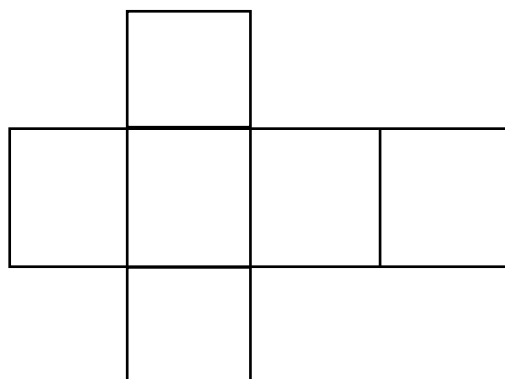


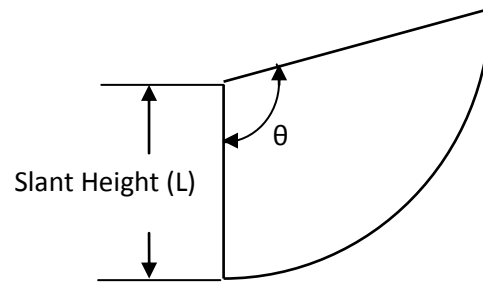
Unit- 4, Part 2: Development of surfacesTheory Questions

1. What is meant by development of a surface of a solid?  
A. When a solid is opened and laid out on a plane, the opened surface obtained is usually called as the development of the solid. Usually, solids are cut by some section plane in different orientations and then the left over portion is opened out. This leftover opened portion is called as the development of the lateral surface of the remaining portion.
2. What are the applications of development of surfaces?  
A. The development of surfaces concept is useful in making of sheets, trays, tins, etc in packaging industry. Also the automobile body works are developed using the concepts of development of surfaces. Hence development of surfaces find wide application in sheet metal industry, packaging industry, automobile industry, etc.
3. Explain the parallel line method in development of prisms and cylinders.  
A. Prisms and Cylinders are developed by using parallel line method. In this method, the solid is first opened out (laid out) as a surface and then a no. of parallel lines are drawn from the points of intersection of the section plane on the solid (from the front view) to intersect the respective edges or sides on the opened surface.
4. Explain the radial line method used in development of pyramids and cones.  
A. This method is usually used for development of pyramids and cones. In this method, the true slant height of the cone or pyramid is first found out and this is used as the radius of development. After this, the true slant height is drawn in the development portion such that all the lines in the developed portion represent the true slant height. Also in the front view of the solid, when it is cut by the section plane, the points have to be projected onto the true slant height only to translate the points into the developed portion. Every line on the development must correspond to the true length of the corresponding edge on the surface.
5. What is the angle of a sector in development of a cone?  
A. The angle of sector in the development of a cone is given by  $\theta = 360^\circ * (R/L)$  where R is the base radius of the cone and L is the true slant height or generator of the cone.
6. In the development of surfaces of a hexagonal pyramid, give the number of squares, rectangles, triangles and hexagons marked.  
A. If the opening of the top and bottom portion is neglected, then only 6 rectangles are marked in the development of a hexagon. If the top and bottom portion of the hexagon is also considered, then we see also two hexagons in addition to the 6 rectangles.
7. Show the development of a cube of 40 mm edges.

A. Cube development:

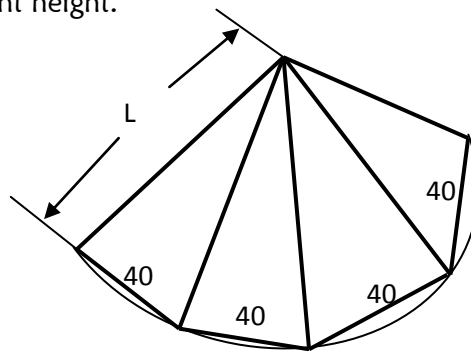


8. Draw the development of a right circular cone of base 40 mm diameter and axis 60 mm.  
A.

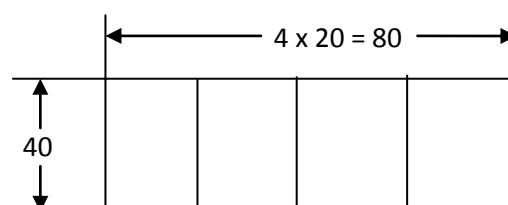


L is the slant height to be measured from the front view of the cone and  $\theta$  is the angle of sector of cone already mentioned earlier.

9. Sketch the development of surface of a square pyramid of base 40 mm and axis 60 mm.  
A. L is the true slant height.



10. Develop the lateral surface of a square-base prism of base edge 20 mm and axis 40 mm.  
A.



11. A cone of base radius 40 mm and height 60 mm has its development of its lateral surface as a sector of circle. What are the radius of the sector and the angle of the sector?  
A. Draw the front view, top view and geometrically find the length of generator and take that as the radius of the sector. Angle of sector is obtained by  $\theta = 360^\circ \times (R/L)$
12. A right regular pentagonal prism edge of base 25 mm and height 70 mm resting on its base on HP is cut by a section plane  $40^\circ$  to the HP and meeting the axis at 20 mm from its top end. Develop the lateral surface of the cut prism. (Assignment).
13. How do you find the distance between any two points A & B situated on the surfaces of a cylinder?  
A. The shortest distance between any two points on a cylinder shown in the front view can be found by developing the cylinder and mapping the points of front view on to the development.  
Note: Length of cylinder for opening in development is  $L = 2\pi R$  or  $\pi D$

*Problems (Refer Solutions)*

14. A right rectangular pyramid of base 50mm x 35 mm and height 70 mm rests on its base in the HP with one of its base sides parallel to VP. A section plane, perpendicular to the VP and inclined at  $30^\circ$  to the HP cuts the pyramid, bisecting its axis. Develop the lateral surface of the truncated pyramid.
15. A square pyramid of base 30 mm sides and axis 40 mm long has its base on HP such that an edge of its base is perpendicular to VP. It is cut by a horizontal section plane bisecting the axis. Draw the development of the frustum of square pyramid. (find true slant height)
16. Draw the development of lateral surface of the truncated cone obtained as per data given here: The right circular cone of 50 mm diameter and 80 mm long axis resting its base on H.P is cut by a plane normal to V.P, inclined at  $30^\circ$  to H.P. and passing through midpoint of the axis.
17. A pentagonal pyramid of base 40 mm and axis 70 mm long has its base on HP such that an edge of its base is perpendicular to VP. It is cut by an AIP normal to VP and inclined at  $30^\circ$  to HP and passing through a point on the axis, 30 mm below the apex. Draw the development of the lateral surface of the lower part of the pyramid.
18. A pentagonal pyramid of base 30 mm side and height 50 mm stands with its base on HP such that an edge of its base is parallel to VP. It is cut by a plane, normal to VP, inclined at  $45^\circ$  to the HP and passing through a point on the axis, 30 mm above the base. Draw the development of the lateral surface of the lower part of the pyramid.
19. A right regular pentagonal pyramid, edge of base 30 mm and height 70 mm, resting on its base on ground plane such that left side base edge is perpendicular to the VP. It is cut by two cutting planes perpendicular to VP as (i) parallel to the base at 30 mm from its top and (ii) at its base,  $20^\circ$  inclined to HP and the cut plane passing through its axis line. Draw the development of the lateral surface of the pyramid.
20. A right regular hexagonal prism, edge of base 20 mm and height 50 mm rests on its base with one of its vertical faces perpendicular to VP. An AIP inclined at  $30^\circ$  to the HP and perpendicular to the VP cuts its axis at a distance 30 mm from the base. Develop the lateral surface of the truncated prism.
21. A 50 mm diameter cylinder, 100 mm long axis is resting on the HP with its axis normal to HP. It is cut by a section plane, inclined at  $45^\circ$  to the HP & passing through a point on the axis 30 mm from the top. Develop the lateral surface of the truncated cylinder.
22. A cylinder of base diameter 40 mm and axis 55 mm long rests with its base on HP. It is so sectioned that its elevation appears as an isosceles triangle of base 40 mm and height 55 mm. Develop its surface.