KSU CET UNIT

FIRST YEAR NOTES

CET UNIT

7

Intersection of surfaces

7.1. Introduction.

When two lines in a plane, either perpendicular or inclined to each other, are extended they meet at a point. This point is common to both the lines and is called point of intersection of two lines. When two plane surfaces are extended, they meet along a straight line which is common to both the surfaces. This common straight line is called line of intersection of two plane surfaces. When two solids meet, they form a common surface. The boundary of this surface may be a straight line or a curve. When this common boundary is a line, it is called line of intersection and when the common boundary is a curve, it is called curve of intersection of solids. When a solid completely penetrates another solid, there will be two lines or curves of intersection, one at the front and the other at the back of the solid.

7.2. Procedure to locate points of intersection.

When a solid penetrates another solid, their axes may be perpendicular to each other or inclined to each other. When the axis of one of the solid is vertical (Perpendicular to HP) and the axis of the other solid is parallel to both HP and VP, the following procedure is used to locate the various points of intersection.

1. Draw the plan, elevation and side view of the solid whose axis is vertical.
2. Draw the side view, elevation and plan of the other solid whose axis is parallel to both HP and VP.
3. Mark the common contact points in the side view.
4. In the top view of the solid, locate the plan of those points which are already located in the side view.
5. In the front view, the elevation of these points can be located by drawing horizontal lines from the side view points and vertical lines from the corresponding plan points.

Example 7.1

A square prism, having base with a 50mm side, is resting on its base on the H. P. It is completely penetrated by another square prism having base with a 35 mm side, such that the axes of both the prisms intersect each other at right angles and faces of both the prisms are equally inclined to the V. P. Draw the projections of the combination and show the lines of intersection.

Solution.

Draw the plan, elevation and side view of the square prism as shown in Fig. 7.1. In the side view locate the axis of the horizontal prism. This point is in the axis of the vertical prism. Complete the side view which is a square of side 35mm.

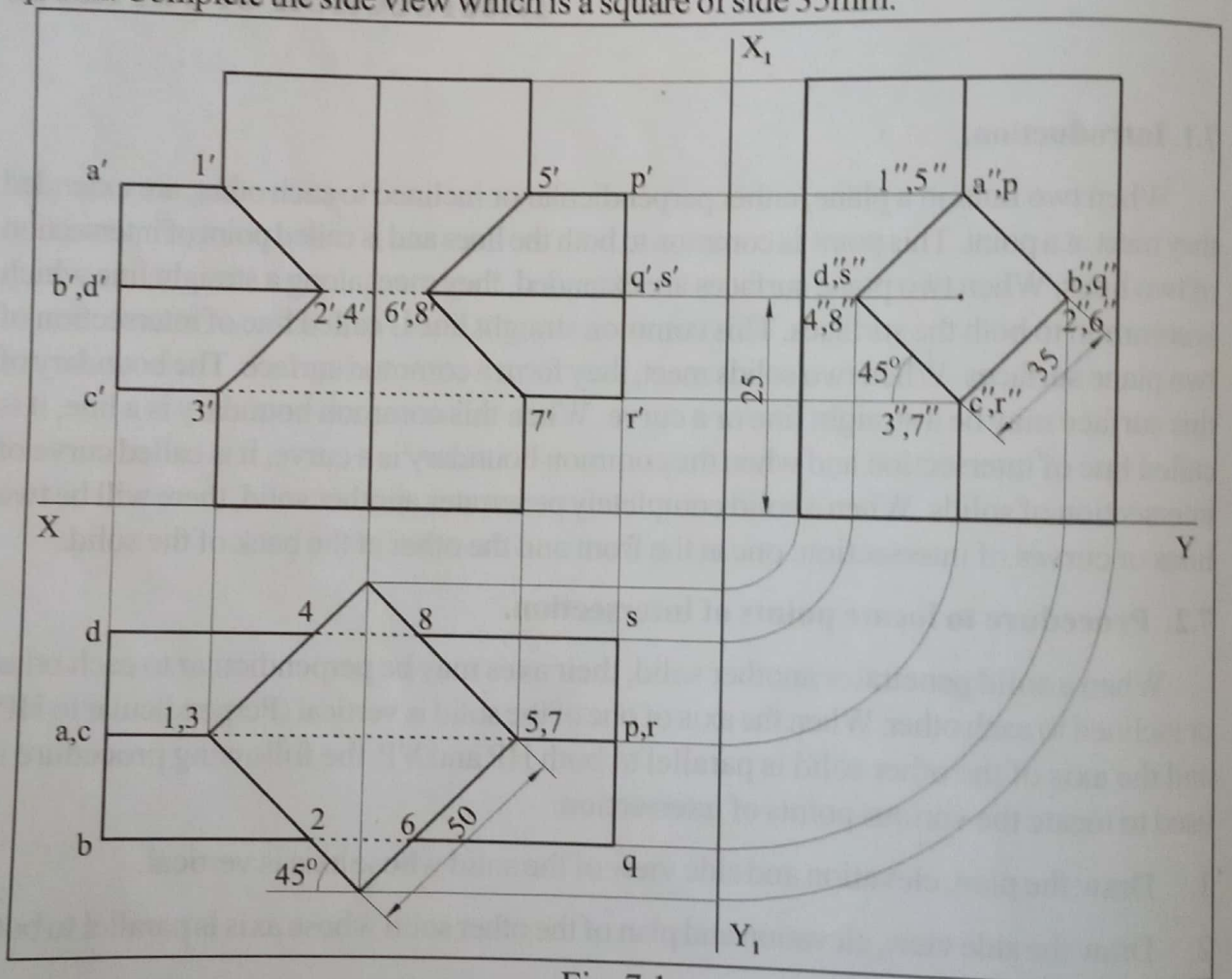

Fig. 7.1

Mark the side view points as a'', b'', c'', d'' and p'', q'', r'', s'' as shown in Fig. 7.1. Draw the corresponding elevation, a'p', b'q', c'r', d's' and plan, ap, bq, cr, ds of the horizontal prism. Mark the points 1'', 2'', 3'' and 4'' in the side view. Locate the points 1, 2, 3 and 4 in the plan. Point 1 is on ap, 2 is on bq, 3 is on cr and 4 is on ds. Also locate the points

5,6,7 and 8. Point 5 is on ap, 6 is on bq, 7 is on cr and 8 is on ds. Locate the elevation points 1′, 2′, 3′ and 4′ by drawing vertical lines from points 1, 2, 3, 4 and horizontal lines from points 1″, 2″, 3″ and 4″. Join these elevation points as shown in Fig.7.1. Similarly locate the points 5′, 6′, 7′ and 8′. Join these points by straight lines.

Problem for practice

1. A square prism side of base 30 mm and axis height 60 mm is kept with its base on HP, with all the vertical faces equally inclined to VP. It is completely penwetrated by a horizontal suare prism of side of base 20 mm and height 60 mm. All the rectangular faces of this prism are equally inclined to both HP and VP. Draw the projectons showing the lne of intersection, when the axis of the horizontal prism is parallel to VP and it bisects the axis of the vertical prism.

University question

1. A square prism edge of base 40 mm and height 90 mm resting on its base on HP with the edges equally inclined to VP is completely penetrated by another horizontal prism, edge of base 25 mm and 90 mm long having faces equally inclined to HP. The axis of the two prisms are parallel to VP and bisects each other at right angles. Draw the projections of the solids showing the lines of intersection. [KU Jan 2009].

Example 7.2

A square prism, side of base 20mm and height 35mm is kept with its base on HP. All the vertical faces are equally inclined to VP. It is penetrated by an equilateral triangular prism, side of base 20mm and axis height 45mm. The axis of this triangular prism is parallel to both HP and VP and bisects the axis of the square prism. One of the rectangular faces of the triangular prism is parallel to HP and nearer to HP. Draw the projections, showing the line of intersection.

Solution.

Draw the plan, elevation and side view of the vertical square prism. Draw the side view of the horizontal prism. It is an equilateral triangle of side 20mm. The centre of this triangle should be at the mid point of the axis of the vertical prism and one of the sides of the triangle should be kept parallel to XY line and nearer to XY line. Draw the plan and elevation of the horizontal prism as shown in Fig.7.2. Mark the points a″, b″, c″and p″, q″, r″ in the side view and then a, b, c and p, q, r in the plan. Locate the points a′, b′, c′and p′, q′, r′ in the elevation. Mark points 1″, 2″, 3″ and 4″ in the side view and the points1,2,3 and 4 in the plan. Locate points 1′, 2′, 3′ and 4′ in the elevation by drawing vertical lines from the points 1,2,3 and 4. Similarly locate the points 5′, 6′, 7′ and 8′, in the elevation as shown in Fig. 7.2. Join these elevation points by straight lines.

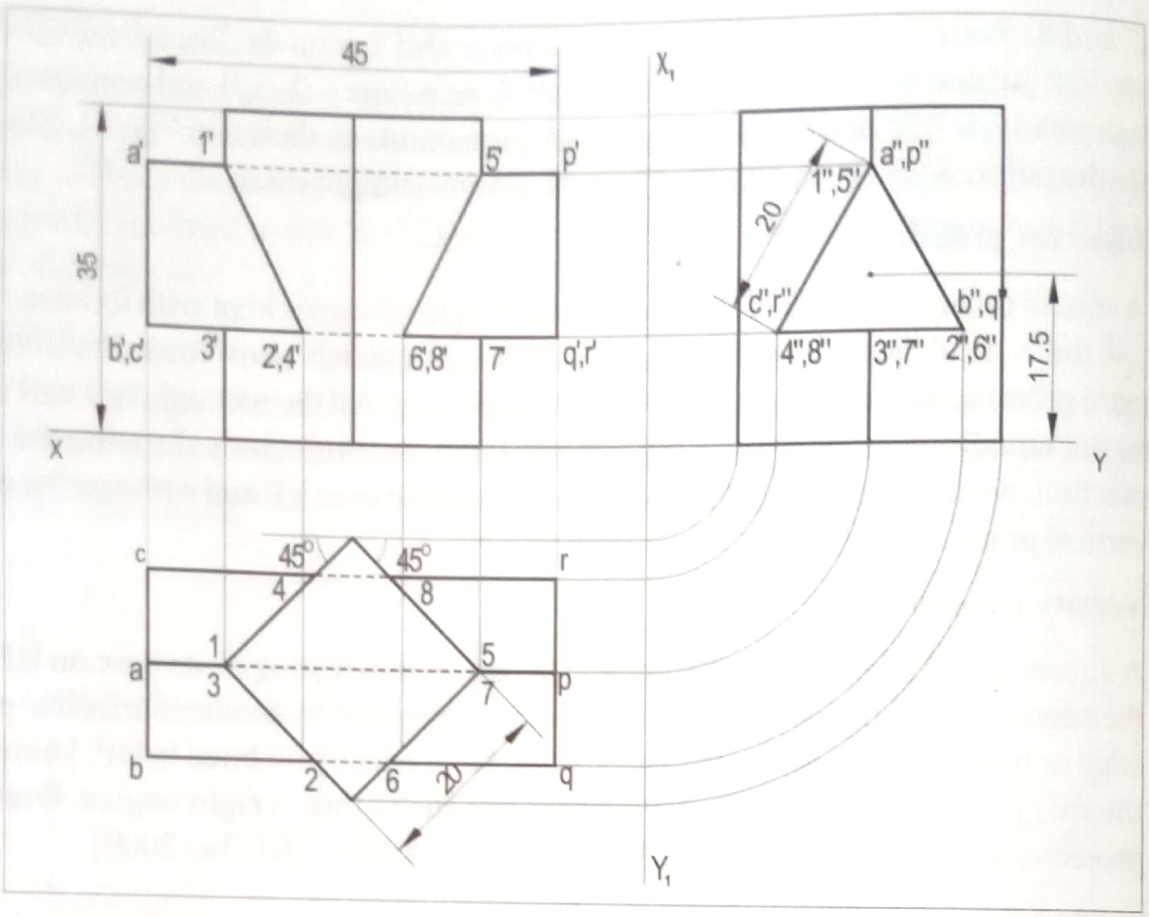

Fig. 7.2

University questions

1. A square prism base 45 mm side and 100 mm long is resting on its square base on HP with the two adjacent vertical faces equally inclined to VP. It is penetrated by a triangular prism 45 mm side and 90 mm long in such a way that these axes intersect each other at right angles at their mid points. If the two rectangular faces of the triangular prism are equally inclined to HP, draw the projection of the solids showing the lines of intersection. [CUSAT June 2013].

2. A square prism base 50 mm side and 80 mm long is resting vertically on HP. It is penetrated by a triangular prism of 44 m side and 100 mm long so that their axes intersect each other at right angles. If the faces of the square prism are equally inclined to VP and one of the triangular faces of the triangular prism is parallel to HP, draw the projections showing the lines of intersection. [KU June 2011]

Example 7.3

A pentagonal prism, side of base 20 mm and height 35mm is resting on its base on HP with a rectangular face perpendicular to VP. It is penetrated centrally by a square prism of base 20 mm side and axis height 60 mm. The axes of the two prisms intersect at right angles at a point 17.5 mm above HP. The lateral surface of the square prism are equally

inclined to HP and VP. Draw the projections showing the lines of intersection.

Solution.

Draw the plan, elevation and sideview of the vertical prism. The plan is a regular pentagon of side 20 mm. One of the sides of pentagon should be kept perpendicular to XY line as shown in Fig.10.6. Draw the side view of the square prism. The centre of this square should be on the axis of vertical prism and at a distance 17.5 mm above the XY line. All the sides of this square should be inclined at 45° with XY line. Draw the plan and elevation of this square prism. Mark the points, 1″, 2″, 3″ etc. in the side view as show in Fig. 7.3. Locate the plan and elevation of these intersecting points and join the elevation points as shown in Fig.7.3

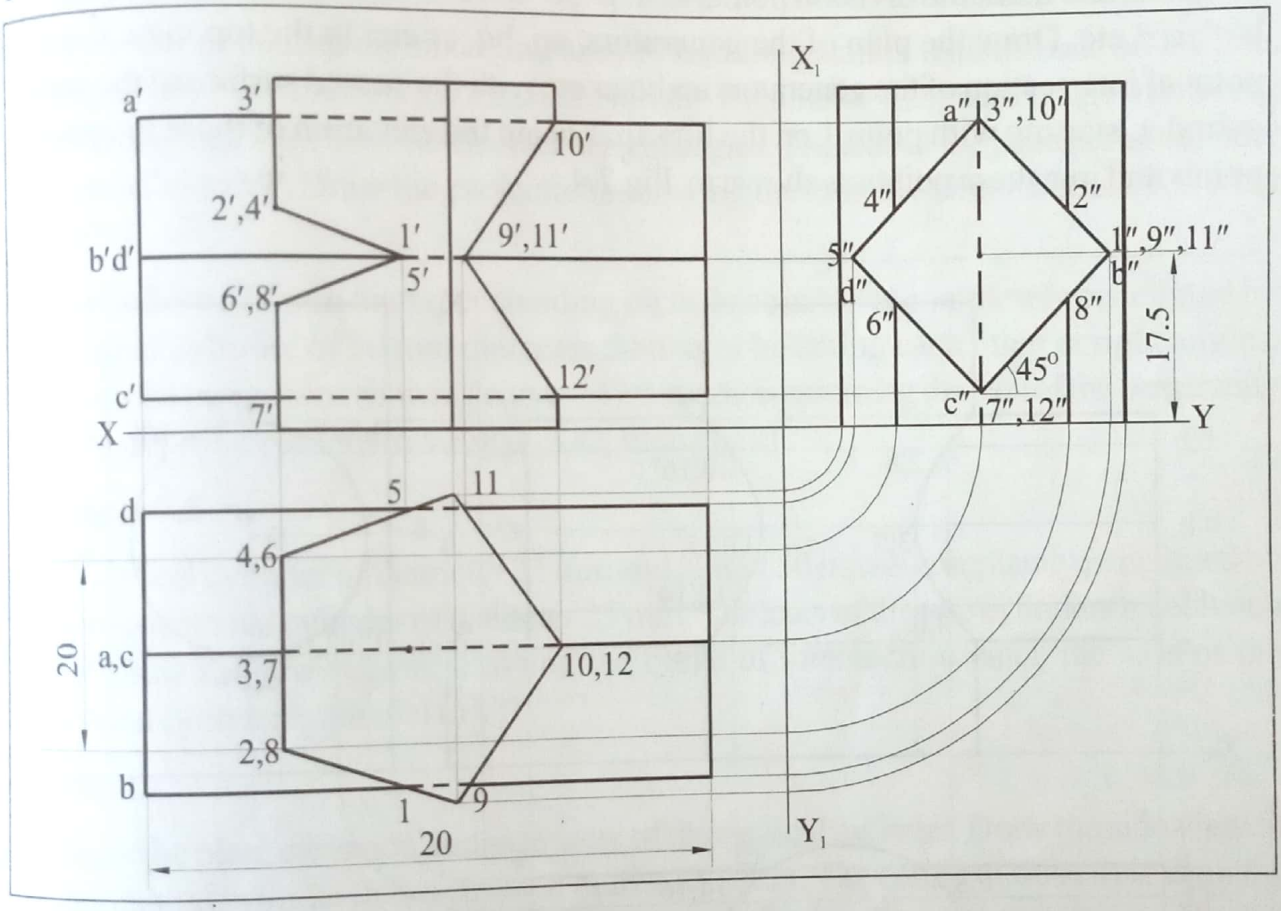

Fig. 7.3

Problem for practice.

A hexagonal prism of side of base 20 mm and height 60 mm is kept with its base on HP. One ofthe rectangular faces is parallel to VP. It is completely penetrated by a square prism of side of base 20 mm and axis height 60 mm. The axis of the square prism is parallel to both HP and VP. All the rectangular faces of this square prism are equally inclined to HP. Draw its projections showing the lines of intersection.

Example 7.4

A horizontal cylinder of 50 mm diameter and 140 mm long penetrates a vertical cylinder of 60mm diameter and 100mm long resting on HP. The axis of the horizontal cylinder is parallel to VP and 50mm above the HP. Draw the projection showing the curve of the intersection.

Solution.

Draw the plan, elevation and side view of the vertical cylinder. Draw the side view of the horizontal cylinder. It is a circle of radius 12.5 m. The centre of this circle is on the axis of the vertical cylinder, 25 mm above XY line. Divide this circle into any number of equal divisions and mark the division points as a″p″, b″q″, c″r″ etc. Draw the elevation a′p′, b′q′, c′r′ etc. Draw the plan of the generators, ap, bq, cr etc. In the top view mark the point of intersection of the generators ap,bq,cr etc with the curved surface of the vertical cylinder, starting with point 1 on the line ap. Locate the elevation of these intersecting points and join these points as shown in Fig.7.4.

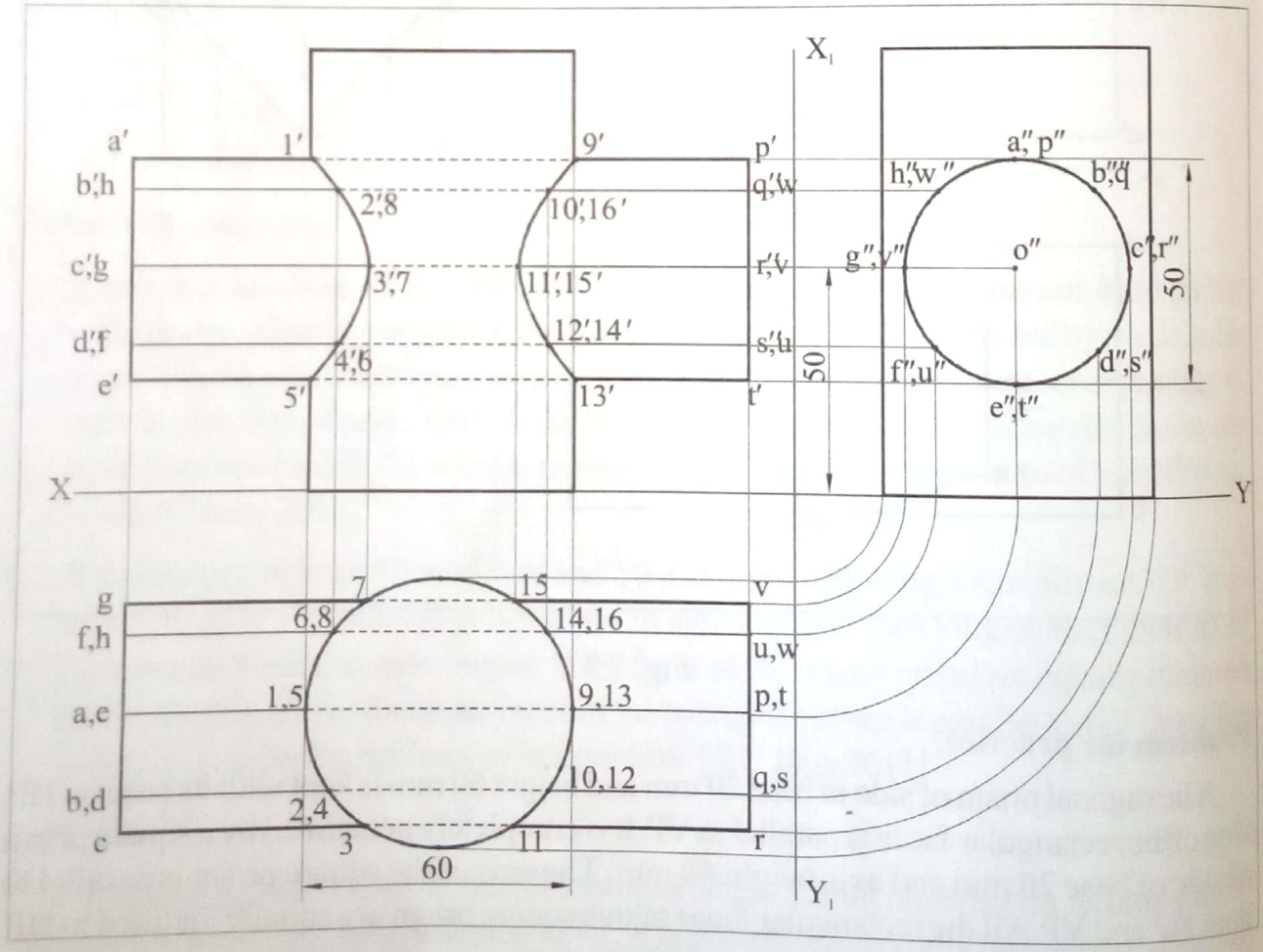

Fig.7.4

Problem for practice.

A vertical cylinder of diameter 50 mm and height 60 mm is completely penetrated by another horizontal cylinder of diameter 40 mm. The axes of the two cylinders bisect each other with the axis of horizontal cylinder parallel to VP. Draw the projections showing the curves of intersection.

University questions.

1. A right circular cylinder of base diameter 60 mm and height 90 mm is resting on its base on HP. It is completely penetrated by another cylinder of base diameter 45 mm and 90 mm long such that their axes bisects each other at right angles and are parallel to VP. Draw their projections showing the curves of intersection. [KU June 2010]
2. A cylinder of 60 mm diameter and axis 80 mm long stands with its base on HP. It is completely penetrated by a horizontal cylinder of diameter 40 mm and axis 80 mm long such that their axes bisect each other at right angles. The axis of the penetrating cylinder is parallel to VP. Draw the projections showing the curves of intersection [KU May 2009]
3. A cylinder of 75 mm diameter standing on its base in HP is completely penetrated by another cylinder of 50 mm diameter their axes bisecting each other at right angles. Draw the projections showing curves of intersection assuming the axis of the penetrating cylinder to be parallel to VP. [CUSAT June 2012]

Example 7.5

A vertical cylinder of diameter 25 mm and height 50 mm is completely penetrated by another horizontal cylinder of diameter 25 mm. The axes of the two cylinders bisect each other. Draw the projections showing the curve of intersection when the axis of the horizontal cylinder is parallel to VP.

Solution.

Draw the plan, elevation and side view of the vertical cylinder. Draw the side view of the horizontal cylinder. It is a circle of radius 12.5 mm. The centre of this circle is on the axis of the vertical cylinder, 25 mm above XY line. Divide this circle into any number of equal divisions and mark the division points as a″p″, b″q″, c″r″ etc. Draw the elevation a′p′, b′q′, c′r′ etc. Draw the plan of the generators, ap, bq, cr etc. In the top view mark the point of intersection of the generators ap,bq,cr etc with the curved surface of the vertical cylinder, starting with point 1 on the line ap. Locate the elevation of these intersecting points and join these points as shown in Fig. 7.5.

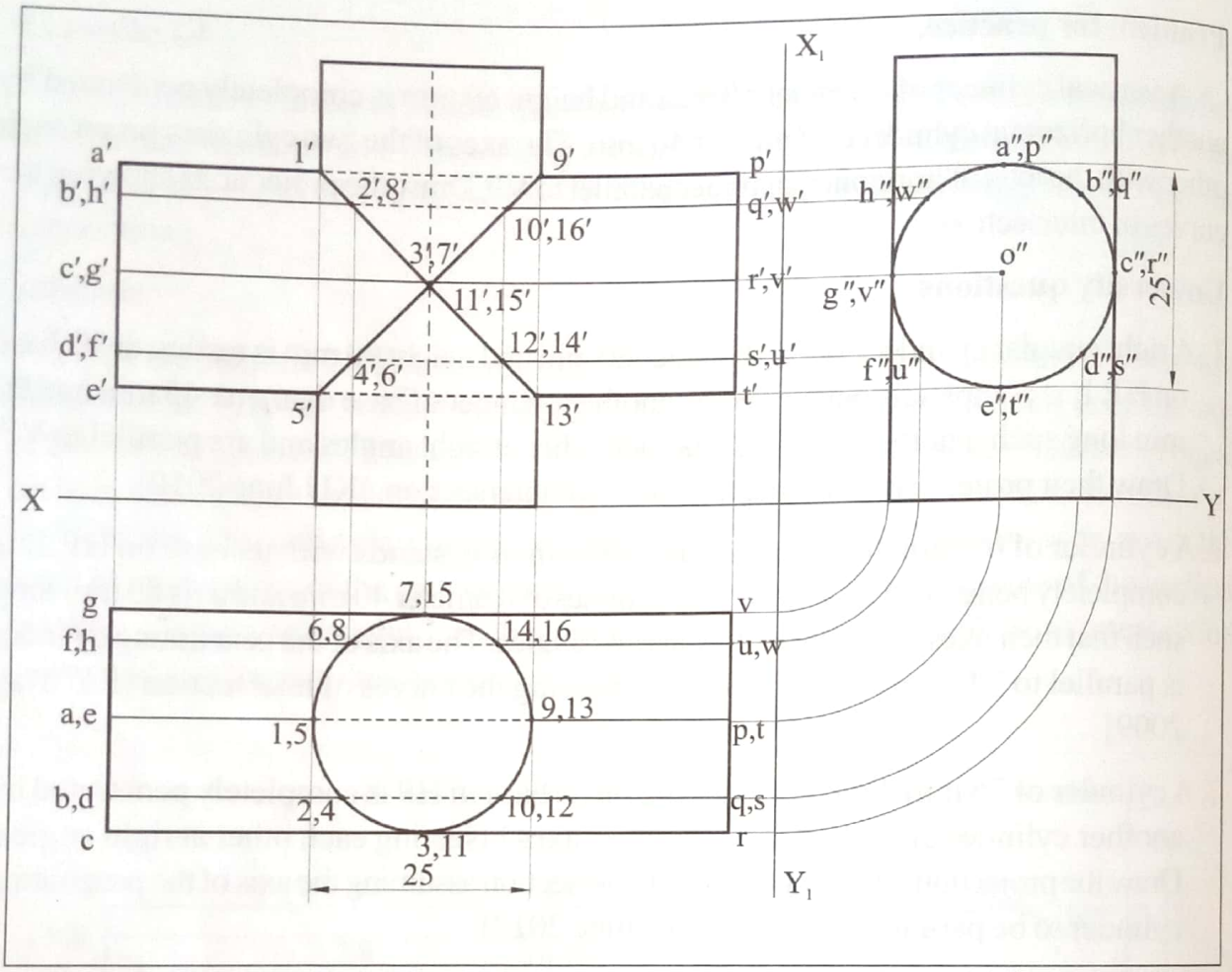

Fig. 7.5.

Example 7.6

A vertical cylinder of 45mm diameter has a circular hole of 30mm side cut through the centre of the cylinder. The axis of the hole is horizontal and 5mm from the axis of the cylinder. Draw the projection showing the curve of intersection of the hole. The axis of the hole is parallel to VP. Assume suitable height for the cylinder.

Solution.

Draw the plan, elevation and side view of the vertical cylinder. Draw the side view of the hole. It is a circle of radius 15 mm. The centre of this circle is 5mm towards right of axis of the cylinder. Divide this circle into any number of equal divisions and mark the division points as 1", 2", 3", etc. In the top view mark the point of intersection of the circle with the curved surface of the vertical cylinder as 1, 2, 3, etc. Locate the elevation of these intersecting points 1', 2', 3' etc. and join these points as shown in Fig. 7.6.

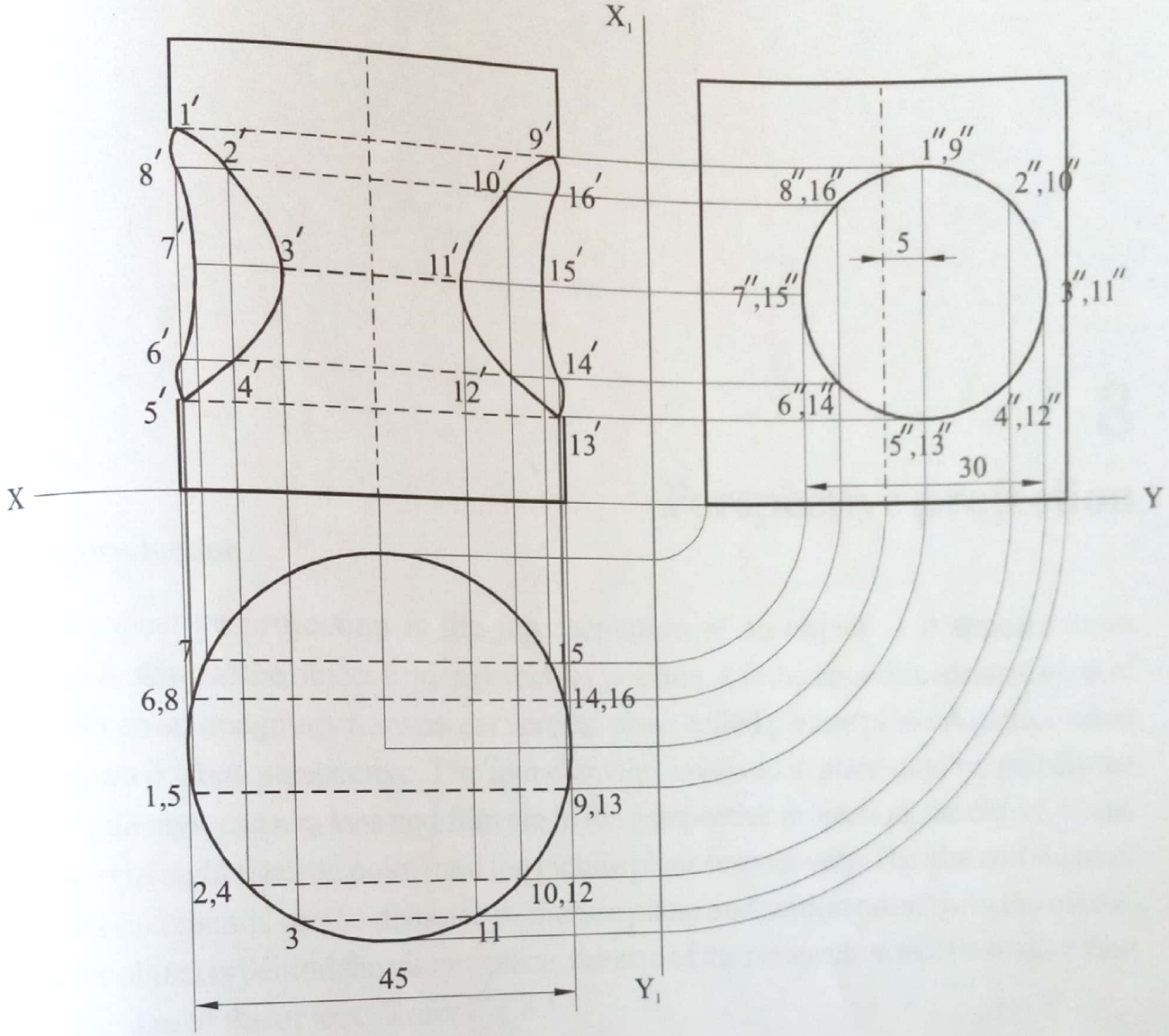

Fig. 7.6.