SRM
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University u/s 3 of UGC Act, 1956)

18MES101L – Engineering Graphics and Design

Week 2

E2- Conic sections and special curves

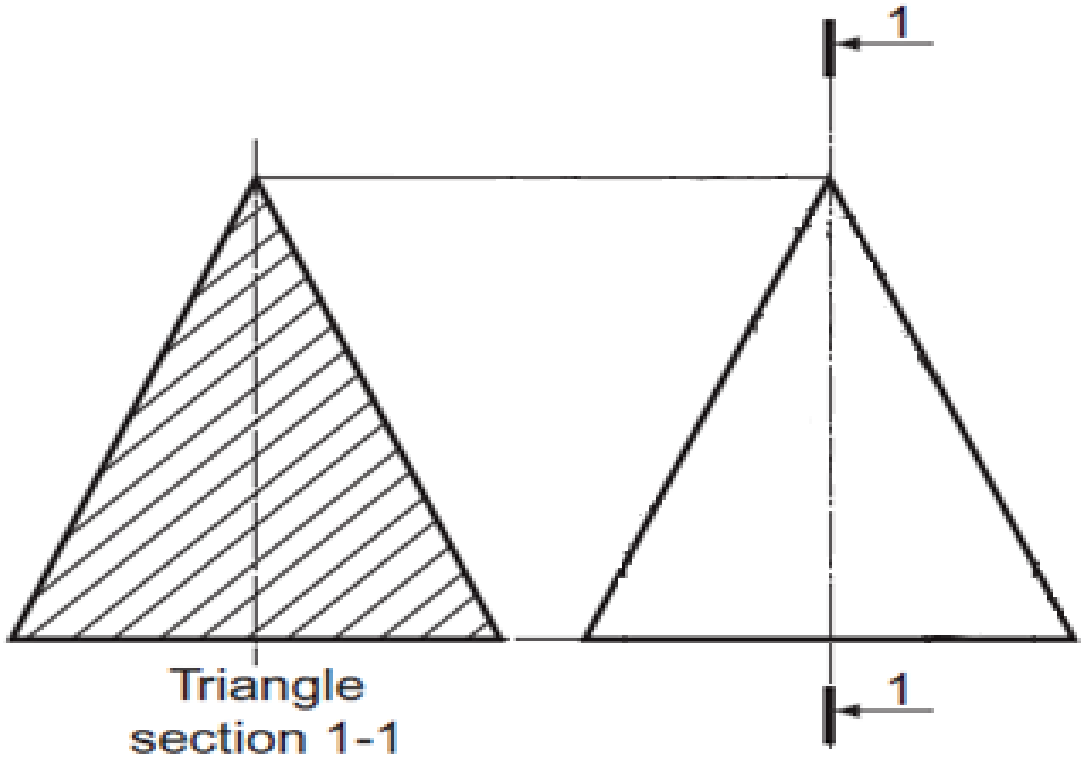
Conics

- When a cone is cut by a plane, the curve formed along the section is known as a conic.

- A cone may be cut by different section planes to obtain the different conic sections.

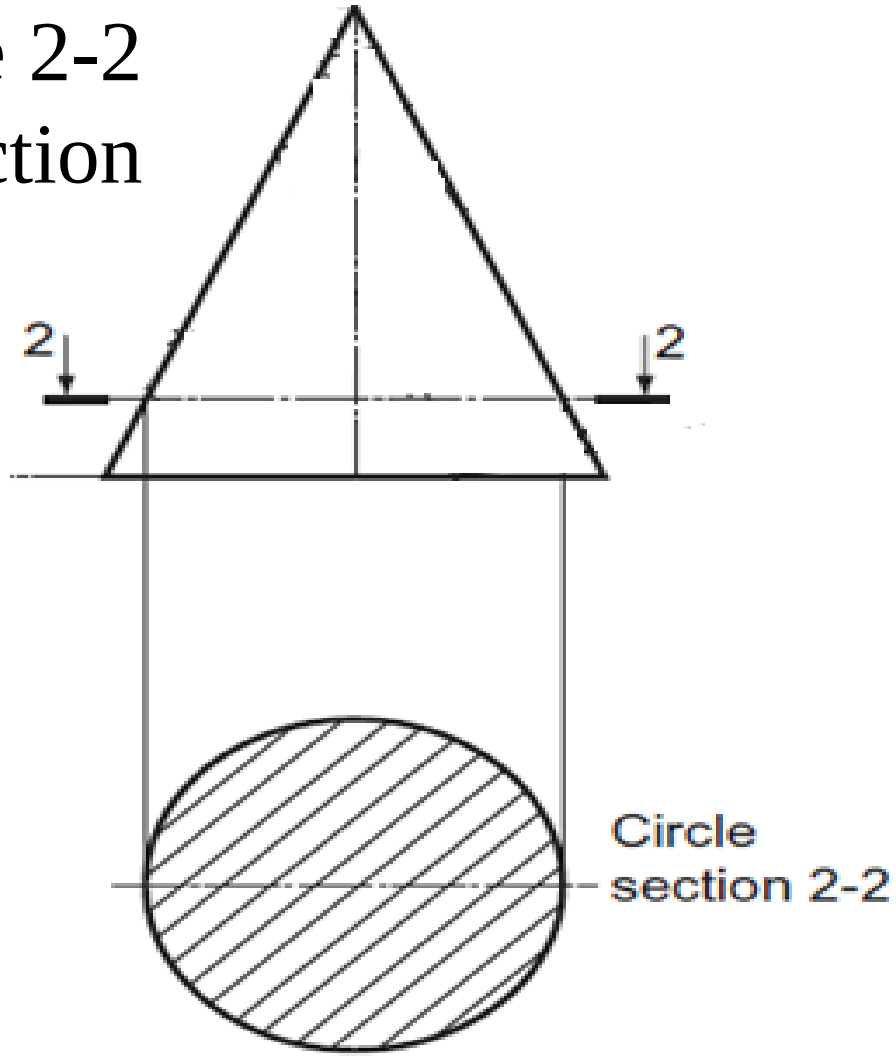
Triangle

When a cone is cut by a section plane 1-1, passing through the axis, then the section obtained is a triangle.



Circle

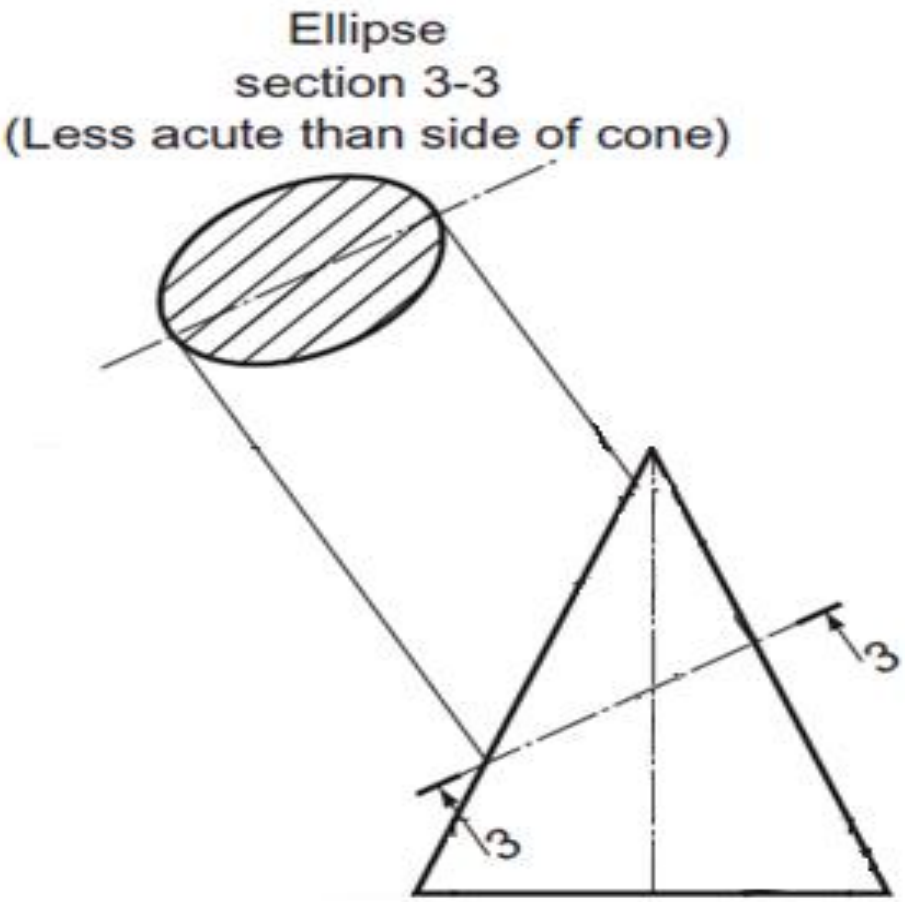
When a cone is cut by a section plane 2-2 perpendicular to the axis, then the section obtained is a circle.



Ellipse

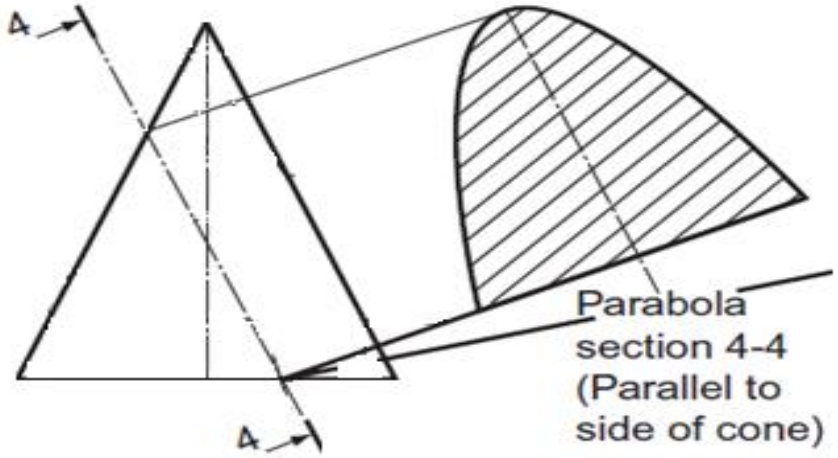
When a cone is cut by a section plane 3-3 at an angle α, $90° > \alpha > \theta$ (½ apex angle), the curve of the section is an ellipse.

Its size depends on the angle α and the distance of the section plane from the apex of the cone.



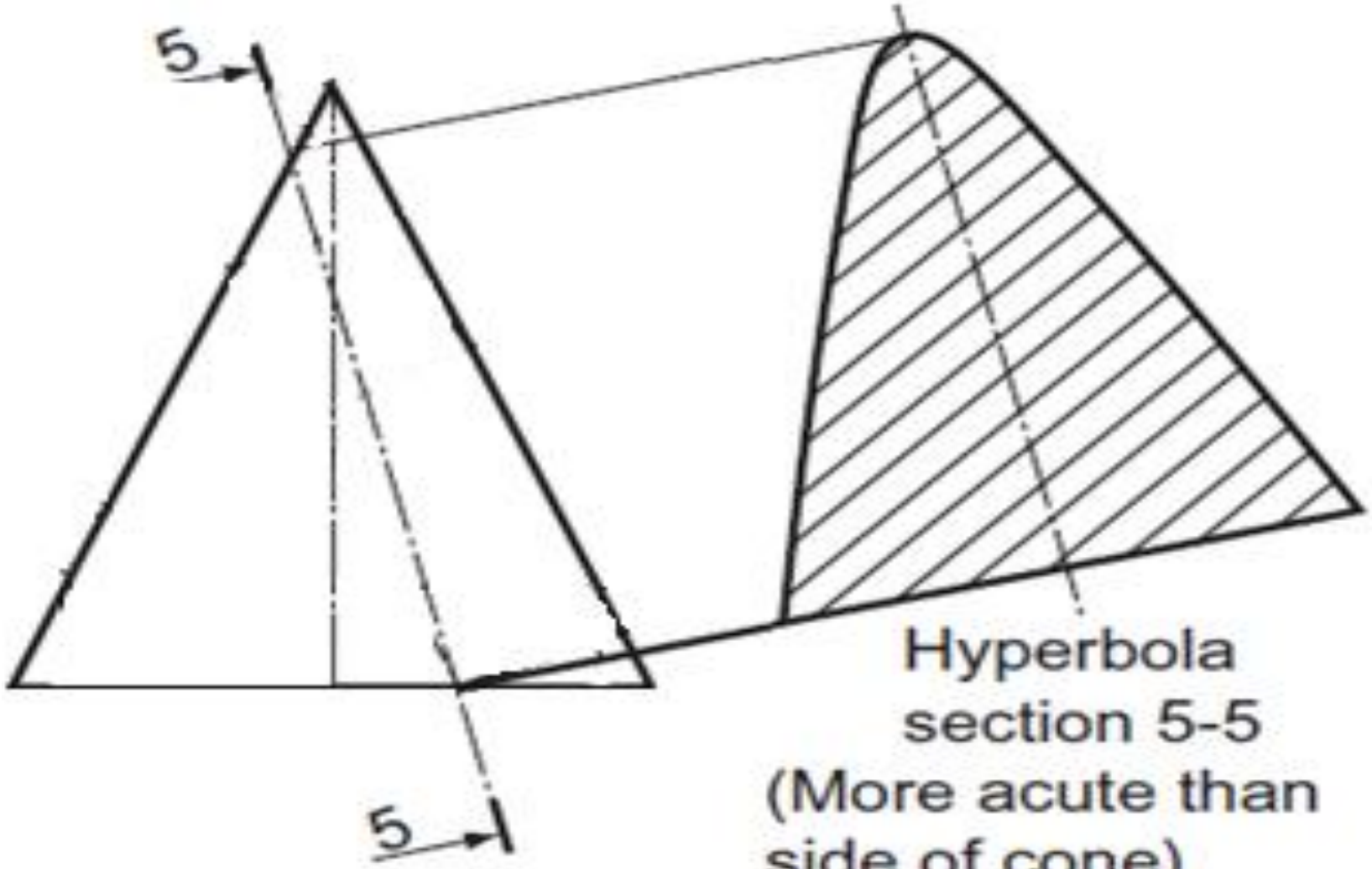
Parabola

- When a cone is cut by a section plane 4-4 parallel to the slant side of the cone, then the curve at the section is a parabola.
- This is not a closed figure like circle or ellipse.
- The size of the parabola depends upon the distance of the section plane from the slant side of the cone.

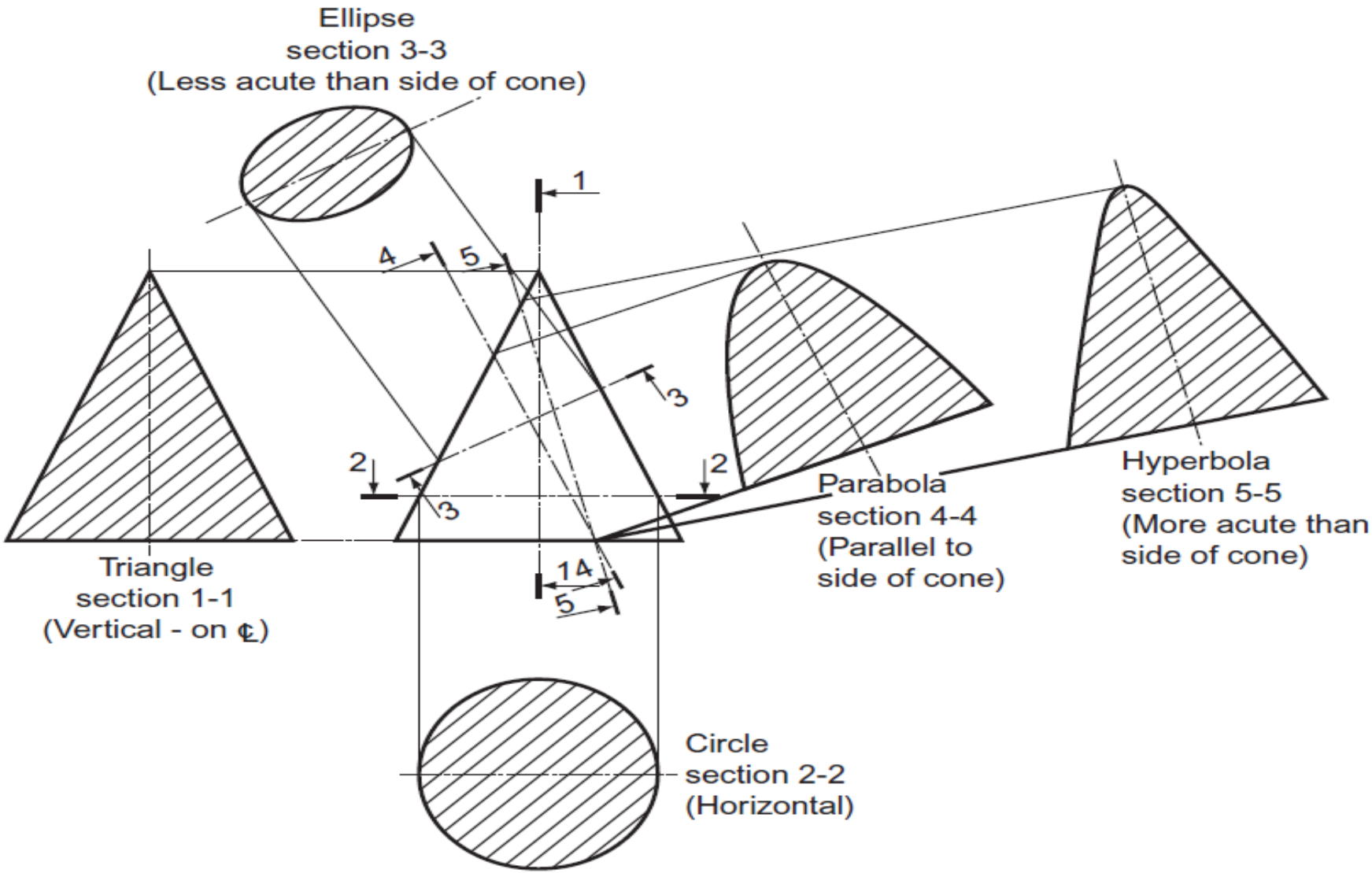


Hyperbola

- When a cone is cut by a section plane 5-5 at an angle $\alpha < \theta$ (½ apex angle), the curve of the section is a hyperbola.
- The section will be a hyperbola, if $\alpha = \theta$, provided the section plane is not passing through the apex of the cone.
- However if the section plane passes through the apex, the section produced is an isosceles triangle.


5
5
Hyperbola
section 5-5
(More acute than
side of cone)

Conic section

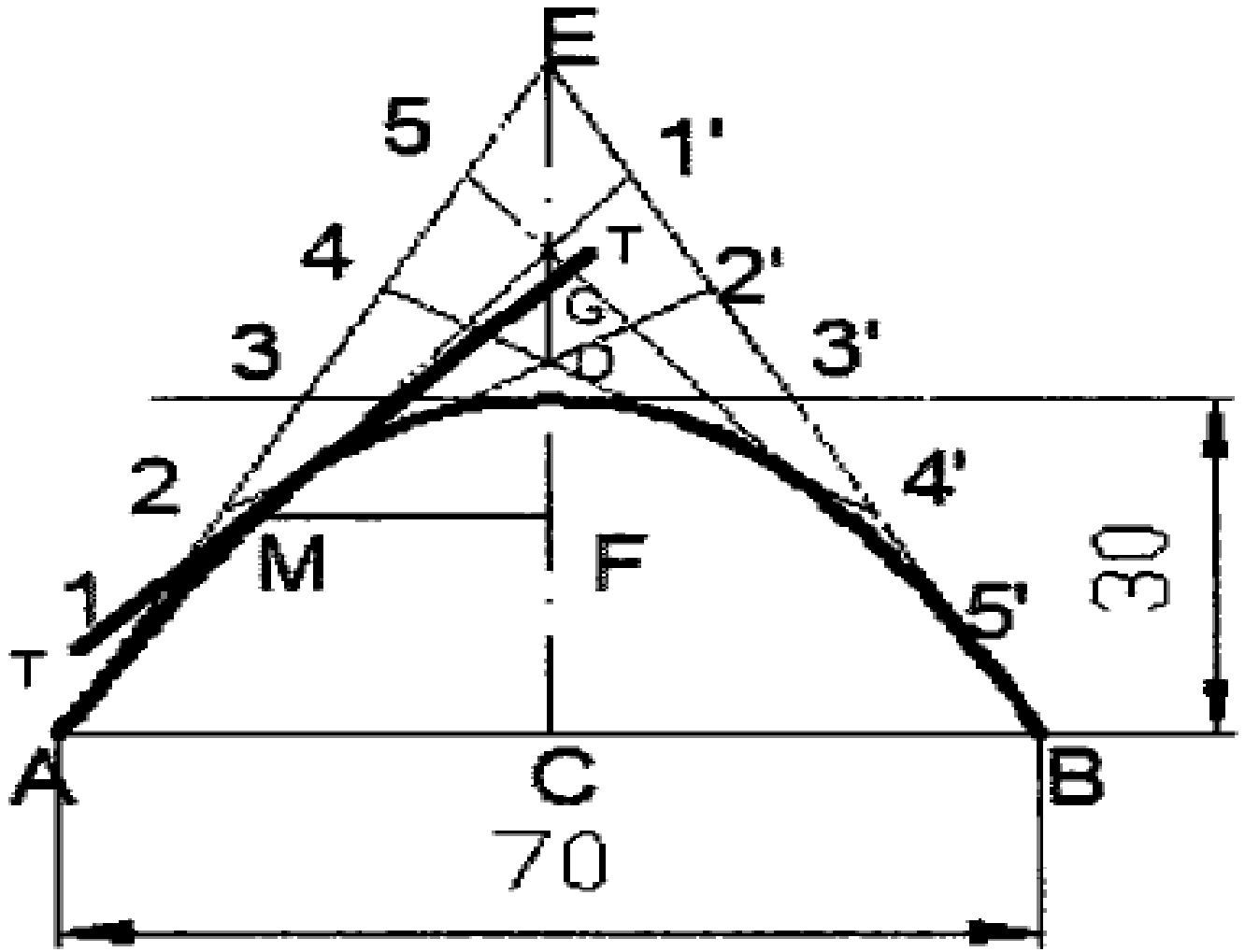


Construction of conic sections

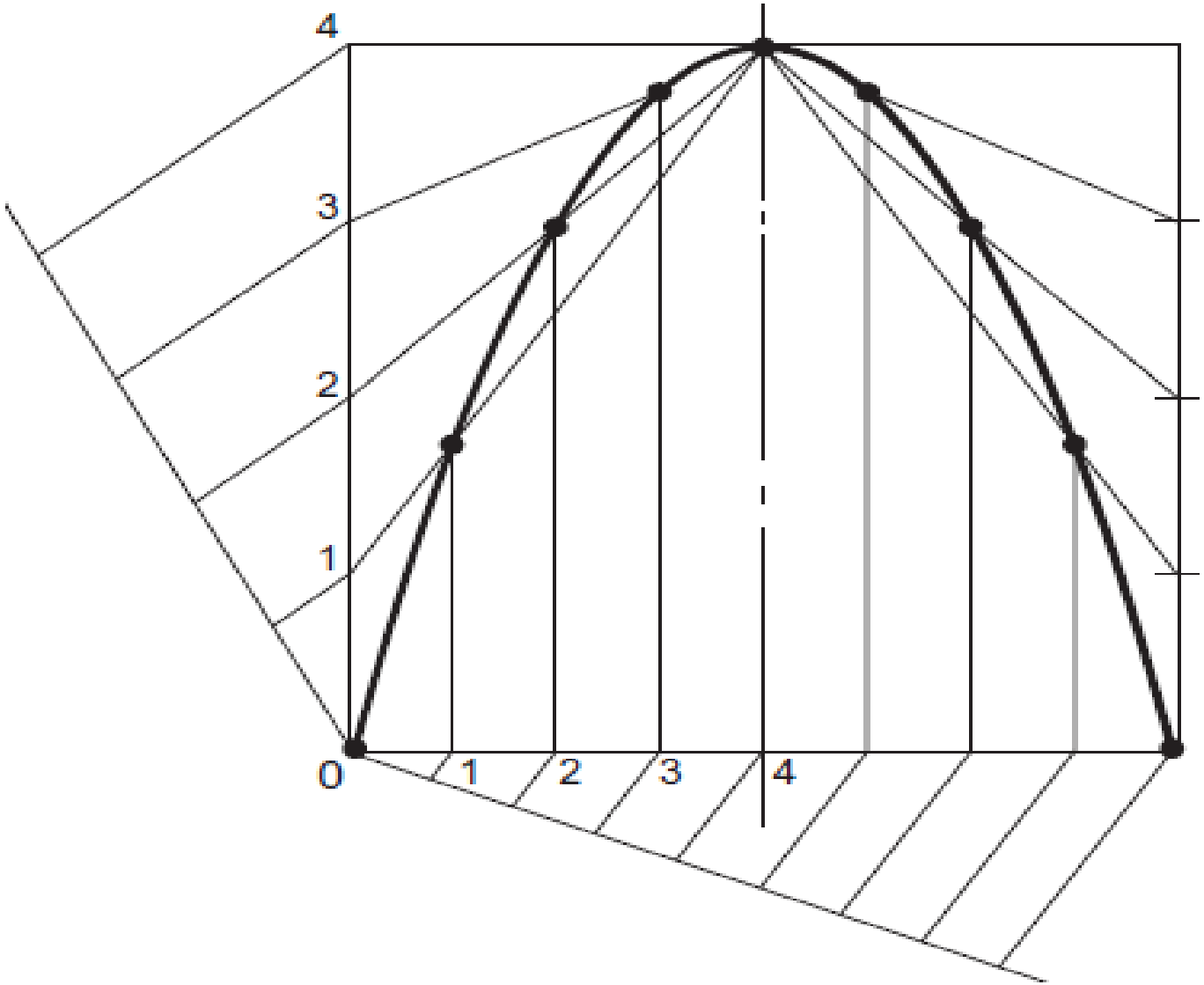
Parabola:

- Tangent method
- Rectangle method

Parabola – Tangent method



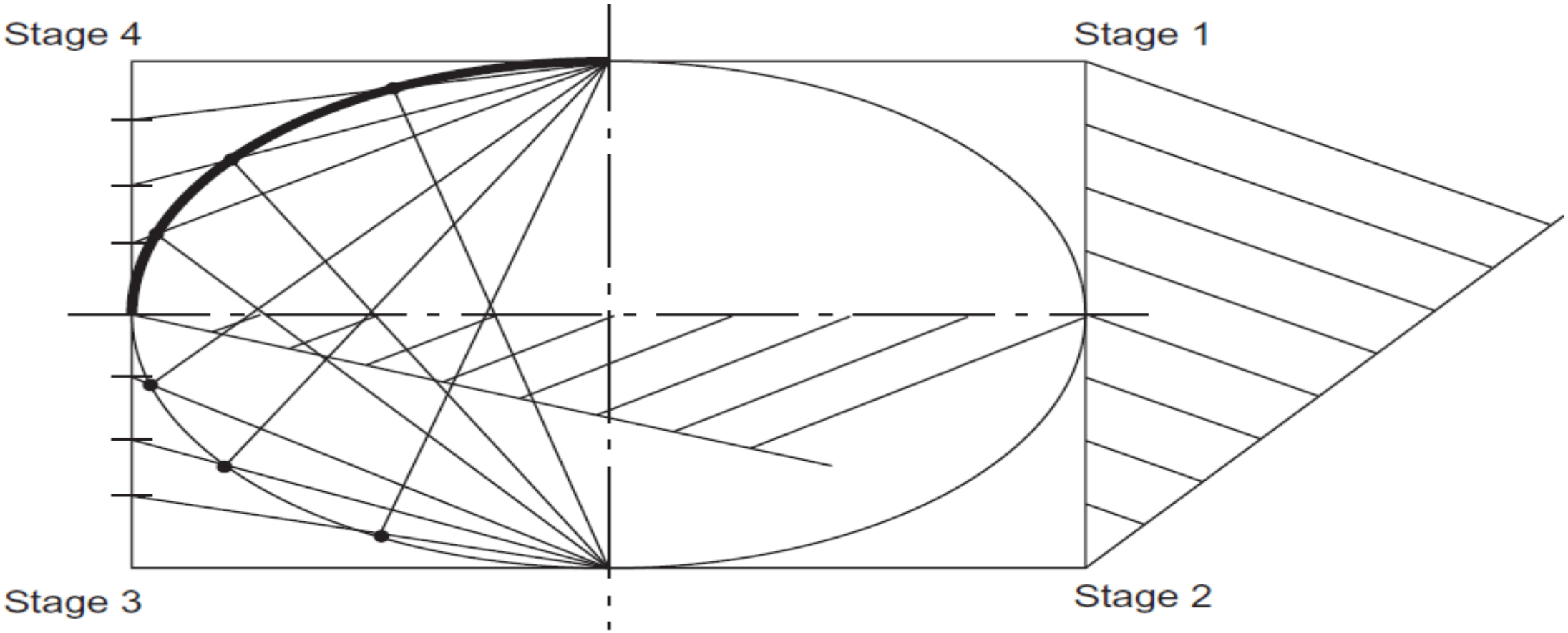
Parabola – Rectangle method



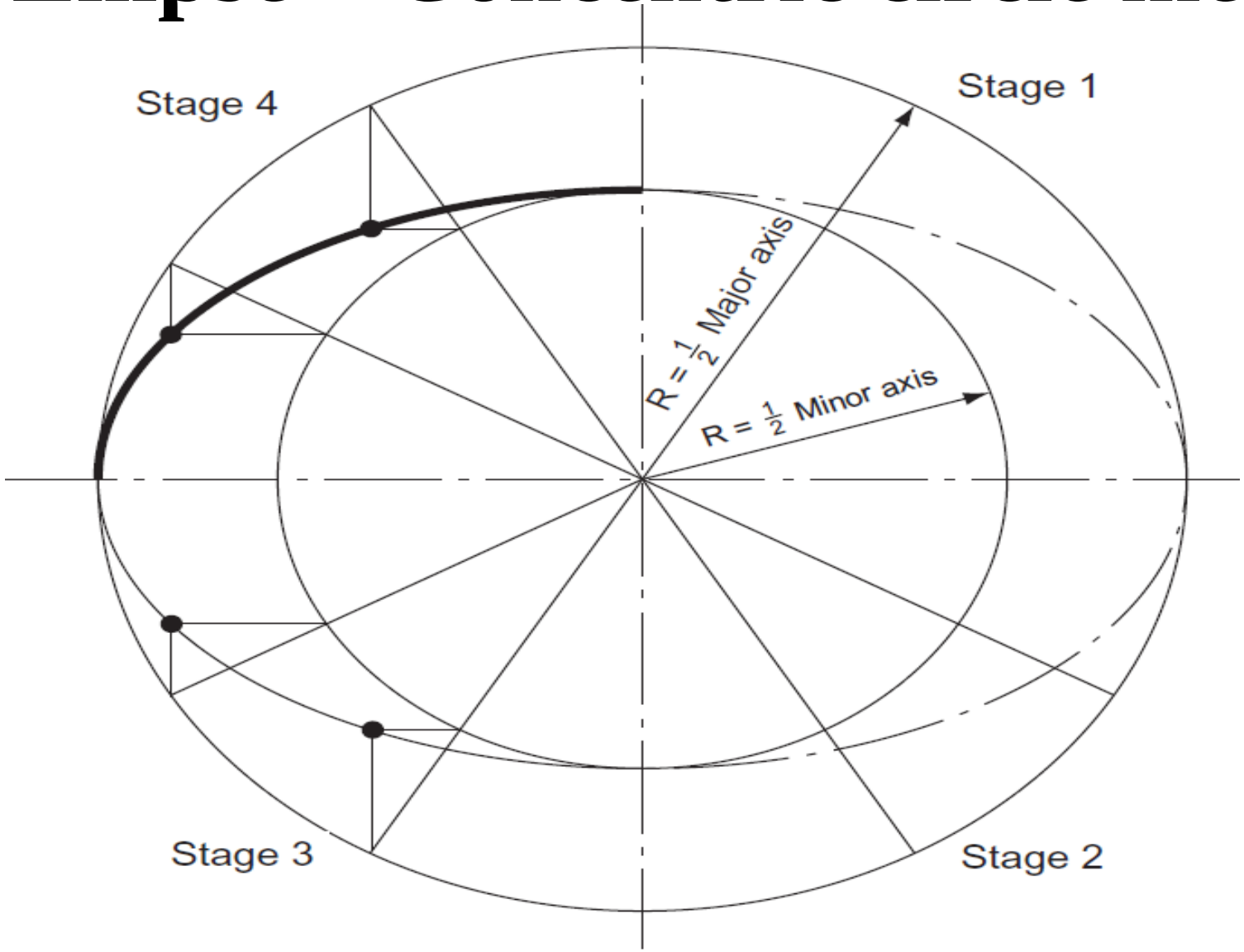
Ellipse

- Oblong method
- Concentric circle method

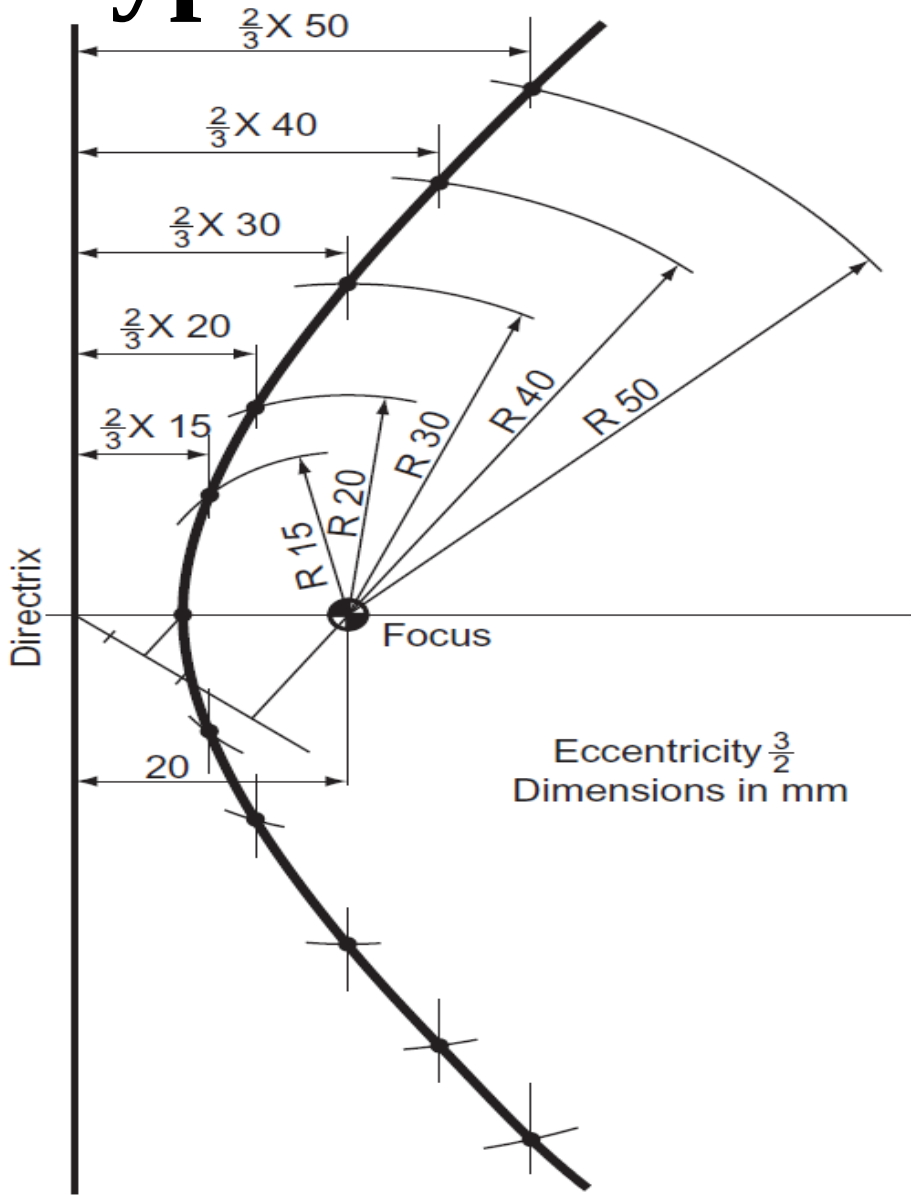
Ellipse – Oblong method



Ellipse – Concentric circle method



Hyperbola – Eccentricity method



Eccentricity

Eccentricity is the factor related to conic sections which shows how circular the conic sections. More the eccentricity less circular the shape is and more the eccentricity less circular the shape is. The eccentricity of the line is ∞. The two conic sections will be of same shape if they have same eccentricity. A conic section is defined as the locus of all points whose distances to a point (the focus) and a line (the directrix) are in a constant ratio. This ratio is called Eccentricity. It is denoted by“e”.

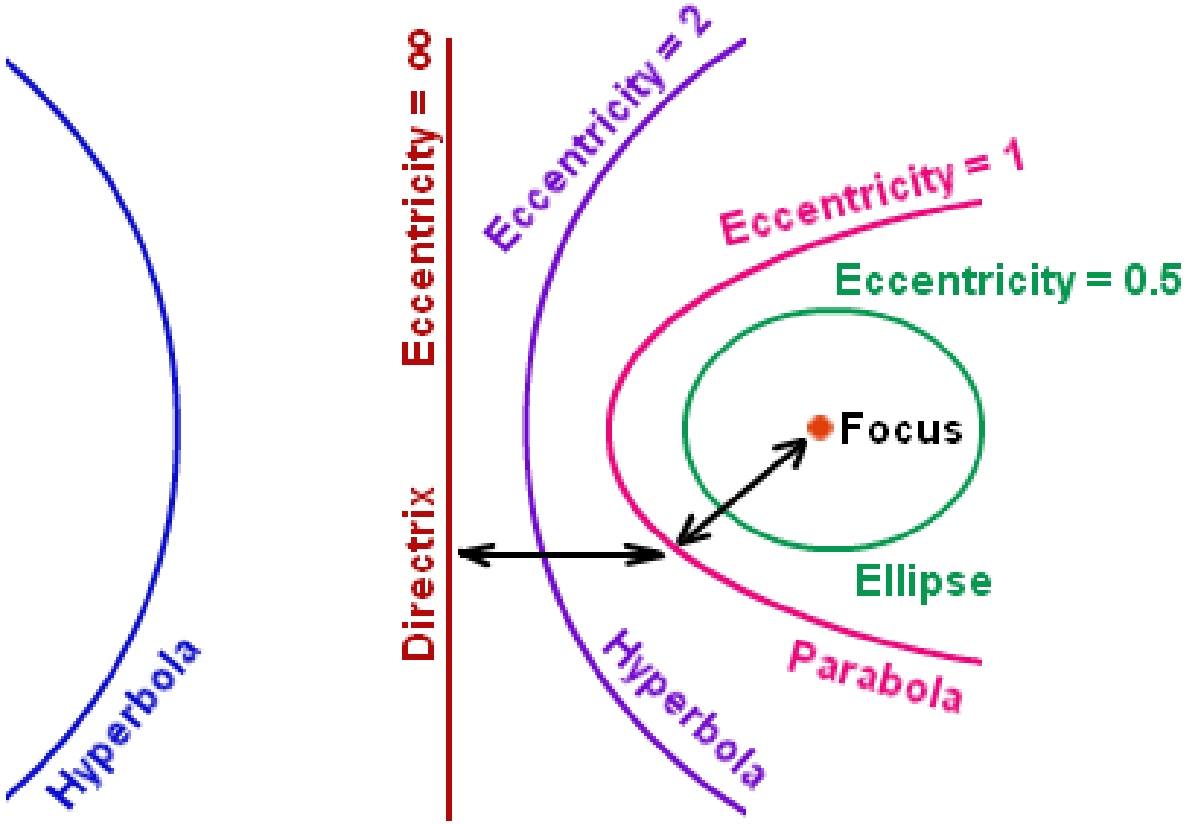
Eccentricity of circle is 0.

Eccentricity of ellipse is $0 < e < 1$.

Eccentricity of parabola $e = 1$.

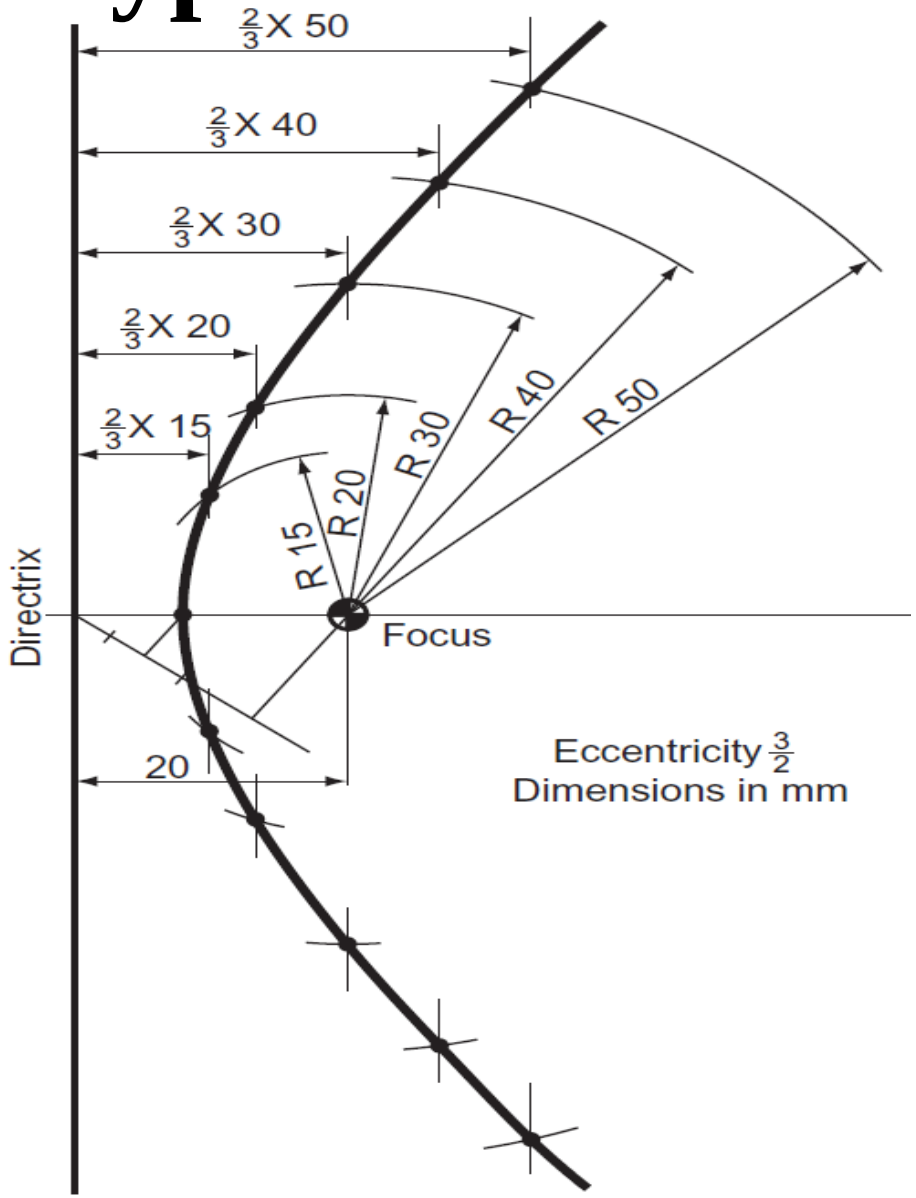
Eccentricity of hyperbola $e > 1$.

Eccentricity

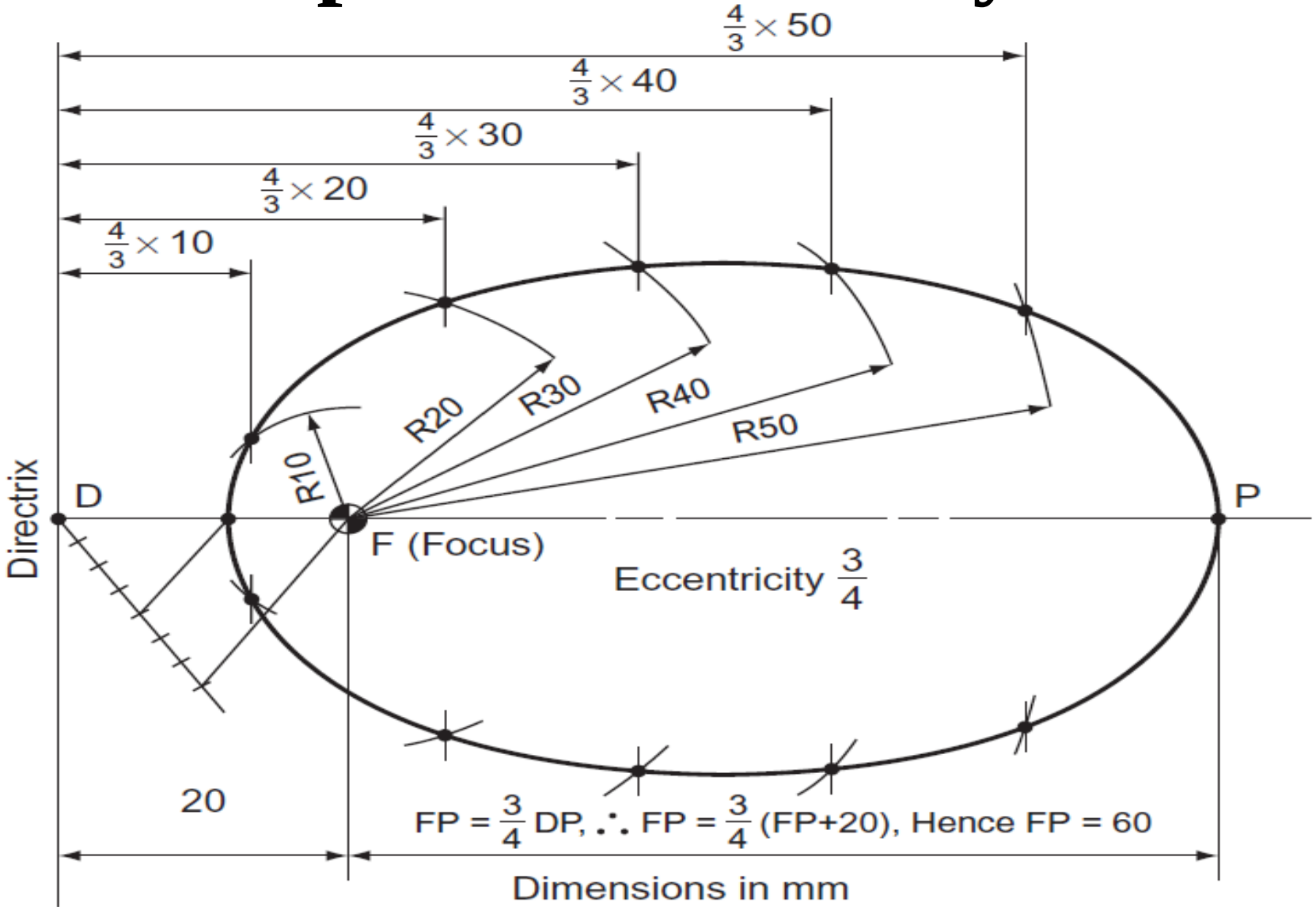


https://www.askiitians.com/iit-jee-mathematics/coordinate-geometry/conic-sections/

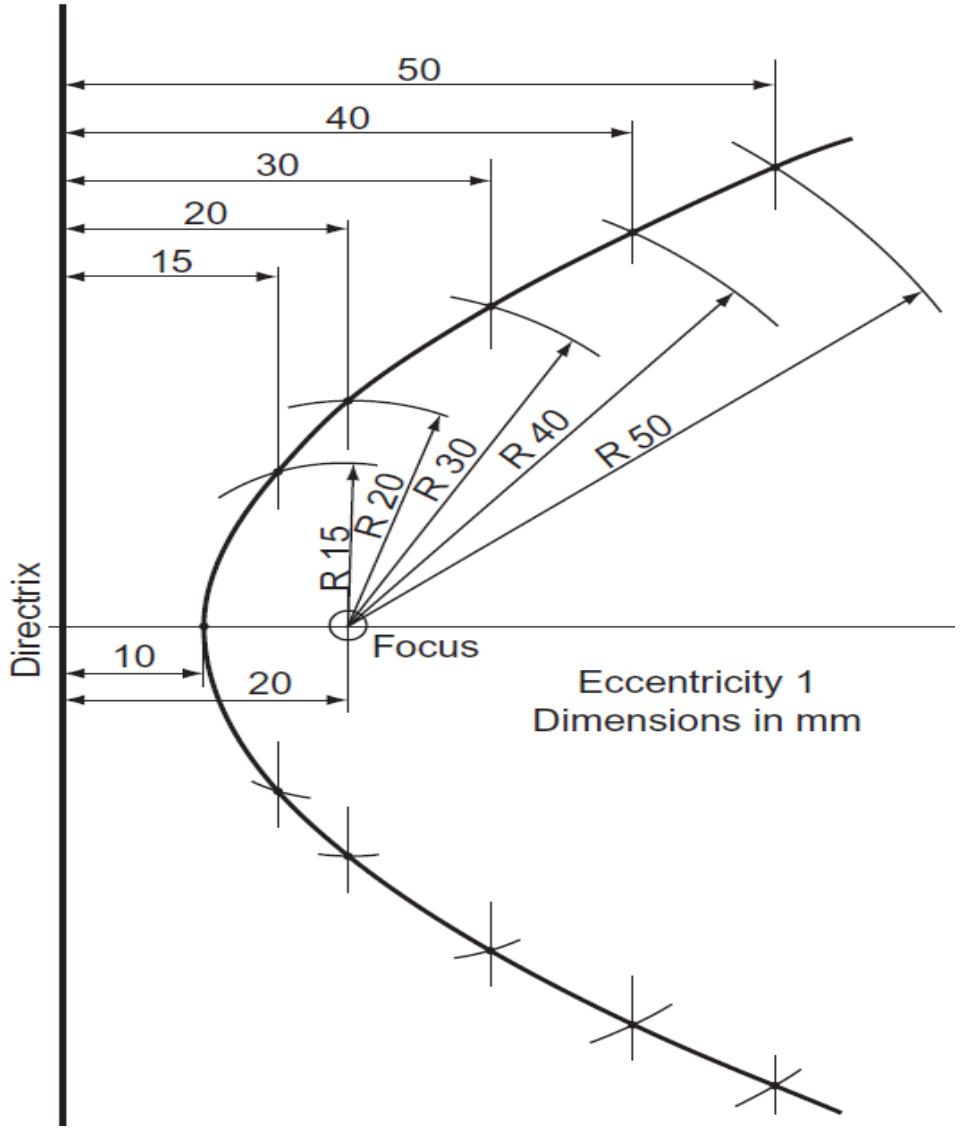
Hyperbola – Eccentricity method



Ellipse – Eccentricity method



Parabola – Eccentricity method

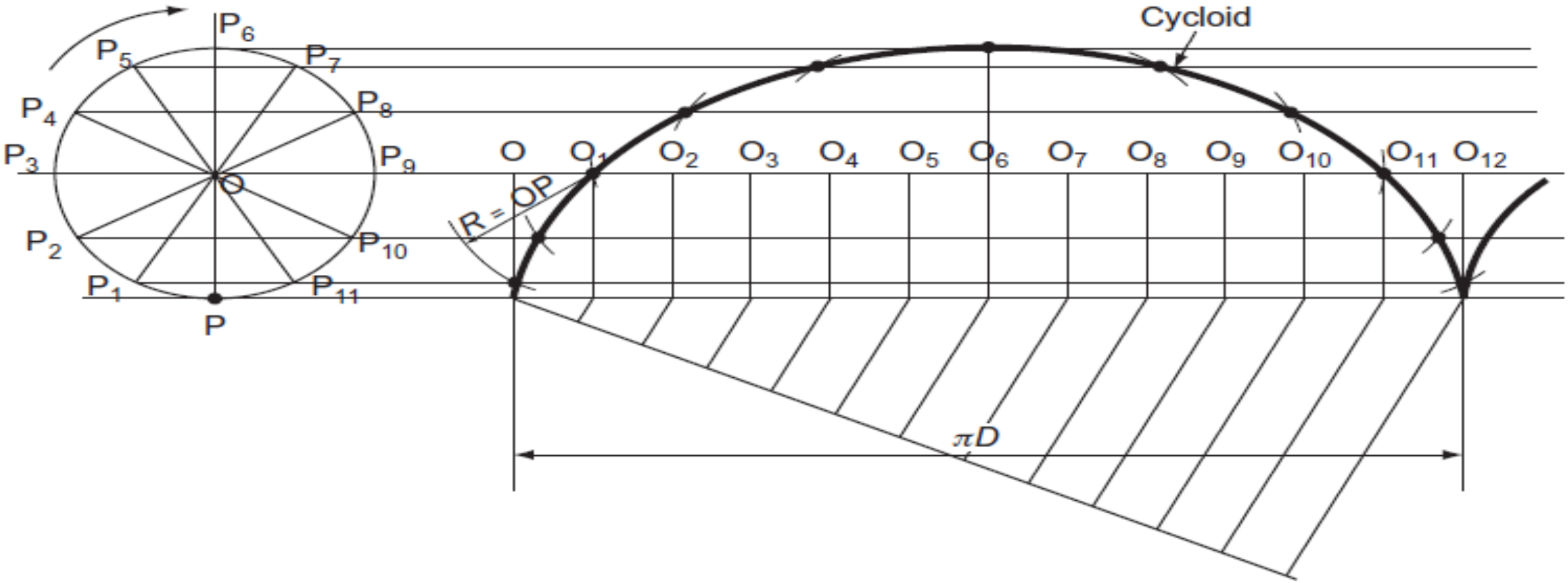


Special curves

- **Cycloid**
- Epi – cycloid
- Hypo – cycloid
- Trochoid
- Involute
- **Spiral**
- Helix

- A **cycloid** is the curve traced by a point on a circle as it rolls along a straight line without slipping.
- The **involute of a circle** is the path traced out by a point on a straight line that rolls around a **circle**.
- The **Archimedean spiral** has the property that any ray from the origin intersects successive turnings of the **spiral** in points with a constant separation distance.
- Spiral is a plane curve generated by a point moving around a fixed point while constantly receding from or approaching it.

Cycloid


Cycloid
P
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
O
O1
O2
O3
O4
O5
O6
O7
O8
O9
O10
O11
O12
R = OP
πD

Spiral