24ESGE101 – ENGINEERING GRAPHICS

Module V – Section and Development of Lateral Surface

Course Outcome 5

Draw the section and development of lateral surfaces for the regular solids like Prism, Pyramid, Cylinder and Cone for the axis perpendicular to HP. (K3)

Content

Projection of Sectioned Solids (Prisms, Pyramids, Cylinder and Cone) and True Shape of the sections, when the **axis of the solid is perpendicular to HP alone** and **cutting plane inclined to HP only**.

Development of Lateral Surfaces of Sectioned Regular Vertical Solids (Prisms, Pyramids, Cylinder and Cone) with **cutting plane inclined to HP only**.

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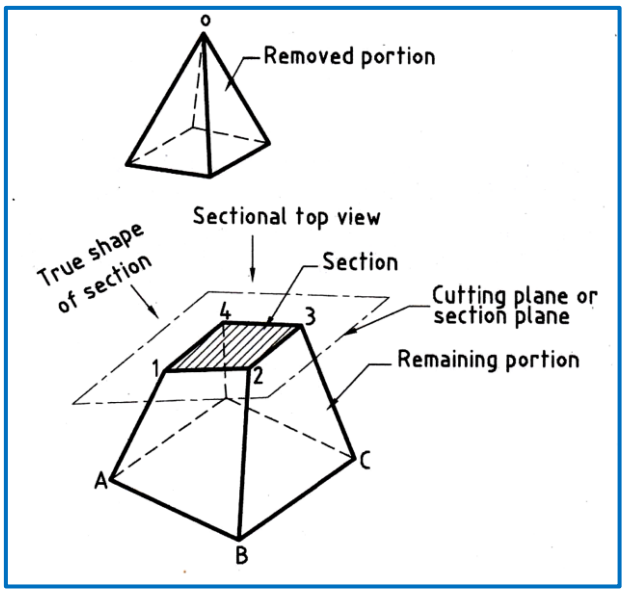
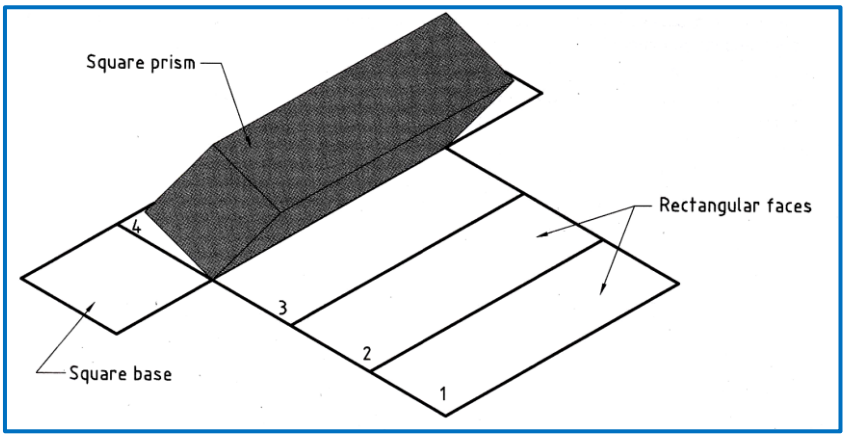
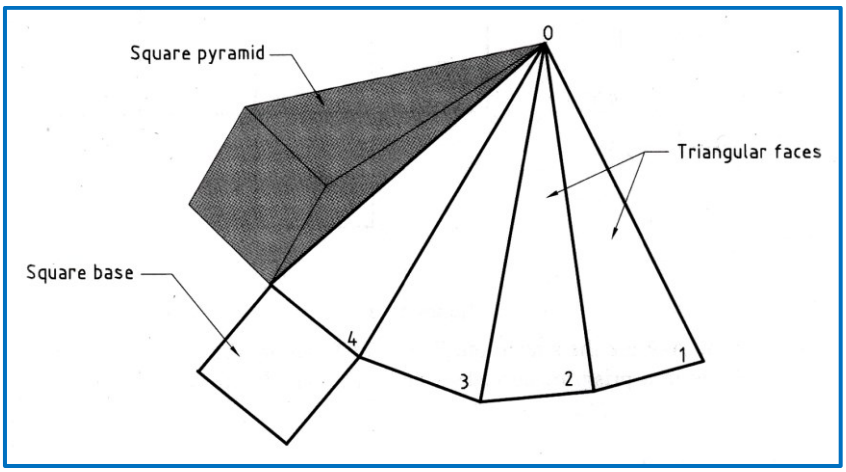
- When an object has more invisible details and a complicated shape, a section plane or cutting plane may be assumed suitably, to cut the object.
- The cutting planes are generally in any one of the following positions:
  - i) Cutting plane perpendicular to HP and parallel to VP.
  - ii) Cutting plane perpendicular to VP and parallel to HP.
  - iii) Cutting plane perpendicular to both HP and VP.
  - **iv) Cutting plane inclined to HP and perpendicular to VP.**
  - v) Cutting plane inclined to VP and perpendicular to HP.
- The cutting plane is an imaginary plane. The view of an object with cut portion is projected on to a reference plane and is known as the sectional view.
- The **actual shape of the cut portion** is known as **true shape of section**. It is projected and obtained in a principal reference plane or auxiliary plane which is parallel to the cutting plane.
- In a view where the cut portion is not seen as its true shape is known as apparent section.
- The cut portion projected and obtained in the apparent section or true shape of section is represented by uniformly spaced hatching lines. These hatching lines are approximately inclined at 45° to the principal outer lines. They have a uniform space (2 to 3 mm).
- When a cutting plane cuts a solid, the cut portion is removed and the section with new corners or points are obtained on the sides or edges of the solid. These points are obtained in the projection and joined in proper sequence to draw the section in that view.



Development of Surface

❖ The opening of the surfaces (e.g., faces and bases) of an object and laying them out on a flat plane is called the development of surfaces of that object.

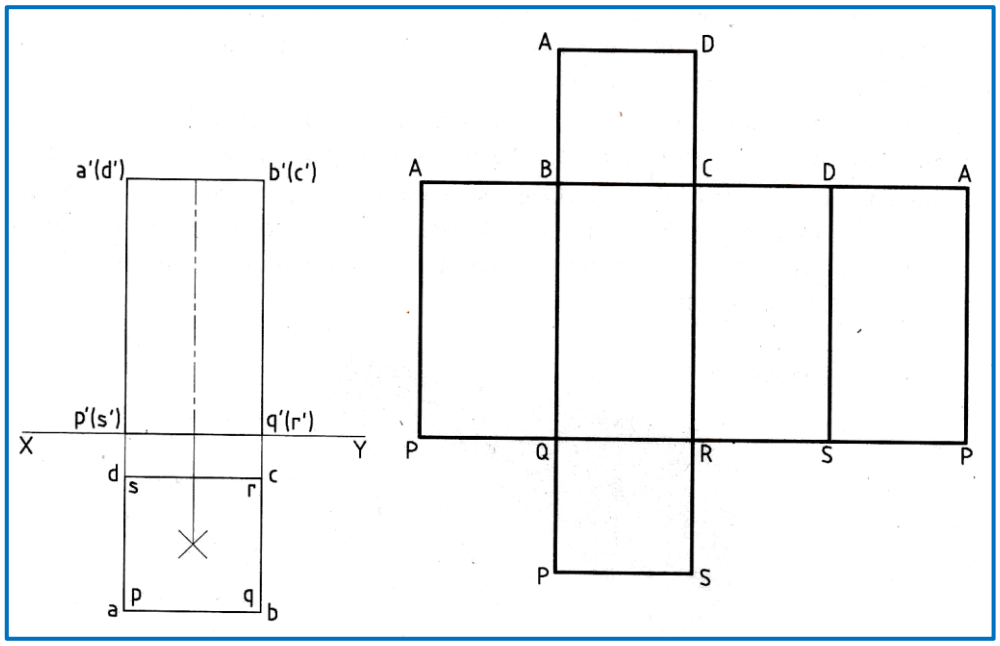




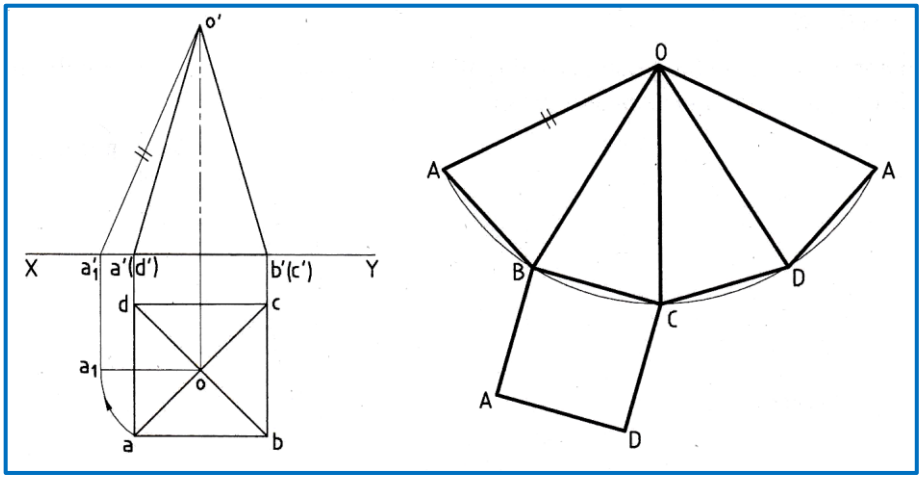
❖ Methods to Draw Development of Surfaces

- Parallel Line Method

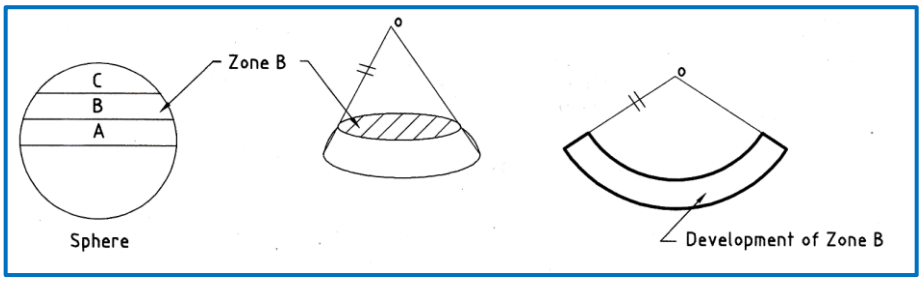
  ✓ Used to draw development of prisms and cylinder



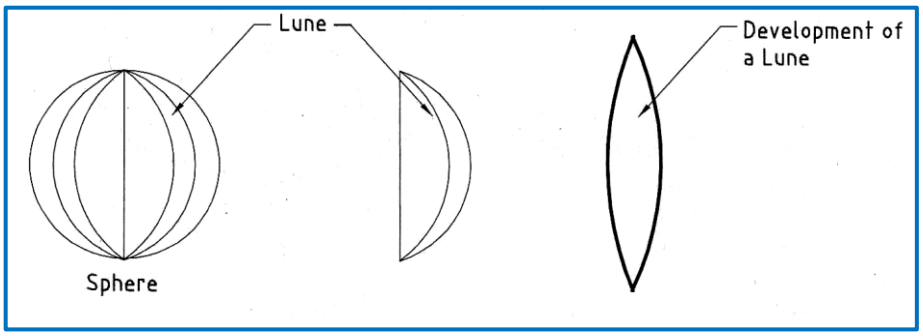
- Radial line method
  - ✓ Used to draw development of pyramids and cone



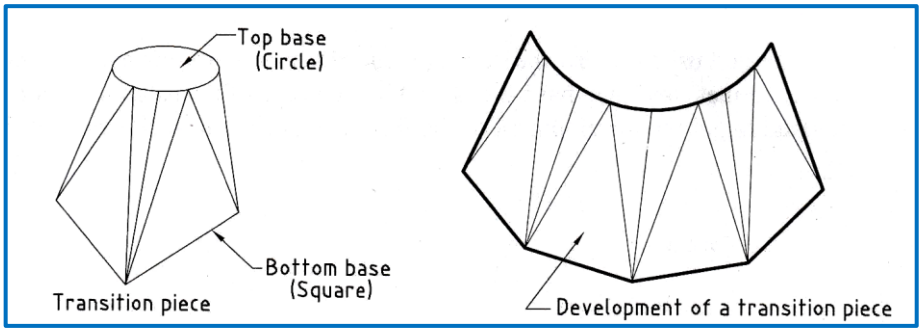
- Zone method
  - ✓ Used to draw the development of a sphere



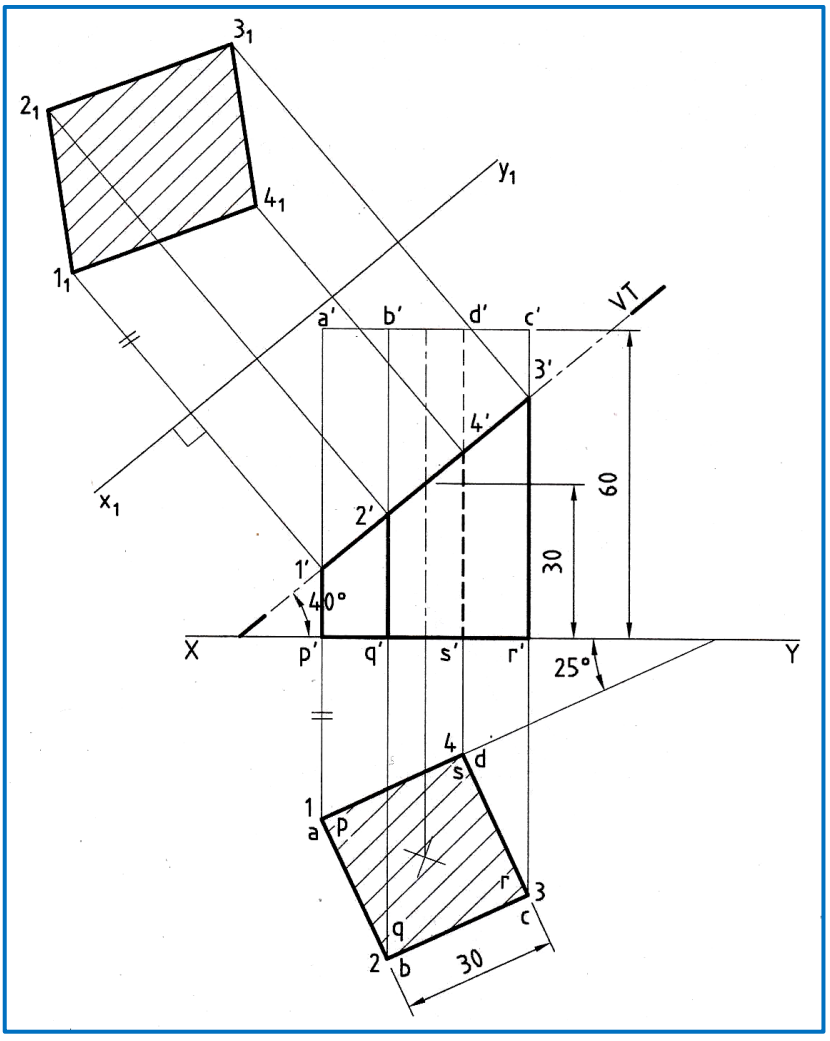
- Lune method
  - ✓ Used to draw the development of a sphere



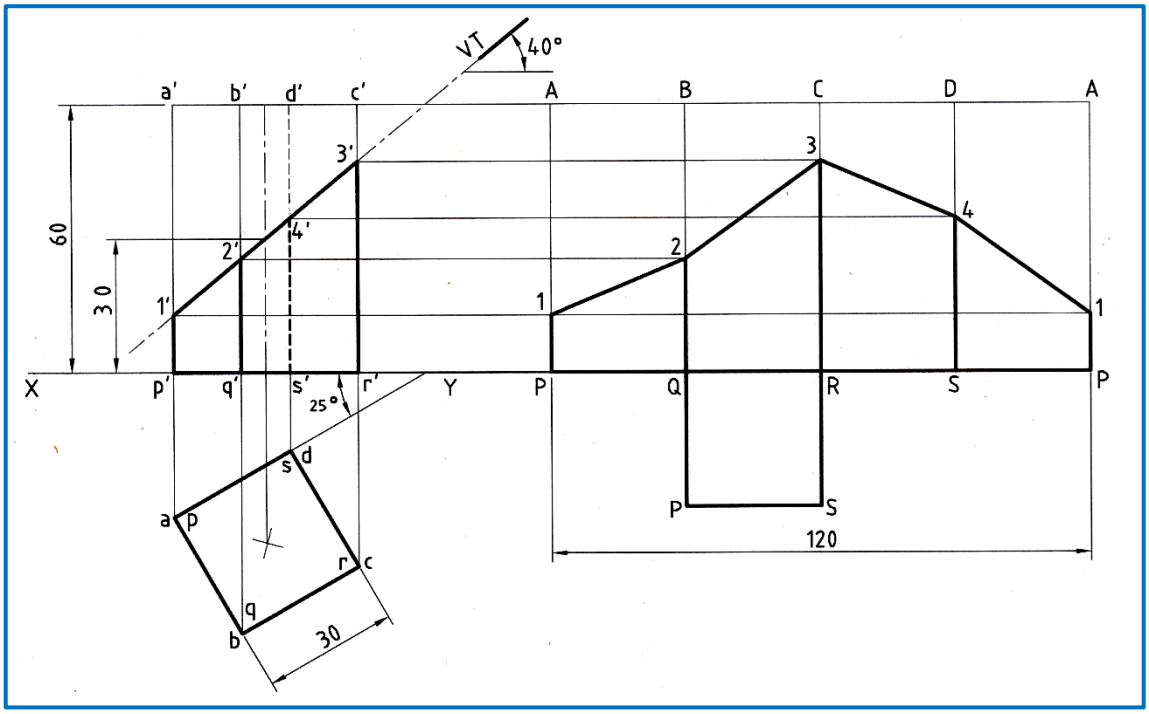
- Triangulation method
  - ✓ Used to draw the development of **Transition Pieces** (solid with bottom and top bases of dissimilar and different shapes)



1. A **Square Prism** of base side 30 mm and axis length 60 mm is **resting on HP on one of its bases,** with a **base side inclined at 25° to VP.** It is **cut by a plane inclined at 40° to HP and perpendicular to VP** and is **bisecting the axis of the prism.** (i) Draw its front view, sectional top view and true shape of section. (ii) Draw the development of the remaining portion of the prism.

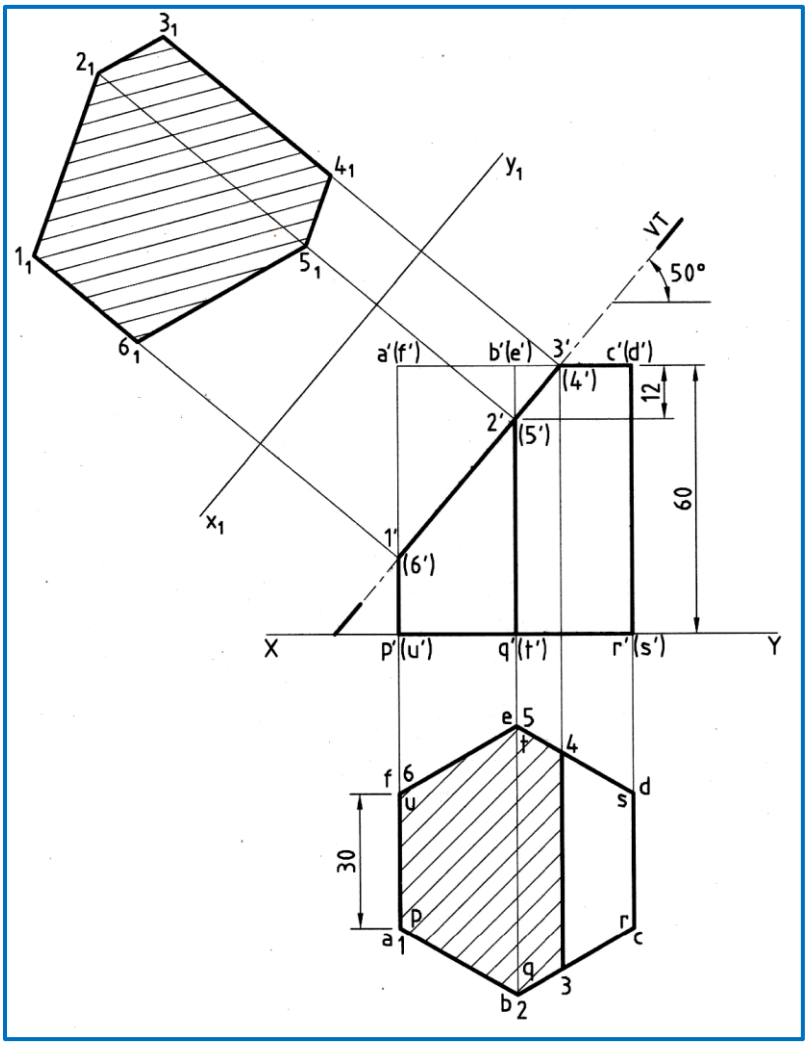


(i)

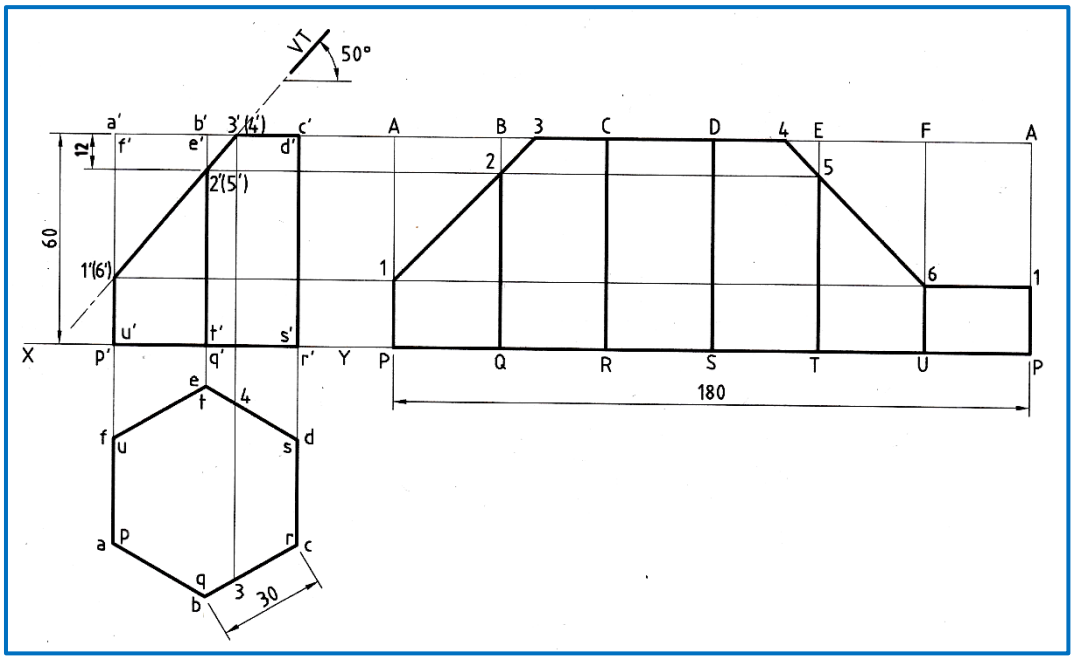


(ii)

2. A **Hexagonal Prism** of base side 30 mm and axis length 60 mm is **resting on HP on one of its bases with two of the vertical faces perpendicular to VP.** It is **cut by a plane inclined at 50° to HP and perpendicular to VP** and **passing through a point at a distance 12 mm to the top base.** (i) Draw its front view, sectional top view and true shape of section. (ii) Draw the development of the lateral surface of the prism.



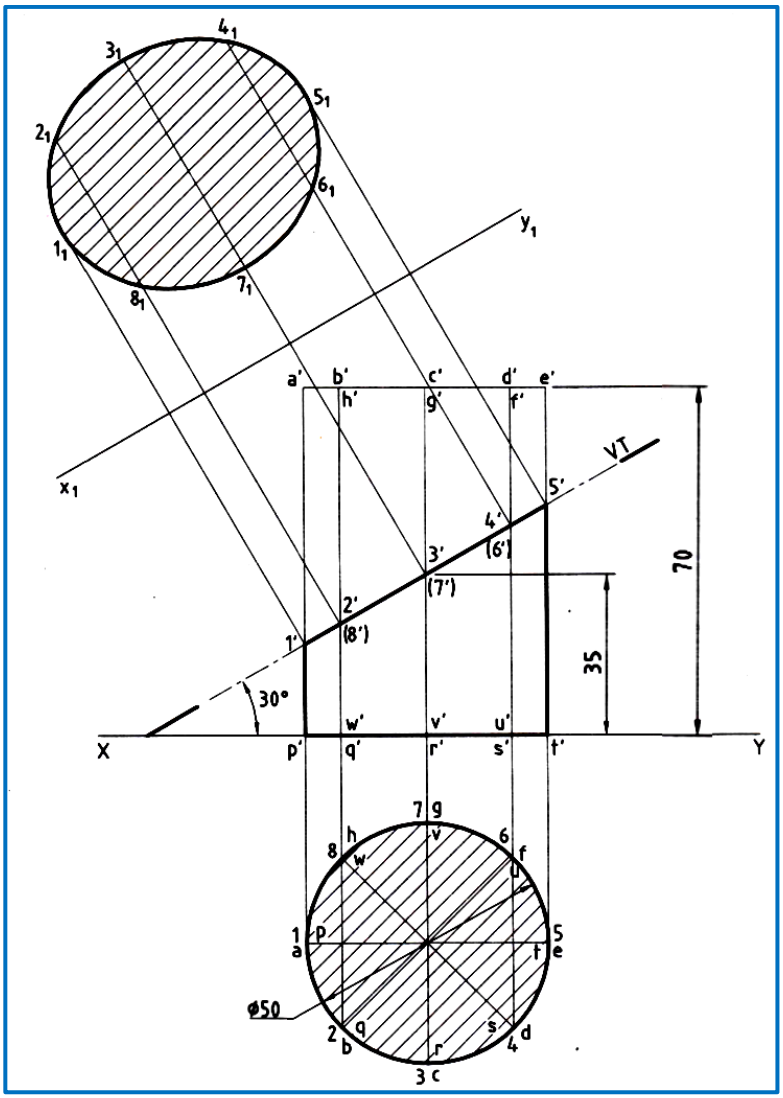
(i)



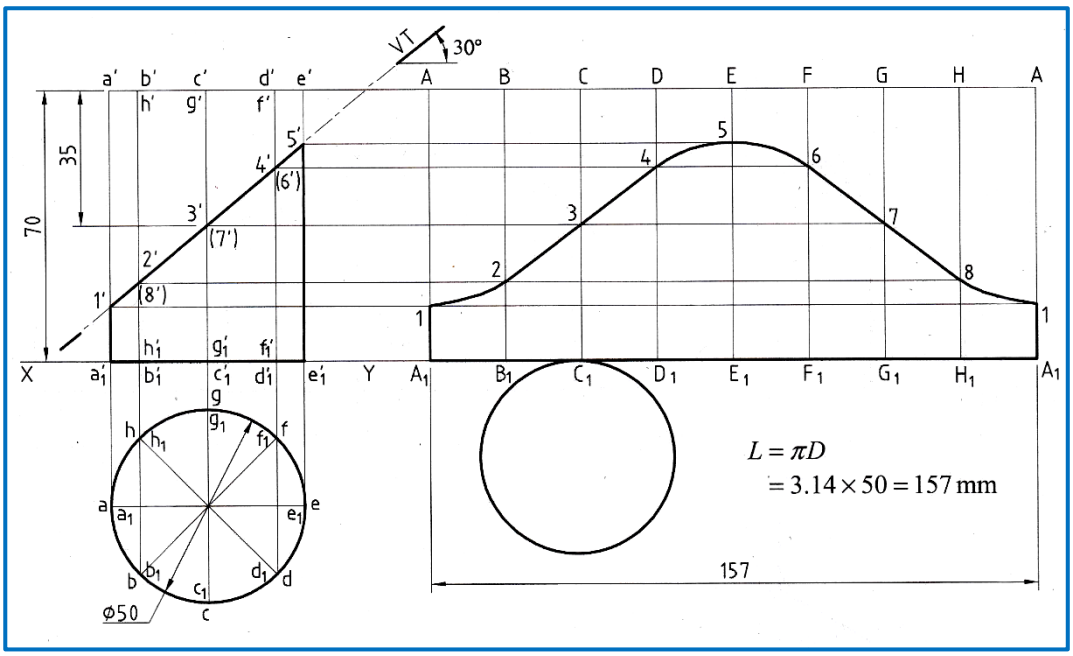
(ii)

3. A **Cylinder** of base diameter 50 mm and height 70 mm **rests on its base on HP.** It is **cut by a plane perpendicular to VP and inclined at 30° to HP** and **meets the axis at a distance 35 mm from base.** (i) Draw the front view, sectional top view, and the true shape of section. (ii) Draw the development of the lower portion of a cylinder.

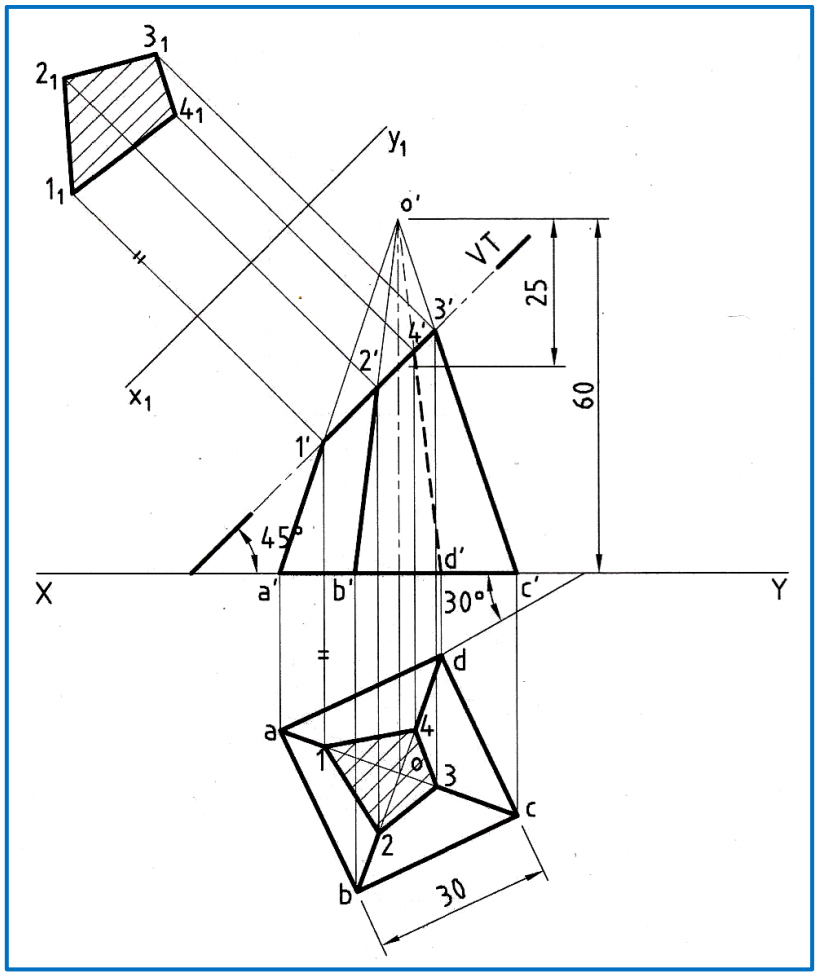
(i)



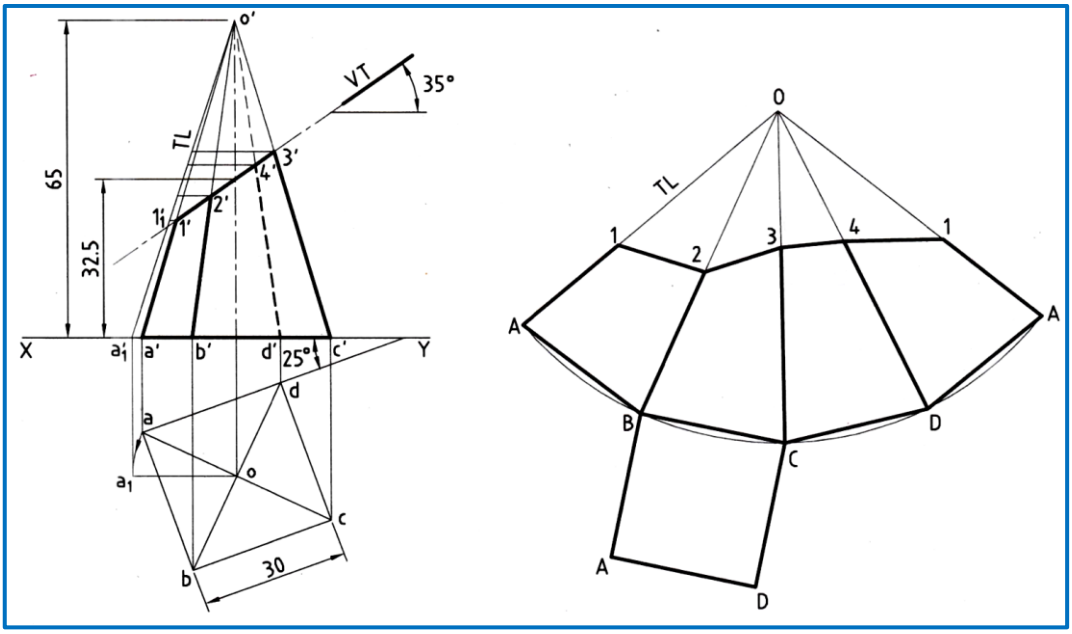
(ii)



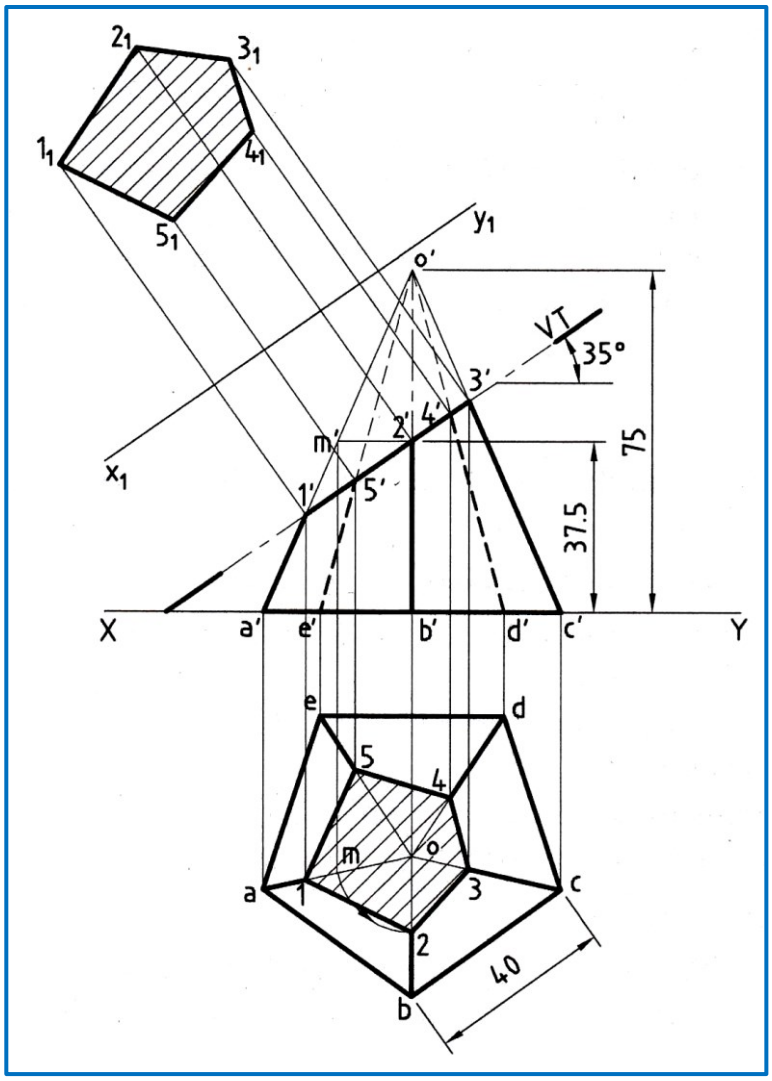
4. A **Square Pyramid** of base side 30 mm and axis length 60 mm is **resting on HP on its base** with one side of **base inclined at 30° to VP.** It is **cut by a plane inclined at 45° to HP and perpendicular to VP** and **passes through the axis at a distance 25 mm from the apex.** Draw its front view, sectional top view and true shape of the section.



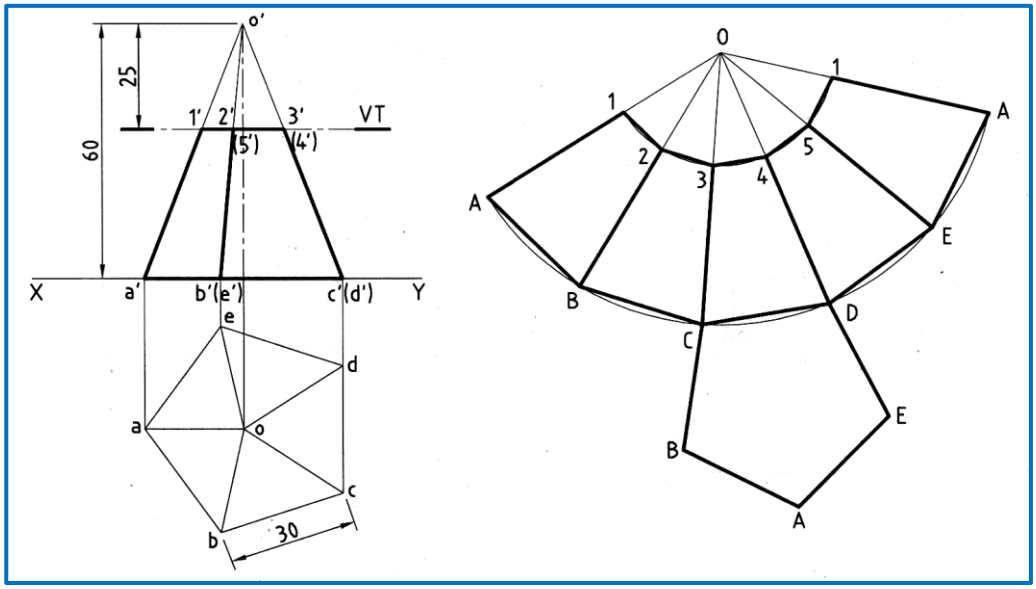
5. A **Square Pyramid** of base side 30 mm and altitude 65 mm is **resting on HP on its base with a side of base inclined at 25° to VP.** It is **cut by a plane inclined at 35° to HP and perpendicular to VP** and **bisects the axis**. Draw the development of the remaining lower portion of the pyramid.



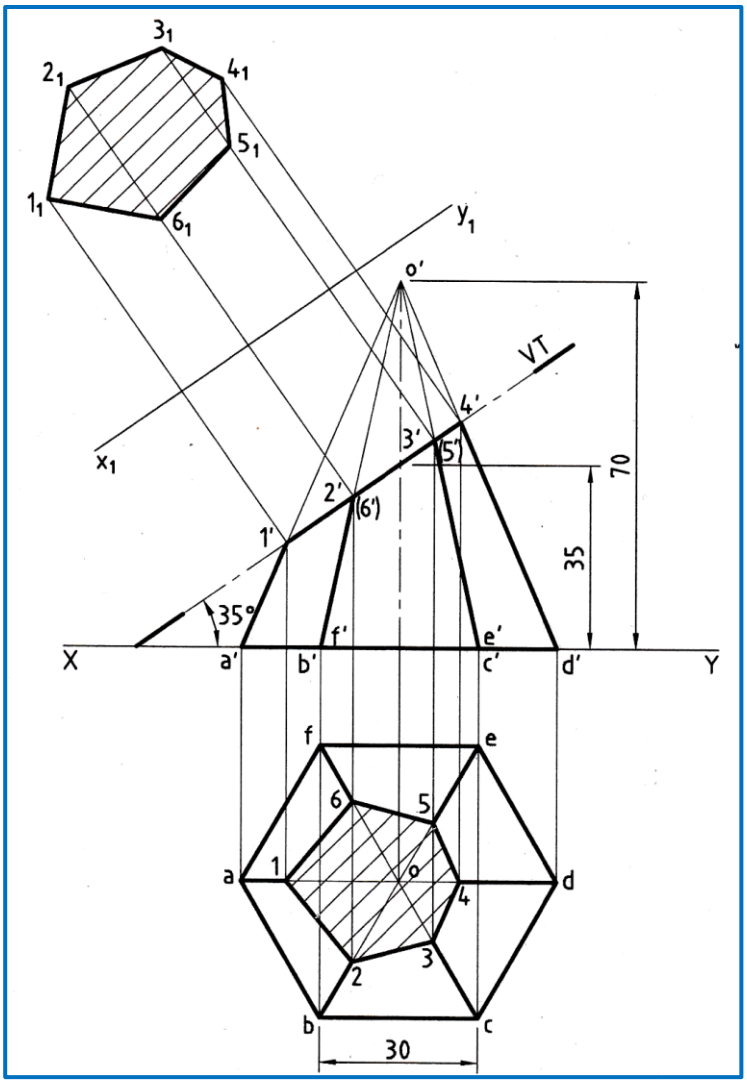
6. A **Pentagonal Pyramid** of base side 40 mm and axis length 75 mm is **resting on HP on its base** with **one of its base sides parallel to VP.** It is **cut by a plane inclined at 35° to HP and perpendicular to VP** and is **bisecting the axis.** Draw its front view, sectional top view, and the shape of section.



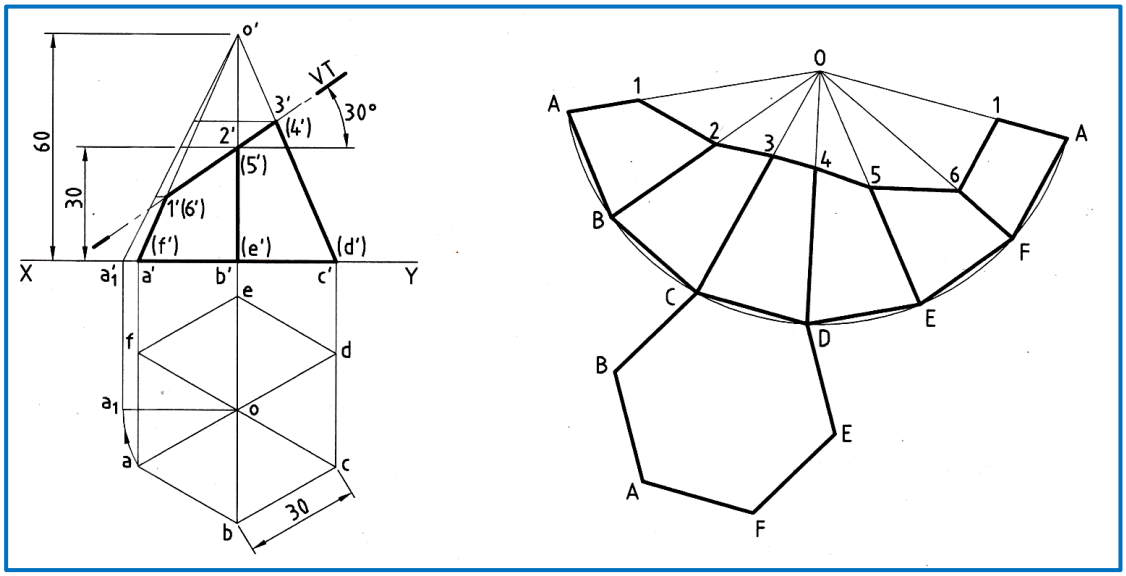
7. A **Pentagonal Pyramid** of base side 30 mm and axis length 60 mm is **resting on HP** on its **base with a side of base perpendicular to VP.** It is **cut by a plane perpendicular to VP and parallel to HP** and **meets the axis at a distance 25 mm from the vertex**. Draw the development of the remaining portion of the pyramid.



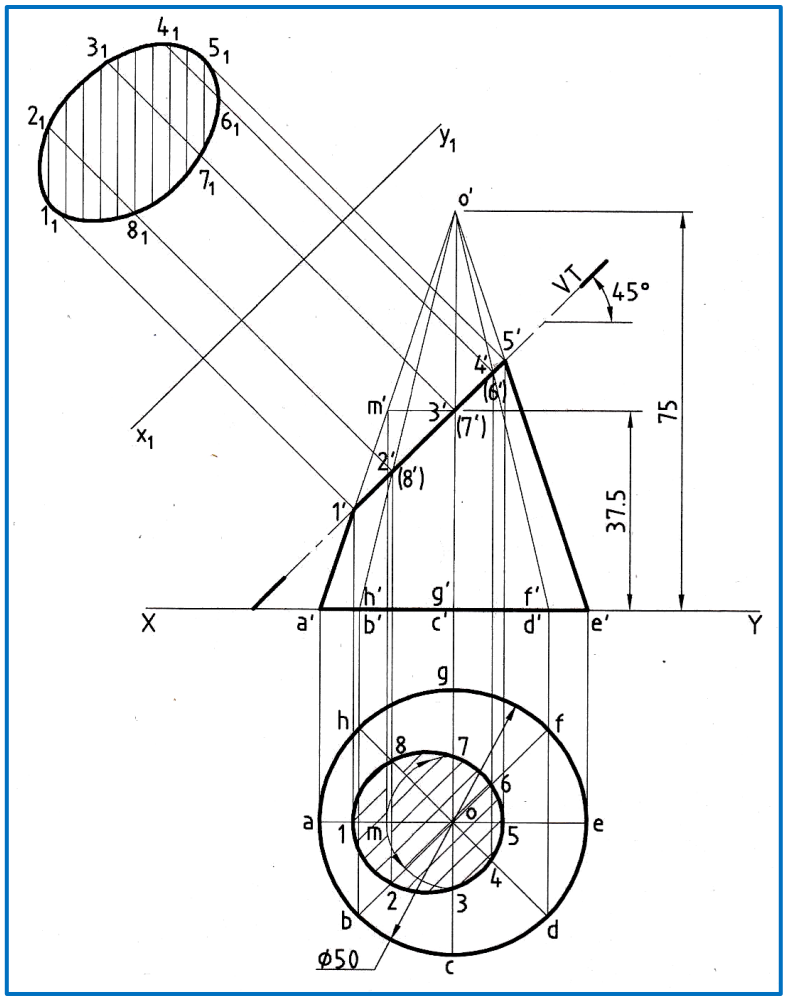
8. A Hexagonal Pyramid side of base 30 mm and altitude 70 mm rests with its base on HP and with a side of base parallel to VP. It is cut by a cutting plane inclined at 35° to HP and perpendicular to VP and is bisecting the axis. Draw the sectional plan of the pyramid and the true shape of the section.



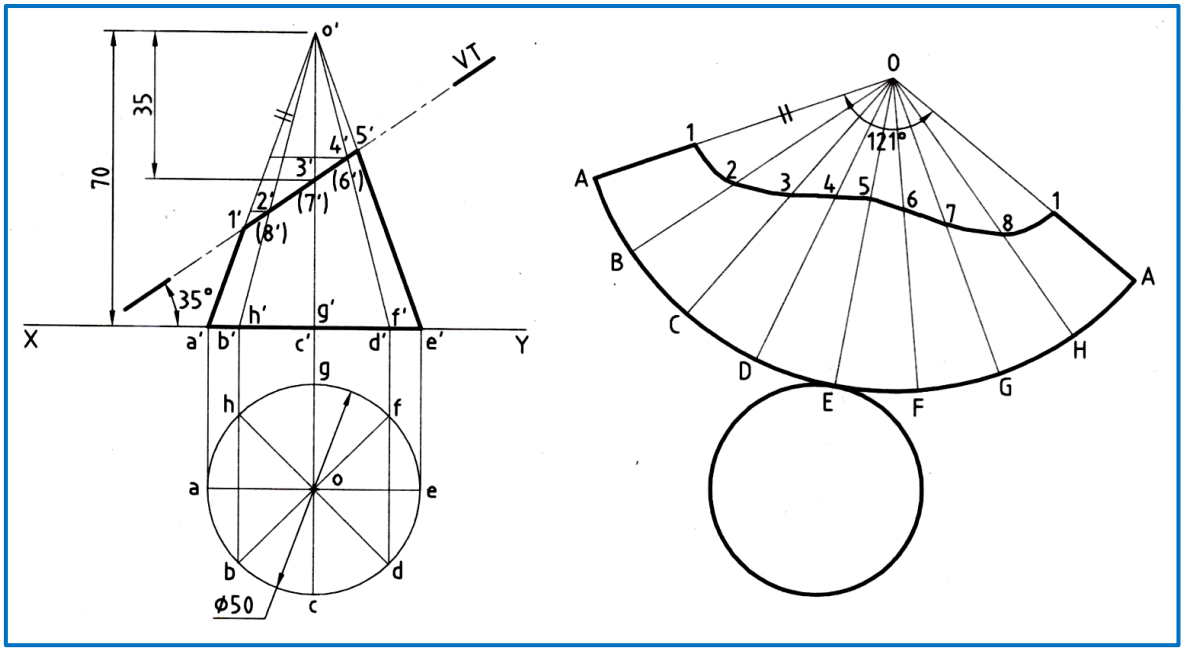
9. A Hexagonal Pyramid of side 30 mm and altitude 60 mm is resting on HP on its base with two of the base sides perpendicular to VP. The pyramid is cut by a plane inclined at 30° to HP and perpendicular to VP and is bisecting the axis. Draw the development of the remaining portion of the pyramid.



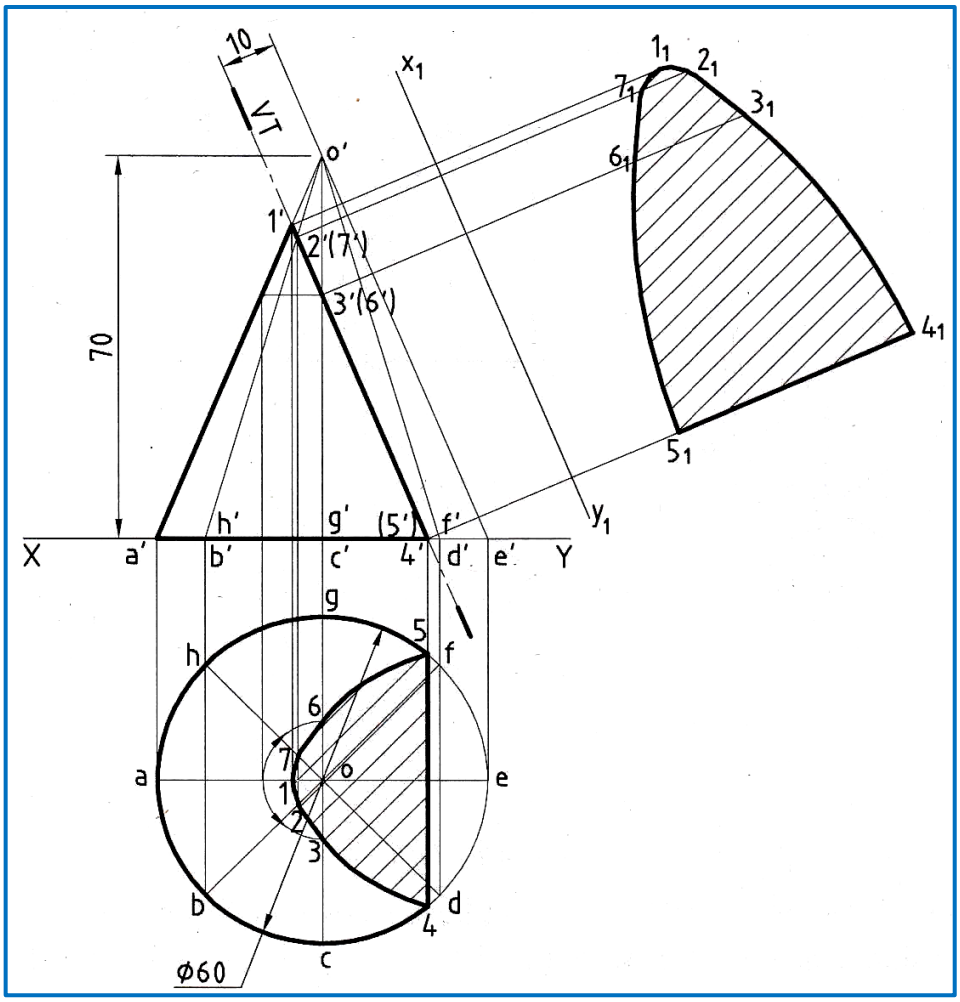
10. A **Cone** of base diameter 50 mm and axis length 75 mm is **resting on HP on its base.** It is **cut by a plane inclined at 45° to HP and perpendicular to VP** and is **bisecting the axis.** Draw the front view and sectional top view and true shape of this section.



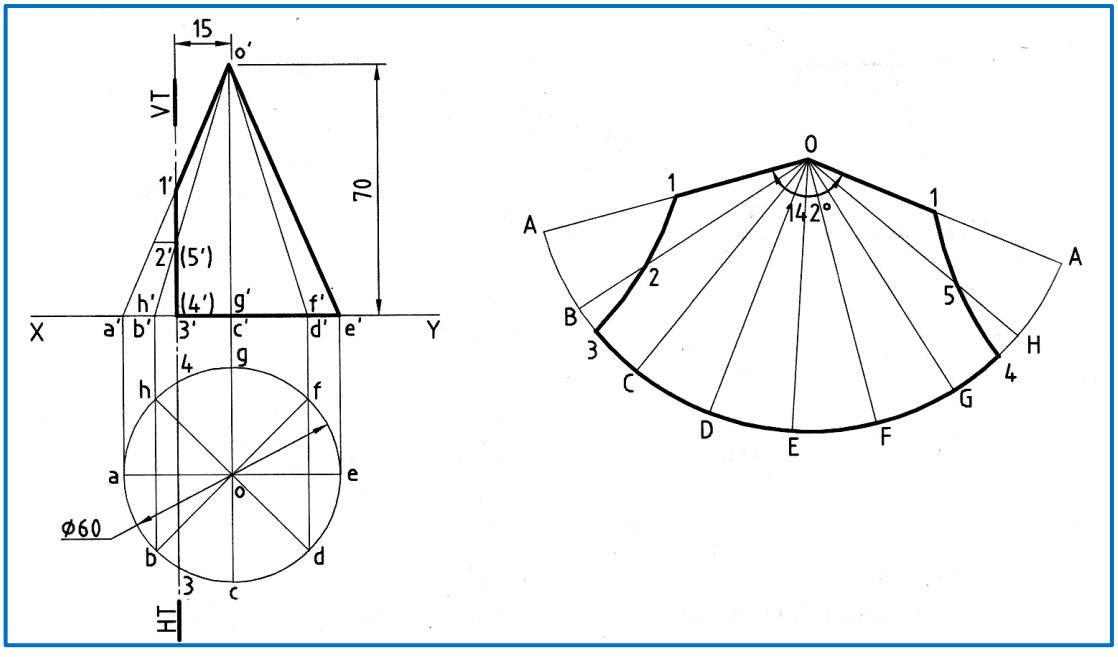
11. A **Cone** of base diameter 50 mm and axis length 70 mm **rests with its base on HP.** A **section plane perpendicular to VP and inclined at 35° to HP bisects the axis** of the cone. Draw the development of the truncated cone.



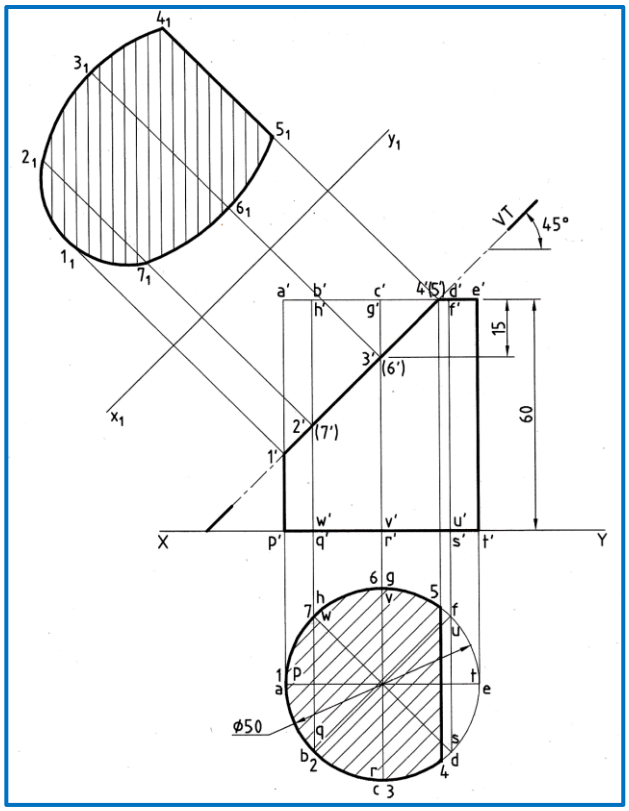
12. A **Cone** of base diameter 60 mm and axis length 70 mm is **resting on HP on its base.** It is **cut by a plane perpendicular to VP and parallel to a contour generator and is 10 mm away from it.** Draw the front view, sectional top view and the true shape section.



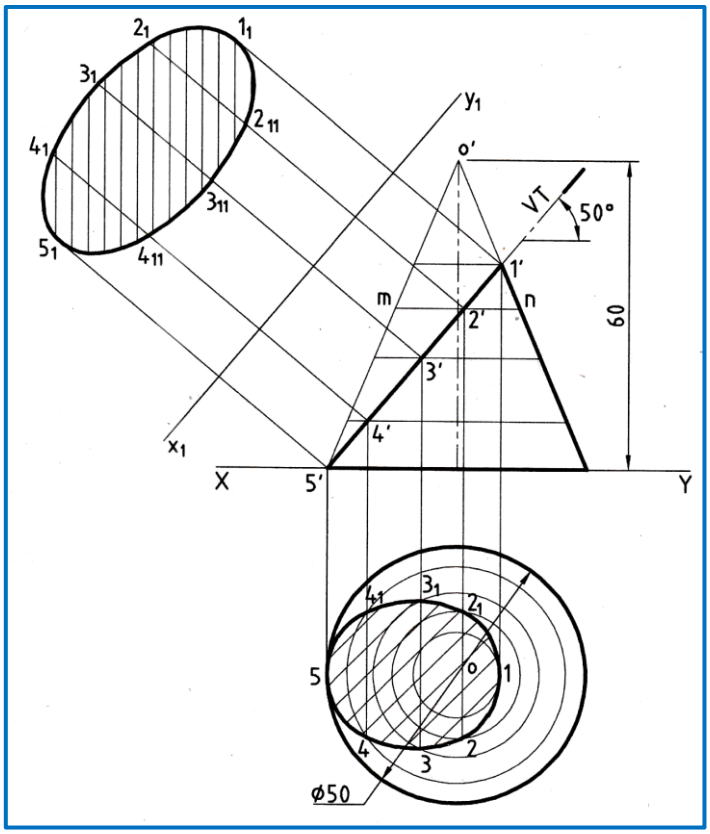
13. A **Cone** of base diameter 60 mm and height 70 mm is **resting on its base on HP.** It is **cut by a plane perpendicular to both the HP and VP** at a **distance 15 mm to the left of the axis**. Draw the development of the lateral surface of the right remaining portion.



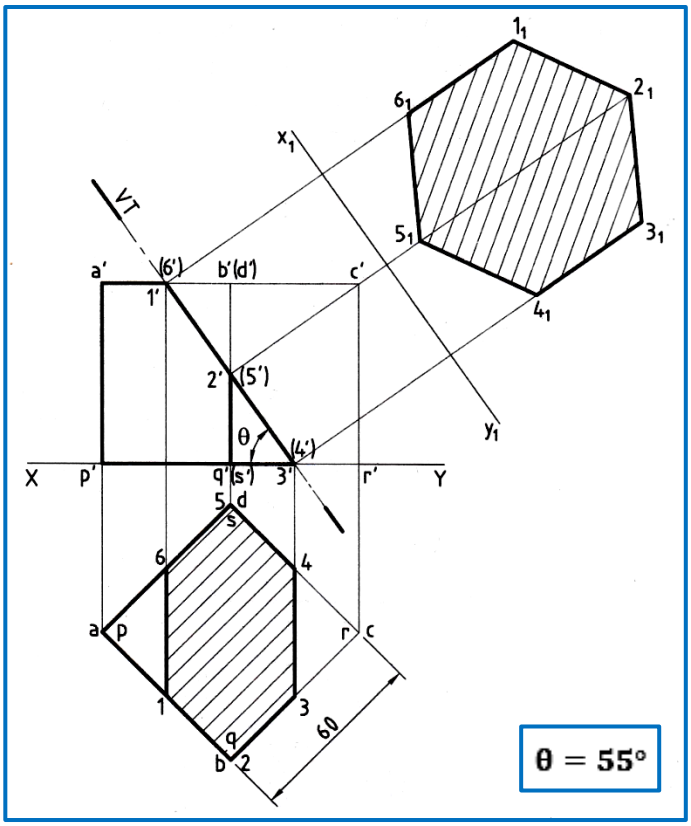
14. A **Cylinder** of base diameter 50 mm and height 60 mm **rests on its base on HP.** It is **cut by a plane perpendicular to VP and inclined at 45° to HP.** The **cutting plane meets the axis at a distance 15 mm from top to the base.** Draw the sectional plan and true shape of section.



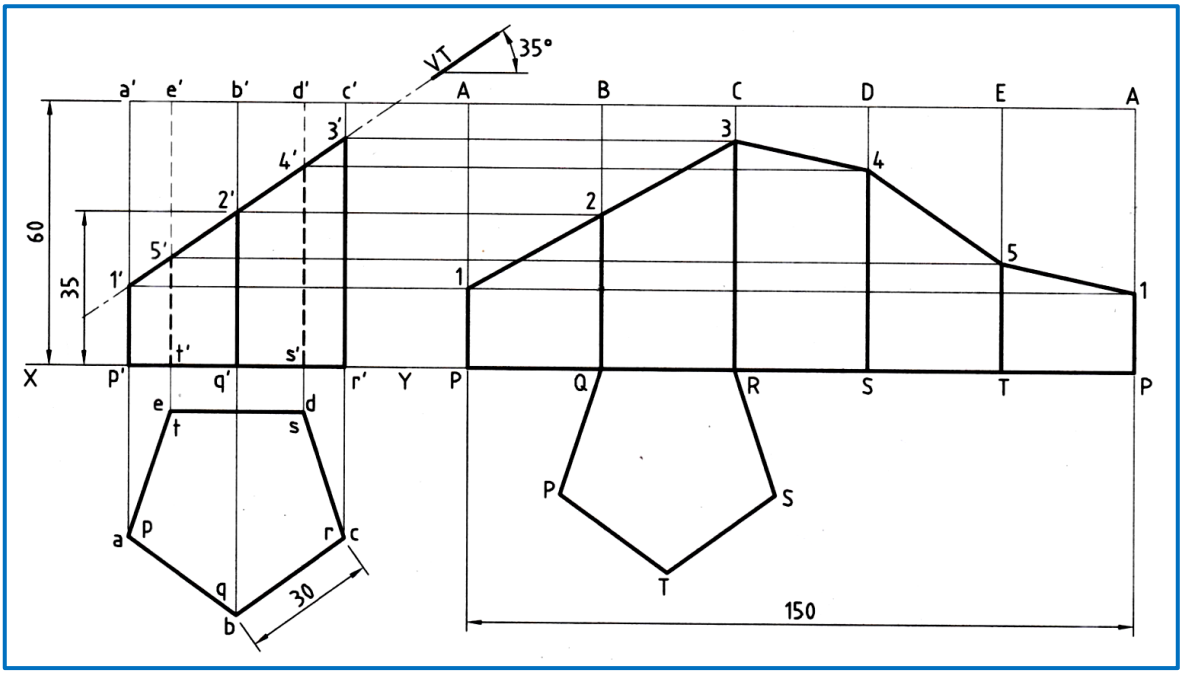
15. A **Cone** of base diameter 50 mm and axis length 60 mm **stands with its base on HP.** Draw the true shape of section made by a **plane perpendicular to VP and inclined to the HP at 50°** and **passing through a point on the base circle of the cone.**



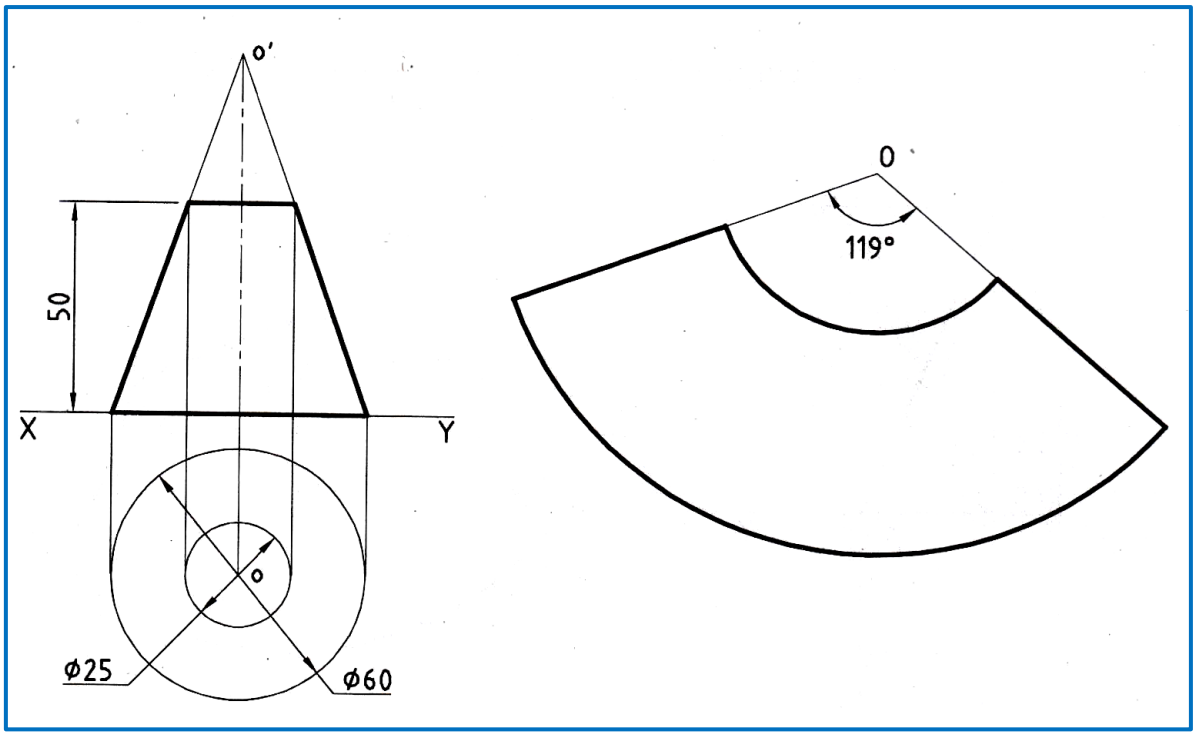
16. A **Cube** of 60 mm side has its **base edges equally inclined to VP.** It is **cut by a sectional plane perpendicular to VP**, so that the **true shape of cut section is a regular hexagon.** Locate the plane and determine the angle of inclination of the VT with the reference line XY. Draw the sectional top view.



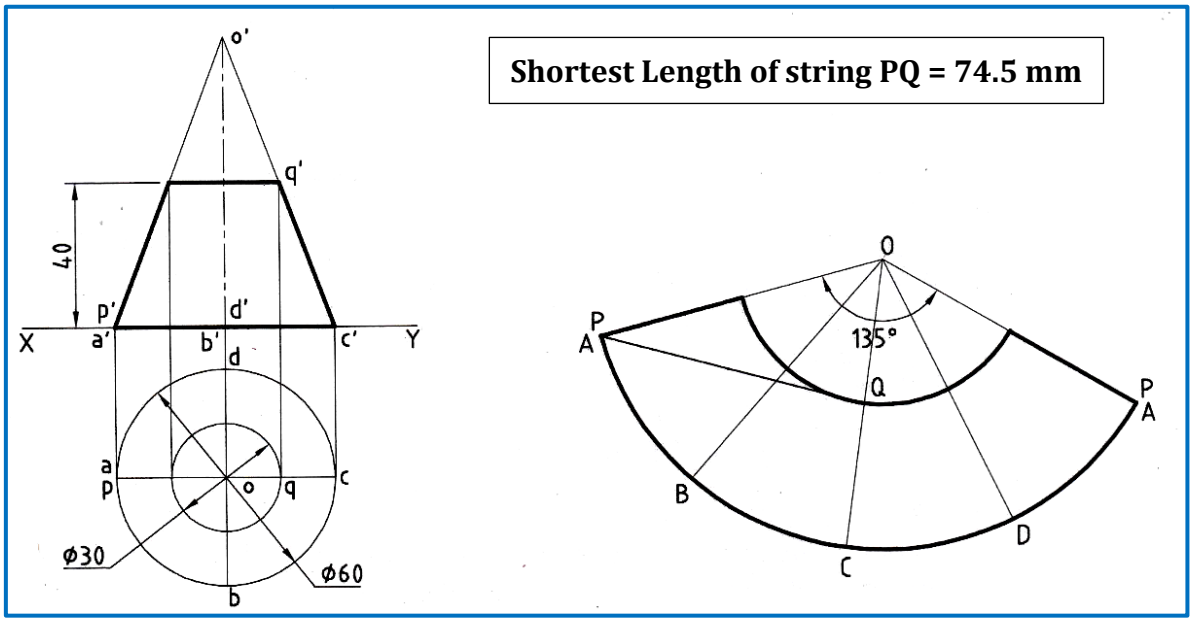
17. A **Pentagonal Prism** of base side 30 mm and axis length 60 mm is **resting on HP on its base** with a **side of base parallel to VP.** It is **cut by a plane inclined at 35° to HP and perpendicular to VP** and **meets the axis at a distance 35 mm from the base.** Draw the development of the lower portion of the prism.



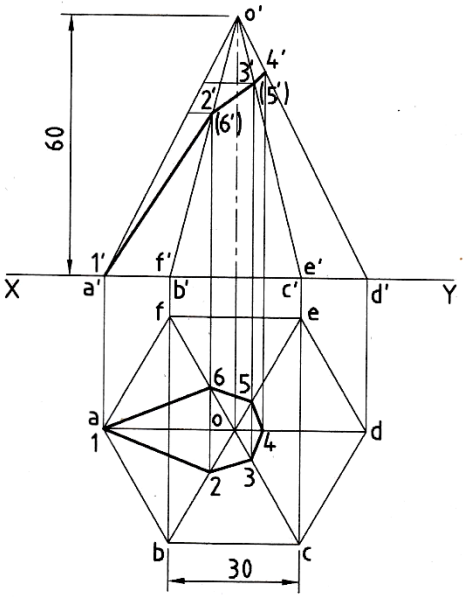
18. Draw the development of lateral surface of **Frustum of a Cone** of base diameter 60 mm, top base diameter 25 mm and height 50 mm.

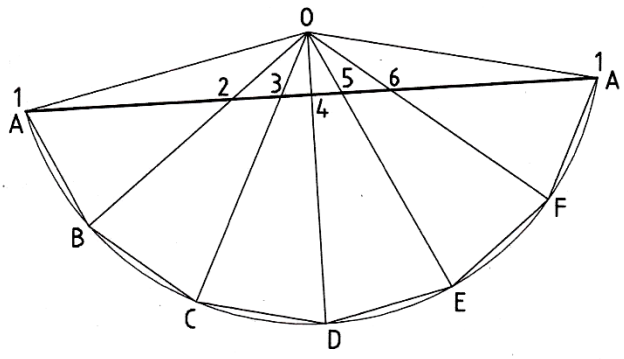


19. Determine the **Shortest Length** measured along the surface of a **Frustum of a Cone**, between two points P and Q. **Point P is on the base of the frustum** which is 6 cm in diameter. **Point Q is a diametrically opposite point on the top surface** which is 3 cm in diameter. The height of the frustrum is 4 cm.



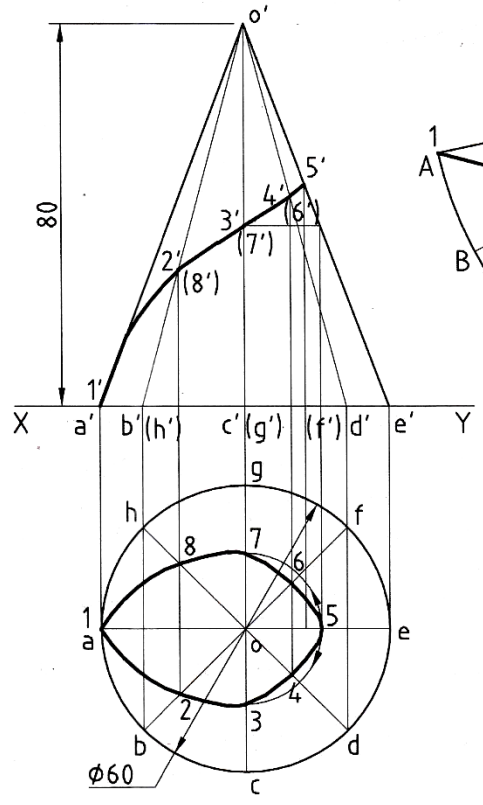
20. A **Hexagonal Pyramid** of base side 30 mm and height 60 mm **rests vertically on HP** with **one of the base sides parallel to VP**. A **string is wound round the surfaces** of the pyramid from the left extreme point on the base and ending at the same point. Find graphically the shortest length of the string required. Also trace the path of the string in the front and top views.

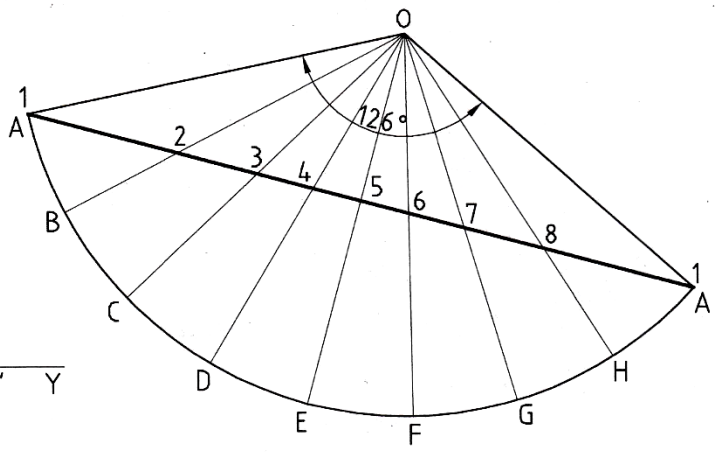




Shortest Length of string = 131 mm

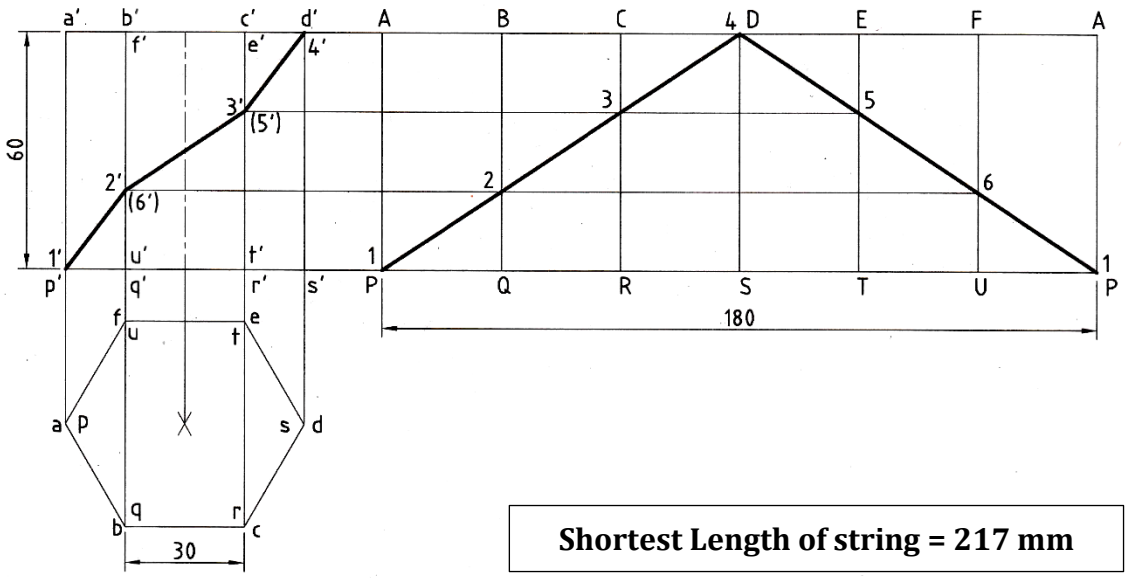
21. A **Cone** of base 60 mm and height 80 mm is **resting with its base on HP.** An **insect starts from a point on the circumference** of the base, **goes round the solid and reaches the starting point in the shortest path.** Find the distance travelled by the insect and also the projections of the path followed by it.





Shortest Distance Travelled = 143 mm

22. A **Hexagonal Prism** of base side 30 mm and height 60 mm rests vertically on the HP with a **side of base parallel to VP.** A **string is wound round the surfaces** of the prism **starting from left extreme point on the base** to the **diametrically opposite corner on the top base** and **ending at the same point.** Find graphically the shortest length of the string required. Also sketch it in the front view.



Shortest Length of string = 217 mm