Development and Interpenetration

Given the plan and incomplete elevation of two intersecting cylinders. Find the line of interpenetration and draw a surface development of the curved surfaces, Fig. 10.29.

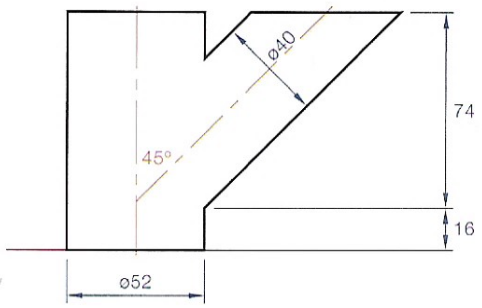
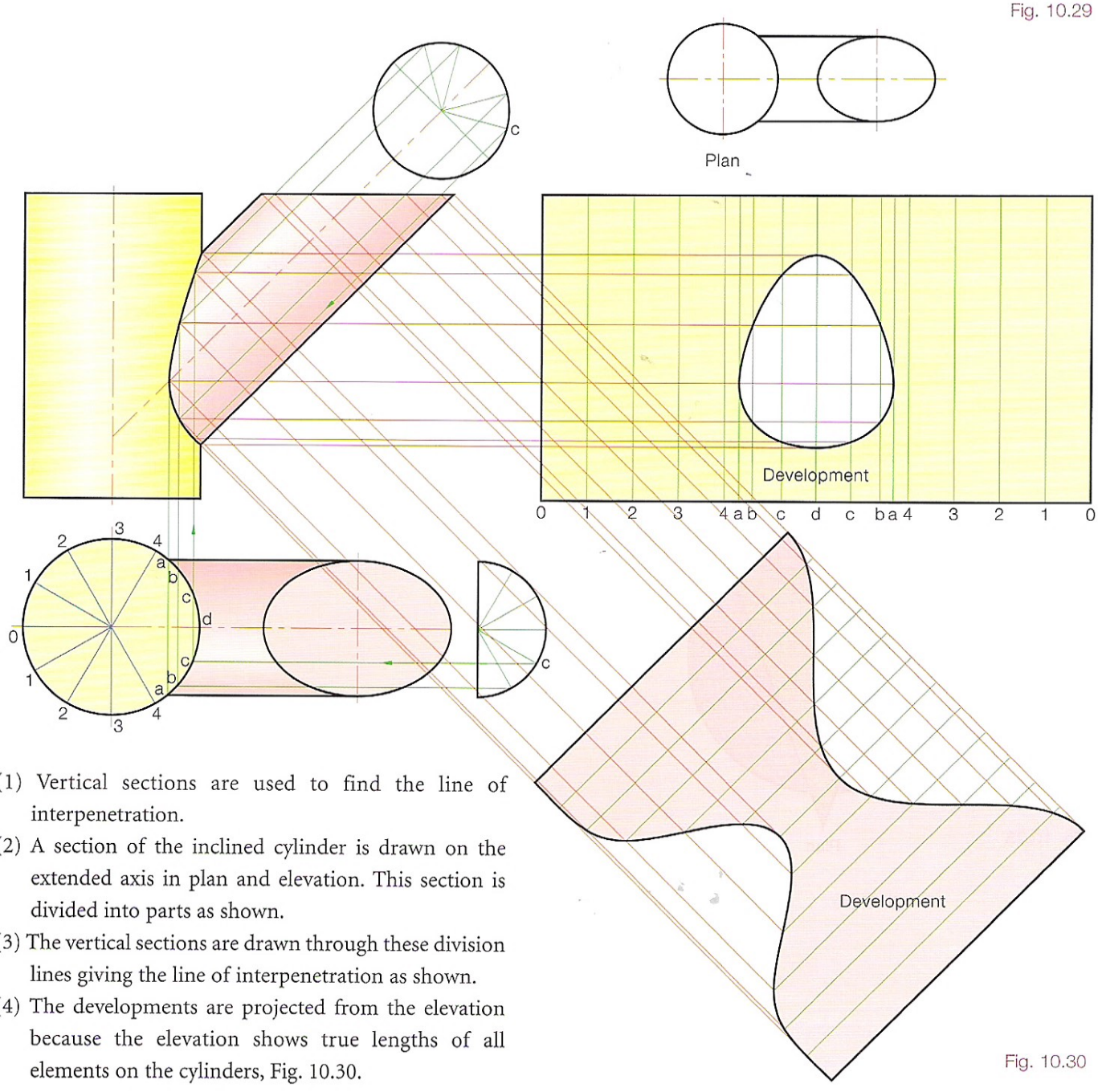


Fig. 10.29



(1) Vertical sections are used to find the line of interpenetration.

(2) A section of the inclined cylinder is drawn on the extended axis in plan and elevation. This section is divided into parts as shown.

(3) The vertical sections are drawn through these division lines giving the line of interpenetration as shown.

(4) The developments are projected from the elevation because the elevation shows true lengths of all elements on the cylinders, Fig. 10.30.

Fig. 10.30

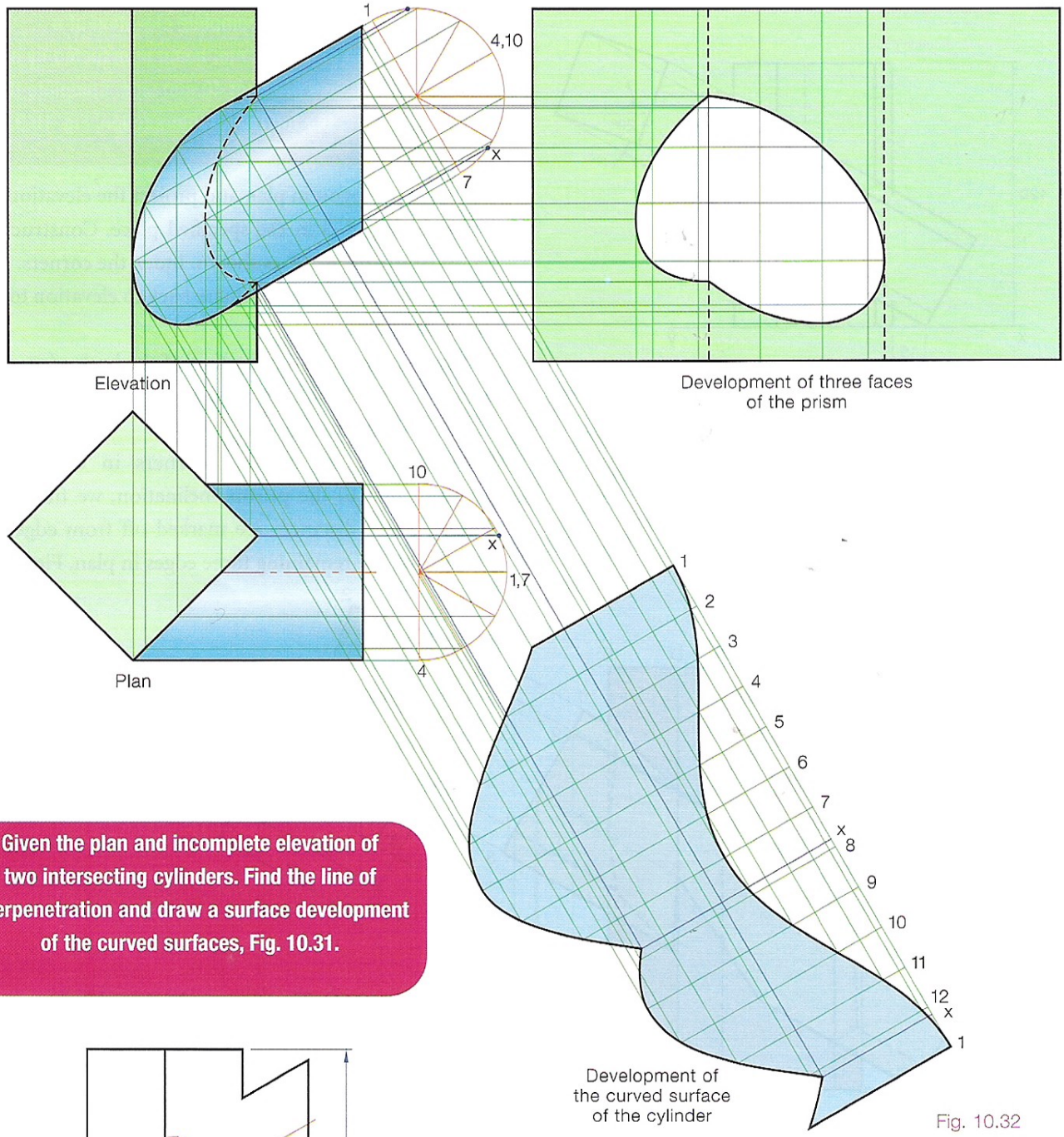


Fig. 10.32

Given the plan and incomplete elevation of two intersecting cylinders. Find the line of interpenetration and draw a surface development of the curved surfaces, Fig. 10.31.

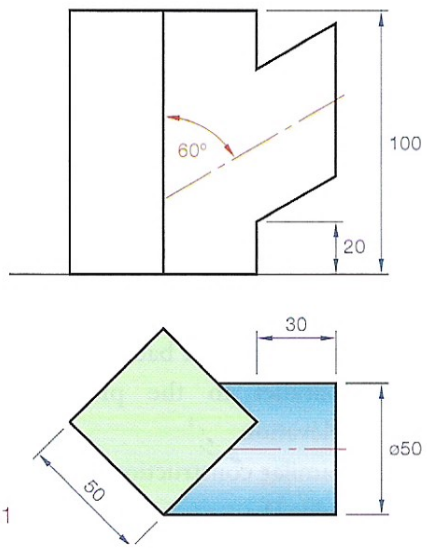


Fig. 10.31

(1) Draw a partial section of the cylinder on the extended axis in plan and elevation. A semicircle is sufficient. Divide each into six equal divisions as shown.

(2) The interpenetration is found by projection of elements as shown.

(3) Point X must be located in plan, where the cylinder hits the corner of the prism. Once found on the section in plan it is transferred with the compass to the section in elevation. Thus we can find the bend points in elevation.

(4) Point X is also needed in the development of the cylinder.

(5) Complete as shown, Fig. 10.32.

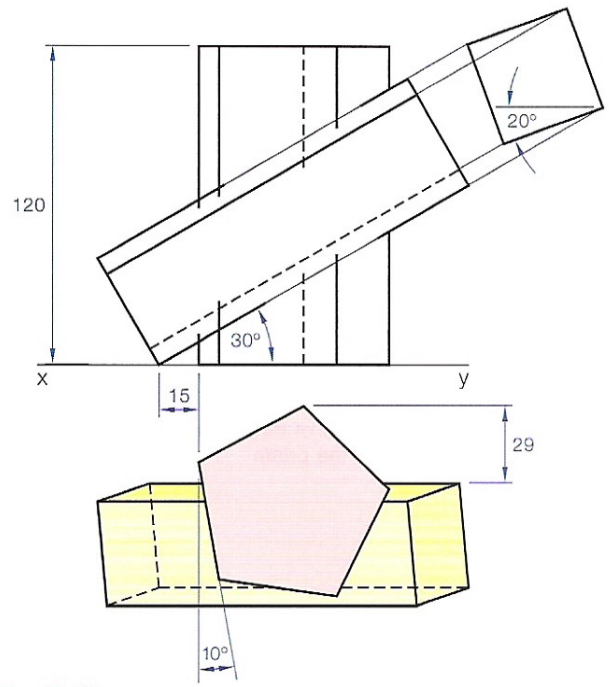


Fig. 10.33

Given the plan and incomplete elevation of a pentagonal prism of side 45 mm being intersected by an inclined square-based prism of 40 mm side. Complete the elevation showing the full line of intersection, Fig. 10.33.

(1) Draw the pentagon in plan and project the elevation.

(2) Draw the line 3–3 in the specified place. Construct the sectional square at 20° as shown. Index the corners.

(3) Project the corners of the square back to elevation to give the prism edges.

(4) In plan we are given the location of the back edge of the inclined prism. This edge must be edge 4 as this is shown as a dotted line in elevation.

(5) By projecting the square's corners in the section, perpendicular to the prisms inclination, we find d_1, d_2 and d_3. These distances are marked off from edge 4 in plan giving the remaining three edges in plan, Fig. 10.34.

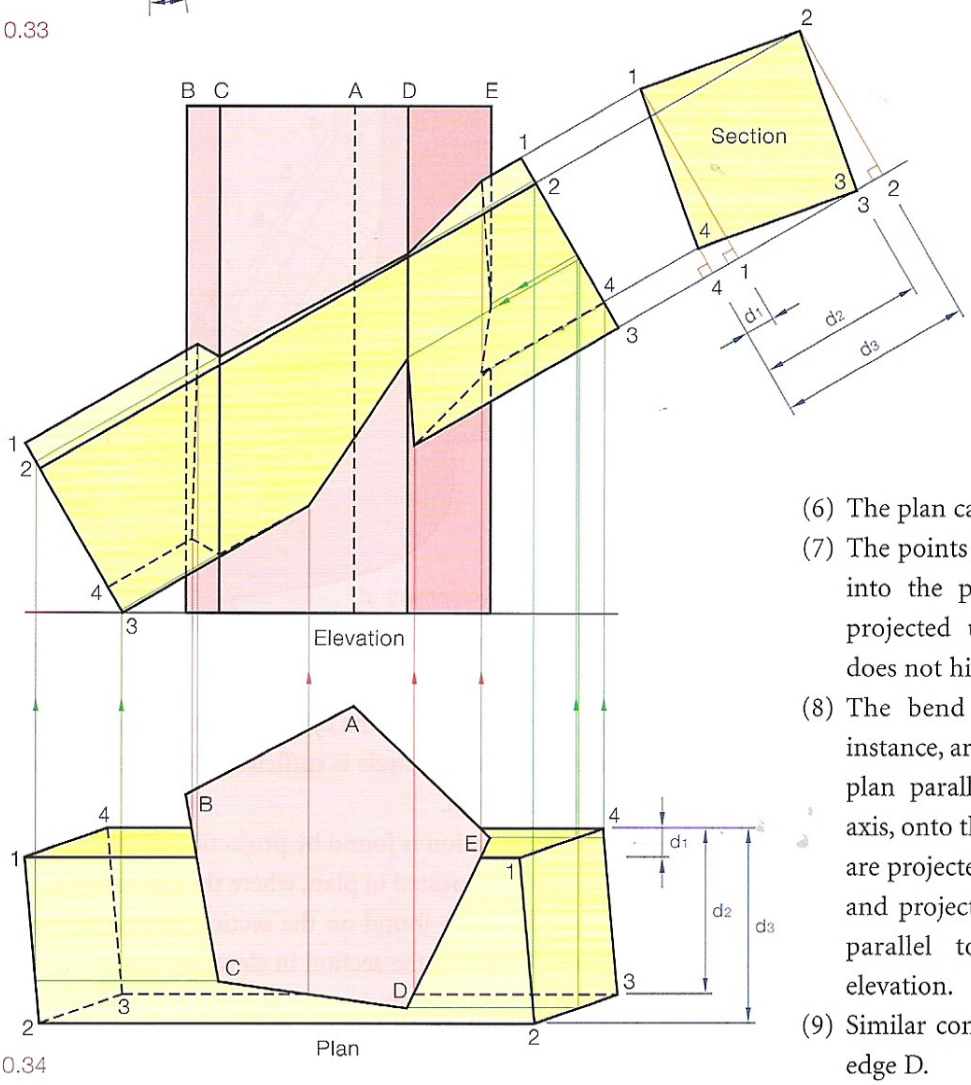


Fig. 10.34

(6) The plan can be completed.

(7) The points where edge 4,1 and 3 run into the pentagonal prism can be projected up to elevation. Edge 2 does not hit the pentagonal prism.

(8) The bend points on edge E, for instance, are found by projecting E in plan parallel to the square prism's axis, onto the prism's end. The points are projected to the prism's elevation and projected back down to edge E parallel to the prism's axis in elevation.

(9) Similar construction for edge C and edge D.

Use of Auxiliary Plans

Fig. 10.35 shows the projections of a square-based prism of 50 mm side. This solid is being intersected by an equilateral triangular-based prism of 50 mm side. Draw the projections of the solids showing all lines of interpenetration

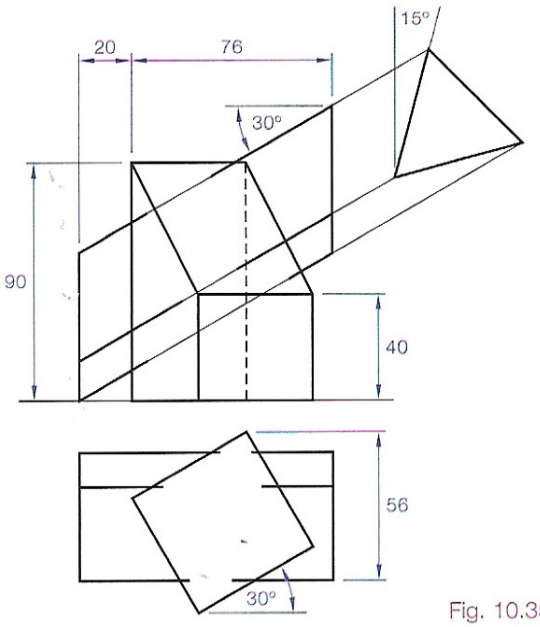


Fig. 10.35

(1) Draw the square prism in plan and elevation.

(2) Details for the lowest line of the inclined triangular prism are given. Draw this line in elevation. Extend this line to the right and construct the equilateral section as given.

(3) Index the corners and project back to elevation.

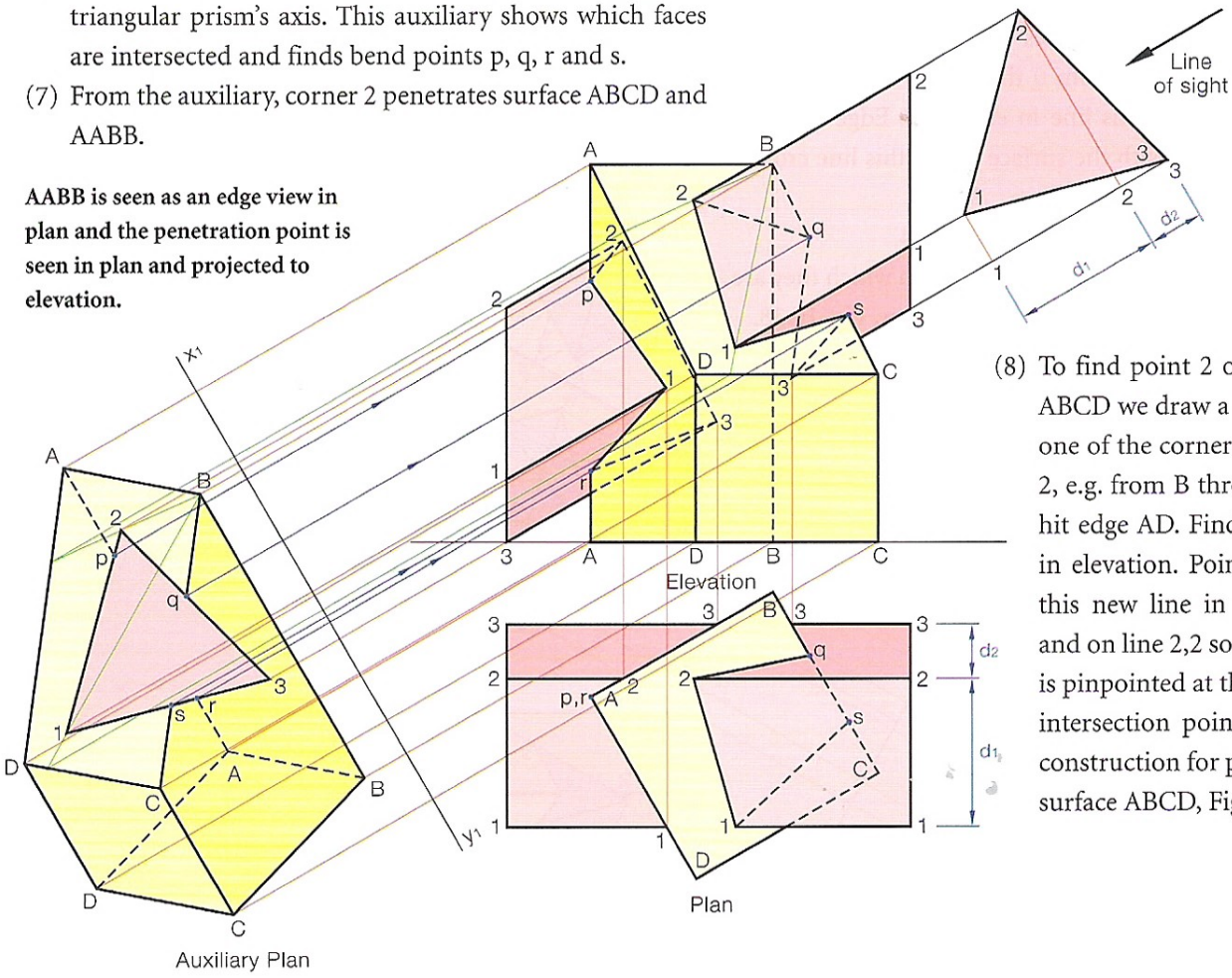
(4) Project the corners of the section triangle perpendicularly to the prism axis thus finding d_1 and d_2.

(5) Details of one of the triangular prism edges is given in plan. This edge must be edge 1. Step distances d_1 and d_2 in plan to find the other two edges.

(6) An auxiliary plan is drawn, viewing down along the triangular prism's axis. This auxiliary shows which faces are intersected and finds bend points p, q, r and s.

(7) From the auxiliary, corner 2 penetrates surface ABCD and AABB.

AABB is seen as an edge view in plan and the penetration point is seen in plan and projected to elevation.



(8) To find point 2 on surface ABCD we draw a line from one of the corners through 2, e.g. from B through 2 to hit edge AD. Find this line in elevation. Point 2 is on this new line in elevation and on line 2,2 so therefore is pinpointed at these lines' intersection point. Similar construction for point 1 on surface ABCD, Fig. 10.36.

Fig. 10.36

HIGHER LEVEL

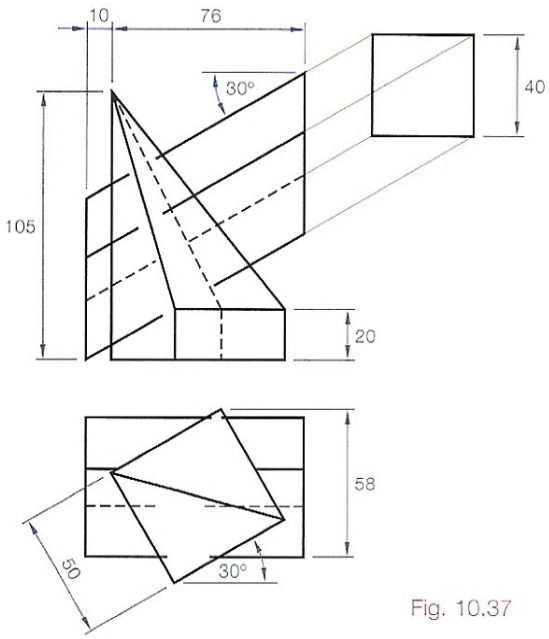


Fig. 10.37

Fig. 10.37 shows the incomplete projections of an oblique pyramid with a 50 mm square base. This solid is penetrated by a square-based prism of 40 mm side. Draw the projections of the solid

(1) Draw the oblique pyramid in plan and elevation.

(2) Draw the lowest line of the penetrating square prism as given. Extend this line and draw the square section as shown.

(3) Index the corners and project them back to the elevation.

(4) Find distances d_1, d_2 and d_3 from the sectional view by projecting the corners of the section perpendicular to the prism axis.

(5) One of the prism edges is given in plan. This must be edge 3, because edge 1 is appearing as a dotted line in elevation and is therefore at the back.

(6) Using distances d_1, d_2 and d_3, locate the other edges of the prism in plan.

(7) Draw the auxiliary plan.

(8) The auxiliary shows all bend points. Index these and project them back to elevation and plan.

(9) Edges 1 and 3 do not make contact with the pyramid.

(10) Edge 2 hits the vertical surface 0,0,AA. This surface is an edge view in plan and therefore shows the penetration point clearly.

(11) Edge 2 also makes contact with edge OBC. Draw a line from 0 through 2 to hit the edge BC. Find this line in elevation. Edge 2 makes contact with the surface where this line crosses line 2,2.

(12) Similar construction for edge 4.

(13) Join up the points. The order in which they are joined is found from the auxiliary, Fig. 10.38.

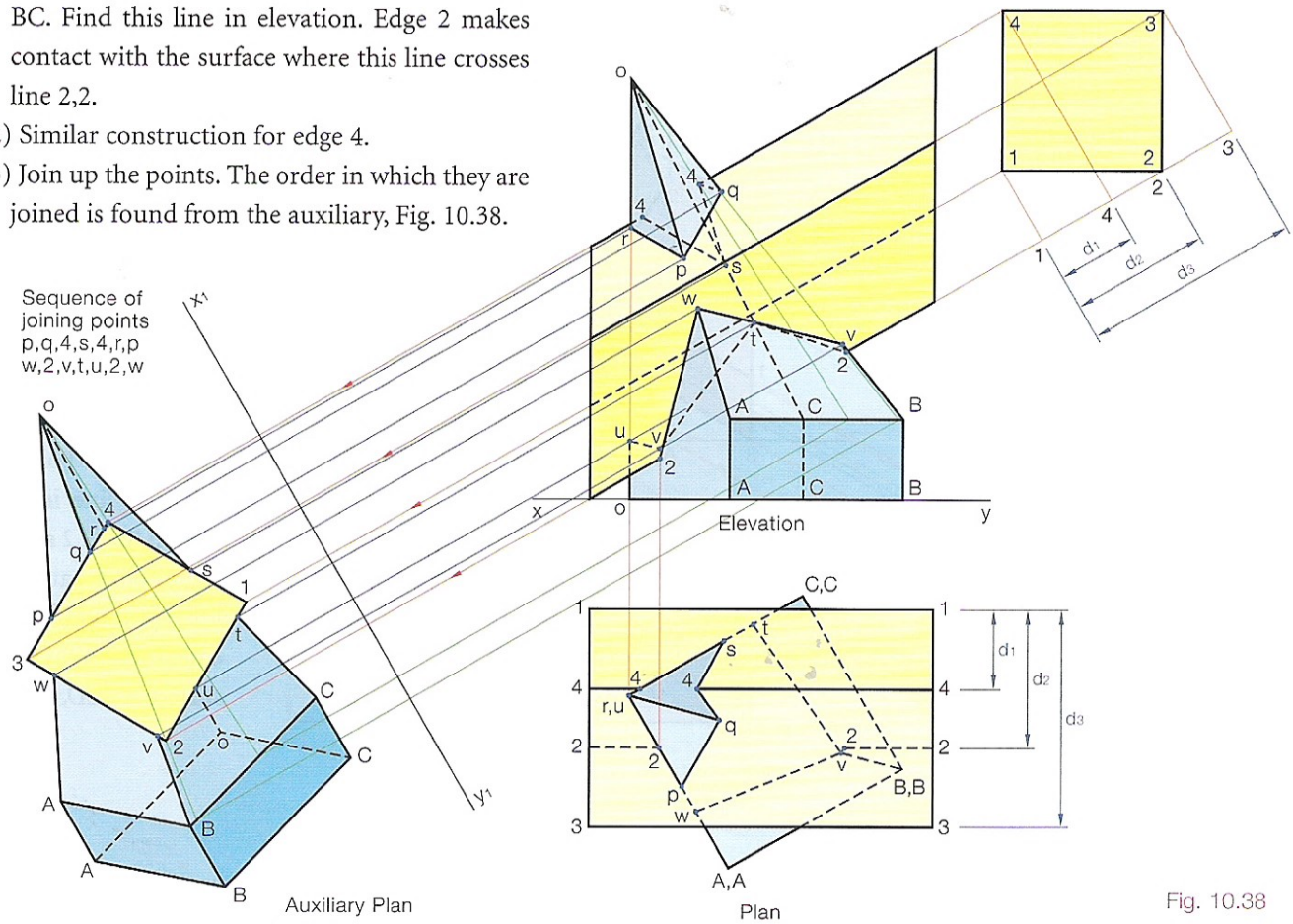


Fig. 10.38

To show a complete surface development of all the surfaces of the intersecting solids shown in Fig. 10.38, see Fig. 10.39.

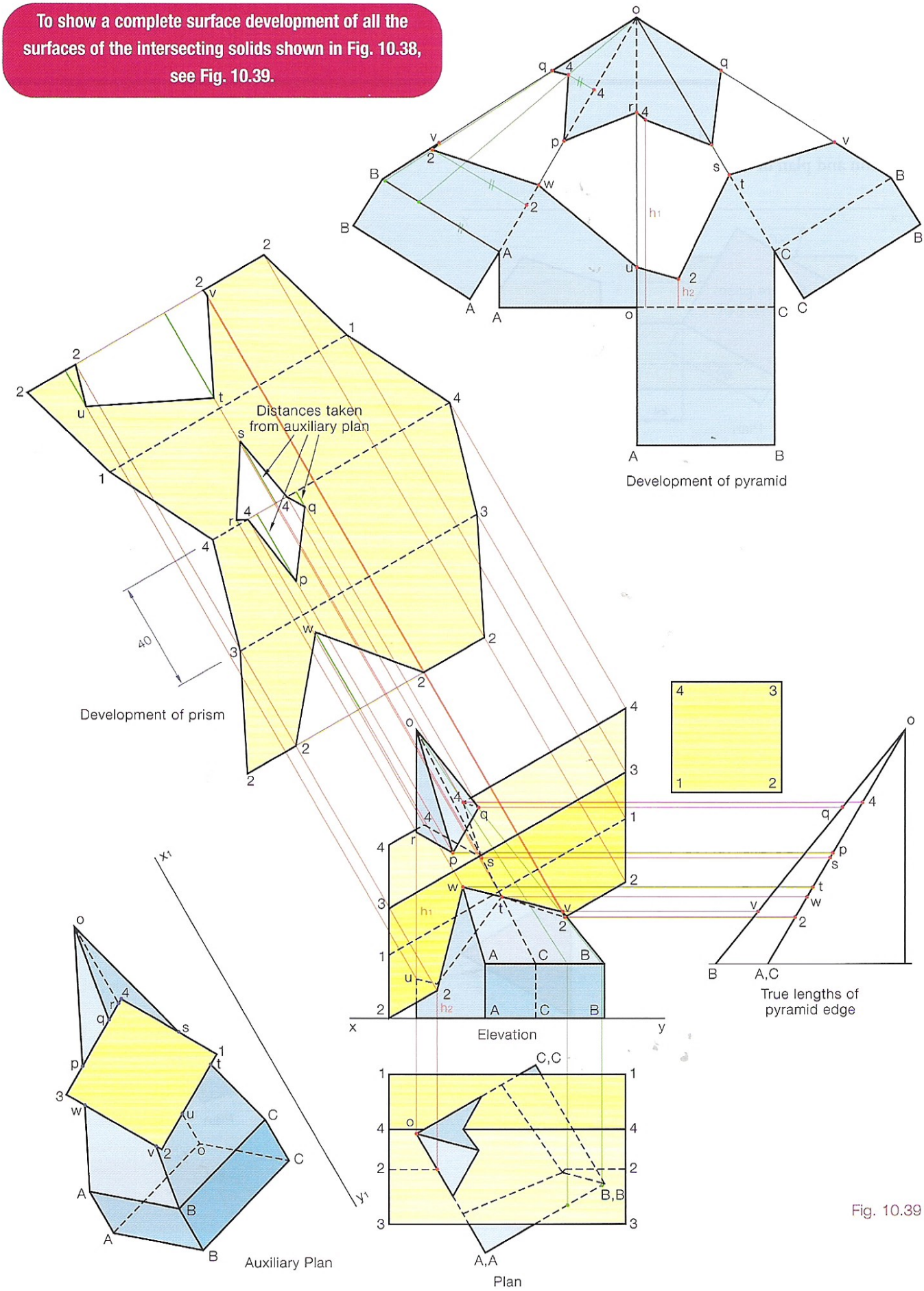


Fig. 10.39