How to Encourage the Students Interest to Engineering Graphics, Methods and Application of Ellipse, Parabola, Hyperbola

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Abstract -: *In various universities engineering graphic is one of the most difficult stage in engineering drawings interpretation. There were made many attempts to recognize various types of engineering graphics entities. In this we present the simple analysis of cone which are used to generate a given conic curve by section by plane. It was found that if given curve is an ellipse, then the plane curve which is mirror symmetrical is parabola, then the locus of vertices of cone is hyperbola. In engineering graphics course, the weaker student are entering with lower technical background. Such students have difficulties in keeping high their attention level during lessons. The focus of this paper is to defend the necessity of engineering graphics in engineering education by discussing the benefits of and the need for the skill developed in this course. Engineers who possess engineering graphics skills are valuable to company because of time and money they can save that company through productivity and advance analysis. As in the past the conic curves appear to be very interesting fruitful mathematical beings. This article presents how to increase interest of students in engineering graphics with the help of imagination and application of curves.*

Key Words: Engineering graphics, Curve, Ellipse, parabola, hyperbola

1. INTRODUCTION

The successful introduction of the engineering graphics technologies is extensive application of 3D geometric model. Development of spatial imagination and 3D models by means of CAD systems should be tackle in engineering courses. The best known plane curves are straight lines and circles, which are characterized as the plane curves of constant curvature. The next most familiar plane curves are arguably the conic sections. A drawing is a graphical representation of an idea or a concept which actually or potentially exists in life. Drawing is one of the most oldest forms of communication.

1.1 Background

A drawing is the graphical representation of an object, a part of it is drawn on a rough map to give directions to each other, this is graphical communication. The graphics communication is the best way of communication rather than verbal communication. The ability to communicate graphically with the use of engineering graphics and computer aided design (CAD) software. The graphics communication into a engineering fields is vital because of importance in engineering field and because of its relevancy in modern engineering practices. A conic section is a curve obtained by intersection of the conical surface with the plane. The surface of the cone is sectioned by a plane at various angles, which produces different kind of conics. In engineering courses of geometry is knows that ellipse, hyperbola and parabola are obtained by section of cone by a plane. Parabola is obtained by intersection of a plane and conical surface to generating straight line of that surface. An ellipse is the intersection of conical surface by a plane which produces a closed curve. Hyperbola is similar to parabola which has eccentricity greater than 1. Here we would like to present cone and its methods of construction which is very interesting.

1.2 Motivation

We know that digramatical representation is very much useful for explaining complicated contents. Thus, Engineering graphics is the base of all subjects of mechanical, civil, electrical branch. The complicated diagrams which have replaced many words or paragraphs can be easily encoded by taking interest in the way of drawing them. The industrial format is generally based on design which consist of these complicated diagrams, hence it will be useful not only there syllabus but also in there career.

2. Methods of curve

The position of the cutting plane relative to the axis of cone, decides whether the obtained figure will be ellipse, parabola or hyperbola.

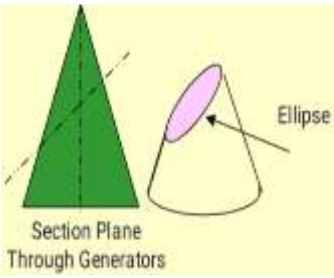
Mathematically conic is defined as locus of a point moving in a plane in a particular manner such that the ratio of its distance from the focus to the fixed straight line is always a constant. This ratio is known as eccentricity (e).

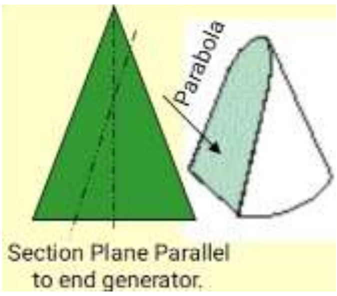
Eccentricity (e) of ellipse is always <1

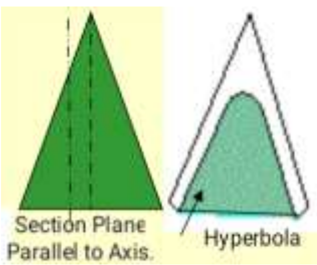
Eccentricity (e) of parabola is always =1

Eccentricity (e) of hyperbola is always >1

The fixed line is known as the Directrix. Axis is defined as the line passing though the focus and perpendicular to the directrix. Vertex is such a point where the conic cuts its axis. Ellipse, parabola, hyperbola are known as conic sections because after cutting by typical cutting planes these curve appear on the surface of a cone.





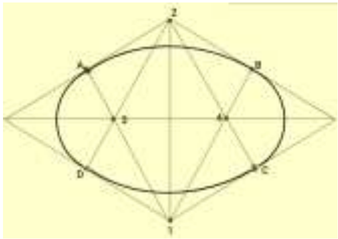


Problem 1.

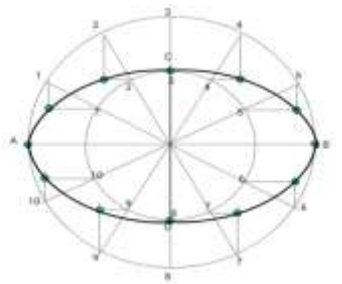
Draw rohmbus of 100mm and 70mm long diagonals and inscribed an ellipse in it.

Steps:

1. Draw rohmbus of given dimensions.
2. Mark midpoints of all sides and name those A, B, C,and D.
3. Join these points to the ens of smaller diagonals.
4. Mark points 1,2,3,4 as four centres.
5. Taking 1 as centre and 1-A radius draw an arc AB.
6. Take 2 as centre draw an arc CD.
7. Similarly taking 3 and 4 as centre and 3-D radius draw arc DA and BC.



Problem 2.
Construct an ellipse by concentric circle method.
Where the measurement of minor axis is 70 mm and that of major axis 100 mm.
Steps:
1. Draw both axis as perpendicular by sector of each other and name their ends as shown.
2. Taking their intersecting point as a centre, draw two concentric circle considering both as respective diameter.
3. Divide both circles in 12 equal parts and name as shown.
4. Construct upward vertical lines and downward vertical lines by considering all points of outer circle, also draw horizontal lines to intersect those vertical lines from all points of inner circle.
5. Interesting points should be marked properly.
6. All these points can be joined with a smooth curve along with the ends.



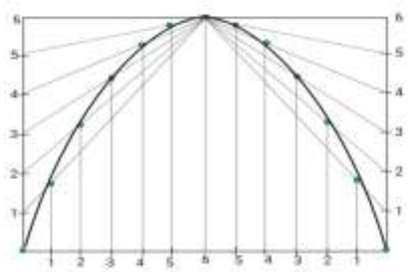
Problem 3.

A stone is thrown in air making some angle with horizontal. After sometime it reaches a maximuma height of 100 m and its range is 150 m.

Draw the path of the ball.

Steps:

1. Construct a rectangle of 100x150 and then divide that rectangle into two equal parts vertically.
2. First the left of construction should be considered. Divide it's length and height in equal number of parts and name them 1, 2, 3, 4, 5, 6.
3. Connect all vertical points to the top center of rectangle.
4. Now we have to draw upward vertical line from horizontal 1,2,3,4,5 and mark the intersection these lines with the previously drawn inclined line in sequence, now join these points with smooth possible curve.
5. Reconstruct the same on RHS.

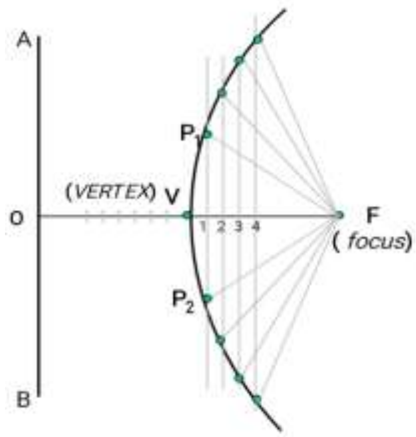


Problem 4.

The focus is 50 mm away from vertical straight line AB. Construct a locus of point P, moving in plane in such a fashion that it's remains equidistant from focus and line AB.

Steps:

1. First of all we have to locate the center of line, which is perpendicular to line AB from point F. This will be initial point P and also the vertex.
2. Mark 5 mm distance on its RHS, name those points 1, 2, 3, 4.
3. Now form these points 1, 2, 3, 4 draw lines parallel to AB.
4. Mark 5 mm distance on its LHS of P and name it 1.
5. Considering the radius as O-1 and F as center draw an arc cutting first parallel line to AB. Name the lower point as P2 and upper point as P1.
6. Similarly we can locate P3 and P4 by repeating the same procedure
7. Construct a smooth curve by joining all these points.



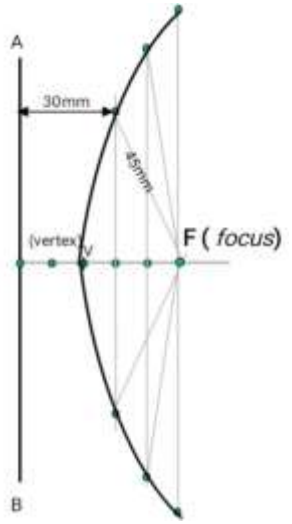
Problem 5.

Draw the locus of point P such that Point F is 50 mm away from a line AB. The eccentricity (e) is 2/3.

Steps:

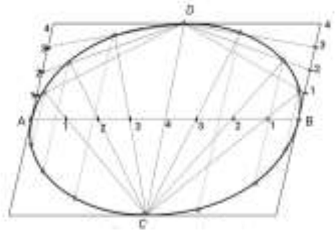
1. Construct a vertical line AB and Focus (F) 50 mm away from it.
2. This 50 mm distance should be divided into 5 equal parts.
3. The second part from Focus (F) is named as V. It is 30 mm and 20 mm from line AB and Focus respectively.
4. Find more points giving same ratio such as 30/45, 40/60, 50/75, etc.
5. Considering 45, 60 and 75mm distance from line AB, construct three vertical lines to the it's RHS.
6. Take 30, 40 and 50 mm length in compass cut lines above with F as center.
7. Take 30, 40 and 50 mm length in compass cut lines above with F as center.

8. Connect these points through V in Smooth curves to obtain the result.



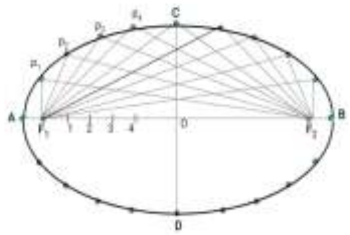
Problem 6.
Construct an ellipse by oblong method. Consider the length of minor axis as 70 mm long and that of major axis as 100 mm long.

Steps:
1. Construct a rectangle 100x70.
2. Perpendicular bisectors of both the axis should be drawn..
3. Next step is to select upper left part of rectangle. 4. Equal parts should be made of vertical and horizontal sides.
5. Now join all vertical points 1,2,3,4 to the upper end of minor axis.
6. Join horizontal points i.e.1,2,3,4 to the lower end of minor axis.
7. Now here extend line C-1 line till D-1 and mark that points
8.Repeat the same procedure for C-2,C-3,C-4 lines upto D-2,D-3,D-4 lines.
9. Select all these points and join with a smooth a curve with ends A and D.
10. Reconstruct the above RHS along with lower half of the rectangle. Connect the points with smooth curve.



Problem 7.
Construct an ellipse by arc of circle method. Take the measure of major axis as 100 mm (AB) and measure of minor axis as 70 mm (CD)
Steps :
1. Construct the major axis of 100 mm and minor axis of 70 mm interesting to each other at midpoint. 2. Take 50 mm distance from C, mark F1&F2 on AB.
3. Divide F1-O taking any distance, mark point 1,2,3 & 4
4. Take F1 as the center, considering distance A-1 draw an arc above AB
5. Take F2 as the center, considering distance B-1 cut this arc. Name the point P1.
6. Repeat above procedure with Same centers but taking now A-2 & B-2 distances.
7. Now perform the same steps to get all other P points.
8. Ellipse can be obtained by connecting the points with a smooth curve.

2.1Applications of ellipse



- Football
- Cushion
- Optics
- Astronomy

2.2 Application of parabola
- Parabolic signal receiver
- Parabolic mirror
- Parabolic satellite dish
- Path of water fountain
- Spinning water
- Car headlight

2.3 Application of hyperbola
- Sundials
- Cooling tower of nuclear reactors
- Lampshade

3. CONCLUSIONS

Engineering graphics and engineering drawings are the most universal language in the product documentation engineering, where the drawing shows the basic construction of the product or workpiece in manufacturing process. A product documentation in engineering using both paper media as well as software media as per requirement. The role of engineering drawings knowledge plays developing in thinking and problem solving skills among the engineering students. Attitude of engineering students toward the engineering graphics subject itself is positive. Therefore, for the best result to be achieved in learning process of engineering graphics and drawing all the negative factors need to be addressed and improved on it. In this paper, we analyzed all the engineering graphics entities. The mathematical entities such that conic curve we discussed in this paper. We have shown very interesting methods of ellipse, hyperbola and parabola by using simple geometry. An ellipse, parabola and hyperbola is created by the locus of vertices of cone which generate the conics. Introducing the industrial application of engineering graphics to the first year students provides safe environment to gain technical knowledge and invaluable lessons in career development. This article is presented to give a clear ideas of various techniques to understand the methods of construction of various conic sections. The sections which are very much useful in the higher standards and industrial format. The number of method of each sections gives us in detail knowledge of the content and also provides its application part.

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