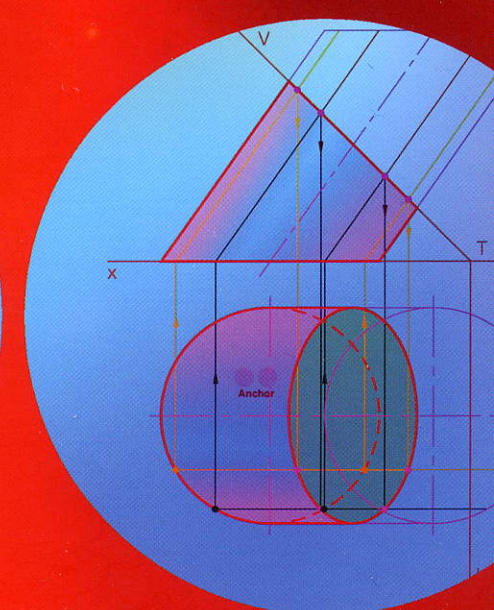
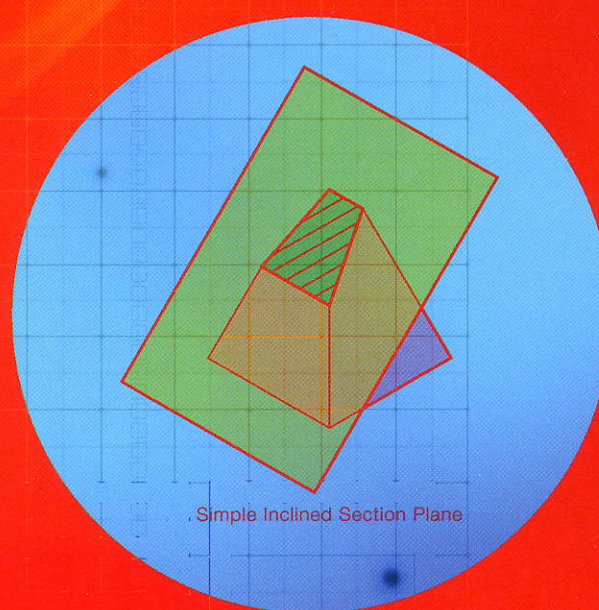
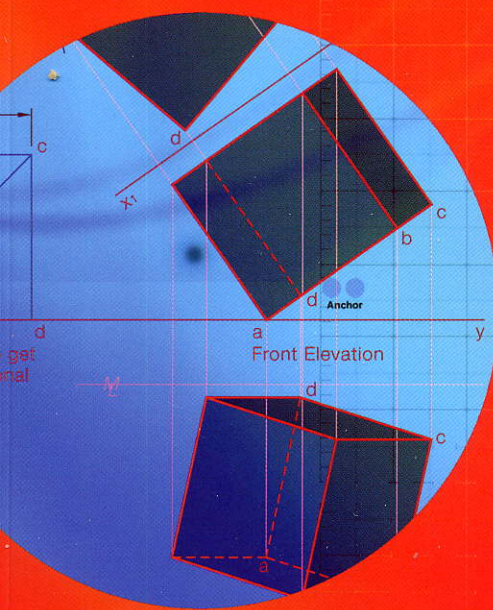


GRAPHICS IN DESIGN & COMMUNICATION

1

PLANE AND DESCRIPTIVE GEOMETRY



DAVID ANDERSON

6

Pictorial Projection 1

SYLLABUS OUTLINE

Areas to be studied:

- Isometric drawing of solids. • Derivation, construction and application of the isometric scale.
- The axonometric plane and axes. • Principles of orthogonal axonometric projection.

Learning outcomes

Students should be able to:

Higher and Ordinary levels

- Complete isometric drawings of solids containing plane and/or curved surfaces.
- Complete a portion of the axonometric plane given the projection of the axes of the planes of reference.
- Determine the true shape of the planes of reference, showing the axonometric plane.
- Determine the isometric projections of solids, including the sphere, using the isometric scale.
- Determine the axonometric projections of solids, including the sphere, using the axes method.
- Project a two-dimensional view of an object from its axonometric view on to one of the principal planes of reference.
- Demonstrate a knowledge of the principles involved in the isometric scale.

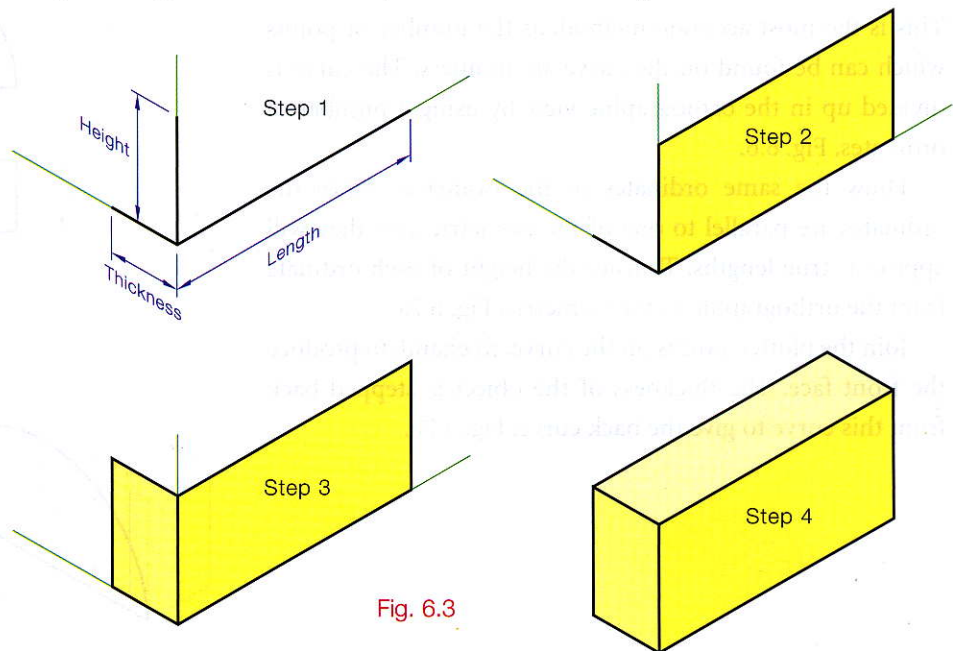
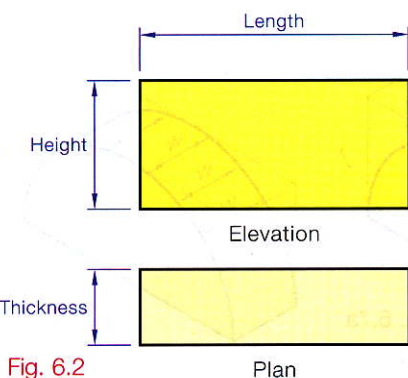
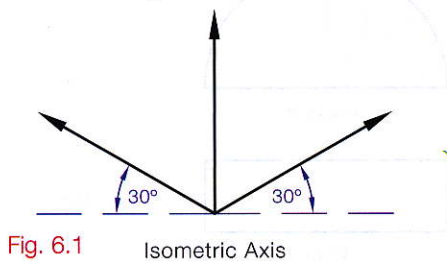
Higher level only

- Project orthogonal axonometric views of objects when the axes are inclined in isometric, dimetric or trimetric positions.

Isometric

In isometric drawings, measurements are transferred onto isometric lines. These isometric lines are parallel to the isometric axes. It is a pictorial view and will often show a solid more clearly than an orthographic can.

Sloping lines do not maintain their true length in isometric, circular curves become elliptical and angles do not show their true angle. Care must be taken when producing isometrics and they can often be slow to produce.



Axonometric Plane

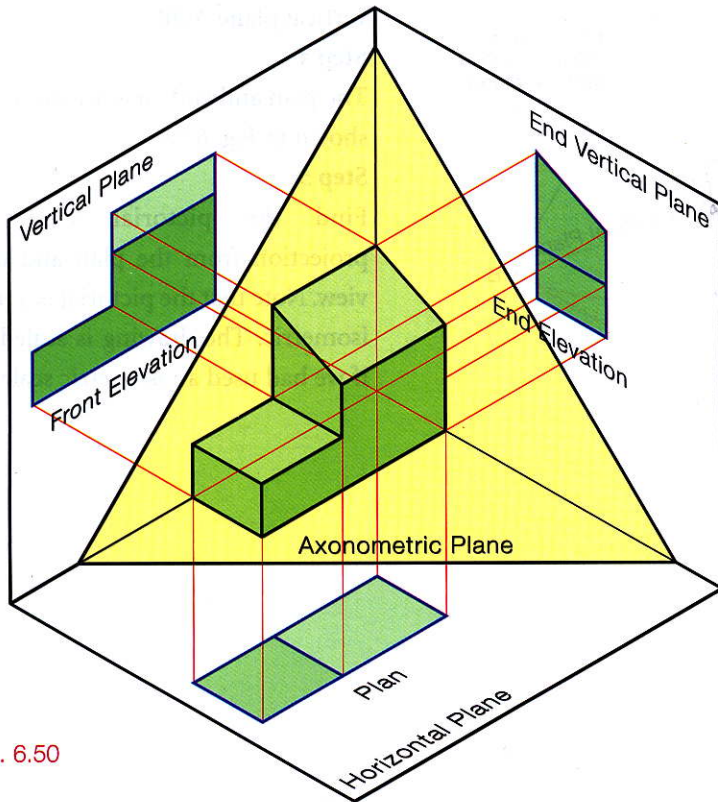


Fig. 6.50 shows a pictorial drawing of the planes of reference and an axonometric plane. When lines are projected from an object perpendicularly onto the axonometric plane we get an isometric of that object. What is happening here is that rather than tilting the object, as in Fig. 6.28 on a plane at $35^{\circ}16'$, we are tilting the plane onto which the object is projected. For isometric, this plane must make equal angles with the horizontal, vertical and end vertical plane. The plane itself will be an equilateral triangle. The axonometric plane is seen as a true shape in the pictorial. The isometric will be a scaled isometric.

Fig. 6.50

True Isometric

Draw a true isometric of the object shown in Fig. 6.51 using the axonometric plane method.

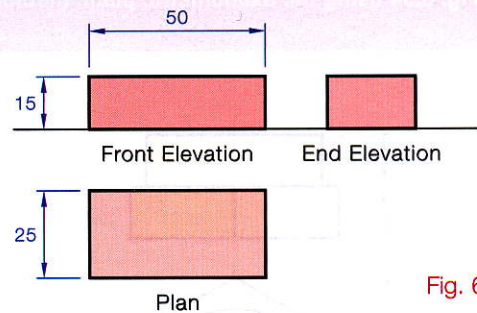


Fig. 6.51

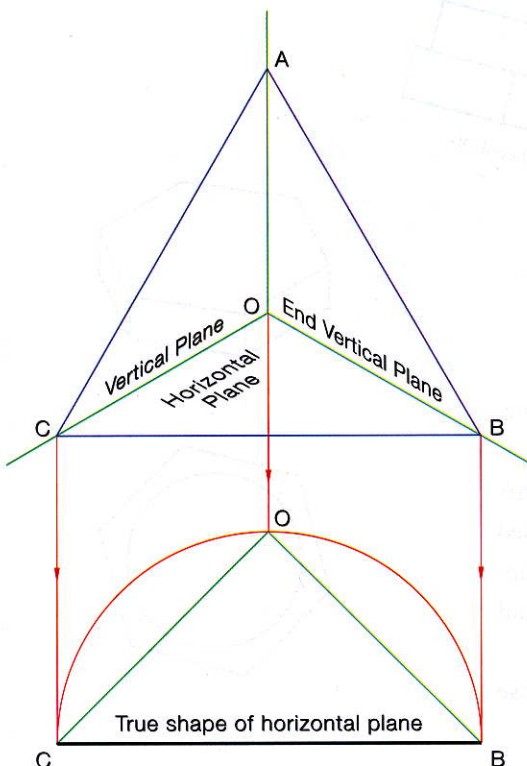


Fig. 6.52

Step 1

Draw the axonometric plane. It will be an equilateral triangle ABC. Draw the lines of intersection between the horizontal, the vertical and the end vertical planes OC, OB and OA. These lines meet in the background.

Step 2

In order to draw the isometric we need a minimum of two orthographic views. We will use the plan and end elevation. The true shape of the triangular portion of the horizontal plane OBC is found as shown in Fig. 6.52. The angle COB must be a right angle so the construction is based on the angle in a semicircle.

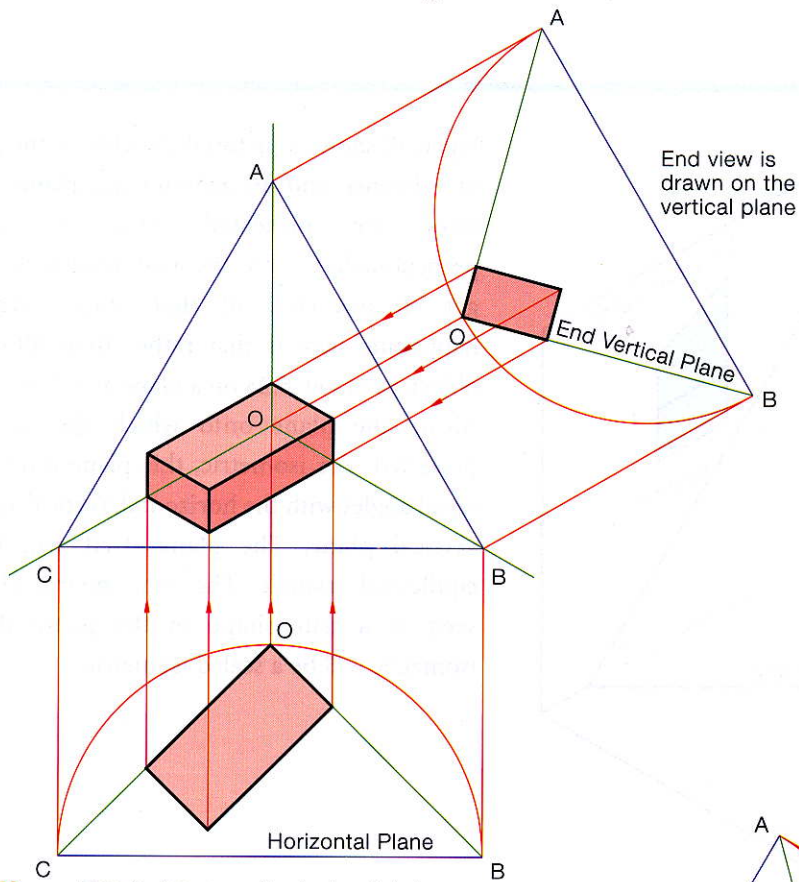


Fig. 6.53 Plan is drawn on the horizontal plane

Draw a true isometric of the object shown in Fig. 6.54 using the axonometric plane method.

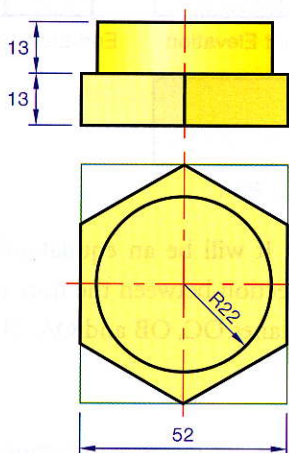


Fig. 6.54

- (1) Set up the axonometric plane, an equilateral triangle.
- (2) Draw any two orthographic views. In Fig. 6.55 we have used the plan and the front elevation.
- (3) Crating may still be used to aid the setting up of these views.
- (4) Project the isometric of the base section of the solid, Fig. 6.55.

Step 3

A similar construction is used for finding the true shape of the end vertical plane AOB.

Step 4

The plan and end view are drawn as shown in Fig. 6.53.

Step 5

Find the pictorial view by projection from the plan and end view. Note that the pictorial is a true isometric. The drawing is scaled as if we had used an isometric scale.

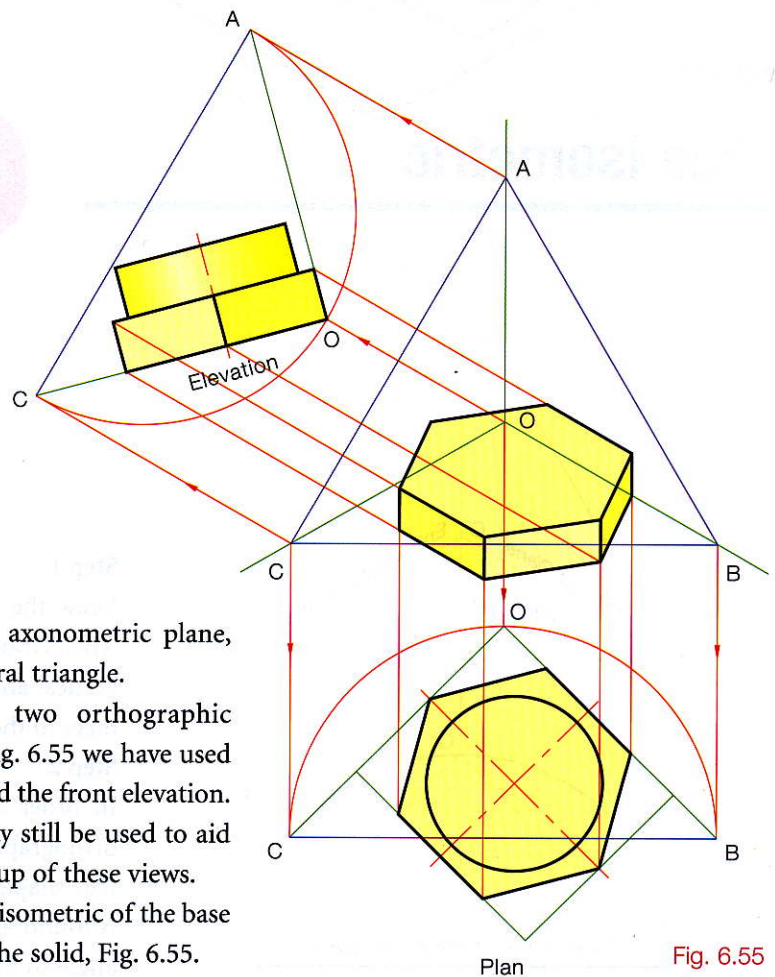


Fig. 6.55

- (5) The top of the circular section is constructed using the ortho four-centre ellipse but could easily be constructed using ordinates. The following example will be done using ordinates.

The circle is crated in the plan. The crate is constructed in the isometric, Fig. 6.56. The centre lines are found.

- (6) The centre points for the four curves are found as shown earlier in the chapter in Fig. 6.12.
- (7) The lower curve is found by drawing the bottom of the crate. Draw in the diagonal.

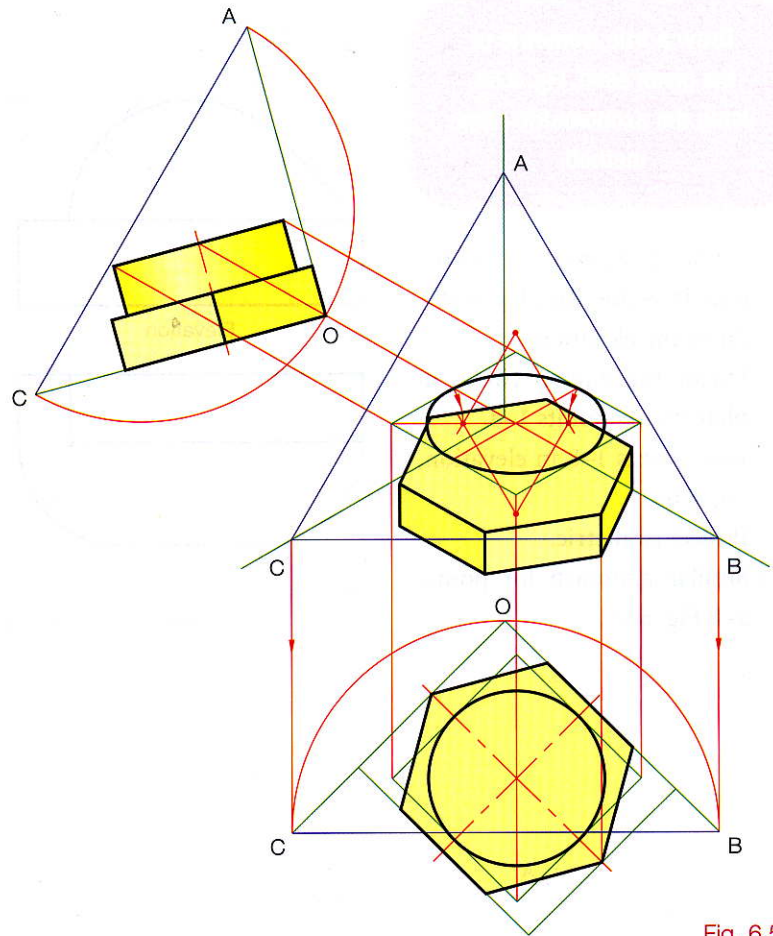


Fig. 6.56

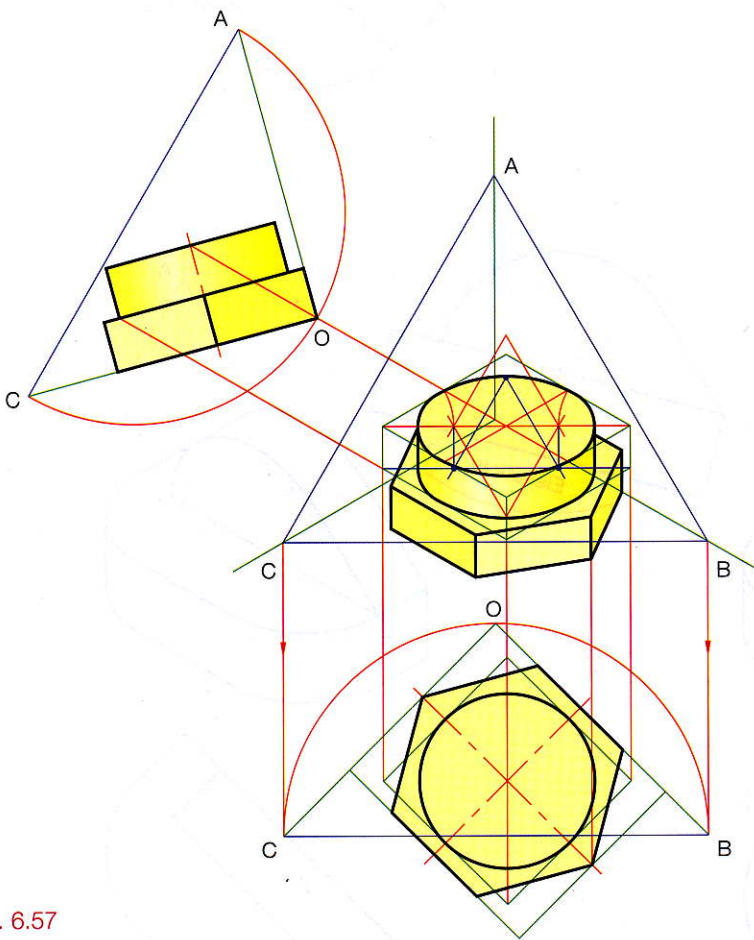


Fig. 6.57

- (8) Drop down the centres for the small arcs onto this diagonal, Fig. 6.57.
- (9) The centre for the large arc can be found by dropping down the centre from the top ellipse or by drawing 60° lines as we did here.
- (10) Complete the isometric. Hidden detail is not shown in isometric unless essential for dimensioning or to clarify some detail.

Draw a true isometric of the given solid, Fig. 6.58, using the axonometric plane method.

- (1) Set up the axonometric plane and draw the plan, Fig. 6.59.
- (2) Draw the elevation.
- (3) Divide the quarter-circles in plan, giving points 1–8.
- (4) Find points 1–8 in elevation, Fig. 6.60.
- (5) Project isometric.
- (6) Similar approach for points a–f, Fig. 6.61.

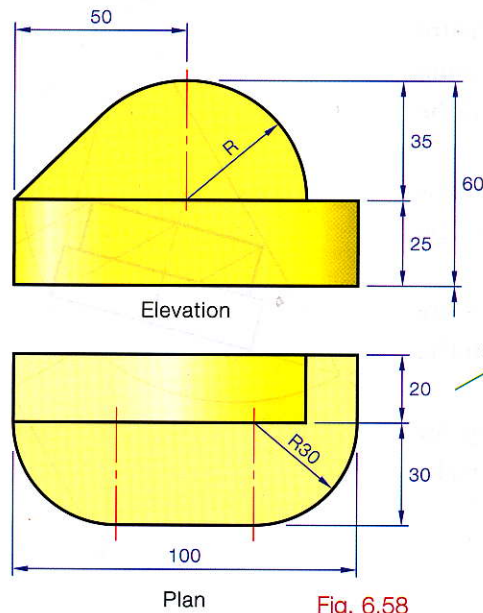


Fig. 6.58

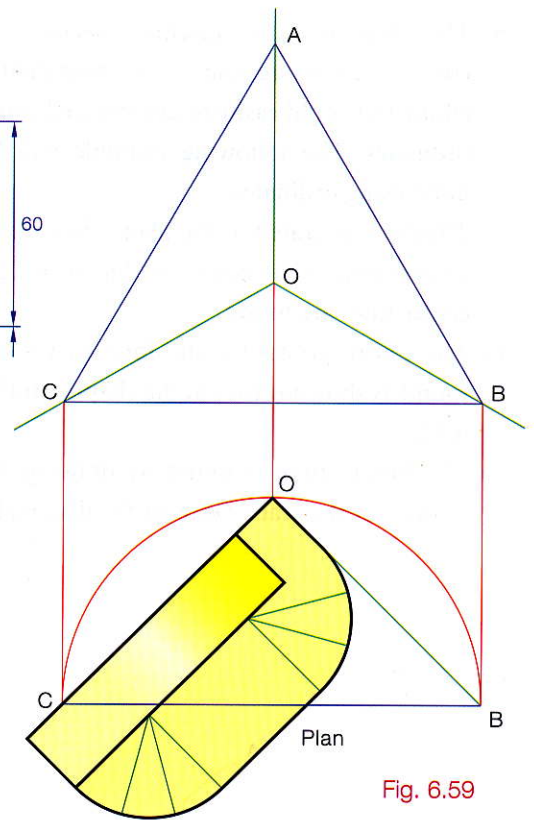


Fig. 6.59

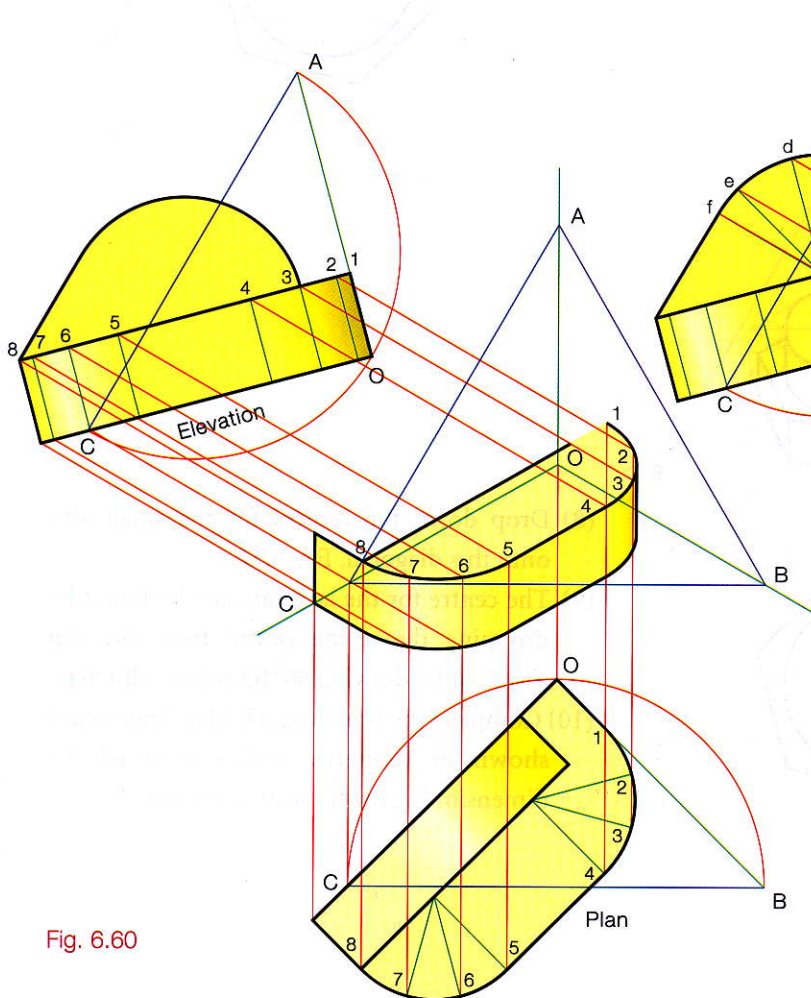


Fig. 6.60

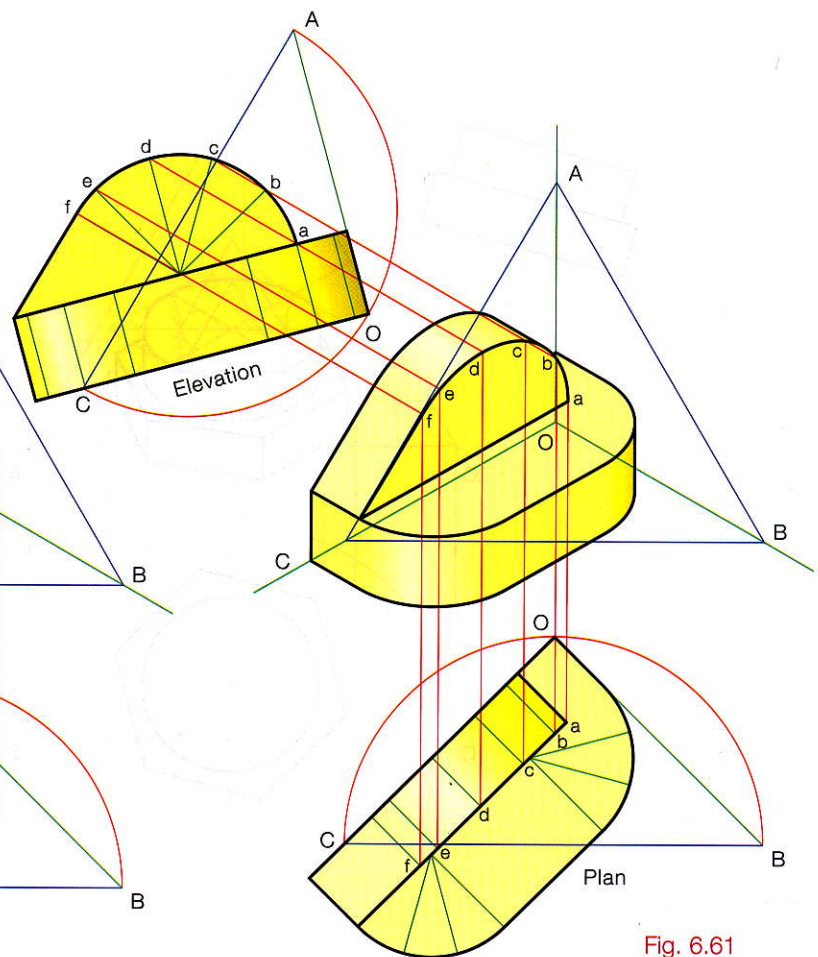


Fig. 6.61

Draw a true isometric of the solid shown in Fig. 6.62, using the axonometric plane method.

The construction of the axonometric plane, the elevation and the plan are as usual, Fig. 6.63.

It should be noted that in the isometric the radius of the hemisphere will be the same as in the plan and elevation, as discussed in Figures 6.34 to 6.37.

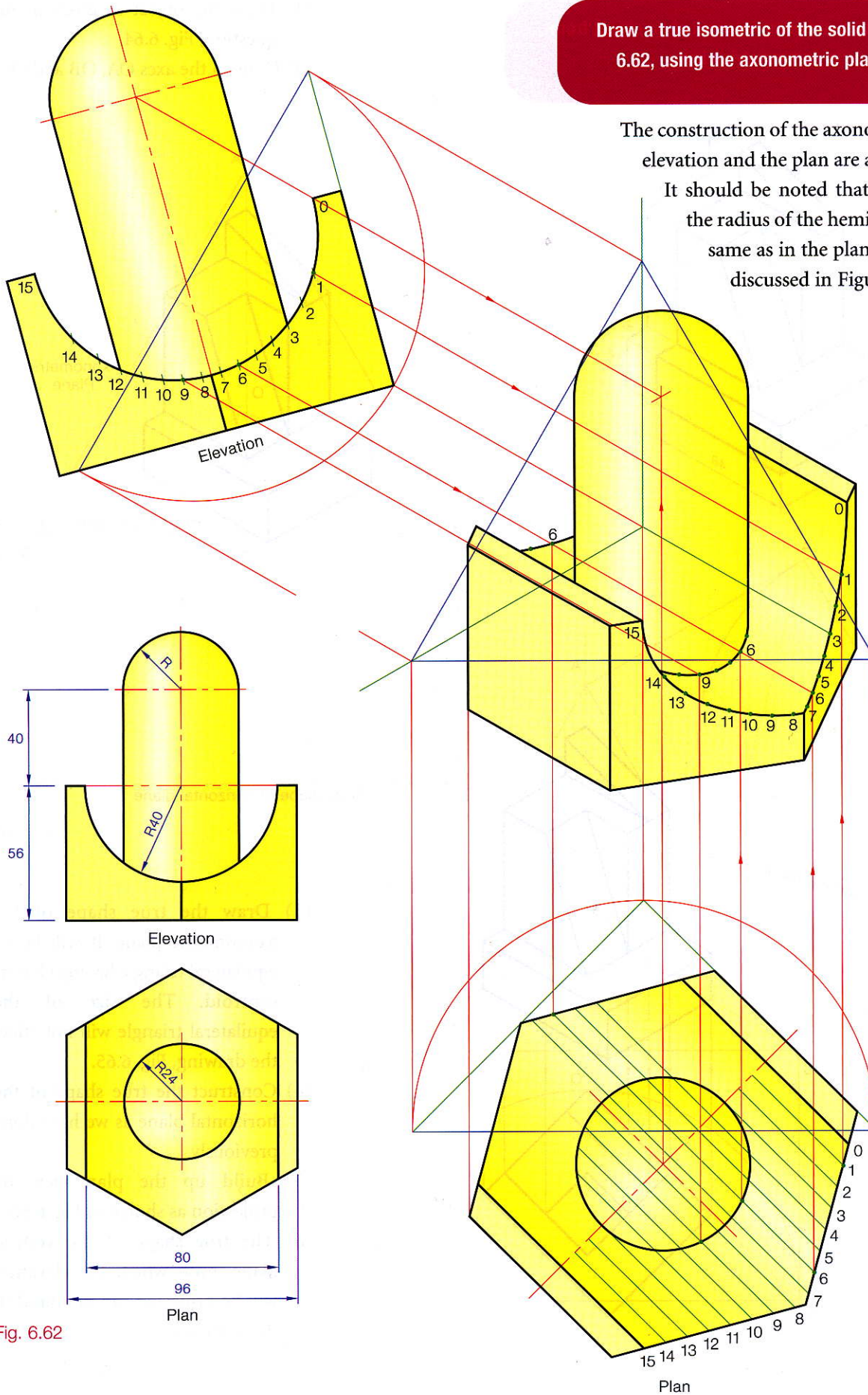


Fig. 6.62

Fig. 6.63

To project a two-dimensional view of an object from its axonometric view.

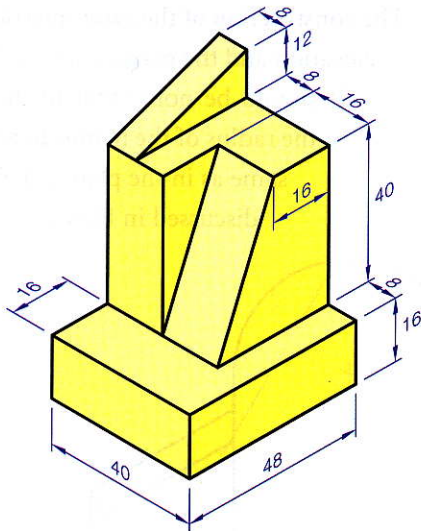


Fig. 6.64

- (1) Draw the object as given in the question, Fig. 6.64.
- (2) Draw in the axes OA, OB and OC.

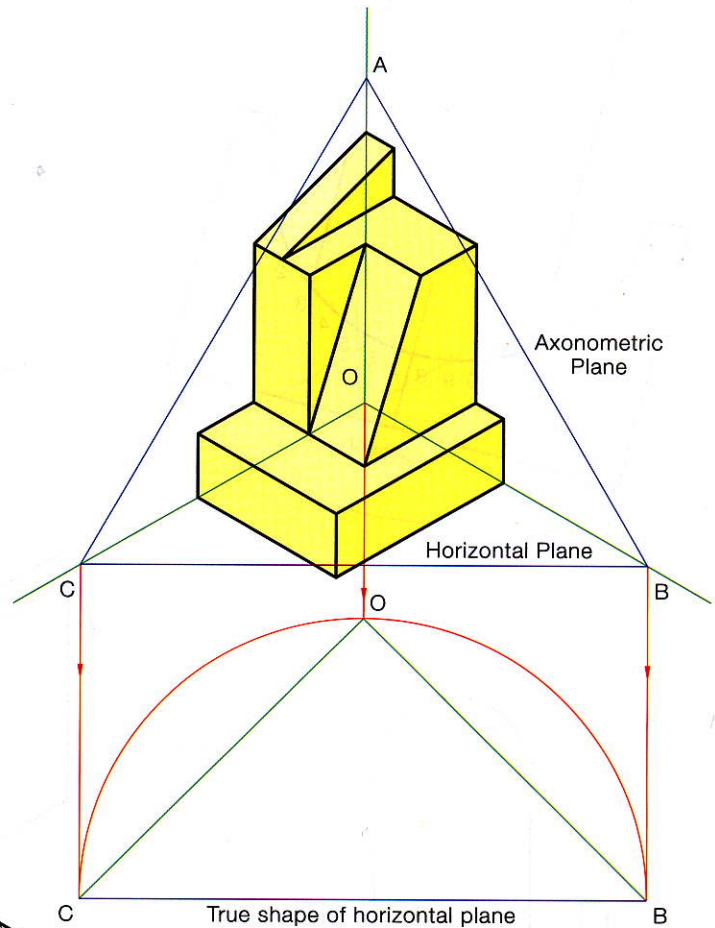


Fig. 6.65

- (3) Draw the true shape of the axonometric plane. It will be an equilateral triangle having O as its centroid. The size of the equilateral triangle will not effect the drawing, Fig. 6.65.
- (4) Construct the true shape of the horizontal plane as we have done previously.
- (5) Build up the plan view by projection as shown in Fig. 6.66.
- (6) The true shape of the vertical plane, onto which the elevation will be projected can be found in the same way.

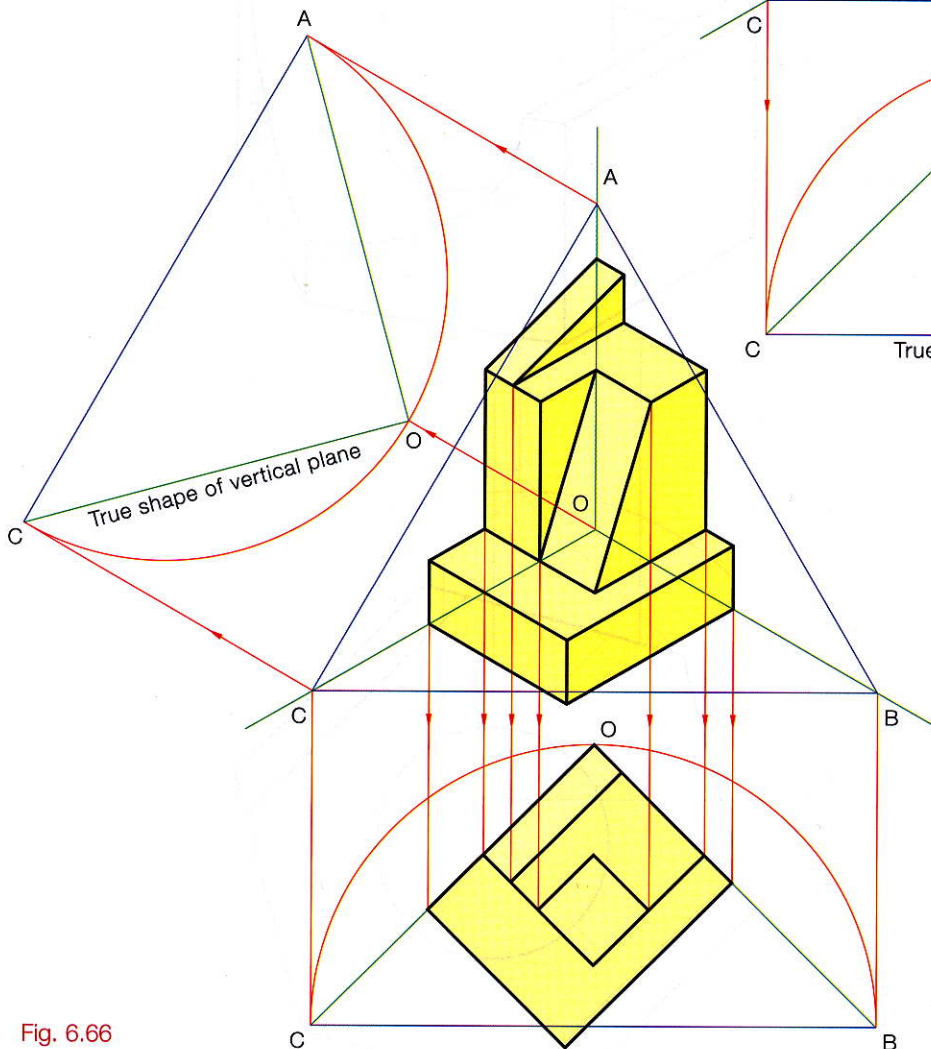


Fig. 6.66

- (7) Similar construction for the end vertical plane if it is needed.
- (8) Front elevation and end view are found as shown in Fig. 6.67.

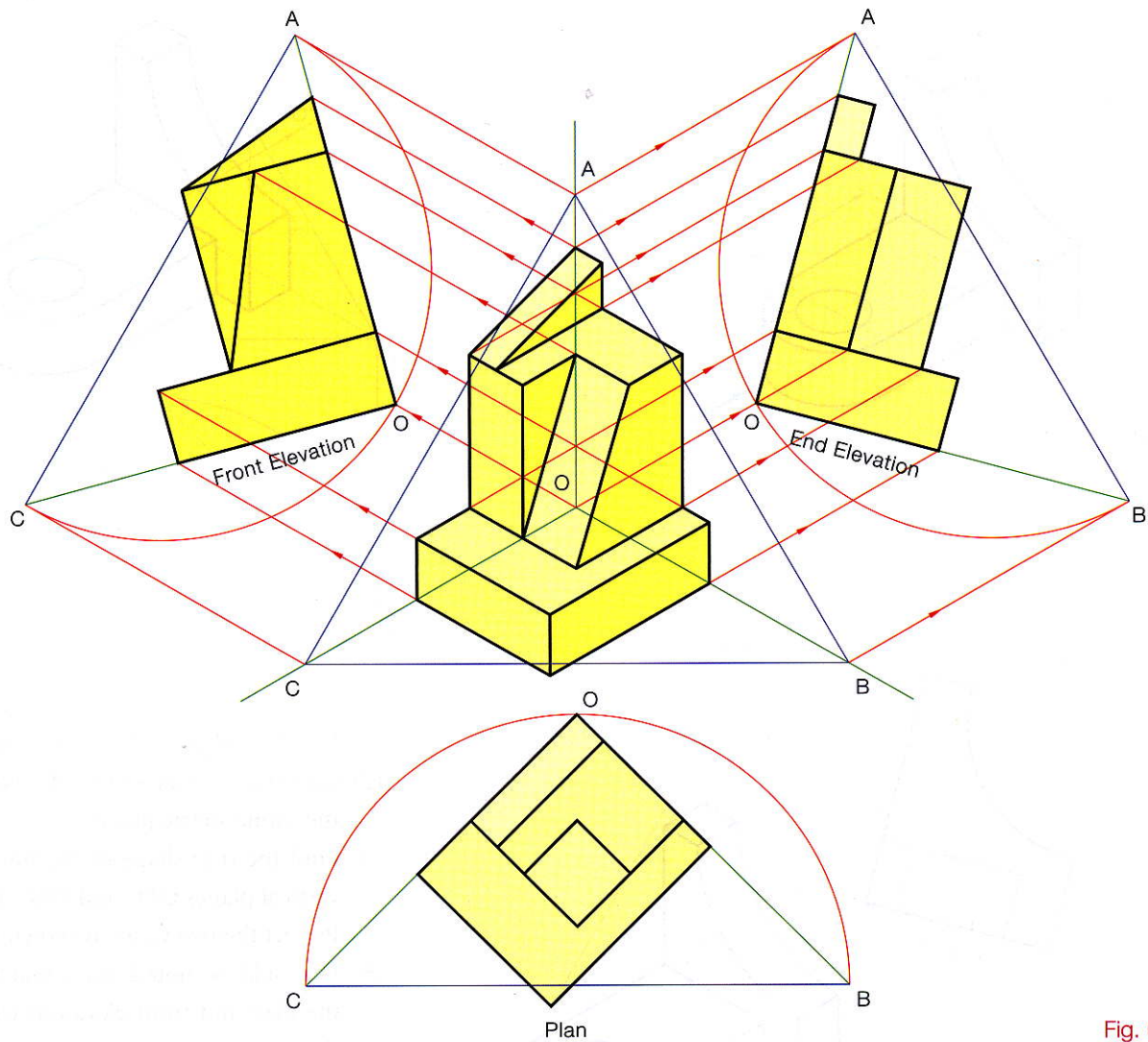


Fig. 6.67

To draw a front elevation and plan of an object given its axonometric view.

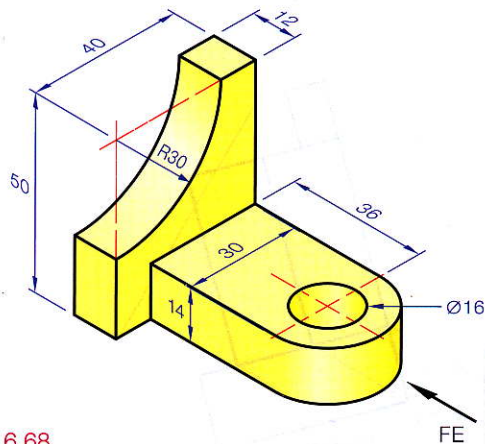


Fig. 6.68

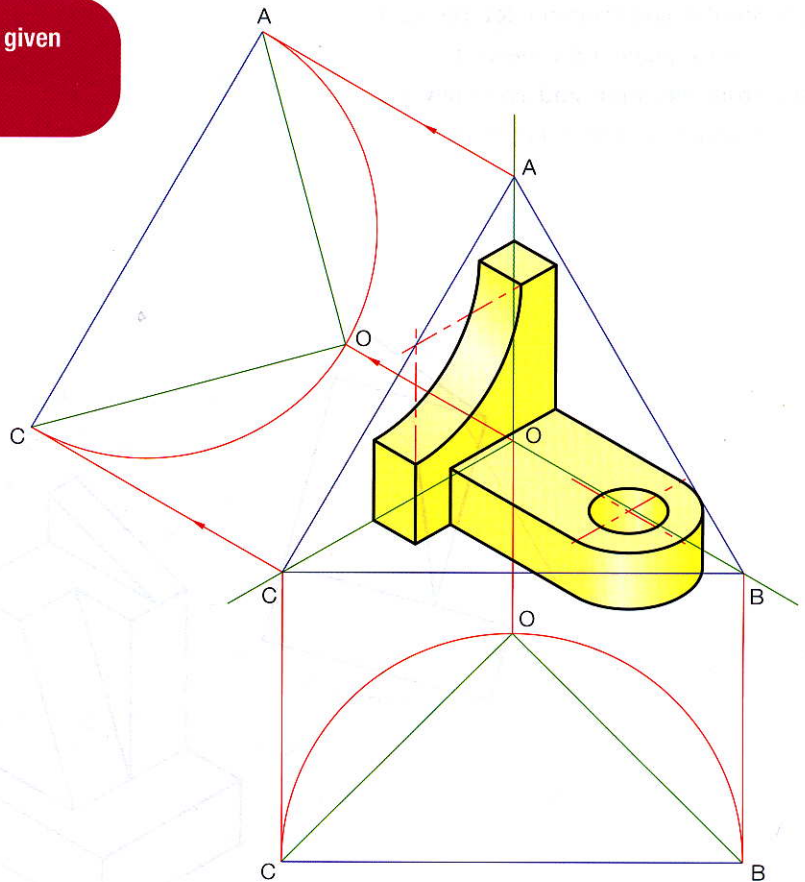


Fig. 6.69

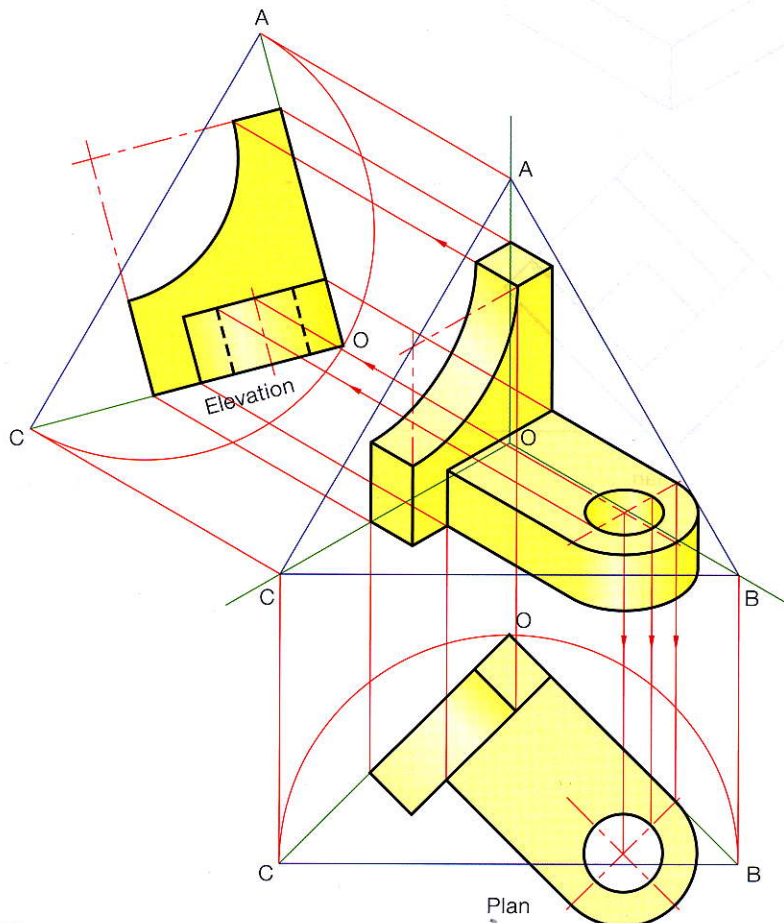


Fig. 6.70

- (1) Draw the object to the given sizes, Fig. 6.68.
- (2) Construct the axes OA, OB and OC. Draw the axonometric plane.
- (3) Find the true shape of the horizontal and vertical planes OBC and OAC, Fig. 6.69.
- (4) Project the two views as shown in Fig. 6.70.
- (5) It should be noted again that the sizes of the plan and front elevation will be larger than the true isometric. The radii of the circle, semicircle and quadrant therefore must all be found by projection.

The isocircle could be created and the centre found in the orthographic views, thus finding the centre and radius, or alternatively the centre and radius can be found as shown.