1 ISOMETRIC PROJECTION

SECTION I: INTRODUCTION TO ISOMETRIC PROJECTION

Orthographic projection shows drawings of an object in a two-dimensional format, with views given in plan, elevation and end elevation (as explained in Chapter 17 on constructions, Section II: geometric planes). Isometric projection gives a pictorial view of objects in a three-dimensional form. There are other pictorial forms such as oblique, axonometric and perspective projection, but isometric projection will be dealt with in this chapter.

In **Fig. 1.1b** the axis lines of isometric projection are shown. These consist of three lines: one is vertical and two are at an angle of 30° to the left and right. These may also be presented as the three 120° angles shown.

What does this mean? Quite simply that lines that are horizontal in orthographic projection become 30° lines in isometric, and lines that are vertical in orthographic will remain vertical in isometric; but more importantly, true measurements can only be applied (in isometric) to the axis lines, or lines parallel with them.

Fig. 1.1a shows the elevation and the isometric projection of an envelope. In both views the perimeter dimensions are the same, but dimensions **A-C** and **B-D** in isometric will not have the same dimensions as their counterparts in elevation.

In **Fig. 1.2** a 45° set square is shown in elevation and isometric. The longest edge of the set square will not have a true measurement in isometric, whereas the two shorter edges will, because they are on the axis lines, or parallel to them.

The elevation and end elevation of a *truncated* prism is shown in **Fig. 1.3**, and a completed isometric projection is also given. This solid could represent a roof. The dimensions **H**, **j**, **k**, **m**, **W** and **L** are all taken directly from the elevation and end elevation and applied to the isometric lines as shown. In the isometric view the lines that are not 'true' are: **A-B**, **A-C**, **D-E**, and **D-F**; in other words, they will be different from their counterparts in elevation and end elevation.

A useful method of transferring objects from orthographic to isometric is to 'box the object', as shown in dotted construction in isometric projection in **Fig. 1.3.**

In **Fig. 1.4** a square-based pyramid is shown in orthographic and isometric projection. Again the object is 'boxed-in' to facilitate easy transfer to isometric projection. Note that perimeter dimensions **a**, **b**, **c**, **d** and height **H** remain the same in both projections. It is also important to note here that when a square is drawn in isometric, its diagonals will end up horizontal and vertical, respectively (see diagonals **A-C** and **B-D** in the isometric projection in **Fig. 1.4**).

Fig. 1.5 shows orthographic and isometric views of an octagonal pyramid, the octagon in plan has a grid drawn on it, which takes in the eight corners.

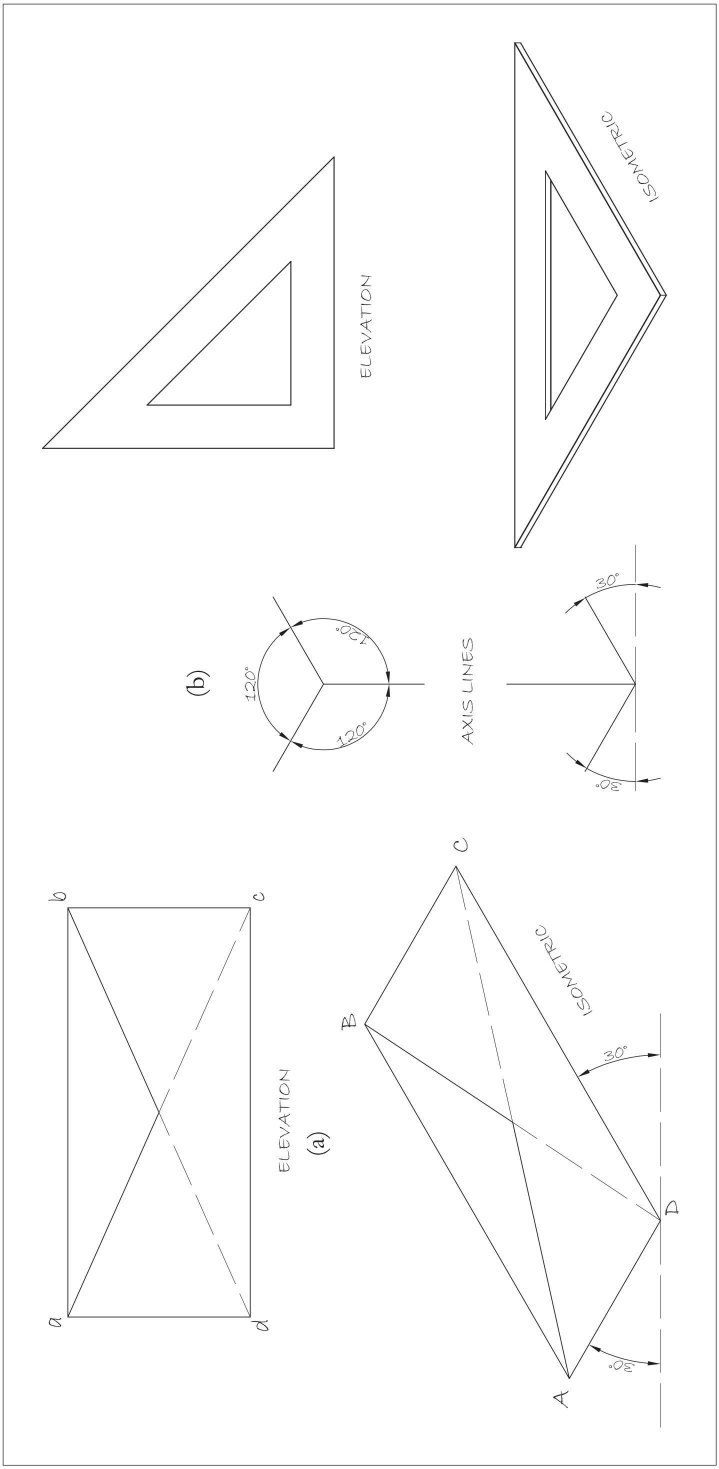

Fig. 1.1a
Fig. 1.1b
Fig. 1.2

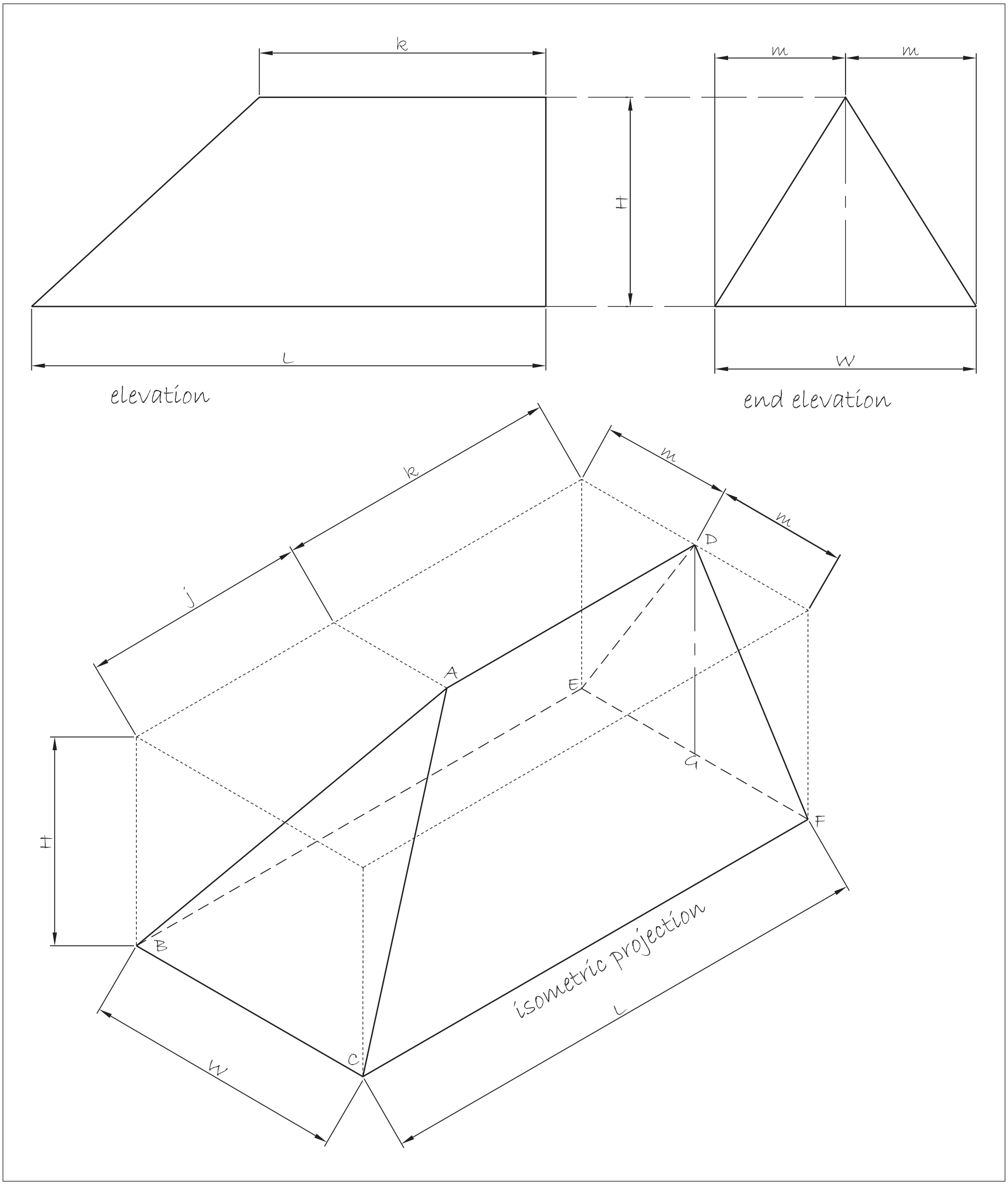
k
m
m
H
L
W
elevation
end elevation
k
m
m
j
D
A
E
H
G
F
B
isometric projection
C
W
L

Fig. 1.3

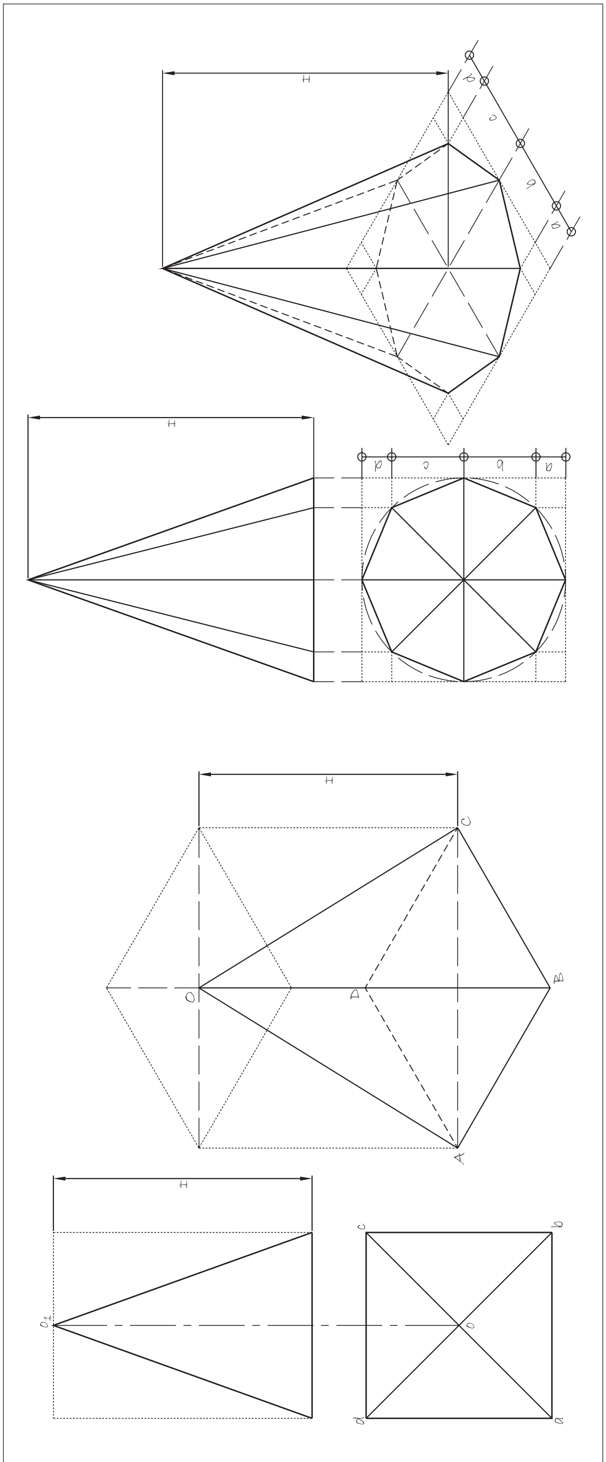

Fig. 1.4
Fig. 1.5

By transferring the grid into isometric, the octagon's corners can be easily found.

To complete:

- Mark-off the height **H** from the centre of the isometric grid to find the apex and join to the corners as shown.

SECTION II: CURVES IN ISOMETRIC PROJECTION

When drawing curved objects in isometric, it is necessary to make a grid for the curve, similar to the method for **Fig. 1.5**. In **Figs. 1.6** and **1.7** a cylinder and cone are used to illustrate the procedure.

Method

- Construct the circle of the cylinder in orthographic and describe a square around it as shown in **Fig. 1.6a**, then divide the top side of the square into a number of parts, eight in this case.
- Complete the grid by extending the divisions to the bottom of the square and mark where they intersect with the circle. These points will give measurements **1**,**2**,**3**,**4**,**3**,**2**,**1** to the centre line of the circle.
- Construct the square in isometric (as in **Fig. 1.6b**) and locate on it the division lines, then plot the measurements **1**,**2**,**3**,**4**,**3**,**2**,**1**, to find the points on the curve.
- This curve, which is an ellipse, will be the base of the cylinder; a similar construction gives the top of the cylinder. These two will be set apart by the height as shown.

In **Fig. 1.7** the apex of the cone is found by measuring the height above the centre point of the isometric grid. In the above two figures, **Figs. 1.6** and **1.7**, the isometric grid is lying flat, and consequently the ellipse, because the objects are standing. In **Fig. 1.8** the cylinder is lying on its side.

In **Fig. 1.8** a cylinder is shown lying on its side in isometric projection where a different method is employed to transfer the circle into isometric. A compass is used to draw the arcs that make up the ellipse (a false ellipse in this case).

Method

- Construct the square in isometric in the usual way (but this time standing vertically).
- Draw diagonals **a-c**, **b-d**, and shorter diagonals **e-d** and **b-f**.
- Where **e-d** intersects with **a-c** the centre **j** for arc **e-g** is found.
- Where **b-f** intersects with **a-c** the centre **k** for arc **h-f** is found.
- Point **b** is the centre for arc **g-f**, and **d** is the centre for arc **e-h**.

In **Fig. 1.9** some common items in carpentry and joinery are shown drawn in what is called *exploded isometric*, that is, the items are pulled apart to show what is inside. This device is useful for giving pictorial details of the make-up, or working parts, of the item in question. This form of isometric often accompanies the instructions for flat-pack furniture and appliances, where a certain amount of assembly is required.

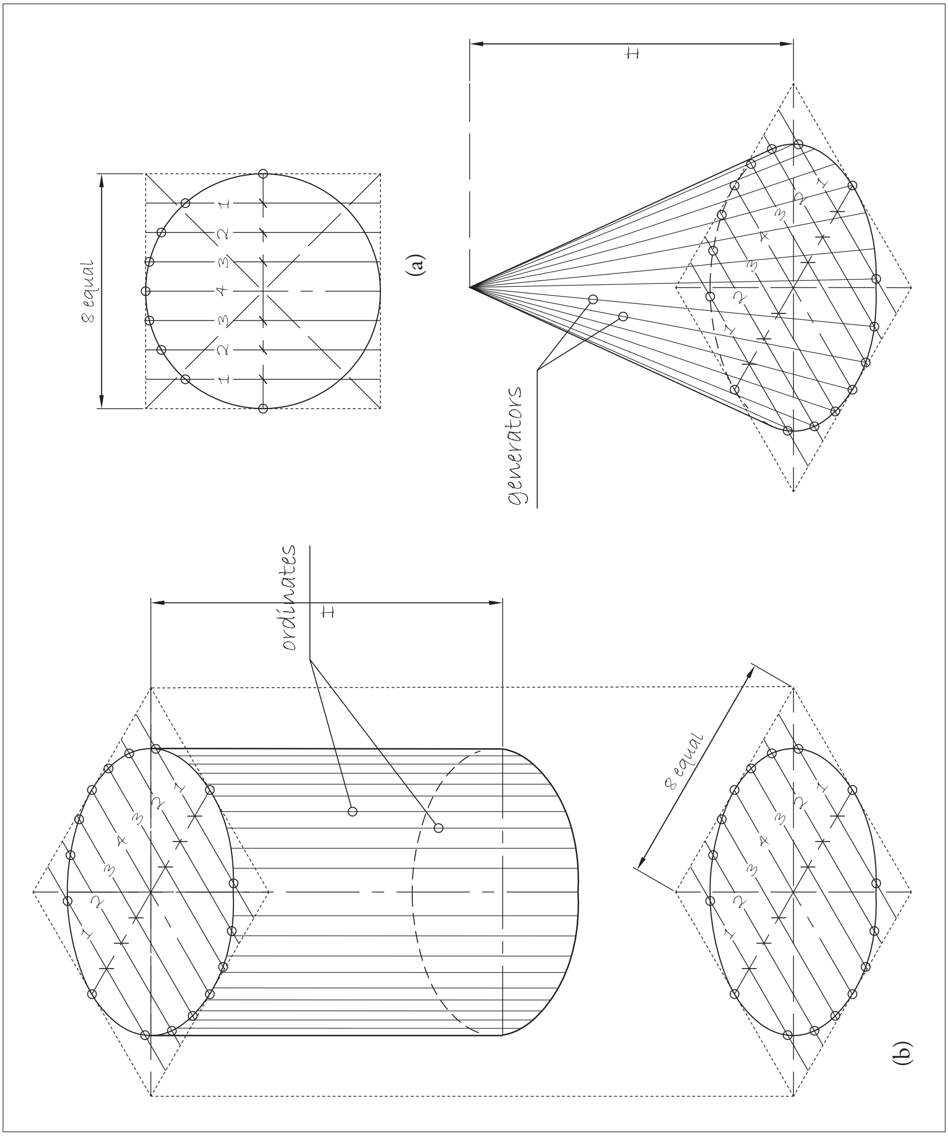

Fig. 1.6a
Fig. 1.6b
Fig. 1.7

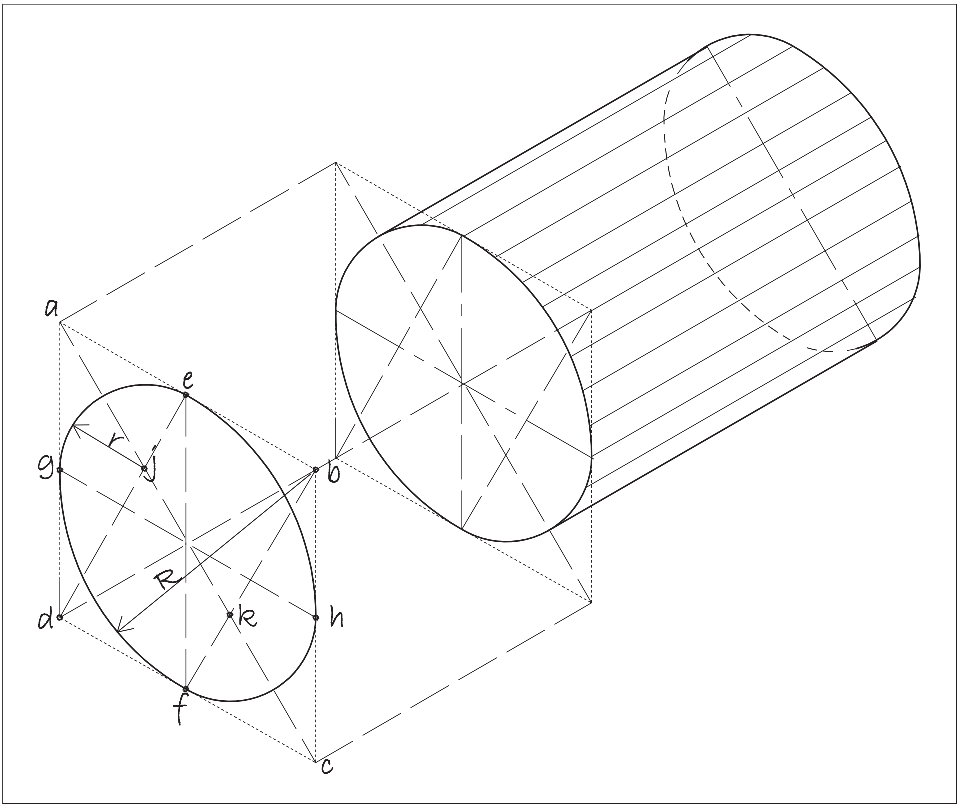

Fig. 1.8

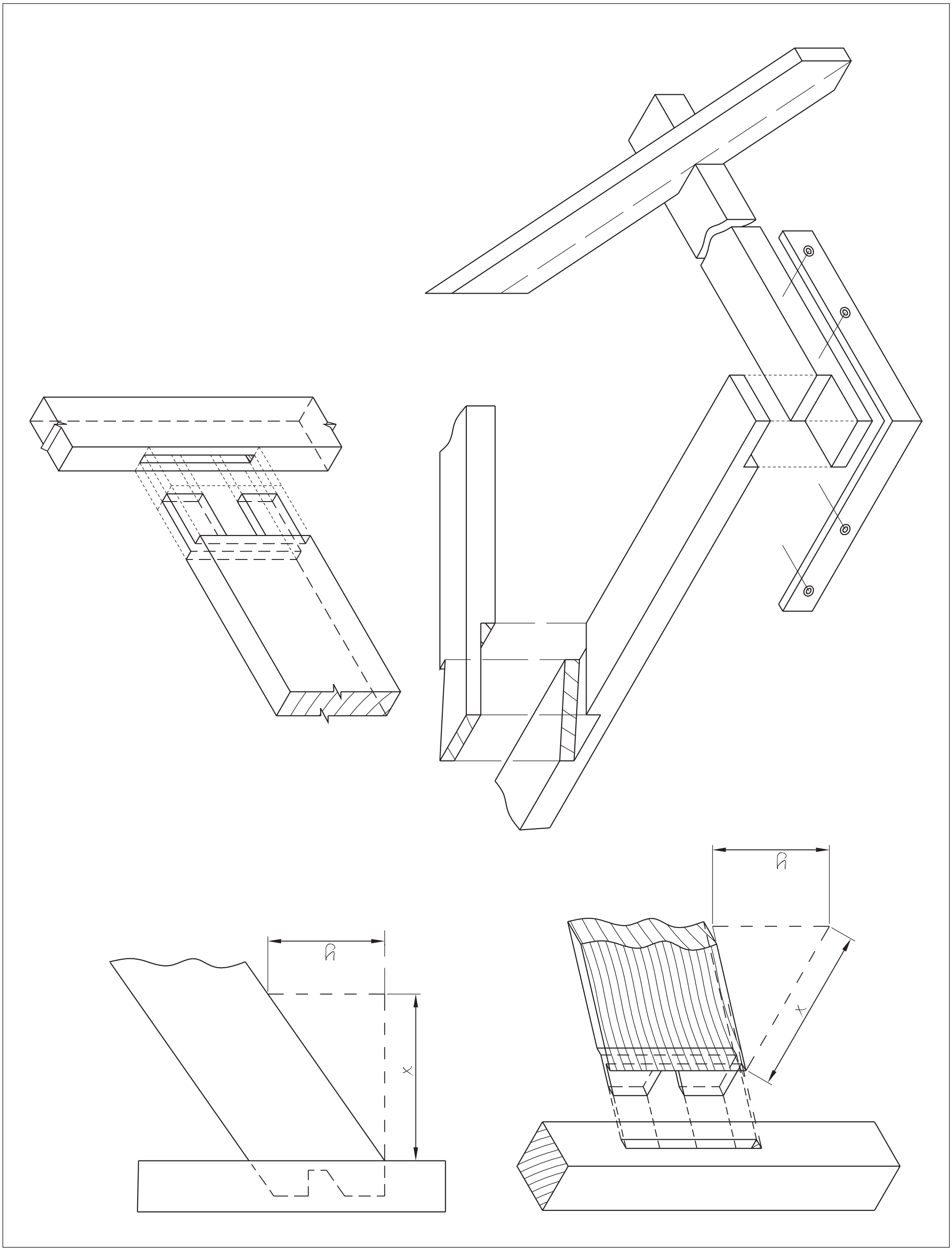

Fig. 1.9

Exercise

The orthographic projection of a roof is shown in **Fig. 1.10**. Reproduce **Fig. 1.10** and complete the exercise.

- Draw an isometric projection of the roof. Let the semi-circular part of the roof be the lowest end of the projection.

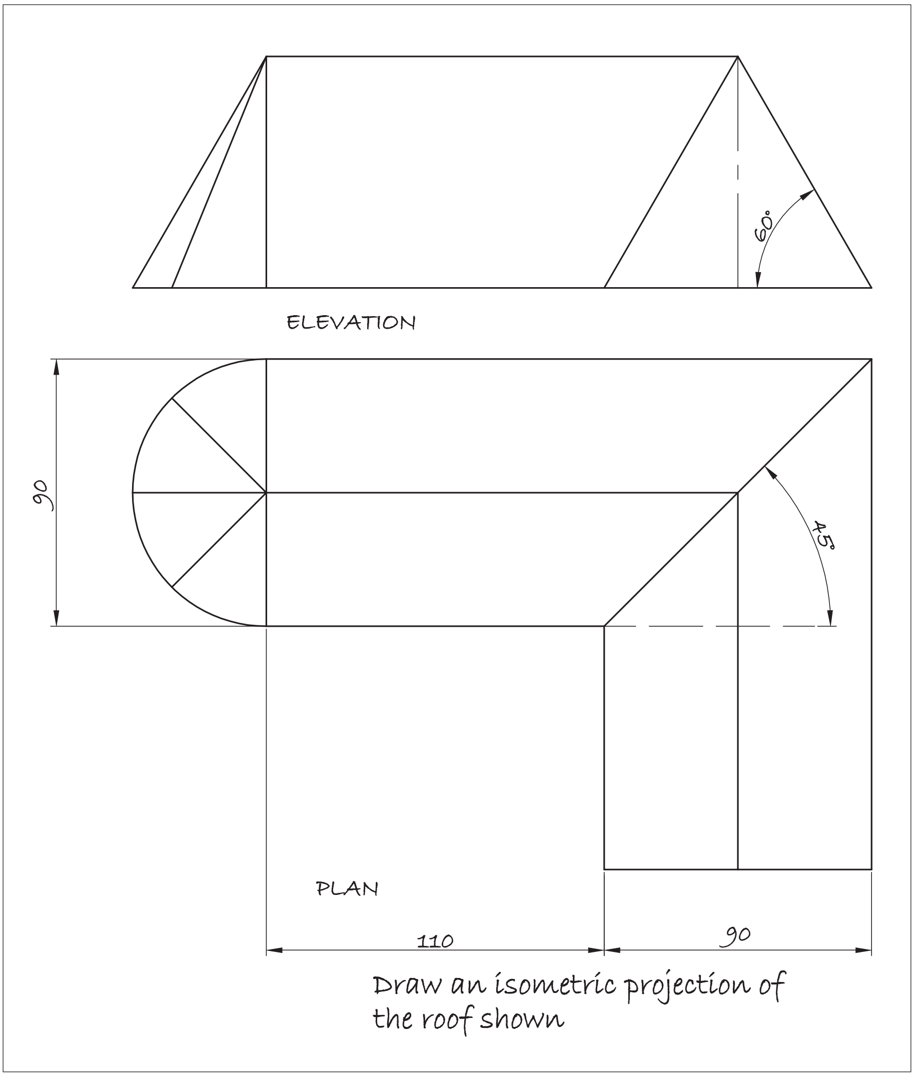

Fig. 1.10