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

- A pair of hinged rectangular acrylic plates; this can be used to denote the quadrants.

ME119:
Engineering Drawing & Graphics

3. Projections of Points and Straight Lines

Department of Mechanical Engineering
Indian Institute of Technology Bombay

Feedback

Show the Word file.

Projections of Points

- Chapters 9 covers the details on Projections of Points.
- Roughly work out all the problems given to you.

Outline

- Projections of Points
- Projections of Straight Lines
- Finding the Trace of a Straight Line
- Finding the True Length of a Straight Line

Projections of Points

Projections of Points

Conventions

Item	Label
Points in space (3D points)	A, B, C, …
Corresponding points in plan (top view)	a, b, c, …
Corresponding points in elevation (front view)	a', b', c', …
Corresponding points in side views	a_1, b_1, c_1, …
Corresponding points in auxiliary views (depending on whether it resembles with top or front view)	a_1, b_1, c_1, … or a'_1, b'_1, c'_1, …
Hidden lines	Dashed
Axis lines	Dot dashed

Projection of points and lines are independent of projection angles. The distinction comes only for higher geometries.

Projections of Points

Various possible positions of the point

(a) The point is in the 1st quadrant

(b) The point is in the 2nd quadrant

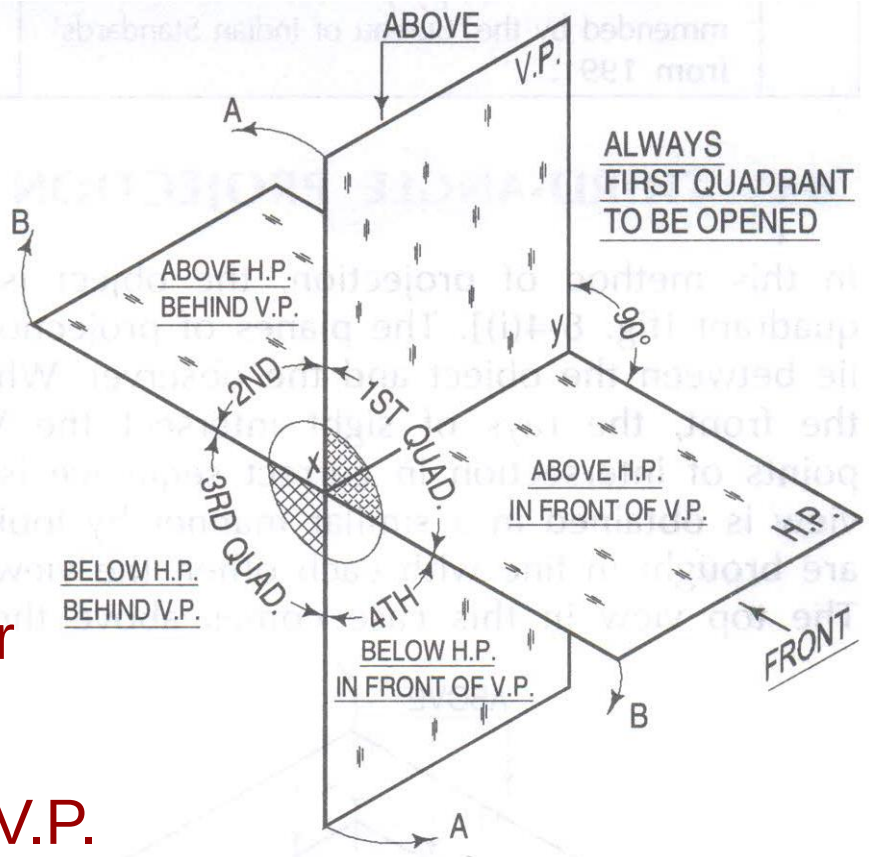
(c) The point is in the 3rd quadrant

(d) The point is in the 4th quadrant

(e,f) The point is lying in V.P. (above or below xy)

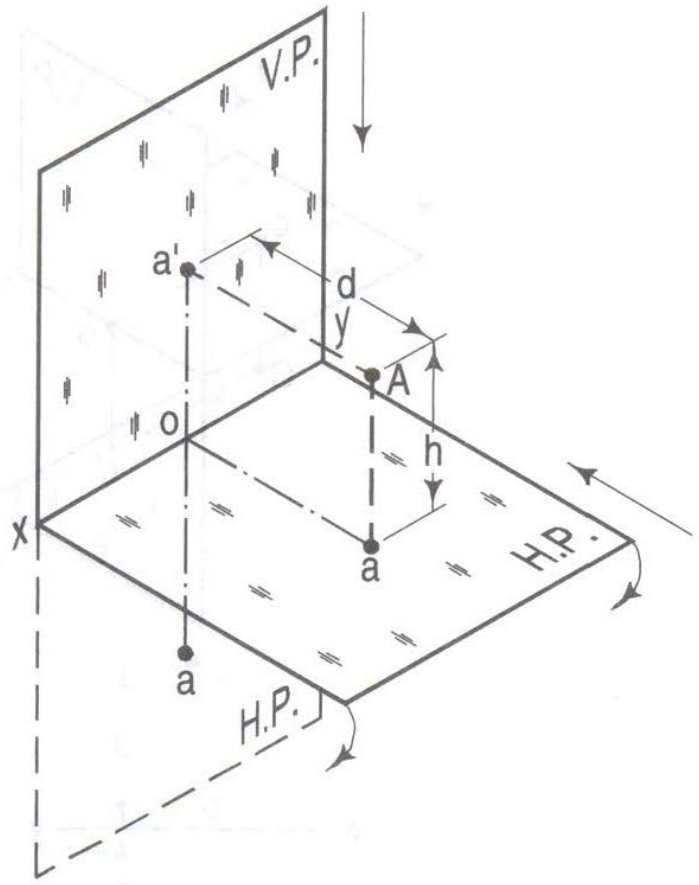
(g,h) The point is lying in H.P. (in front or back of xy)

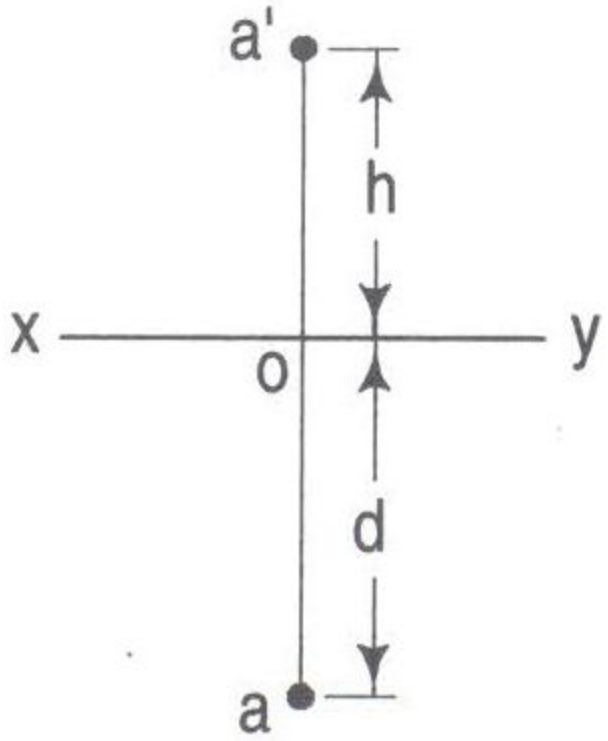
(i) The point is lying in both H.P. and V.P. (The point is lying in xy.)



Projections of Points

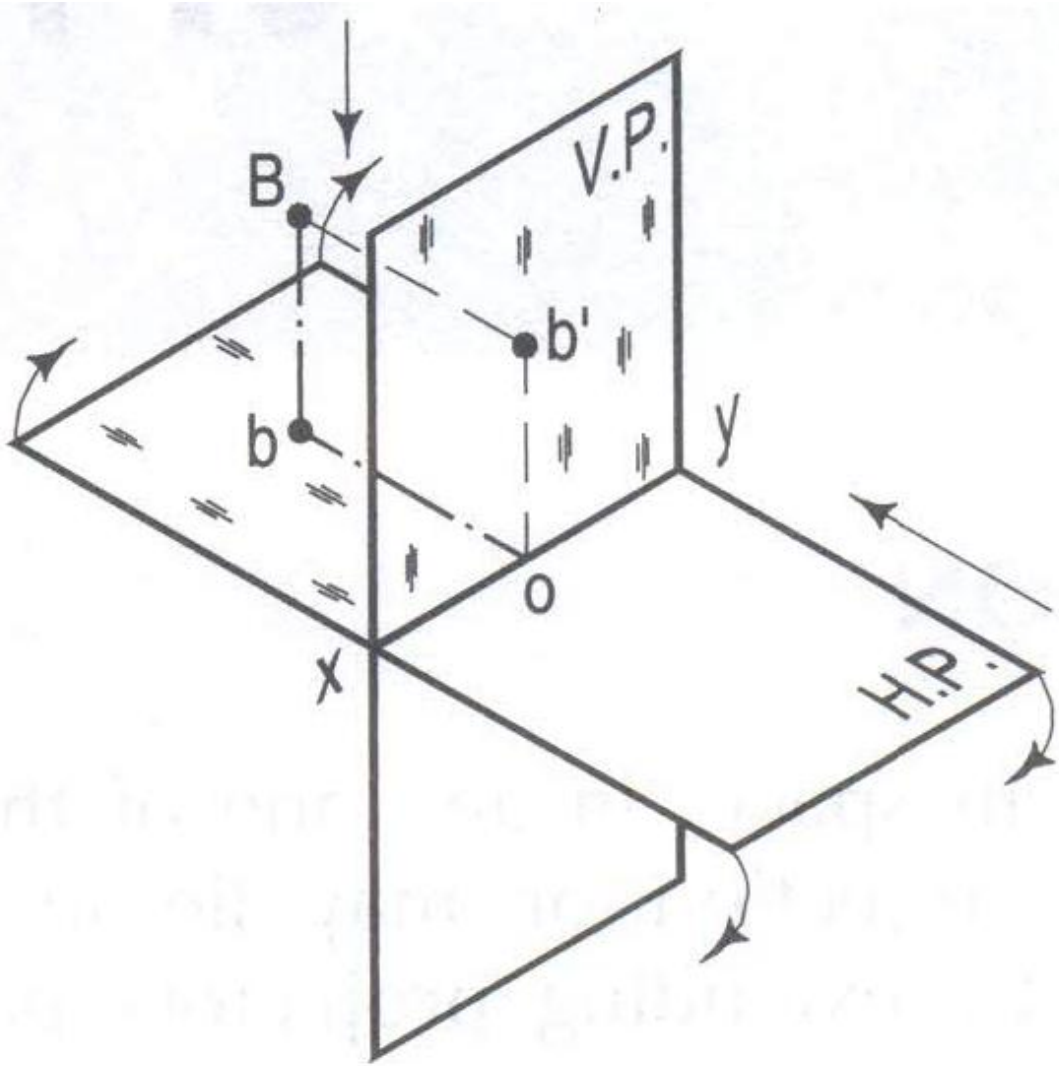
(a) Projection of a point in the 1st quadrant

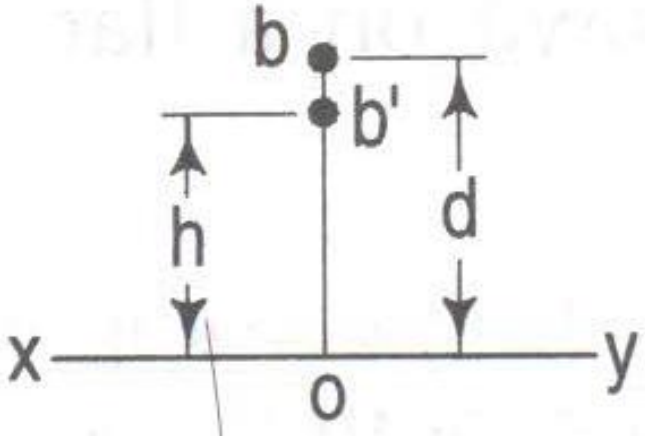




Projections of Points

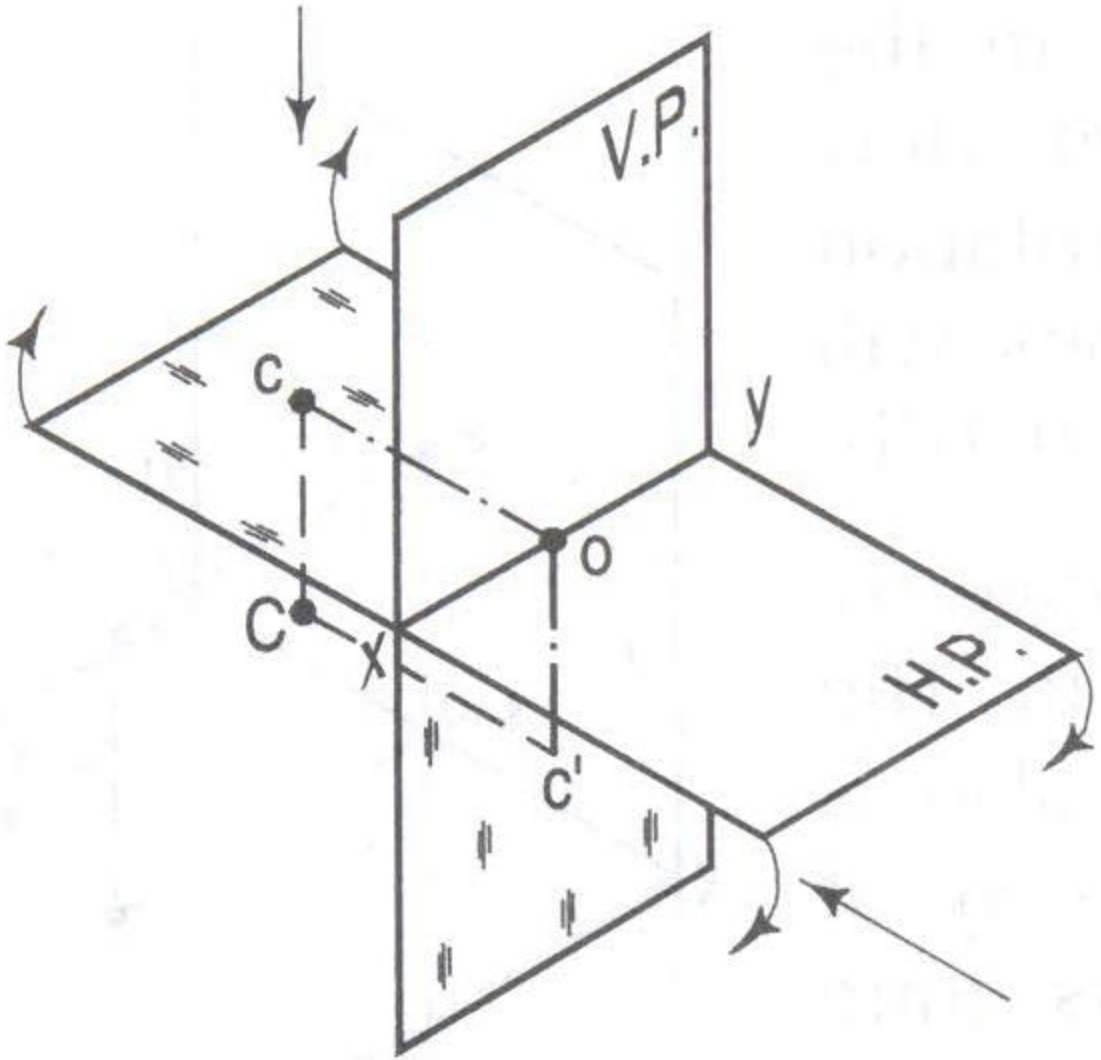
(b) Projection of a point in the 2nd quadrant

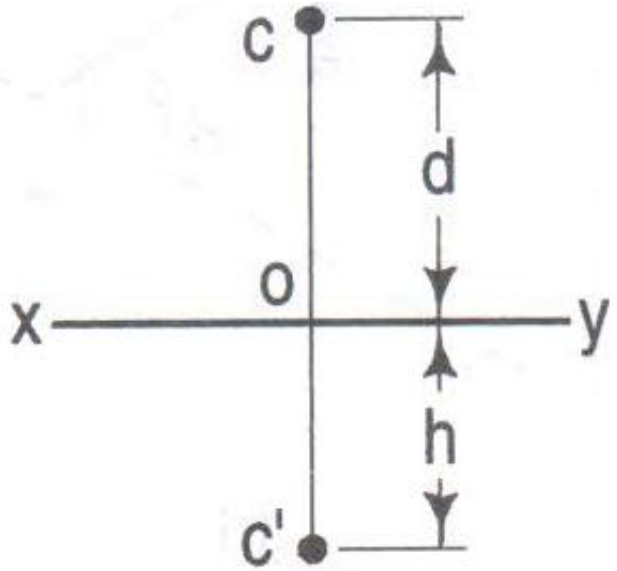




Projections of Points

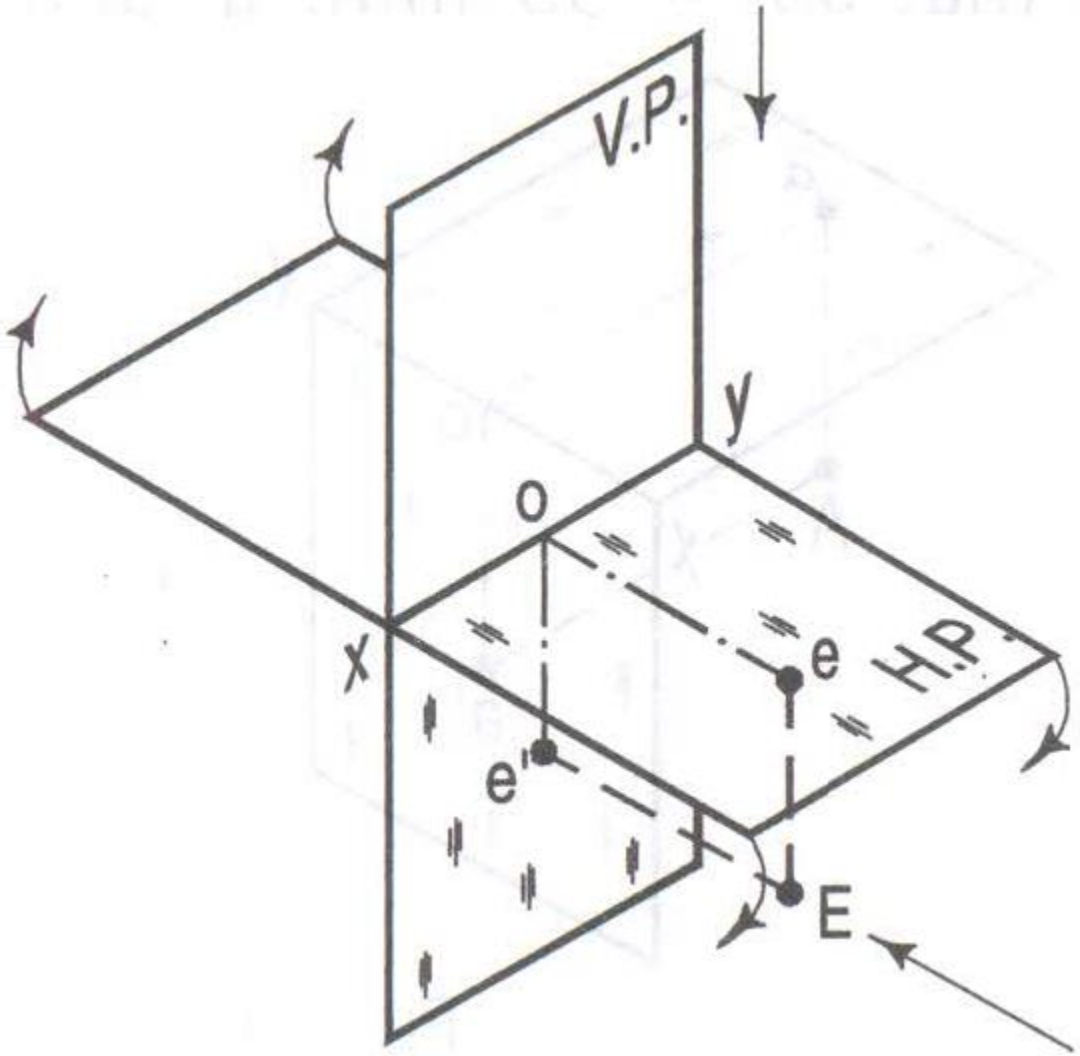
(c) Projection of a point in the 3rd quadrant

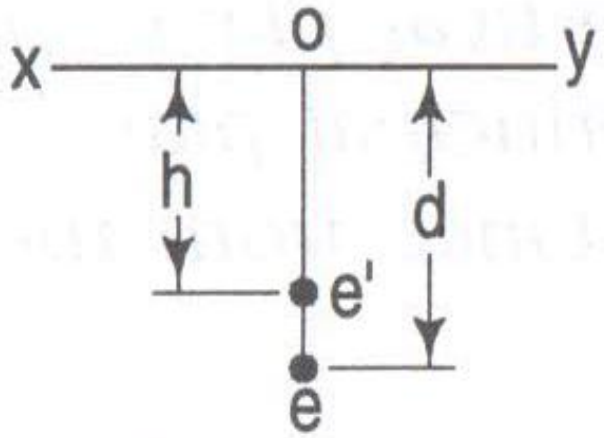




Projections of Points

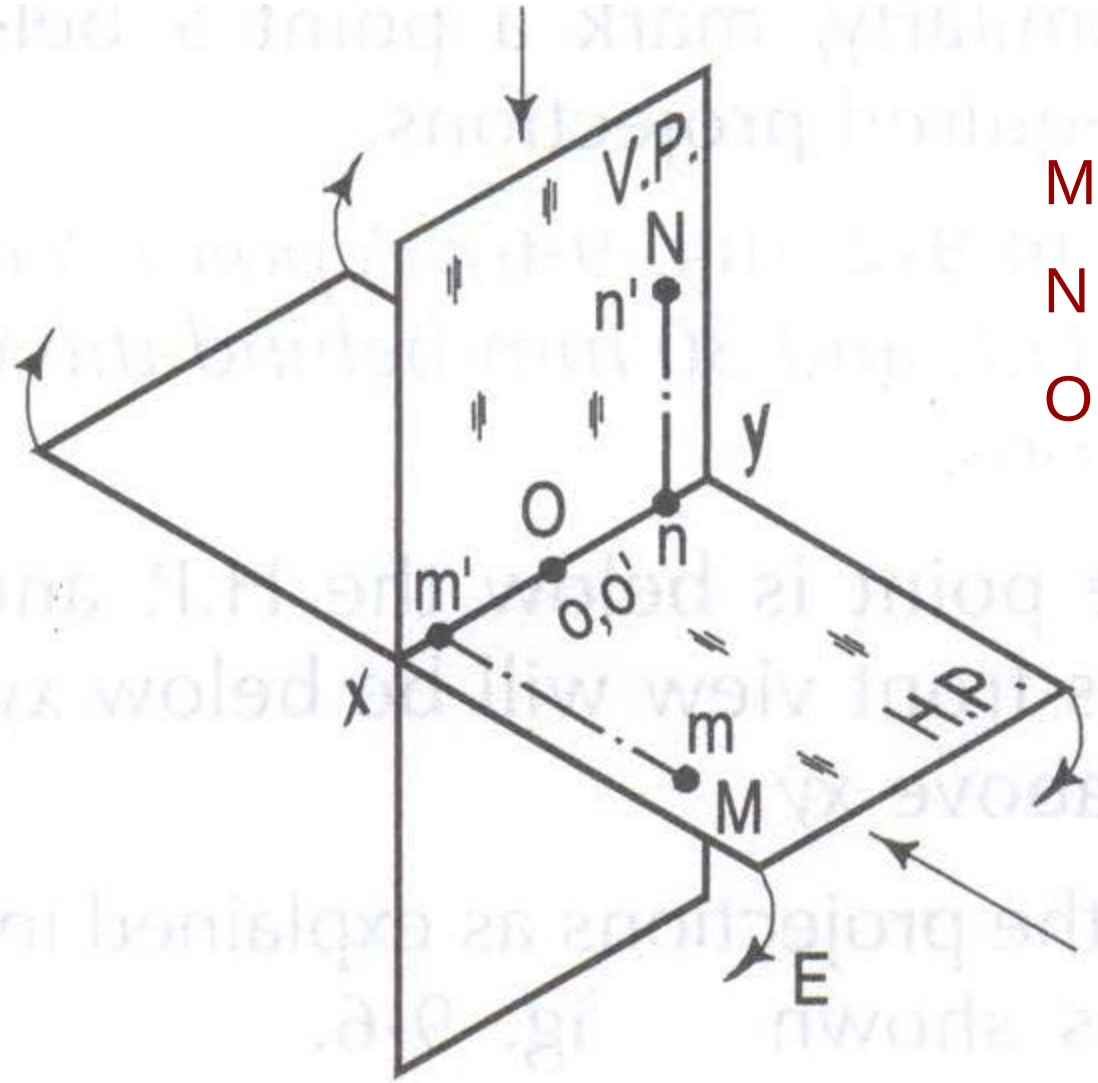
(d) Projection of a point in the 4th quadrant





Projections of Points

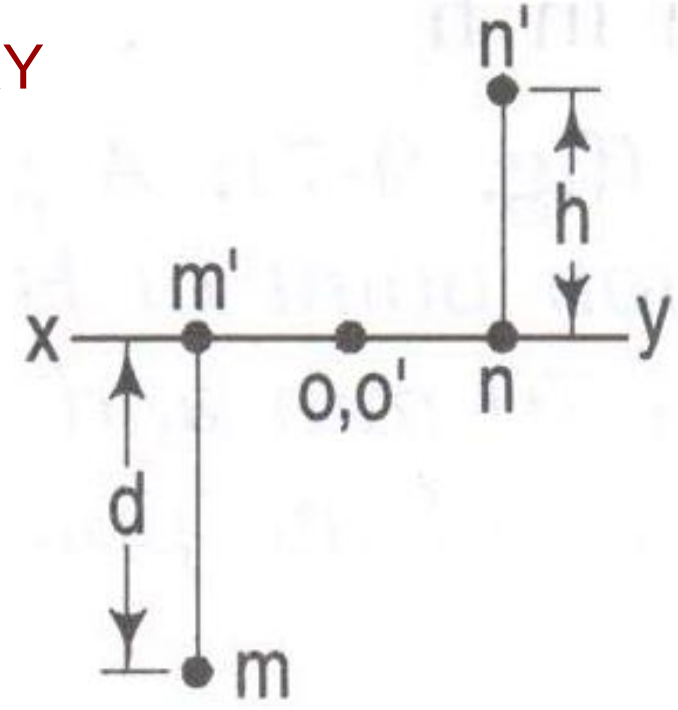
(e, f, g) Projection of a point in V.P./ H.P./ in XY



M is in H.P.

N is in V.P.

O is in XY



Projections of Points

Summary (old – see table in the next slide)

- When a point is above H.P., its front view is above *xy* and *vice versa*.
- When a point is in front of V.P., its top view is below *xy* and *vice versa*.
- When a point is in the reference plane (V.P. or H.P.), its projection in the other reference plane is in *xy*.
- When a point is in the intersection of V.P. and H.P., both its projections coincide and lie in *xy*.

Projections of Straight Lines

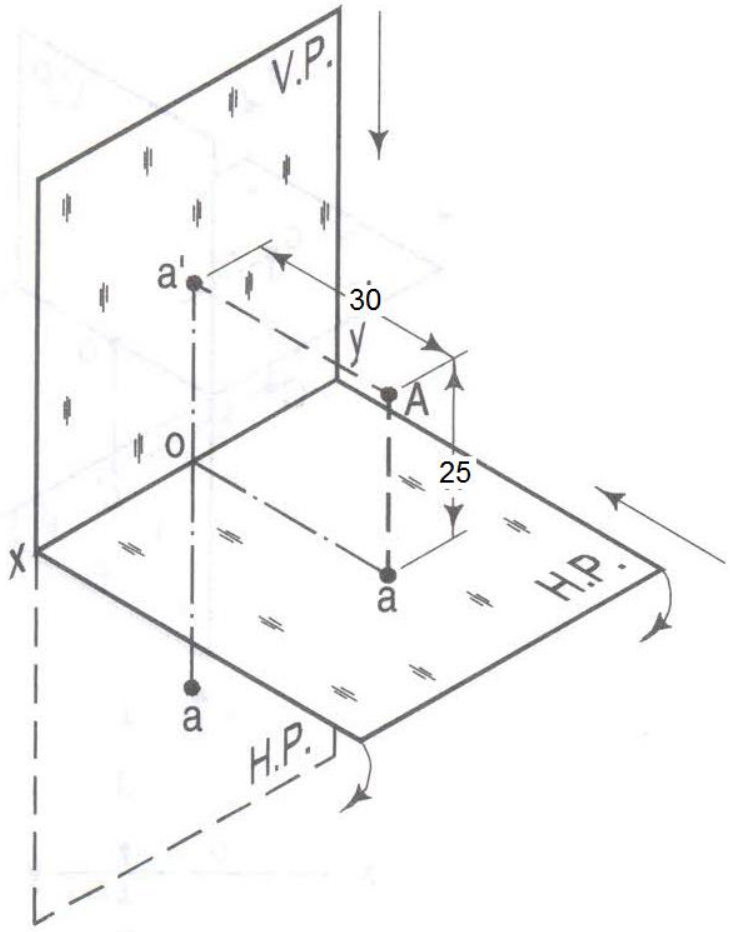
Summary

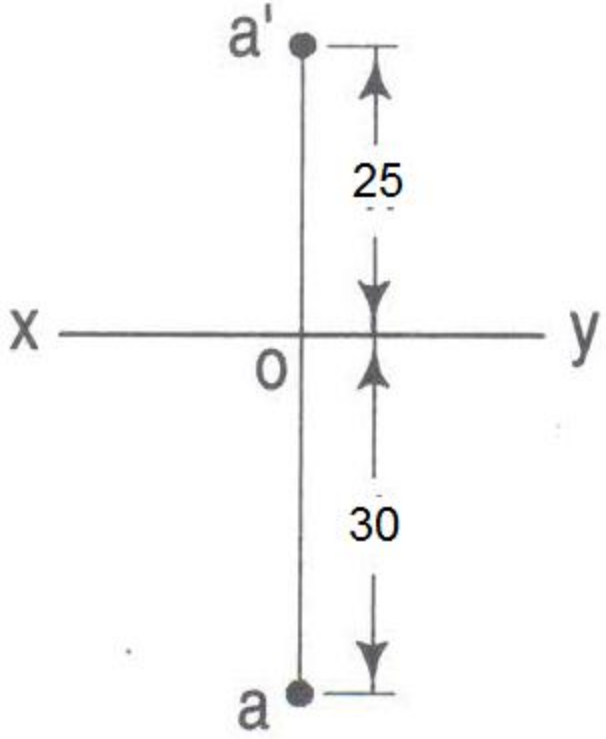
Case	Quadrant	With respect to		Views w.r.t. xy Line	
		H.P.	V.P.	Front View	Top View
(a)	I	Above	In front	Above	Below
(b)	II	Above	Behind	Above	Above
(c)	III	Below	Behind	Below	Above
(d)	IV	Below	In front	Below	Below
(e)	I & II	Above	On	Above	On
(f)	III & IV	Below	On	Below	On
(g)	I & IV	On	In front	On	Below
(h)	II & III	On	Behind	On	Above
(i)	I, II, III & IV	On	On	On	On

Projections of Points

Example-1

Point A is 25mm above H.P. and 30mm in front of V.P. Draw its projections.

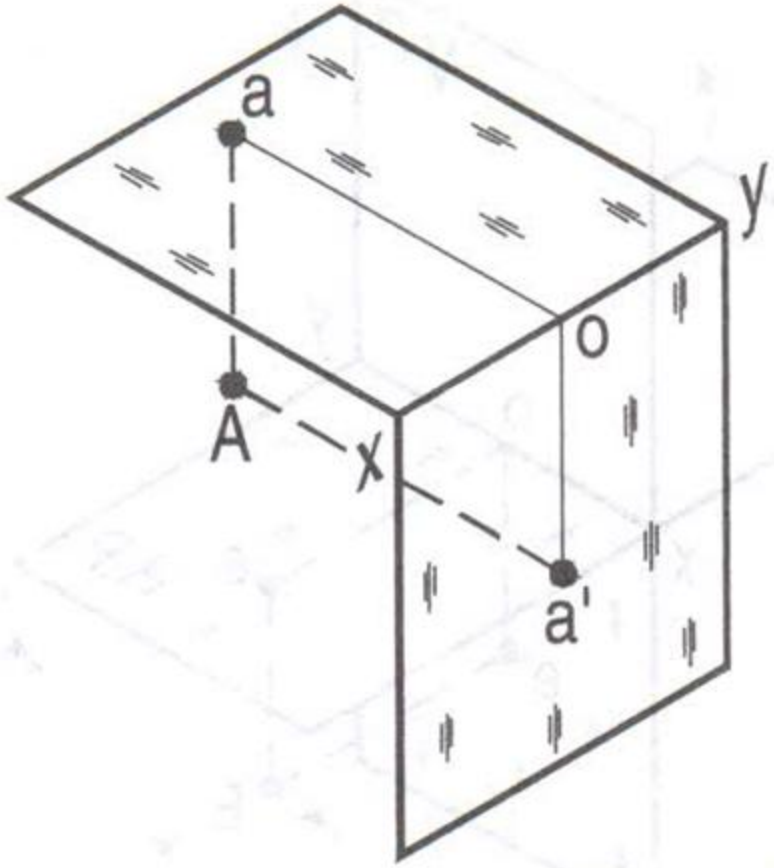


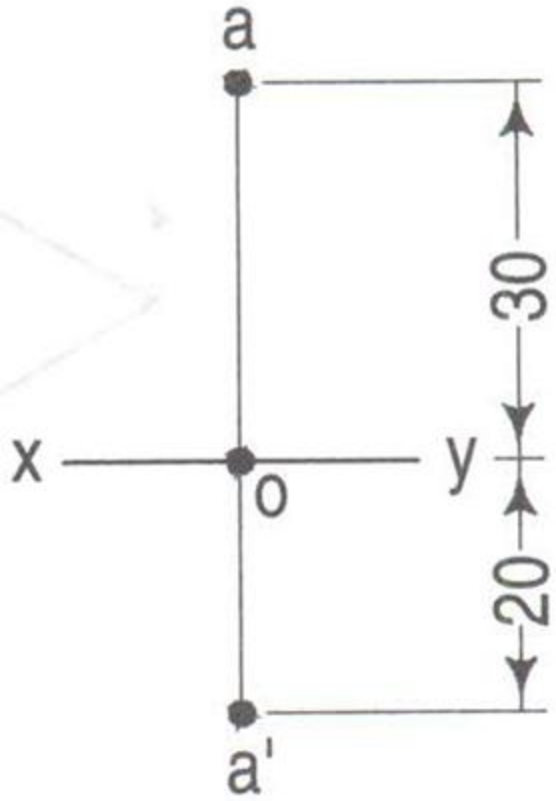


Projections of Points

Example-2

Point A is 20mm below H.P. and 30mm behind V.P. Draw its projections.

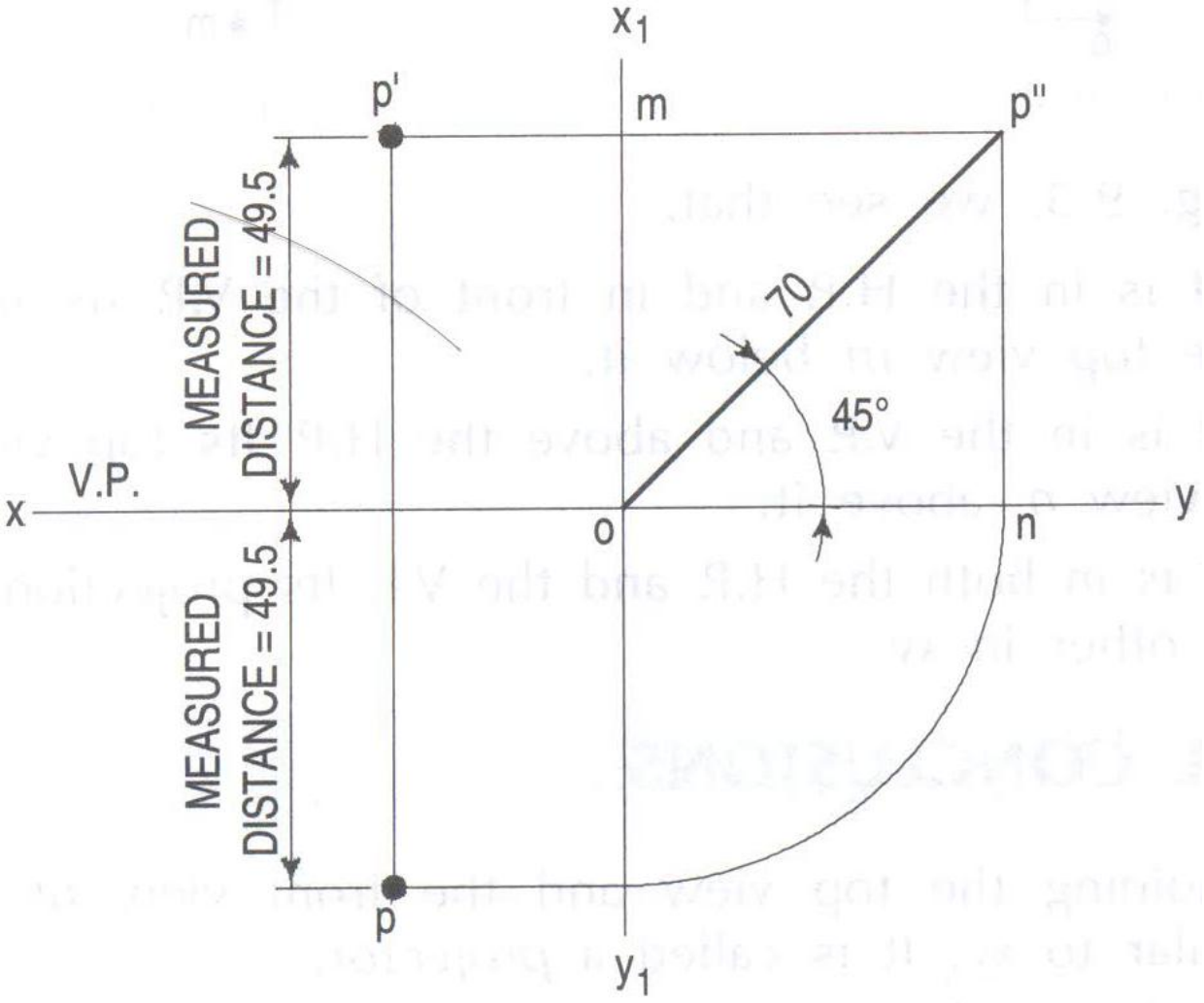




Projections of Points

Example-3

Point P is in the 1st quadrant and lies in an auxiliary plane perpendicular to H.P. and V.P. Its shortest distance from *xy*, the intersection of H.P. and V.P. is 70mm and is equidistant from both these planes. Draw its projections of this point and determine its distances from H.P. and V.P.



Projections of Points

Exercise-1

Draw the projections of points on the same ground line xy keeping the projectors 25mm apart:

A: in H.P. and 20mm behind V.P.

B: 40mm above H.P. and 25mm in front of V.P.

C: 40mm above H.P. and in V.P.

D: 25mm below H.P. and 25mm behind V.P.

E: 15mm above H.P. and 50mm behind V.P.

F: 40mm below H.P. and 25mm in front of V.P.

G: in H.P. and in V.P.

Projections of Points

Exercise-2

A point P is 40mm above H.P. and 30mm in front of V.P. Draw its projections. Find its shortest distance from xy by drawing its side view.

Projections of Straight Lines

Projections of Straight Lines

- Chapters 10 covers the details on Projections of Straight Lines.
- Roughly work out all the problems given to you.

Projections of Straight Lines

Various possible positions of the straight line

(a) The line is parallel to one or both the reference planes

  (a_1) Special case: Line contained by one or both of the reference planes

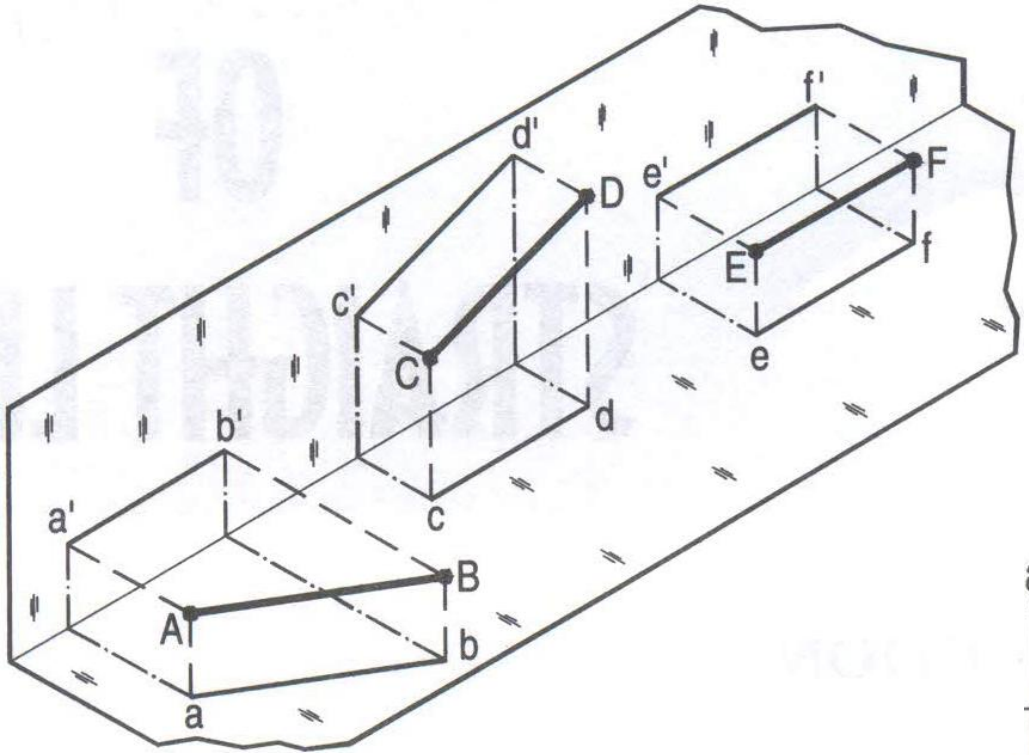
(b) The line is perpendicular to one of the reference planes

(c) The line is contained in a plane perpendicular to both the reference planes

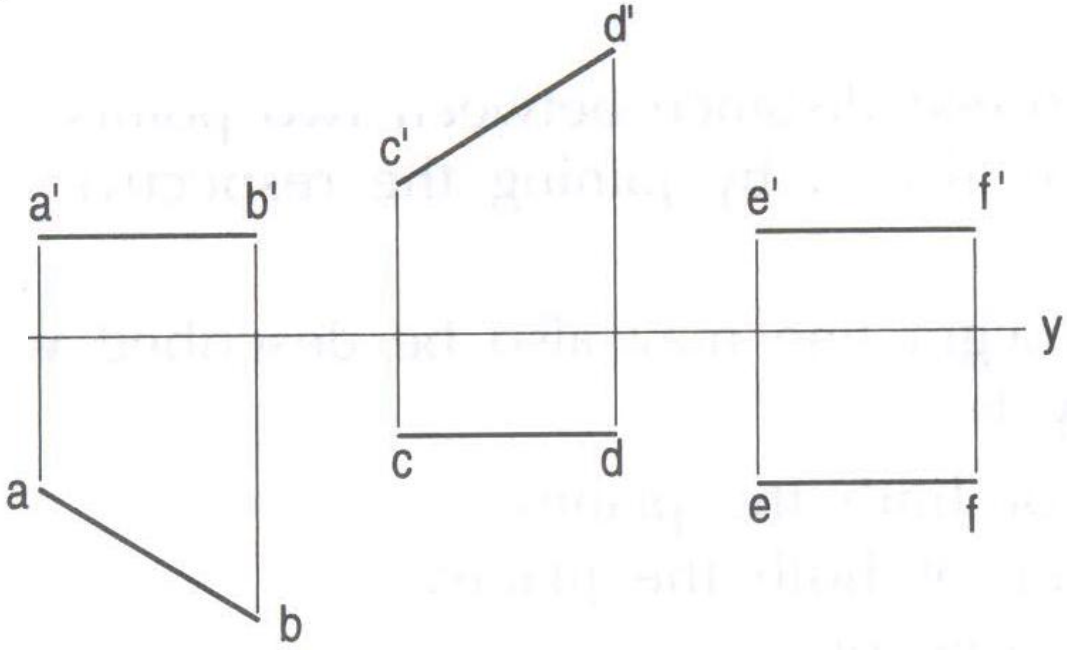
(d) The line is inclined to both the reference planes

Projections of Straight Lines

(a) Line parallel to one or both the ref. planes

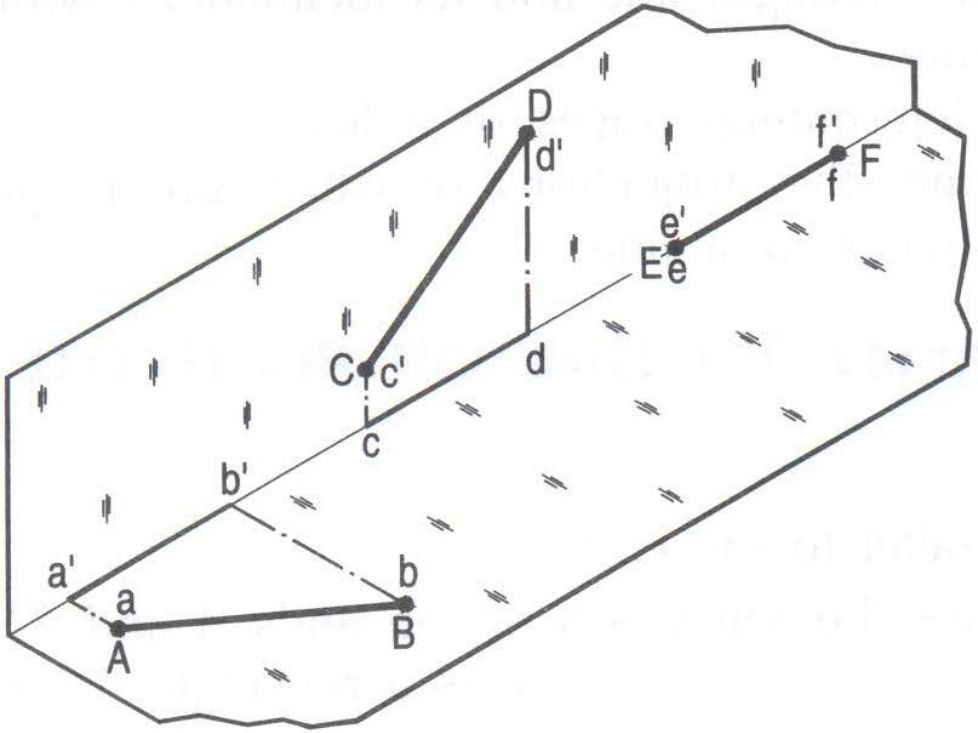


Note: When a line is parallel to a plane, its projection on that plane will be of *true length*.

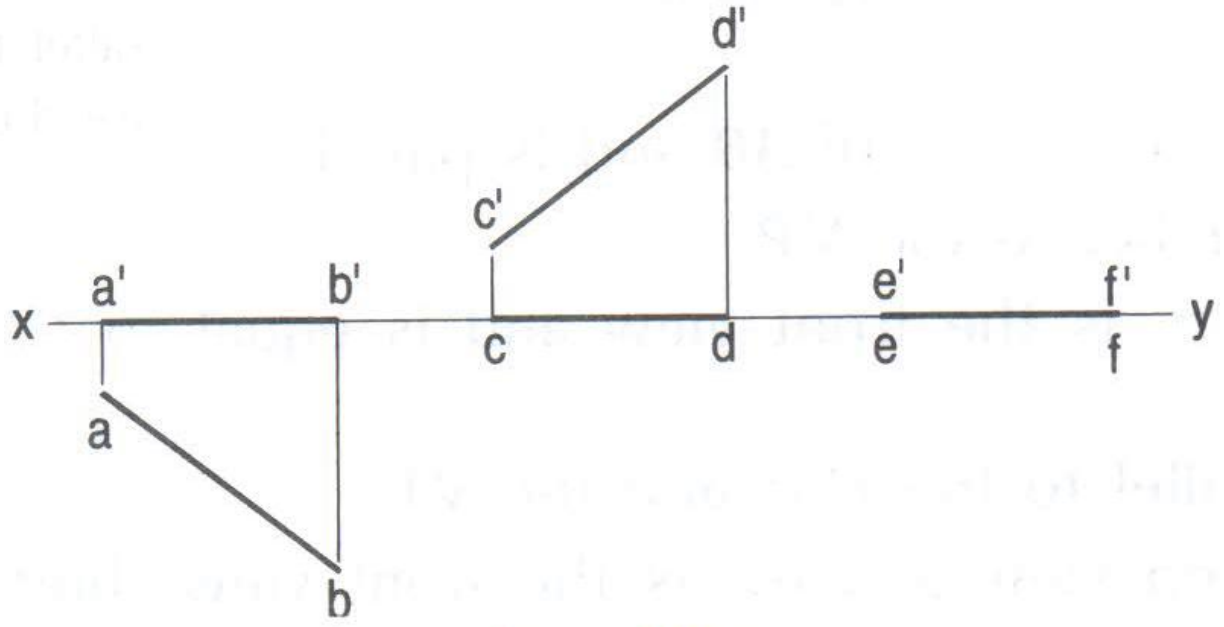


Projections of Straight Lines

(a_1) Line contained by one or both the ref. planes

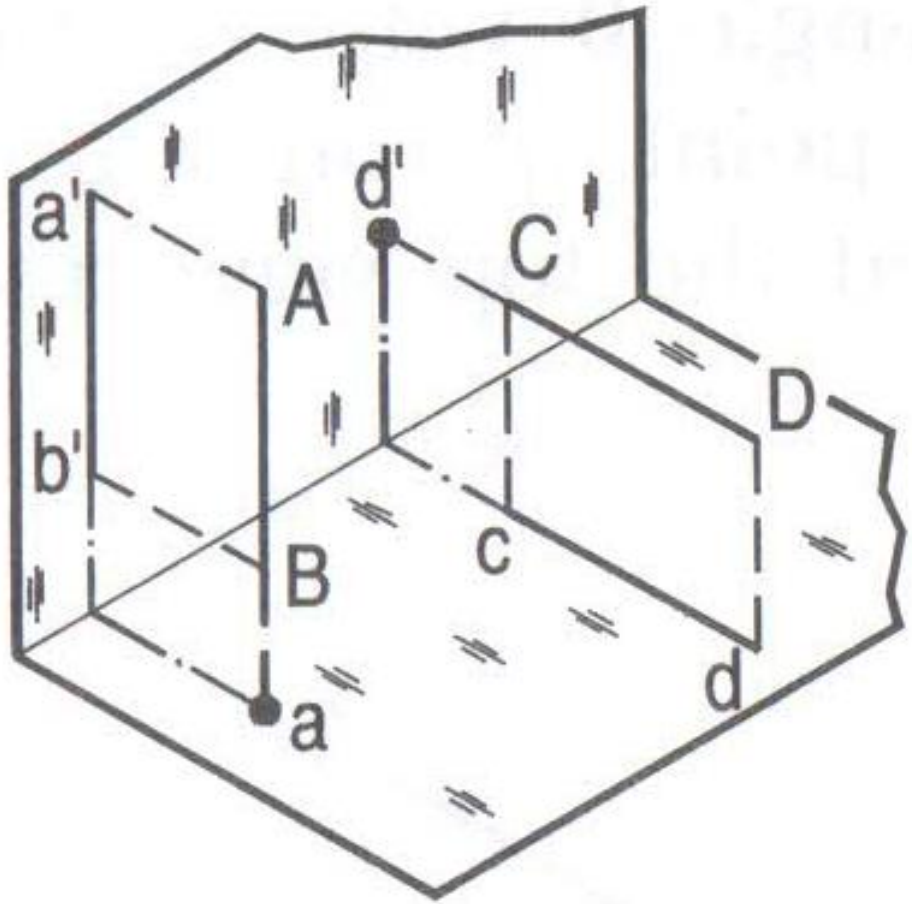


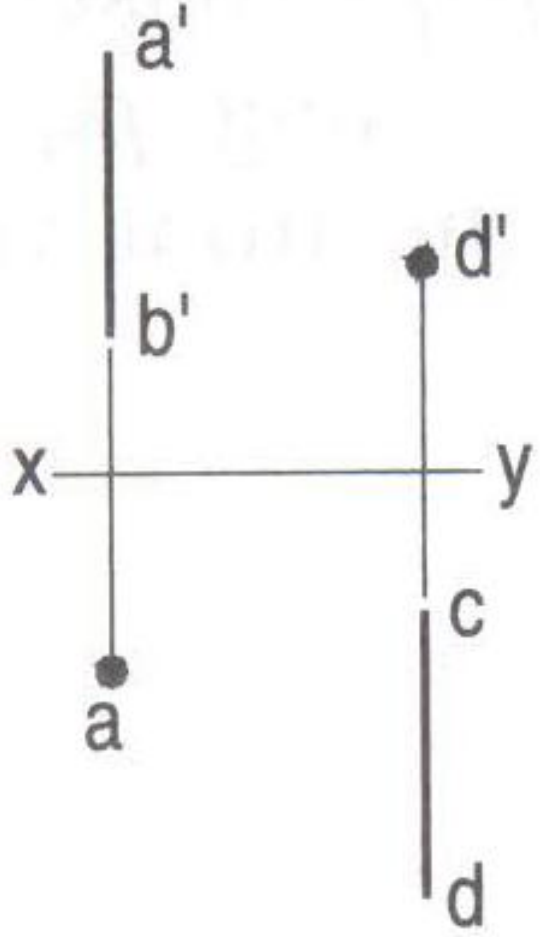
This is a special case of (a)



Projections of Straight Lines

(b) Line perpendicular to one of the ref. planes

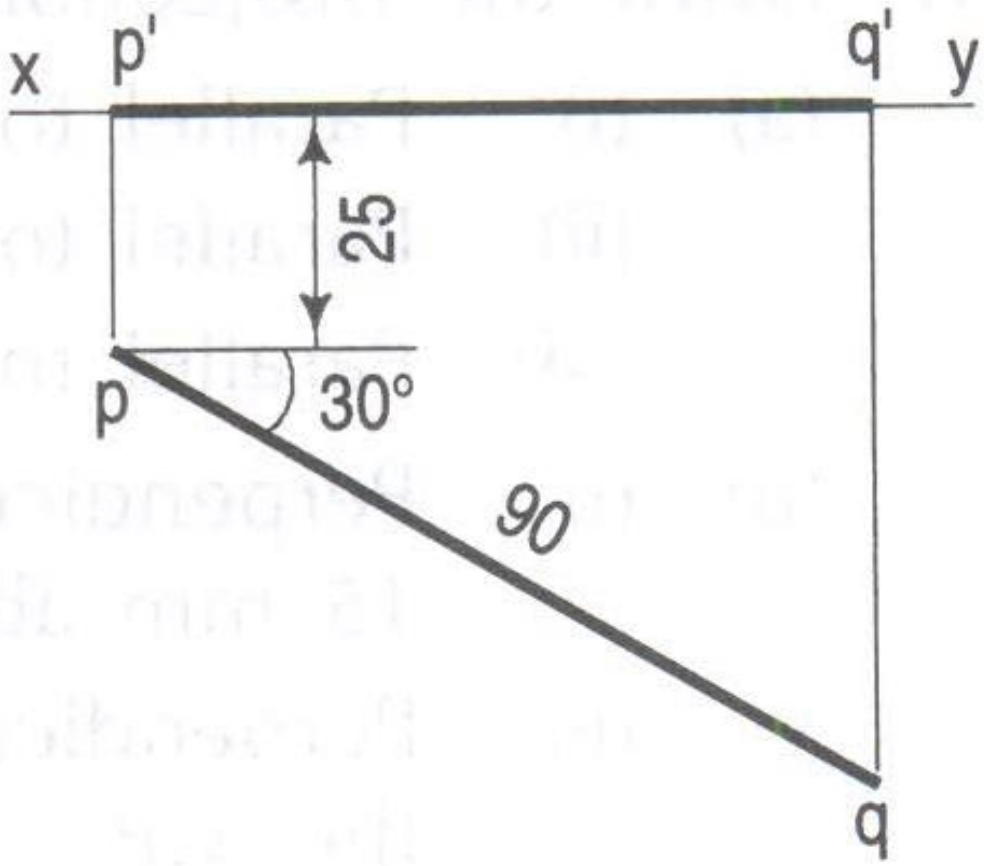




Projections of Straight Lines

Example-1 (Solved Pb. 10-1, pp. 199)

A line PQ of 90mm long is in the H.P. and makes and angle of 30° with V.P. Its end P is 25mm in front of V.P. Draw its projections.



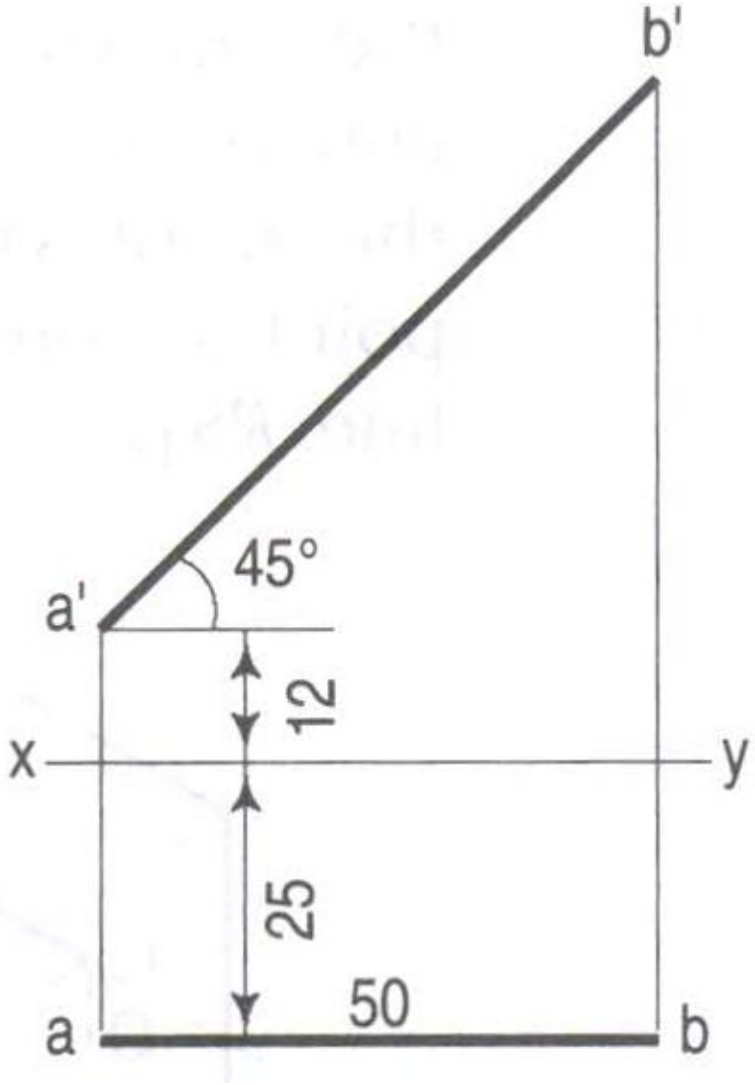
Projections of Straight Lines

Example-2 (Solved Pb. 10-2, pp. 200)

The length of the top view of a line parallel to V.P. and inclined at 45° to H.P. is 50mm. One end of the line is 12mm above H.P. and 25mm in front of V.P.

(a) Draw its projections.

(b) Find its true length.



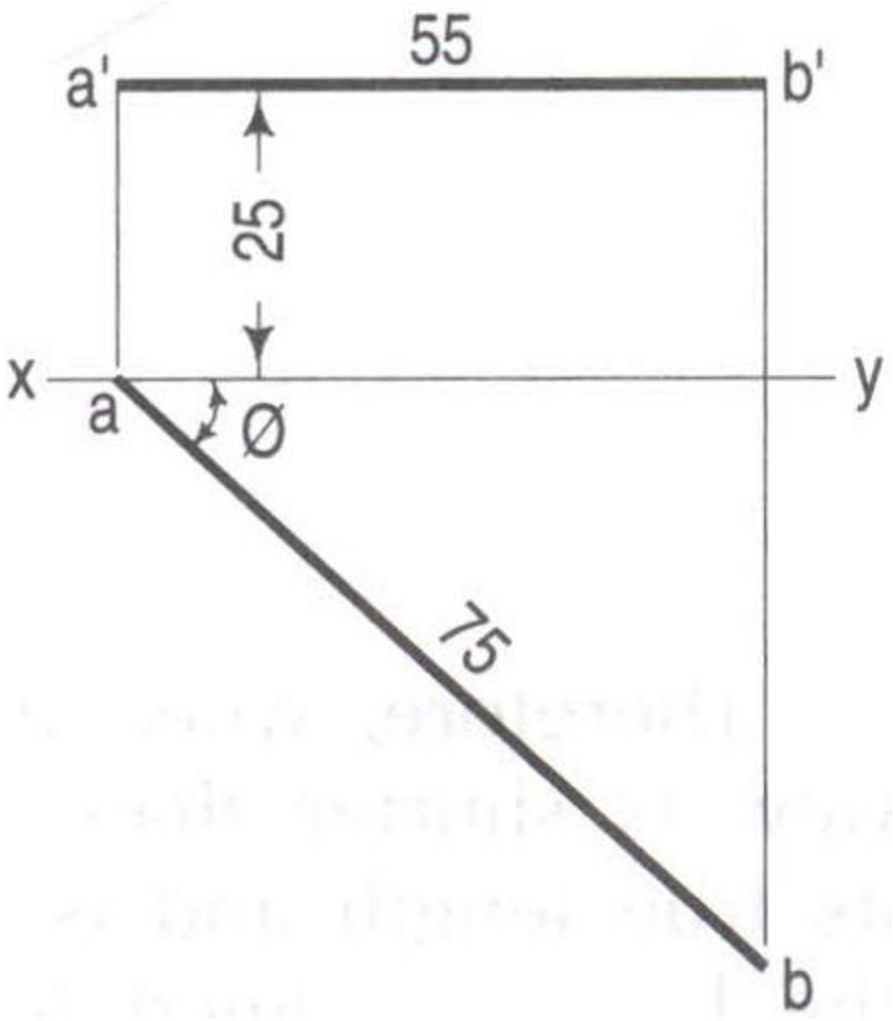
True length is a'b'.

Projections of Straight Lines
Example-3 (Solved Pb. 10-3, pp. 200)

The front view of a 75mm long line parallel to H.P. measures 55mm. One of its ends is in V.P. and 25mm above H.P.

(a) Draw its projections.

(b) Determine its inclination with V.P.



φ=acos(55/75)=42.833°

Projections of Straight Lines

Exercise-1 (Exercise Pb. 10(a)-4, pp. 201)

The top view of a 75mm long line measures 55mm. It lies in V.P. and has its one end 25mm above H.P. Draw its projections.

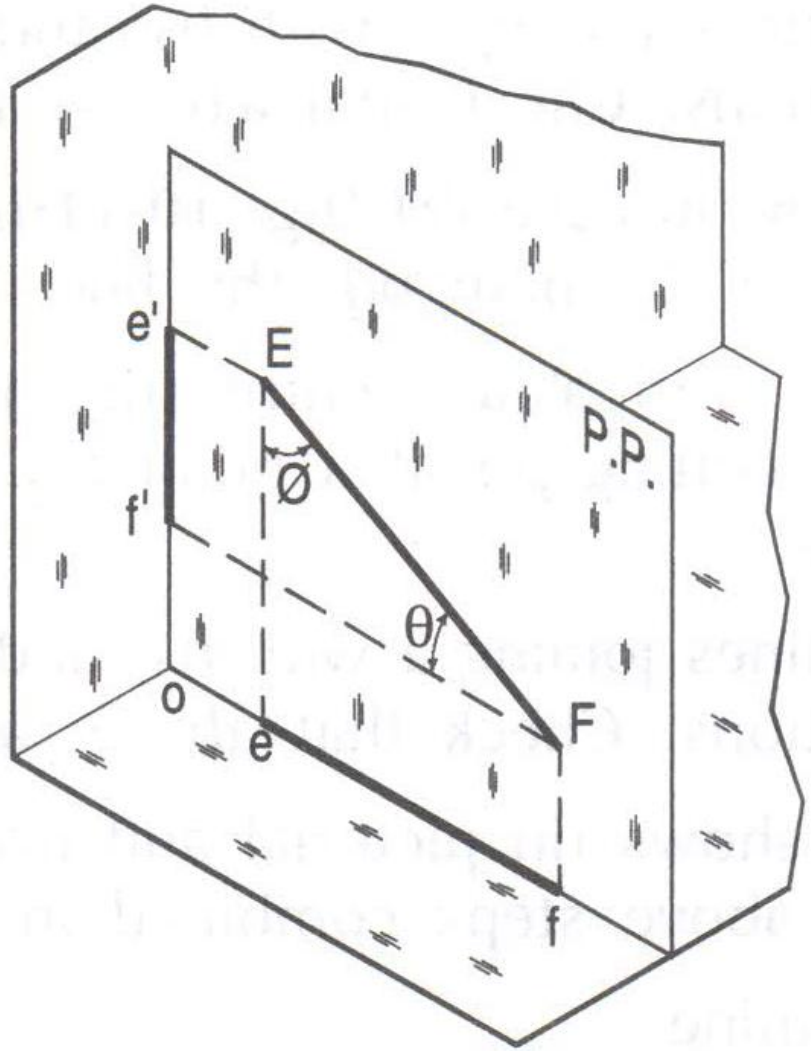
Projections of Straight Lines

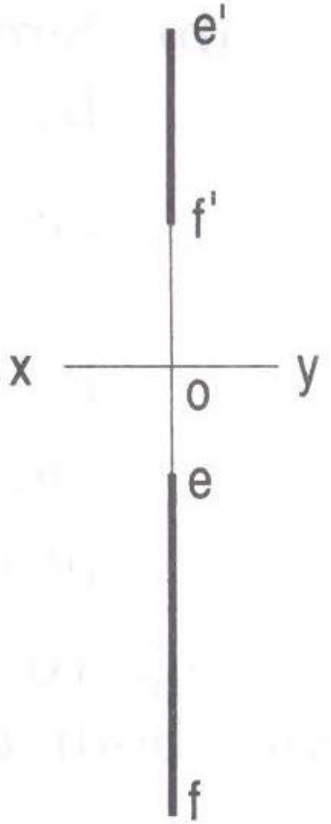
Exercise-2 (Exercise Pb. 10(a)-7, pp. 201)

Two pegs fixed on a wall are 4.5m apart. The distance between the pegs measured parallel to the floor is 3.6m. If one peg is 1.5m above the floor, find the height of the second peg and the inclination of the line joining the two pegs with the floor.

Projections of Straight Lines

(c) Line contained by a plane perp. to both ref. planes

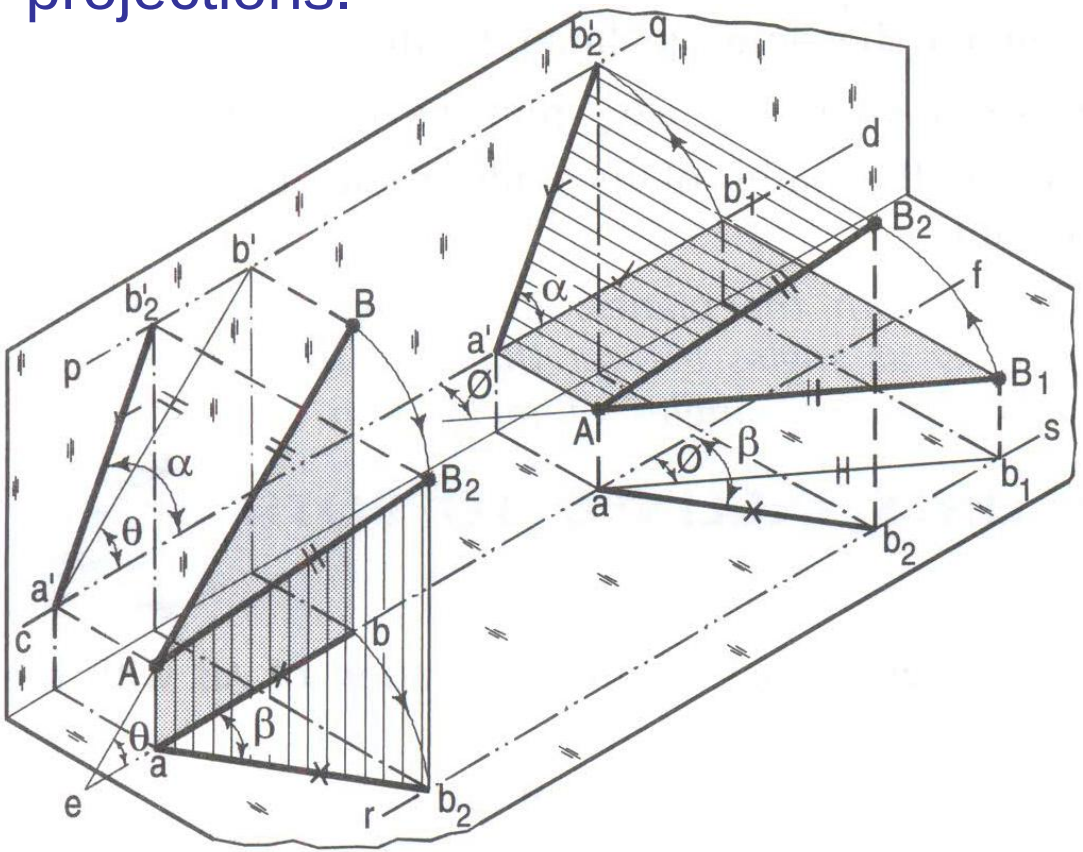




Projections of Straight Lines

(d) Line inclined to both the ref. planes

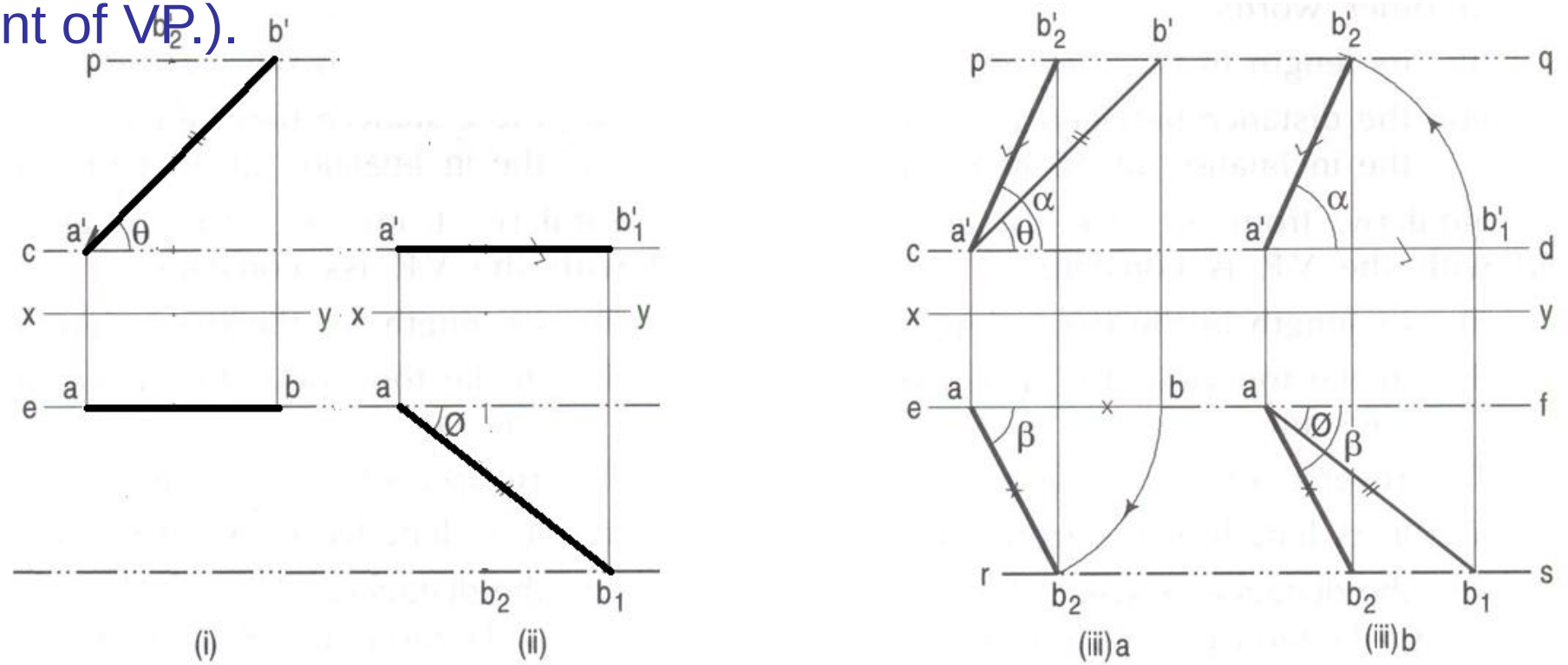
A line AB, of length l, is inclined by θ to H.P. and by φ to V.P. Draw its projections.



(i) (ii)

Projections of Straight Lines
(d) Line inclined to both the ref. planes

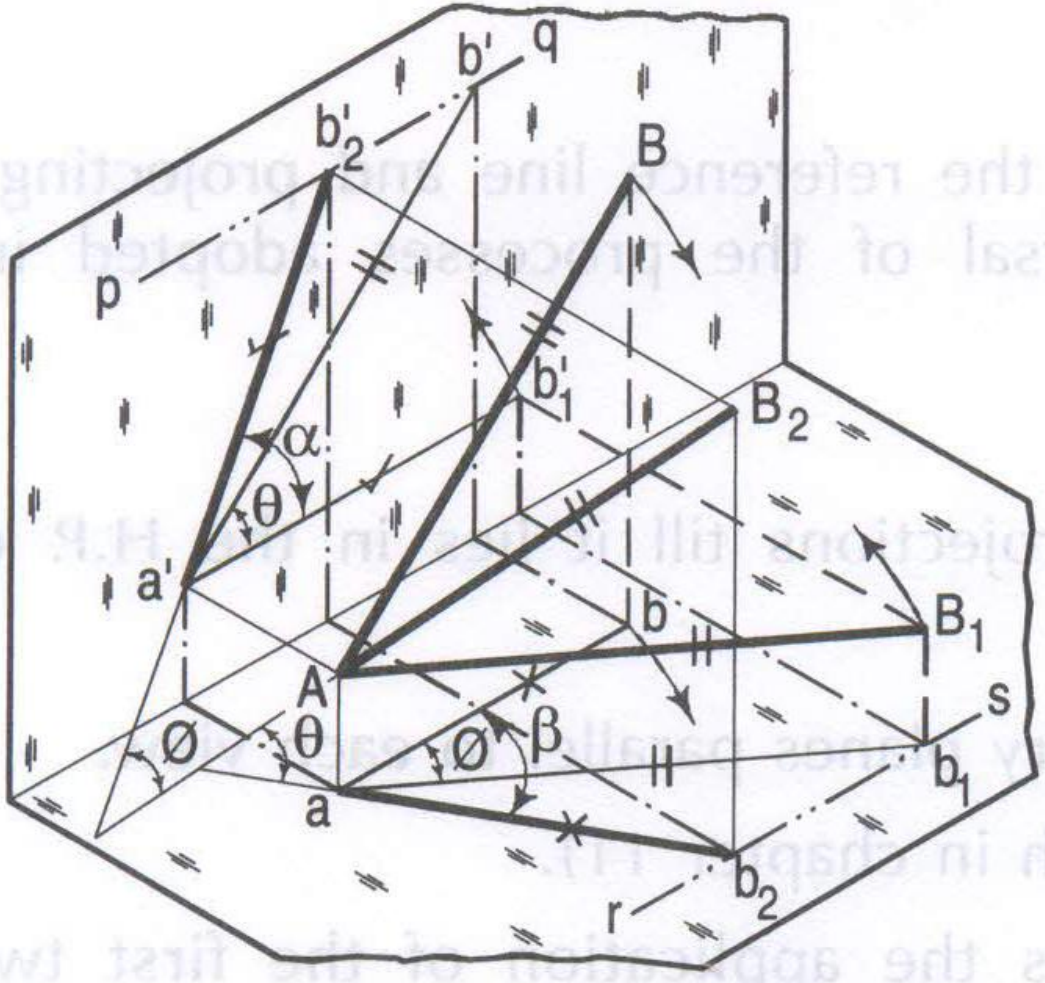
A line AB, of length l, is inclined by θ to H.P. and by φ to V.P. Draw its projections (by θ = 45; φ = 30; l = 80; A is 15 above HP and 25 in front of VP.).

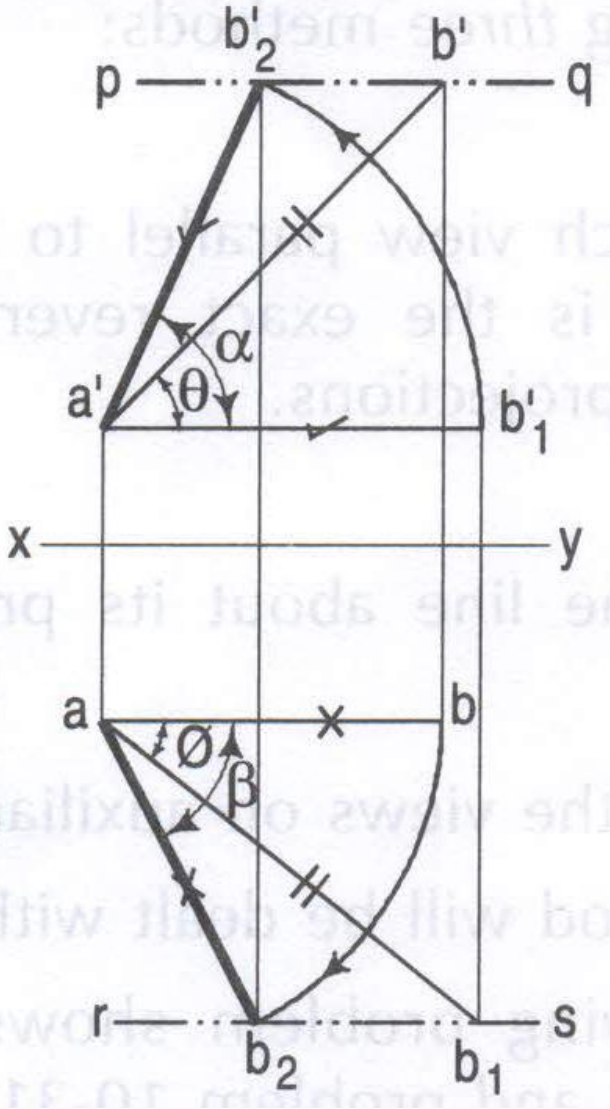


Angle: Apparent > actual
Dist. : Apparent < actual

Projections of Straight Lines

(d) Line inclined to both the ref. planes …



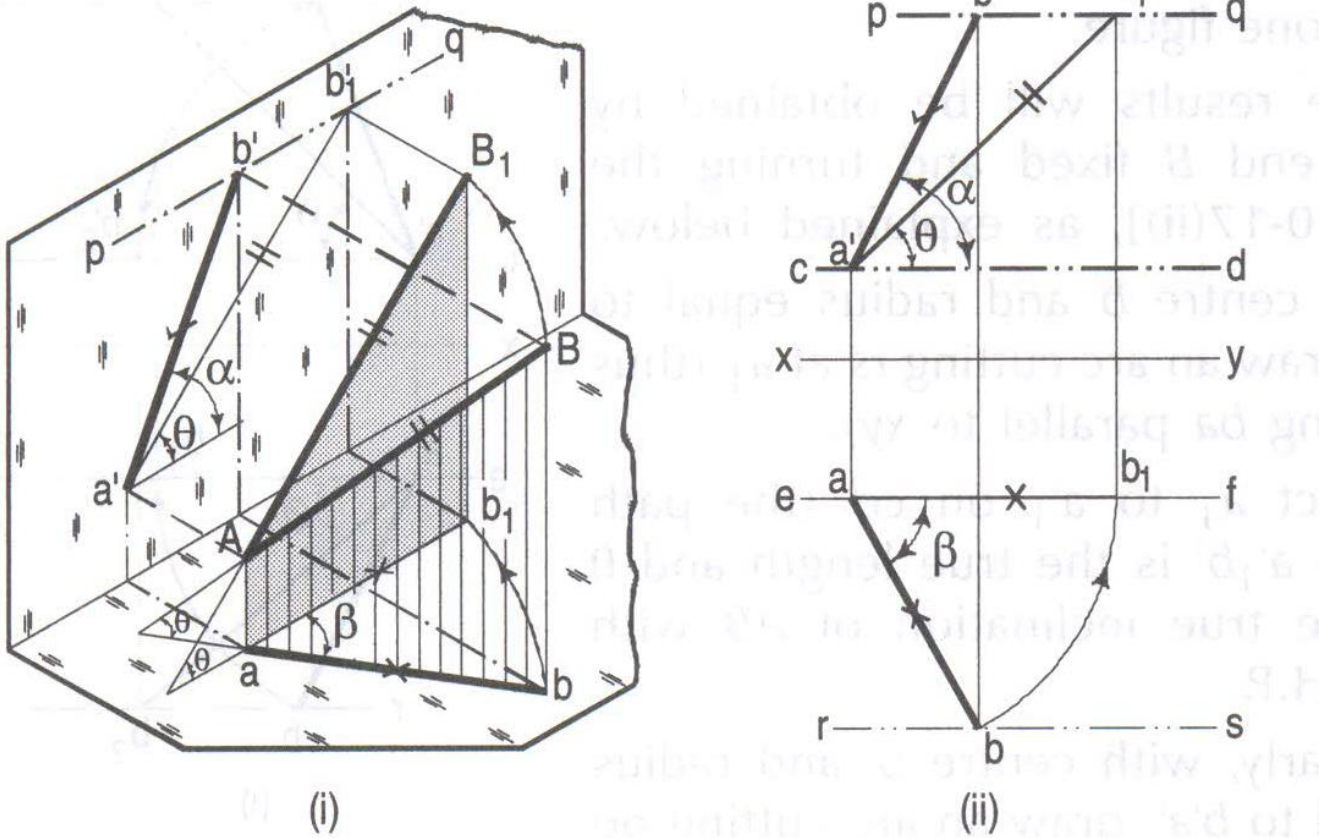


True Length of a Straight Line

True Length of a Straight Line

Alternative 1

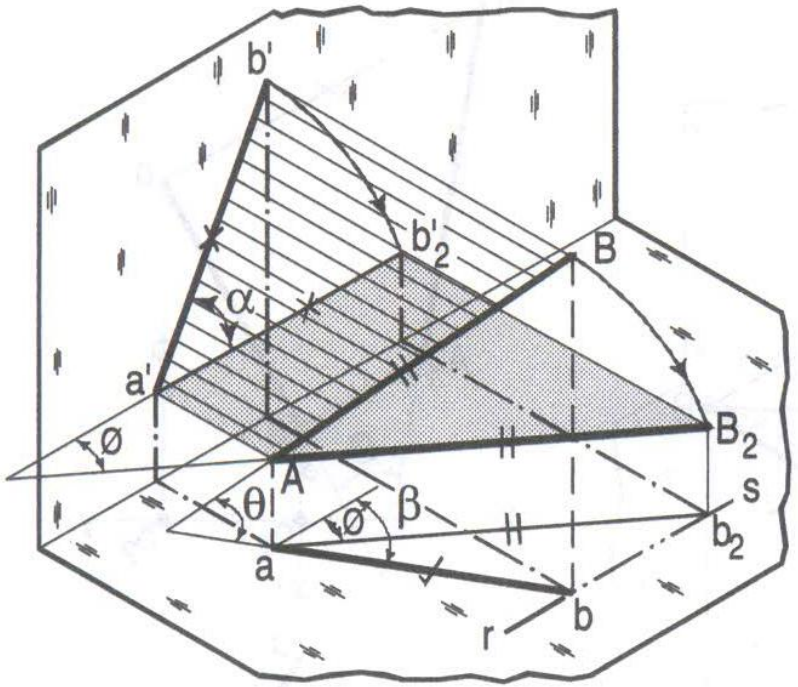
Make the line parallel to H.P. The top view will be a horizontal line and the front view will give the true length.



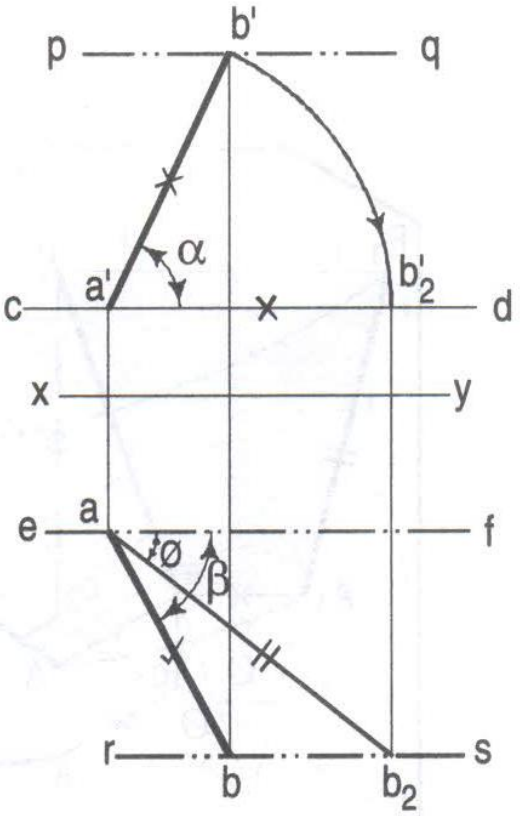
True Length of a Straight Line

Alternative 2

Make the line parallel to V.P. The front view will be a horizontal line and the top view will give the true length.



(i)



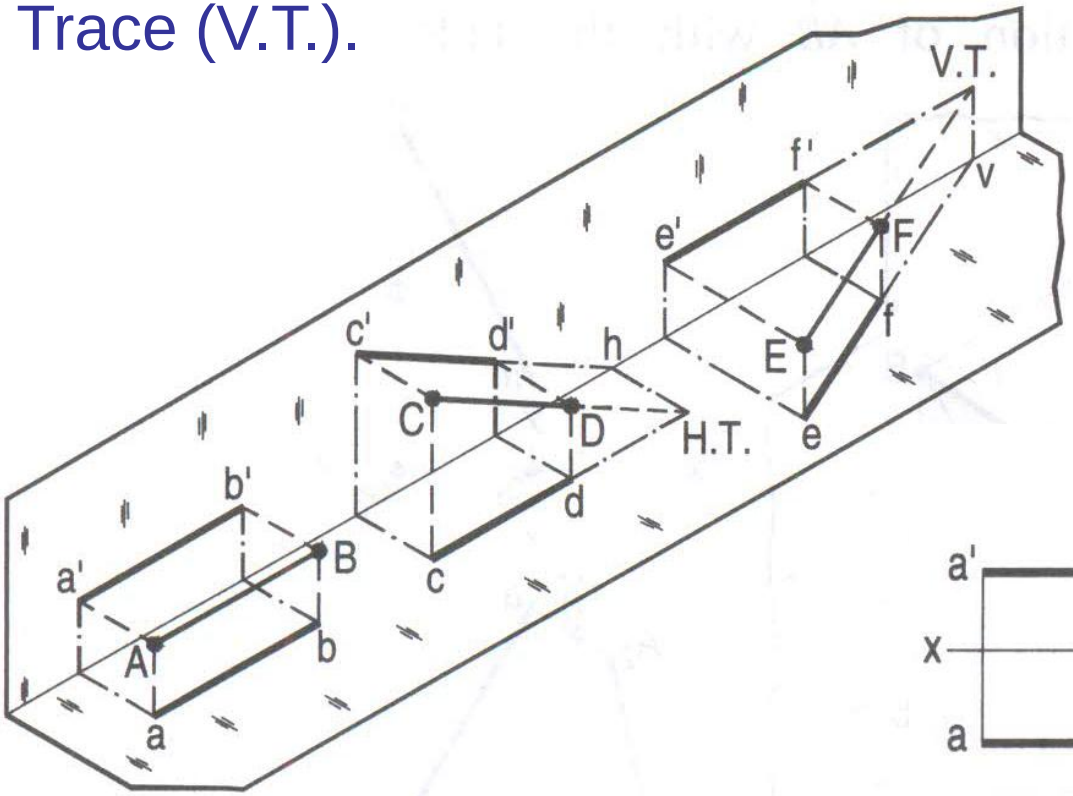
(ii)

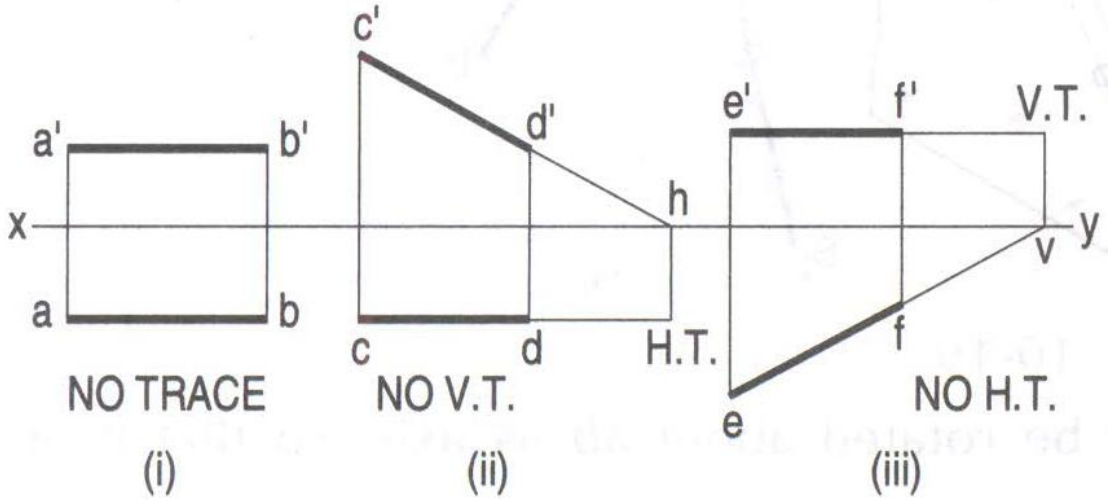
Trace of a Straight Line

Trace of a Straight Line

Line is parallel to one or both the reference planes

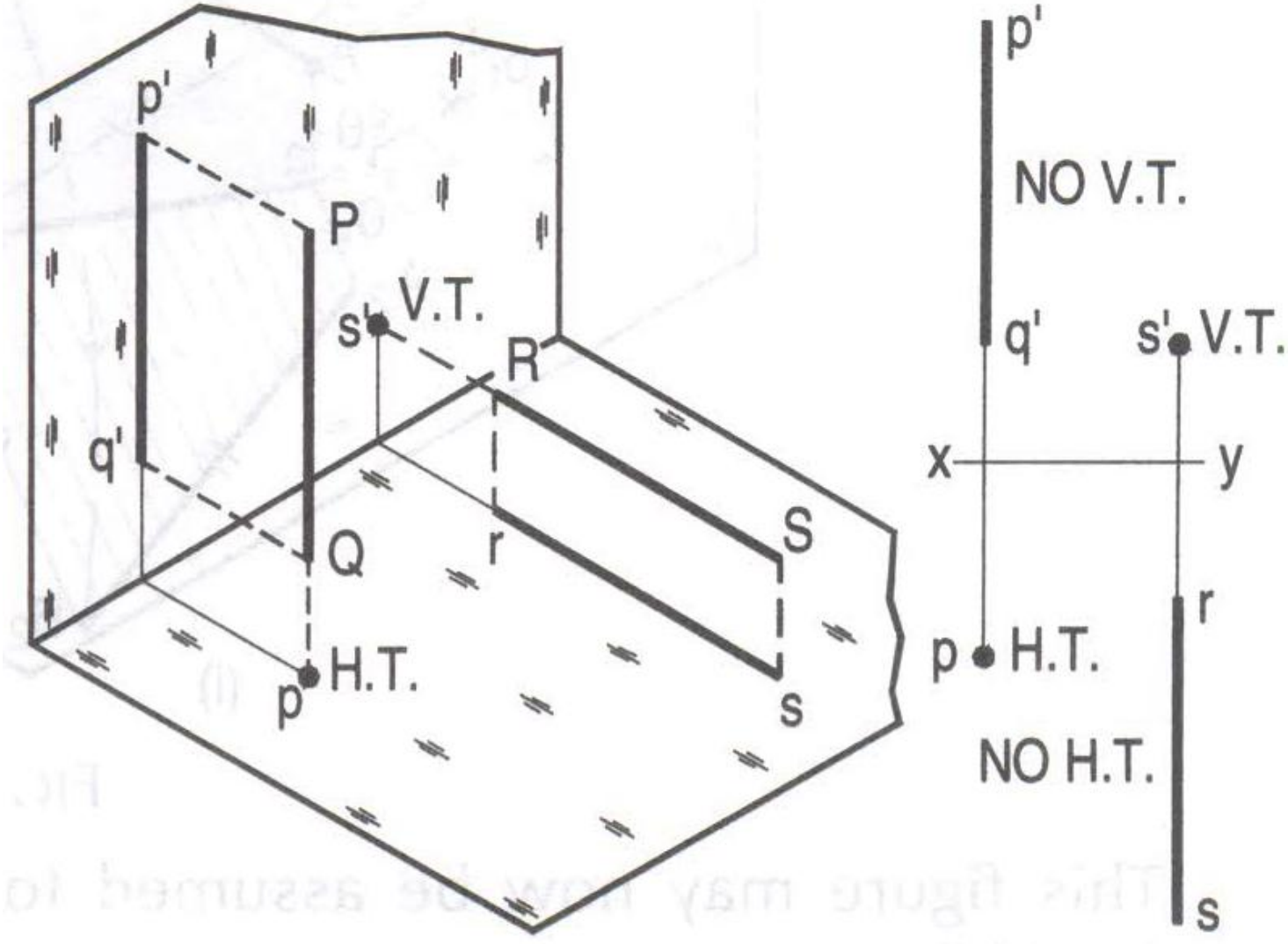
Trace is the point of intersection of the line with the reference planes H.P. and V.P., respectively called Horizontal Trace (H.T.) and Vertical Trace (V.T.).





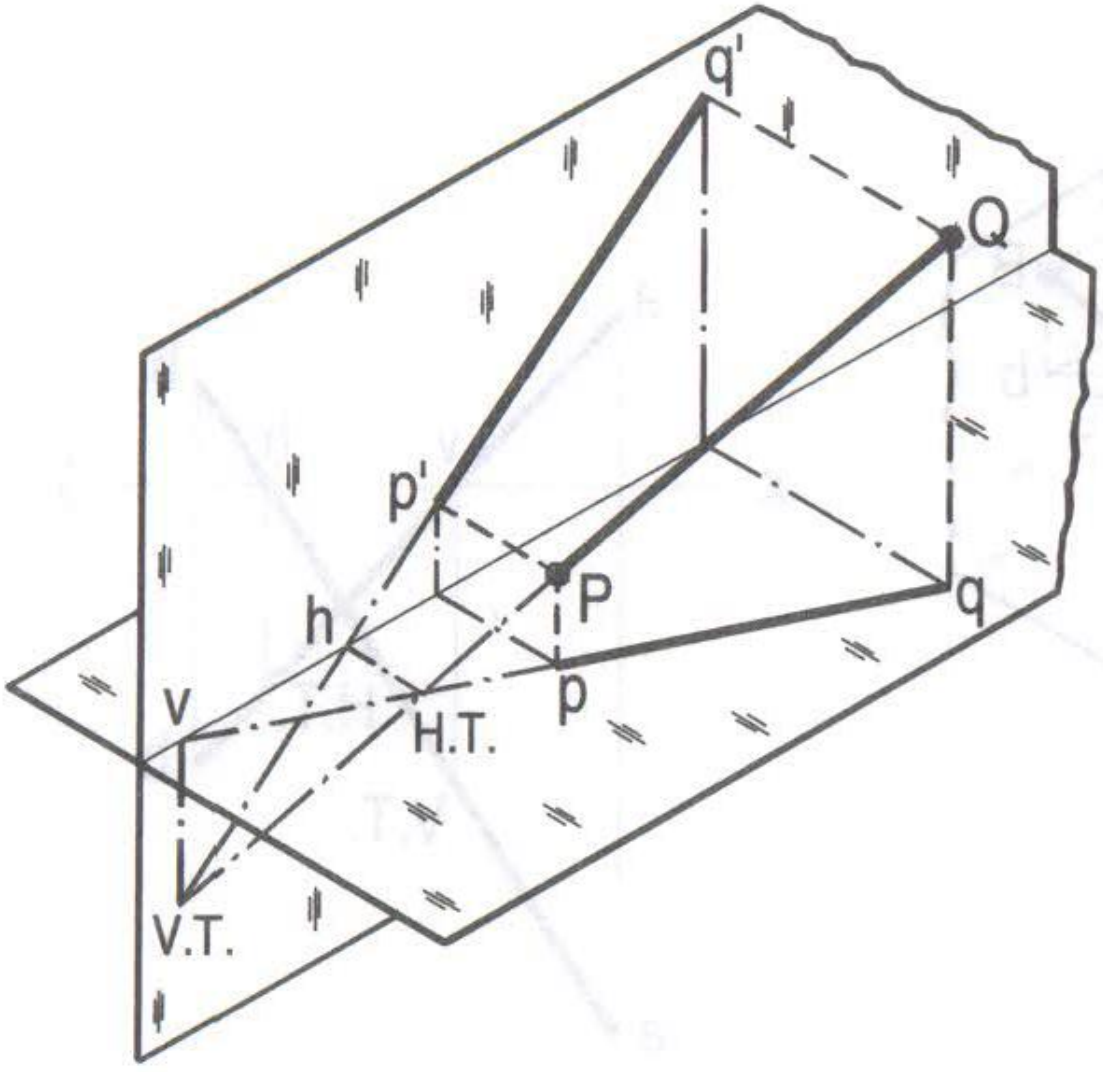
Trace of a Straight Line

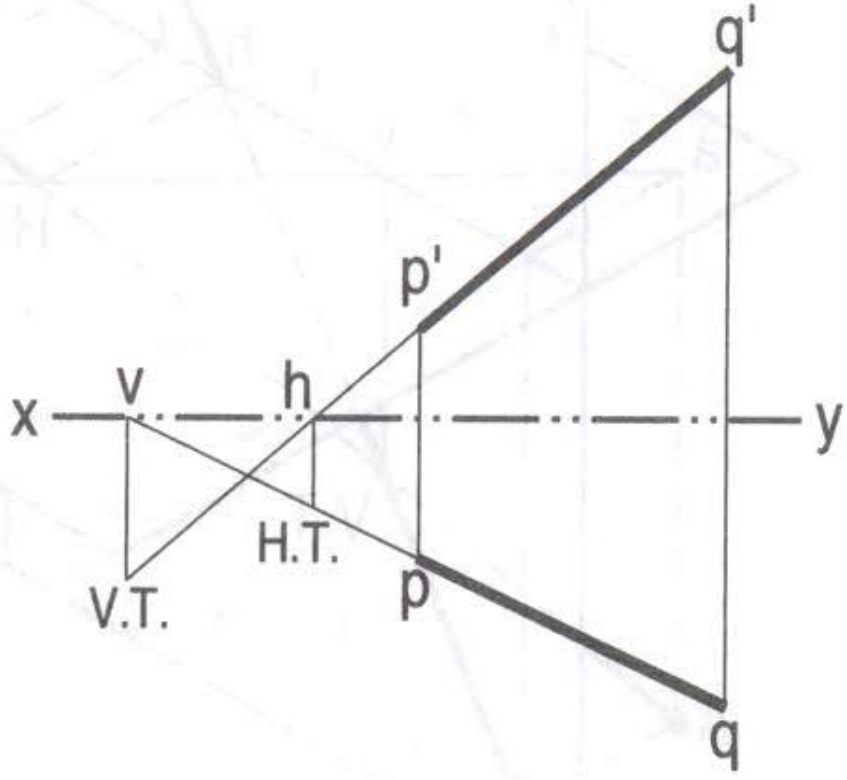
Line perpendicular to one the reference planes



Trace of a Straight Line

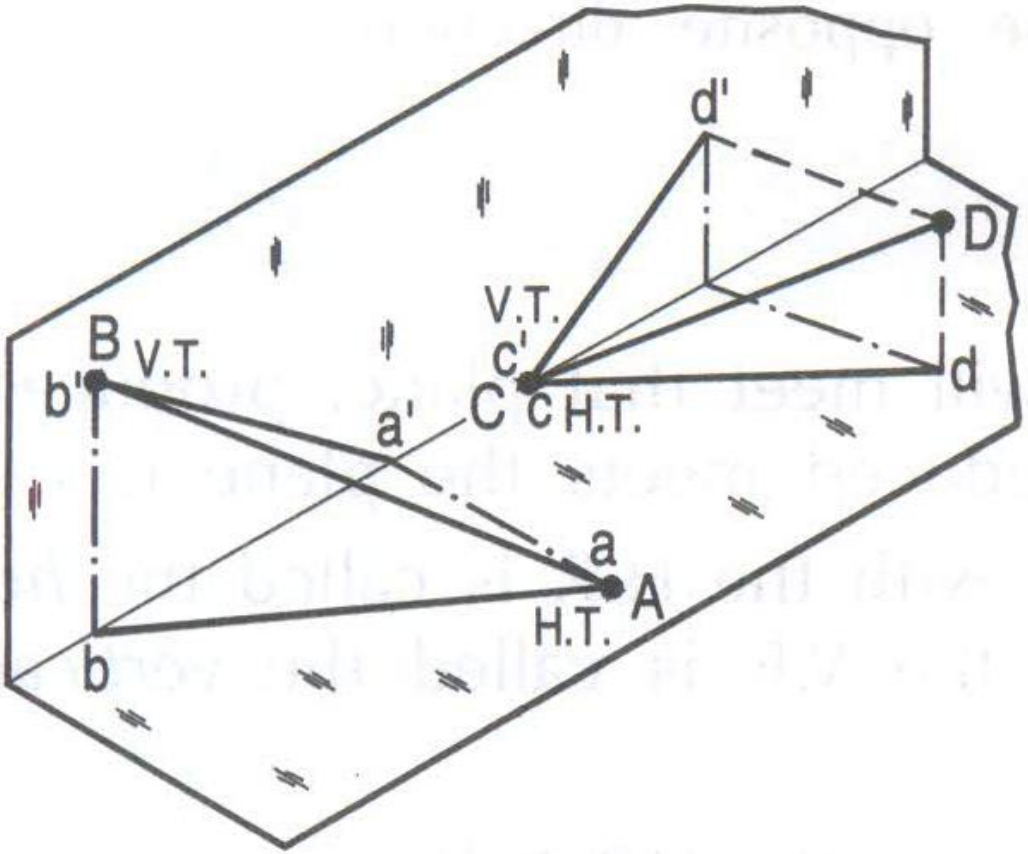
Line inclines to both the ref. planes

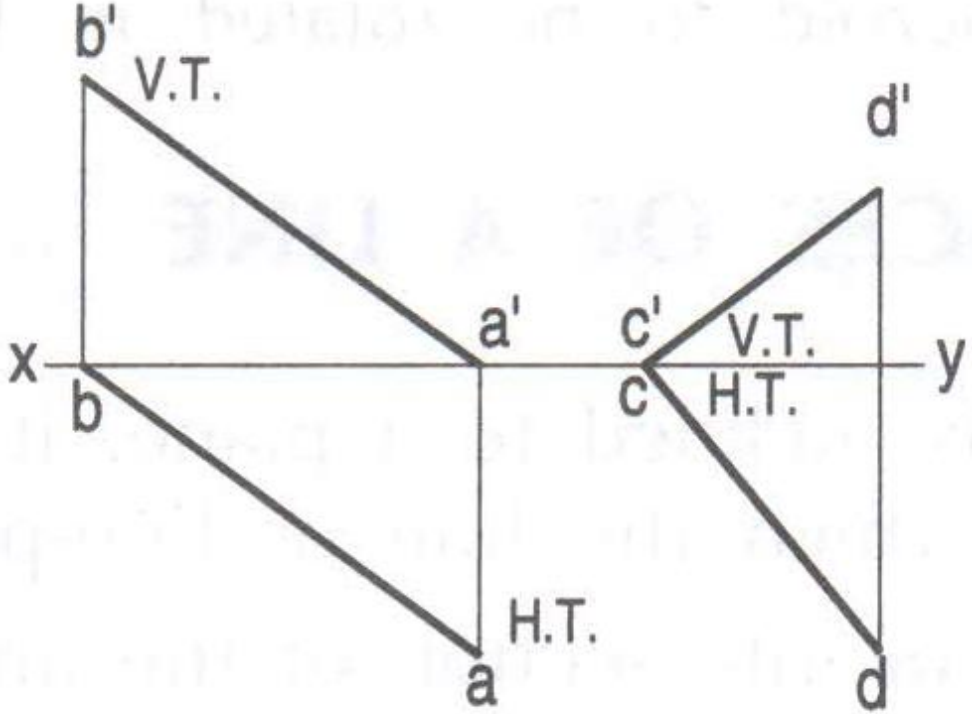




Trace of a Straight Line

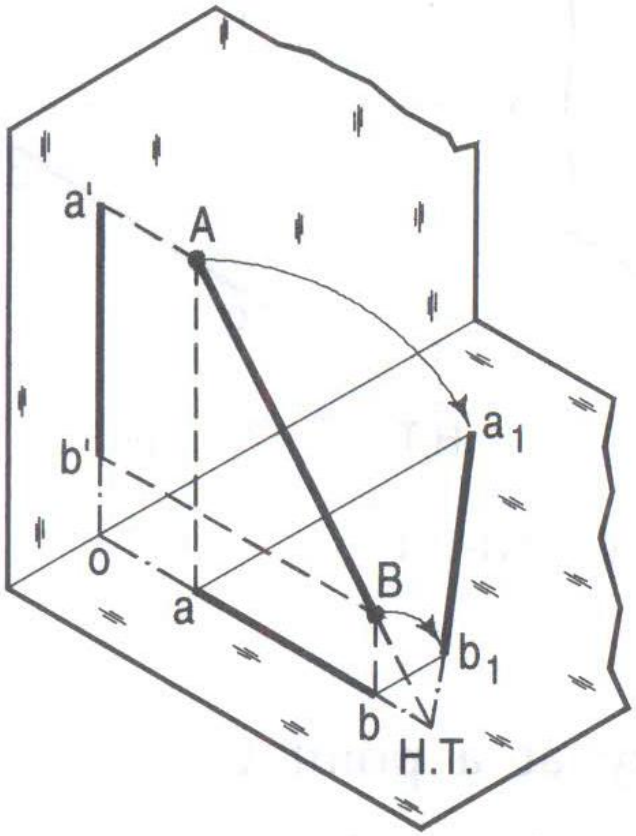
Line having ends in the reference planes

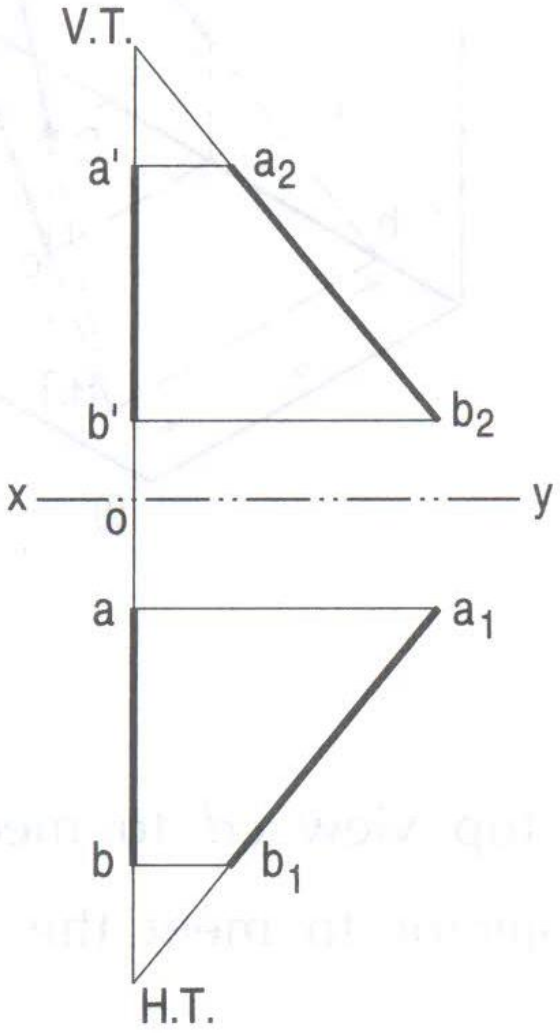


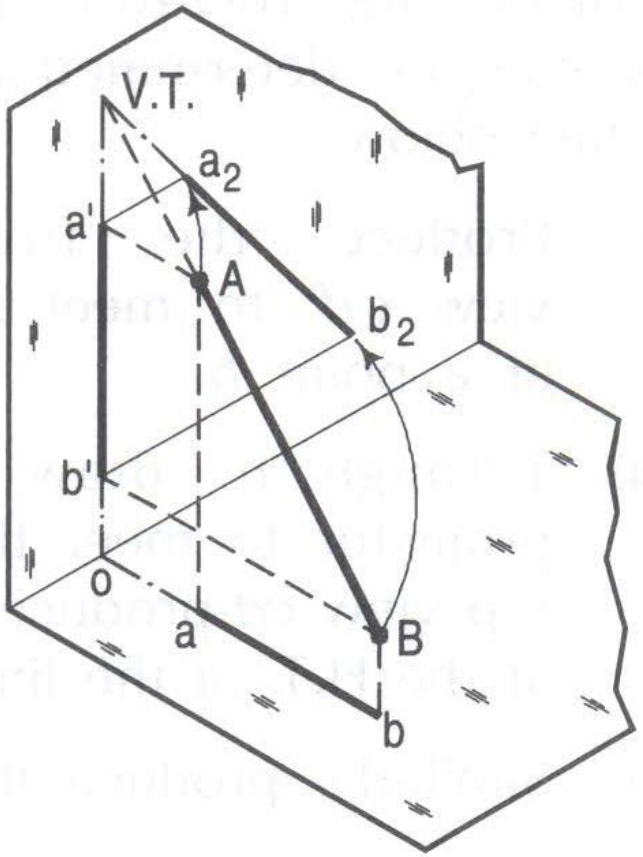


Trace of a Straight Line

Line in a plane perpendicular to both the ref. planes



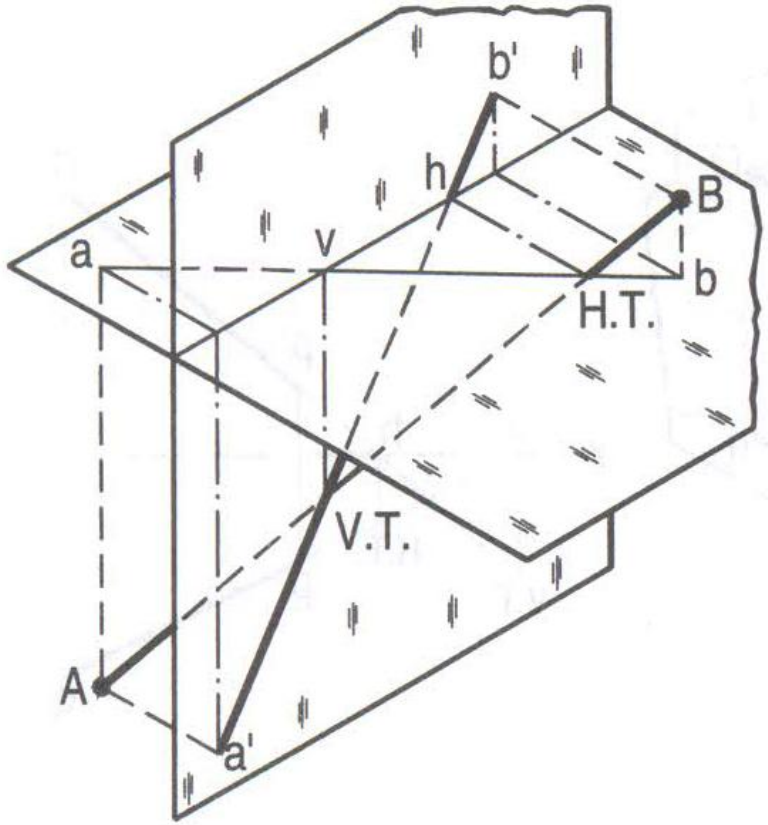


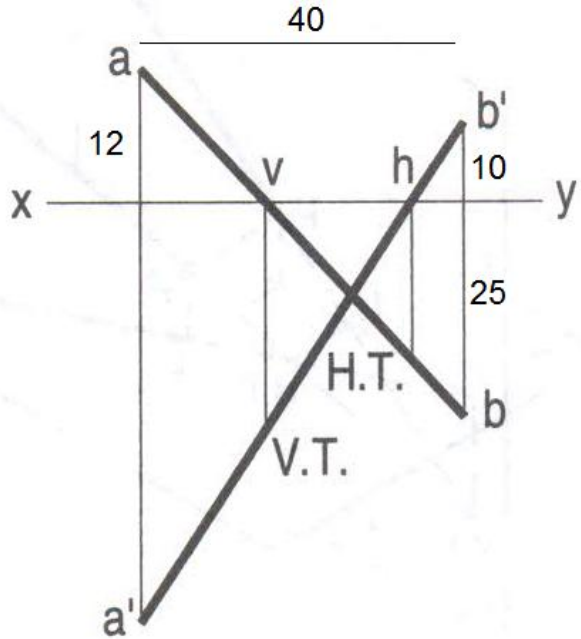


Trace of a Straight Line

Example-4 (Solved Pb. 10-7, pp. 213)

Point A is 50mm below H.P. and 12mm behind V.P. Point B is 10mm above H.P. and 25mm in front of V.P. The distance between the projectors of A and B is 40mm. Determine the traces of the line AB.

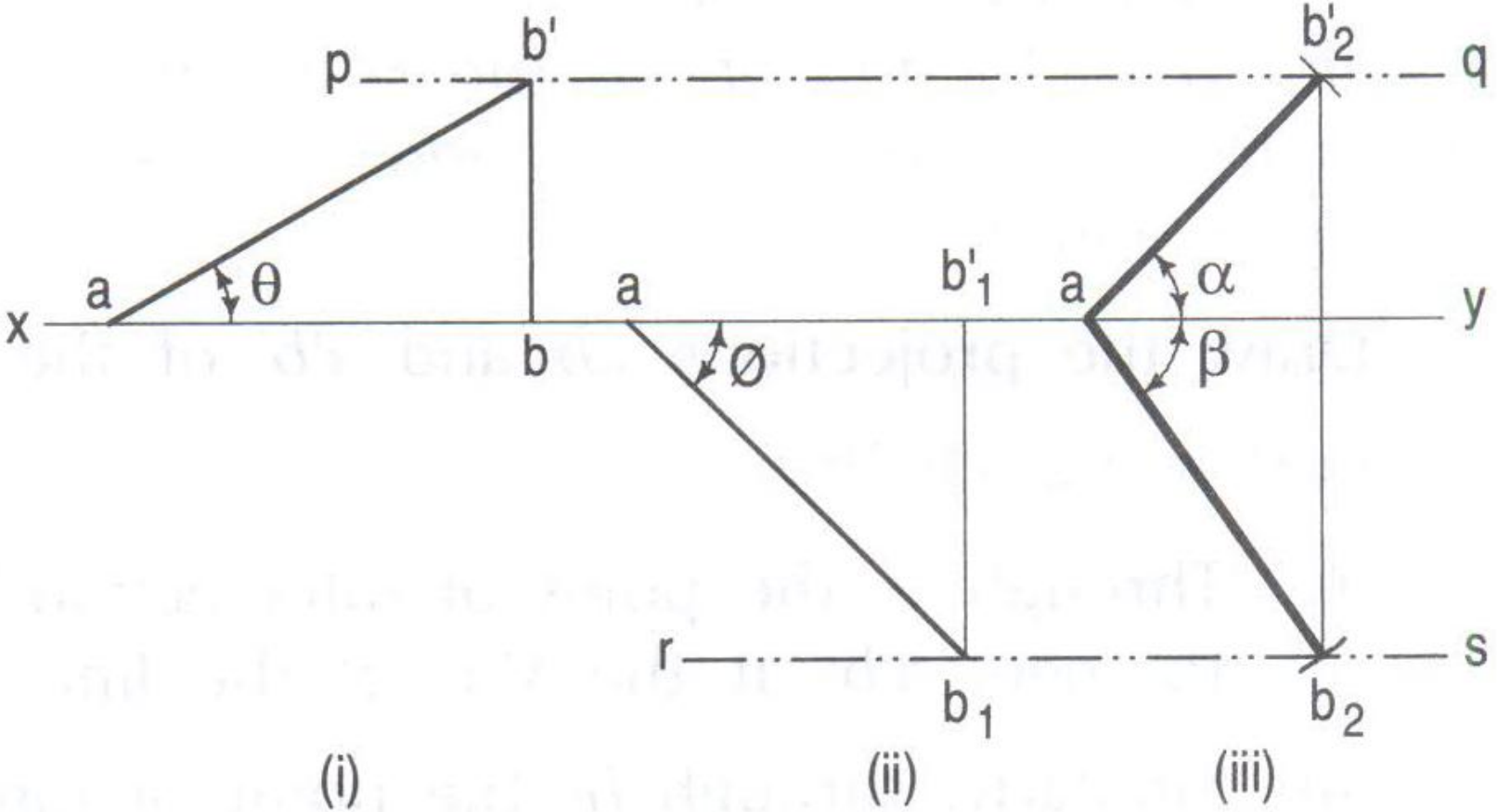




Projections of Straight Lines

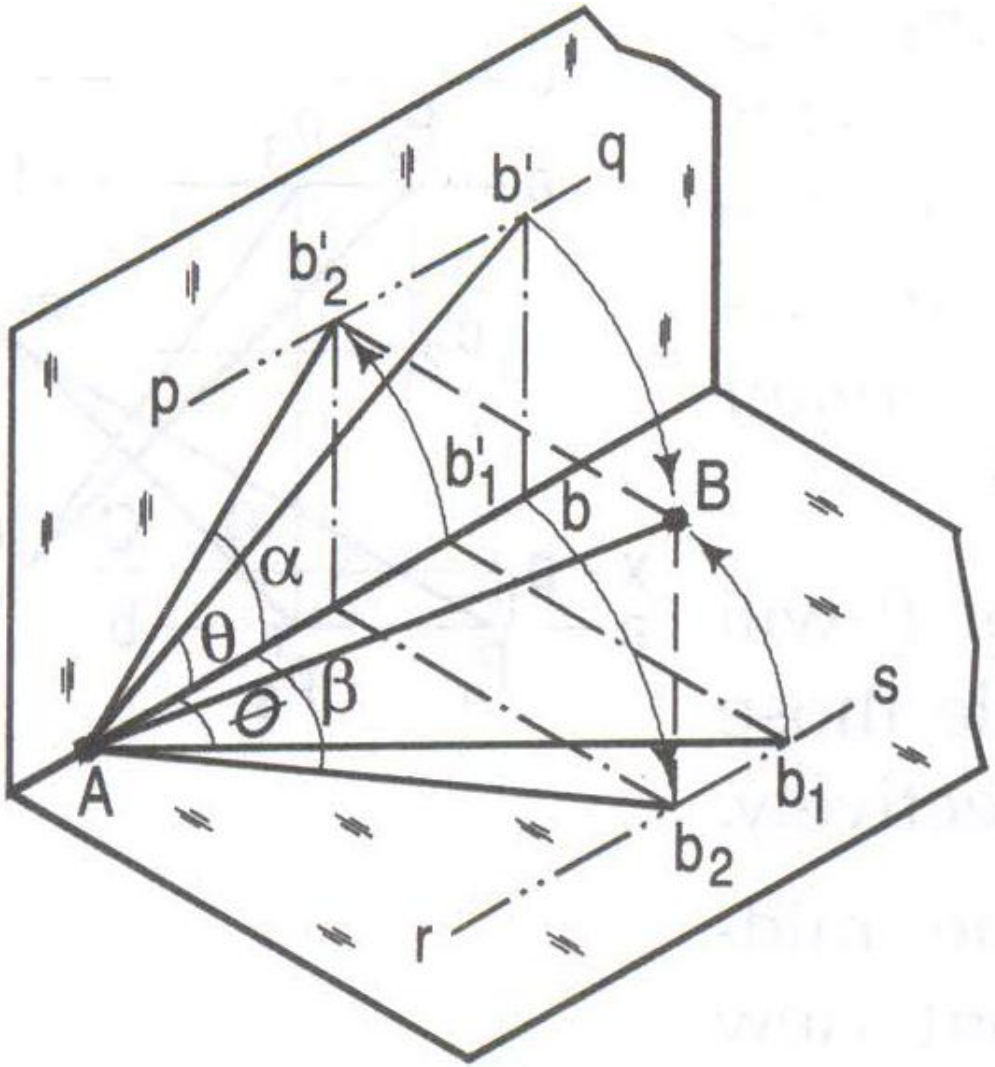
Example-5 (Solved Pb. 10-8, pp. 214)

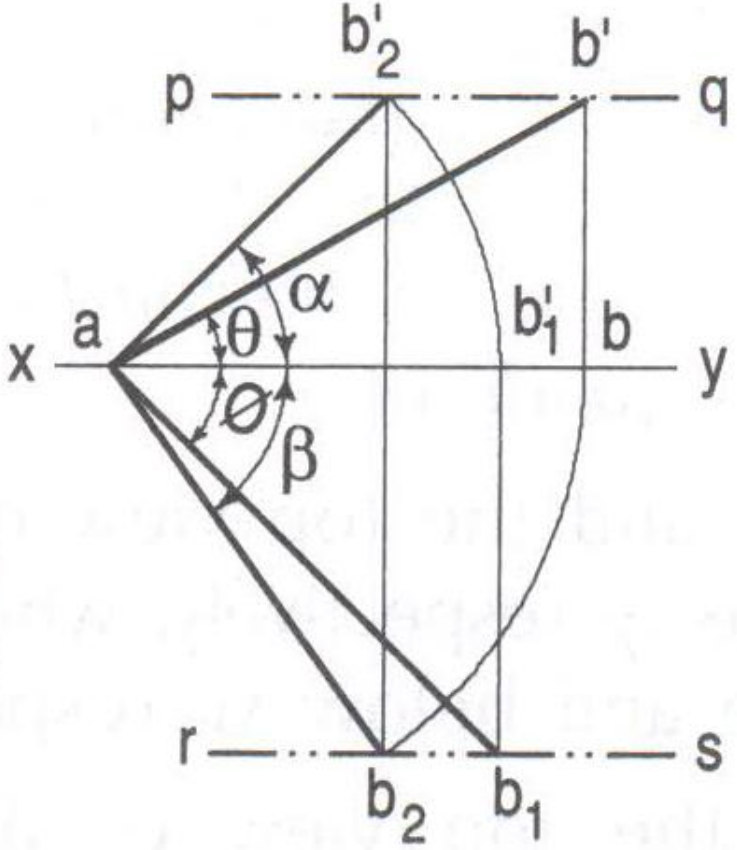
A line AB, 50mm long, has its end A in both H.P. and V.P. It is inclined at θ=30° to H.P. and at .φ=45° to V.P. Draw its projections.



Projections of Straight Lines

Example-5 (Solved Pb. 10-8, pp. 214) …

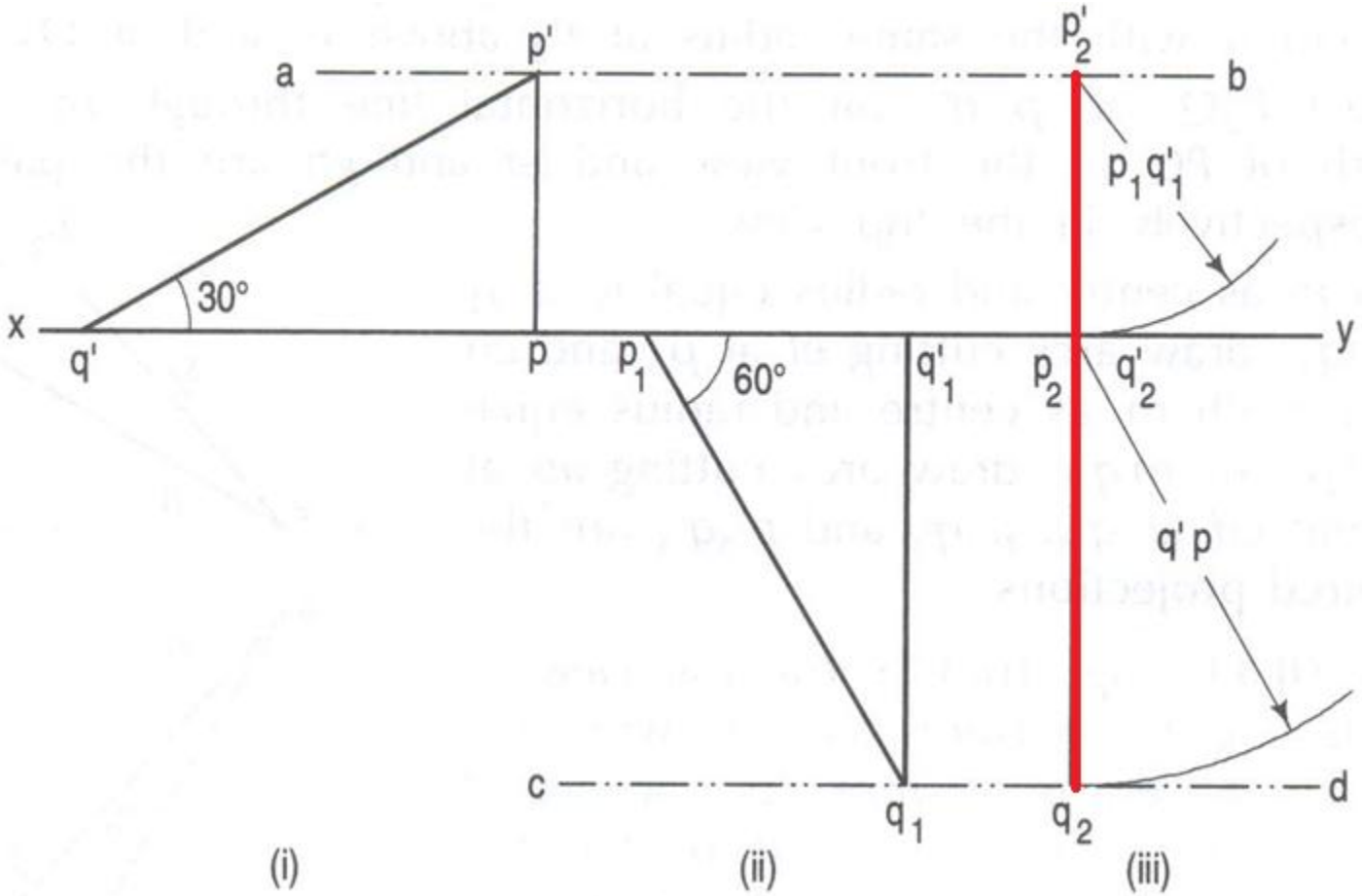




Projections of Straight Lines

Example-6 (Solved Pb. 10-9, pp. 215)

A line PQ, 75mm long, has its end P in V.P. and end Q in H.P. It is inclined at 30° to H.P. and at 60° to V.P. Draw its projections.



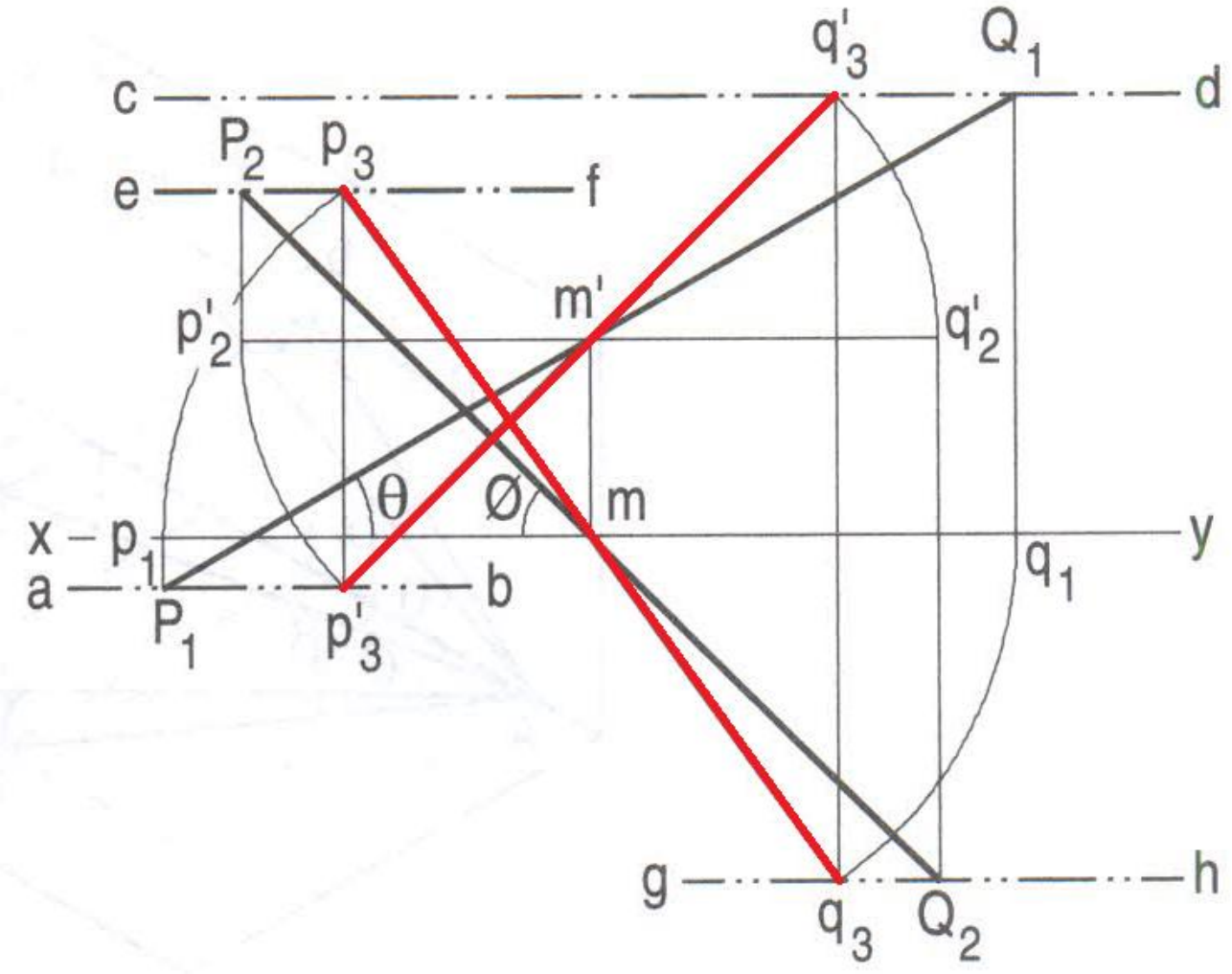
Note:

As the sum of the angles is 30+60=90°, both projections become a vertical line.

Projections of Straight Lines

Example-7 (Solved Pb. 10-10, pp. 216)

A line PQ, 100mm long, is inclined at 30° to H.P. and at 45° to V.P. Its mid-point is in V.P. and 20mm above H.P. P is in 3rd quadrant and Q is in 1st quadrant. Draw its projections.



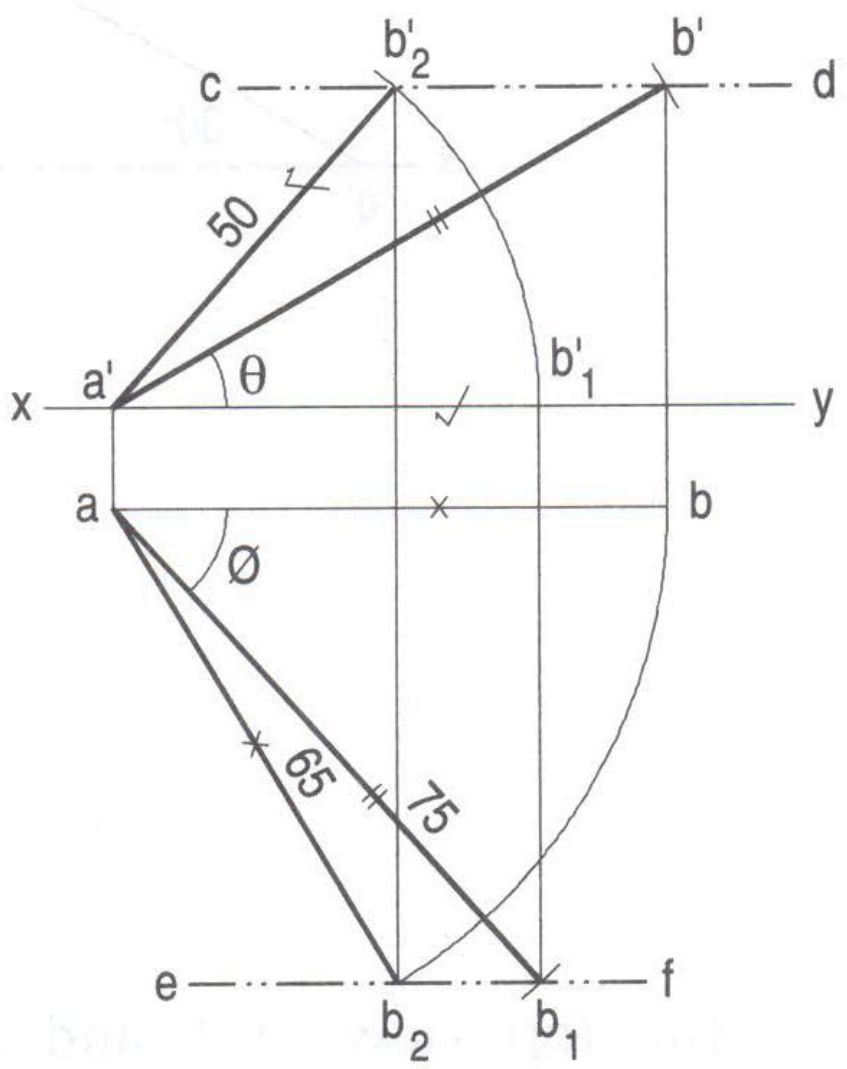
Projections of Straight Lines

Example-8 (Solved Pb. 10-11, pp. 216)

The top view of a 75mm long line AB measures 65mm, while the length of its front view is 50mm. Its one end A is in H.P. and 12mm in front of V.P.

(a) Draw the projections of AB.

(b) Determine its inclinations with H.P. and V.P.



θ=acos(65/75)=29.926°

φ=acos(50/75)=48.190°

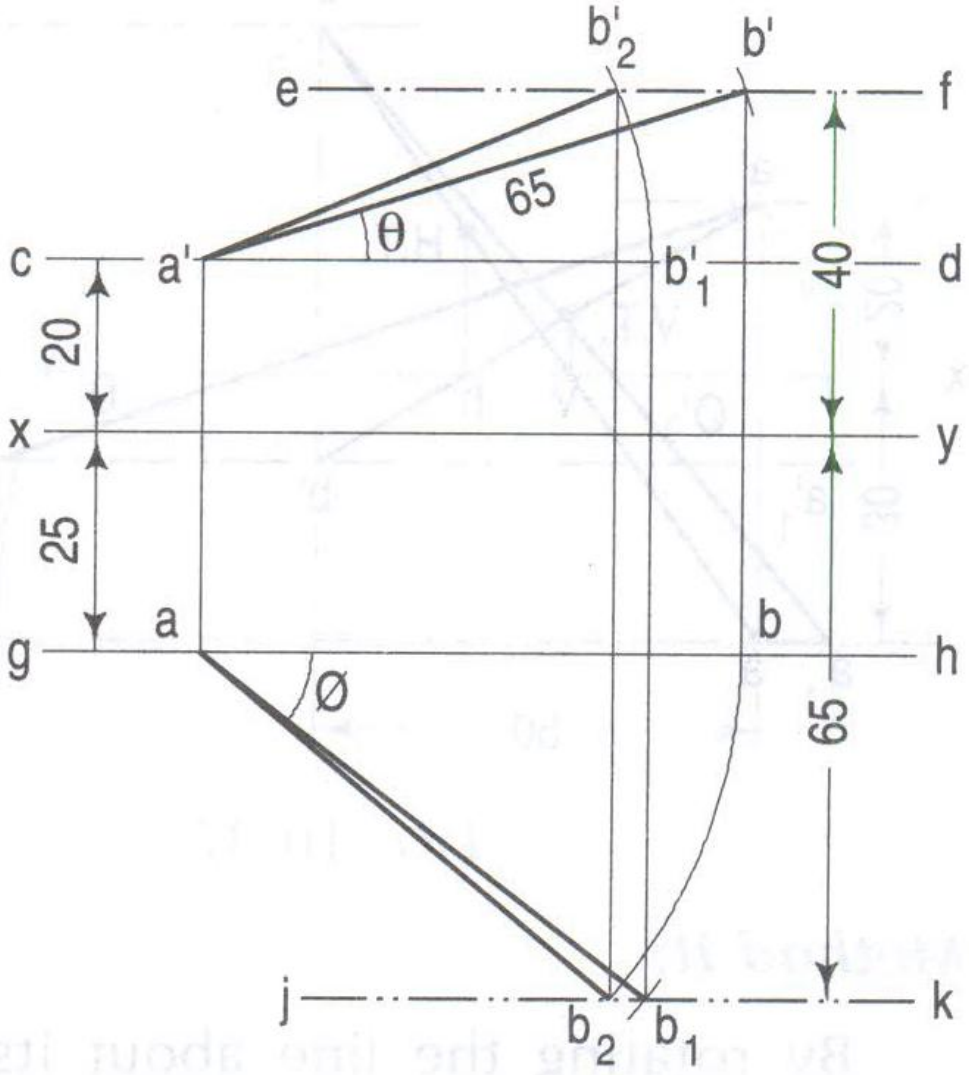
Projections of Straight Lines

Example-9 (Solved Pb. 10-12, pp. 217)

A line AB 65mm long has its end A 20mm above H.P. and 25mm in front of V.P. The end B is 40mm above H.P. and 65mm in front of V.P.

(a) Draw the projections of AB.

(b) Determine its inclinations with H.P. and V.P.



θ=asin(20/65)=17.920°

φ=asin(40/65)=37.980°

Projections of Straight Lines

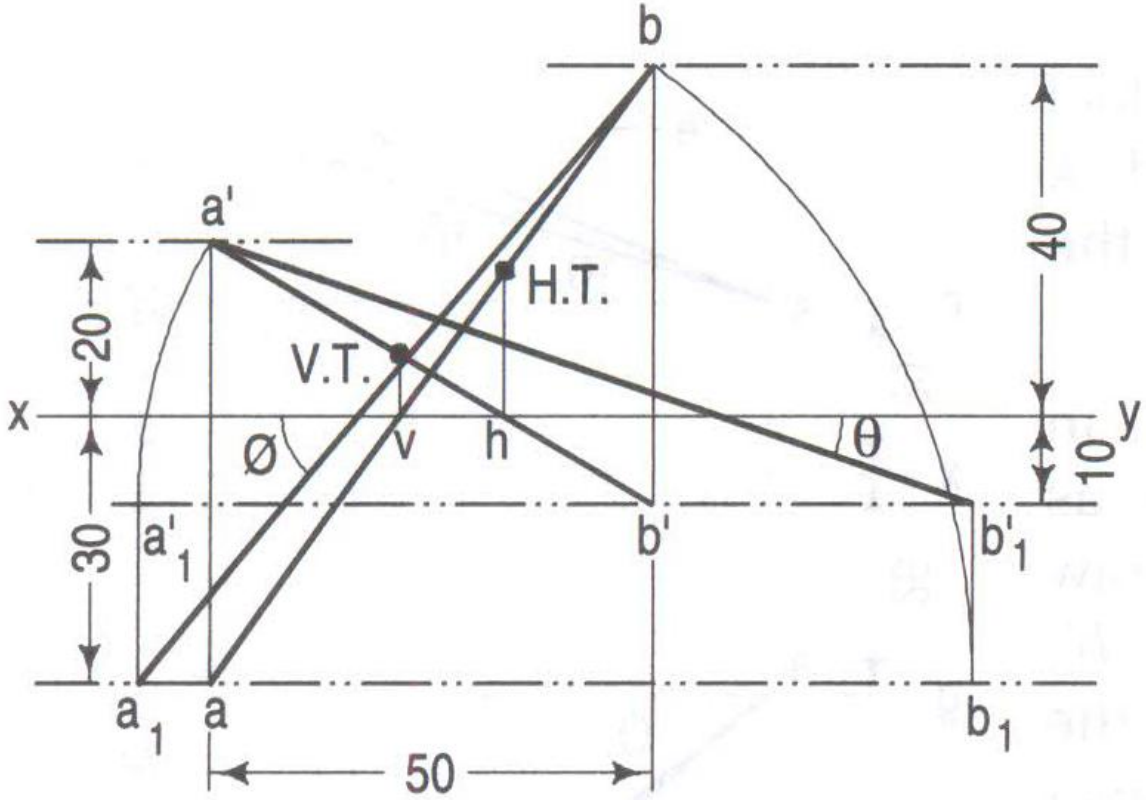
Example-10 (Solved Pb. 10-13, pp. 217)

The projectors of the ends of a line AB are 50mm apart. The end A 20mm above H.P. and 30mm in front of V.P. The end B is 10mm below H.P. and 40mm behind V.P.

(a) Draw the projections of AB.

(b) Determine its true length.

(c) Determine its inclinations with H.P. and V.P.



Ans: AB= θ=asin(20/65)=17.920° φ=asin(40/65)=37.980°

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!