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.

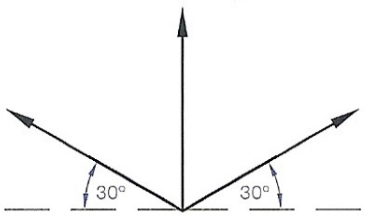


Fig. 6.1

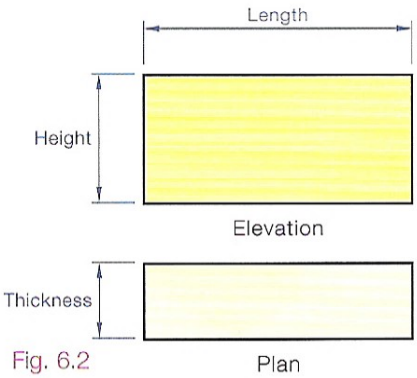
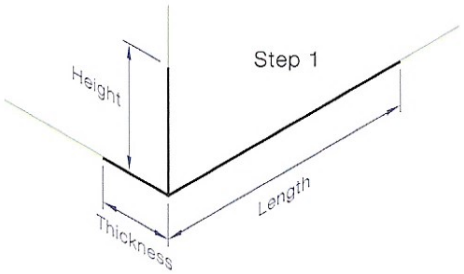
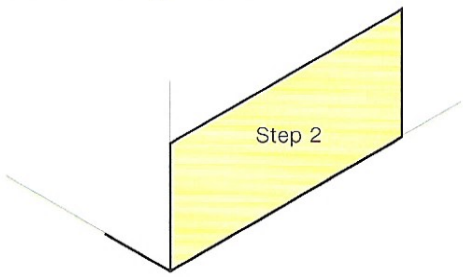
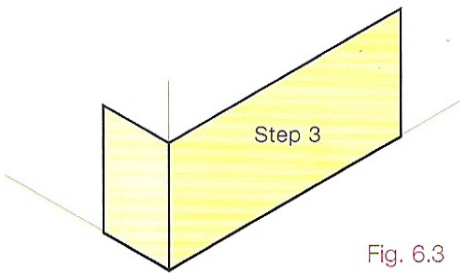


Fig. 6.2







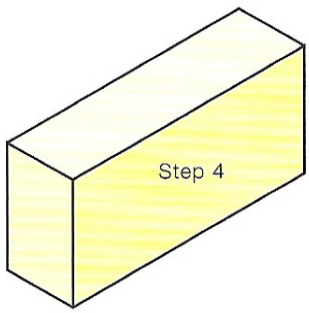


Fig. 6.3

Sloping Lines and Surfaces

Sloping lines do not maintain their true length in isometric drawing and angles do not measure as true angles. No angular measurements can therefore be used in these drawings. Angular measurements must be changed into linear measurements along the isometric axes.

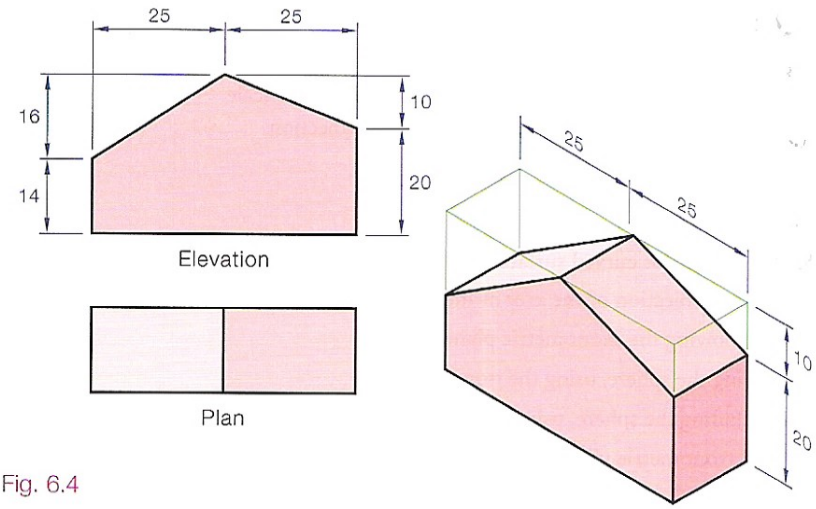


Fig. 6.4

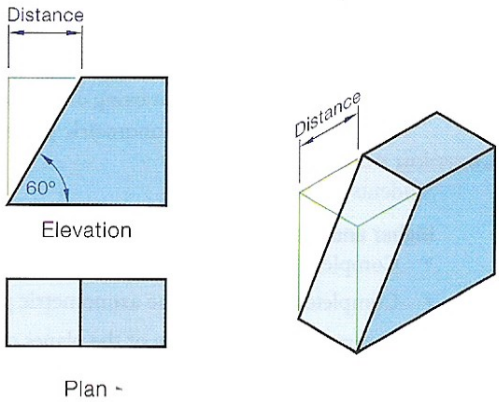


Fig. 6.5

Circles in Isometric

Circles will appear elliptical in isometric, and depending on the size of the circle and the accuracy needed we have the choice of several methods of construction.

COORDINATE METHOD

This is the most accurate method, as the number of points which can be found on the curve are limitless. The curve is divided up in the orthographic view by using a number of ordinates, Fig. 6.6.

Draw the same ordinates in the isometric. Since the ordinates are parallel to one of the isometric axes they will appear as true lengths. Transfer the height of each ordinate from the orthographic to the isometric, Fig. 6.7a.

Join the plotted points on the curve, freehand, to produce the front face. The thickness of the object is stepped back from this curve to give the back curve, Fig. 6.7b.

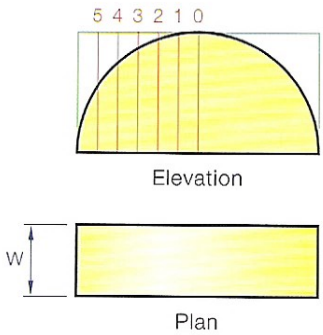


Fig. 6.6

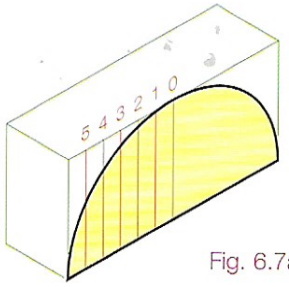


Fig. 6.7a

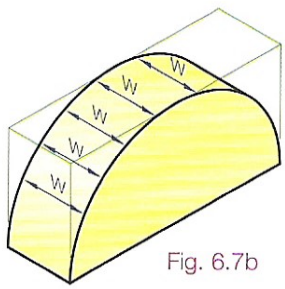


Fig. 6.7b

The coordinate method is ideal for irregular curves, as can be seen in Fig. 6.8.

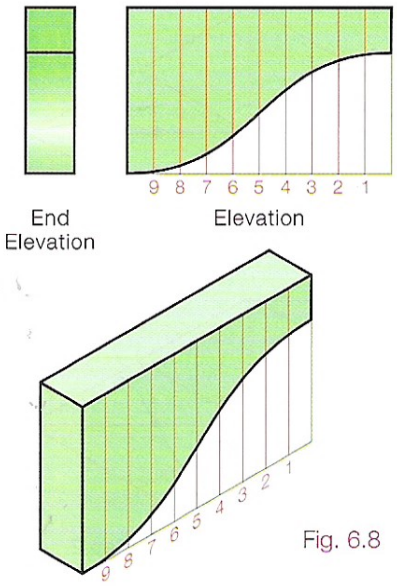


Fig. 6.8

FOUR-CENTRE ELLIPSE

For most isometric drawings which contain circles, an approximate ellipse is perfectly satisfactory, as exact measurements are rarely taken from isometrics. They are used more for explanatory purposes. For this reason an ellipse which can be constructed quickly with the aid of a compass is very useful, Fig 6.9.

(1) Draw the isometric box to contain the circle.
(2) Draw lines from the corners perpendicular to the opposite sides. These will be 60° lines.
(3) Where these lines cross gives the centres for the small arcs.
(4) The top and bottom corners are the centres for the large arcs.

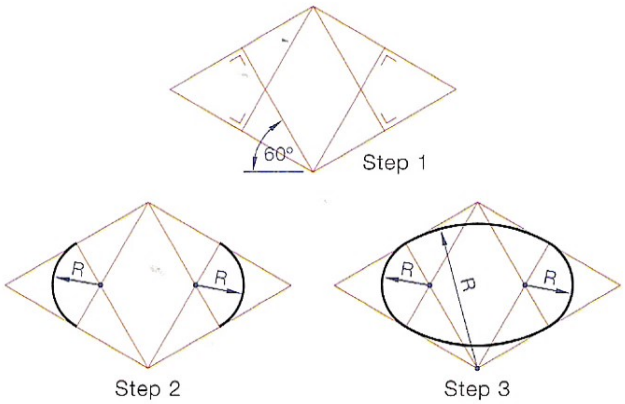


Fig. 6.9

When drawing an object having concentric circles (Fig. 6.10) it should be noted that each ellipse has its own parallelogram and centres (Fig. 6.11).

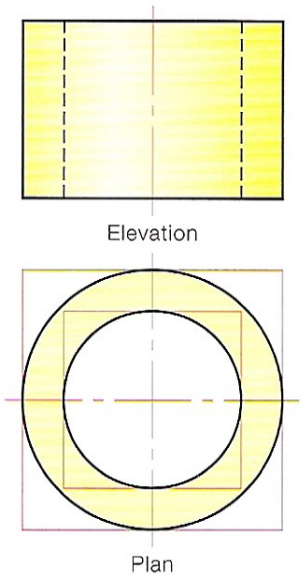


Fig. 6.10

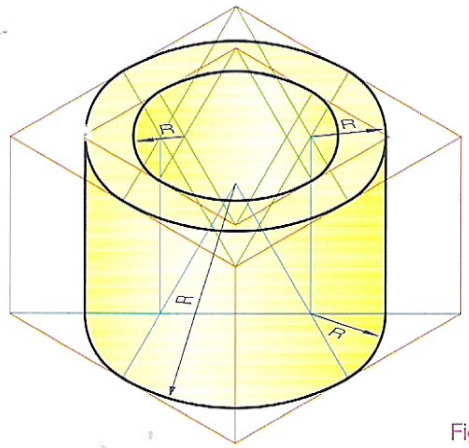


Fig. 6.11

It should be noted again that this construction of ellipses is not accurate, but it is sufficient for most isometrics.

A closer approximation to a true ellipse can be found by the following method.

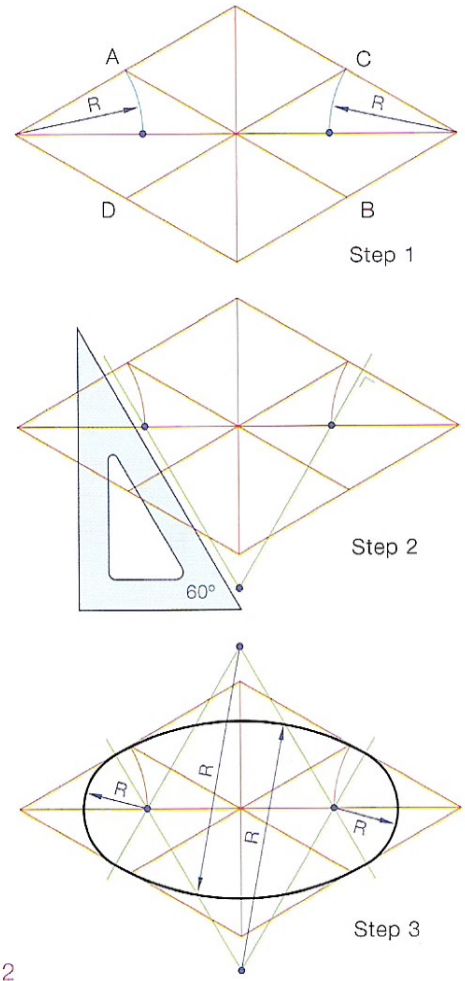


Fig. 6.12

Hidden lines and centre lines should only be drawn if they are needed to make the drawing clearer or for dimensioning.

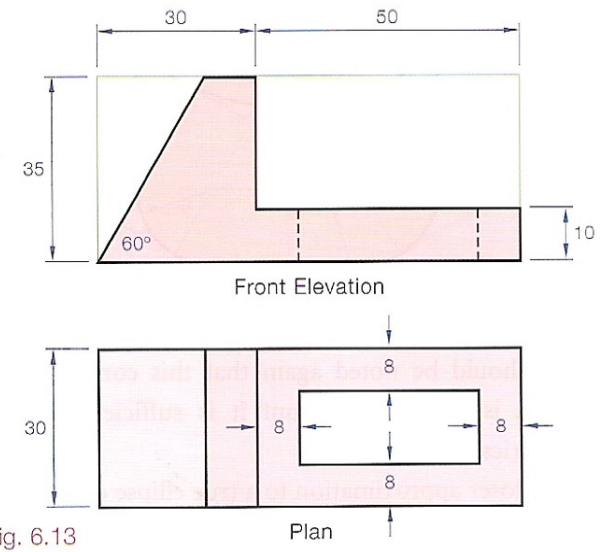


Fig. 6.13

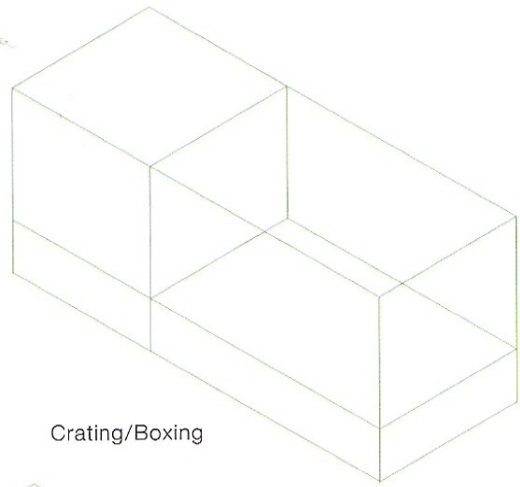
ORTHO FOUR-CENTRE ELLIPSE

(1) Draw the isometric of the square which will contain the isometric circle. The sides of the square will equal the length of the diameter.
(2) Join the diagonals and the bisectors of the sides AB and CD.
(3) Swing the ends of the bisectors onto the diagonal as shown. This gives the centre of the small arcs.
(4) Draw perpendiculars to the sides, through these centre points locating the centres for the large arcs.
(5) Complete the drawing with the compass.

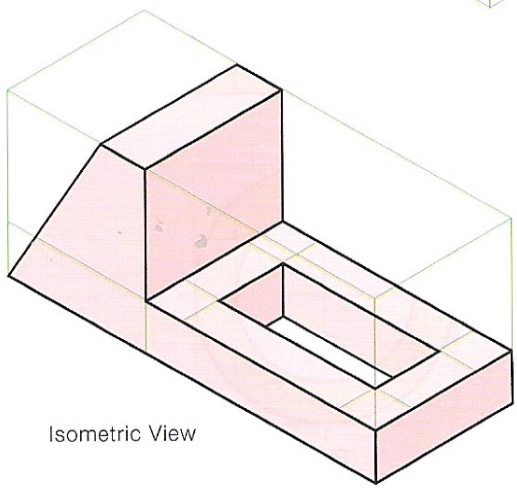
Crating or Boxing

Objects can be more easily constructed in isometric by the use of crating. This involves constructing a box around the whole object or parts of the object in the orthographic, Fig. 6.13.

These boxes can then be drawn in isometric giving a good starting point for the rest of the drawing details to be filled in, Fig. 6.14.



Crating/Boxing



Isometric View

Fig. 6.14

Worked Examples

Given the front elevation, end elevation and plan of a shaped solid. Draw the given views and produce an isometric view of the object.

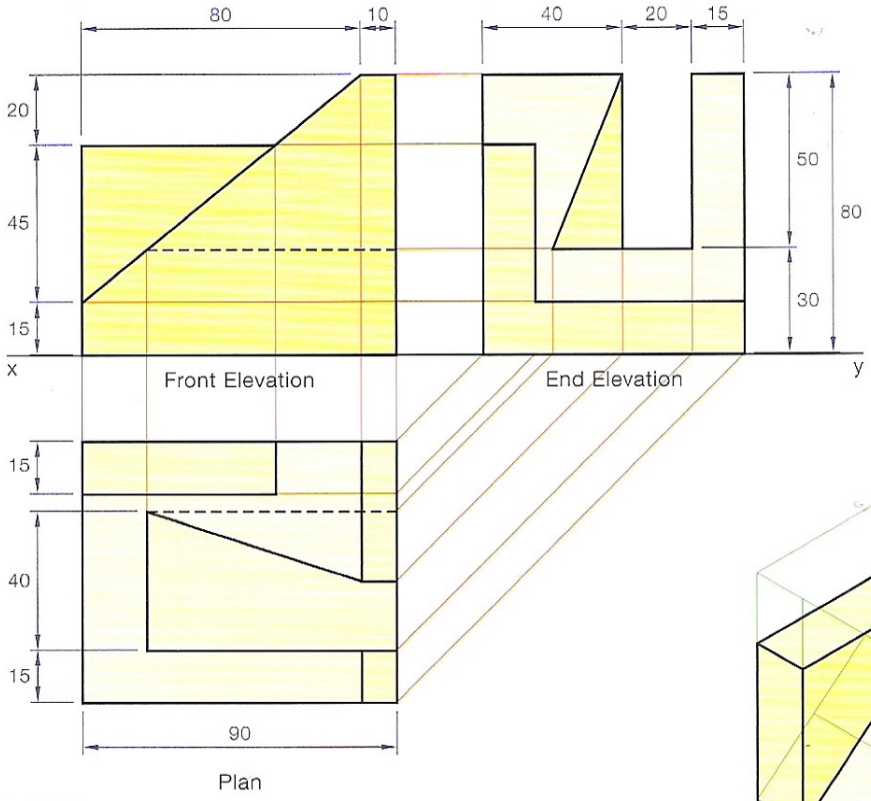


Fig. 6.15

(1) The orthographic views are drawn first, Fig. 6.15.

(2) Produce an isometric crate 90 mm long, 75 mm thick and 80 mm high. Details are mapped in remembering that measuring is only allowed in the direction of the isometric axes, Fig. 6.16.

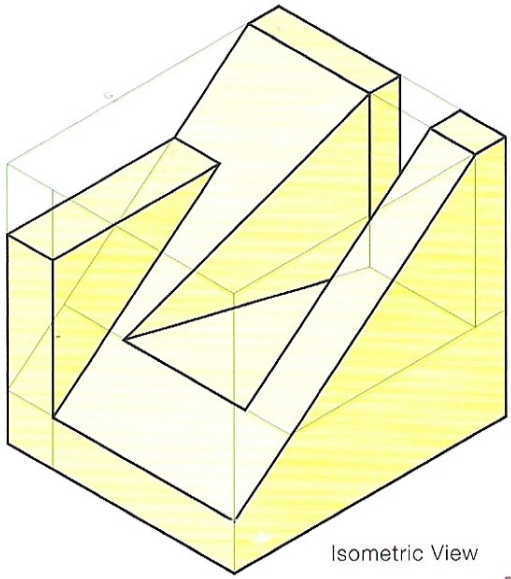


Fig. 6.16

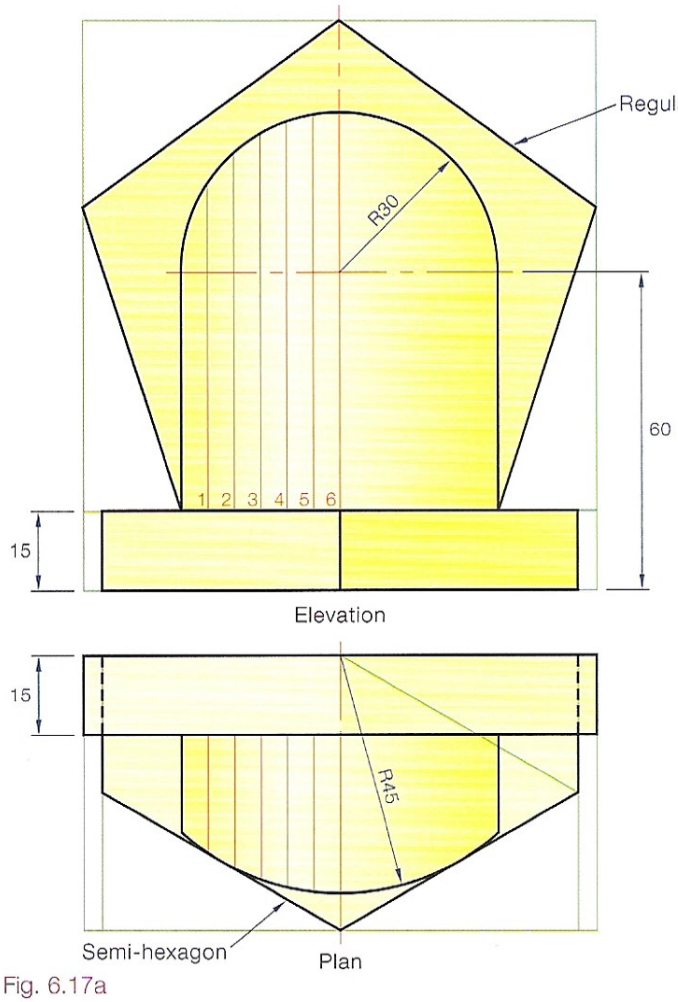


Fig. 6.17a

Fig. 6.17a shows the plan and elevation of a solid. Draw the given views and draw an isometric of the solid.

(1) Draw the elevation of the central portion.

(2) From this draw the regular pentagon using a protractor. Pentagon sides will be 60 mm long.

(3) The semi-hexagon in plan will be tangential to the radius 45 mm curve in plan. The length of the sides of the hexagon can be found by drawing a 30° line from the circle centre. Alternatively we could work out that the width of the base will be 90 mm, i.e. the diameter of the circle forming the central portion.

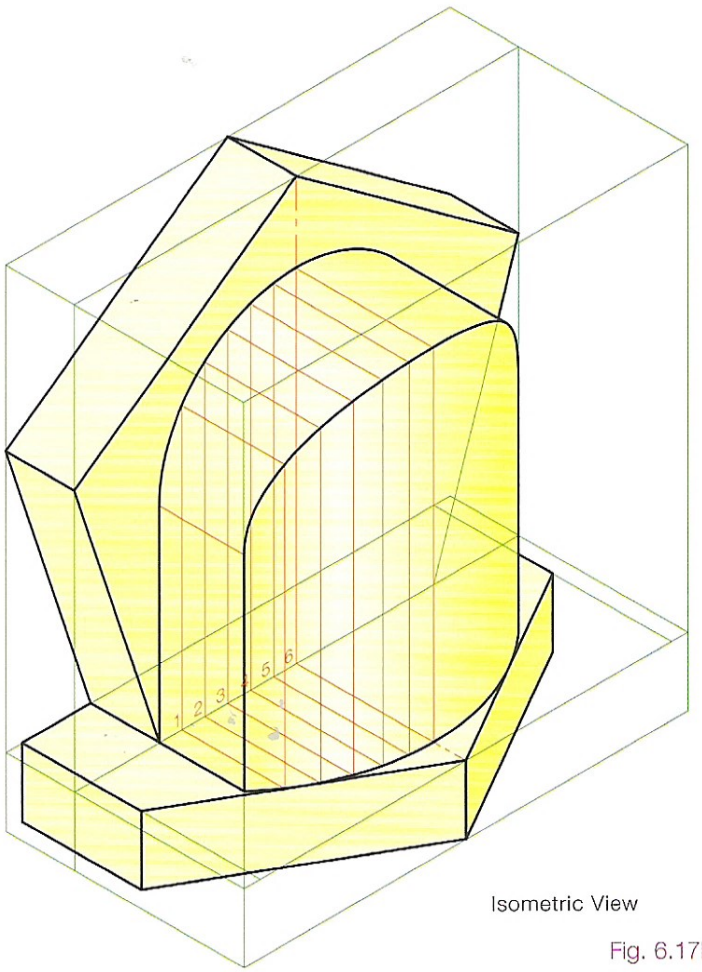


Fig. 6.17b

(4) The best way to approach the isometric is by crating.

(5) The curved central portion must be constructed using ordinates as shown. The fact that the front is doubly curved means that the four-centre ellipse will not work. For the sake of clarity some of the ordinates have not been shown in the isometric, Fig. 6.17b.

Fig. 6.18a shows the plan and elevation of a shaped solid. Draw the given views and draw an isometric of the solid.

(1) Start with the plan of the square prism.
(2) Draw the hexagonal prism having sides of the same length as the square.
(3) Draw the R44 arc and build up the right-hand side of the base.
(4) The centre of the R24 arc must be located by adding the two radii, 44 + 24 = 68 mm. Scribe an arc. Another arc of 24 mm radius is drawn from the corner, 40 mm in from the right.
(5) The isometric is produced by caging each element of the solid separately.
(6) Start with the base. The curve is drawn by using ordinates.
(7) Draw the upper curve and step the lower curve 28 mm below it.

The step will be stepped down 14 mm, Fig. 6.18b.

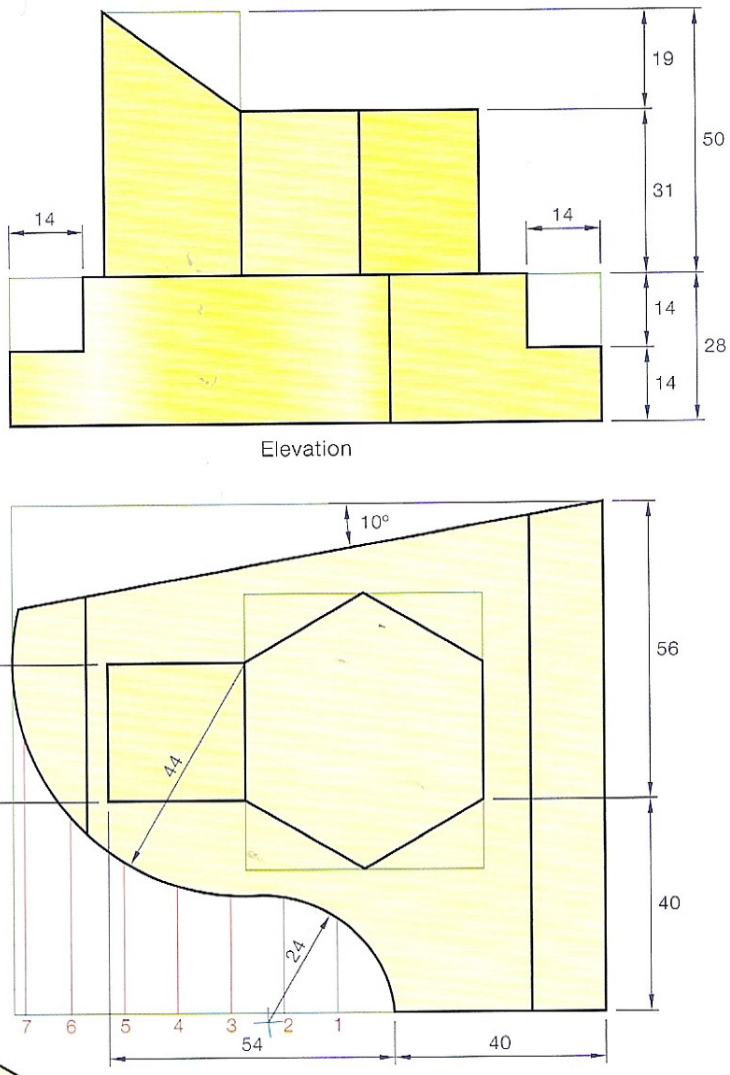


Fig. 6.18a

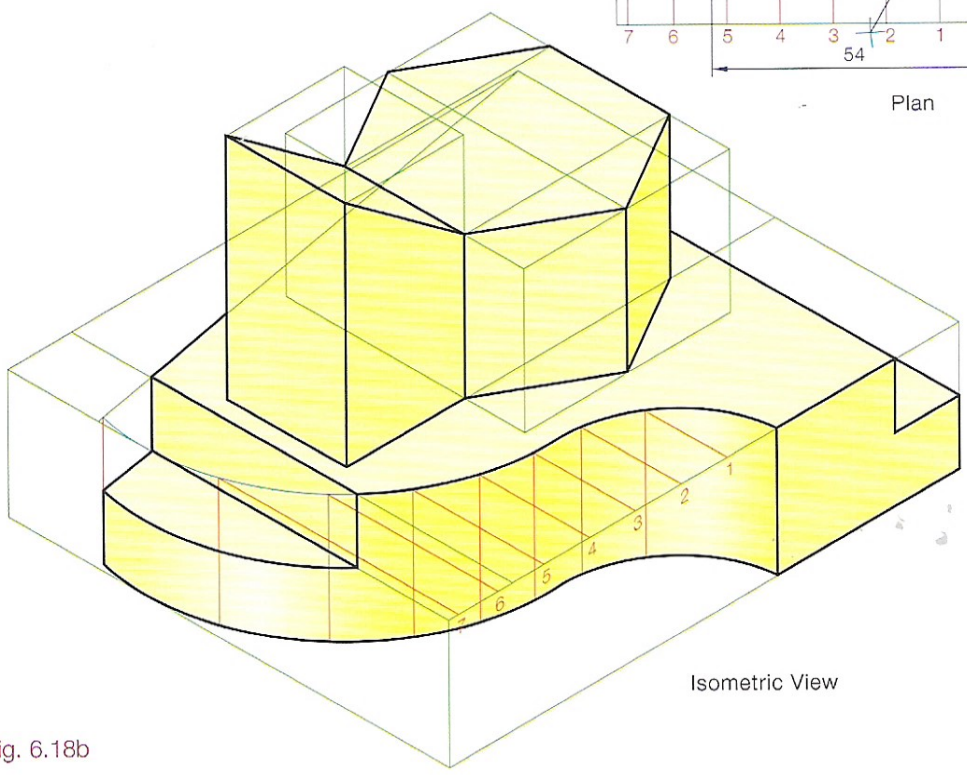


Fig. 6.18b

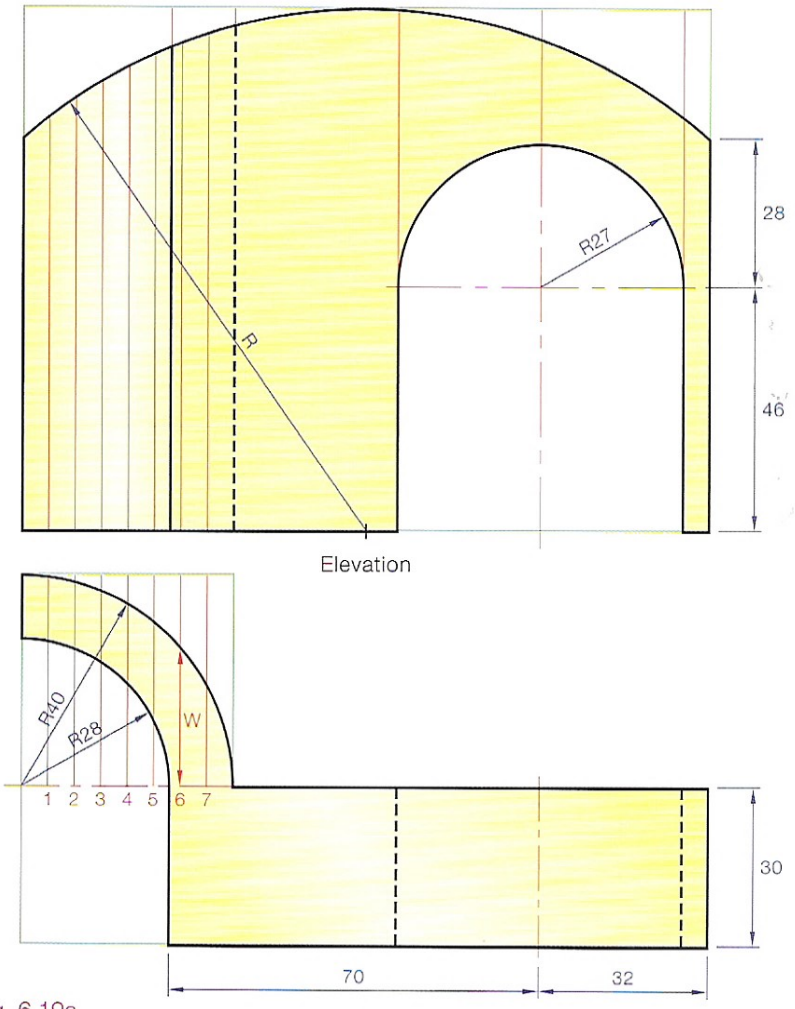


Fig. 6.19a

Fig. 6.19a shows the plan and elevation of a shaped solid. Draw the given views and produce an isometric projection of the solid.

(1) When the plan and elevation are complete we box them in an L-shaped crate.

(2) Draw the crate in the isometric.

(3) The arch was drawn in the isometric using the four-centre ellipse method.

(4) The quadrant on the left of the object is drawn using ordinates because we need to use the divisions to find the heights of the doubly curved portion at the top.

(5) The curves at the back are found by stepping back widths as shown from the front curves, Fig. 6.19b.

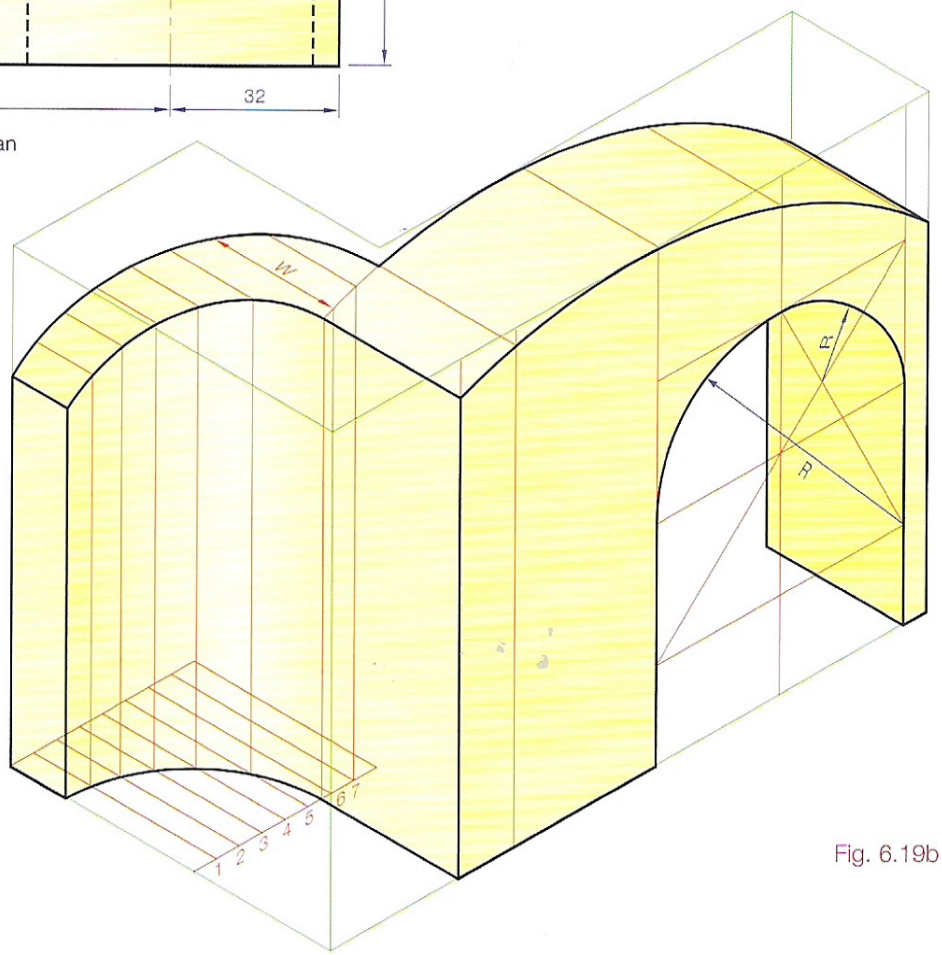


Fig. 6.19b