengths 3.67", 1.54" and 0.48".

Soln: R.f = $\frac{\text{length of drawing}}{\text{Actual length of object}}$

W.K.T the full-size vernier scale R.f is = 1

R.f = 1

Maxm = 4 inches

L.O.S = R.f X Maxm length to be measure

LOS = 1 X 4 Inches

1 INCH = 2.54 cm

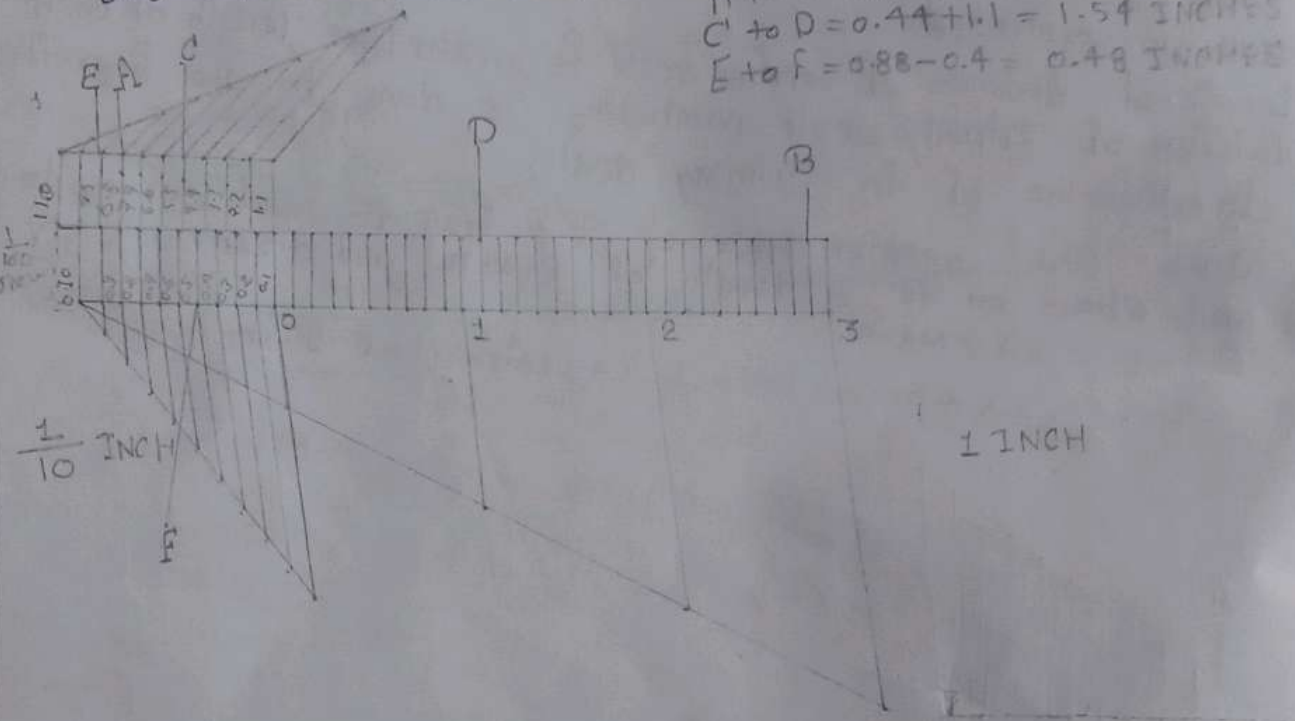
LOS = 1 X 4 X 2.54 cm

LOS = 10.16 cm ≅ 10cm

A to B = 0.77 + 2.9 = 3.67 INCHES

C to D = 0.44 + 1.1 = 1.54 INCHES

E to F = 0.88 − 0.4 = 0.48 INCHES



Q3:- Construct a vernier scale of R.F. = $\frac{1}{80}$ to read inches and to measure upto 15 yards.

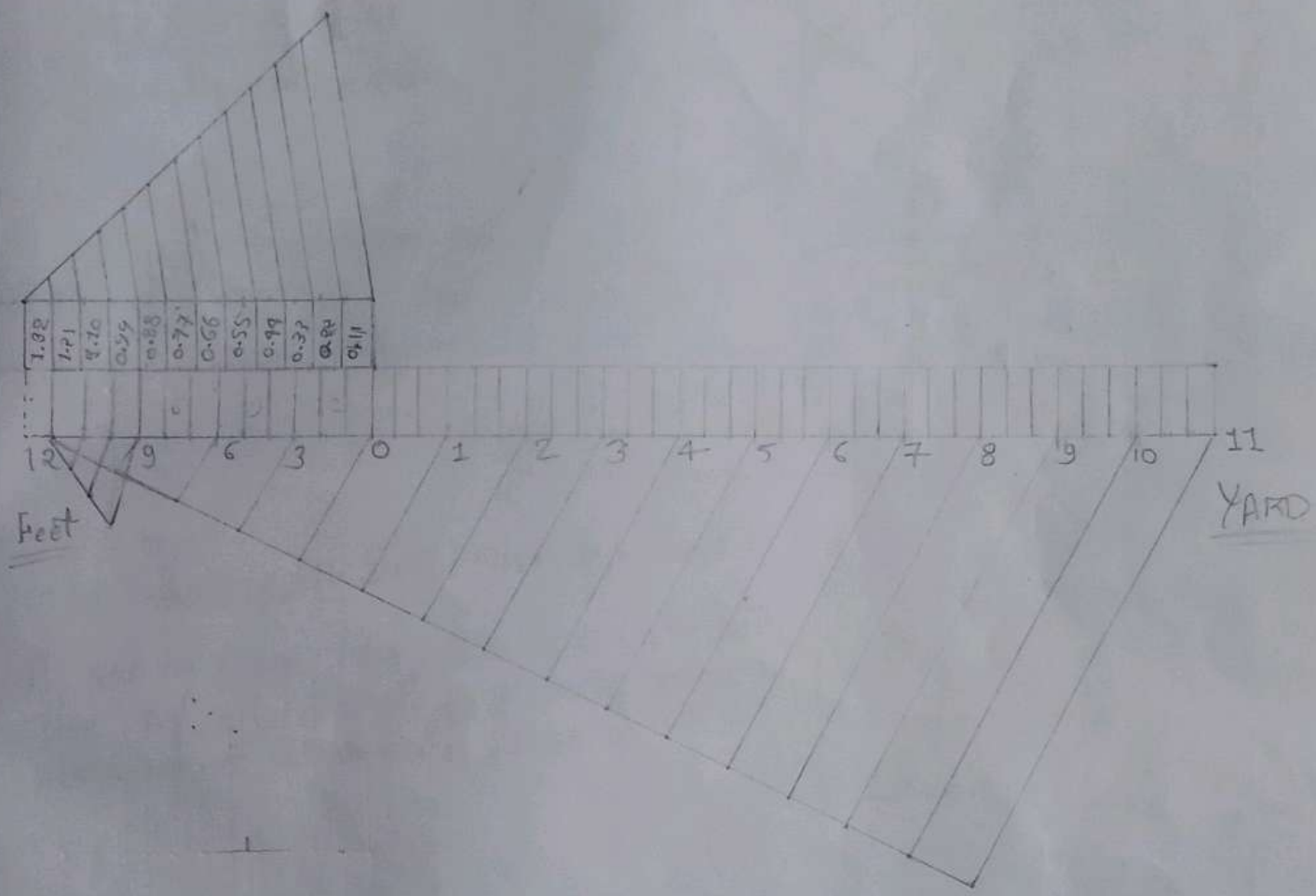
Soln:- R.F = $\frac{1}{80}$

Length of the Scale = $\frac{1}{80}$ × 15 yards

LOS = $\frac{1}{80}$ × 15 × 3 × 12 × 2.54 cm

LOS = 17.145 ≅ 17 cm

60%



Projection of Point and line

Projection of line

↳ # Basic Condition of line

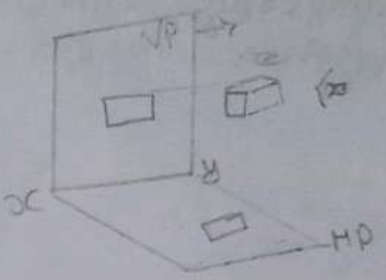
Position of objection I quadrant/I Angle

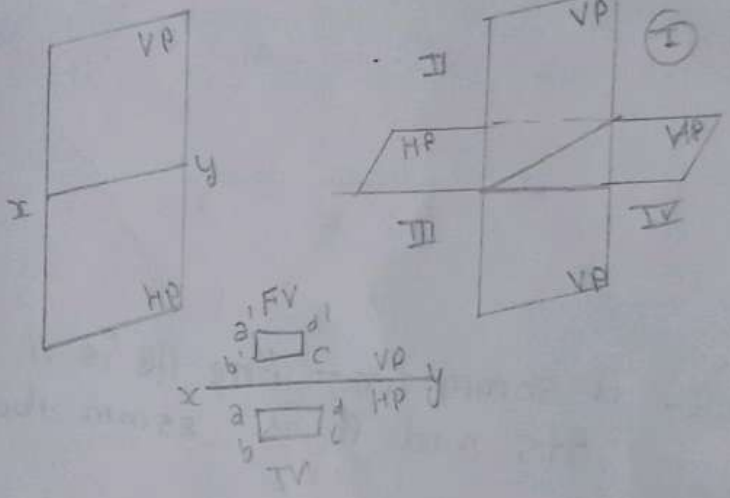
Above HP and Infront of V.P

object lie in between the plane of projection & observer

AL = Aparent line

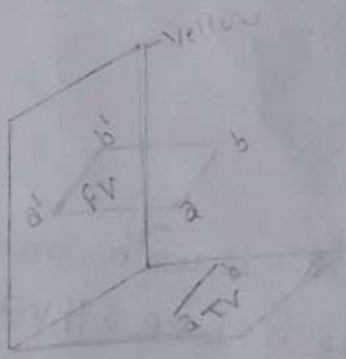
Av = Aparent view.

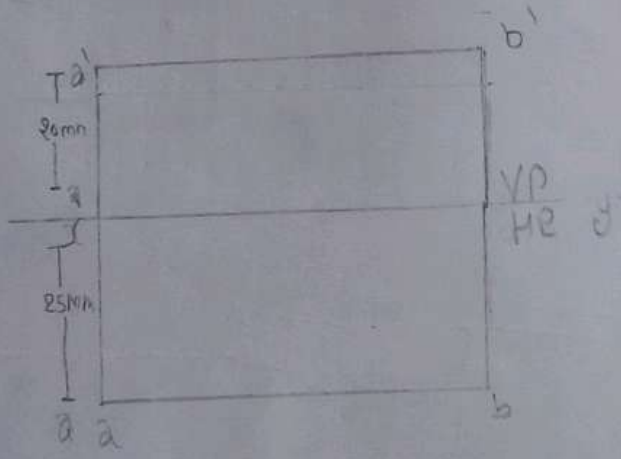


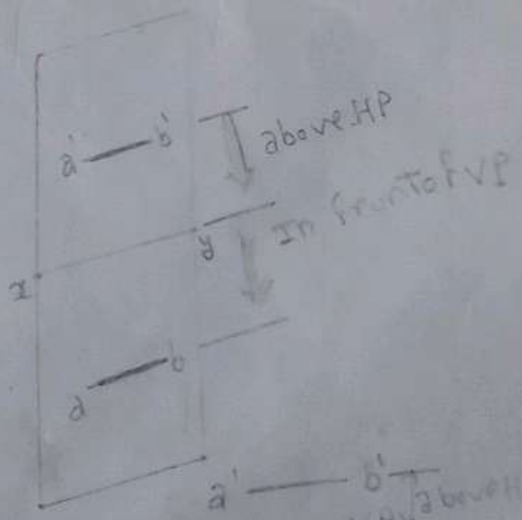


1) line is // with both the refe. plane

A 50mm long line AB is // with both the ref. plane ptg and A is 20mm above HP & 25mm in front of VP.

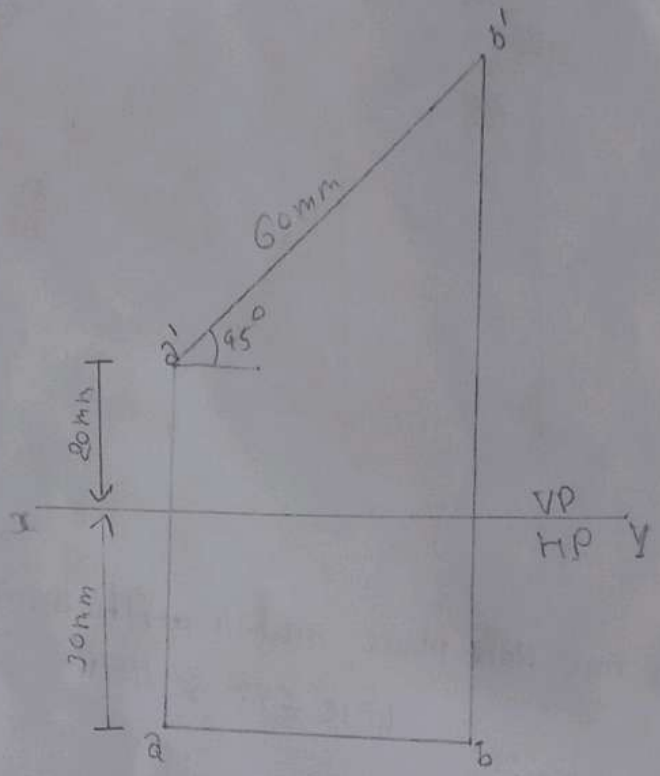






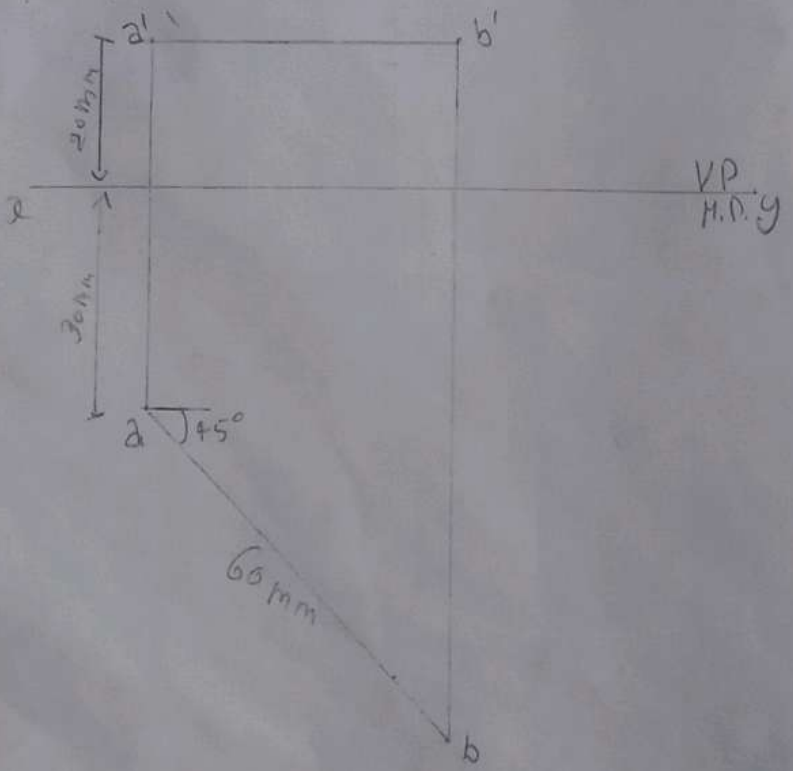
Q.7 A 60mm long line AB is ∠ that 45° to the HP ll to VP its end A is 20mm above the H.P. 30mm in front of VP. Draw its projection. (Traces)

Soln
θ - ∠HP
ϕ - ∠VP



Q.8 A 60mm long line AB is ∠ that 45° to VP ll to the H.P. its end A is 20mm above the HP. 30mm in fron of V.P. Draw its projection.

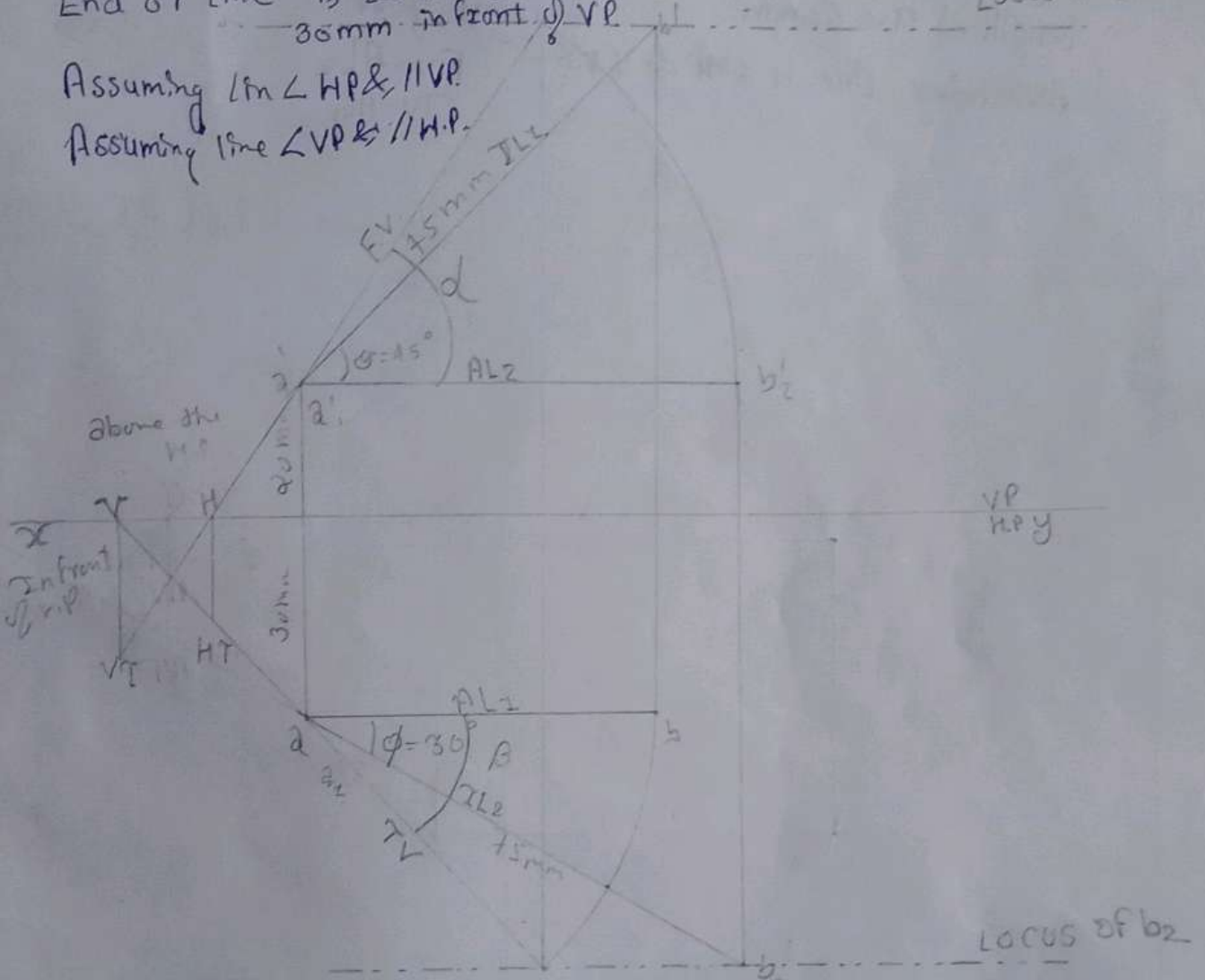
Soln



Q.13 A 75mm long line AB is ∠ at 45° to the HP and 35° to the VP. Draw its projection when the end point A is 20mm above H.P & 30mm in front of VP also find its traces.

Sol^n Given, length of line AB = 75mm
Inclination ~~Incluactioned~~ line with H.P $\theta = 45°$
Inclination ~~Incluactioned~~ line with V.P $\phi = 35°$
End of Line is 20mm above the HP
30mm in front of VP

Assuming line ∠ HP & // VP
Assuming line ∠ VP & // H.P.



θ ⇒ Inclination of T.L of Line with H.P
φ ⇒ Inclination of True length of line with V.P
α ⇒ Inclination of F.V of Line with H.P
β ⇒ Inclination of T.V of line with V.P.

$AL_2 = FV$
$AL_1 = TV$

TL ⇒ True length AL = Apparent length
TV ⇒ Top view (plan) FV = Front view (Elevation)

Traces are two types VT and HT
VT ⇒ Vertical Trace
HT ⇒ Horizontal Trace

Q12 The front views of 75mm long line AB measures F.V 50mm. By the length of its top view 60mm Draw its projection when the end point A is 20mm above the H.P and 25mm in front of V.P. Also Draw its traces.

Soln ⇒ AB = 75mm.

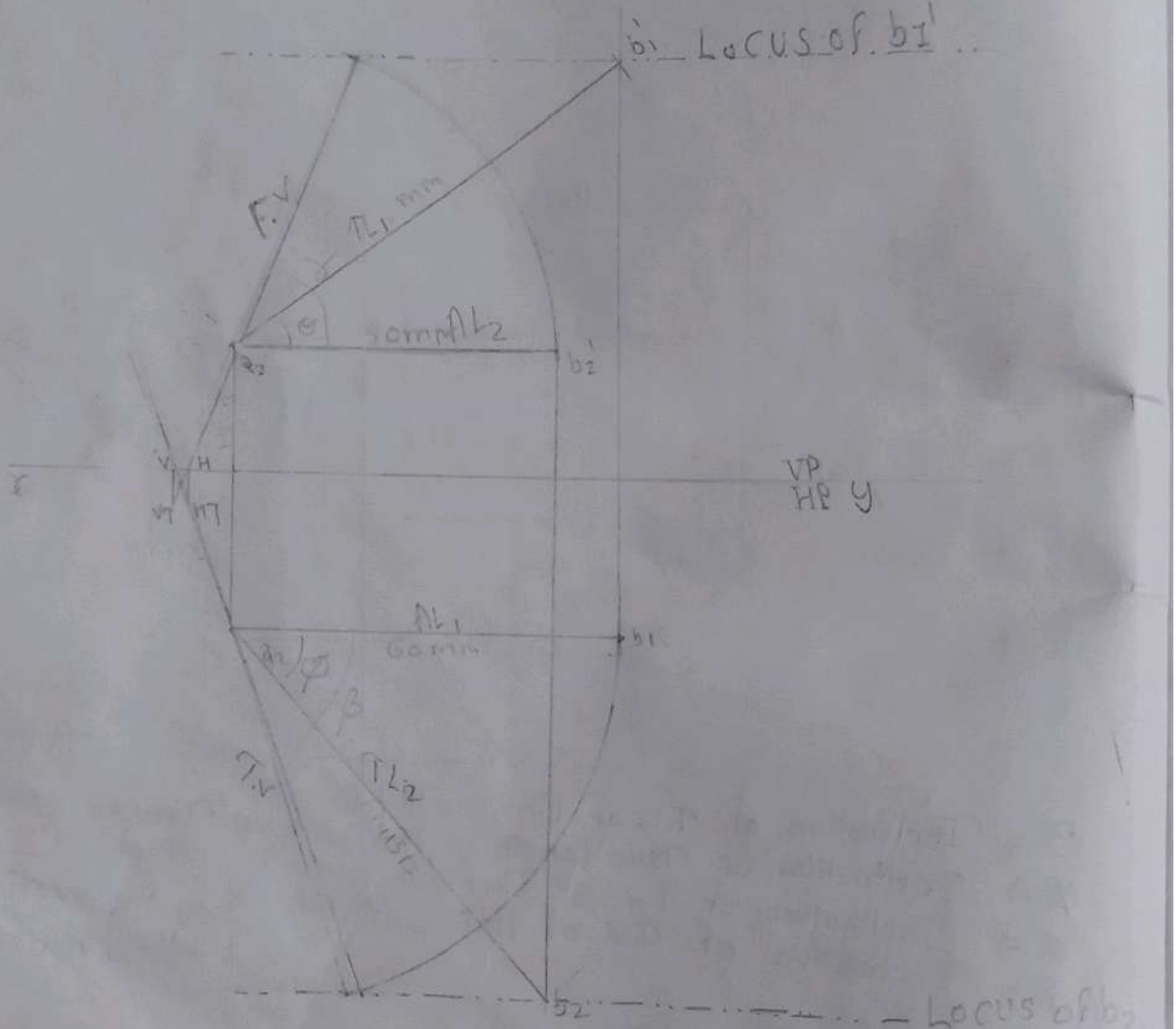
length of FV = 50mm

length of TV = 60mm

End point A is 20mm above the H.P & 25mm in front of V.P

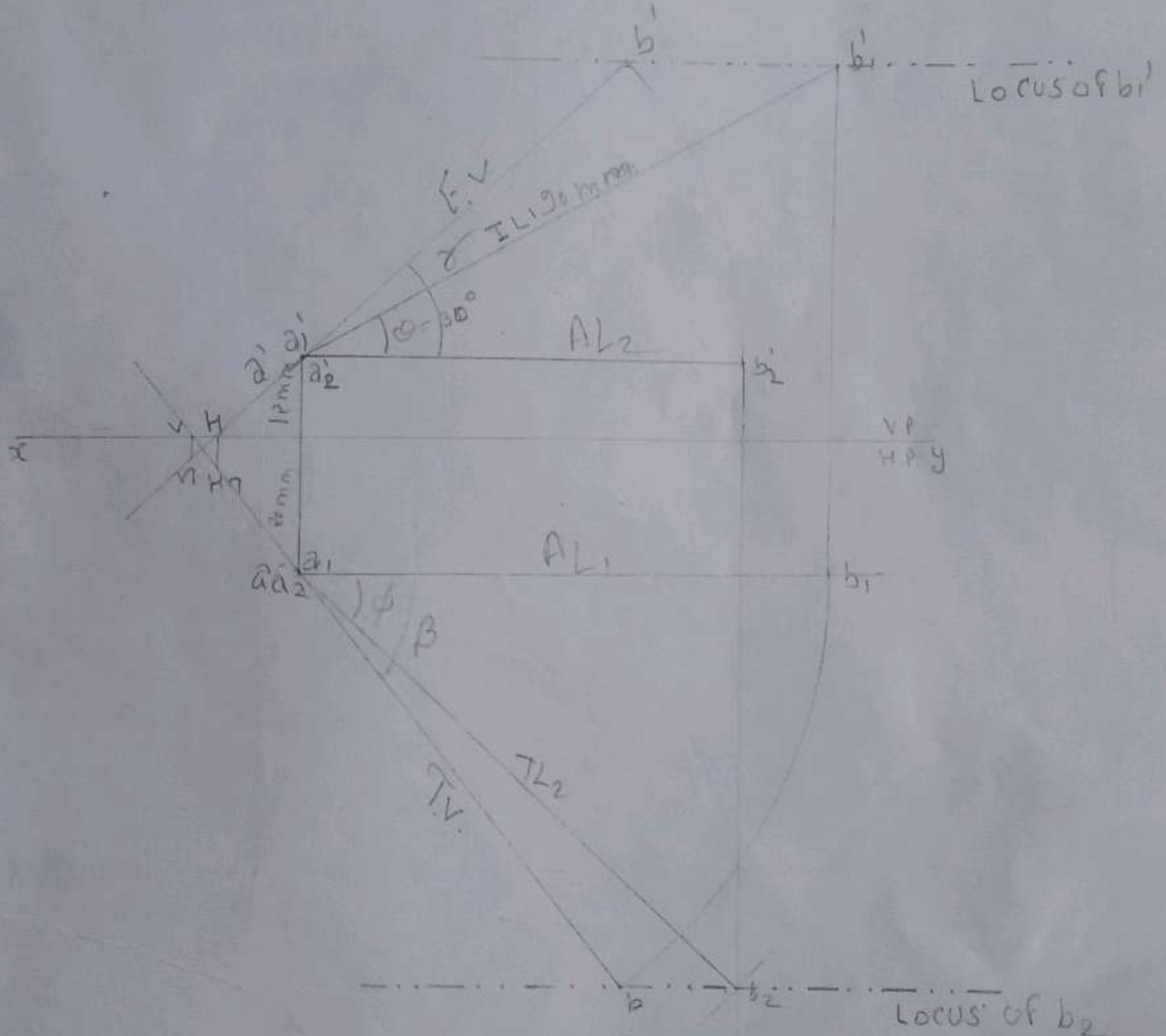
Assuming line ∥ to ∠ HP & ∥ V.P – FV = AL_2

TV = AL_1



Q7→ A line AB 90mm. long is inclined at 30° to the H.P. Its end A is 12mm. above the H.P. and 20mm. in front of V.P. Its ~~view~~ Front view measures 65mm. Draw the top view of AB and determine Pts' inclination with V.P.

Solution:
length of line AB = 90mm.
length of F.V. = 65mm
End A — 12mm above HP
20mm in front of V.P.
$\theta = 30°$
$\phi = ?$



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

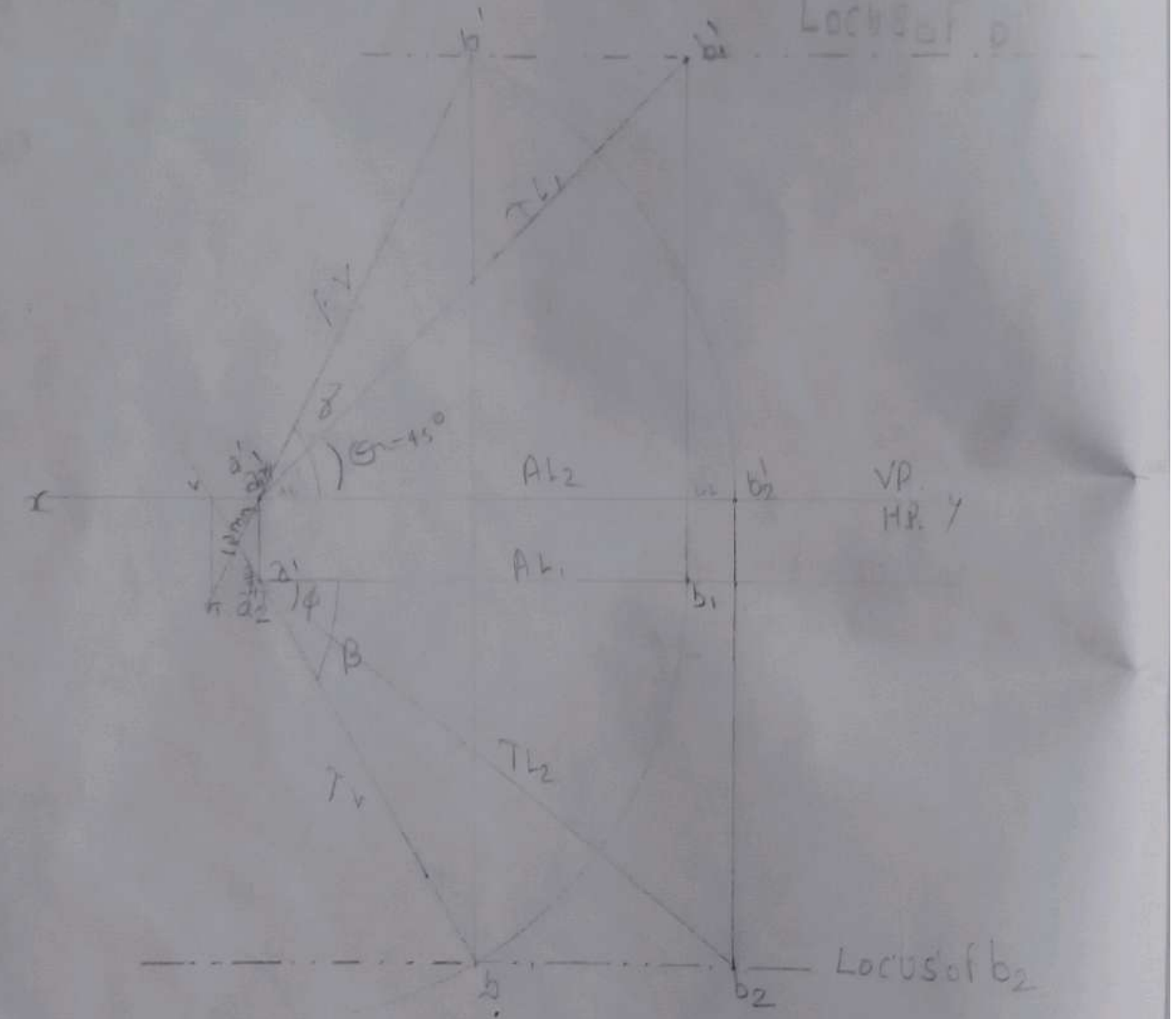
Sol^n Given Line HB is 90mm

$\theta = 45°$

$\beta = 60°$

End A is in the HP.

12mm in front of V.P.



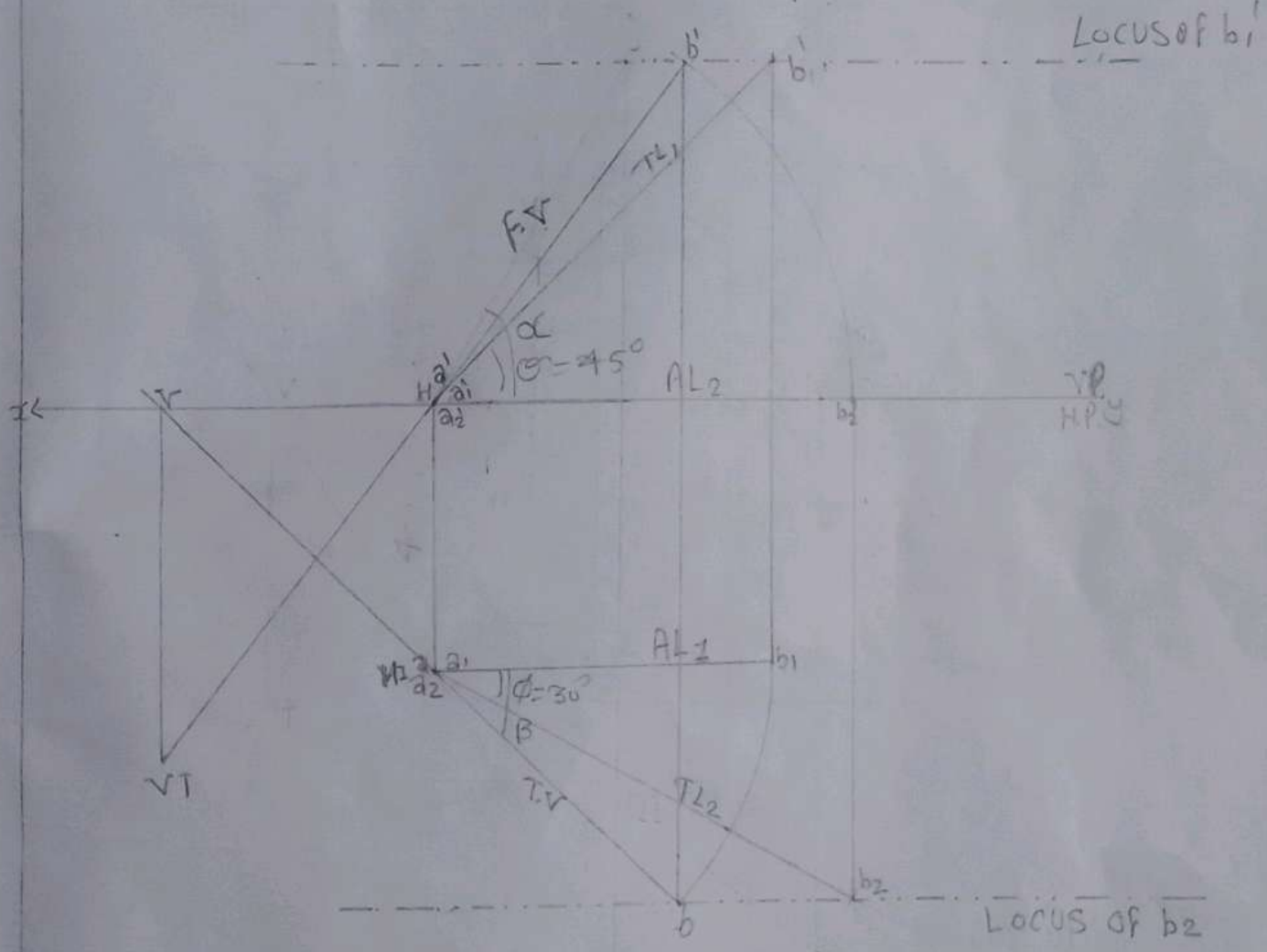
Q9 - Draw the projection and find out the true length of line AB with end B on H.P. 40mm in front of V.P. AB is inclined at 45° to the H.P. and 30° to V.P. and its plan measure 50mm.

Soln Given, $\theta = 45°$

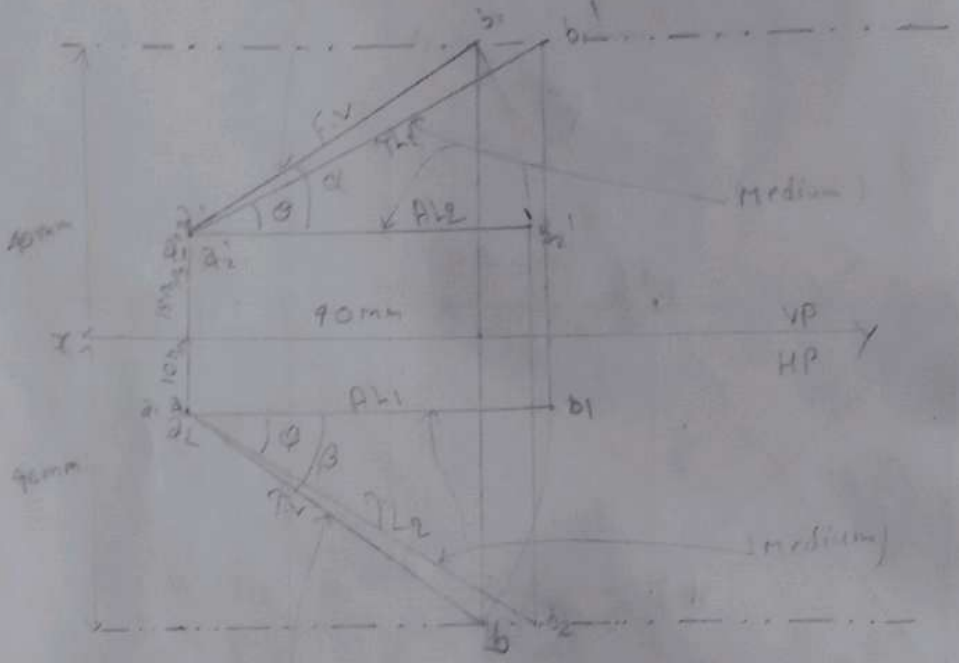
Infront of V.P = 40mm

AL 1 = 50mm

$\phi = 30°$

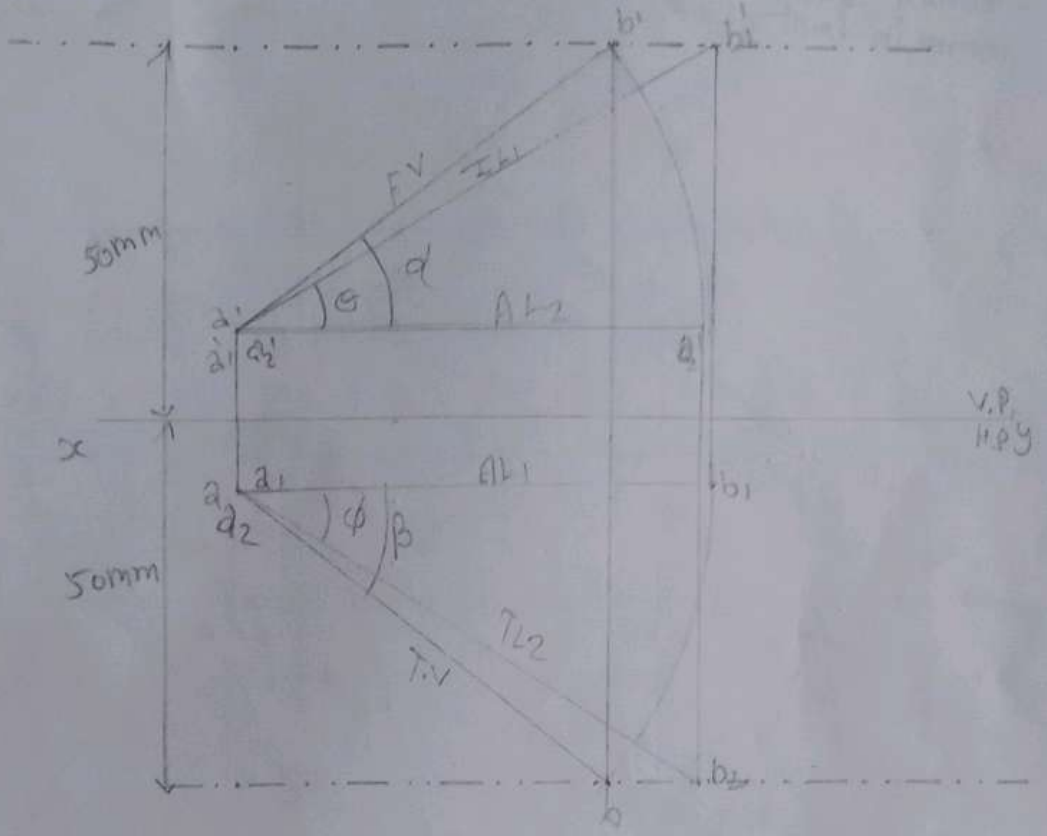


Q10:- The distance between projectors of two ends of straight line is 40mm. one end is 15mm. above the H.P. and 10mm. in front of V.P. the other end is 40mm above the H.P and 40mm. in front of V.P. find the true length and true inclination of line.



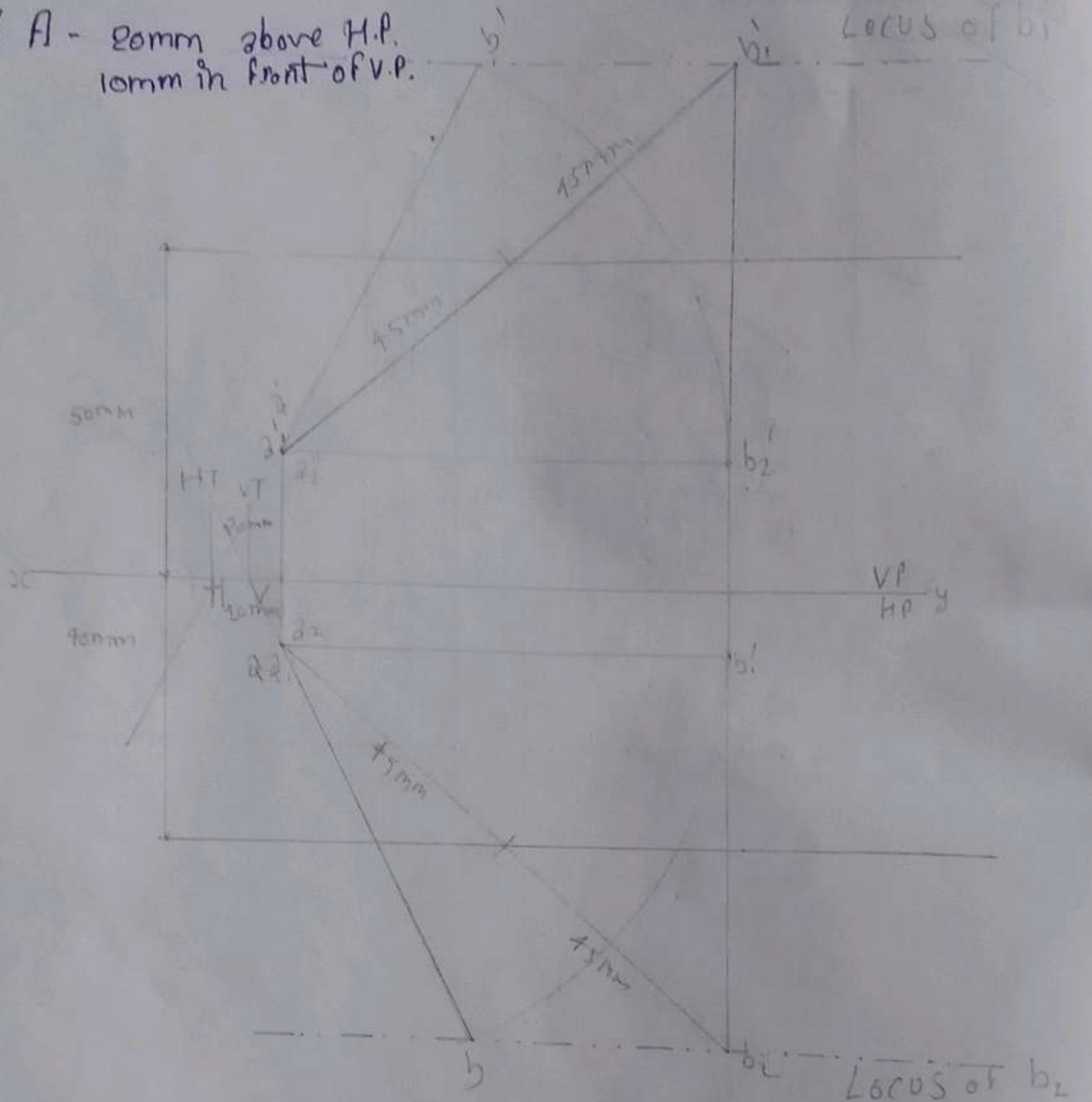
Q.1) A line AB has its end A 12mm. above H.P. and 10mm. in front of V.P. the end B is 50mm. above the H.P. and ~~and~~ the line is inclined at 30° to the H.P. the distance between the end projectors of the line is 50mm. Draw the projection of the line, find its inclination with V.P. and locate its traces.

Soln Given End A - 12mm above H.P
10mm in front V.P.
End B - 50mm above H.P
$\theta = 30°$
Distance b/w End Projectors = 50mm.



Q5→ Draw the projection of line AB, 90mm. long its midpoint M being 50mm above the H.P. and 40mm. in front of V.P. The end A is 20mm. above the H.P. and 10mm. in front of V.P. Show the traces and inclination of line with H.P. and V.P.

Sol→ AB = 90mm
Mid point M - 50mm above HP
40mm in front of V.P.
End A - 20mm above H.P.
10mm in front of V.P.



A 75mm long line AB is inclined at 55° to the H.P and 35° to the V.P its a end A in the H.P. and 20mm in front of V.P. Draw its projection.

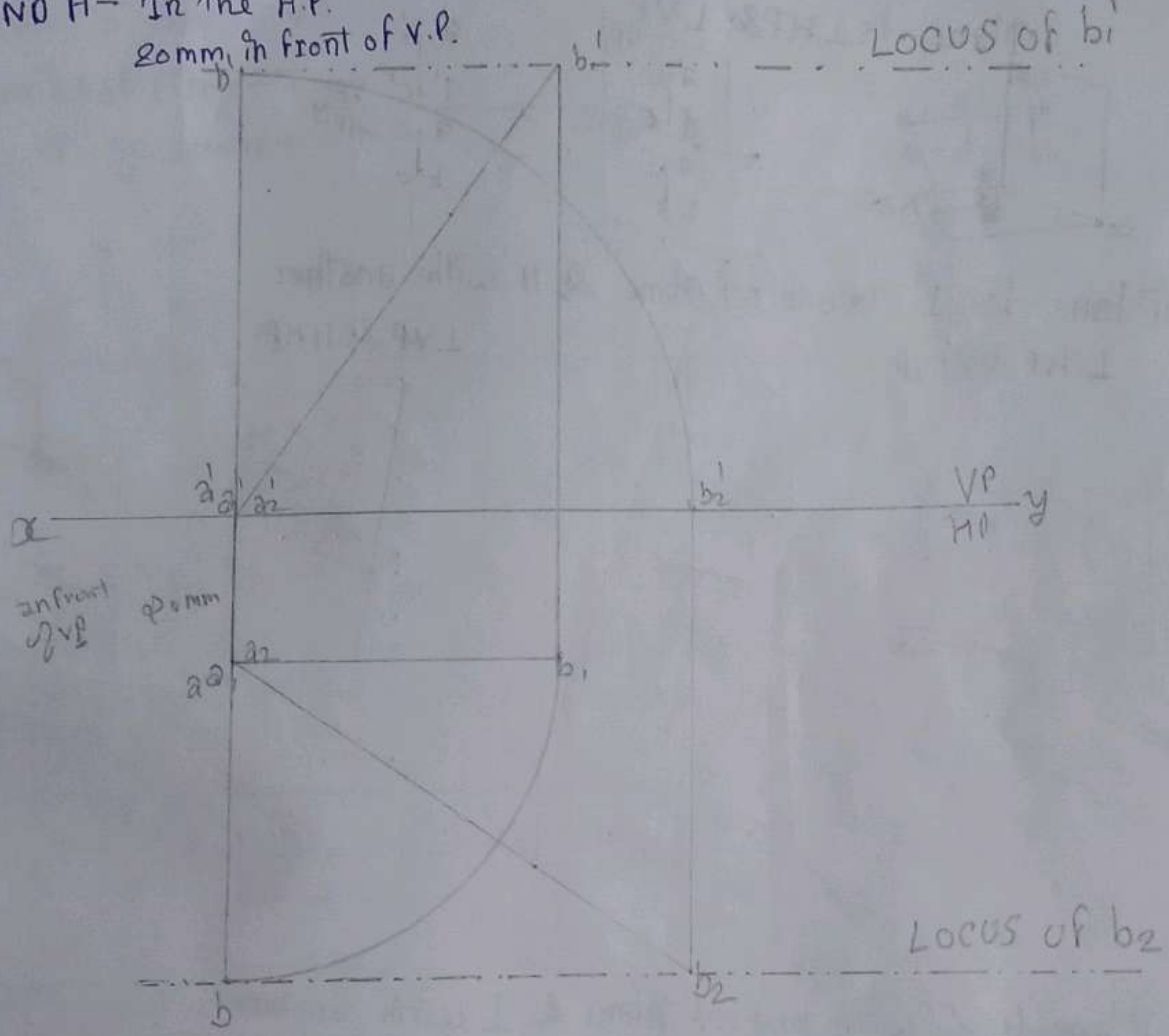
AB = 75mm

$\theta = 55°$

$\phi = 35°$

END A – In the H.P.

20mm in front of V.P.



27 November, 2024

UNIT-03

Projection of Planes

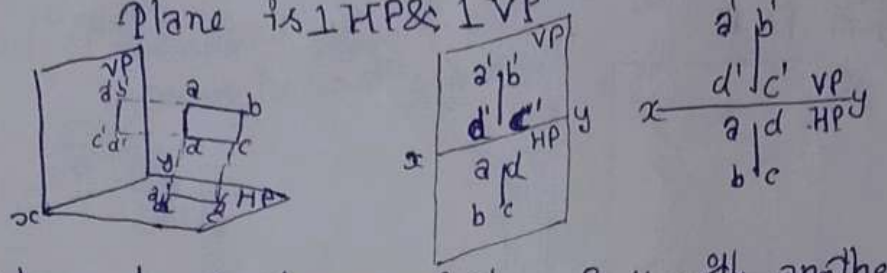
#Condition of the plane w.r.t.x ref. Planes

① Plane - ?

It is a close ~~negative~~ lamina

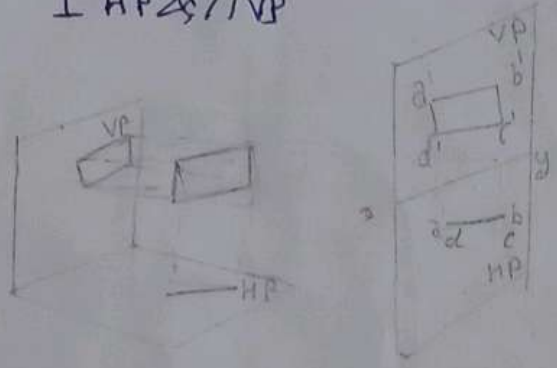
#Plane is perpendicular with both the ref. plane

Plane is ⊥ HP & ⊥ VP

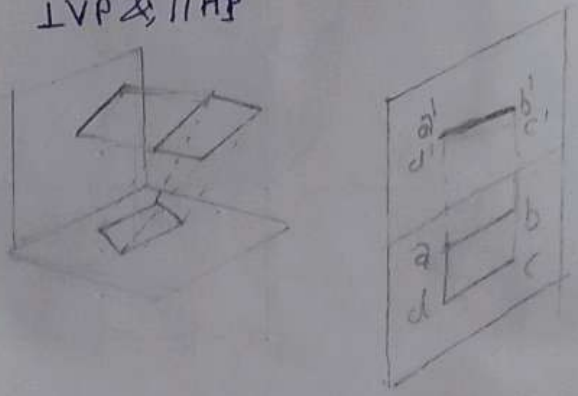


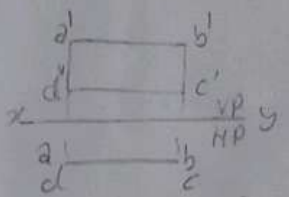
Plane is ⊥ to one ref. Plane & ∥ with another

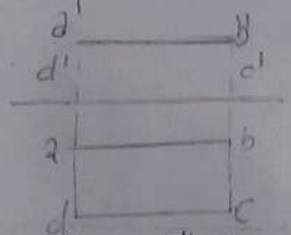
⊥ HP & ∥ VP



⊥ VP & ∥ HP

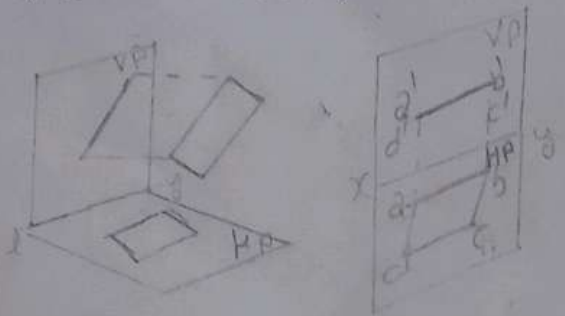




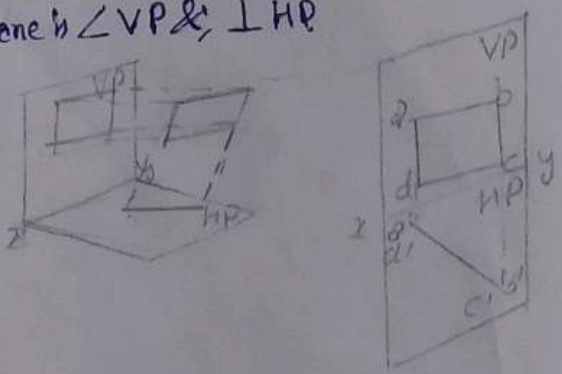


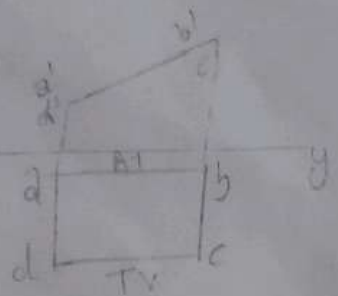
Q.1:- Plane is ∠ with one ref plane & ⊥ with another.

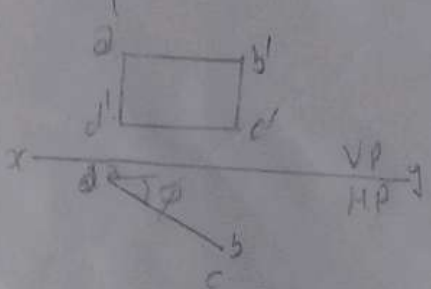
Sol:- Plane is ∠ HP & ⊥ VP.



Plane is ∠ VP & ⊥ HP







Q.2 A thin circular plate of 50mm diameter is inclined at 45° to the H.P. and ⊥ to the V.P. Draw its projection when the centre point of the plate is 40mm above the H.P. & 45mm in front of V.P.

Sol^n: Assuming plain is ||HP & ⊥VP

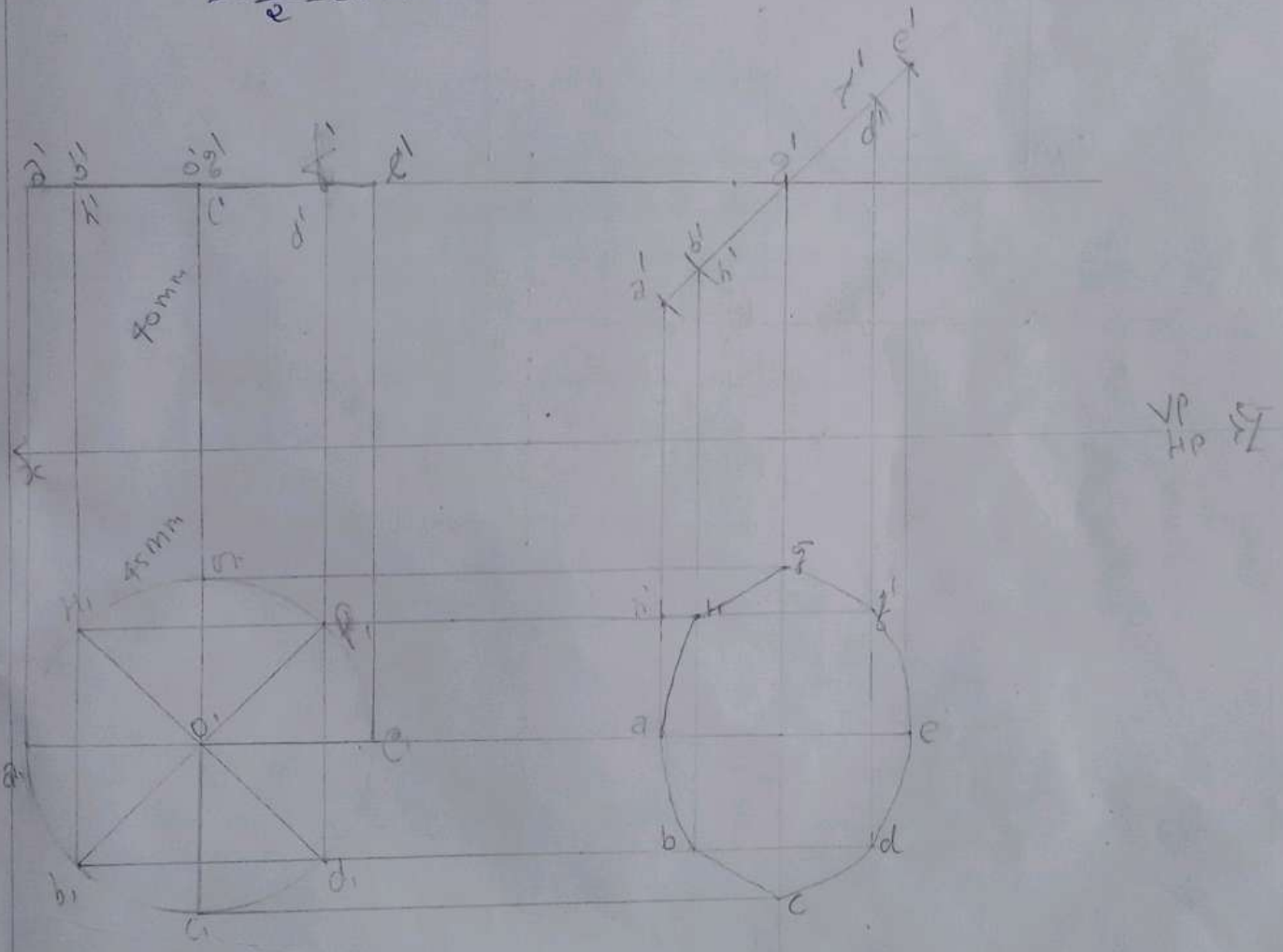
Given.

40mm above the H.P

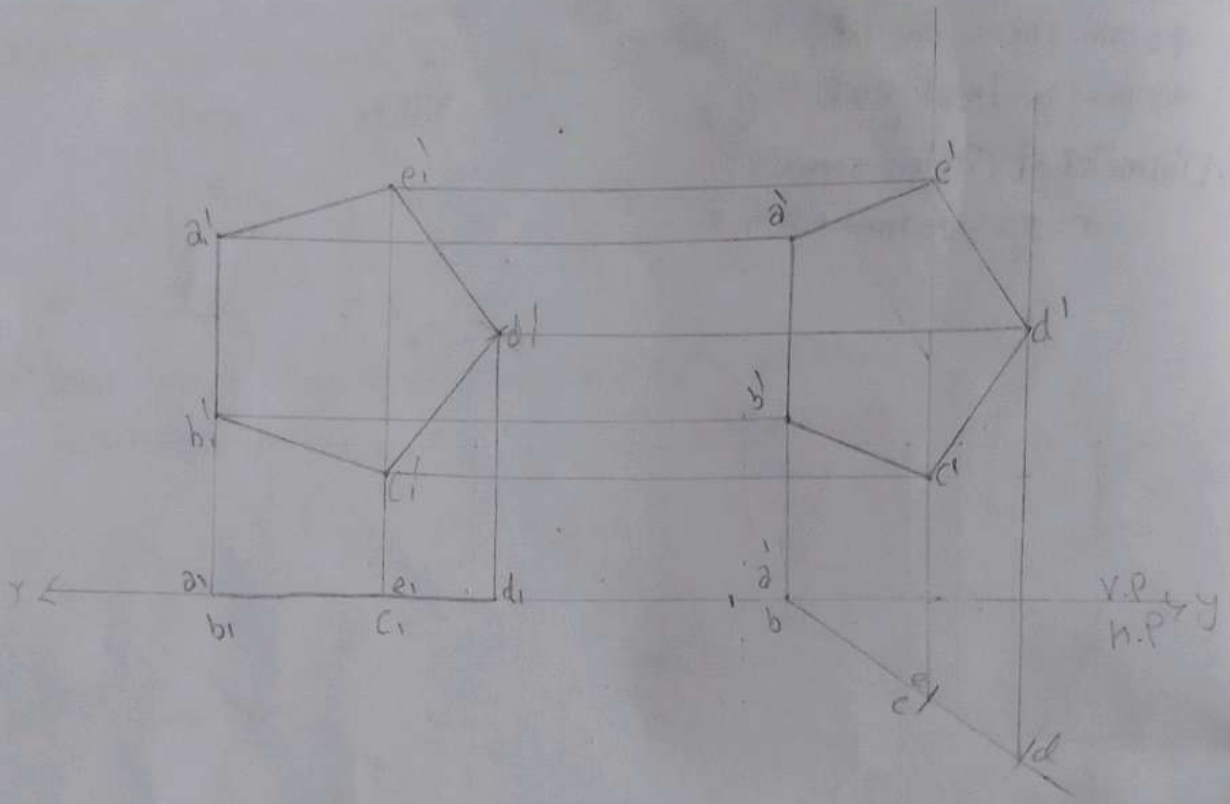
45mm in front of V.P.

Diameter of Circle = 50mm

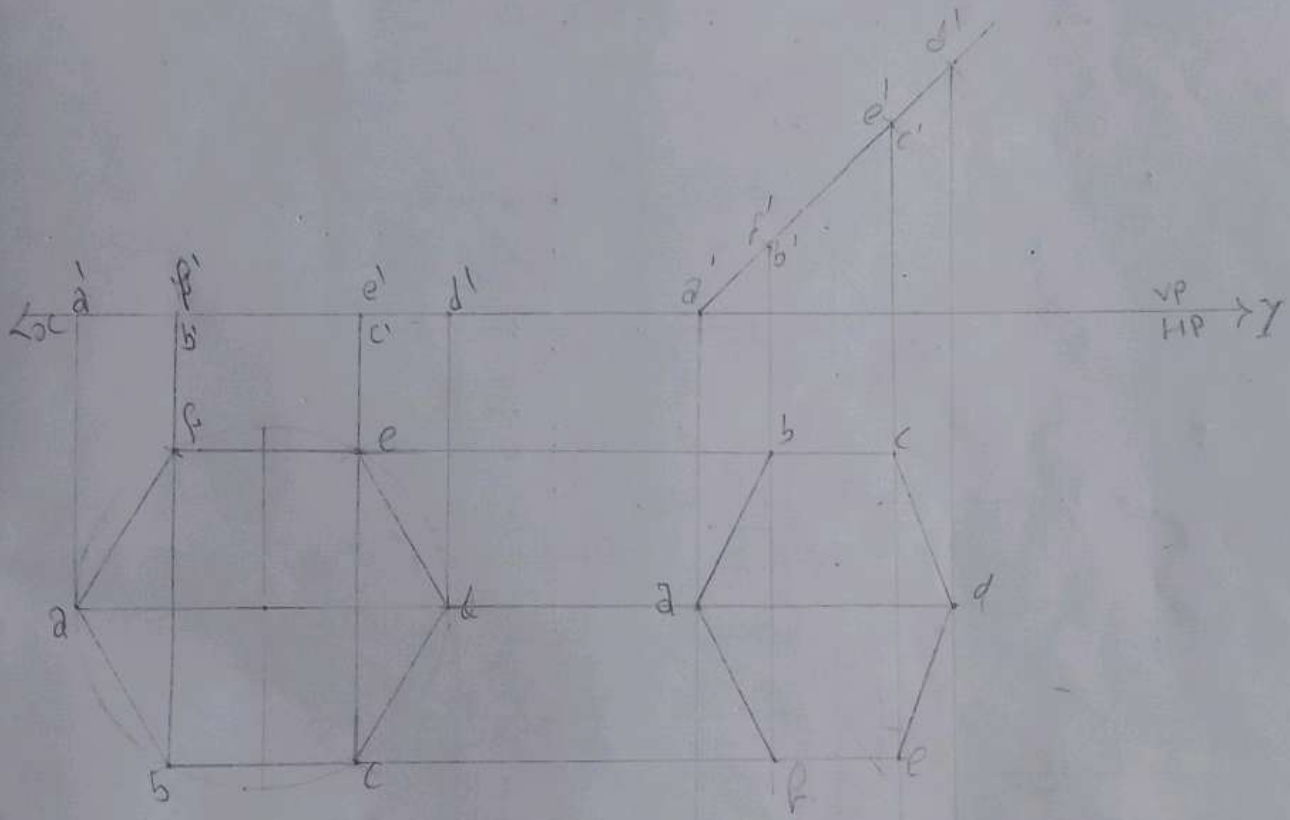
$$r = \frac{50}{2} = 25mm = 2.5cm$$



Q.3 A pentagonal plane of 25mm side resting on its side in the V.P. Its surface is Inclined at 30° to the V.P ⊥ to the H.P Draw its Projection.

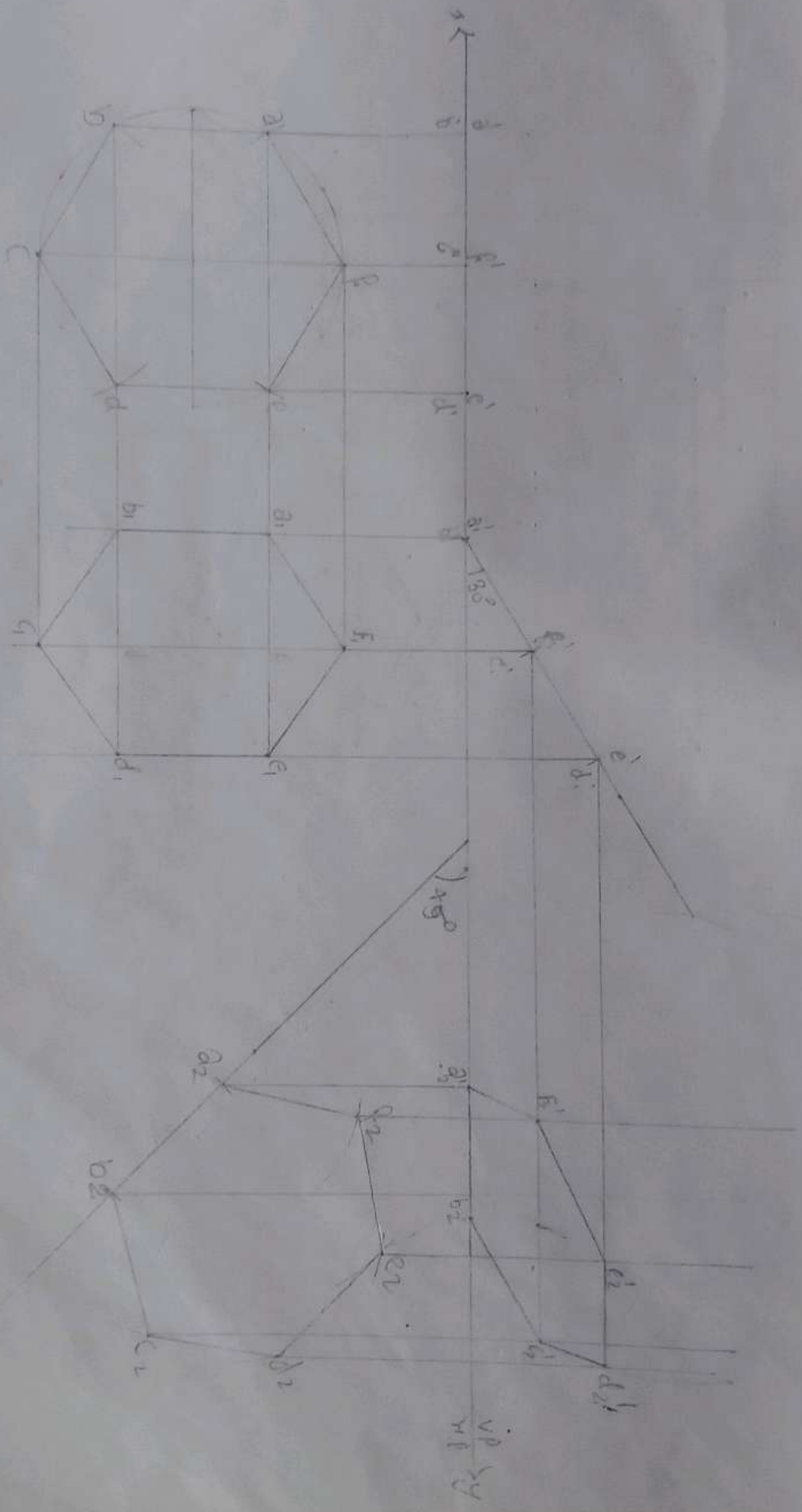


Q.4 → A hexagonal lamina of 25mm side resting on its corner on the H.P such that it inclined at 45° to the H.P ⊥ to the V.P. Draw its Projection.



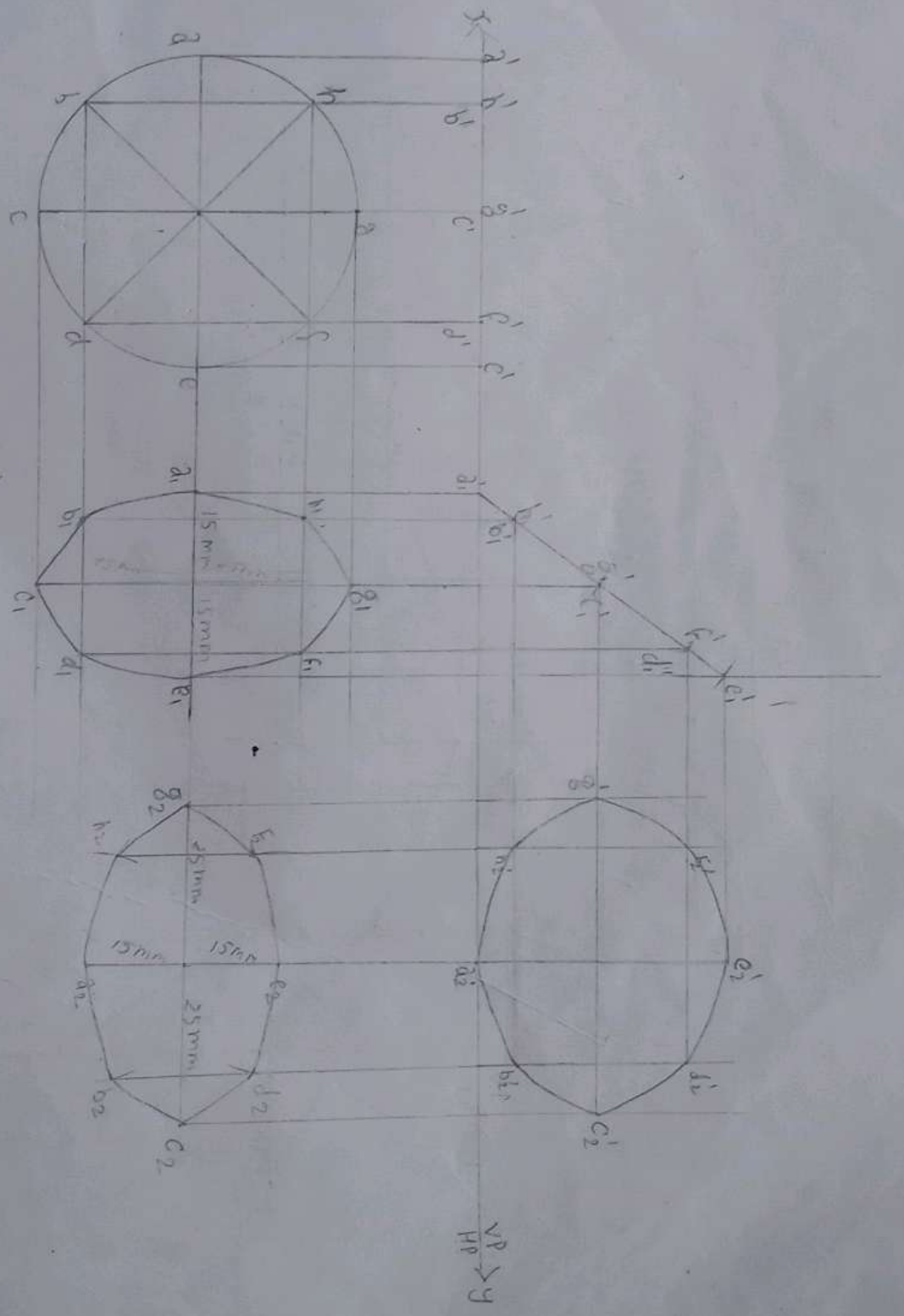
Q.5 → A hexagonal lamina of 25mm side is resting on its side on the H.P such that its surface (its plane) is inclined at 30° to the H.P. and this side is resting in the H.P is inclined at ~~HP is~~ 45° to the V.P.

Soln → Assuming plane is // HP & ⊥ V.P



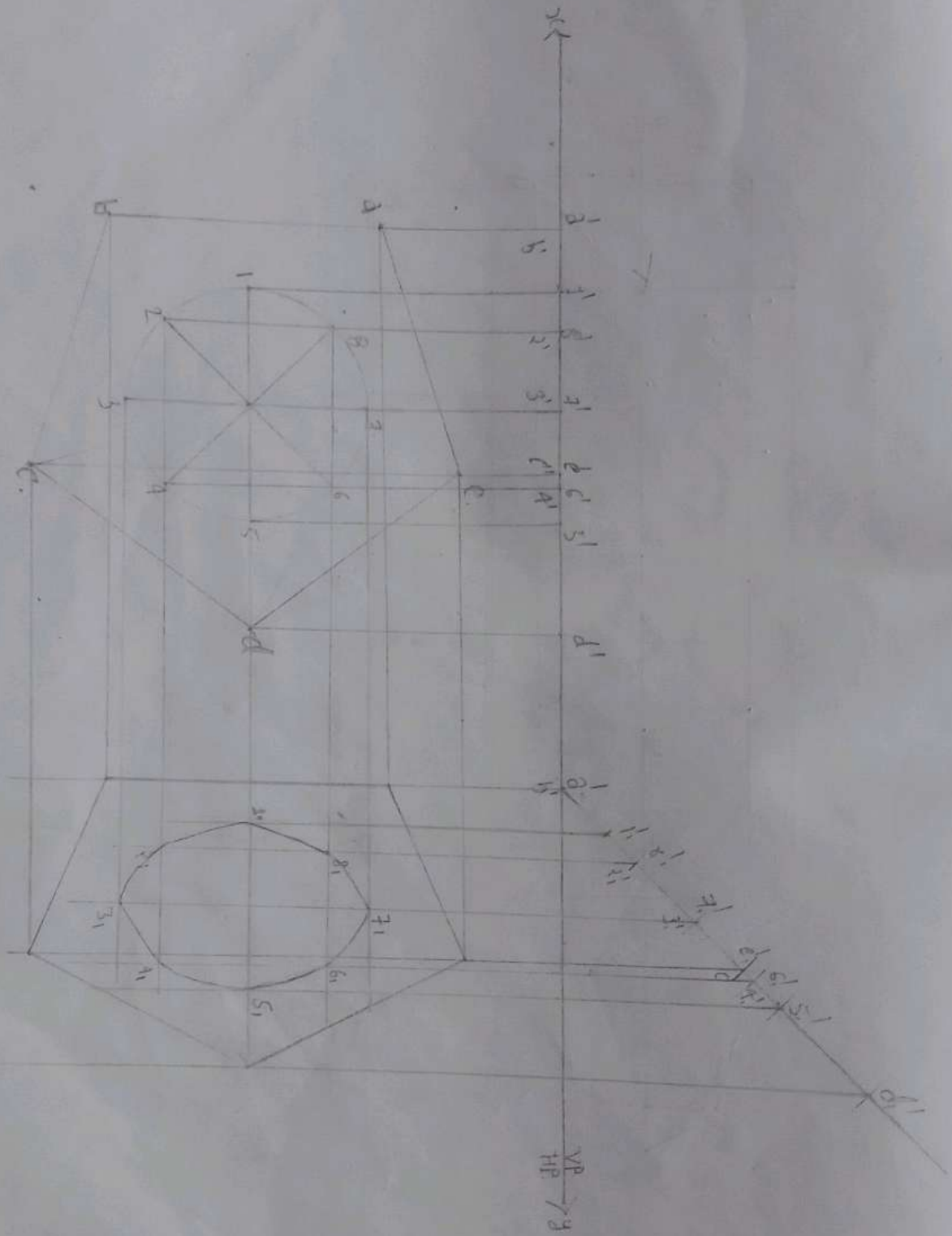
Q.P:- A circular plate of negligible thickness and 50mm diameter appears as an ellipse in the ~~front~~ TOP view, having its major axis 50mm long and minor axis 30mm long. Draw its top view when the major axis of the ellipse is horizontal.

Sol^{n}:- As the plate is seen as an ellipse in the front view, its surface must be inclined to the V.P.



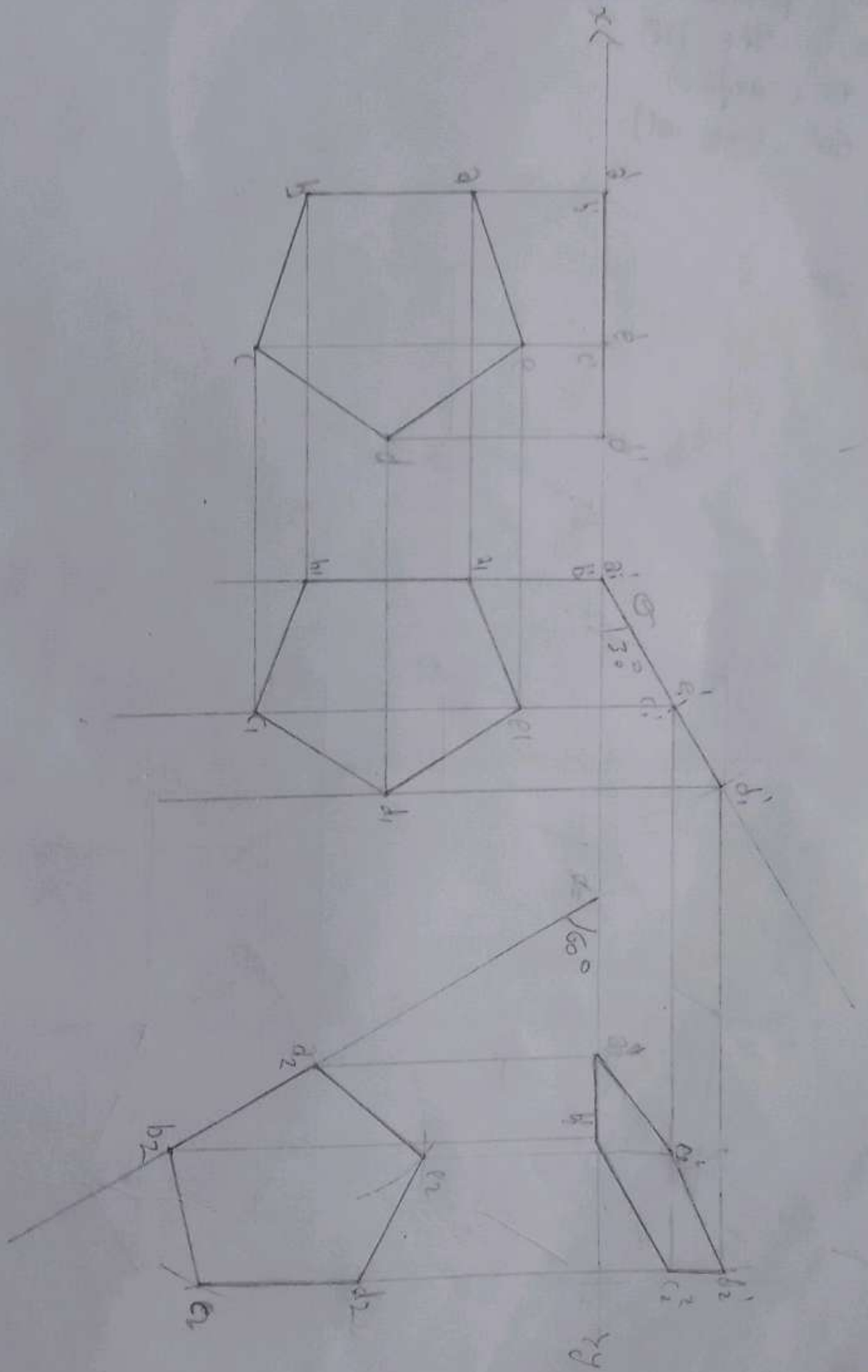
Q.15 → A pentagonal plate of 45mm side has a circular hole of 40mm diametre in its centre. The plane stands on one of its sides on the H.P. with its plane perpendicular to V.P. and 45° inclined to the H.P. Draw the projection.

Soln →



(1) Draw the projections of a regular pentagon of 25mm side, having its surface inclined at 30° to the H.P. and a side parallel to the H.P. and inclined at an angle of 60° to the V.P.

Sol^n



Q.9 A regular Hexagon of ~~side 30~~ 25 mm side has a corner in the H.P, its surface inclined at 45° to the HP and the top view of the diagonal through the corner which is in the HP makes an angle of 60° with the V.P. Draw its projections.

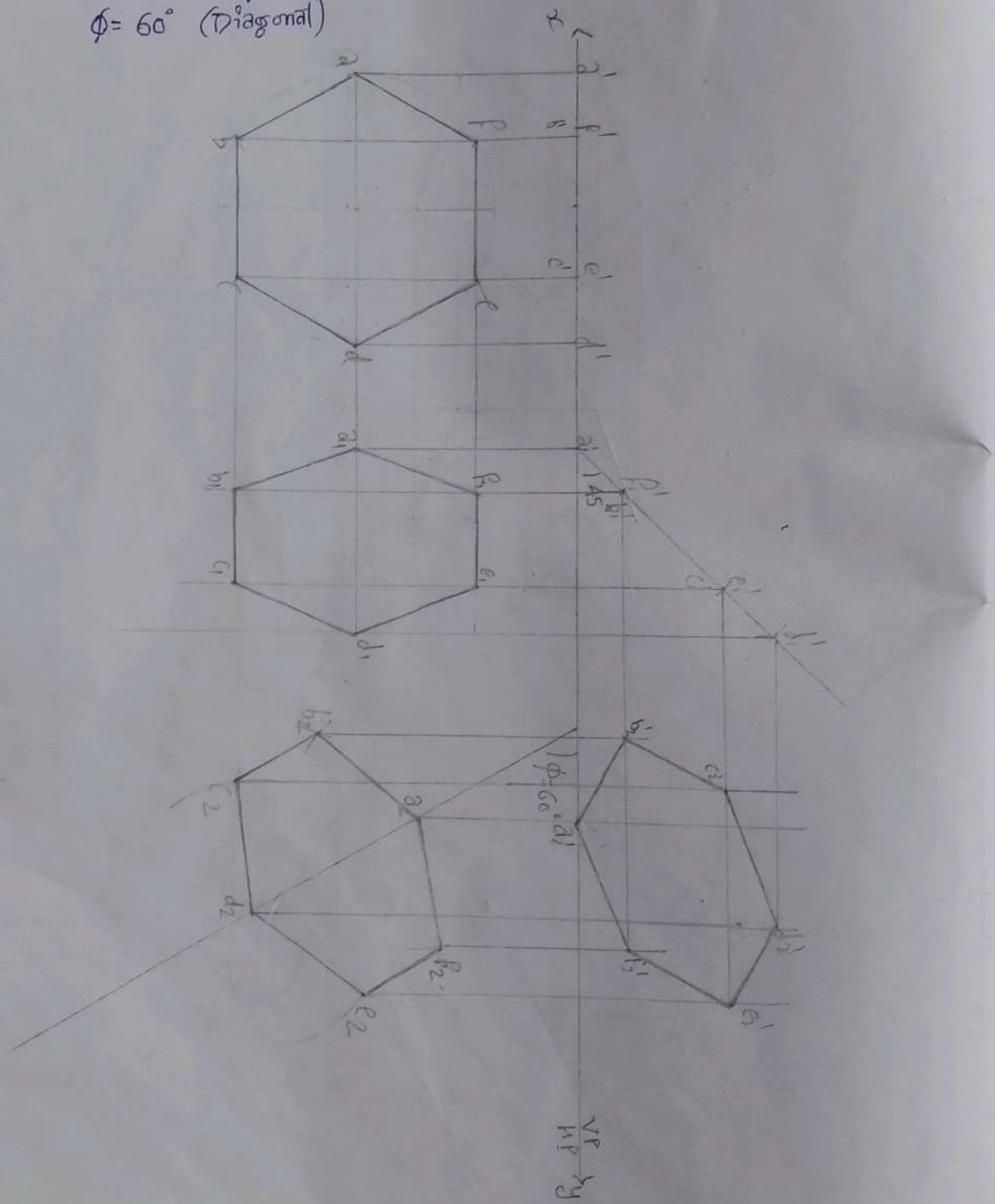
Soln ~~side 30~~ 25 mm Hexagon 25mm side

Assuming plane is // HP & ⊥ VP.

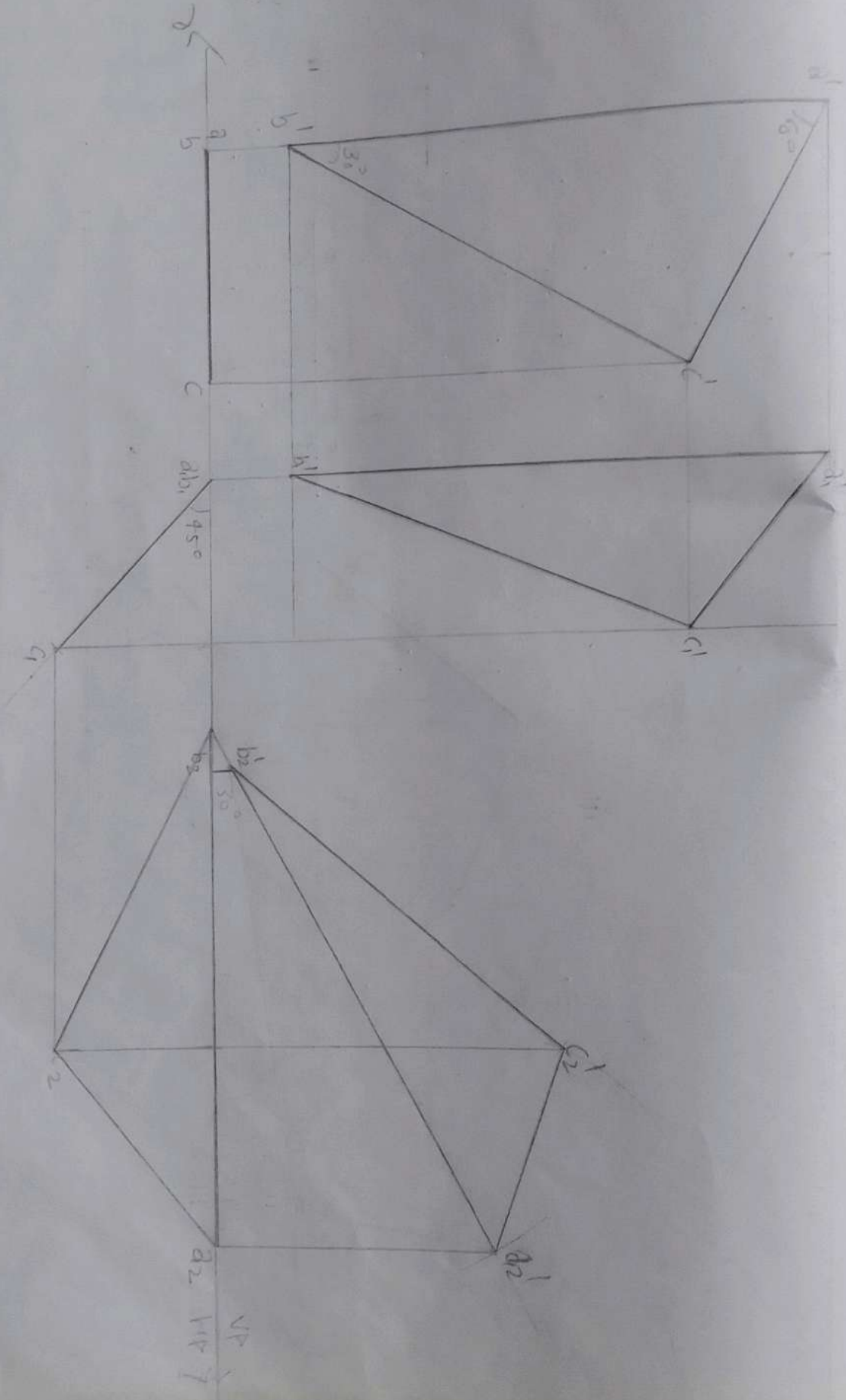
Corner in the HP

$\theta = 45°$ (surface)

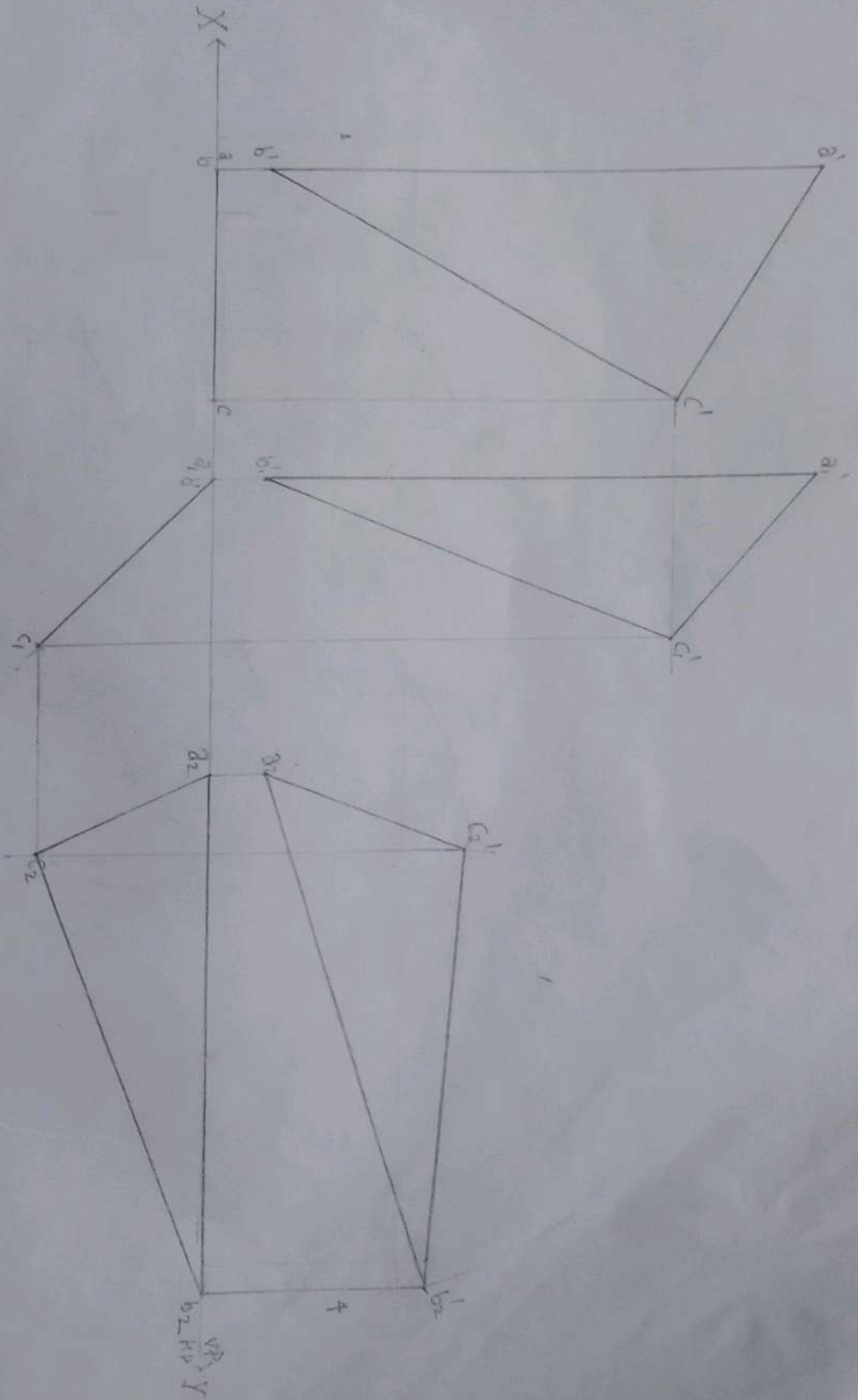
$\phi = 60°$ (Diagonal)



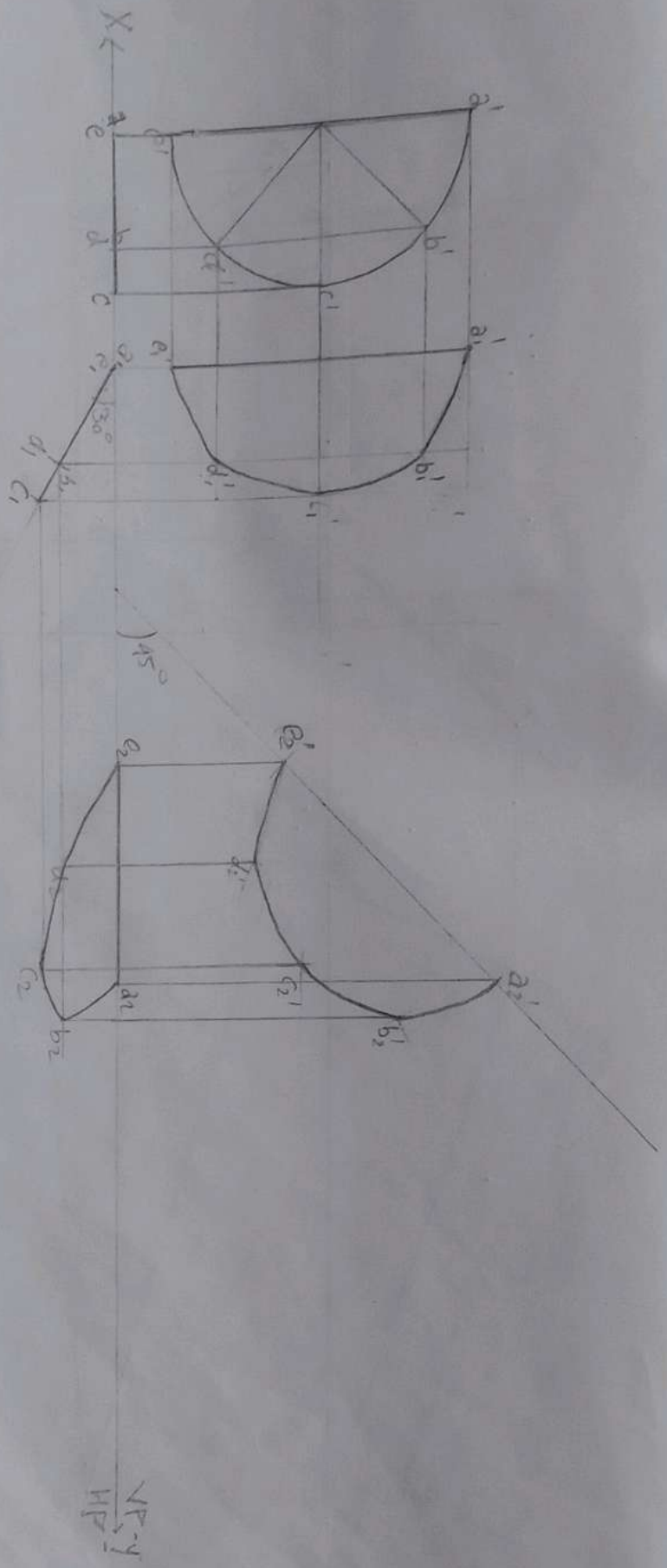
Q11 A 30°–60° set Square of longest Side 100mm [illegible] inclined To HP while it's surface is 45° inclined to VP Draw it's Projections



Q.11.2 A 30° - 60° set square of longest side 100mm long is in VP and it's surface ~~is~~ 45° inclined to VP. One end of longest side is 10mm and other end is ~~40~~ mm above HP. Draw it's projections.

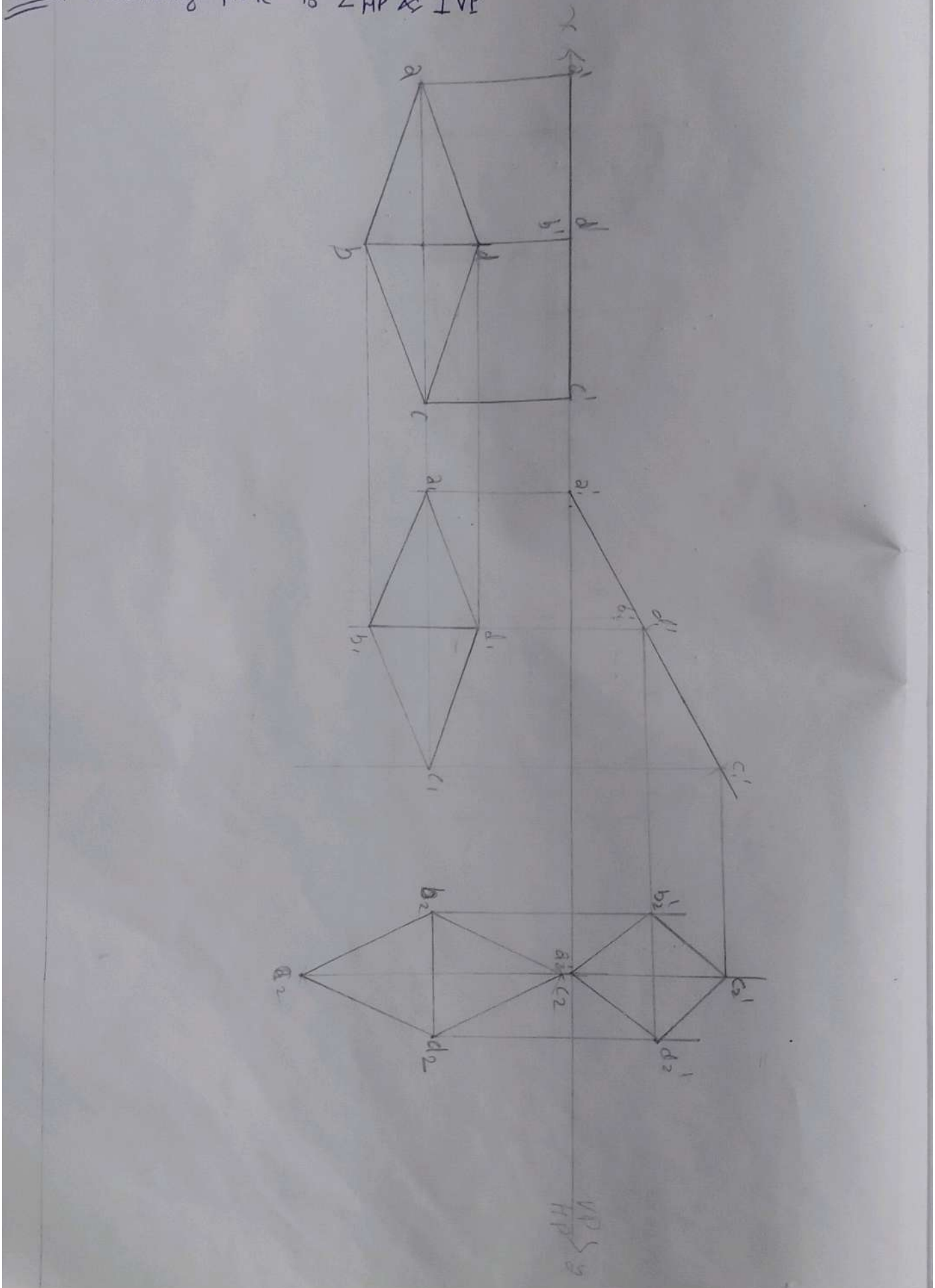


13 → A Semicircular plate of 50mm diameter has its straight edge in the VP and inclined at 45 to HP. The surface of the plate makes an angle of 30 with the V.P. Draw its projections.

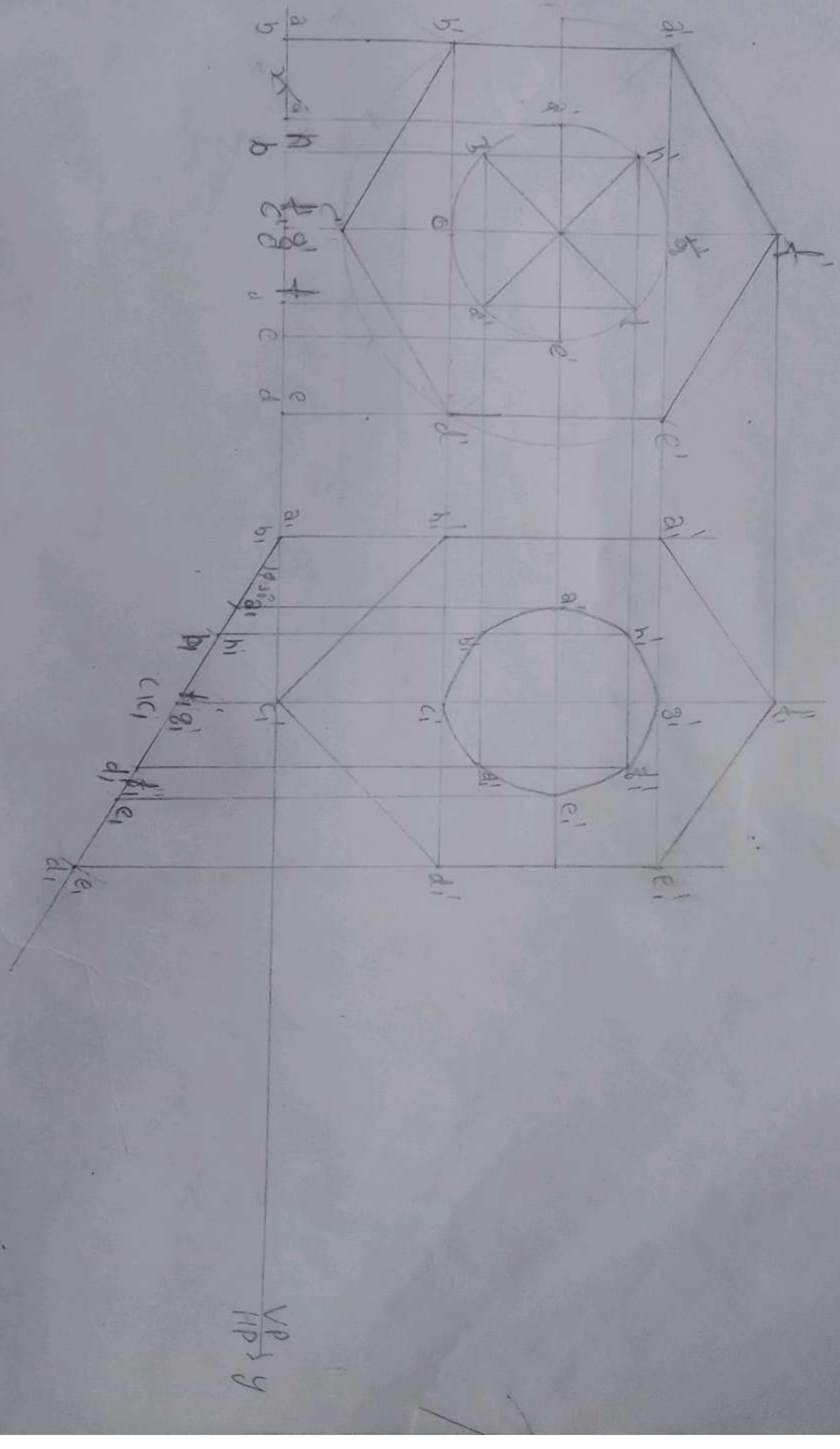


Q.15: Draw projections of a rhombus having diagonals 125mm and 50mm long, the smaller diagonal of which is parallel to both the principal planes, while the other is inclined at 30° to the HP. (2006)

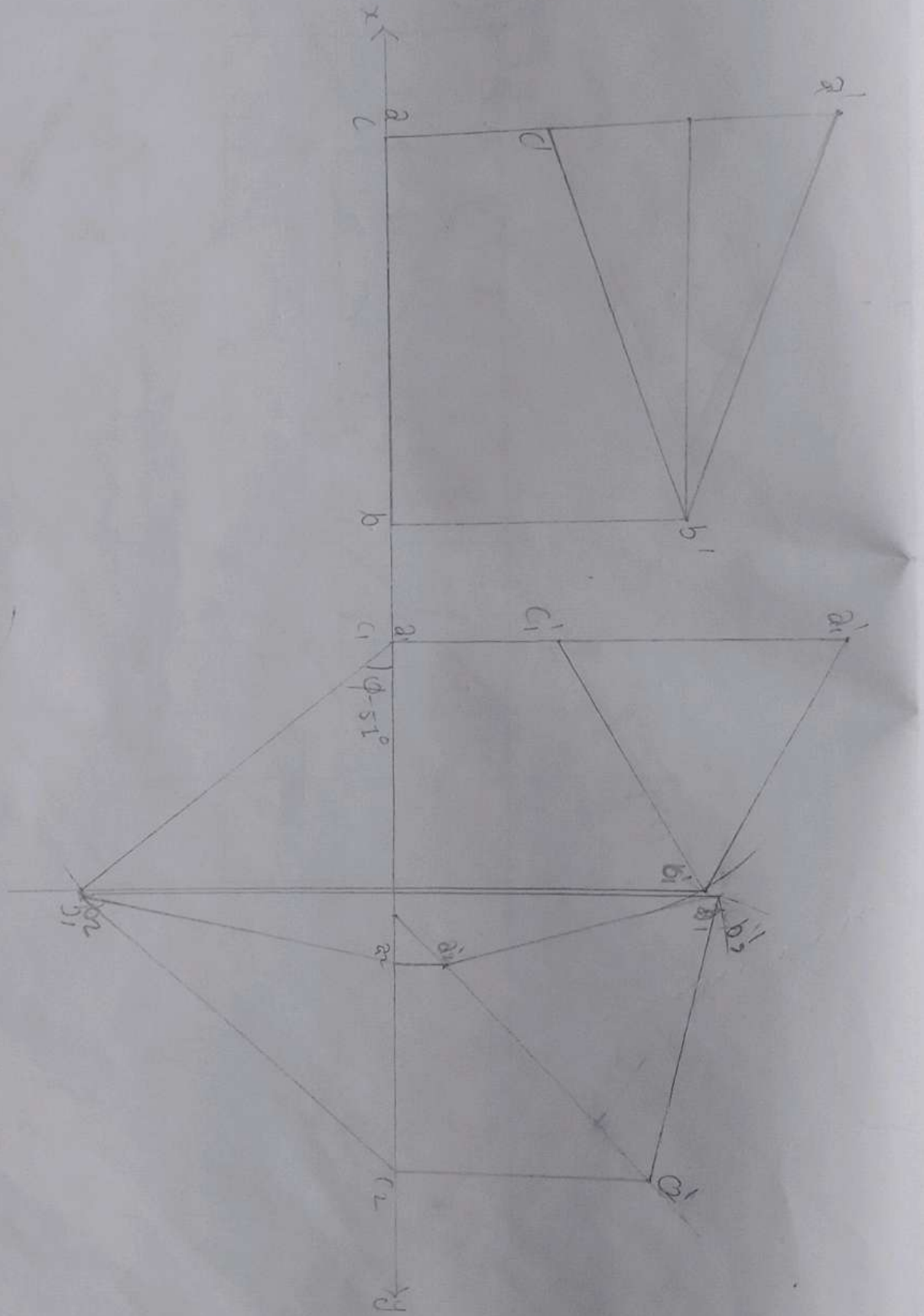
Soln: Assuming plane is ∠ HP & ⊥ VP



13 Draw a regular hexagon of 40mm sides, with its two sides vertical. Draw a circle of 40mm diameter in its centre. The figure represents a hexagonal plate with a hole in it and having its surface parallel to the V.P. Draw its projections when the surface is vertical and inclined at 30° to the V.P. (2006)

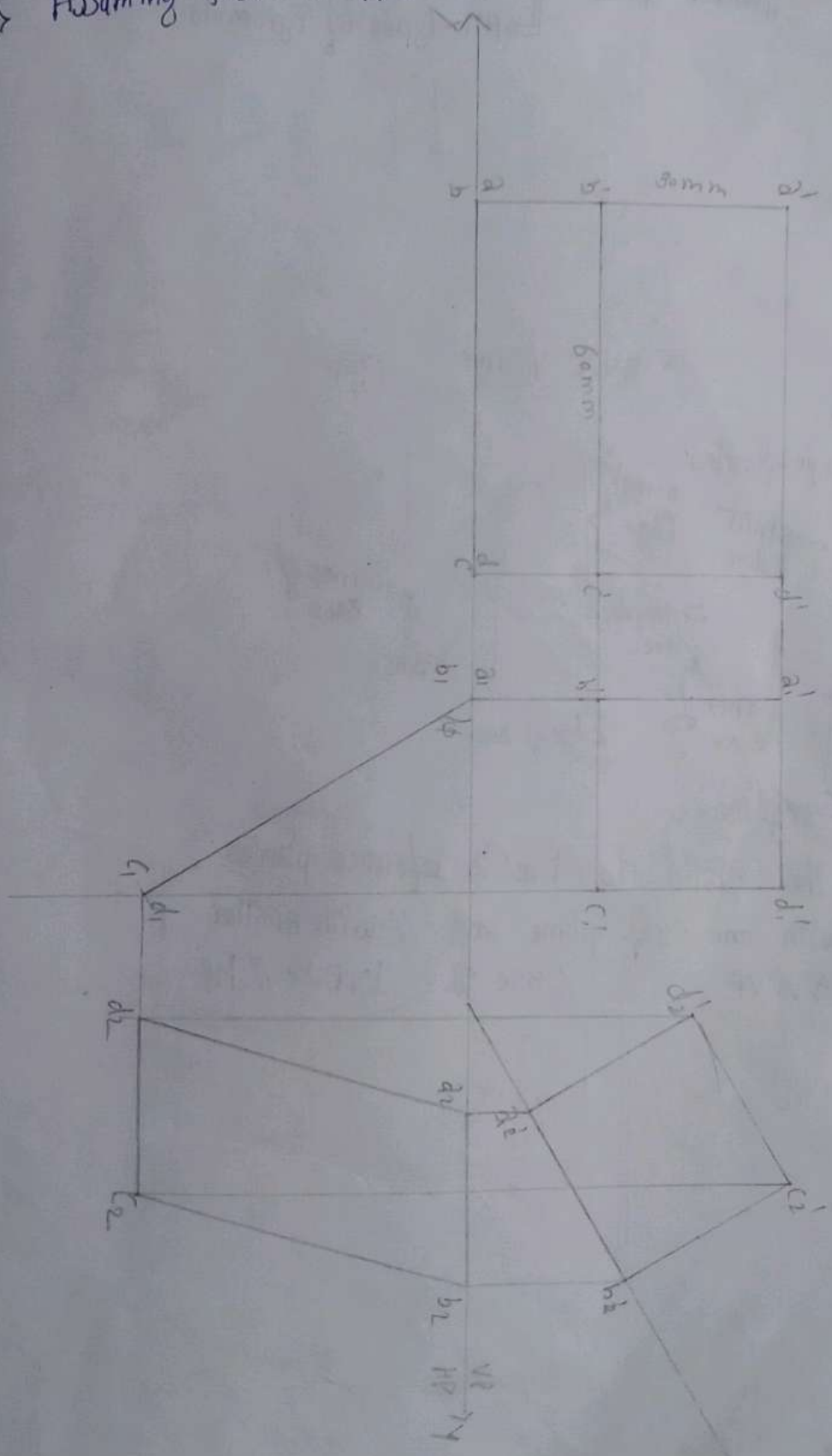


Q.16 A plate having shape of an isosceles triangle has base 50mm long and altitude 70 mm. It is so placed that in the front view it is seen as an equilateral triangle of 50mm sides and one side inclined at 45° to xy. Draw its top view.



3.18 A Thin rectangular plate of side 60mm. X 30mm. has its shortest side in the V.P. and inclined at 30° to the H.P. Project its top view if its ~~Hori~~ Front view is a square of 30mm. long side. (2006)

Sol^n → Assuming plane is // V.P & ⊥ H.P.



Projection of Solid

Types of Solids

Solids of Revolution

Cone

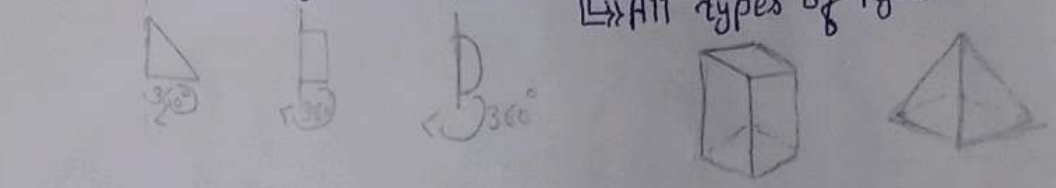
Cylinder

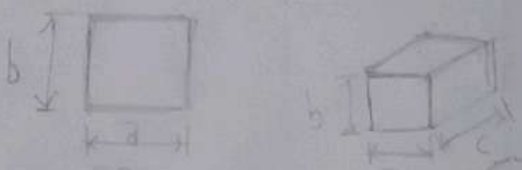
Sphere

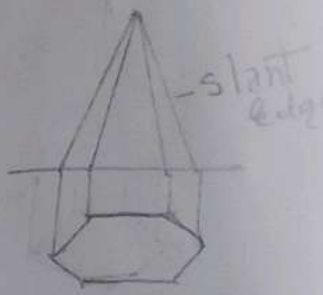
Polyhydra

→All types of Prism

→All types of Pyramids







axb Area

axbxc Volume

Top

Appex/vertex

Triangular Face

slant Edge

straight Edge

Rectangular face

Corner of Base

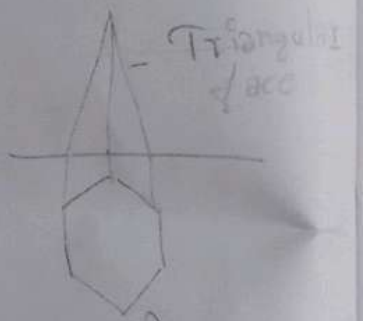
Base

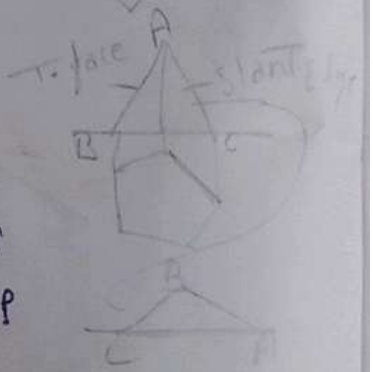
Corner of Base

Edge of Base

Base

Edge of Base

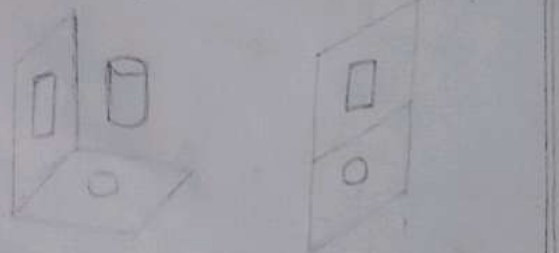




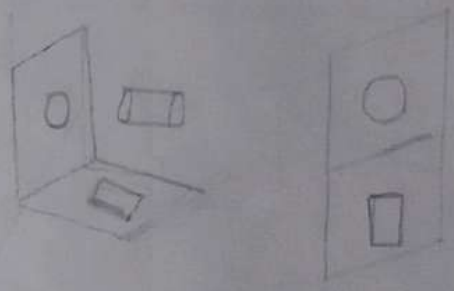
Condition of the Solid w.r.t. to reference planes.

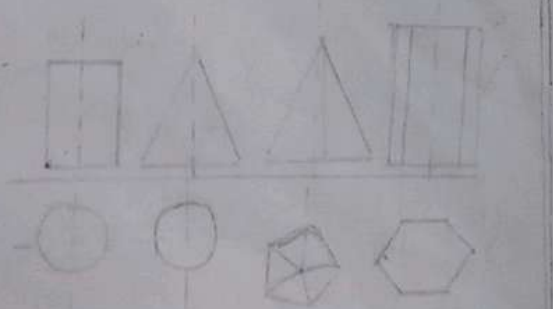
Solid is ⊥ with one ref plane and // with another

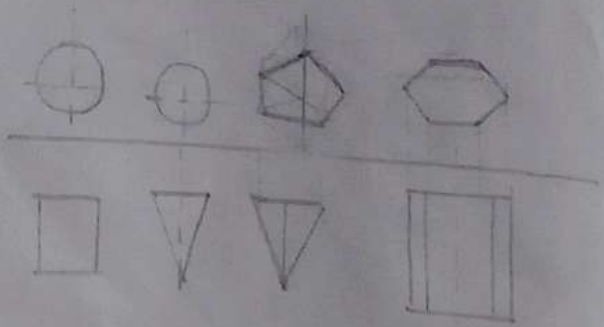
Case I ⇒ ⊥ HP & // VP



Case II ⇒ ⊥ VP & // HP



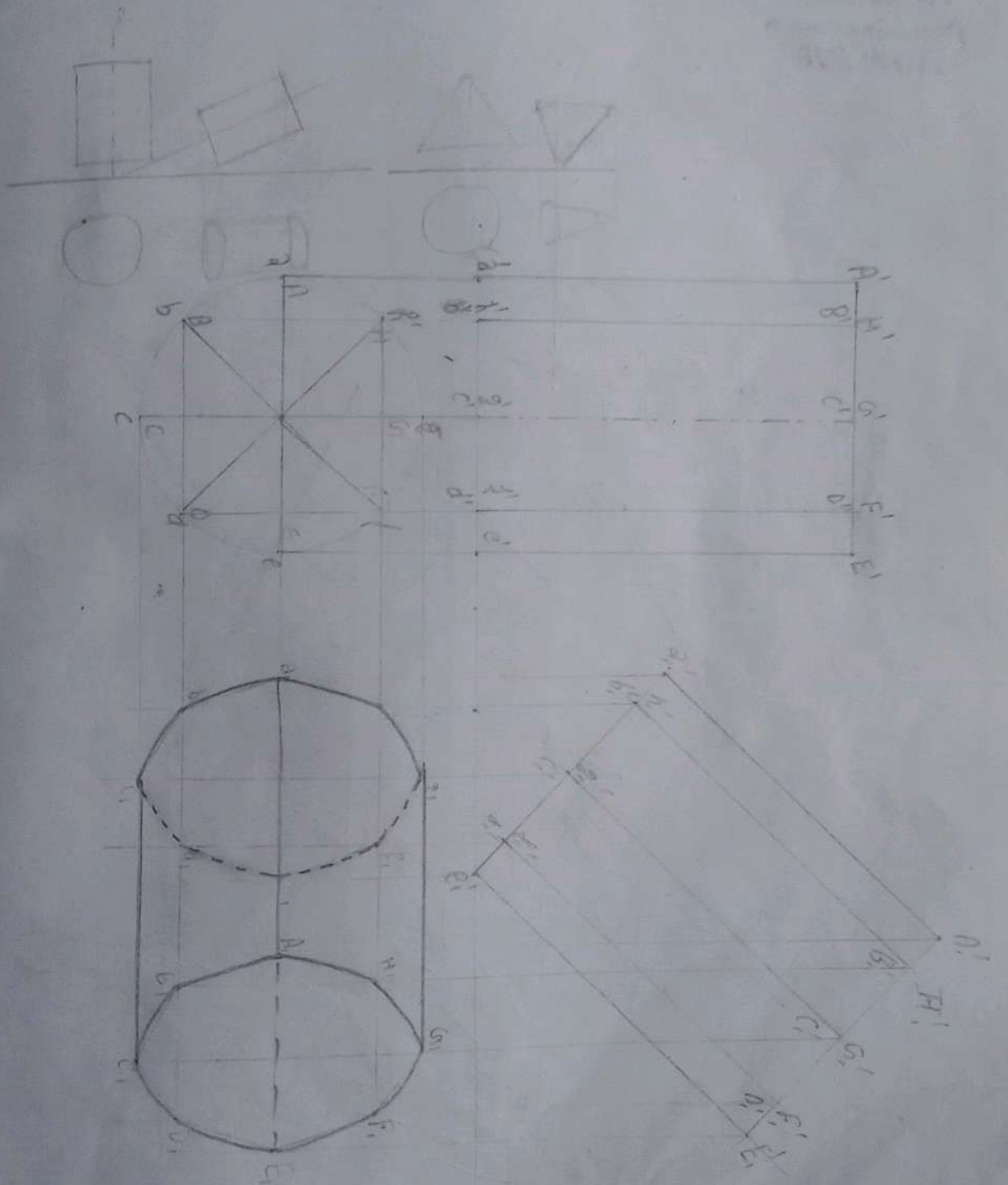




Q.1 A Cylinder of 50mm diameter 70mm height is resting on its base on the H.P. such that its axis is inclined at 45° to the H.P. & // to the V.P.

Soln: Solid is ∠ with one ref plane and // with another

(I) Assuming Axis of Solid is ⊥ HP // VP (II) ⊥ VP & // HP



Q.2 A Cone of 50mm diameter & 70mm height is inclined at 45° to the H.P. & the axis of its top view makes an angle of 30° with the V.P. Draw its projection. (Traces) Revolution

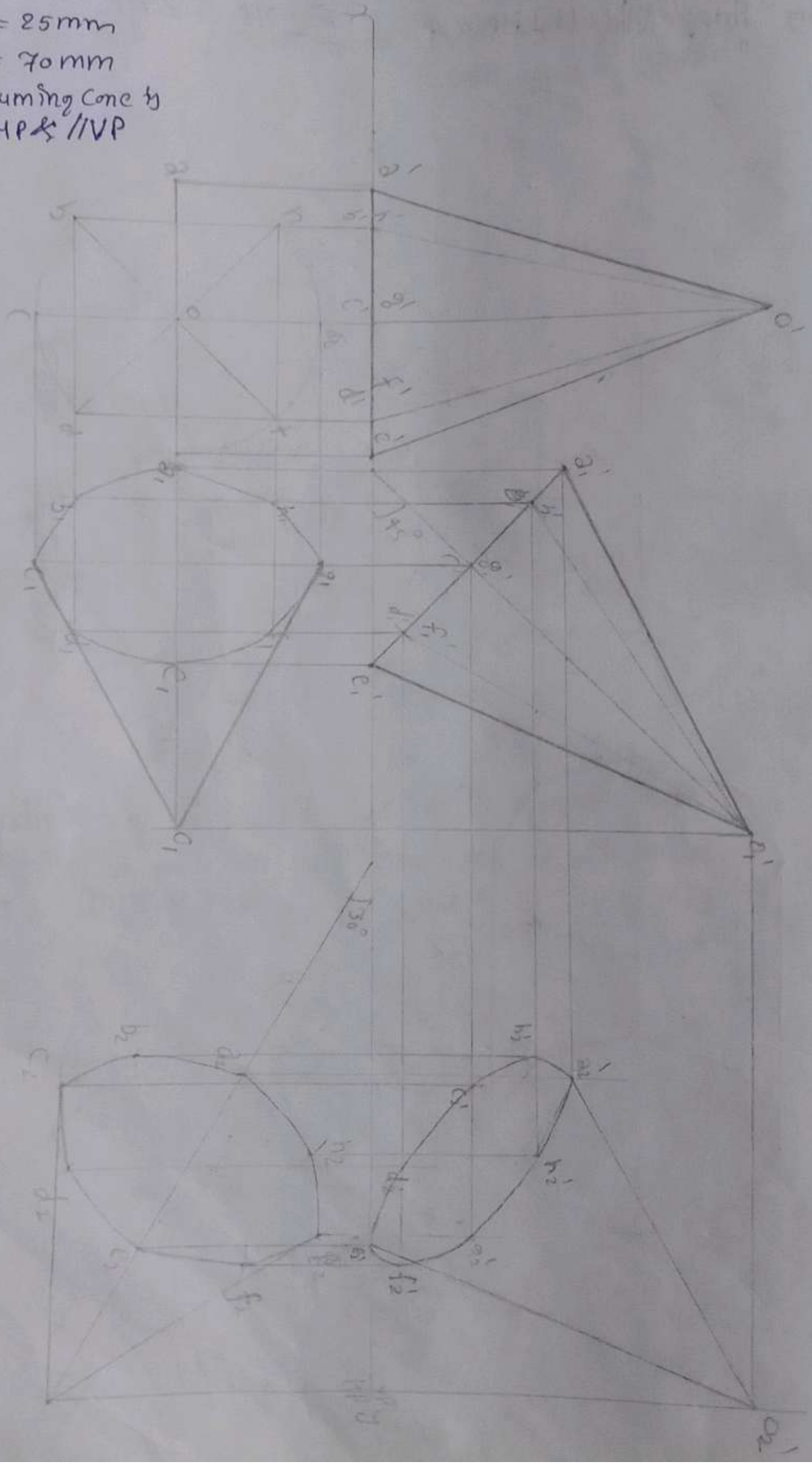
Soln

$\phi = 50mm$

$r = 25mm$

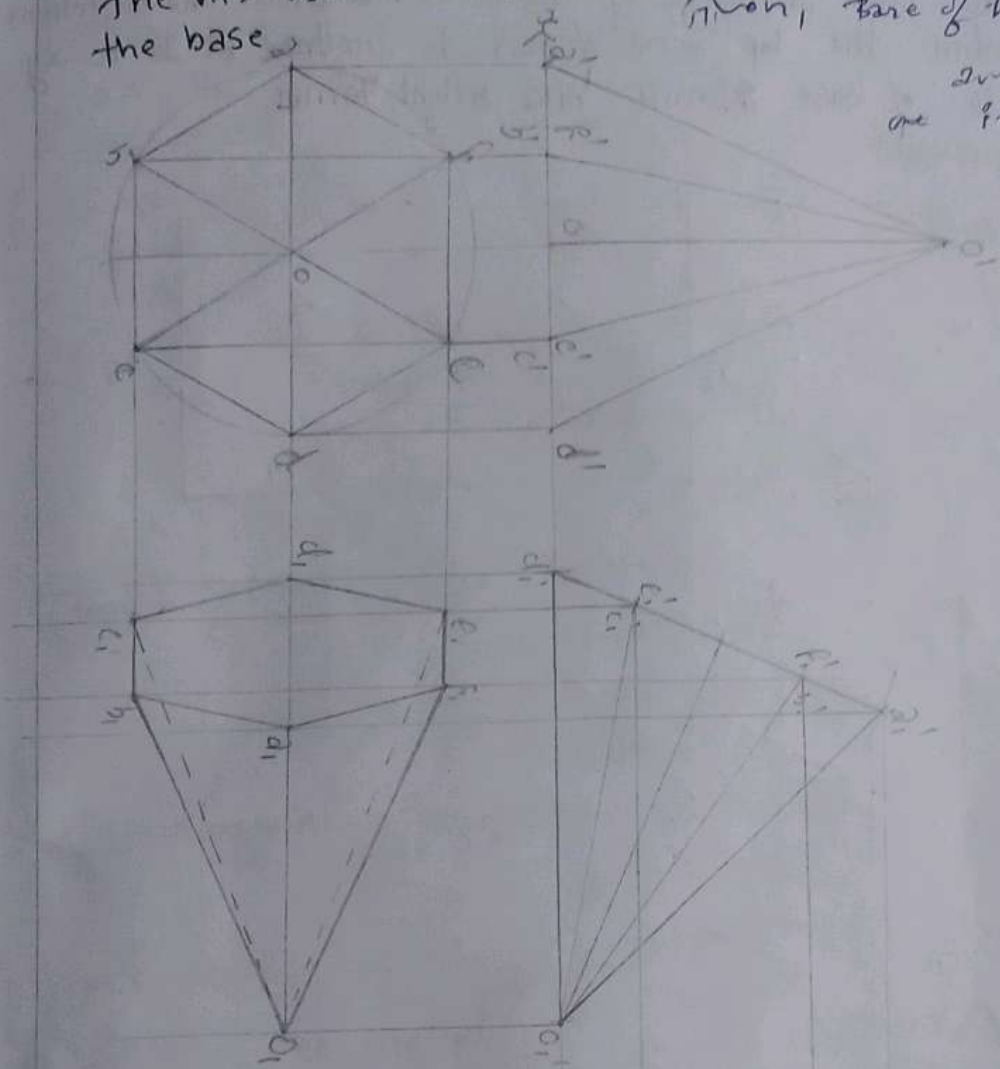
$H = 70mm$

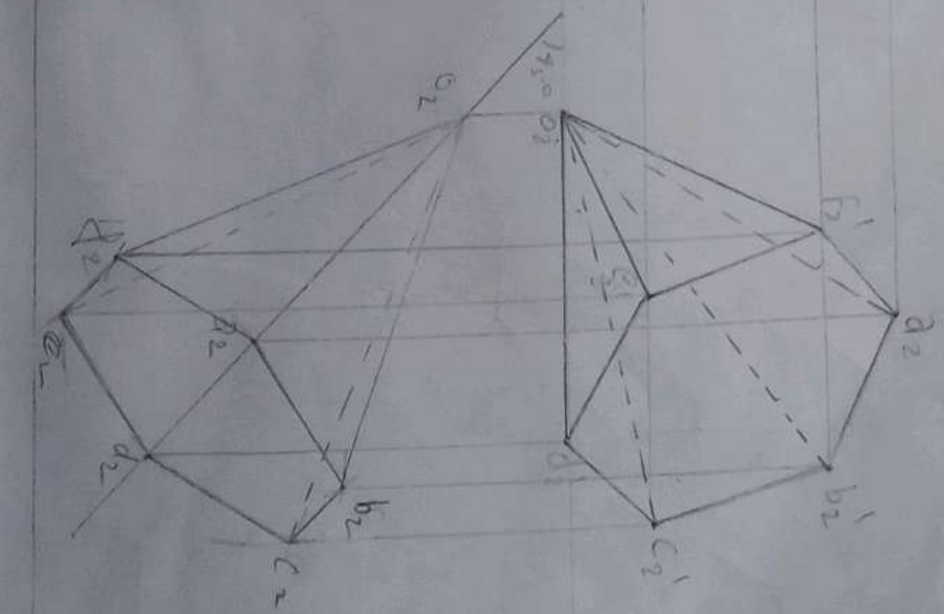
Assuming Cone is ⊥ HP & // VP



Q.13 A hexagonal pyramid Base 25mm side axis 55mm long & has one of its slants edge on the ground. A plane containing that edge ~~and~~ and the axis ⊥ to the H.P. & inclined at 45° to the V.P. Draw its projection when the apex is nearer to than the base.

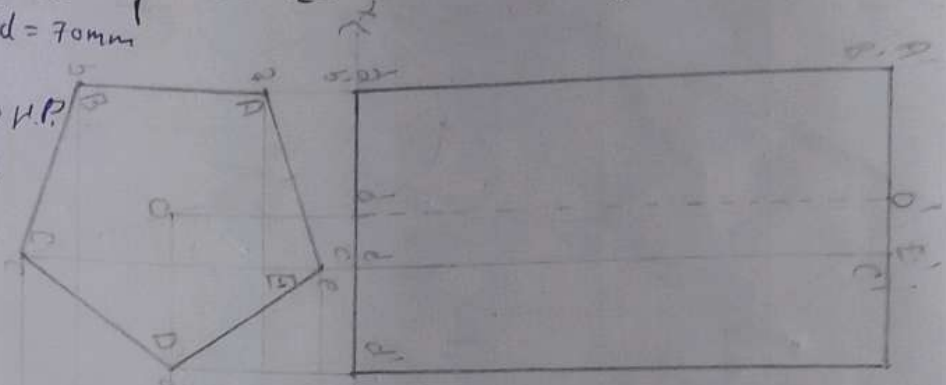
Given, Base of hexagonal Pyramid 25mm side and its axis 55mm long one its one slant age ⊥ to the H.P ∠ at 45° to V.P

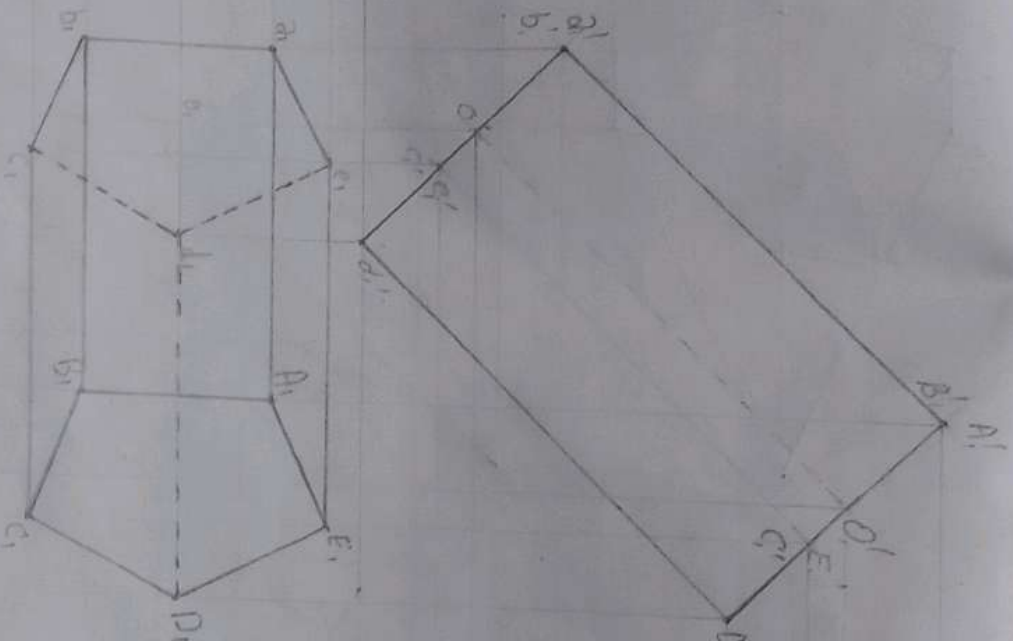


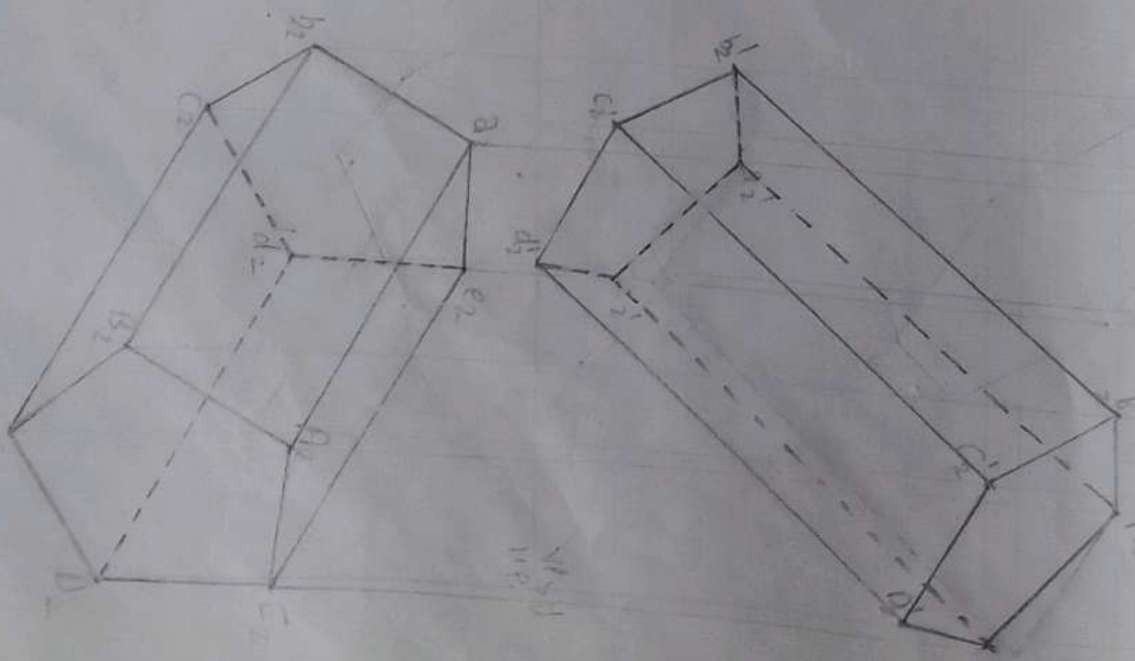


Q.13] A pentagonal prism is resting on one of the corners of its base on the H.P. The longer edge containing that corner is inclined at 45° to the H.P. The axis of the prism makes an angle of 30° to the V.P. Draw the projections of the solid. Also draw the projections of the solid when the top view of axis is inclined at 30° to xy
Take the side of base 25mm and height 70mm.

Soln ⇒ height of solid = 70mm
base = 25mm
∠ at 45° to the H.P.
30° to the V.P.



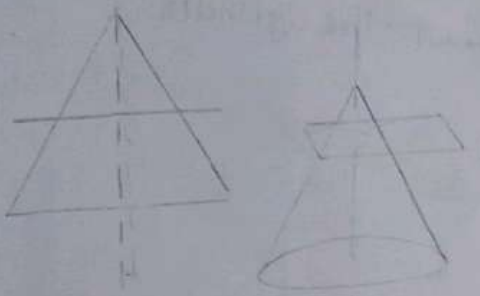




UNIT-04

SECTION OF SOLID & Development of Surface

Cutting plane is // with base of solid ⊥ with Axis of Solid



Cutting plane is ∠ with base of solid

Cutting plane is ∠ with Axis of the Solid.

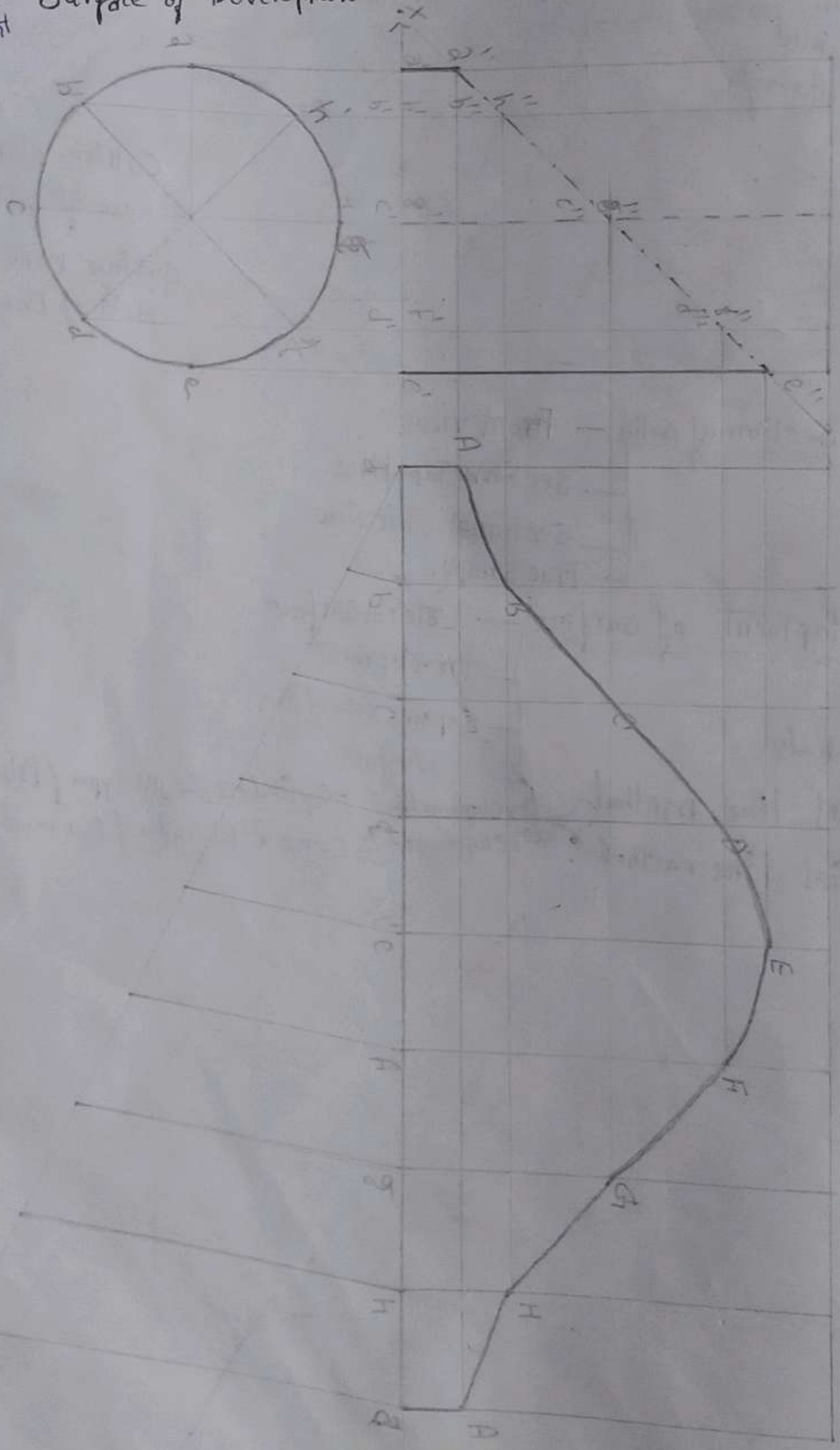
Topic - Section of Solid
- Front view
- Sectional Top view
- Sectional Side view
- True shape.

Development of Surface
- Lateral Surface Development
- Expansion of the Surface

Methods
1. Parallel line method → development of Cylinder & All type of Prism
2. Radial line method → development of Cone & All type of Pyramid.

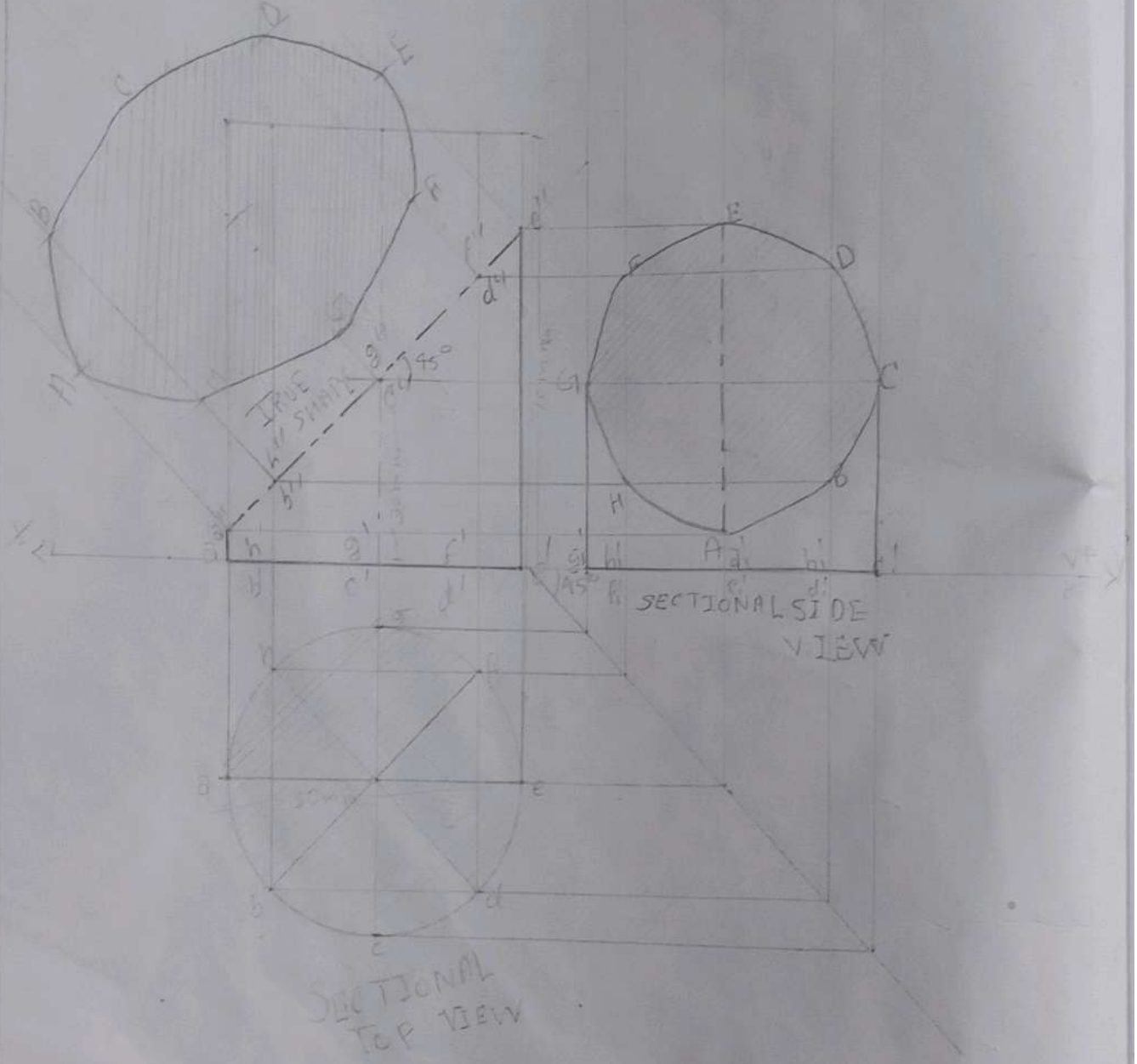
Q.1 A Cylinder of 50mm diameter & 70mm height is resting on its base on the H.P. Such that its axis ~~inclined at~~ is ⊥ to the H.P. // to the V.P. A cutting plane inclined at 45° to the HP & ⊥ to the V.P. bisects the axis of the cylinder draw the development of the Lateral Surface of ~~Development~~ the Cylinder

bisect मध्यबिंदु को Mid point mark करना है।

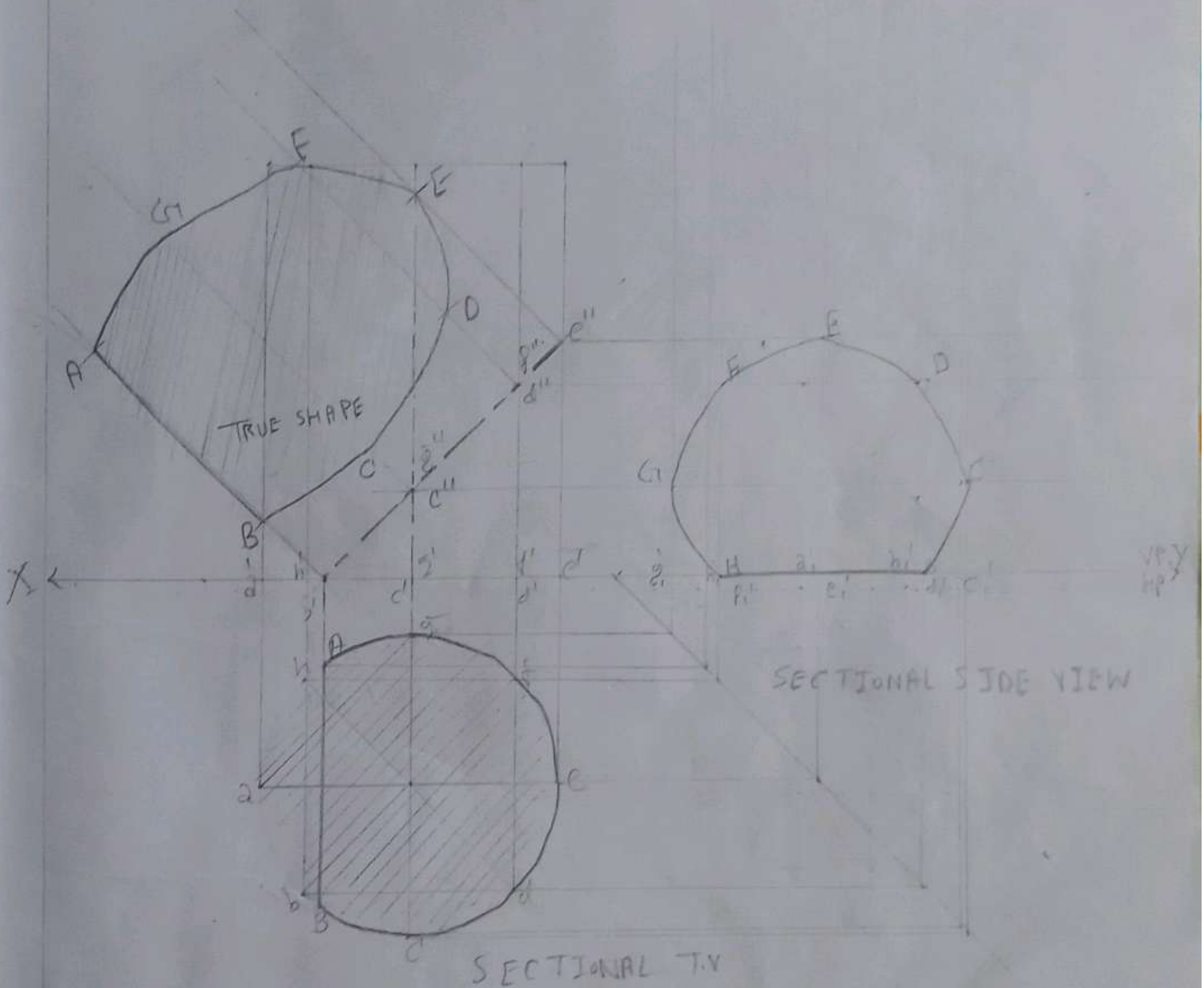


Q.3:- A cyclinder of 50mm diameter & 70mm height is resting on its base on the H.P. its axis is // to the V.P & ⊥ to the H.P. It is cut by a Sectional plane at a distance of 30mm from the base & plane is inclined to the H.P. at 45° & ⊥ to the V.P. Draw it sectional front view, sectional side view, Sectional top view & true shape of the Section.

Soln:-

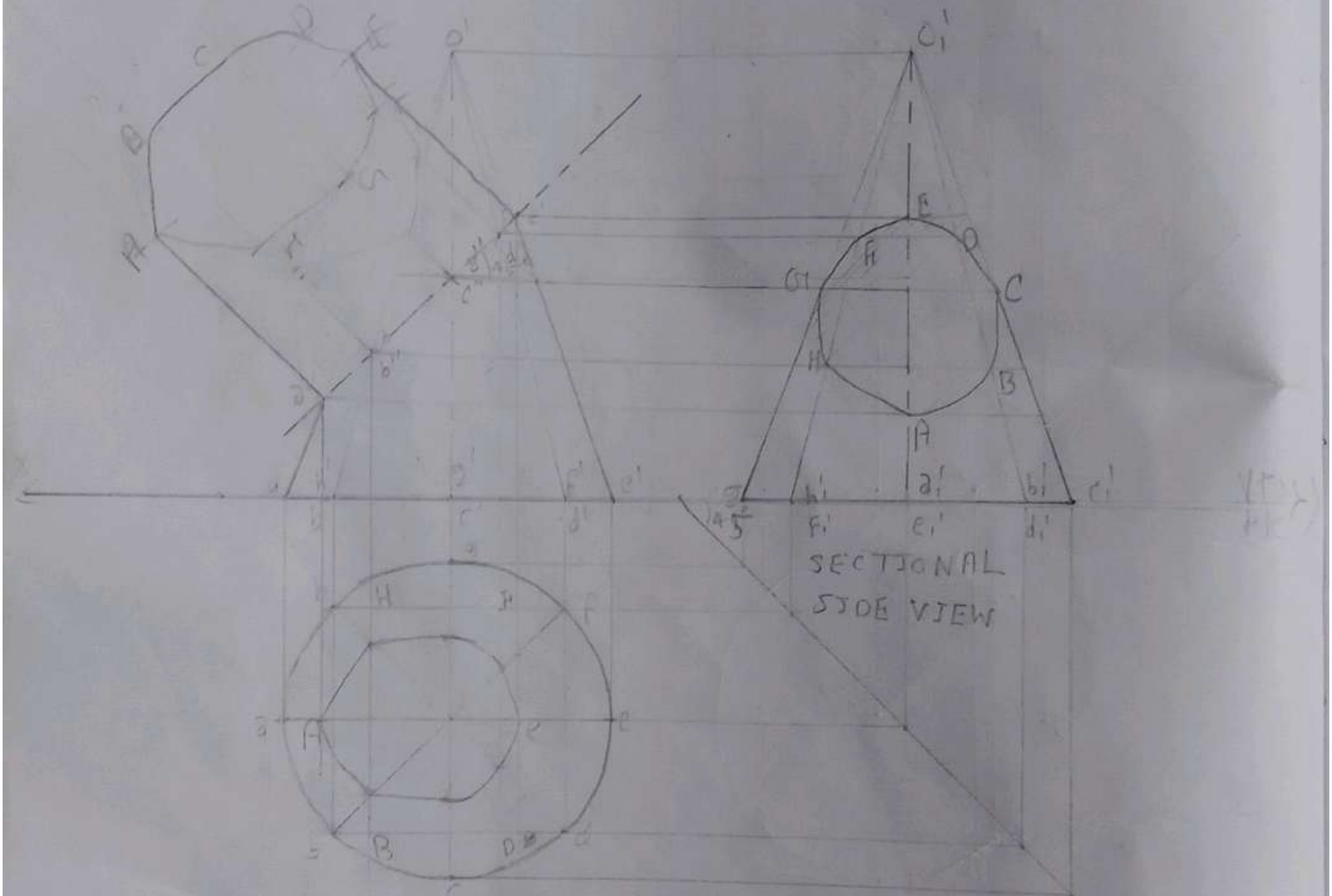


6.4 Sol^n, Diameter of A cylinder 50mm & h = 70mm
Sectional plane at a distance of 15mm from the base & plane to ∠ 45° to H.P.

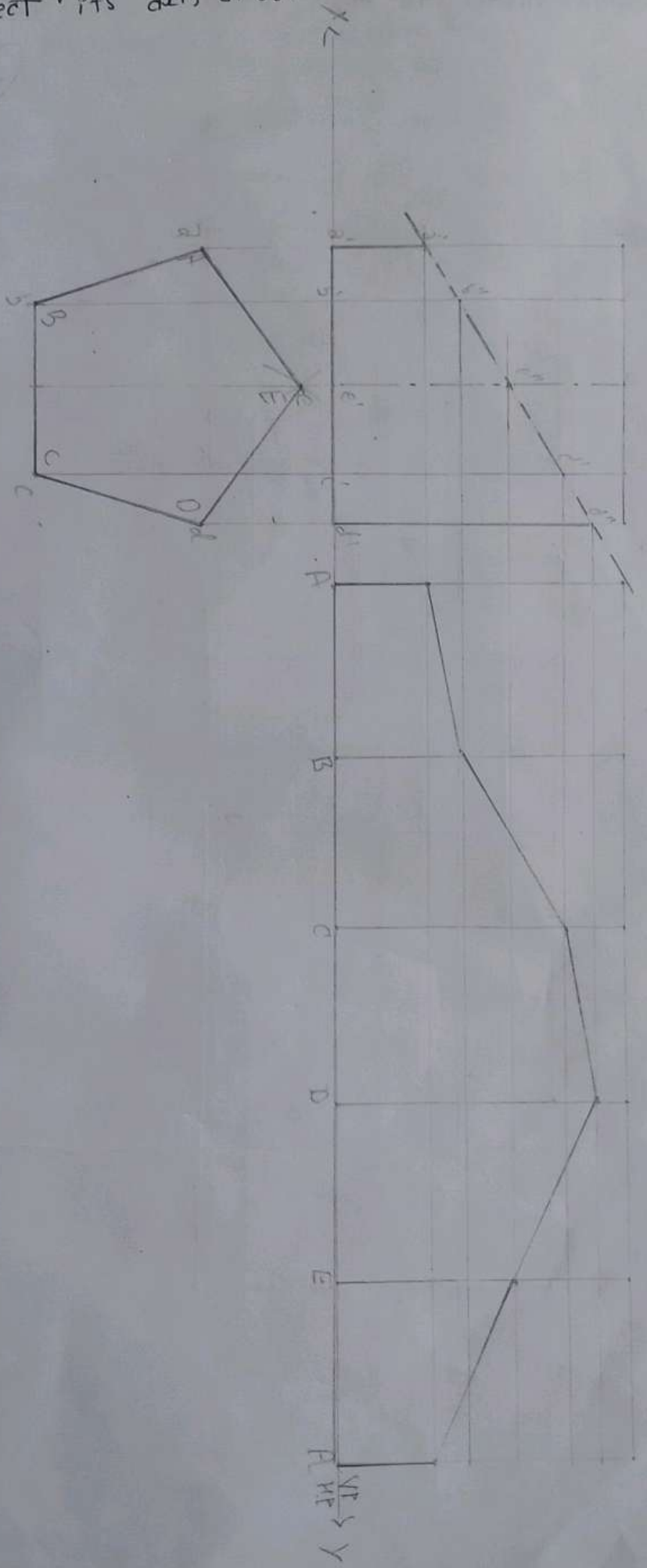


Q.5 A Cone of 50mm diameter & 70mm height is resting on its base on the H.P. It's axis is // to the VP & ⊥ to the H.P. It is cut by a sectional plane at a distance of 30mm from the base & plane is inclined to the H.P. at 45° & ⊥ to the V.P. Draw it sectional front view, sectional side view, sectional top view & true shape of the section.

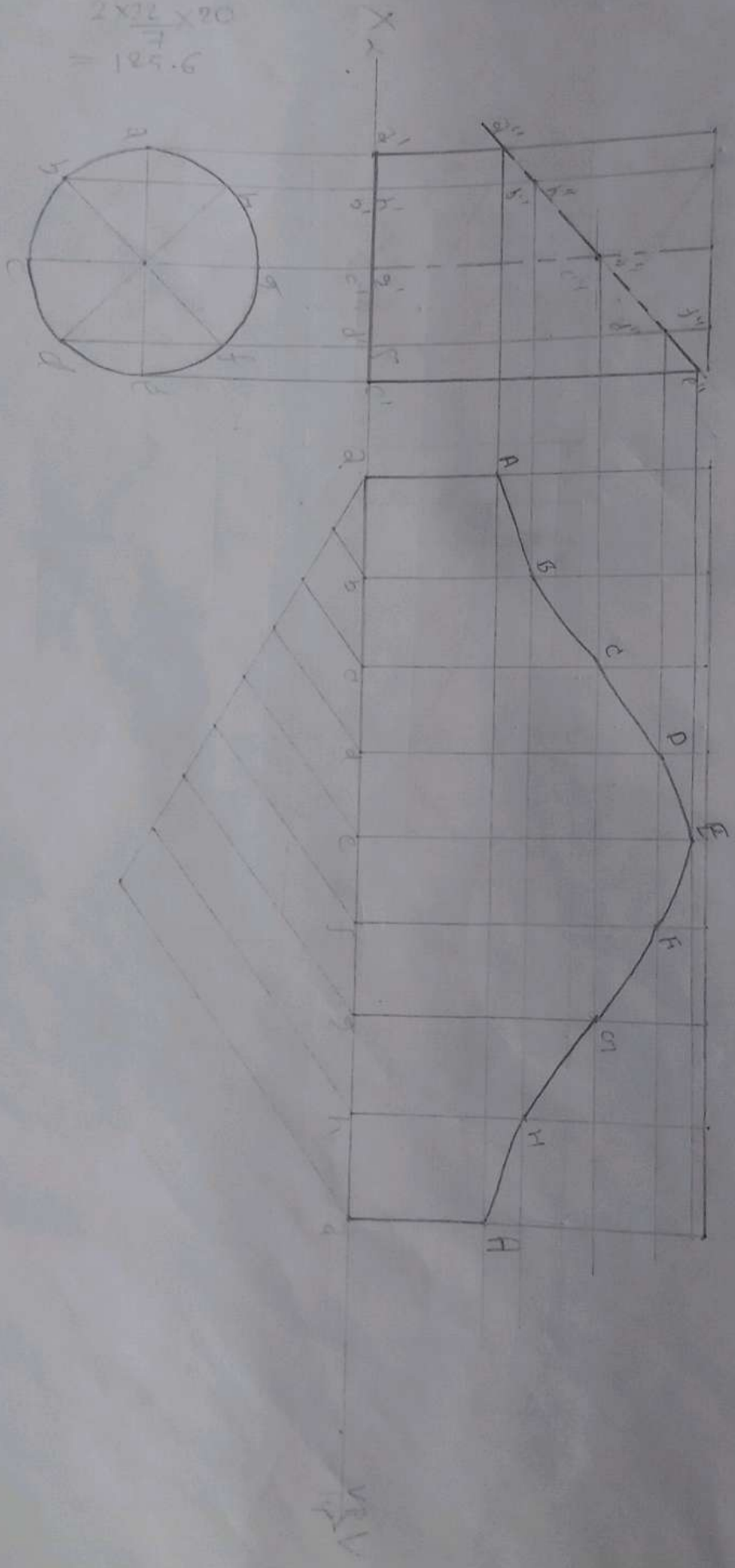
Sol^n



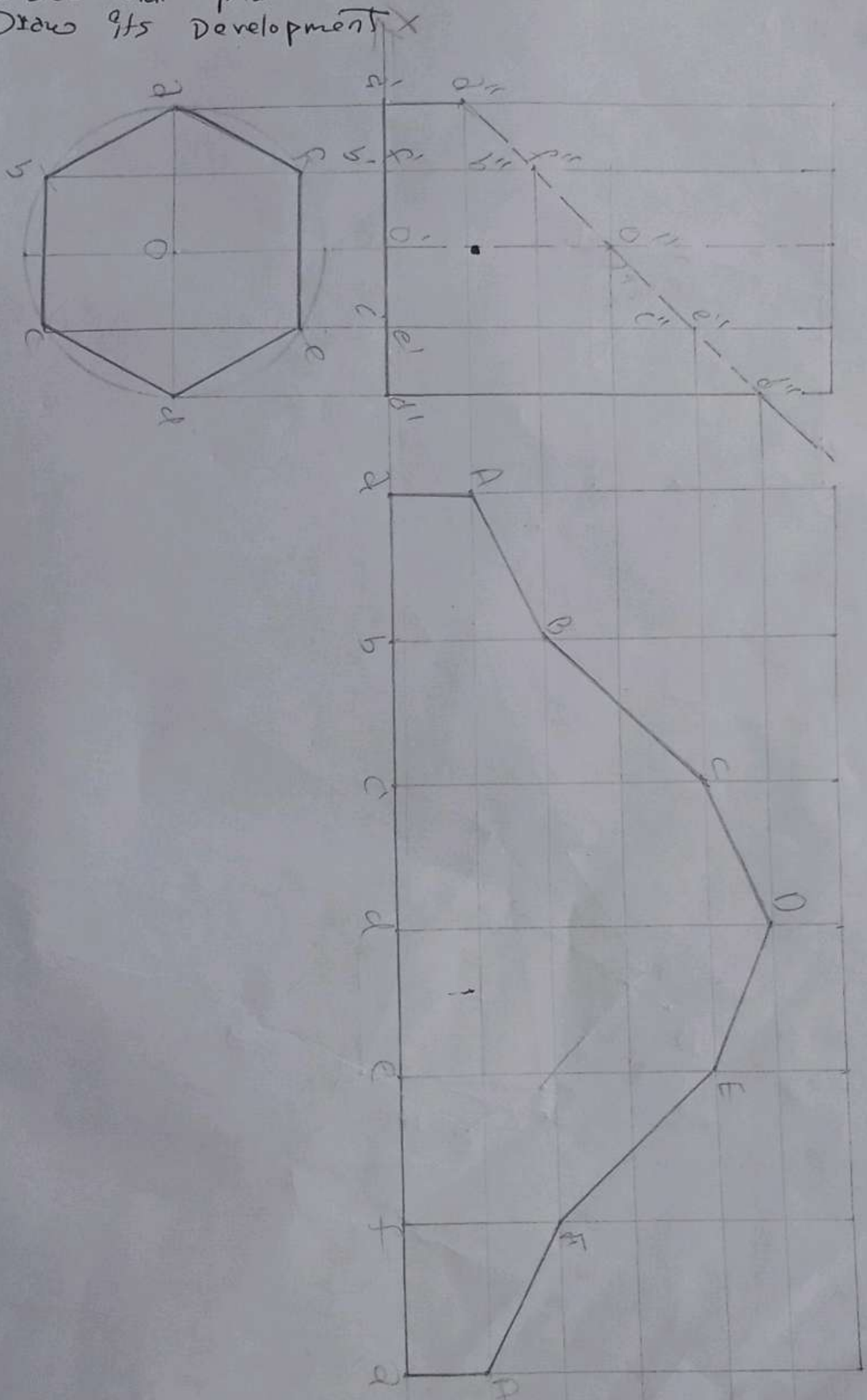
Q.6 / Draw the development of lateral surface of an regular pentagonal Prism of side 30mm and Height of 50mm long. A cutting plane is bisect its axis at 30°.



8. Draw the development of a lateral ~~Cylinder~~ cut its axis, is 90mm & axis is 60mm long. A section plane 90mm above the base and makes 40° angle to H.P.

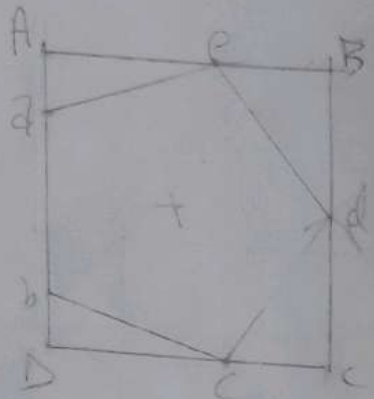


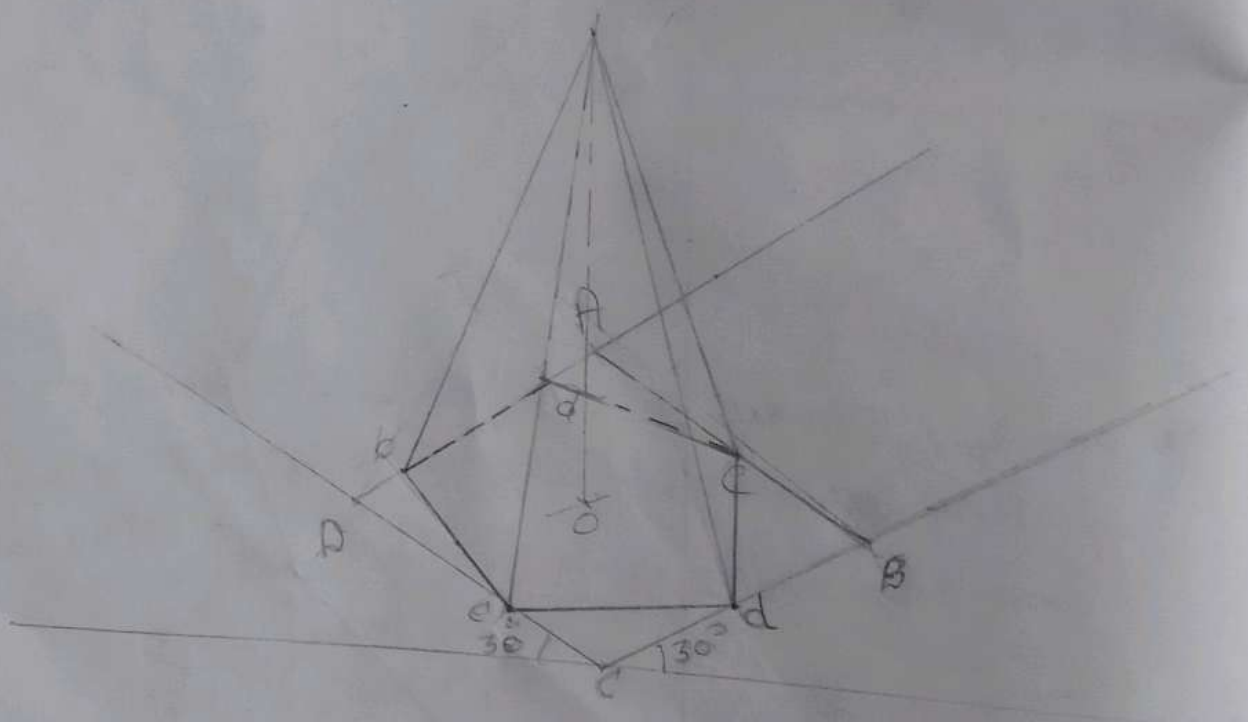
D.1 A Hexagonal Prism of Side of base 25 mm & Axis 75 mm long is resting on its base on the H.P., Two Sides of the base are ∥ to the V.P. It is cut by (It is bisect by) a sectional plane ∠ at 45° to the H.P ⊥ to the V.P. Draw its Development



Pentagonal Prism

Side = 25mm
Axis H = 65 mm





Hexagonal prism

Side = 25 mm

H = 70 mm