**Exp No.- 04 Conic Sections**

**Aim-**

To study about the different types of Conic Sections and construct them with the help of methods and rules of construction.

**Theory-**

1. A cone is a surface generated by rotating a straight line such that it always keeps contact with a closed curve, called base and contains a fixed point which does not lie in the plane of the curve.
2. A conic section is originated from the convergence of a right circular cone by a plane in distinct positions relative to the axis of the cone. The locus of a point moving in a plane such that the ratio of the distance of the point from focus to the distance of the point from the directrix is always the same. This ratio is termed eccentricity (e).
3. An ellipse is formed when the plane is inclined to the axis, cutting all the generators on one side of the axis. Its eccentricity is less than 1. An ellipse has two foci and two directrices.
4. A Parabola is formed when the plane runs parallel to one of the generators and is inclined to the axis. Its eccentricity is always equal to 1. A parabola has one focus and one directrix.
5. A hyperbola is formed when two cones face each other and are intersected by a plane that is parallel to the axes of the cone. The eccentricity of this type of conic section is greater than 1.
6. A Parabola is found in numerous forms in real life such as a ball thrown high forms a parabolic path, automobile headlights and the bulbs in lighthouses are also parabolic, many architectural structures are built in parabolic geometry. Ellipse is used to reflect sound and light. Also when a cylindrical shape is cut at by a cutting plane inclined to its axis, the section shape obtained is ellipse. The sides of a guitar are in Hyperbolic shape and hyperbolic gears are found in gear transmissions.

**Pretest**

**Beginner level**

* 1. Which of the following is a closed figure?
     1. Ellipse
     2. Hyperbola
     3. Parabola
     4. All of the above

**Ans. a) Ellipse**

* 1. What does the eccentricity of a conic section determine?
     1. Area
     2. Perimeter
     3. Shape
     4. None of the above

**Ans c) Shape**

**Intermediate level**

* 1. The section obtained when the cone is cut by a plane at an angle of 90° with the axis is called \_\_\_\_?
  2. Ellipse
  3. Hyperbola
  4. Parabola
  5. Circle

**Ans. d) Circle**

4) A parabola has a single focus and a single directrix.

a) True

b) False

**Ans. a) True**

5)What is the point at which the conic cuts its axis called?

* 1. Directrix
  2. Vertex
  3. Focus
  4. None of the above

**Ans. b) Vertex**

**Advanced level**

1. Mathematically, an ellipse is illustrated by the equation \_\_\_\_?
   * 1. x² / a² + y² / b² = 1
     2. x²= 4ay
     3. x²/ a² – y² / b² = 1
     4. None of the above

**Ans. a) x² / a² + y² / b² = 1**

1. What does the equation y= 4x²+ 3x + 5 represent?
   1. Parabola
   2. Circle
   3. Ellipse
   4. Hyperbola

**Ans a) Parabola**

1. What does the equation (x²/ 36) – ( y²/ 9) = 1 represent?
   1. Parabola
   2. Hyperbola
   3. Ellipse
   4. Circle

**Ans b) Hyperbola**

**Procedure –**

1. **To draw a parabola with a given distance of focus from the directrix. Also, draw a normal and a tangent at a given point from the directrix.**
2. Draw the axis AB and directrix CD perpendicular to each other.
3. Mark the point as focus F at a distance given from the directrix.
4. Mark the vertex V on the axis such that VF= AV.
5. From V, draw a perpendicular line VE whose length is equal to VF.
6. Join VE with point A and produce the line such that the eccentricity is equal to 1.
7. Mark points 1, 2,3, 4, 5 and so on to the right-hand side of V.
8. Through each of the points, raise perpendicular lines meeting AE at points 1’,2’, 3’,4’, 5’ and so on.
9. Take a radius of 1-1’ and with F as the centre, draw arcs on the line for the first point on either side of the axis. Mark the points as P1 and P1’ respectively.
10. Repeat the same procedure for the rest of the points.
11. Join all the points obtained by marking off arcs. The smooth curve so obtained is the required parabola.
12. Locate the point in the parabola where the tangent and normal has to be drawn.
13. Join the point with the focus. Draw a line perpendicular to it such that it's one end touches the directrix. Mark it as T.
14. From T, draw a line passing through the desired point and extend it. This is the required Tangent.
15. Draw a line on the desired point that is perpendicular to the tangent. This is the required normal.
16. **To draw an ellipse with a given distance of focus from the directrix having an eccentricity equal to 2/3. Also, draw a tangent and normal at a given point from the directrix.**
17. Draw the axis AB and directrix CD perpendicular to each other.
18. Mark the point as focus F at a distance given from the directrix.
19. Divide AF into five equal segments.
20. Locate the vertex V from the second division point from A or from third division point from F. So the eccentricity e= 2/3.
21. From the vertex draw a perpendicular line VE that is equal to VF. Join AE and extend it.
22. Mark points 1, 2,3, 4, 5 and so on to the right-hand side of V.
23. Through each of the points, raise perpendicular lines meeting AE at points 1’,2’, 3’,4’, 5’ and so on.
24. With a radius of 1-1’ and having F as the centre, mark arcs on the line for the first point on either side of the axis. Mark the points as P1 and P1’ respectively.
25. Correspondingly, locate the points P2, P2’, P3, P3’ and so on.
26. A closed curve is formed by joining all the points which is the required ellipse. It has two directories and two foci.
27. Mark the point in the ellipse where the tangent has to be constructed.
28. Join the point with the focus and draw a line perpendicular to it. Name its one end as T.
29. Draw a line from T, passing through the point and extend it. This is the required tangent.
30. Draw a line perpendicular to the tangent on the desired point. This is the required normal.
31. **To draw a hyperbola at a given distance of focus from the directrix having an eccentricity equal to 3/2. Also, draw a normal and a tangent at a given point from the directrix.** 
    1. Draw the axis AB and directrix CD perpendicular to each other.
    2. Mark the point as focus F at a distance given from the directrix.
    3. Divide AF into 5 equal parts.
    4. Mark the vertex V on the point from the second division of focus. Draw a perpendicular line VE whose length is equal to VF.
    5. Join AE and produce the line.
    6. From V locate points 1, 2, 3 and so on, on the axis.
    7. Draw perpendicular lines from each of the points meeting the line AE at points 1’,2’, 3’ and so on.
    8. Take 1-1’ as the radius and have F as the centre draw arcs on each of the lines on either side of the axis.
    9. Obtain the points P1, P1’, P2, P2, and so on.
    10. Join all the points and curve so obtained is a hyperbola.

**Post-test**

**Advanced level**

1) What is the eccentricity if the distance from the directrix is 50 units and the distance from the focus is 20 units?

a) 0.8

b) 0.2

c) 0.5

d) 0.4

**Ans. d) 0.4**

2) For hyperbola, the ratio of the distance of point from the focus to the distance of point from the directrix is\_\_\_\_?

a) Equal to 1

b) Greater than 1

c) Less than 1

d) None of the above

**Ans. b) Greater than 1**

3) Which of the following conic section is formed if the distance of point from the directrix is 35 units and the distance of point from the focus is 45 units?

a) Hyperbola

b) Parabola

c) Ellipse

d) Circle

**Ans. a) Hyperbola**

**Intermediate level**

1. Which of the conic section if formed, if the eccentricity is 0.333
2. Hyperbola
3. Parabola
4. Ellipse
5. Circle

**Ans. c) Ellipse**

1. The eccentricity of a circle is \_\_\_\_.
   1. 1
   2. Greater than 1
   3. Less than 1
   4. 0

**Ans d) 0**

1. Which of the following statement is correct?
   1. The distance between the foci of an ellipse is the minor axis.
   2. The distance between the foci of an ellipse is twice the length of the major axis.
   3. The distance between the foci of an ellipse is the major axis.
   4. The distance between the foci of an ellipse is twice the length of the minor axis.

**Ans d) The distance between the foci of an ellipse is twice the length of the minor axis**.

**Beginner level**

7) The practical application of a parabola is in\_\_\_\_\_?

a) Water channels

b) Cooling towers

c) Light reflectors

d) None of the above

**Ans. c) Light reflectors**

* 1. Which of the following conic section is formed if the distance from a fixed point is equal to the distance from a fixed straight line?

a) Hyperbola

b) Parabola

c) Ellipse

d) Circle

**Ans b) Parabola**

* 1. Which of the following conic section is formed by the intersection of a plane with both halves of a double cone?
  2. Parabola
  3. Ellipse
  4. Hyperbola
  5. Circle

**Ans c) Hyperbola**