KSU CET UNIT

FIRST YEAR NOTES

CET UNIT

5
Development of surfaces

5.1. Introduction.

The complete surface of an object laid out on a plane is called the development of the surface of the object. All the vertical edges of a prism and all the generators of a cylinder are parallel to each other and hence the developed lateral surfaces of these solids are rectangles. The lateral surfaces of pyramids are isosceles triangles and there will be as many isosceles triangles as the number of base edges of the pyramid. The developed lateral surface of pyramid and cone can be obtained by drawing an arc with radius equal to the true length of the slant edge of pyramid or length of generator of cone. Fig. 5.1 shows the three dimensional view of a rectangular prism and the complete development of its surfaces.

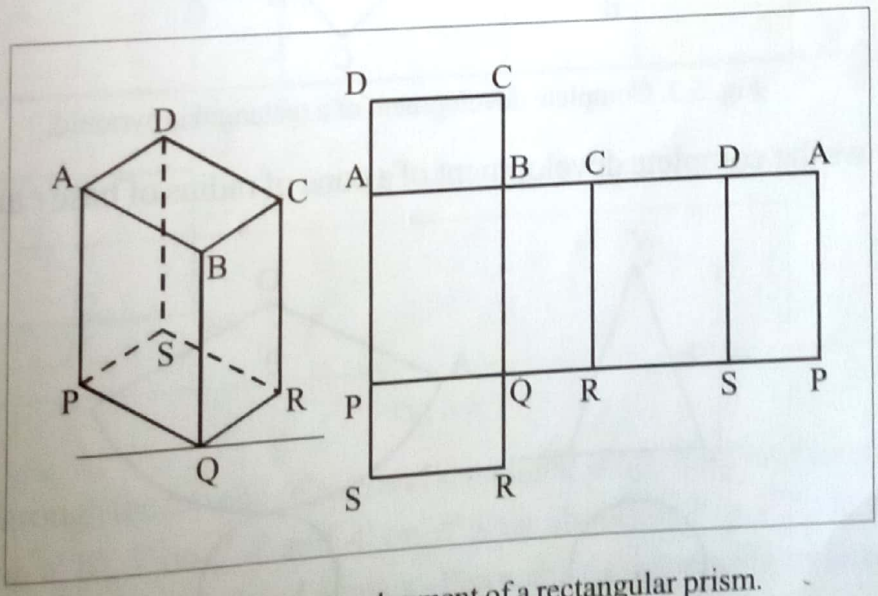

Fig. 5.1. Complete development of a rectangular prism.

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5.2

Fig. 5.2 shows the complete development of a cylinder of radius r and height h.

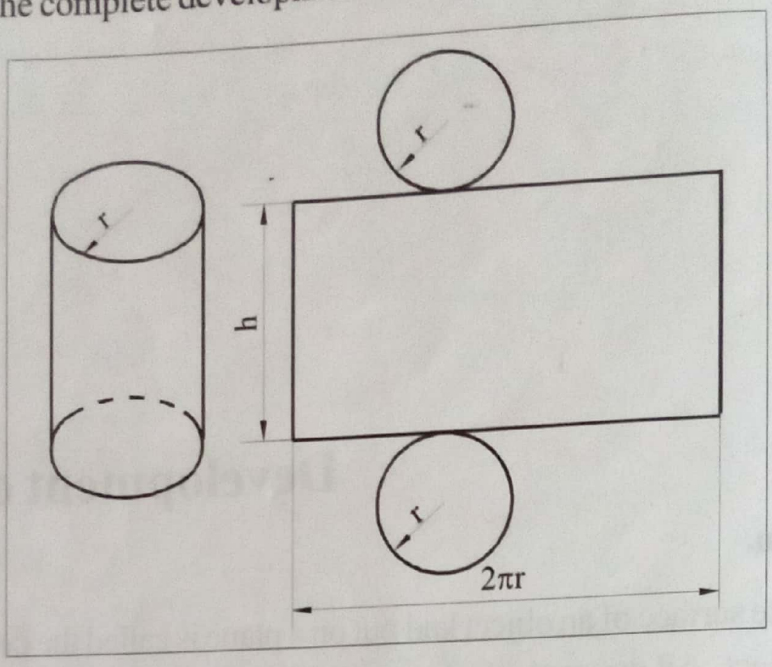

Fig. 5.2. Complete development of a cylinder.

Fig. 5.3 shows the complete development of a rectangular pyramid.

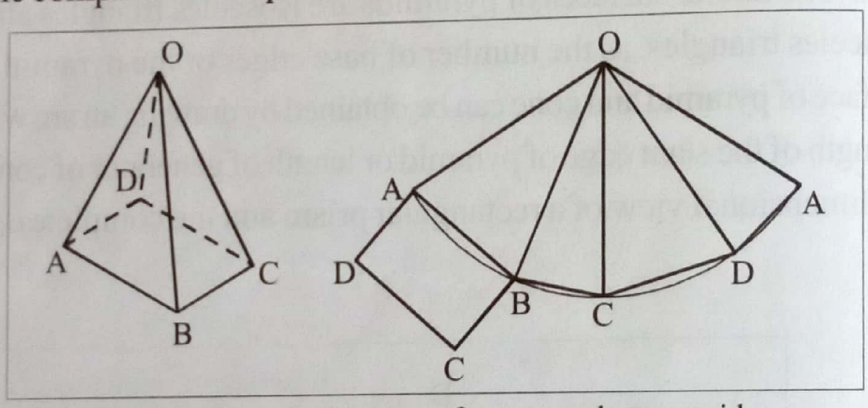

Fig. 5.3. Complete development of a rectangular pyramid.

Fig. 5.4 shows the complete development of a cone of radius of base r and axis height h.

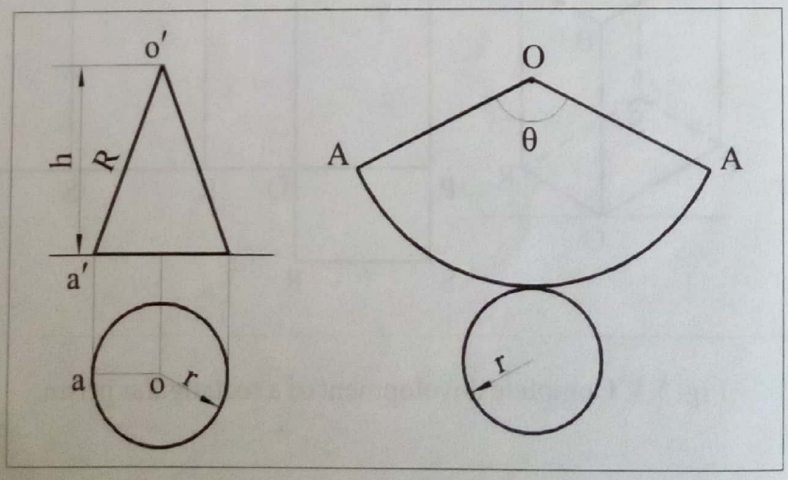

Fig. 5.4. Complete development of a cone.

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Radius of the arc AA is the length of generator, R.

Length of arc AA = $2\pi r$

$R\theta = 2\pi r$

$$\theta = \left(2\pi \times \frac{r}{R}\right) \text{rad.}$$

$$\theta = \left(360 \times \frac{r}{R}\right)^{o}$$

Example 5.1.

A rectangular prism, side of base 25mm x 15mm and axis height 35mm is kept with its base on HP with the 25mm base edge parallel to VP. It is cut by a section plane perpendicular to VP, inclined at 60° with HP and passing through the top end of the axis. Draw the development of the lateral surface of the lower portion of the prism.

Solution.

Draw the plan and elevation of the prism. Draw the vertical trace of the section plane

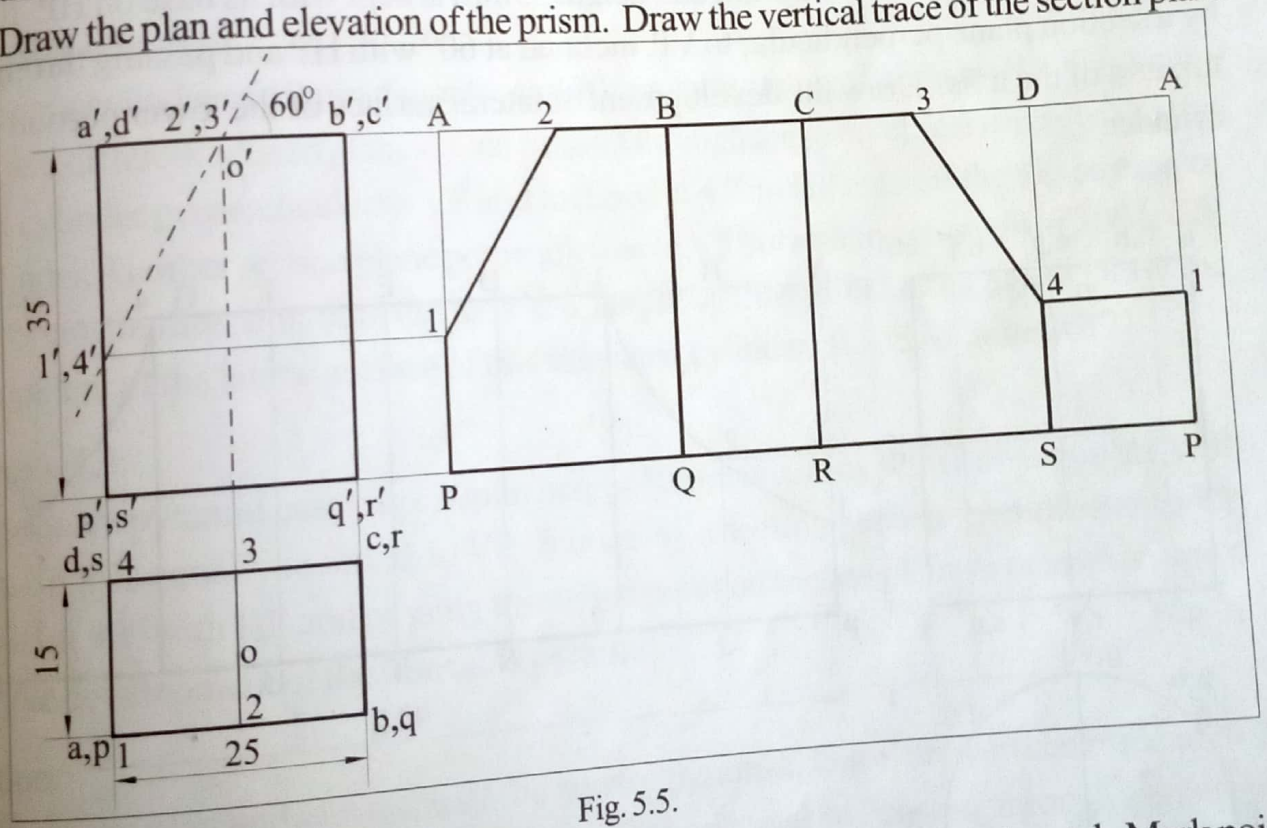

Fig. 5.5.

which passes through the top end of axis and is inclined at 60° with horizontal. Mark point 1′ on a′ p′, 2′ on a′ b′, 3′ on c′ d′ and 4′ on d′ s′ as shown in Fig. 5.5. In the plan mark point 1 on ap, 2 on ab, 3 on cd and 4 on ds. Draw the development of lateral surface of the prism. It consists of four rectangles as shown in Fig. 5.5. Mark point 1 on AP such that P-1 = p′ 1′. Mark point 2 on AB such that A-2 = a-2 in the plan. Mark point 3 on CD

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such that C-3 = c′ - 3′ and point 4 on DS such that S-4 = S′-4′. Join the points 1,2,3,4 and 1 by straight lines.

Problem for practice.

A pentagonal prism side of base 25mm and height 60 mm is kept with its base on HP with one of the base edges parallel to VP and nearer to it. It is cut by a section plane perpendicular to VP, inclined at 45° with HP and passing throught the mid point of the axis. Draw the development of the lateral surface of the bottom portion of the prism.

University question.

A pentagonal prism with 20mm side of base and 45mm height stands vertically on its base with two of its rectangular faces equally inclined to VP. The VT of cutting plane inclined at 45° to the axis of the prism passes through the left corner of the top face of the prism. Develop the lateral surface of the lower portion of the prism. [CUSAT June 2011].

Example 5.2.

A cylinder of diameter 30mm and height 35mm is kept with its base on HP. It is cut by a section plane perpendicular to VP, inclined at 60° with HP and passing through the top end of the axis. Draw the development of lateral surface of the lower portion of the cylinder.

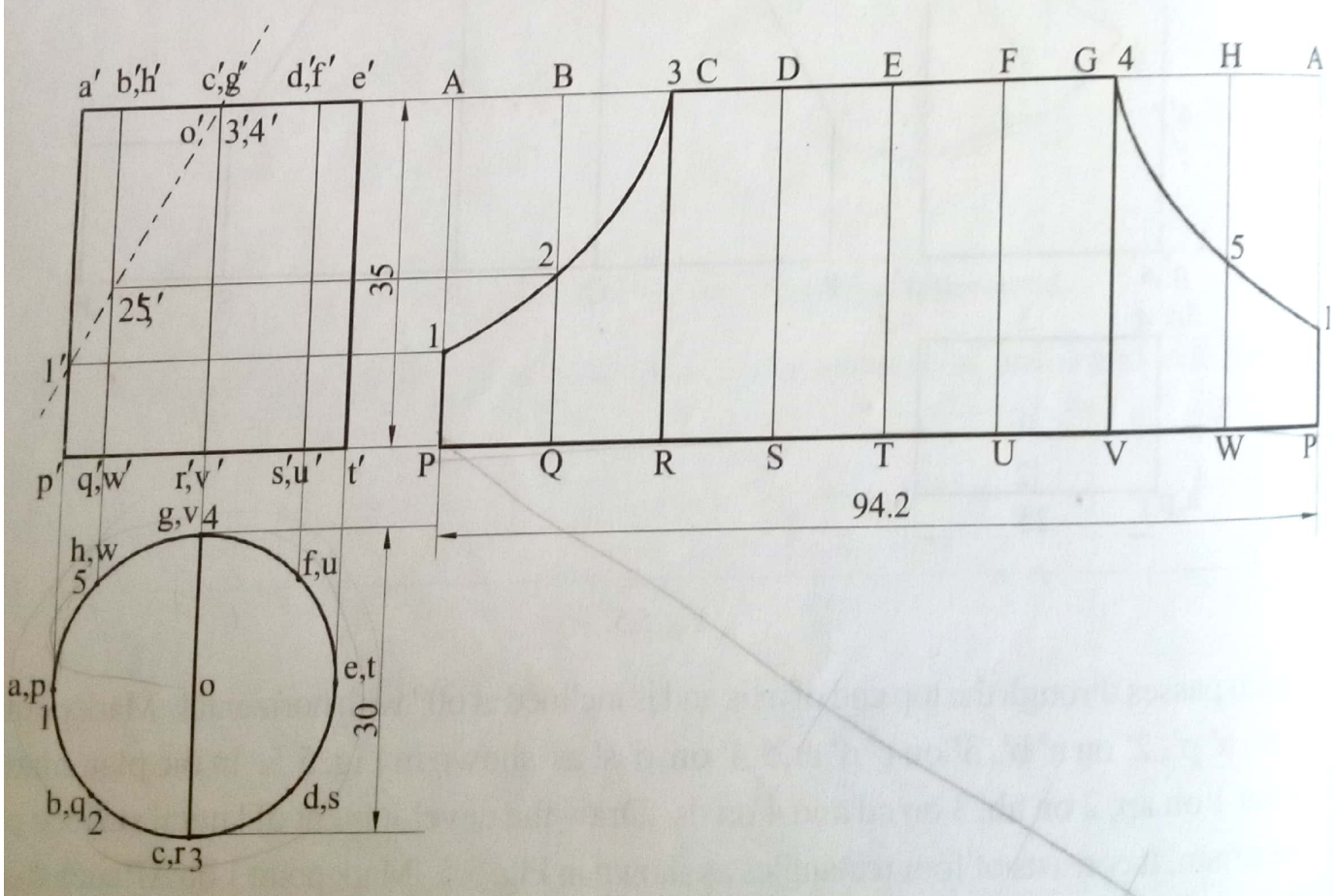

Fig. 5.6.

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Solution.

Draw the plan and elevation of the cylinder. Draw the vertical trace of the cutting plane which is a line passing through the top end of the axis and is inclined at 60° with horizontal. Mark point 1 on a′ p′, 2′ on b′ q′, 3′ at c′, 4′ at g′, and 5′ on h′ w′.

Draw the development of the cylinder which is a rectangle of width $2\pi r = 2 \times \pi \times 15 = 94.2$mm and height 35mm. Divide this rectangle into eigtht equal parts and mark the points A, B, C etc. at the top and P, Q, R etc. at the bottom as shown in Fig. 5.6. Mark point 1 on AP, 2 on BQ, 3 at C, 4 at G and 5 at HW. Join these points by a smooth curve.

Problem for practice.

A cylinder of diameter 50mm and height 60mm is kept with its base on HP. It is cut by a section plane perpendicular to VP, inclined at 45° with HP and passing through the mid point of the axis. Draw the development of the lateral surface of the lower portion of the cylinder.

University question.

A right cylinder of 50mm diameter and 90mm long resting upright on HP. It is being cut by two different section planes. One passing through the geometrical centre of the top face of cylinder perpendicular to VP and inclined at 45° to HP cuts off the top portion of the cylinder. Another section plane perpendicular to VP but making an angle of 30° to HP in the opposite direction cuts the axis at a height of 20mm from the base. Draw the development of the lateral surface of this truncated cylinder. [CUSAT June 2012].

Example 5.3.

A square pyramid base edge 20mm height 30mm is resting with its base on HP with the base edges equally inclined to VP. It is cut by a section plane perpendicular to VP, inclined at 40° with HP and passing through a point on the axis 15mm below the apex. Draw the development of the truncated pyramid.

Solution.

Draw the plan and elevation of the square pyramid. Draw the vertical trace of the section plane which is a line inclined at 40° with horizontal and passing through a point on the axis, 15mm below the apex. Mark point 1′ on o′ a′, 2′ on o′b′, 3′ on o′c′ and 4′ on o′d′. Locate point 1 on ab, 2 on ob, 3 on oc and 4 on od. In the elevation o′a′ is the true length of slant edge of the pyramid. This is because in the plan the line oa is horizontal. With a point O as centre, draw an arc of radius o′a′. Locate point C on this arc, vertically below the point O. Locate points A, B, D and A on the arc such that

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5.6

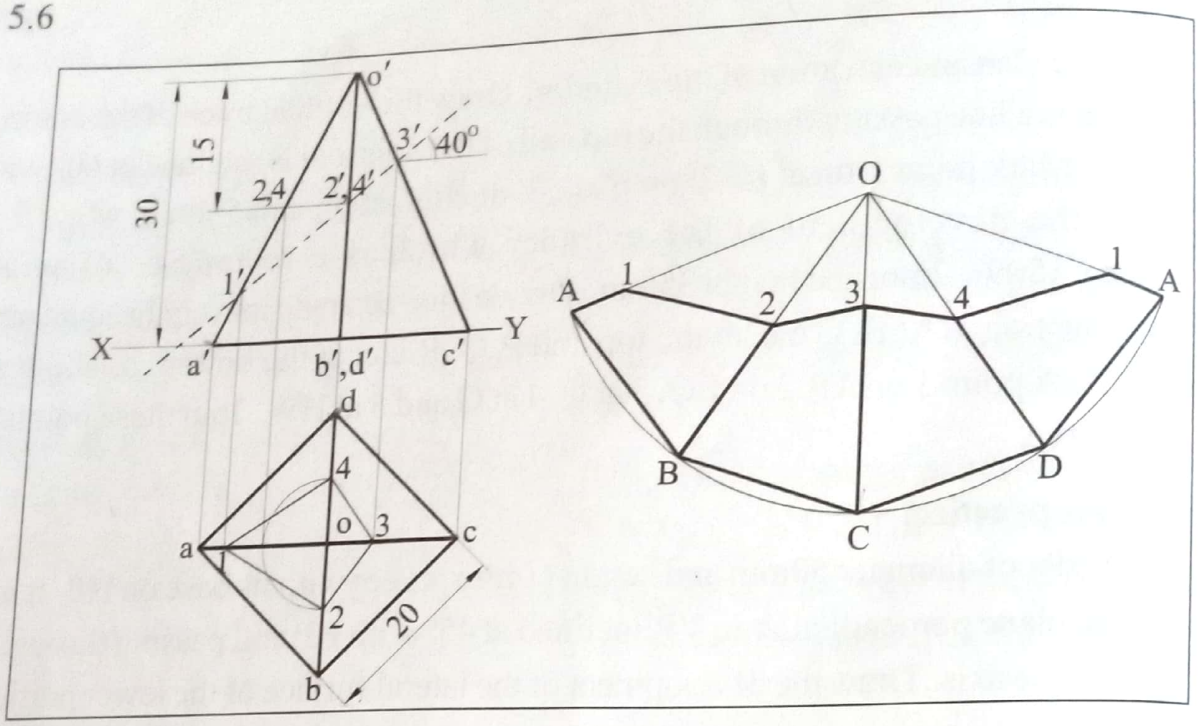

Fig.5.7

CB=BA=CD=DA=20mm. Join the points 1, 2, 3, 4 and 1as shown in Fig. 5.7.

Problem for practice.

A hexagonal pyramid side of base 25mm and axis height 60 mm is kept with its base on HP with one of its base edges parallel to VP. It is cut by a plane perpendicular to VP, inclined at 45° with HP and passing through the mid point of its axis. Draw the development of the lateral surface of the truncated pyramid.

University question.

1. A square pyramid, edge of base 45mm and height 60mm, is resting on its base in HP such that its base edges are equally inclined to VP. It is cut by a section plane perpendicular to the VP and inclined at 30° to the HP and intersecting the axis at a point 20 mm from the apex. Develop the lateral surface of the truncated pyramid. (KU June 2012).

2. A regular hexagonal pyramid of base 3 cm side and axis 7 cm long is resting on the ground with a side of the base parallel to VP. It is cut by a plane inclined at 30° to the HP and passes through the extreme corner of the base. Draw its development. (KU Jan 2009).

3. A hexagonal pyramid of base 25mm and altitude 50mm rests on its base on the HP and two sides of the base perpendicular to VP. It is cut by a plane bisecting the axis and inclined at 45° to the base. Draw the development of the lateral surface of the

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lower part of the pyramid. (CUSAT June 2013).

4. A hexagonal pyramid base edge 30 mm and height 60 mm is resting on its base on HP with one of its base edges parallel to VP. It is cut by two auxiliary inclined planes which are inclined at 30° and 60° with HP respectively. The cutting planes intersect on the axis at a height of 20 mm above th base.Draw the development of the bottom portion if the common portion above the cutting planes is only removed. (CUSAT June 2013).

Example 5.4.

A cone with a 60 min base diameter and a 70mm long axis, rests on its base on the H. P. Draw the development of its lateral surface when it is cut by an inclined plane bisecting the axis and inclined at 45° to the H. P.

Solution.

Draw the plan and elevation of the cone. Draw the vertical trace of the section plane which is inclined at 45° with horizontal and passes through the mid point of the axis. Divide the circumference of top view into eight equal parts and mark the points a,b,c, etc. In the

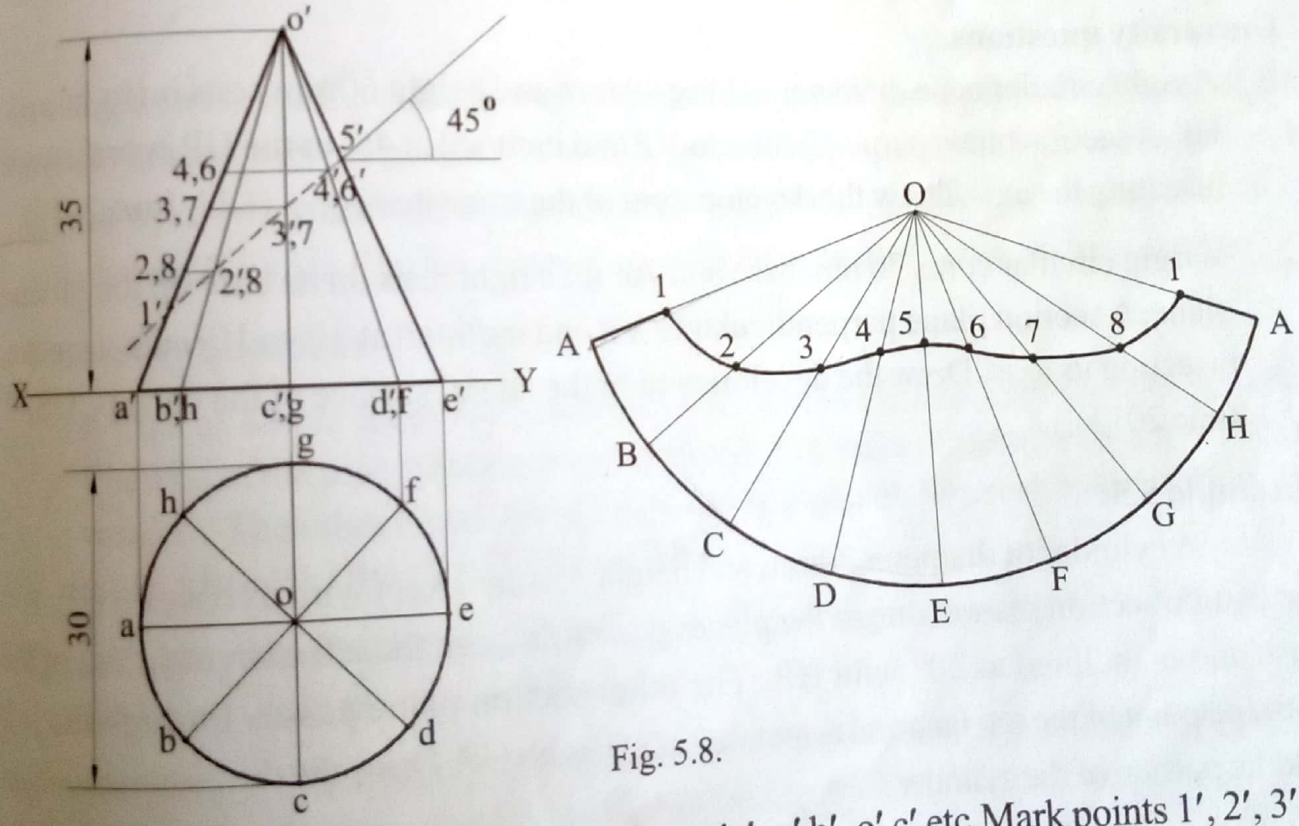

Fig. 5.8.

elevation draw the elevation of generators, o′a′, o′ b′, o′ c′ etc.Mark points 1′, 2′, 3′ etc on the respective generators, o′a, o′b′,o′c′ etc as shown in Fig. 5.8. Draw the development of lateral surface of the cone which is sector of radius equal to the true lengthof generator and arc length AA=2 π r = 2 × π × 15 = 94.2mm. The corresponding angle θ is

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given by, $\theta = (360 \times \frac{r}{R})^{o} = (360 \times \frac{15}{38}) = 142^{o}$. Draw the arc AA with radius OA= o'a' and angle AOA= 142°. Divide this arc AA into eight equal parts and mark the points B,C,D etc as shown in Fig. 5.8. Join these points with O. In the elevation points 1′ and 5′ are on the true length line. Therefore we can locate point I on line OA and point 5 on line OE such that O-1 = o'a' and O-5 = o'e'. The other points, 2′, 3′ etc. are on the apparent length of generators and hence these points 2, 3, 4 etc in the development cannot be located as the points 1 and 5 are located. All the points on the apparent length line are to be transferred to the true length line. From the points 2′, 3′, 4′ etc draw horizontal lines to meet the generator o'a' at points 2, 3, 4 etc. Now locate the points 2, 3, 4 etc on OB, OC, OD etc. such that O-2=o'-2 measured along the generator, o' a', O-3 = o' -3 etc. Join the points 1, 2, 3 etc in the development, by a smooth curve.

Problem for practice.

A cone of base diameter 50 mm and axis height 60mm is kept with its base on HP. It is cut by a plane perpendicular to VP, inclined at 45° with HP and bisecting the axis. Draw the development of the truncated cone.

University questions.

1. A right circular cone diameter of base 40 mm and height 60mm rests on its base on HP. A section plane perpendicular to VP and inclined at 45° to the HP cuts the cone bisecting the axis. Draw the development of the truncated cone. (KU. June 2010).
2. A right circular cone, 70 mm base and 70mm height rests on its base on the ground plane. A section plane perpendicular to VP and inclined at 30° to HP cuts the cone, bisecting its axis. Draw the development of the lateral surface of the cone.(CUSAT June 2013).

Example 5.5:

A cylinder of diameter 30mm and height 35mm is kept with its base on HP. It is cut by two section planes, one of the planes passes through the left extreme point of the base and is inclined at 20° with HP. The other section plane passes through the left extreme point of the top face and is inclined at 25° with HP. Draw the development of the middle portion of the cylinder.

Solution.

Draw the plan and elevation of the cylinder and show the vertical traces of the cutting planes as shown in Fig. 5.9. Draw the development of lateral surface of the cylinder which is a rectabgle of height 35mm and breadth 94.2mm(2**r). Divide this

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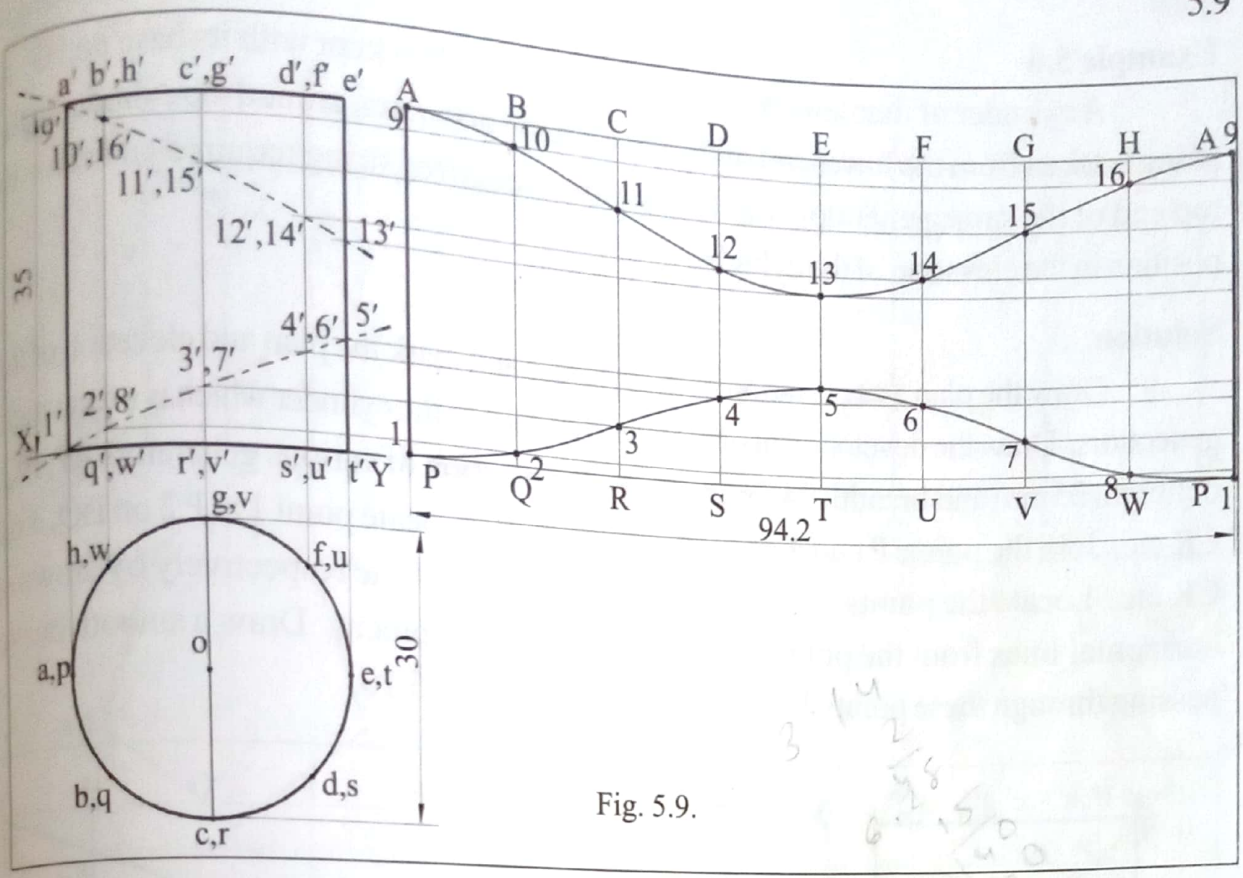

Fig. 5.9.

rectangle and the plane of the cylinder into any number of equal parts. The lines AP, BQ, CR etc are the various generators and the points 1,2,3 etc on these generators can be located by drawing horizontal lines from the points 1', 2', 3', etc, in the elevation of the cylinder, as shown in Fig. 5.9. Draw a smooth curve passing through these points.

University questions.

1. A pipe of 45mm diameter is welded to the vertical side of a rectangular steel tank. The axis of the pipe 100mm long is inclined at an angle of 60^0 to the side to which it is welded. The other end of the pipe makes an angle of 30^0 to its own axis. Draw the development of the pipe.[KU May 2009]
2. A right cylinder of 50mm diameter and 90mm long resting upright on HP. It is being cut by two different section plane,

i) one passing through the geometrical centre of the top face of the cylinder, perpendicular to VP and inclined at 45^0 to HP cuts off the top portion of the cylinder.

ii) Another section plane perpendicular to VP but making an angle of 30^0 to HP in the opposite direction cuts the axis at a height of 20mm from the base. Draw the development of the lateral surface of this truncated cylinder. [CUSAT June 2012]

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Example 5.6

A cylinder of diameter 30mm and height 35mm is kept with its base on HP. A string is taken from the lower end of the left extreme generator, around the cylinder to the top end of the same generator. Find the shortest length of string required and show its position in the elevation of the cylinder.

Solution.

Draw the plan and elevation of the cylinder and mark the plan and elevation of the generators. Draw the development of the lateral surface of the cylinder which is a recatangle of height 35mm and breadth 94.2mm. Show the position of various generators AP, BQ, CR etc. Join the points P and A as shown in Fig. 5.10. Locate point 1 at P 2 on BQ, 3 on CR etc. Locate the points 1', 2', 3'etc at p", b", q", c", r"etc respectively by drawing horizontal lines from the points 2,3,4 etc, in the development. Draw a smooth curve passing through these points 1', 2',3' etc as shown in Fig 5.10.

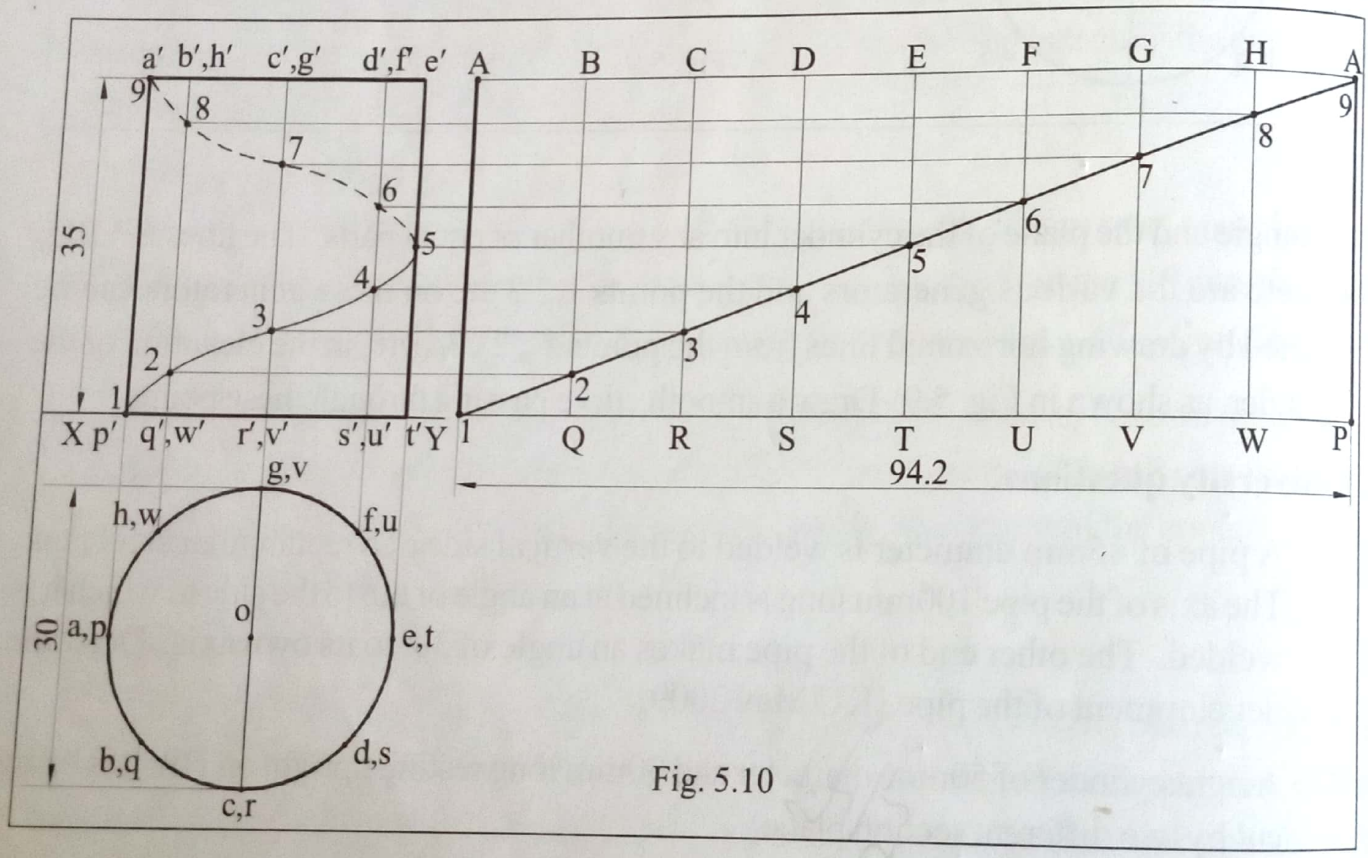

Fig. 5.10

Example 5.7

A pentagonal prism of side 15mm and length of axis 35mm is kept on HP on one of its end faces with one of the rectangular faces parallel to VP and nearer to it. A thread is wound around the prism starting from the left extreme corner of the base and is brought back to the top of the same vertical edge. Find the minimum length of the thread and show it in the front view of the prism.

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Solution.

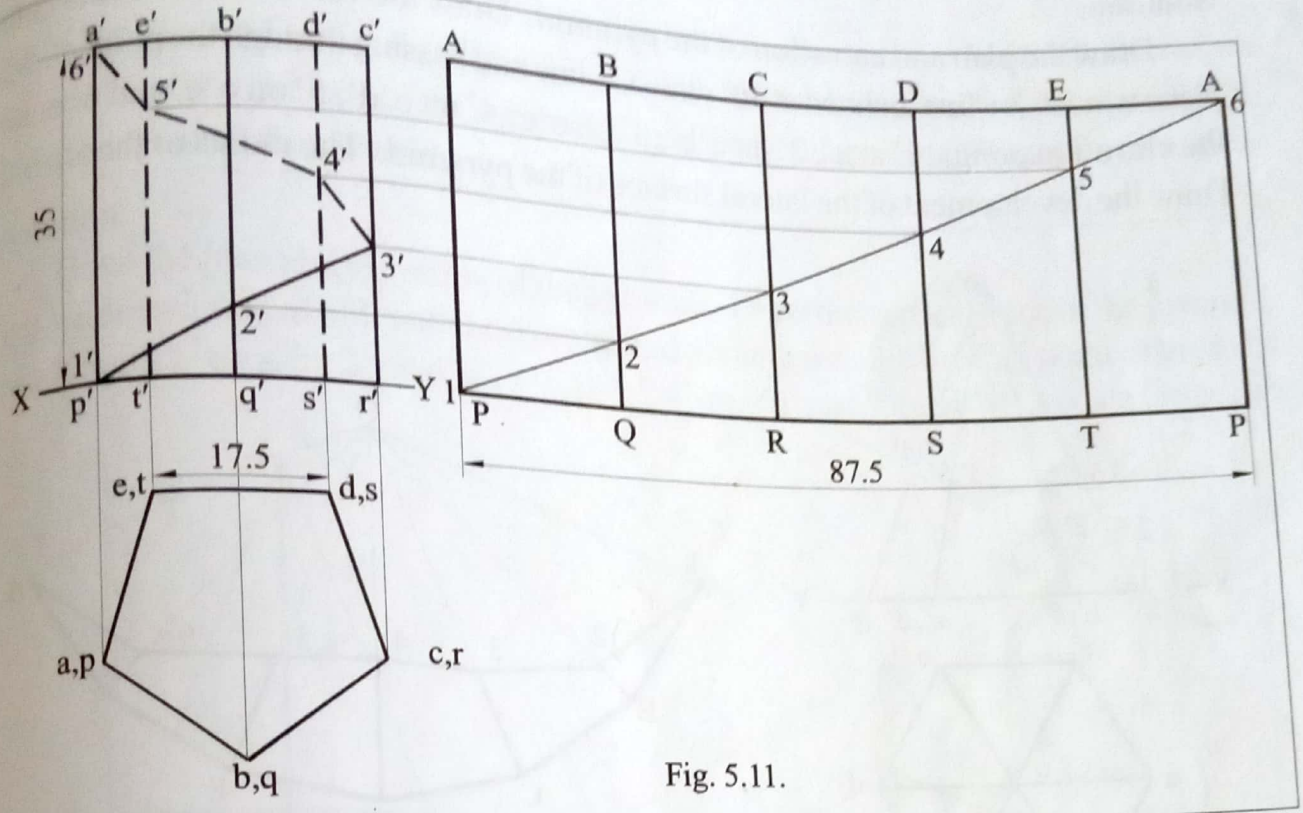

Fig. 5.11.

Draw the plan and elevation of the prism. Draw the development of the lateral surface of the prism as shown in Fig. 5.11. Join the points P and A by a straight line. The length of this line PA is the required minimum length of thread. Mark point 1 at P, 2 on BQ, 3 on CR, 4 on DS, 5 on ET and 6 at A. Locate the points 1', 2' etc in the elevation by drawing horizontal lines from the points 1,2,3etc. Join these points by straight lines as shown in Fig. 5.11 .

University question.

A regular pentagonal prism of side 40mm and length of axis 75mm is kept on the ground on its base with one of its rectangular faces away from the observer and parallel to the VP. A thread is wound around the prism starting from the nearest corner of the base and is brought back to the top of the same vertical edge. Find the minimum length of the thread and show it in front view and side view. (KU. June 2010).

Example 5.8

A hexagonal pyramid side of base 15mm and axis height 35mm is resting on HP with a side of base parallel to VP. It is cut by a plane inclined at 30^0 to HP and passing through an extreme corner of the base. Draw the development of lateral surface of the pyramid.

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Solution.

Draw the plan and elevation of the pyramid. Draw the vertical trace of the cutting plane whidch is a line inclined at 30^0 with XY line and passing through the point a'. Mark the elevation points, 1' at a', 2' on o'b', 3' on o'c',4' on o'd', 5' on o'e' and 6' on o'f'. Draw the development of the lateral surface of the pyramid. The radius of the arc is the

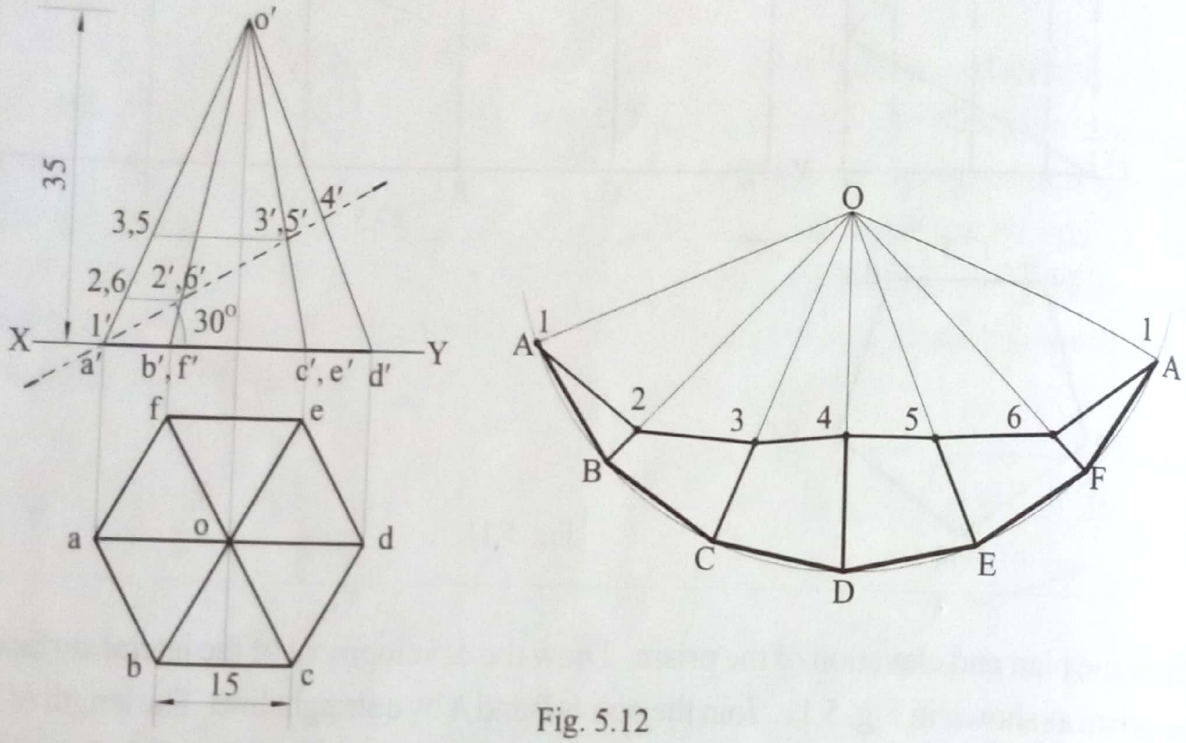

Fig. 5.12

true length of slant edge o'a'. Mark point A,B,C etc on this are such that AB = BC = CD = DE = EF = FA = 15 mm. Join these point with the centre of the arc, O. In the elevation, the points 2',3',5' and 6' are on the apparent length of slant edge and hence these points are to be transferred to the true length line o'a', by drawimg horizontal lines from points 2',3',5 and 6'. In the development locate the point. 2 on OB, 3 on OC, 5 on OE and 6 on OF by measuring the distance of these points marked in the true length line o'a', either from o' or from a'. Join the point 1,2,3 etc by straight lines as shown in Fig. 5.12.

University question.

A regular hexagonal pyramid of base 3cm side and axis 7cm long is resting on the ground with a side of the base parallel to VP. It is cut by a plane inclined at 30^0 to the HP and passes through the extreme corner of the base. Draw its development. [KU May 2008 and Jan. 2009]

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Example 5.9

A square pyramid side of base 20mm and axis height 35mm is kept with its base on HP. All the base edges are equally inclined to VP. It is cut by a plane indclined at 60^0 with HP and bisecting the axis of the pyramid. Draw the development of lateral surface of the lower portions of the pyramid.

Solution.

Draw the plan and elevation of the pyramid. Draw the vertical trace of the pyramid. It is a line inclined at 600 with horizontal and passing through the mid point of the axis. Mark point 1' on a'b', 2' on o'b', 3' on o'c', 4' on o'd' and 5' on d''a'. Locate the points

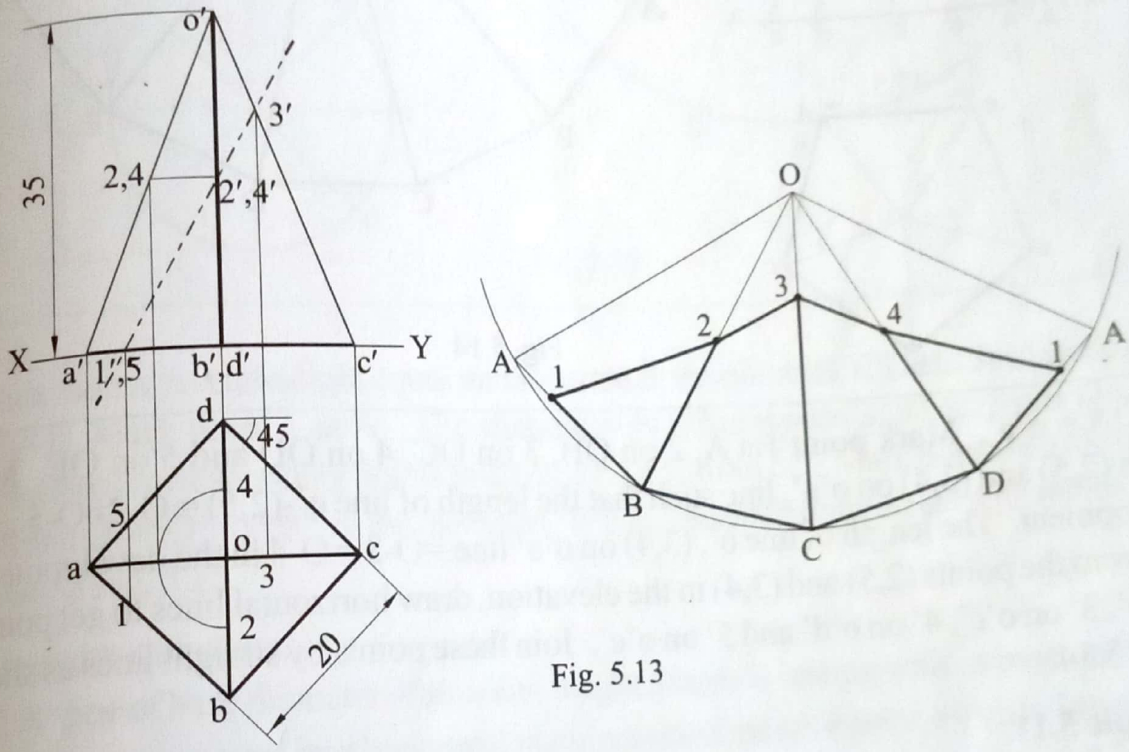

Fig. 5.13

1 and 5 in the plan. Point 1 is on ab and 5 is on ad. Draw the development of the pyramid and mark point 1 on AB such that A-1= a-1 in the plan. The distance of 2 and 4 from O in the development is the distance of 2 and 4 in the elevation from o'. The distance of point 3 from O is the distance o'3' in the elevation. Join the points by straight lines as shown in Fig. 5.13

Example 5.10

A pentagonal pyramid side of base 17.5mm and axis height 35mm is kept with its base on HP. One of the base edges is parallel to VP and is nearere to VP. A string is taken around the pyramid from the left extreme base corner back to the same point. Obtain the shortest length of string required and show its position in the plan and elevation of the pyramid.

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Solution.

Draw the plan and elevation of the pyramid. Draw the development of the lateral surface of the pyramid and join the points A and A, as shown in Fig. 5.14. The radius f of

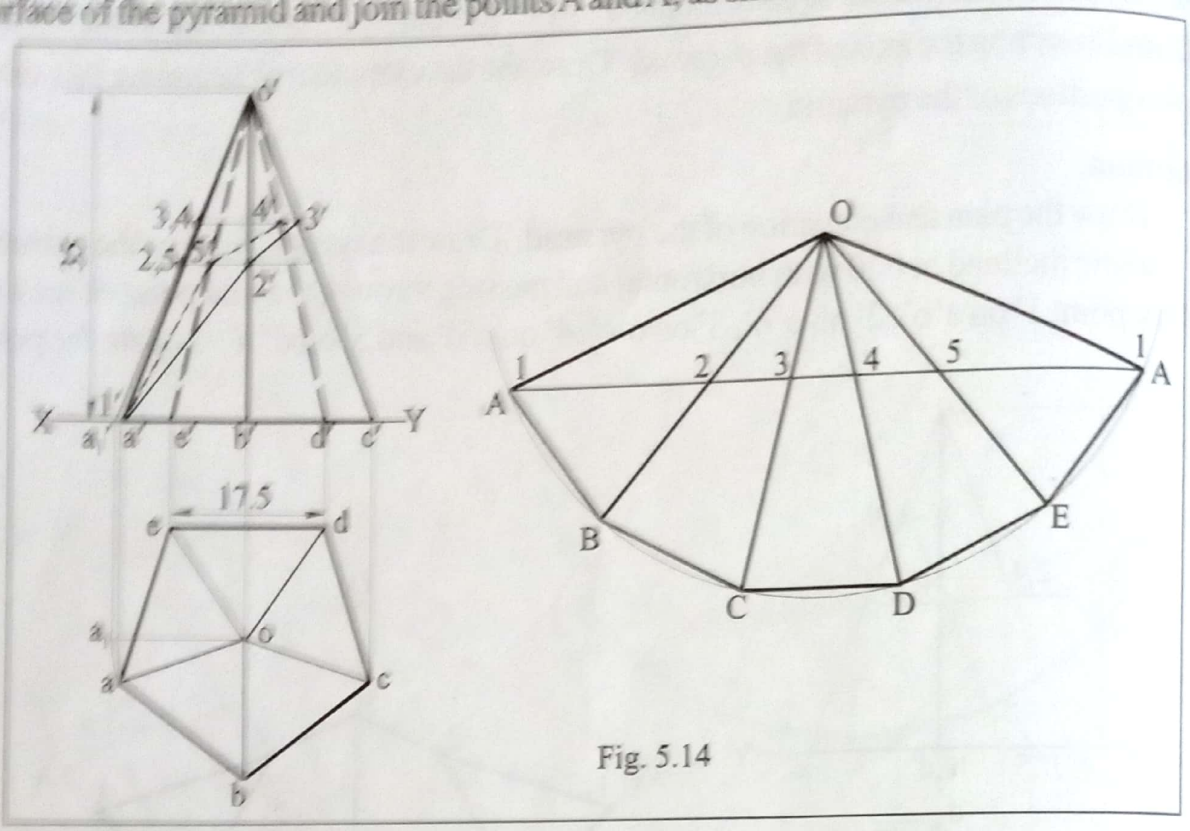

Fig. 5.14

are, OA = o'a'. Mark point 1at A, 2 on OB, 3 on OC, 4 on OD and 5 on OE. Mark points (2,5) and (3,4) on o'a', line such that the length of line o'-(2,5) = O-2=O-5 in the development. The length of line o', (3,4) on o'a' line.=O-3 = O-4 in the development.

From the points (2,5) and (3,4) in the elevation, draw horizontal lines to get point 2' on o'b', 3' on o'c', 4' on o'd' and 5' on o'e'. Join these points by straight lines as shown in Fig. 5.14.

Example 5.11.

A cone of base diameter 30mm and axis height 35mm is kept with its base on HP, It is cut by two section planes,

i) a horizontal section plane passing through a point on the axis, 15mm below the apex.

ii) a plane inclined at 30° with HP and passisng through the extreme left end of the horizontal diameter. Draw the development of the middle portion of the cone.

Solution.

Draw the plan and elevation of the cone. Draw the vertical traces of the section pllanes and mark the points 1', 2' etc. Draw the development of the lateral surface of the cone. The radius of arc AA = R, the length of generator. The angle ADA is given by

$$\theta = 360 \times \frac{r}{R} = 360 \times \frac{15}{38} = 142^0$$

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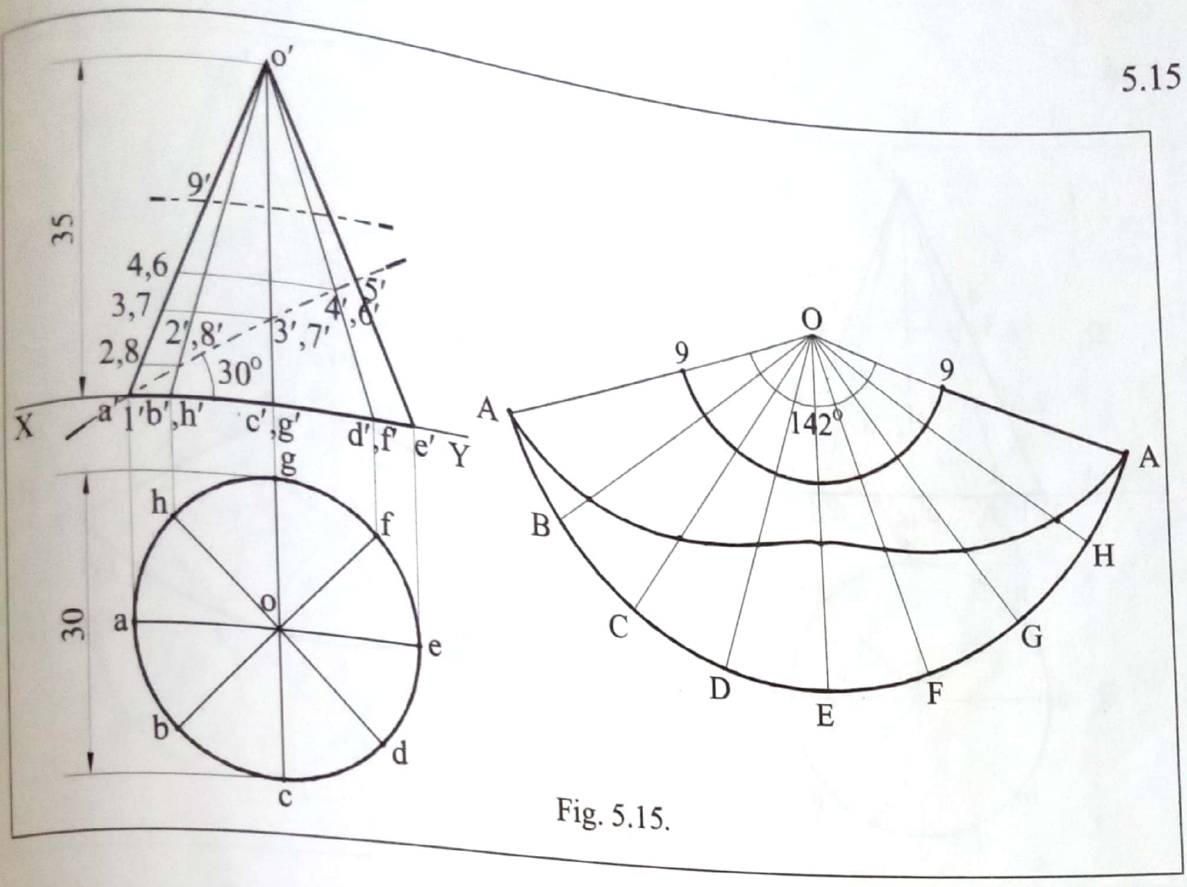

Fig. 5.15.

Divide the arc AA into eight equal parts and mark the points B, C D etc. Join these points with O. Mark point 1 at A. The distances of other points 2, 3 etc. from O are the distances of corresponding points in the line o' a' , from o' . Mark point 9 on the line oA such that O-9=Q' o' 9' in the elevation. With O as centre draw an are with radius 0-9, as shown in Fig. 5.15.

University question.

A cone of base diameter 40mm and height 58mm is resting with its base on HP. The top portion is removed by a horizontal plane passing through a point which is 24mm below the apex of the cone. The bottom portion is then removed by a plane inclined at 30° to HP and passing through the extreme right of the base. Draw the development of the remaining portion of the cone. [CUSAT June 2013].

Example 5.12.

A cone of base diameter 30mm and axis height 35mm is kept with its base on HP. It is cut by a plane inclines at 60°with HP and passing through a point on the axis, 20mm below the apex of the cone. Draw the development of the lateral surface of the bottom portion of the cone.

Solution.

Draw the plan and elevation of the cone. Draw the vertical trace of the cutting plane which is a line inclined at 60° with HP and passisng through a point on the axis 20mm

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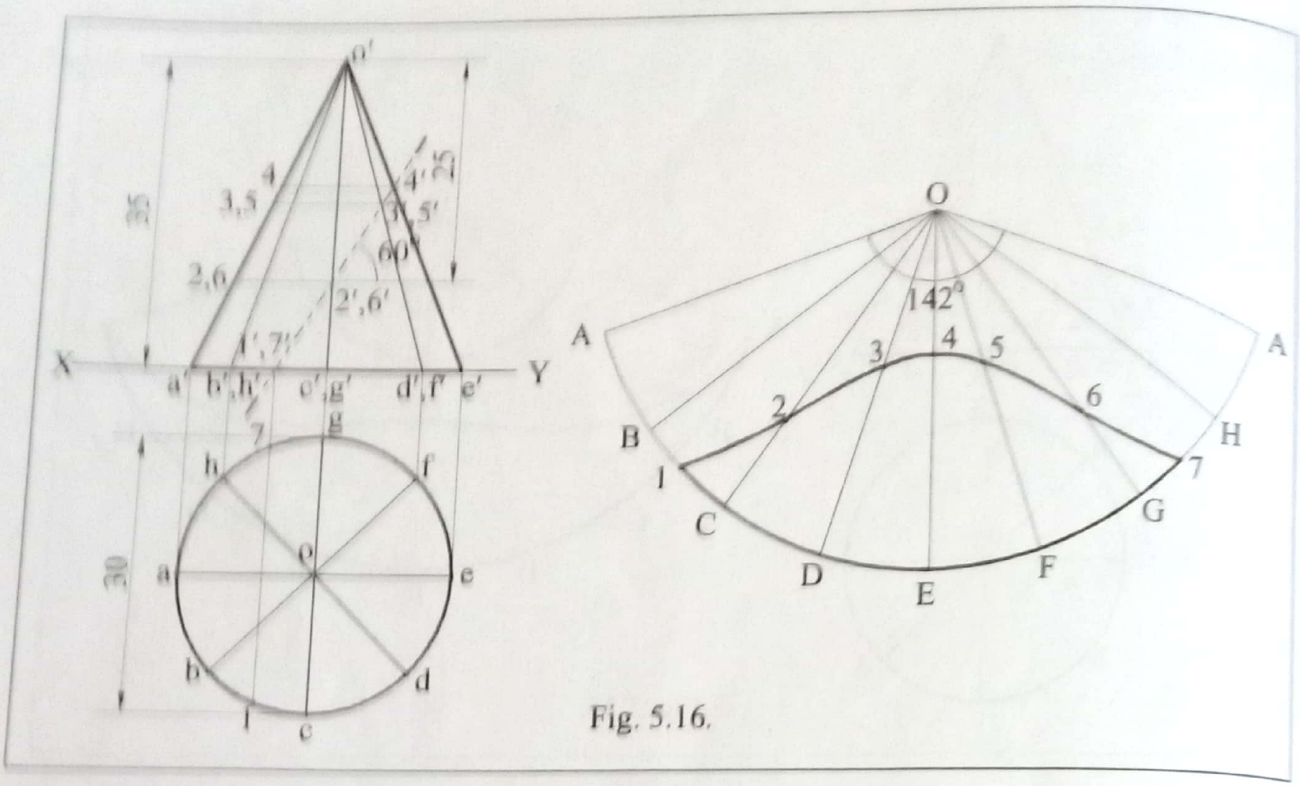

Fig. 5.16.

below the apex of the cone. Mark the points 1', 2', 3' etc. The point 1' is in between b' and c'. The point 7' is in between g' and h'. Locate point 1 in between b and c, point 7 in between g and h. Locate points 1 and 7 in the development such that B-1 = b-1 in the plan and G-7 in the development = g-7 in the plan.

University question.

A cone of 50mm diameter and 60mm high rests with its base on ground. It is cut by a plane perpendicular to VP and inclined at 60^0 to HP and passing through a point on the axis 30mm above the ground. Draw the development.[KU June 2009]

Examaple 5.13.

A cone of base diameter 30mm and axis height 35mm is kept with its base on HP. It is cut by a section plane perpendicular to both HP and rP, which is 7.5 mm away from the axis. Draw the development of the lateral surface of the larger portion of the cone.

Solution.

Draw the plan, and elevation of the cone. Draw the vertical trace of the section plane which is a line 7.5mm away from the axis. Mark the points 1, 2, 3 etc. in the plan and 1', 2', 3' etc. in the elevation. Point 1 is in between c and d, point 5 is in between f and g. C and D such that C-1=C1 in the plan and F-5=F-5 in the plan. Locate the other points as shown in Fig. 5.17.

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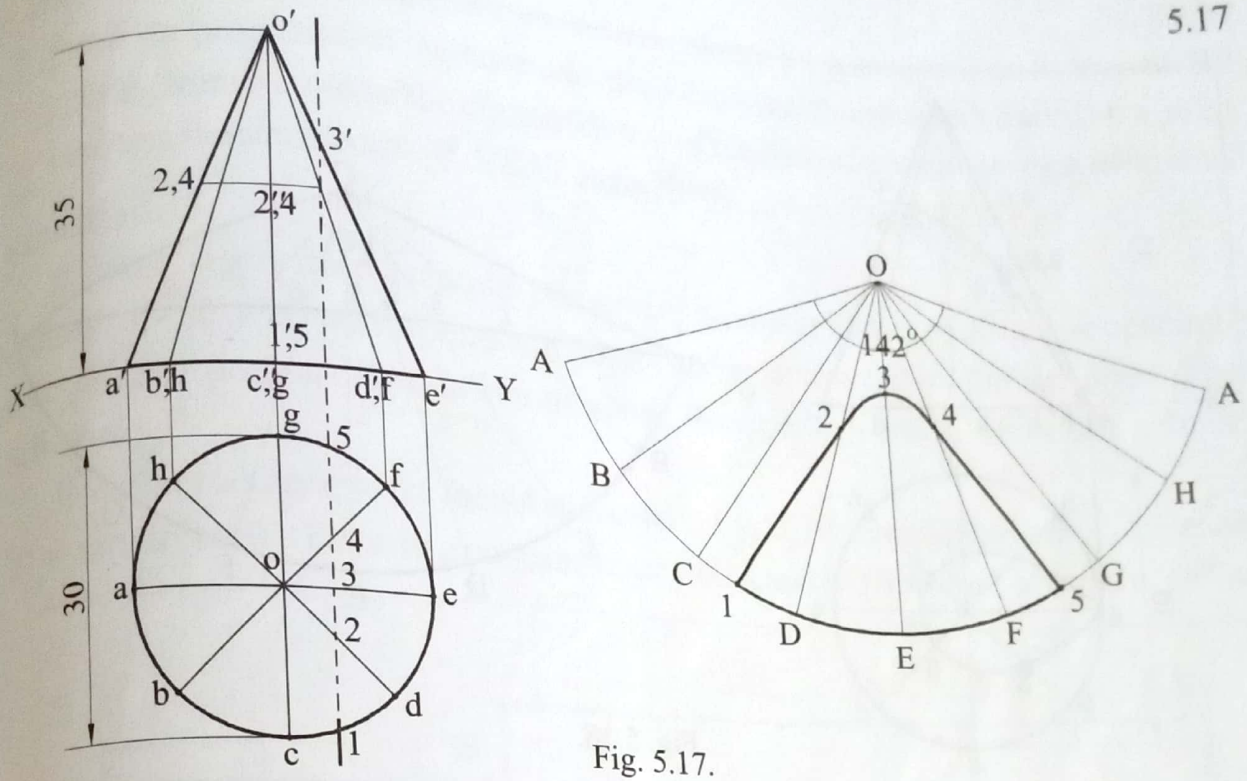

Fig. 5.17.

University question.

A cone of 50mm diameter and 60mm high rests with its base on ground. It is cut by a plane perpendicular to both HP and VP and 10-mm away from the axis. Draw the development of the conical section. [KU June 2011].

Example 5.14.

A cone of diameter of base 25mm and axis 30mm long is resting on its base on HP. Draw the projection of the cone and show on it the shortest path traced by a point, starting from a point on the circumference of the base of cone, moving around it and reaching the same point.

Solution.

Draw the plan and elevation of the cone. Draw the development of lateral surface of cone. It is a sector AOA, with length of OA=R=32.5mm and angle AOA, $\theta = 360 \times \frac{r}{R} = 133.46^{o}$. Join points A and A by a straight line. Mark point 1 at A, 2 on OB, 3 on OC etc. Locate points 2 on the true length line o' a' such that o' 2 = O2 from the development. Similarly locate points 3, 4 etc. on the true length line o' a'. From these points 2, 3, 4 etc. on o' a' , draw horizontal lines to intersect the line o' b' at 2', o' c' at 3'

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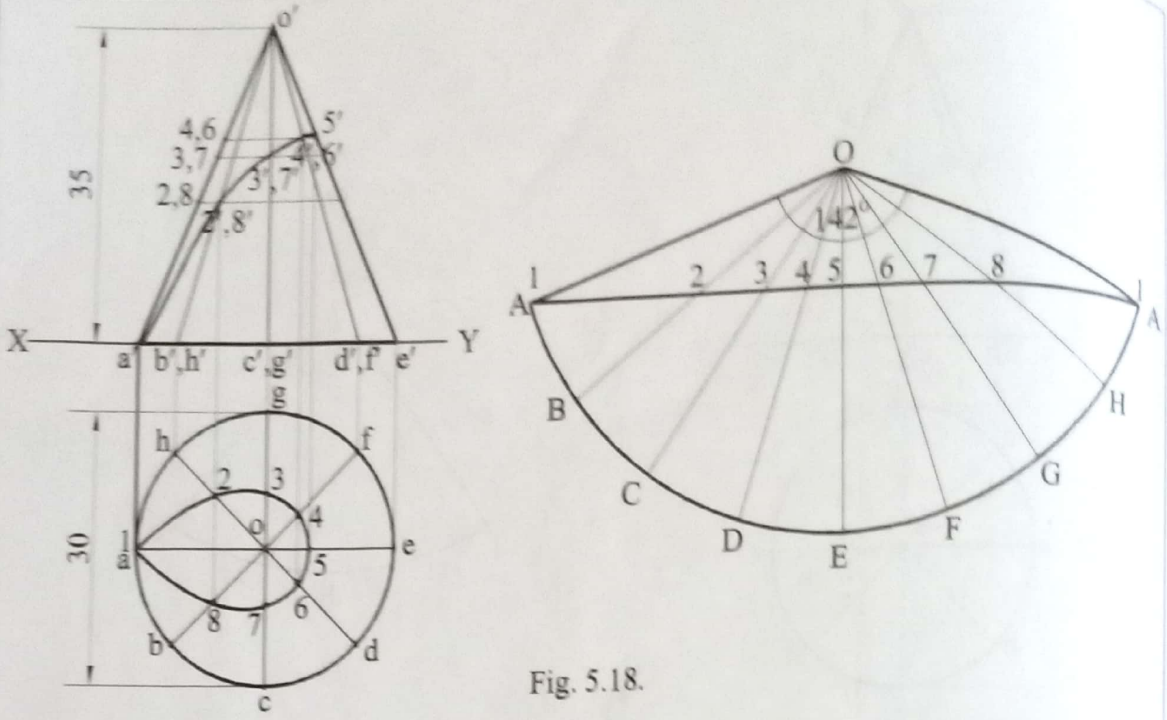

Fig. 5.18.

etc. Join these points by a smooth curve. Locate points 2, 3, 4 etc. in the top view and join these points by a smooth curve.

Problem for practice.

Draw the projections of a cone of diameter of base 60mm and axis 70mm long, resting on the ground on its base and show on them, the shortest path by which a point P, starting from a point on the circumference of the base and moving around the cone will return to the same point.

University questions.

1. A right circular cone of 55mm diameter and 80mm height rests on ground plane on its base. A bee starts from a point on the base rim on right hand side and moves around the surface of the cone and finally comes back to the starting point. Find the length of the shortest path the bee should take in covering the distance along the surface of the cone. Also show the path in front and top views. [KU. June 2011and CUSAT June 2009].

2. A sugar jar is in the form of a right circular cone of base diameter 60mm and height 90mm and it rests on HP. An ant starts moving from extreme left end of its base, returns to its starting point after moving around it. Find geometrically the length of the shortest path the ant can take. Show this path in both front and top views. (CUSAT June 2012].

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3. A cone of diameter of base 50mm and axis 60mm long, is resting on its base on HP. Draw the projection of the cone and show on it the shortest path traced by a point, starting from a point on the circumference of the base of cone, moving around it and reaching the same point. (CUSAT June 2010].

Example 5.15.

A funnel tapers from a circular opening of diameter 25mm to a circular opening of diameter of 100 over an axial length of 20mm and extends axially a further 15mm. There is a cylindrical portion of height 10mm above the tapering portion. Develop the funnel.

Solution.

Draw the elevation of the funnel as shown in Fig. 5.19. Extend the lines a' b' and c' d' to intersect at 0'. Draw two concentric arcs ACA and BDB with o' a' amd p' n' and

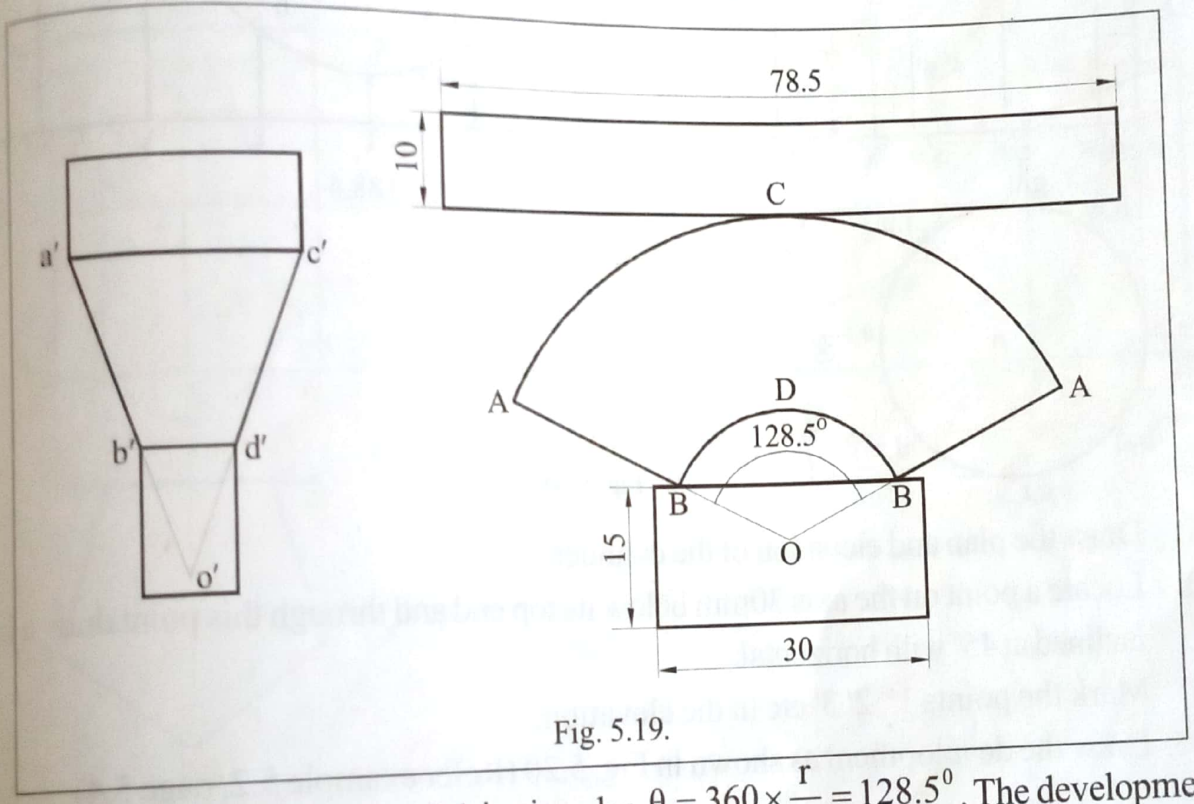

Fig. 5.19.

o' b' as radius . The angle AOA is given by, $\theta = 360 \times \frac{r}{R} = 128.5^0$. The development of top cylindrical portion is a rectangle of height 10mm and breadth equal to $2\pi r = 2 \times 3.14 \times 5 = 31.4$mm. The development of the lower cylindrical portion is also a rectangle of height 15mm and breadth equal to $2\pi r = 2 \times 3.14 \times 12.5 = 78.5$mm.

University question.

A funnel tapers from a circular opening of diameter 70mm to a circular opening of diameter 20mm over an axial length of 50mm and extends axially a further 40mm. There is a cylindrical portion of height 15mm above the tapering portion. Develop the funnel [MGU May 2013].

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Problem 5.1

A cylinder of diameter 60mm and length of axis 70mm rests on its base with the axis perpendicular to the HP. It is cut by the cutting plane perpendicular to the VP, inclined at 45° to the HP and passing through a point on axis 30mm from the top. Draw the development of the lateral surface of the cylinder.

Solution

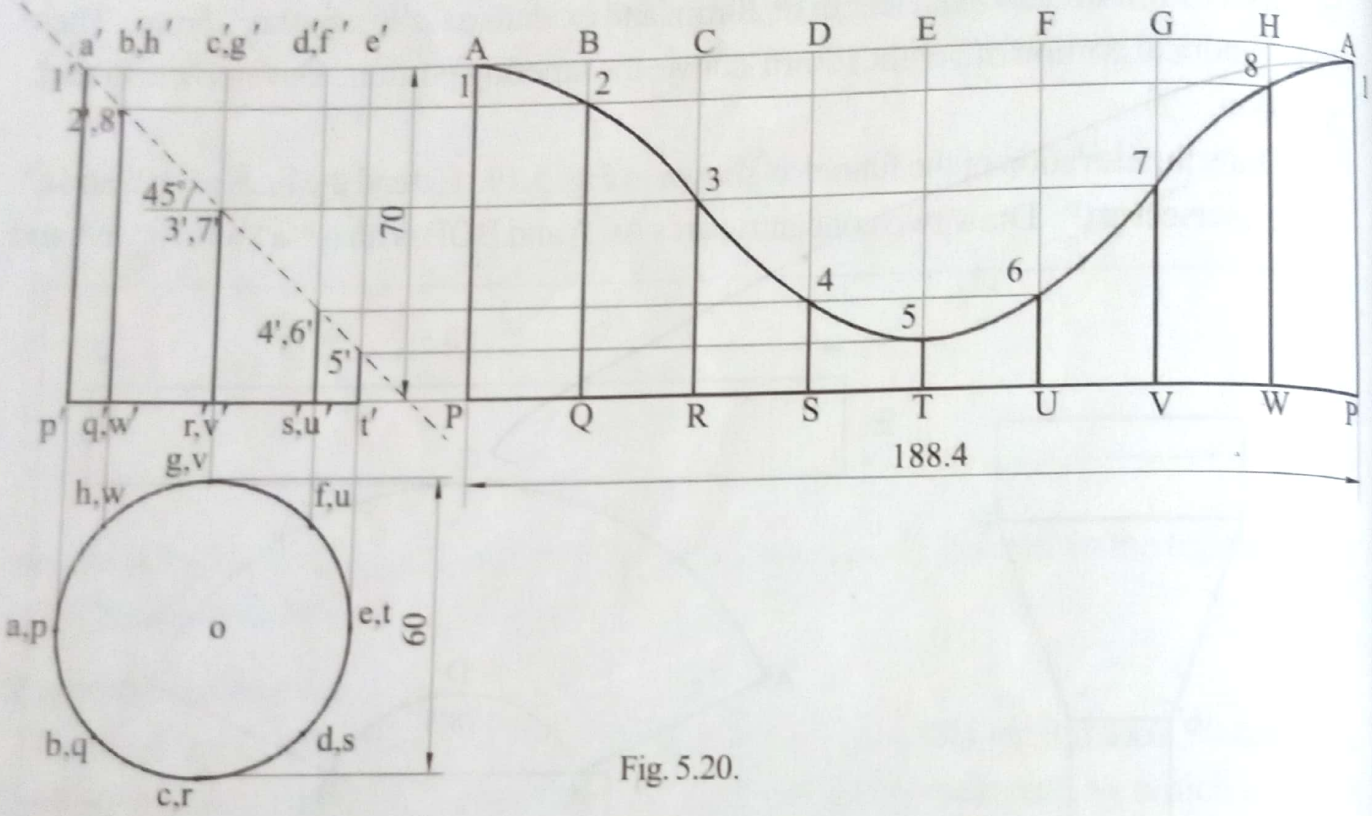

Fig. 5.20.

1. Draw the plan and elevation of the cylinder.
2. Locate a point on the axis 30mm below its top end and through this point draw a line inclined at 45° with horizontal.
3. Mark the points 1′, 2′ 3′ etc in the elevation.
4. Draw the development as shown in Fig. 5.20 (Refer example 5.2, page 5.4)

Problem 5.2

A pentagonal prism, having a base with a 30mm side and a 70mm long axis, is resting on its base on HP such that one of the rectagular faces is parallel to the VP. It is cut by an auxiliary inclined plane making an angle 45° with the HP and passes through the midpoint of the axis. Draw the development of the lateral surface of the truncated prism.

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Solution.

1. Draw the plan and elevation of the pentagonal prism.
2. Draw the vertical trace of the section plane which passes through the mid point of the axis and inclined at 45^0 with horizontal.
3. Mark points 1′, 2′, 3′, 4′ and 5′ in the elavation.
4. Draw a rectangle of height 70mm and width $35 \times 5 = 175$mm and divide it into five equal parts.
5. Mark the division points as A, B, C,D, E and A at the top and points P, Q, R, S, T and P at the bottom horizontal line.
6. Mark points 1 on AP, 2 on BQ, 3 on CR, 4 on DS, 5 on ET. Join these points by straight lines.

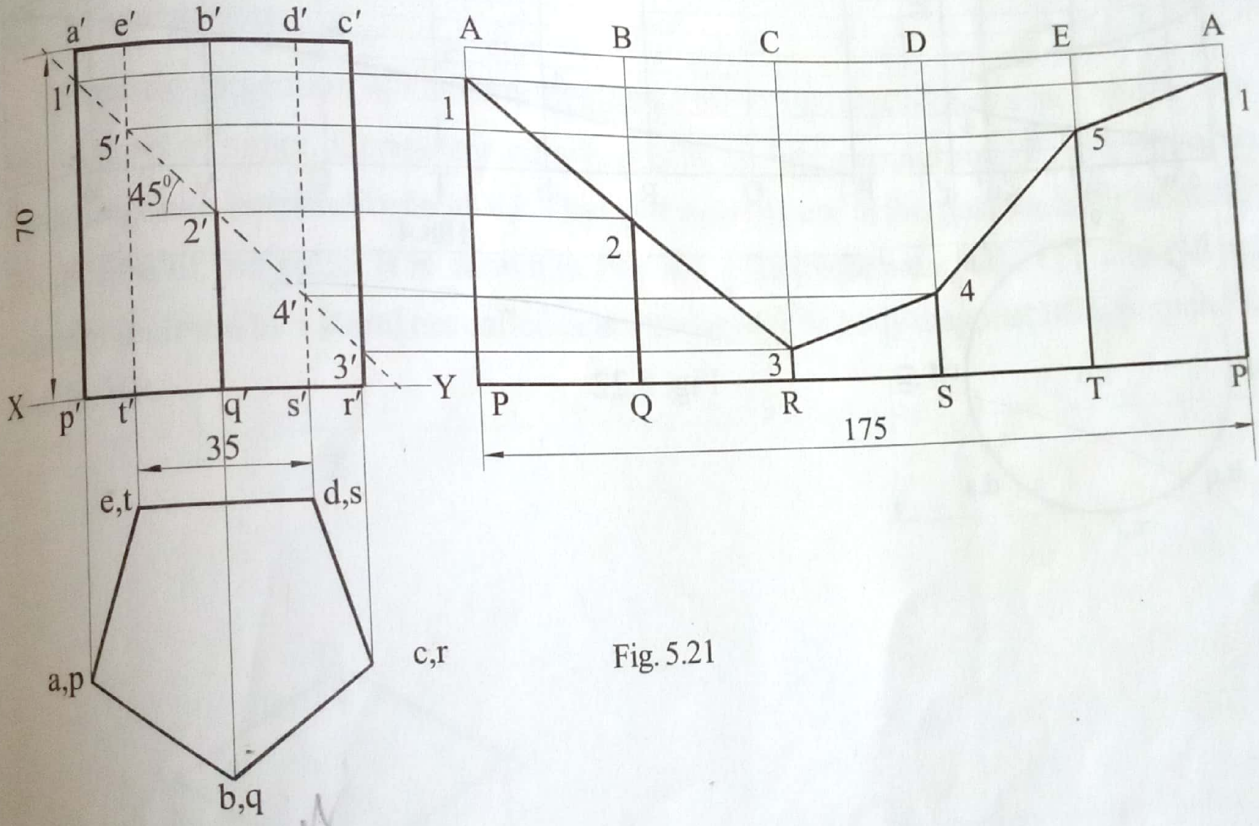

Fig. 5.21

Problem 5.3

A right circular cylinder of base diameter 60mm and height 70mm resting upon HP on its base. An insect starts from a point on the base edge at the bottom, moves around the curved surface of the cylinder and reaches the top after completing two revolutions along the shortest path. Draw the development and sketch the path of the insect in the front view.

Solution

1. Draw the plan and elevation of the cylinder.
2. Draw the development of the lateral surface of the cylinder. It is a rectangle of height 70mm and width equal to $2\pi r = 2 \times 3.14 \times 30 = 188.4$mm

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5.22

3. Divide the rectangle into eight equal parts and mark the points A, B, C, D etc and P, Q, R etc as shown in Fig. 5.22.
4. Mark the midpoint of the line AP at the right end and join this point with the points A and P at the left end of the rectangle as shown in Fig. 5.22.
5. Mark points 1, 2, 3 etc in the development and points 1′, 2′ 3′ etc in the elevation.
6. Join these points by a smooth curve. (Refer example 5.6, page 5.10)

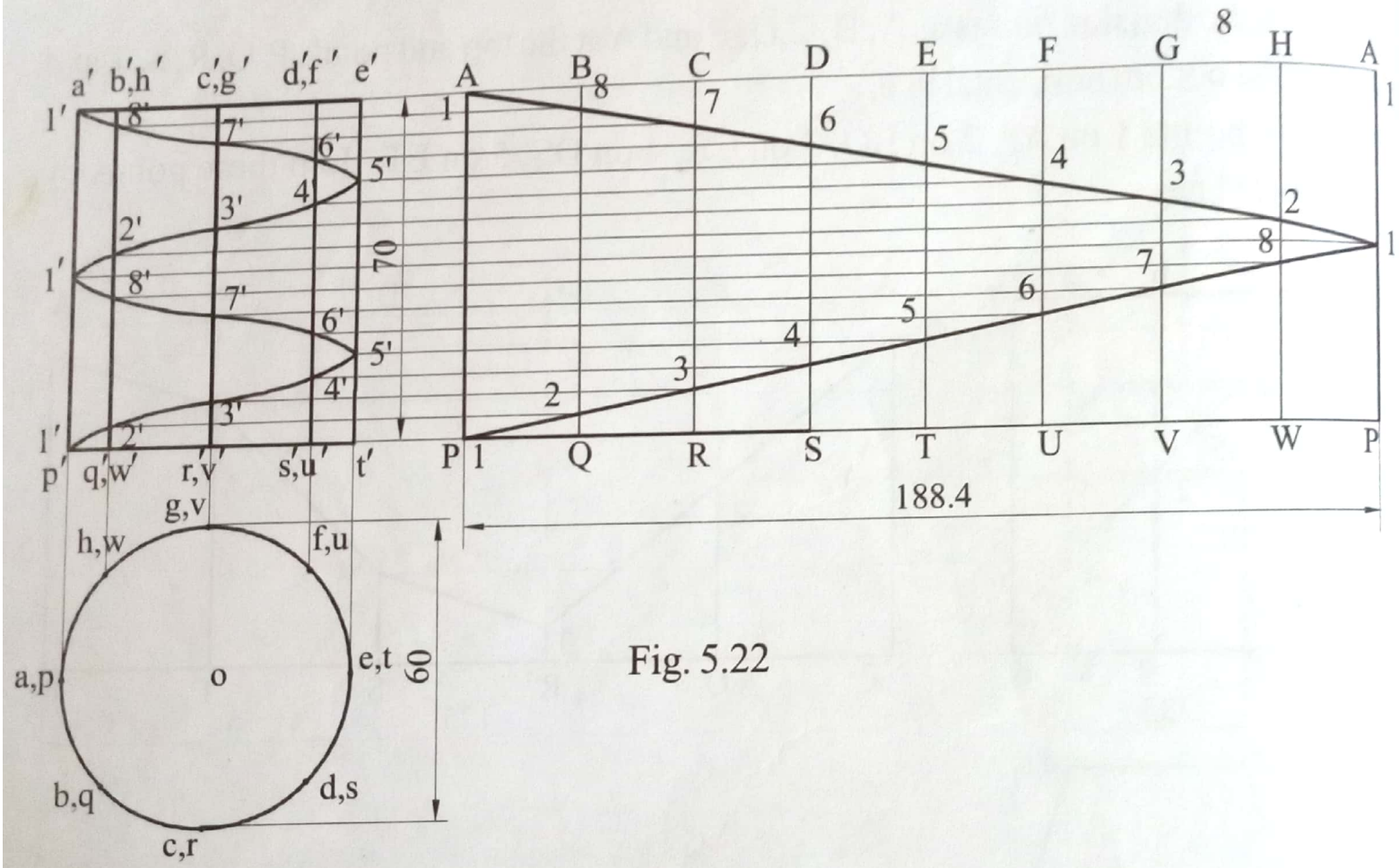

Fig. 5.22

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