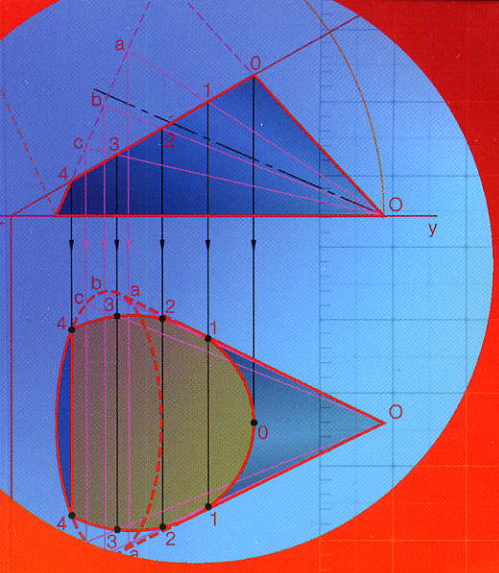
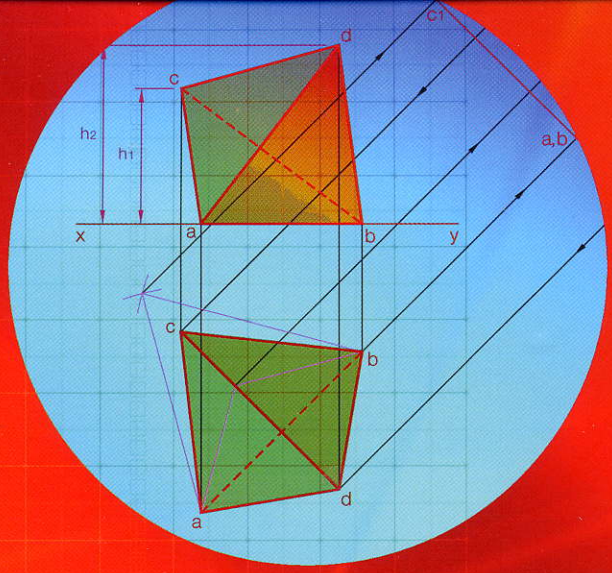
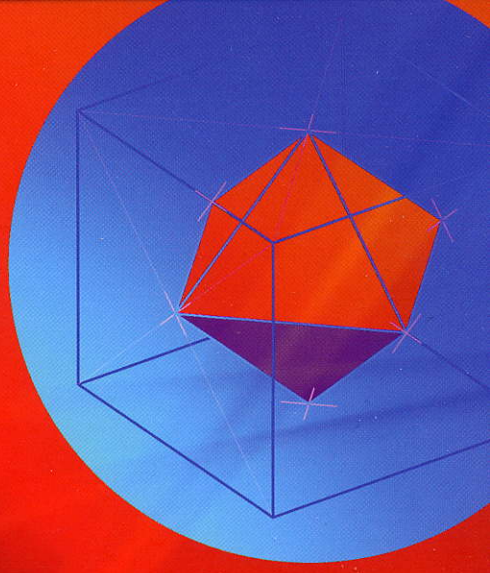
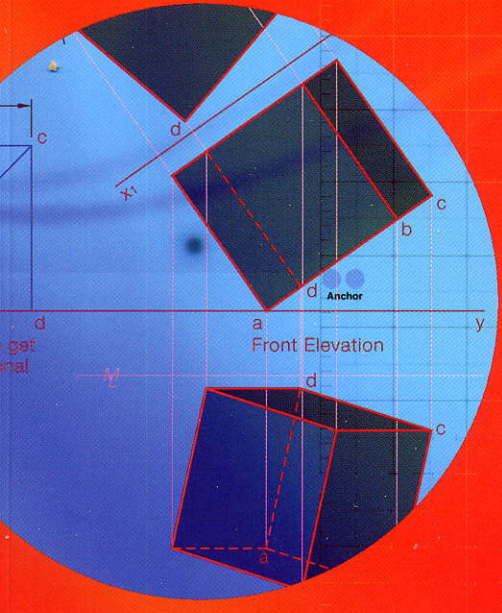


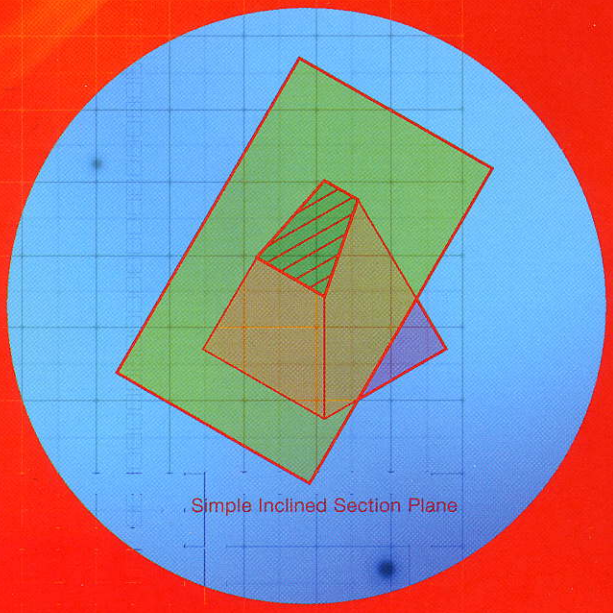


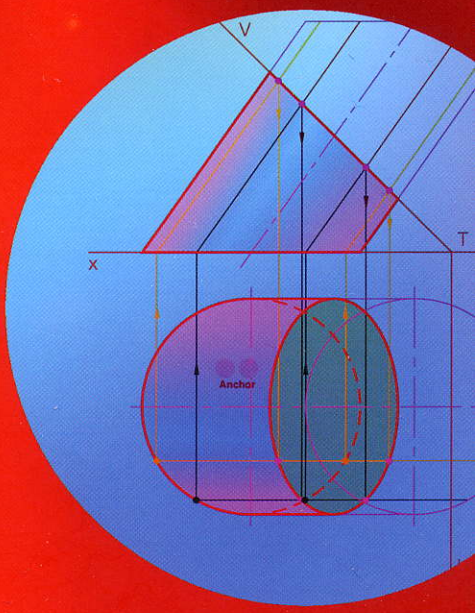


GRAPHICS IN DESIGN & COMMUNICATION 1

PLANE AND DESCRIPTIVE GEOMETRY







DAVID ANDERSON

AREA 2

PROJECTION SYSTEMS

Third-angle Auxiliary Views

The projection of auxiliary views, in third-angle projection, follow the same rules as in first angle. Fig. 2.71 shows an auxiliary elevation projected and Fig. 2.72 shows an auxiliary plan projected.

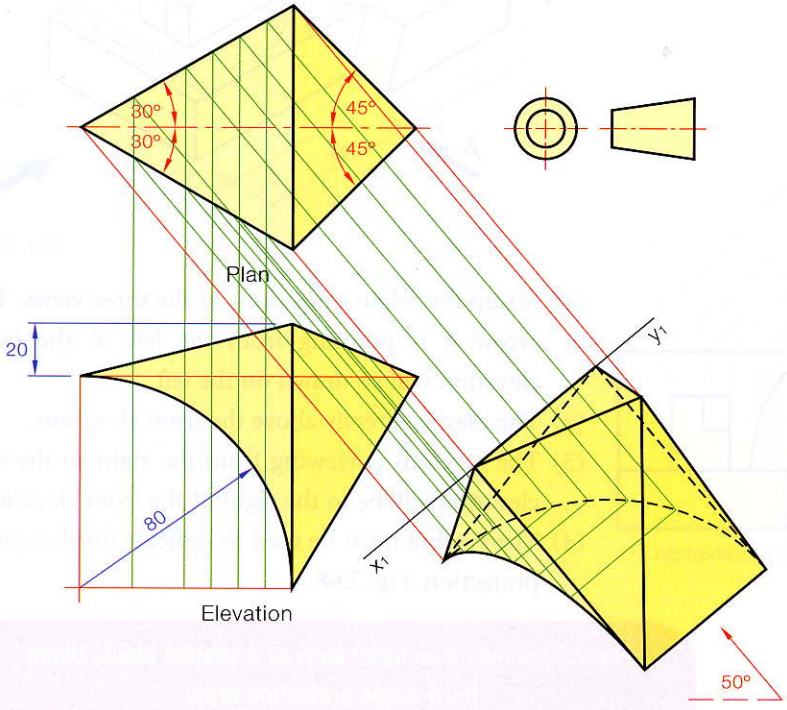


Fig. 2.71

Draw the given plan and elevation in third-angle projection. Project an auxiliary elevation in the direction of the arrow shown. Show all hidden detail.

The construction should be clearly visible from the diagram, Fig. 2.71.

Fig. 2.72 shows the plan and elevation of a truncated pentagonal prism with a hole drilled through its centre. Third-angle projection has been used. Draw the given views and project a new plan viewing in the direction shown. Show hidden detail.

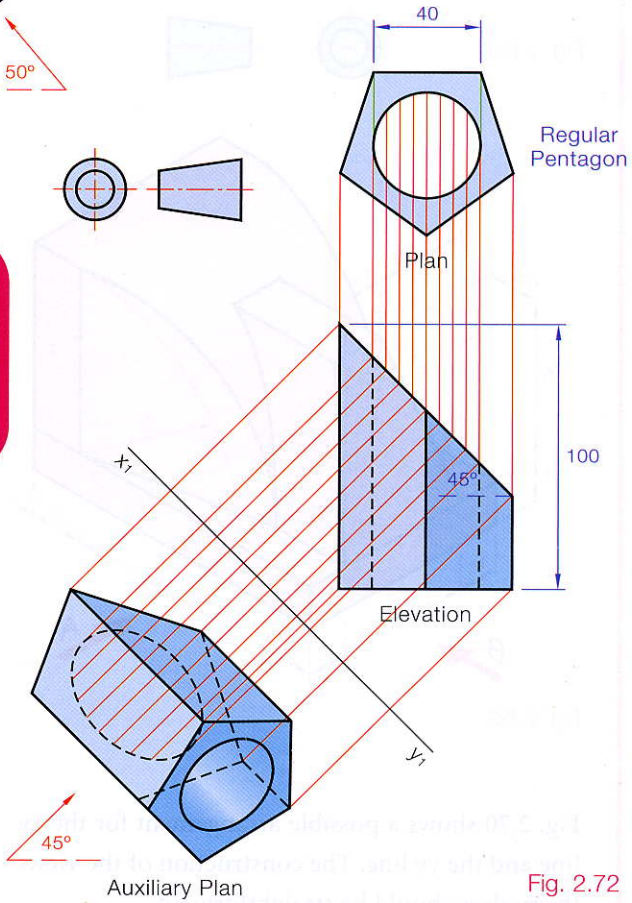


Fig. 2.72

HIGHER LEVEL

Second Auxiliary Views

Once an auxiliary view is constructed it can be used as a basis for another auxiliary. The second auxiliary can be used to get a third auxiliary view and so on. An auxiliary plan can only be projected from an elevation or an auxiliary elevation. Similarly an auxiliary elevation can only be projected from a plan or an auxiliary plan.

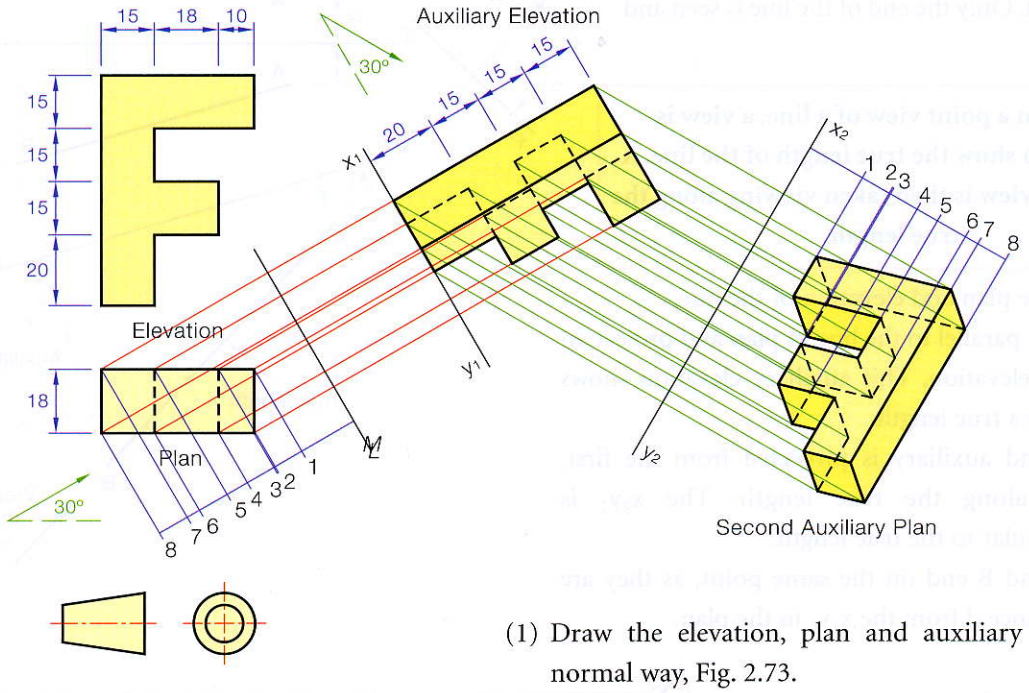


Fig. 2.73

(1) Draw the elevation, plan and auxiliary elevation in the normal way, Fig. 2.73.

(2) The new line of sight is shown at 30° to the x_1y_1. Set up the x_2y_2 perpendicular to this line of sight.

(3) Points are projected from the auxiliary elevation in the direction of the line of sight.

(4) The distances for the second auxiliary plan are measured from the x_1y_1 back to the plan for each point. It is often useful to put a line, parallel to the x_1y_1 line, closer to the plan. This line is called a **measuring line** or a **datum line**. Measuring from the measuring line to the plan instead of from the x_1y_1 line to the plan has the effect of bringing the second auxiliary plan closer to the x_2y_2 line.

Note:

- **Lines that are parallel remain parallel in all views.**
- **When finding distances for an auxiliary you measure from the xy line before the one for the view being found, e.g. if projecting a fourth auxiliary we would be drawing it from x_4y_4. Measurements would be taken from the previous xy line, i.e. x_3y_3.**
- **When finding distances for an auxiliary you measure to the view before the view being projected from, e.g. if projecting a fourth auxiliary, the view would be projected from the third auxiliary, therefore the measurements are taken from the second auxiliary.**

Applications of Second Auxiliary View

To project the point view of a line.

A point view of a line is when a view is taken down the length of the line and the whole line is only seen as a point. Only the end of the line is seen and it is a dot.

To obtain a point view of a line, a view is projected to show the true length of the line. A subsequent view is then taken viewing along the true length.

(1) Project the plan and elevation of the line.
(2) Draw x_1y_1 parallel to the line in plan and project an auxiliary elevation. This auxiliary elevation shows line AB as a true length.
(3) The second auxiliary is projected from the first, viewing along the true length. The x_2y_2 is perpendicular to the true length.
(4) Both A and B end on the same point, as they are both distance d from the x_1y_1 in the plan.

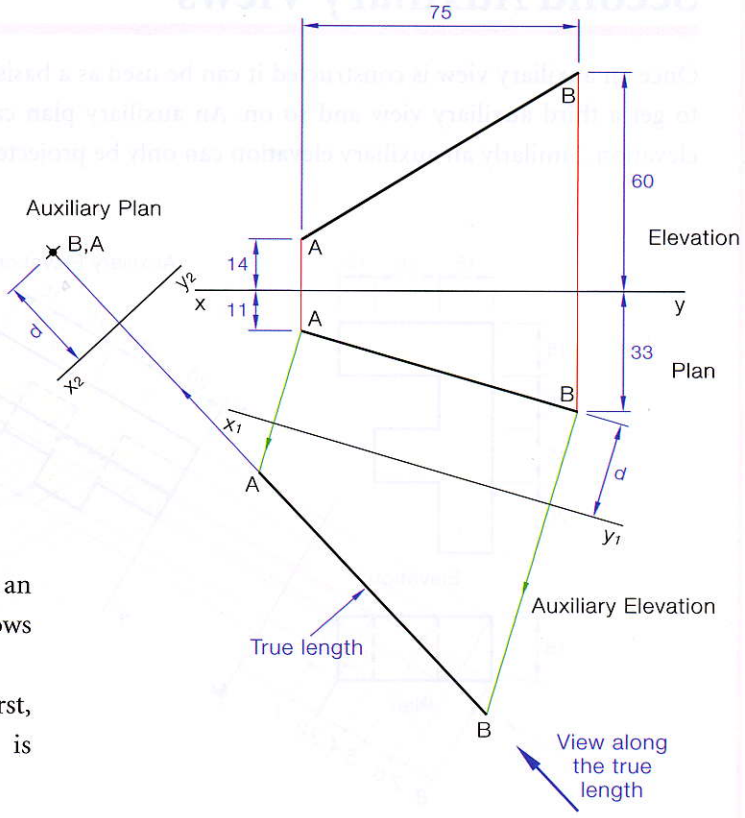


Fig. 2.74

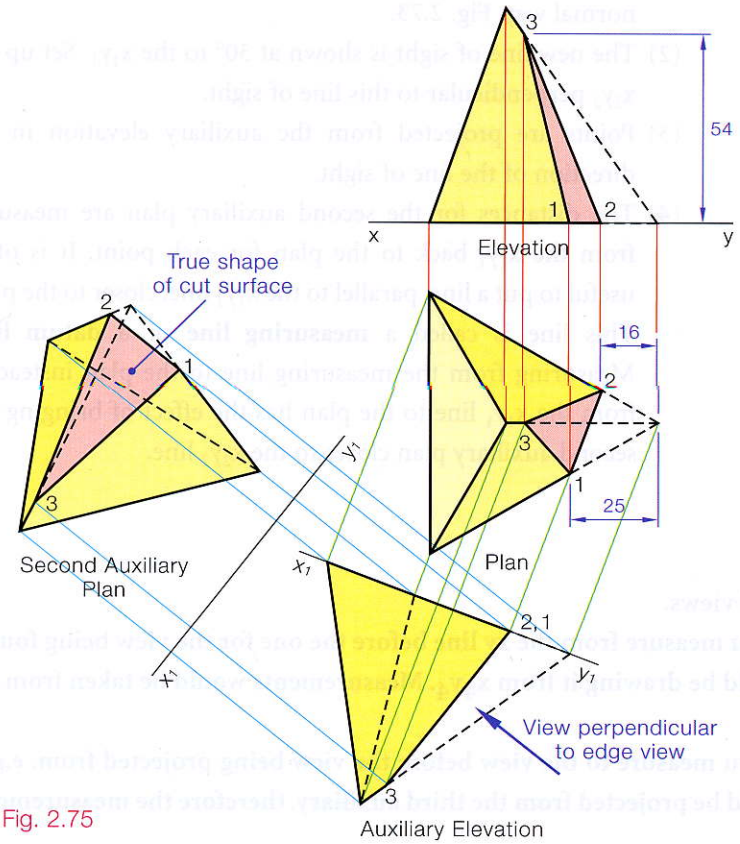


Fig. 2.75

Given a tetrahedron of 75 mm side which is cut as shown in Fig. 2.75. Project a view of the given solid showing the true shape of the cut surface.

(1) The edge 1,2 is horizontal and is therefore seen as a true length in plan.

If we view along the true length of a line, the plane on which the line rests will be seen as an edge view.

Project the auxiliary elevation with x_1y_1 perpendicular to 1,2 in plan.
(2) Project perpendicular to the edge view to show the true shape. Draw x_2y_2 parallel to the edge view. Distances for the second auxiliary plan are taken from the x_1y_1 back to the plan.

Given the solid, Fig. 2.76.
Side 1,2 = 60 mm, side 1,3 = 75 mm, side 2,3 = 80 mm.
Find the true angle between surface A and B.

(1) Line 0,3 is the line of intersection between the two planes. Project either an auxiliary elevation or auxiliary plan to show this line as a true length. In Fig. 2.76 x_1y_1 is drawn parallel to 0,3 in the elevation. The auxiliary plan will show 0,3 as a true length.

(2) Project a point view of 0,3. View in the direction of the true length. The x_2y_2 line is perpendicular to the true length. When this view is projected, both plane A and plane B are seen as edge views. The angle between the planes is clearly seen. This angle is called the **dihedral angle**.

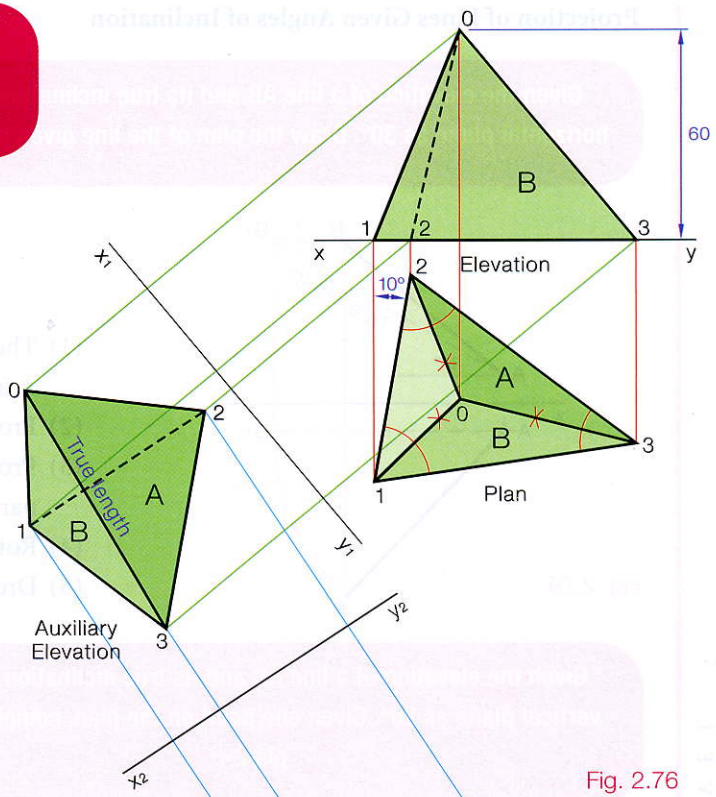
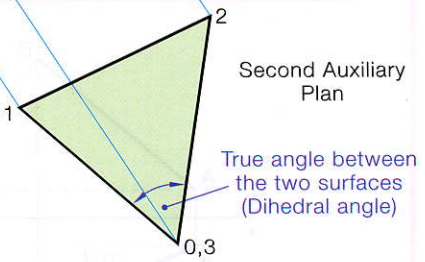


Fig. 2.76



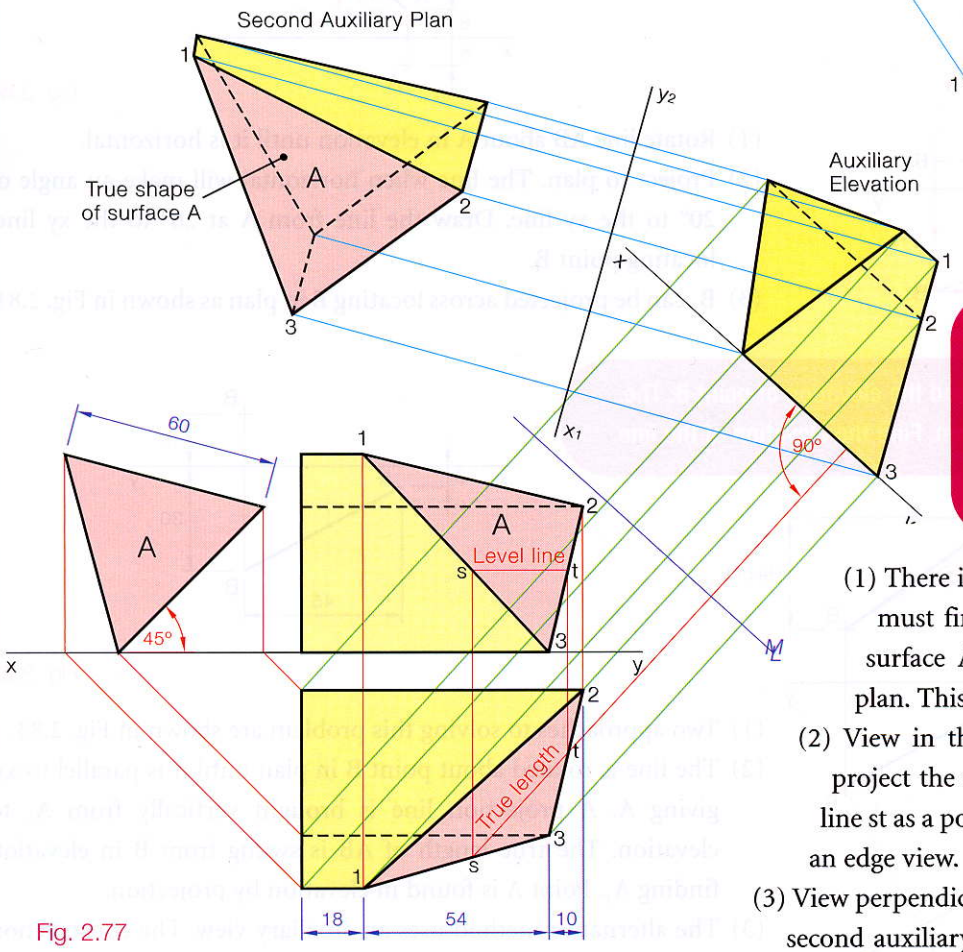


Fig. 2.77

Fig. 2.77 shows an equilateral triangular prism which has been cut as shown. Project a view of the solid to show a true shape of the cut surface A.

(1) There is no true length on surface A so we must find one. Draw a horizontal line on surface A in elevation, line st. Find st in plan. This line is a true length.

(2) View in the direction of the true length to project the auxiliary elevation. This shows the line st as a point view and the plane it rests on as an edge view.

(3) View perpendicular to the edge view to project the second auxiliary plan which shows the true shape of surface A. Note the measuring line.

Projection of Lines Given Angles of Inclination

Given the elevation of a line AB and its true inclination to the horizontal plane as 30°. Draw the plan of the line given one point.

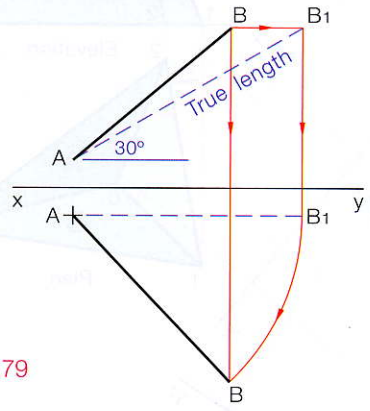


Fig. 2.79

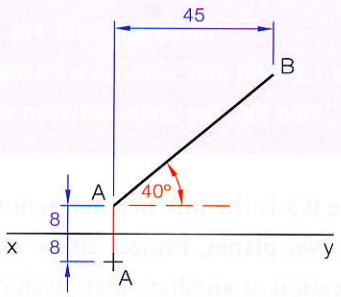


Fig. 2.78

(1) The heights of A and B will remain the same. Draw a line starting at A in elevation and at the correct angle.
(2) Project B across to intersect this line at B.
(3) Project to plan. Since it is a true length in elevation it must be parallel to the xy line in plan.
(4) Rotate the line about point A in plan.
(5) Drop point B from elevation to intersect the rotation.

Given the elevation of a line AB and its true inclination to the vertical plane as 20°. Given one point on the plan, complete the plan.

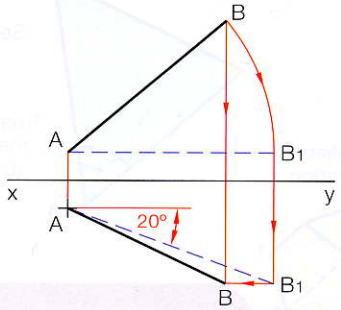


Fig. 2.81

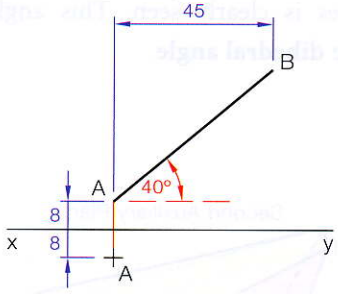


Fig. 2.80

(1) Rotate line AB about A in elevation until it is horizontal.
(2) Project to plan. The line when horizontal will make an angle of 20° to the xy line. Draw the line from A at 20° to the xy line, locating point B.
(3) B_1 can be projected across locating B in plan as shown in Fig. 2.81.

Given the plan of a line AB and the elevation of point B. The true length of the line is 60 mm. Find the elevation of the line.

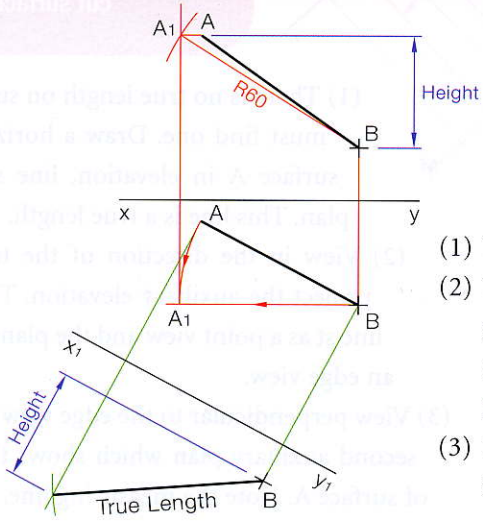


Fig. 2.83

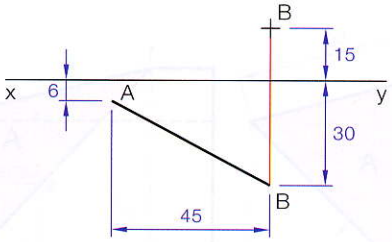


Fig. 2.82

(1) Two approaches to solving this problem are shown in Fig. 2.83.
(2) The line is rotated about point B in plan until it is parallel to xy, giving A. A projection line is brought vertically from A_1 to elevation. The true length of AB is swung from B in elevation finding A_1. Point A is found in elevation by projection.
(3) The alternative method uses an auxiliary view. The construction is self-explanatory.

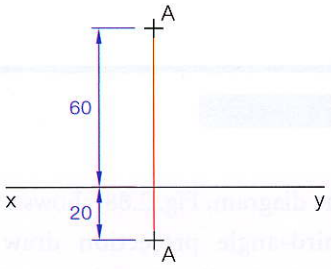


Fig. 2.84

Given the true length of a line AB, its true angle to the vertical plane and its true angle to the horizontal plane. Draw a plan and elevation of the line.
Length = 60 mm, Angle to vertical plane (VP) = 20°, Angle to HP = 40°.

(1) Locate point A in plan and elevation.
(2) From A in the elevation, draw a line that is 60 mm long and is inclined at 40° to the horizontal plane.
(3) Rotate this line about a vertical axis through A. This forms a cone with A as apex having every generator 60 mm long and inclined at 40° to the horizontal plane, Figures 2.85 and 2.86.

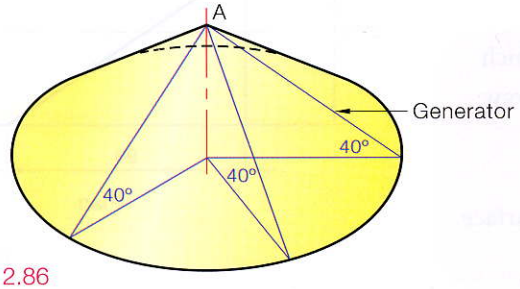


Fig. 2.86

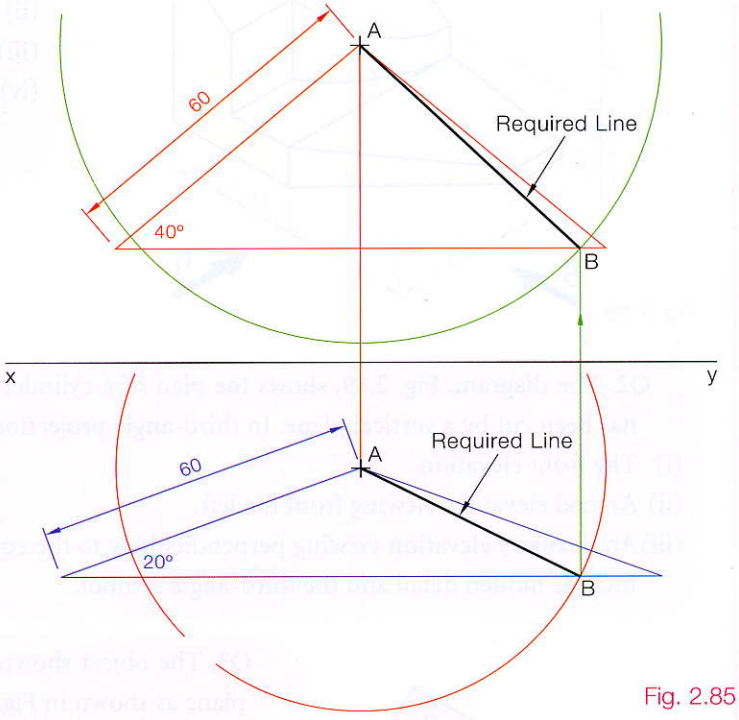


Fig. 2.85

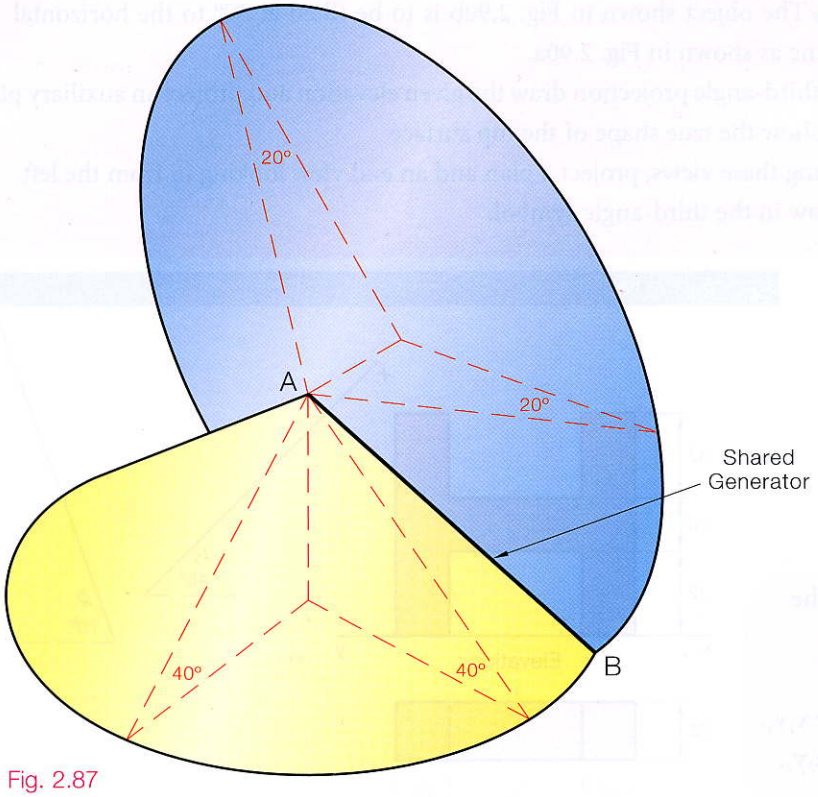


Fig. 2.87

(4) Draw the cone in plan.
(5) From A in plan draw a line that is 60 mm long and is inclined at 20° to the vertical plane.
(6) Rotate this line about a horizontal axis through A. This forms a cone with A as apex having every generator 60 mm long and inclined at 20° to the vertical plane.
(7) The two cones produced will intersect along a shared generator in two locations. Either of these is the required line, Fig. 2.87.

Activities

HIGHER LEVEL

THIRD-ANGLE PROJECTION

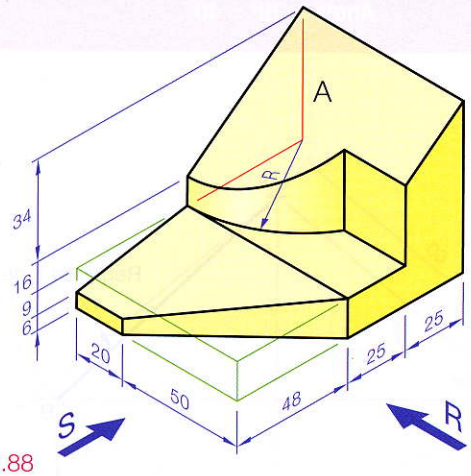


Fig. 2.88

Q1. The diagram, Fig. 2.88, shows a shaped solid.
(i) In third-angle projection draw a front elevation viewing in the direction of arrow R.
(ii) Draw an end view looking in the direction of arrow S.
(iii) Project a plan from these views.
(iv) Project a new plan of the solid that will show the true shape of surface A.

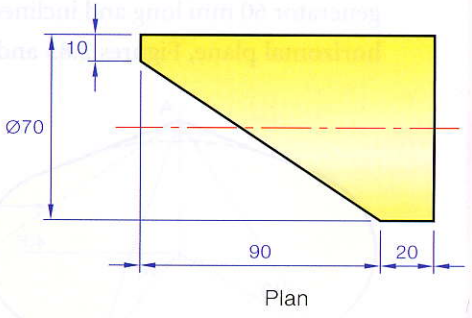


Fig. 2.89

Q2. The diagram, Fig. 2.89, shows the plan of a cylinder which has been cut by a vertical plane. In third-angle projection draw:
(i) The front elevation.
(ii) An end elevation viewing from the left.
(iii) An auxiliary elevation viewing perpendicularly to the cut surface. Include hidden detail and the third-angle symbol.

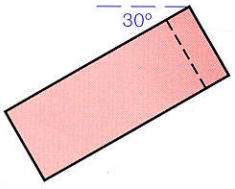


Fig. 2.90a

Q3. The object shown in Fig. 2.90b is to be tilted at 30° to the horizontal plane as shown in Fig. 2.90a.
(i) In third-angle projection draw the given elevation and project an auxiliary plan to show the true shape of the top surface.
(ii) Using these views, project a plan and an end view looking in from the left.
(iii) Draw in the third-angle symbol.

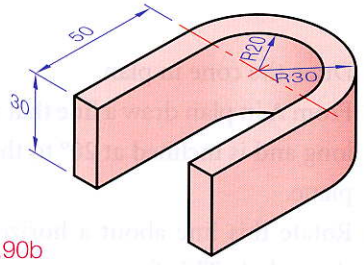


Fig. 2.90b

SECOND AUXILIARY

Q4. The diagram in Fig. 2.91 shows the elevation and plan of a letter.
(i) Draw the given views.
(ii) Project an auxiliary elevation onto the x_1y_1.
(iii) Project a second auxiliary plan onto x_2y_2.

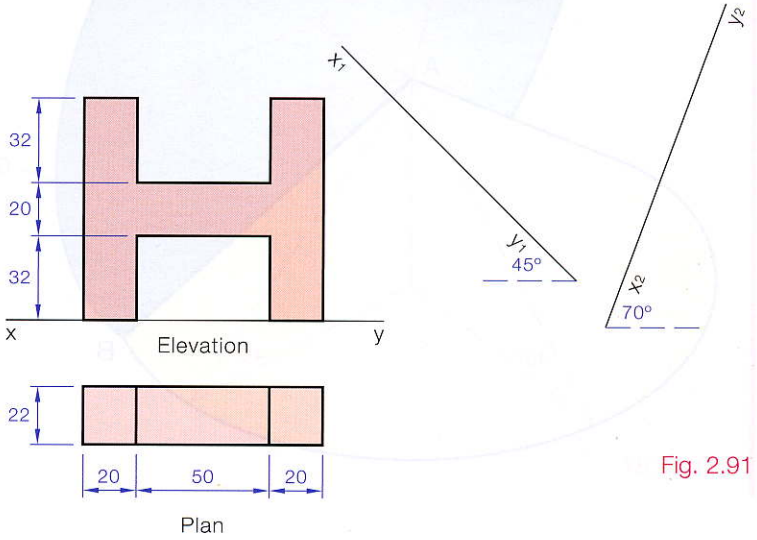


Fig. 2.91

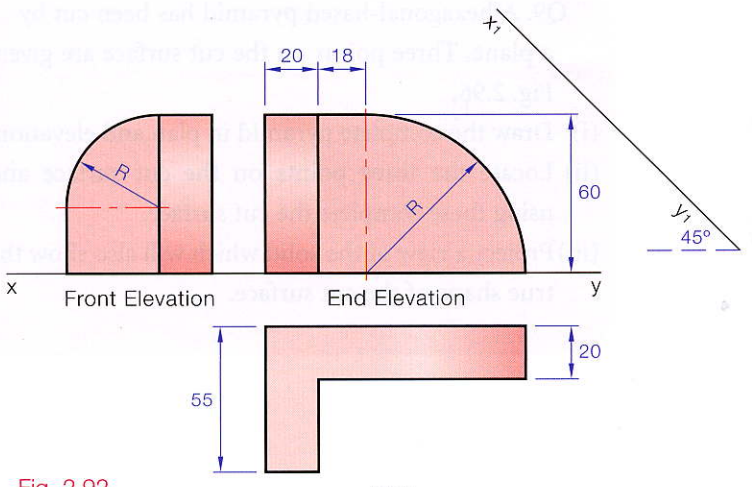


Fig. 2.92

Q5. Draw the views indicated in Fig. 2.92 and project an auxiliary elevation and a second auxiliary plan on the xy lines shown.

Q6. The diagram, Fig. 2.93, shows the plan and elevation of a regular pentagonal prism.

(i) Draw the given views.

(ii) Project a new elevation showing the true length of the line of intersection between surfaces A and B.

(iii) Project a second auxiliary plan showing the dihedral angle between surfaces A and B.

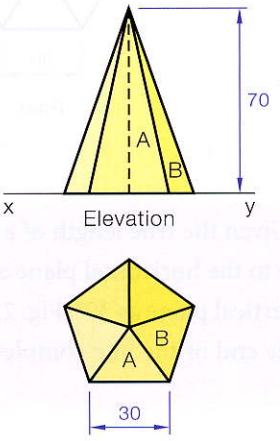


Fig. 2.93

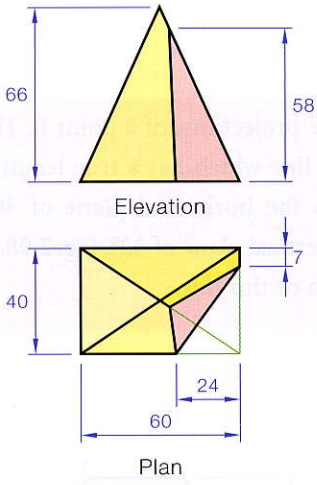


Fig. 2.94

Q7. A rectangular-based pyramid has been cut by a plane as shown in Fig. 2.94.

(i) Draw the given views.

(ii) Project an auxiliary elevation which will show the true angle the cutting plane makes with the horizontal plane.

(iii) Project a second auxiliary plan showing the true shape of the cut surface.

Q8. In end view AB = 60 mm, BC = 70 mm and AC = 50 mm, Fig. 2.95.

(i) Draw the given views.

(ii) Project an auxiliary plan showing the true angle between plane ABC and the vertical plane.

(iii) Project a second auxiliary elevation to show the true shape of ABC.

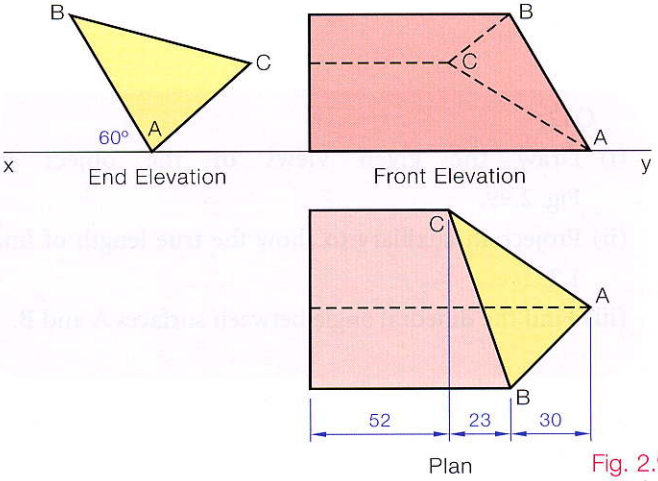


Fig. 2.95

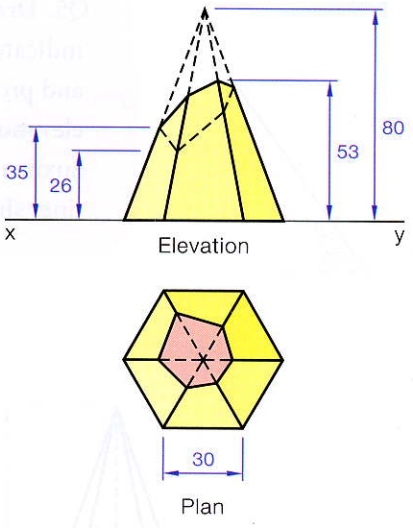


Fig. 2.96

Q9. A hexagonal-based pyramid has been cut by a plane. Three points on the cut surface are given, Fig. 2.96.

(i) Draw the complete pyramid in plan and elevation.

(ii) Locate the three points on the cut surface and using these complete the cut surface.

(iii) Project a view of the solid which will also show the true shape of the cut surface.

Q10. Given the true length of a line as 70 mm, its true angle to the horizontal plane as 45° and its true angle to the vertical plane as 30°, Fig. 2.97. Given the projections of one end of the line complete the plan and elevation.

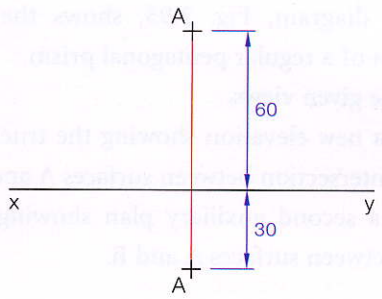


Fig. 2.97

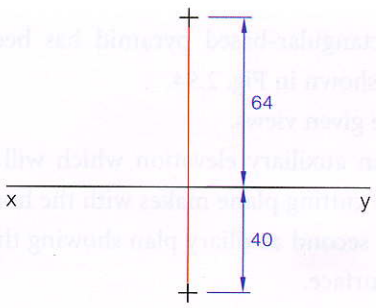


Fig. 2.98

Q11. Given the projections of a point B. This point is one end of a line which has a true length of 70 mm, a true angle to the horizontal plane of 40° and a true angle to the vertical plane of 32°, Fig. 2.98. Find the plan and elevation of this line.

Q12.

(i) Draw the given views of the object in Fig. 2.99.

(ii) Project an auxiliary to show the true length of line 1,2.

(iii) Find the dihedral angle between surfaces A and B.

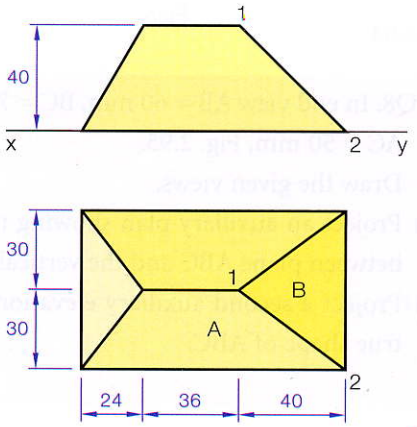


Fig. 2.99