GE 8152— ENGINEERING GRAPHICS

Common to all Branches

First Semester

Unit -1

PLANE CURVES AND FREEHAND SKETCHING

1. Construct a hyperbola with the distance between the focus and directrix as 40 mm and eccentricity as 3/2. Also draw the tangent and normal to the curve at a point, 25 mm from the axis.

[20] [M/J, 17]

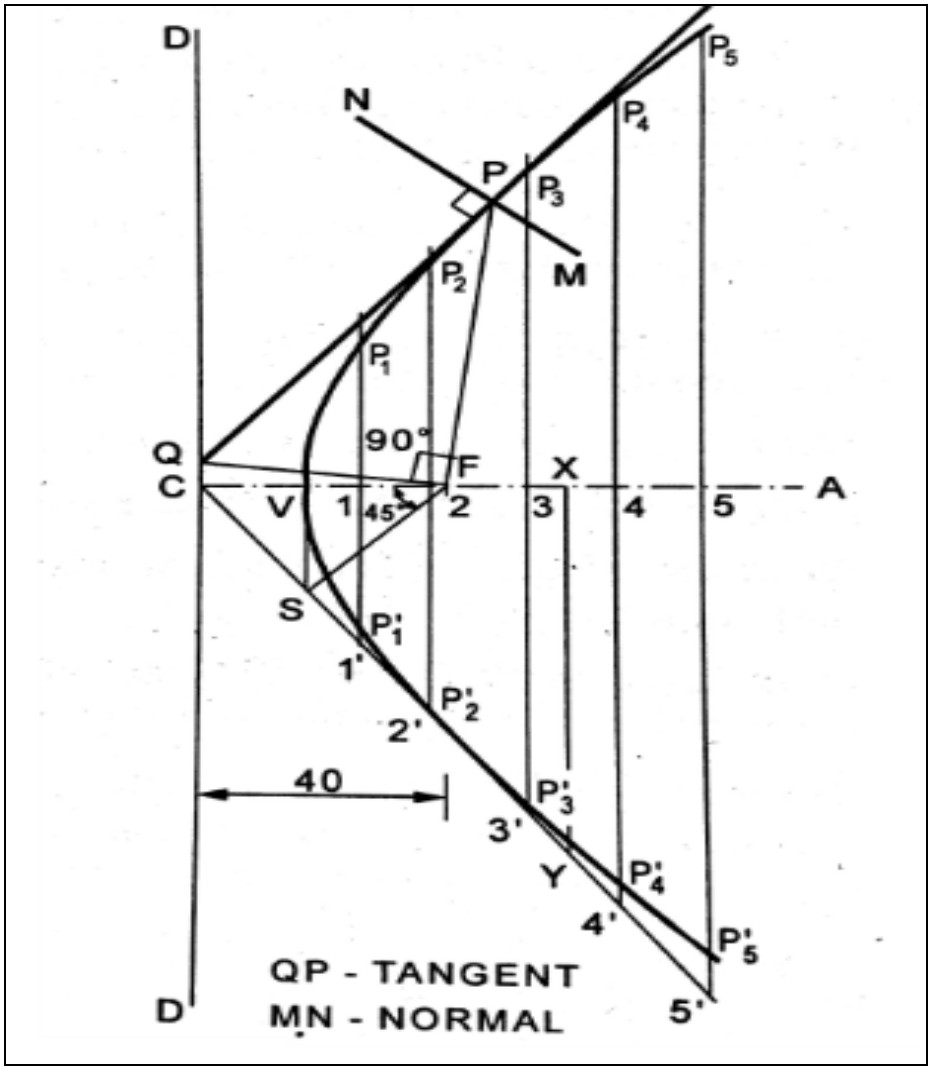
Eccentricity = 3/2

Number of divisions = Numerator value + Denominator value

= 3 + 2

= 5 divisions

Size of each Division= 40 / 5 = 8 mm



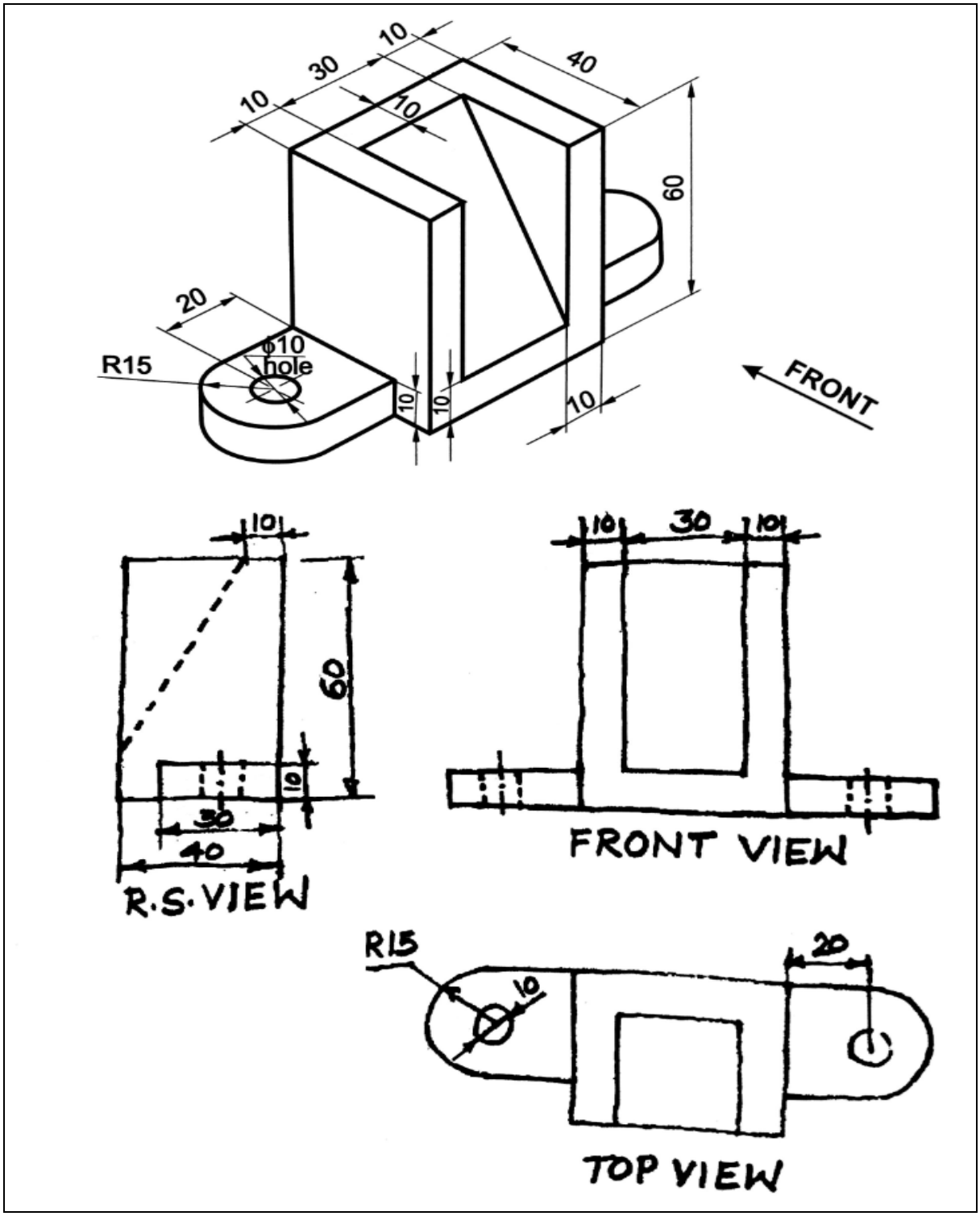
Procedure:

1. Draw the directrix d-d'.
2. Draw a horizontal (axis) line perpendicular from a point C on directrix.
3. Mark a point F (Focus) at a distance on the horizontal line at a distance of 40 mm from directrix.
4. Mark a point V (Vertex) by leaving three divisions from focus (each of size 12 mm) and the name the divisions as 1 and 2. Mark the remaining three divisions from V.
5. Draw a vertical line from V, so that VA is equal to VF.
6. Draw a line joining CA and extend it in the same angle and direction.
7. Draw vertical lines crossing the points 1, 2,3,4,5 etc.
8. Mark the points 1', 2', 3' etc., on the inclined line.
9. With 1-1' as radius F as center draw the arcs above below the horizontal line on the line 1-1' and name the points as P1' and P1 respectively.
10. Follow the same procedure and mark the points P2' and P2 and so on.
11. Join all the points with a single stroke smooth curve to get a Hyperbola.

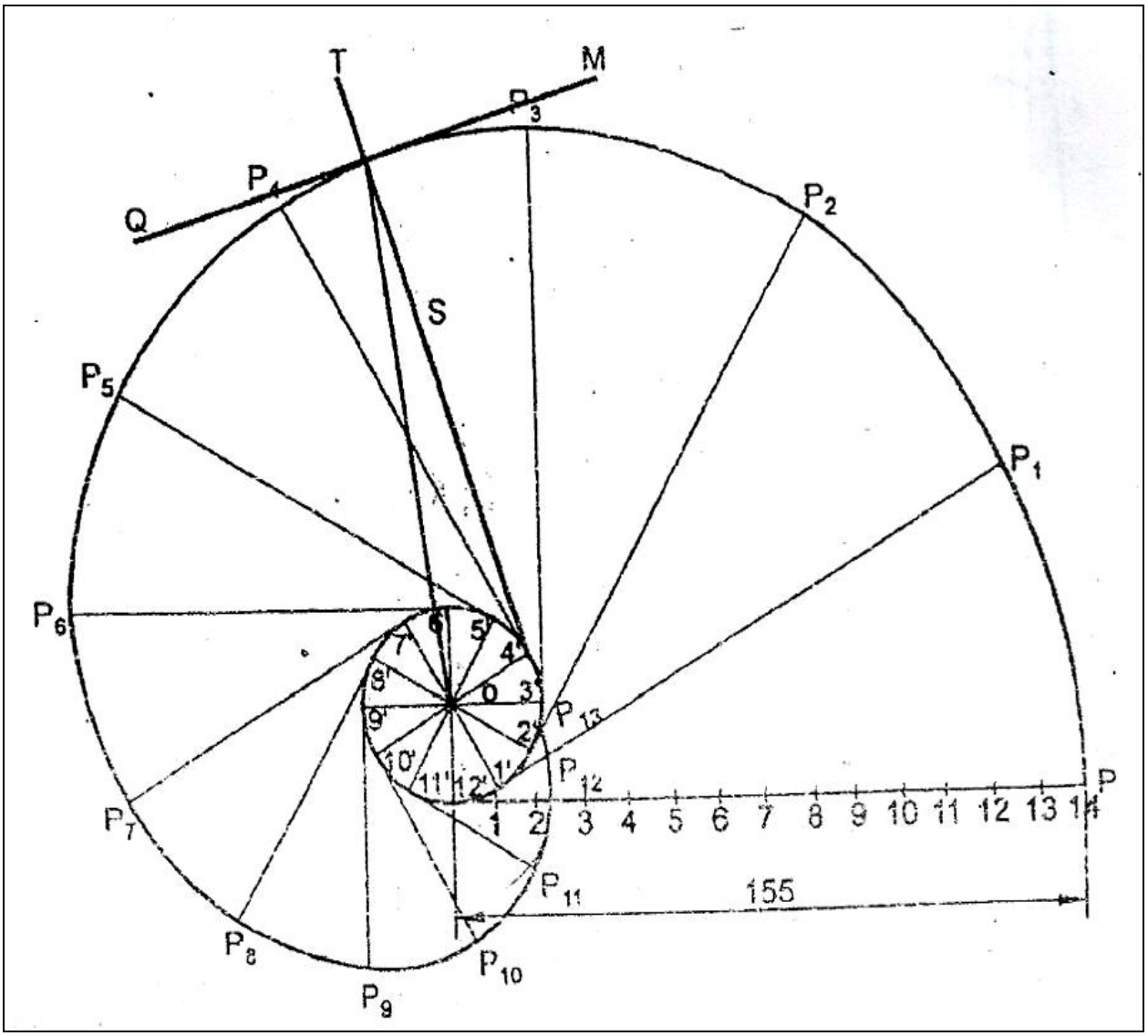
Procedure to draw tangent and normal

1. Mark a point P on the ellipse.
2. Join P and F.
3. Draw a perpendicular to the line PF till the line meets the directrix at the point M
4. Join the points M and P for getting a tangent for the ellipse.
5. Keep the protractor parallel to the line TP and draw the perpendicular line from P for getting a normal.

2. Draw the front view, top view and right side view of the object shown in figure. [20] [M/J, 17]



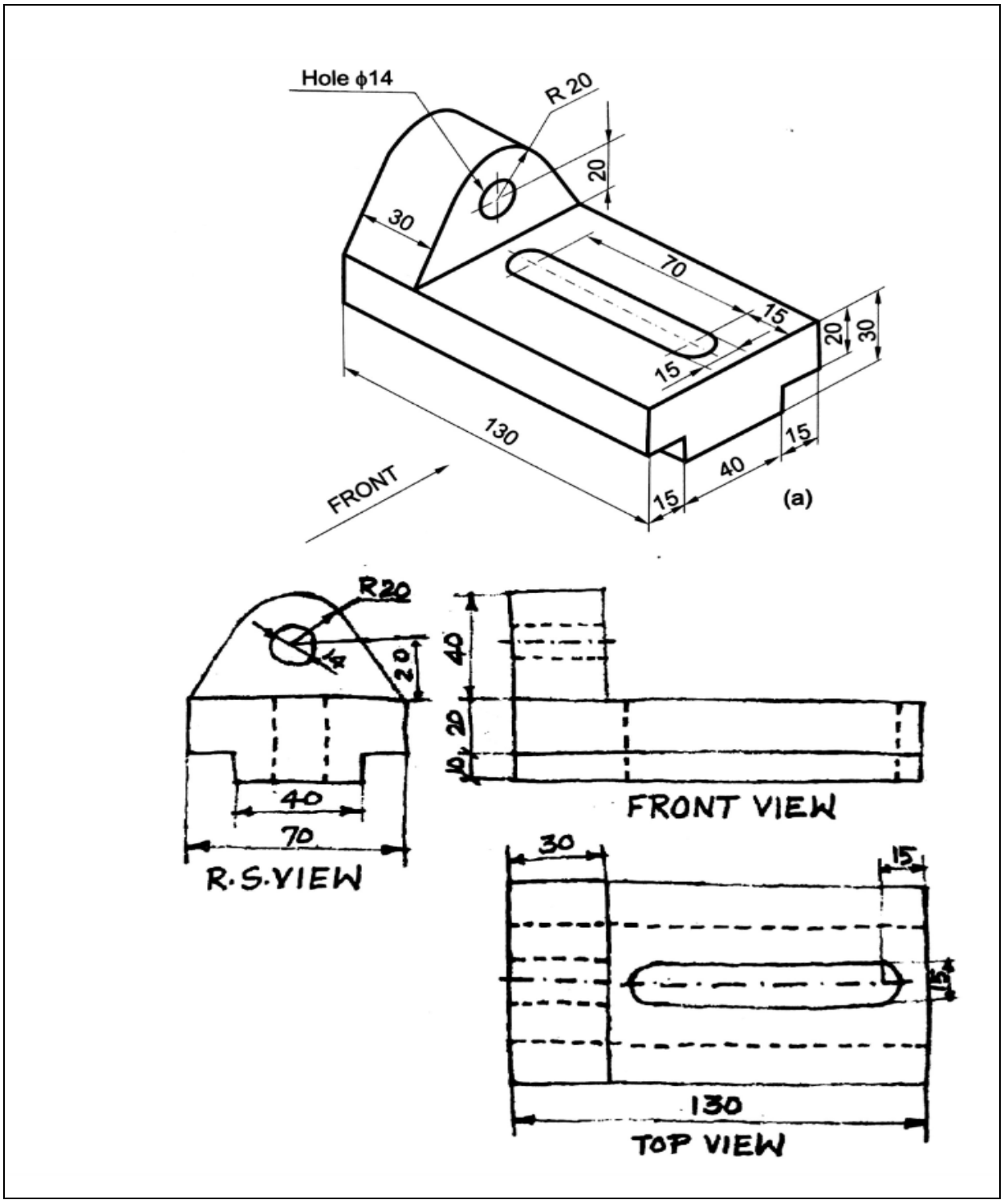
3. A String of length 155 mm is wound round a circle of radius 20 mm. Draw the path traced by the end of the string. Also draw a tangent and normal to a point on the involute.[20] [N/D, 16]



Procedure:

1. Draw a line 12-P tangent to 12. Divide the line 12 equal parts only for a distance of L=πd (d – diameter of circle).
2. Mark the same divisions after that till p.
3. Follow the same procedure with the starting radius of 12-14 with 1’ as center.
4. The involute will be closed after 12’, since the length of chord is more than circumference of the circle.

4. Sketch by free hand the top view, front view and any one side views of the object shown, all dimensions are in mm. [20] [N/D, 16]



5. Draw an ellipse when the eccentricity is 2/3 and the distance of the focus from the directrix is equal to 30 mm. Also draw a normal and tangent to a point on the ellipse which is at a distance of 70 mm from the directrix. [20] [M/J, 16]

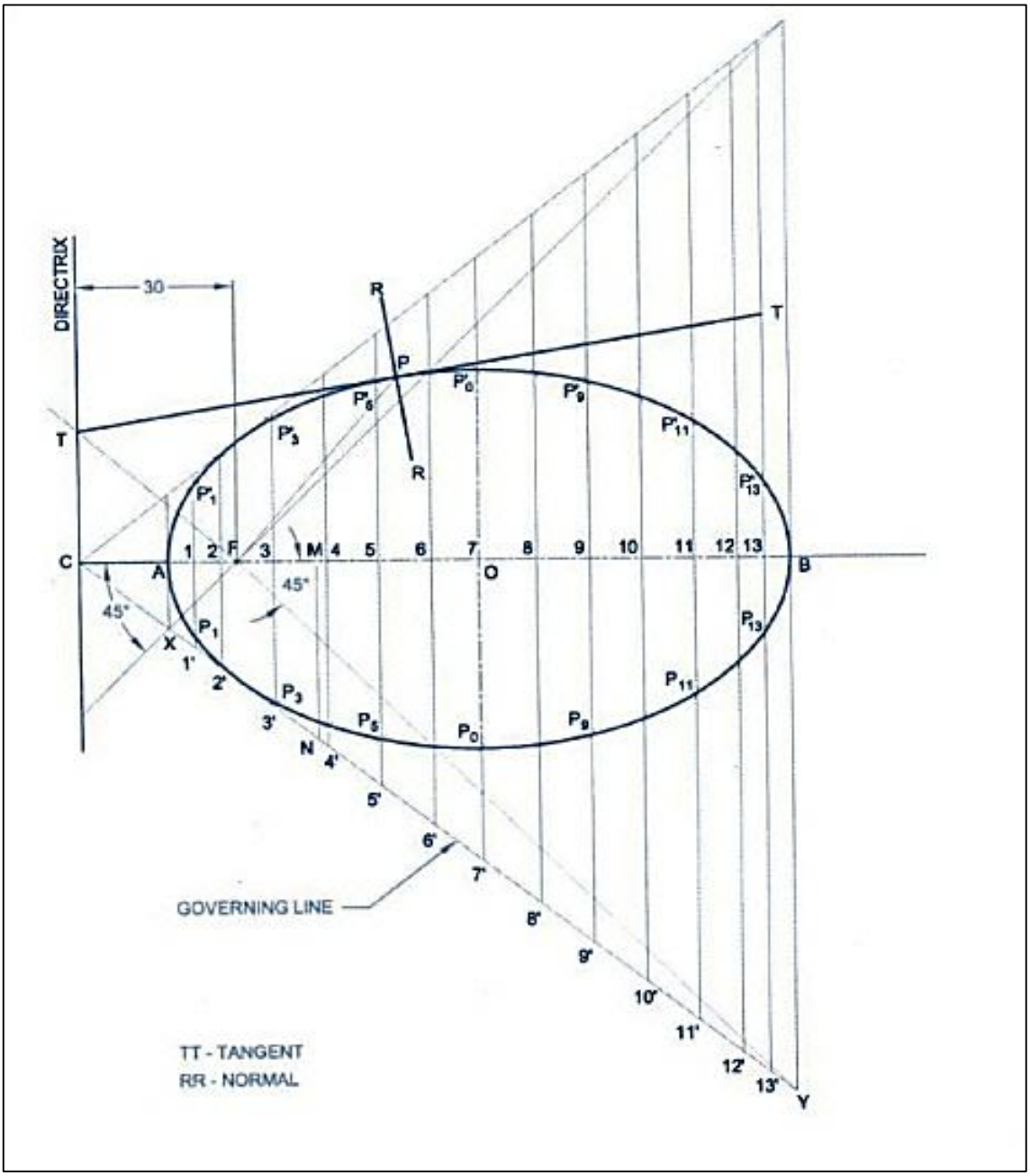
Eccentricity = 2/3

Number of divisions = Numerator value + Denominator value

= 2 + 3

= 5 divisions

Size of each Division= 30 / 5 = 6 mm



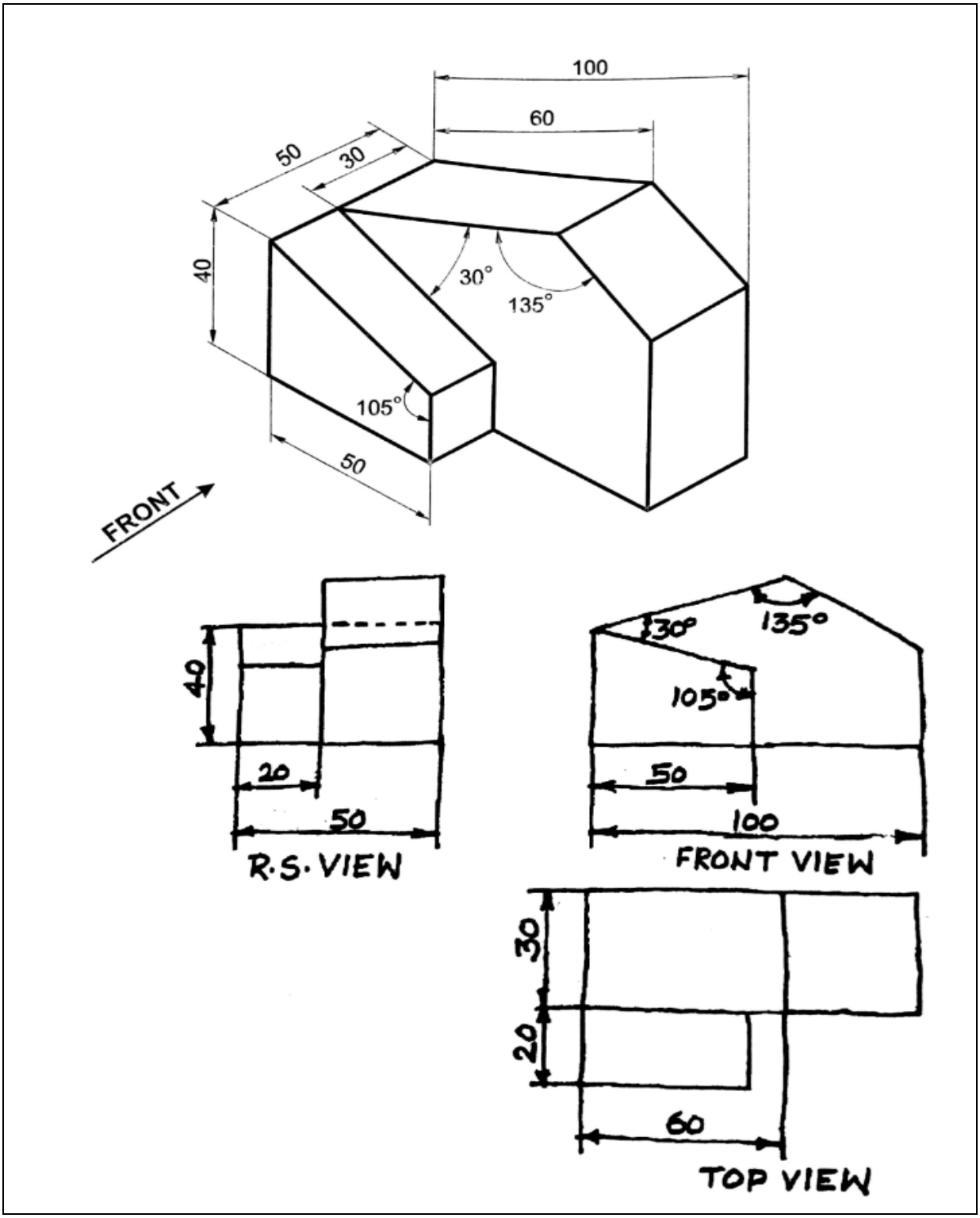
Procedure:

1. Draw the directrix.
2. Draw a horizontal (axis) line perpendicular from a point C on directrix.
3. Mark a point F (Focus) at a distance on the horizontal line at a distance of 30 mm from directrix.
4. Mark a point A (Vertex) by leaving two divisions from focus (each of size 6 mm) and the name the divisions as 1 and 2. Mark the remaining three divisions from A.
5. Draw a vertical line from A, so that AX is equal to FA.
6. Draw a line joining C and X and extend it in the same angle and direction.
7. After focus mark the points 3, 4, 5 etc. so that each division is of 6 mm.
8. Draw vertical lines crossing the points 1, 2,3,4,5 etc.
9. Mark the points 1', 2', 3' etc., on the inclined line.
10. With 1-1' as radius F as center draw the arcs above below the horizontal line on the line 1-1' and name the points as P1' and P1 respectively.
11. Follow the same procedure and mark the points P2' and P2 and so on.
12. Join all the points with a single stroke smooth curve to get an ellipse.

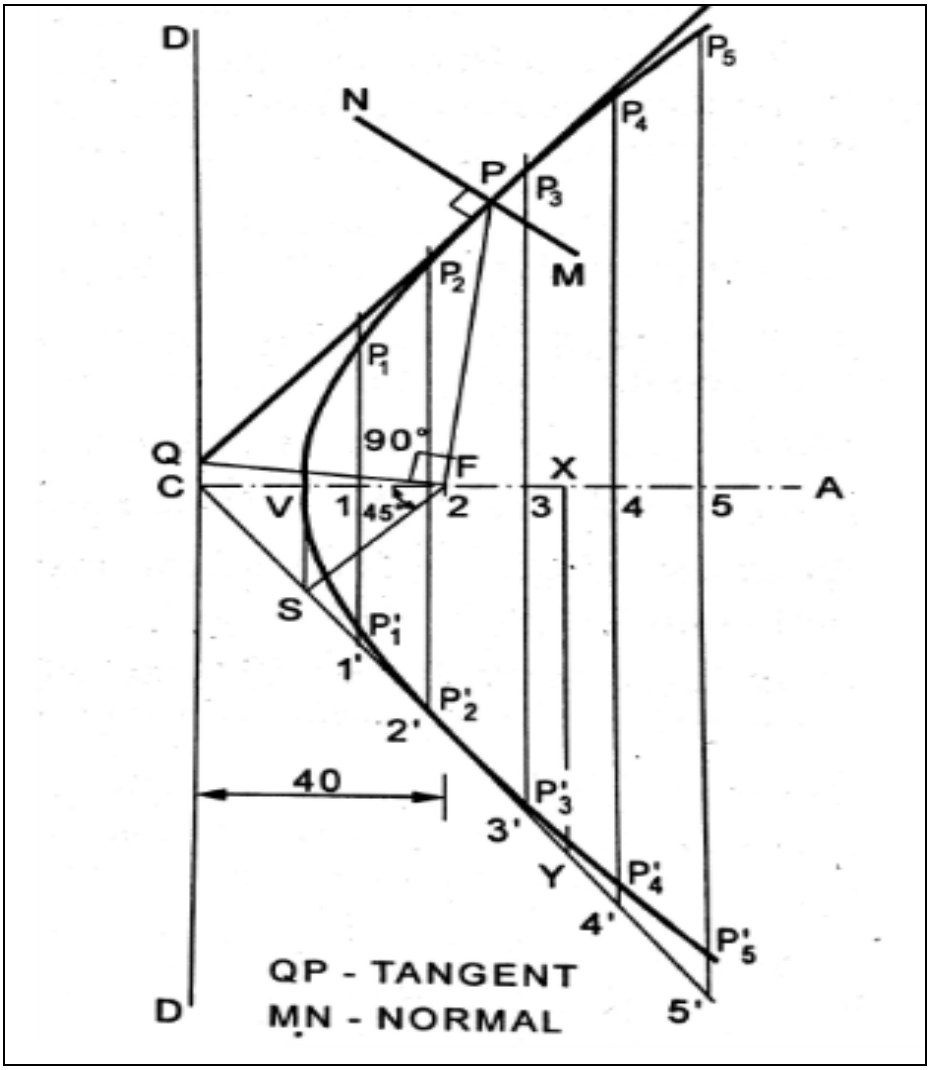
Procedure to draw tangent and normal

1. Mark a point P on the ellipse.
2. Join P and F.
3. Draw a perpendicular to the line PF till the line meets the directrix at the point T
4. Join the points T and P for getting a tangent for the ellipse.
5. Keep the protractor parallel to the line TP and draw the perpendicular line from P for getting a normal.

6. Draw the following views of the Component shown in figure by free hand sketching:
   i. Front view
   ii. Top view and
   iii. Right side view [20] [M/J, 16]



7. Draw a hyperbola given thedistance of the focus from the directrix as 40 mm and eccentricity as 4/3.Also draw a tangent andnormal at any pointP on the hyperbola. [20][N/D, 15]



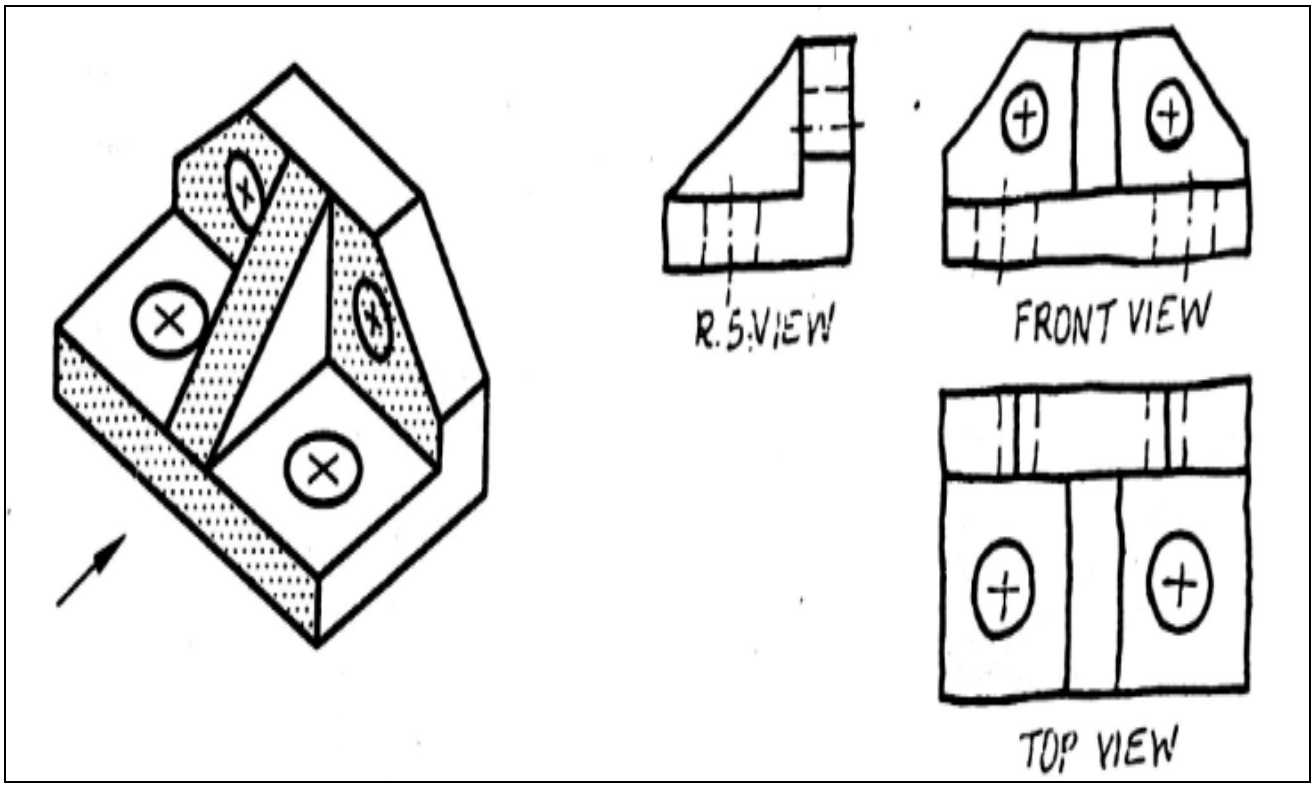
Procedure:

1. Draw the directrix C-D.
2. Draw a horizontal (axis) line perpendicular from a point A on directrix.
3. Mark a point F (Focus) at a distance on the horizontal line at a distance of 40 mm from directrix.
4. Fix the vertex V in the axis.
5. Draw a vertical line from V, so that VE is equal to FV.
6. Draw a line EA and extend it in the same angle and direction.
7. Draw vertical lines crossing the points 1, 2, 3, etc.
9. Mark the points 1', 2', 3' etc., on the inclined line.
10. With 1-1' as radius F as center draw the arcs above below the horizontal line on the line 1-1' and name the points as a_1' and a_1 respectively.
11. Follow the same procedure and mark the points a_2' and a_2 and so on.
12. Join all the points with a single stroke smooth curve to get a hyperbola.

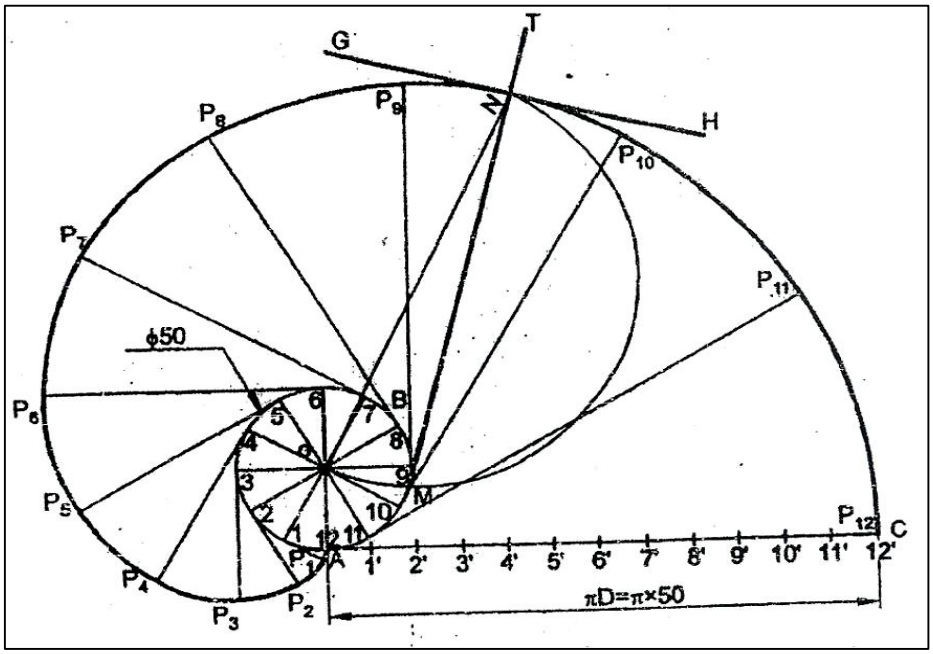
Procedure to draw tangent and normal

1. Mark a point P on the curve.
2. Join P and F.
3. Draw a perpendicular to the line PF till the line meets the directrix at the point M
4. Join the points M and P for getting a tangent for the curve.
5. Keep the protractor parallel to the line MP and draw the perpendicular line from P for getting a normal.

8. Sketch byfreehandthe top, frontand right sideviewsof theobjectshownin Figure: [20] [N/D, 15]



9. Draw the involute of a circle of diameter 50 mm. Also draw a tangent and normal to the curve at any point on the curve. [20][A/M, 15]



Procedure:

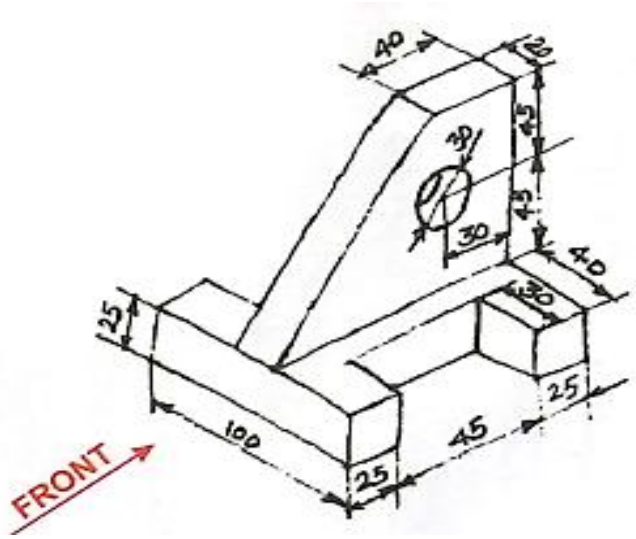
1. Draw a circle of diameter 50 mm.
2. Divide the circle into 12 equal parts and mark the names 1, 2, 3, etc., in clockwise direction starting from a point next to the bottom most one. Mark the center point of the circle as O.
3. Draw a tangent AC from point 12 for a length of L = πd, (d – diameter of circle).
4. Divide AC into 12 equal points and the name points 1', 2', 3'...etc.,
5. Draw tangents from 1, 2, 3, etc., as shown in figure.
6. With 11-11' as radius 11 as center cut an arc on the tangent drawn from 11 and name the point as P11.
7. Similarly obtain other points P10, P11,etc.,
8. Join all the points by a smooth curve to obtain an involute.

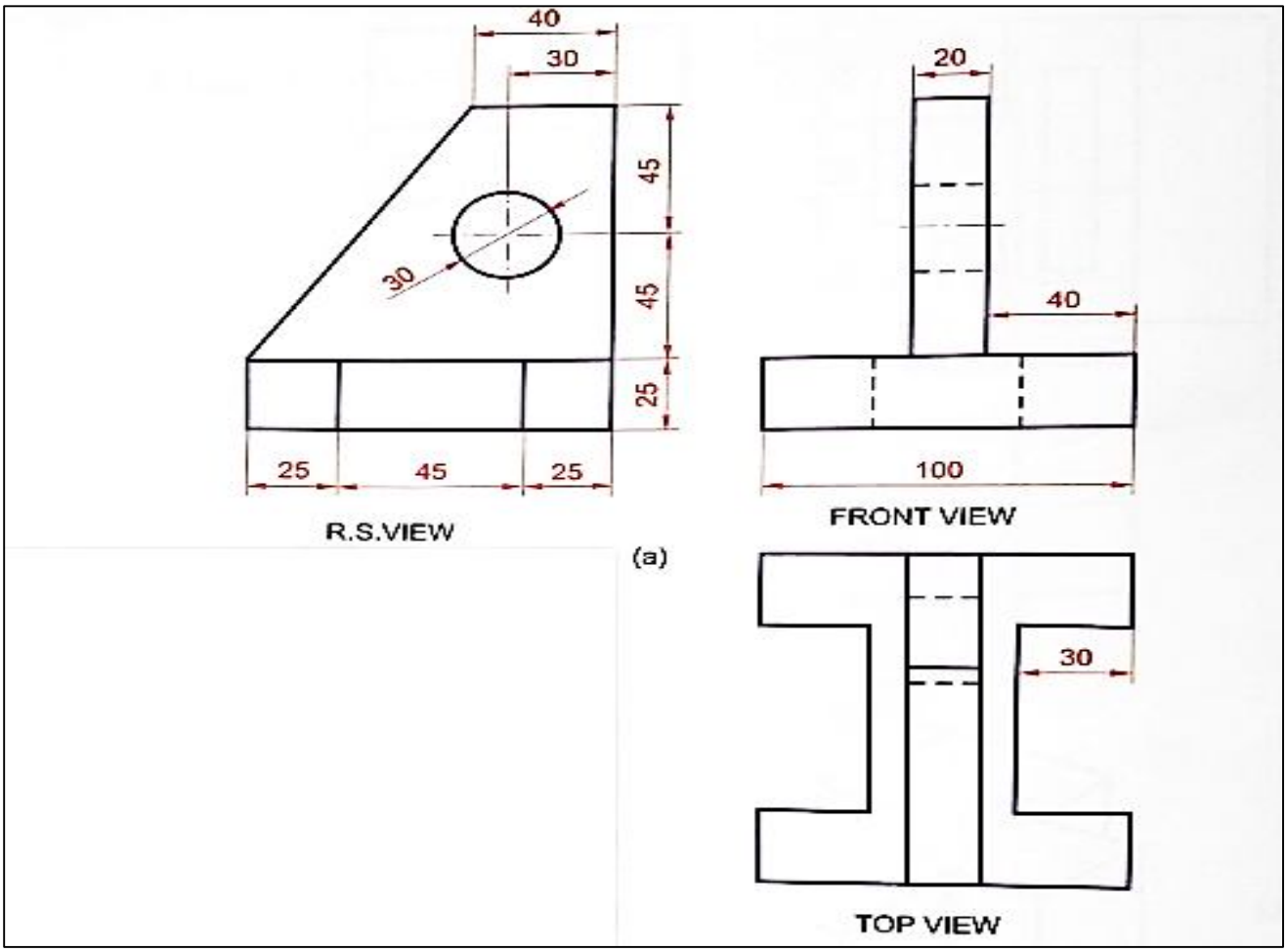
Procedure to draw a tangent and normal to an involute:

1. Mark a point N on the involute.
2. Join N and O. With the midpoint of ON as center, half of ON as the radius, draw a semicircle on the opening side of the involute.
3. Mark the cutting point of the semicircle and circle as M.
4. Join M and N, which will be the normal.
5. Keep the protractor parallel to MN and draw a perpendicular from N, to draw the tangent.

10. Sketch free-hand the top, front and right side views of the object shown in Figure.

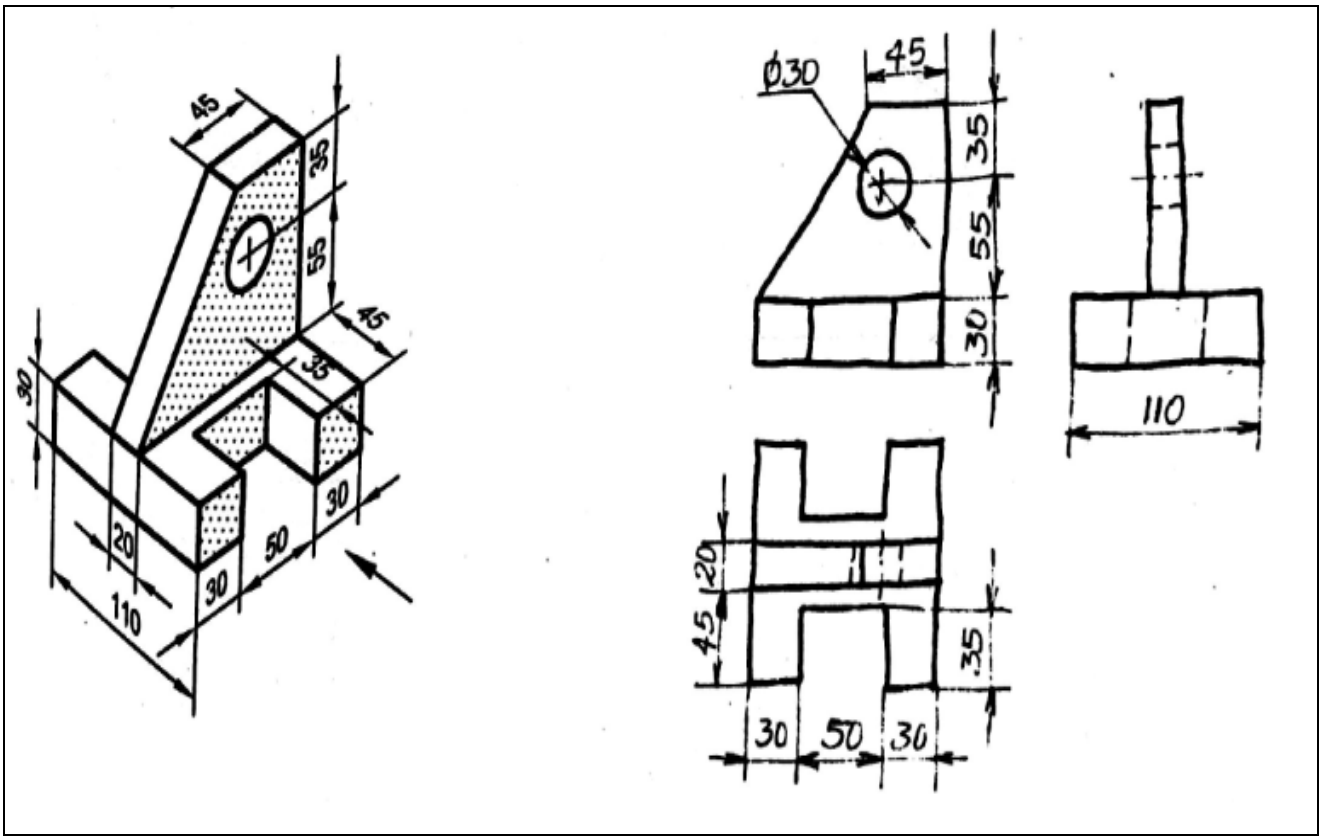
[20] [A/M, 15]



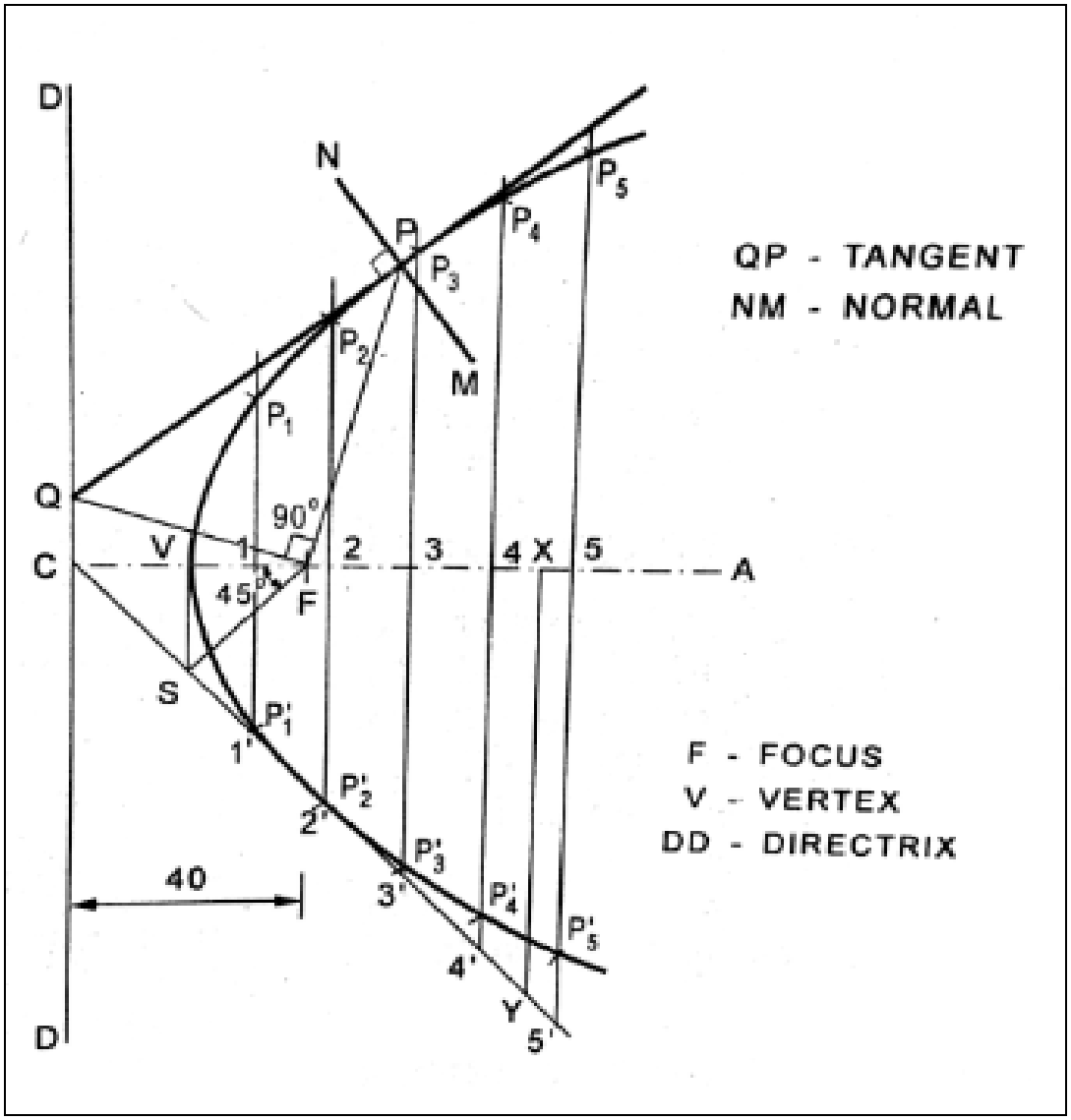


11. For the object shown in Figure, draw free hand sketching of:

i. Front view
ii. Top view and
iii. Left hand side view [20] [N/D, 14]



12. Construct a parabola, with the distance of the focus from the directrix as 40 mm. Also, draw a normal and tangent to the curve at any point. [20] [N/D, 14]



Procedure:

1. Draw the directrix A-B.
2. Draw a horizontal (axis) line perpendicular from a point C on directrix.
3. Mark a point F (Focus) at a distance on the horizontal line at a distance of 40 mm from directrix.
4. Mark a point V (Vertex) at the midpoint of CF.
5. Draw vertical lines crossing the points 1, 2,3,4,5 etc.
6. With C-1 as radius F as center draw the arcs above below the horizontal line on the perpendicular line at 1and name the points as P1' and P1 respectively.
7. Follow the same procedure and mark the points P2' and P2 and so on.
8. Join all the points with a single stroke smooth curve to get a parabola.

Procedure to draw tangent and normal:

1. Mark a point P on the curve.
2. Join P and F.
3. Draw a perpendicular to the line PF till the line meets the directrix at the point T
4. Join the points T and P for getting a tangent for the curve.
5. Keep the protractor parallel to the line TP and draw the perpendicular line from P for getting a normal.

13. A circus man rides a motor bike inside a globe of 6 m diameter. The motor-bike has the wheel of 1 m diameter. Draw the locus of the point on the circumference of the motor-bike wheel for one complete revolution. Adopt suitable scale. [20] [M/J, 14]

Answer: similar to the problem solved below.

(Draw hypocycloid of a circle of 40 mm diameter, which rolls inside of another circle of160 mm diameter for one revolution counter clockwise. Draw a tangent and normal to it at a point 65 mm from the center of the directing circle.)

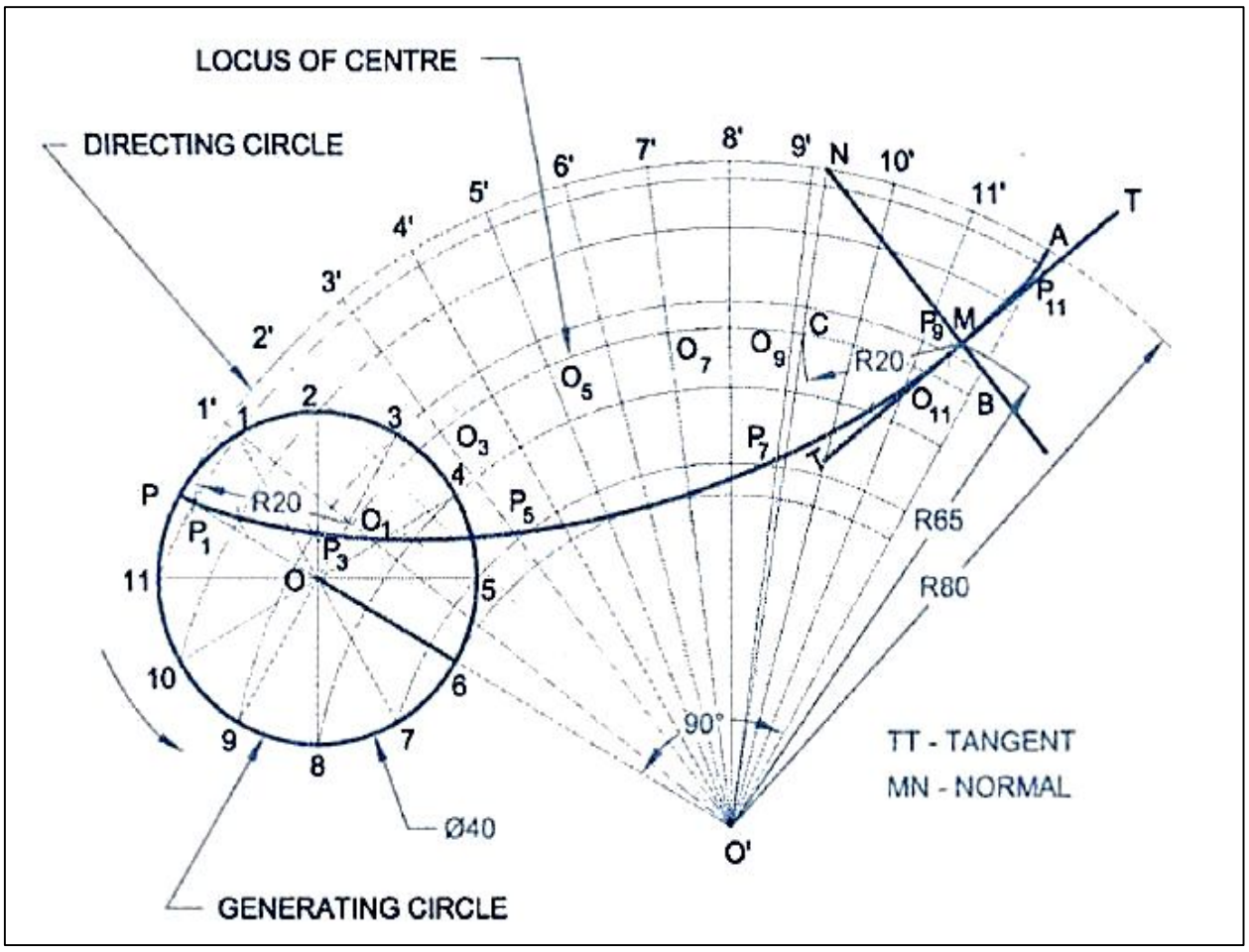
$\Theta = (r/R) \times 360$

r - Radius of rolling circle

R - Radius of directing circle

$\Theta = (20/80) \times 360$

$= 90^{o}$



Procedure:

1. Mark a point O'.
2. With O' as center draw a sector (O'PA) with radius of generating circle 80 mm for an angle of 90^{o}.
3. Mark P on the line PO' so that OP = radius of rolling circle.
4. With O as center, draw the rolling circle of diameter 40 mm.
5. Divide the circle into 12 equal parts and name the points as 1,2,3..etc., in the clockwise direction from the point next to the top most one.
6. With O' as center, draw the arcs passing through the points 11-1, 10-2, 9-3 etc.
7. Divide the sector in to 12 equal angles and draw the lines starting from O'.
8. Mark the cutting points of the lines on the arc starting from 3-9, as O1, O2 etc.
9. O1 as center, 20 mm as radius draw an arc on the curve drawn from 11. Name the cutting point as P1.
10. Similarly mark the other points P2, P3, P4, etc.
11. Join all the points by a smooth curve to get an epicycloid.

14. Draw the front top and side views of the component shown in figure, by free hand. [20] [M/J, 14]