Tishk International University
Engineering Faculty
Petroleum and Mining Engineering Department

Engineering Drawing

Lecture 5: Scale & Conic Sections

First Grade- Fall Semester 2020-2021

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Content:

- Scale
- Reducing and Enlarging Scales
- Cone
- Conic sections:

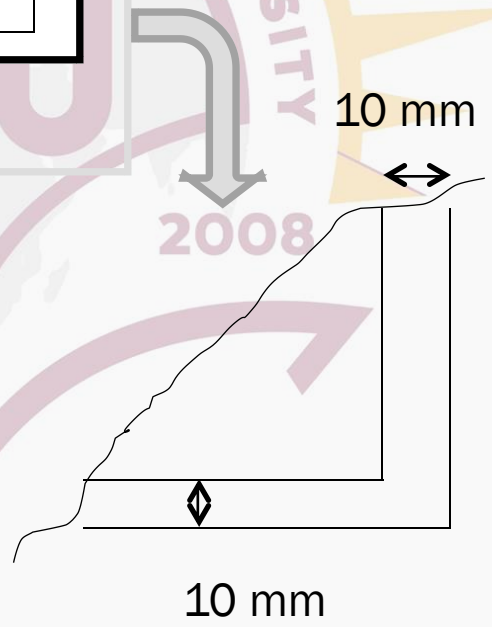
✓ Circle, Draw a Circle

✓ Ellipse, Draw an Ellipse

✓ Parabola, Draw a Parabola

✓ Hyperbola, Draw a Hyperbola

Draw a border line 10 mm from the edge all round the sheet



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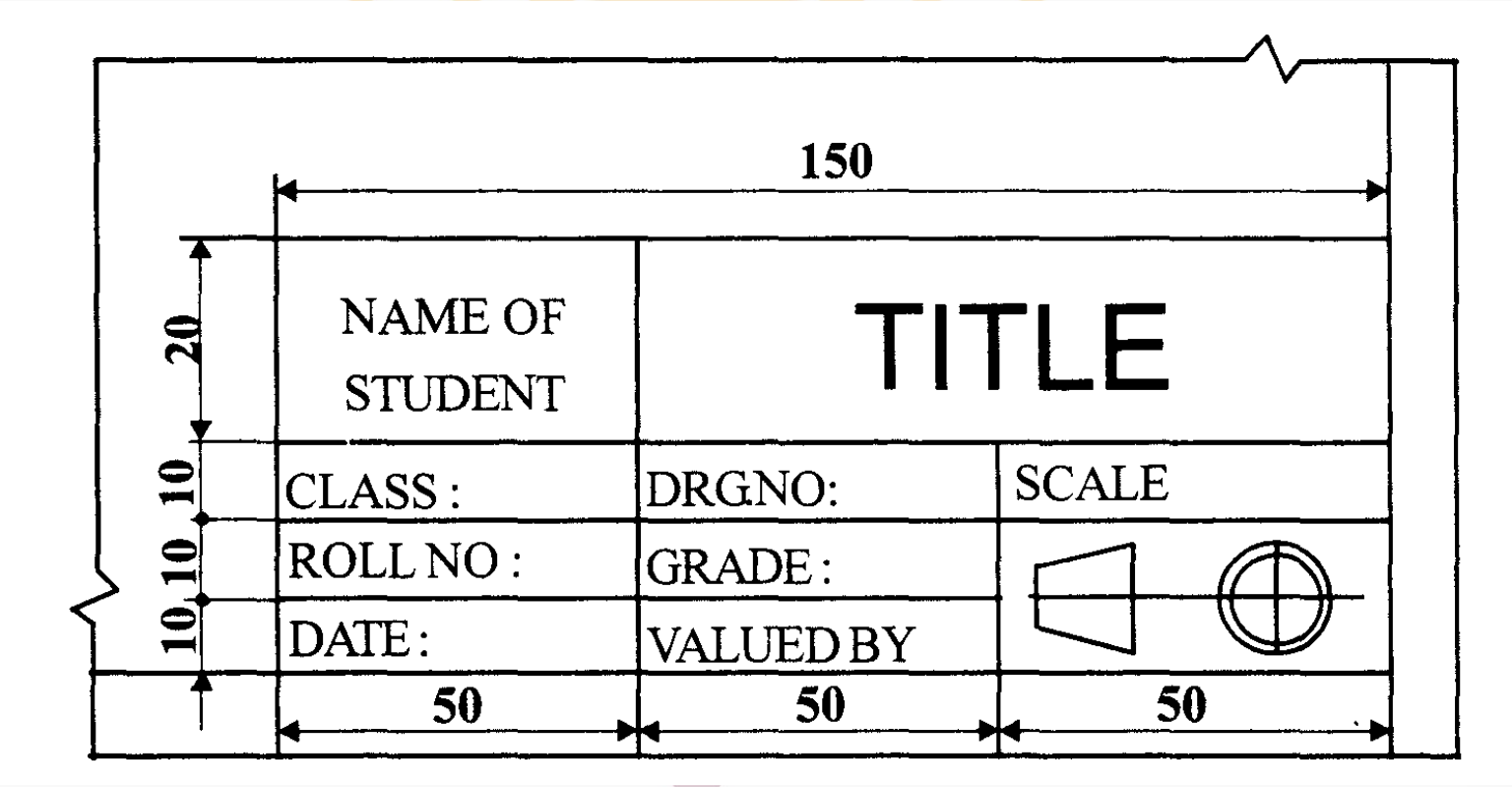
150
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NAME OF STUDENT
TITLE
CLASS :
DRGNO:
SCALE
ROLL NO :
GRADE :
DATE :
VALUED BY
50
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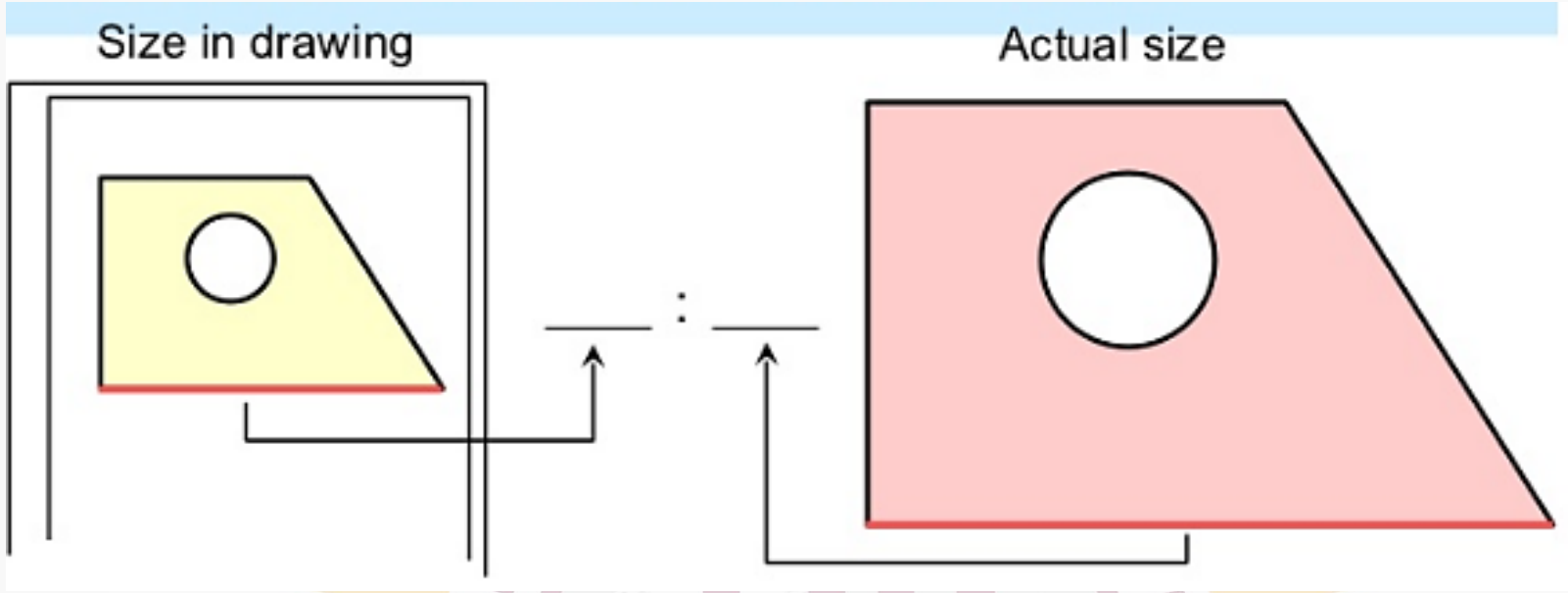
50

Scale:

- ✓ It is not possible always to make drawings of an object to its actual size.
- ✓ If the actual linear dimensions of an object are shown in its drawing, the scale used is said to be a full size scale. Wherever possible, it is desirable to make drawings to full size.
- ✓ **Scale** is the ratio of linear dimension (length, size) of an element of an object shown in the drawing, to the real dimension of the same element of the object.



- Designation of a scale consists of the word "SCALE" followed by the indication of its ratio, as follow

SCALE 1:1	for full size	
SCALE **X**:1	for ***enlargement*** scales	(X > 1)
SCALE 1:**X**	for ***reduction*** scales	(X > 1)

Reducing and Enlarging Scales:

- Objects which are very big in size can not be represented in drawing to full size.
- In such cases the object is represented in reduced size by making use of reducing scales.
- Reducing scales are used to represent objects such as large machine parts, buildings, town plans etc.
- A reducing scale, say 1: 10 means that 10 units length on the object is represented by 1 unit length on the drawing.

- Similarly, for drawing small objects such as watch parts, instrument components etc., use of full scale may not be useful to represent the object clearly. In those cases enlarging scales are used.
- An enlarging scale, say 10 : 1 means one unit length on the object is represented by 10 units on the drawing.
- SCALE, followed by the indication of its ratio as follows.

10 cm= 1 cm or 10 : 1 and by R.F= 10/1

1 cm = 100 cm or 1 : 100 and by RF= 1/100

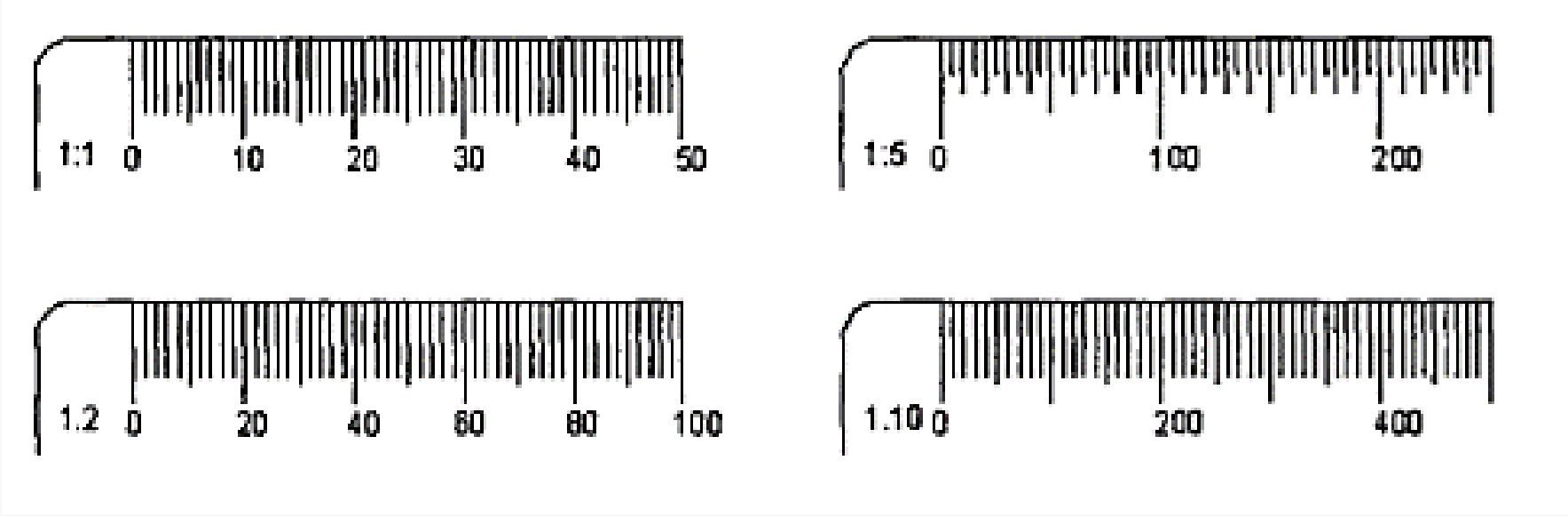
1 cm = 1 cm or 1 : 1 and by R.F= 1/1

- (Standard scales are shown in figure below),

  Scale 1 : 1 for full size scale

  Scale 1 : x for reducing scales (x = 10,20 ..... etc.,)

  Scale x : 1 for enlarging scales.



Reducing Scales

Scale			
	1 : 2	1 : 5	1 : 10
	1 : 20	1 : 50	1 : 100
	1 : 200	1 : 500	1 : 1000
	1 : 2000	1 : 5000	1 : 10000

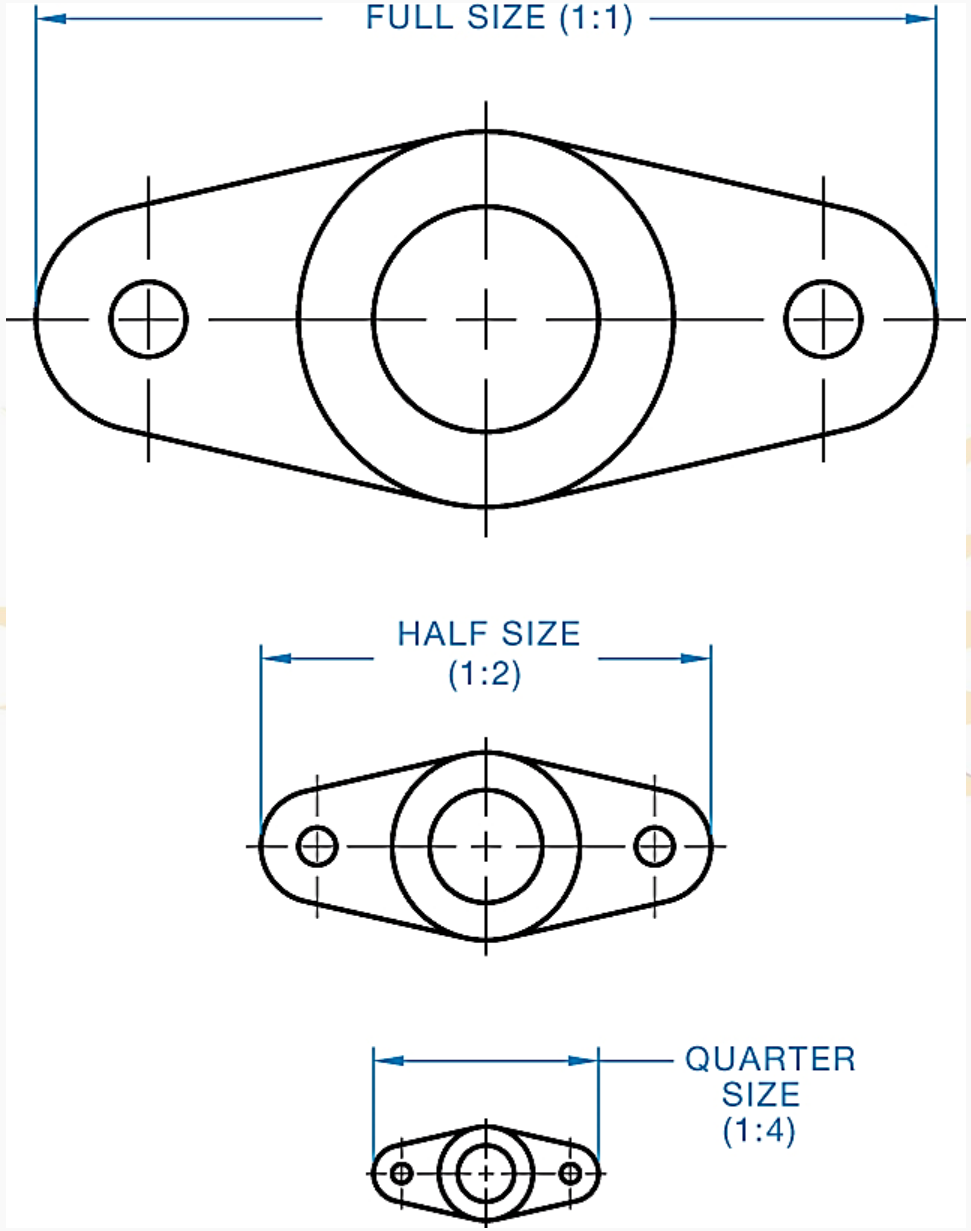
Enlarging Scales

Scale		
	2 : 1	20 : 1
	5 : 1	50 : 1
	10 : 1	100 : 1

1:1 Full size
1:2 Half size
1:5 Fifth size
1:10 Tenth size
1:20 Twentieth size
1:50 Fiftieth size

Representative fraction (R.F.)

a map scale in which figures representing units (as centimeters, inches, or feet) are expressed in the form of the fraction $1/x$ (as 1/250,000) or of the ratio $1 : x$ to indicate that one unit on the map represents x units (as 250,000 centimeters) on the earth's surface


FULL SIZE (1:1)
HALF SIZE
(1:2)
QUARTER
SIZE
(1:4)

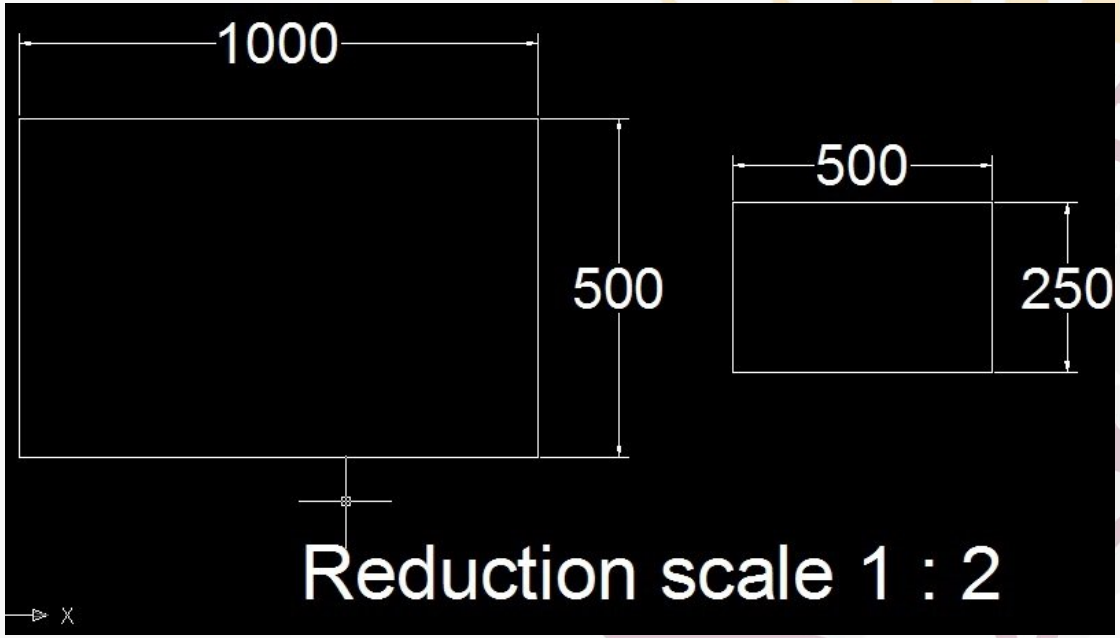
- When a 1 cm long line in a drawing represents 1 meter length of the object,

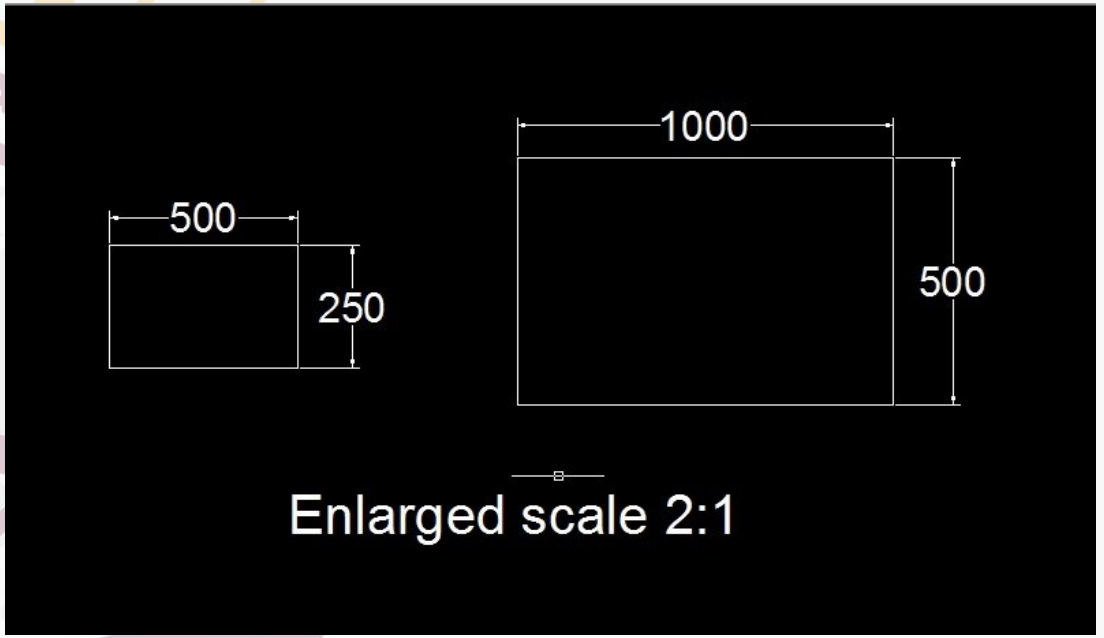
$$R.F = \frac{1\,cm}{1\,m} = \frac{1\,cm}{1\,x\,100\,cm} = \frac{1}{100}$$

1 cm = 1 m or 1 cm = 100 cm or 1 : 100

BE FRIENDLY WITH THESE UNITS.

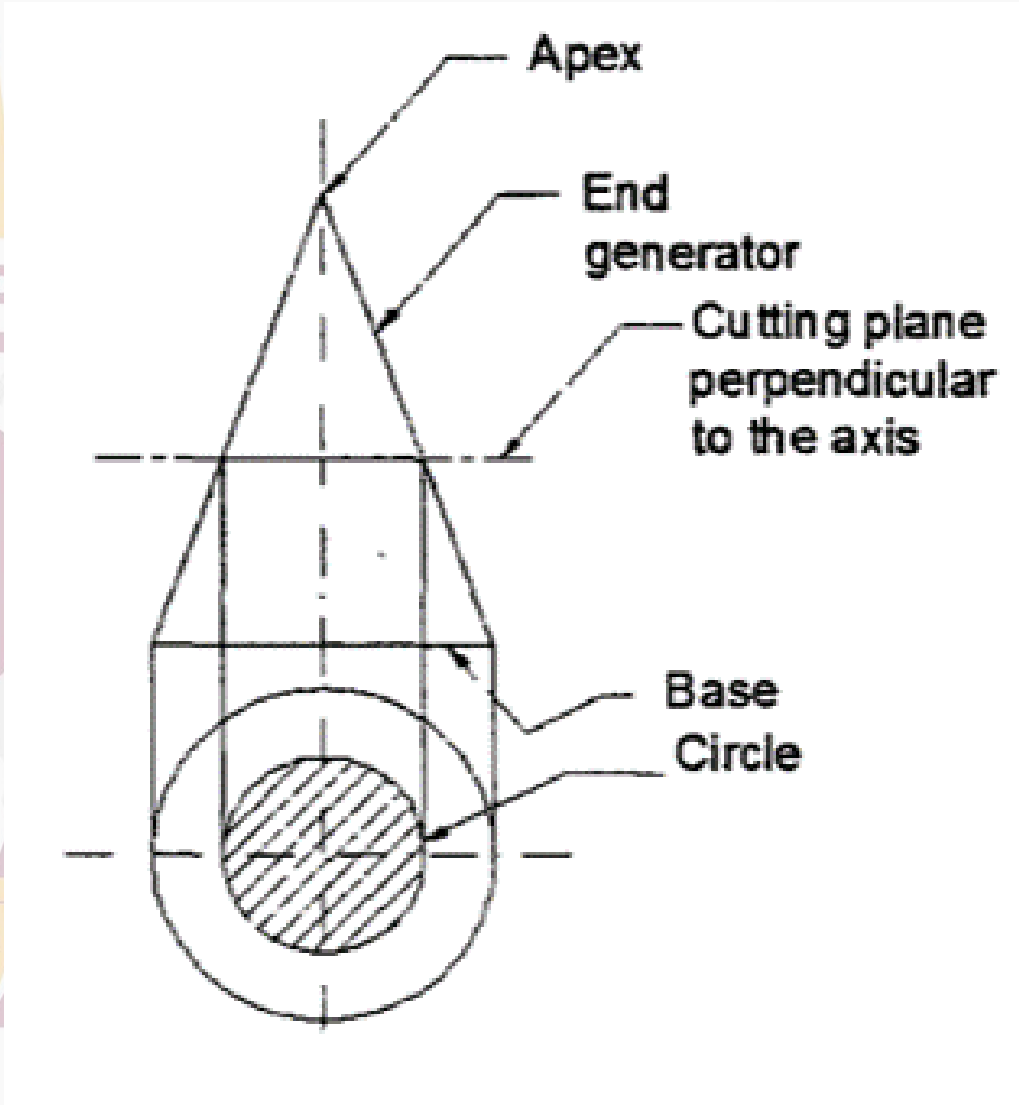
1 KILOMETRE	= 10 HECTOMETRES
1 HECTOMETRE	= 10 DECAMETRES
1 DECAMETRE	= 10 METRES
1 METRE	= 10 DECIMETRES
1 DECIMETRE	= 10 CENTIMETRES
1 CENTIMETRE	= 10 MILIMETRES


1000
500
500
250
Reduction scale 1 : 2
X


500
250
1000
500
Enlarged scale 2:1

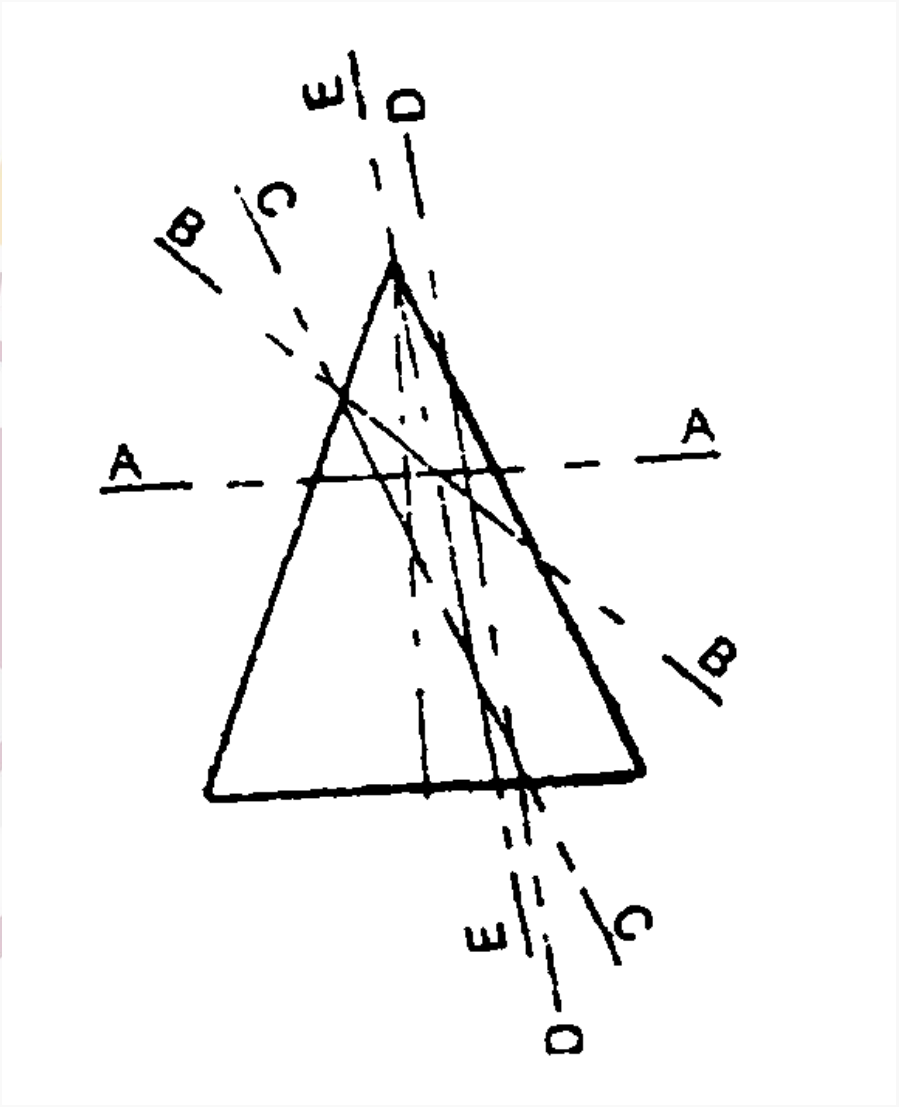
Cone:

- Cone is formed when a right-angled triangle with an apex and angle Θ is rotated about its altitude as the axis. The length or height of the cone is equal to the altitude of the triangle and the radius of the base of the cone is equal to the base of the triangle. The apex angle of the cone is 2Θ.

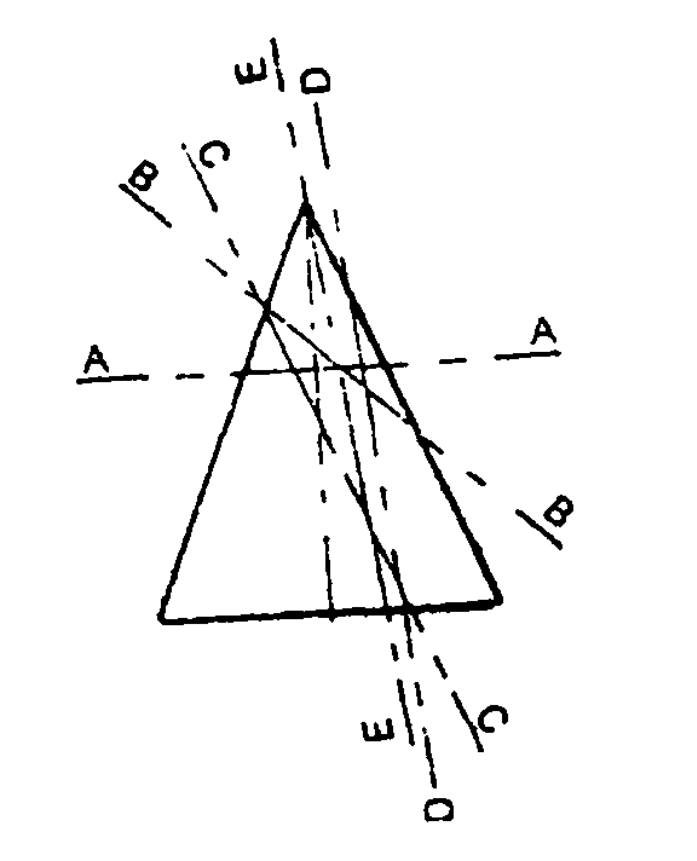


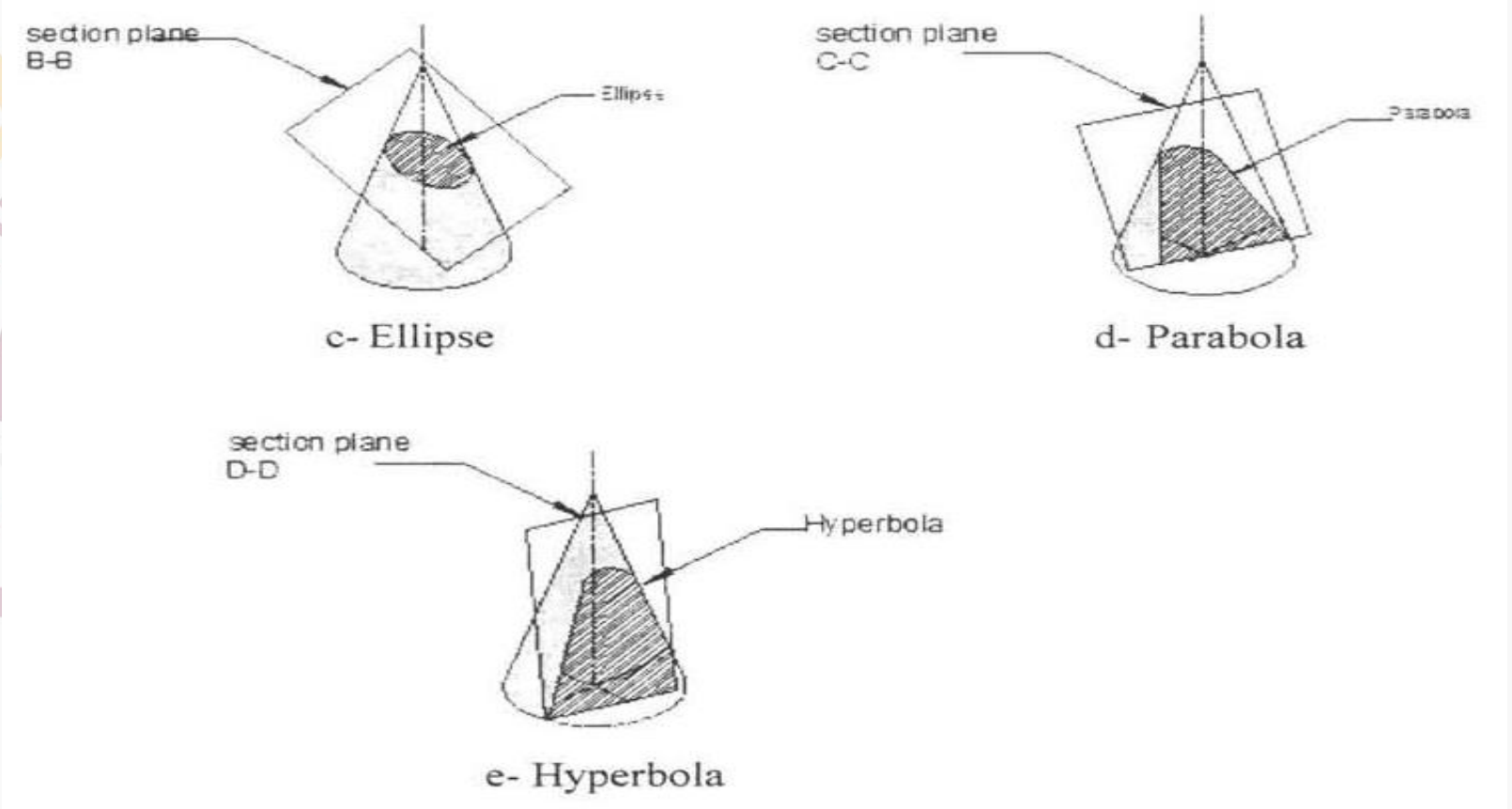
Conic Sections:

- When a cone is cut by a plane, the curve formed along the section is known as a conic.
- For this purpose, the cone may be cut by different section planes and the conic sections obtained are shown in the figure.

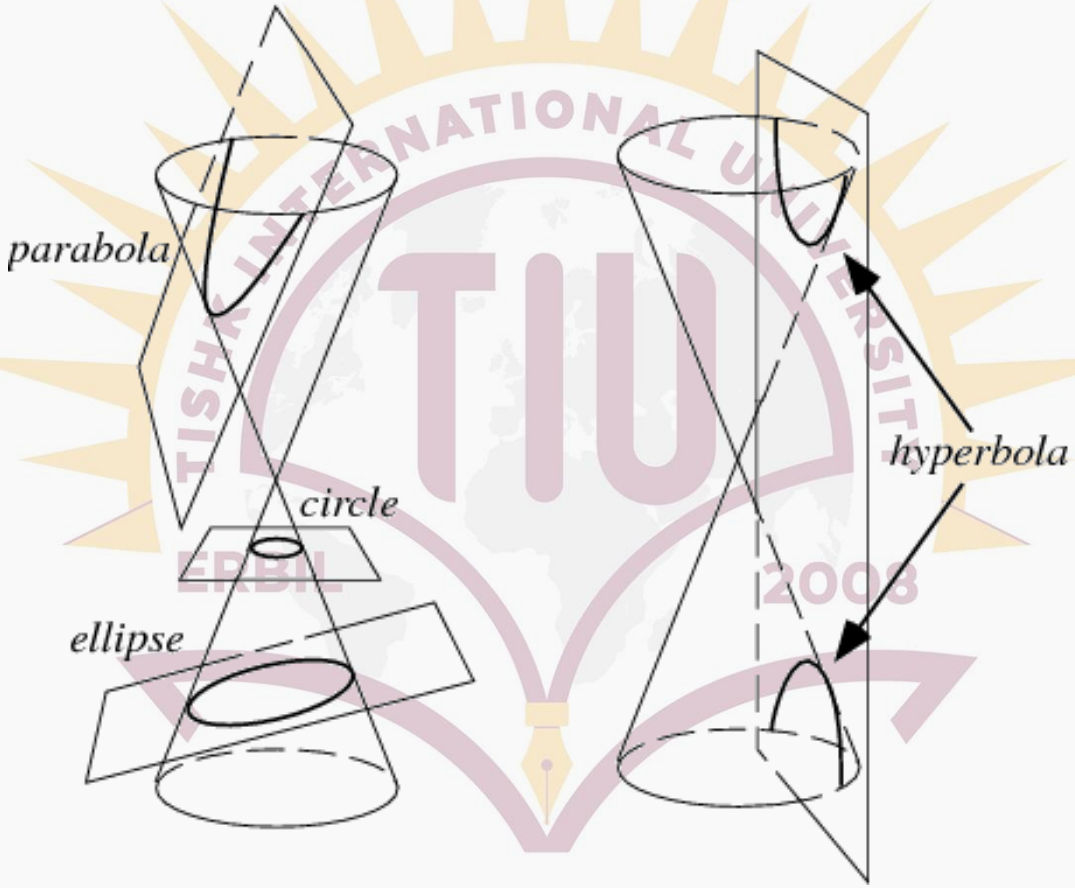


Conic Sections:



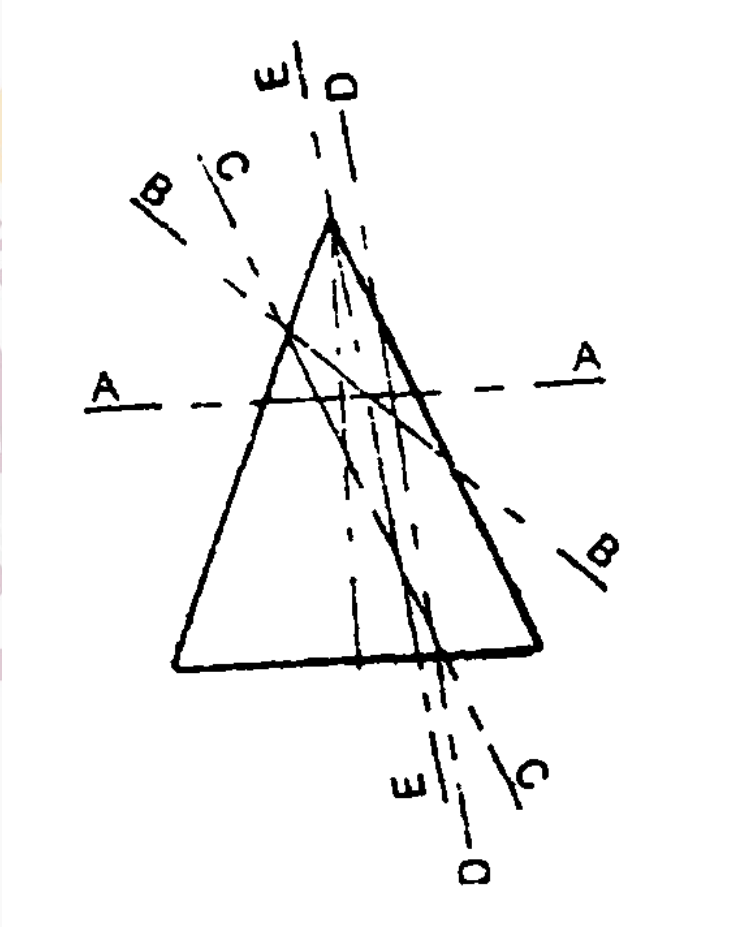


Conic Sections:



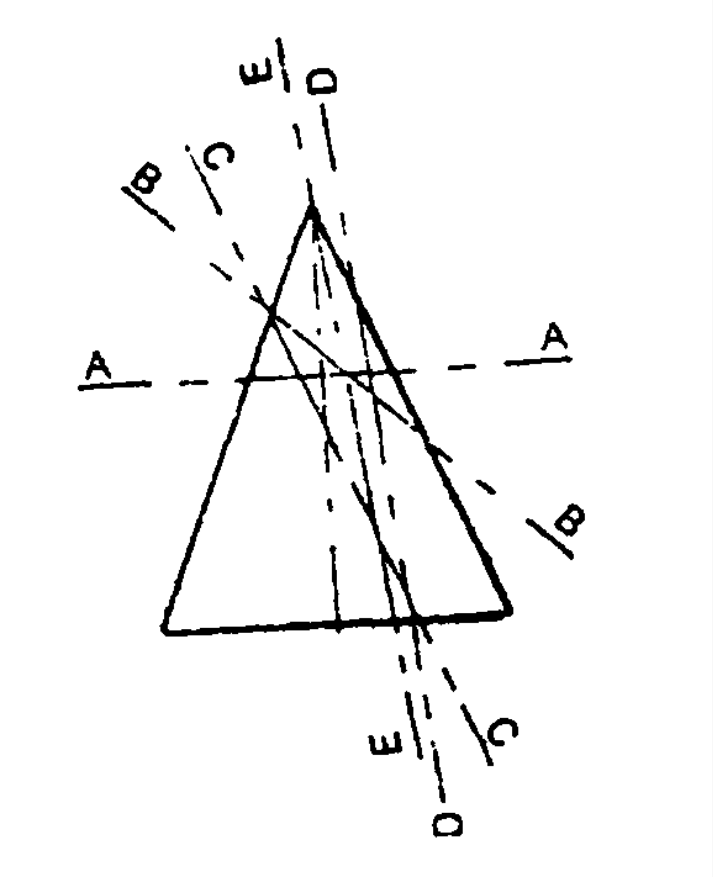
Conic Sections:

- **Circle:** When a cone is cut by a section plane A-A making an angle α = 90° with the axis, the section obtained is a circle.
- **Ellipse:** When a cone is cut by a section plane B-B at an angle, α more than half of the apex angle i.e., e and less than 90°, the curve of the section is an ellipse.



Conic Sections:

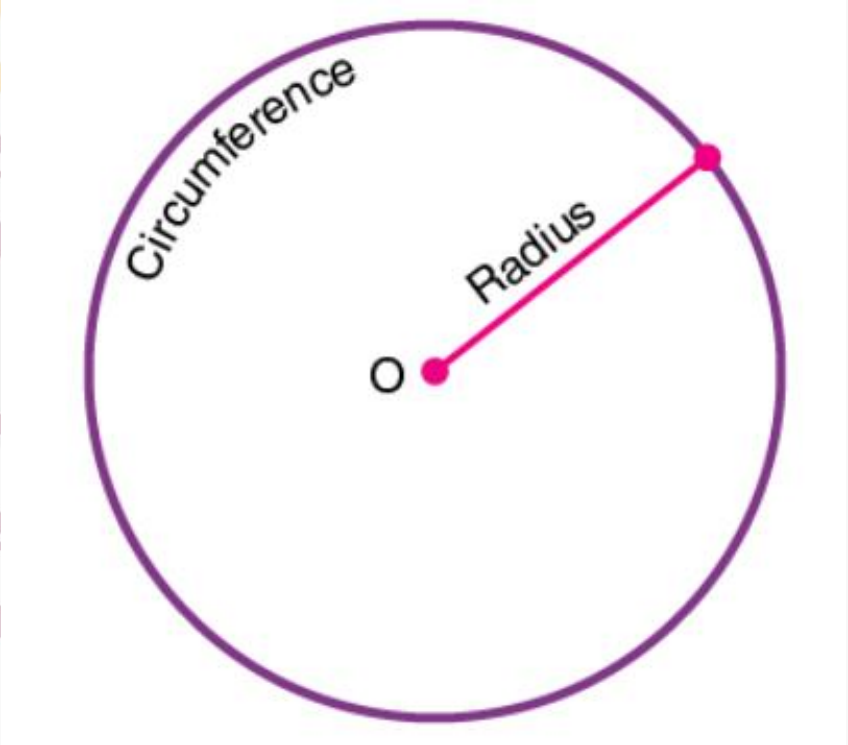
- **Parabola:** If the angle a is equal to α i.e., when the section plane C-C is parallel to the slant side of the cone, the curve at the section is a parabola. This is not a closed figure like circle or ellipse.
- **Hyperbola:** If the angle α is less than e (section plane D-D), the curve at the section is hyperbola.



Conic Sections:

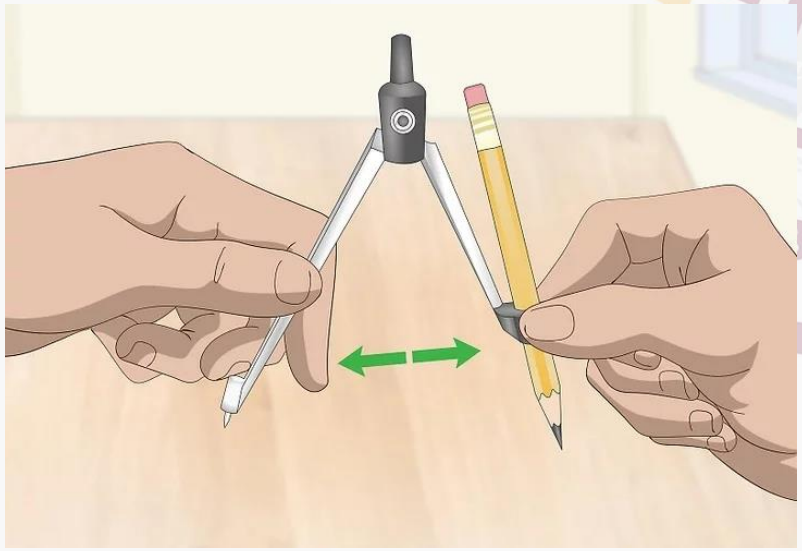
Circle:

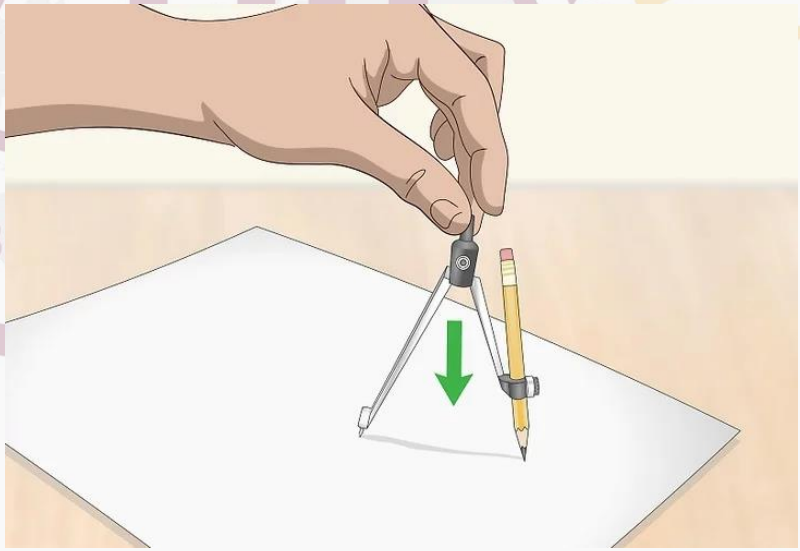
- A circle is a closed two-dimensional figure in which the set of all the points in the plane is equidistant from a given point called “centre”.

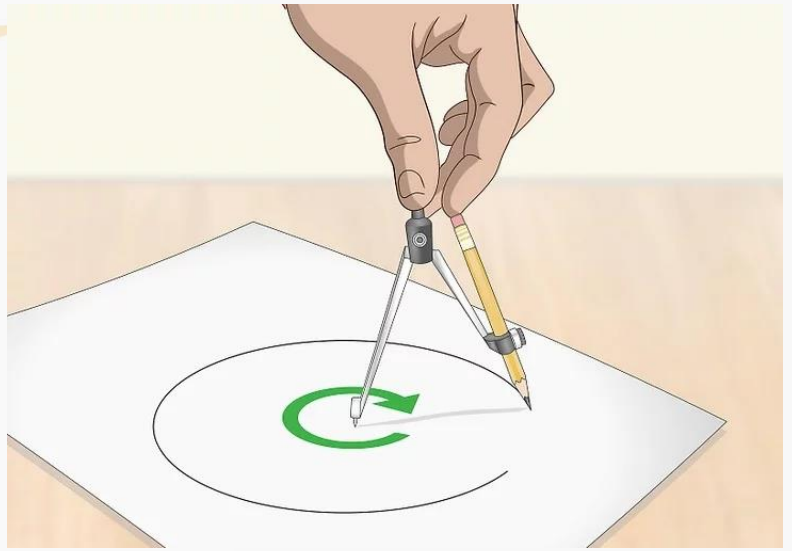


Conic Sections:

Draw a Circle:



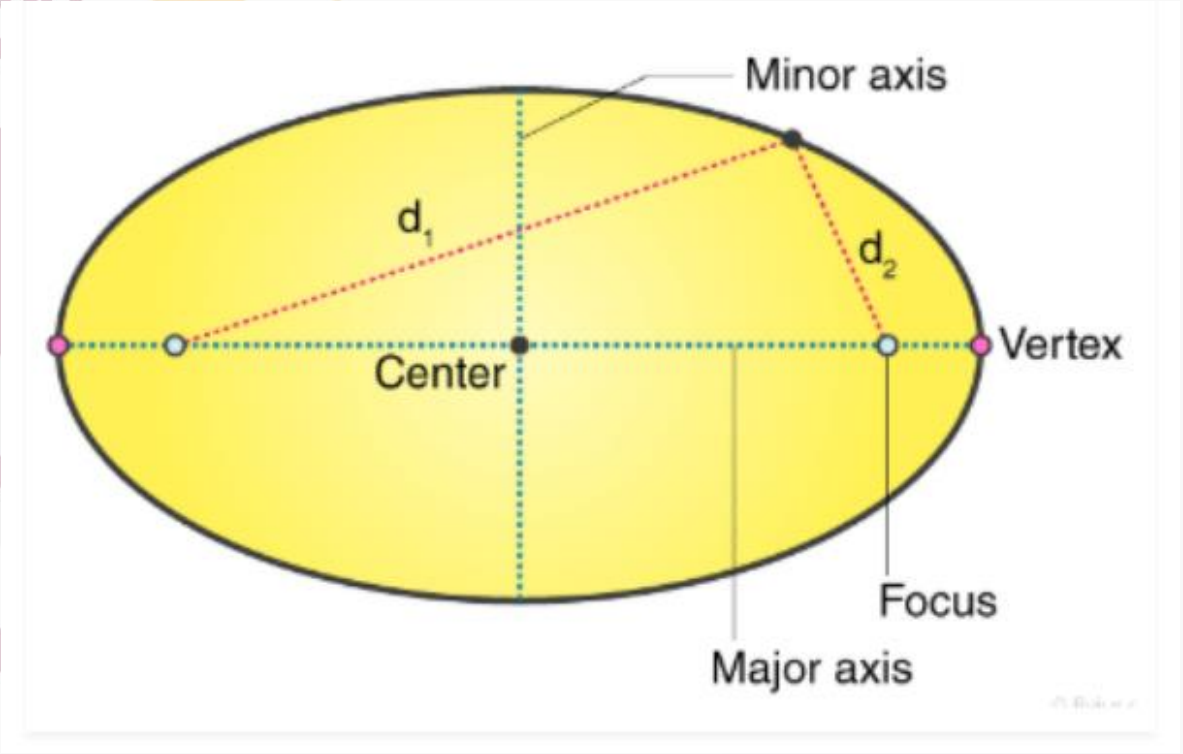




Conic Sections:

Ellipse:

- An ellipse is the locus of all those points in a plane such that the sum of their distances from two fixed points in the plane, is constant.
- The fixed points are known as the foci (singular focus), which are surrounded by the curve.
- The fixed line is directrix and the constant ratio is eccentricity of ellipse.
- Eccentricity is a factor of the ellipse, which demonstrates the elongation of it and is denoted by ‘e’.
- Any conic section can be defined as the locus of points whose distances to a point (the focus) and a line (the directrix) are in a constant ratio. That ratio is called the eccentricity, commonly denoted as e.



Conic Sections:

Draw an Ellipse:

Construct an ellipse when the distance of the focus from the directrix is equal to 50 mm and eccentricity is 2/3.

Eccentricity: $\frac{2}{3} = \frac{PF}{PC} = \frac{Distance\ from\ Focus}{Distance\ of\ the\ same\ point\ from\ the\ directrix}$

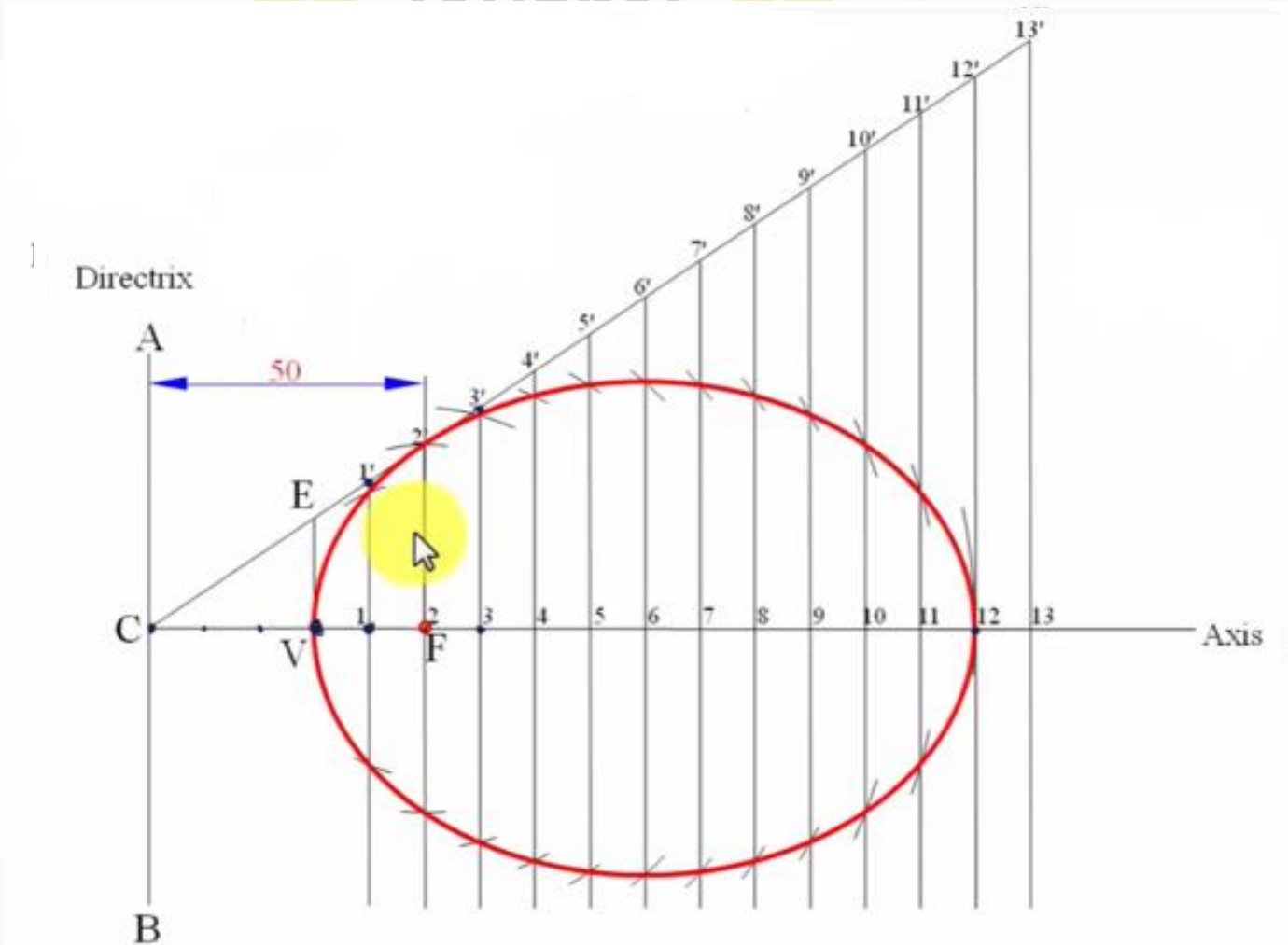
$$[PF + PC = 3 + 2 = 5]$$

Eccentricity: $\frac{2}{3} = \frac{VF}{VC} = \frac{Distance\ from\ Vertex\ to\ Focus}{Distacne\ from\ Vertix\ to\ C}$

Conic Sections:

Draw an Ellipse:

Construct an ellipse when the distance of the focus from the directrix is equal to 50 mm and eccentricity is 2/3.

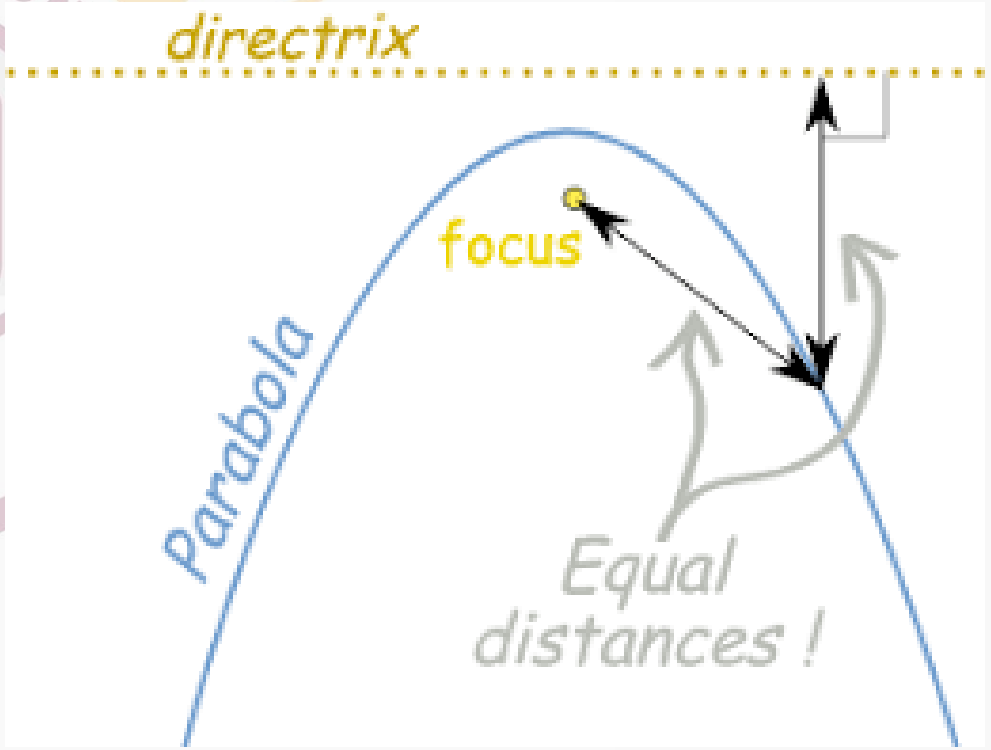


Take arc of radii	Put arc with F as center
1-1'	
2-2'	
3-3'	

Conic Sections:

Parabola:

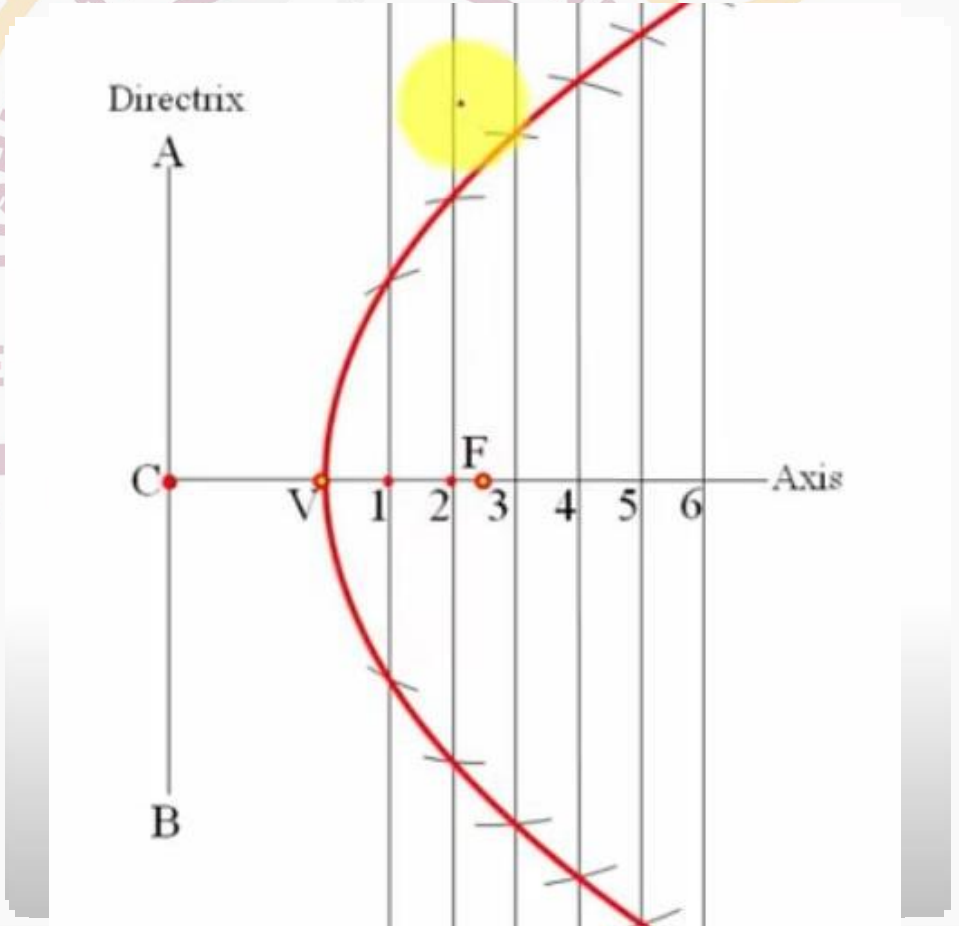
a parabola can be defined as a curve where any point is at an equal distance from the **directrix** (a line) and the **focus** (a point).



Conic Sections:

Draw a Parabola:

Construct a parabola when the distance of the focus from the directrix is equal to 50 mm.

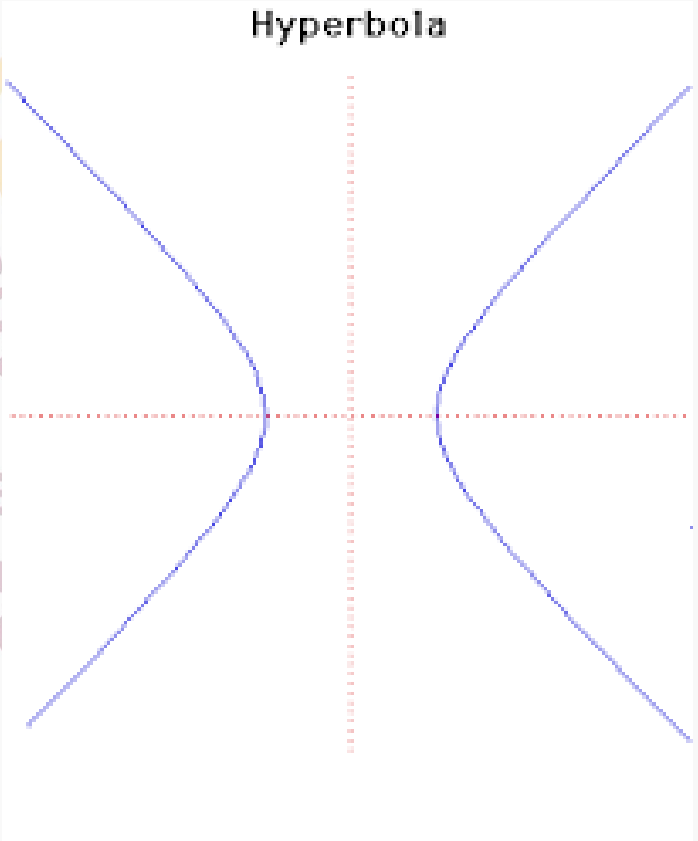


Take arc of radii	Put arc with F as center
C1	
C2	
C3	

Conic Sections:

Hyperbola:

A hyperbola is formed by the intersection of a plane perpendicular to the bases of a double cone.



Conic Sections:

Draw a Parabola:

Construct an ellipse when the distance of the focus from the directrix is equal to 50 mm and eccentricity is 3/2.

Eccentricity: $\frac{3}{2} = \frac{PF}{PC} = \frac{Distance\ from\ Focus}{Distance\ of\ the\ same\ point\ from\ the\ directtrix}$

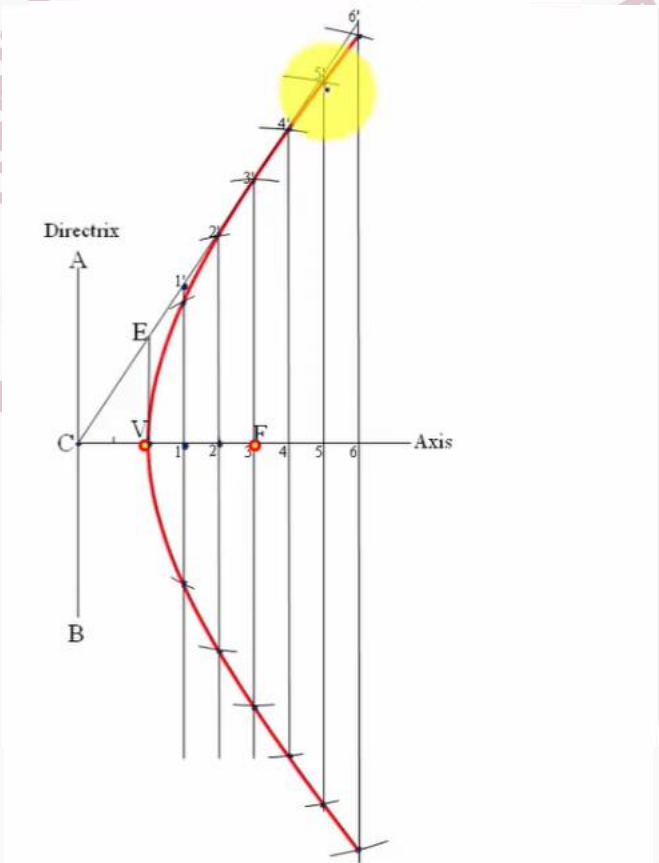
$[PF + PC = 3 + 2 = 5]$

Eccentricity: $\frac{3}{2} = \frac{VF}{VC} = \frac{Distance\ from\ Vertex\ to\ Focus}{Distacne\ from\ Vertix\ to\ C}$

Conic Sections:

Draw a Parabola:

Construct a parabola when the distance of the focus from the directrix is equal to 50 mm and eccentricity is 3/2.



Take arc of radii	Put arc with F as center
1-1'	
2-2'	
3-3'	

Important Note:

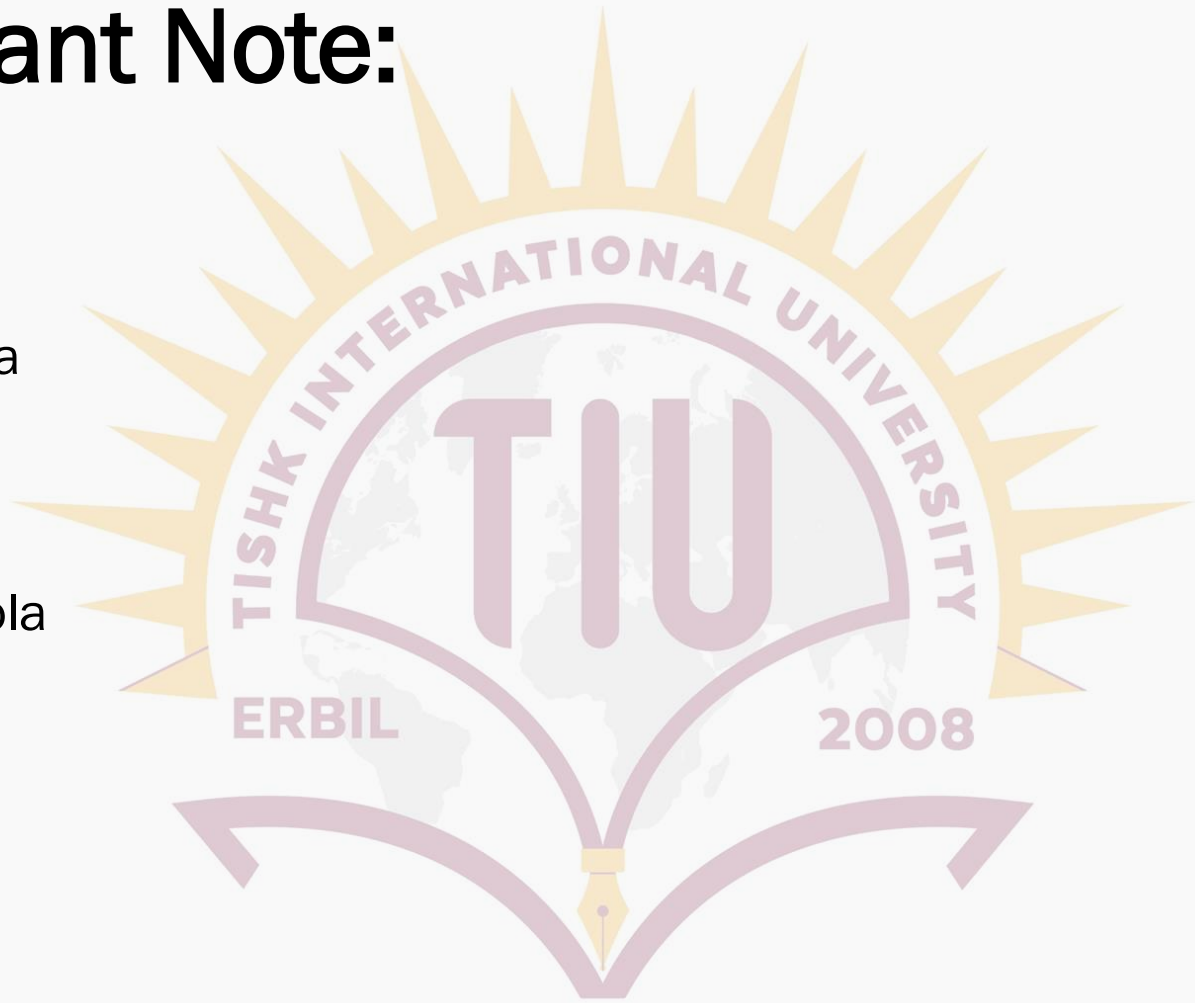
When

e= 1, Parabola

e< 1, Ellipse

e> 1, Hyperbola

e= 0, Circle



Homework 5.1:

1. Construct a parabola when the distance of the focus from the directrix is equal to 100 mm and eccentricity is 3/2.
2. Construct a parabola when the distance of the focus from the directrix is equal to 100 mm.
3. Construct an ellipse when the distance of the focus from the directrix is equal to 100 mm and eccentricity is 2/3.

Homework 5.2:

4. Draw the parabola again with a reduction scale of 1:2.

5. Draw the parabola again with an enlargement scale of 2:1.

6. Draw the ellipse again with a reduction scale of 1:2.