Teaching Aids Required for this Sheet
(The RA should bring them to the class)

- A pair of hinged square acrylic plates; this can be used to denote the quadrants.
- A square acrylic plate to denote auxiliary plane.
- The following shapes in cardboard: Equilateral triangle, Isosceles triangle, Right angle triangle with other angles as 30° and 60°, Square, Rectangle, Regular pentagon, Regular hexagon, Circle.

ME119:
Engineering Drawing & Graphics

4. Projections on Auxiliary Planes

Department of Mechanical Engineering
Indian Institute of Technology Bombay

Projections on Auxiliary Planes

- Chapters 11 covers the details on Projections on Auxiliary Planes.
- Roughly work out all the problems given to you.

Note: For the sake of simplicity and uniformity, we shall use only 1st angle projection.

Outline

- Types of Auxiliary Planes and Views
- Projections of Points on Auxiliary Planes
- Projections of Lines on Auxiliary Planes
- Projections of Planes on Auxiliary Planes
- Point-Views of Lines
- Edge-Views of Planes
- True Lengths of Lines
- True Sizes and Shapes of Planar Features
- Conclusions

Projections on Auxiliary Planes

Definition and Need

Auxiliary plane is any plane with orientation other than the six faces of the superscribing cube of the object. Its uses are:

- To capture features not visible in 6 views
- To capture the true length of a line
- To capture the point-view of a line
- To capture the edge-view of a plane
- To capture the true size and shape (form) of a planar feature (polygon etc.) …

What is the relationship between trace and point-/edge-view?

To reveal a detail, either the object can be rotated or you can go around the object; the former is traditional 6 views and the latter are auxiliary views.

Side views are special cases of aux. views.

Note: Hidden features can be captured only in sectional views.

Projections on Auxiliary Planes

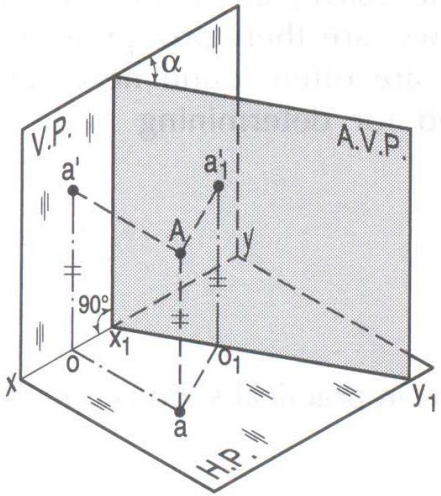
Three types

(a) Auxiliary Vertical Plane (A.V.P.)

(b) Auxiliary Inclined Plane (A.I.P.)

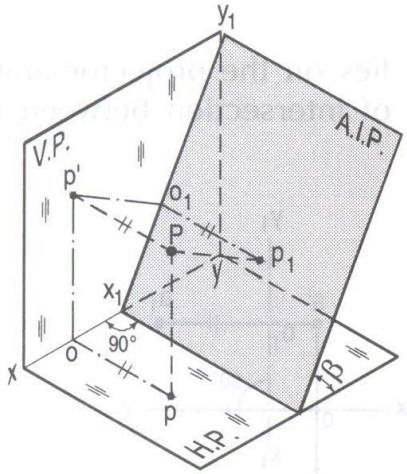
(c) General Auxiliary Plane (G.A.P.)

We shall not use G.A.P. as the same effect is realized through a pair of aux. views.



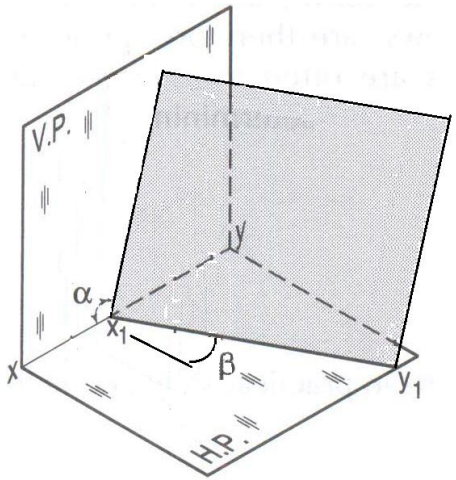
1. Auxiliary Vertical Plane (A.V.P.): Orthogonal to H.P. and inclined to V.P.

Projection is *Aux. Front View*



2. Auxiliary Inclined Plane (A.I.P.): Orthogonal to V.P. and inclined to H.P.

Projection is *Aux. Top View*

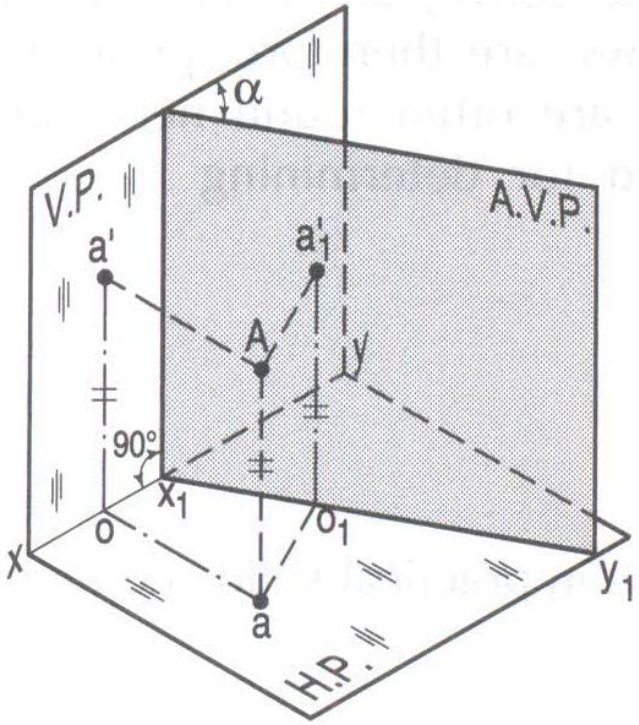


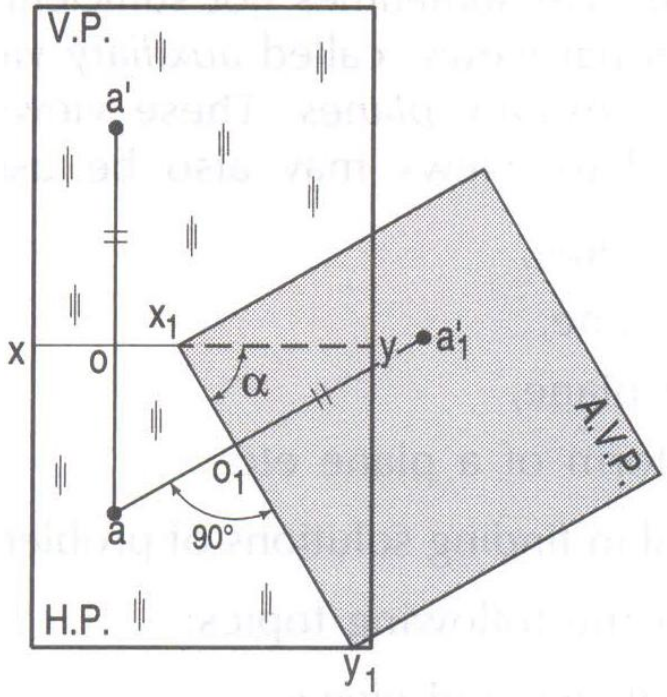
3. General Auxiliary Plane (G.A.P.): Inclined to both H.P. and V.P.

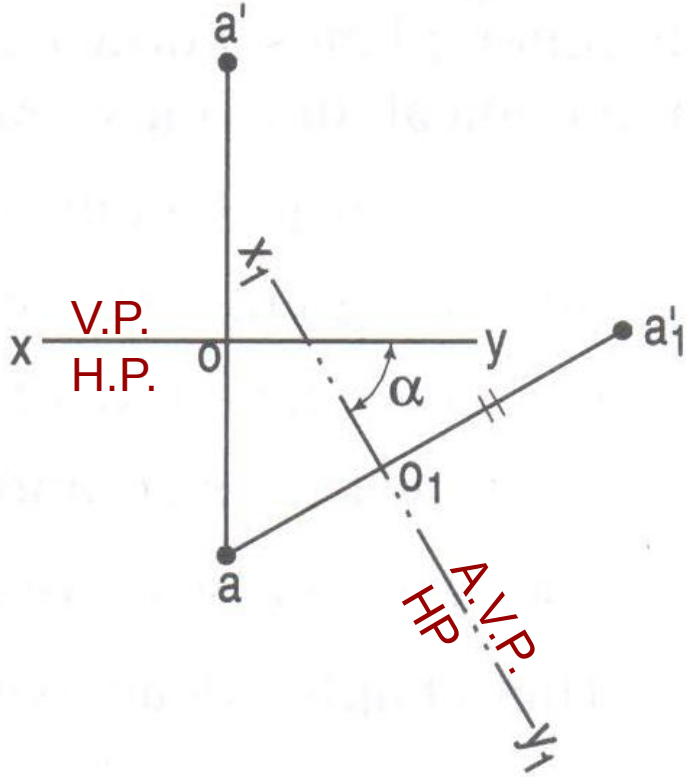
Projections of Points on Auxiliary Planes

Projections of Points on Auxiliary Planes

A.V.P. inclined to V.P. by α

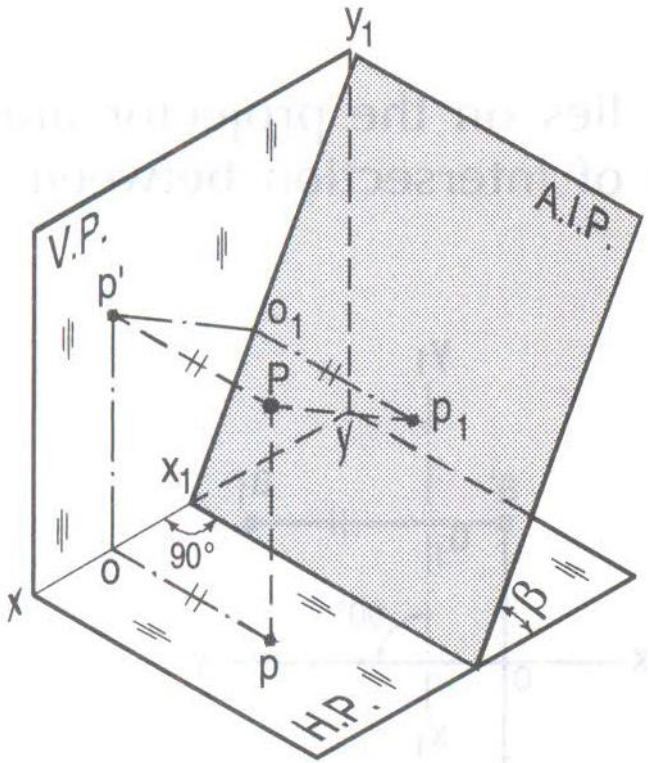


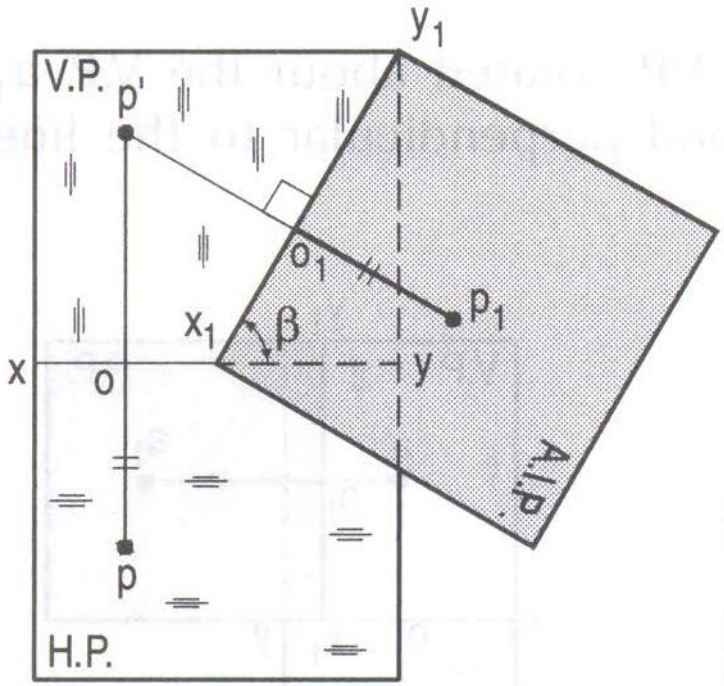


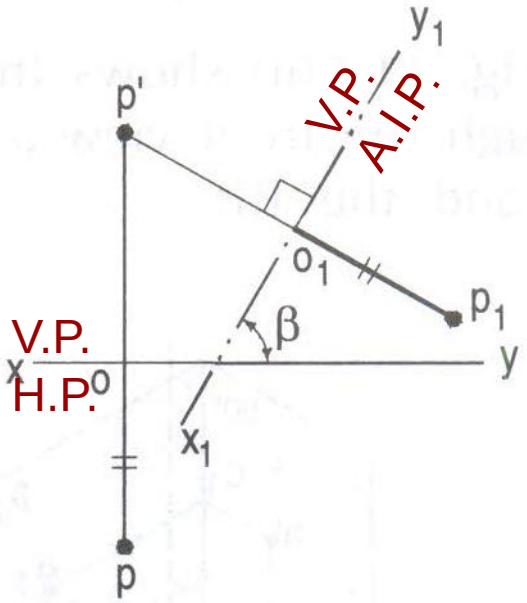


Projections of Points on Auxiliary Planes

A.I.P. inclined to H.P.



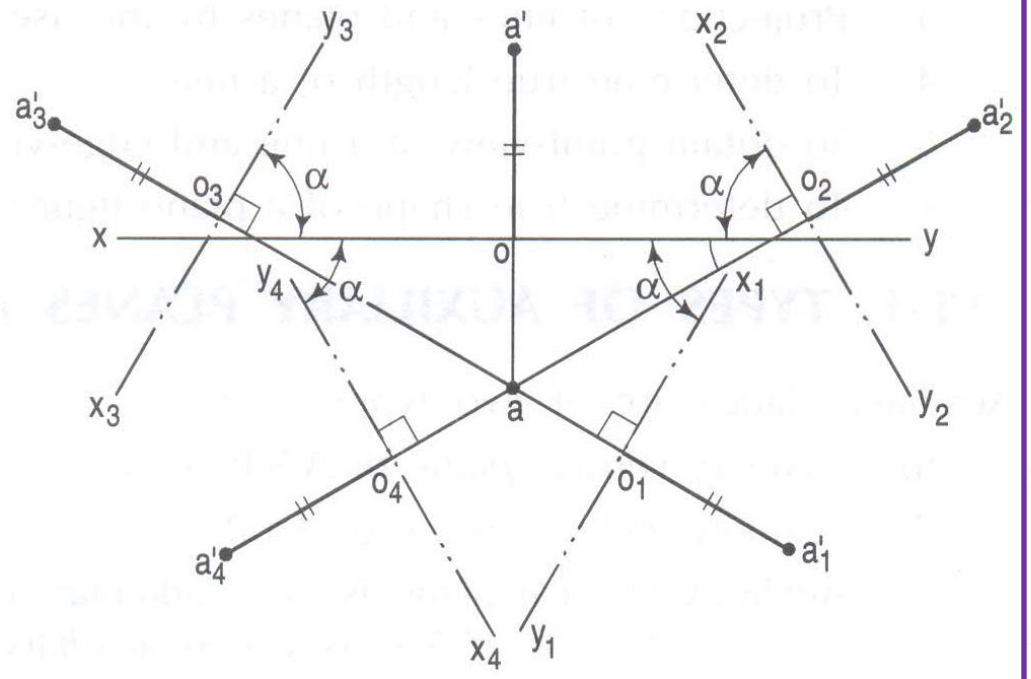


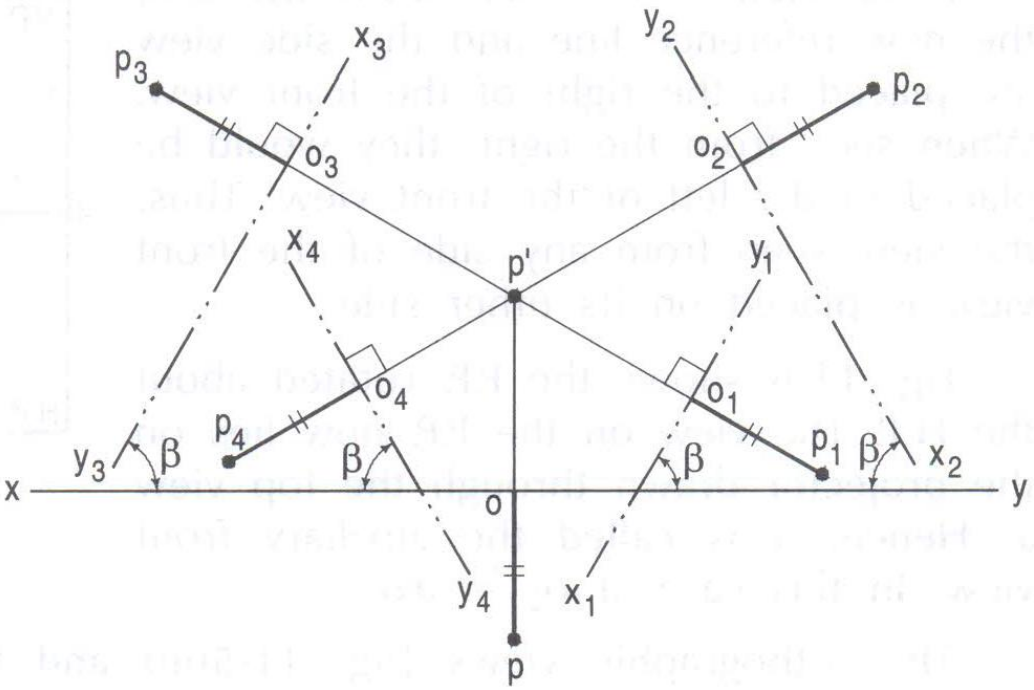


Projections of Points on Auxiliary Planes

Aux. plane is inclined to V.P. or H.P.

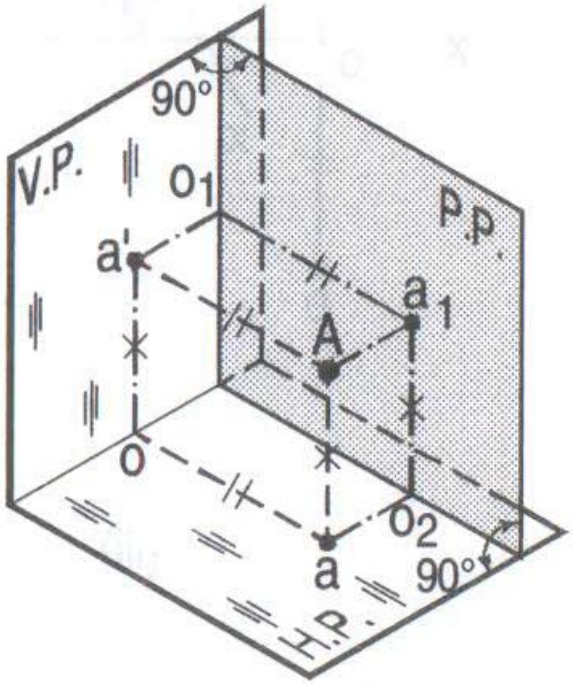
α and β, each can have four possibilities which lead to four different projections. Therefore, the definition of the aux. plane should be carefully understood to resolve the ambiguities. If the data is not enough to resolve, you can use any of them.

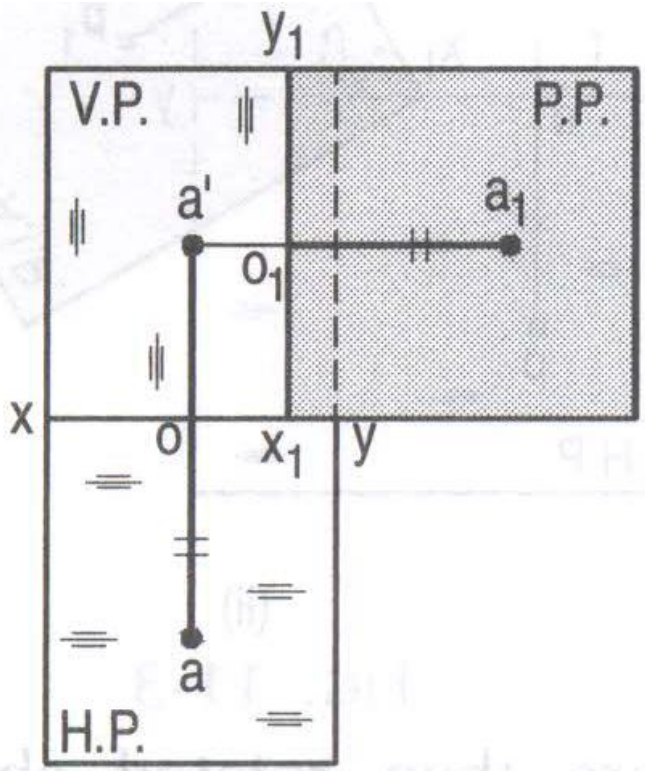


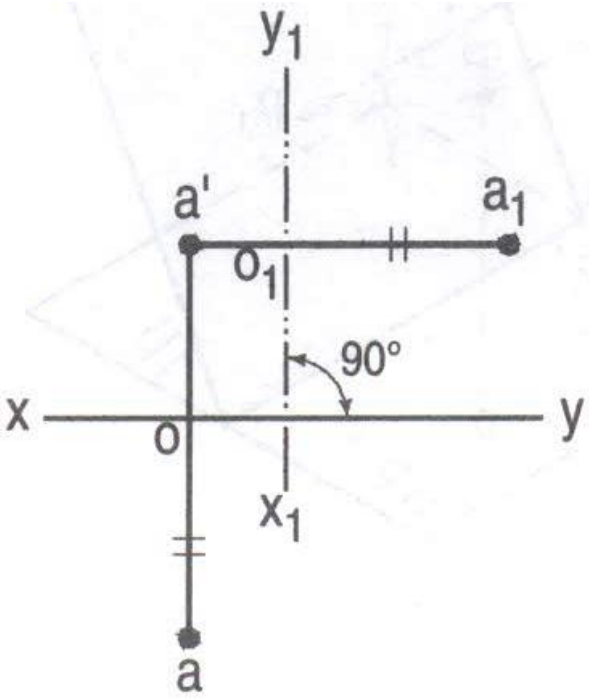


Projections of Points on Auxiliary Planes

Aux. plane: orthogonal to both H.P. and V.P.







This is nothing but the familiar side view.

Projections of Points on Auxiliary Planes

Summary

- The aux. top view of a point lies on a line drawn through the front view perpendicular to the new reference line x_1y_1 and at a distance from it equal to the distance of the first top view from its own reference line *xy*.
- The aux. front view of a point lies on a line drawn through the top view perpendicular to the new reference line x_1y_1 and at a distance from it equal to the distance of the first front view from its own reference line *xy*.
- The distances of all the front views of the same point (projected from the same top view) from their respective reference lines are equal.
- The distances of all the top views of the same point (projected from the same front view) from their respective reference lines are equal.

Projections of Lines and Planes on Aux. Planes

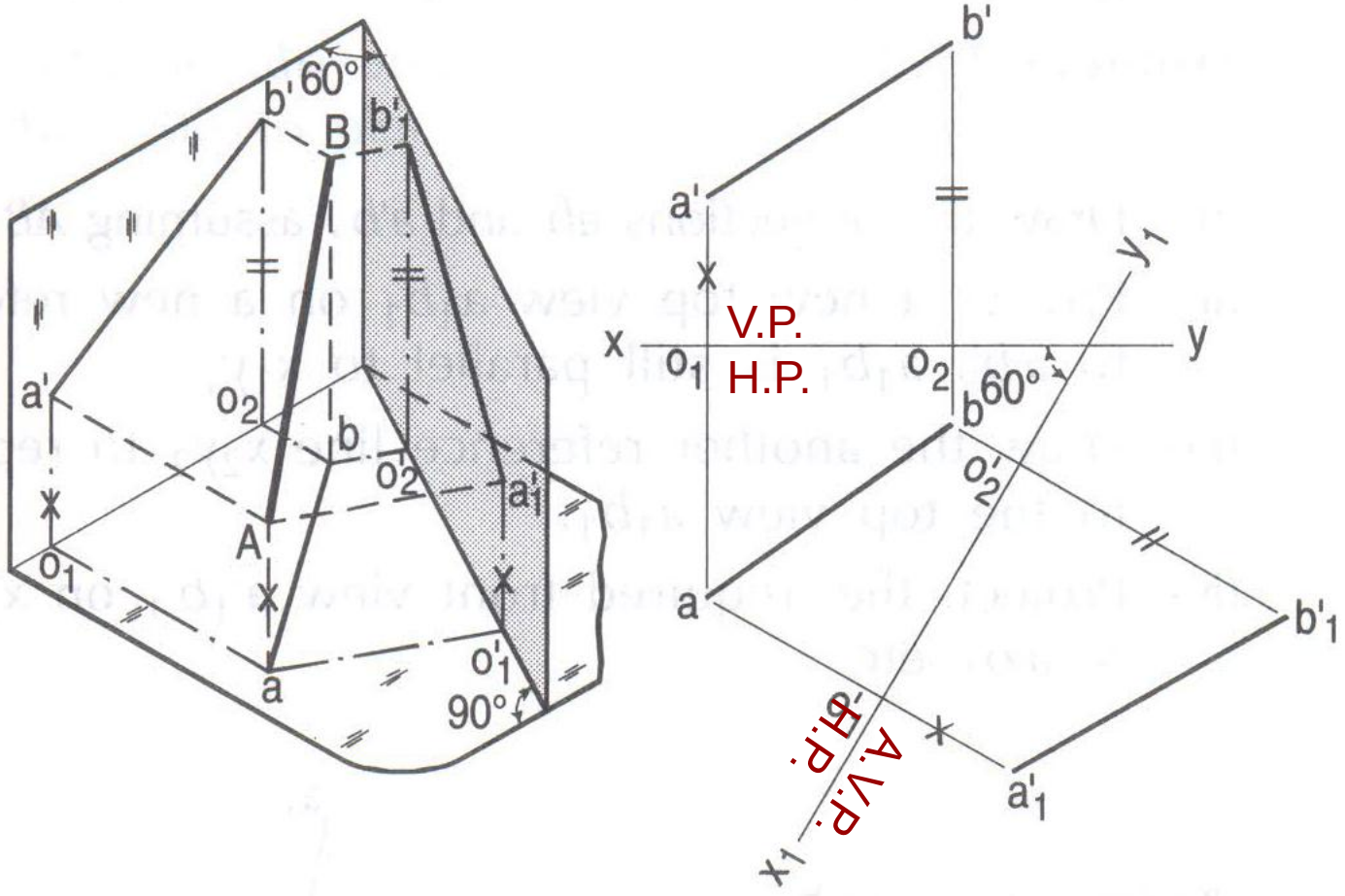
- Projection of a line is obtained by projecting its end points.
- Projection of a planar feature is obtained by projecting its sides.
- Whatever problems we solve using aux. plane method can be solved using only front and side views by rotating the object. However, use of aux. plane will prove more elegant in certain situations. So, although it will be slightly tougher to understand, and you may not appreciate its significance now, be patient and pursue it. We shall show nice examples later which demonstrate the power of aux. views.
- Analogy between conv. views and aux. views: To see the details not visible from your current position, either you rotate the object or you go round the object. These are complementary or inverse of each other.

Projection of a Line Using Aux. Planes

Projection of a Line on an Aux. Plane

Example-1 (Solved Pb. 11-1a, pp. 245)

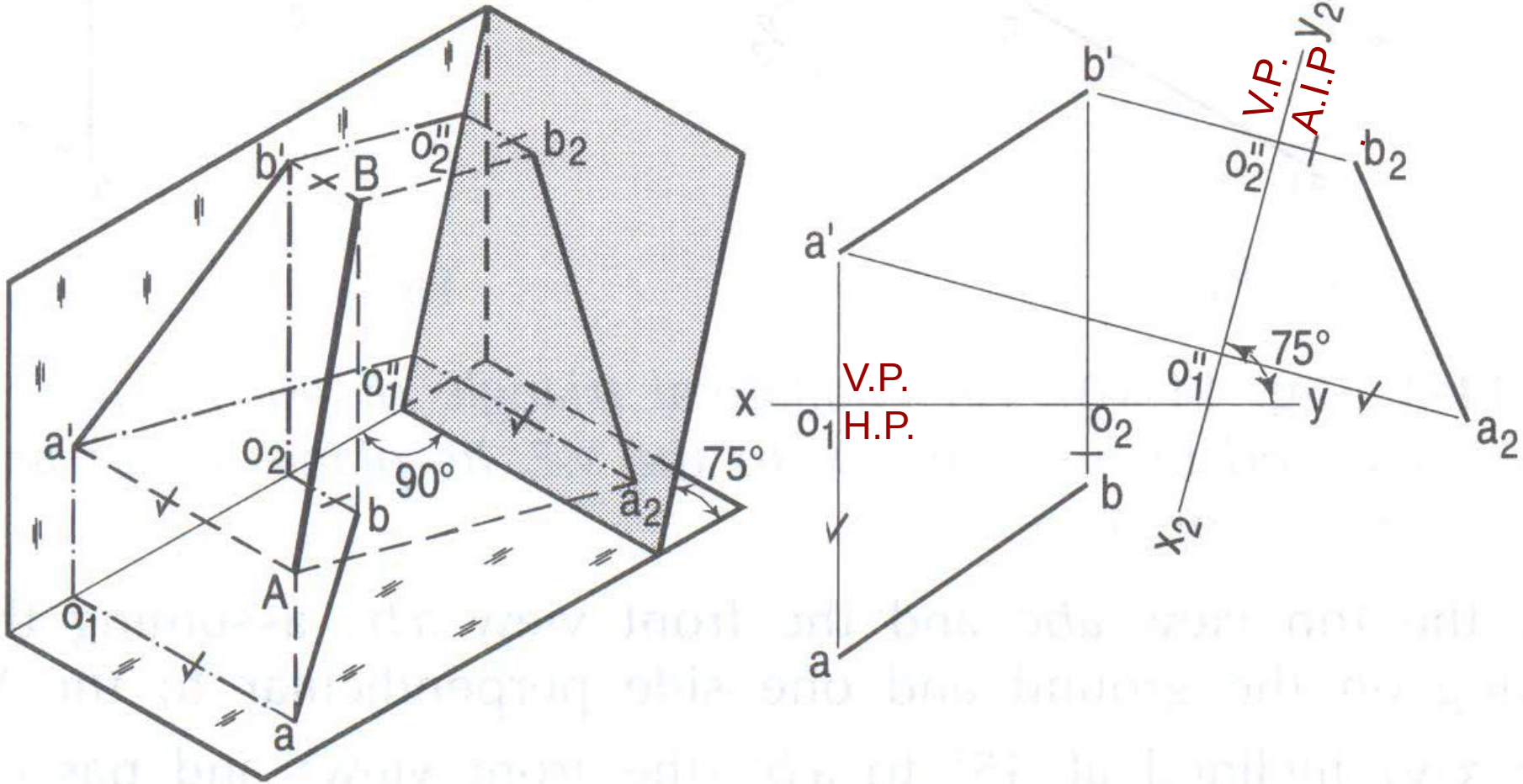
The projections of line AB are given. Draw the aux. front view of the line on an A.V.P. inclined at 60° to V.P.



Projections of a Line on an Aux. Plane

Example-1 (Solved Pb. 11-1b, pp. 245)

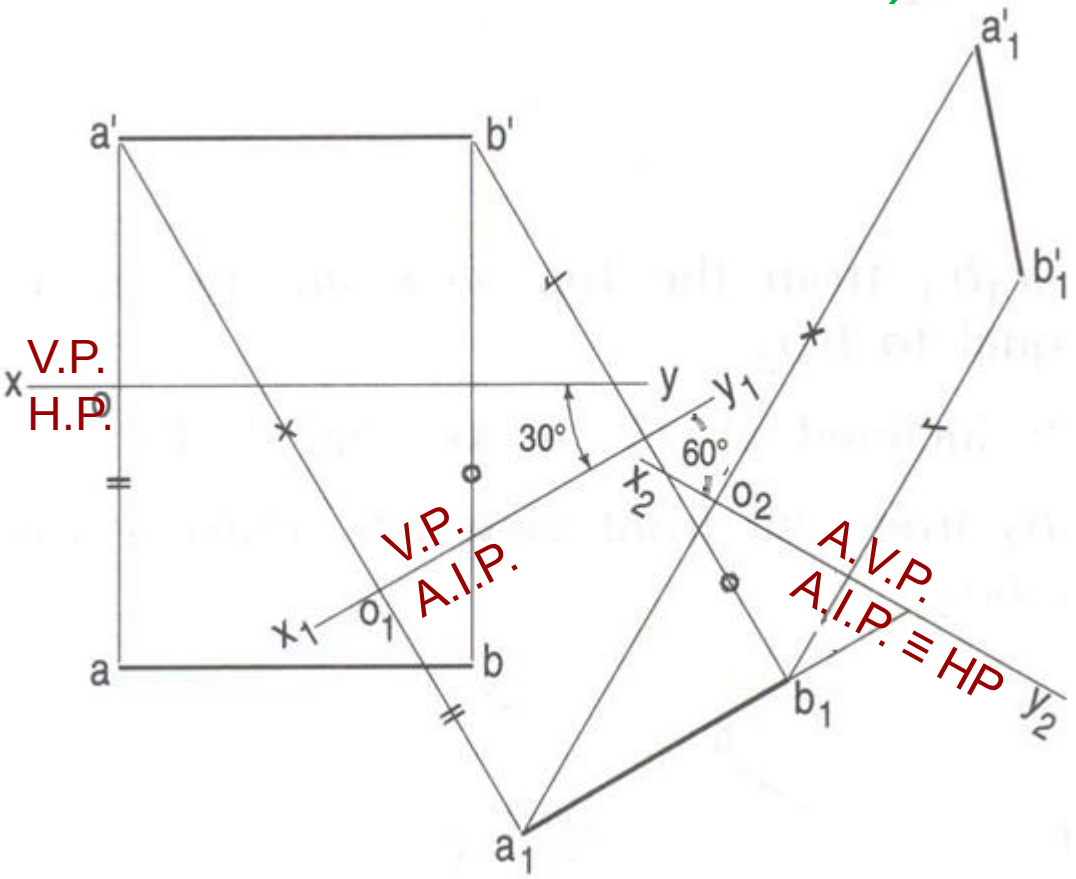
The projections of line AB are given. Draw the aux. top view of the line on an A.I.P. inclined at 75° to H.P.



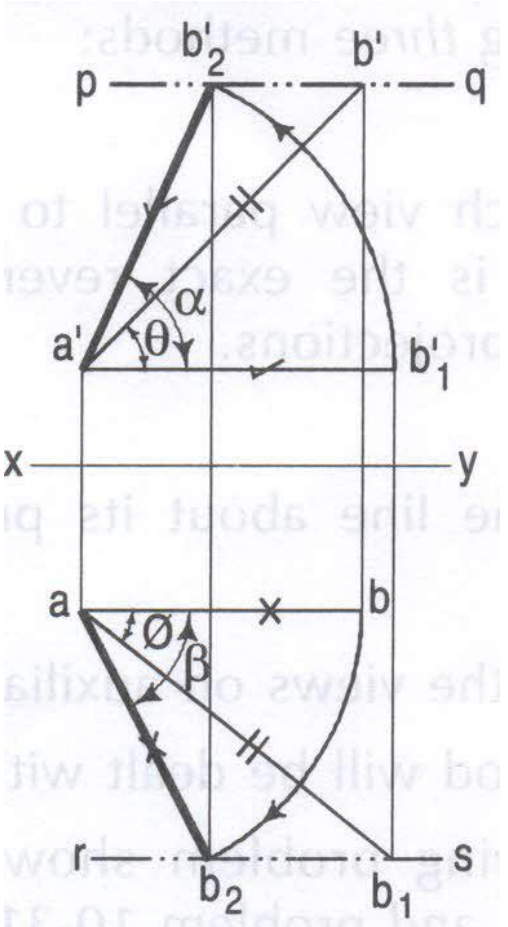
Projections of a Line Using Aux. Planes

Example-2 (modified) (Solved Pb. 11-2, pp. 246)

A line AB, 50mm long, is inclined at 30° to H.P. and it makes an angle of 60° with V.P. Draw its projections. (Assume that A is 10mm above H.P. and 25mm in front of V.P.)



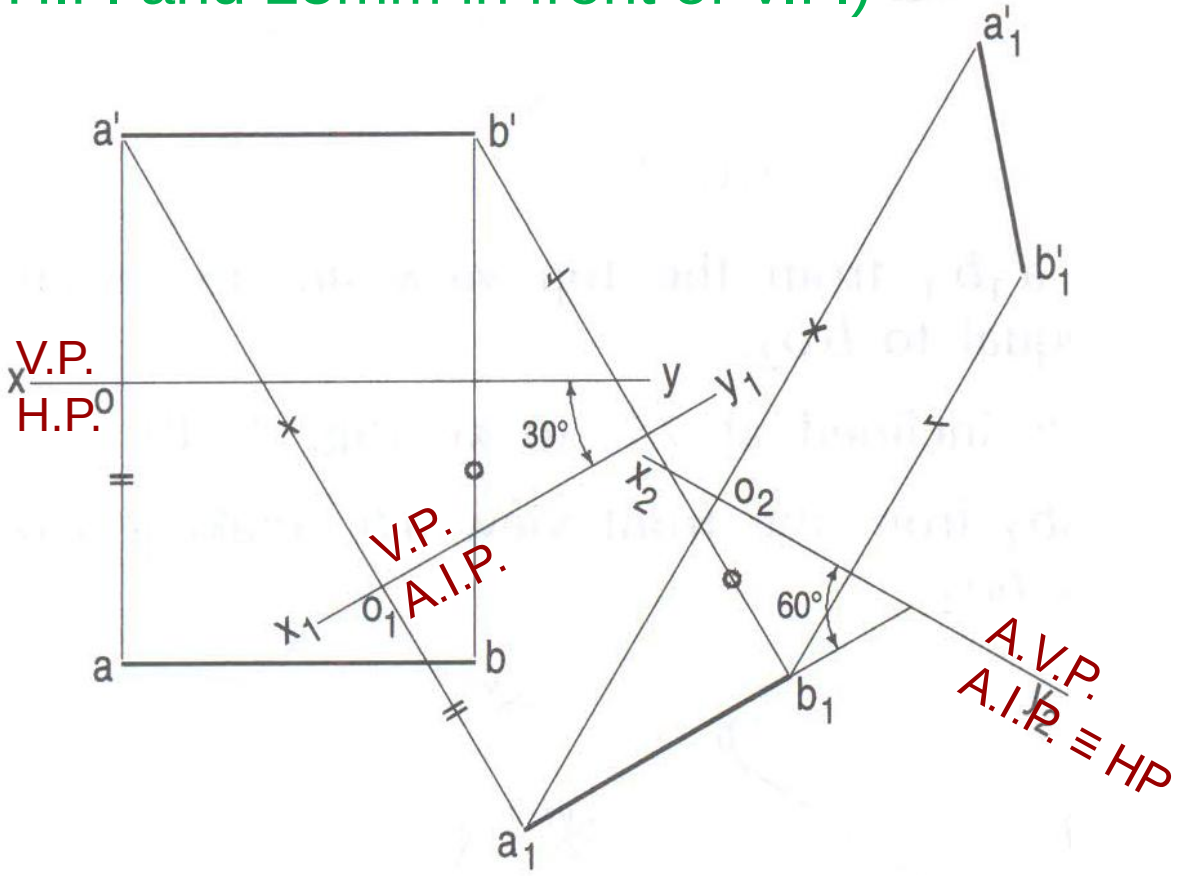
Note: We have solved similar problem in the previous sheet using conv. method (Solved Pb. 10-8, pp. 214).



Projections of a Line Using Aux. Planes

Example-2 (Solved Pb. 11-2, pp. 246)

A line AB, 50mm long, is inclined at 30° to H.P. and its top view makes an angle of 60° with V.P. Draw its projections. (Assume that A is 10mm above H.P. and 25mm in front of V.P.)

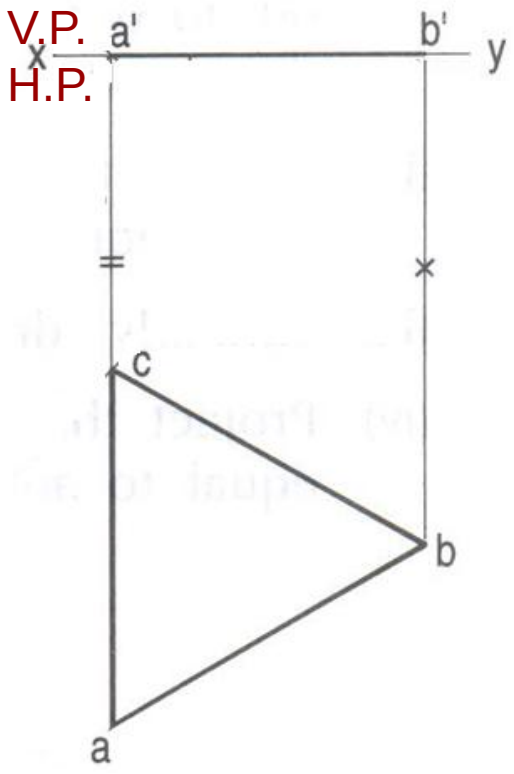


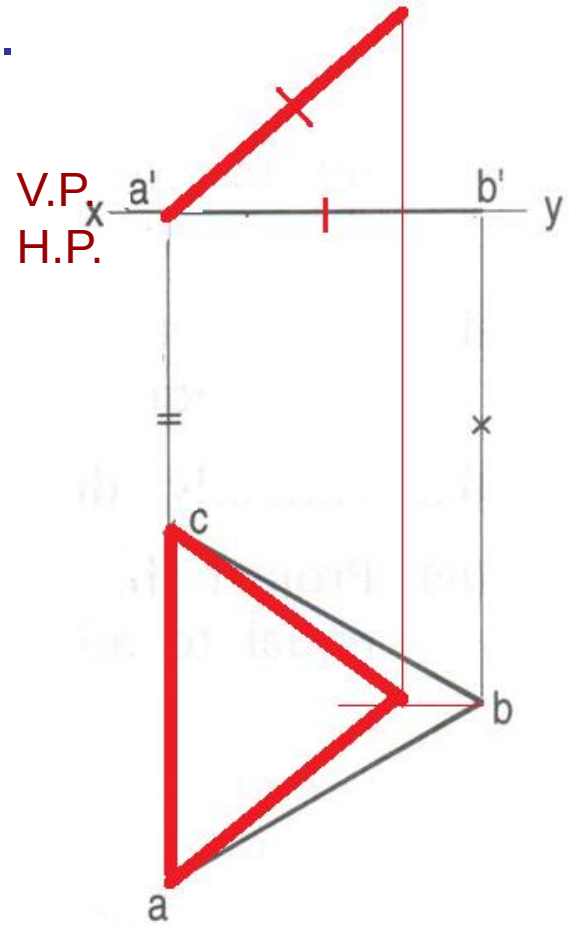
Projection of a Plane Using Aux. Planes

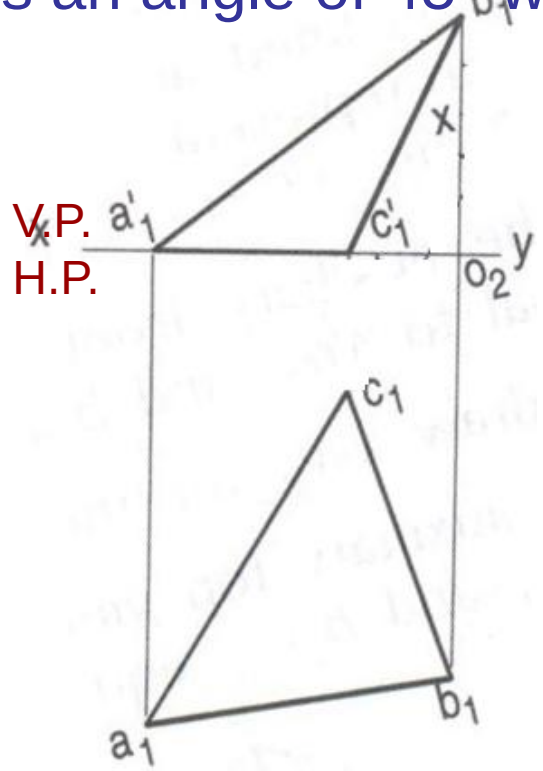
Projections of a Triangle Using Aux. Planes

Example-3 (Solved Pb. 11-3, pp. 246)

An equilateral triangle of 40mm long sides has an edge on the ground and is inclined at 60° to V.P. Its plane makes an angle of 45° with H.P. Draw its projections.





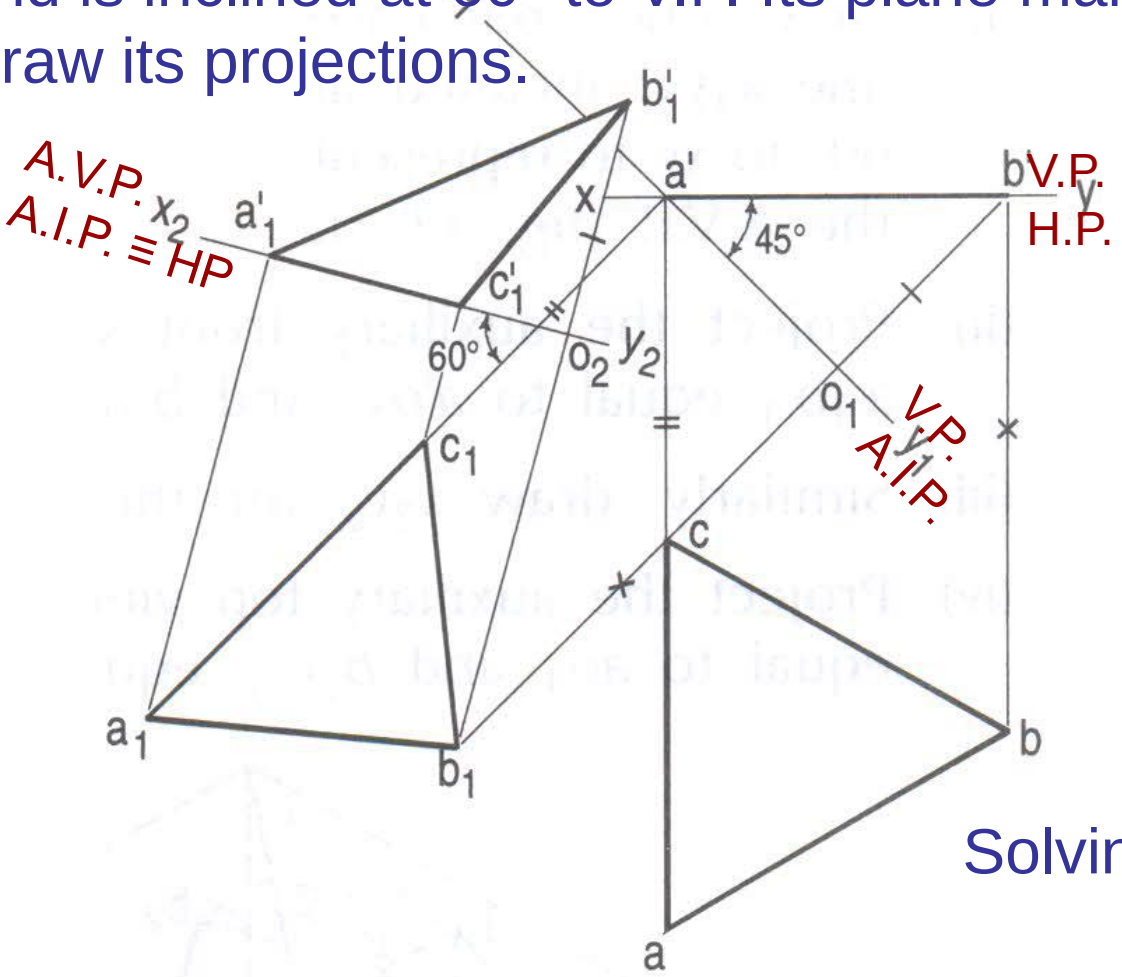


Solving using traditional orthographic projection.

Projections of a Triangle Using Aux. Planes

Example-3 (Solved Pb. 11-3, pp. 246) …

An equilateral triangle of 40mm long sides has an edge on the ground and is inclined at 60° to V.P. Its plane makes an angle of 45° with H.P. Draw its projections.



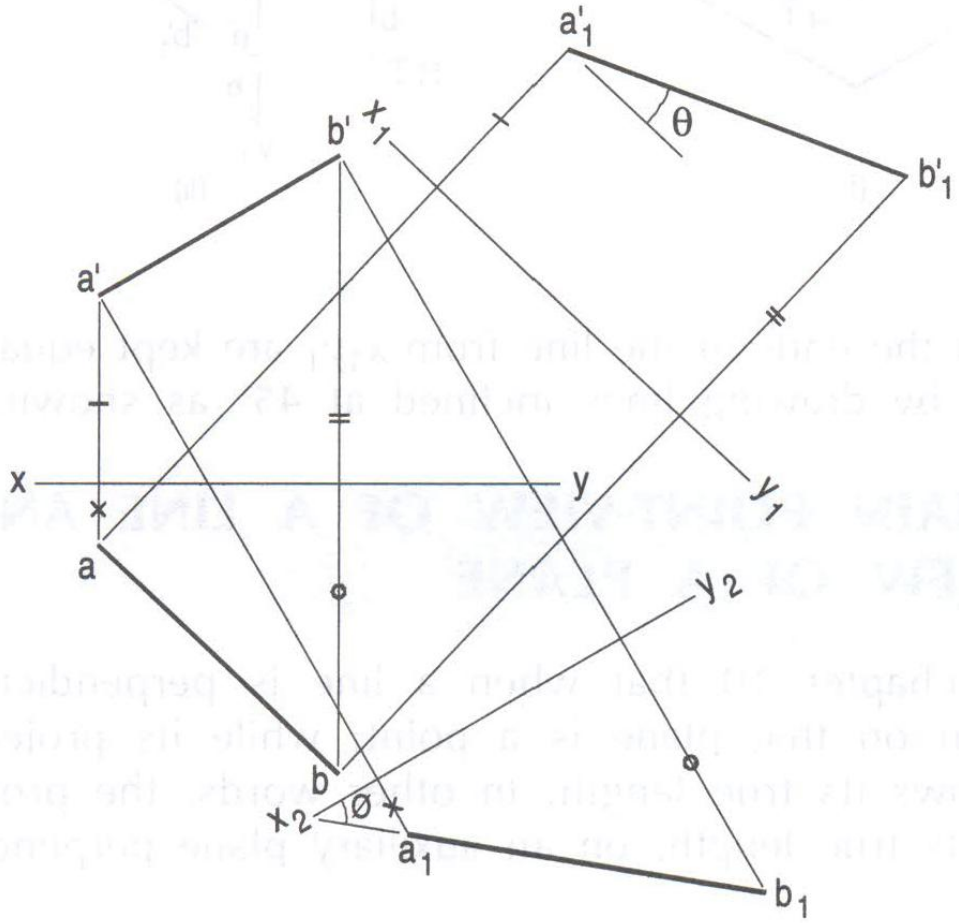
Solving using auxiliary projection.

True Length of a Line

True Length of a Line

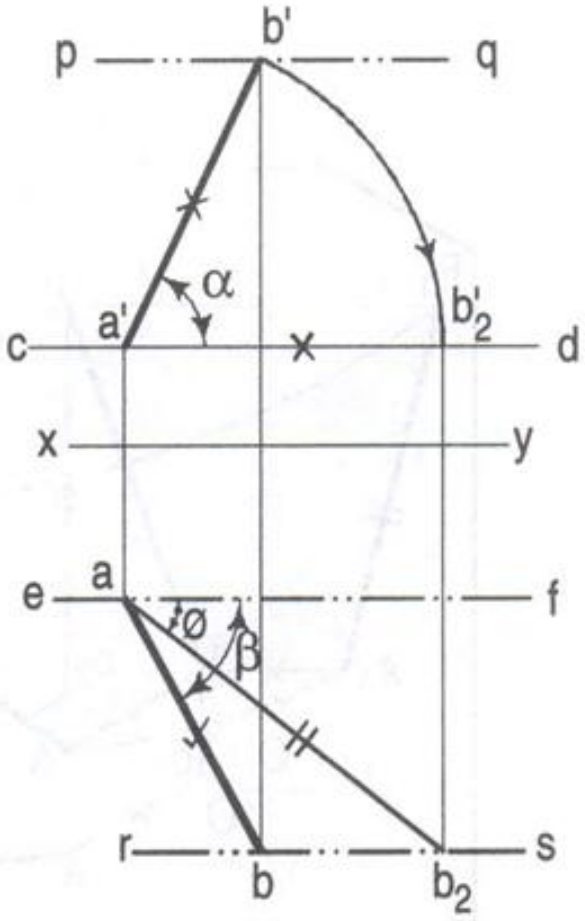
Example-4 (Solved Pb. 11-4, pp. 247)

The projections of a line AB are given (α=30, β=45 etc.). Determine its true length and its true inclinations with H.P. and V.P.



Note:

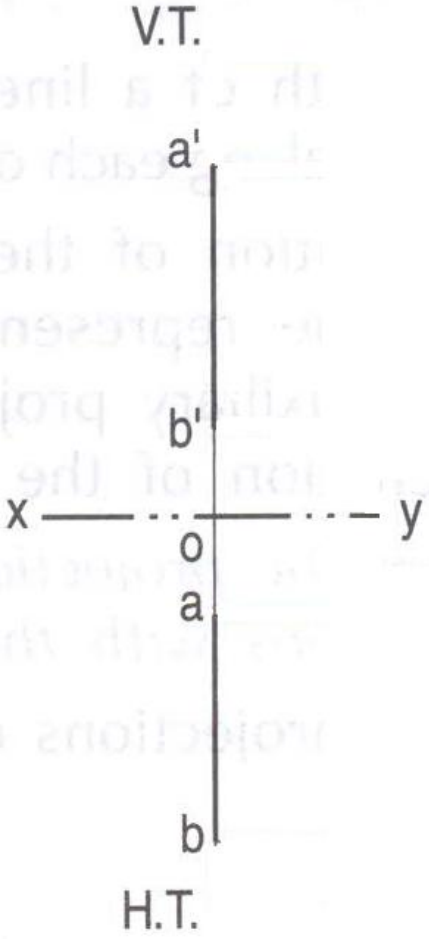
We have done the same in the previous sheet using another method.

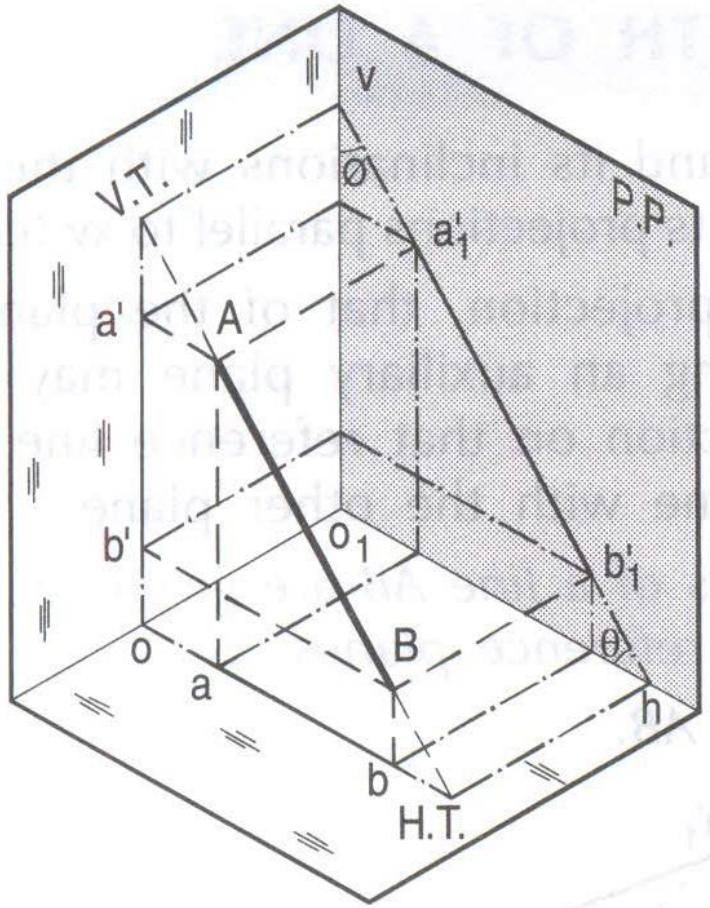


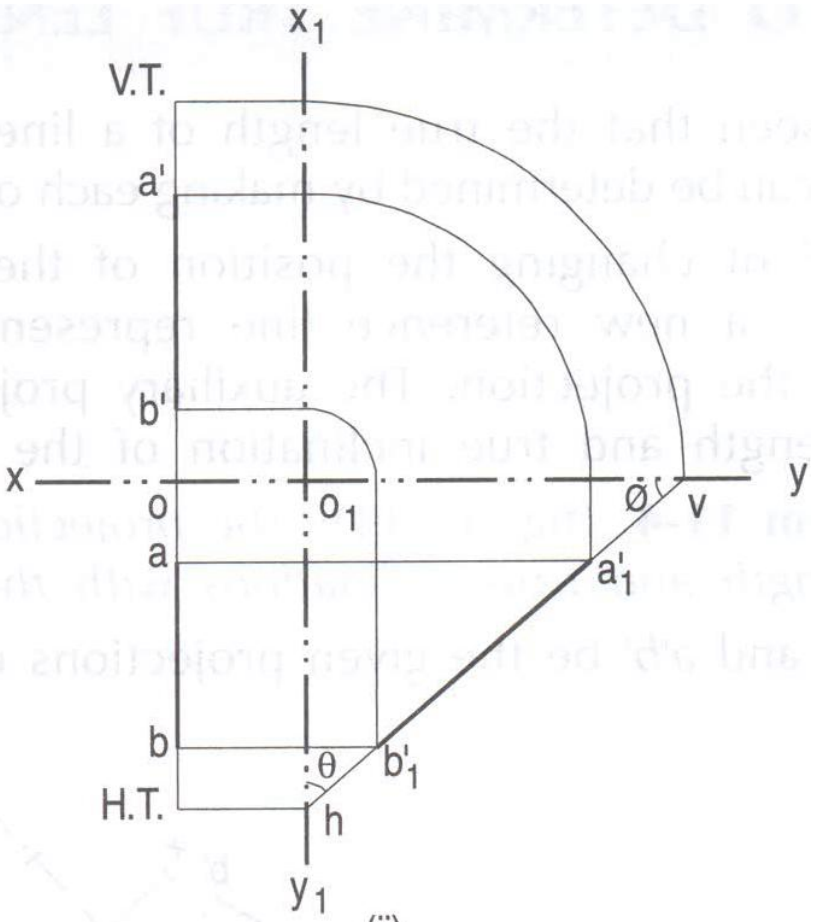
True Length of a Line

Example-5 (Solved Pb. 11-5, pp. 247)

The projections of a line AB are given in the left figure. Determine its true length, its true inclinations with H.P. and V.P. and its traces.







Point-View and Edge-View

Point-View and Edge-View

The auxiliary view in which an entity degenerates one level. i.e., a line becomes a point and a planar surface becomes a line.

- Point-view is the (aux.) view in which a line looks as a point. It is a plane normal to the line.
- Line-view is the (aux.) view in which a planar surface patch looks as a line. It is a plane normal to the planar surface patch.

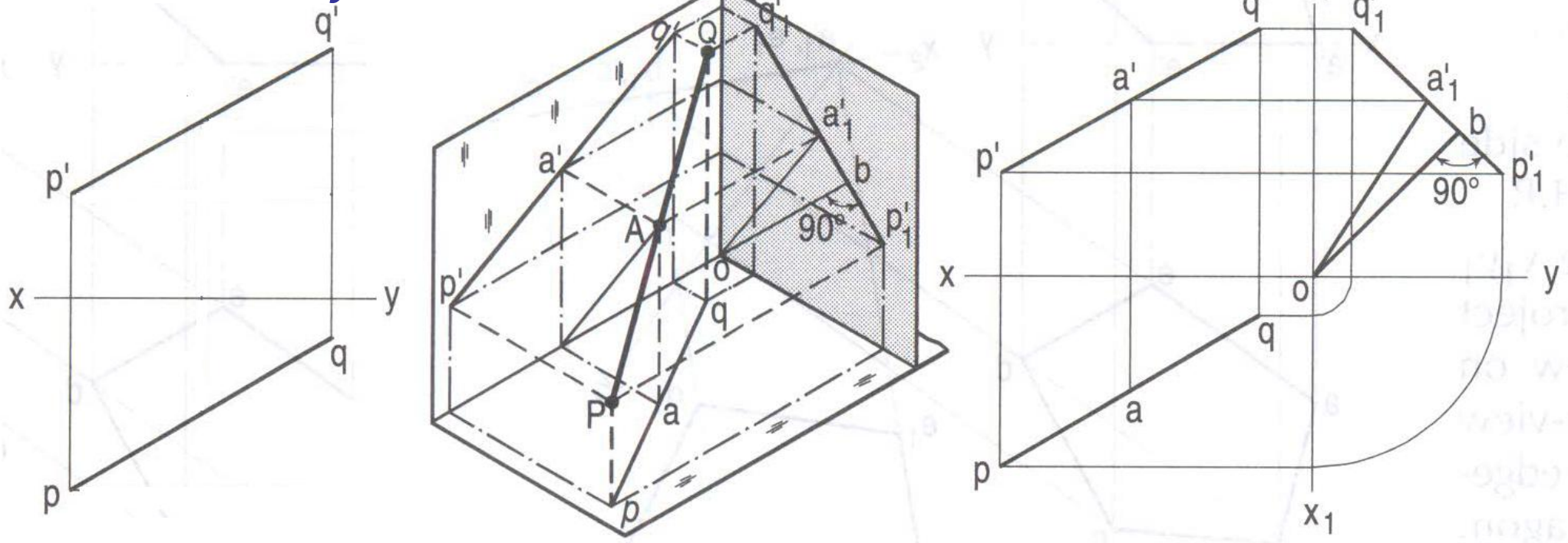
Point-View and Edge-View

Compare the notions of trace and view

- In both, the entity is degenerated by one level. i.e., a line becomes a point and a planar surface becomes a line.
- While trace is the intersection of the entity onto VP or HP, view is an aux. view normal to the entity.
- While point-view and line-view are views or planes, the traces are the elements/entities in the front/top view.

Point-View and Edge-View
Example-6 (Solved Pb. 11-6, pp. 248)

The projections of a line PQ are given in the left figure. Determine (a) the distance of its mid-point from *xy* and (b) the shortest distance of the line from *xy*.

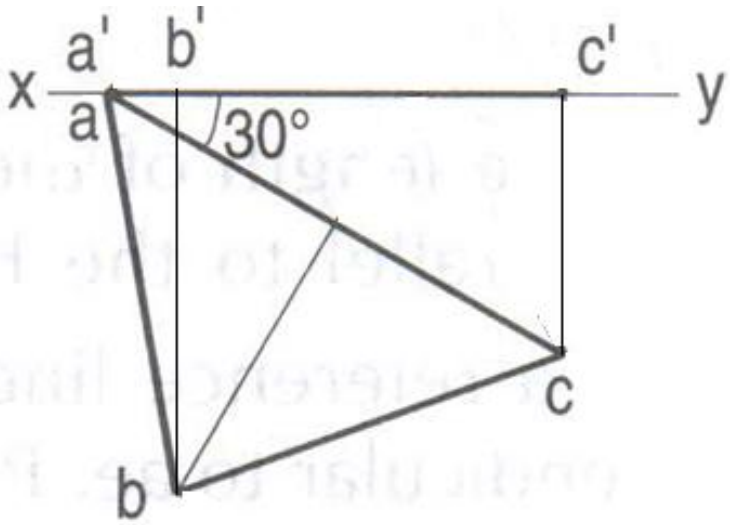


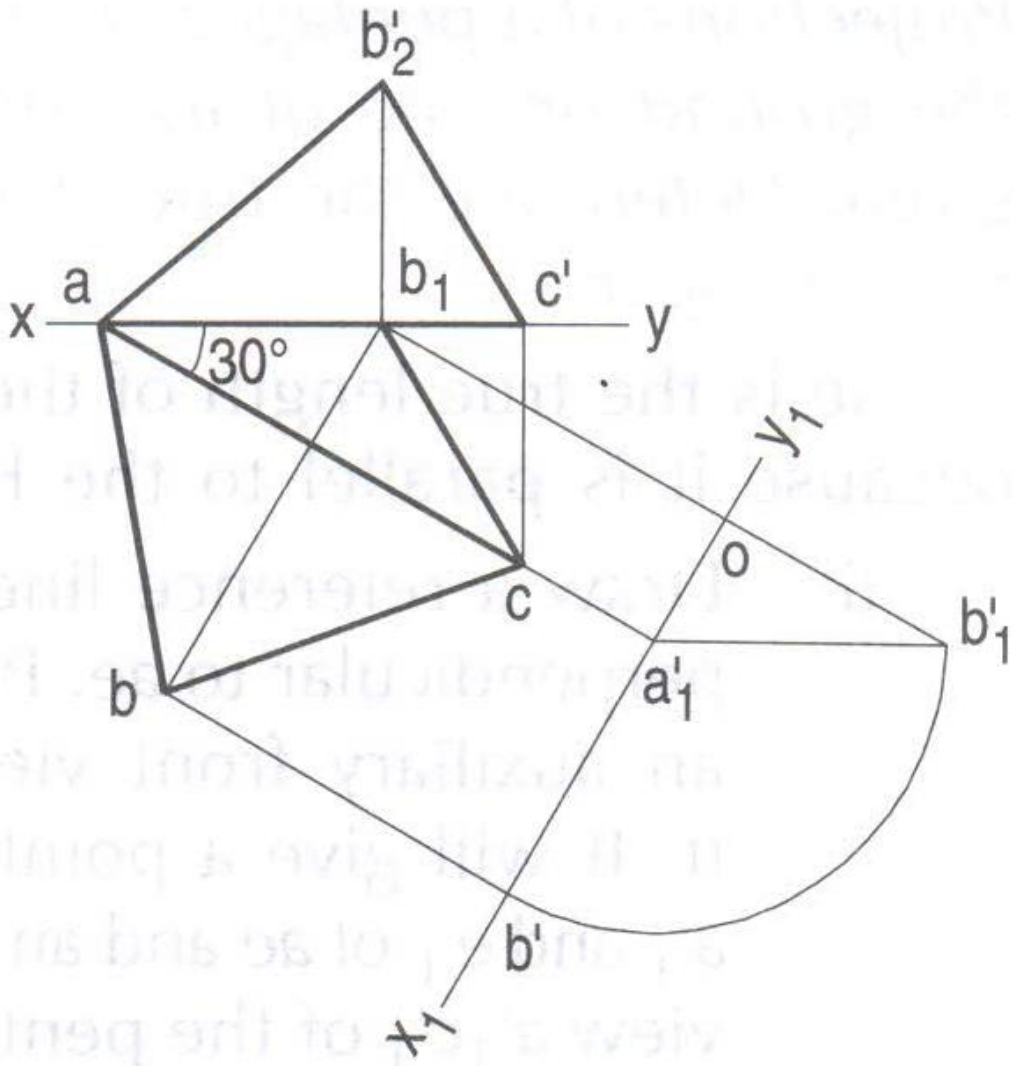
Hint: *xy* becomes a point in the side view. So, the required two distances will be available in the side view only.

Point-View and Edge-View

Example-7 (Solved Pb. 11-7, pp. 249)

An isosceles triangle ABC of base 60mm and altitude 40mm has its base AC in H.P. and is inclined at 30° to V.P. Its corners A and B are in V.P. Draw its projections.





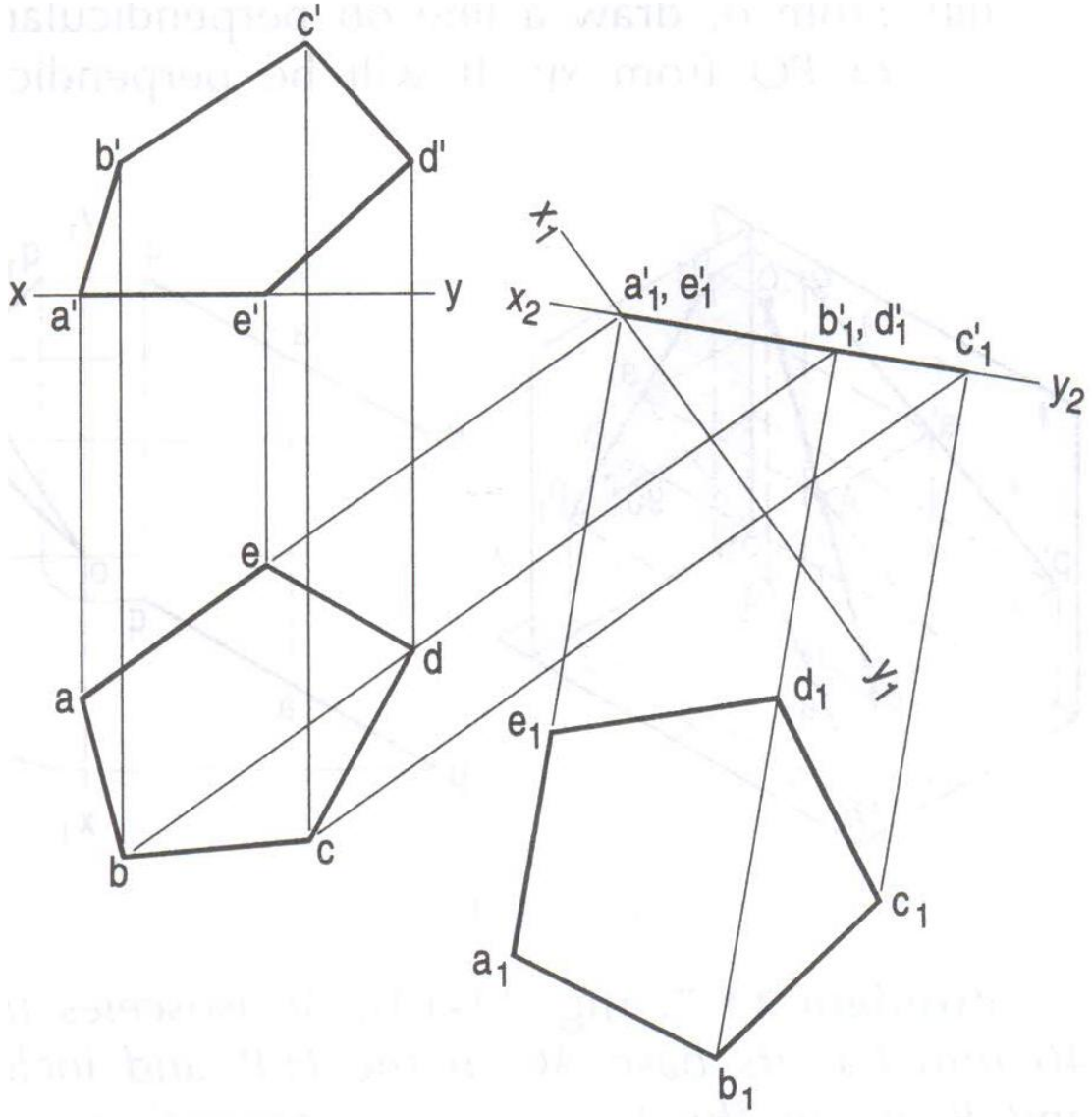
True Shape and Size of a Planar Feature

True Shape and Size of a Planar Feature

Example-8 (Solved Pb. 11-8, pp. 250)

Projections of a pentagon resting on the ground on one of its sides are given. Determine the true shape and size of the polygon.

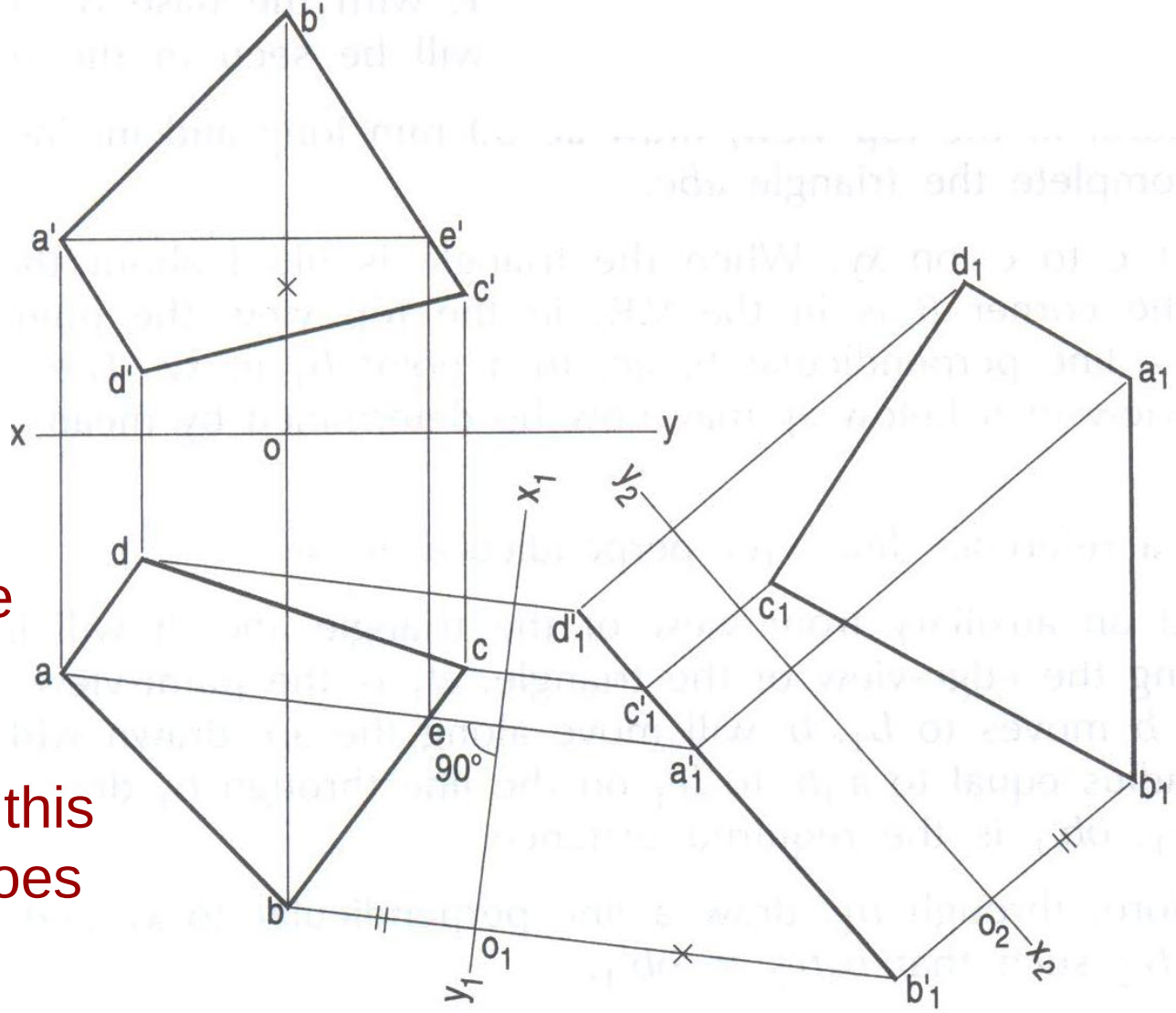
Hint: Identify at least one edge whose true size is available. Generate aux. views w.r.t. this edge. In this case. AE has true length in top view.



True Shape and Size of a Planar Feature

Example-9 (Solved Pb. 11-9, pp. 250)

Projections of a quadrilateral are given. Determine its true shape and size.



Hint: Identify at least one edge whose true size is available. Generate aux. views w.r.t. this edge. In this case as such an edge does not edge, AE is created.

True Shape and Size of a Planar Feature

Example-10 (Solved Pb. 11-10, pp. 251)

The projections of a triangular plate PQR are described below:

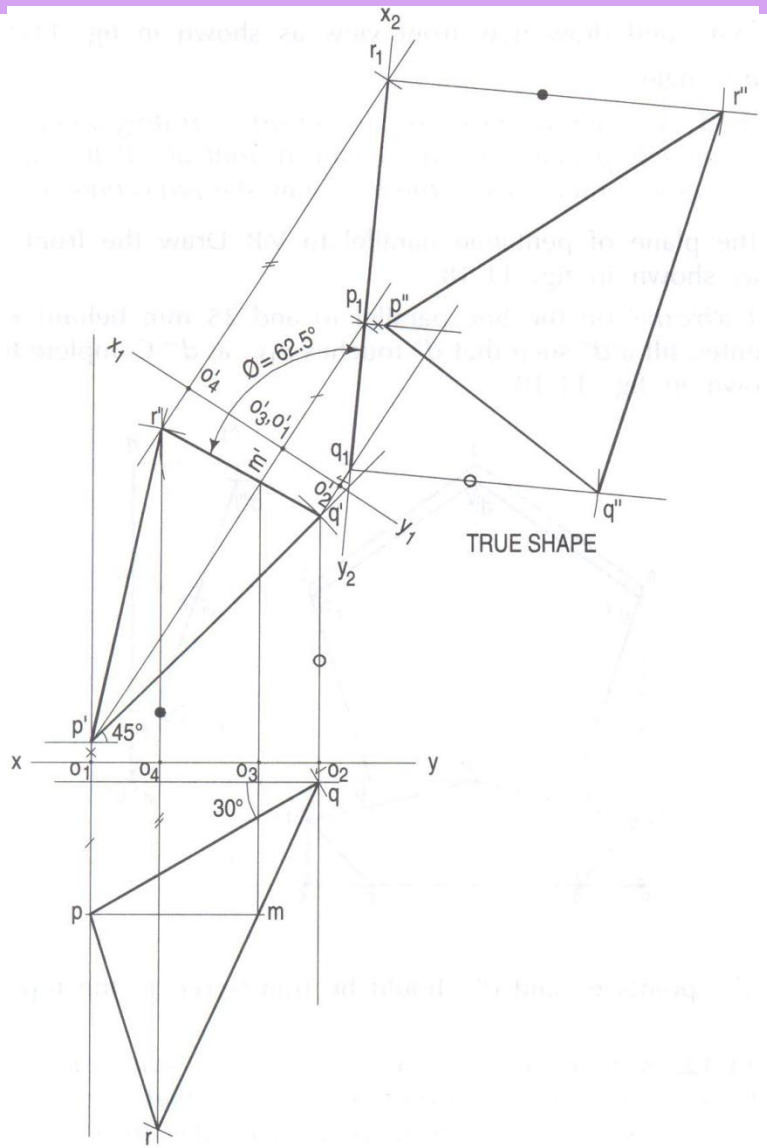
Top view: pq makes 30° with *xy*. qr=95mm. q is 5mm in front of V.P.

Front view: p'q'=80mm. q'r'=45mm. r'p'=80mm. p'q' makes and angle of 45° with *xy*. P is is 5mm above H.P.

Draw the projections of the plate and determine the true shape and size of this triangular plate.

True Shape and Size of a Planar Feature

Example-10 (Solved Pb. 11-10, pp. 251) …

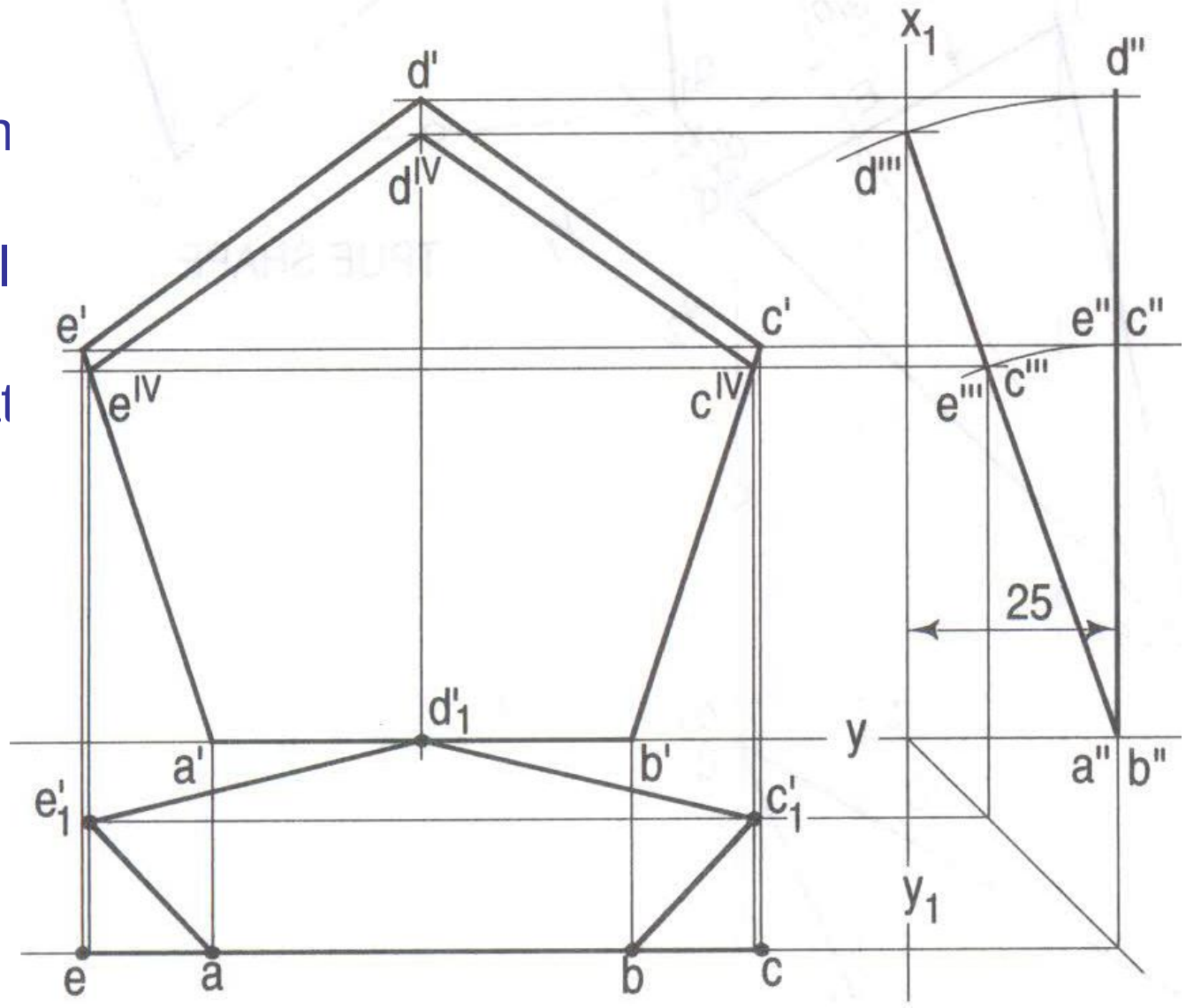


True Shape and Size of a Planar Feature

Example-11 (Solved Pb. 11-11, pp. 252)

A regular pentagon of 50mm side is resting on one of its sides on H.P. having that side parallel to and 25mm in front of V.P. It is tilted about that side so that its highest corner rests in V.P. Draw its projections.

Locus of c' and e' are cones. So, I think the thinly gaped parallel lines are incorrect.



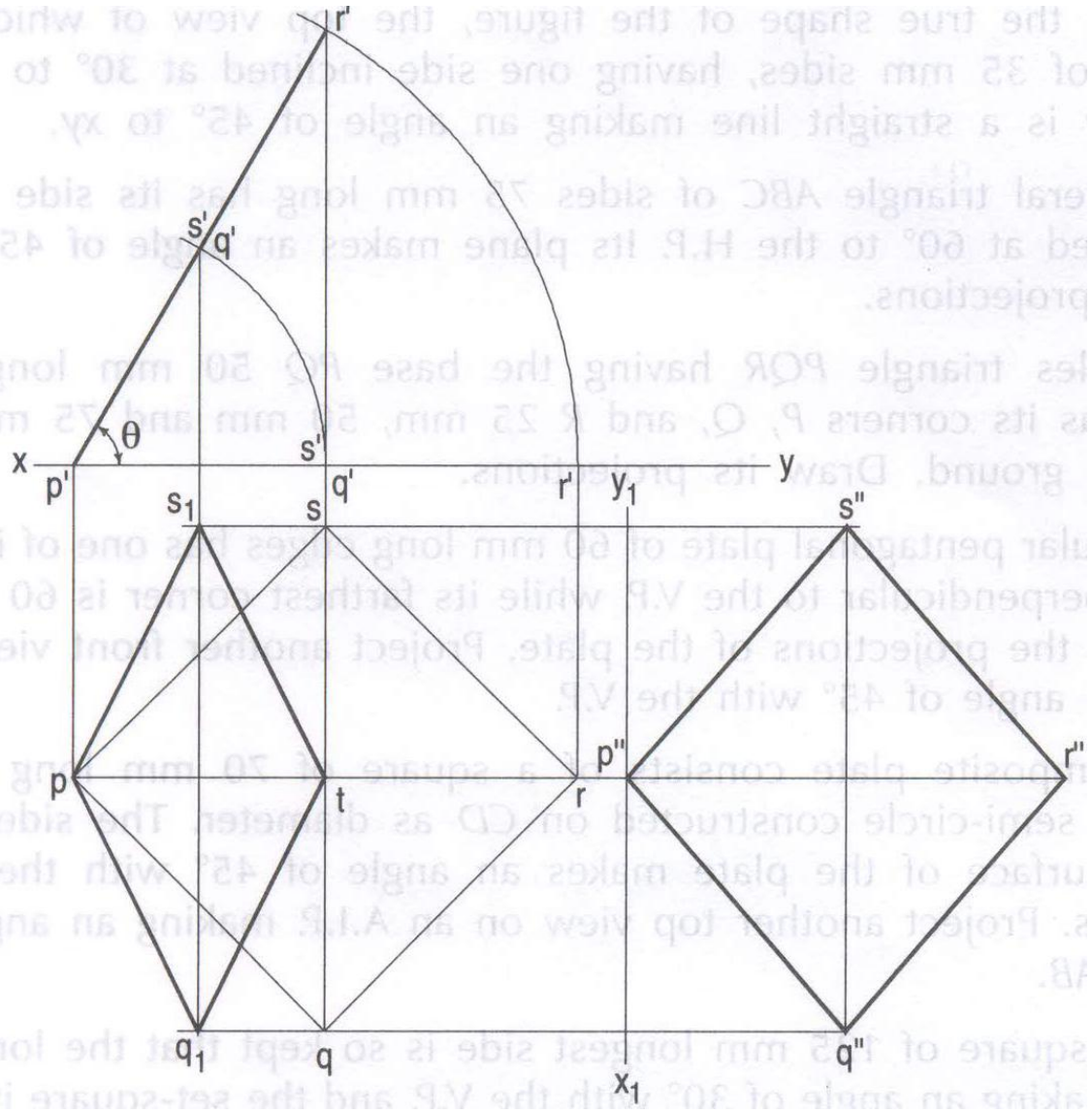
True Shape and Size of a Planar Feature

Example-12 (Solved Pb. 11-12, pp. 252)

A thin square plate with 60mm side stands on one of its corners in H.P. and its opposite corner is raised so that one of its diagonals is twice that of the others. One of the diagonals is parallel to both the planes.

(a) Draw its projections

(b) Determine the inclination of the plate with H.P.



Conclusions

- Roughly work out all the problems given to you. Only if you come prepared, you will be able to complete all problems of the sheet in the drawing session.


Thank You!