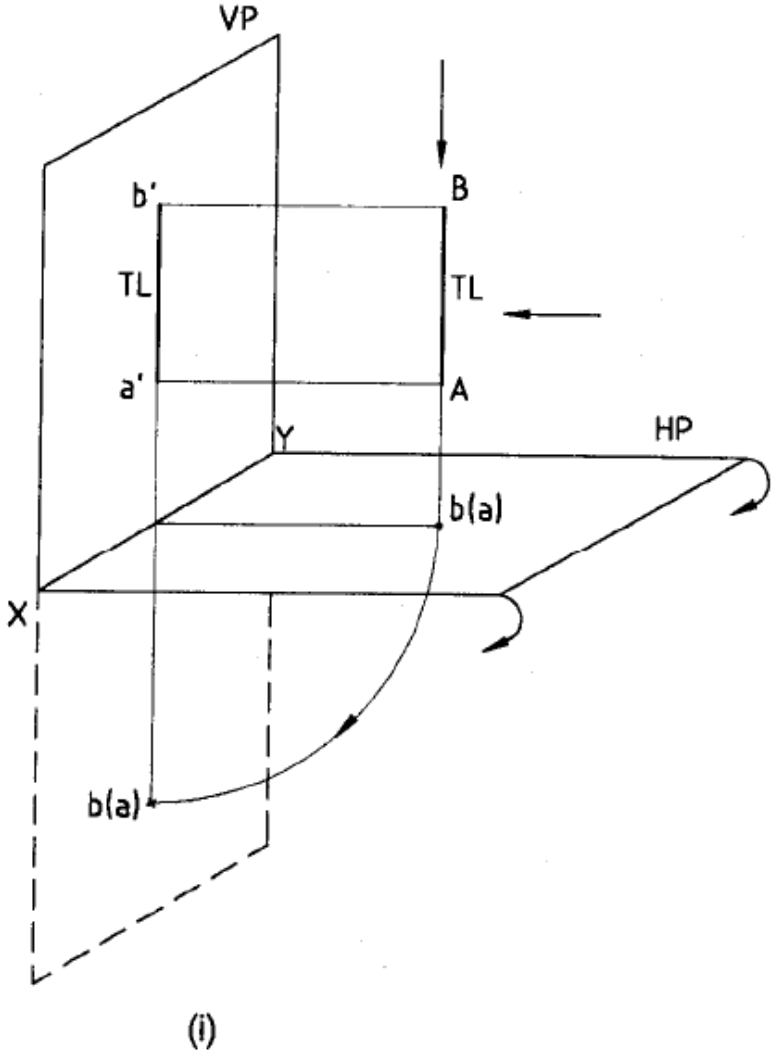
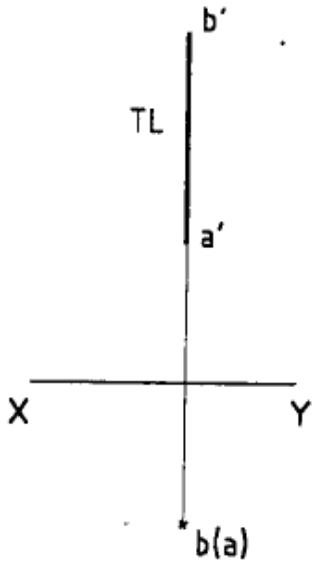
Projection of a Line kept Perpendicular to HP and Parallel to VP



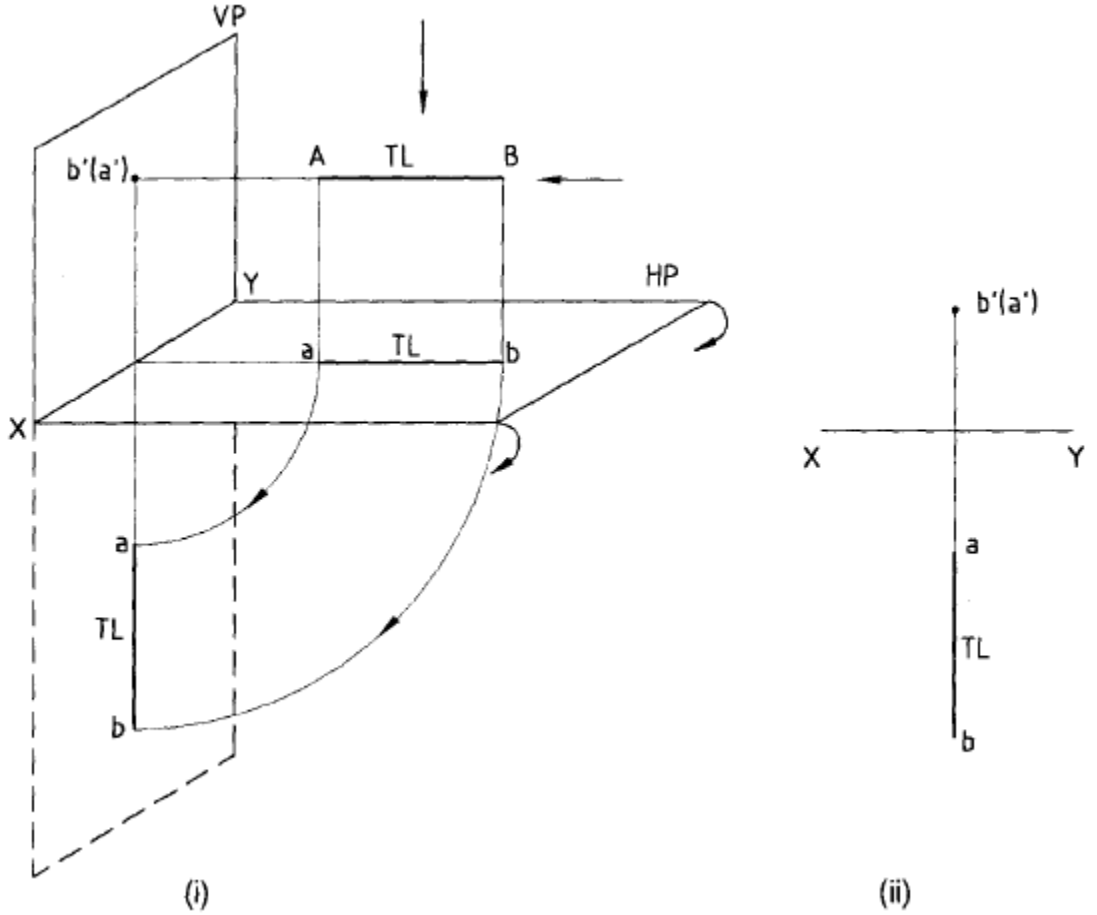
(i)



(ii)

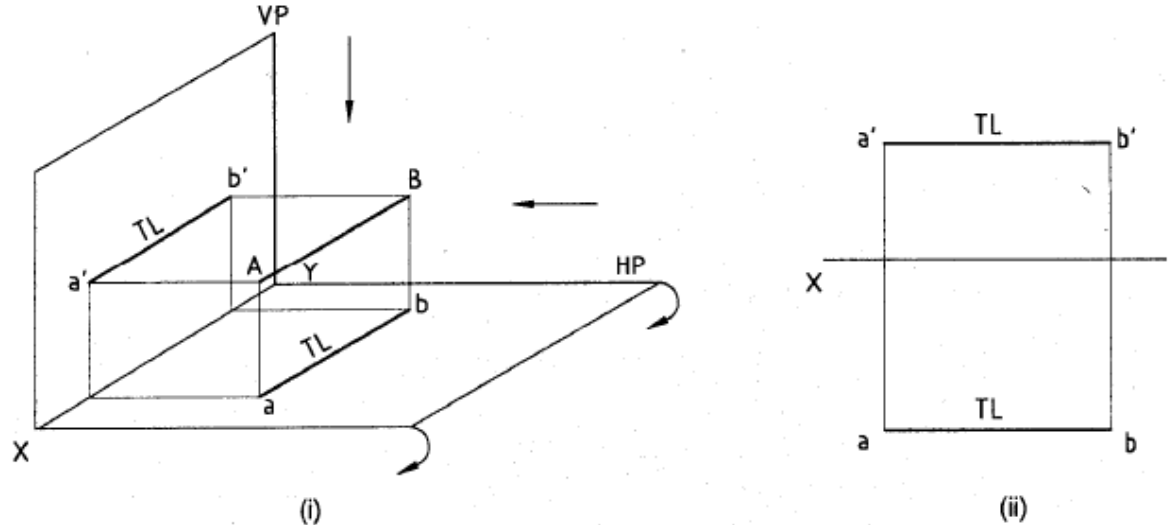
1. Draw the XY line.
2. Draw the front view a'b'. which is a line perpendicular to XY and having true length (TL).
3. Projected the top view ab. The end b is visible and the invisible end a is marked inside ( ).

Projection of a Line kept Perpendicular to VP and Parallel to HP



1. Draw the XY line.
2. Draw the top view ab, a line perpendicular to XY and having true length (TL).
3. Projected the front view a'b'. The end b' is visible ad the invisible end a' is marked inside ( ).

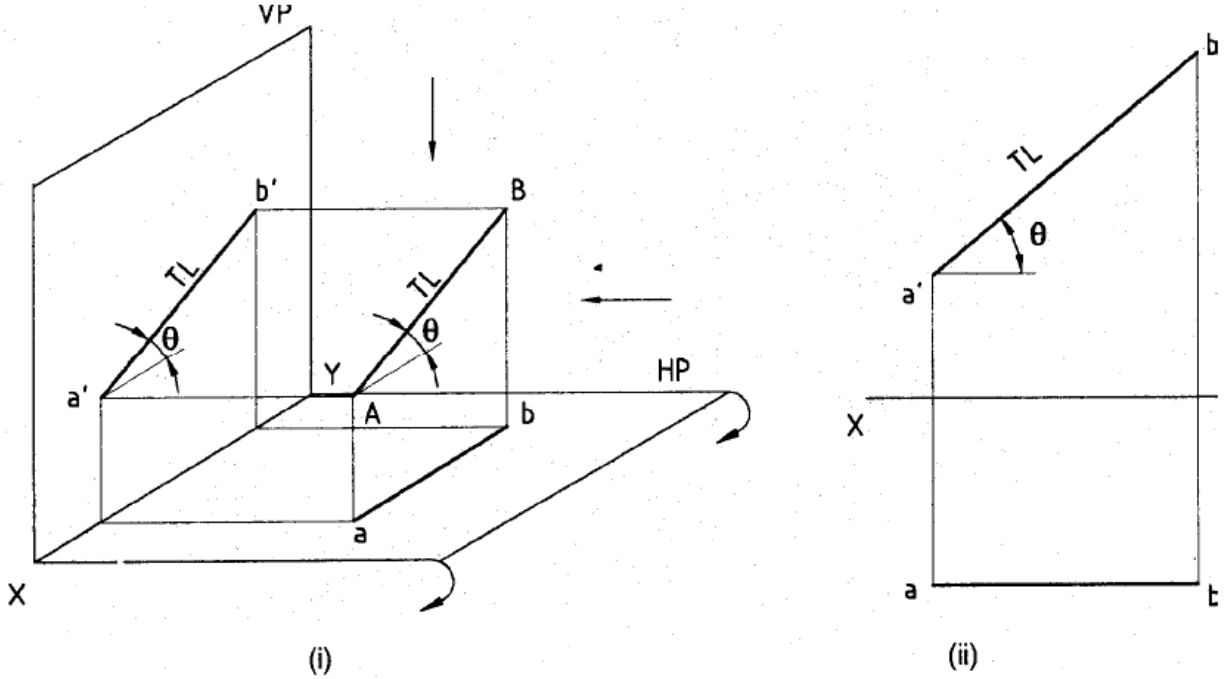
Projection of a Line kept parallel to Both HP and VP



1. Draw the XY line.

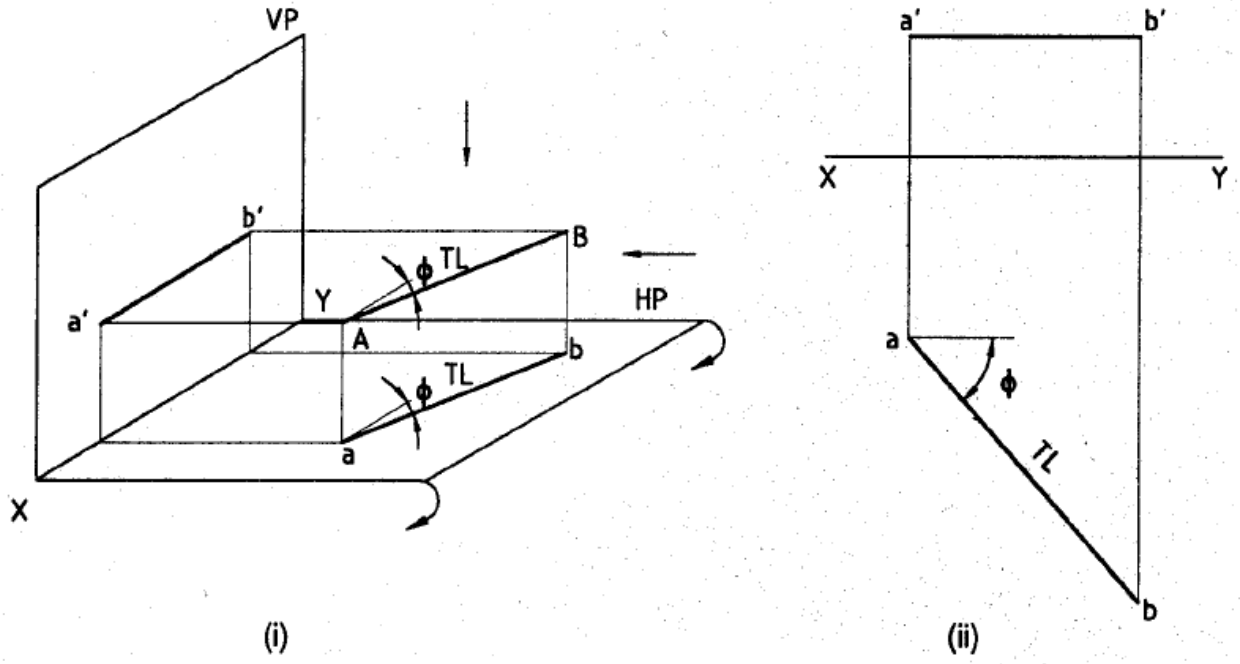
2. Draw the front view a'b', a line parallel to XY and having true length (TL)
3. Project the top view ab which is also a line parallel to XY having true length (TL).

Projection of a Line kept inclined to HP and Parallel to VP



1. Draw the XY line.
2. Draw the front view a'b', a line inclined at an angle · to XY having true length (TL).
3. Project the top view ab which is also a line parallel to XY and smaller than true length.

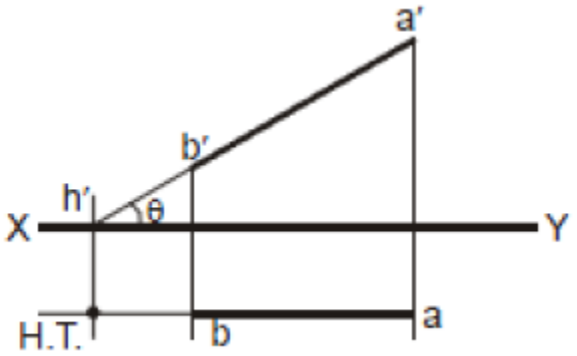
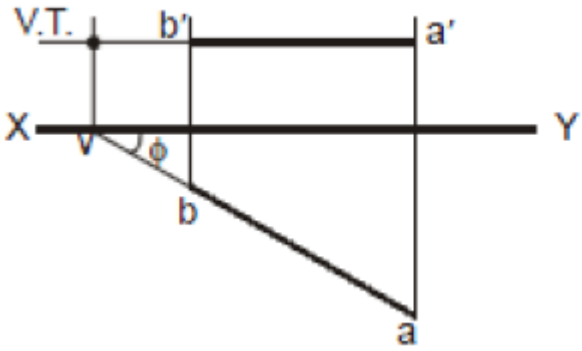
Projection of a Line kept Inclined to VP and Parallel to HP



1. Draw the XY line

2. Draw the top view ab, a line inclined at an angle · to XY and having true length (TL).
3. Project the front view a'b', which is also a line parallel to XY but smaller than true length.

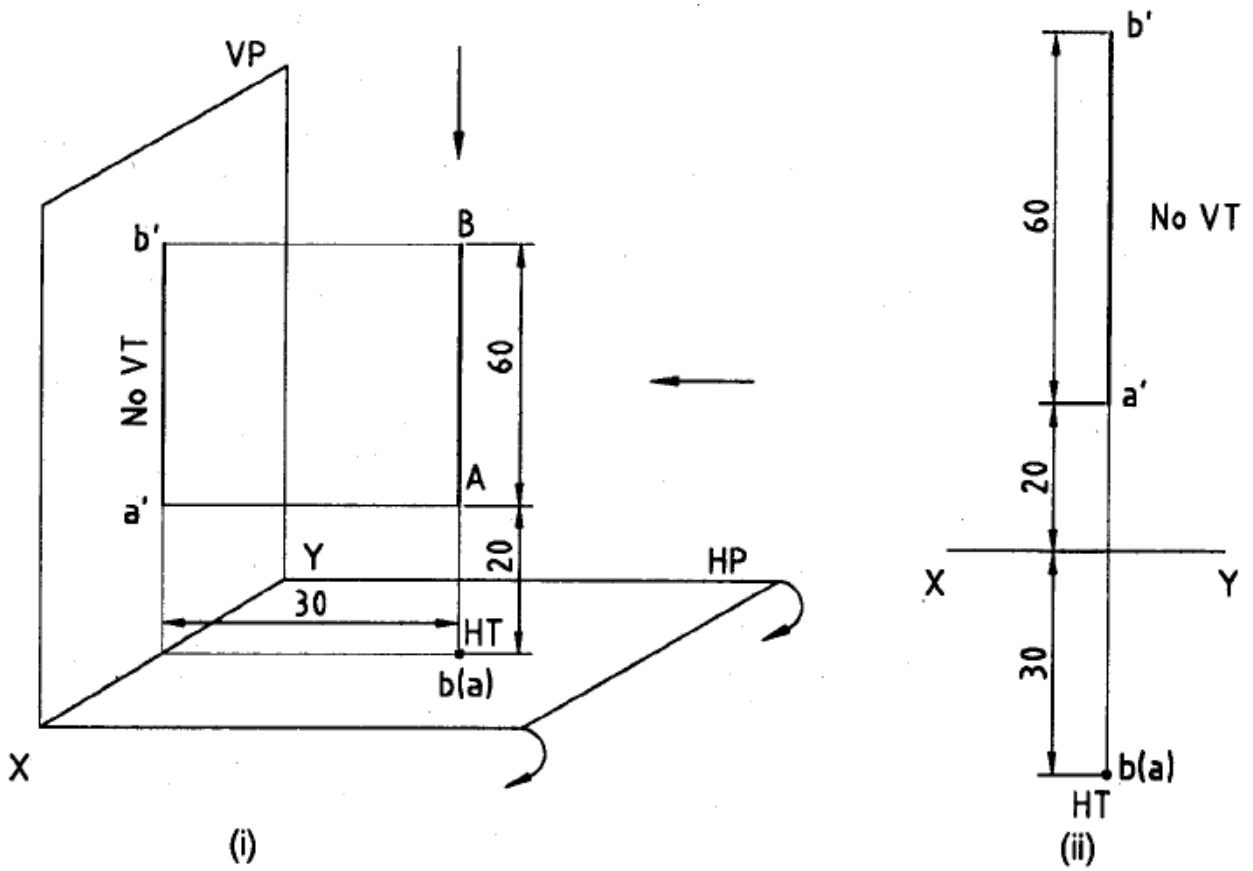
TRACE OF A LINE- The point of intersection or meeting of a line with the reference plane, extended if necessary, is known as the ***trace of a line***. The point of intersection of a line with the HP is known as the *horizontal trace*, represented by HT and that with the VP is known as the *vertical trace*, represented by VT. No trace is obtained when a line is kept parallel to a reference plane.

Rule For obtaining HT of an inclined line ***AB***	Rule For obtaining VT of an inclined line ***AB***
	

For obtaining the VT the procedure is reversed
(a) Extend the plan towards X-Y line till it intersects X-Y. The point of intersection is v.
(b) Draw a line perpendicular to X-Y from h.
(c) Extend the elevation in its own direction, so that it intersects the perpendicular drawn from h.
(d) The point of intersection is VT. (In some cases, the elevation need not be extended and the perpendicular from h will intersect the elevation. This point of intersection is VT)

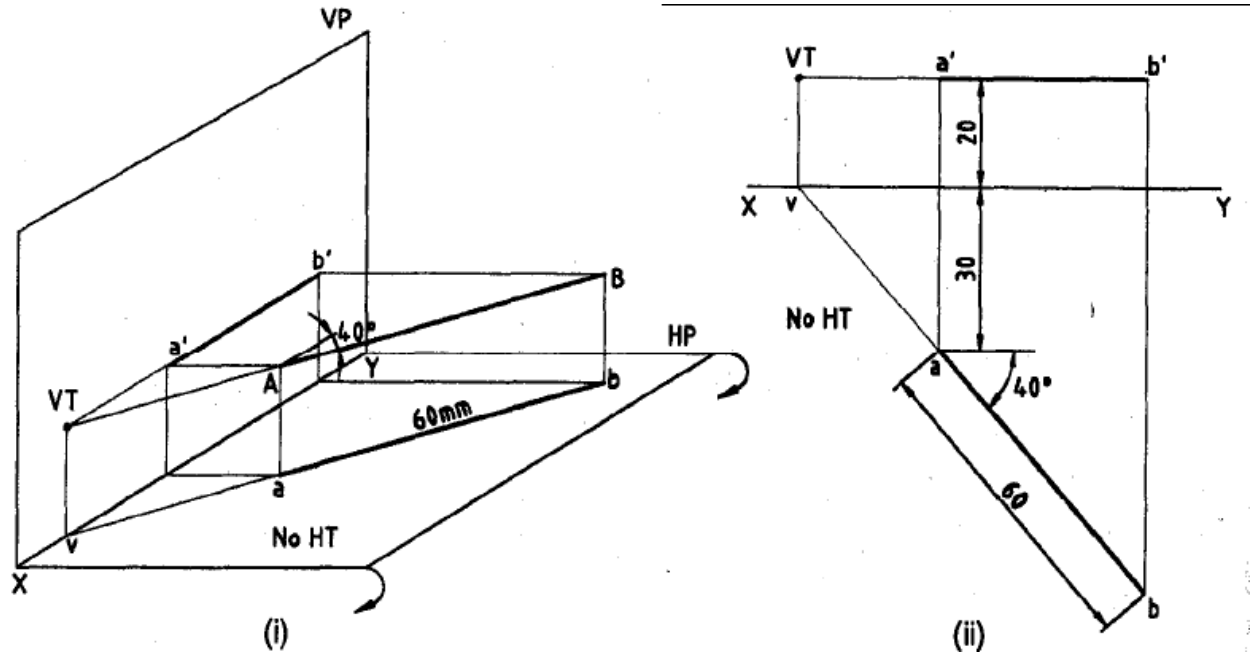
EXAMPLE-*A line AB 60 mm long has its end 20 mm above HP and 30 mm in front of VP. The line is kept perpendicular to HP and parallel to VP. Draw its projections. Also mark the traces.*

Sol.-
1. Mark the projections of the end A by considering it as a point. Its front view a' is 20 mm above XY and the top view a is 30 mm below XY.
2. The front view of the line a'b' is obtained by drawing a line perpendicular to XY from a' and having a length of 60 mm.
3. Top view of the line is obtained by projecting the other end b which coincides with a. The invisible end a is enclosed in ( ).
4. The horizontal trace (HT) is marked coinciding with the top view of the line. NO vertical trace (VT) is obtained.



EXAMPLE-*A line AB 60 mm long has its end A 20 mm above HP and 30 mm in front of VP. The line is inclined at 40₀ to VP and parallel to HP. Draw its projections. Also mark the traces.*

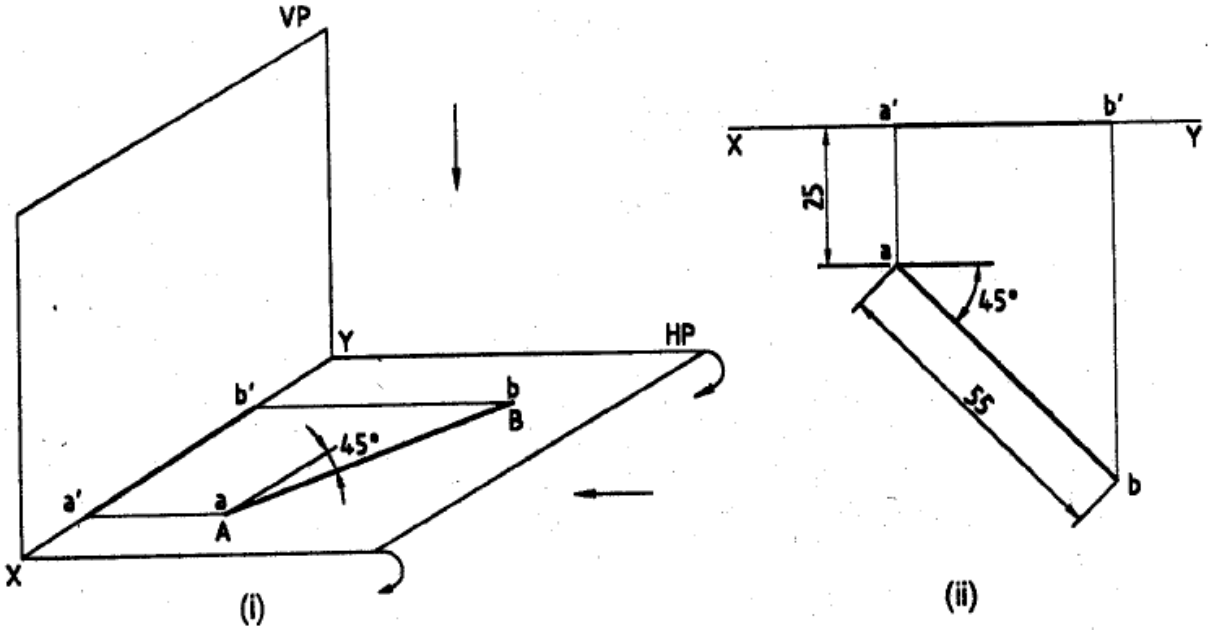
SOLUTION-



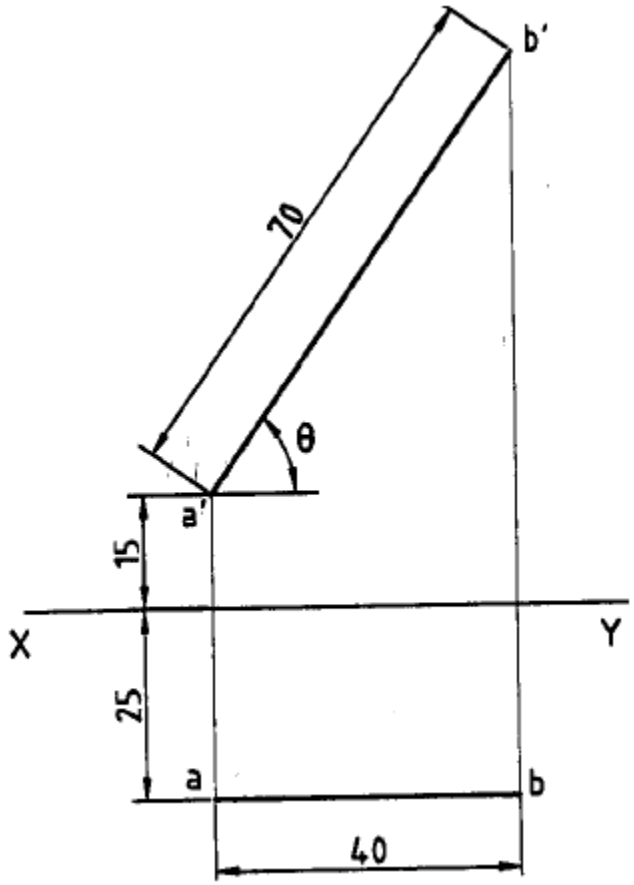
1. Mark the projections of end A by considering it as a point. Its front view a' is 20 mm above XY and top view a is 30 mm below XY.

2. The top view of the line ab is obtained by drawing a line inclined at an angle 40_0 to XY from a and having a length of 60 mm.
3. The front view of the line a'b' is obtained by drawing a line parallel to XY from a' and drawing a vertical line (projector) from b. It is parallel to XY and smaller than the true length.
4. To mark the vertical trace (VT) the top view of the line ab is extended to intersect with XY line at v. Then by drawing a vertical line from v and a horizontal line from a'b', the VT is located. No horizontal trace (HT) is obtained.

EXAMPLE-*A line AB 55 mm long has its end 25 mm in front of VP and in HP. The line is inclined at 45^0* to *VP. Draw its projections.*
SOLUTION-



EXAMPLE-*A line AB 70 mm long has its end A 15 mm above HP and 25 mm in front of VP. Its top view (plan) has a length of 40 mm. Draw its projections and find the inclination of the line with HP.*
SOLUTION-



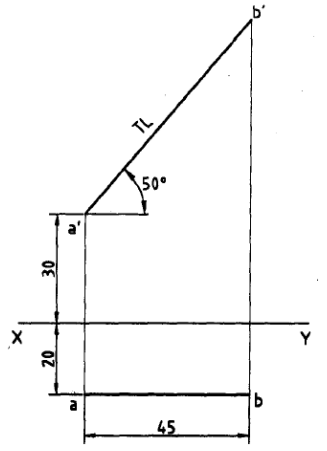
ANSWER

θ = 55°

1. Mark the projections of end A by considering it as a point. Its front view a' is 15 mm above XY and top view a is 25 mm below XY.
2. The top view of the line ab is drawn parallel to XY to the given length of 40 mm.
3. Draw a vertical line (projector) from b.
4. Using true length 70 mm as radius and a' as centre, mark a point in the vertical line to get b'.
5. The inclination of a'b' with XY is measured to get angle.

EXAMPLE-*A line AB has its end 30 mm above HP and 20 mm front of VP. Its plan has a length of 45mm. The line is inclined at 50° to HP and parallel to VP. Draw its projections and find the true length of the line.*

SOLUTION-

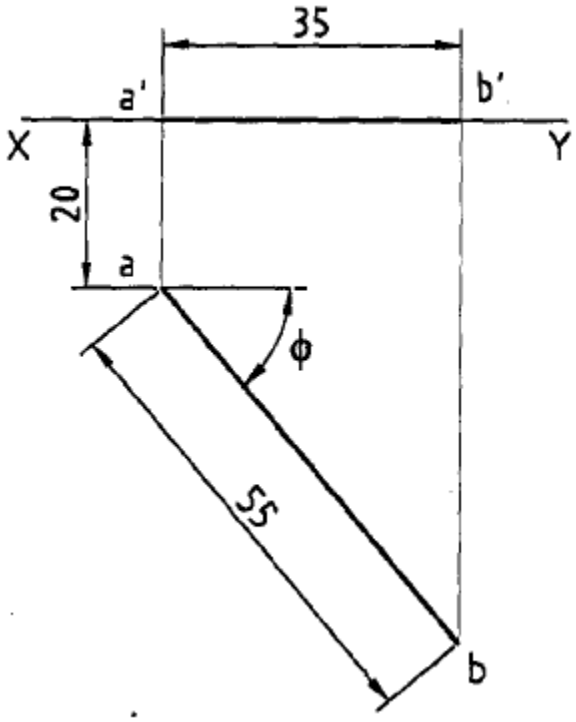


ANSWER

TRUE LENGTH = 70mm

EXAMPLE-*A line AB 55 mm long is in HP and inclined to VP. The end A is 20 mm in front of VP. The length of front view is 35 mm. Draw the projections of the line and also find the inclination of the line with VP.*

SOLUTION-



ANSWER

$\phi = 50°$

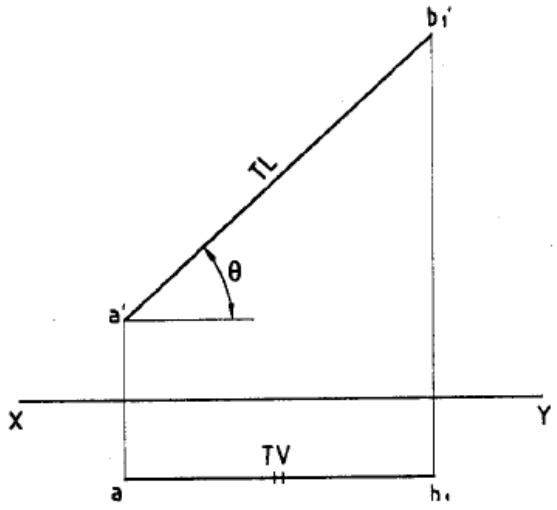
Projection of a Line kept Inclined to Both HP and VP

1. Rotating Line Method

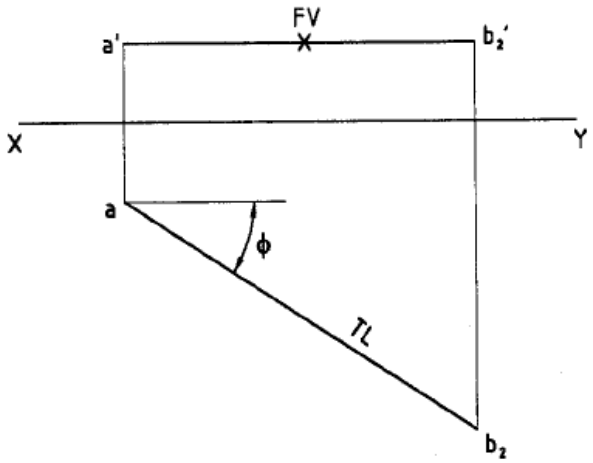
Consider a line AB is placed inclined at θ to HP and ϕ to VP. Draw its projections assuming that the line is placed in the first quadrant. The following steps are to find the top view (plan) and front view (elevation) lengths and then, they are rotated to the required position to represent the projections of the line in the given position.

Step 1: Assume that the line is kept inclined to HP and a re parallel to VP. Draw the front view $a'b_1'$, it is a line inclined at θ to XY ad having true length (TL). Project and get the top view ab_1 length which is parallel to XY line. Then this will be rotated to the required position. [Figure.(i)].

Step2: Assume the line is kept inclined to VP and parallel to HP. Draw the top view ab_2, it is a line inclined at ϕ to XY and having true length (TL). Project and get the front view ab_2' length which is parallel to XY line. Then this will be rotated to the required position. [Figure (ii)].



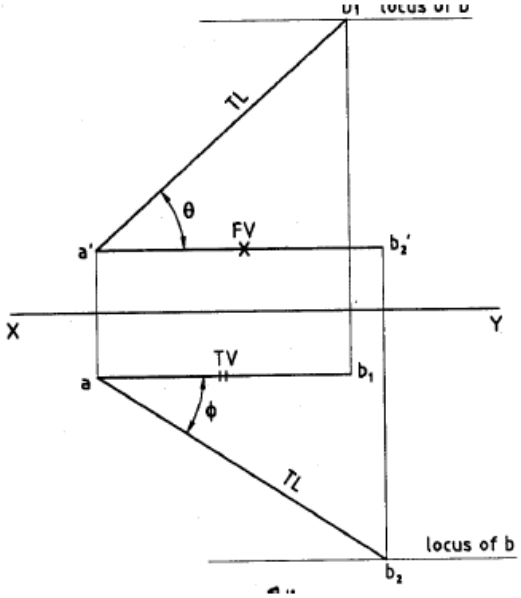
(i)



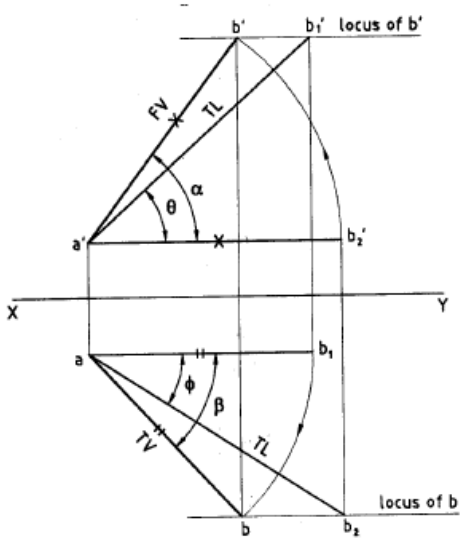
(ii)

Step3: Draw the locus of the other end B of the line in top and front views. Draw the locus of the front view b' as a line passing through b_1' and parallel to XY line. Draw the locus of the top view b as a line passing through b_2 and parallel to XY line [Fig.(iii)]. Note that step 1 and step 2 are shown together.

Step4: Rotate the top view ab_1 and front view $a'b_2'$ to the required position. Take a as centre, top view length ab_1 as radius, draw an arc to intersect with the locus of b at b. Join a and b to get the top view ab of the line in required position. Taking a' as centre, front view $a'b_2'$ as radius, draw an arc to intersect the locus of b' at b'. Join a' and b' to get the front view a'b' of the line in required position [Fig.(iv)].



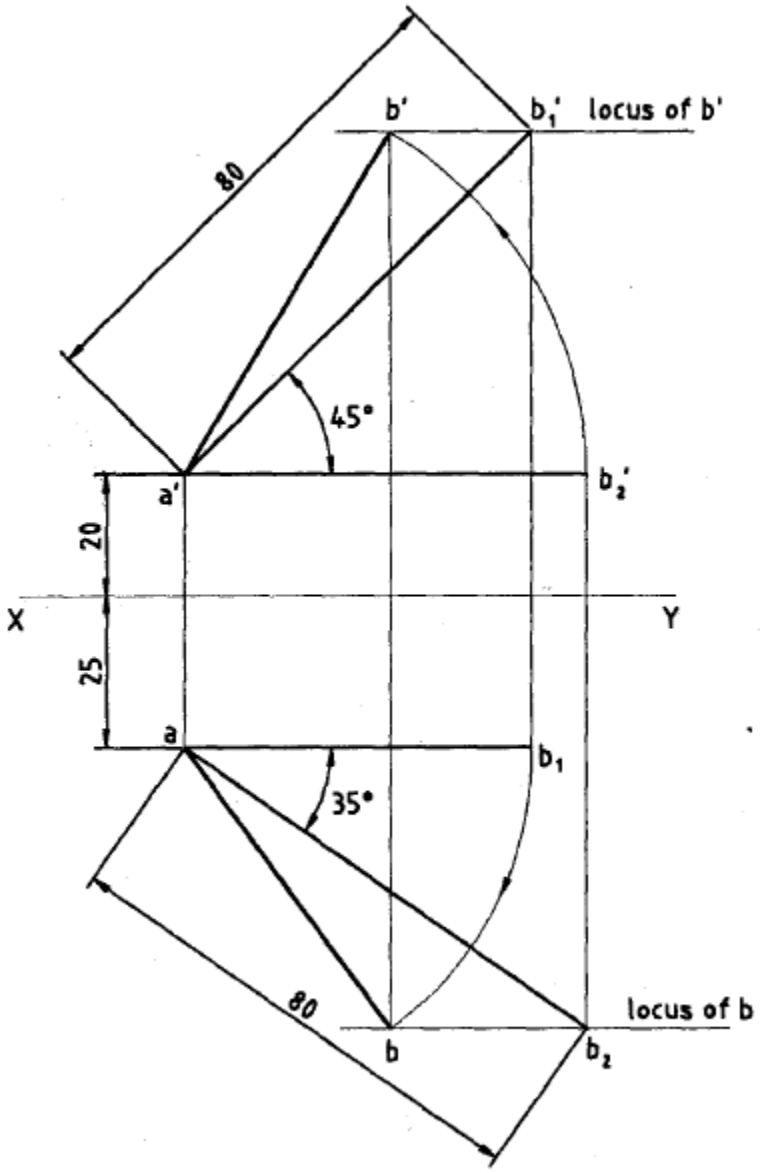
(i)



(ii)

EXAMPLE-*A line AB 80 mm long has its end A 20 mm above HP and 25 mm in front of VP. The line is inclined at 45⁰ to HP and 35⁰ to VP. Draw its projections.*

SOLUTION-

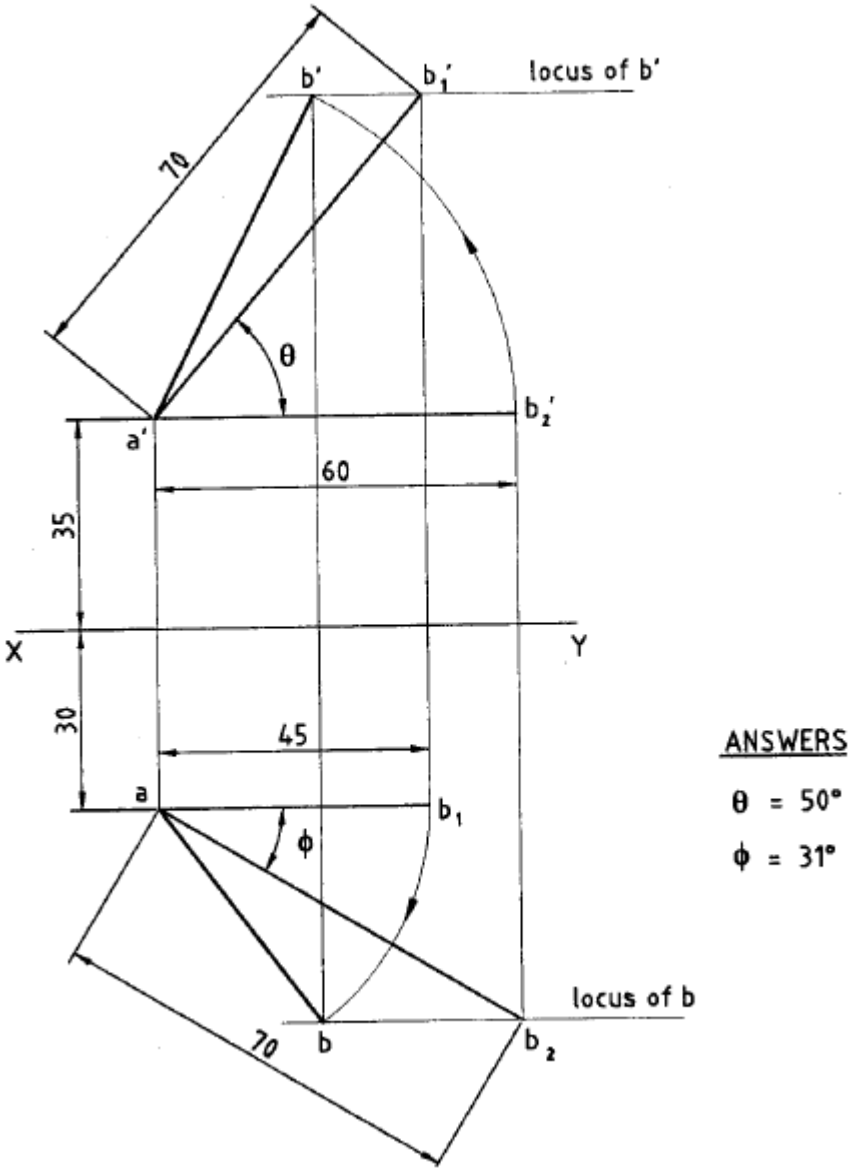


Mark the projections of end A by considering it as a point. Its front view a' is 20 mm above XY and top view a is 25 mm below the XY line.

1. Assume that the line is kept inclined to HP and parallel to VP. Draw the front view $'_1$a 'b , a line inclined at 45⁰ to Xy line and having a length of 80 mm. Project and get the top view ab_1 length which is parallel to XY line.
2. Assume that the line kept inclined to VP and parallel to HP. Draw the top view ab_2, a line inclined at 35⁰ to XY line and having a length of 80 mm. Project and get the front view $'_2$a 'b length which is also parallel to XY line.
3. Draw the locus of the other end B of the line in top and front views. Draw the locus of b' which is a line passing through $'_1$b and parallel to XY line. Also draw the locus of b which is a line passing through b_2 and parallel to XY line.

4. Rotate the top view ab_1 and front view $'_2a\ 'b$ to the required position. Take a as centre, top view length ab_1 as radius, draw an arc to intersect the locus of b at b. Join and b to get the top view ab of the line. Take a' as centre, front view length $'_2a\ 'b$ as radius, draw an arc to intersect the locus of b' at b'. Join a' and b' to get the front view a'b' of the line.
5. Check the result obtained by drawing the projector joining b' and b which should be a vertical line.

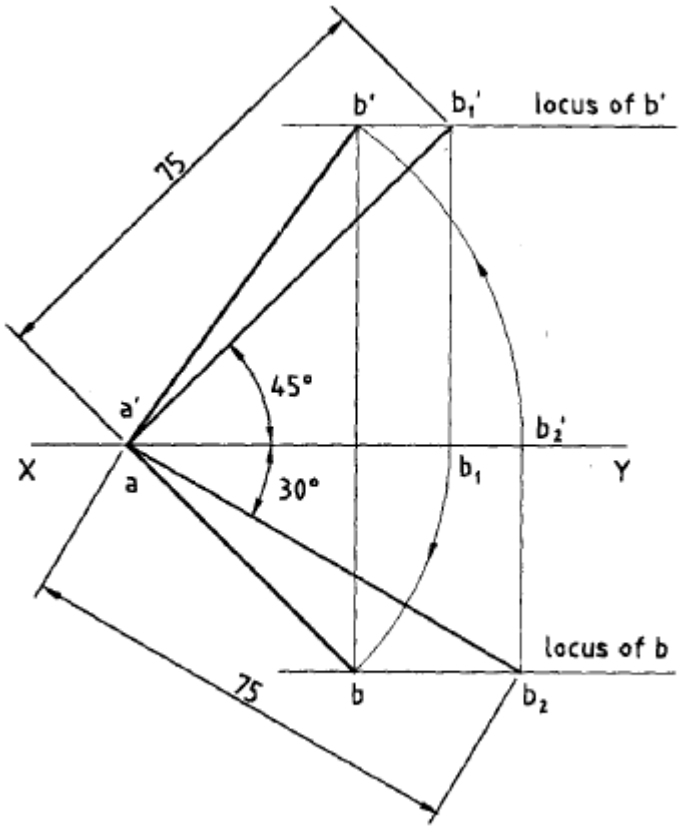
EXAMPLE-*A line AB 70 mm long, has its end A 35 mm above HP and 30 mm in front of VP. The top view and front view has a length of 45 mm and 60 mm respectively. Draw its projections.*



SOLUTION-
Mark the projections of the end A by considering it as a point. Its front view a' is 35 mm above XY and top view a is 30 mm below XY line.

1. Assume that the line is kept inclined to HP and parallel to VP. In this case, considering the given data the top view ab_1 can be drawn parallel to XY and having a length of 45 mm. Draw a vertical (projector) through b_1. Using true length 70 mm as radius and a' as centre, draw an arc to intersect the vertical line through b_1 to get b_1' which represents the true length of the line. The inclination of $a'b_1'$ to XY is the inclination of the line with HP(θ).
2. Assume that the line is kept inclined to VP and parallel to HP. In this case, considering the given data, the front view $a'b_2'$ can be drawn parallel to XY and having a length of 60 mm. Draw vertical line (projector) through b_2'. Using true length 70 mm as radius and a as centre, draw an arc to intersect the vertical line through b_2' to get b_2. Join a and b_2 which represents the true length of the line. The inclination ab_2 to XY is the inclination of the line with VP(ϕ).
3. Draw the locus of the other end B of the line in top and front views. Draw the locus of b' which is a line passing trough b_1' and parallel to XY line. Also draw the locus of b which is a line passing through b_2 and parallel to XY line.
4. Rotate the top view ab_1 and front view $a'b_2'$ to the required position. Take a as centre, top view ab_1 as radius, draw an arc to intersect with the locus of b at b. Join a and b to get the top view ab of the line. Take a' as centre, front view $a'b_2'$ as radius, draw an arc to intersect the locus of b' at b'. Join a' and b' to get the front view a'b' of the line.
5. Check the result obtained by drawing the projector joining b' and b which should be a vertical line.

Example-*A line AB 75 mm long has its end A in both HP and VP. The line is kept inclined at 45^0 to HP and 30^0 to VP.*



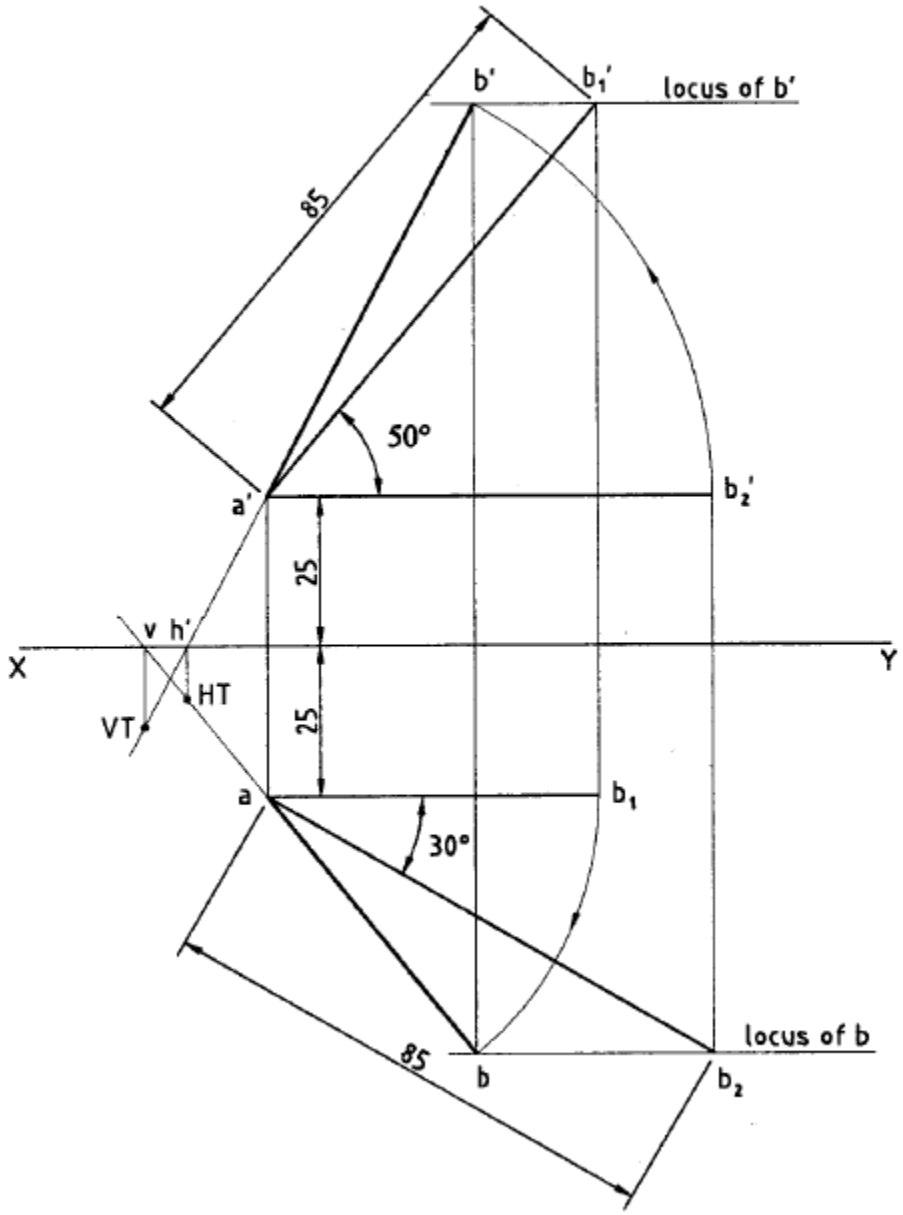
Solution-

EXAMPLE-*A line AB 85 mm long has its end A 25 mm away from both the reference planes and is in the first quadrant. The line is inclined at 50⁰ to HP and 30⁰ to VP. Draw its projections and mark the traces of the line.*

SOLUTION-

Mark the projections of end A by considering it as a point. Its front view a' is 25 mm above XY and top view a is 25 mm below XY line.

1. Assume that the line is kept inclined to HP and parallel t VP. Draw the front view a' $_1$b which is inclined at 50⁰ to XY line and has a length of 85 mm. The top view length ab$_1$ is projected and obtained parallel to XY line.
2. Assume that the line is kept inclined VP and parallel to HP. Draw the top view ab$_2$ which is inclined at 30⁰ to XY line and has a length of 85 mm. The top length ab$_1$ is projected and obtained parallel to XY line.
3. Draw the locus of b', passing through $'_1$b and parallel to XY line. Also draw the locus of b, passing through b$_2$ and parallel to XY line.
4. Rotate the top view ab$_1$ to the required position by taking a as a centre, ab$_1$ as radius to get the intersection point b with the locus of b. Join a and b to complete the top view ab of the line.
5. Rotate the front view a' $'_2$ b by taking a' as centre, a' $'_2$ b as radius to get the intersection point b' with the locus of b'. Join a' and b' to get the front view a'b' of the line.
6. Check the result obtained by drawing the projector joining b' and b which should be a vertical line.

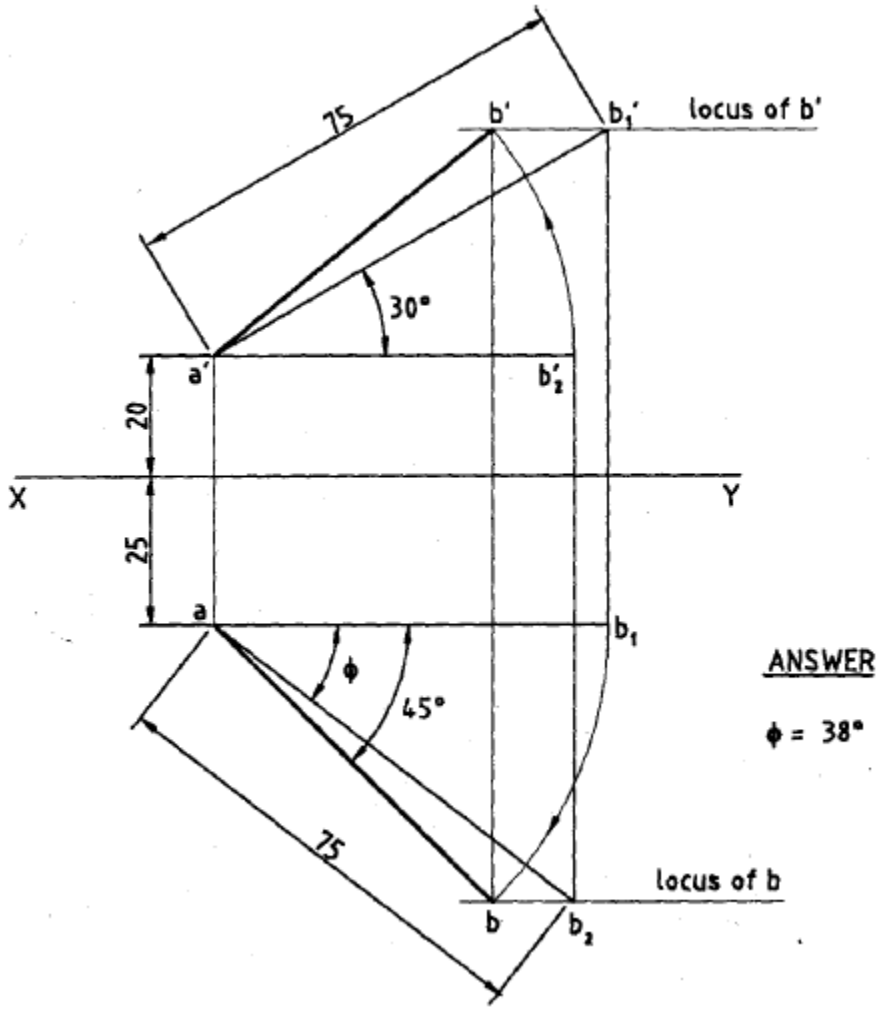


To mark the traces

1. Extended the front view a'b' to get the intersection point h' with XY line.
2. Produce the top view ab to get the intersection point · with XY line.
3. Draw the vertical line from h' to intersect with the top view to get the horizontal trace (HT) of the line.
4. Draw another vertical line from · , to intersect with the front view to get the vertical trace (VT) of the line.

EXAMPLE-*One end A of a line AB, 75 mm long is 20 mm above HP and 25 mm in front of VP. The line is inclined at 30⁰ to HP and the top view makes 45⁰ with VP. Draw the projections of the line and the find the true inclinations with the vertical plane.*

SOLUTION- Mark the projections of end of A. Its front view a' is 20 mm above XY and top view a is 25 mm below XY line.

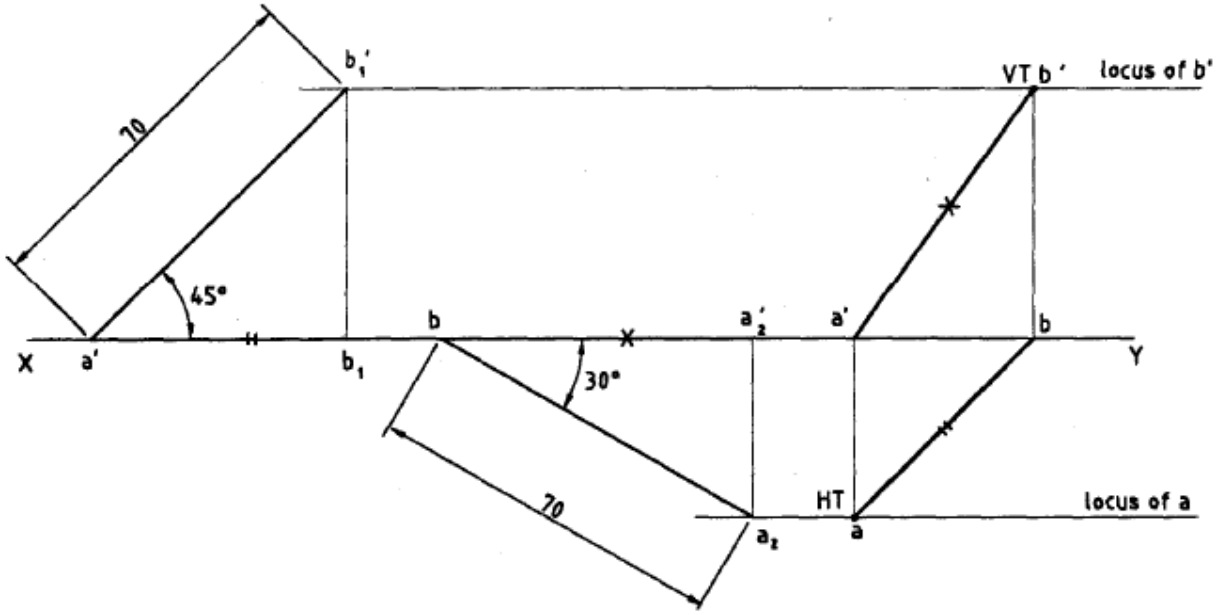


1. Assume that the line kept inclined to HP and parallel to VP. Draw the front view a'b1 inclined at 30^0 to XY and having a length of 75 mm. The top view length ab1 is projected and obtained parallel to the XY line.
2. From top view a draw a line inclined at 45^0 to XY, where the top view b of the line will be obtained. Rotate the top view length ab1 with the centre a to get the intersection point b. Join a and b to get the top view ab of the line.
3. Draw the locus of b', passing through ' 1b and parallel to XY line. Also draw the locus of b, passing through b and parallel to XY line.
4. Assume that the line is kept inclined to VP and parallel to HP. Draw the top view by drawing an arc with a as centre and radius 75 mm to intersect the locus of b at a point b2. Join a and b2 to get the inclination with VP (•). The front view length a' 2b is projected and obtained parallel to XY line.
5. Rotate the front view a' 2b as radius to get the intersection point b' with the locus of b'. Join a' and b' to get the front view a'b' of the line.
6. Check the result by drawing the projector joining b' and b which should be a vertical line.

Projections of a Line when One End of the Line is in HP and the other in VP

EXAMPLE-*A straight line AB is inclined 45^0 to HP and 30^0 to VP. The point A is in HP and the point B is VP. The length of the straight line is 70 mm. Draw the projections of the straight line AB. Also mark the traces.*

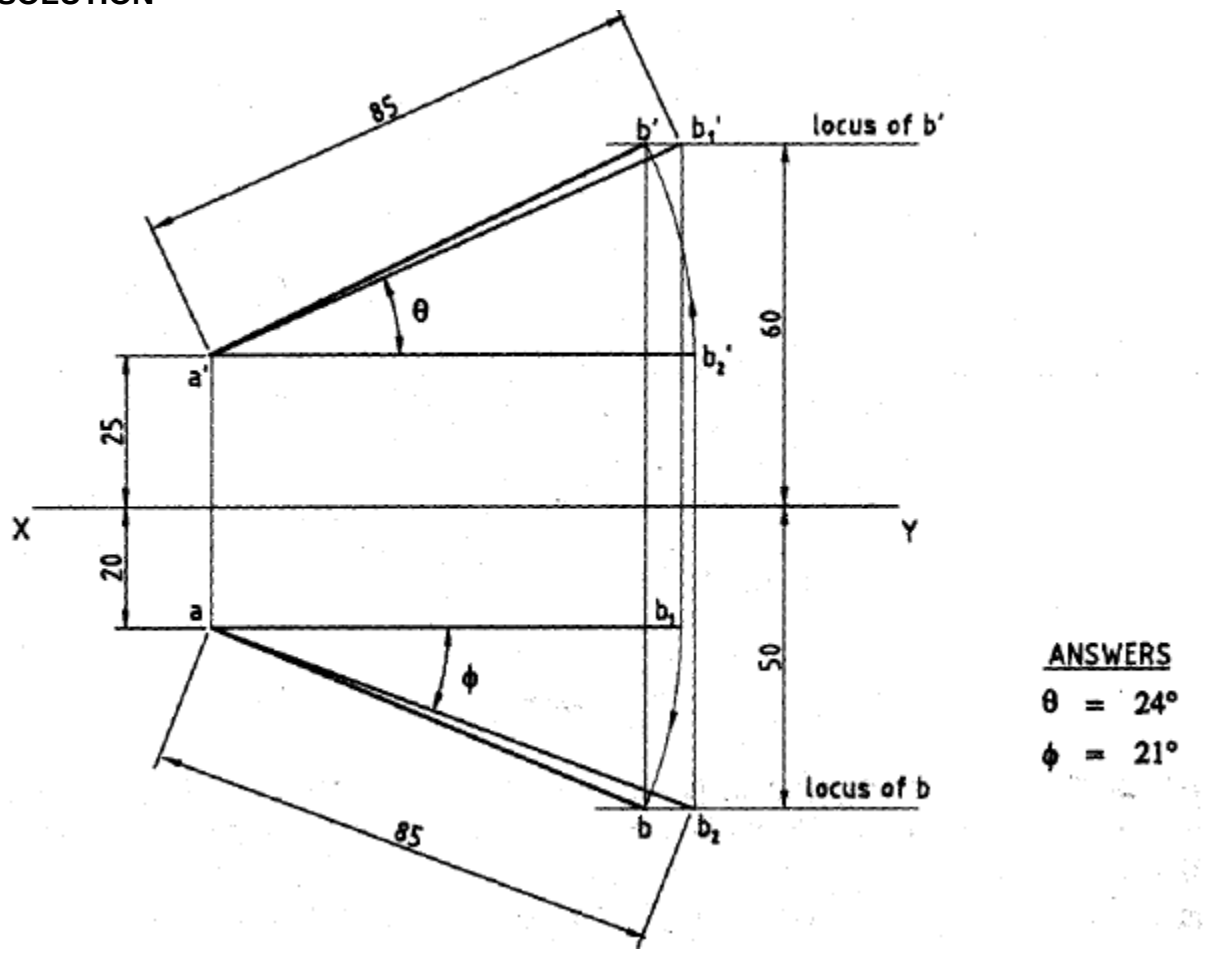
SOLUTION-



The end A is in HP, so the horizontal trace (HT) is marked coinciding with the top view a of the line. The end B is in VP, so the vertical trace (VT) is marked coinciding with the front view b' of the line.

EXAMPLE-*A line AB 85 mm long its end A 25 mm above the HP and 20 mm in front of VP. The end B is 60 mm above HP and 50 mm in front of VP. Draw the projections and find its inclination with HP and VP.*

SOLUTION-



Mark the projections of end A. Its front view a' is 25 mm above XY and top view a is 20 mm below the XY line.

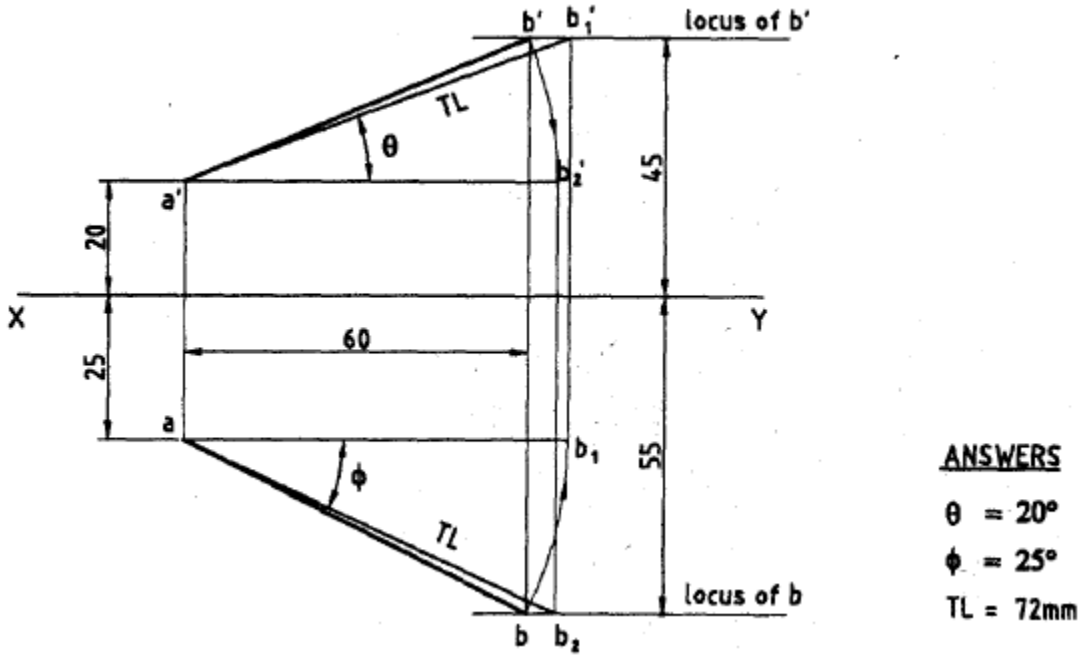
1. Draw the locus of the other end B in front and top views. Locus of b' is drawn at a distance of 60 mm above the XY line and parallel to it. Locus of b is drawn at a distance of 50 mm below XY line and parallel to it.
2. Assume that the line is kept inclined to HP and parallel to VP. Draw the front view a' b_1' by considering a' as centre and true length 85 mm as radius, cut an arc in the locus of b' to mark b_1' with XY is the inclination of the line with HP(θ).
3. Assume that the line is kept inclined to VP and parallel to HP. Draw the top view ab_2 by considering a as centre and true length 85 mm as radius, cut an arc in the locus of b to mark b_2. The front view length a' b_2' is projected and obtained parallel to XY line.

   The inclination of top view ab_2 with XY is the inclination of the line with VP(ϕ).

4. Rotate the top view ab_1 to the required position by taking a as centre, ab_1 as radius to get the intersection point b with the locus of b. Join a and b to complete the top view ab of the line. Rotate the front view a' $'_2$ b by taking a' as centre, a' $'_2$ b as radius to get the intersection point b' with the locus of b'. Join a' and b' to get the front view a'b' of the line.

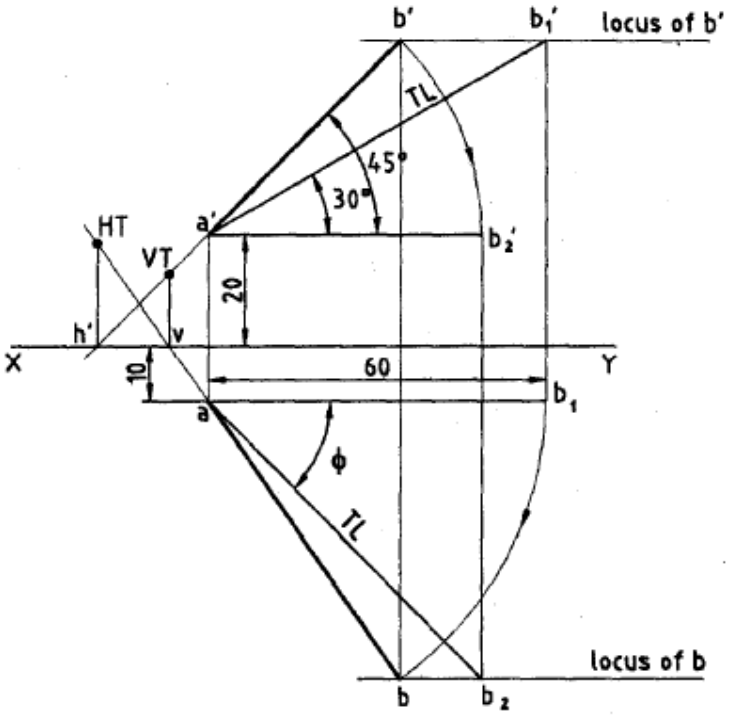
EXAMPLE-*A line AB has its end A 20 mm above HP and 25 mm in front of VP. The other end B is 45 mm above HP and 55 mm in front of VP. The distance between the end projectors is 60 mm. Draw its projections. Also find the true length and true inclinations of the line with HP and VP.*

SOLUTION-



EXAMPLE-*The end A of a line AB is 10 mm in front of VP and 20 mm above HP. The line is inclined at 30⁰ to HP and front view is 45⁰ with XY. Top view is 60 mm long. Draw the projections. Find the true length and inclination with VP. Locate the traces.*

SOLUTION-



ANSWERS

ϕ = 45°

TL = 70mm

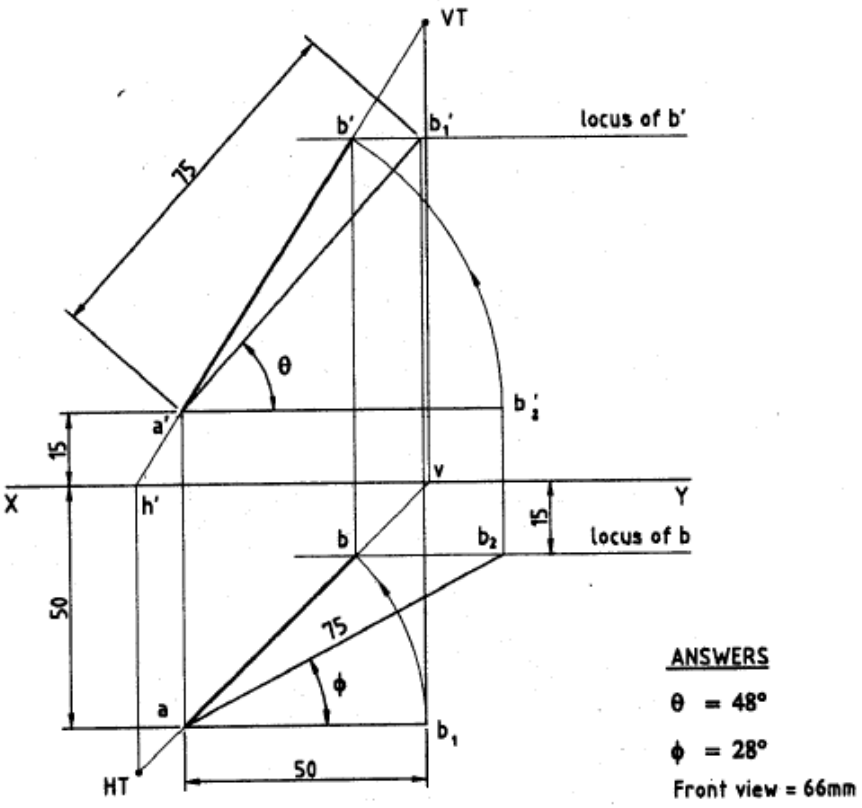
Mark the projections of end A. Its front view a' 20 mm above XY and top view a is 10 mm below XY line.

1. Assume that the line is kept inclined to HP and parallel to VP. Draw its top view ab_1 from a which is parallel to the XY line for a length of 60 mm. Draw a vertical line (projector) from b_1 and draw a line from a' inclined at 30^0 to XY line, intersecting at $'_1b$. The front view length a'_1b is the true length (TL) of the line.
2. Draw the locus of b' passing through $'_1b$ and parallel to XY line. Draw the front view a'b' of the line inclined at 45^0 to the XY line from a' and intersecting the locus of b' at b'.
3. Draw the vertical line (projector) passing through b'. Rotate the top view ab by taking a as centre and ab_1 as radius to intersect with the projector at b. Draw the locus of b passing through b and parallel to XY line.
4. Rotate the front view a'b' in the reverse order. Take a' as centre, front view length a'b' as radius and draw an arc to get $'_2b$, parallel to XY line. Project $'_2b$ to the locus of b to get b_2. Join ab_2 which ahs the true length (TL) of the line. The inclination of ab_2 with the XY line is the true inclination of the line with VP(·).

To mark the traces

1. Extend the front view a'b' to get the intersection point h' with XY line.
2. Produce the top view ab to get the intersection point · with XY line.
3. Draw a vertical line from h' to intersect with the top view to get horizontal trace (HT). Draw another vertical line from · to intersect with the front view to get the vertical trace (VT).

EXAMPLE-*A line AB measuring 75 mm long has one of its ends 50 mm in front of VP and 15 mm above HP. The top view of the line is 50 mm long. Draw and measure the front view. The other end is 15 mm in front of VP and is above HP. Determine the true inclinations and traces.*



SOLUTION-

Mark the projections of end A, its front view a' is 15 mm above XY and top view a is 50 mm below XY line. Draw the locus of b, at a distance 15 mm below the XY line.

1. Assume that the line is kept inclined to HP and parallel to VP. The top view ab_1 is marked parallel to XY line for a length of 50 mm. Draw a vertical line (projector) from b_1. Using true length 75 mm as radius and a' as centre, draw an arc to intersect with the vertical line through b_1 to get $'_1b$. Join a' and $'_1b$ which represents the true length of the line. The inclination of a' $'_1b$ with XY is the inclination of the line with HP(·).

2. Assume that the line is kept inclined to VP and parallel to HP. Mark the top view ab_2, by considering a as centre and true length 75 mm as radius, cut an arc on the locus of b to get b_2. The inclination of ab_2 with XY is the inclination of the line with VP(·). The front view length a' $'_2$b is projected and obtained parallel to XY line.

3. Draw the locus of b' which is a line passing through $'_1b$ and parallel to XY line.

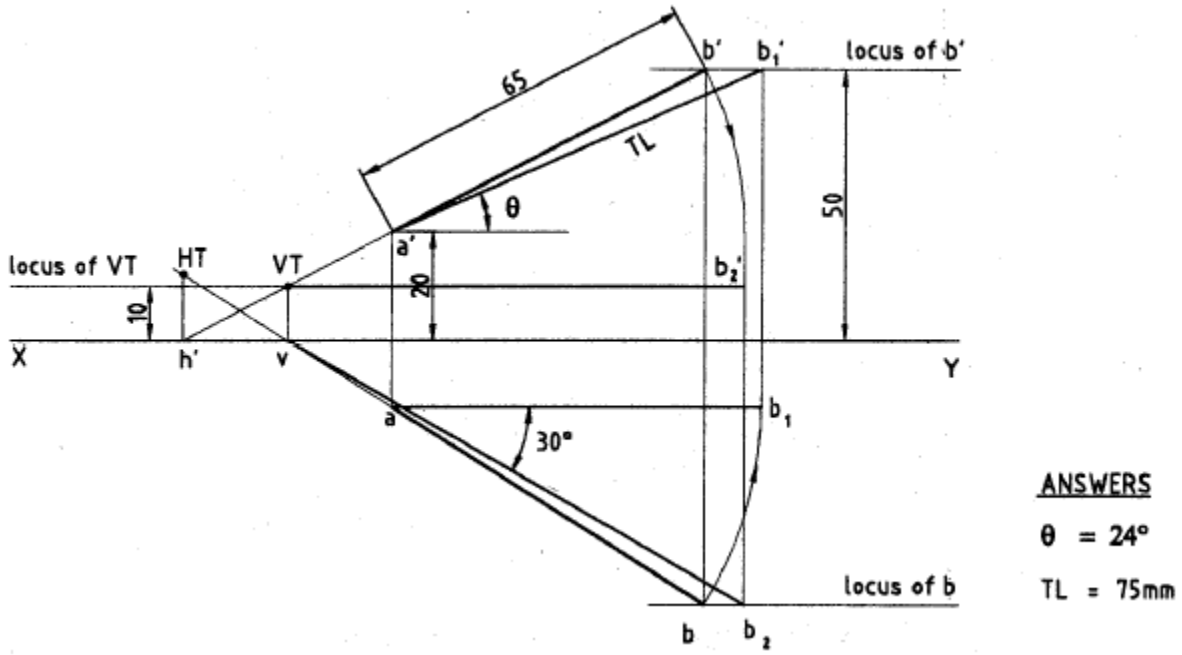
4. Rotate the top view ab_1 and front view a' $'_2$b to the required position. Take a as centre, top view length ab_1 as radius, draw an arc to intersect with the locus of b at b. Join and b to get the top view ab of the line. Take a' as centre, front view length a' $'_2$b as radius draw an arc to intersect with the locus of b' at b'. Join a' and b' to get the front view a'b' of the line.

To mark the traces

1. Extend the front view a'b' to get the intersection point h' with XY line.
2. Produces the top view ab to get the intersection point · with XY line.
3. Draw the vertical line from h' to intersect the top view to get the horizontal trace (HT) of the line.
4. Draw another vertical line from · to intersect the front view to get vertical trace (VT) of the line.

EXAMPLE-*A line AB is inclined at 30₀ to VP has its ends 20 mm and 50 mm above the HP. The length of the front view is 65 mm and its VT is 10 mm above HP. Determine the true length of AB, its inclination with HP and its HT.*

SOLUTION-



Mark the projection of end A, its front view a' is 20 mm above the XY line.

1. Draw the locus of b' at a distance 50 mm above the XY line. Mark the front view a'b', by considering a' as centre and 65 mm length as radius, cut an arc on the locus of b' to get b'. Join a' with b' to get the front view a'b' of the line. Draw the locus of VT at a distance 10 mm above the XY line. Extend the front view a'b' to mark the VT.
2. Considering the length of the upto the VT where it meets VP. Project the top view of VT which is obtained on XY line and is marked as ・ . Assume that this line is inclined to VP and parallel to HP. From ・ , draw its top inclined at 30₀ to XY line. Rotate its front view VT b' with VT as centre, parallel to XY line to get ' 2 b and project it to get b2 on the inclined line.
3. Draw the locus of b passing through b2 and parallel to XY line. Project b' to get b on the locus of b. Join ・ and b to get the top view ・ b for the line upto VT. Project a' to get the top view ab of the required line.
4. Assume that the line is kept inclined to HP and parallel to VP. Rotate the top view ab by taking a as centre and ab as radius to get parallel to XY line. Project b1to locus of b' to get ' 1b . Join a' and ' 1b to get the true length of the line. The inclination of a' ' 1b with XY is the inclination of the line with HP(・).