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Chapter 1:

- ENGINEERING CURVES

By
Abhishek Navlakhi
(Tel: 9820246760 / 9769479368)

Cycloid and Trochoid

1. Cycloid
2. Inferior trochoid
3. Superior trochoid

Epicycloid and Epitrochoid

1. Epicycloid
2. Inferior epitrochoid
3. Superior epitrochoid

Hypocycloid and Hypotrochoid

1. Hypocycloid
2. Inferior Hypotrochoid
3. Superior Hypotrochoid

1.6.2.1 Cycloid and Trochoid

1. Cycloid

Example 51 : A circle of 40 mm diameter rolls along a straight line without slipping. Draw the curve traced out by a point P on the circumference, for one complete revolution of the circle. Name the curve. Draw a tangent to the curve at a point on it 27 mm from the line.

Refer Fig. 1.90

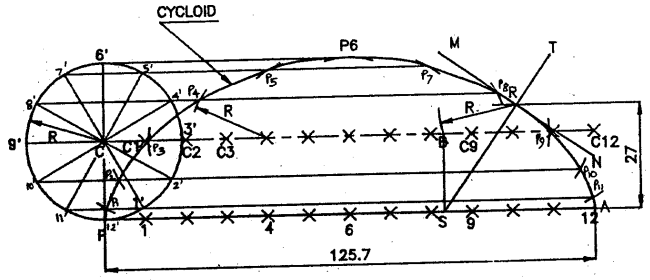


Fig. 1.90

Procedure :-

1. Draw a circle of diameter 40 mm and mark its centre as C.
2. Mark point P on the circumference of the circle as the initial position of a point P.
3. Divide the circle into 12 equal parts and mark on the circle 1', 2', ..., 12' in opposite direction to rotation.
4. Draw line PA tangent to the circle as the **directing line** and of length equal to the circumference of the circle = $\pi D = \frac{22}{7} \times 40 = 125.7$ mm.
5. Draw horizontal lines or parallel lines to the directing line through 1', 2', .., 12'.
6. Divide line PA into 12 equal parts and mark them by 1, 2,.. 12.
7. From C draw parallel line to directing line and mark on it $C_1, C_2, .., C_{12}$ corresponding to 1, 2,.. 12 of the directing line.
8. Now, when the circle has rolled without slip by $\frac{1}{12}$ th of a revolution, the centre point C must have moved to C_1 and the point P must have moved and achieved the height of point 1' of the circle.
9. Accordingly, with C_1 as the centre and radius equal to $\frac{40}{2} = 20$ mm draw an arc to cut the horizontal line through 1' of the circle at P_1.
10. Similarly, get arc-line intersection points $P_2, P_3, .. P_{12}$ by drawing arcs with $C_2, C_3, .. C_{12}$ as centres and radius equal to $\frac{40}{2} = 20$ mm to intersect with lines through 2', 3', .., 12' of circle respectively.
11. Join $P, P_1, P_2, \ldots, P_{12}$ by means of a smooth curve to get cycloid.
12. Mark point R on cycloid which is lying on a line 27 mm from the directing line.
13. Now with R as the centre and radius equal to $\frac{40}{2} = 20$ mm, draw an arc to cut centre line C_1-C_{12} at some point B. Through B, draw a line BS perpendicular to the directing line PA and cutting it at S.
14. S is the point of contact and B is the position of the centre of the generating circle when the generating point P is at R. Draw a line through R and S. This line is the required normal. Through R draw a line MN at right angles to RS. MN is the **tangent to the cycloid**.

Example 52 : A wheel of 56 mm diameter rolls downward on a vertical wall for half revolution and then on the horizontal floor for half revolution. Draw the locus of a point P on the circumference of the wheel, the initial position of which is the contact point with the wall. Name the curve. (B.U. May'93)

Refer Fig. 1.91

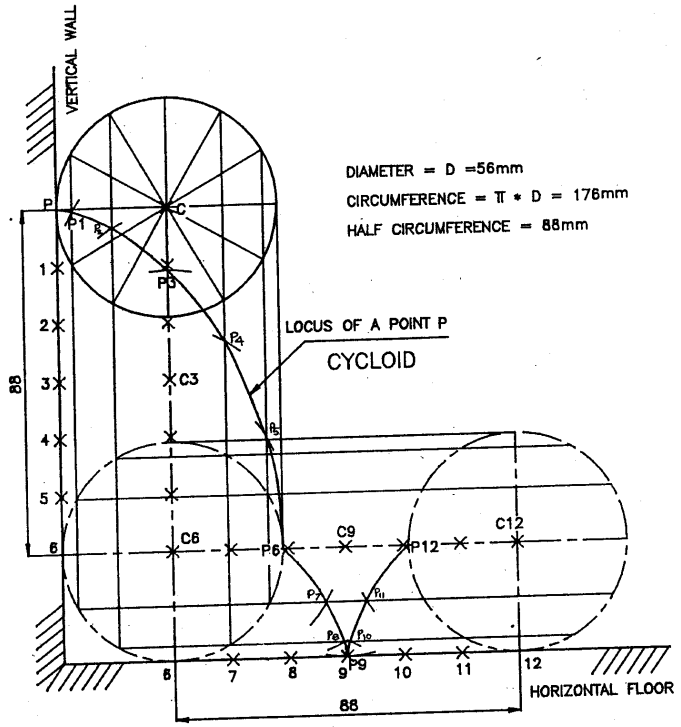


Fig. 1.91

2. Inferior Trochoid

Example 53 : A circle of 50 mm diameter rolls along a straight line without slipping. Draw the curve traced by point Q located 15 mm inside the circle. Take initial position of point Q at the bottom on vertical centre line of circle. Name the curve traced.

Refer Fig. 1.92

Method I :

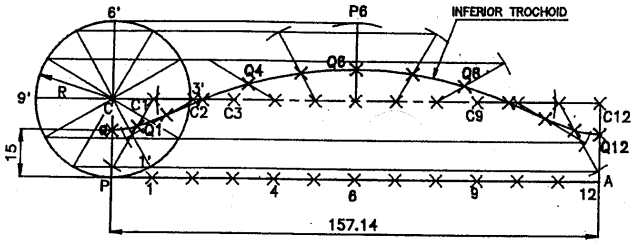


Fig. 1.92

Procedure :-

1. Draw a circle of diameter 50 mm and mark C as its centre.
2. Divide the circle into 12 equal parts and mark on the circle 1', 2',.. 12' in the opposite direction to rotation.
3. Draw line PA tangent to the circle as the directing line and of length equal to the circumference of the circle = $\pi D = \frac{22}{7} \times 50 = 157.14$ mm.
4. Draw horizontal lines or parallel lines to directing line through 1', 2', .. 12'.
5. Divide the line PA into 12 equal parts and mark on it C_1, C_2, .. C_{12} corresponding to 1, 2,.. 12 of the directing line.
7. Do the same construction as done for cycloid and obtain points P, P_1, .. P_{12} as shown in the figure.
8. Join CP and mark Q on it by taking PQ = 15 mm. Take Q inside.
9. Similarly, find points Q_1, Q_2, .. Q_{12} on lines C_1P_1, C_2P_2, Q_{12} in sequence by a smooth curve to get **inferior trochoid.**

Method II

Procedure : Method (I) described in example 54 can also be used to solve this example 53.

3. Superior Trochoid

Example 54 : A circle of 50 mm diameter rolls along a straight line without slipping. Draw the curves traced by point R located 15 mm outside the circle. Take initial position of point R at the bottom on vertical centre line of circle. Name the curves traced.

Refer Fig. 1.93

Therefore, $\theta = \frac{d}{R} = \frac{x\ 75}{\frac{150}{2}} = \pi^c = 180^0$.

3. Draw an arc of radius $R = \frac{150}{2} = 75$ mm and subtending an angle of 180^0 at centre O.
4. Follow further, the procedure same as explained in the example 59 and obtain the prints P, P_1, P_2, .. P_{12}.
5. Observe that after joining P, P_1, P_2, .., P_{12} in sequence, we get a hypocycloid as a straight line and hence this is considered as the special case of hypocycloid.
6. Also observe that when the diameter of the rolling circle is half the diameter of the directing circle, the hypocycloid is a straight line and is a diameter of the directing circle.

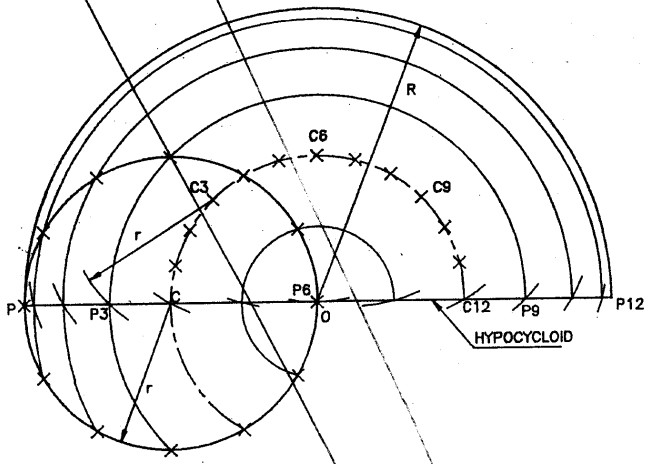


Fig. 1.101

1.6.3 Involutes

Definition : It is a curve traced out by an end of a piece of thread unwound from a circle or a polygon, the thread being kept tight. OR

It is a curve traced out by a point in a straight line which rolls without slipping along a circle or a polygon.

Example 63 : Draw an involute of a circle of 50 mm diameter. Also, draw a normal and tangent to it at a point 100 mm from the centre of the circle.

Refer Fig. 1.102

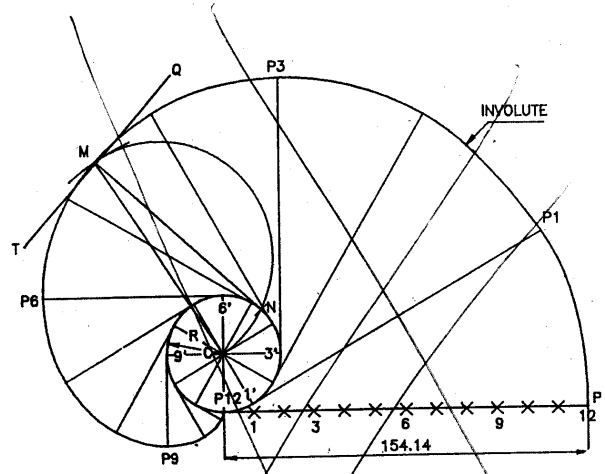


Fig. 1.102

Procedure :-

1. Draw a circle of 50 mm diameter and divide it into 12 equal parts and mark them as 1', 2', .. 12'.
2. Draw a line of length equal to the circumference of circle as $\pi d = \pi \times 50 = 157.14$ mm and tangent to the circle. Divide this line into 12 equal parts and mark them as 1, 2, .., 12.
3. Draw tangents to the circle at points 1', 2', .. 12' in the direction of position of string during wounding operation.
4. On tangents at points 1', 2', .., 12' take length equal to arc length 1P, 2P, .., 12P to mark points P_1, P_2, .. P_{12} respectively.
5. Join points P, P_1, P_2 .. P_{12} by a smooth curve to get **involute of a circle** as shown in the figure.
6. Now, to draw normal and tangent to the involute at any point M on it (which is obtained on a curve 100 mm from the centre of the circle) join M with the centre of the circle. With that line as diameter draw a semicircle cutting the circle of involute at point N. Join N with M to get normal and draw right angle to this normal at point M to get tangent TQ.

Example 64 : Draw a circle with diameter AB equal to 65 mm. Draw a line AC tangent to the circle at A and of length 135 mm. Trace the path of end A of the line AC when it rolls on circle without slipping. Name the curve. Draw a normal and tangent to the curve at a point 100 mm from the centre of the circle. (B.U., May, '94)

Refer Fig. 1.103

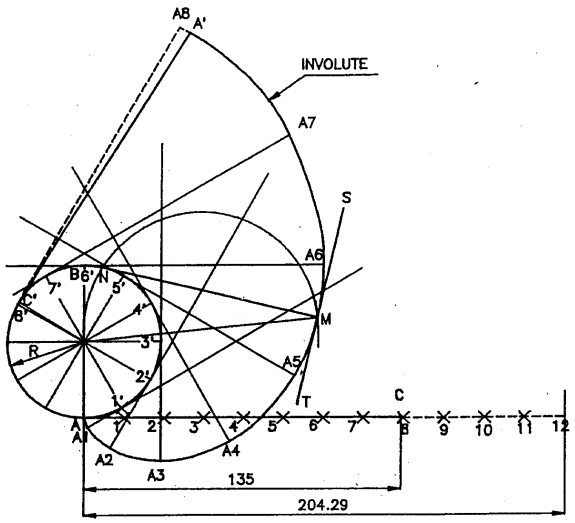


Fig. 1.103

Procedure :-

1. Draw a circle of 65 mm diameter and divide it into 12 equal parts and mark them as 1', 2', .., 12'.
2. Draw a line of length equal to the circumference of the circle as $\pi d = \pi \times 65 = 204.29$ mm and tangent to the circle. Divide this line into 12 equal parts and mark them as 1, 2, .. 12.
3. Mark a position of point C on this tangent line such that AC = 135 mm. Observe that the C is a point lying **inside** the circumference length of tangent line.
4. Draw tangents to the circle at points 1', 2', .. in the direction of position of string during unwinding operation.
5. On tangents at points 1', 2', .. take length equal to arc length A-1, A-2, .. to mark points A_1, A_2,.. respectively.
6. Join points A, A_1, A_2, .. in sequence by a smooth curve to get required involute.
7. Follow the procedure same as explained in example 63, to get normal and tangent to the curve at a point 100 mm from the centre of the circle.

Example 65 : An inelastic string 140 mm long, has its one end attached to the circumference of a circular disc of 35 mm diameter. Draw the curve traced out by the other end of the string, when it is completely wound around the disc, keeping the string always tight.

Refer Fig. 1.104

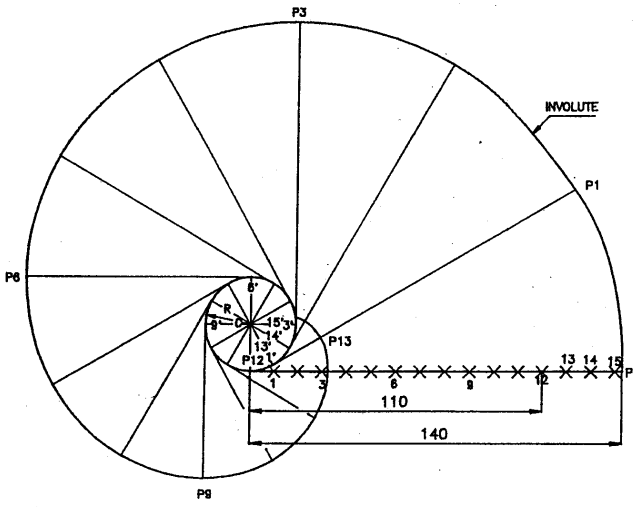


Fig. 1.104

Procedure :-

1. Follow the procedure same as explained in example 63 with a difference of location of point P, which is **outside** the circumference length of tangent line.

Example 66 : Construct one complete turn of an involute of a square of 30 mm side.

Refer Fig. 1.105

Procedure :-

1. Draw a square of 30 mm side and mark corners 1', 2', 3', 4'.
2. Extend lines 4'1', 1'2', 2'3' and 3'4' by suitable amount.
3. Draw quarter circles with centres 4', 1', 2', 3' and radii equal to R_1, R_2, R_3, R_4 respectively to cut previously drawn lines at points P_1, P_2, P_3 and P_4 as shown.
4. Combination of these quarter circles PP_1, P_1P_2, P_2P_3, P_3P_4 the required **involute of a square**.

Note : The same procedure is followed for a regular polygon, in order to get an **involute of a polygon**.

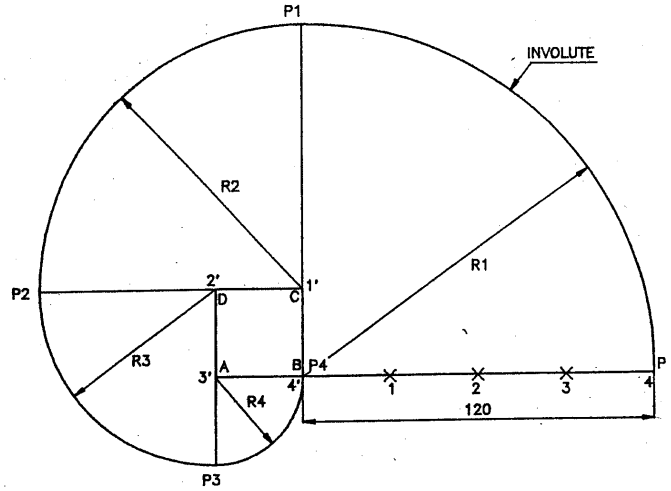


Fig. 1.105

Example 67 : A disc in the form of a semicircle and a semi-regular hexagon of thickness 10 mm is shown in Fig. 1.106(A). The disc is firmly fixed at point "O". An inelastic string of length 160 mm is fixed at point A and the free end B of the string wound round the disc in the anticlockwise direction. Draw the locus of B. Draw tangent and normal to the curve at a distance 110 mm away from the pole "O". Name the curve. (B.U., May '92)

Refer Fig. 1.106 (A)

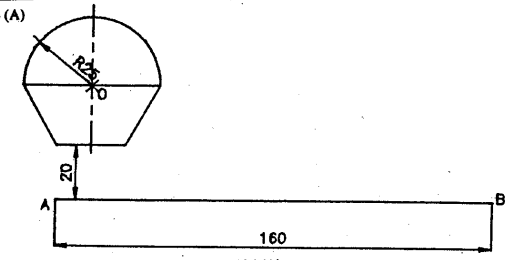


Fig. 1.106 (A)

Refer Fig. 1.106 (B)

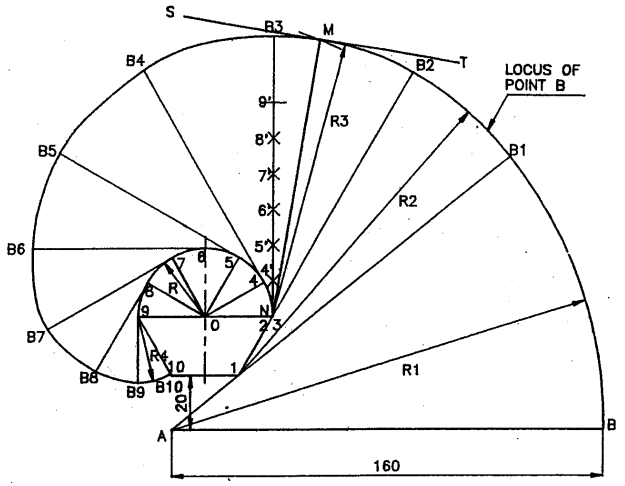


Fig. 1.106 (B)

Procedure :-

1. Locus of point B is shown as B, B_1, B_2, .. B_{10}.
2. Curve B-B_1 is an arc of a circle with radius R_1 and centre as point B.
3. Curve B_1-B_2 is an arc of a circle with radius R_2 and centre as point 1.
4. Curve B_2-B_3 is an arc of a circle with radius R_3 and centre as point 3 (Coincident with point 2).
5. Curve B_3-B_4-B_5-B_6-B_7-B_8-B_9 is obtained as involute of a semi-circle having radius R and centre O_1 with usual procedure of involute.
6. Curve B_9-B_{10} is an arc of a circle with radius R_4 and centre as point 9.

1.6.4 Spirals

Definitions :-

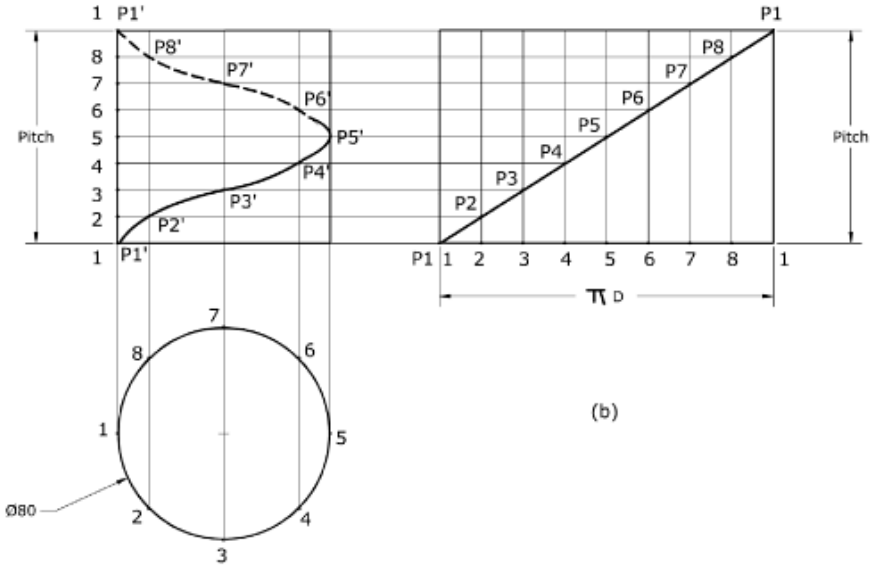
Spiral : If a line rotates in a plane about one of its ends and if at the same time, a point moves along the line continuously in one direction, the curve traced out by the moving point is called a **spiral.**

The point about which the line rotates is called a **pole.** Each complete revolution of the curve is termed the **Convolution.** A spiral may make any number of convolutions before reaching the pole.

W.E. 10.3: *Draw the helix of one convolution on a cylinder of diameter 80mm and height equal to pitch of 100mm.*

The various steps in constructing the helix shown in Fig 10.11 are as follows:

1. Draw the top view and front view of the cylinder. Divide the circle in top view into 8 parts.
2. Indicate the lines in the front view and name them as shown.
3. Mark the pitch from the base on the axis and divide it also into 8 parts. Draw horizontals as shown.



(a) (b)

4. For each 45 degrees of rotation i.e. for every 1/8th rotation, the point moves axially by 1/8th the pitch on the surface.
5. Obtain the points of intersection of horizontal lines and vertical lines as shown.
6. Draw the helix by joining all the points visible by full lines and not visible by dotted. Indicate the points as P1 to P8.

Fig 10.11 (b) represents the development of the cylinder which is a rectangle, with the helix represented by the diagonal of the rectangle as shown. The angle made by the diagonal is called as helix angle.

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Chapter 2:

- Projection of lines

By
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(Tel: 9820246760 / 9769479368)

Projection of Straight Lines

a'b' = FV also horizontal at a (i.e. base of ab_2)
ab = TV also horizontal at a' (i.e. base of $a'b_1'$)

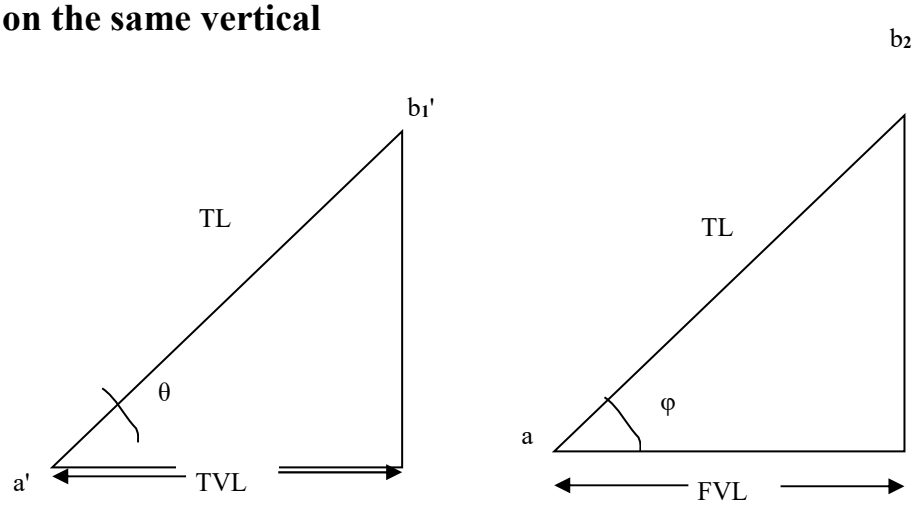
$a'b'_1 = ab_2 = TL$

$\angle a'b' = \alpha$ = angle of front view
$\angle ab = \beta$ = angle of top view

$\angle a'b_1' = \theta$ = angle with HP (seen in VP)
$\angle ab_2 = \varphi$ = angle with VP (seen in HP)

b' and b_1' on the same horizontal
b and b_2 on the same horizontal

a and a' on same vertical
b and b' on the same vertical



1. A line PQ 100mm long is inclined at 40 º to H.P. and 30 º to the V.P. The end P is 10mm above H.P. and 25mm in front of V.P. Assuming the end Q is in the first quadrant draw the projections of line PQ.

2. A line PQ having its end P 25mm above H.P. and 20mm in front of the V.P. The end Q is 85mm above the H.P. and 50mm in front of the V.P. The projector distance between these ends is equal to 80mm. Draw the projections of PQ and show its true length, angle with the H.P. and angle with the V.P.

3. A line AB, 80mm long is inclined at 45 º to the H.P. and 30 º to the V.P. Its end A is in H.P. and 40mm in front of V.P. Draw its projections.

4. A line AB, 80mm long is inclined at 30 º to the H.P. and 45 º to the V.P. Its end A is in H.P. and end B is in V.P. Draw the projections of line AB.

5. The top view of a 80mm long line AB measures 50mm. The point A is 50mm in front of the V.P. and 20mm above the H.P. The point B is 20mm in front of the V.P. and is above the H.P. Draw the front view of AB and find its inclination with the H.P. and the V.P.

6. A line AB 75mm long has its end A in the H.P. and 15mm in front of the V.P. The end B is in the first quadrant. The line is inclined at 35 º to the H.P. and 55 º to the V.P. Draw its projections.

7. A line PQ has its end P 15mm above the H.P. and 25mm in front of the V.P. The line makes an angle of 20 º with the H.P. and its plan measures 90mm. The end Q is in the first quadrant and is equidistant from both the reference planes. Obtain the projections of the line. Find the inclination of the line with the V.P.

8. End M of a line MN which is inclined at 46º to H.P. & 20 º to V.P. is 15mm above the H.P. & it is in front of the V.P., while the end N is 60mm in front of V.P. & is above H.P. Draw the projections of the line, find its true length, if its plan length is 70mm. Locate the points of intersection of the line with the principal planes.

9. The top view & front view of a line AB measures 70mm & 58mm respectively. Line AB is inclined at 35 º to H.P. The end A is 15mm above H.P. & 12 mm in front of V.P. The other end B is also in the first quadrant. Draw the projection of line AB, find its true length & true inclination with V.P.

10. Front view of line PQ is 60 mm long & inclined at 60 º to xy line. The end A is 12mm above H.P. & 25mm in front of V.P. Draw the projections of the line if it is inclined at 45 º to the H.P. & is located in the first dihedral angle. Find the true length & true inclination of the line with the V.P.

11. The front view of the line CD is 50mm long & inclined at 60 º to xy. The end point C is 10mm above H.P. & 20mm in front of V.P. Draw the projections of the line if it is inclined at 45 º to the V.P. & is located in the first dihedral angle. Find the true length & true inclination of the line with the H.P.

12. Line AB 100mm long has its front view inclined at 45 º to xy line. A is in V.P. & 25mm above H.P. The front view measures 60mm. Draw the projections & find true angle of inclination of line with H.P. & V.P.

13. Line AB measures 75mm & is in the first quadrant. Front view & top view are inclined are 45 º to xy. End A is 20mm in front of V.P. & 30mm above H.P. Draw the projections & find true angle of inclination of line with H.P. & V.P.

14. Top view of 75mm long line AB measure 65mm, while the length of its front view is 50mm. End A is 10mm above H.P. & 15mm in front of V.P. The other end is in third quadrant. Draw projections & find inclination of line with H.P. & V.P.

15. Line PQ 150mm long has its end P 55mm behind V.P. & 35mm below H.P. The line makes 30 º with H.P. & has a point on it contained in both the reference planes. Draw the projections; find the inclination with V.P. & the distance of the point which lies in both the reference planes from end P.

16. Line AB 80mm long is inclined at 30 º to H.P. & its top view makes 60 º with xy. End A is in H.P. & 12mm behind V.P. Draw its front view & its true inclination with V.P. Point B is below H.P. & behind V.P.

17. Line PQ 80mm long is inclined at 45 º to H.P. & 30 º to V.P. Its end P is in H.P. & 40mm behind V.P. Draw its projections.

18. Line BC 80mm long is in the second quadrant with end B in H.P. & end C is V.P. The line is inclined at 30 º to H.P. & 45 º to V.P. Draw its projections.

19. Top view of 80mm long line AB measure 50mm. Point A is 50mm in front of V.P. & 20mm below H.P. Point B is 20mm in front of V.P. & is above H.P. Draw the front view of AB & find its inclination with the H.P. & V.P.

20. Line PQ 100mm long is inclined at 40 º to H.P. & 20 º to V.P. End P is in second quadrant & Q in the fourth quadrant. A point R on PQ, 40mm from P is in both the planes. Draw the projections of PQ.

21. Line AB 75mm long has its end A in H.P. & 15mm behind V.P. End B is in first quadrant. AB is inclined at 35 º to H.P. & 55 º to V.P. Draw its projections.

22. Line PQ has its end P 15mm above H.P. & 25mm in front of V.P. PQ makes 20 º with H.P. & its plan measures 90mm. Q is in the second quadrant & is equidistant from both the reference planes. Obtain projection of the line; find the inclination of PQ with V.P.

23. End projectors of line PQ are 80mm apart. P is 20mm above H.P. & 60mm behind V.P. Another point R on line PQ which divides the line in the ratio (PR : RQ) 3 : 5, lies in both the reference planes. Draw the projections; find its true length & inclination with the reference planes. State the position of Q.

24. End projectors of line PQ are 90mm apart. P is 25mm behind V.P. & 30mm below H.P. PQ is inclined at 30 ° to H.P. & 45 ° to V.P. Draw its projection when Q is in the second quadrant. Find its true length.

25. End M of line MN is inclined at 50 ° to H.P. & 30 ° to V.P. & is 15mm below H.P. & behind V.P., while N is 40mm in front of V.P. & above H.P. Draw its projections; find its true length, if its plan length is 70mm.

26. The plan ab of a line AB is 140mm long & makes 45 ° with xy. End A is in V.P. & 85mm from H.P. End B is 20mm from H.P. The whole line lies in the fourth quadrant. Draw its projection; find its true length & inclinations with the reference planes.

27. Front view & top view of line AB 125mm long & lying in third quadrant measures 75mm & 100mm respectively. End A is 30mm from both reference planes. Draw its projection & find its inclination with H.P. & V.P.

28. Line PQ 100mm long is inclined at 30 ° to H.P. & 45 ° to V.P. Its midpoint M is in the V.P. & 20mm above H.P. End P is in third quadrant & end Q is in first quadrant. Draw its projections.

29. End A of line AB 90mm long is in second quadrant & 15mm from both H.P. & V.P. End B is in third quadrant. The line is inclined at 30 ° with H.P. & the distance between the end projectors measured parallel to xy line is equal to 60mm. Draw its projection; find its inclination with V.P.

30. A line AB, 80 mm long, makes an angle of 30° with the V.P. and lies in a plane perpendicular to both H.P. and the V.P. Its end A is in the H.P. and end B is in the V.P. Draw its projections.

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RULES OF PROJECTION OF SOLIDS

(By Abhishek Navlakhi)

Step 1:

➔**Base Edge in H.P.**
True shape in H.P. with that edge perpendicular to xy
Base Line in V.P. on xy

➔**Base Edge in V.P.**
True shape in V.P. with that edge perpendicular to xy
Base Line in H.P. on xy

➔**Corner of Base on/in H.P.**
True shape in H.P. with corner to centre parallel to xy
Base Line in V.P. on xy

➔**Corner of Base on/in V.P.**
True shape in V.P. with corner to centre parallel to xy
Base Line in H.P. on xy

➔**Edge of base parallel to H.P.**
True shape in H.P. with that edge perpendicular to xy
Base Line in V.P. parallel to xy

➔**Base Edge parallel to V.P.**
True shape in V.P. with that edge perpendicular to xy
Line in H.P. parallel to xy

➔**Slant Edge/Generator on/in H.P.**
True shape in H.P. with corner to centre parallel to xy
Base Line in V.P. on xy

➔**Slant Edge/Generator on/in V.P.**
True shape in V.P. with corner to centre parallel to xy
Base Line in H.P. on xy

➔**Face on/in H.P.**
True shape in H.P. with edge perpendicular to xy
Base Line in V.P. on xy

➔**Face on/in V.P.**
True shape in V.P. with edge perpendicular to xy
Base Line in H.P. on xy

Note: *True shape means Base Shape*

Step 2:

➔**Axis inclination**

➔**Slant Edge/ Generator in/on H.P. then place the F.V. of that slant edge or generator on xy (i.e.drop on xy).**

➔**Slant Edge/ Generator in/on V.P. then place the T.V. of that slant edge or generator on xy(i.e.drop on xy).**

➔**Face in/on H.P. then place the F.V. of that face on xy(i.e.drop on xy).**

➔**Face in/on V.P. then place the T.V. of that face on xy(i.e.drop on xy).**

➔**Lifting of the base line**
(lifting of the base line of step 1)

Step 3:

➔**Base Edge Angle**

➔**Any other detail obtained by rotation**

Note: *Locus may be required.*

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Chapter 3:

- Projection of Solids

By
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1. Draw the projections of a pentagonal pyramid, base 30mm edge & axis 60mm long, having its base parallel to the H.P. & an edge of the base perpendicular to the V.P.
2. Draw the projections of a cylinder of base 50mm diameter & axis 75mm long & having its axis perpendicular to the V.P.
3. Draw the projections of a triangular prism, base 50mm edge & axis 70mm long & having its axis parallel to both the H.P. & the V.P. Also the edge of the base perpendicular to the V.P.
4. Draw the projections of a cone, base 60mm diameter & axis 80mm long, when it is resting on the H.P. on a point on its base circle with the axis making an angle of 30° with the H.P. & parallel to the V.P.
5. Draw the projections of a hexagonal prism, base 30mm & axis 70mm long, when its axis is inclined at 30° to the V.P. & parallel to the H.P. An edge of the base is perpendicular to the H.P.
6. Draw the plan & elevation of a right circular cylinder 50mm diameter of base & 90mm long, when its axis is inclined at 50° to the H.P. & 17° to V.P. Assume the object is in the third quadrant.
7. A pentagonal pyramid, base 25mm side & axis 50mm long has edge of the base parallel to the H.P. & inclined at 45° to the V.P. Its axis makes an angle of 60° with the H.P. Draw its projections.
8. A tetrahedron of 60mm long edges has one edge parallel to the H.P. & inclined at 45° to V.P. while the face containing that edge is vertical. Draw its projections.
9. A pentagonal prism of base 30mm & axis 65mm long is resting on a corner of its base on the ground with a longer edge containing that corner inclined at 45° to the H.P. & vertical plane containing that edge & the axis inclined at 30° to the V.P. Draw its projections.
10. A hexagonal pyramid, side of base 50mm & height 90mm rests on one of the edges of its base on H.P., the base being tilted up until the vertex is 60mm above the H.P. Draw the projections of the pyramid with the edge on which it is resting made inclined at 60° to the V.P. Draw its projections.
11. A cube of 60mm sides is resting on the ground on one of its corners, with one of the solid diagonal parallel to the H.P. & inclined at 45° with the V.P. Draw the projections of the cube assuming it is in the third quadrant.
12. Draw the projections of a cone base 50mm diameter & axis 80mm long, having one of its generators in the V.P. & inclined at 30° to the H.P., the apex being in the H.P.
13. A cylindrical disc of 70mm diameter & 35mm length of axis has its axis inclined at 30° to the H.P. & plan of axis inclined at 40° to the V.P. Draw its projections.
14. A triangular prism 20mm side of base & 50mm long rests with one of its shorter edge on the ground such that the rectangular face containing that edge on which the prism rests is inclined at 30^{O} to the ground. The edge on which the prism rests is inclined at 60° to the V.P. Draw its projections.
15. A tetrahedron of 70mm long edge stands on one of its edges in the H.P. with its plane making an angle of 35^{O} with the H.P. The edge of the tetrahedron in the H.P. makes an angle of 35^{O} to the V.P. Draw the projections of the tetrahedron.

16. A square pyramid of base 40mm side & axis 80mm long has one of its triangular faces in the V.P. & edge of its base contained by that face makes an angle of 30^O with the H.P. Draw the projections
17. A frustrum of a pentagonal pyramid base 50mm side, top 25mm side & axis 70mm long, has its side of the smaller pentagon in the V.P. making an angle of 30^O to the H.P. Draw the projections of the solid when its axis is inclined at 60^O to the V.P.
18. A cone, 60mm diameter of base & 70mm height has one of its generators in the H.P. & making an angle of 45^O with the V.P. The apex is towards the observer. Draw the projections of the solid.
19. A square prism, side of base 40mm & axis 70mm is resting on one of the corners of its base on the ground. Draw the projections of the prism when one of its solid diagonal is parallel to the H.P. & inclined at 30^O with the V.P. Assume the object to be in the third quadrant.
20. A pentagonal pyramid side of base 40mm height 60mm is held with the corner of the base on V.P. & the slant edge through that corner perpendicular to V.P. Draw the projections of the pyramid if the plane containing the axis and the above slant edge is inclined to H.P. at 40^O.
21. A hexagonal pyramid of 35mm side of the base & 70mm length of axis is having a corner of its base on ground. The axis makes 40^O with the H.P. The plane containing the axis & corner of base on ground is perpendicular to H.P. & is inclined at 45^O with V.P. Draw the projections of the pyramid as the apex is away from the observer.
22. Draw the projections of a tetrahedron edge 60mm long, resting on a corner on ground with opposite edge parallel to H.P. & inclined at 45^O to the V.P. The edge through the corner on ground is inclined at 45^O to the H.P.
23. A triangular pyramid, 50mm side of base & 70mm height of axis, is suspended by a string attached to one of the corners of its base. Draw the projections of the pyramid if the angle made by the slant edge from the point of suspension is 20^O with the V.P., the apex being nearer to the observer.
24. A right circular cone, diameter of base circle is 60mm & height 80mm rests on its rim on the ground with the vertex 55mm above the ground. The axis of the cone makes an angle of 45^O with the V.P. Draw its projections when vertex is in V.P.
25. A regular pentagonal pyramid of base edge 40mm & length of axis 75mm is held on a corner of its base on ground with the triangular face opposite to it horizontal. Draw the projections of the pyramid when the apex is nearest to the observer.
26. A cone of diameter 80mm & height 90mm is suspended by a string attached to the mid – point of any one of its generators. Draw the projections of the solid when the axis makes 30^O with the V.P., the vertex being away from the observer. Find the inclination of the axis with the H.P.
27. A hexagonal pyramid, edge of base 30mm & length of axis 70mm has a slant edge on the ground making an angle of 45^O with the V.P. Draw the projections of the solid.

28. Draw the plan & elevation of a cube of solid diagonal 80mm length when the solid diagonal is perpendicular to the V.P. & a corner of the cube is in the H.P.
29. A cone of 70mm length of axis is resting on one of its generators, while its axis is inclined at 45^O to the V.P. & the apex is nearer to the V.P. Draw the projections of this cone if the generators of this cone are inclined at 60^O to the base.
30. Frustrum of a square pyramid, top base side 20mm, bottom base side 60mm & axis length 70mm has one of its bottom base sides in the H.P. & parallel to the V.P. while the trapezoidal face containing that base side is vertical & away from the observer. Draw the plan & elevation of the frustrum.
31. A cone of base 50mm diameter & axis 70mm long is lying on one of its generators on the ground with the top view of the axis making an angle of 45^O with the V.P. Draw its projections
32. A pentagonal pyramid has a corner of its base on the H.P. with the triangular face opposite to it inclined at 45^O to the H.P. & a slant edge within that triangular face inclined at 30^O to the V.P. Draw the projections of the pyramid if edges of its base is 30mm & axis is 65mm long.
33. A frustrum of a cone, having bottom base diameter 70mm, top base diameter 30mm & axis 50mm long is resting on one of its generator on the ground. Its axis is inclined at 45^O to the V.P. Draw its projections.
34. A pentagonal pyramid side of base 35mm & axis 70mm long is lying on one of its corners on the H.P. such that the two base edges passing through the corner on which it rests makes equal inclinations with the H.P. One of its triangular surfaces is parallel to the H.P. & perpendicular to the V.P. & the base edge containing that triangular surface is parallel to both H.P. & V.P. Draw the projections of the solid when the apex of the pyramid is nearer to the observer.
35. A square pyramid of side of base 35mm is resting with its apex on the ground such that the inclined edge connecting the apex to one of the corners of the base is vertical & that the triangular face bounded by the vertical edge is perpendicular to the V.P. Draw the projections.
36. Draw three views of a cone having base 60mm diameter & axis 60mm long. D is resting on the ground on a point on its base circle. The axis is inclined at 40^O to the ground & 30^O to the V.P.
37. A regular tetrahedron, edge of base 30mm is held on H.P. on a corner of its base such that the slant edge containing the corner is inclined at 60^O to the H.P. & edge of base opposite the resting corner makes an angle of 45^O to the V.P. Draw the projections.
38. Draw the projections of a square prism resting on an edge of the base in H.P. The axis makes an angle of 30^O with V.P. & 45^O with H.P. Take edge of base as 25mm & axis length 125mm.
39. The body diagonal of a cube is 75mm long & is resting on one of its corners on the ground with the body diagonal perpendicular to the H.P. Draw its projections & find the length of the edges of the cube.
40. A pentagonal pyramid with side of base 20mm & height 80mm is freely suspended from one of the corners of the base in such a manner that the pyramid is inclined at 30^O to the V.P. Draw the projections of the pyramid.

41. A tetrahedron of 75mm long edges having one edge parallel to the H.P. & inclined at 45^O to the V.P. while a face containing that edge is vertical. Draw its three views.
42. A pentagonal pyramid, base 40mm side & height 75mm rests on one edge of its base on the ground so that the highest point in the base is 25mm above the ground. Draw its projections when the axis is parallel to the V.P. Draw another front view on the auxiliary vertical plane inclined at an angle of 30^O to the edge on which it is resting so that the base is visible.
43. Draw the projections of a pentagonal pyramid, side of base 40mm & height 70mm resting in the corner of its base. The slant edge containing that corner makes an angle of 60^O to the H.P. Plane containing the axis & that slant edge makes an angle of 45^O with the V.P.

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Chapter 4:

- Section of Solids

By
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Section of Solids

1. A hexagonal prism, side of base 30mm & height 80mm is resting on one of its corners on the H.P. with a longer edge containing that corner inclined at 60^{O} to the H.P. & a rectangular face parallel to the V.P. A horizontal section plane passes through the midpoint cuts the prism of axis in two pieces. Draw the front view & sectional top view of the cut prism.

2. A square pyramid, base 40mm side & 80mm height stands vertically on the H.P. with the edges of the base equally inclined to the V.P. The cutting plane, parallel to the V.P. & 15mm away from the axis of the pyramid & nearer to the observer cuts the solid. Draw the sectional elevation & plan of the pyramid.

3. A tetrahedron of 70mm long edges is resting on its base in the H.P. with an edge contained by that base perpendicular to the V.P. A section plane which is perpendicular to both the H.P. & the V.P. cuts this solid & which is 15mm away from the axis of tetrahedron & nearer to the observer. Draw its front view, top view & sectional side view.

4. A cube of 75mm long edges has its vertical face equally inclined to the V.P. It is cut by a section plane perpendicular to the V.P., so that the true shape of the section is a regular hexagon. Determine the inclination of the cutting plane with the H.P. & draw the sectional top view & true shape of the section.

5. A hexagonal pyramid has 50mm side & axis 100mm long, is lying on the H.P. on one of its triangular faces with the axis parallel to the V.P. A vertical section plane, the H.T. of which makes an angle of 30^{O} with the reference line, passes through the centre of the base & cuts the pyramid, the apex being retained. Draw the top view, sectional front view & true shape of the section.

6. A pentagonal pyramid of base 50mm side & axis 100mm long is resting on the H.P. on its base, with an edge perpendicular to the V.P. It is cut by a sectional plane which is perpendicular to the P.P. & inclined at 30^{O} to the H.P. The section plane is passing through the mid – point of the axis. Draw the sectional elevation, sectional plan & true shape of the section.

7. A square pyramid base 40mm side & axis 70mm long, is resting on the H.P. on one of its triangular faces, the top view of the axis making an angle of 25^O with the V.P. It is cut by a horizontal section plane, the V.T. of which intersects the axis at a point 8mm from the base. Draw the front view, sectional top view.

8. A square pyramid of sides of base 70mm & length of axis 100mm is placed with one of its triangular faces on the ground with axis parallel to V.P. It is cut by an AVP passing through the C.G. of the solid & inclined at 30^O to V.P. & removing the apex. Draw sectional elevation, plan & show the true shape of the section.

9. A cone 70mm diameter of base & 100mm height is resting on the ground on its curved face with its axis parallel to the V.P. It is cut by an A.I.P. inclined at 30^O to the H.P. & passing through a point on the axis 5mm from the base. Draw the projections if the apex is retained. Project the true shape of the section.

10. A cone of diameter of base 60mm & axis 80mm rests on the H.P. on a point of its base. The axis of cone makes 60^O with H.P. & parallel to V.P. The cone is cut by a vertical cutting plane passing through the mid – point of the axis making an angle of 45^O with V.P. Draw the projections of the solid when smaller part is removed. Also draw the true shape of the section.

11. A rectangular prism with sides of base 40mm & 60mm has height of 65mm & stands on the ground on its base with longer side of the base inclined to the V.P. at 30^O. An A.I.P. inclined at 45^O to the ground cuts the solid & passes through the point on the axis 20mm below the top face. Draw the sectional top view, sectional side view & true shape of the cut surface.

12. A hexagonal prism, side of base 25mm & axis 65mm long is resting on an edge of the base on the V.P. Its axis is inclined at 60^O to the V.P. & parallel to the H.P. A section plane inclined at 45^O to the V.P. & normal to the H.P. cuts the prism & passes through a point on the axis at a distance of 25mm from the top end. Draw the projections, sectional front view & true shape of the section.

13. A semi – cone of diameter 80mm & 90mm axis length is resting on its semi circular base on H.P. such that the triangular face of the semi – cone is parallel to the V.P. & away from the observer. It is cut by a section plane perpendicular to the V.P. & inclined at 45^{O} to the H.P. passing through the midpoint of the axis. Draw the sectional plan, elevation & true shape of the section. Also add the right hand side view which gives the sectional detail on it.

14. A cone, base 70mm diameter & axis 70mm long, has its axis parallel to the V.P. & inclined at 45^{O} to the H.P. A horizontal section plane cuts the cone through the mid – point of the axis. Draw the front view, sectional top view.

15. A vertical cone, diameter of base 80mm is resting on its base on the ground. It is cut by an A.I.P. so that true shape of the section is an equilateral triangle with 70mm side. Determine the length of the axis of the cone & draw the three views.

16. A cone diameter of base 50mm & axis 60mm long is resting on its base on the ground. It is cut by a section plane perpendicular to both the reference planes in such a way that the true shape of the section is a hyperbola having 40mm base. Draw the front view, top view & sectional view.

17. A cone diameter of base 50mm, height 50mm is cut by an A.I.P. such that the true shape of the cut surface is a parabola of height 45mm. Draw its projections when it is placed on its cut surface on the H.P.

18. A cone diameter of base 80mm is cut in such a way that true shape is an isosceles triangle of 50mm base & 70 mm altitude. Draw projections of the larger piece when it is placed on the ground on its cut surface.

19. A cone of base diameter 80mm & 90mm height is resting on the H.P. on its base. It is cut by an A.I.P. in such a way that the true shape of the cut surface is a parabola of 55mm axis length. Draw the F.V. & the T.V. of the remaining portion of the cone. Show also the true shape of the section.

20. A right circular cone of diameter 60mm & length of axis 60mm is resting on H.P. on its base. It is cut by a cutting plane perpendicular to the V.P. & inclined to H.P. such that the true shape is a parabola of height 60mm. Draw the front view, sectional top view & true shape of the section. Measure the angle made by the cutting plane to the H.P.

21. A cylinder of 50mm diameter of base & 75mm length of axis, has one of its ends on the H.P. It is cut by an A.I.P. in such a way that the true shape of the section is an ellipse of largest possible major axis. Draw the sectional plan, true shape of the section & find inclination of the section plane with the H.P.

22. A semi – cylinder of 60mm diameter is resting on its rectangular surface on the ground such that its axis is perpendicular to the V.P. It is cut by a plane perpendicular to both the reference planes so that the true shape of the section is a rectangle of 70mm X 20mm. Draw the three views.

23. A vertical cylinder of 50mm diameter is cut by an A.V.P. making 20^{O} to V.P. in such a way that the true shape of the section is a rectangle of 34mm & 80mm sides. Draw the projections & true shape of the section.

24. A tetrahedron of 60mm long edges is lying on the H.P. on one of its faces, with an edge perpendicular to the V.P. It is cut by a section plane which is perpendicular to the V.P. so that the true shape of the section is an isosceles triangle of base 45mm long & altitude 35mm. Find the inclination of the section plane with the H.P. & draw the elevation, sectional plan & true shape of the section.

25. ABCD is a tetrahedron of 70mm long edges. The face ABC is on the H.P. with edge AB perpendicular to V.P. The solid is cut by an A.I.P. in such a way that the true shape of the section is a trapezoid of parallel sides 40mm & 18mm. Draw the projections of the solid, sectional plan & true shape of the section. Find the inclination of the cutting plane with the H.P.

26. A triangular prism 60mm edge of base, 50mm height stands on its triangular face on ground, with one of its rectangular faces inclined to V.P. at 30^{O}. It is cut by an A.I.P. such that the true shape of the section is a trapezium of 10mm & 50mm parallel sides. Draw its projections when it rests on its cut surface on ground.

27. The true section of the vertical square prism cut by an inclined plane is a rhombus of 40mm & 80mm long diagonals. The plane cuts one of its longer edges at a height of 20mm from the base. Find the inclination of the cutting plane with the H.P. & draw the front view, sectional top view & true shape of the section.

28. A cube of side 40mm is lying on the H.P. on its square base. It is cut by a section plane such that the true shape of the section is a trapezium of parallel sides equal to the length of the diagonal of the square face for one side & half of that length for the other side. Draw the front view, sectional top view & true shape of the section. Measure the angle made by the cutting plane with the H.P. Measure the angle made by cutting plane with the H.P.

29. A pentagonal pyramid side of base 35mm & height 70mm rests on its base in H.P. with one side of its base perpendicular to V.P. It is cut by sectional plane such that:
    a. The true shape of the section is an isosceles triangle of maximum base & minimum height
    b. The true shape of the section is an isosceles triangle of maximum base & maximum height
    c. The true shape of the section is an equilateral triangle of maximum side.

Locate the position of section planes in all the above cases & find the true shape of the section in each case.

30. A square pyramid of 60mm side of base & 70mm length of axis is resting on its base on the ground, having a side of base perpendicular of the V.P. It is cut by two cutting planes; one is parallel to its extreme right face & 10mm away from it while the other plane is parallel to the extreme left face. Both cutting planes intersect each other on the axis of the pyramid. Draw the sectional top view, front view & project the side view.

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Chapter 5:

- Development of Surfaces

By

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Development of Surfaces

1. A hexagonal pyramid of 25 mm edge of the base and axis 50 mm long is resting on its triangular face in H.P. with the axis parallel to the V.P.It is cut by a section plane perpendicular to the H.P.inclined at 30^0 to the V.P. and passing through a point on the axis 20 mm from the base Draw top view, sectional front view and true shape of the section when the apex is removed. 12

2. A hexagonal pyramid base 25 mm side, axis 55 mm long has its base on HP, with an edge of base parallel to VP. A section plane perpendicular to VP and inclined at 60 degrees to HP bisects the axis of the pyramid. Draw FV, sectional TV, true shape of the section and Development of Lateral Surface of pyramid removing apex.

3. A right circular cone of base circle diameter 50 mm and axis 60 mm long is resting on its base on HP. It is cut by a section plane which is perpendicular to VP and inclined to HP such that the plane is parallel to the end generator and 10 mm away from it. Draw the front view, the sectional top view and the true shape of section. Also draw the development of the cone after removing the portion containing the apex. [15]

4. A cylinder, 40 mm diameter and 60 mm long is resting on its base on HP. It is cut by a section plane perpendicular to VP , inclined at 45^0 to HP and passing through the midpoint of the axis. Draw the front view, sectional top view and true shape of the section. Also develop the lateral surface of the cut cylinder. 15

5. A cone of diameter 60mm and height 75mm is resting on H.P. on its base, it is cut by a section plane inclined to HP and perpendicular to VP such that the true shape of the section is a parabola with axis is equal to 60mm. Draw, [15]
   i) Front view (ii) Sectional Top view (iii)True shape of section
   ii) Develop the lateral surfaces of the retained portion of the cone after section.

6. A cone of base 70 mm diameter and axis 90 mm long is resting on its base on HP. It is cut by a section plane perpendicular to the VP and parallel to and 15 mm away from one of its end generators. Draw the sectional top view, front view & sectional side view. Also draw the true shape of the section. Also draw development of the lateral surface of the cone. (15)

7. A right circular vertical cone, base diameter 50 mm and axis 60 mm long is cut by an AIP and bisecting the axis. Draw Front View, Sectional Top View and True Shape of the Section if True Shape of the Section is an ellipse with major axis is 40 mm. What is the inclination of the cutting plane with H.P.? Also draw Development of Lateral Surface of remaining portion of the solid. [15]

8. A hexagonal pyramid of side of base 40mm and axis length of 70mm is resting on its base on HP with two base edges perpendicular to VP. It is cut by an auxiliary inclined plane 60° to HP and passing through a point on the axis 40mm above the base. Draw the front view, sectional top view and the true shape of the section. Also draw the development of the lateral surface of the cut pyramid after removing the portion containing the apex. [15]

9. A square pyramid of base side 25mm and altitude 50mm rests on its base on the HP with two sides of the base parallel to VP. It is cut by a plane bisecting the axis and inclined at 30^0 to the base. Draw front view, sectional top view and true shape of the section. Also draw the development of the lower part of the pyramid. 15

10. A square pyramid of base side 25mm and altitude 50mm rests on its base on the HP with two sides of the base parallel to VP. It is cut by a plane bisecting the axis and inclined at 30° to the base. Draw front view, sectional top view and true shape of the section. Also draw the development of the lower part of the pyramid. 15

...70mm has 6

11. A cone of 70 mm height of axis and base diameter 60 mm is resting on its base on H.P. It is cut by a section plane parallel to one of its end generators and 12 mm away from it. Draw development of lateral surface of truncated solid. 07

12. A cone of base diameter 50 mm and axis height 65 mm is resting on HP on one of its generators with axis parallel to the VP. It is cut by A.I.P. such that the true shape of the section is a parabola with the axis length equal to 60 mm. Draw the projections of cut solid & also draw development of lateral surface of remaining part of the cone (apex is removed). [15]

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Chapter 6:

- ⊕RTH⊕GRAPHIC PR⊕JECTI⊕NS

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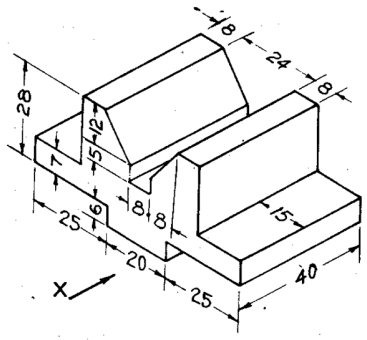
(1) Fig. 18-23:

(i) Front view.

(ii) Side view.

(iii) Top view.

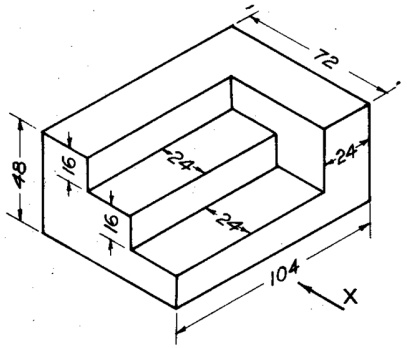


(2) Fig. 18-24:

(i) Front view.

(ii) Side view from the left.

(iii) Top view.



(3) Fig. 18-25: (i) Front view. (ii) Side view. (iii) Top view.

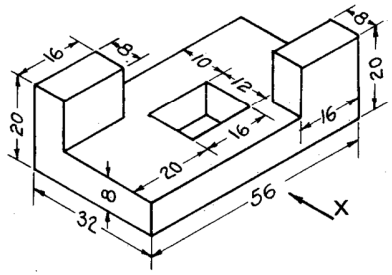


FIG. 18-25

(4) Fig. 18-26: (i) Front view. (ii) Side view from the left. (iii) Top view. Use first-angle projection method.

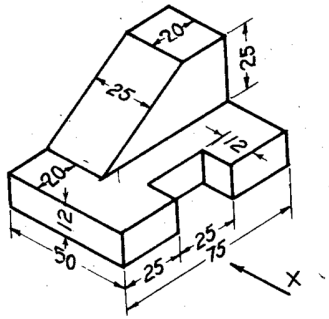


FIG. 18-26

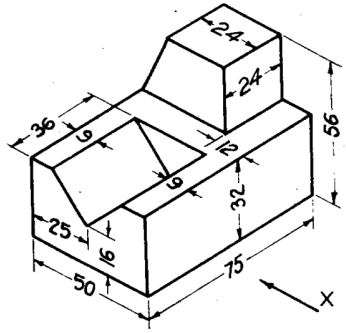


FIG. 18-27

(5) Fig. 18-27: (i) Front view. (ii) Both side views. (iii) Top view.

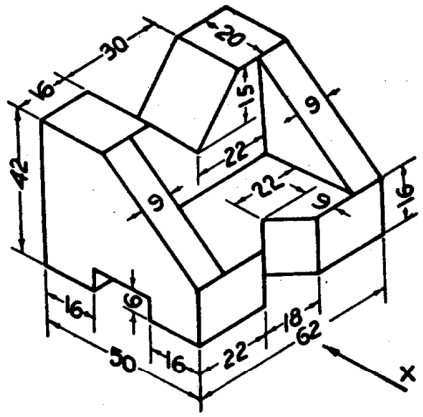


FIG. 18-28

(6) Fig. 18-28: (i) Front view. (ii). Side view. (iii) Top view. Use first-angle projection method.

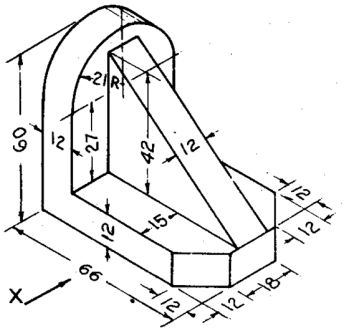
(14) Fig. 18-36:

(i) Front view.

(ii) Side view from the right.

(iii) Top view.

Use first-angle projection method.



(15) Fig. 18-37: (i) Front view. (ii) Side view. (iii) Top view.

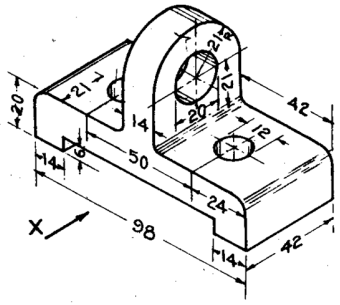


FIG. 18-37

(16) Fig. 18-38: (i) Front view. (ii) Side view. (iii) Top view.

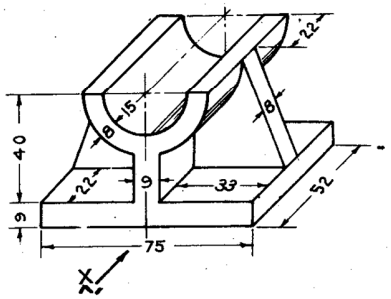


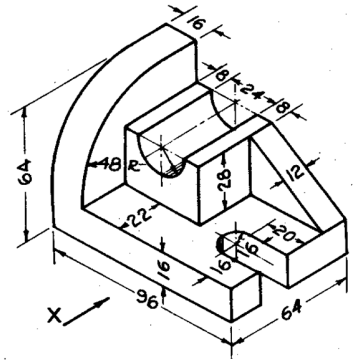
FIG. 18-38

(17) Fig. 18-39:

(i) Front view.

(ii) Side view from the right.

(iii) Top view.

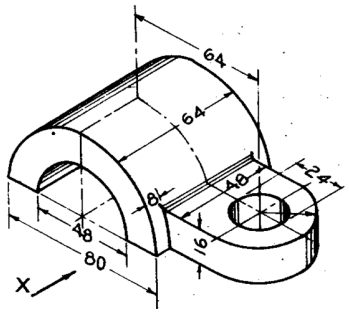


(18) Fig. 18-40:

(i) Front view.

(ii) Side view from the right.

(iii) Top view.



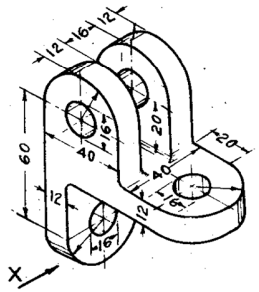
(19) Fig. 18-41:

(i) Front view.

(ii) Both side views.

(iii) Top view.

Use first-angle projection method.



(20) Fig. 18-42: (i) Front view. (ii) Side view from the right. (iii) Top view.

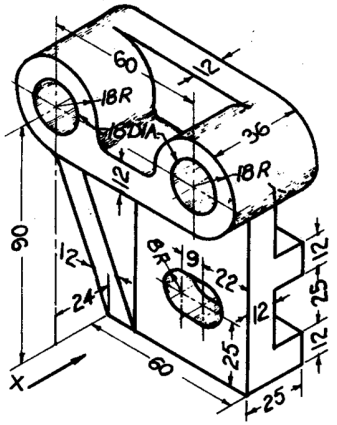


FIG. 18-42

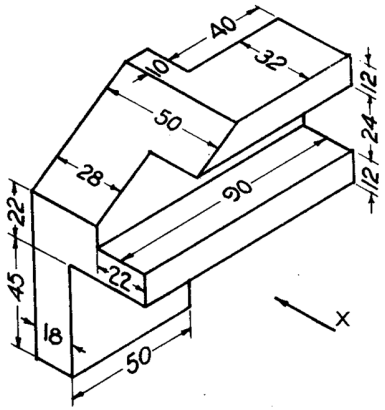


FIG. 18-43

(21) Fig. 18-43: All the six views.

(22) Fig. 18-44: (i) Front view. (ii) Side view from the left. (iii) Top view.

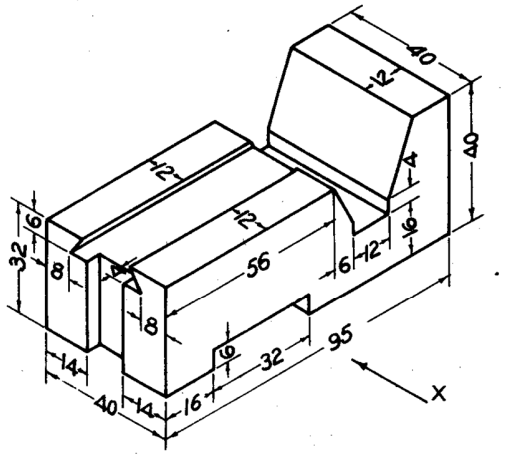


FIG. 18-44

(23) Fig. 18-45: (i) Front view. (ii) Both side views. (iii) Top view.

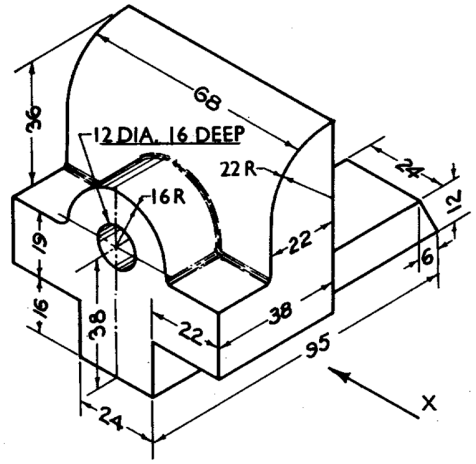


FIG. 18-45

(24) Fig. 18-46: All the six views according to first-angle projection method.

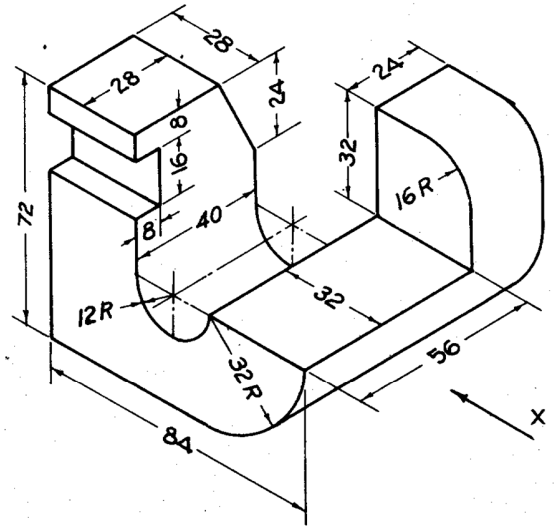


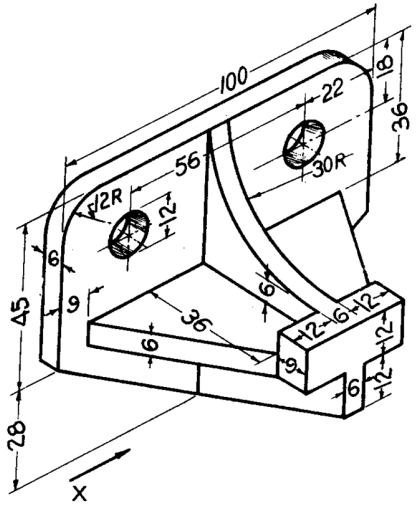
FIG. 18-46

(25) Fig. 18-47:

(i) Front view.

(ii) Side view from the right.

(iii) Top view.



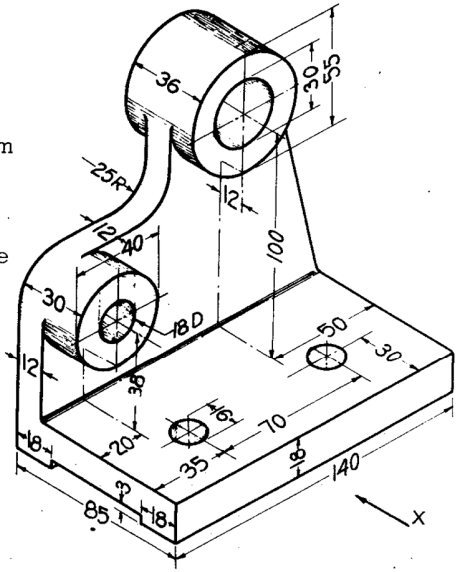
(26) Fig. 18-48:

(i) Front view.

(ii) Side view from the left.

(iii) Top view.

Use first-angle projection method.



(27) Fig. 18-49: (i) Front view. (ii) Side view. (iii) Top view. Use first-angle projection method.

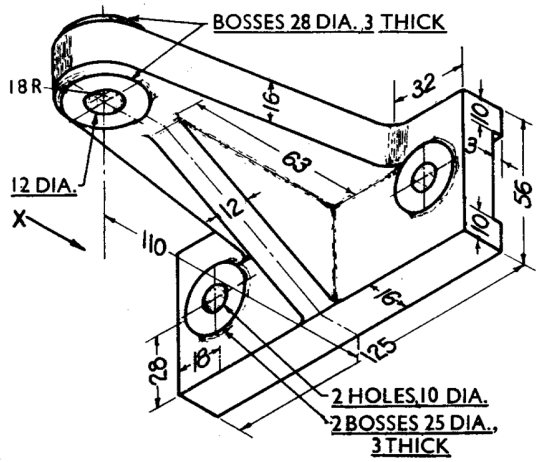


FIG. 18-49

(28) Fig. 18-50: (i) Front view. (ii) Both side views. (iii) Top view.

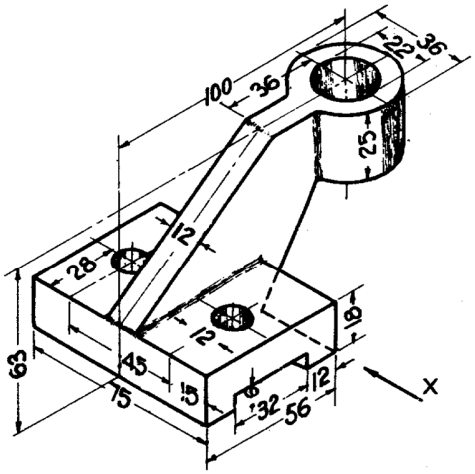


FIG. 18-50

(29) Fig. 18-51: (i) Front view. (ii) Side view from the right. (iii) Top view.

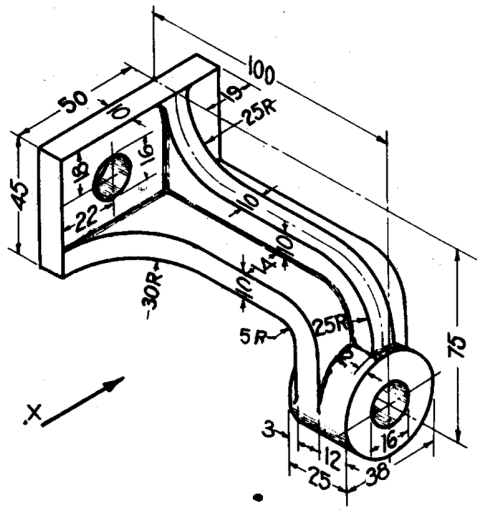


FIG. 18-51

(30) Fig. 18-52: (i) Front view. (ii) Side view from the left. (iii) Top view. Use first-angle projection method.

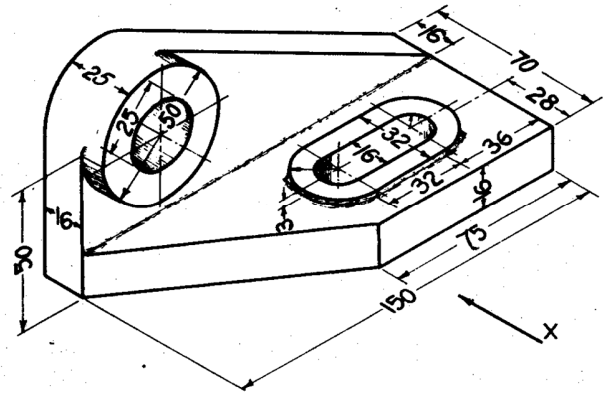


FIG. 18-52

(31) Fig. 18-53: (i) Front view. (ii) Both side views. (iii) Top view.

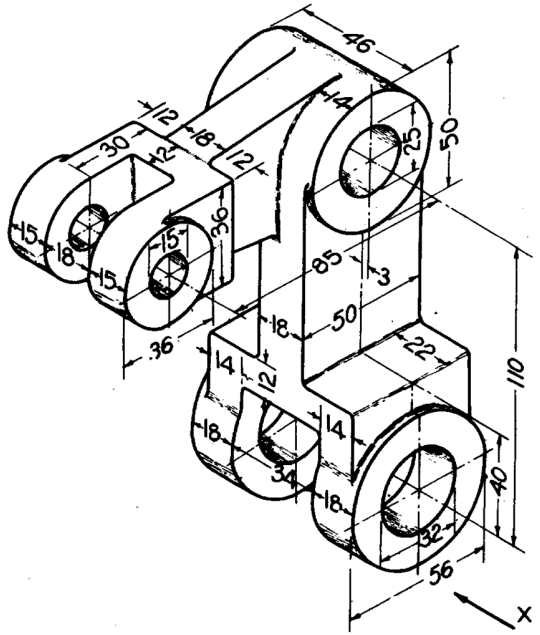
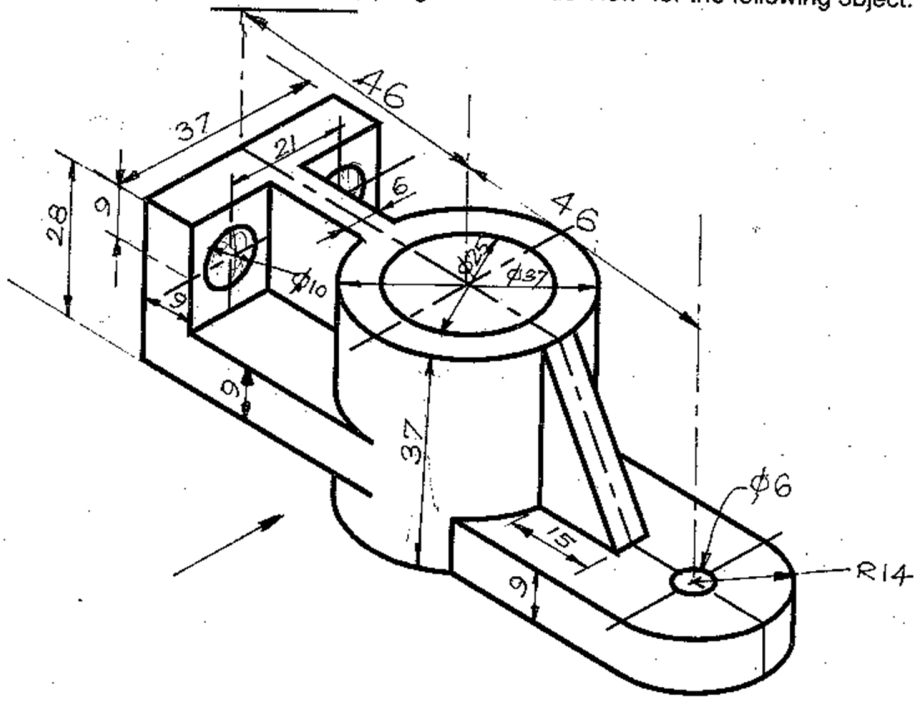
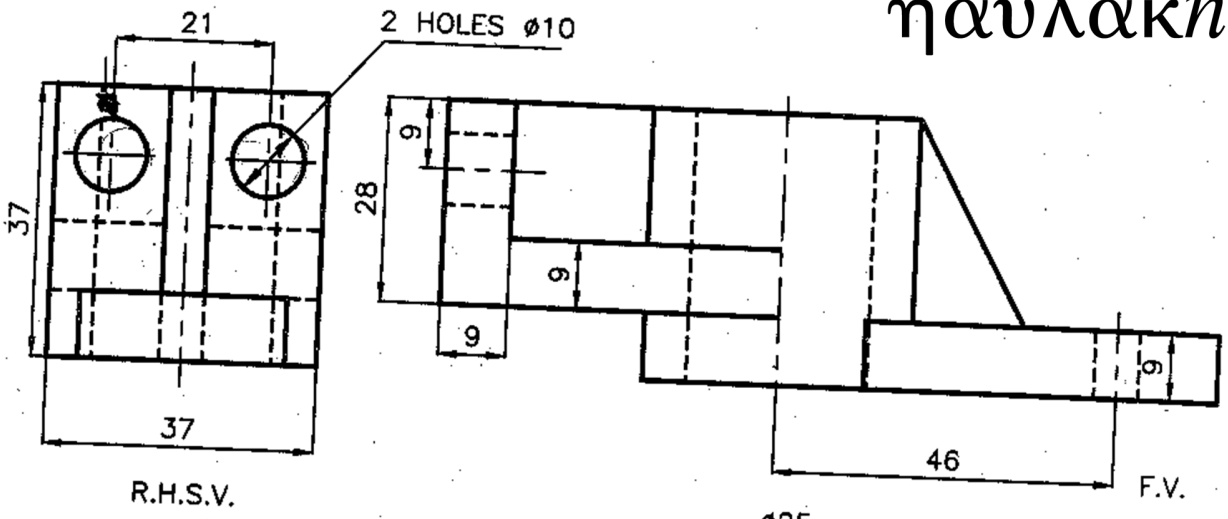
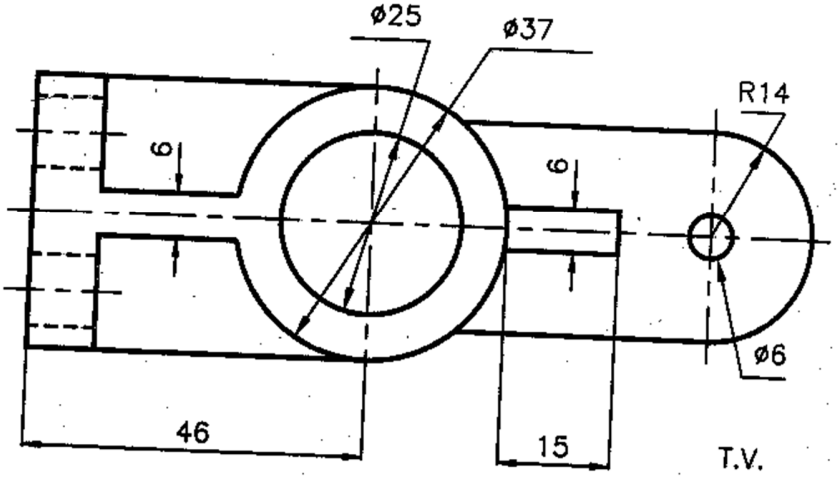


FIG. 18-53

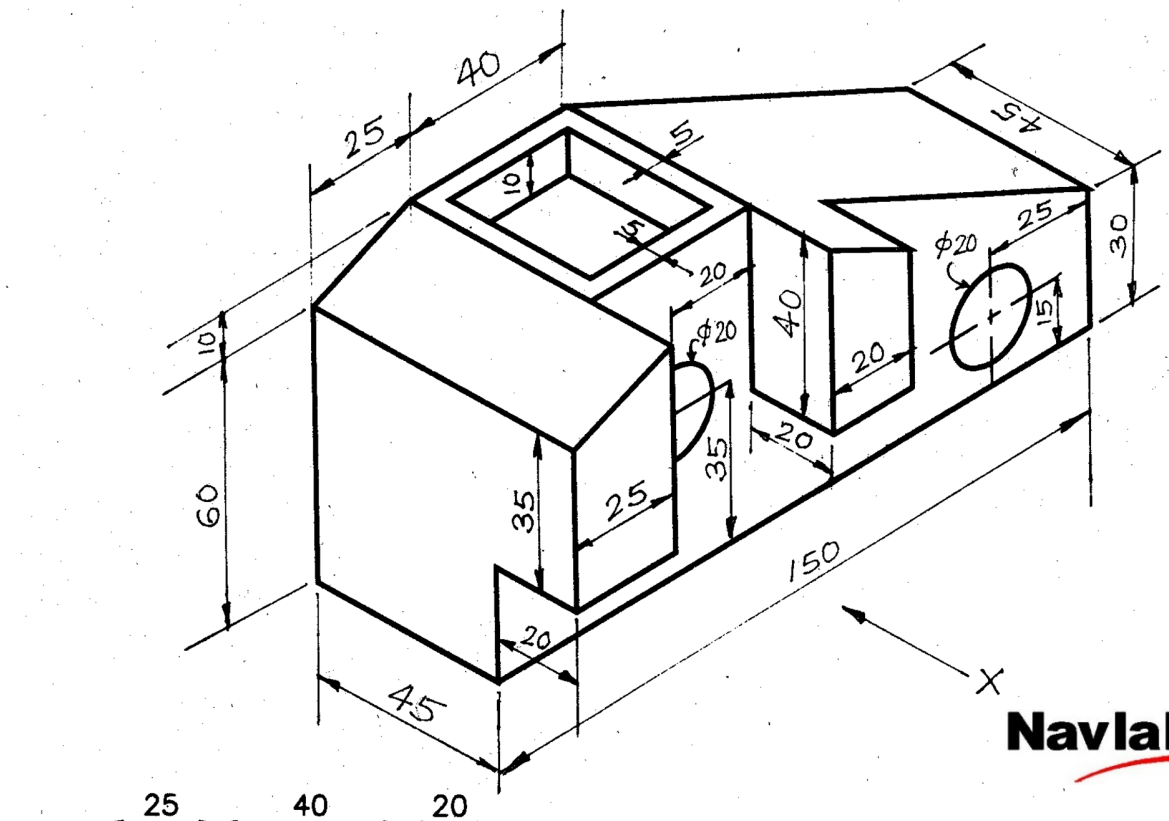
Example Using First Angle Projection Method draw -
(a) Front View (b) Top View and (c) Right Hand Side View for the following object.

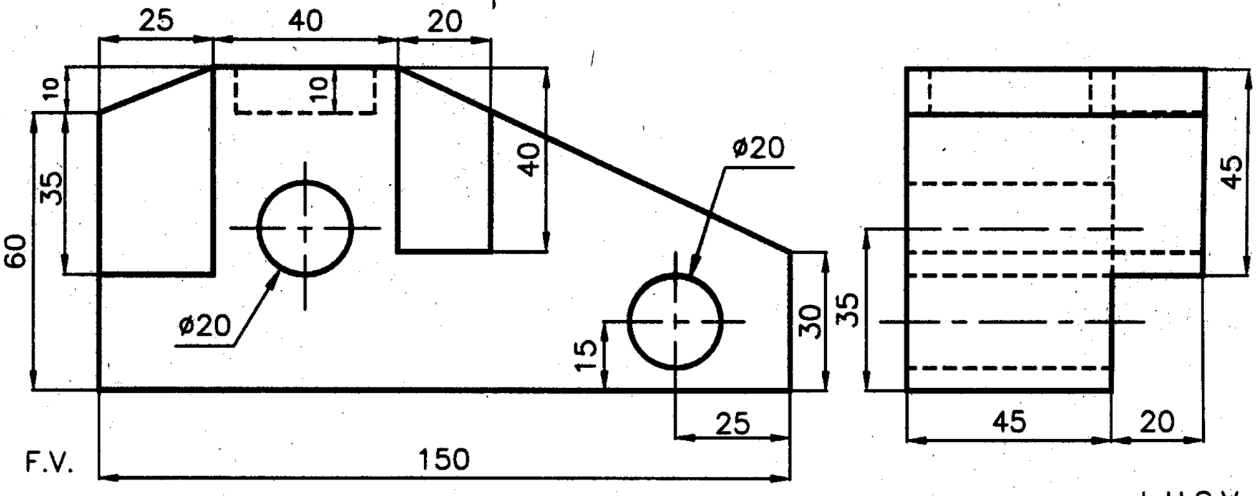


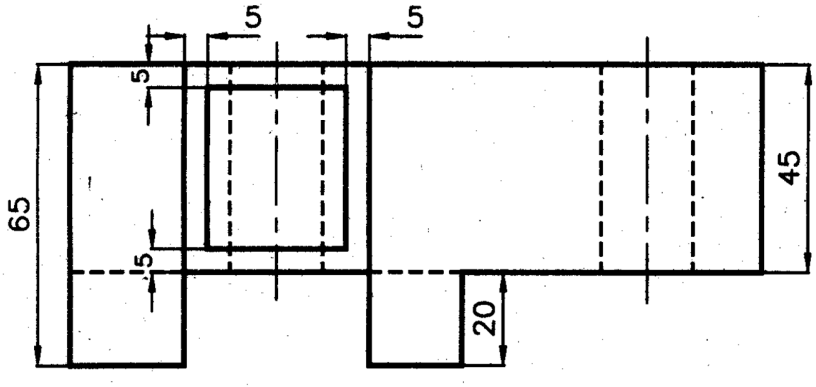




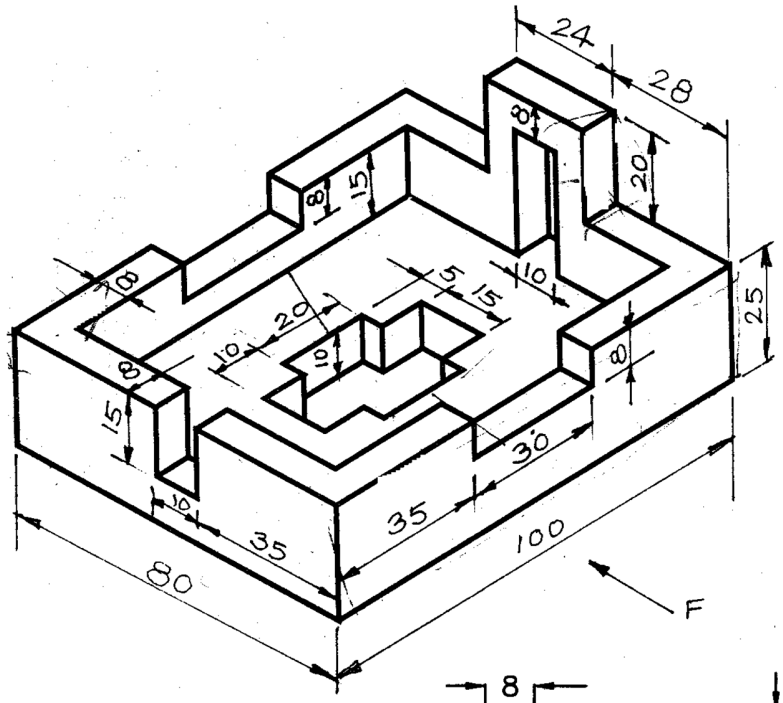
Example Figure shows the pictorial view of a machine block. Draw the following views : (i) Front View looking in the direction of arrow X. (ii) Top view. (iii) Left Hand Side View. Show all hidden details. Use 1 : 1 scale.

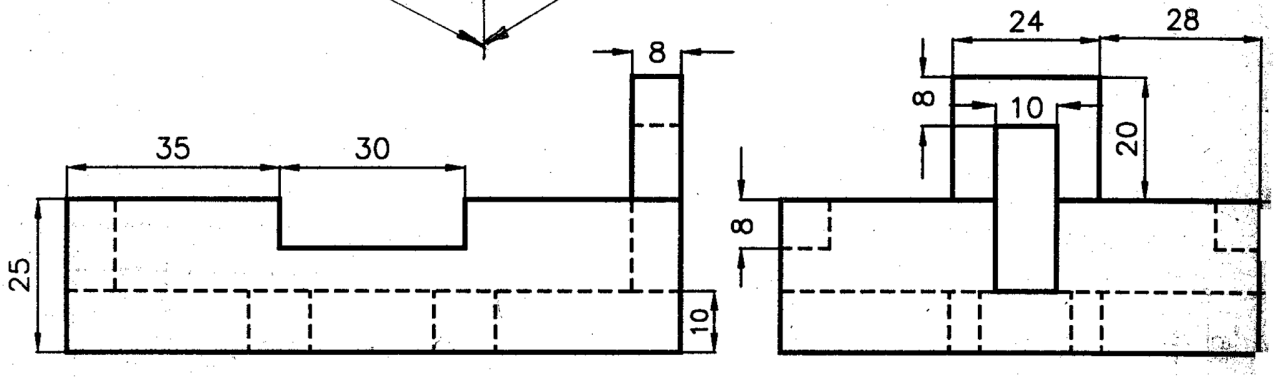


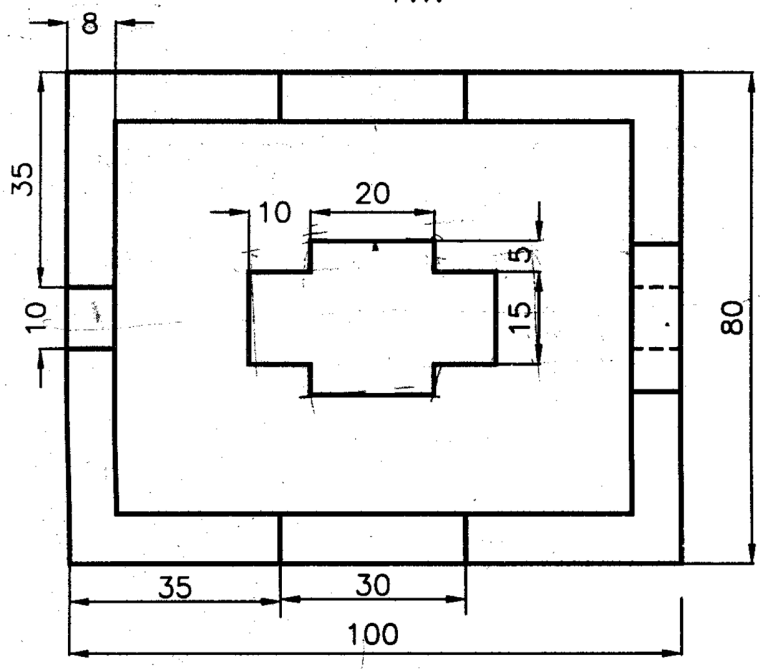




Example Figure shows the pictorial view of a machine block. Draw the following views : (i) Front View looking in the direction of arrow F. (ii) Top View; (iii) Left Side View. Show all the hidden details. Use 1 : 1 scale.







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Chapter 7:

- Sectional Orthographic

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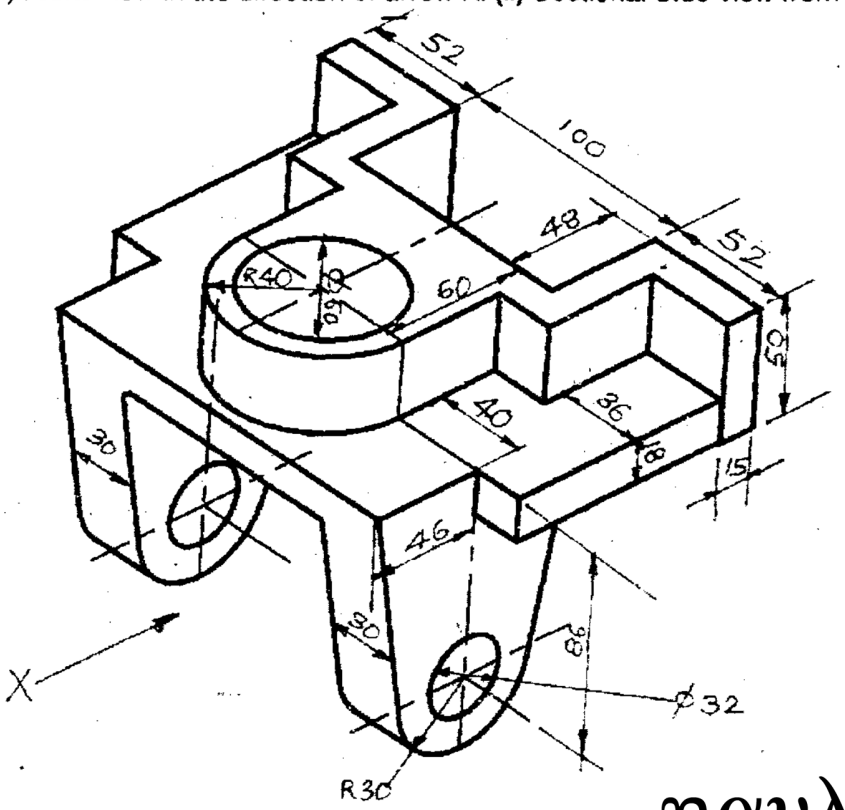
Pictorial view of a block is shown in the figure. Draw the following views using First Angle Projection Method.

(i) Front View in the direction of arrow X. (ii) Sectional Side view from right.



Using Third Angle Projection Method draw -

(a) Sectional Front View; (b) Top View and (c) R.H. Side View for the following object.

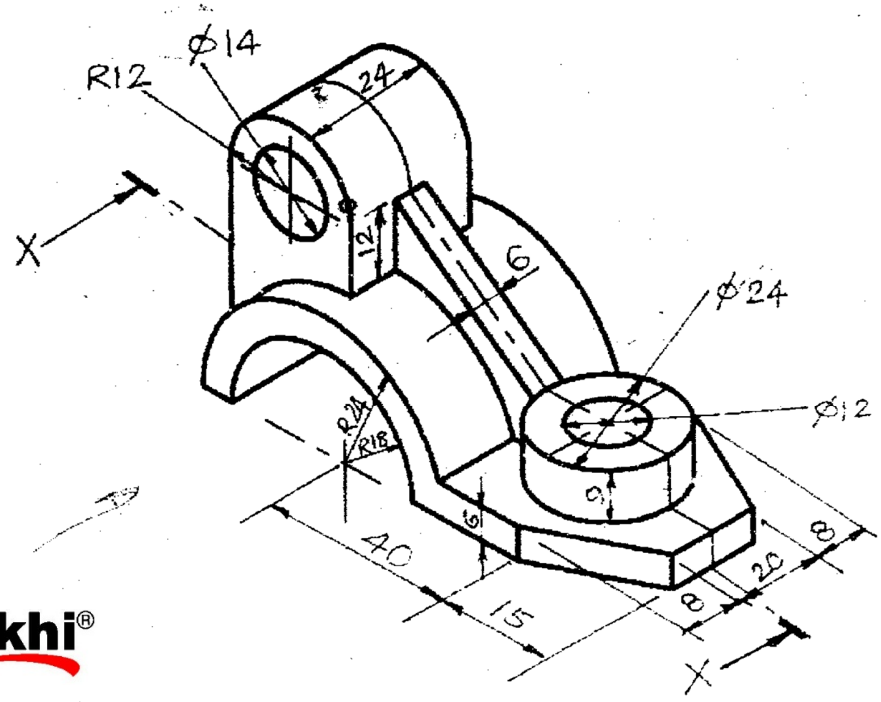


Figure shows an object. Draw the following : (i) Sectional Front View on section A looking in the direction of arrow X; (ii) Top View; (iii) Left Hand Side View. Use First Angle Projection Method only

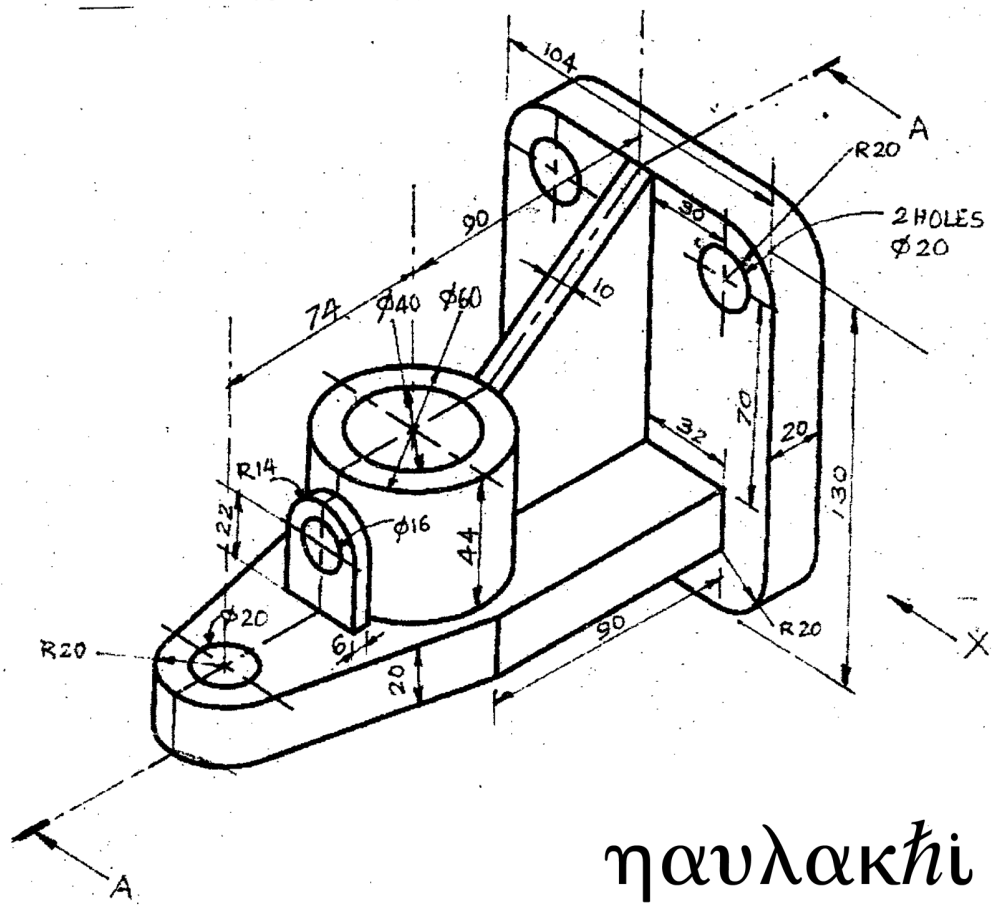


Figure shows the pictorial view of a machine part. Draw the following views using 1 : 1 scale: (i) Sectional Front View along S-S looking in the direction of arrow F; (ii) Top View; (iii) Left Side View. Show all the hidden details.

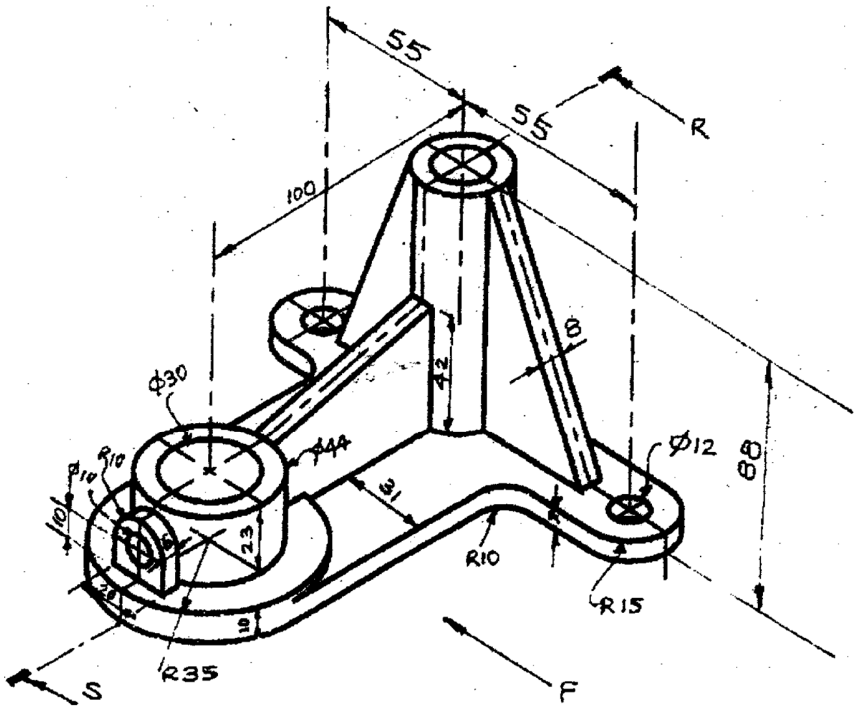


Figure shows the pictorial view of a machine part. Draw the following views using 1 : 1 scale: (i) Sectional Front View along S-S looking in the direction of arrow F; (ii) Top View; (iii) Left Side View. Show all the hidden details.

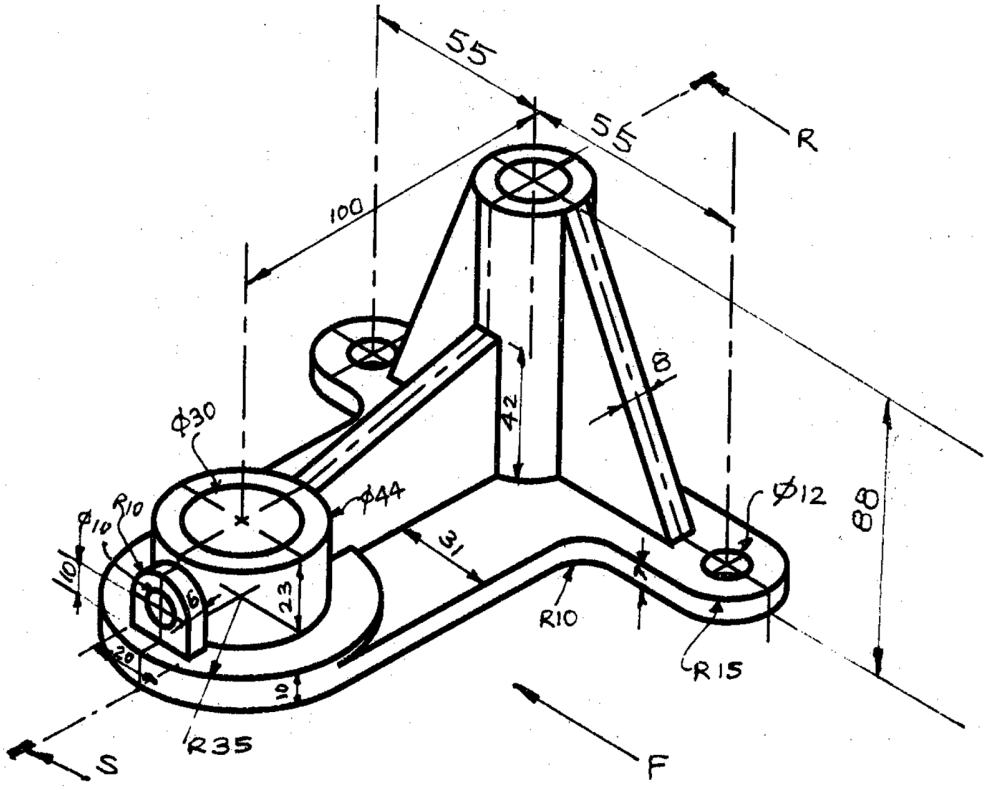
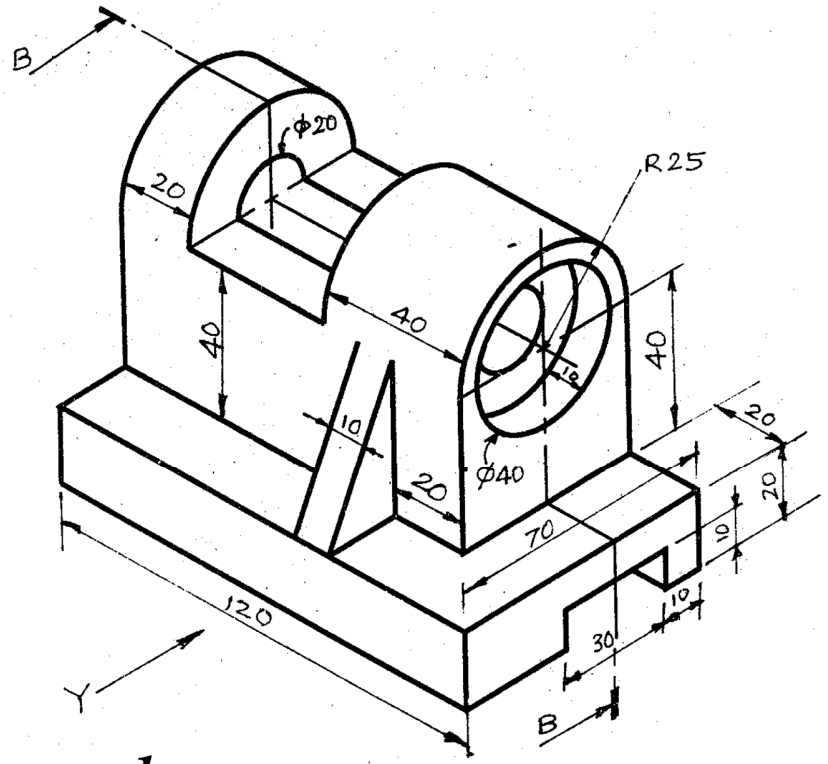


Figure shows the isometric view of a block. Draw the following : (i) Sectional Front View looking along arrow Y (Section B-B); (ii) Top View; (iii) Right Side View. Use First Angle Method of Projection only.



For the object shown, draw the following views using First Angle Method of Projections
(a) Front View in the direction X, (b) Top View, (c) Left Hand Side View. Show all the dimensions.

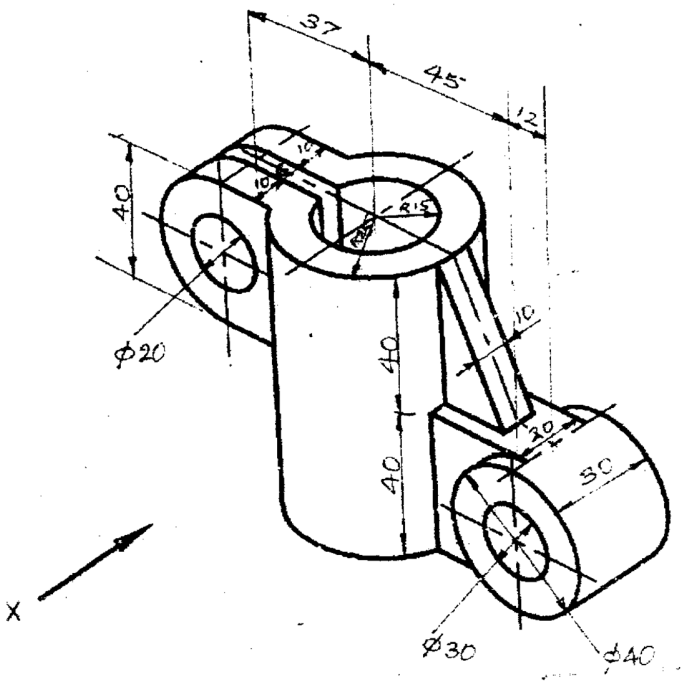


Figure below shows a Block. Using first angle method the following:

(a) Sectional front view on B–B,
(b) Top view,
(c) Side view from left.

Insert important dimensions.

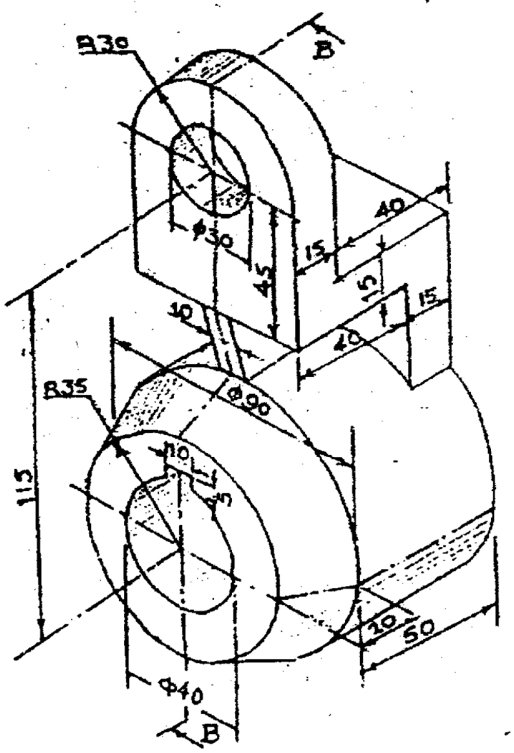


Figure shows pictorial view of a bracket. Draw by First Angle Projection Method the following views : (i) Sectional Front View along A, looking in the direction of arrow P; (ii) Sectional top view along B-B; (iii) Left Hand Side View with all hidden details.

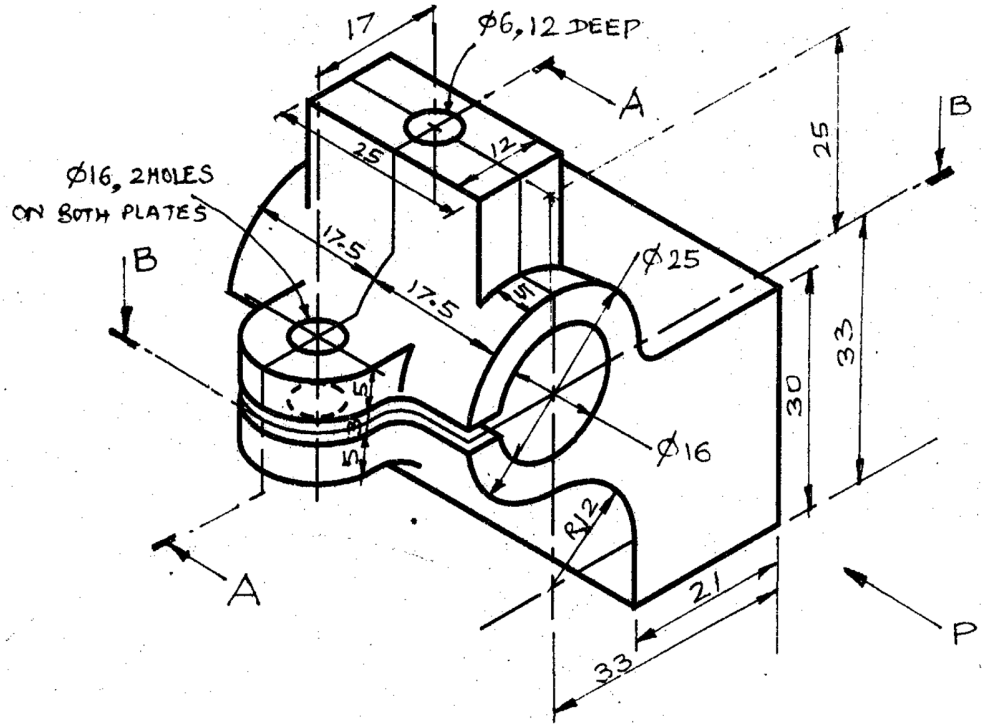
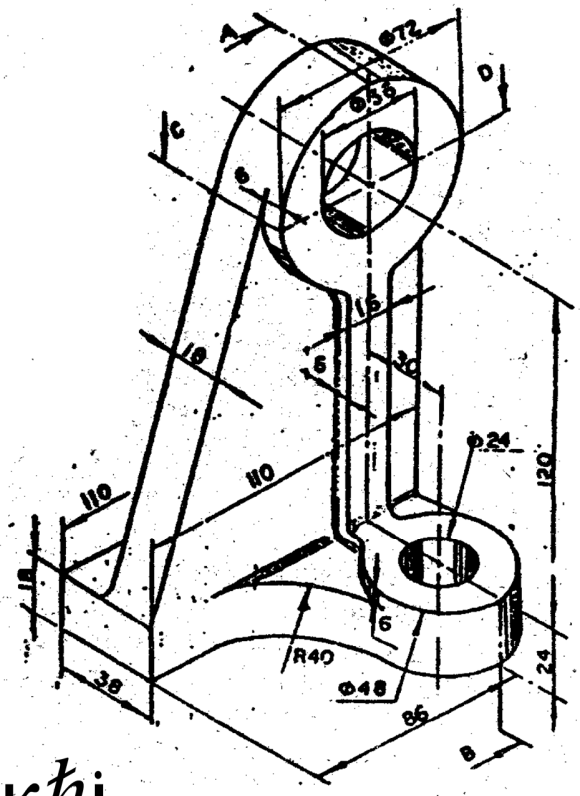


Figure shows object. Draw to scale the following :–

(i) Front view. **(8)**

(ii) Sectional side view from left on section A–B. **(6)**

(iii) Sectional top view on section C–D. **(6)**



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Chapter 8:

- ISOMETRIC PROJECTIONS

By

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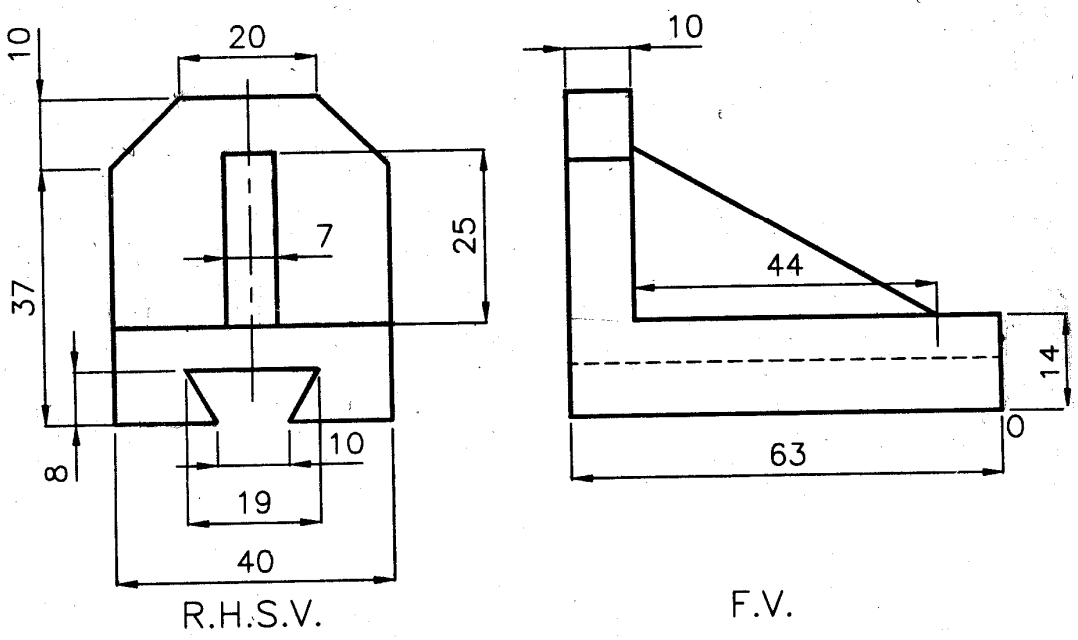
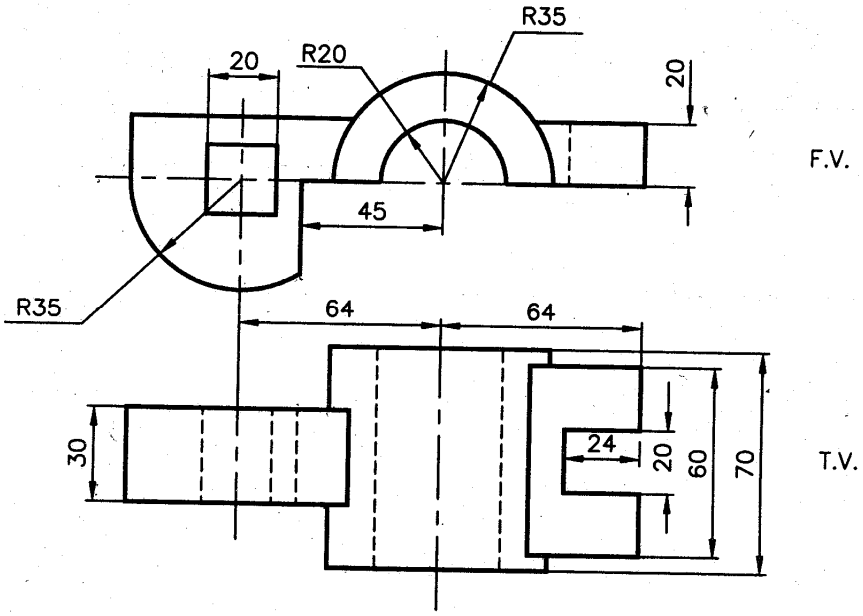
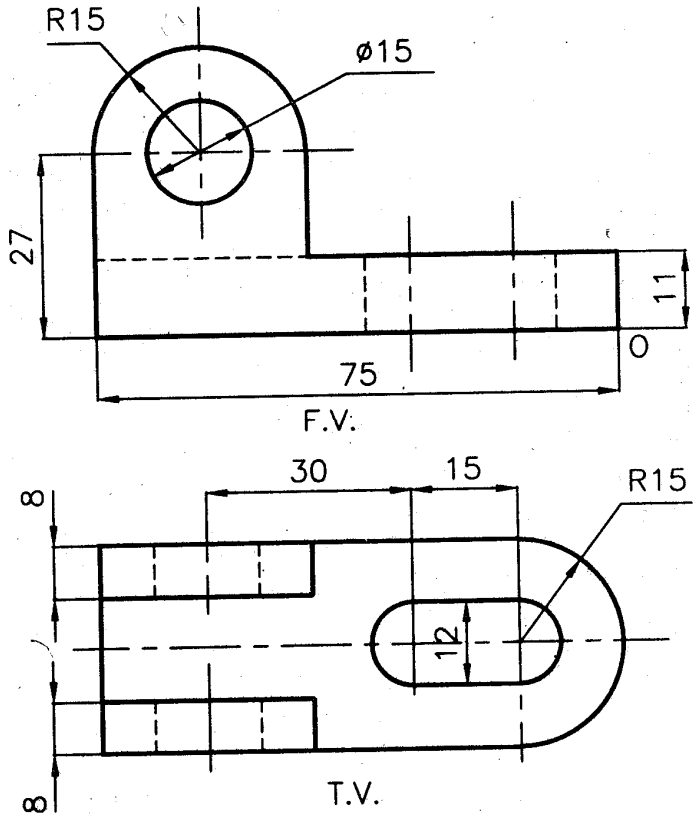
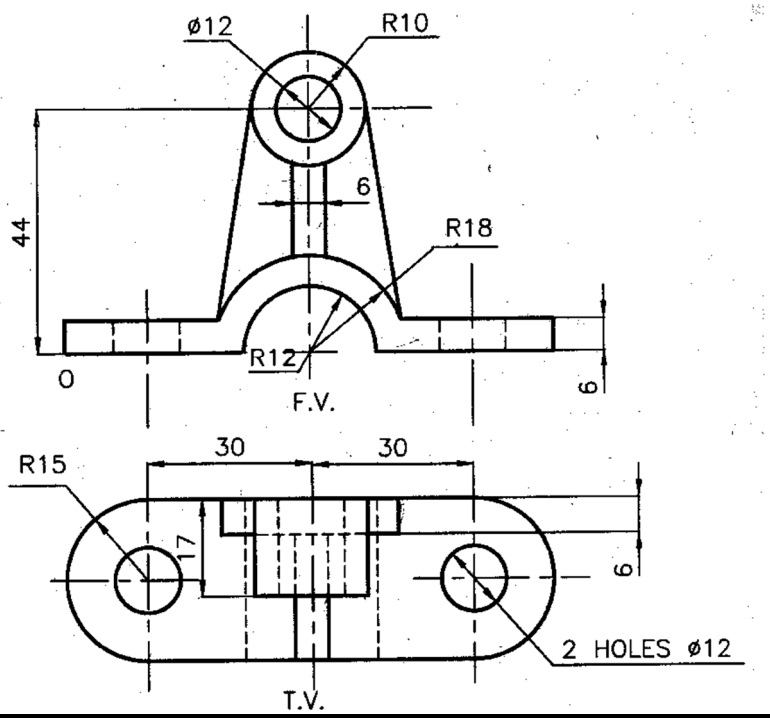
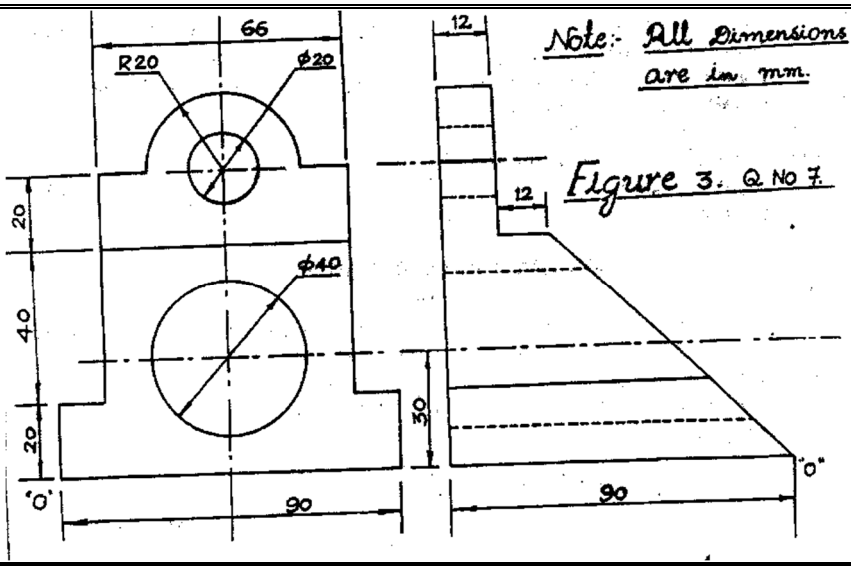




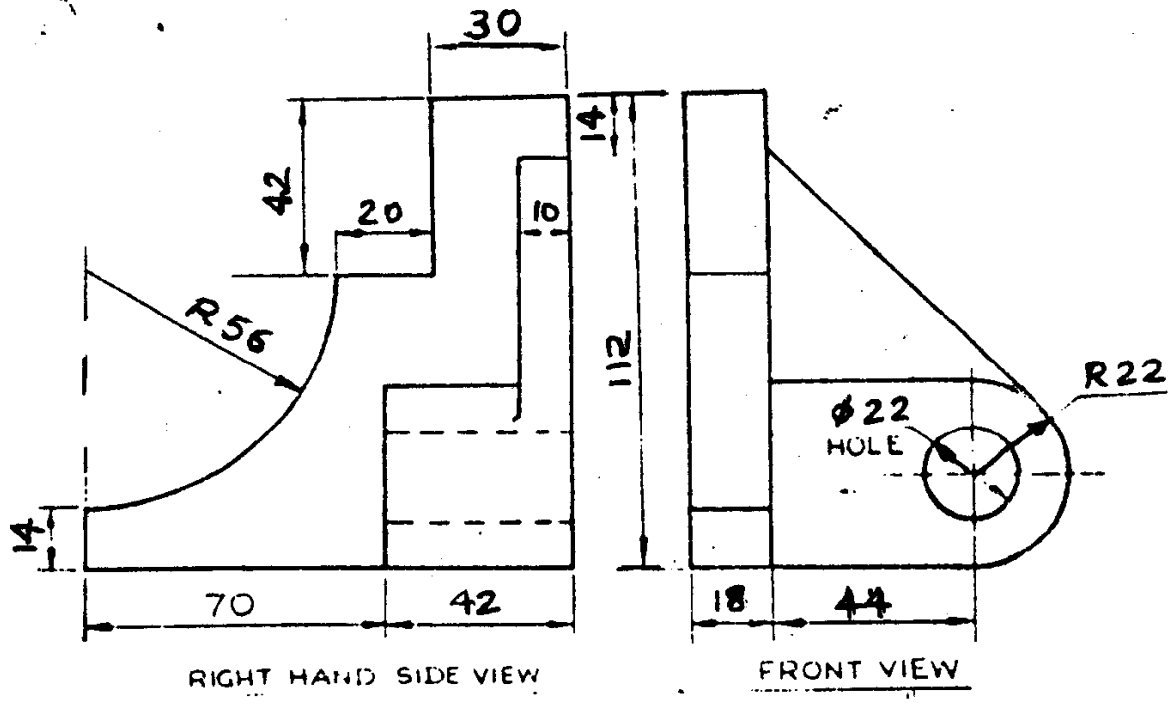






Note:- All Dimensions are in mm.

Figure 3. Q No 7.



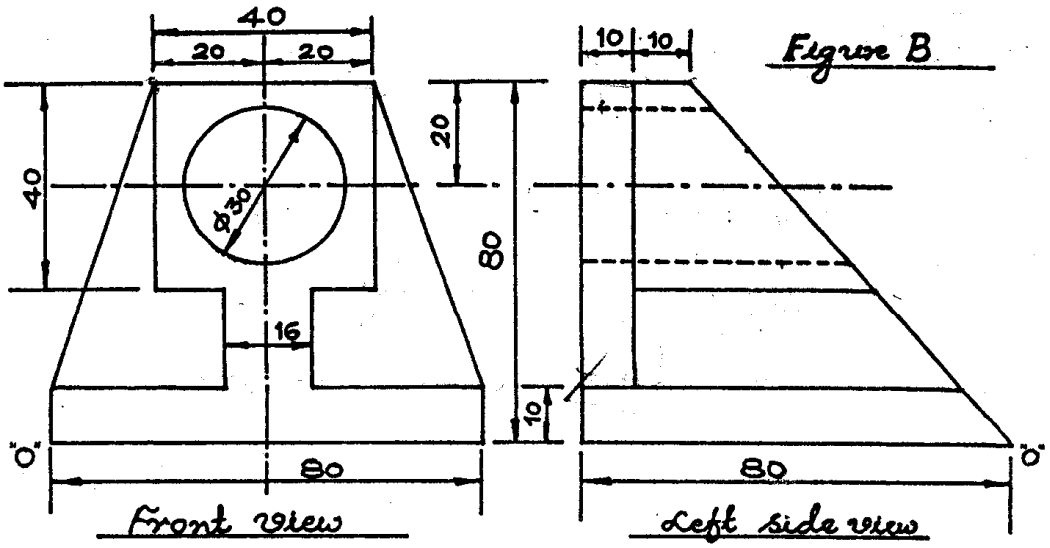


Figure B

Note:- All Dimensions are in mm.

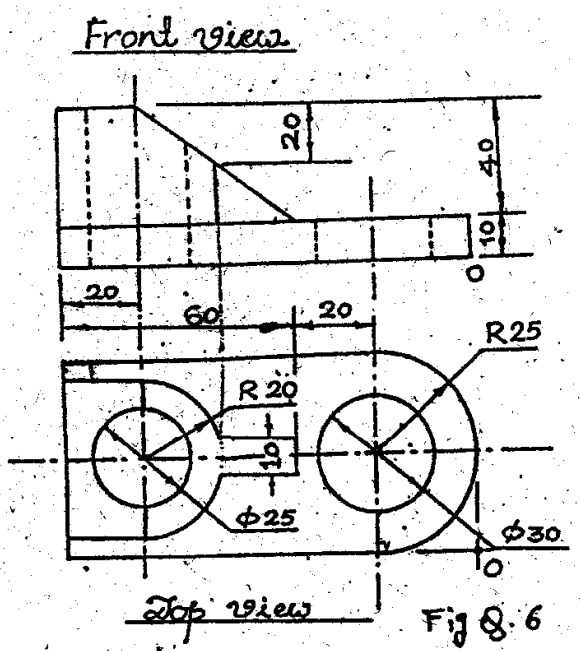


Fig 8.6

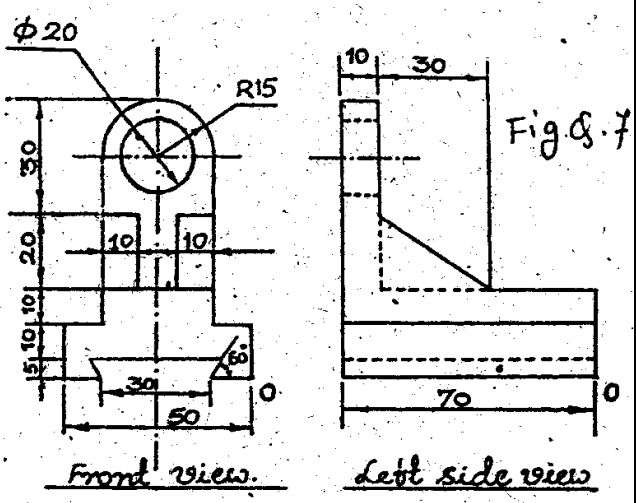
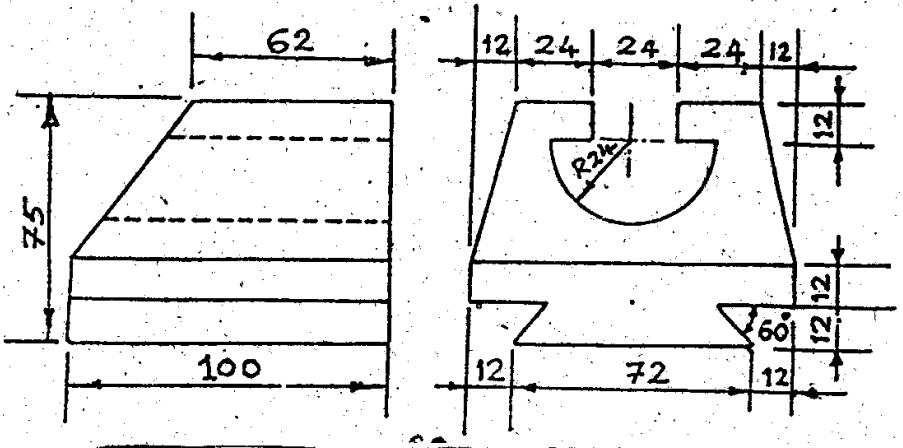


Fig 8.7

* All dimensions are in mm.

* All dimensions are in mm.



7. Front view and left hand side view of an object is shown in figure. Draw the isometric view using natural scale use "O" as the starting point. 10