UNIT II

ORTHOGRAPHIC PROJECTIONS AND PROJECTIONS OF POINTS

2.1 INTRODUCTION

Projection drawing is base of engineering drawing. In order to read a complicated engineering drawing, learner must practice and study the fundamentals of projection drawing.

2.2 CONCEPT OF PROJECTION

- **Projection**: It is defined as representation of any three dimensional object made on a plane. In this Fig. 2.1 shadow is the projection.
- **Plane of Projection**: The plane on which Projection (shadow) appears is called as plane of projection. In this Fig. 2.1 wall is the plane of projection.
- **Projectors or Projection Lines**: The light / visual ray which passes the contour of body to form outline of the projection (shadow) are called as projectors/ projections of lines.
- **Object**: the body which is under study of projections is called as an object.
- **Observer**: the person who watches/observes the body to draw projections is an observer.

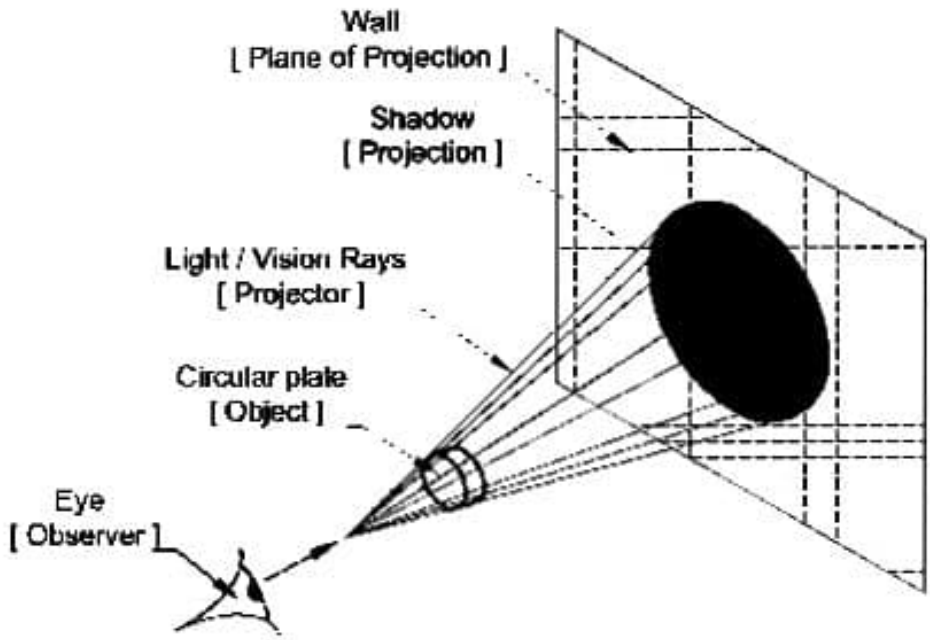


Fig. 2.1

2.3 ORTHOGRAPHIC PROJECTION

- In orthographic projection method, the projectors from the eye of an observer become parallel to each other and perpendicular to plane of projection.
- Since the projectors are perpendicular to the plane of projection i.e. orthogonal, this method is called as orthographic projection.
- This method is introduced to overcome inconvenience of size of projection of object. As size of projection depends upon the distance between observer and reference planes.
- This method gives the size of view of an object is equal to the actual size of an object.

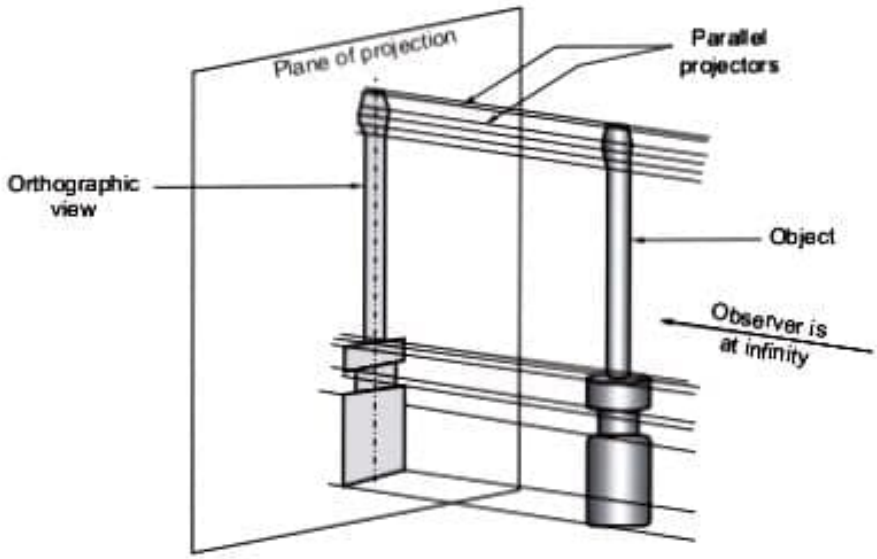


Fig. 2.2

2.4 SYSTEM OF ORTHOGRAPHIC PROJECTION

- When vertical plane & horizontal plane intersect at right angle, four quadrants are formed.
- Line of intersection is 'Reference line i.e. XY'.
- The direction of observer for viewing FV & TV is same for all quadrants.
- FV & TV are obtained on VP & HP respectively.
- For getting an orthographic view, keep VP fixed and rotate HP by 90^0 in clockwise direction.
- This convention of rotation allows us to follow projection method in Ist quadrant and IIIrd quadrant.
- In IInd and IVth quadrant VP & HP will overlap with each other by this convention of rotation, hence cannot be used.

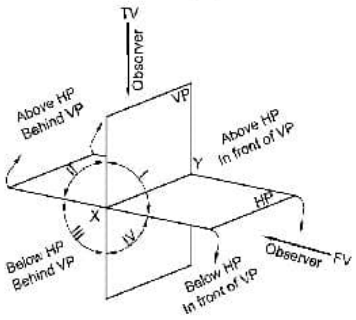


Fig. 2.3

2.5 FIRST ANGLE PROJECTION METHOD

- The object is situated in first quadrant.
- The object lies between the observer and the principal planes i.e. HP/ VP/ PP.
- F.V. is obtained on the V.P. and above XY line.
- T.V. is obtained on the H.P. and below XY line.
- S.V. placed on the P.P. and on the side of F.V.
- L.H.S.V. is drawn on the right side of F.V.
- R.H.S.V. is drawn on the left side of T.V.

VP - Vertical Plane
HP - Horizontal Plane
PP - Profile Plane
FV - Front View
TV - Top View
SV - Side view

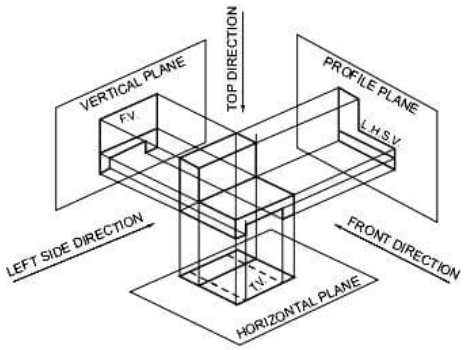
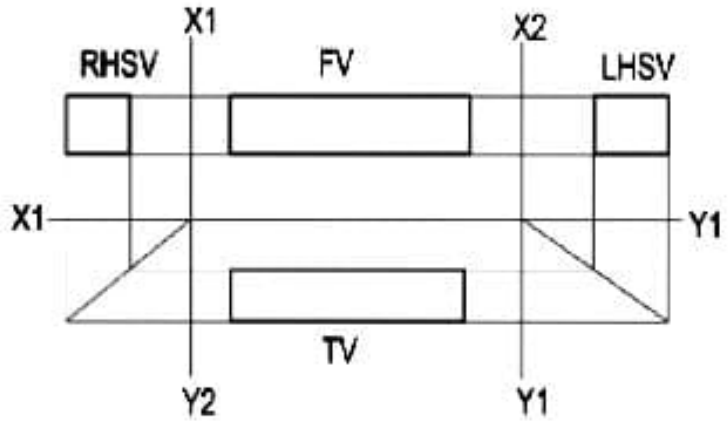
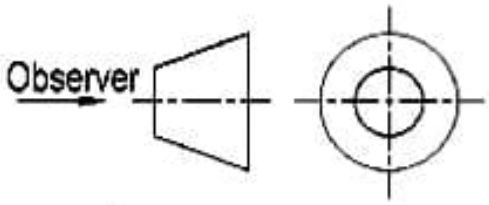


Fig. 2.4



Representation of views



I^st angle method symbol

Fig. 2.5

2.7 ORTHOGRAPHIC VIEWS

Orthographic views are used to convey shape, size and internal details of the object. These are two dimensional views and gives true shape, size and dimensions of an object. (Orthographic projection method is already discussed in chapter 1.)

2.8 STEPS TO SOLVE FOR PREPARING ORTHOGRAPHIC PROJECTIONS

A. Generally the arrow 'X' represents front view direction and the side view's direction is decided by front view direction.

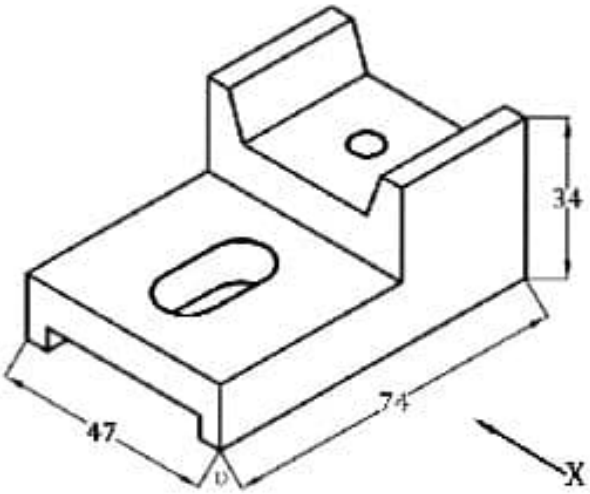


Fig. 2.6

- In above Fig. 2.6 arrow X represents direction for the front view.
- Considering X direction, the left side of the object is visible.
- Hence in above example FV, TV and LHSV can be drawn.
- If direction is not given, select front view in such a way that it will show maximum details.

B. Calculate overall length, height and width of an object from the pictorial view and draw the block for each view with calculated sizes. While drawing blocks, try to keep 20mm gap between different views to give good appearance.

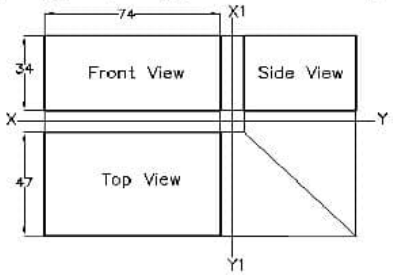


Fig. 2.7

C. Draw required details in all the views simultaneously. Following order must be follow while drawing details

1. Draw center lines
2. Circle
3. Arc of circle
4. Straight lines for shape of an object
5. Straight lines for the minor details.

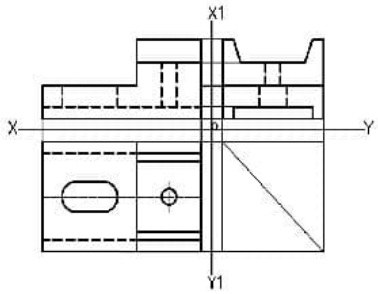


Fig. 2.8

D. Draw Thick lines to show object lines, dash lines to show hidden edges of the object and thin lines to show construction lines.

E. In case of overlapping ,Precedence of lines are given as ,

1. Object line
2. Hidden line
3. Dimension line
4. Section line
5. Center line

F. Insert the dimensions and name the views.

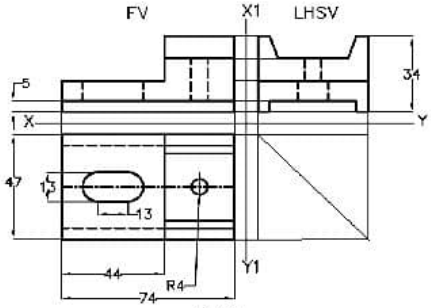


Fig. 2.9

2.9 DRAW DIFFERENT VIEWS FOR THE GIVEN OBJECTS

- This object can be seen from six sides as shown in figure.
- Different possible six views are drawn with first angle projection method in below given figure.
- Normally students are asked to draw Front View, Top View and visible Side view. Not six views.

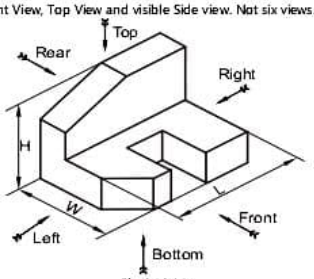


Fig. 2.10 (a)

Solution:

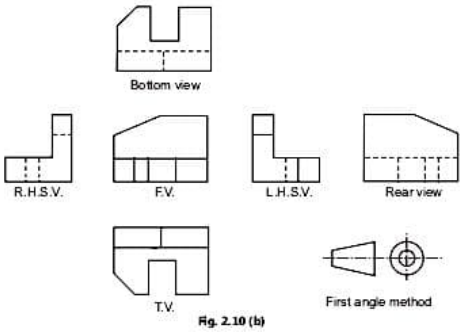


Fig. 2.10 (b)

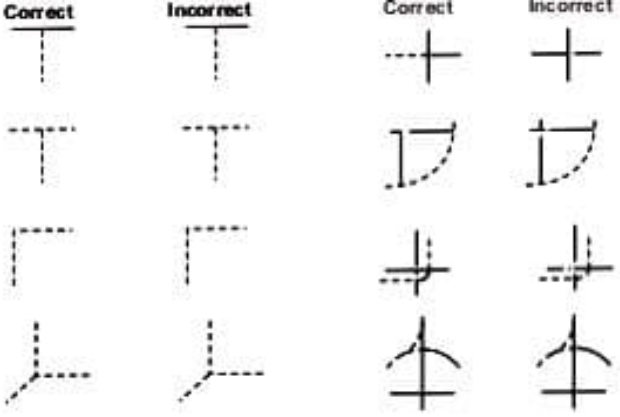


Fig. 2.11

2.11 CORRECT REPRESENTATION OF AN AXIS LINES

- Start and end of an axis line is with a longer dash.
- Two axes when intersect with each other, must intersect with longer dashes.
- The extension of an axis beyond the boundary of the object must be shown with longer dash.

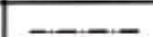
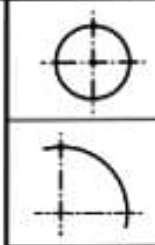
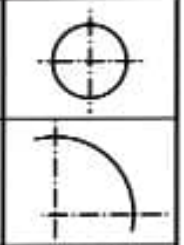
Instructions	Correct	Incorrect
Axis line starts and ends with a longer dash		
Two axes intersect with longer dashes		
Axis extends the boundary with a longer dash		

Fig. 2.12

2.12 CORRECT REPRESENTATION OF ARROW HEADS

The length of the arrow head must be equal to three times its width.

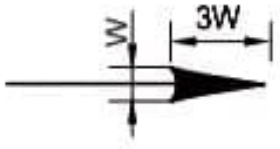


Fig. 2.13

SOLVED PROBLEMS

For the given objects ,Using First Angle Method Projection Draw

1. ***F.V. looking in the direction X,***
2. ***Top view,***
3. ***Required S.V.***

Problem 2.1 :

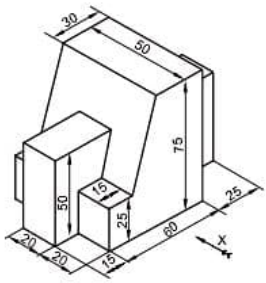


Fig. 2.14 (a)

Solution :

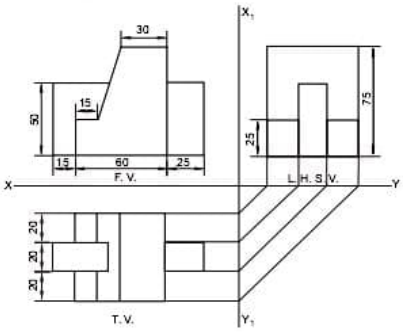


Fig. 2.14 (b)

Problem 2.2 :

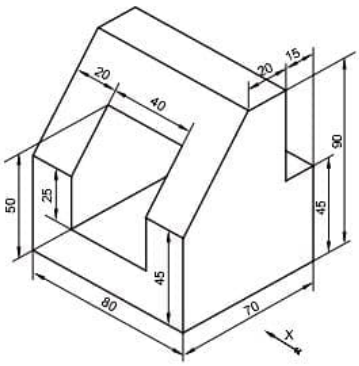


Fig. 2.15 (a)

Solution :

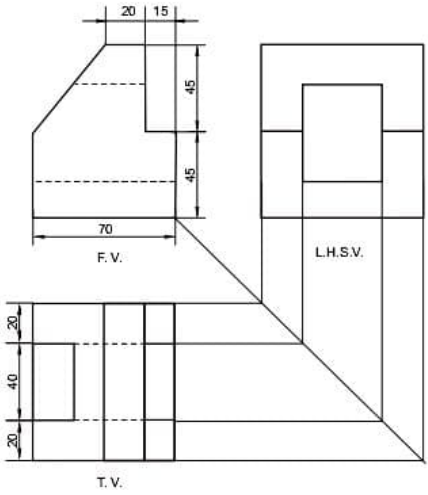


Fig. 2.15 (b)

Problem 2.3 :

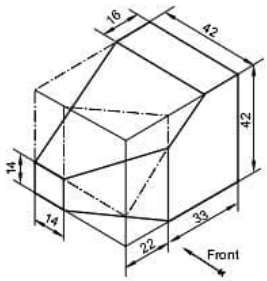


Fig. 2.16 (a)

Solution :

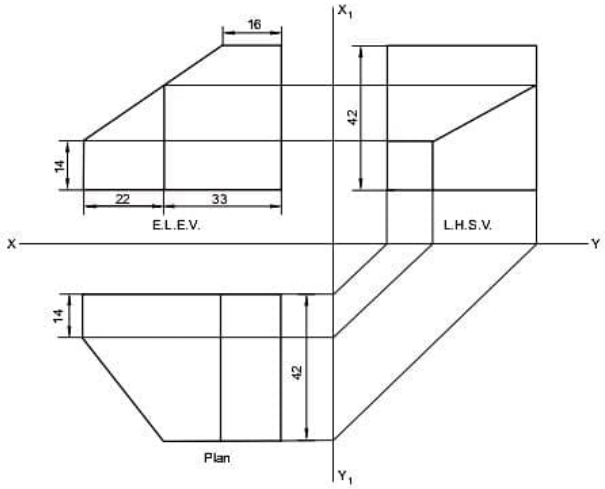


Fig. 2.16 (b)

Problem 2.4 :

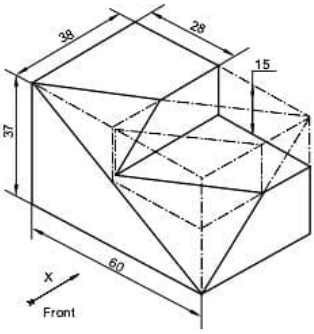


Fig. 2.17 (a)

Solution :

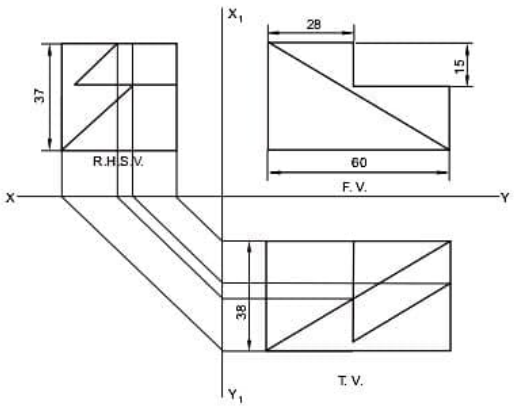


Fig. 2.17 (b)

Problem 2.5 :

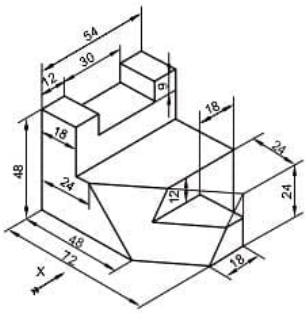


Fig. 2.18 (a)

Solution :

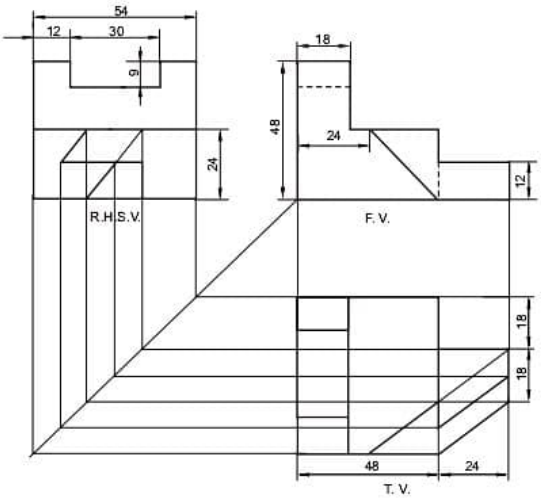


Fig. 2.18 (b)

Problem 2.6 :

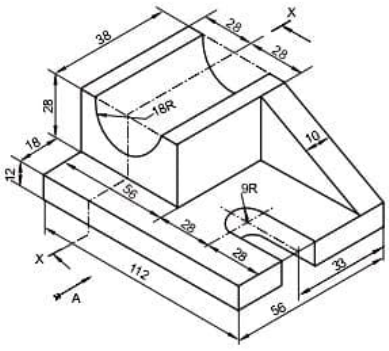


Fig. 2.19 (a)

Solution :

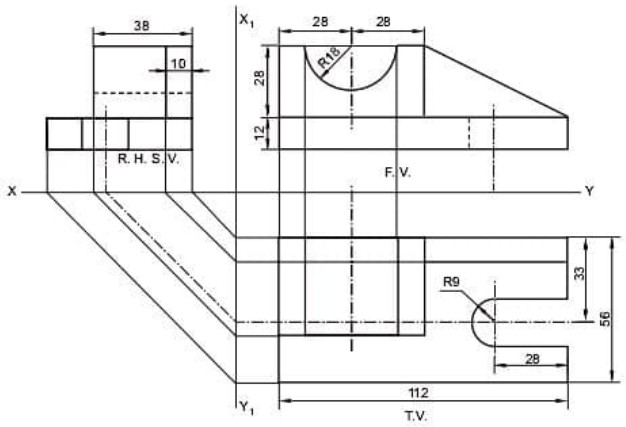


Fig. 2.19 (b)

Problem 2.7 :

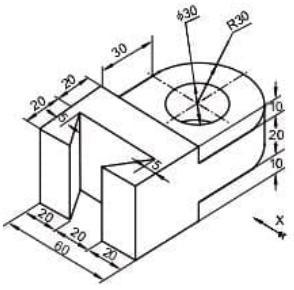


Fig. 2.20 (a)

Solution :

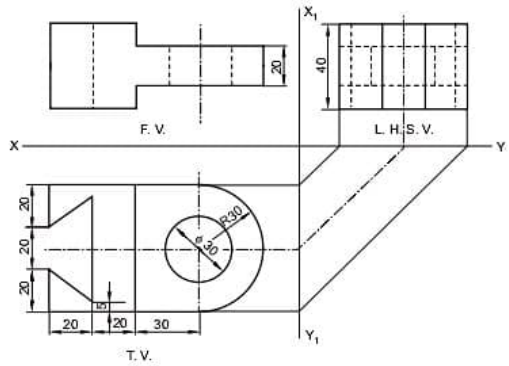


Fig. 2.20 (b)

Problem 2.8 :

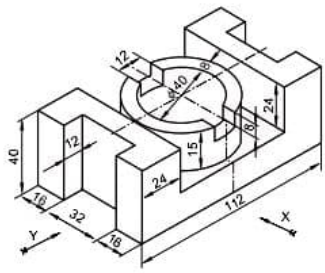


Fig. 2.21 (a)

Solution :

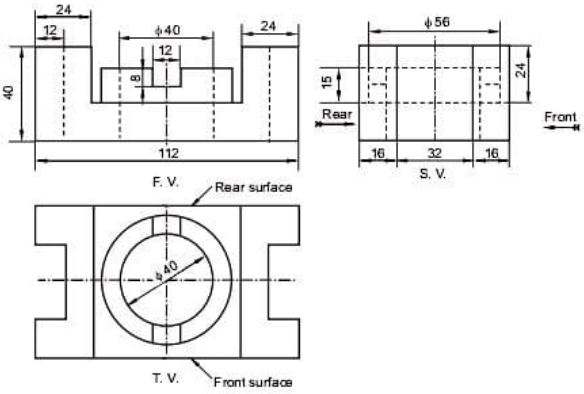


Fig. 2.21 (b)

Problem 2.9 :

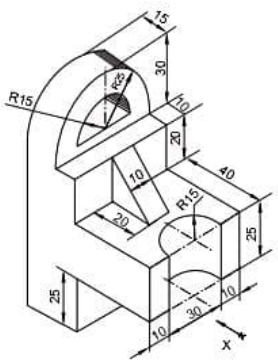


Fig. 2.22 (a)

Solution :

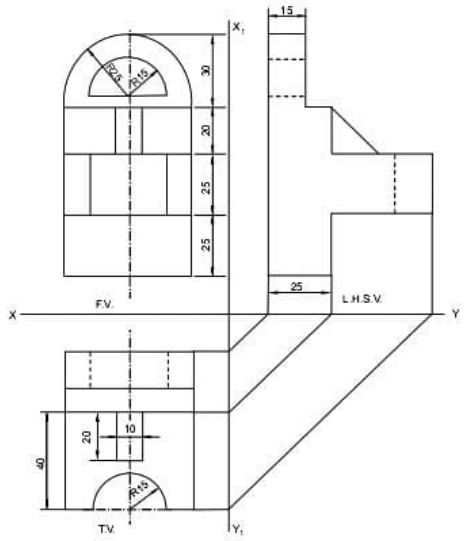


Fig. 2.22 (b)

Problem 2.10 :

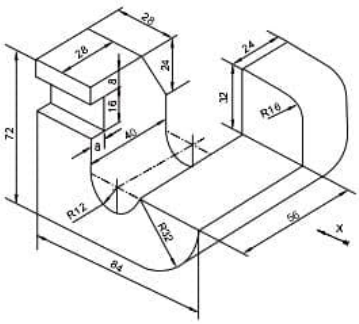


Fig. 2.23 (a)

Solution :

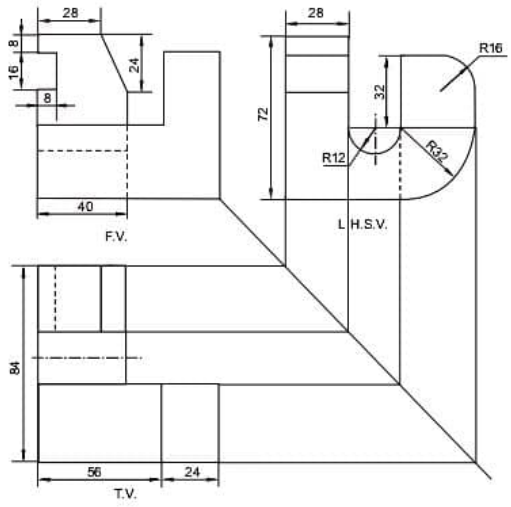


Fig. 2.23 (b)

Problem 2.11 :

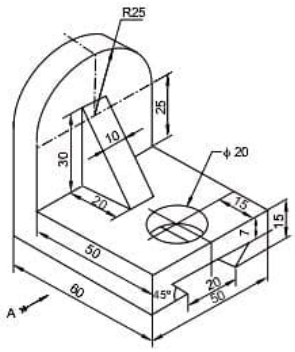


Fig. 2.24 (a)

Solution :

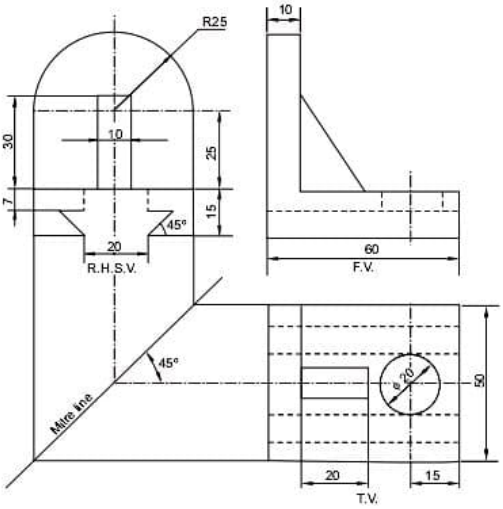


Fig. 2.24 (b)

Problem 2.12 :

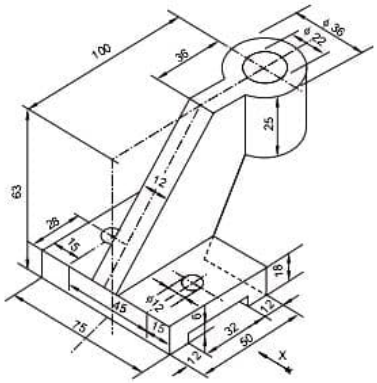


Fig. 2.25 (a)

Solution :

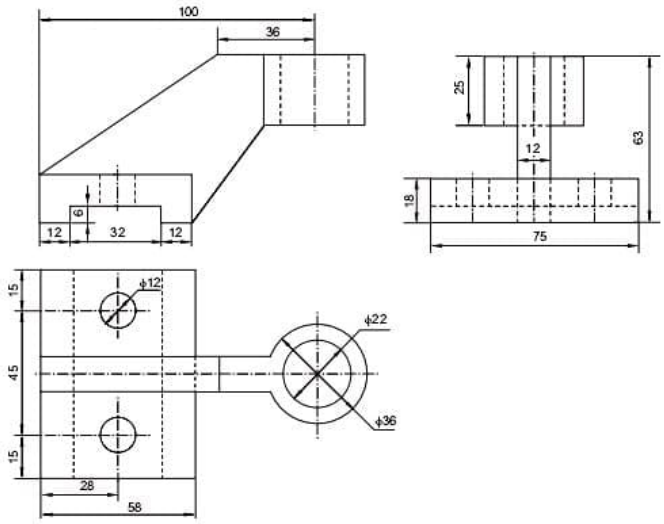


Fig. 2.25 (b)

Problem 2.13:

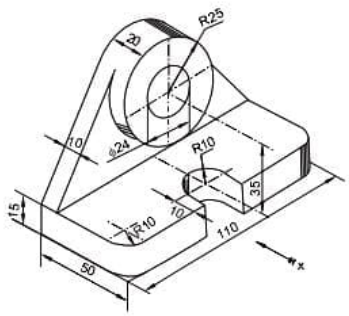


Fig. 2.26 (a)

Solution :

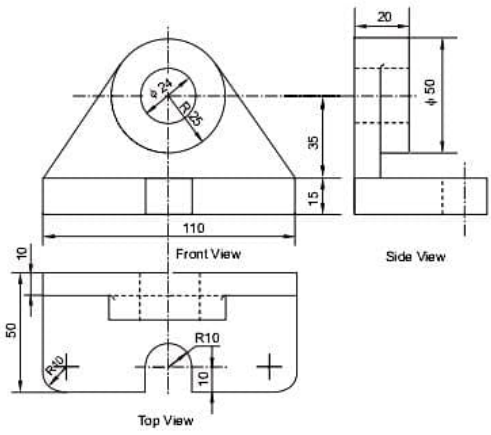


Fig. 2.26 (b)

Problem 2.14 :

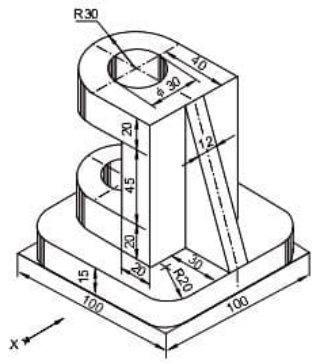


Fig. 2.27 (a)

Solution:

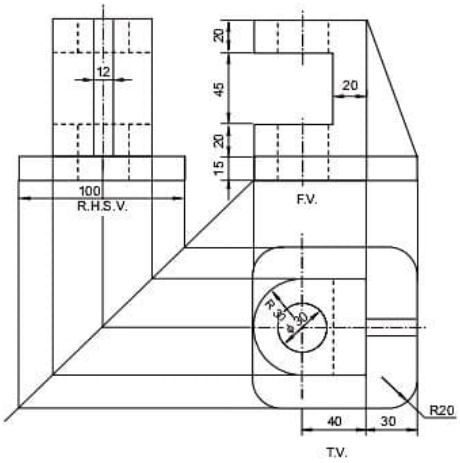


Fig. 2.27 (b)

PROBLEMS FOR PRACTICE

Using First Angle Method, draw three views of each object. A front view is in the direction of arrow X.

1.

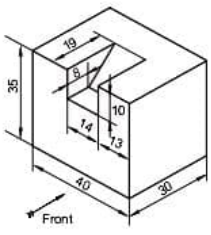


Fig. 2.28

2.

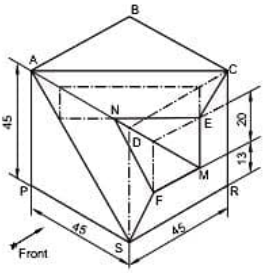


Fig. 2.29

3.

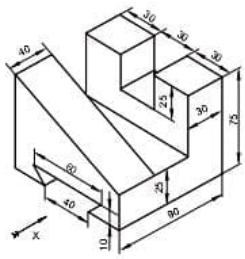


Fig. 2.30

4.

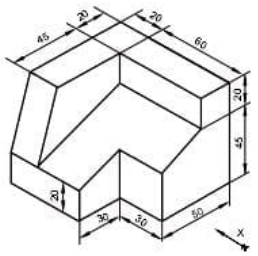


Fig. 2.31

5.

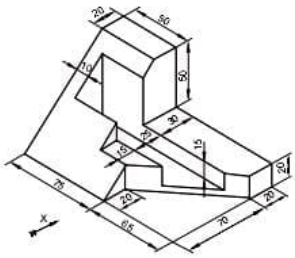


Fig. 2.32

6.

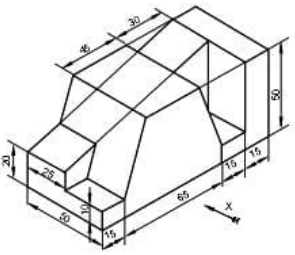


Fig. 2.33

7.

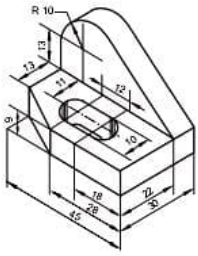


Fig. 2.34

8.

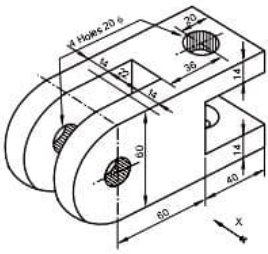


Fig. 2.35

9.

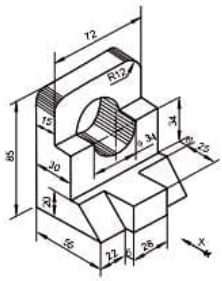


Fig. 2.36

10.

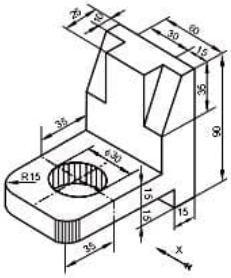


Fig. 2.37

11.

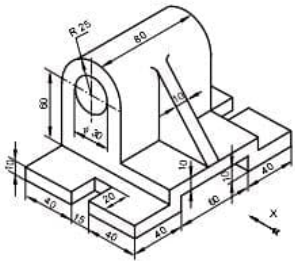


Fig. 2.38

12.

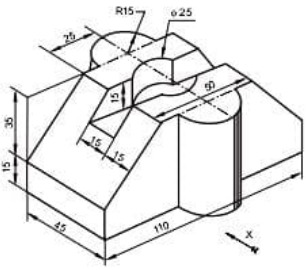


Fig. 2.39

13.

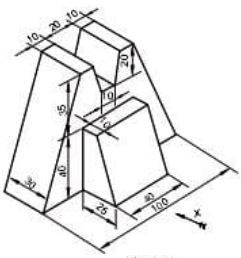


Fig. 2.40

14.

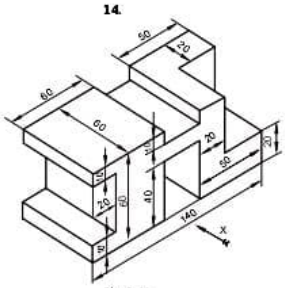


Fig. 2.41

15.

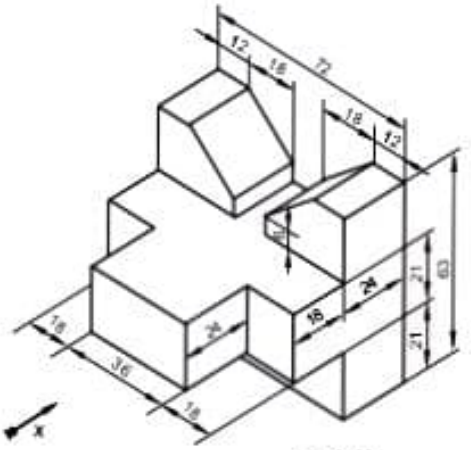


Fig. 2.42

16.

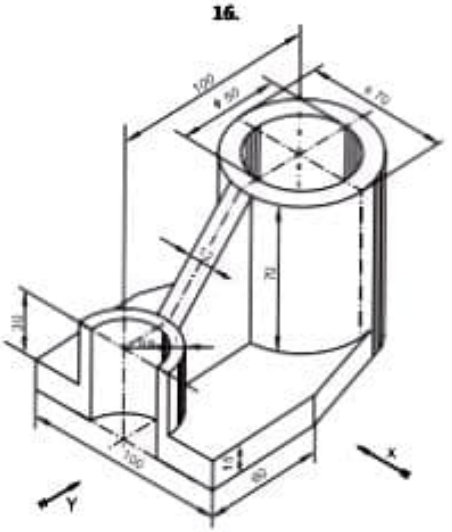


Fig. 2.43

17.

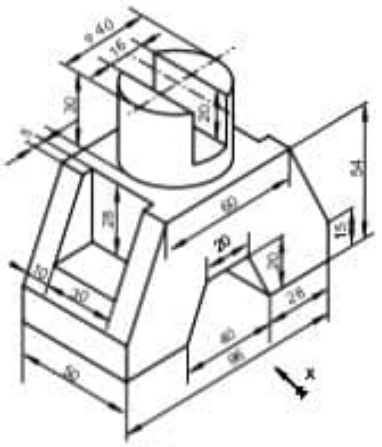


Fig. 2.44

18.

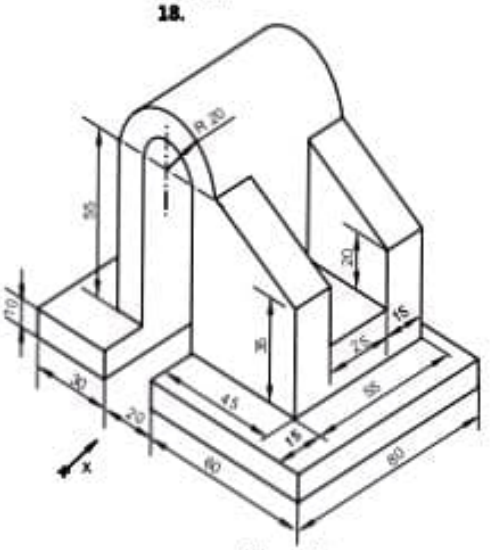


Fig. 2.45

2.13 SECTIONAL ORTHOGRAPHIC PROJECTION

- Many times a object consists of few features which are not visible to observer.
- These features are shown with hidden lines in orthographic projections.
- If there are few hidden lines then it is easy to predict the object for an observer.
- Views with more number of hidden lines, make can views complicated to understand.
- To overcome this difficulty imaginary plane is used to cut complicated objects.
- This method is called as sectional orthographic projection.

2.14 STEPS TO SOLVE FOR PREPARING ORTHOGRAPHIC PROJECTIONS

- Section plane is passed through the required hidden feature to cut the object. E.g. Cutting plane X-X is used to cut the given part. In given condition cutting plane X-X is perpendicular to HP and VP but parallel to Profile Plane i.e. sectional view is visible from side View (RHSV).

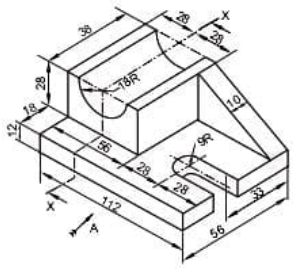


Fig. 2.46

- Portion of an object nearer to the observer (or portion between observer and cutting plane) is imagined to be removed. E.g. in this case material is removed when observer is opposite to the profile plane.

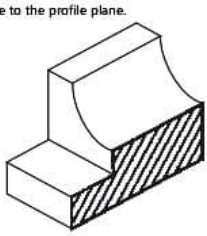


Fig. 2.47

Sectional view must be shown on the reference plane which is parallel to cutting plane. Remaining views are drawn with normal orthographic projection method. E.g. In given problem section is shown in RHSV and FV as well TV is drawn with normal orthographic projection method.

2.15 FOLLOWING POINTS SHOULD BE TAKEN CARE WHILE DRAWING HATCHING LINES

- Lines which are visible contained by the cutting plane and behind the section must be shown.
- Lines behind the section which are not visible are usually not shown.
- Normally hatching or section lines are drawn at 45° with continuous thin lines.

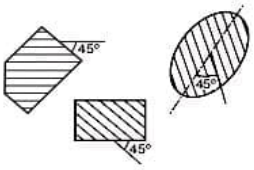


Fig. 2.48

- Hatching lines are equally spaced at about 2mm to 3 mm apart.
- Cutting plane line is drawn by long chain thin and thick at ends only. To show the direction of an observer arrow heads are shown.

Fig. 2.49

- Hatching lines should be drawn in opposite direction for two adjacent parts in order to distinguish them.

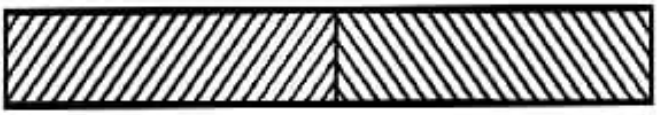


Fig. 2.50

- In case of three parts, third part is consisting of section lines at an angle of 30^0 or 60^0.

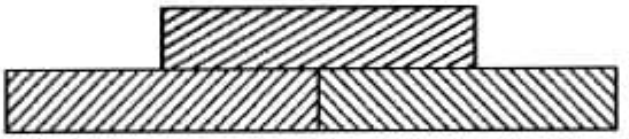


Fig. 2.51

2.16 FULL SECTIONAL VIEW

In this method, object is cut into two equal parts with the help of imaginary cutting plane which is passing through the center line of the object.

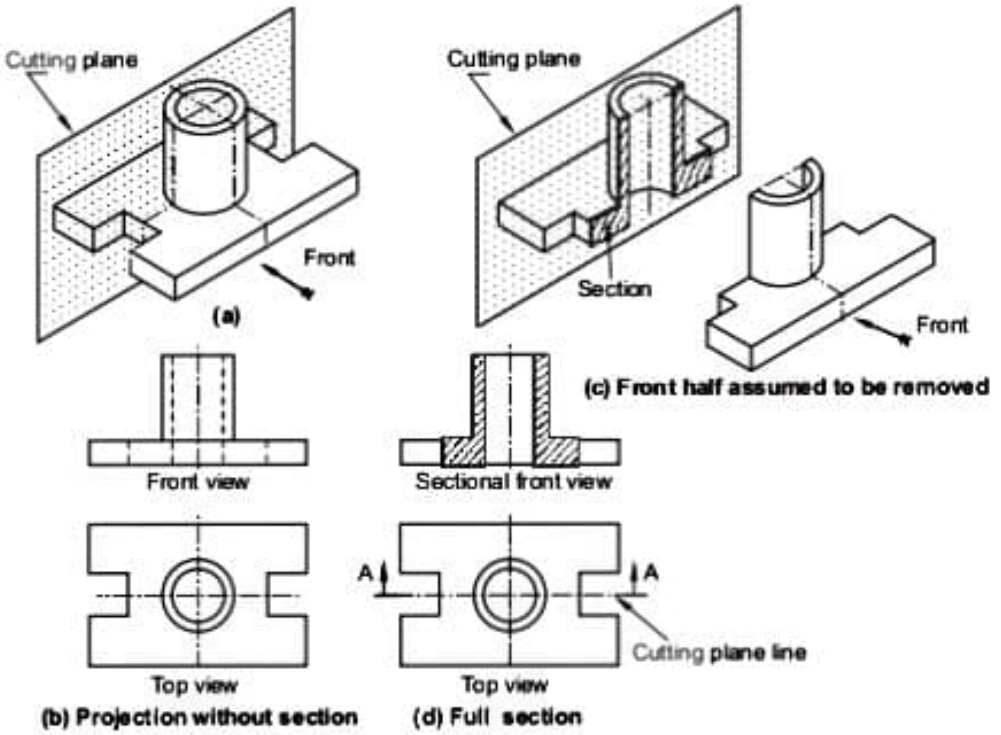


Fig. 2.52

2.17 RIB IN SECTIONAL VIEWS

- A rib is a supporting member used for adding strength to the object.
- If cutting plane passes through the rib parallel to its larger dimension, then in normal practice no need to show hatching lines.
- If cutting plane passes through the rib perpendicular to its larger dimension, then in normal practice no need hatching lines.

Example: Now we will understand how to represent Rib sections with the given object.

1. In object consists of two Rib sections namely B and C.
2. Cutting plane XY passing through Rib B.
3. Cutting plane XY is parallel to larger dimension of rib; therefore hatching lines are not shown in LHSV. But same time it is perpendicular to rib C, therefore hatching lines are shown in sectional LHSV for Rib C.
4. Cutting plane PQ passing through Rib C.
5. Cutting plane PQ is parallel to larger dimension of rib C; therefore hatching lines are not shown in FV for Rib C. But same time it is perpendicular to rib B, Hence hatching lines are shown in sectional FV for Rib B.

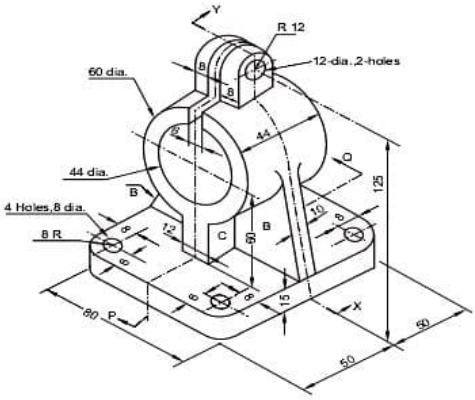


Fig. 2.53

Representation of Rib in Sectional orthographic views:

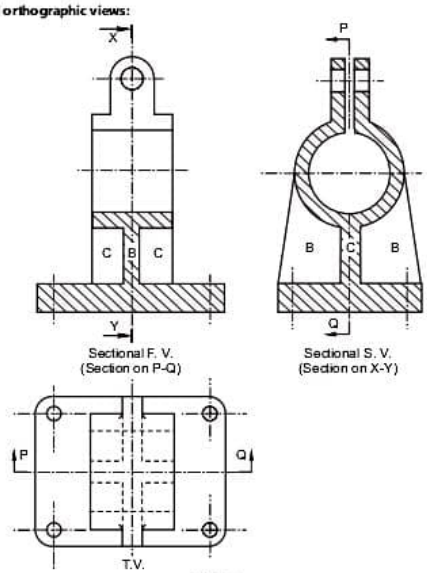


Fig. 2.54

Problem 2.15 : The Following Fig. 2.55 (a) shows a cast iron bracket. By using first angle projection method draw:

1. ***Front view along arrow X***
2. ***Top view***
3. ***Sectional LHSV along plane A-A***

Given all the dimensions :

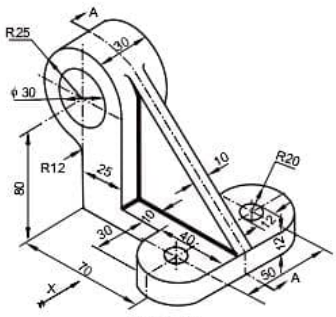


Fig. 2.55 (a)

Solution :

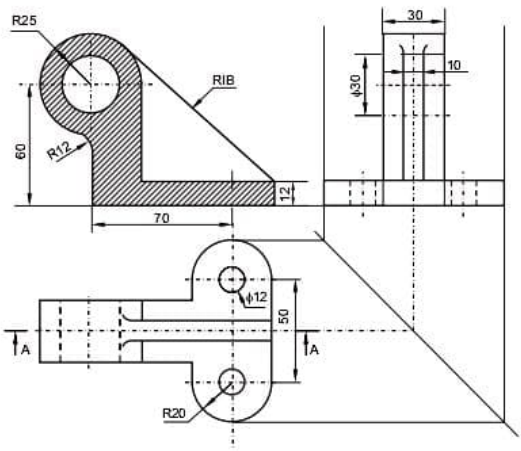


Fig. 2.55 (b)

Problem 2.16 : The Following Fig. 2.56 (a) shows a cast iron bracket. By using first angle projection method draw;

1. ***Sectional front view along plane A-A***
2. ***Top vies***
3. ***LSHV***

Give all the dimensions

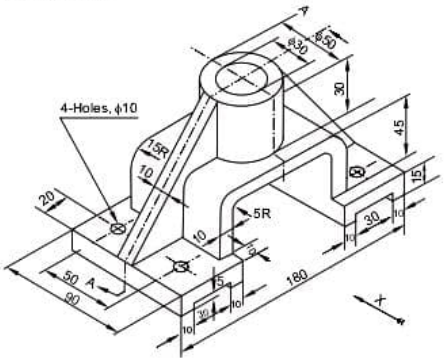


Fig. 2.56 (a)

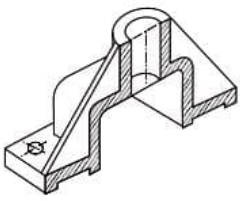


Fig. 2.56 (b)

Solution :

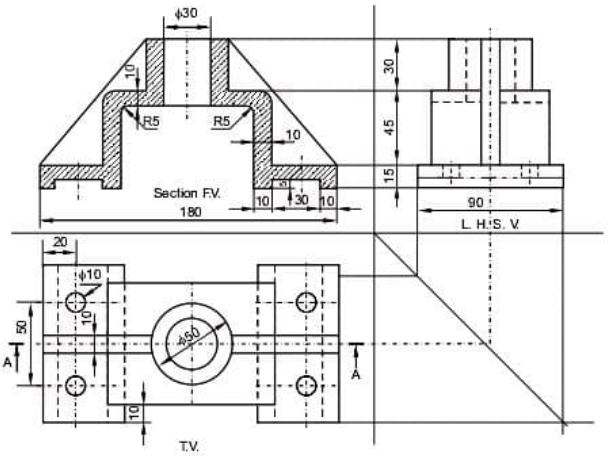


Fig. 2.56 (c)

Problem 2.17 : The following Fig. 2.57 (a) shows a Cast iron bracket. By using first angle projection method draw :

1. ***Front View***
2. ***Top View***
3. ***Sectional LHSV along plane X-X***

Give all the dimensions.

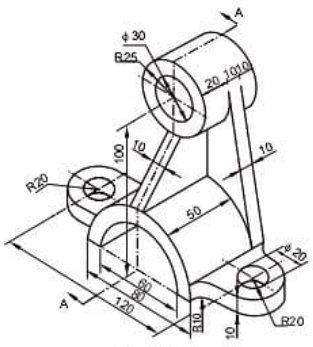


Fig. 2.57 (a)

Solution :

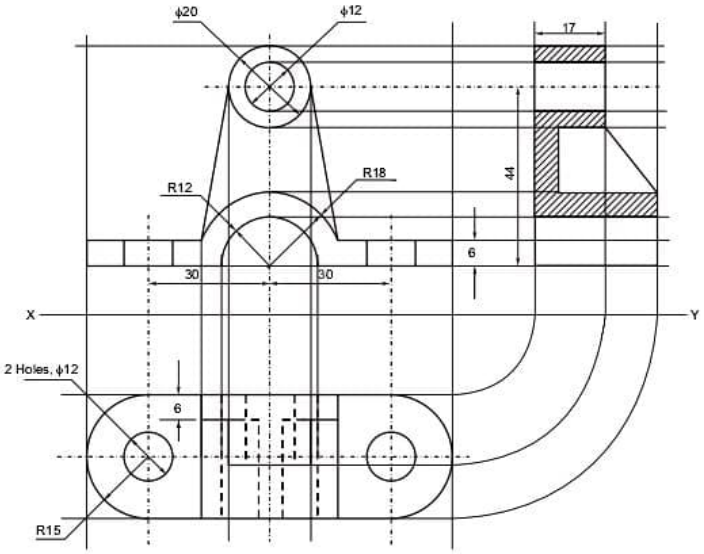


Fig. 2.57 (b)

Problem 2.18 : The following Fig. Shows a cast iron bracket. By using first angle projection method Draw :

1. ***Sectional left hand side view along symmetry of object***
2. ***Top view***
3. ***RHSV***

Give all the dimensions

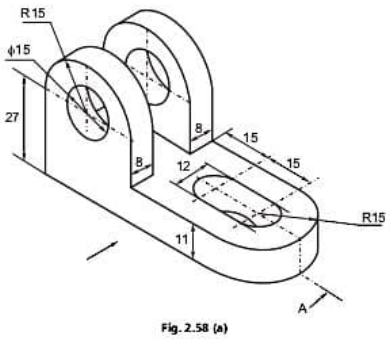


Fig. 2.58 (a)

Solution :

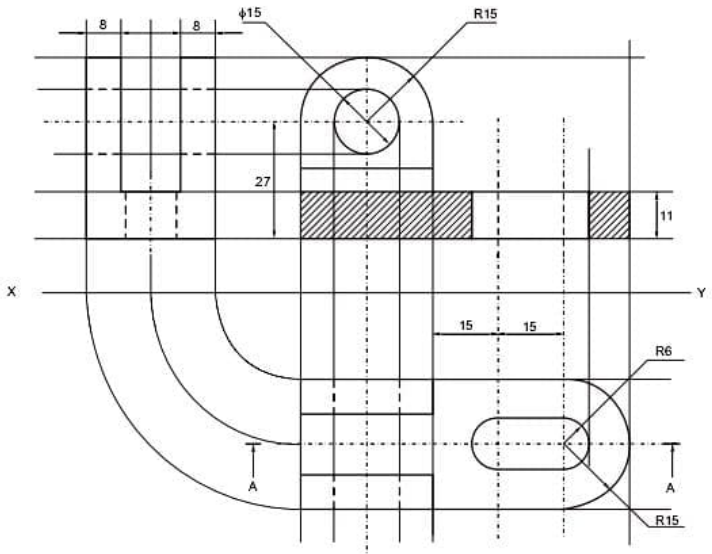


Fig. 2.58 (b)

Problem 2.19 : Figure 2.59 (a) shows a pictorial view of an object. By using first angle method of projections, draw;

1. ***Sectional left hand side view, along given sectional plane***
2. ***Front view***
3. ***Top view***
4. ***Dimensions***

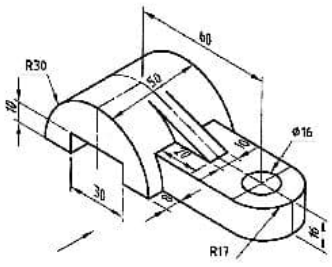


Fig. 2.59 (a)

Solution

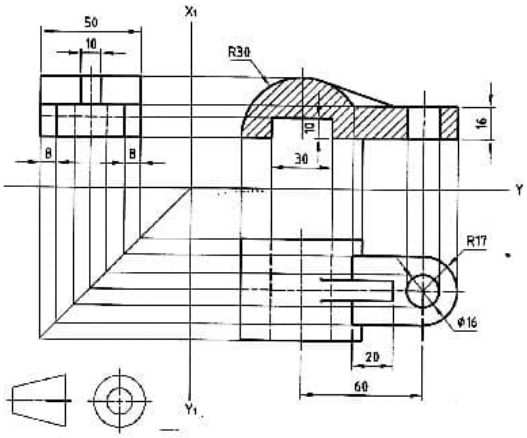


Fig. 2.59 (b)

Problem 2.20 : Figure 2.60 (a) shows a pictorial view of an object. By using first angle method projections, draw;

1. ***Sectional front view, along symmetry of the object***
2. ***Right hand side view***
3. ***Top view***
4. ***Dimensions***

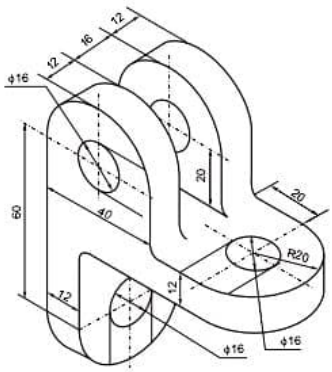


Fig. 2.60 (a)

Solution

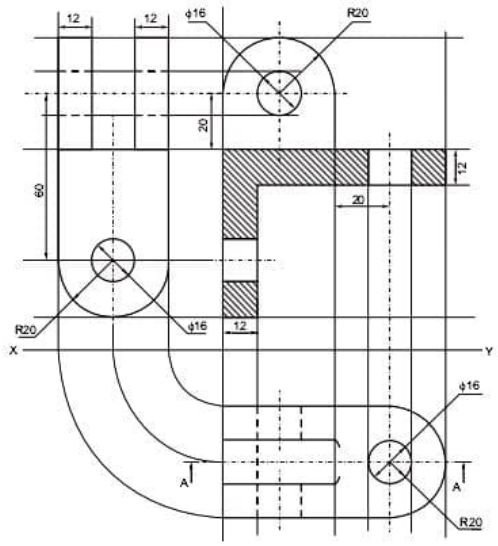


Fig. 2.60 (b)

Problem 2.21 : Figure 2. 61 (a) shows pictorial view of an object. By using first angle method of projections Draw:

1. ***Sectional front view along given section A-A***
2. ***Right hand side view***
3. ***Top View***
4. ***Dimensions***

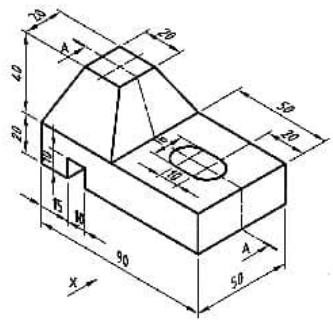


Fig. 2.61 (a)

Solution :

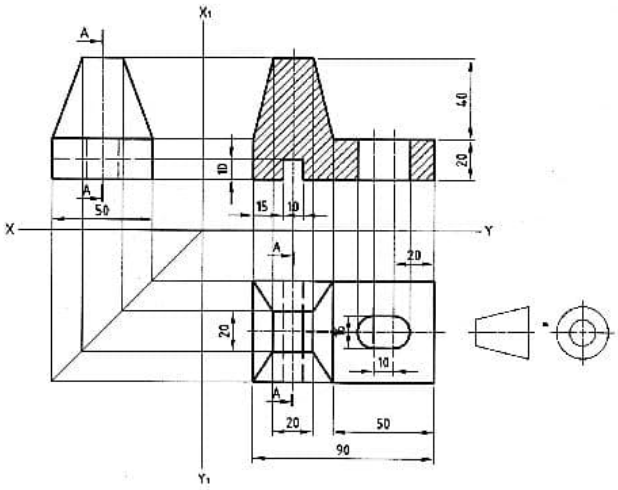


Fig. 2.61 (b)

Problem 2.22 : Figure 2.62 (a) shows a pictorial view of an object.By using first angle method of projections. Draw:

1. ***Sectional front view. along sectional plane A-A.***
2. ***Right Hand side view***
3. ***Top View***
4. ***Dimensions.***

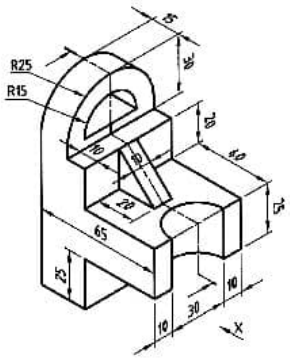


Fig. 2.62 (a)

Solution

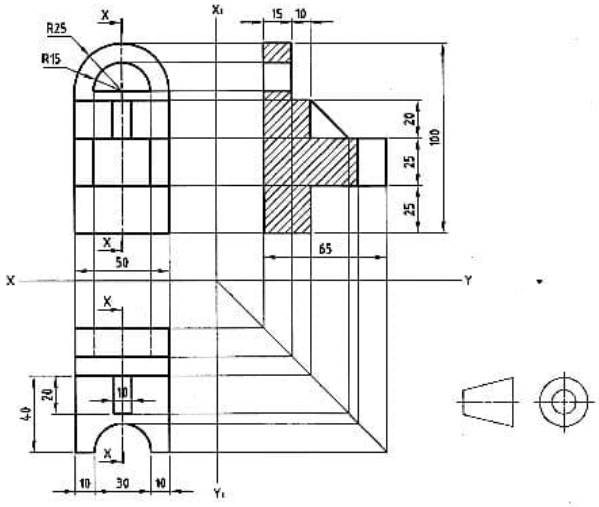


Fig. 2.62 (b)

Problem 2.23 : Using first angle method, draw the following views for the object shown in Fig. 2.63 (a)

1. ***Sec. Elevation (Section A-A)***
2. ***Plan***
3. ***LHSV***
4. ***Give all dimensions.***

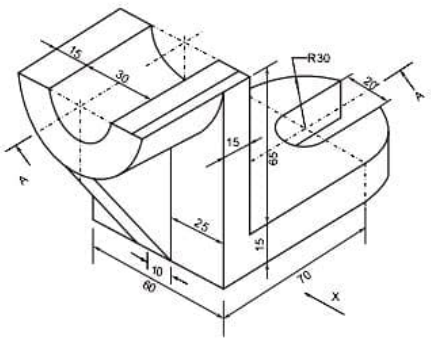


Fig. 2.63 (a)

Solution:

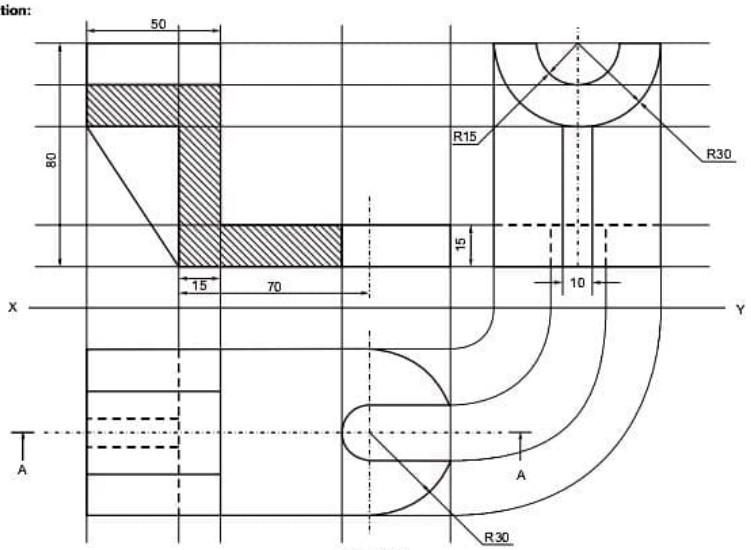


Fig. 2.63 (b)

Problem 2.24 : Using first angle method, draw the following views for the object shown in Fig. 2.64 (a)

1. ***Elevation form the direction of arrow***
2. ***Plan***
3. ***Sectional right hand side view (Section A-A)***
4. ***Give all dimensions.***

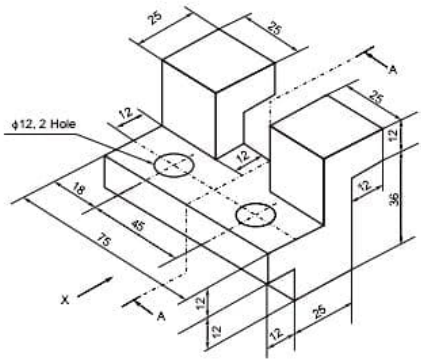


Fig. 2.64 (a)

Solution:

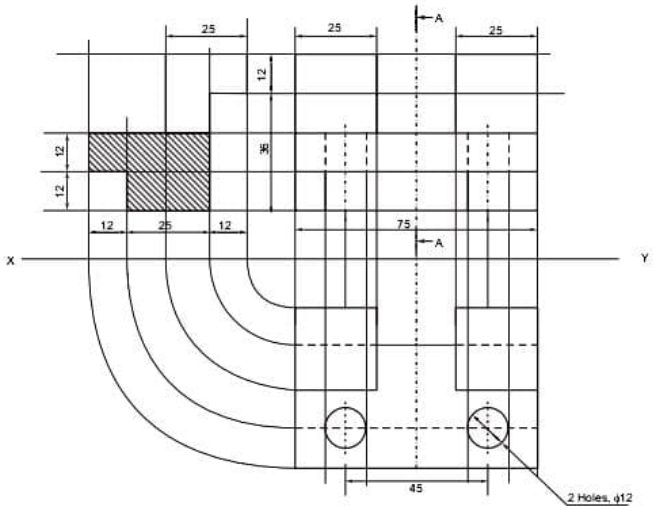


Fig. 2.64 (b)

Problem 2.25 : Figure 2.65 (a) shows a pictorial view of an object. By using first angle method of projections, Draw.

1. ***Sectional front view, along symmetry of object***
2. ***Right hand side view***
3. ***Top view***
4. ***Dimensions***

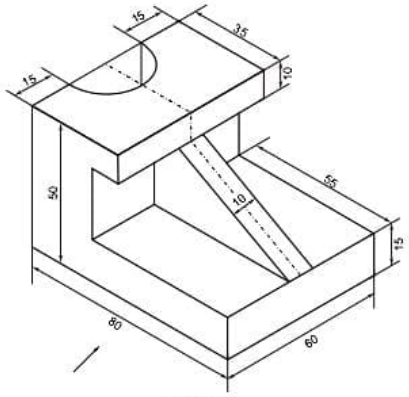


Fig. 2.65 (a)

Solution:

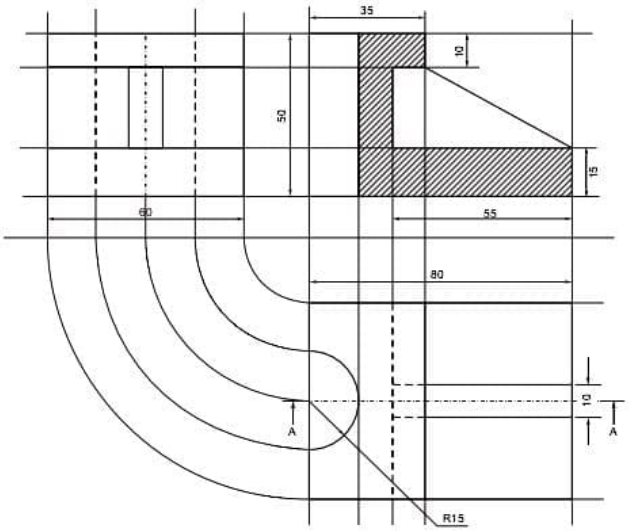


Fig. 2.65 (b)

Problem 2.26 : Figure 2.66 (a) shows a pictorial view of an object. By using first angle method of projection draw.

1. *Sectional front view, along symmetry of object*
2. *Right hand side view*
3. *Top view*
4. *Dimensions.*

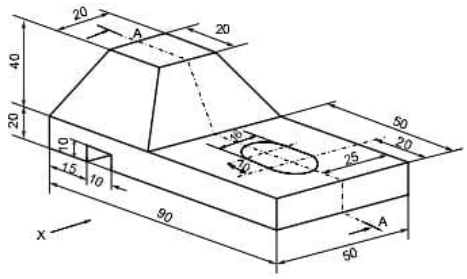


Fig. 2.66 (a)

Solution:

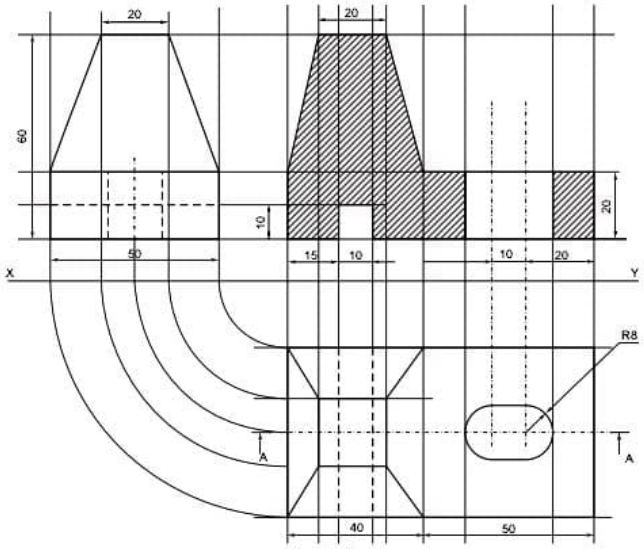


Fig. 2.66 (b)

Problem 2.27 : Figure 2.67 (a) shows a pictorial view of an object. By using first angle method of projections draw:

1. Sectional front view, along symmetry of the object 2. Left hand side view 3. Top view. Give all required dimensions.

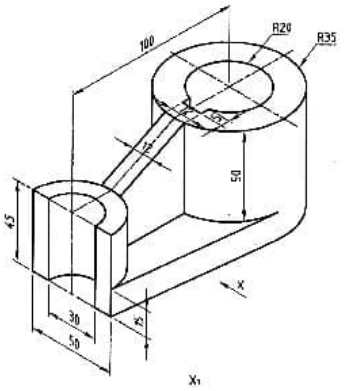


Fig. 2.67 (a)

Solution

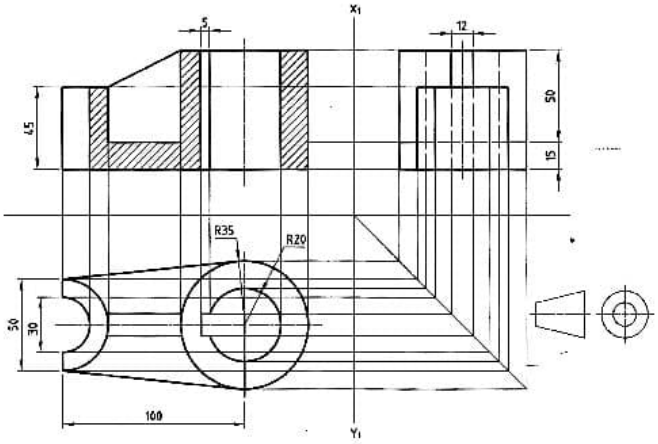


Fig. 2.67 (b)

Problem 2.28 : Figure 2.68 (a) shows a pictorial view of an object. By using first angle method of projections Draw:

1. ***Front view***
2. ***Sectional left hand side view along symmetry of the object.***
3. ***Top view***

Give all required dimensions.

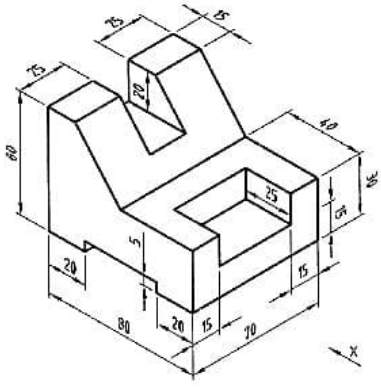


Fig. 2.68 (a)

Solution

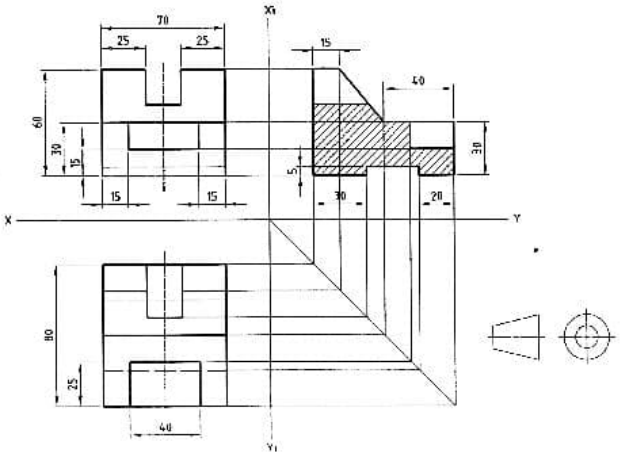


Fig. 2.68 (b)

Problem 2.29 : Figure 2.69 (a) shows a pictorial view of an object. By using first angle method of projections, draw:

1. ***Sectional Left hand side view, along given section plane***
2. ***Front view***
3. ***Top view***
4. ***Dimensions***

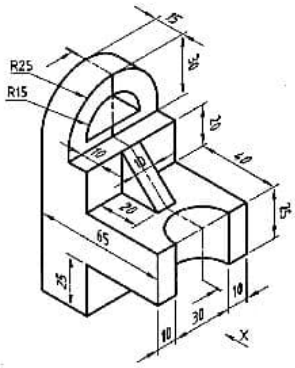


Fig. 2.69 (a)

Solution :

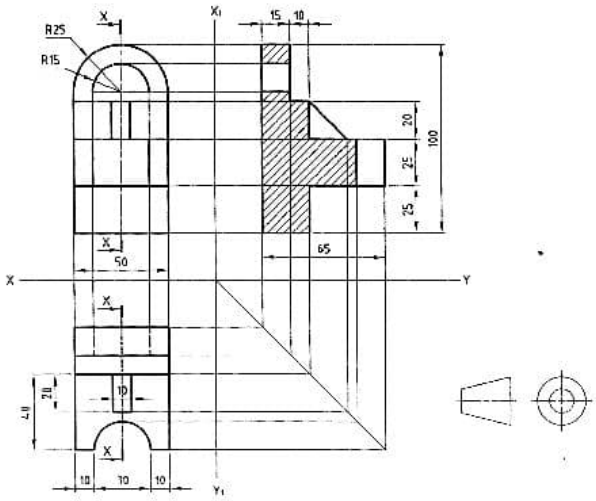


Fig. 2.69 (b)

Problem 2.30 : Figure 2.70 (a) shows a pictorial view of an object. By using First Angle Method of Projections Draw:

1. ***Sectional Front View, along sectional plane A-A.***
2. ***Left Hand Side View***
3. ***Top View***
4. ***Dimensions.***

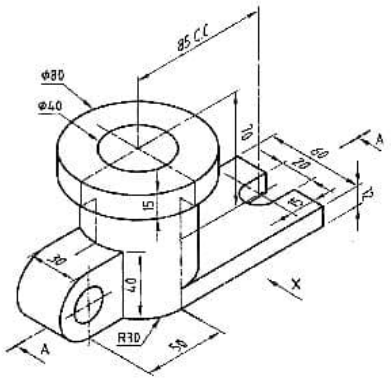


Fig. 2.70 (a)

Solution

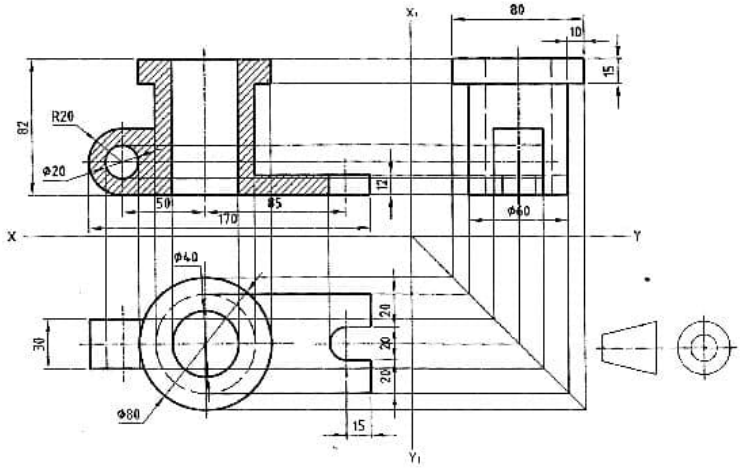


Fig. 2.70 (b)

Fig. shows a pictorial view of an object. Using the first angle method of projection, draw the following views :

1. *F.V.,* 2. *Top view,* 3. *Side view*

Problem 2.31 :

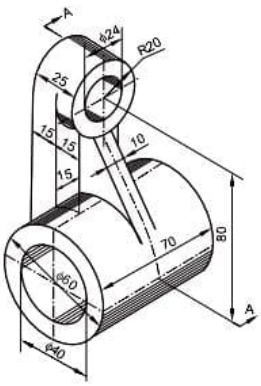


Fig. 2.71 (a)

Solution:

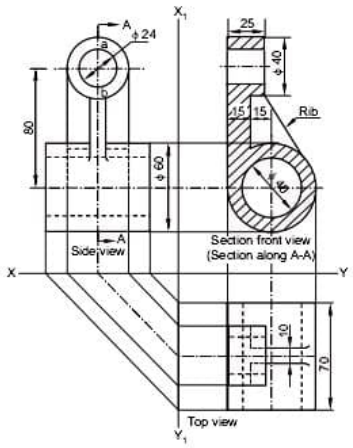


Fig. 2.71 (b)

Problem 2.32 :

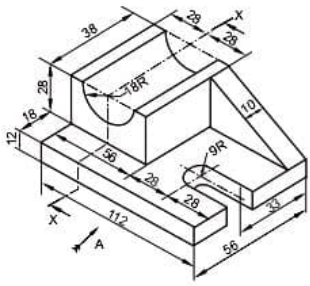


Fig. 2.72 (a)

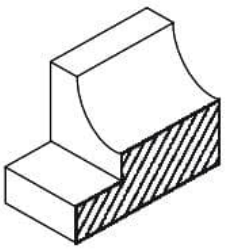


Fig. 2.72 (b)

Solution :

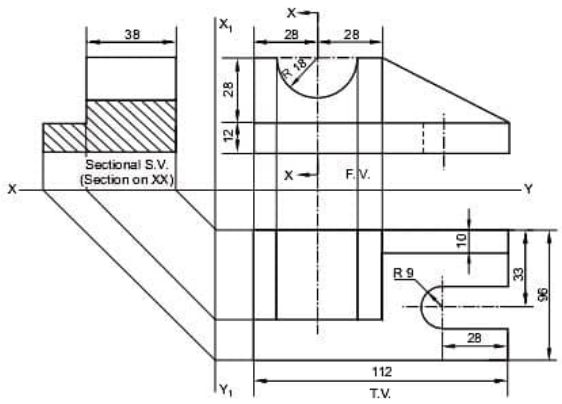


Fig. 2.72 (c)

Problem 2.33 :

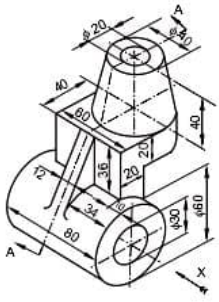


Fig. 2.73 (a)

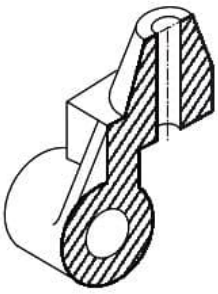


Fig. 2.73 (b)

Solution :

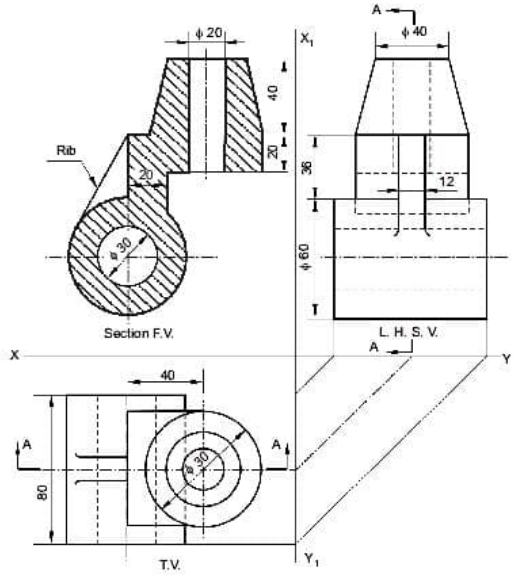


Fig. 2.73 (c)

Problem 2.34 :

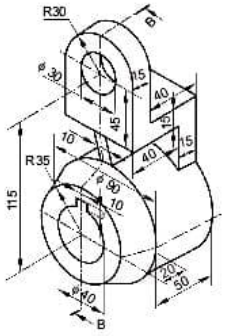


Fig. 2.74 (a)

Solution :

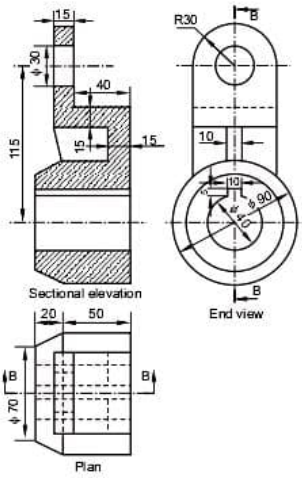


Fig. 2.74 (b)

Problem 2.35 :

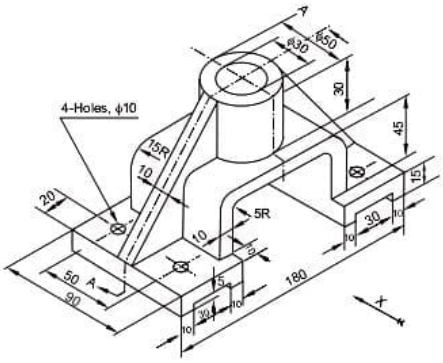


Fig. 2.75 (a)

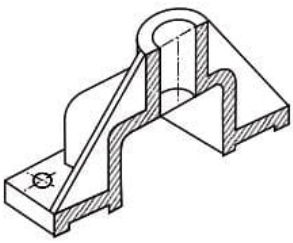


Fig. 2.75 (b)

Solution :

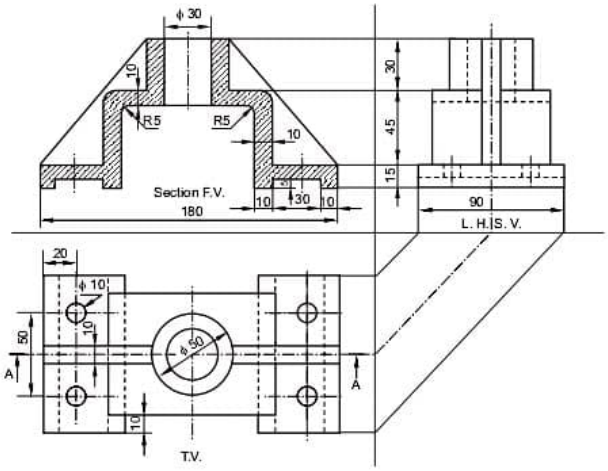


Fig. 2.75 (c)

Problem 2.36 :

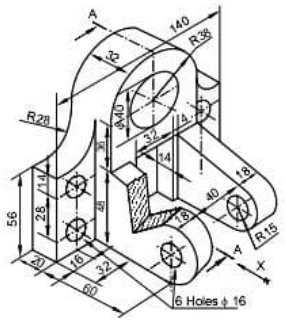


Fig. 2.76 (a)

Solution :

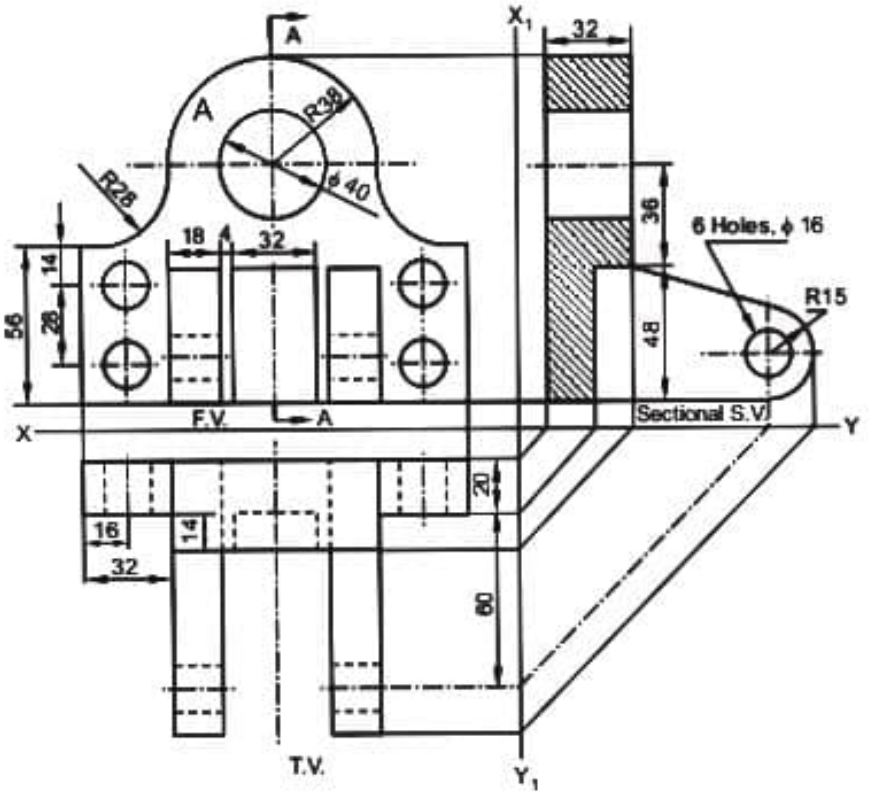
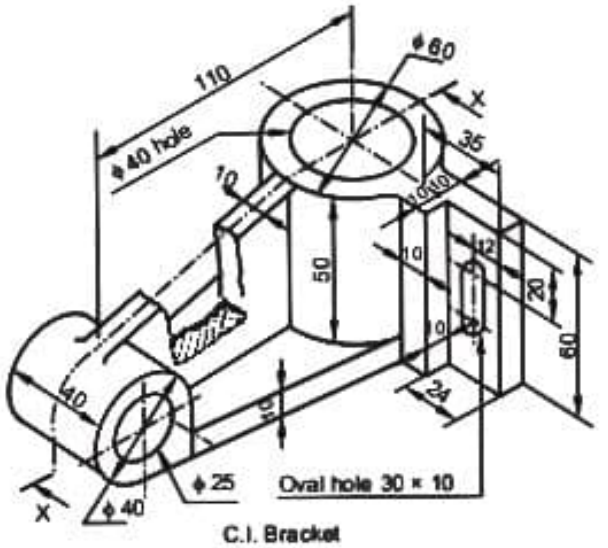


Fig. 2.76 (b)

Problem 2.37 :



C.I. Bracket

Fig. 2.77 (a)

Solution :

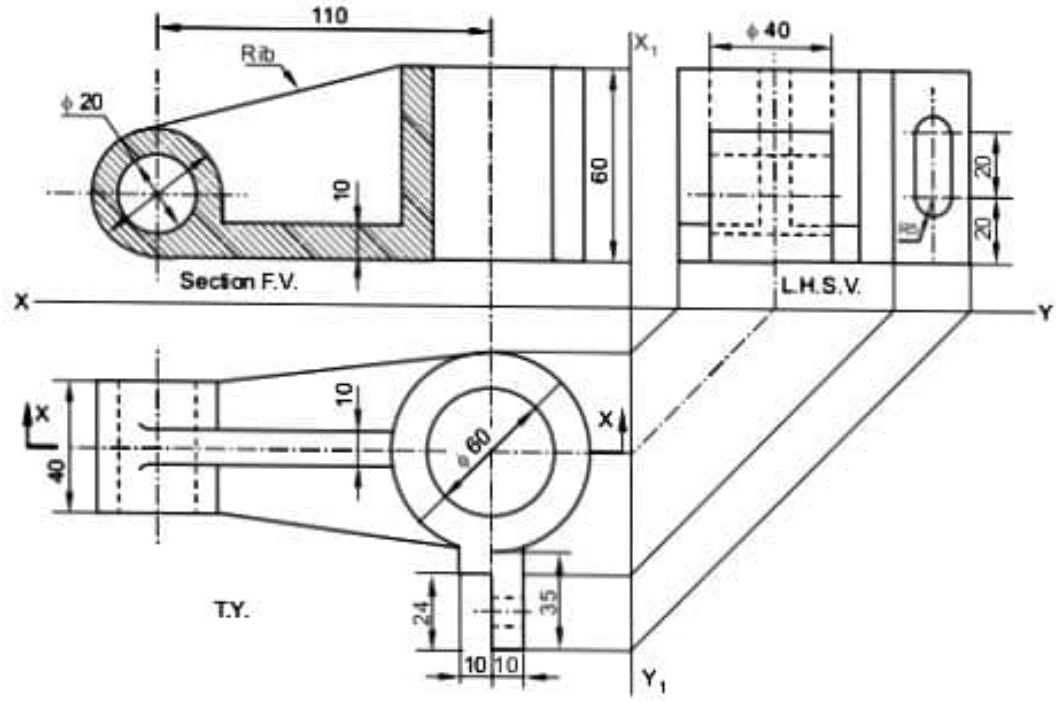


Fig. 2.77 (b)

PROBLEMS FOR PRACTICE

Pictorial views of various objects are given. Draw the views of each object as stated below. Use your judgement for dimensions, which are not given. 1. The front view in each case to be diagrams as seen in the direction of arrow X. 2. TV 3. Side view 4. Show sectional view as per position of cutting plane in respective view.

1.

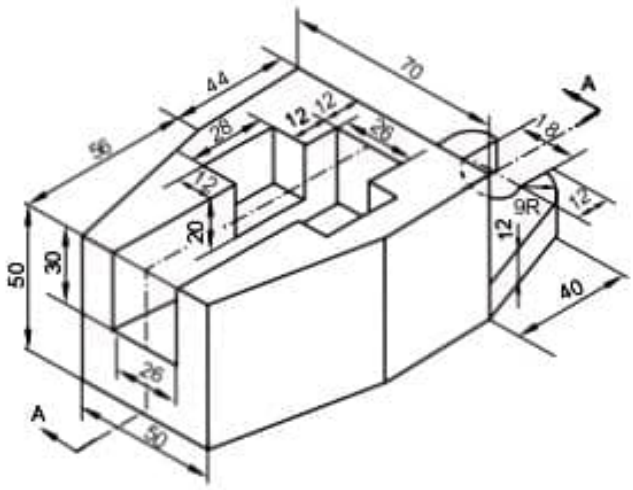


Fig. 2.78

2.

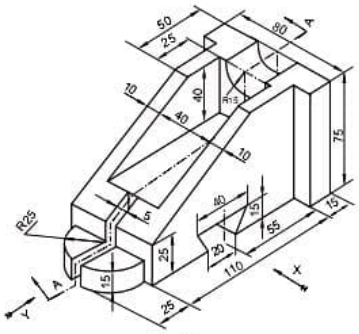


Fig. 2.79

3.

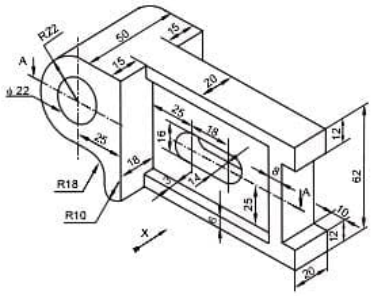


Fig. 2.80

4.

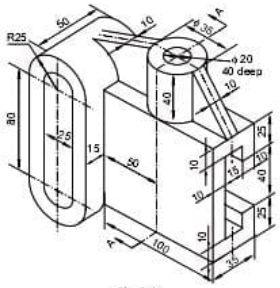


Fig. 2.81

5.

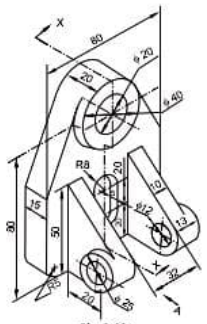


Fig. 2.82

6.

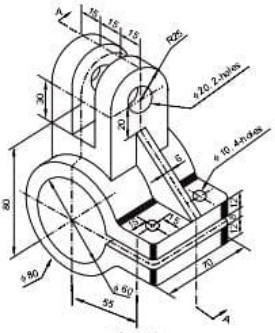


Fig. 2.83

7.

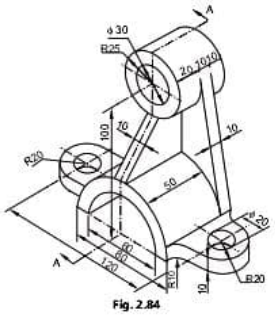


Fig. 2.84

8.

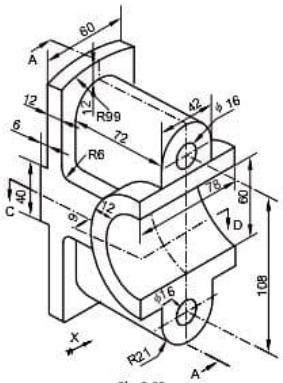


Fig. 2.85

9.

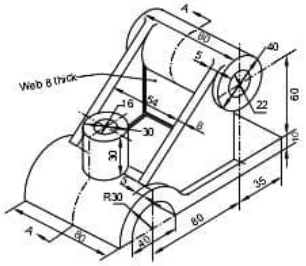


Fig. 2.86

10.

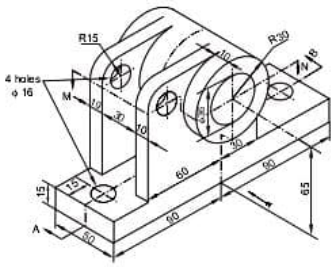


Fig. 2.87

11.

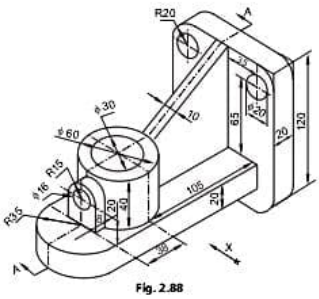


Fig. 2.88

12.

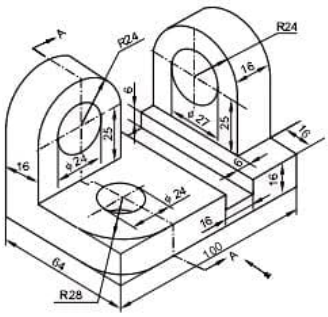


Fig. 2.89

13.

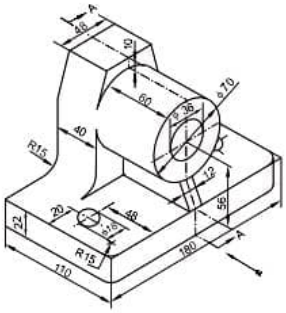


Fig. 2.90

14.

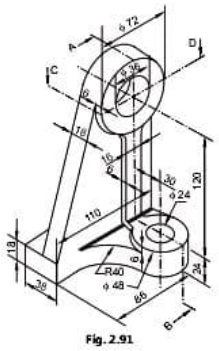


Fig. 2.91

15.

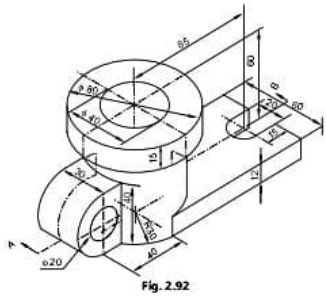


Fig. 2.92

16.

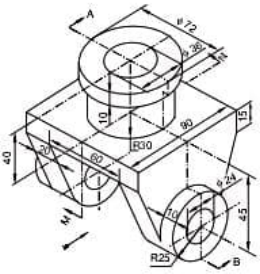


Fig. 2.93

17.

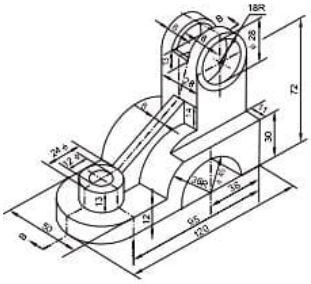


Fig. 2.94

18.

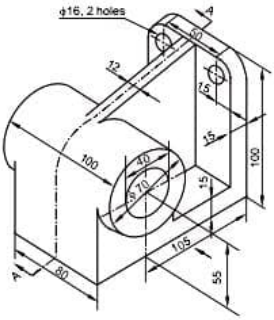


Fig. 2.95

19.

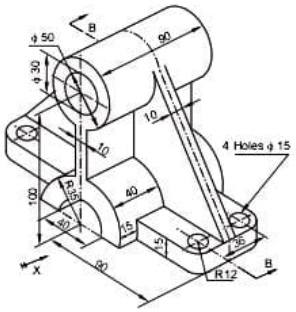


Fig. 2.96

20.

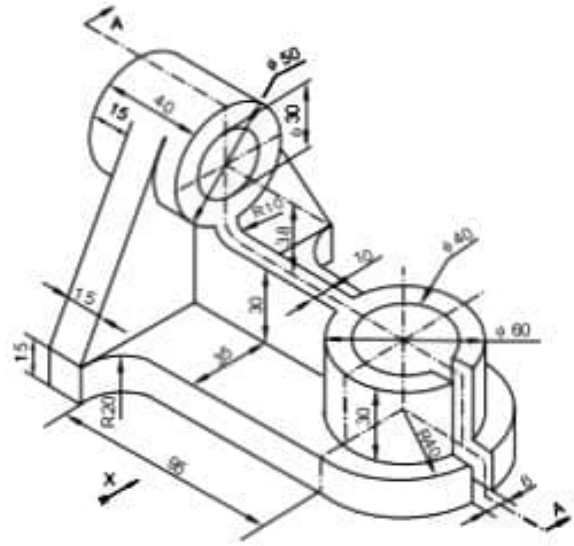


Fig. 2.97

2.18 PROJECTIONS OF POINTS

A point, in geometry, is defined as having position without magnitude and it is represented as a dot.

●A

Fig. 2.98

2.19 POSITIONS OF POINTS IN FIRST QUADRANT

Following are the positions of a point in the 1st Quadrant with respect to the reference planes:

1. Point A is above the H.P. and in front of the V.P.
2. Point B is above the H.P. and on the V.P.
3. Point C is on the H.P. and in front of the V.P.
4. Point D is on the H.P. and on the V.P.

Fig. 2.99 represents 3D and 2D representation of position of points in 1st quadrant.

Fig. 2.99

2.19.1 Point A is Above the H.P. and in Front of the V.P.

Problem.1: *The point A is 25 mm above the H.P. and 33 mm in front of the V.P. Draw its projections.*

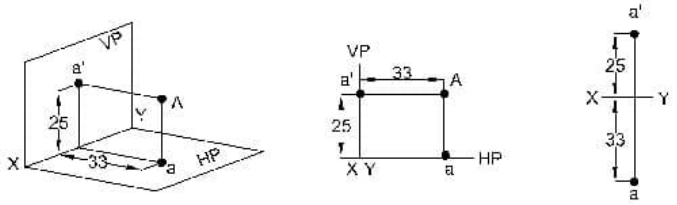


Fig. 2.100

2.19.2 Point B is Above the H.P. and on the V.P.

Problem 2: *The point B is 25 mm above the H.P. and on the V.P. Draw its projections.*

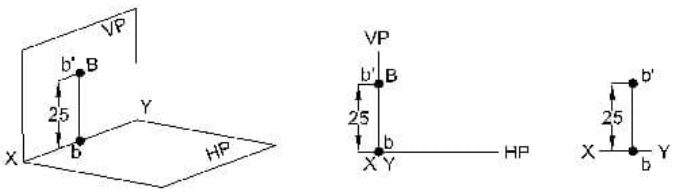


Fig. 2.101

2.19.3 Point C is on the H.P. and in Front of the V.P.

Problem 3: *The point C is on the H.P. and 33 mm in front of the V.P. Draw its projections.*

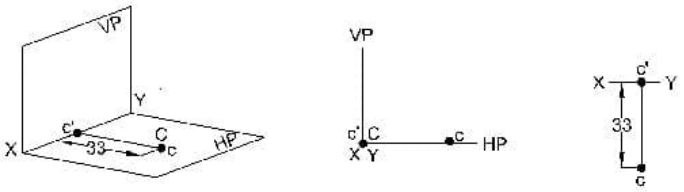


Fig. 2.102

2.19.4 Point D is on the H.P. and on the V.P.

Problem 4: *The point D is on the H.P. and on the V.P. Draw its projections.*

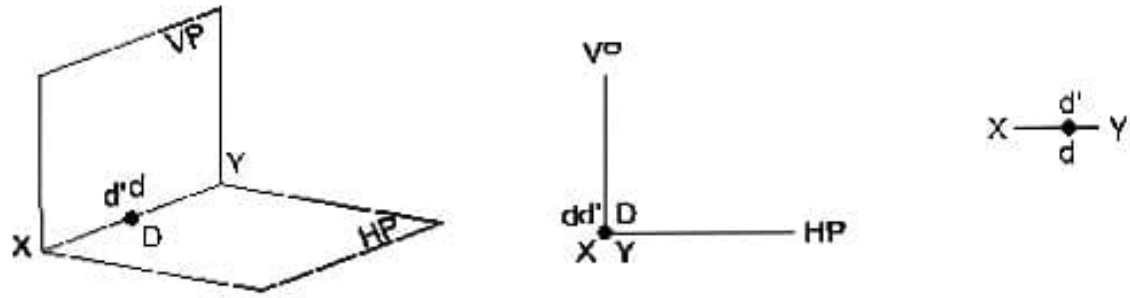


Fig. 2.103

2.20 CONCLUSIONS (USING 1ST ANGLE PROJECTION METHOD)

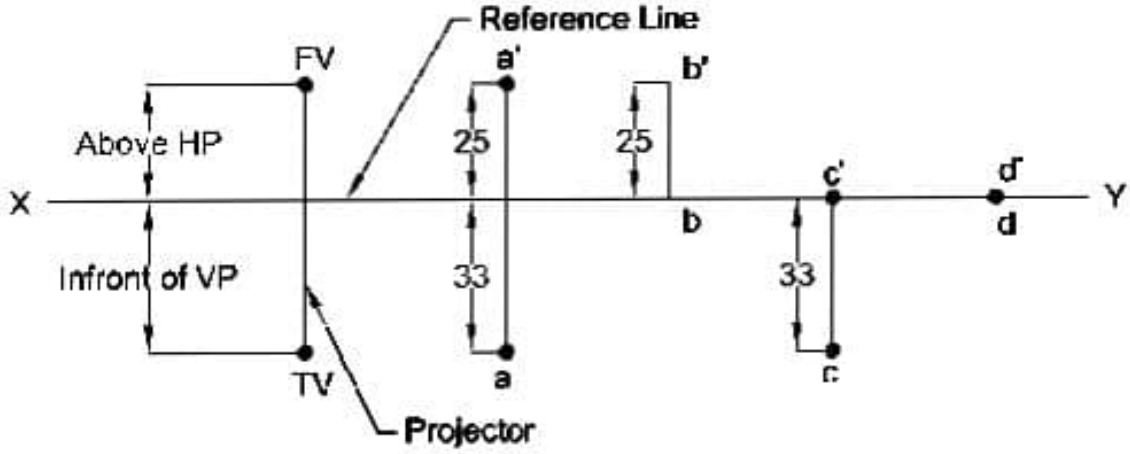


Fig. 2.104

2.20.1 Notations and Position of Views

Object	A	B	C	D	Position of View with XY	Reference plane
FV	a'	b'	c'	d'	FV either lies on XY or above XY line. FV never lies below XY line.	On Vertical Plane
TV	a	b	c	d	TV either lies on XY or Below XY line. TV never lies above XY line.	On Horizontal Plane

2.20.2 Position of Views with XY when Distance of Object with Respect to Reference Plane is known

Sr. No.	Distance	Position w.r.t. XY	View	Reference Plane
1	Above HP	Above XY	Front View (FV)	Vertical Plane (VP)
2	On/In HP	On XY	Front View (FV)	Vertical Plane (VP)
3	In front of VP	Below XY	Top View (TV)	Horizontal Plane (HP)
4	On/In VP	On XY	Top View (TV)	Horizontal Plane (HP)

2.21 POSITIONS OF POINTS IN THIRD QUADRANT

Following are the positions of a point in the IIIrd Quadrant with respect to the reference planes:

1. Point C is below the H.P. and behind V.P.
2. Point B is on the H.P. and behind V.P.
3. Point C is below the H.P. and on the V.P.

Fig. 2.105 represents 3D and 2D representation of position of points in 3rd quadrant.

2.21.1 Point is Below the H.P. and Behind the V.P.

Problem 5: The point C is 40 mm below the H.P. and 50 mm behind the V.P. Draw its projections.

The given point C is in the Third Quadrant. For the point C, its elevation is represented by **c'** and its plan is represented by **c**.

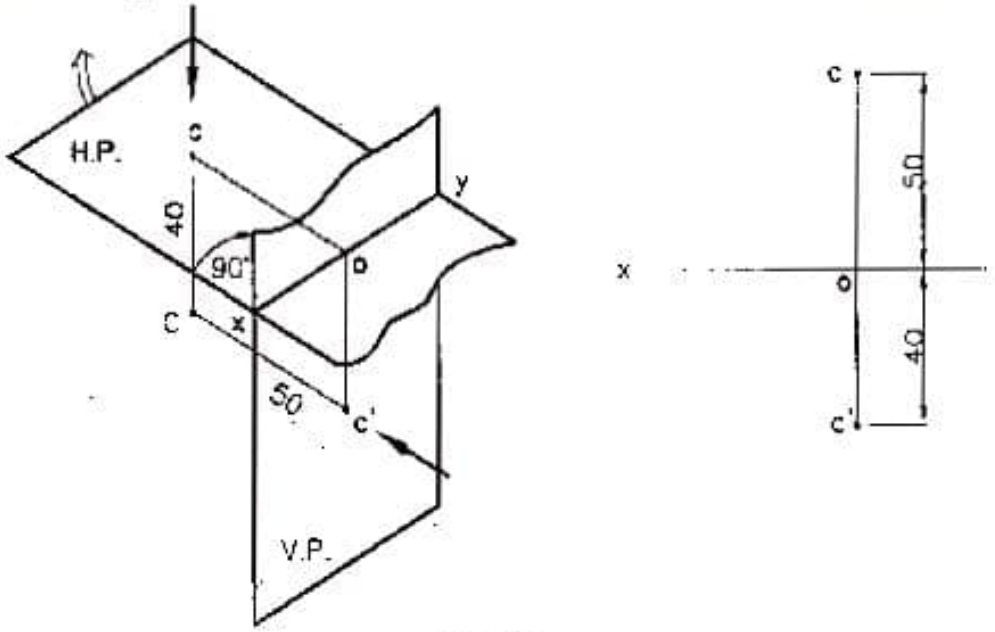


Fig. 2.105

2.21.2 Point is On the H.P. and Behind the V.P.

Problem 6: The point F is on the H.P. and 50 mm behind the V.P. Draw its projections.

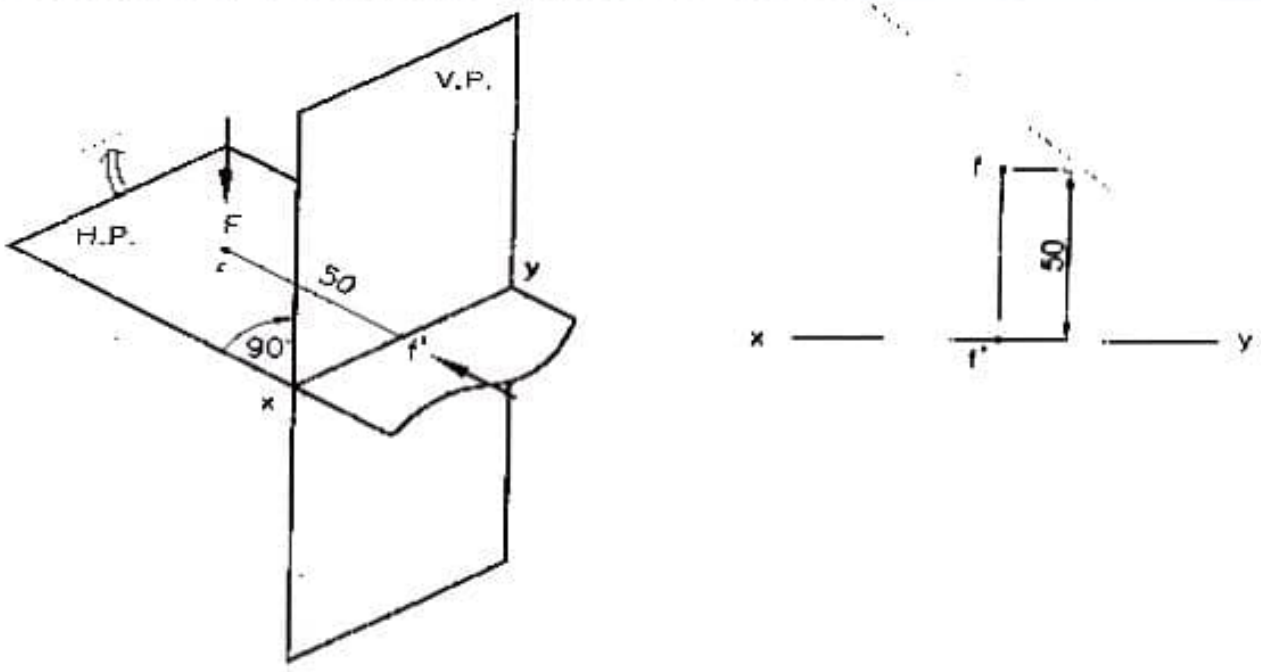


Fig. 2.106

2.21.3 Point is Below the H.P. and On the V.P.

Problem 7: The point H is 40 mm below the H.P. and on the V.P. Draw its projections.

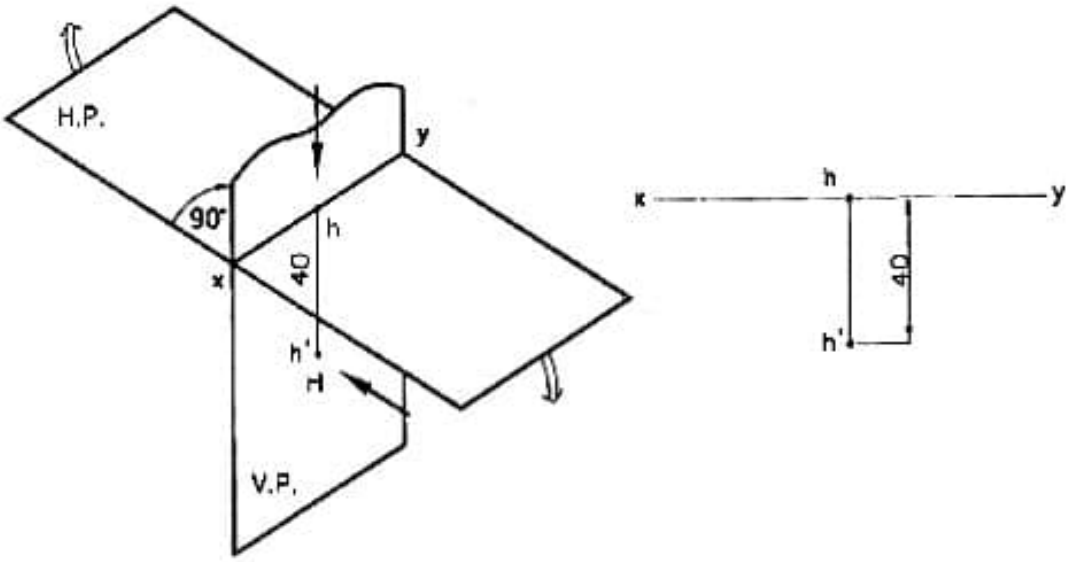


Fig. 2.107

2.22 CONCLUSIONS (USING 3RD ANGLE PROJECTION METHOD)

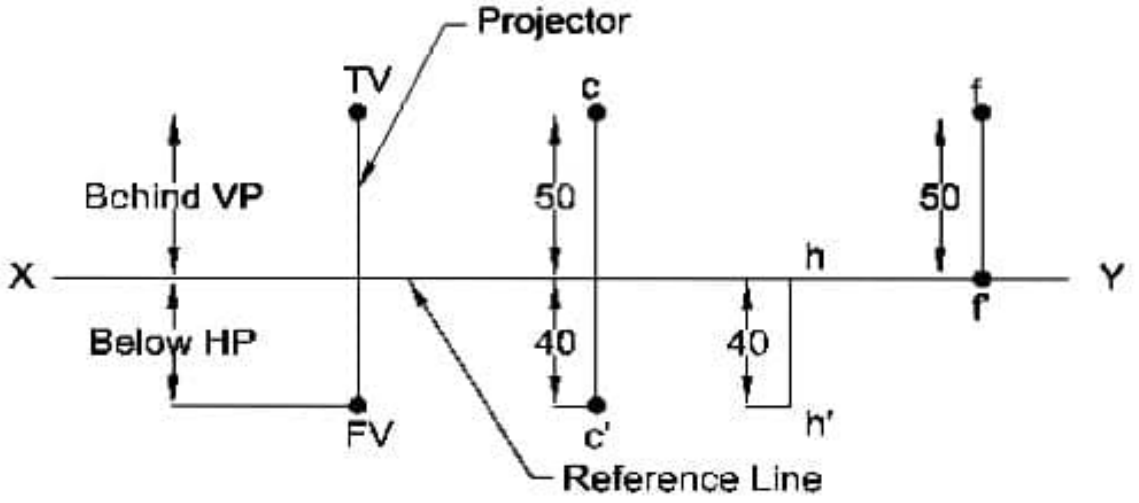


Fig. 2.108

2.22.1 Notations and Position of Views

Object	A	B	C	D	Position of View with XY	Reference Plane
FV	a'	b'	c'	d'	FV either lies on XY or Below XY line.	On Vertical Plane
TV	a	b	c	d	TV either lies on XY or above XY line.	On Horizontal Plane

2.22.2 Position of Views with XY when Distance of Object with Respect to Reference Plane is known

Sr. No.	Distance	Position w.r.t. XY	View	Reference Plane
1	Below HP	Below XY	Front View (FV)	Vertical Plane (VP)
2	On/In HP	On XY	Front View (FV)	Vertical Plane (VP)
3	Behind VP	Above XY	Top View (TV)	Horizontal Plane (HP)
4	On/In VP	On XY	Top View (TV)	Horizontal Plane (HP)

PROBLEMS FOR PRACTICE

1. Draw the projections of the following points

   (i) A is 60 mm above the HP and 40 mm in front of the VP

   (ii) B is 60 mm above HP and in the VP.

   (iii) C is on the HP and 40 mm in front of the VP

   (iv) D is on the HP and on The VP

2. Fill in the Blanks

   (i) If a point is in front of VP, its TV is _____ XY line. (Above/Below)

   (ii) The FV and TV of a point lies on a line which is perpendicular to the XY line, this perpendicular line is called _____ (Projection / Projector).

   (iii) If TV of a point is on the XY line and FV is above the XY line, then point is lying on the _____ Plane.

   (iv) If a point is above HP, its F.V. is _____ XY line. (Above/Below).

   (v) Find distance between FV & TV perpendicular to XY.

(v) TV of a point is 50mm below the XY and FV of a point is 20mm above XY line.

(vi) The point is 40mm above the HP and on the VP.

(vii) State the position of each point with respect to H.P. & V.P.

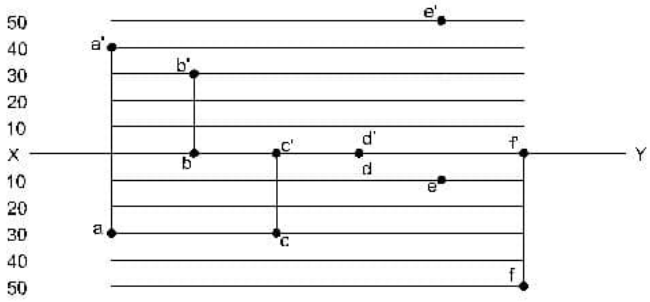


Fig. 2.109