1. Engineering Drawing

Engineering Drawing:-
The graphical representation of an object containing details like size, shape etc. on a 2D plane is called "Engineering Drawing."

Conic Section

Focus:- The fixed point is called focus.

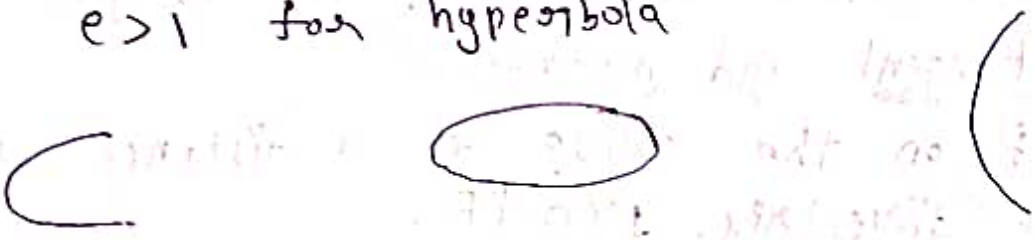
Directrix:- The fixed straight line is called directrix.

Vertex:- The point at which conic section intersects the axis is called vertex.

Eccentricity:-

$$e = \frac{\text{Distance of the point from the focus}}{\text{Distance of the point from the directrix}} = \frac{VF}{VA}$$

If $e = 1$ for parabola
$e < 1$ for ellipse.
$e > 1$ for hyperbola



parabola Ellipse Hyperbola

HB = Harness & Boldness ⇐ rounded ✓ fix ✓ above.

H =

2H =

(1). Construct a parabola, when the distance of the focus from the directrix is 50. Also draw a tangent and normal to the curve at a point 40 from the directrix.

Sol:- Procedure:-

(i) Draw a horizontal line AB.

(ii) Draw the vertical line CD i.e, directrix.

(iii) Mark focus (F) at a distance of 50mm from the directrix.

(iv) Mark vertex (V) in the middle of AF.

(v) From V draw a vertical line, i.e. $VE = VF$

(vi) Join VE and extend. From V, devide the equal number of parts say each 10mm.

(vii) From 1, 2, 3, ..., draw the vertical lines to intersect at AE line and mark as $1', 2', 3', \ldots$

(viii) Take $11'$ as radius and F as centre to cut $11'$ line either side of AB line.

(ix) $22', 33', \ldots$ as radius and F has centre to cut $22', 33', \ldots$ lines.

(x) Join all arcs along with V, we get parabola

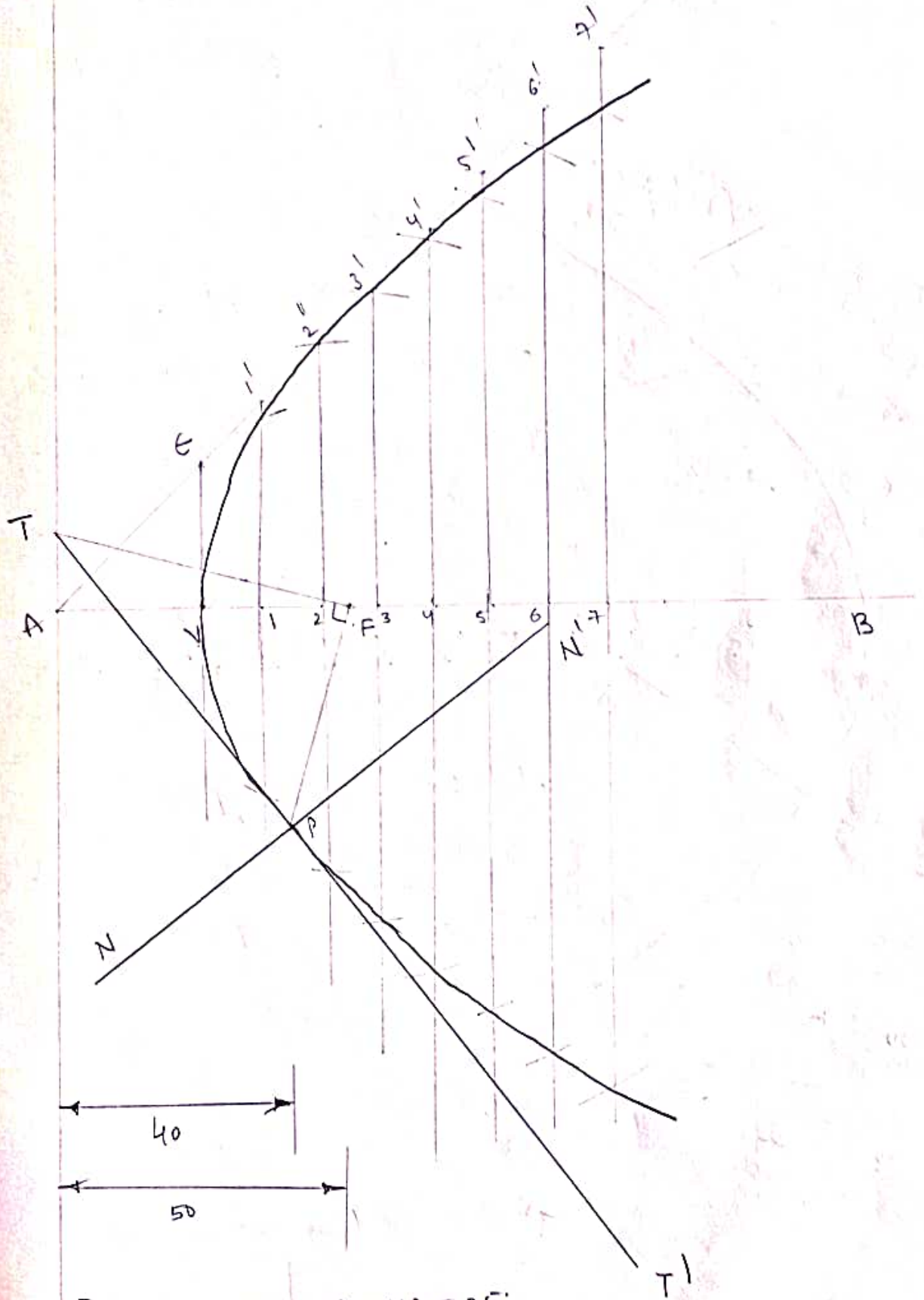
To draw tangent and normal:-

(i) Mark P on the curve at a distance of 40mm from the directrix. Join PF.

(ii) From F, draw a perpendicular line to PF. Intersect at CD line, Mark as T.

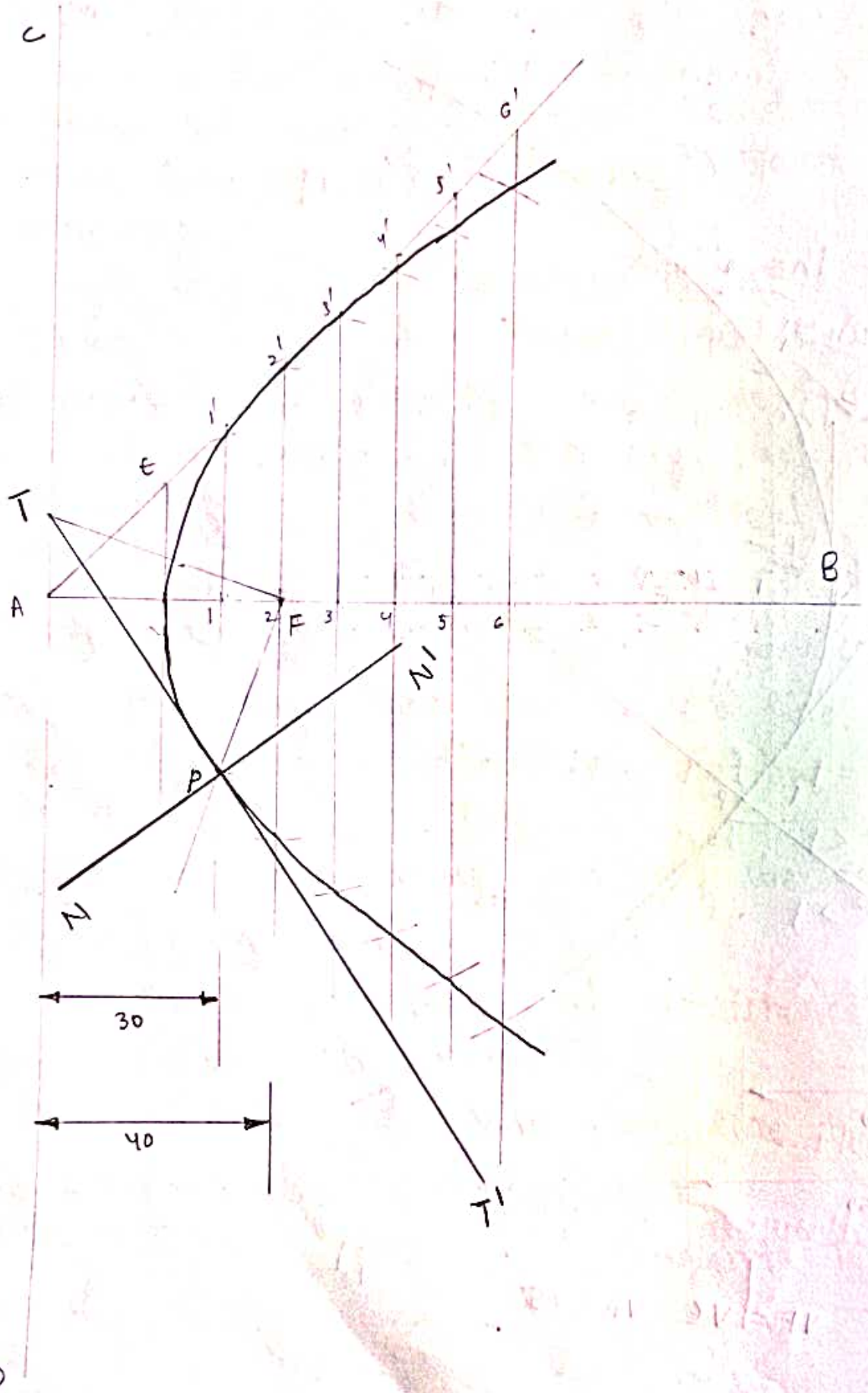
(iii) Join TP and extend, i.e, tangent TT'.

C

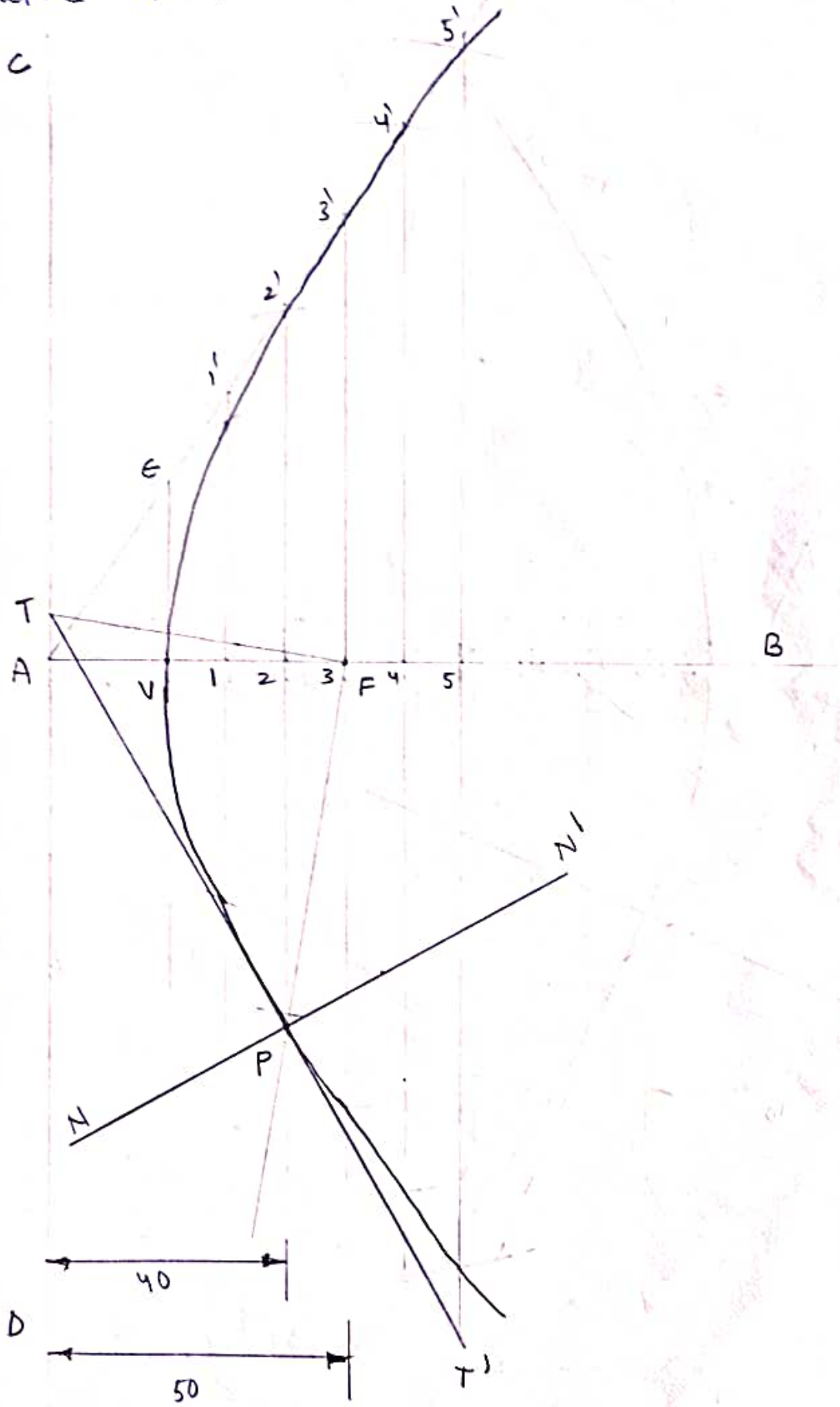


D $VF = VE = VA = 25$

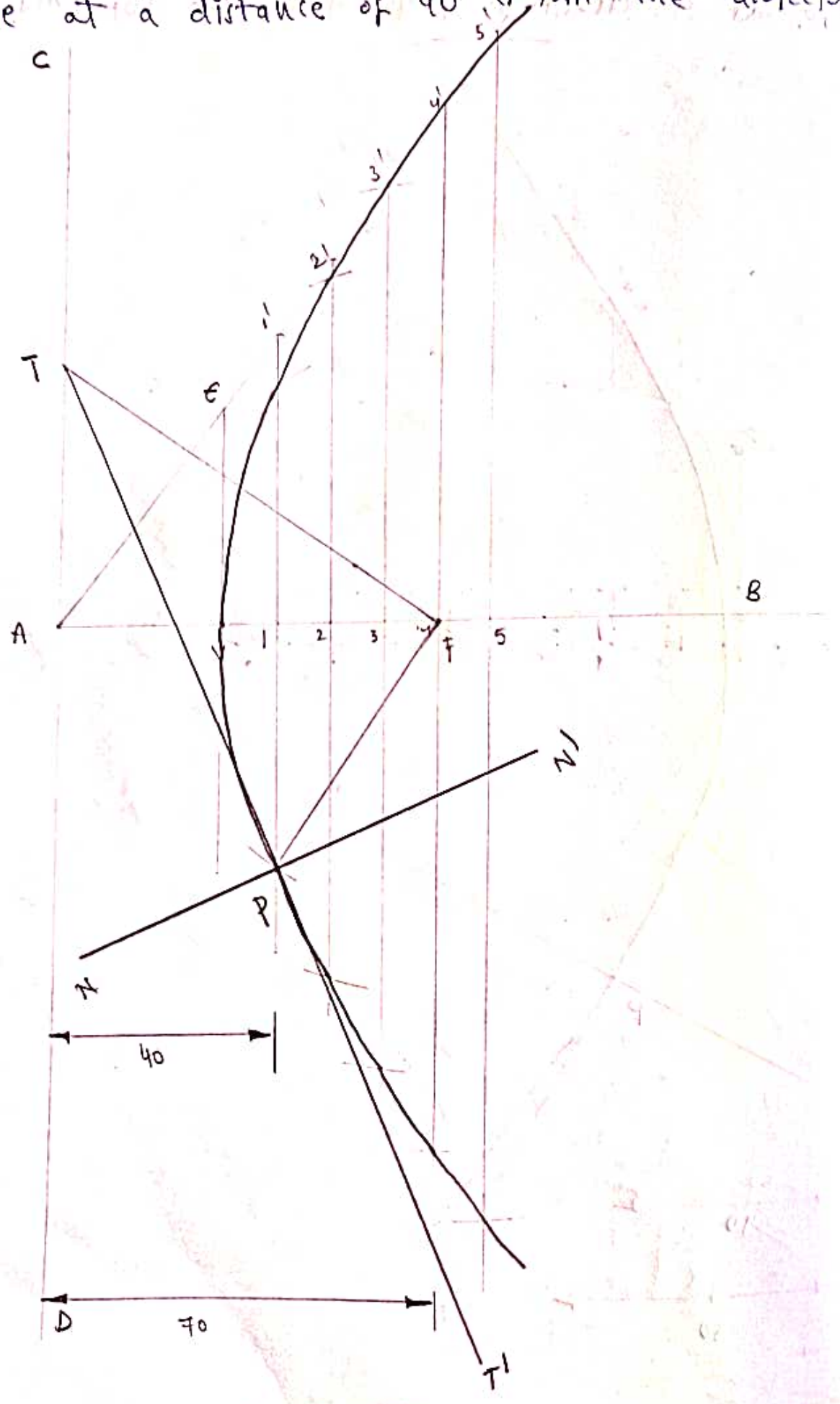
(2). Construct a parabola, when the distance of the focus from the directrix is 40. Also draw a tangent and normal to the curve at a distance of 30 from the directrix.



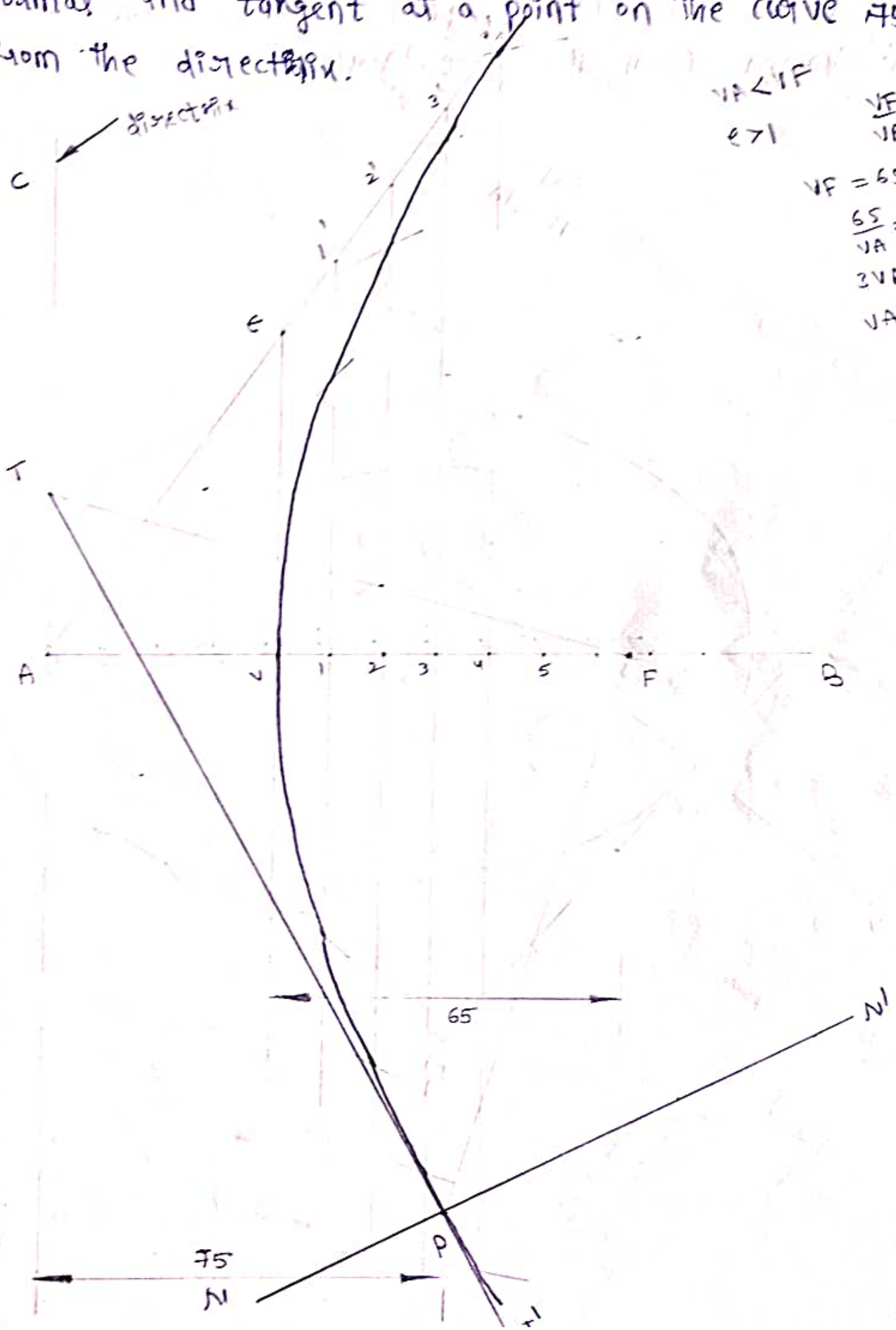
5. Construct a hyperbola, when the distance of the focus from the directrix is 50. and eccentricity is $\frac{3}{2}$. Also draw a tangent and normal to the curve at a distance of 40 from the directrix.



(4) Construct a hyperbola when the distance of the focus from the directrix is 70. and eccentricity is $\frac{4}{3}$. Also draw a tangent and normal to the curve at a distance of 40 from the directrix.



⑤. The vertex of a hyperbola is 65mm from its focus draw the curve if the eccentricity is $\frac{3}{2}$. Draw a normal and tangent at a point on the curve 75mm from the directrix.



$VA < VF$

$e > 1$

$\frac{VF}{VA} = \frac{3}{2}$

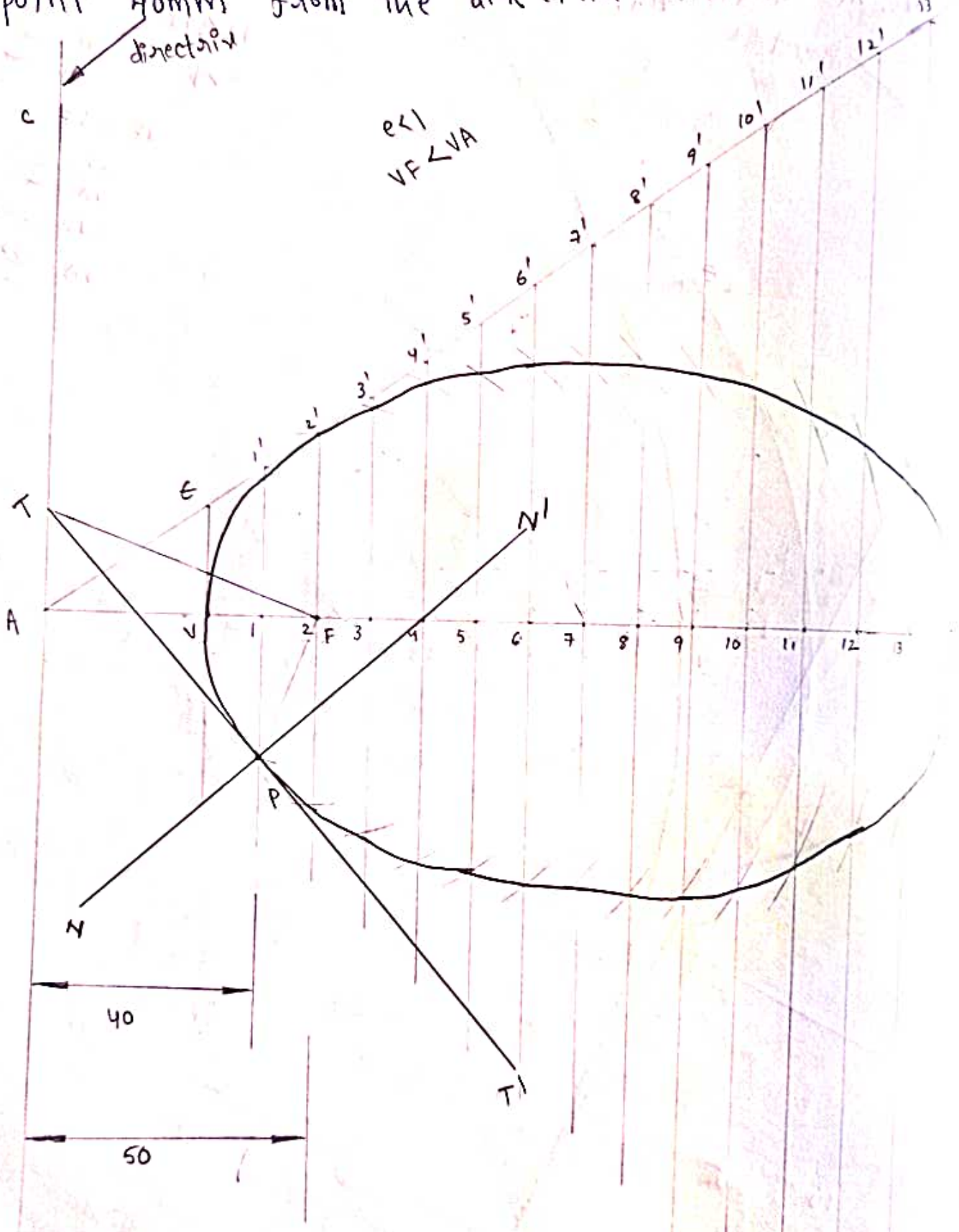
$VF = 65$

$\frac{65}{VA} = \frac{3}{2}$

$3VA = 2 \times 65$

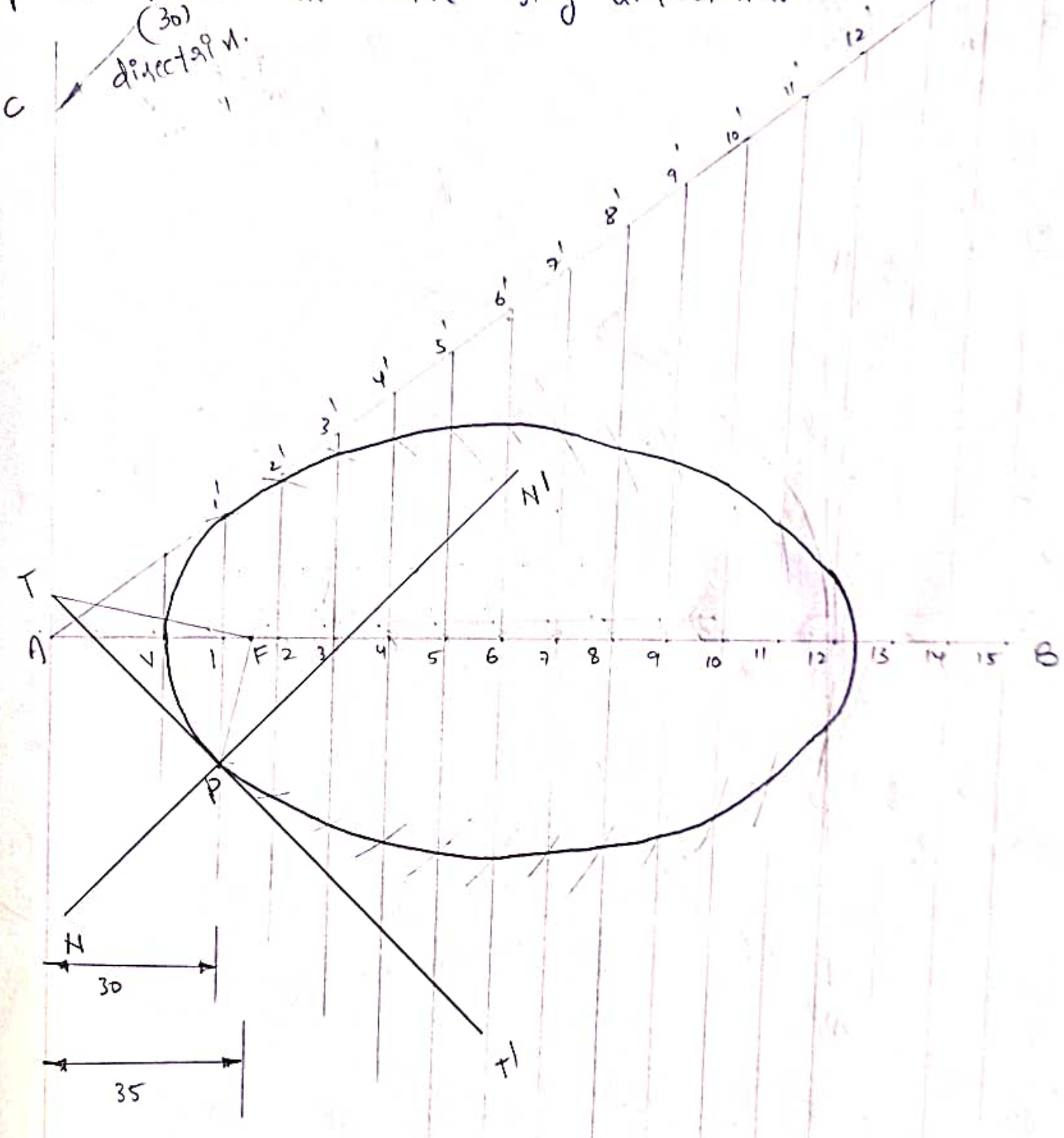
$VA = \frac{130}{3}$.

⑥ Construct an ellipse when the distance b/w the focus and directrix is 50. and eccentricity $\frac{2}{3}$. Also draw a normal and tangent to the curve at a point 40mm from the directrix.

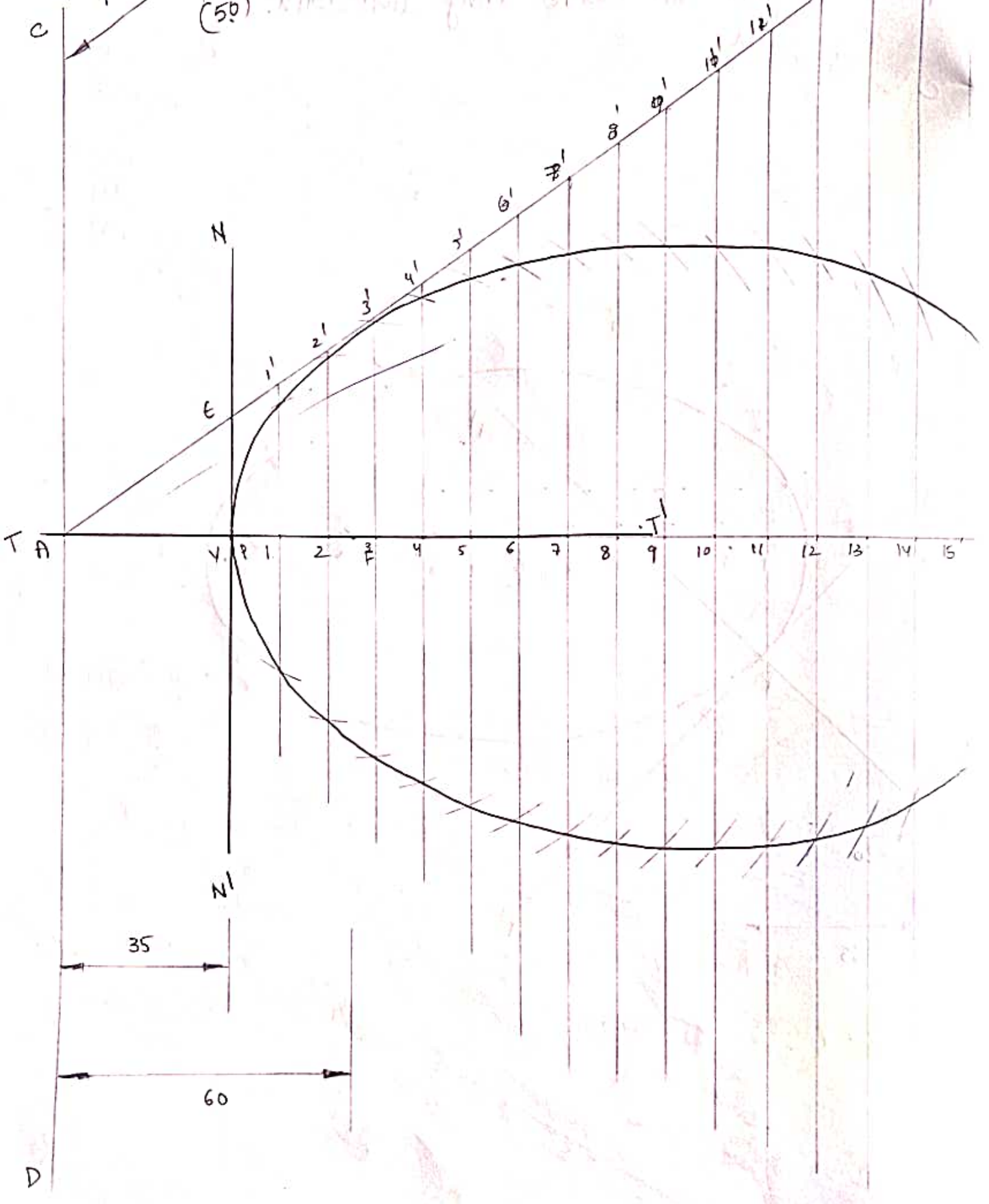


D

④ Construct an ellipse when the distance b/w the focus and the directrix is 35mm and eccentricity is $\frac{3}{4}$. Also draw the tangent and normal at any point 'P' on the curve using directrix.

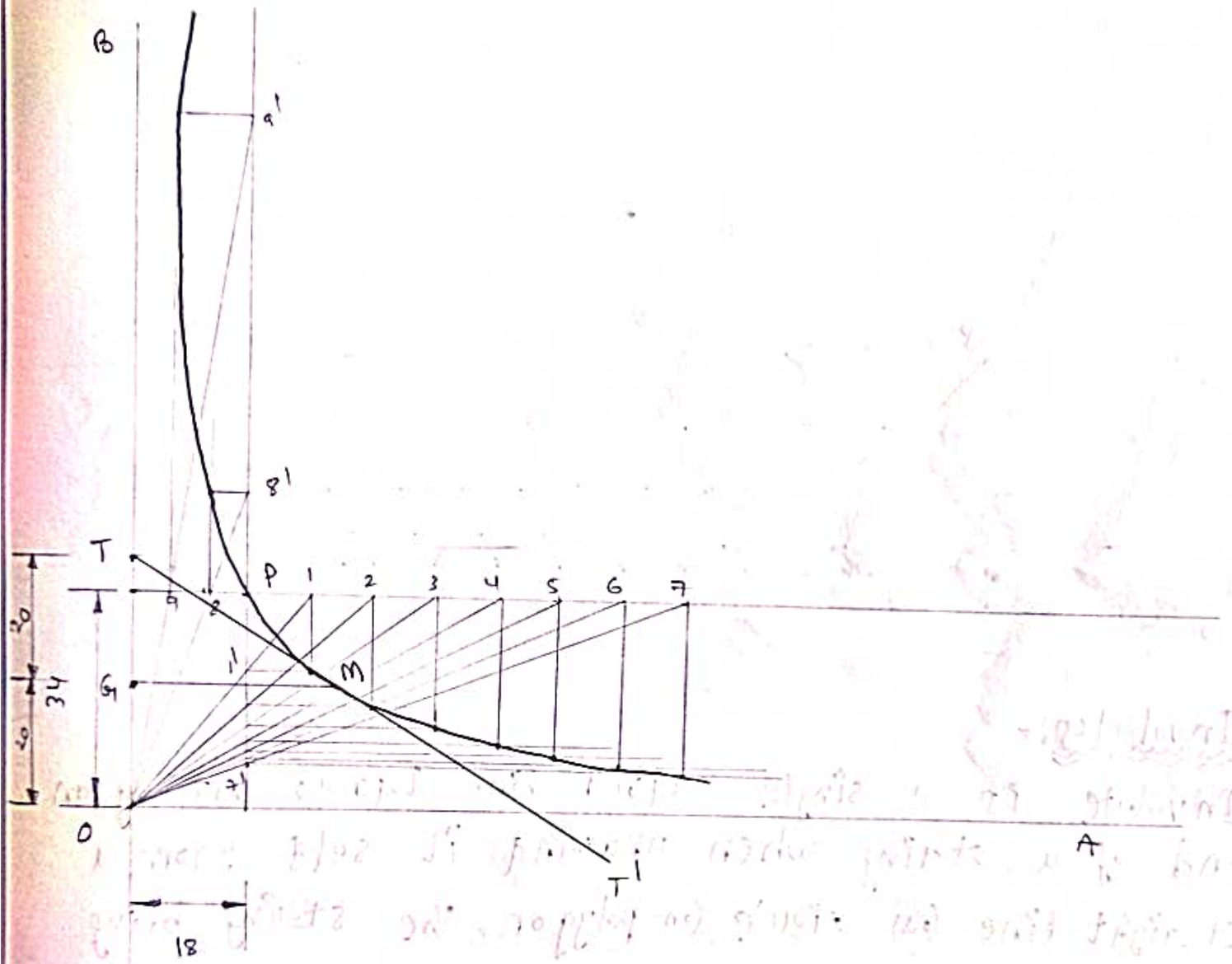


(8) Construct an ellipse when the distance of the focus from the directrix is 60mm, and eccentricity $\frac{2}{3}$. Also draw a tangent and normal to the curve at a point 35mm from the directrix.

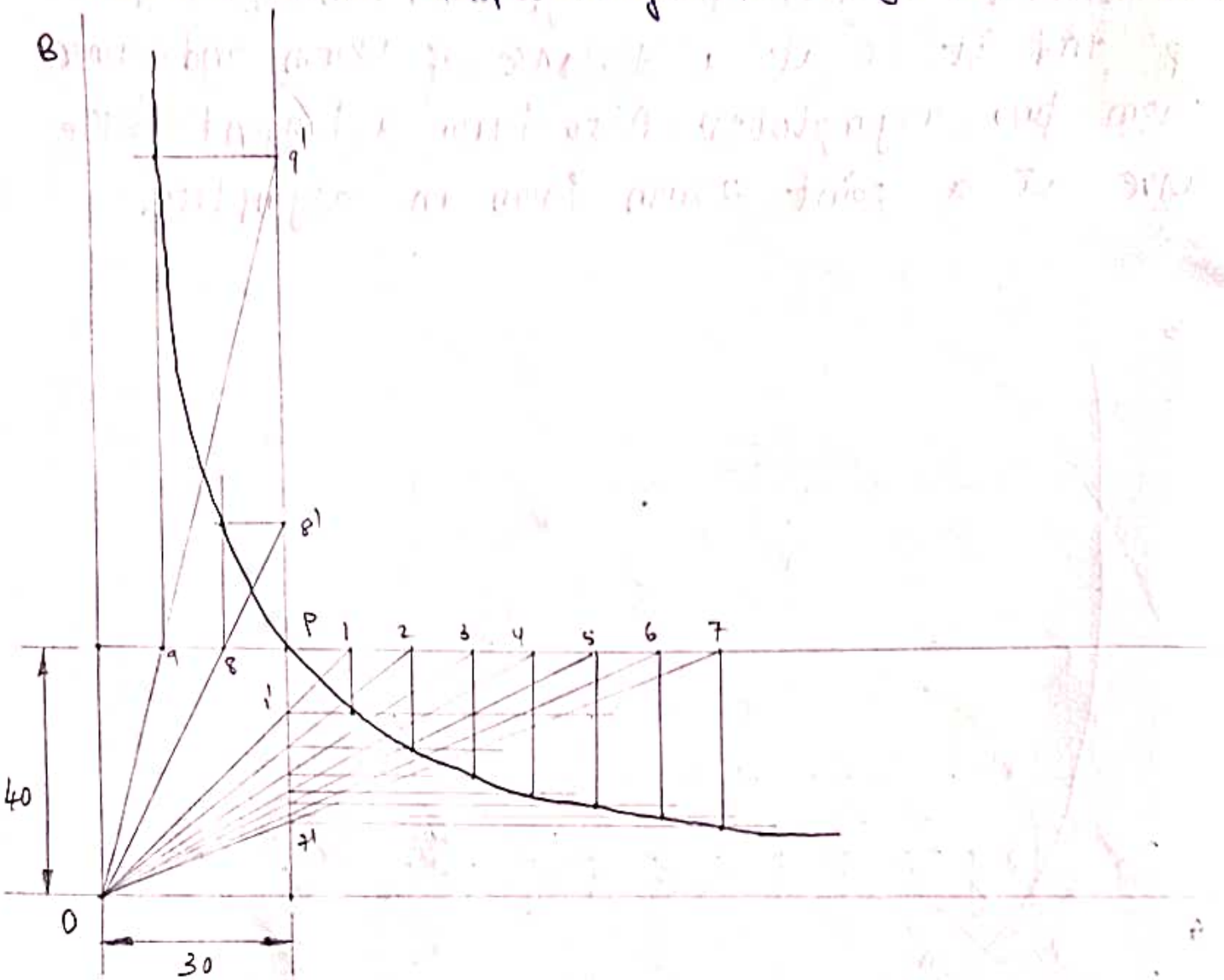


Rectangular Hyperbola :- $e = \frac{1}{2}$.

(9). Construct a rectangular hyperbola, when a point 'P' and it is at a distance of 18mm and 34mm from two asymptotes. Also draw a tangent to the curve at a point 20mm from an asymptote.



(10) Point 'P' is 40mm and 30mm from horizontal and vertical axis respectively. Draw hyperbola through it.



Involutes:-

Involute is a single curved line traced out by an end of a string when unwound it self from a straight line (or) circle (or) polygon, the string being always kept taut.

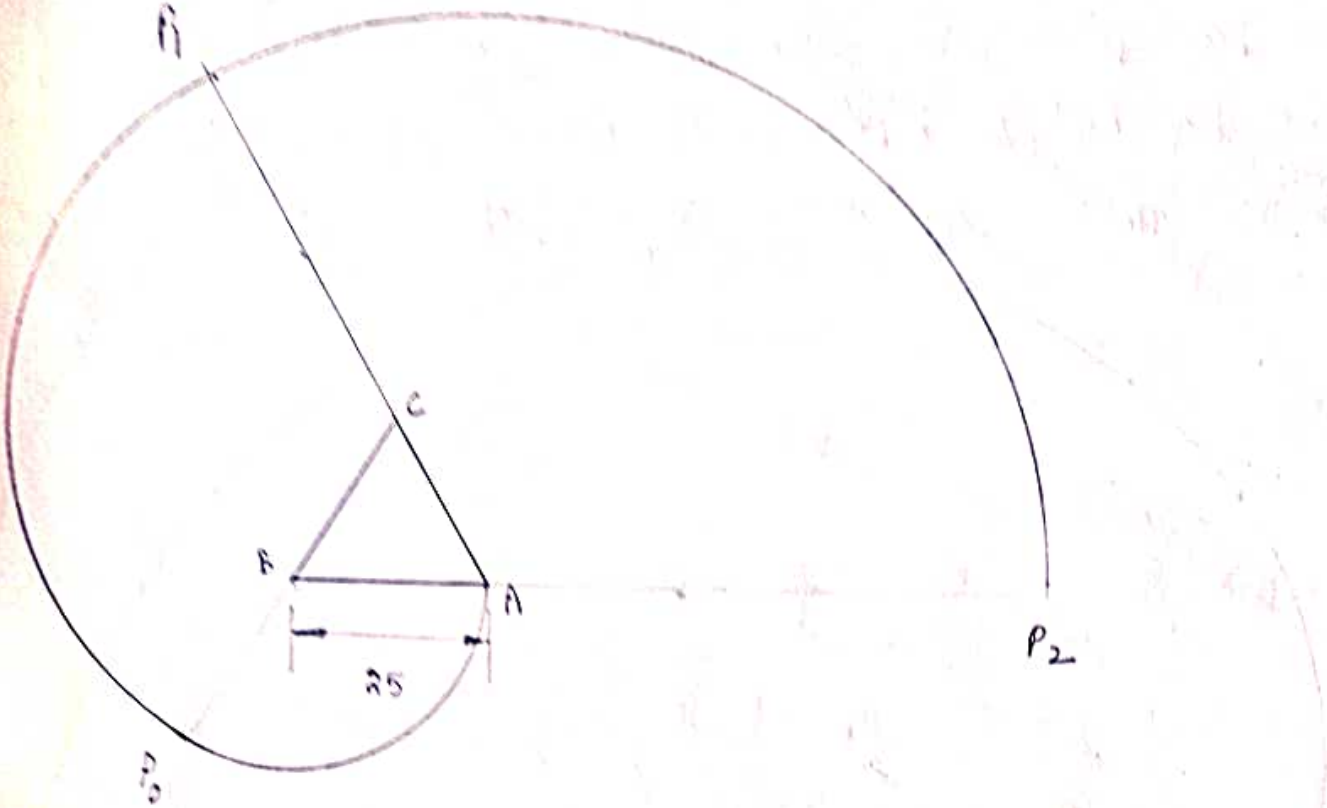
(11). Draw the involute of a Δle of 25mm side.

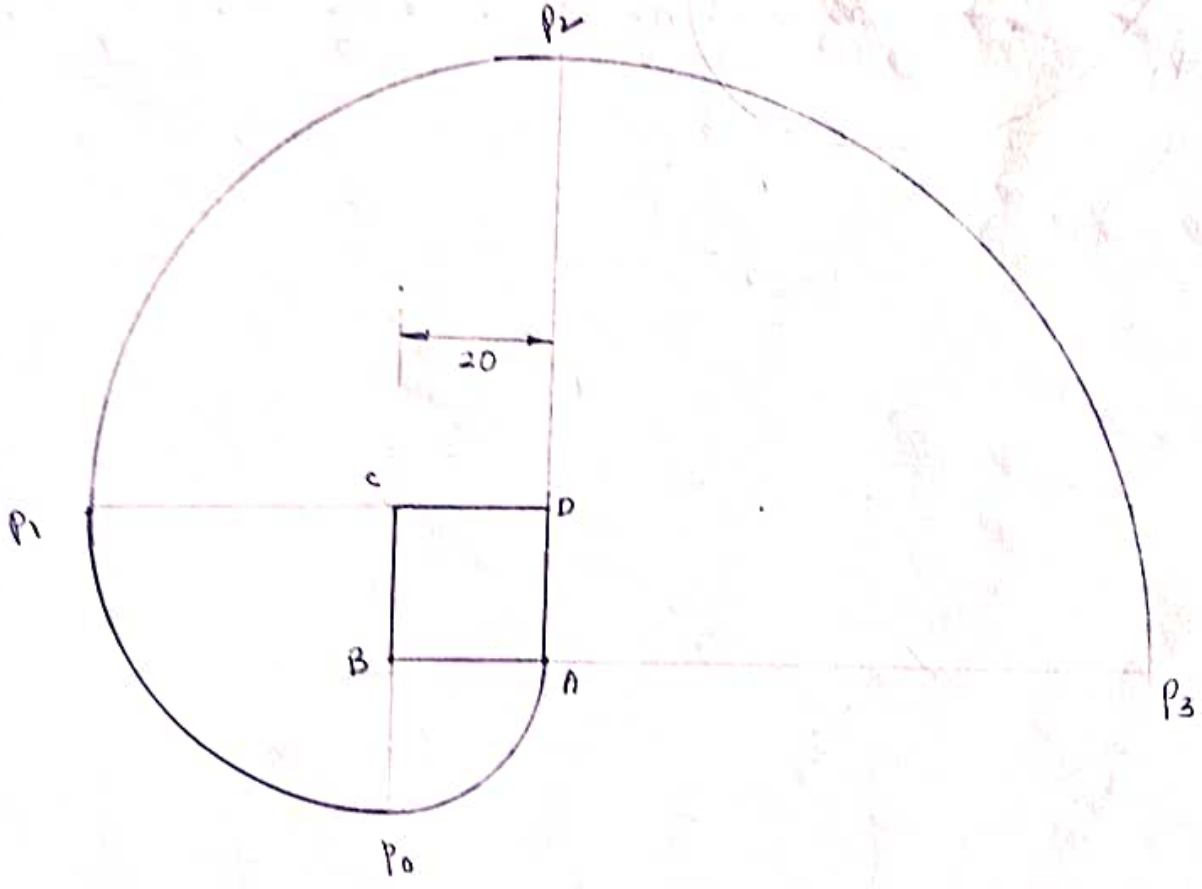
(12). Draw the involute of a square of side 20mm.

Sol:- Tri $= \frac{360}{3} = 120°$, Square $= \frac{360}{4} = 90°$

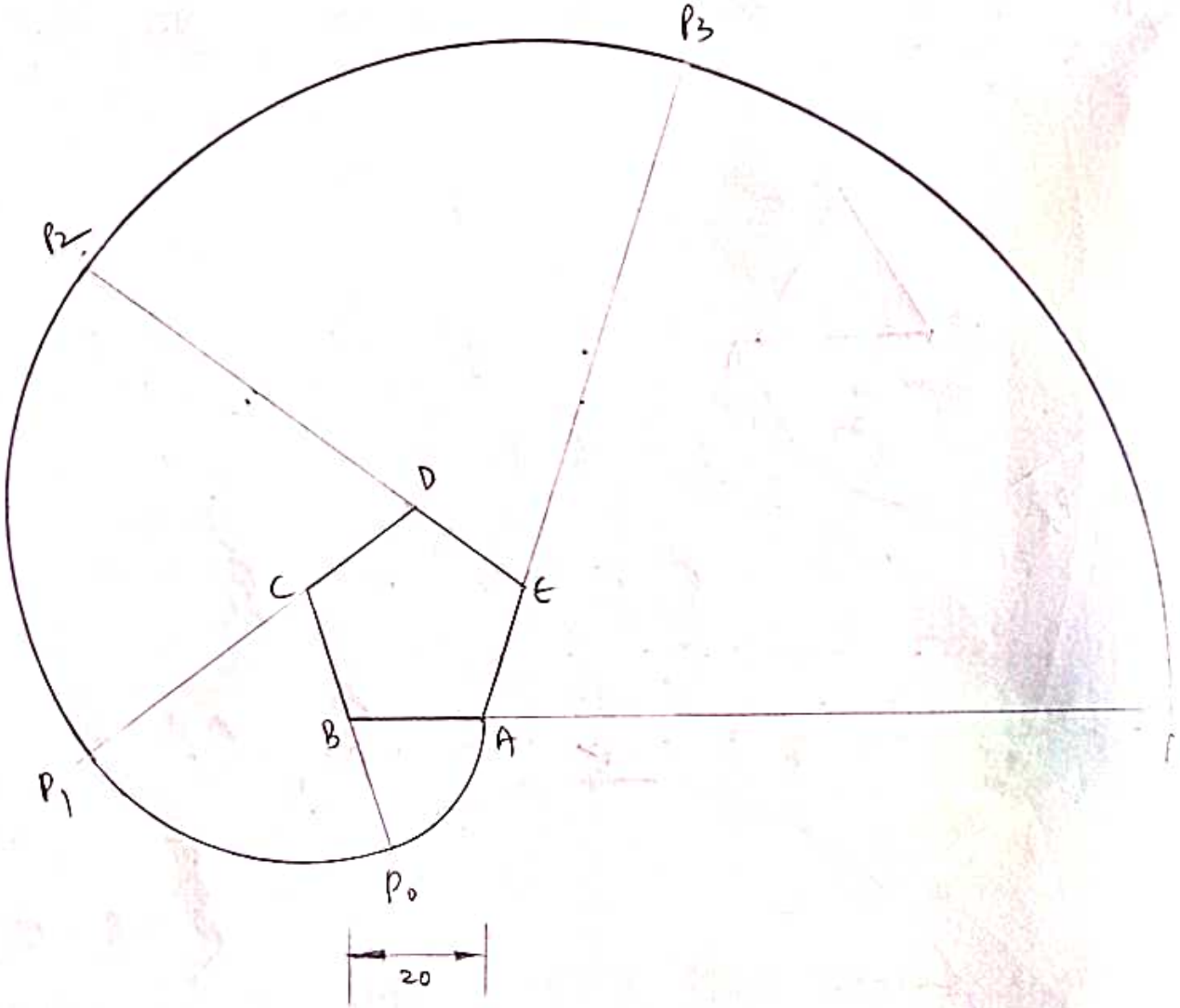
penta $= \frac{360}{5} = 72°$, Hexa $= \frac{360}{6} = 60°$

Hepta, Octa none, etc.

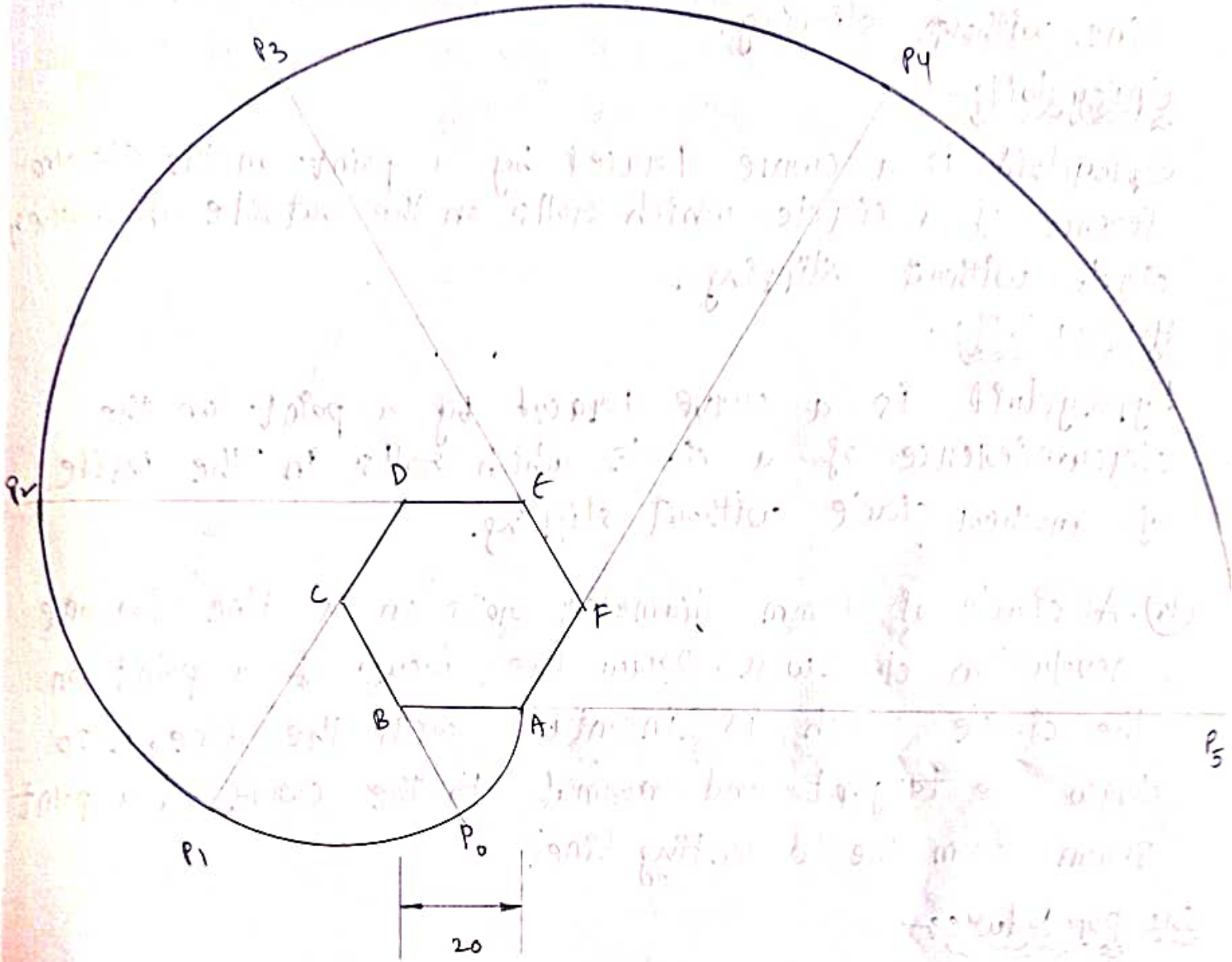

P1
C
B
A
25
P0
P2


P2
20
C
D
P1
B
A
P3
P0

(13) Draw the involute of a pentagon of 20mm side.



(14). Draw the involute of a hexagon of 20mm side.



Cycloid:-

Cycloid is a curve traced by a point on the circumference of a circle which rolls along a straight line without slipping.

Epicycloid:-

Epicycloid is a curve traced by a point on the circumference of a circle which rolls on the outside of another circle without slipping.

Hypocycloid:-

Hypocycloid is a curve traced by a point on the circumference of a circle which rolls in the inside of another circle without slipping.

(15). A circle of 40mm diameter rolls on a line for one revolution clockwise. Draw the locus of a point on the circle which is incontact with the line. Also draw the tangent and normal to the curve at a point 35mm from the directing line.

Sol:- Procedure:-

(i) Draw a circle of 20mm radius.

(ii) Devide the circle in to 12 equal parts.

i.e, $\frac{360}{12} = 30^\circ$ each part. and marks the points names as 1, 2, 3, ---, 11, P.

(iii). From 'P', draw a horizontal line with the length of πd. i.e, $\pi \times 40 = 125.6 \simeq 126$mm.

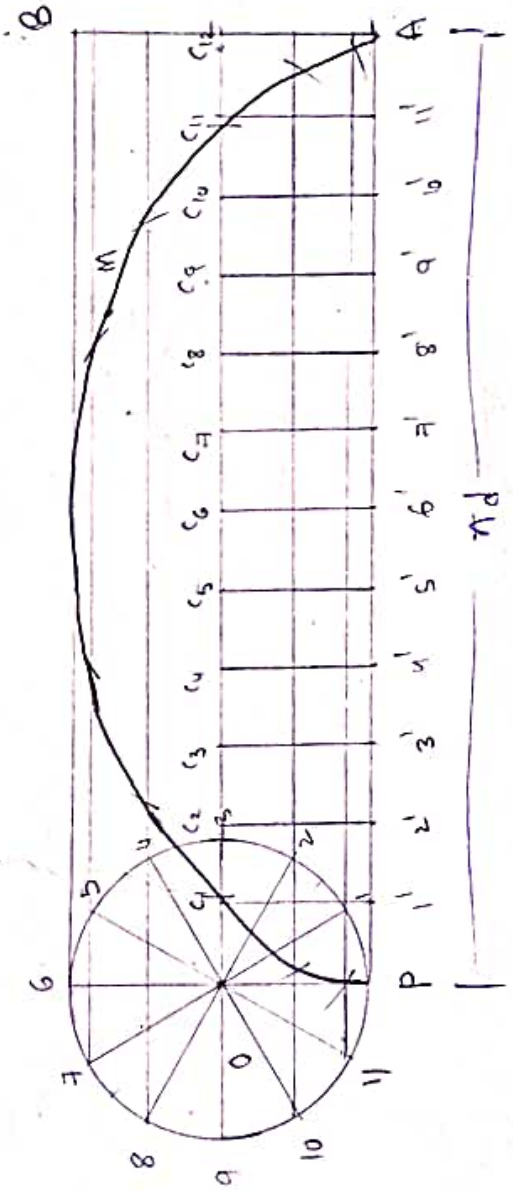
(iv) From 'A' draw a vertical line of 40mm.

i.e, AB = 40mm and join B-6.

(v) From 7, 8, 9, 10, 11 draw the horizontal lines to AB line.

(vi) Device PA into 12 equal parts.

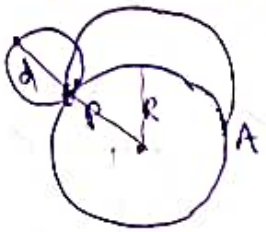
i.e, $\frac{126}{12} = 10.5$mm each part.



Epicycloid:-

① Draw an epicycloid of a circle of 40mm diameter which rolls outside on another circle of 120mm diameter for one revolution clockwise. Draw a tangent and normal to it at any point on the curve (Epicycloid).

cycloid.



Epicycloid.

Hypocycloid.

② Construct an epicycloid generated by a rolling circle of diameter 50mm and directing circle of diameter of 150mm. Draw the tangent and normal at any point on the epicycloid.

$d = 50,\ r = 25,\ D = 150,\ R = 75$

$\theta = 360 \times \frac{r}{R} = 360 \times \frac{25}{75} = 120$

$\frac{120}{12} = 10$

Home Work for you $R + d = 75 + 50 = 125$ You draw the diagram.

Hypocycloid:-

① Draw a hypocycloid of 40mm diameter which rolls inside of another circle of 160mm for one revolution for one counter clockwise. Draw a tangent and normal to it at any point on the curve.

$D = 160, R = 80$
$d = 40, r = 20$

$\theta = 360 \times \frac{r}{R} = 360 \times \frac{20}{80} = 90^\circ$ $\left| \frac{\theta}{12} = 7.\right.$

(1)

$\Rightarrow R+d$

$60+40=100$

$d=40 \quad \theta=20$

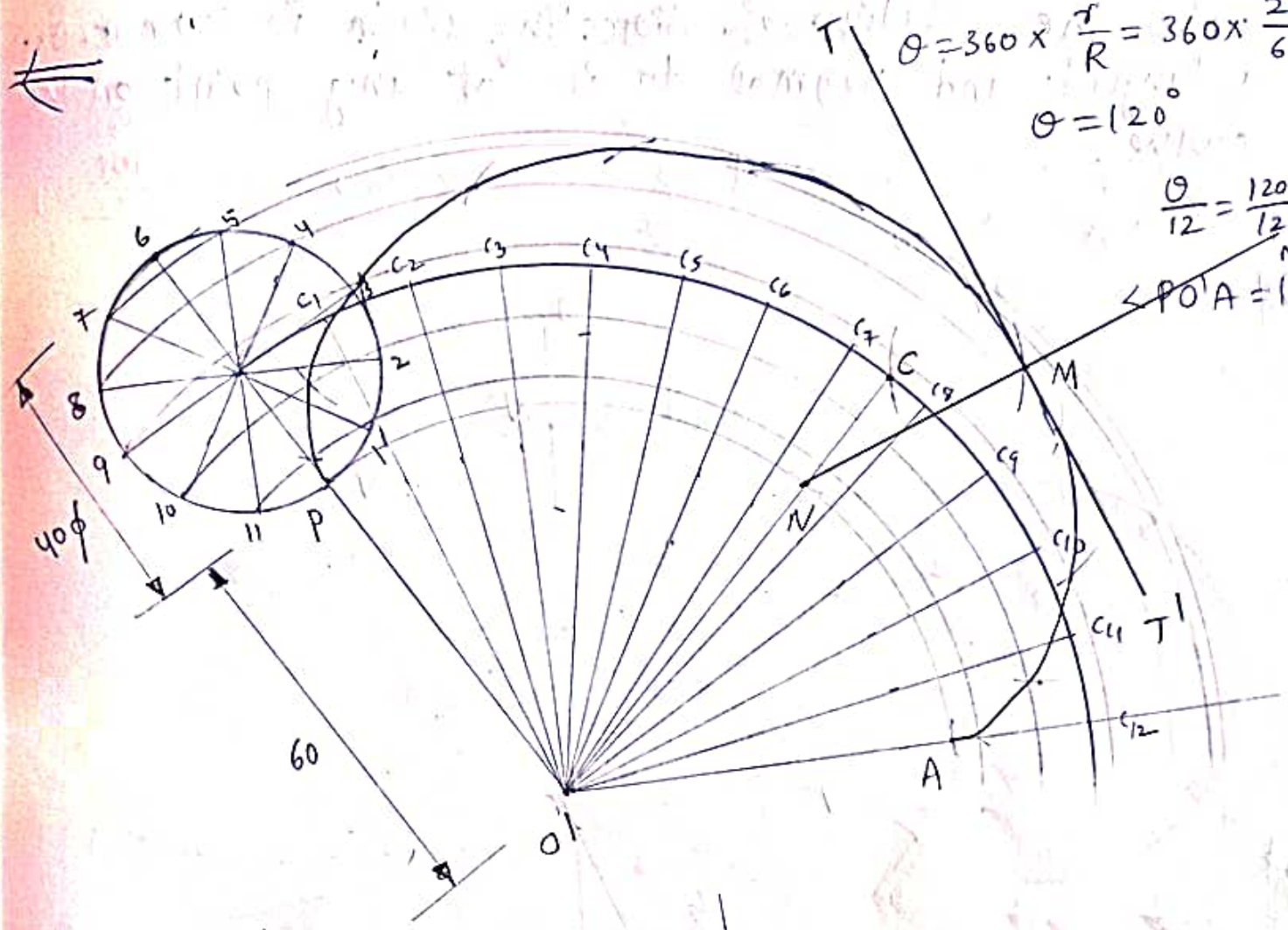
$D=120 \quad R=60\,mm$

$\theta=360\times\frac{r}{R}=360\times\frac{20}{60}$

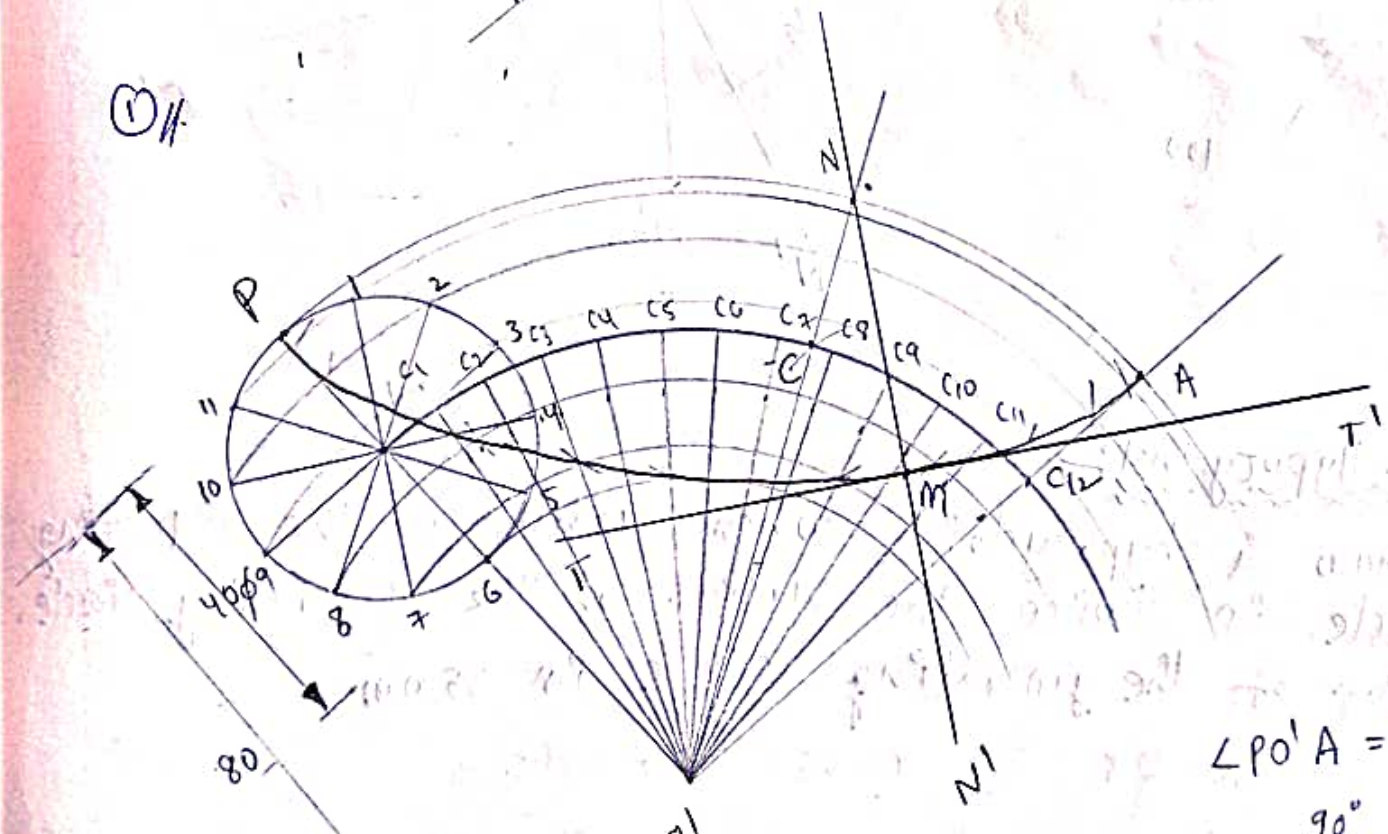
$\theta=120^\circ$

$\frac{\theta}{12}=\frac{120}{12}=10$

$\angle PO'A=120^\circ$



(1)



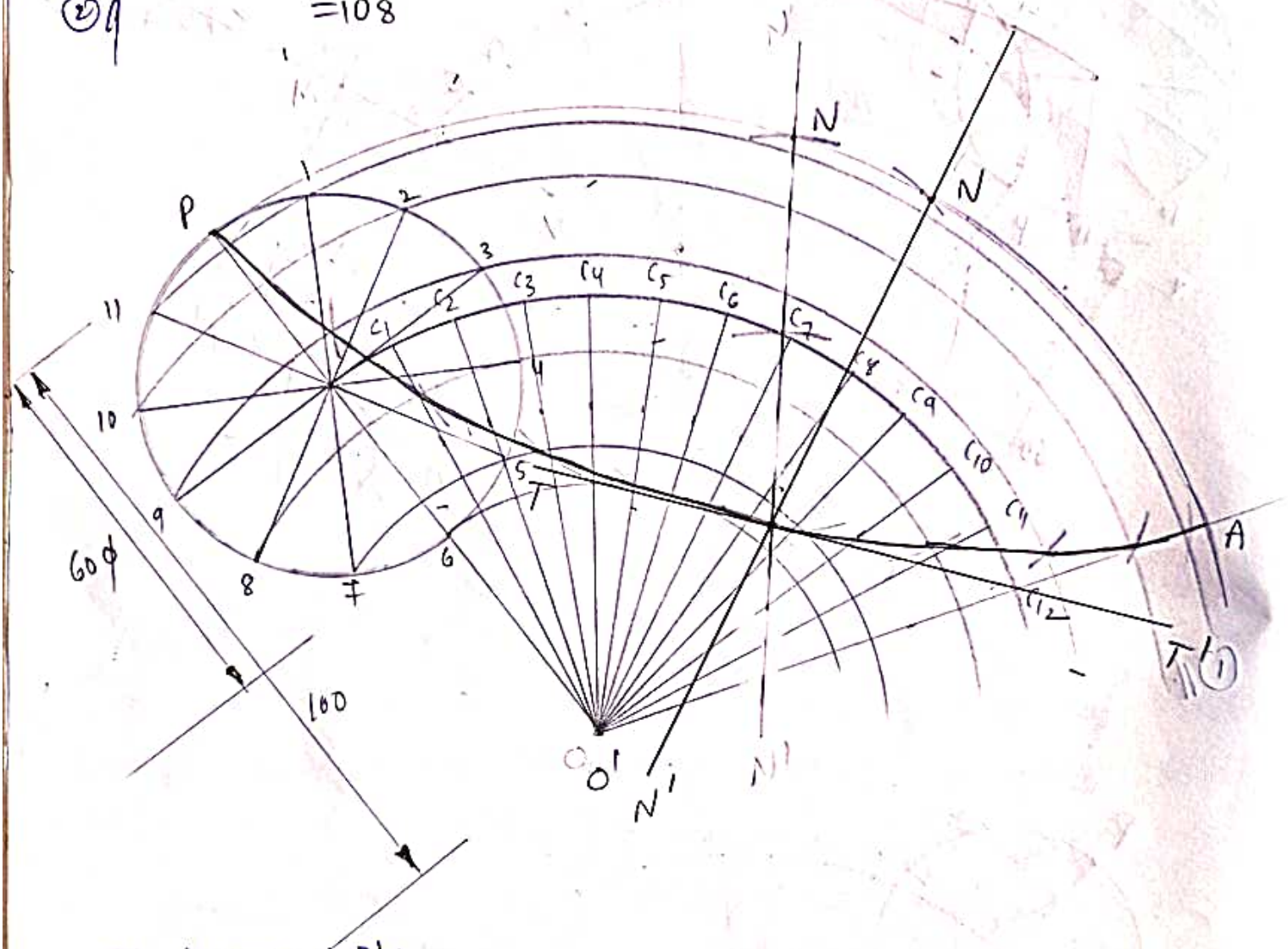
$\angle PO'A=90^\circ$

$\frac{90^\circ}{12}=7.5$

② . Draw a hypocycloid generated by a rolling circle of 60mm for 1 revolution counter clock wise. the radius of directing circle is 100 mm. Draw a tangent and normal to it at any point on the curve.

$\theta = 360 \times \frac{r}{R} = 360 \times \frac{30}{100}$ $\quad d = 60$ $\quad R = 100$ $\quad \frac{108}{12} = 9$

$= 108$ $\quad r = 30$.



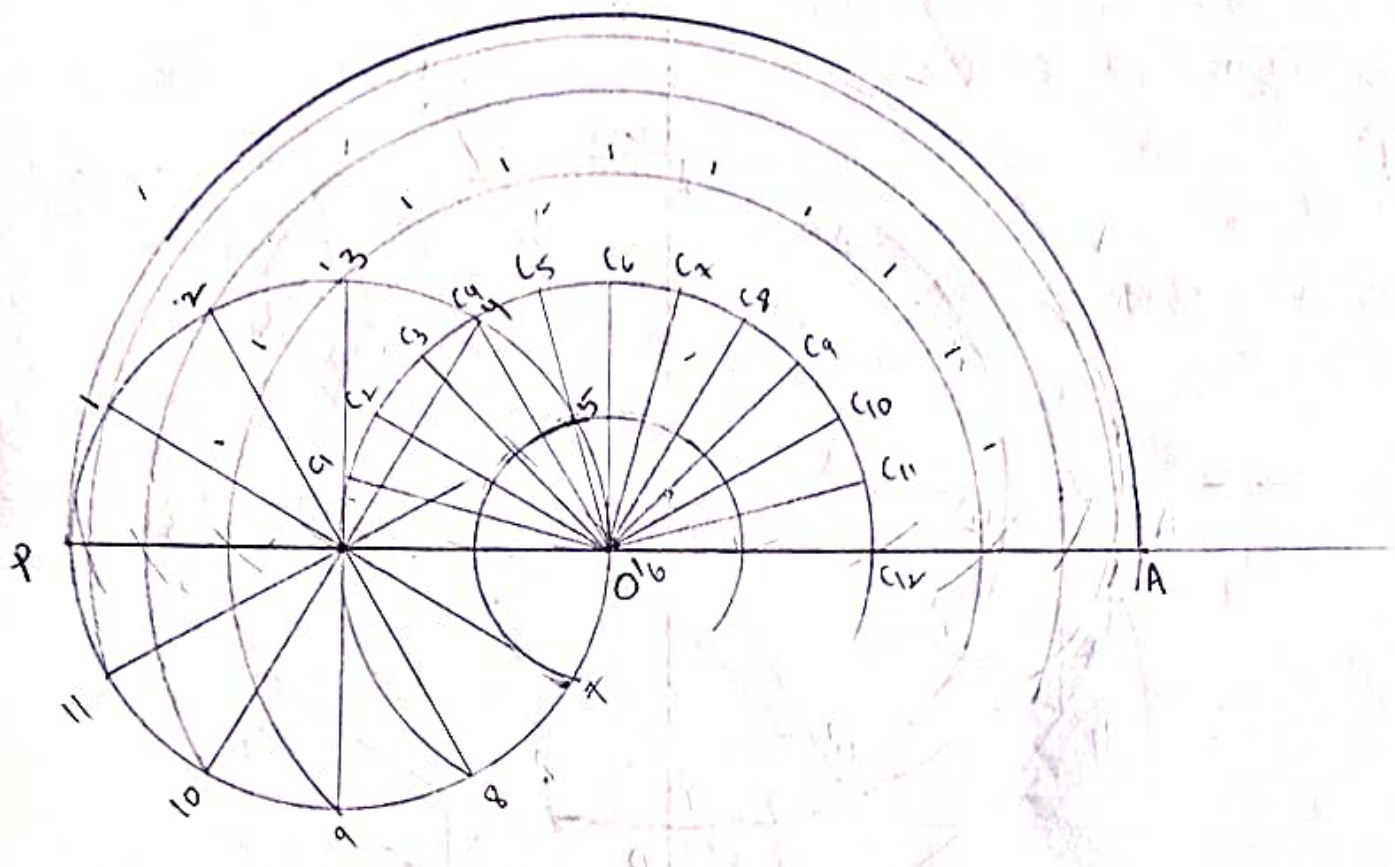
S.L. Hypocycloid

③ Draw a hypocycloid when, radius of the directing circle is twice the radius of the generating circle. Radius of the generating circle is 35mm.

$R = 2r$ $\quad r = 35$. $\quad R = 70$.

$\theta = 360 \times \frac{r}{R} = 360 \times \frac{35}{70_2} = 180^\circ$ $\quad \frac{\theta}{12} = \frac{180}{12} = 15^\circ$

(3) 4

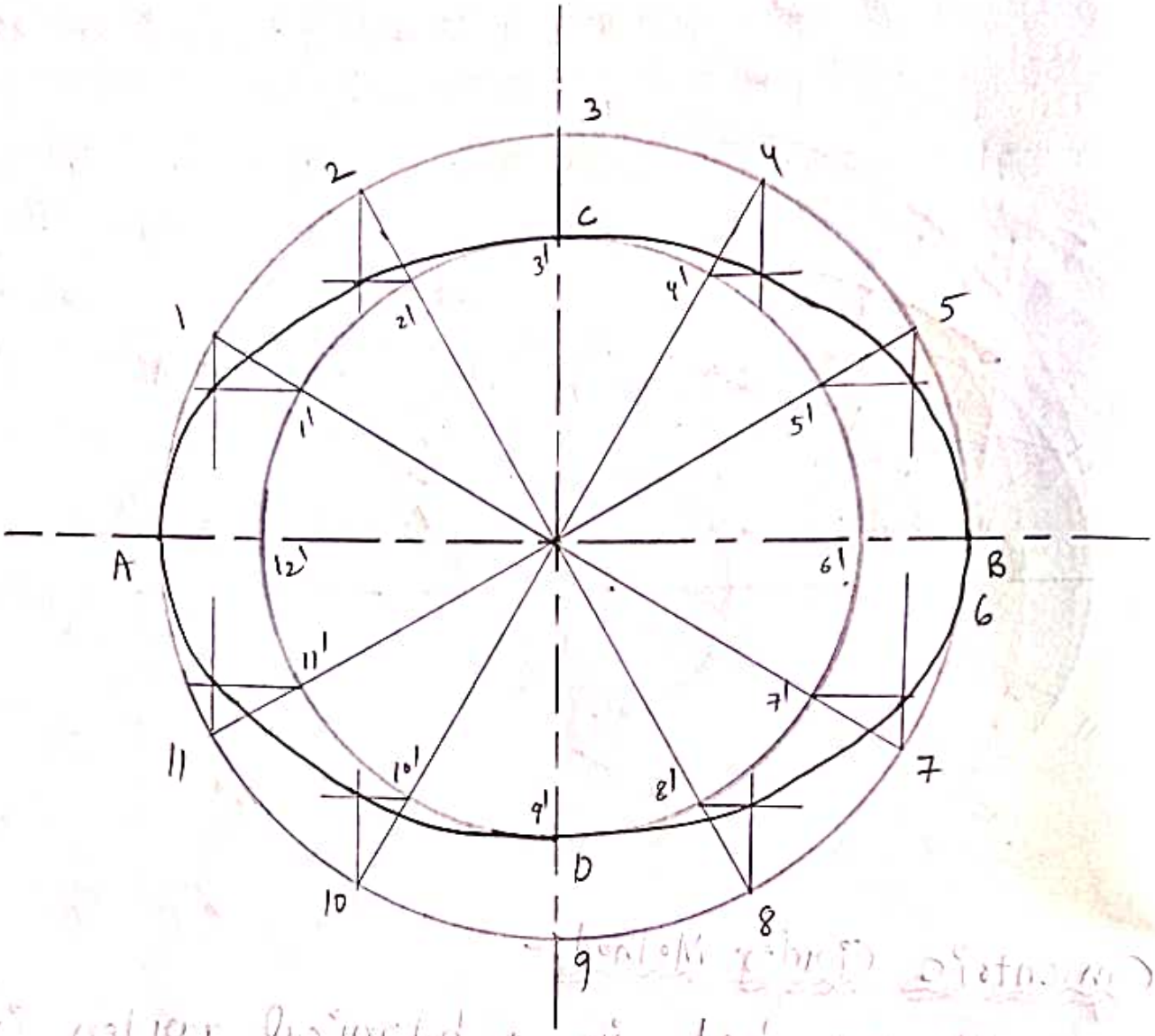


Concentric Circles Method:-

(4). A flower bed in a botanical garden is elliptical in shape. Major and minor axis are 120mm and 90mm respectively. Draw the profile of the flower bed.

Major axis = 120mm R = 60mm

Minor axis = 90mm r = 45mm


1
2
3
4
5
6
7
8
9
10
11
12
A
B
C
D
1'
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4'
5'
6'
7'
8'
9'
10'
11'
12'