111U06C105 – Engineering Drawing

Module
Section and Development of Solids

Introduction

When the surface of solid is considered to be completely opened out and laid on a plane, then surface is said to be developed and such a shape and size, which can be folded or formed to make the required object is called the ***Development of Surface****. It can also be stated as a process of unfolding all the surfaces of an object.*

Application of Development of Surfaces in Engineering Products

Sheet metal working is based on the knowledge of development of surfaces. Products like tanks, boiler's, funnels, hopper's, bins, airconditioning ducts, aeroplane parts, ship parts, chimneys etc. are made from flat sheets of metal. The metal sheets are cut as per the size required and is fabricated into the desired shapes.

Methods of development

Parallel line method

If stretch out lines principle is used in case of prism and cylinder, we get the development of surfaces by parallel line method because the vertical edges of prism and generators of cylinder are parallel to each other.

Radial line method

If stretch out lines principle is used in case of pyramid and cone, we get the development of surfaces by radial method because the slant edges of pyramid and generators of cone are uniform in true length and radiates from apex in each case.

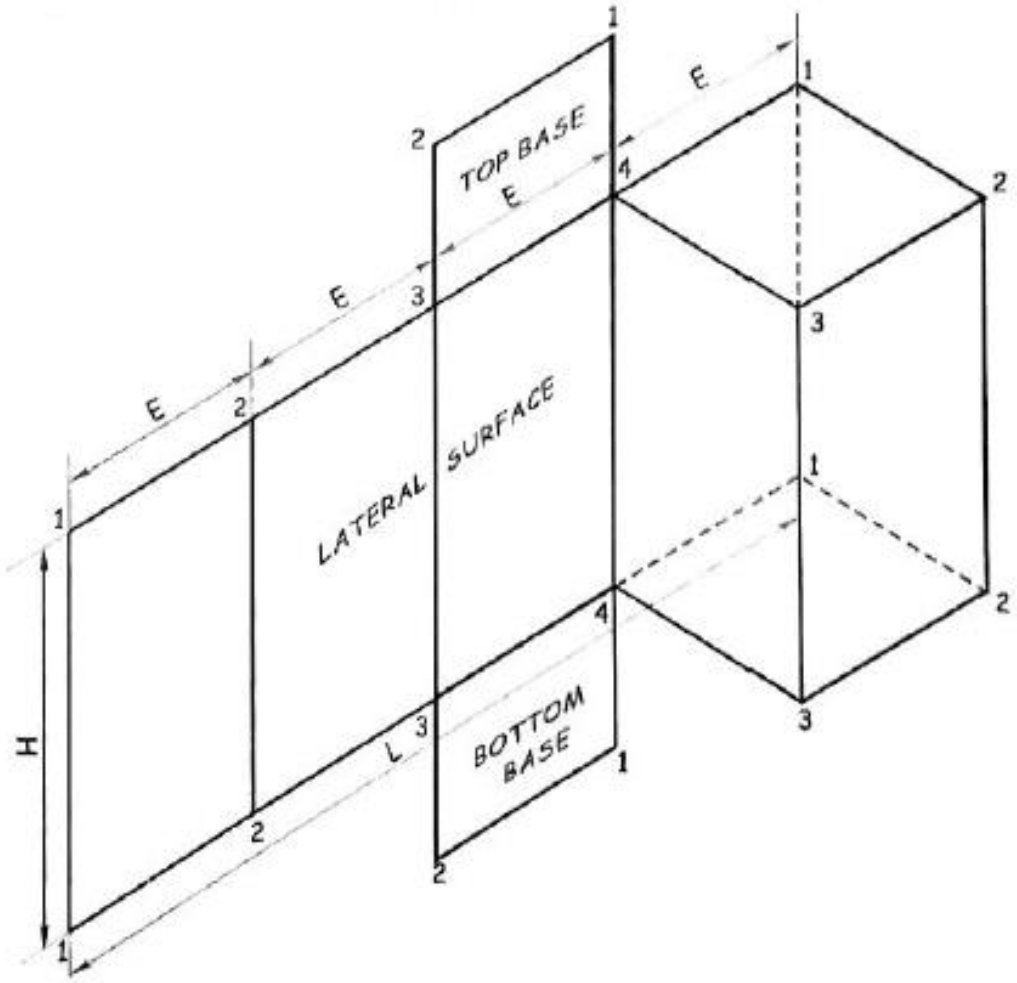
Introduction contd…

Development of Prism

development of lateral surface of a prism is obtained by placing a number of rectangular face one adjacent to the other, equal to the number of edges of base. Hence the development of lateral surface of prism is represented as

Rectangle of size = Height × Perimeter of base
= H × L
= H × n × E

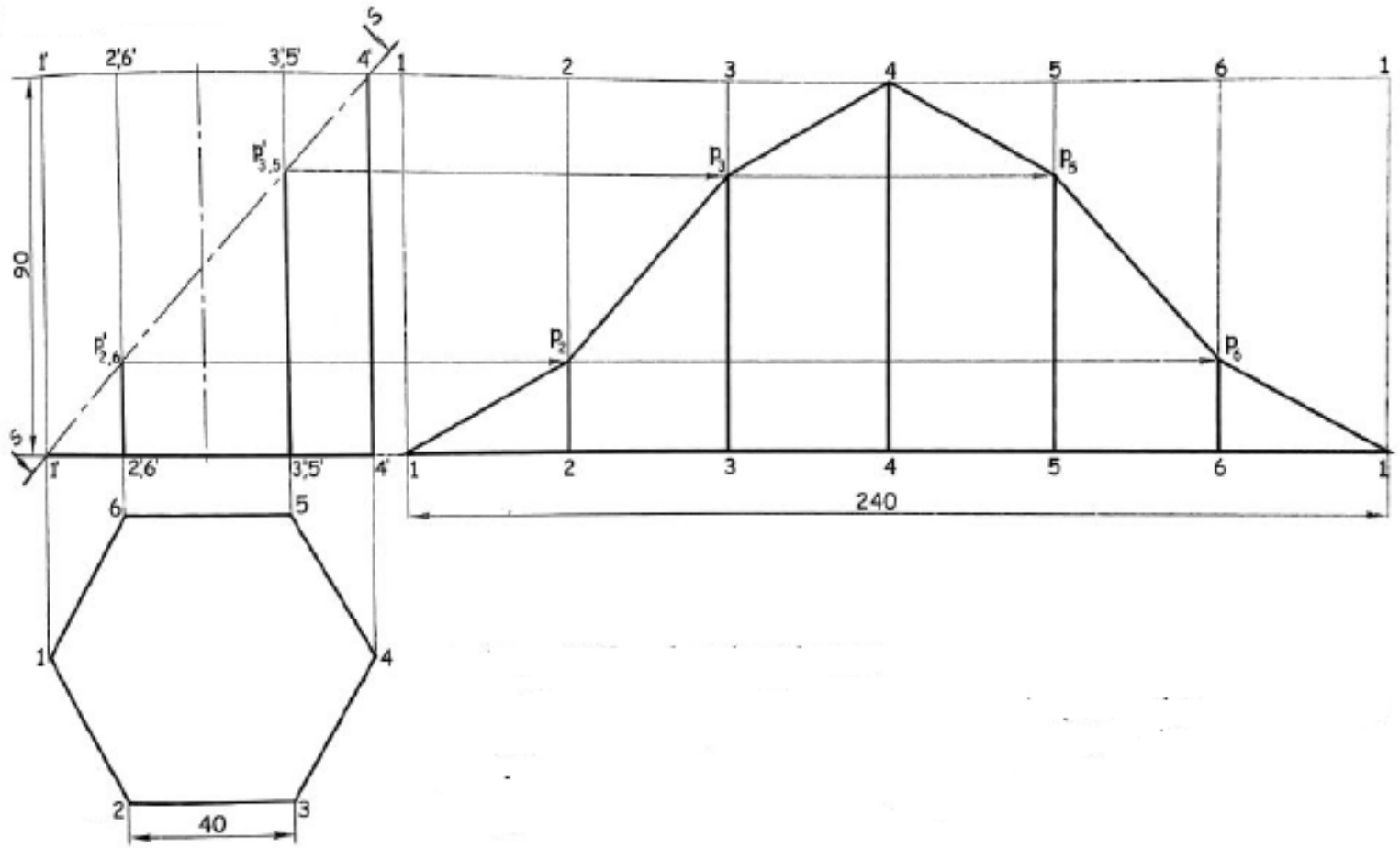
where H = Height of prism
n = Number of edges of base
L = Perimeter of base
E = Length of the edge of base



Introduction contd…

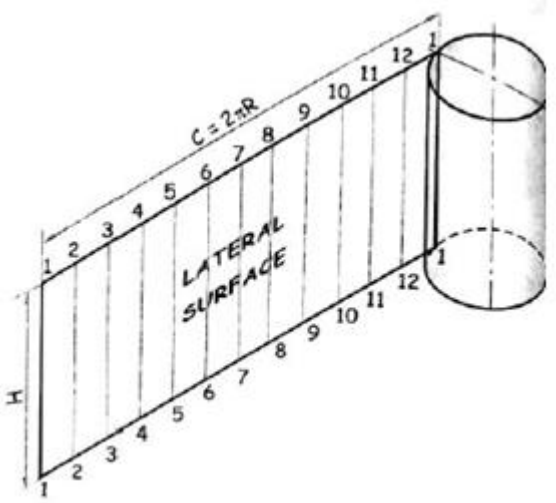
A hexagonal prism side of base 40 mm, axis height 90 mm has its two sides of base parallel to V.P. A section plane, cut the prism such that section plane passes through extreme left bottom corner to extreme right top corner of prism. Show the development of lateral surface of half cut prism.

Solution



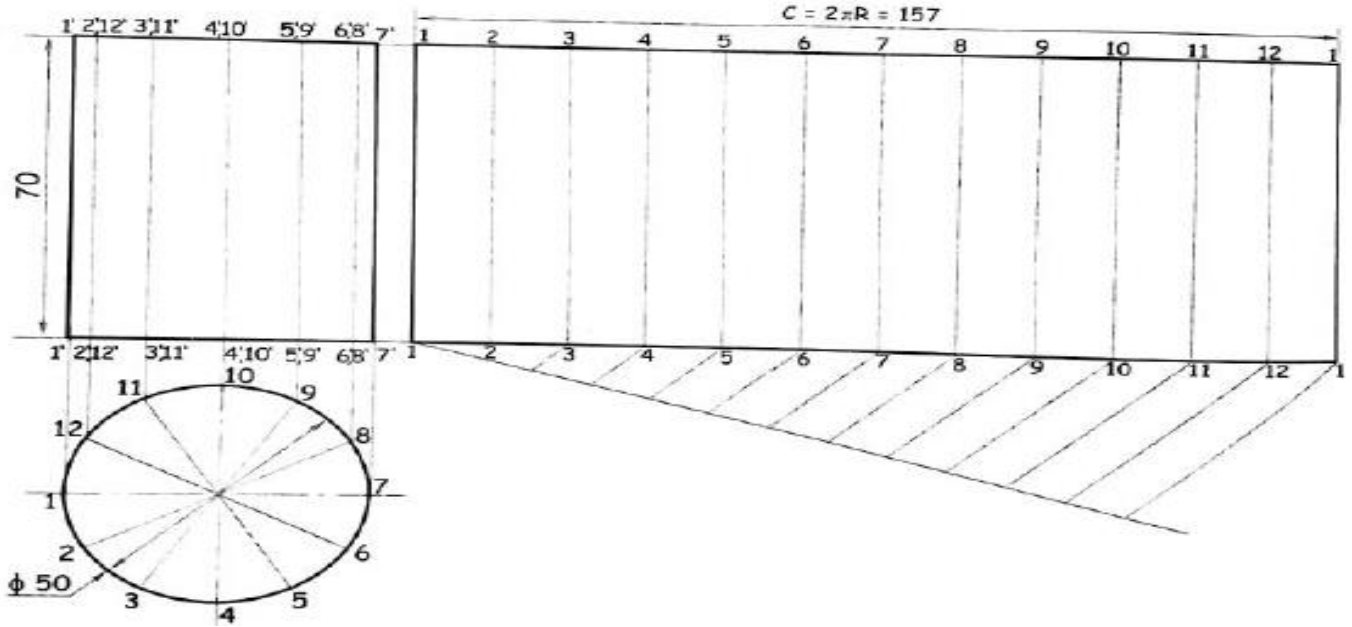
Development of Cylinder

If cylinder is rolled for one complete revolution on a plane then it moves the distance equal to circumference of its base circle. The area covered by it in one revolution will be equal to its Development of Lateral Surface (D.L.S.) which is a rectangle of sides equal to the circumference (C) of its base circle and the height (H) of the cylinder.



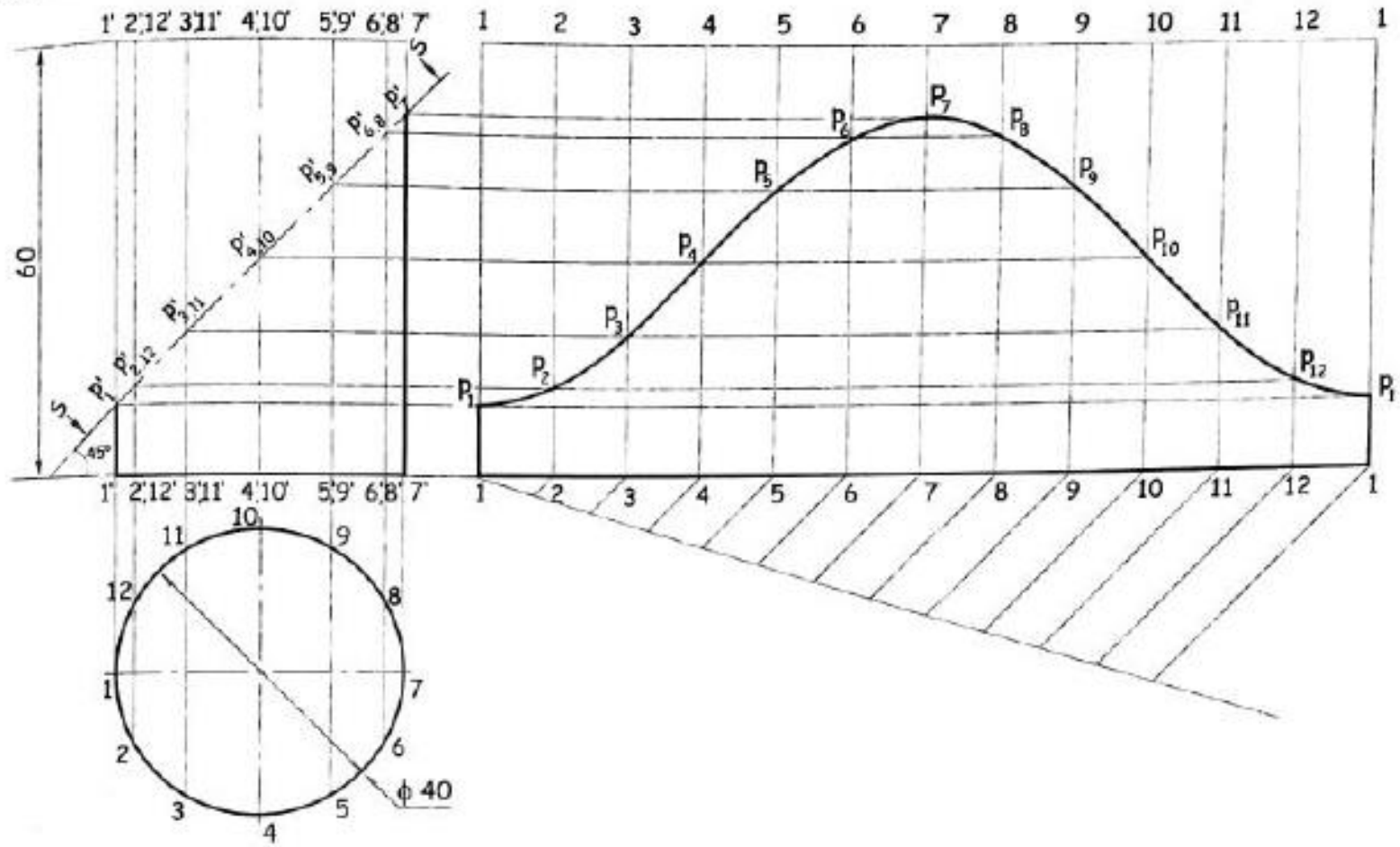
A right circular cylinder of base diameter 50 mm and axis height 70 mm is resting on it's base on H.P. Draw the development of lateral surface (D.L.S.) of cylinder.

Solution

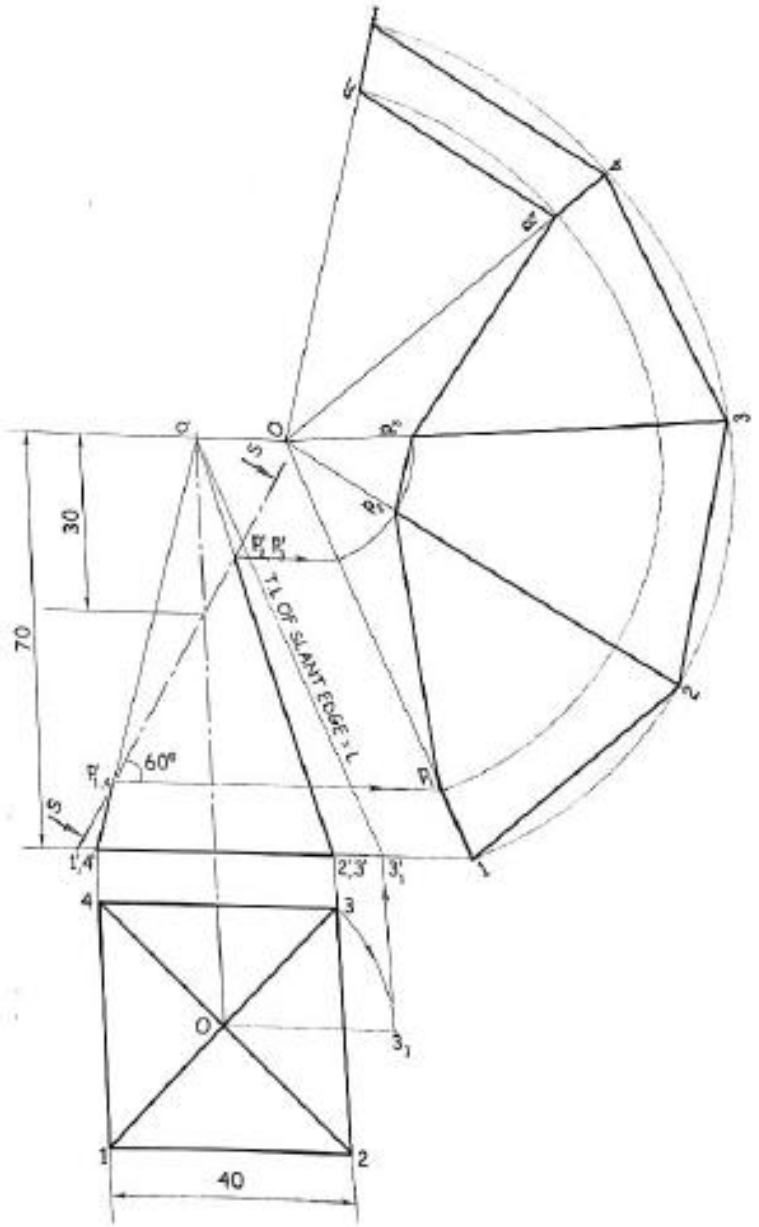


A cylinder of base diameter 40 mm and axis height 60 mm has it's axis perpendicular to H.P. and parallel to V.P. It is cut by a cutting plane perpendicular to V.P. inclined at 45° to H.P. and bisecting the axis of cylinder. Show the development of lateral surface (D.L.S.) of truncated cylinder.

Solution :



A square pyramid of 40 mm side of base and 70 mm height stand with its base in the H.P. Its sides of base are parallel to V.P. An Auxillary Inclined Plane (A.I.P.) cuts the pyramid passing through a point on axis 30 mm from apex and inclined to H.P. at 60°. Draw the D.L.S. of pyramid assuming apex to be removed.



Development of Cone

If a cone is rolled for one complete rotation on a plane with apex of the cone hinged at a point then the area covered by the cone will be a sector of circle which represents the development of lateral surface of a cone.

The radius of the sector (R) will be equal to the true length of the generator of the cone and the length of the arc will be equal to the circumference of the base circle of the cone.

The angle θ subtended by the arc of length equal to the circumference of base circle can be calculated as follows :

$$\theta = \frac{\textit{Circumference of the base circle}}{\textit{Circumference of the circle of radius } R} \times 360^{\circ}$$

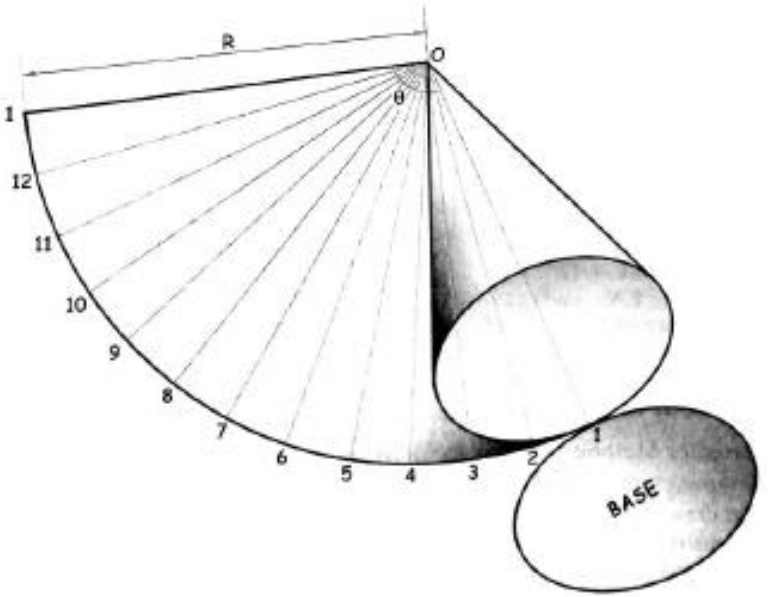
$$= \frac{2\pi r}{2\pi R} \times 360^{\circ}$$

$$\theta = \frac{r}{R} \times 360^{\circ}$$

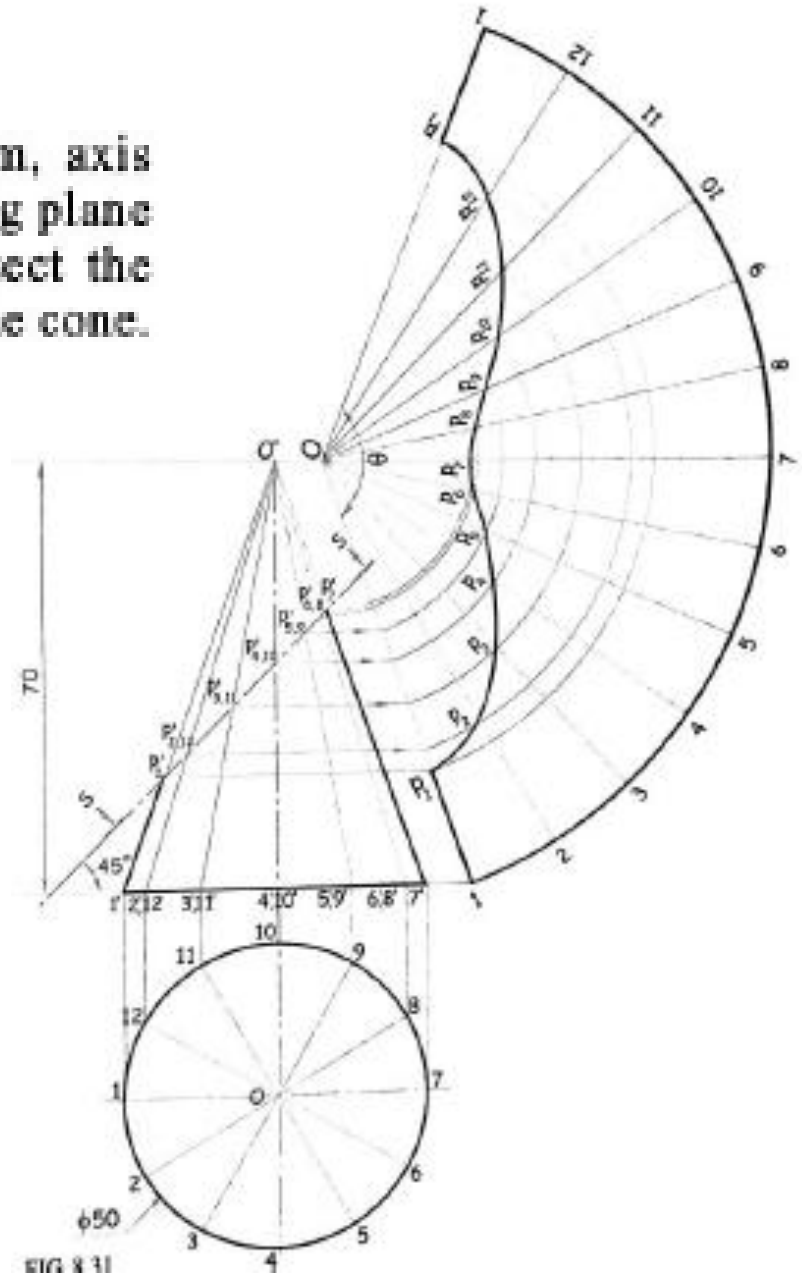
Where

r is the radius of the base circle.

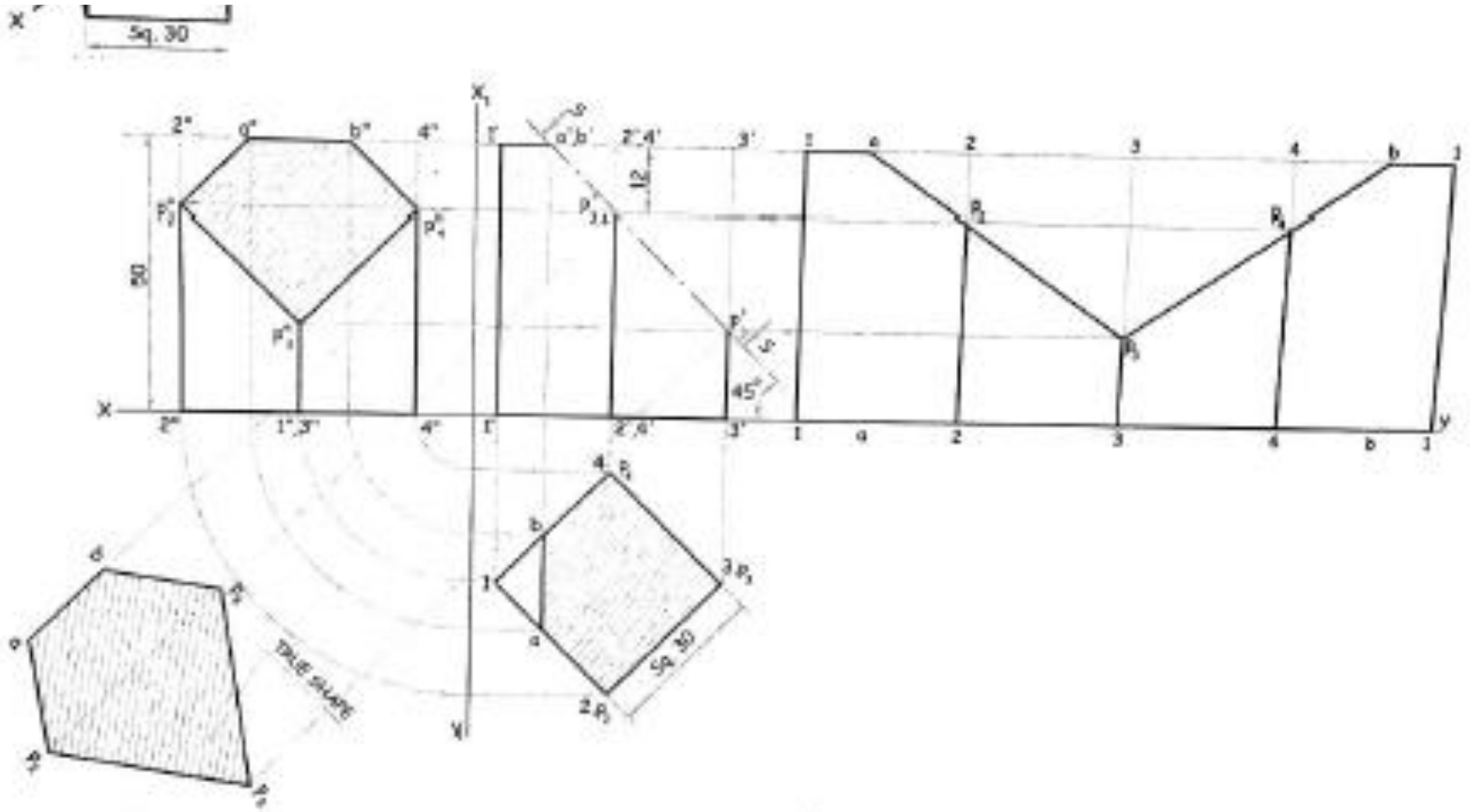
R is the true length of generator.



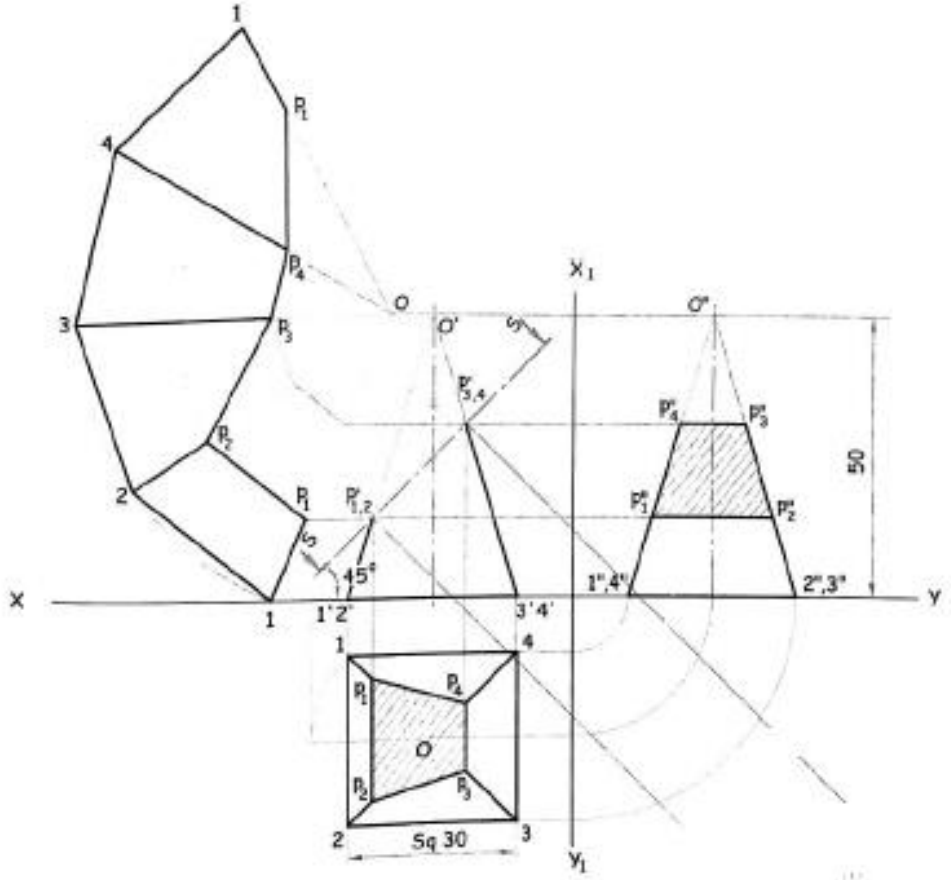
A right circular cone having diameter at base 50 mm, axis length 70 mm resting on it's base in H.P. is cut by cutting plane perpendicular to V.P. and inclined to H.P. at 45°, bisect the axis. Draw the DLS of the lower remaining portion of the cone.



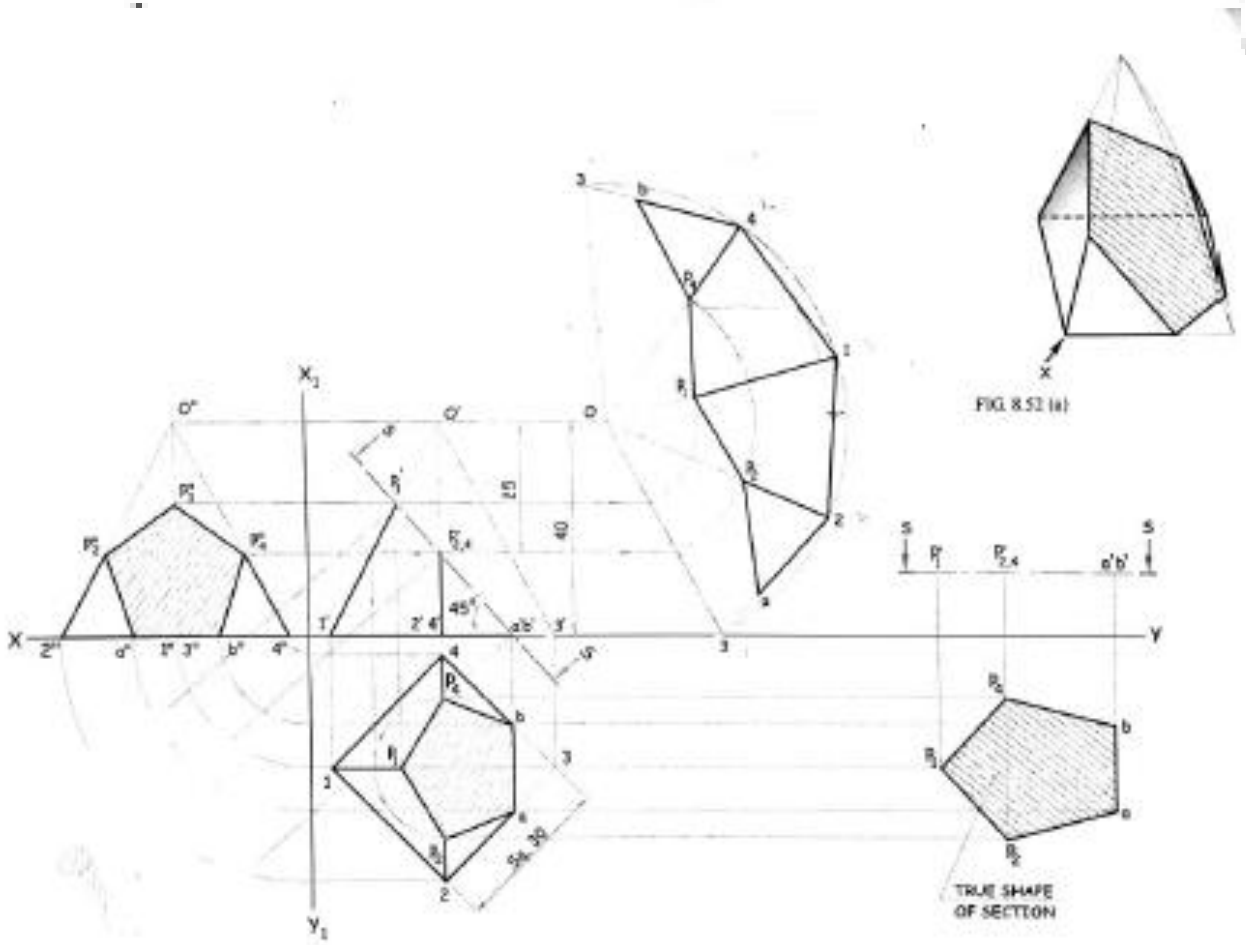
Square prism side of base 30 mm, axis height 50 mm has its base in the H.P. such that its sides of base are equally inclined with the V.P. A section plane perpendicular to the V.P. and inclined to the H.P. at 45° cuts the prism such that it passes through the point on the axis at a distance of 12 mm below the top base. Assuming the major part to be retained, draw the projection of a prism showing the F.V., sectional T.V., sectional S.V. and the true shape of a section. Add development of lateral surface of the retained prism.



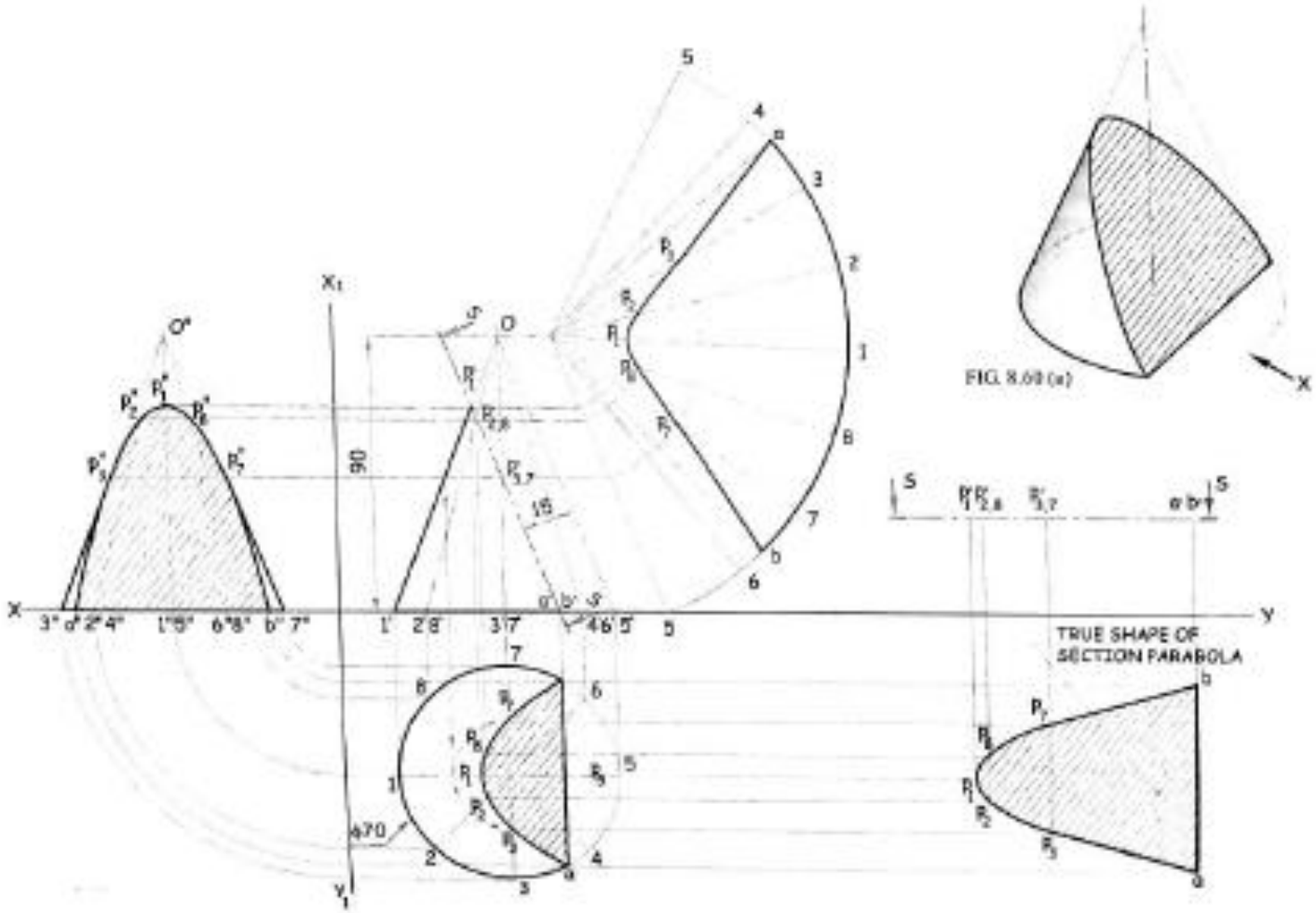
A square pyramid of 30 mm edges of base and 50 mm height is resting on its base with one of the edges of the base perpendicular to the V.P. It is cut by an A.I.P. in such a way that it bisects the axis and is inclined at 45^0 to the H.P. Draw elevation, sectional plan, sectional end view and the true shape of section. Also draw the development of lateral surface.



A square pyramid, base 30 mm and axis 40 mm long stands vertically on the H.P. with the edges of a base equally inclined to the V.P. It is cut by the section plane perpendicular to the V.P., inclined at 45° to the H.P. and passing through the point on the axis 25 mm from the apex. Draw the F.V., sectional T.V., sectional S.V. and the true shape of a section. Also draw the D.L.S. assuming apex part to be



A cone, of base 70 mm diameter and axis 90 mm long is resting on its base on H.P. It is cut by a section plane perpendicular to V.P. and parellel to and 15 mm away from one of its end generators. Draw the Sectional T.V., F.V., Sectional S.V. and the true shape of a section. Also draw the development of lateral surface.



A cylinder of 60 mm diameter and 80 mm long stands with its circular base on the H.P. A section plane perpendicular to V.P. and inclined at 60° to H.P. cuts the axis at a point 20 mm from its top end. Draw the sectional top view, front view, sectional side view and the true shape of section. Also draw its development of lateral surface.