

Engineering Drawing Lecture 3

Typical problems and dimensions

Typical problems

- **1- drawing paper layout:**
- **Using drawing paper size A3**
- **Paper must be parallel to T- square**
- **Fix the paper at the four corners with adhesive tape**
- **For portable boards a certain mechanism is located**
- **Then draw a boarder lines of 10 mm from the edges of the paper along the four sides of the paper**
- **Corners should be sharp right angles**
- **At the right lower corner inside the frame draw rectangle (30*90)**
- **Divide the 30 distance to three divisions 10 mm each**
- **Divide the upper division to three equal parts (30 mm each)**
- **Divide the second division to two divisions from left to right (80 and 10)**
- **Divide the last division to three divisions from left to right (50, 20 and 20mm)**

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Student name		Student serial NO.
Sheet title	Ex. No.	date

Typical Problems: First Angle Projection

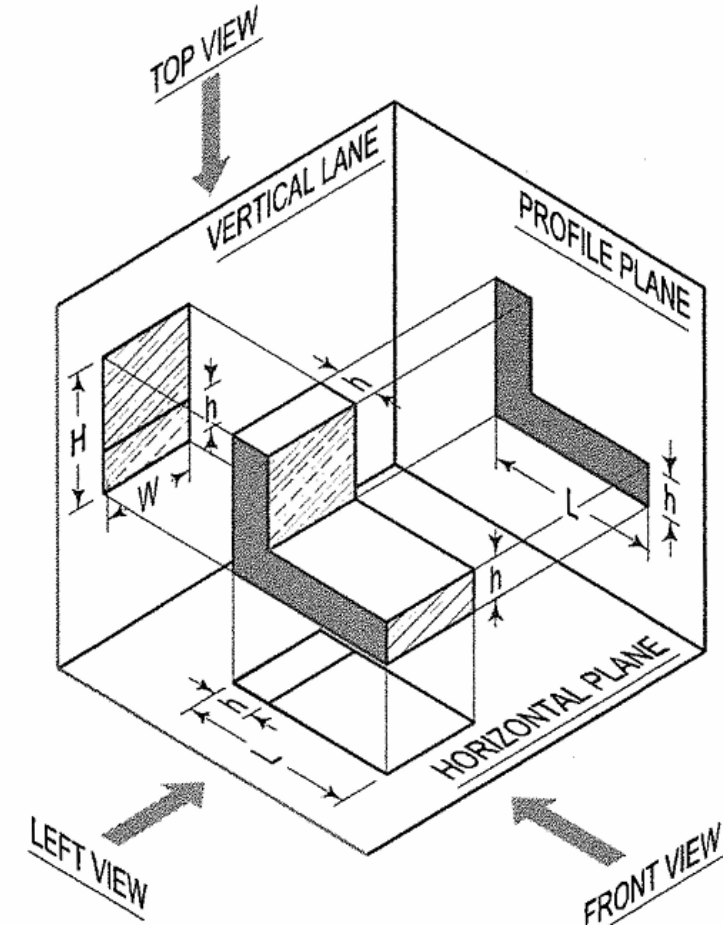
Problem 1-shaped solid object having dimensions of length (L) width (W) and height (H) in the fig..

Assuming that this object is lying in the first quadrant. Draw it's front view, top view and side view.

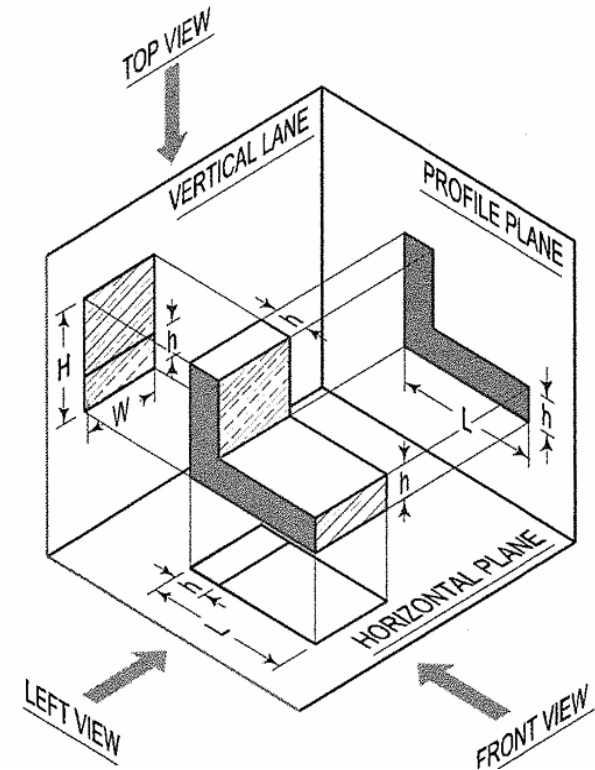
When the given object is in the first quadrant, its front view appears in the imaginary vertical plane V.P. behind it.

while its top view appears in an imaginary horizontal plane, H.P. below.

The side view appears to the right or left of the front view depending on from which side the object is being viewed.



Mark the visible corners of the given block as shown,
drawing front orthogonal view: Assume that you are
viewing the object in the direction of the arrow towards the
imaginary V.P. What you will see is a rectangle of height H
and width W on V.P. This will be the front view. li
To draw this view: Draw a reference line xy , which
represents the intersecting line of the planes V.P. and H.P.
Draw a rectangle as shown W and H , above xy make sure
that the width is parallel to the line xy . The rectangle is the
front orthogonal view of the object.
Draw a line parallel to and thickness of h to the line 1-2. The
rectangle 1-2-4-3 is the front view of the horizontal L
shaped stem of the object.

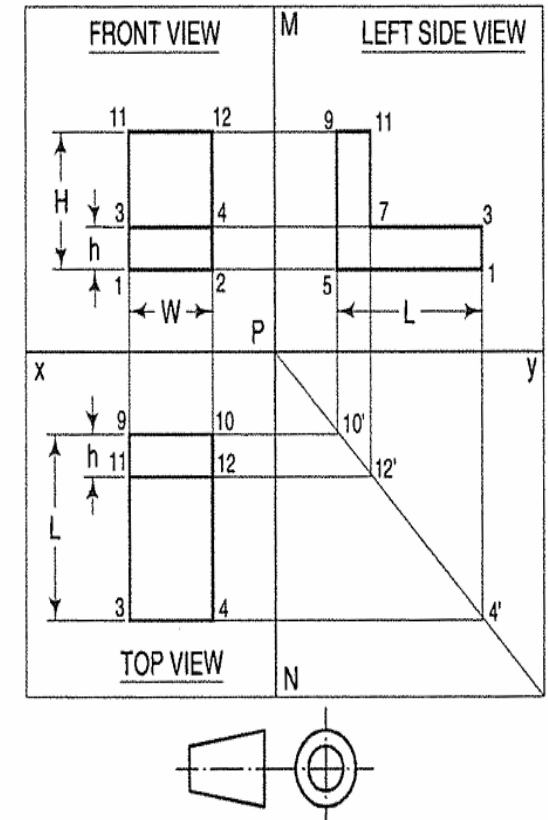
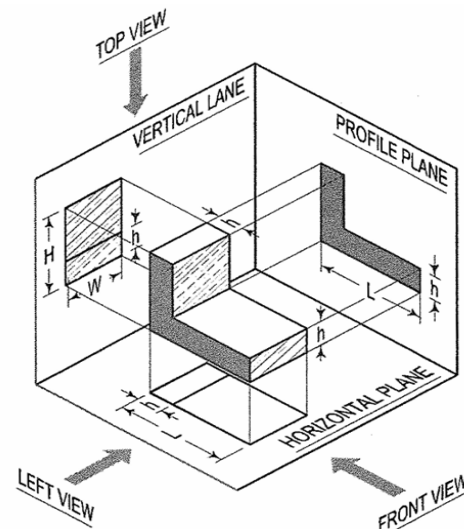


Now, if you look the object from the top, you will see a rectangle of Length L and width W on the horizontal plane. This is the top view of plan of the object.

(iv) To draw this view: Draw vertical projectors from 1 and 2 and extend them beyond the line xy . Draw a line 9-10 below and parallel to the reference line xy . Draw the lines 9-3 and 10-4 equal to the length L of the object. Join line 3-4. The rectangle 9-10-3-4 is the top view of the object.

(v) Draw a line 11-12 parallel to and below 9-10 of thickness h . The rectangle 9-11-12-10 is the view of the vertical stem of the object. Drawing the side orthogonal view:

Now if you look at the object from the left side, what you will see is an L-shaped image having a length of L and height of H on the auxiliary plane, AP . This view appears adjacent and to the right of front view. To draw this view:



Draw a reference vertical line MN at right angles to xy cutting it at P. From P draw a construction line at 45° in the fourth quadrant.

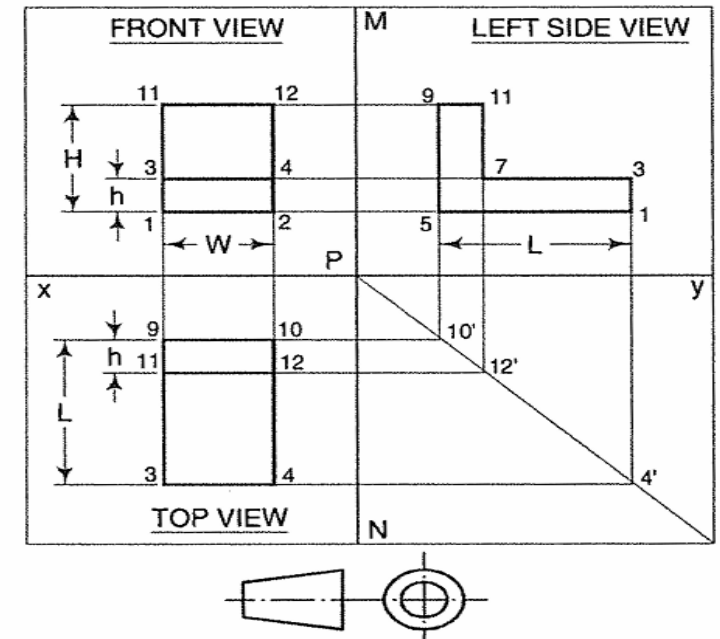
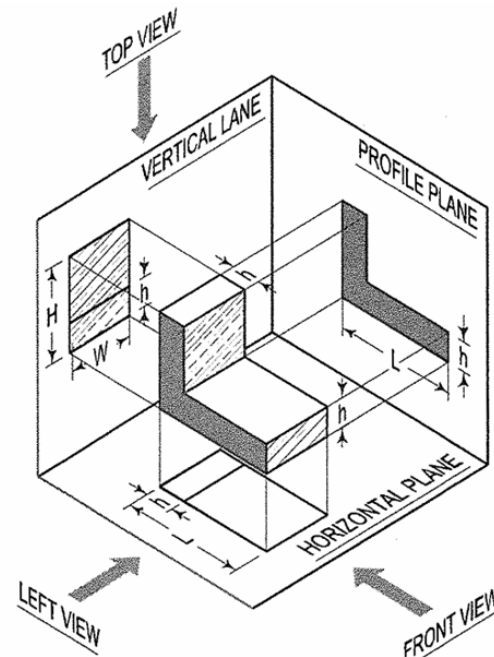
Project lines from the points 10, 12 and 4 of the top view to meet this inclined line at 1 O', 12' and 4'.

Project lines from points 2, 4 and 12 from the front view parallel to line xy.

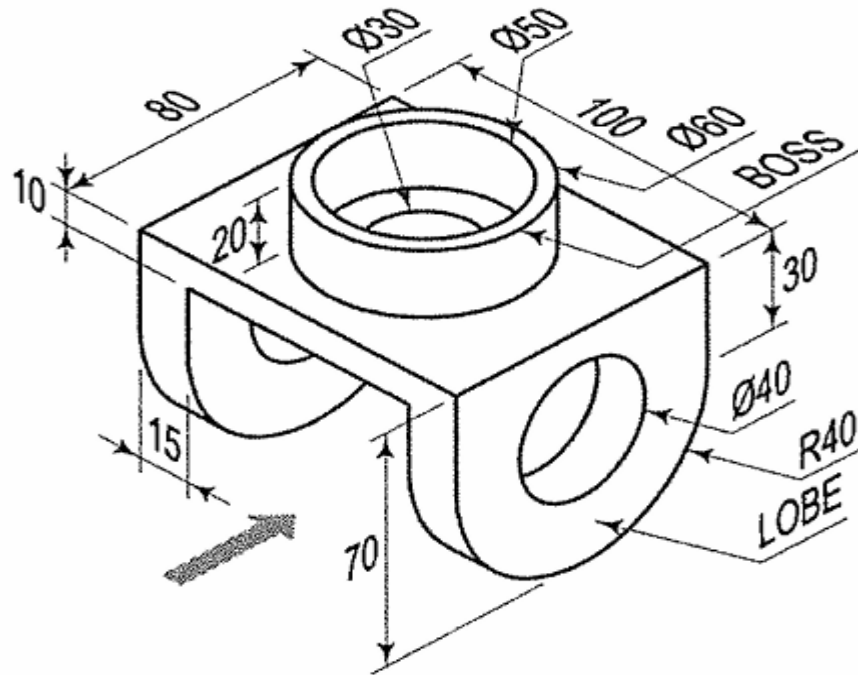
From points 1 O', 12' and 4' project lines vertically upwards to meet these horizontal projections.

Join points 5-1-3-7-11-9. This will be the side view of the object.

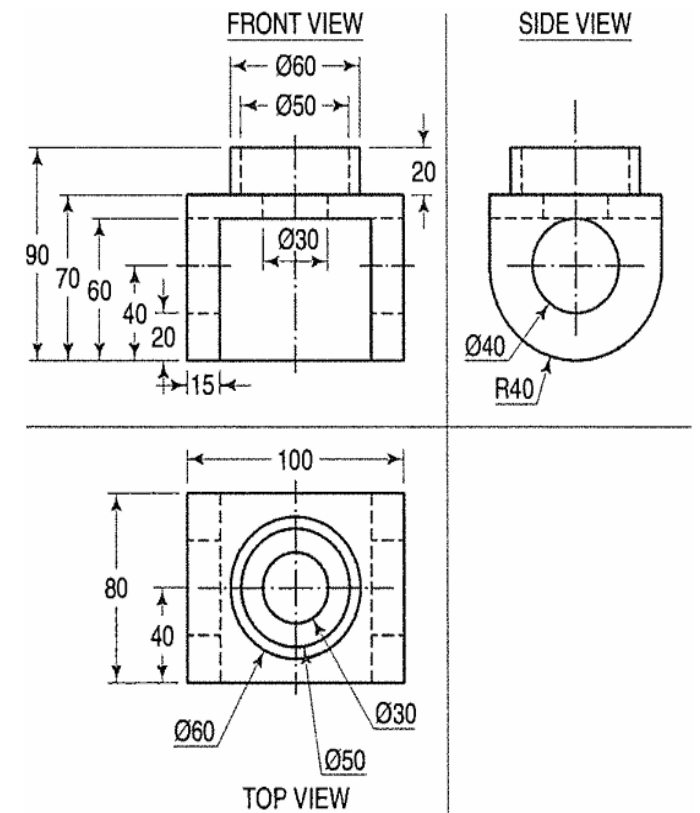
Finally draw the symbol of first angle projection at the right bottom corner of the drawing.



Problem (2) pictorial view of a machine bracket is shown in the figure. Draw using the first angle projection method front view, top view and right end side view. Assume that you are viewing the object in the direction of the arrow towards the imaginary V.P. What will you see? It is two rectangles of total height 90 mm and width 100 mm on V.P. This will be the front view. To draw this view:



- (i) Draw a Reference line xy, which represents the intersecting line of the planes V.P. and H.P.
- (ii) Draw rectangular block of size 100 x 70 and the thickness is 15 mm each on the two parallel portions of the slot.
- (iii) Now on the top of this rectangular block draw a rectangle of size 60 mm x 20 mm. This rectangle represents a boss of $\varnothing 60$ on the rectangular block.
- (iv) Draw a hole of $\varnothing 50$ in the above boss. Note carefully that the lines are dashed lines as they are invisible from the front side. The $\varnothing 30$ hole is in the rectangular block.



(v) Draw the two holes on the parallel edges of the rectangular block. These holes are represented by dotted lines in the front view as they are hidden. This completes the front view construction.

(vi) To draw the top view, project all the details from front view.

(vii) Draw a vertical centre line from the centre of the rectangular block.

(viii) The top view of the rectangular block appears as a rectangle of size 100 x 80.

(ix) Draw the holes in the centre of the rectangle. These holes are drawn taking the common centre point on vertical centre line.

(x) The two holes of $\varnothing 40$ on the lobes are not visible, so they are projected as dashed lines. This completes the top view.

(xi) To draw the side view, draw projectors from all the points in front view and top view to side view. Join the intersection points. This completes the side view.

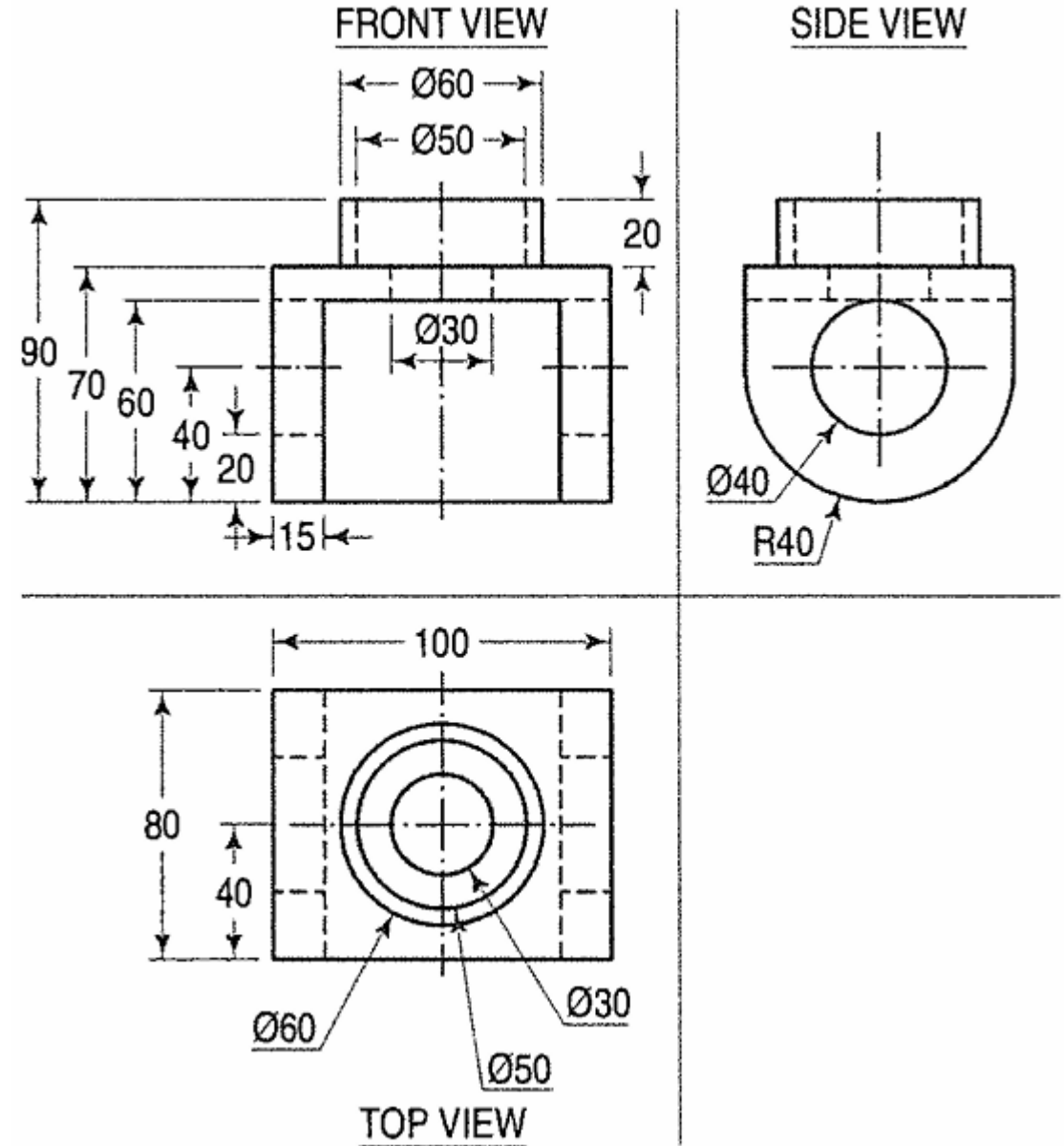
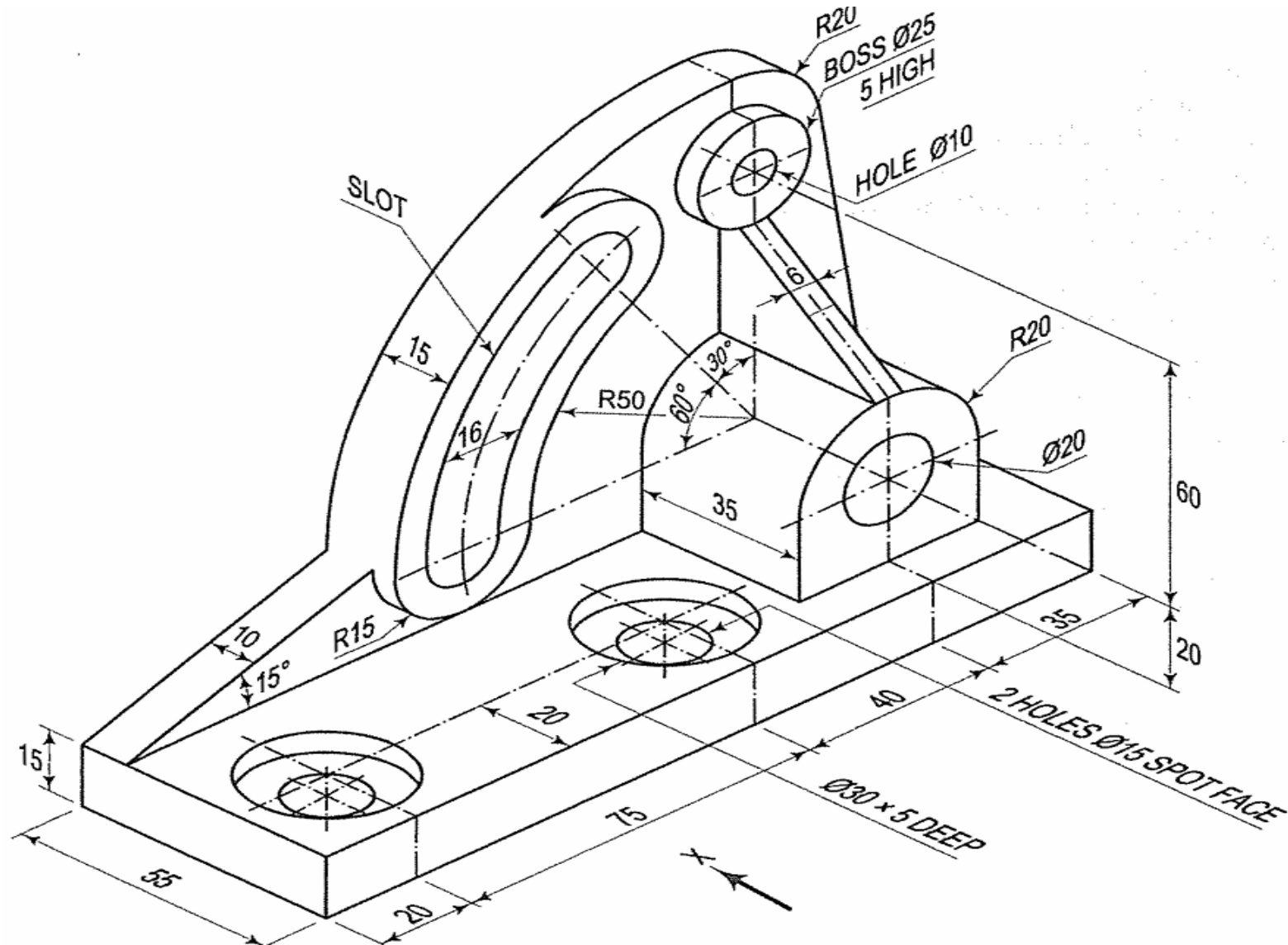


Fig. 3 shows the pictorial view of the object Draw the front view, top view and left-hand side view.



(i) To draw F.V. in the direction of X, L.H.S.V. and T.V.

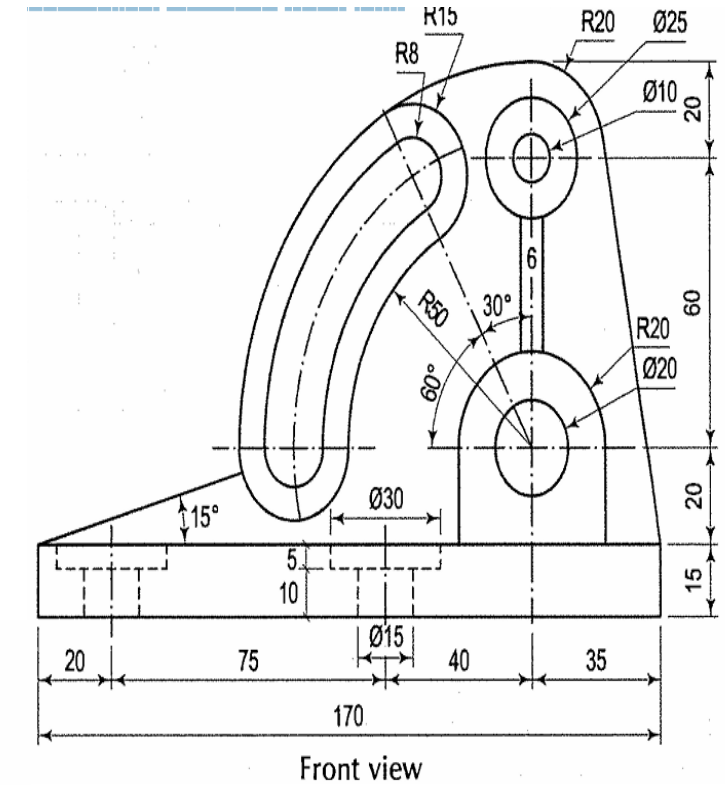
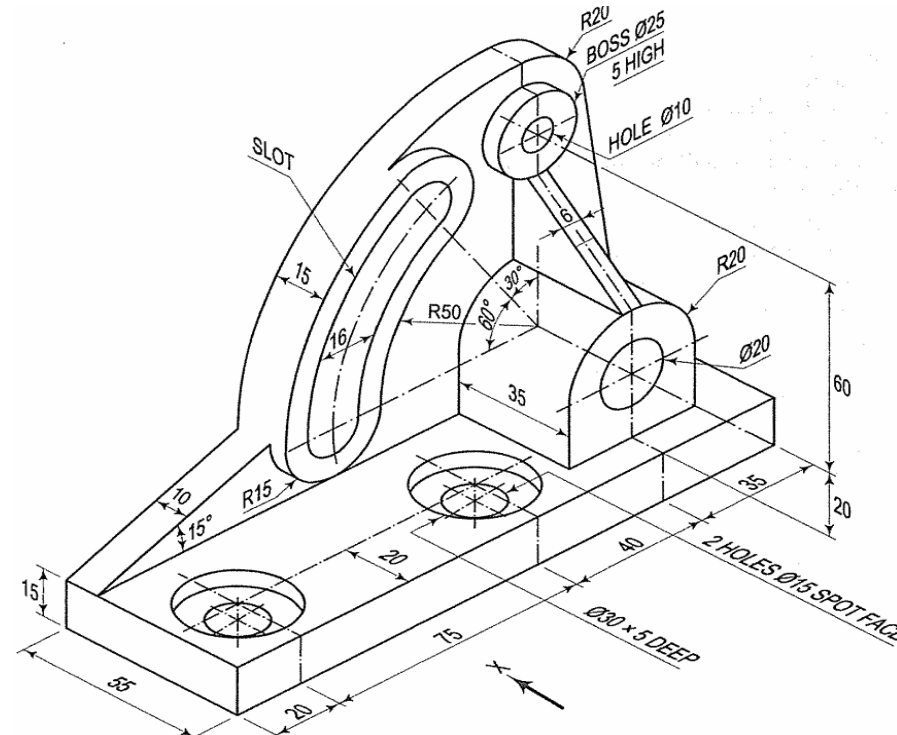
(ii) As the L.H.S.V. is to be drawn, fix the position of xy at centre of page and x1y1 to the left side as L.H.S.V. will come to the right of F.V.

(iii) Draw the rectangles for the F.V. (170 x 115), project it down to locate T.V. (170 x 55) and take the projections of F.V. to right to draw L.H.S.V., complete the rectangle of L.H.S.V. by taking the projections from T.V.

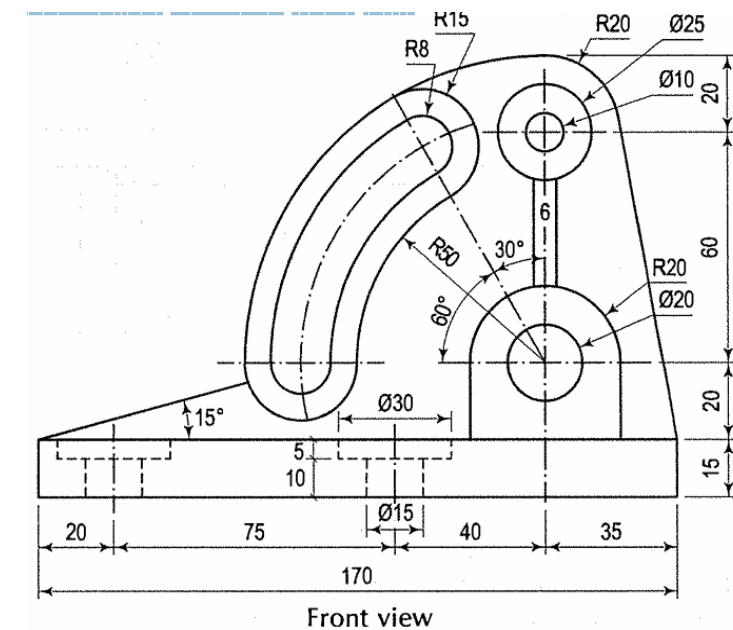
(iv) First we will start with F.V. (a) Draw the rectangle for base plate (170 x 15)

(b) Draw vertical centre lines at 20 mm and 75 mm and 40 mm

(consecutive distance) from left.



(iii) (k) From third centre point, draw centre line at 30° . Draw arcs of 50 mm, 73 mm, 57 mm, 80 mm.



(m) Draw an arc of centre line pattern of 65 mm radius. Draw center line for an arc.

(n) Taking intersection of this as reference and horizontal centre line draw semi-circle of radius 15 mm and 8 mm. (o) (p) (q) (r) (s) (v)

(o) Also draw same arcs, where this line intersects with 30° inclined line.

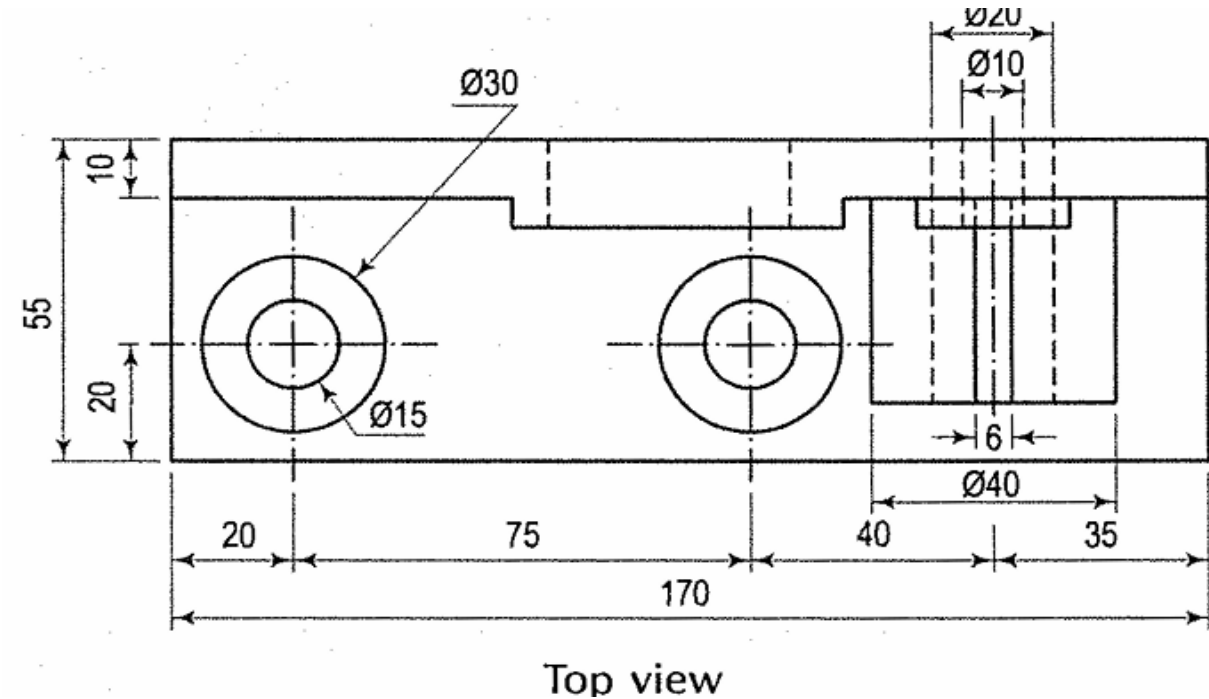
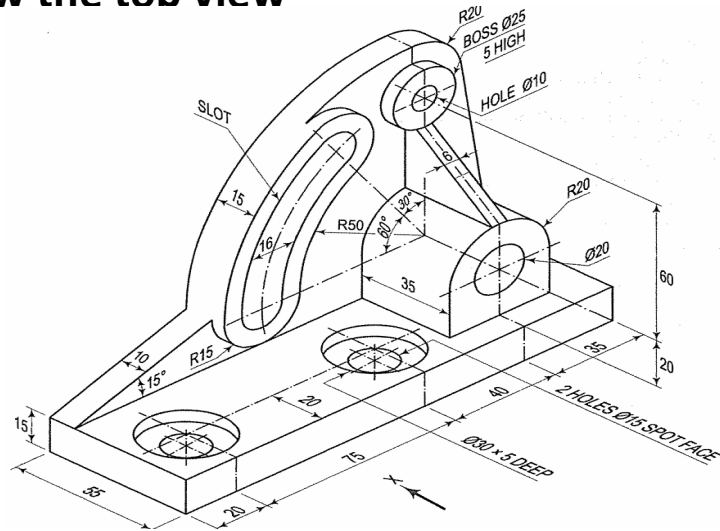
(p) Erase unwanted arcs if any.

(q) Draw inclined line at 15° from left end of block.

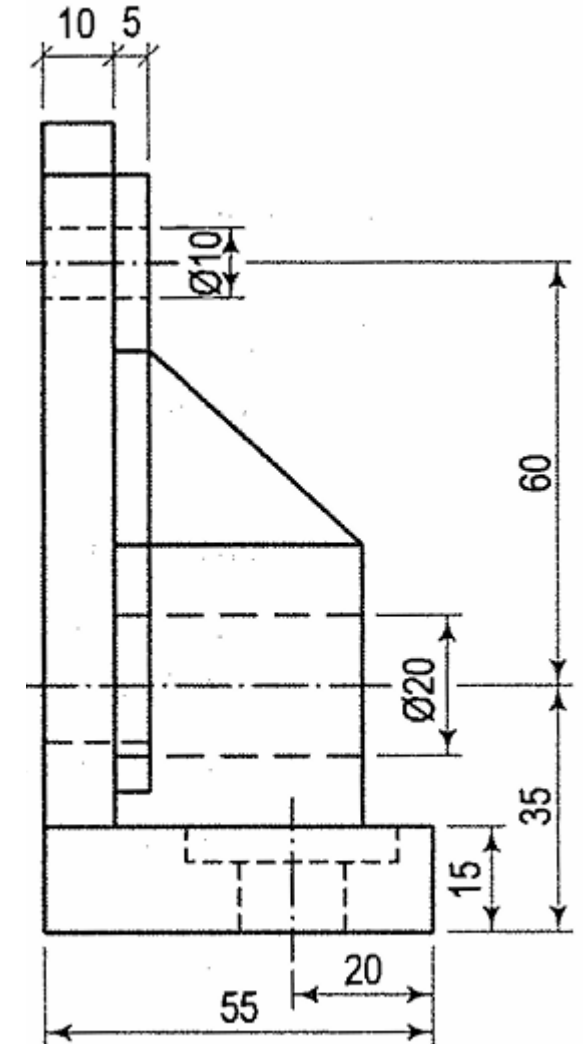
(r) Show the required dimensions.

(s) Now project all the required line to draw T.V.

(t) Now draw the top view

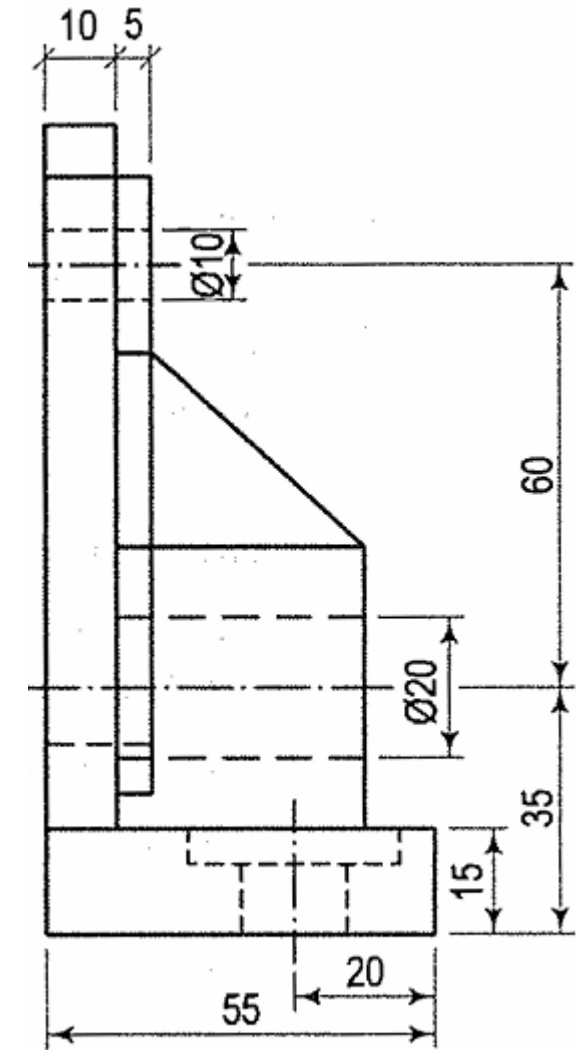


- (a) Complete the rectangle of the top view (170 x 55)
- (b) Project the centre lines. (Vertical at 20, 75 and 40 consecutive distances from left and at 20 above base)
- (c) Draw the two circles of $\varnothing 30$ and $\varnothing 15$ to represent spot holes.
- (d) Draw projection of inclined rib 10 thick and circular slot 15 thick.
- (e) Draw hidden lines for inner circular slot.
- (f) Draw rectangle for semicircular projection from F.V. projections
- (g) Draw hidden lines for hole of $\varnothing 20$ in it.
- (h) Show the projections of boss holes.
- (i) Draw hidden lines for hole of $\varnothing 10$.
- (j) Show the required dimensions.
- (k) Take projections from F.V. and T.V. to complete L.H.S.V. Complete the base rectangle of 55 mm x 15 mm. To represent the base.



L.H.S.V.

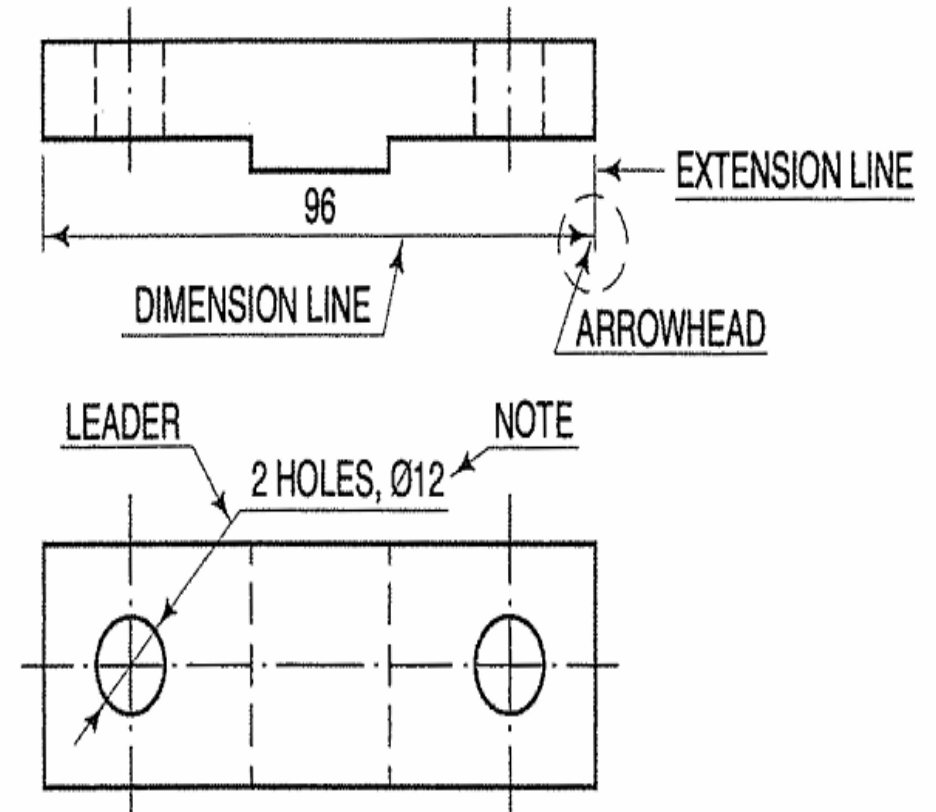
- (b) Complete the rectangle at left side in L shape of 10 mm thick.
- (c) Show the projections of projected semi-circle.
- (d) Show hidden lines of hole in it.
- (e) Show projection of projected slot and show hidden lines in it.
- (f) Draw projection of boss and show hole in it by dotted line.
- (g) Show inclined line for the rib.
- (h) Draw front view, top view and L.H.S.V. in their relative position.



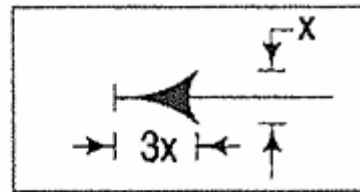
L.H.S.V.

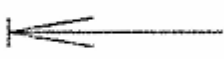
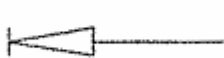
2 - Dimensioning Terms and Notations

- (1) **Dimension line:** Dimension line is a thin continuous line. It is terminated by arrowheads touching the outlines, extension lines or centre lines.
- (2) **(2) Extension line):** An extension line is also a thin continuous line drawn in extension of an outline. a gap of about 1 mm should be kept between the extension line and an outline or object boundry. It extends by about 3 mm beyond the dimension line.
- (3) **(3) Arrowhead:** An arrowhead is placed at each end of a dimension line. Its pointed end touches an outline, an extension line or a centre line. The size of an arrowhead should be proportional to the thickness of the outlines. The length of the arrowhead should be about three times its maximum width. It is drawn freehand with two strokes made in the direction of its pointed end. The space between them is neatly filled up. Different types of arrow heads are shown in fig.. Generally closed and filled arrowhead is widely used in engineering drawing.

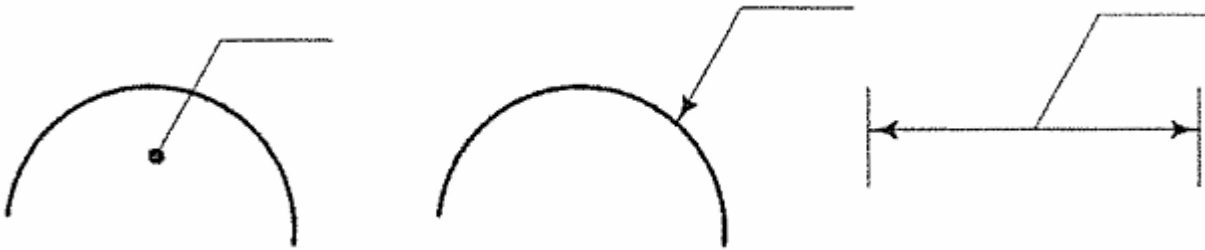


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- (i)  OPEN ($\angle 90^\circ$)
- (ii)  OPEN ($\angle 20^\circ$)
- (iii)  CLOSED
- (iv)  CLOSED AND FILLED
- (v)  OBLIQUE STROKE
- (vi)  SMALL OPEN CIRCLE

(4) leader): A leader or a pointer is a thin continuous line connecting a note or a dimension figure with the feature to which it applies. One end of the leader terminates either in an arrowhead or a dot. The arrowhead touches the outline, while the dot is placed within the outline of the object. The other end of the leader is terminated in a horizontal line at the bottom level of the first or the last letter of the note. The leader is never drawn vertical or horizontal or curved. It is drawn at a convenient angle of not less than 30° to the line to which it touches. When pointing to a circle or an arc it is drawn radially. Use of common leaders for more than one feature should never be made.

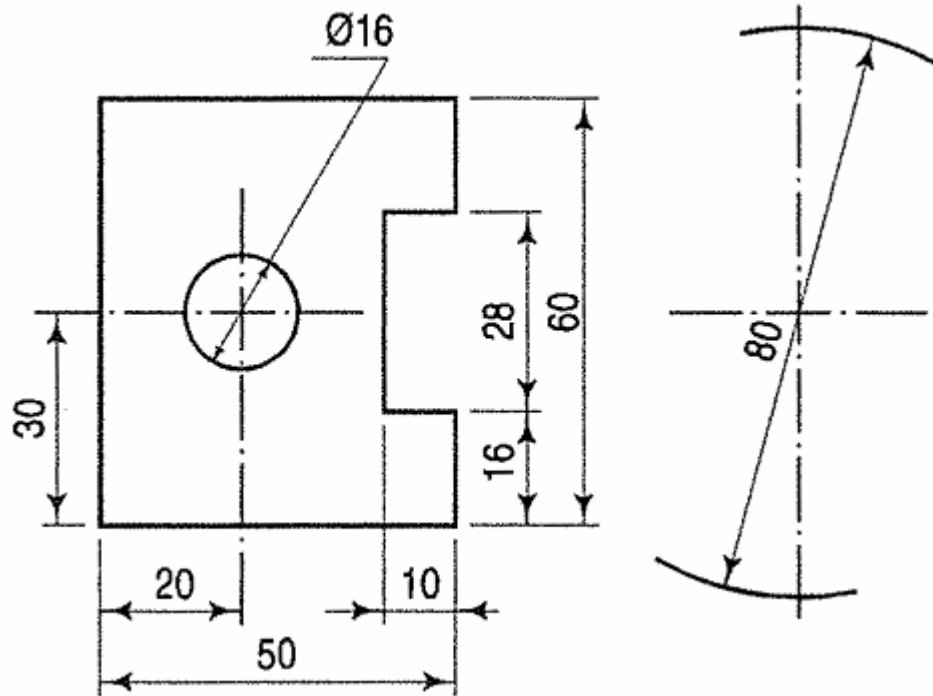


Systems of Placing Dimensions:

The two systems of placing dimensions are:

- (1) Aligned system and
- (2) Unidirectional system.

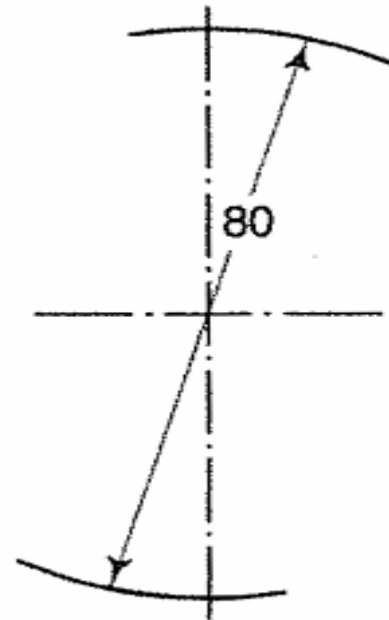
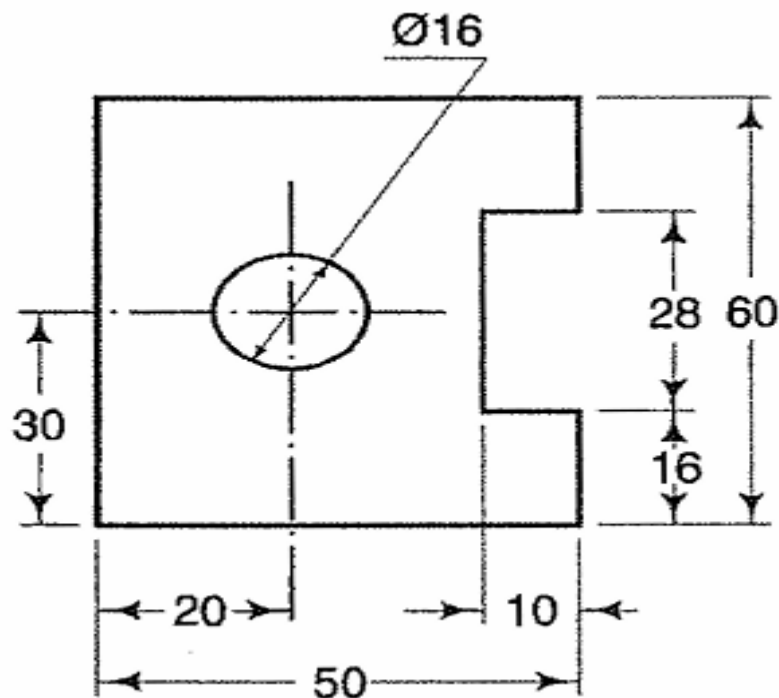
(1) Aligned system: In the aligned system the dimension is placed perpendicular to the dimension line in such a way that it may be read from the bottom edge or the right-hand edge of the drawing sheet. The dimensions should be placed near the middle and above, but clear of the dimension lines.



(2) : In unidirectional system :

All dimensions are so placed that they can be read from the bottom edge of the drawing sheet.

The dimension lines are broken near the middle for inserting the dimensions. 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.



General Rules For Dimensioning:

- 1- Dimensioning should be done so completely that further calculation or assumption of any dimension, or direct measurement from the drawing is not necessary.
 - 2- Every dimension must be given, but none should be given more than once.
 - 3- A dimension should be placed on the view where its use is shown more clearly.
 - 4- Dimensions should be placed outside the views, unless they are clearer and more easily read inside.
 - 5- Mutual crossing of dimension lines and dimensioning between hidden lines should be avoided. Dimension lines should not cross any other line of the drawing.
 - 6- An outline or a centre line should never be used as a dimension line.
 - 7- A centre line may be extended to serve as an extension line.
- Aligned system of dimensioning is recommended.

Practical Hits on Dimensioning:

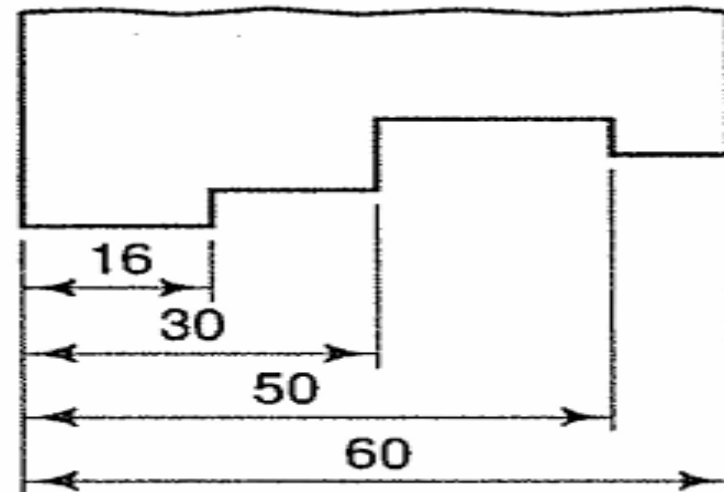
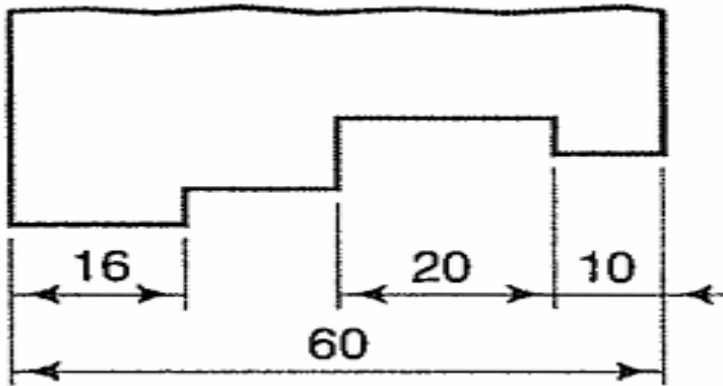
1- Dimension lines should be drawn at least 8 mm away from the outlines and from each other.

2- Dimensions in a series may be placed in any one of the following two ways:

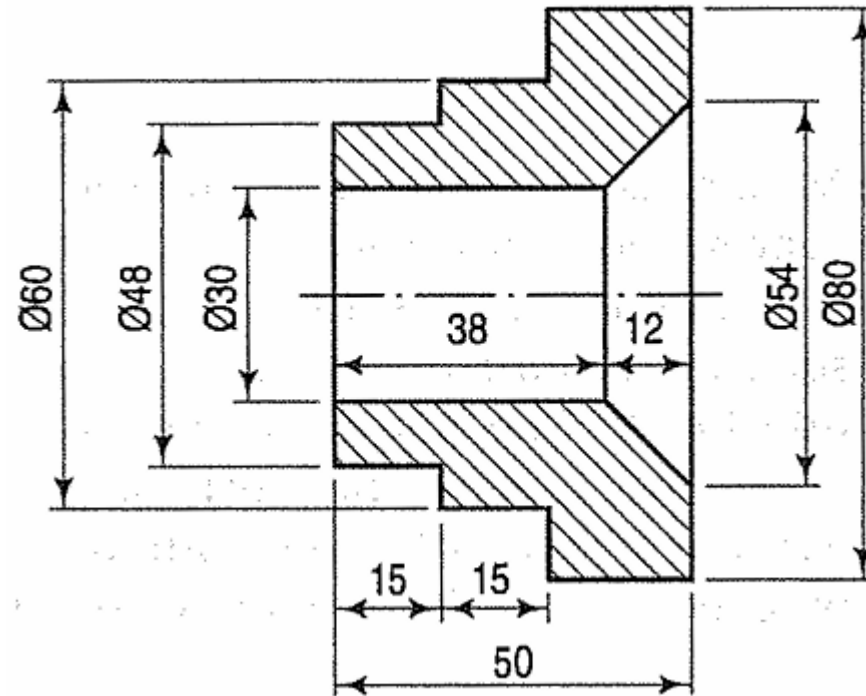
(i) Continuous or chain dimensioning: Dimensions are arranged in a straight line. An overall dimension is placed outside the smaller dimensions. One of the smaller dimensions (the least important) is generally omitted.

(ii) Progressive or parallel dimensioning): All dimensions are shown from a common base line. Cumulative error is avoided by this method. This method is preferable.

(iii) Smaller dimensions should be placed nearer the view and the larger further away so that extension lines do not cross dimension lines. Extension lines may cross each other or the outlines



- (4) When a number of parallel dimension lines are to be shown near each other, the dimensions should be staggered
- (5)-. Dimensions should be shown where the shape is easily identified.
- (6) Arrowheads should ordinarily be drawn within the limits of the dimensioned feature.



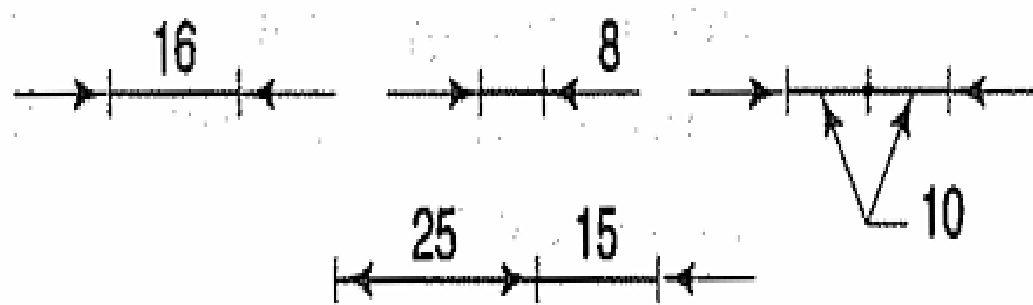
But when the space is too narrow,

they may be placed outside

A dot may also be used to replace an arrow head, due to lack of space

, the dimension figure may be written above the extended portion of the dimension line,

but preferably on the right- hand side



Dimensions of cylindrical parts:

Dimensions of cylindrical parts

should as far as possible be placed in the views in which they are seen as rectangles. The dimension indicating a diameter should always be preceded by the symbol $\varnothing$

. Dimension of a cylinder should not be given as a radius

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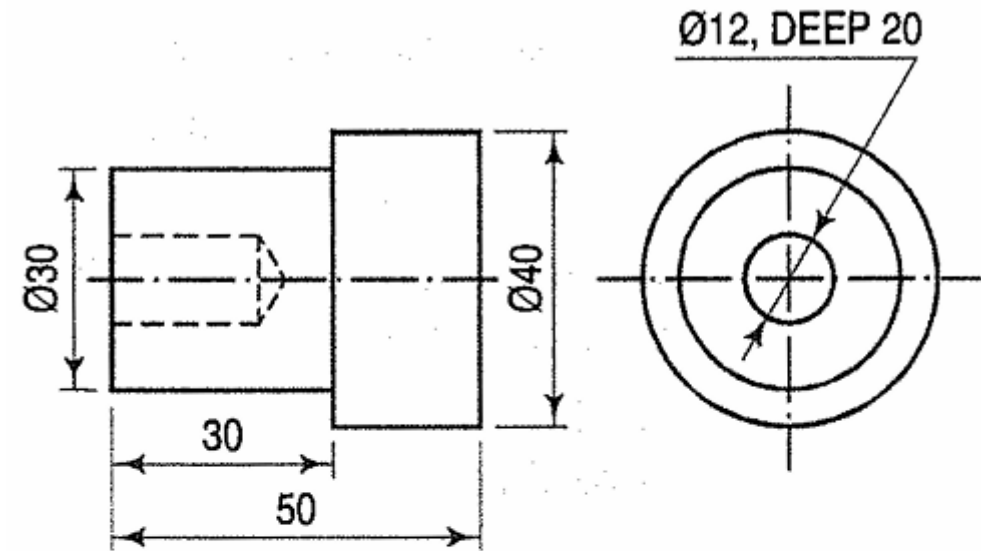
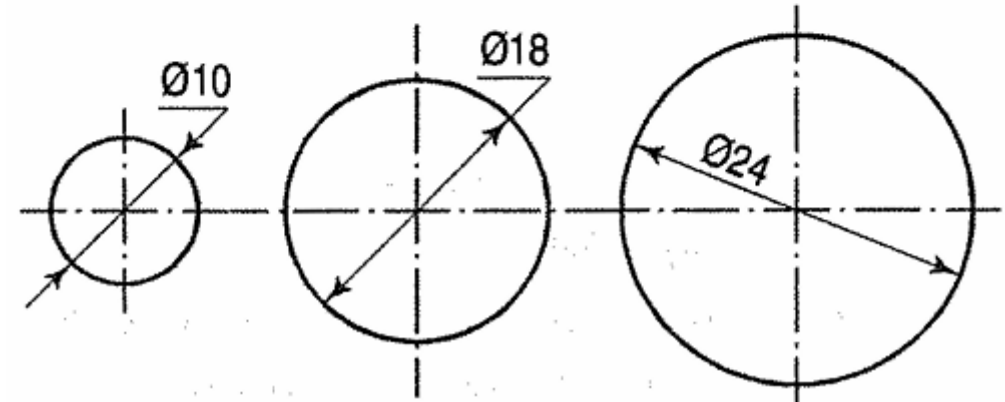


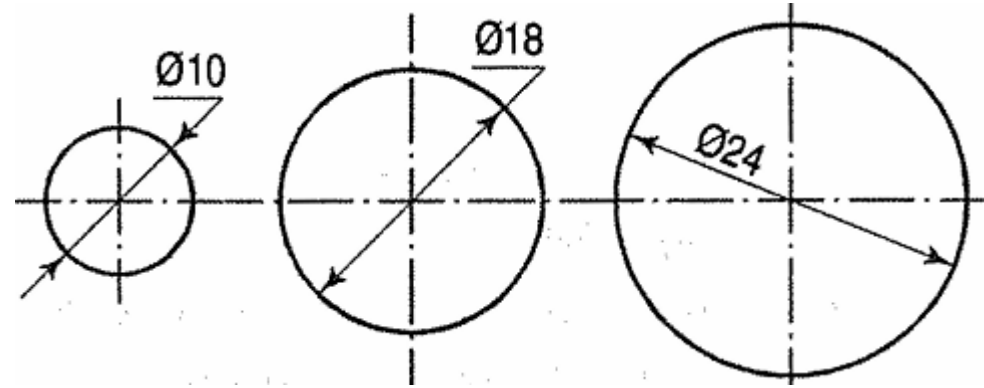
FIG. 3-18



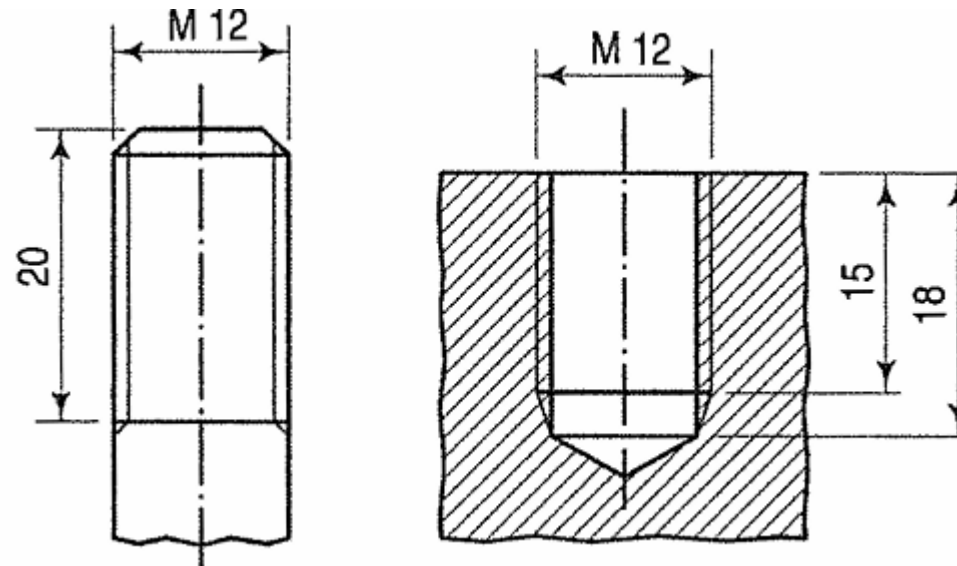
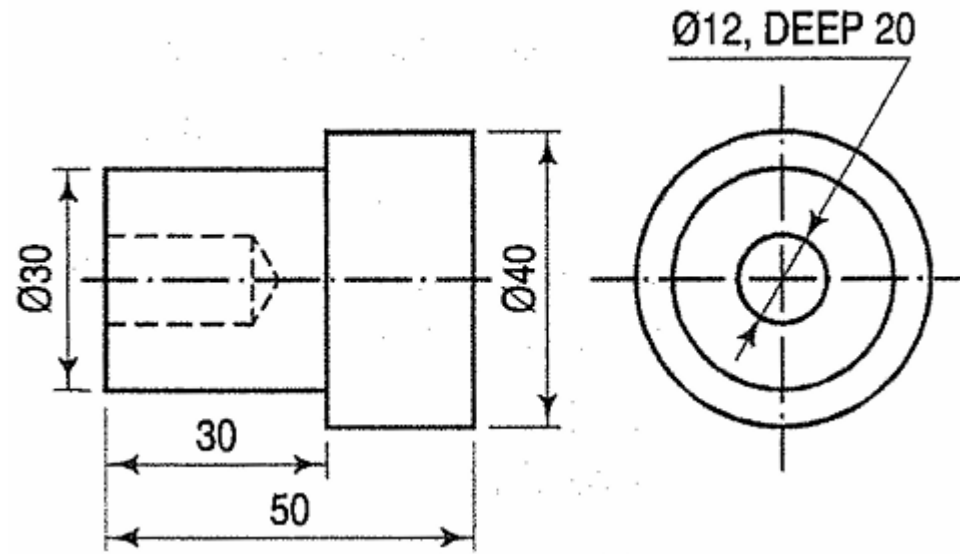
The Fig. shows various methods of dimensioning different sizes of circles.

Dimensions should be shown in one view only, the same dimension must not be repeated in other view.

Holes should be dimensioned in the view in which they appear as circles, they should be located by their center lines.



As far as possible, all dimensions for one particular operation, such as diameter and depth of a drilled hole), or size and depth of a threaded hole should be given in one view only.



THANKS