# 3

# Principles of Dimensioning

## 3.1 INTRODUCTION

Every drawing consists of the views necessary to describe the shape of the object and must supply its exact length, width, height, size, position of holes and any other details required for the manufacturing of the object. Suppling this information on a drawing is called dimensioning.

## 3.2 TYPES OF DIMENSIONS

A drawing usually requires two types of dimensions :

(*i*) Size or functional dimension

(*ii*) Location or datum dimension

(*i*) **Size or functional dimension :** It gives the size of a piece or component as shown in the Fig. 3.1. It is usually represented by the letter *S*.

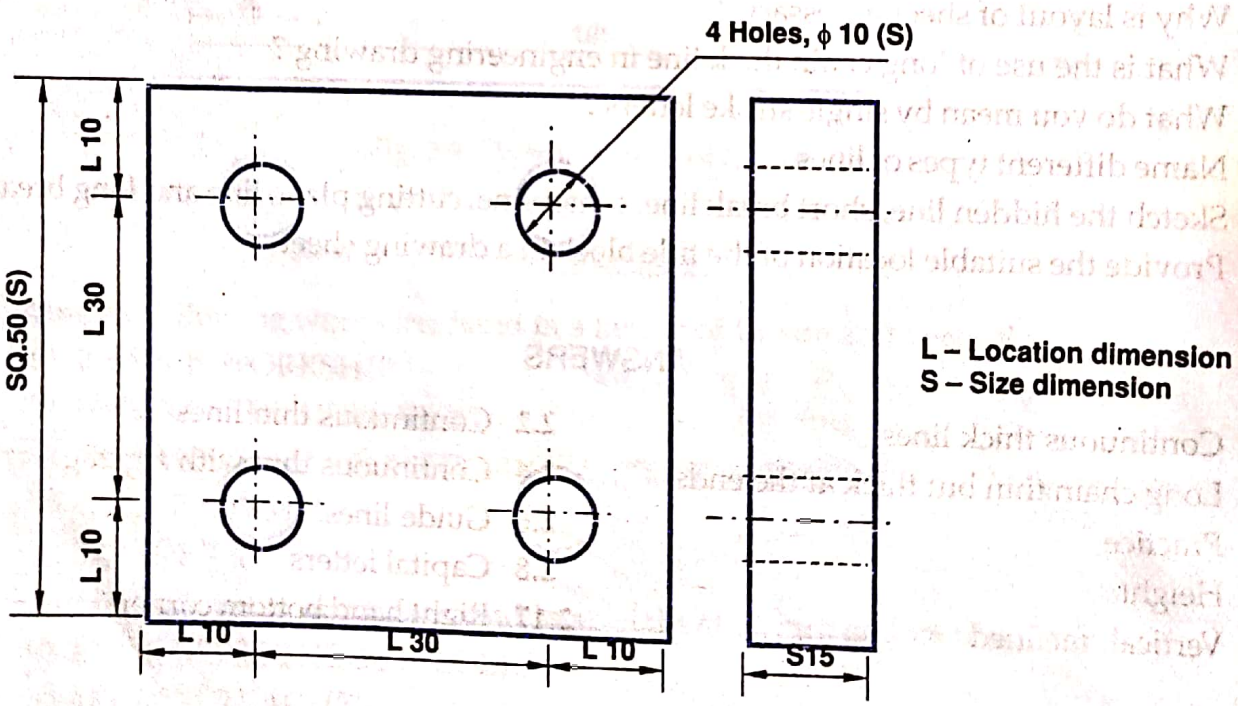


Fig. 3.1 Types of dimensions

(*ii*) **Location or datum dimension :** It fixes the relationship of the component parts (holes, slots etc.) of a piece of structure. It may be from centre to centre, surface to surface or surface to centre as shown in the Fig. 3.1. Generally it is denoted by the letter *L*.

## 3.3 ELEMENTS OF DIMENSIONING

The elements of dimensioning include the extension or projection line, dimension line, leader line, arrowhead and the dimension itself. The various elements of dimensioning are shown in Fig. 3.2.

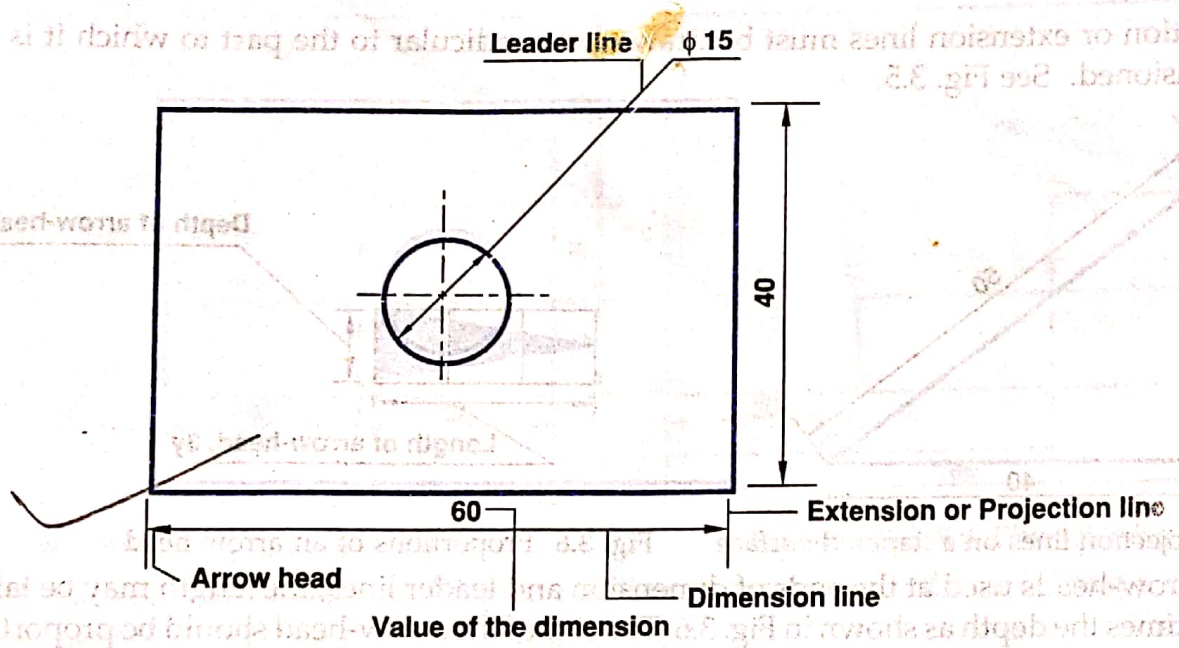


Fig. 3.2 Elements of dimensioning

## 3.4 EXECUTION OF DIMENSIONS

The following are the points to be observed while executing dimensions :

(*i*) Projection lines should be drawn from the visible features of the object and extend slighly beyond the dimension line as shown in Fig. 3.3.

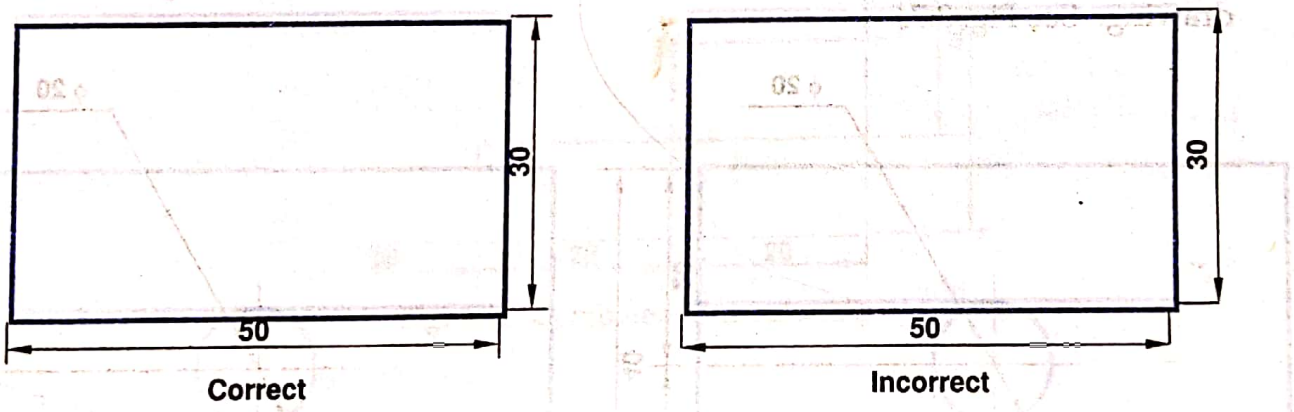


Fig. 3.3 Placing of projection lines

(*ii*) Mutual crossing of dimension and projection lines should be avoided. See Fig. 3.4.

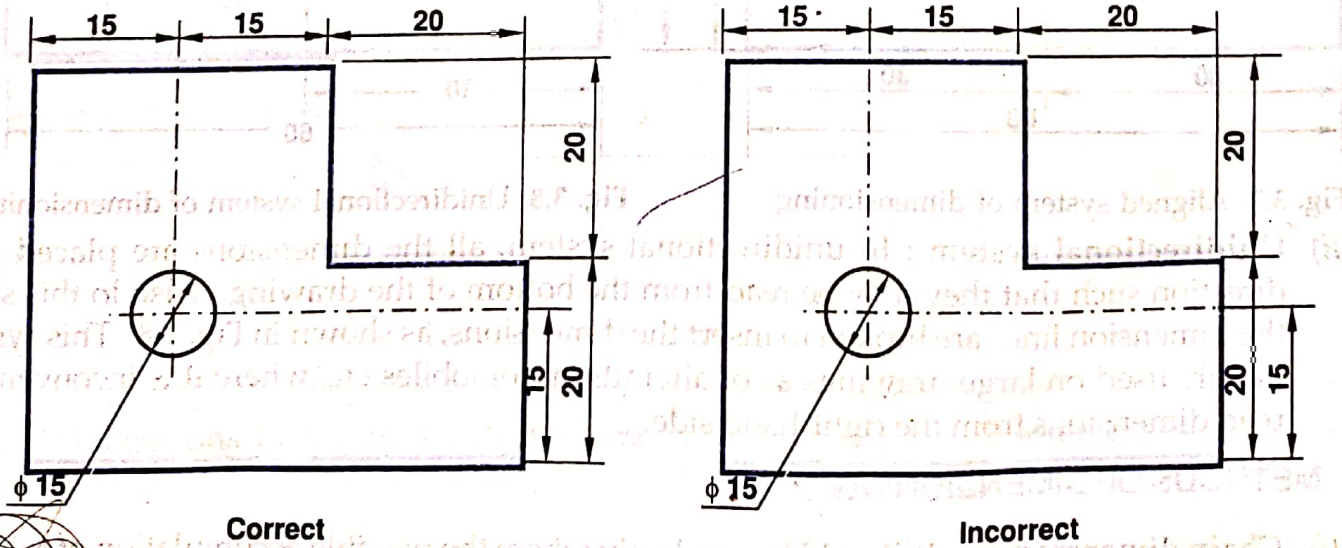


Fig. 3.4 Placing of projection and dimension lines

(*iii*) Projection or extension lines must be drawn perpendicular to the part to which it is to be dimensioned. See Fig. 3.5.

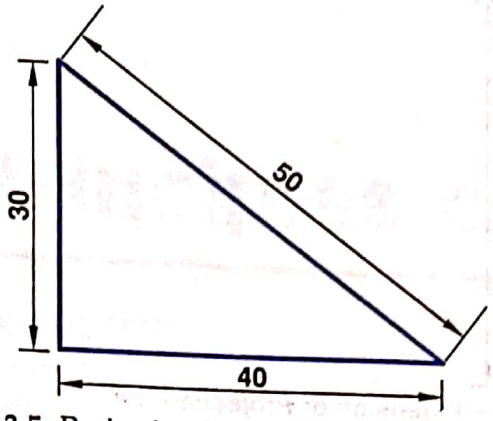


Fig. 3.5 Projection lines on a tapered surface

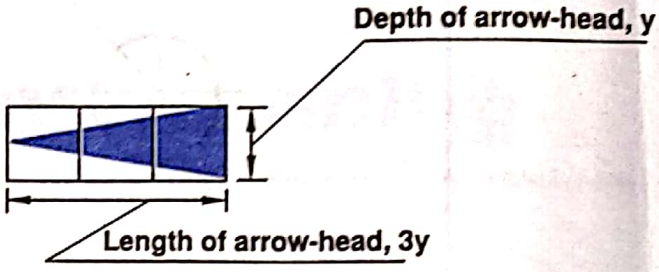


Fig. 3.6 Proportions of an arrow-head

(*iv*) For arrow-heads used at the ends of dimension and leader lines, the length may be taken as three times the depth as shown in Fig. 3.6. The size of the arrow-head should be proportionate to the size of the drawing.

## 3.5 PLACING OF DIMENSIONS

Dimensions may be placed either of the following two systems :

(*i*) **Aligned system :** In an aligned system, all the dimensions are placed above the dimension line such that, they may be read either from the bottom or from the right hand side of the drawing. See Fig. 3.7.

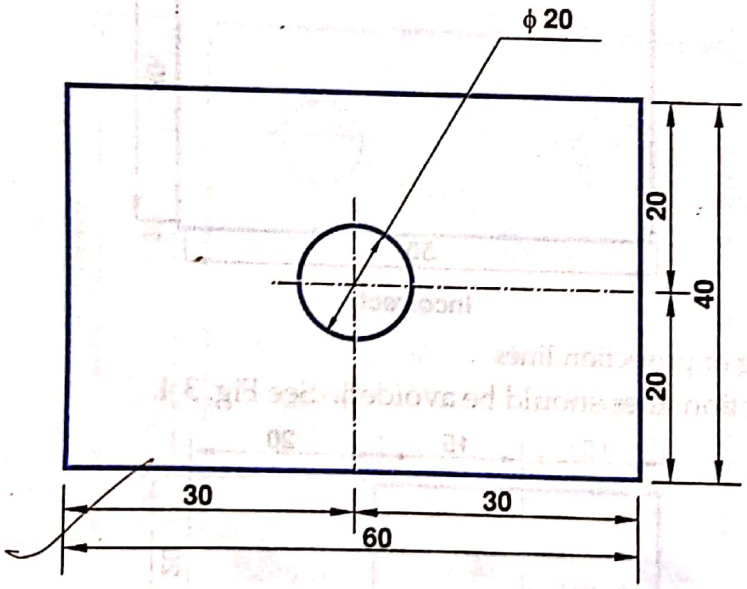


Fig. 3.7 Aligned system of dimensioning

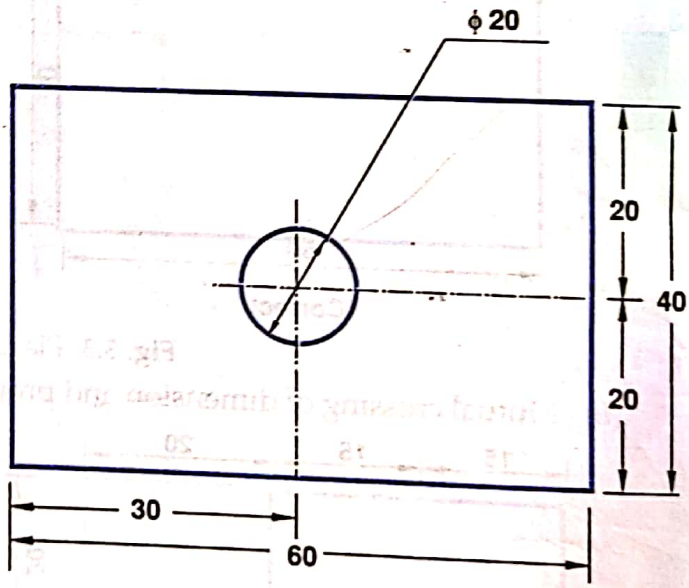


Fig. 3.8 Unidirectional system of dimensioning

(*ii*) **Unidirectional system :** In unidirectional system, all the dimensions are placed in one direction such that they may be read from the bottom of the drawing. Also in this system, the dimension lines are broken to insert the dimensions, as shown in Fig. 3.8. This system is mainly used on large drawings as of aircrafts, automobiles etc, where it is inconvenient to read dimensions from the right-hand side.

## 3.6 METHODS OF DIMENSIONING

(*i*) **Chain dimensioning :** It should be used only where the possible accumulation of tolerances does not endanger the functional requirement of the object. See Fig. 3.9.

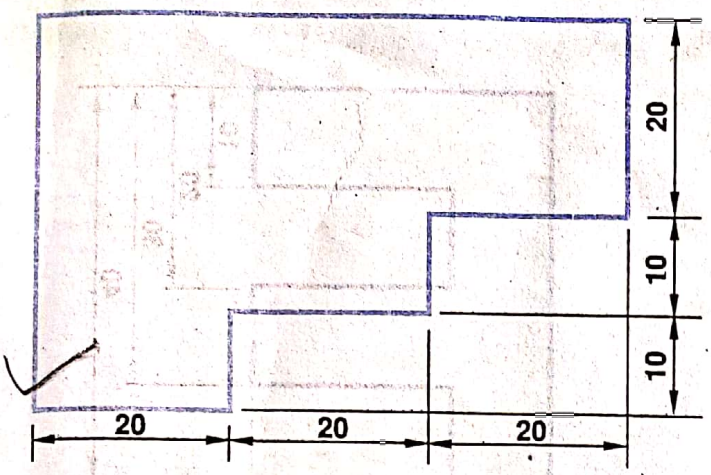


Fig. 3.9 Chain dimensioning

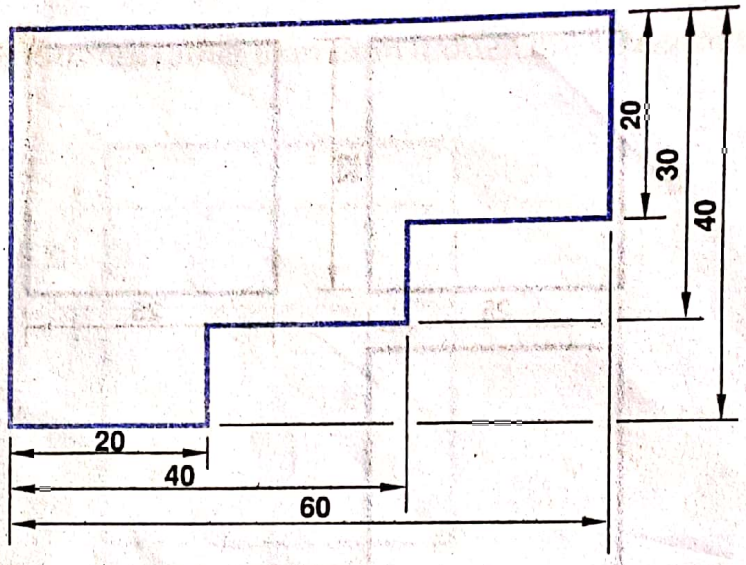


Fig. 3.10 Parallel dimensioning

(*ii*) **Parallel dimensioning.** When a number of dimensions of a part have a common datum feature. See Fig. 3.10.

(*iii*) **Combined dimensioning :** In combined dimensioning, both chain and parallel dimensioning are followed. See Fig. 3.11.

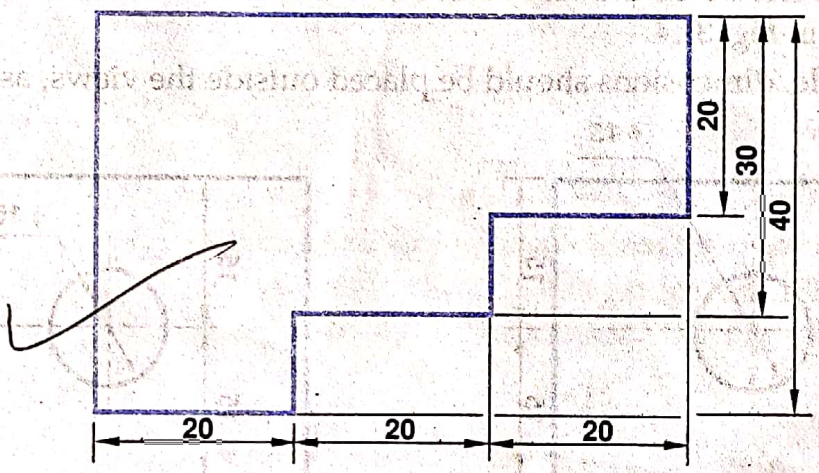


Fig. 3.11 Combined dimensioning

## 3.7 PRINCIPLES OF DIMENSIONING

The following are some of the principles to be applied in dimensioning :

(*i*) Any dimension given, must be clear and permit only one interpretation. See Fig. 3.12.

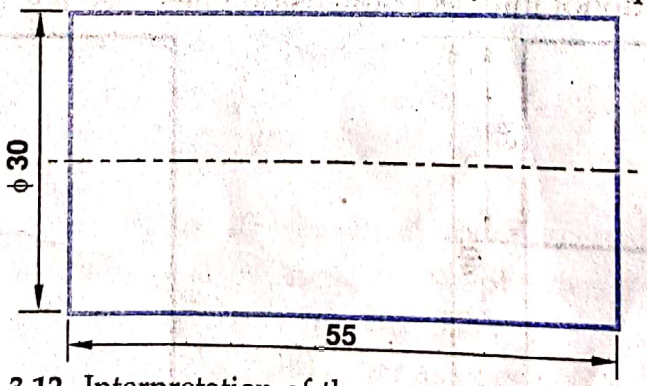


Fig. 3.12 Interpretation of the part to be dimensioned

(*ii*) Dimensions indicated in one view need not be repeated in another view, as shown in Fig. 3.13.

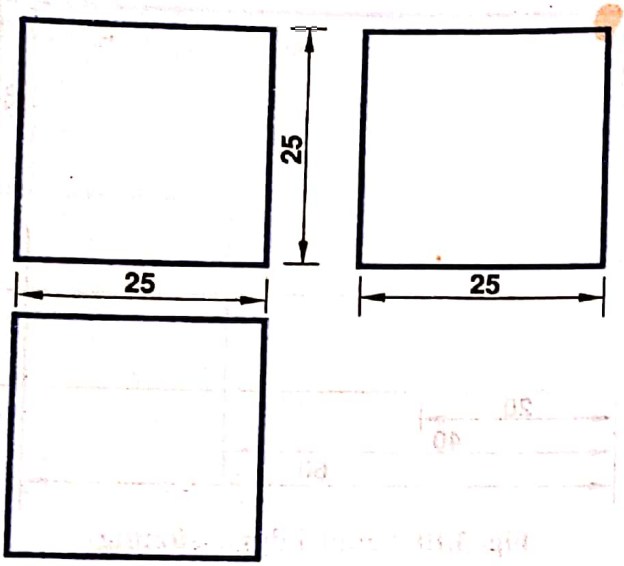


Fig. 3.13 Repetition of dimensioning in various views should be avoided

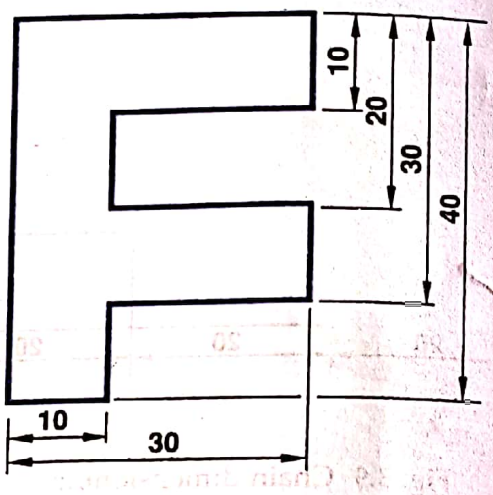


Fig. 3.14 Spacing of the dimension lines

(iii) Dimension lines should be drawn atleast 5 to 8 mm away from the outlines and from each other as shown in Fig. 3.14.

(iv) As far as possible, dimensions should be placed outside the views, as shown in Fig. 3.15.

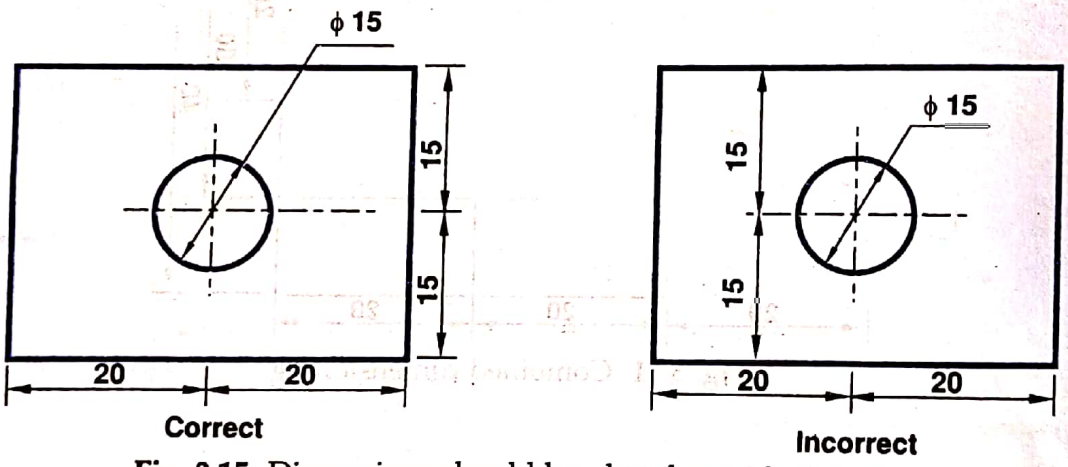


Fig. 3.15 Dimensions should be placed outside the view

(v) Smaller dimensions should be placed nearer the view and the larger further away so that the extension lines donot intersect dimension lines. See Fig. 3.16.

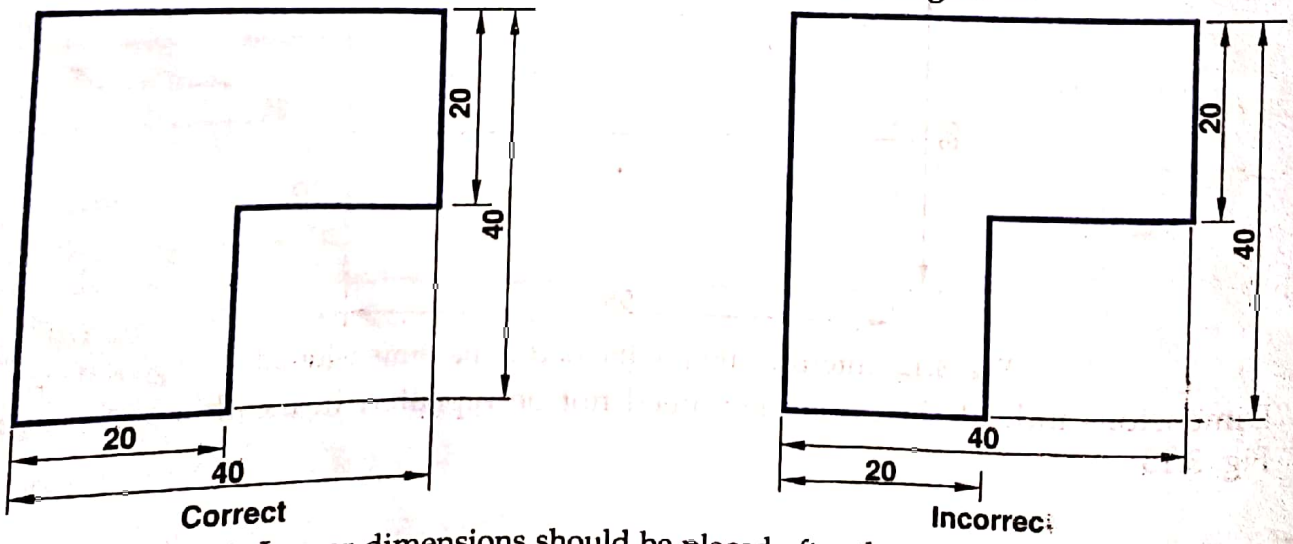


Fig. 3.16 Larger dimensions should be placed after the smaller dimension

(*vi*) Dimensions should be marked from visible outlines rather than from hidden lines, as shown in Fig. 3.17.

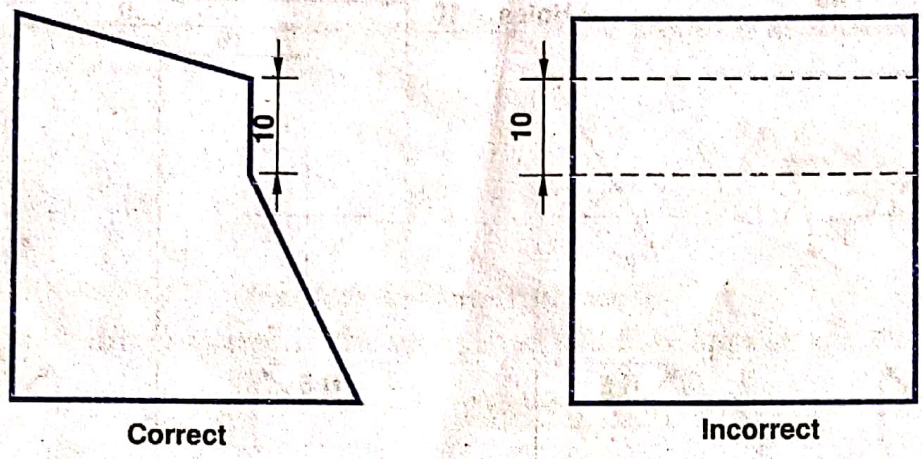


**Fig. 3.17** Dimensions should be marked from the visible outlines

(*vii*) Arrow-heads should normally be drawn within the limits of the dimensioned feature. But when the space is too narrow, they may be placed outside. A dot may also be used to replace an arrowhead. Sometimes due to lack of space, the dimension figure may be written above the extended portion of the dimension line. See Fig. 3.18.

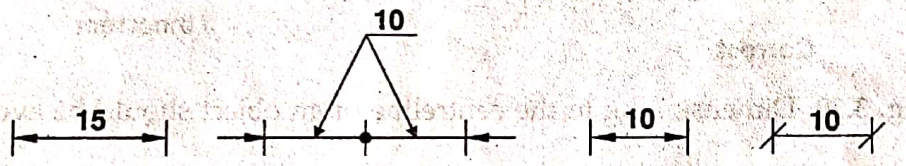


**Fig. 3.18** Different ways of dimensioning of length when the space is insufficient

(*viii*) Dimensioning should be marked from a base line or centre line of a hole or cylindrical part or finished surfaces etc., which may readily be located. See Fig. 3.19.

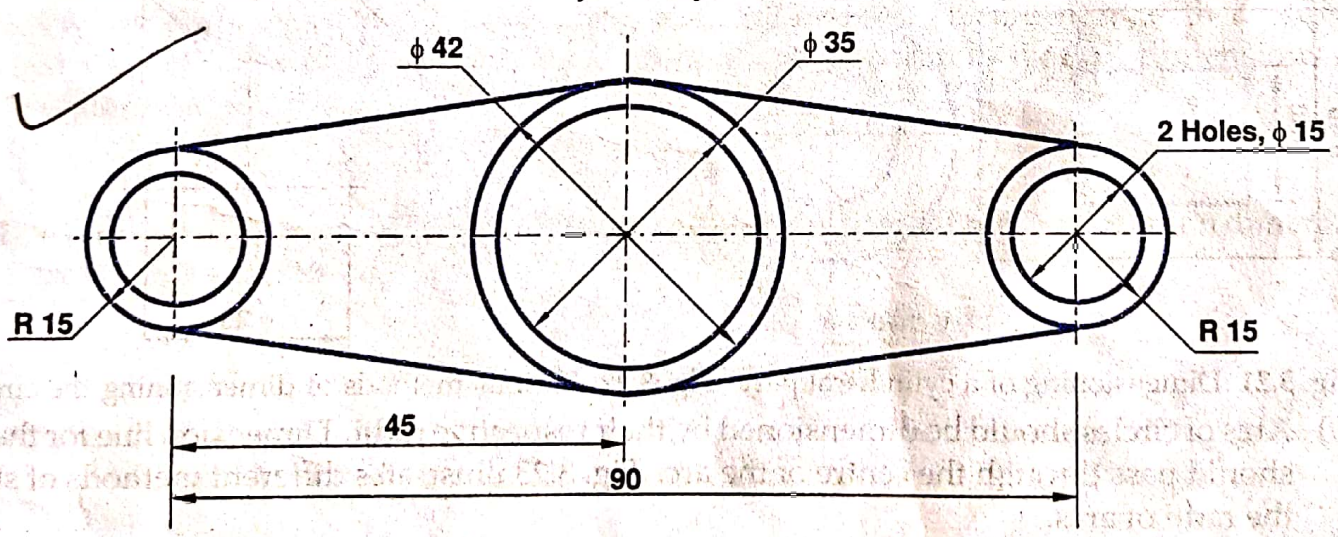


**Fig. 3.19** Dimensioning should be marked from the centre of a hole

(*ix*) Dimensioning to a centreline should be avoided except when the centreline passes through the centre of a hole or a cylindrical part. See Fig. 3.20.

(*x*) Dimensioning of a cylindrical parts should as far as possible be placed in the views in which they are seen as rectangles. See Fig. 3.21.

(*xi*) Dimensions indicating a diameter should always be preceded by the symbol ϕ. Fig. 3.22 shows various methods of dimensioning different sizes of circles.

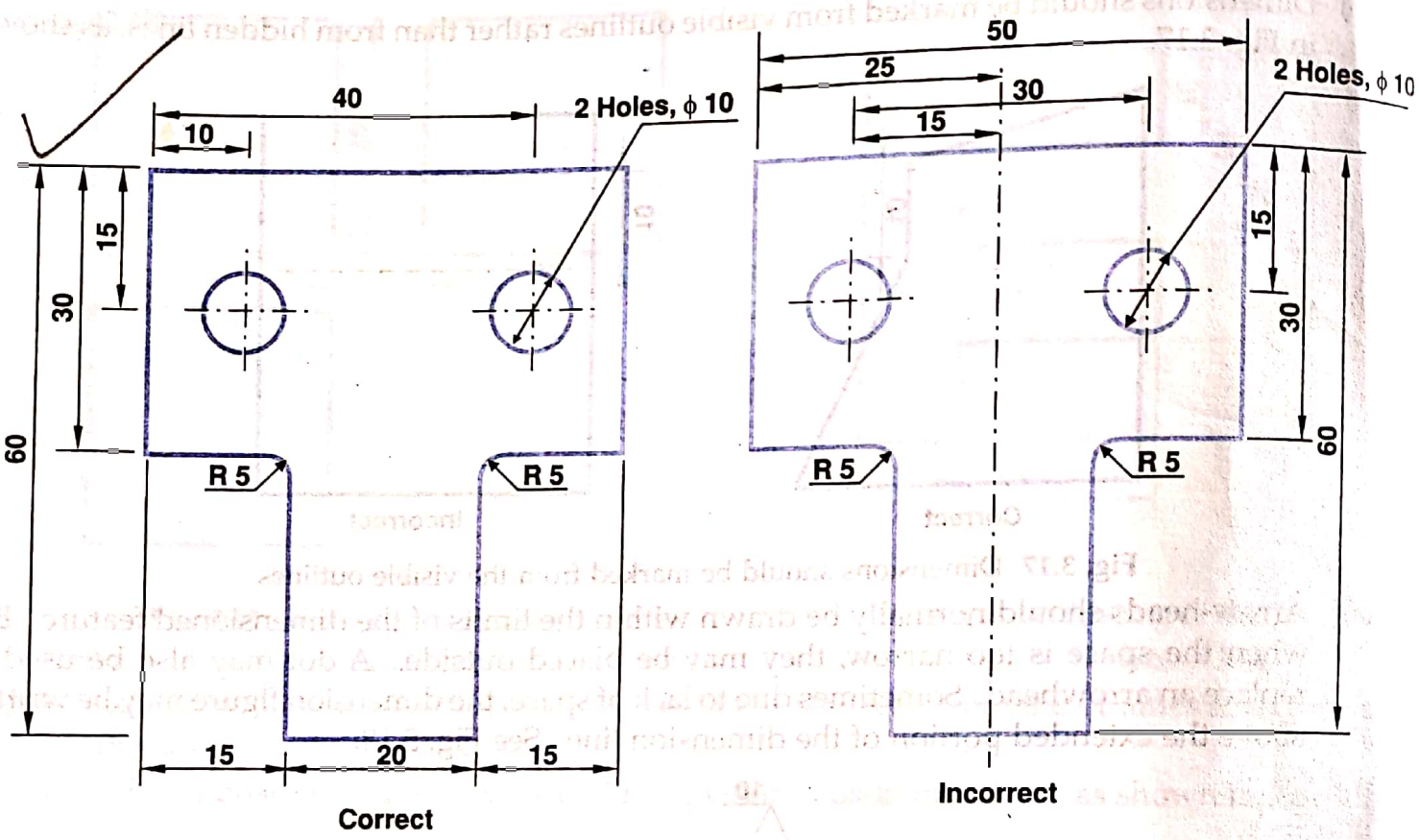


Fig. 3.20 Dimensioning to the centreline of an object should be avoided

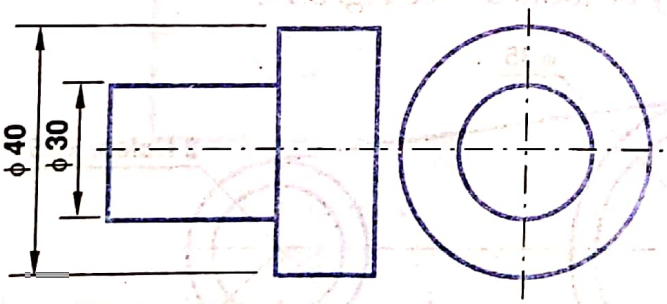


Fig. 3.21 Dimensioning of a cylindrical part

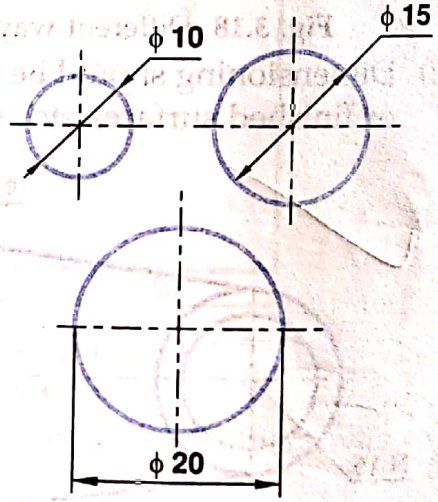


Fig. 3.22 Various methods of dimensioning the circles

(*xii*) Arcs of circles should be dimensioned by their respective radii. Dimension line for the radius should pass through the centre of the arc. Fig. 3.23 illustrates different methods of showing the radii of arcs.

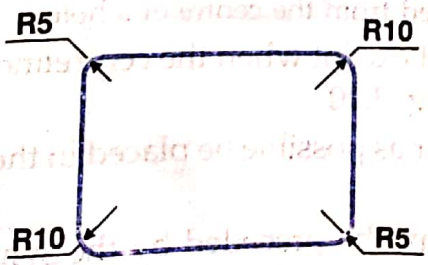


Fig. 3.23 Different methods of showing the radii of arcs

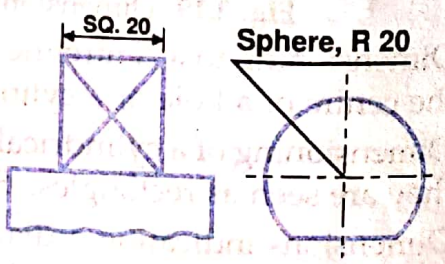


Fig. 3.24 Dimensioning of a square rod and a sphere

(*xiii*) Letter *SQ* should precede the dimension for a square rod, whereas letter *R* should precede the dimension for a sphere. See Fig. 3.24.

(*xiv*) Angular dimensions may be given by any one of the methods as shown in Fig. 3.25.

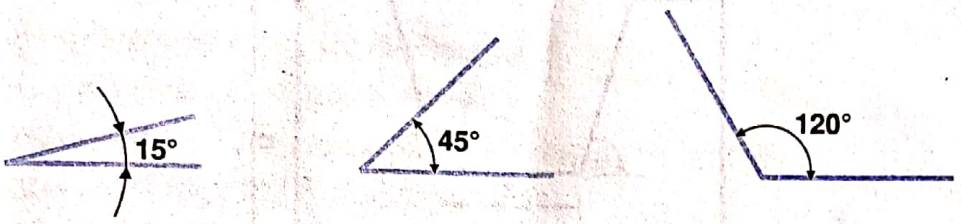


**Fig. 3.25** Dimensioning angles

(*xv*) Holes should be dimensioned in the view, in which they appear as circles. See Fig. 3.26.

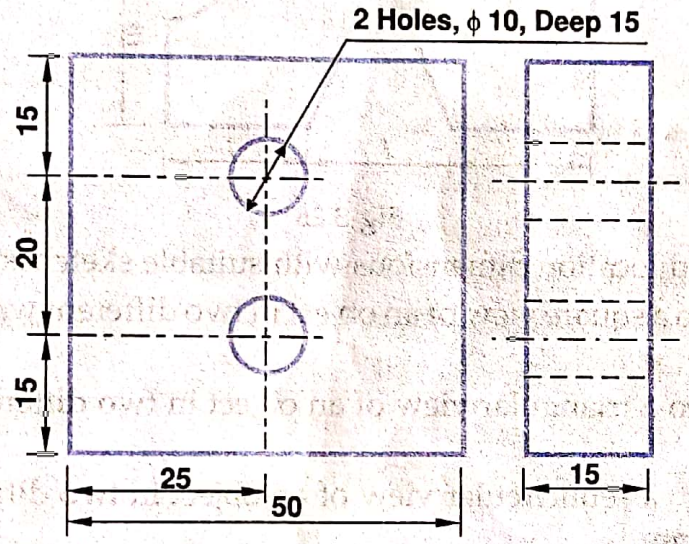


**Fig. 3.26** Typical case of dimensioning of a hole size

(*xvi*) Preferably dimensions should be expressed in millimetres. The unit mm can then be dropped at the end of each dimension by adding a note separately that all dimensions are in millimetres.

## EXERCISES

**3.1** For the view, as shown in Fig. 3.27, indicate the chain, parallel and combination dimensioning by using any sizes.

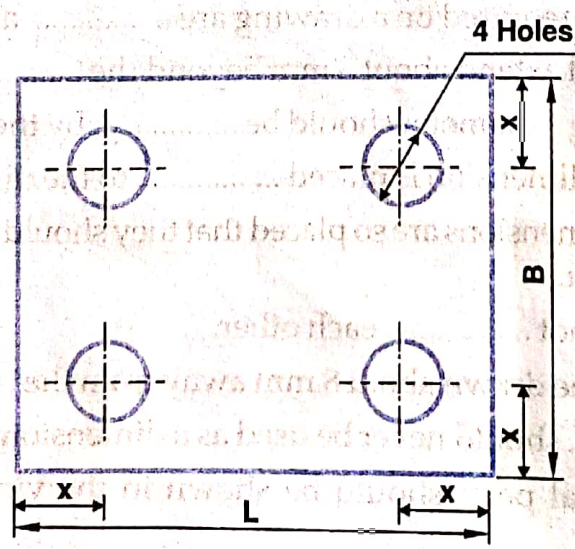


**Fig. 3.27**

**3.2** Show a rectangle of 60 mm × 40 mm by using two systems of dimensioning ?

**3.3** Fig 3.28 shows the view of an object. Redraw the view and give all the necessary dimensions.

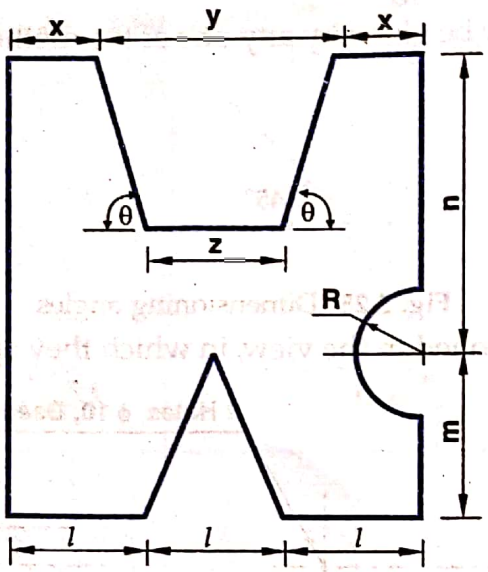


**Fig 3.28**

**3.4** Explain the size and location dimensions with suitable sketches ?

**3.5** Write dimensions to a square view of an object in two different ways ? Each side of the square is 40 mm.

**3.6** Write dimensions to a triangular view of an object in two different ways ? Each side of the triangle is 55 mm.

**3.7** Write dimensions to a semicircular view of an object in two different ways ? Radius of the semicircular is 25 mm.

**3.8** Explain the methods of dimensioning of circles and radii with simple sketches ?

**3.9** List out the various principles to be followed while dimensioning a drawing.

**3.10** Show by means of suitable examples aligned and unidirectional systems of dimensioning.

## OBJECTIVE QUESTIONS

**3.1** Two systems of placing dimensions on a drawing are ..... and ..... .

**3.2** As far as possible, dimensions should be given in ..... unit only, preferably in ..... .

**3.3** Two types of dimensions required on a drawing are ..... and ..... dimensions.

**3.4** The extension line should extend about 3 mm beyond the ..... .

**3.5** The dimension indicating a diameter should be ..... by the symbol ..... .

**3.6** In ..... system, the dimension is placed ..... to the dimension line.

**3.7** In ..... system, all dimensions are so placed that they should be readable from the ..... edge of the drawing sheet.

**3.8** Dimension lines should not ..... each other.

**3.9** Dimension lines should be drawn about 8 mm away from the ..... .

**3.10** An ..... or ..... should never be used as a dimension line.

**3.11** Dimensions of cylindrical parts should be shown in the views in which they appear as ..... .

**3.12** The line connecting a view to note is called a ..... .

**3.13** Dimensions should be taken from visible ..... rather than from hidden lines.

**3.14** What is the importance of dimensioning ?

**3.15** What is a leader line ?

**3.16** How the diameters and radii are designated ?

**3.17** What are general rules of dimensioning ?

**3.18** What is the necessity of dimensioning the drawing of an object ?

**3.19** Dimensions may be marked from hidden lines. (True/False)

**3.20** What is the proportion of an arrow-head ?

## ANSWERS

**3.1** Aligned, unidirectional
**3.2** One, millimetres
**3.3** Size, location
**3.4** Dimension line
**3.5** Preceded, $\phi$
**3.6** Aligned, perpendicular
**3.7** Unidirectional, bottom
**3.8** Cross
**3.9** Outlines
**3.10** Outline, centreline
**3.11** Rectangles
**3.12** Leader
**3.13** Outlines
**3.19** False
**3.20** Length : Depth = 3 : 1