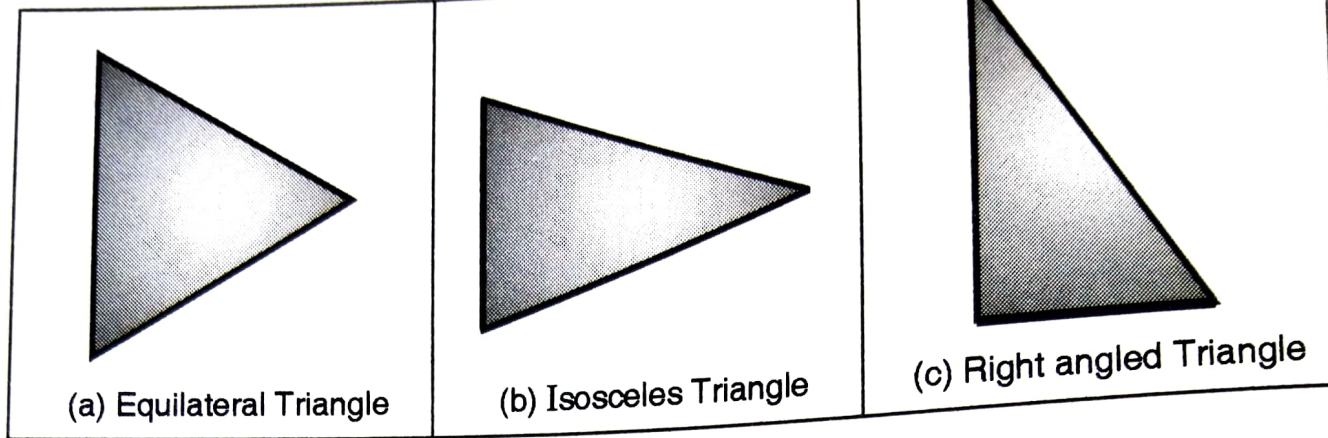


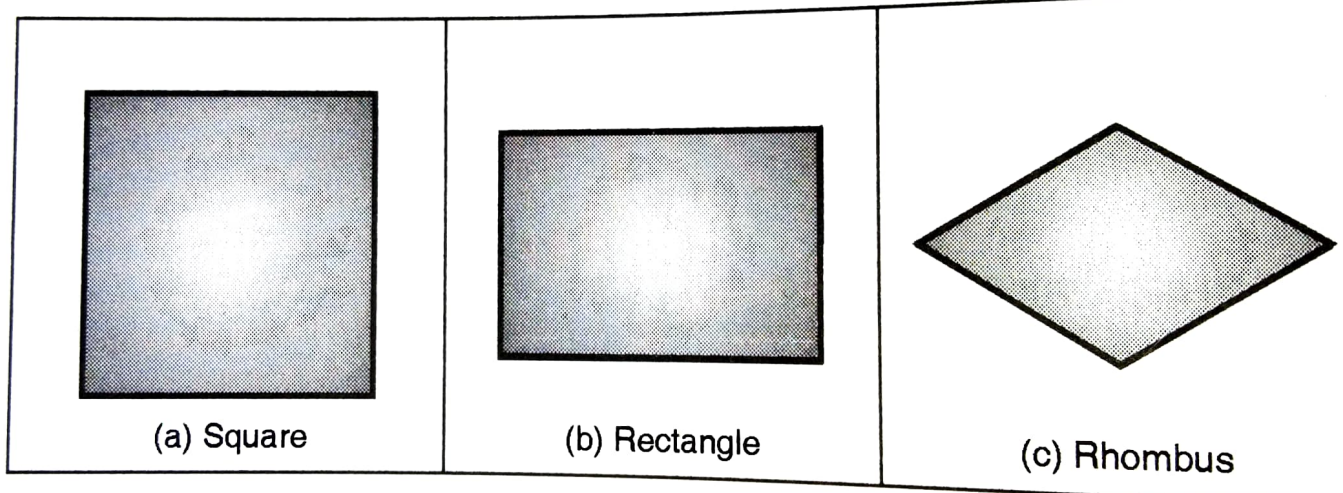
3. Pentagonal Plane
4. Hexagonal Plane
5. Circular and Semicircular Planes

1. **Triangular Planes** : Refer Fig. 4.1.



**Fig. 4.1**

2. **Quadrilateral Planes** : Refer Fig. 4.2.



**Fig. 4.2**

3. **Pentagonal Plane** :

Refer Fig. 4.3

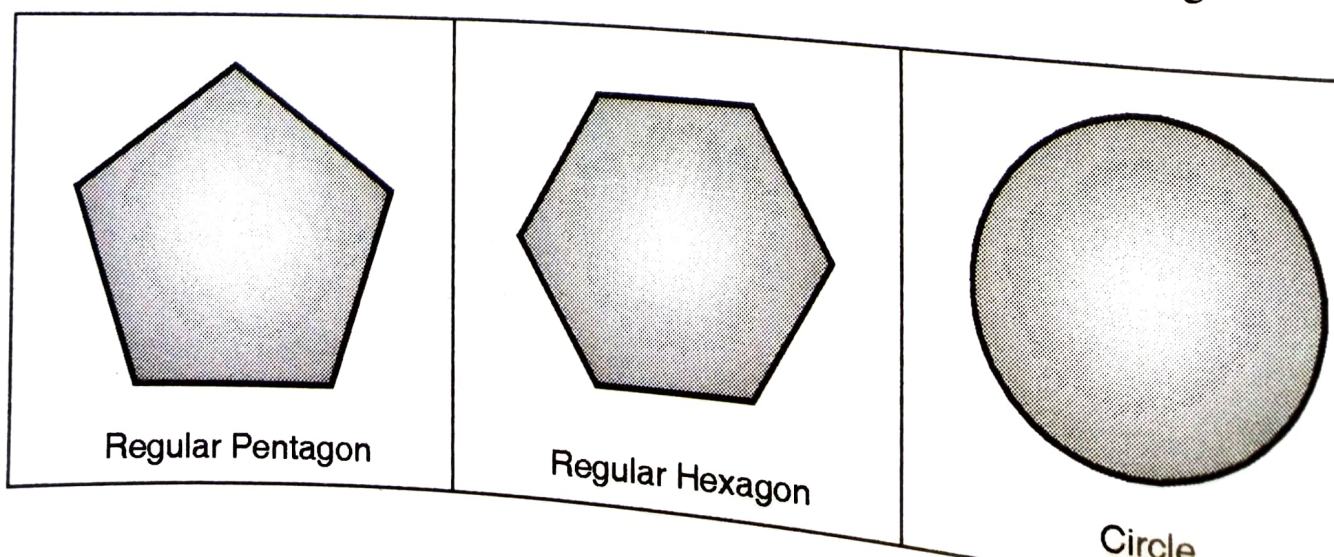
4. **Hexagonal Plane** :

Refer Fig. 4.4

5.

**Circular and Semicircular Planes**

Refer Fig. 4.5



## 4.4 Surface of Planes Parallel to One Principal Plane and Perpendicular to the Other Two :

We will categorize the planes which are parallel to one of the principal planes and perpendicular to the other two into three types which are given as below :

- (i) Planes parallel to H.P. and perpendicular to V.P. and P.P.
- (ii) Planes parallel to V.P. and perpendicular to H.P. and P.P.
- (iii) Planes parallel to P.P. and perpendicular to H.P. and V.P.

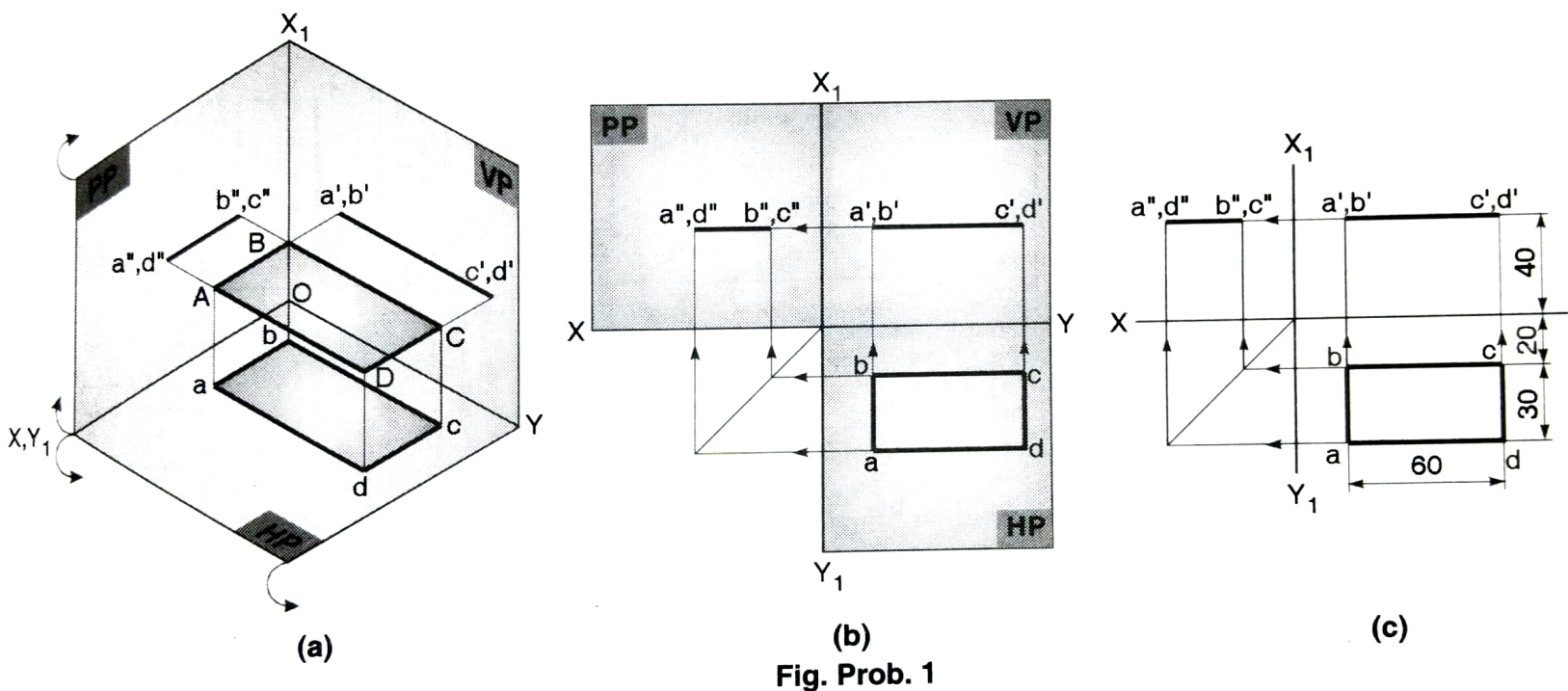
Now we will study the projections of these types of planes one by one, by taking few examples, in 1<sup>st</sup> angle projection method.

### 4.4.1 Surface of Planes Parallel to H.P. and Perpendicular to V.P. and P.P. :

**Prob. 1 :** A rectangular plane  $ABCD$  having  $60 \text{ mm} \times 30 \text{ mm}$  size is parallel to H.P. and perpendicular to V.P. and P.P. Draw the projections of the rectangle when it is  $40 \text{ mm}$  above H.P. and one of the longer sides is parallel to V.P. and  $20 \text{ mm}$  in front of it.

**Soln. :** Refer Figs. Prob. 1(a), (b) and (c).

**Visualisation of plane in space :** (Refer Fig. Prob. 1(a))



**Fig. Prob. 1**

Fig. Prob. 1(a) shows a rectangular plane  $ABCD$  situated in the first quadrant such that its surface is parallel to H.P. and  $40 \text{ mm}$  above it and one of the longer sides  $BC$  is parallel to V.P. and  $20 \text{ mm}$  in front of it. Plane  $ABCD$  is perpendicular to both V.P. and P.P. The rectangular plane  $ABCD$  is projected on to H.P., V.P. and P.P. indicated by projection lines.  $abcd$  is the T.V. of the rectangular plane projected on H.P.  $a'b'-c'd'$  is the F.V. of the plane projected on V.P.  $a''d''-b''c''$  is the right side view of the plane projected on P.P. Since the rectangular plane is held parallel to H.P., the T.V.  $abcd$  is in true shape. Since the plane is perpendicular to V.P. and P.P., both the F.V.  $a'b'-c'd'$  and the right side view  $a''d''-b''c''$  are projected as lines.

**Rotation of principal planes :** (Refer Fig. Prob. 1(b)).

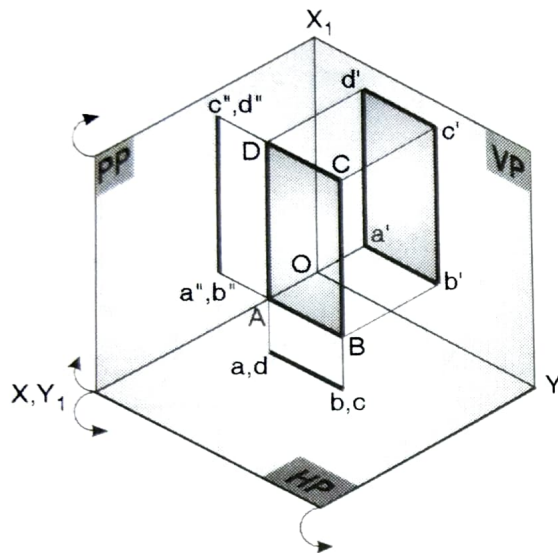


Conclusion : When a plane is parallel to V.P. and perpendicular to H.P. and P.P., will show the true shape of the plane. F.V. and S.V. will be seen as lines parallel to the  $XY$  and  $X_1Y_1$  line respectively and will be projected with the help of T.V.

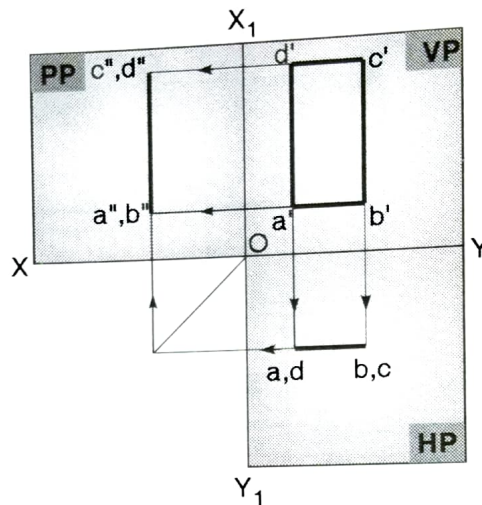
#### 4.4.2 Surface of Planes Parallel to V.P. and Perpendicular to H.P. and P.P. :

**Prob. 2 :** A rectangular plane  $ABCD$  having  $60\text{ mm} \times 30\text{ mm}$  size is parallel to V.P. and perpendicular to H.P. and P.P. Draw the projections of the rectangle when it is  $40\text{ mm}$  in front of V.P. and one of the smaller sides is parallel to H.P. and  $20\text{ mm}$  above it.

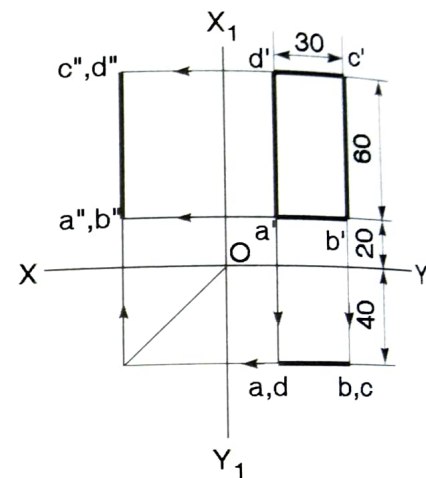
**Soln. :** Refer Figs. Prob. 2(a), (b) and (c). **Visualisation of plane in space :** (Refer Fig. Prob. 2(a))



(a) Visualisation of plane in space



(b) Rotation of principal planes  
Fig. Prob. 2



(c) Orthographic projections of plane

**Conclusion :** When a plane is parallel to V.P. and perpendicular to H.P. and P.P., always draw F.V. first as it will show the true shape of the plane. T.V. and S.V. will be seen as lines parallel to the  $XY$  and  $X_1Y_1$  line respectively and will be projected with the help of F.V.

#### 4.4.3 Surface of Planes Parallel to P.P. and Perpendicular to H.P. and V.P. :

**Prob. 3 :** A rectangular plane  $ABCD$  having  $60\text{ mm} \times 30\text{ mm}$  size is parallel to P.P. and perpendicular to H.P. and V.P. Draw the projections of the rectangle when it is  $40\text{ mm}$  in front of P.P. and one of the longer sides is parallel to V.P. and  $20\text{ mm}$  in front of it.

**Soln. :** Refer Figs. Prob. 3(a), (b) and (c). **(i) Visualisation of plane in space :** (Refer Fig. Prob. 3(a))

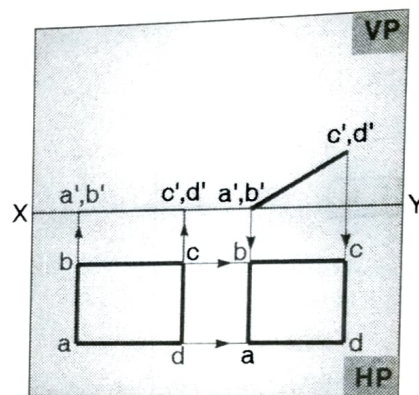
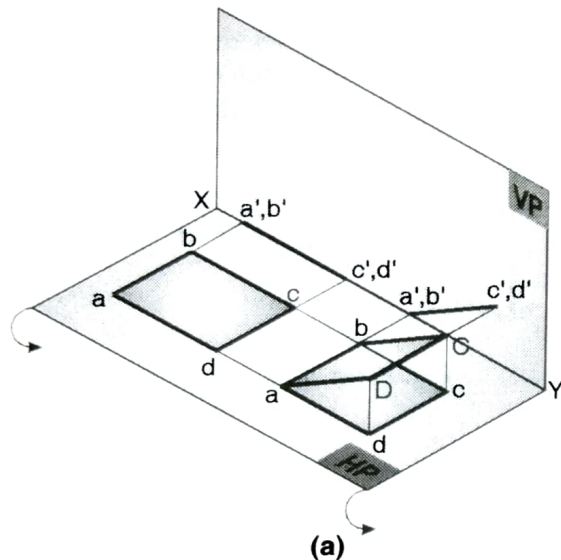
stage, the plane is assumed to be parallel to or kept at the required inclination in the second stage. When we talk about tilting (rotating) keep the plane one of its sides and (ii) we can keep the plane on one of its corners.

Now we shall study each case one by one.

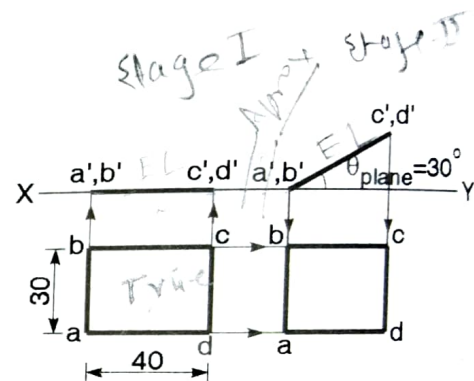
#### 4.5.1 Surface of a Plane Perpendicular to V.P., Inclined to H.P. with One of the Sides of the Plane on H.P. :

**Prob. 16 :** A rectangular plane  $ABCD$  having its smaller side  $AB = 30$  mm and longer side  $BC = 40$  mm is kept on the H.P. on its smaller side  $AB$  and is inclined to H.P. at an angle of  $30^\circ$ . Draw the projections of the rectangle when its surface is perpendicular to V.P.

**Soln. :** Refer Figs. Prob. 16(a), (b) and (c).



(b)  
Fig. Prob. 16



(c)

#### Initial position :

**Step 1 :** Since rectangular plane  $ABCD$  is inclined to H.P., initially we will assume that the plane is kept on the H.P. in such a way that the smaller side  $AB$  which is in the H.P. is perpendicular to V.P. (i.e.  $XY$ ).

**Step 2 :** As we have kept the plane on H.P., its T.V. will show the true shape. Hence draw the T.V.  $abcd$  with smaller side  $ab$  perpendicular to the  $XY$  line and project the F.V.  $a'b' - c'd'$  which will be seen as a line coinciding with the  $XY$  line.

### 5.3 Surface of a Plane Perpendicular to H.P., Inclined to V.P. with One of the Sides of the Plane on V.P. :

Prob. 20 : A rectangular plane  $ABCD$  having its smaller side  $AB = 30$  mm and longer side  $BC = 40$  mm is kept on the V.P. on its smaller side  $AB$  and is inclined to V.P. at an angle of  $30^\circ$ . Draw the projections of the rectangle when its surface is perpendicular to H.P.

Ans. : Refer Figs. Prob. 20(a), (b) and (c).

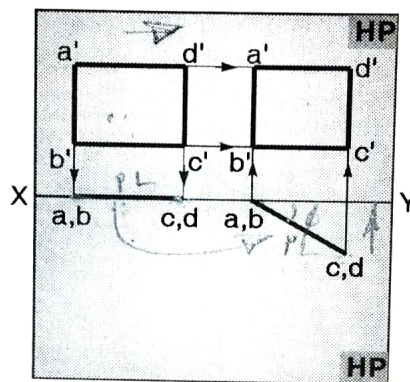
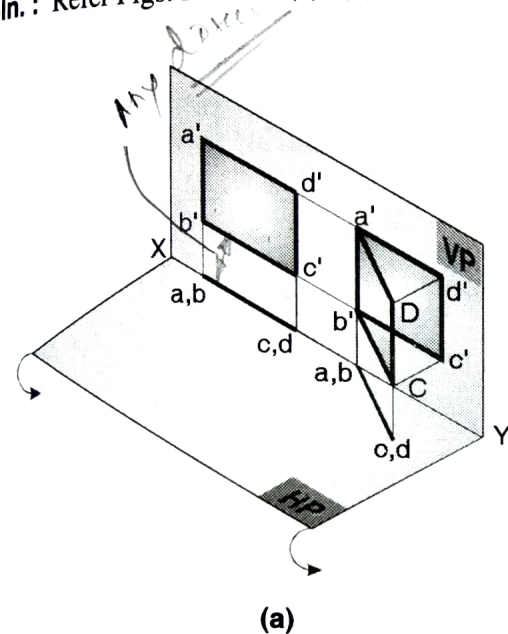
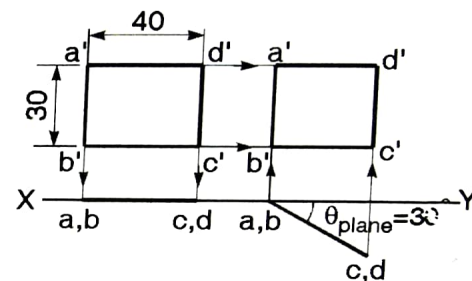


Fig. Prob. 20



Initial position :