

Engineering Graphics & Computer Aided Design – ME102

INDIAN INSTITUTE OF TECHNOLOGY GOA



In this class...

Projection of lines

Projection of skew lines

Trace of a line

What is a line?

A line has length & direction, but no thickness.

➤ Straight line = Shortest distance between 2 points.

Projections of a line are obtained by projecting its end points.

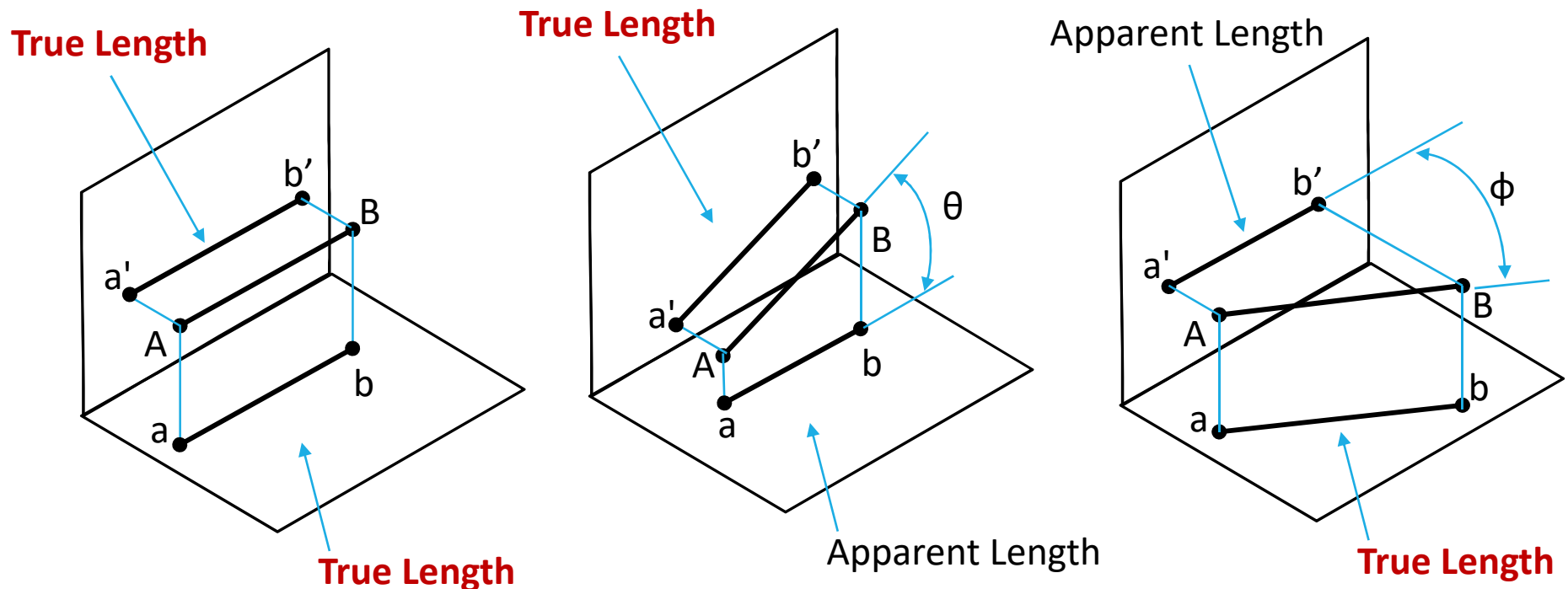
A line may be:

- Parallel to one or more reference planes
- Inclined to one or more reference plane
- Perpendicular to a reference plane
- Contained within one or more reference planes
- Line contained in or parallel to the profile plane

Projection of lines

When a line is parallel to a reference plane

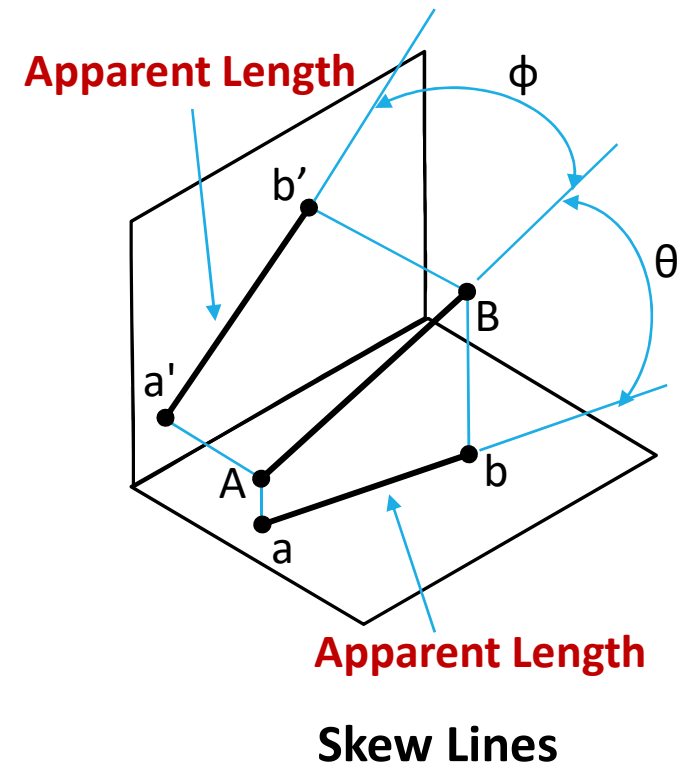
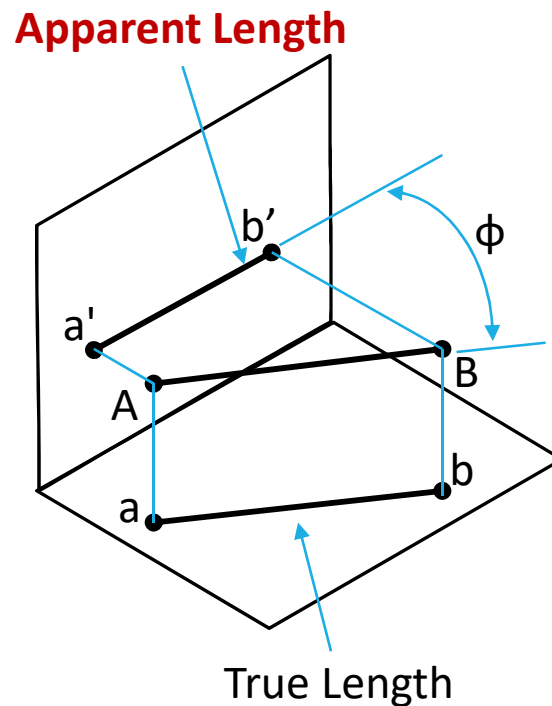
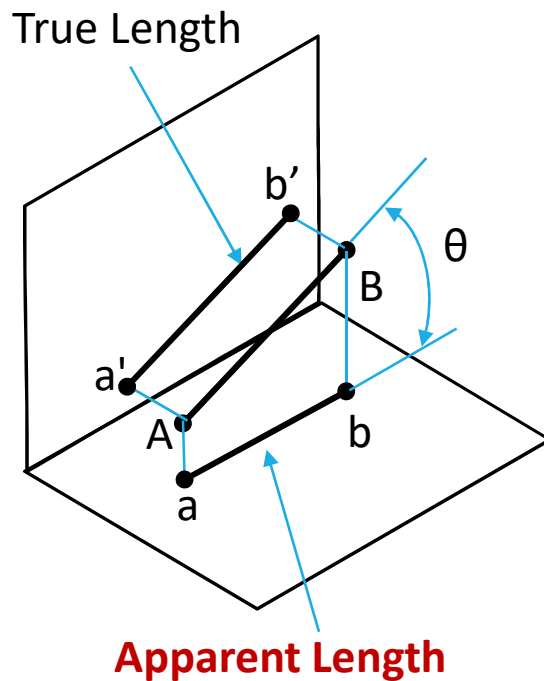
- The projection of the line on to the parallel plane shows its true length and true inclination



Projection of lines

When a line is inclined to a reference plane

- The projected length on the inclined plane is shorter than the true length (apparent length).



Projection of lines

Line perpendicular to one of the reference planes

- The projection on the perpendicular plane is a point

Line in one or both reference planes

- The projection appears on the XY line

Line contained in or parallel to the profile plane

- True length is visible in side view

Questions?

Projection of lines – Exercise

1. Line AB having length 80 mm is parallel to both HP and VP. The line is 70 mm above HP, 60 mm in front of VP.
2. Line CD of length 80 mm is parallel to VP and perpendicular to HP. The line is 80 mm in front of VP and 80 mm in front of right PP. The lower end of the line is 30 mm above HP.
3. Line PQ, 90 mm long is inclined at 30° to HP and parallel to VP. The line is 80 mm in front of VP. The lower end A is 30 mm above HP.
4. Line AB 200 mm long has its end A 75 mm above HP and 50 mm in front of VP. Endpoint B is in 1st quadrant. The line is parallel to HP and makes an inclination of 30° to VP.

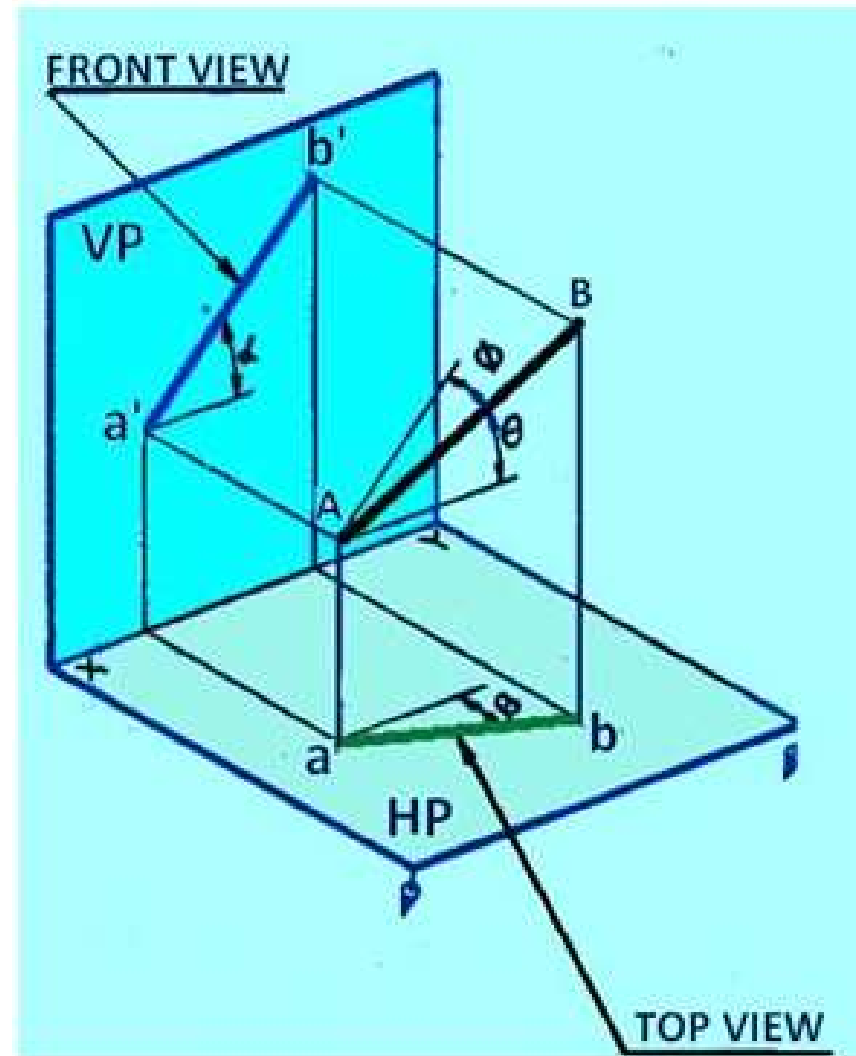
Projection of skew lines

Projected inclination \neq True inclination.

Projected length \neq True length.

Notation

- Actual inclinations: θ° to HP and ϕ° to VP.
- Apparent Inclinations: α° to HP and β° to VP.
- Apparent Lengths for line AB: ab in TV and $a'b'$ in FV



Projection of skew lines

Types of problems

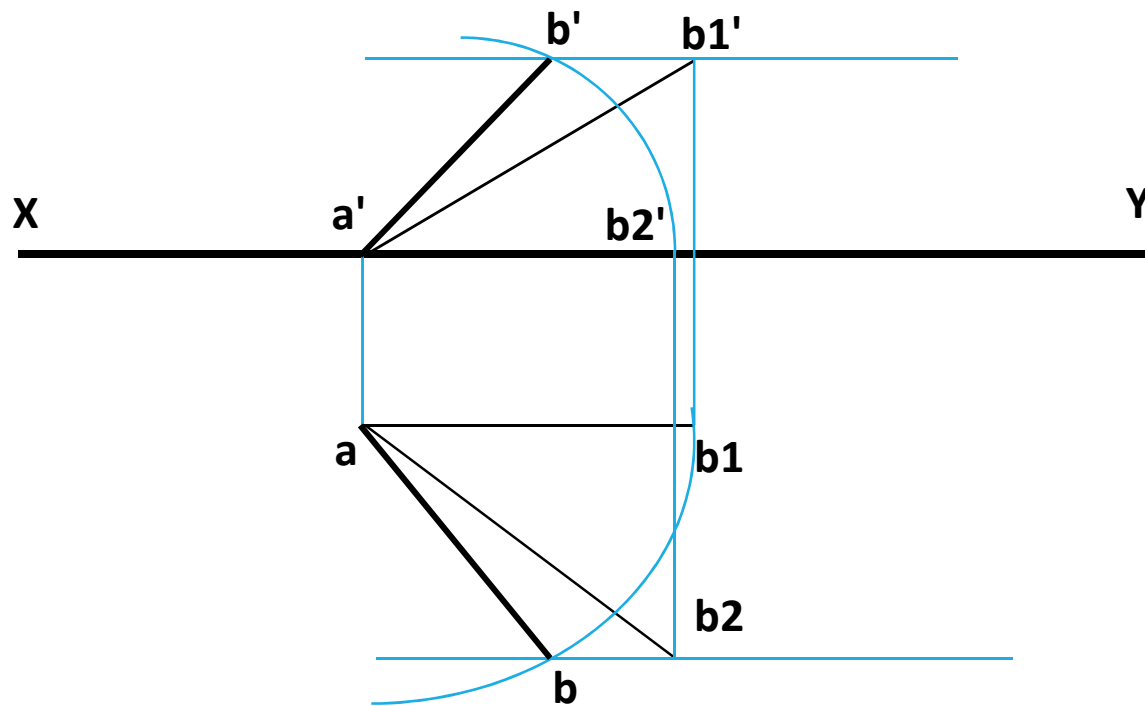
- Type 1: The true lengths and true inclinations are known. Find the apparent values?
- Type 2: The apparent lengths and apparent inclinations are known. Find the true values?

Solution methods

- The rotating line method
- Auxiliary plane method (more on this later...)

Type 1 – Rotating line method

Line AB 200 mm long, inclined 40° to the HP and 50° to the VP has its end A 25 mm in front the VP and is in the HP. End point B is in 1st quadrant. Draw projections & find apparent inclinations.



Type 1 – Rotating line method

Step 1: Make AB parallel to VP alone (AB_1)

➤ $a'b_1'$ shows true length & inclination θ°

Step 2: Make AB parallel to HP alone (AB_2)

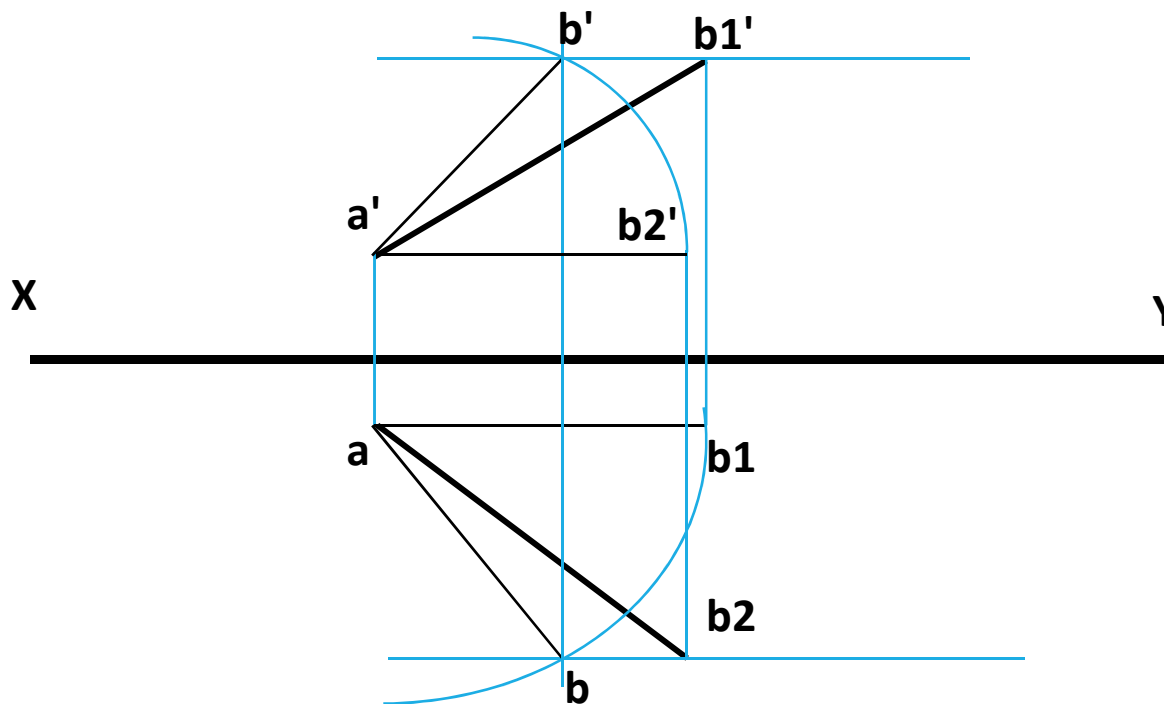
➤ ab_2 shows true length & inclination ϕ°

Step 3: Draw locus of end B in the FV and TV

Step 5: Obtain the top and front views of AB

Type 2 – Rotating line method

Line AB has its end A 75 mm above HP and 50 mm in front of VP. The other end B is 175 mm above HP and 175 mm in front of VP. The projector distance is 275 mm. Draw projections of line AB and find true inclinations.



Questions?

Trace of a line

The trace of a line is defined as a point at which the given line, if produced, meets or intersects a plane.

No traces

- line parallel to both planes

Only horizontal trace (HT)

- Line is inclined to HP.
- Visible in FV

Only vertical trace (VT)

- Line is inclined to VP.
- Visible in TV

Both traces

- line inclined to both planes

Trace of a line

Line AB 200 mm long has its end A 75 mm above HP and 50 mm in front of VP. Endpoint B is in 1st quadrant. The line is parallel to VP and makes an inclination of 30° to HP. Draw the projections of straight line AB. Obtain HT and VT.

Line AB 200 mm long has its end A 75 mm above HP and 50 mm in front of VP. Endpoint B is in I-quadrant. The line is parallel to HP and makes an inclination of 40° to VP. Draw the projections of straight line AB. Obtain HT and VT.

Line AB has its end A 75 mm above HP and 50 mm in front of VP. The other end B is 175 mm above HP and 175 mm in front of VP. The projector distance is 275 mm. Draw projections of line AB. Obtain HT and VT.

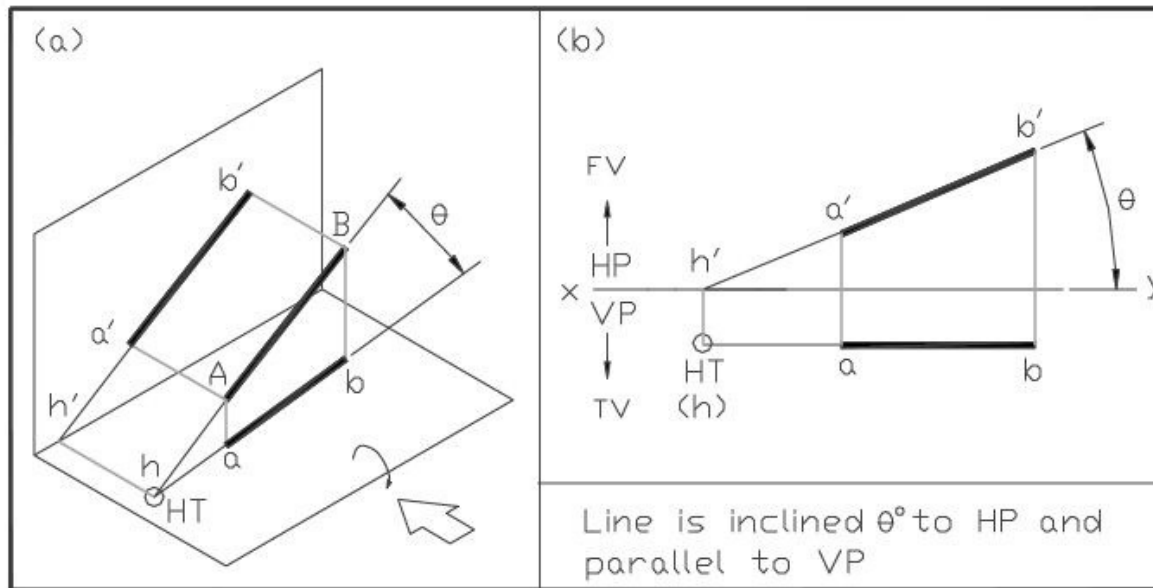
Find Horizontal trace (HT)

Extend $a'b'$ to meet XY line. The meeting point is h' .

Draw a projector line passing through h' .

Extend ab to intersect the projector line to obtain h .

h represents the HT.



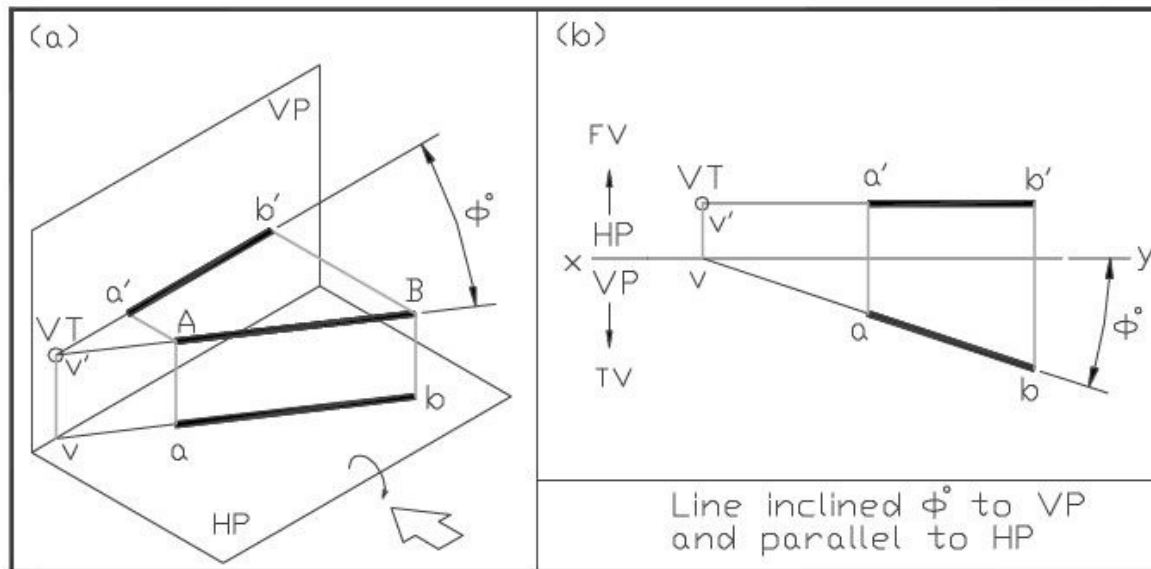
Find Vertical trace (VT)

Extend ab to meet xy line. The meeting point is v .

Draw a projector line passing through v .

Extend $a'b'$ to intersect projector line to obtain v' .

v' represents VT



Questions?

Practice problems

Point P is in the first quadrant and its shortest distance from the intersection point of X-Y and X1-Y1 is 70 mm. It is also equidistant from both HP and VP. Draw its projections.

Point Q is in the third quadrant and 20 mm below HP. Its shortest distance from the intersection point of X-Y and X1-Y1 is 60 mm. Draw its projections.

Line AB 200 mm long has its end A 75 mm above HP and 50 mm in front of VP. Endpoint B is in 1st quadrant. The line is parallel to HP and makes an inclination of 40° to VP. Draw the projections of straight line AB.

Practice problems

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

The ends of a line PQ are on the same projector. The end P is 30 mm below the H.P. and 12 mm behind the V.P. The end Q is 55 mm above the H.P. and 45 mm in front of the V.P. Determine the true length and traces of PQ and its inclinations with the two planes.

An object O is placed 1.2 m above the ground and in the centre of a room 4.2 m x 3.6 m x 3.6 m high. Determine graphically its distance from one of the corners between the roof and two adjacent walls.

The End

