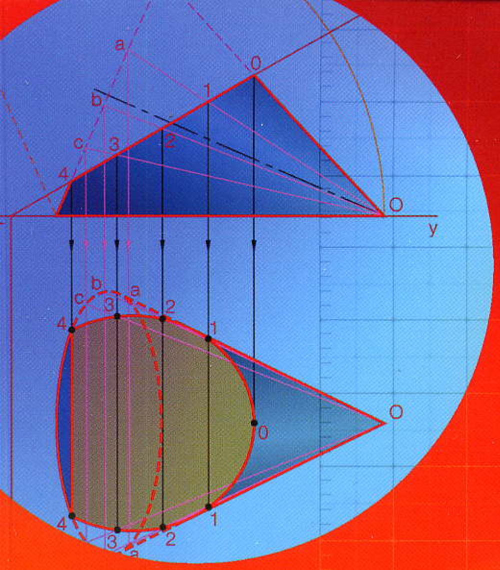
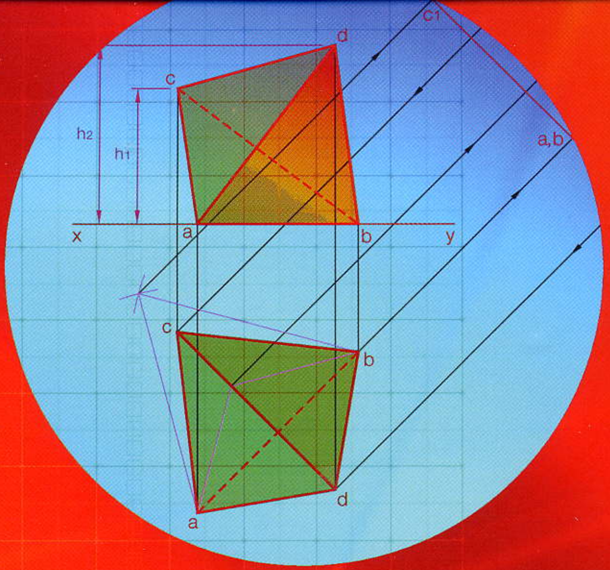
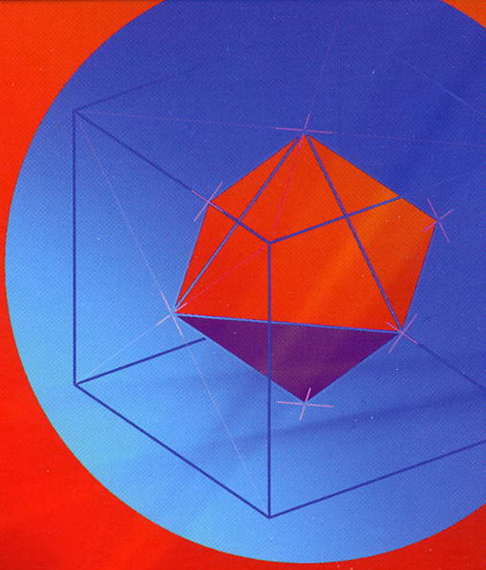
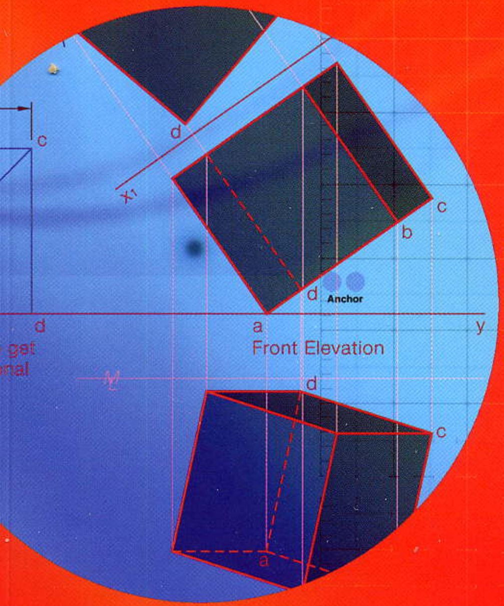


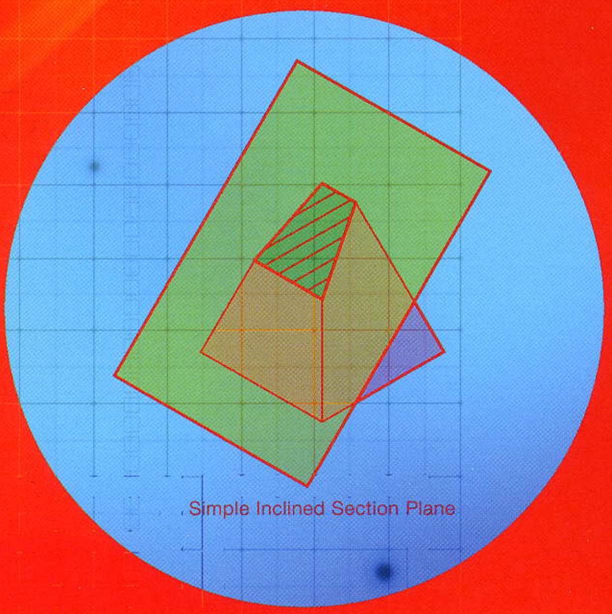


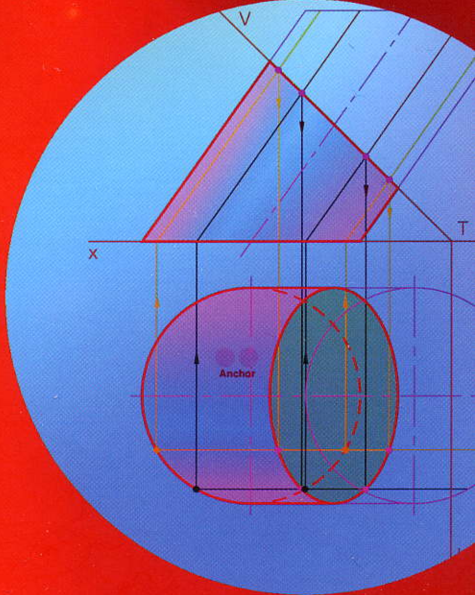


GRAPHICS IN DESIGN & COMMUNICATION 1

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.

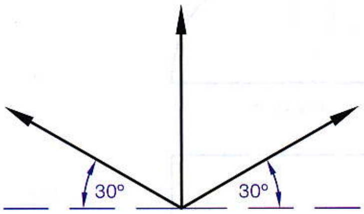


Fig. 6.1 Isometric Axis

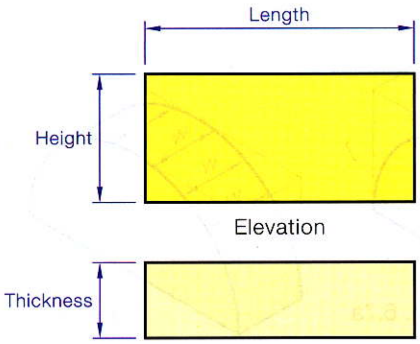


Fig. 6.2

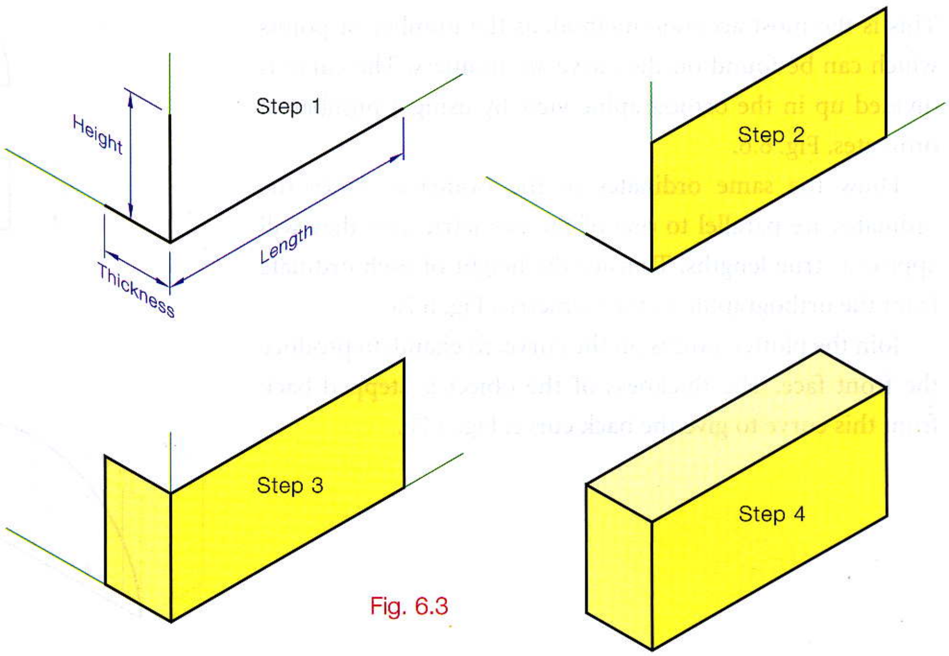


Fig. 6.3

Isometric, Dimetric and Trimetric Projection – A Comparison

Isometric

So far we have only looked at isometric projection. In isometric the principal edges (axes) of an object make equal angles with the plane of projection, either by tilting the object (Figures 6.28, 6.29 and 6.30) or by using an axonometric plane (Fig. 6.50).

Isometric has only one scale as all sides are inclined equally to the projection plane.

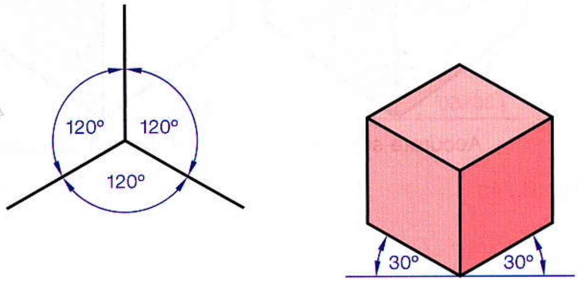


Fig. 6.71

Dimetric (Two Measures)

A dimetric projection is an axonometric projection of an object having two of its axes equally inclined to the projection plane. The third axis makes a different angle to the projection plane. Generally the object is so placed that one of its axes will be vertical when projected. Two different scales are needed in dimetric projection. The axes of similar angle will be foreshortened by the same amount. The third axis will need its own scale.

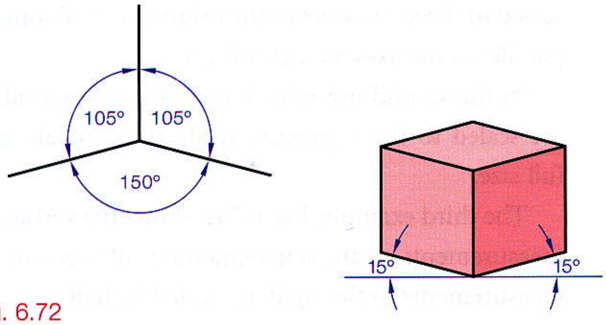


Fig. 6.72

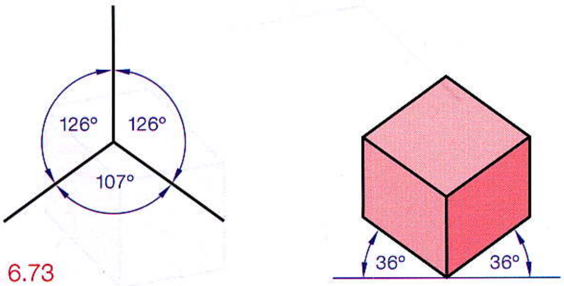
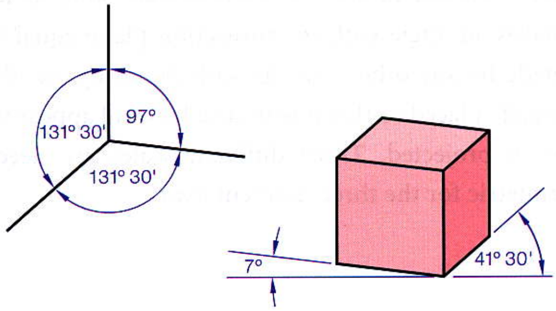


Fig. 6.73

This choice of angles shows more of the top face of the object.



A different choice of angles shows more of the left face.

HIGHER LEVEL

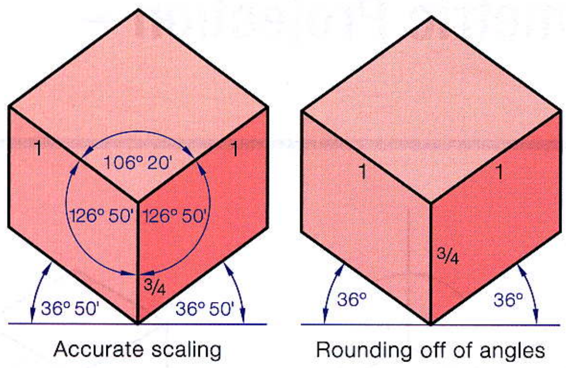


Fig. 6.74a

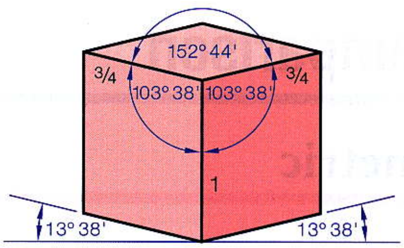


Fig. 6.74b

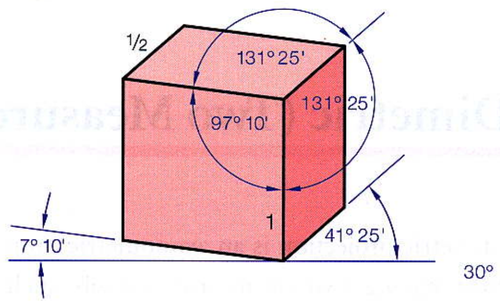


Fig. 6.74c

In order to get a realistic pictorial the measurements must be scaled. If we select our angles carefully we can do this quite easily. Fig. 6.74 shows a choice of dimetric angles which give easy scaling factors. These angles can be rounded off without much loss of accuracy.

In the first example, Fig. 6.74a, the vertical lines are scaled to three-quarters of the original size. Sloping lines parallel to the axes are left full size.

In the second example, Fig. 6.74b, the two side axes are scaled to three-quarters while the verticals are left full size.

The third example, Fig. 6.74c, shows the verticals and measurements to the left remaining full size while the measurements to the right are scaled by half.

Trimetric (Three Measures)

A trimetric projection is an axonometric projection of an object placed in such a position that none of its axes makes an angle with the projection plane equal to that made by any other axis. As with dimetric, the object is usually placed so that one of its edges will appear vertical when projected. Three different scales are needed in trimetric for the three different axes.

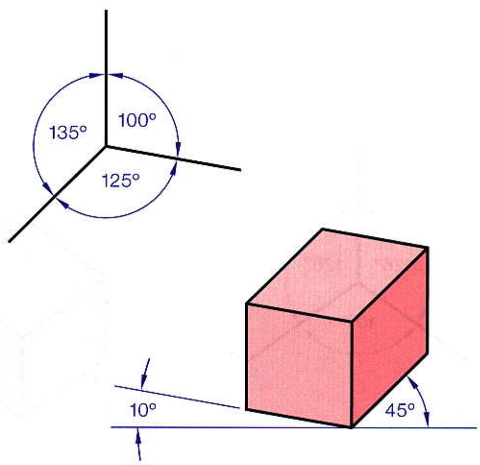


Fig. 6.75

Draw a dimetric projection of the given solid Fig. 6.76 having axes inclined as shown. Use the axonometric plane method.

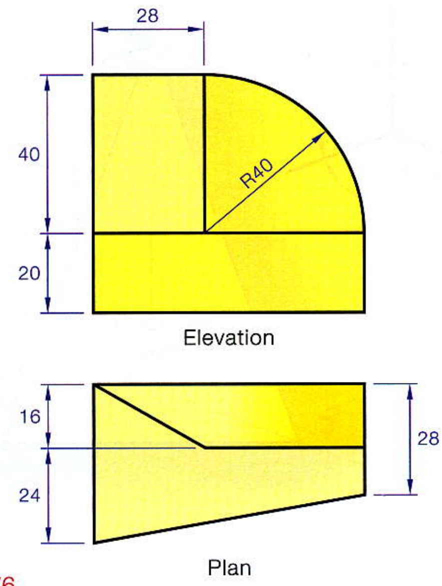
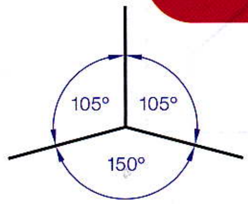


Fig. 6.76



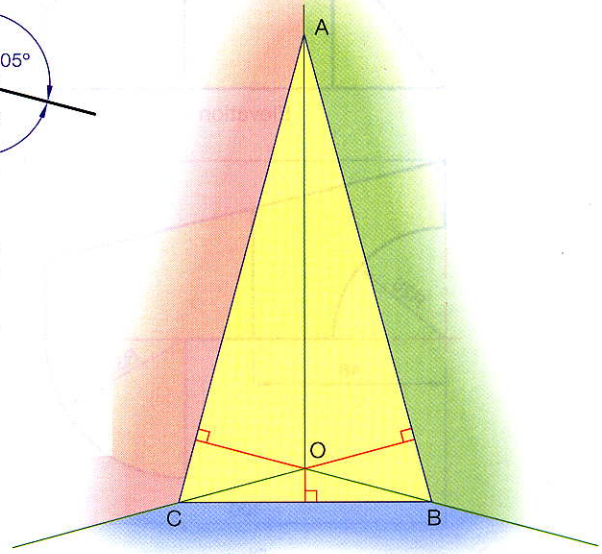


Fig. 6.77

(1) Set up the axes as shown in Fig. 6.77.

(2) The axonometric plane is now drawn. The plane is drawn such that edge AB is perpendicular to axis CO, edge BC is perpendicular to axis AO and edge CA is perpendicular to axis BO. The size of the triangle does not matter.

(3) Find the true shape of the triangular portion of the horizontal plane BOC in the same way as we did for isometric projection.

(4) Similarly for the vertical plane, triangle COA.

(5) Construct the orthographic views on these true shapes.

(6) The dimetric view is found by projection from the elevation and plan as we have done for isometric.

(7) The pictorial will be scaled automatically, Fig. 6.78.

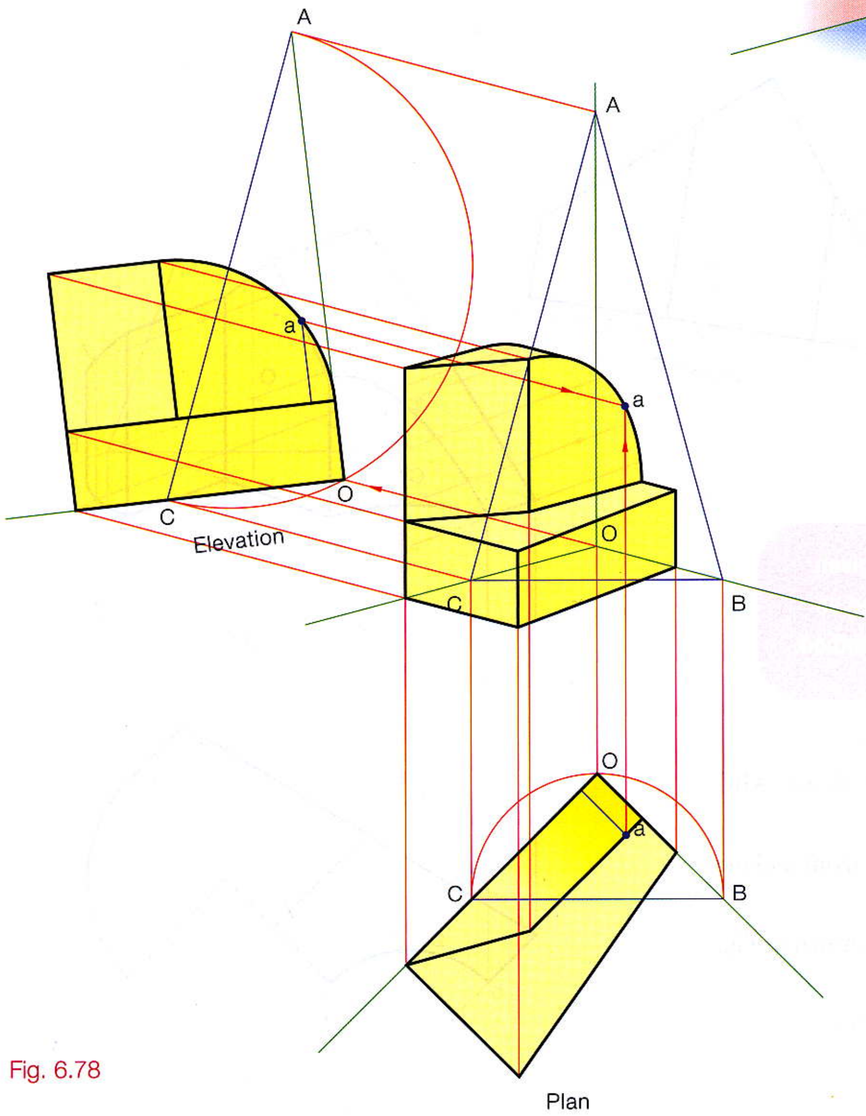


Fig. 6.78

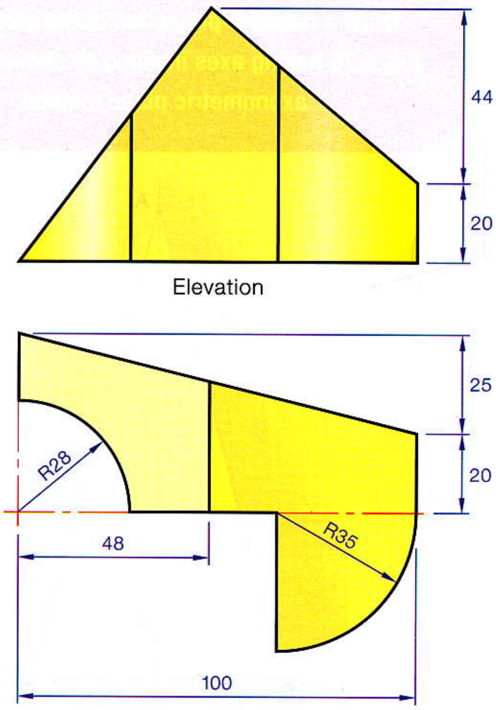


Fig. 6.79

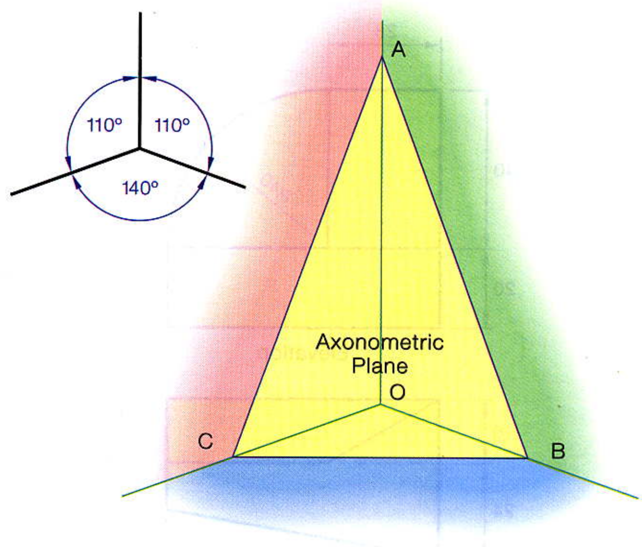


Fig. 6.80

HIGHER LEVEL

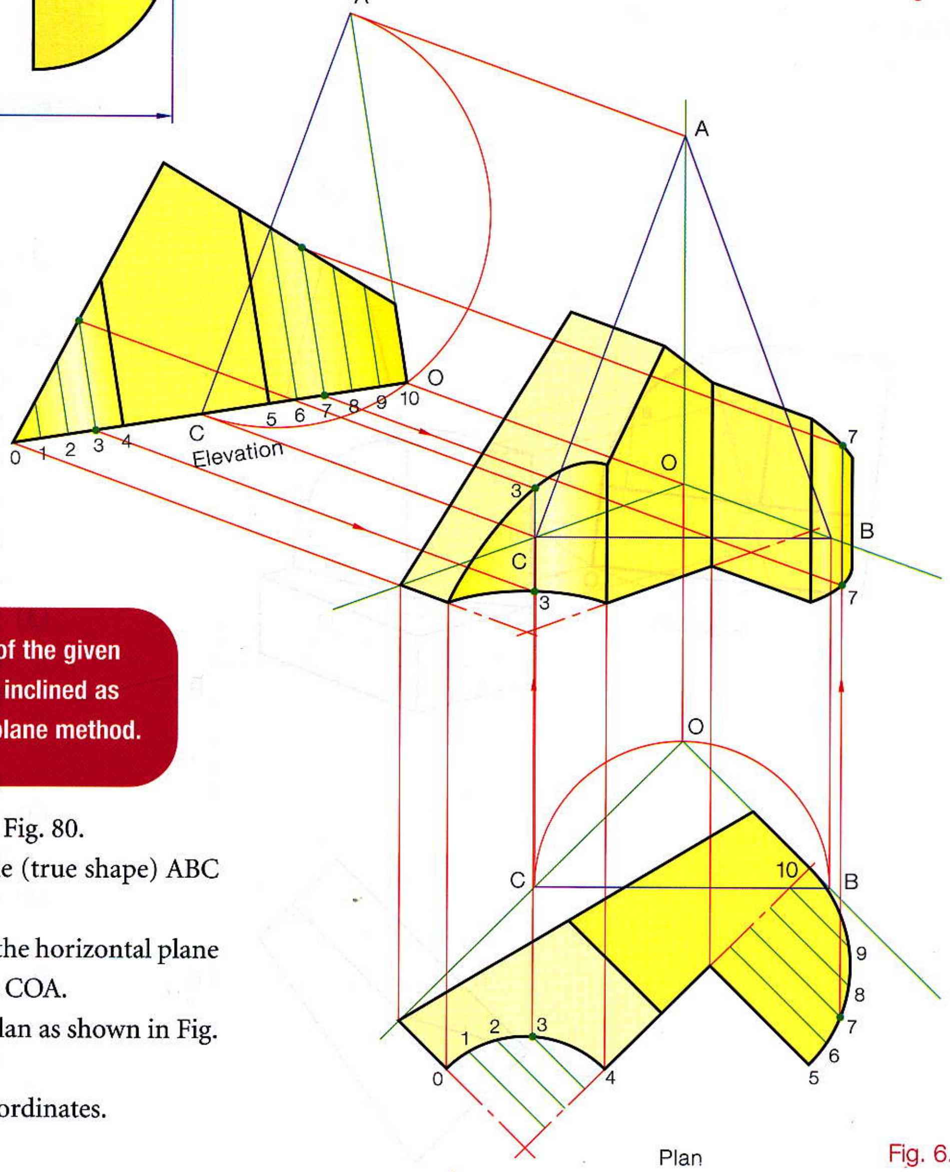


Fig. 6.81

Draw a dimetric projection of the given solid, Fig. 6.79, having axes inclined as shown. Use the axonometric plane method.

(1) Set up the axes as shown in Fig. 80.
(2) Draw the axonometric plane (true shape) ABC as before.
(3) Find the true shape of both the horizontal plane COB and the vertical plane COA.
(4) Draw in the elevation and plan as shown in Fig. 6.81.
(5) Divide up the curves using ordinates.
(6) Project the dimetric view.

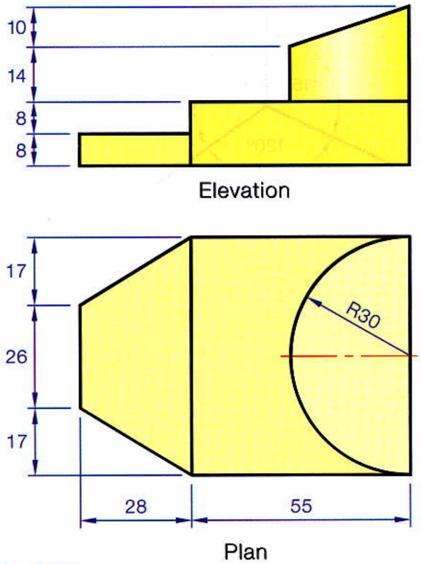


Fig. 6.82

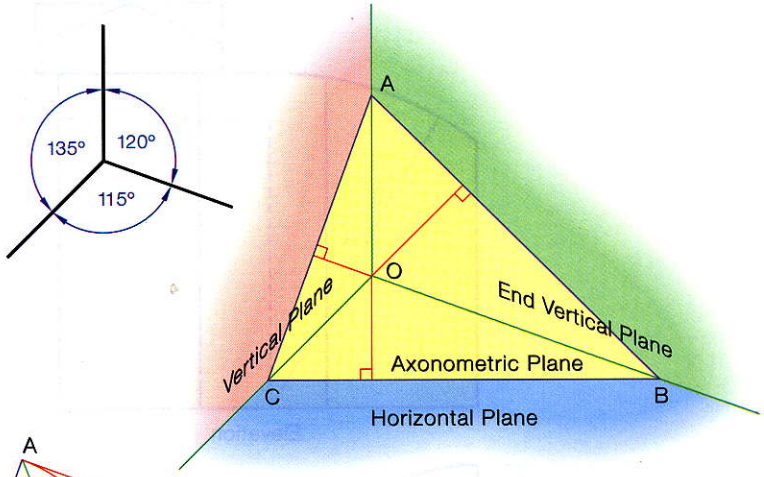


Fig. 6.83

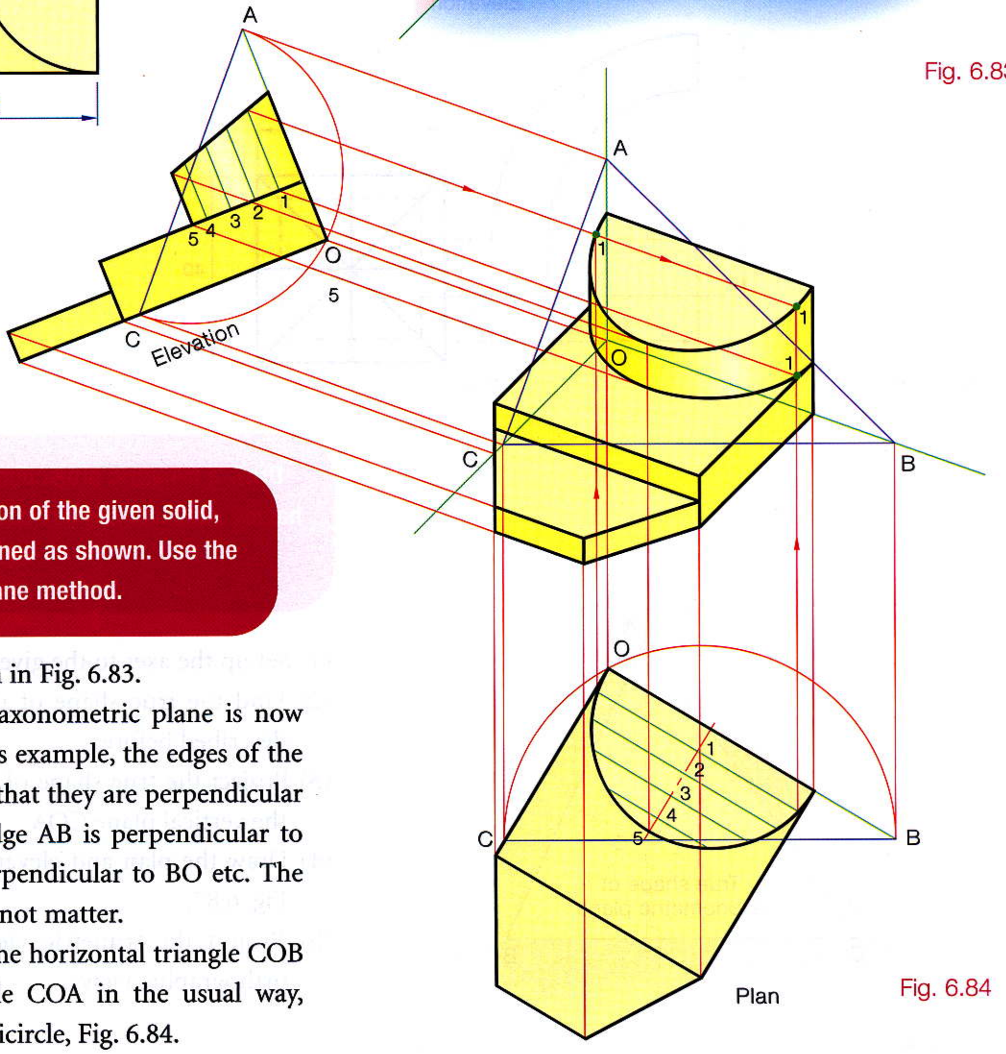


Fig. 6.84

Draw a trimetric projection of the given solid, Fig. 6.82, having axes inclined as shown. Use the axonometric plane method.

(1) Set up the axes as shown in Fig. 6.83.

(2) The true shape of the axonometric plane is now drawn. Like the previous example, the edges of the plane are positioned so that they are perpendicular to the opposite axis. Edge AB is perpendicular to axis CO, edge AC is perpendicular to BO etc. The size of the triangle does not matter.

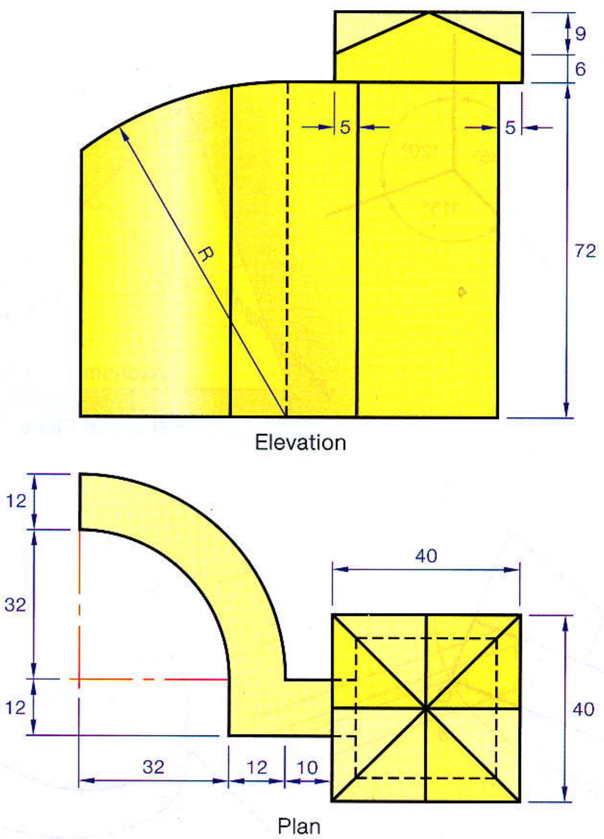
(3) Find the true shape of the horizontal triangle COB and the vertical triangle COA in the usual way, using the angle in a semicircle, Fig. 6.84.

(4) Construct the orthographic views in these triangles.

(5) The trimetric is found by projection from these views parallel to the axes.

(6) The cylindrical portion is found by using ordinates as shown.

(7) The lengths are scaled automatically using this method.



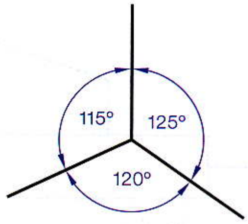


Fig. 6.85

Draw a trimetric projection of the given solid, Fig. 6.85, having axes inclined as shown. Use the axonometric plane method.

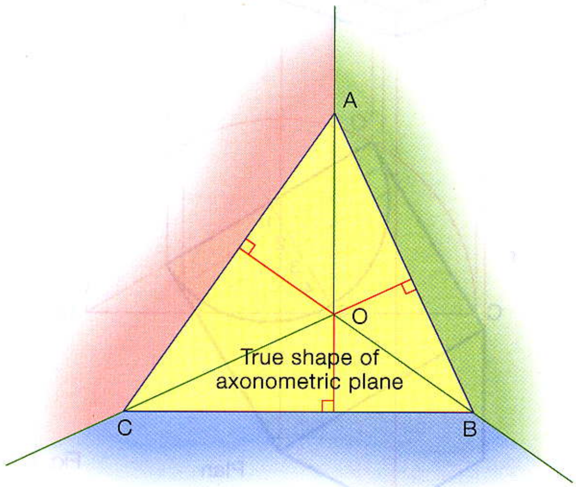


Fig. 6.86

(1) Set up the axes to the given angles, Fig. 6.86.

(2) Find the true shape of the axonometric plane ABC as described before.

(3) Project the true shape of the horizontal plane COB and the vertical plane COA.

(4) Draw the plan and elevation on their respective planes, Fig. 6.87.

(5) Project the trimetric view of the solid from the two orthographic views.

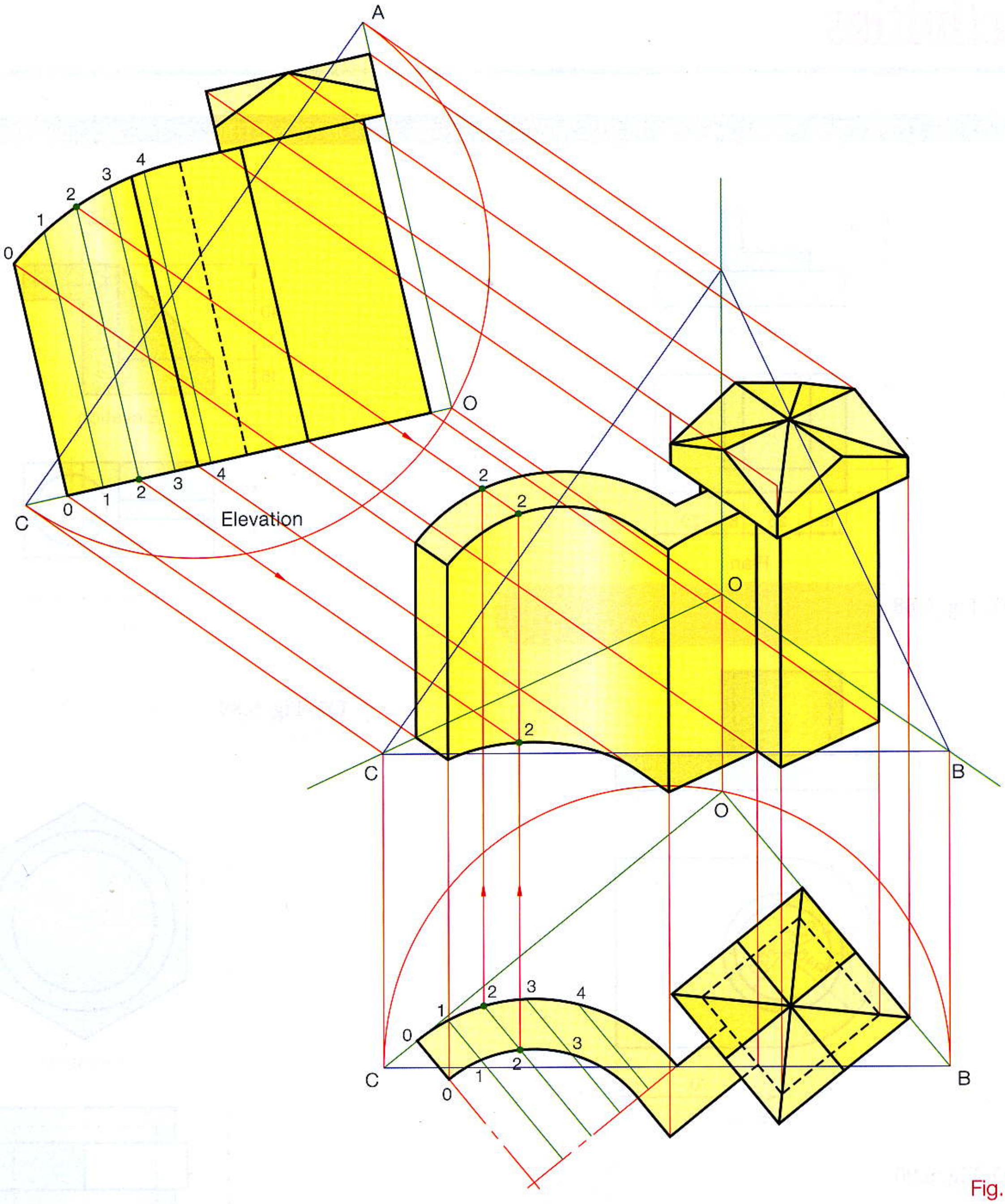


Fig. 6.87

Activities

Q1. TO Q5. USING THE AXONOMETRIC PLANE METHOD, DRAW A TRUE ISOMETRIC OF THE FOLLOWING SOLIDS.

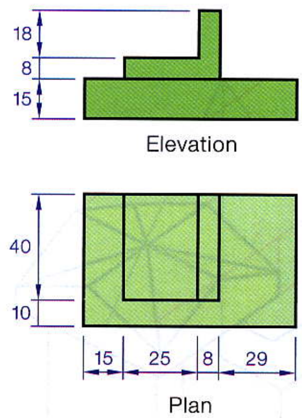


Fig. 6.88

Q1. Fig. 6.88

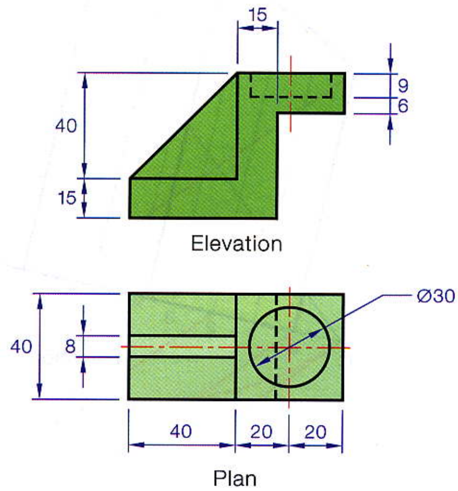


Fig. 6.89

Q2. Fig. 6.89

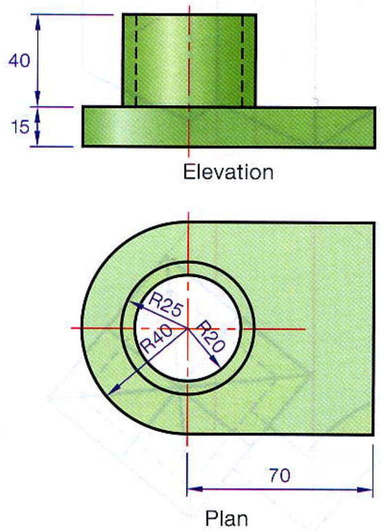


Fig. 6.90

Q3. Fig. 6.90

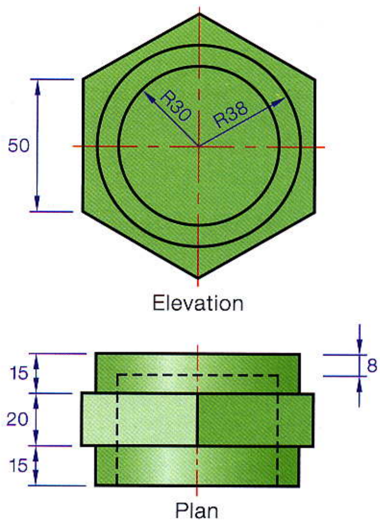


Fig. 6.91

Q4. Fig. 6.91

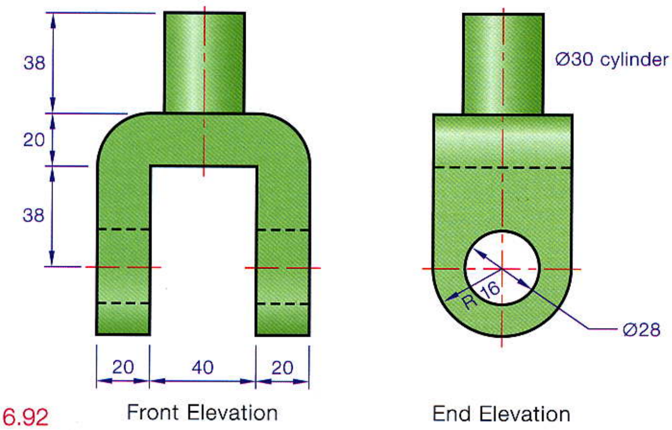


Fig. 6.92

Q5. Fig. 6.92

Q6., Q7. AND Q8. GIVEN THE TRUE ISOMETRIC VIEWS, FIND THE FRONT ELEVATION, END ELEVATION AND PLAN USING THE AXONOMETRIC PLANE METHOD.

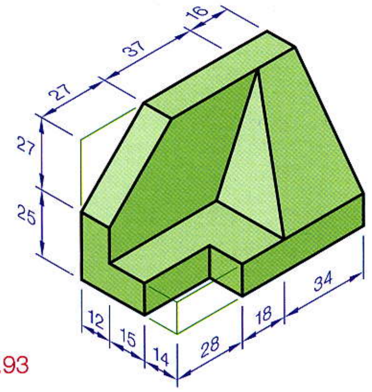


Fig. 6.93

Q6. Fig. 6.93

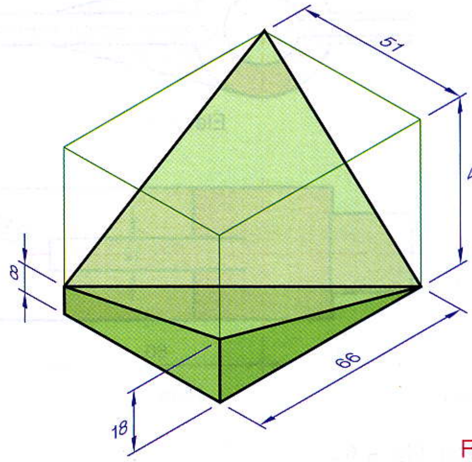


Fig. 6.94

Q7. Fig. 6.94

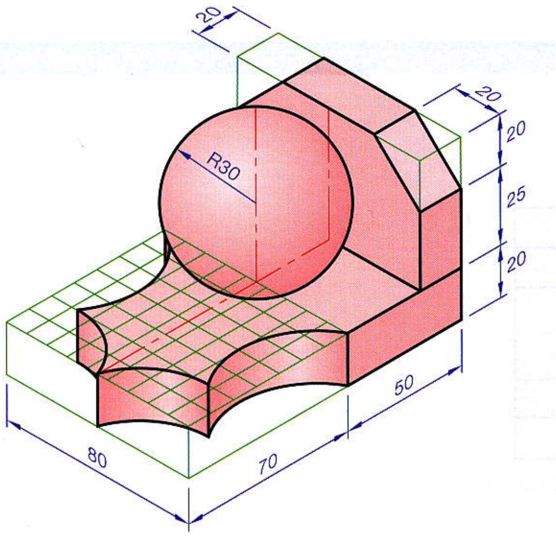


Fig. 6.95

Q8. Fig. 6.95

Q9. AND Q10. GIVEN ORTHOGRAPHIC VIEWS OF AN OBJECT, CONSTRUCT A DIMETRIC VIEW. THE AXES ARE AS SHOWN.

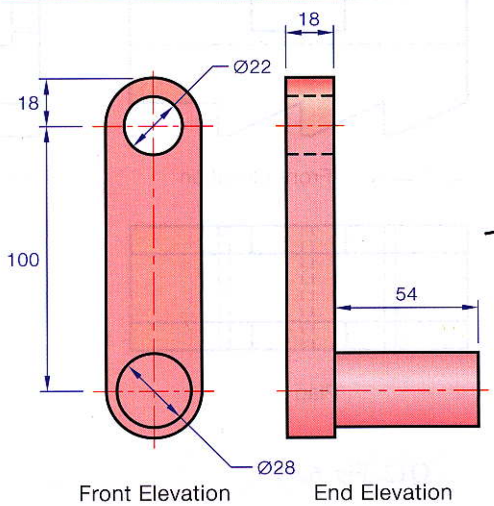
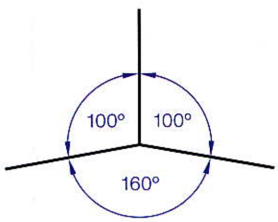


Fig. 6.96



Q9. Fig. 6.96

HIGHER LEVEL

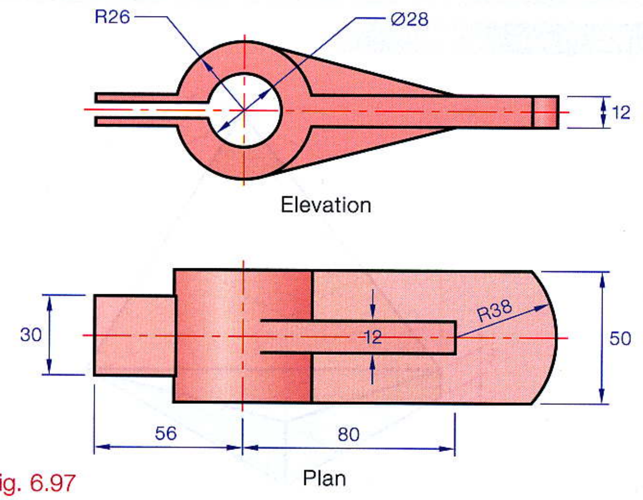


Fig. 6.97

Q10. Fig. 6.97

Q11. AND Q12. GIVEN ORTHOGRAPHIC VIEWS OF AN OBJEC. CONSTRUCT A TRIMETRIC VIEW GIVEN THE AXES.

HIGHER LEVEL

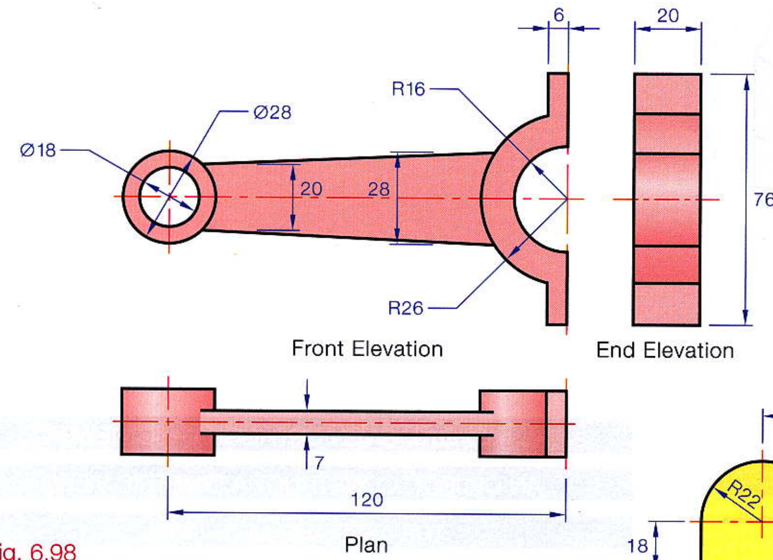


Fig. 6.98

Q11. Fig. 6.98

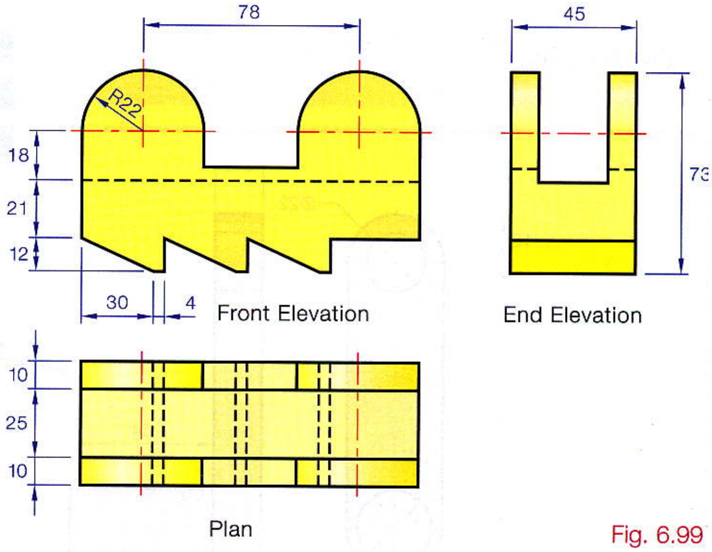


Fig. 6.99

Q12. Fig. 6.99