

Projection of points and lines

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ORTHOGRAPHIC PROJECTIONS

OF POINTS, LINES, PLANES, AND SOLIDS.

TO DRAW PROJECTIONS OF ANY OBJECT,
ONE MUST HAVE FOLLOWING INFORMATION

A) OBJECT

{ WITH IT'S DESCRIPTION, WELL DEFINED. }

B) OBSERVER

{ ALWAYS OBSERVING PERPENDICULAR TO RESP. REF. PLANE. }

C) LOCATION OF OBJECT,

{ MEANS IT'S POSITION WITH REFERENCE TO H.P. & V.P. }

TERMS 'ABOVE' & 'BELOW' WITH RESPECTIVE TO H.P.
AND TERMS 'INFRONT' & 'BEHIND' WITH RESPECTIVE TO V.P.
FORM 4 QUADRANTS.

OBJECTS CAN BE PLACED IN ANY ONE OF THESE 4 QUADRANTS.

IT IS INTERESTING TO LEARN THE EFFECT ON THE POSITIONS OF VIEWS (FV, TV)
OF THE OBJECT WITH RESP. TO X-Y LINE, WHEN PLACED IN DIFFERENT QUADRANTS.

STUDY ILLUSTRATIONS GIVEN ON NEXT PAGES AND NOTE THE RESULTS. TO MAKE IT EASY
HERE A POINT  IS TAKEN AS AN OBJECT. BECAUSE IT'S ALL VIEWS ARE JUST POINTS.

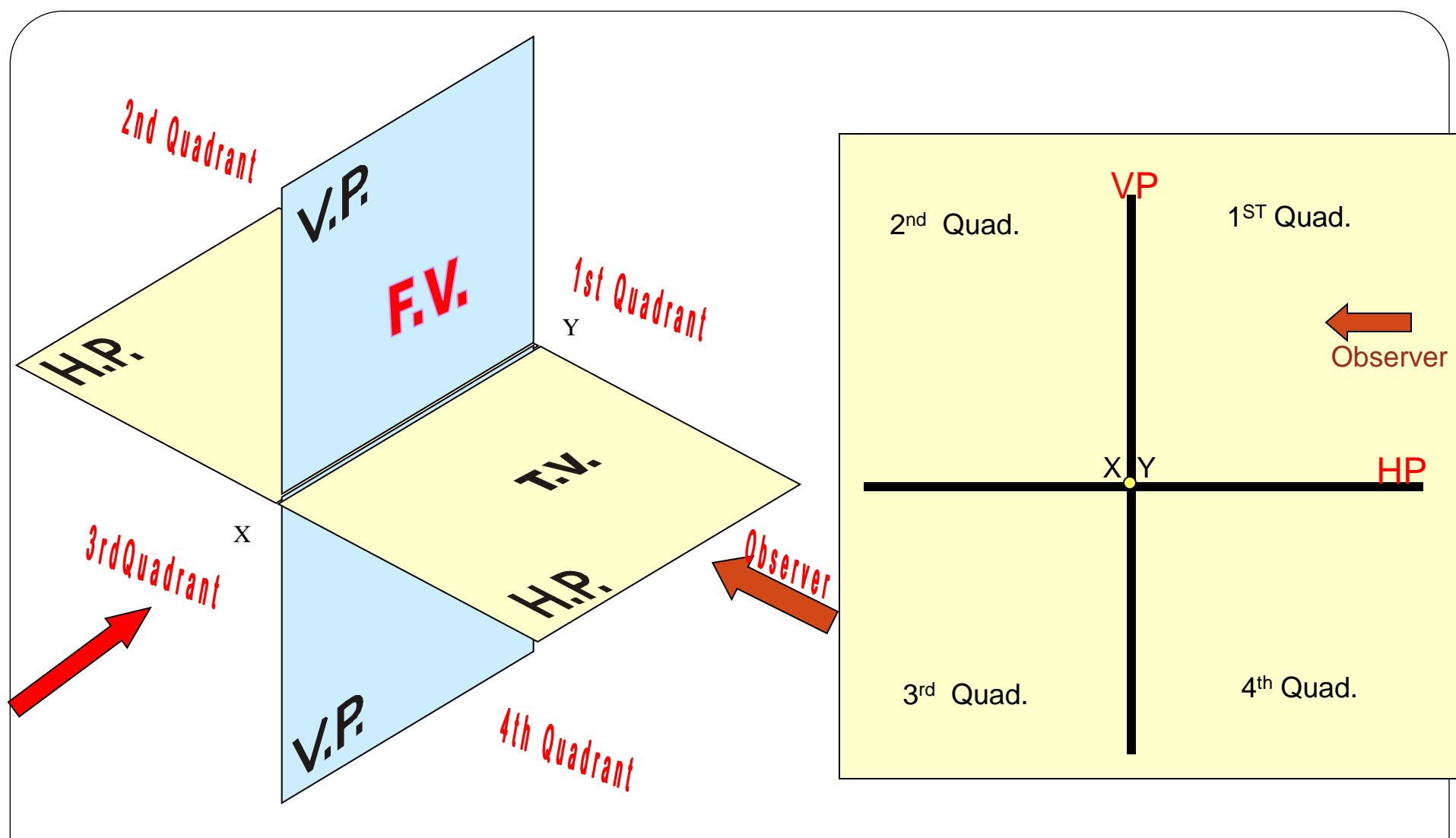


NOTATIONS

FOLLOWING NOTATIONS SHOULD BE FOLLOWED WHILE NAMEING DIFFERENT VIEWS IN ORTHOGRAPHIC PROJECTIONS.

OBJECT	POINT A	LINE AB
IT'S TOP VIEW	a	a b
IT'S FRONT VIEW	a'	a' b'
IT'S SIDE VIEW	a''	a'' b''

*SAME SYSTEM OF NOTATIONS SHOULD BE FOLLOWED
INCASE NUMBERS, LIKE 1, 2, 3 – ARE USED.*



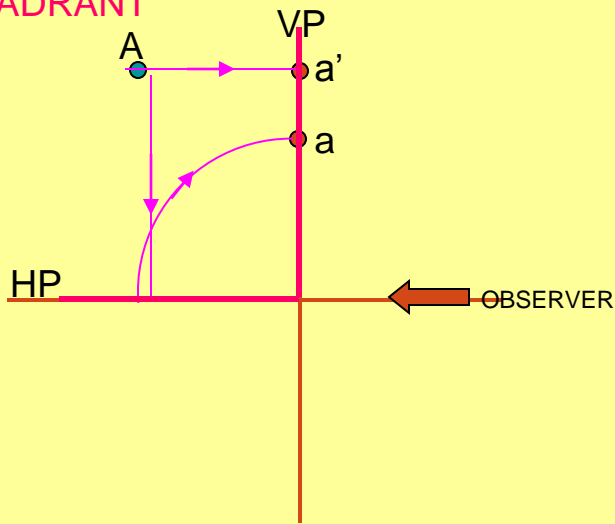
THIS QUADRANT PATTERN,
 IF OBSERVED ALONG X-Y LINE (IN RED ARROW DIRECTION)
 WILL EXACTLY APPEAR AS SHOWN ON RIGHT SIDE AND HENCE,
 IT IS FURTHER USED TO UNDERSTAND ILLUSTRATION PROPERLLY.

Point A is Placed In different quadrants and it's Fv & Tv are brought in same plane for Observer to see clearly.

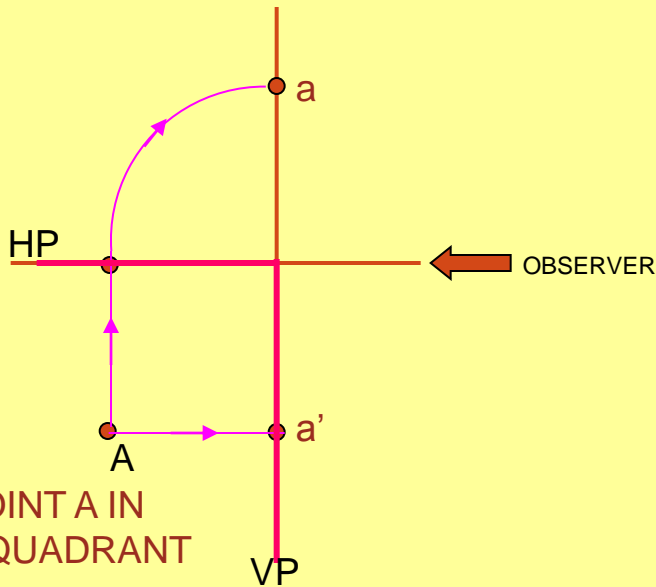
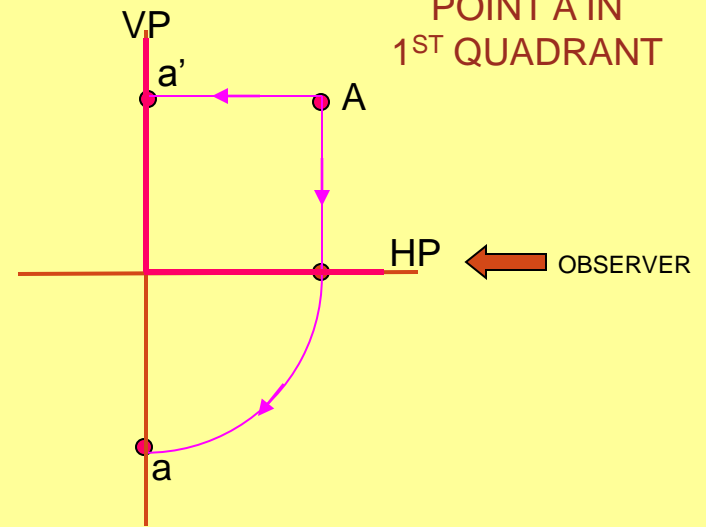
Fv is visible as it is a view on VP. But as Tv is is a view on Hp, it is rotated downward 90° , In clockwise direction. The In front part of Hp comes below xy line and the part behind Vp comes above.

Observe and note the process.

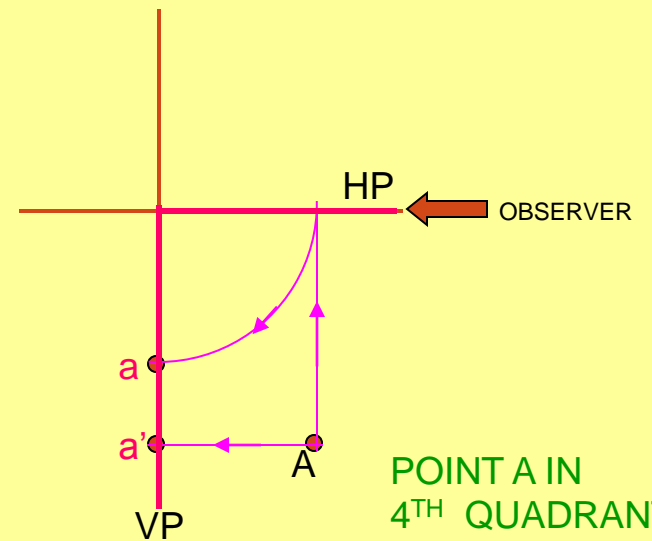
POINT A IN 2ND QUADRANT



POINT A IN 1ST QUADRANT



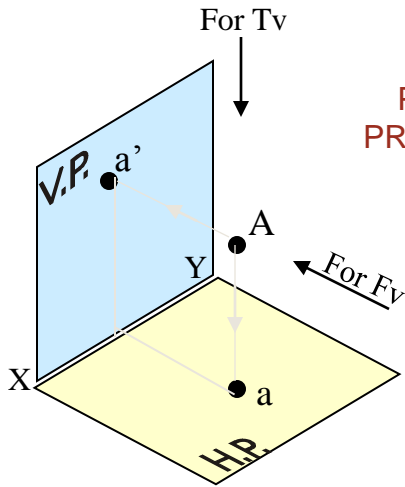
POINT A IN 3RD QUADRANT



POINT A IN 4TH QUADRANT

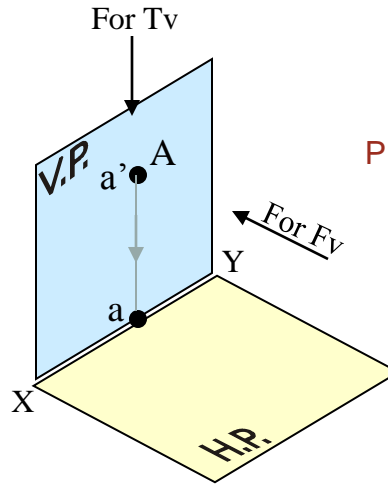
PROJECTIONS OF A POINT IN FIRST QUADRANT.

POINT A ABOVE HP
& IN FRONT OF VP



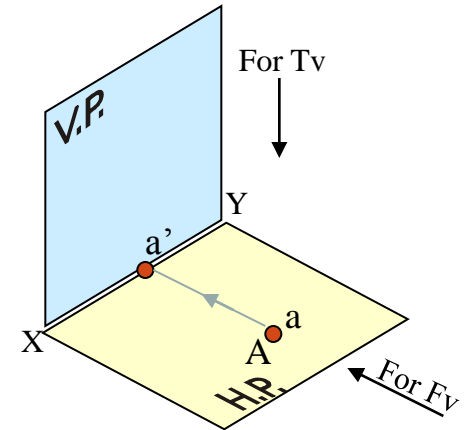
PICTORIAL
PRESENTATION

POINT A ABOVE HP
& IN VP



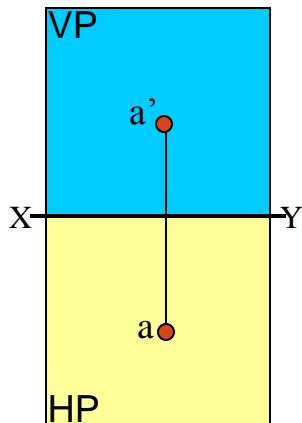
PICTORIAL
PRESENTATION

POINT A IN HP
& IN FRONT OF VP

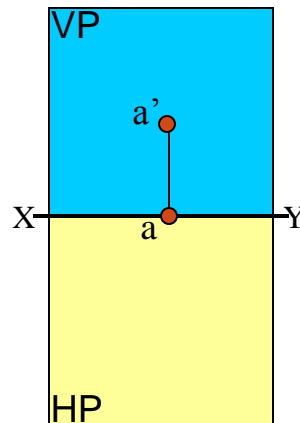


ORTHOGRAPHIC PRESENTATIONS
OF ALL ABOVE CASES.

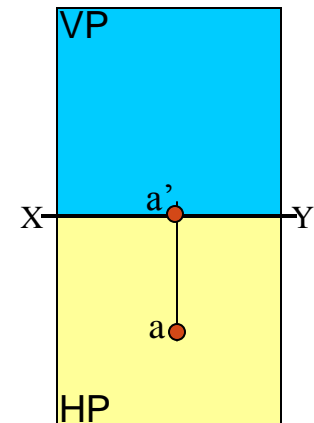
*Fv above xy,
Tv below xy.*



*Fv above xy,
Tv on xy.*



*Fv on xy,
Tv below xy.*



PROJECTIONS OF STRAIGHT LINES.

INFORMATION REGARDING A LINE *means*
IT'S LENGTH,
POSITION OF IT'S ENDS WITH HP & VP
IT'S INCLINATIONS WITH HP & VP WILL BE GIVEN.

AIM:- TO DRAW IT'S PROJECTIONS - MEANS FV & TV.

SIMPLE CASES OF THE LINE

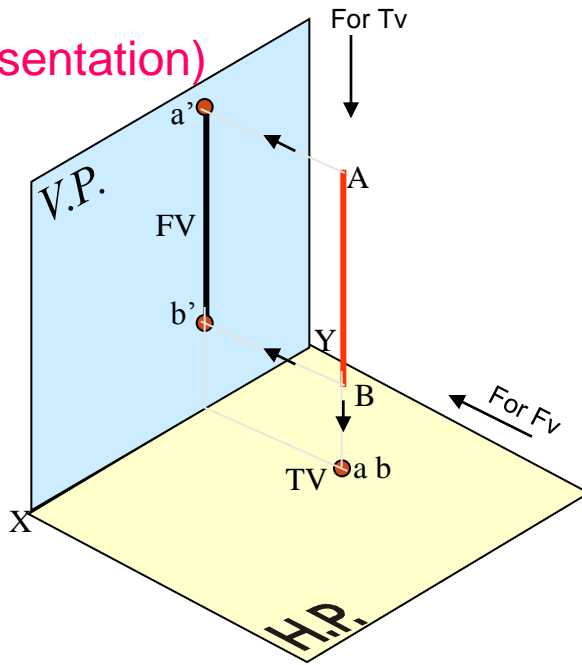
1. A VERTICAL LINE (LINE PERPENDICULAR TO HP & // TO VP)
2. LINE PARALLEL TO BOTH HP & VP.
3. LINE INCLINED TO HP & PARALLEL TO VP.
4. LINE INCLINED TO VP & PARALLEL TO HP.
5. LINE INCLINED TO BOTH HP & VP.

**STUDY ILLUSTRATIONS GIVEN ON NEXT PAGE
SHOWING CLEARLY THE NATURE OF FV & TV
OF LINES LISTED ABOVE AND NOTE RESULTS.**

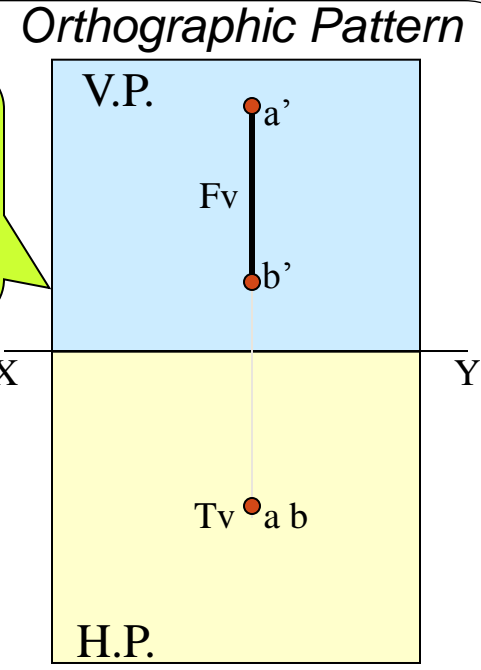
(Pictorial Presentation)

1.

A Line perpendicular to Hp & // to Vp



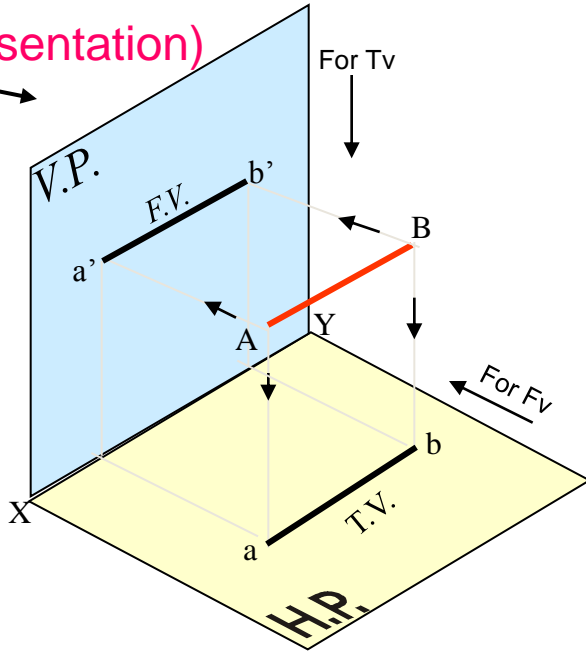
Note:
Fv is a vertical line showing True Length & Tv is a point.



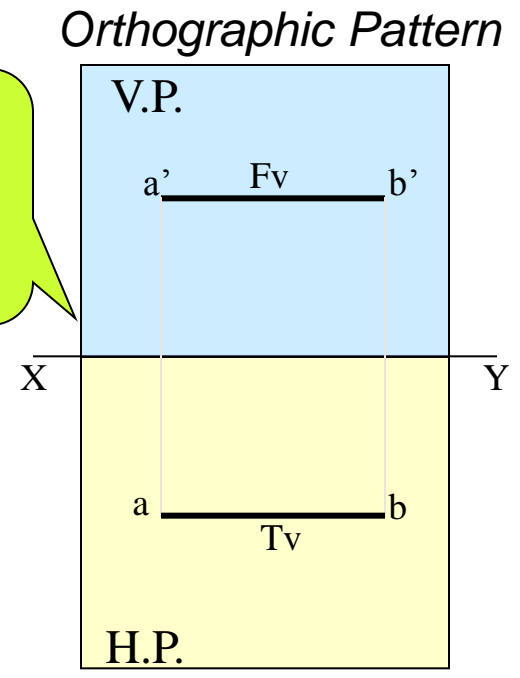
(Pictorial Presentation)

2.

A Line // to Hp & // to Vp



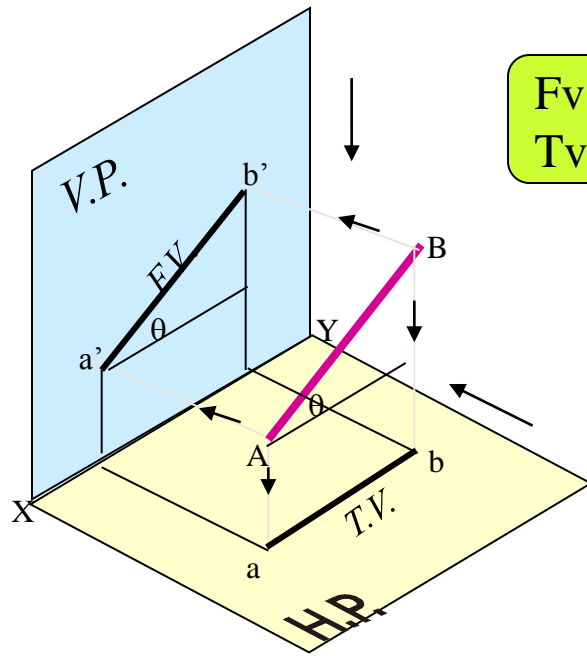
Note:
Fv & Tv both are // to xy & both show T. L.



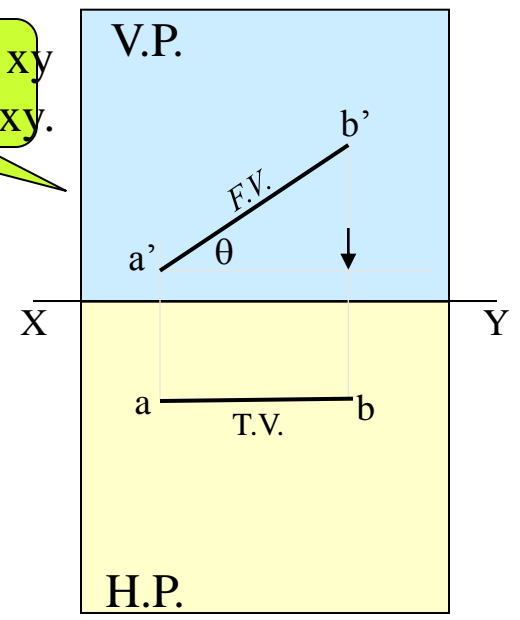
3.

A Line inclined to Hp
and
parallel to Vp

(Pictorial presentation)



Fv inclined to xy
Tv parallel to xy.

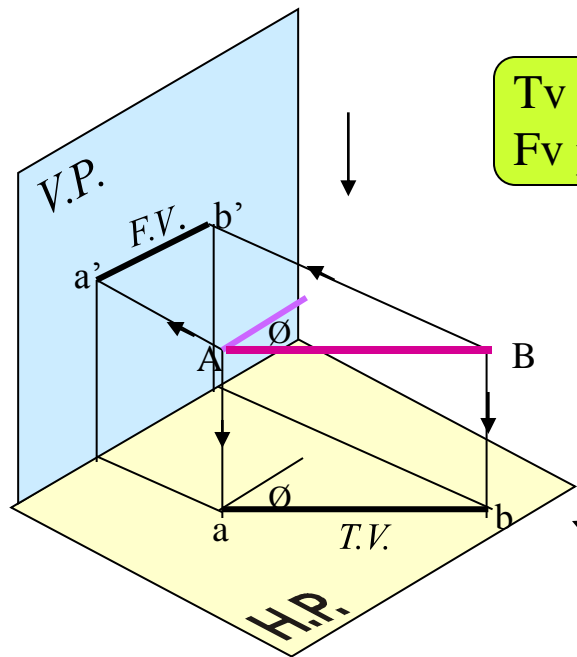


Orthographic Projections

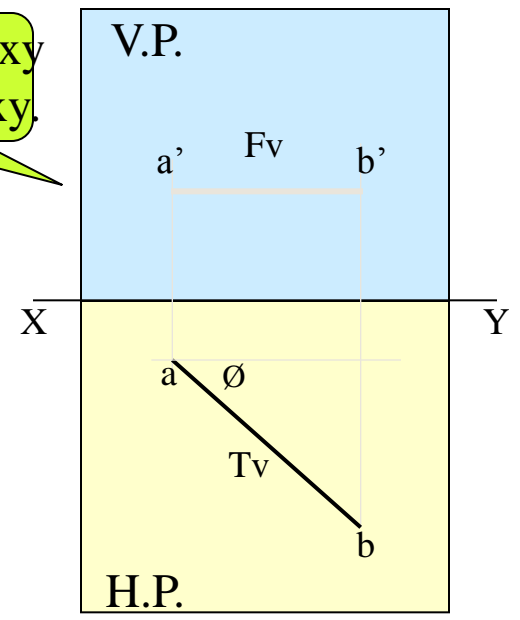
4.

A Line inclined to Vp
and
parallel to Hp

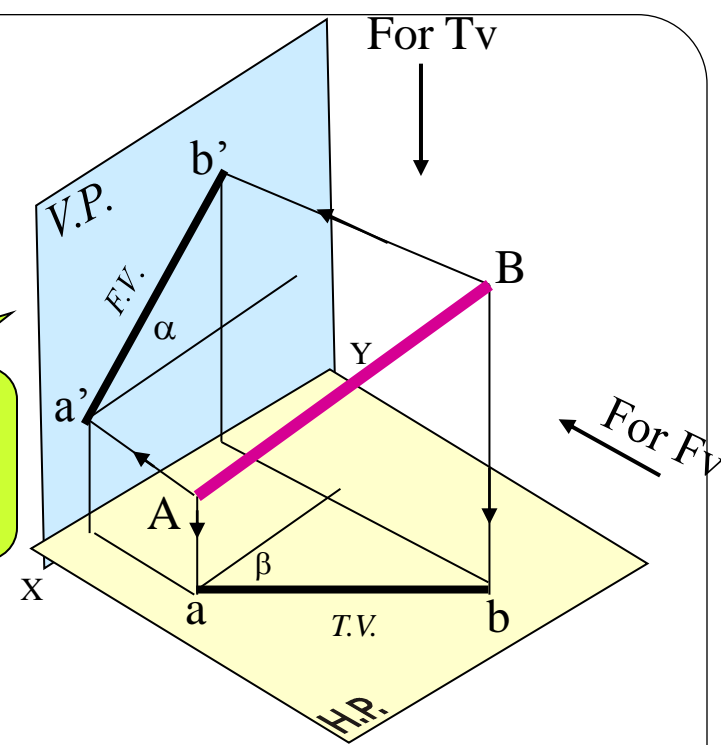
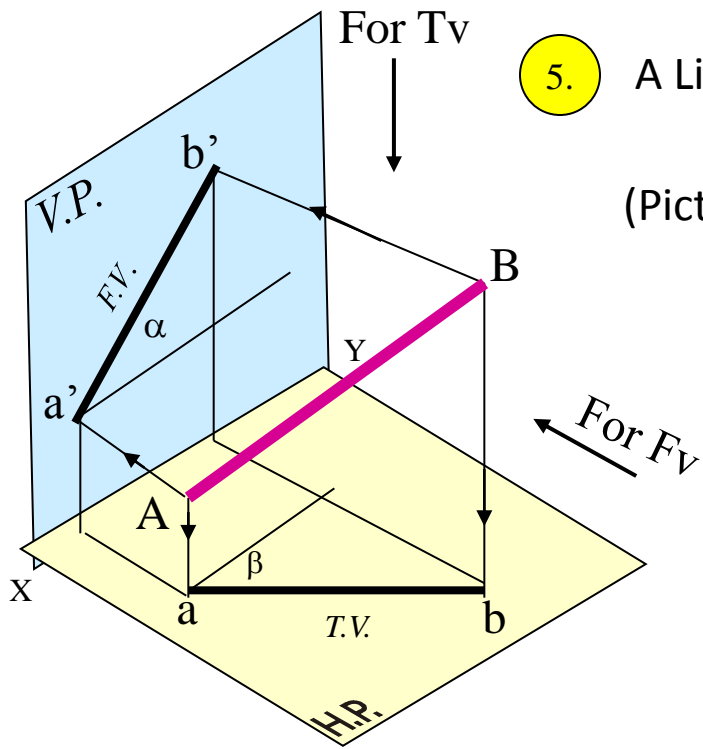
(Pictorial presentation)



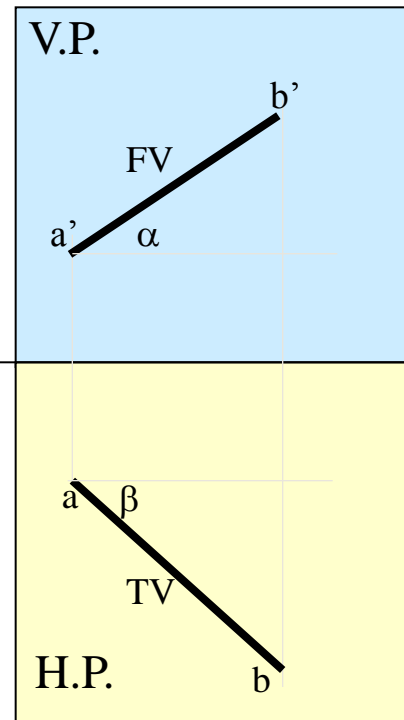
Tv inclined to xy
Fv parallel to xy.



5. A Line inclined to both Hp and Vp
(Pictorial presentation)



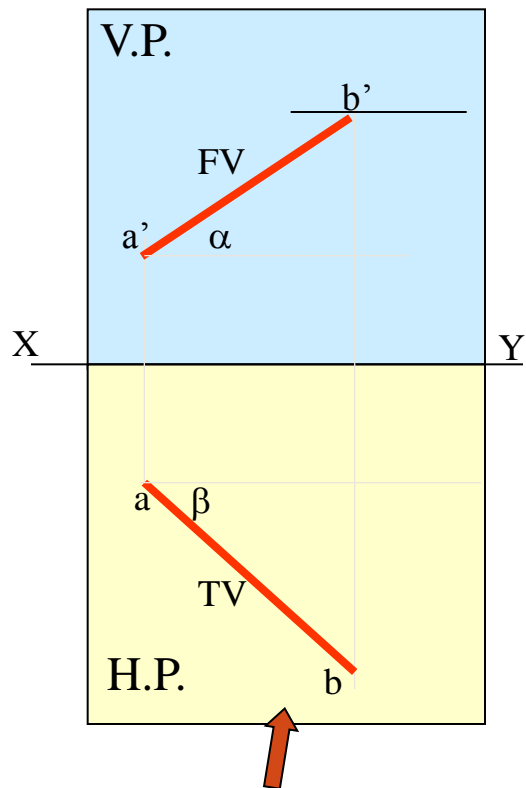
On removal of object
i.e. Line AB
Fv as a image on Vp.
Tv as a image on Hp,



Orthographic Projections
Fv is seen on Vp clearly.
To see Tv clearly, Hp is rotated 90° downwards,
Hence it comes below xy.

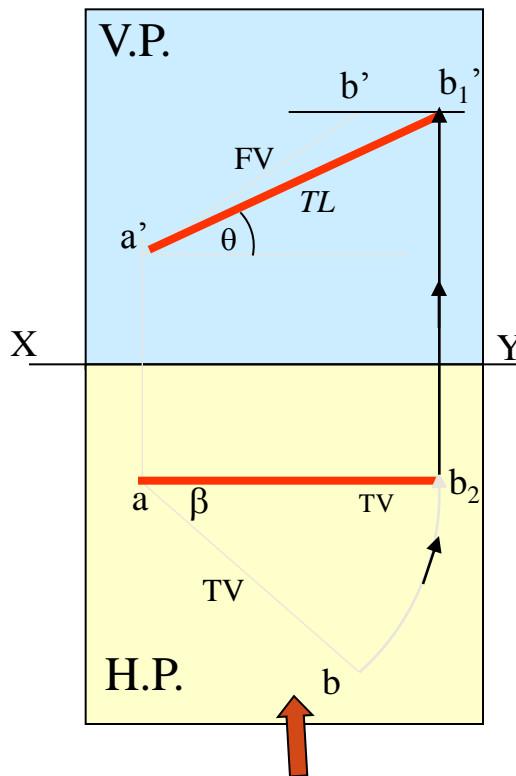
Note These Facts:-
Both Fv & Tv are inclined to xy.
(No view is parallel to xy)
Both Fv & Tv are reduced lengths.
(No view shows True Length)

Orthographic Projections
Means Fv & Tv of Line AB
are shown below,
with their apparent Inclinations
 α & β



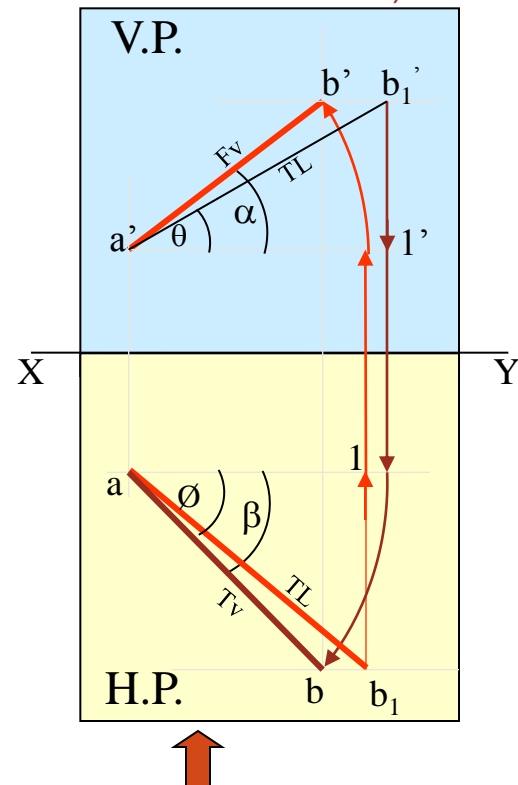
Here TV (ab) is not // to XY line
Hence it's corresponding FV
 $a'b'$ is *not* showing
True Length &
True Inclination with Hp.

Note the procedure
When Fv & Tv known,
How to find True Length.
(Views are rotated to determine
True Length & it's inclinations
with Hp & Vp).



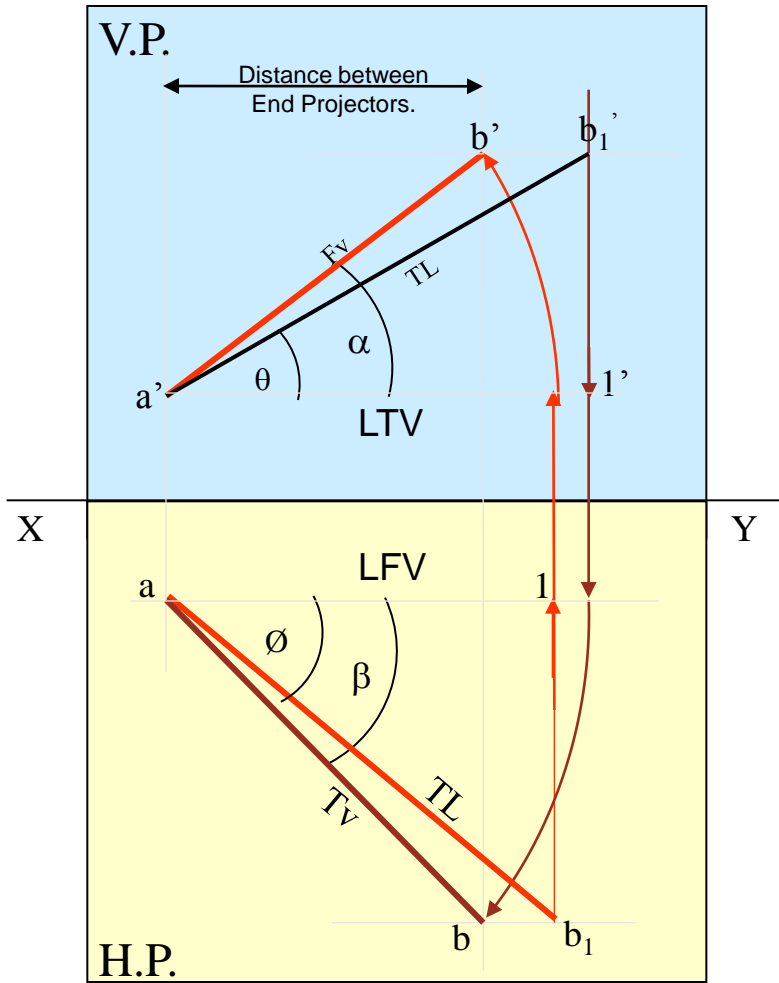
In this sketch, TV is rotated
and made // to XY line.
Hence it's corresponding
FV $a'b_1'$ is showing
True Length
&
True Inclination with Hp.

Note the procedure
When True Length is known,
How to locate Fv & Tv.
(Component $a-1$ of TL
is drawn which is further rotated
to determine Fv)



Here $a-1$ is component
of TL ab_1 gives length of Fv.
Hence it is brought Up to
Locus of a' and further rotated
to get point b' . $a'b'$ will be Fv.
Similarly drawing component
of other TL ($a'b_1'$) Tv can be drawn.

The most important diagram showing graphical relations among all important parameters of this topic. Study and memorize it as a *CIRCUIT DIAGRAM* And use in solving various problems.



- 1) True Length (TL) – $a' b_1'$ & $a b$
- 2) Angle of TL with Hp - θ
- 3) Angle of TL with Vp – \emptyset
- 4) Angle of FV with xy – α
- 5) Angle of TV with xy – β
- 6) LTV (length of FV) – Component (a-1)
- 7) LFV (length of TV) – Component ($a'-1'$)
- 8) Position of A- Distances of a & a' from xy
- 9) Position of B- Distances of b & b' from xy
- 10) Distance between End Projectors

Important
TEN parameters
to be remembered
with Notations
used here onward

NOTE this

- θ & α Construct with a'
- \emptyset & β Construct with a
- b' & b_1' on same locus.
- b & b_1 on same locus.

Also Remember

- True Length is never rotated. It's horizontal component is drawn & it is further rotated to locate view.
- Views are always rotated, made horizontal & further extended to locate TL, θ & \emptyset

GROUP (A)

GENERAL CASES OF THE LINE INCLINED TO BOTH HP & VP
(based on 10 parameters).

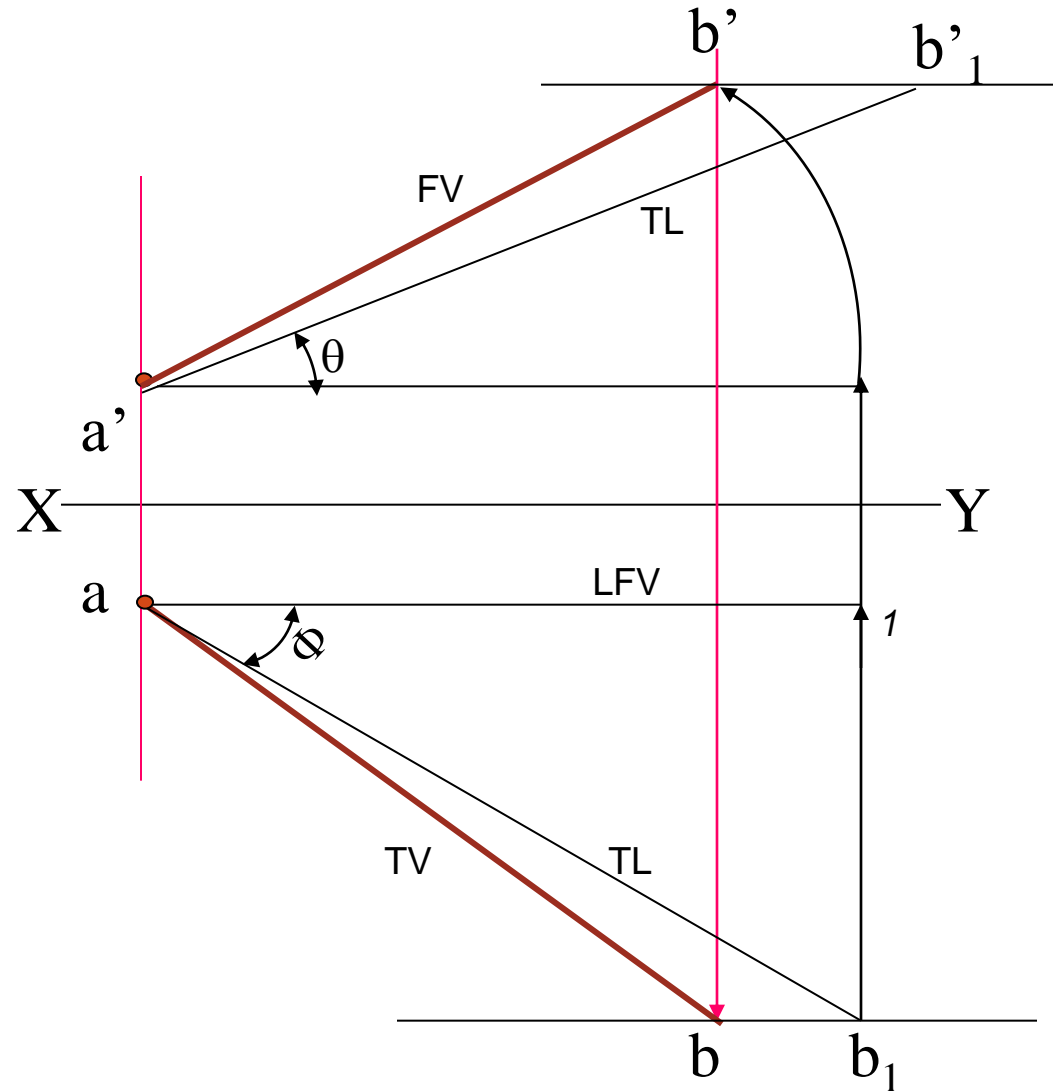
PROBLEM 1)

Line AB is 75 mm long and it is 30° & 40° Inclined to Hp & Vp respectively.
End A is 12mm above Hp and 10 mm in front of Vp.

Draw projections. Line is in 1st quadrant.

SOLUTION STEPS:

- 1) Draw xy line and one projector.
- 2) Locate a' 12mm above xy line & a 10mm below xy line.
- 3) Take 30° angle from a' & 40° from a and mark TL i.e. 75mm on both lines. Name those points b₁' and b₁ respectively.
- 4) Join both points with a' and a resp.
- 5) Draw horizontal lines (Locus) from both points.
- 6) Draw horizontal component of TL a b₁ from point b₁ and name it 1. (the length a-1 gives length of Fv as we have seen already.)
- 7) Extend it up to locus of a' and rotating a' as center locate b' as shown. Join a' b' as Fv.
- 8) From b' drop a projector down ward & get point b. Join a & b i.e. Tv.

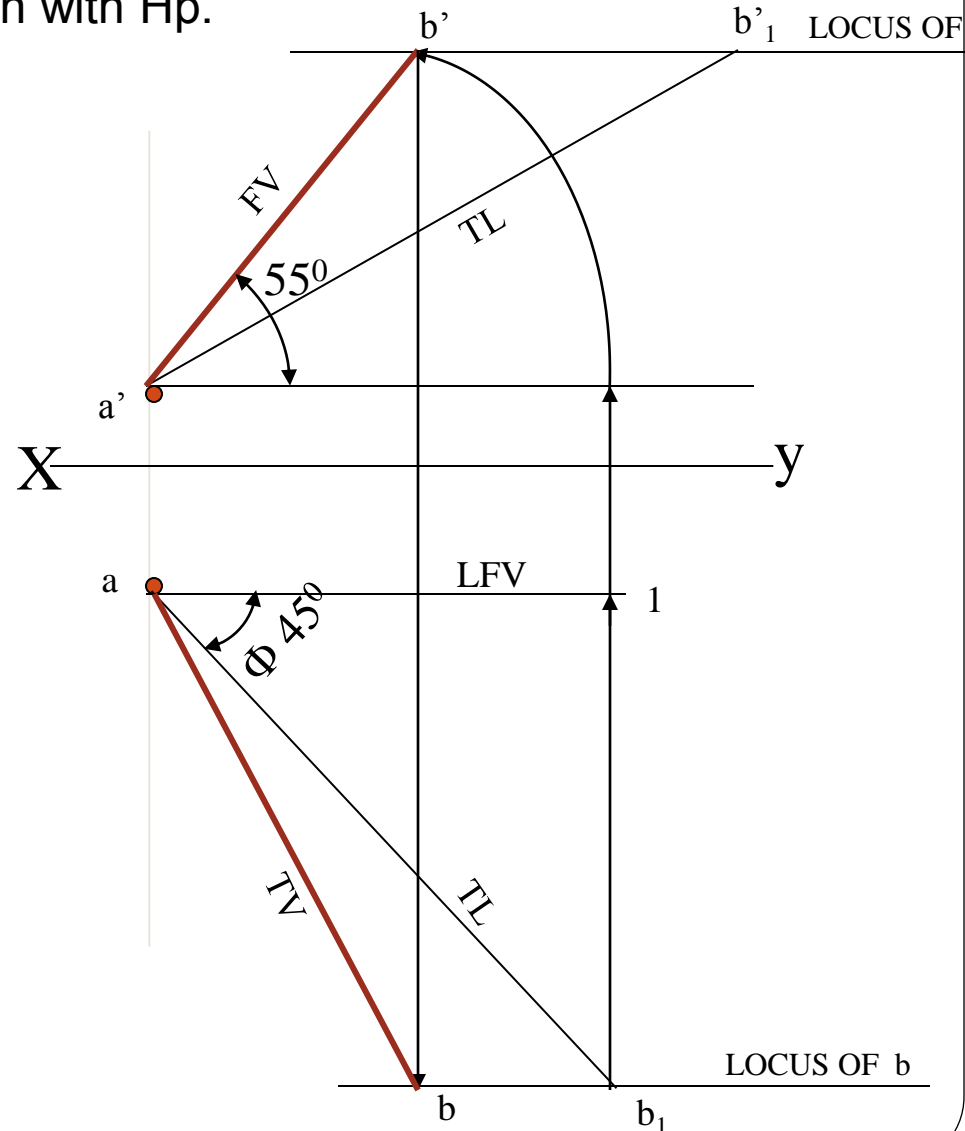


PROBLEM 2:

Line AB 75mm long makes 45° inclination with Vp while its Fv makes 55° . End A is 10 mm above Hp and 15 mm in front of Vp. If line is in 1st quadrant draw its projections and find its inclination with Hp.

Solution Steps:-

1. Draw x-y line.
2. Draw one projector for a' & a
3. Locate a' 10mm above x-y & a 15 mm below xy.
4. Draw a line 45° inclined to xy from point a and cut TL 75 mm on it and name that point b_1 . Draw locus from point b_1
5. Take 55° angle from a' for Fv above xy line.
6. Draw a vertical line from b_1 up to locus of a and name it 1. It is horizontal component of TL & is LFV.
7. Continue it to locus of a' and rotate upward up to the line of Fv and name it b' . This $a'b'$ line is Fv.
8. Drop a projector from b' on locus from point b_1 and name intersecting point b . Line ab is Tv of line AB.
9. Draw locus from b' and from a' with TL distance cut point b_1'
10. Join $a'b_1'$ as TL and measure its angle at a' . It will be true angle of line with HP.

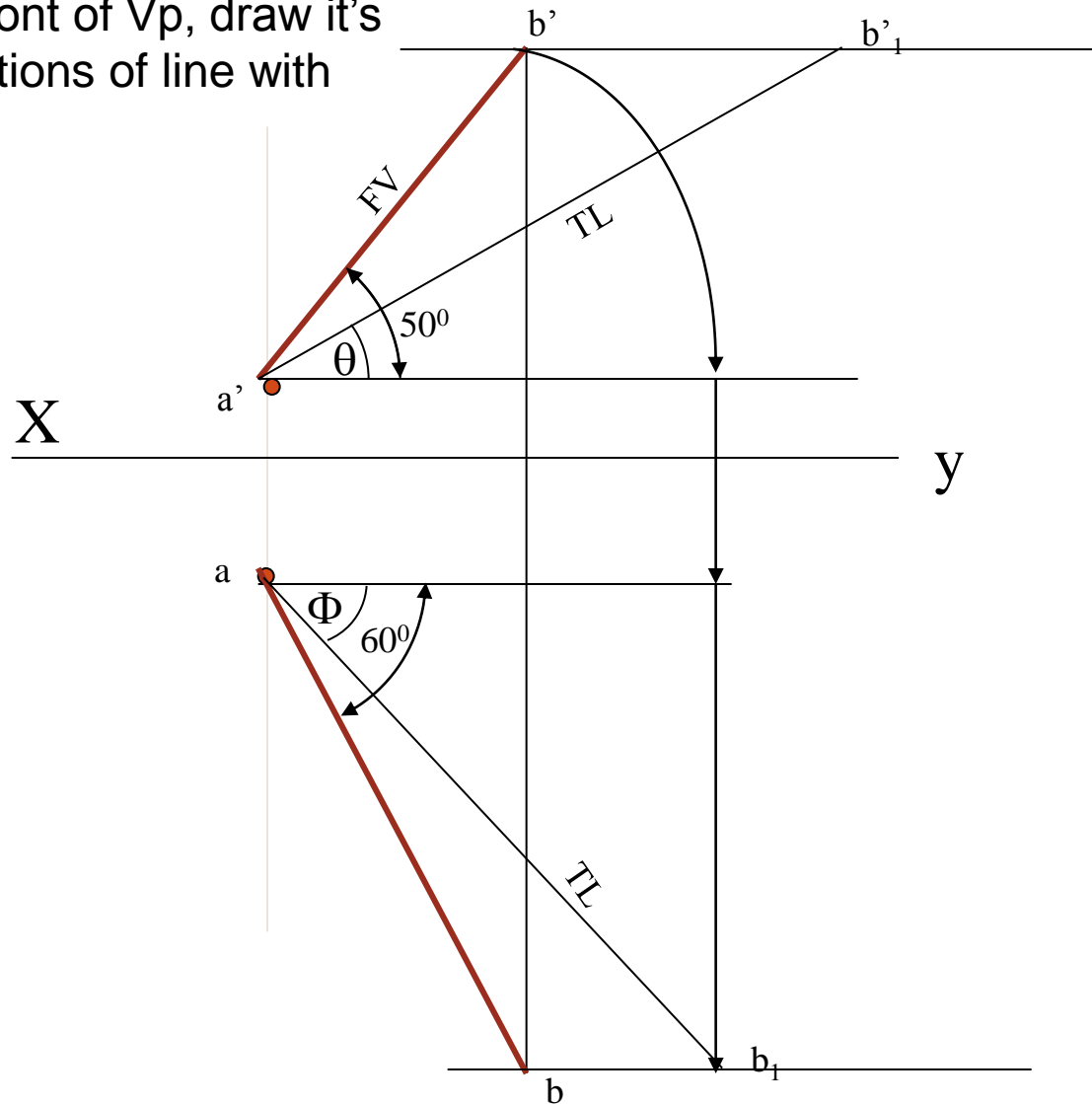


PROBLEM 3:

Fv of line AB is 50° inclined to xy and measures 55 mm long while its Tv is 60° inclined to xy line. If end A is 10 mm above Hp and 15 mm in front of Vp, draw its projections, find TL, inclinations of line with Hp & Vp.

SOLUTION STEPS:

1. Draw xy line and one projector.
2. Locate a' 10 mm above xy and a 15 mm below xy line.
3. Draw locus from these points.
4. Draw Fv 50° to xy from a' and mark b' cutting 55mm on it.
5. Similarly draw Tv 60° to xy from a & drawing projector from b' Locate point b and join a b .
6. Then rotating views as shown, locate True Lengths ab_1 & $a'b_1'$ and their angles with Hp and Vp.

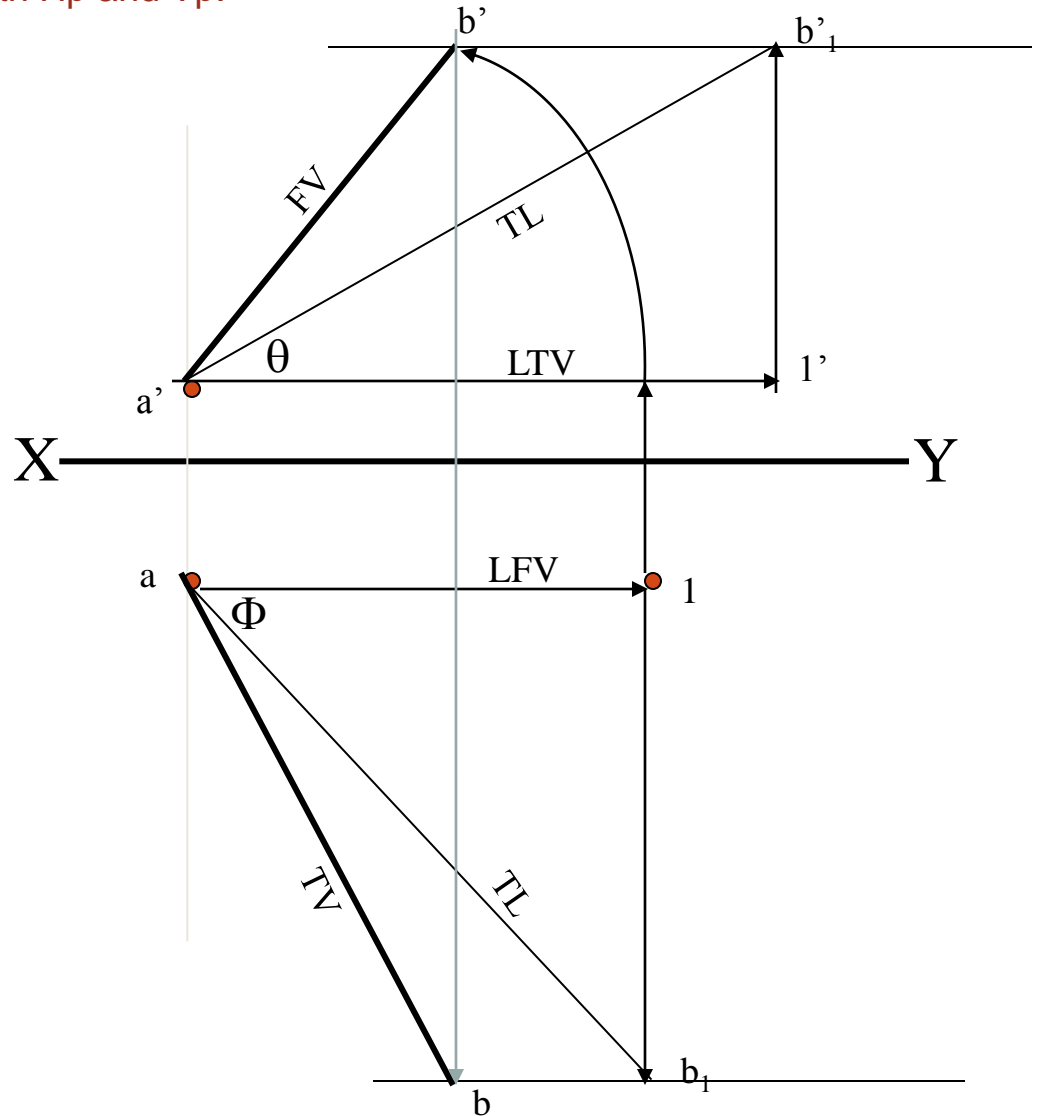


PROBLEM 4 :-

Line AB is 75 mm long .It's Fv and Tv measure 50 mm & 60 mm long respectively.
End A is 10 mm above Hp and 15 mm in front of Vp. Draw projections of line AB
if end B is in first quadrant.Find angle with Hp and Vp.

SOLUTION STEPS:

1. Draw xy line and one projector.
2. Locate a' 10 mm above xy and a 15 mm below xy line.
3. Draw locus from these points.
4. Cut 60mm distance on locus of a' & mark $1'$ on it as it is LTV.
5. Similarly cut 50mm on locus of a and mark point 1 as it is LfV.
6. From $1'$ draw a vertical line upward and from a' taking TL (75mm) in compass, mark b'_1 point on it. Join $a' b'_1$ points.
7. Draw locus from b'_1
8. With same steps below get b_1 point and draw also locus from it.
9. Now rotating one of the components i.e. $a-1$ locate b' and join a' with it to get Fv.
10. Locate tv similarly and measure Angles θ & Φ



PROBLEM 5 :-

T.V. of a 75 mm long Line CD, measures 50 mm.

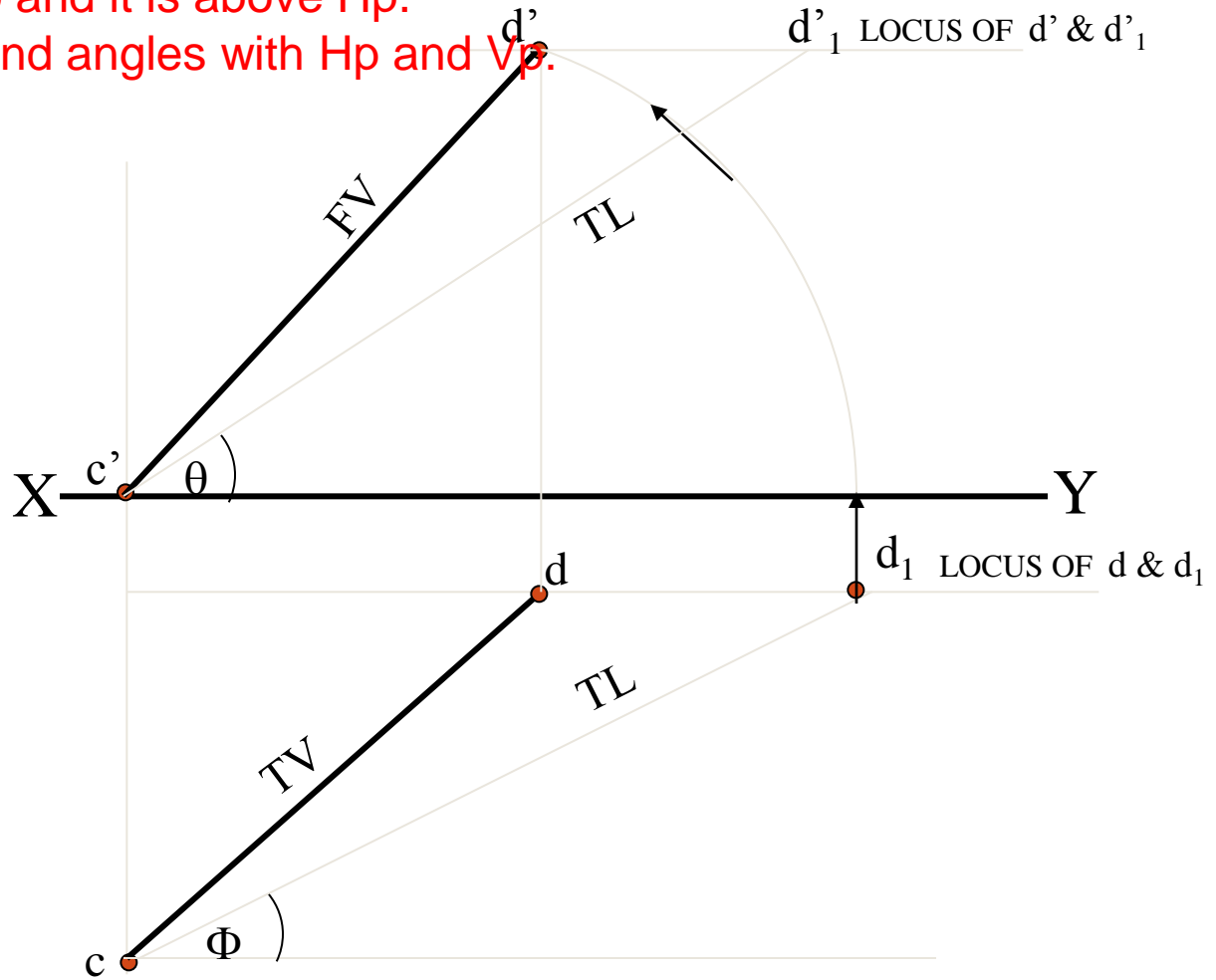
End C is in Hp and 50 mm in front of Vp.

End D is 15 mm in front of Vp and it is above Hp.

Draw projections of CD and find angles with Hp and Vp.

SOLUTION STEPS:

1. Draw xy line and one projector.
2. Locate c' on xy and c 50mm below xy line.
3. Draw locus from these points.
4. Draw locus of d 15 mm below xy
5. Cut 50mm & 75 mm distances on locus of d from c and mark points d & d_1 as these are Tv and line CD lengths resp. & join both with c .
6. From d_1 draw a vertical line upward up to xy i.e. up to locus of c' and draw an arc as shown.
7. Then draw one projector from d to meet this arc in d' point & join c' d'
8. Draw locus of d' and cut 75 mm on it from c' as TL
9. Measure Angles θ & Φ



GROUP (B)

PROBLEMS INVOLVING TRACES OF THE LINE.

TRACES OF THE LINE:-

THESE ARE THE POINTS OF INTERSECTIONS OF A LINE (OR IT'S EXTENSION) WITH RESPECTIVE REFERENCE PLANES.

A LINE ITSELF OR IT'S EXTENSION, WHERE EVER TOUCHES H.P., THAT POINT IS CALLED TRACE OF THE LINE ON H.P.(IT IS CALLED H.T.)

SIMILARLY, A LINE ITSELF OR IT'S EXTENSION, WHERE EVER TOUCHES V.P., THAT POINT IS CALLED TRACE OF THE LINE ON V.P.(IT IS CALLED V.T.)

V.T.:- It is a point on V_p .
Hence it is called F_v of a point in V_p .
Hence it's T_v comes on XY line.(Here onward named as V)

H.T.:- It is a point on H_p .
Hence it is called T_v of a point in H_p .
Hence it's F_v comes on XY line.(Here onward named as 'h')

STEPS TO LOCATE HT.

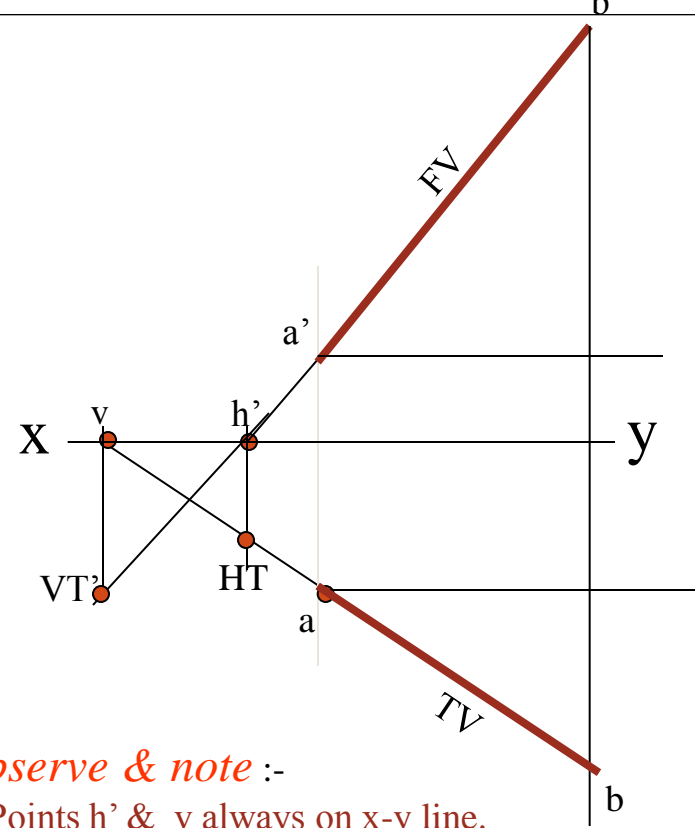
(WHEN PROJECTIONS ARE GIVEN.)

1. Begin with FV. Extend FV up to XY line.
2. Name this point h'
(as it is a Fv of a point in Hp)
3. Draw one projector from h' .
4. Now extend Tv to meet this projector.
This point is HT

STEPS TO LOCATE VT.

(WHEN PROJECTIONS ARE GIVEN.)

1. Begin with TV. Extend TV up to XY line.
2. Name this point v
(as it is a Tv of a point in Vp)
3. Draw one projector from v .
4. Now extend Fv to meet this projector.
This point is VT



Observe & note :-

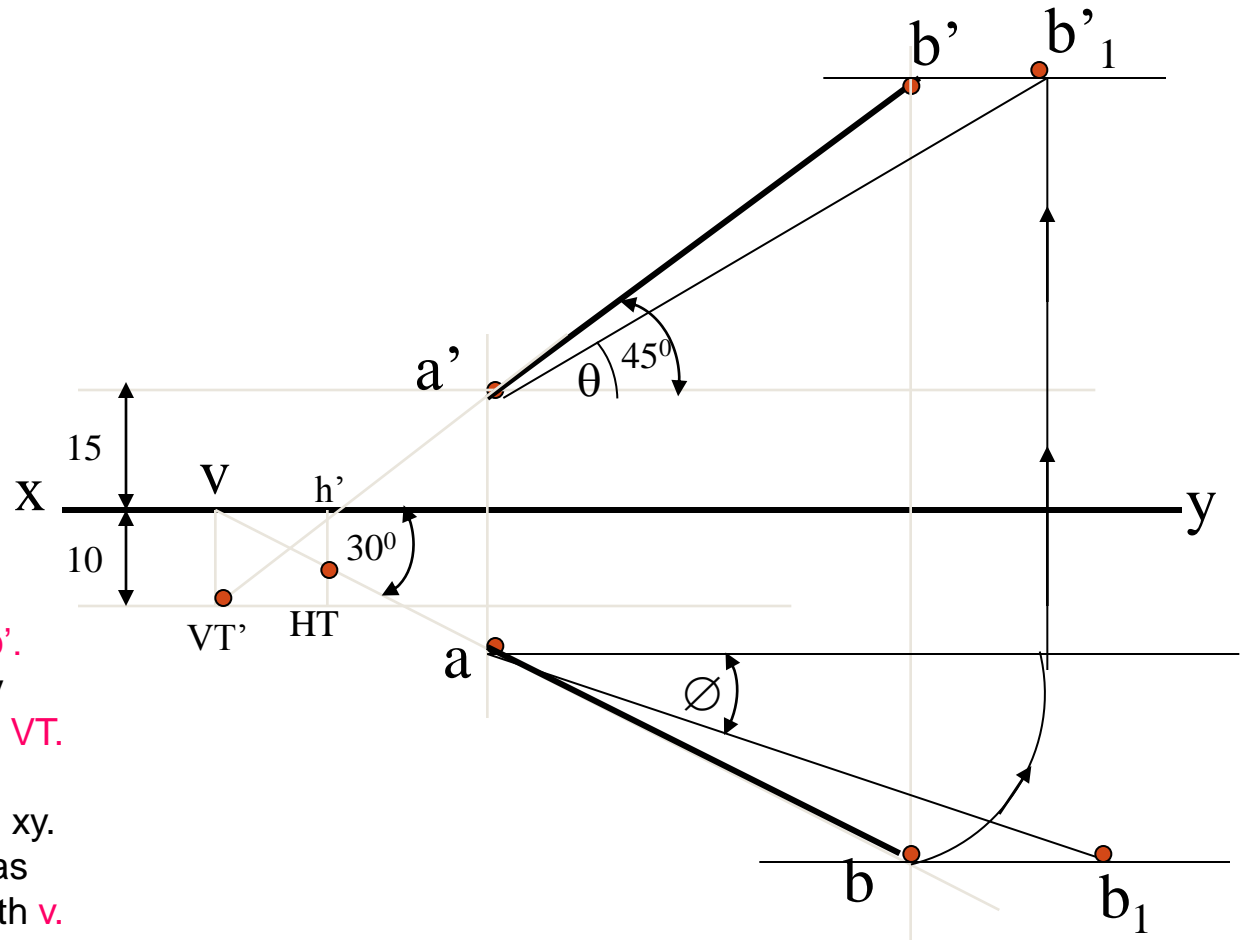
1. Points h' & v always on x-y line.
2. vt' & v always on one projector.
3. ht & h' always on one projector.
4. $FV - h' - vt'$ always co-linear.
5. $TV - v - ht$ always co-linear.

These points are used to solve next three problems.

PROBLEM 6 :- Fv of line AB makes 45° angle with XY line and measures 60 mm. Line's Tv makes 30° with XY line. End A is 15 mm above Hp and it's VT is 10 mm below Hp. Draw projections of line AB, determine inclinations with Hp & Vp and locate HT, VT.

SOLUTION STEPS:-

Draw xy line, one projector and locate fv a' 15 mm above xy. Take 45° angle from a' and marking 60 mm on it locate point b' . Draw locus of VT, 10 mm below xy & extending Fv to this locus locate VT. as $fv-h'-vt'$ lie on one st.line. Draw projector from vt, locate v on xy. From v take 30° angle downward as Tv and it's inclination can begin with v. Draw projector from b' and locate b i.e. Tv point. Now rotating views as usual TL and it's inclinations can be found. Name extension of Fv, touching xy as h' and below it, on extension of Tv, locate HT.

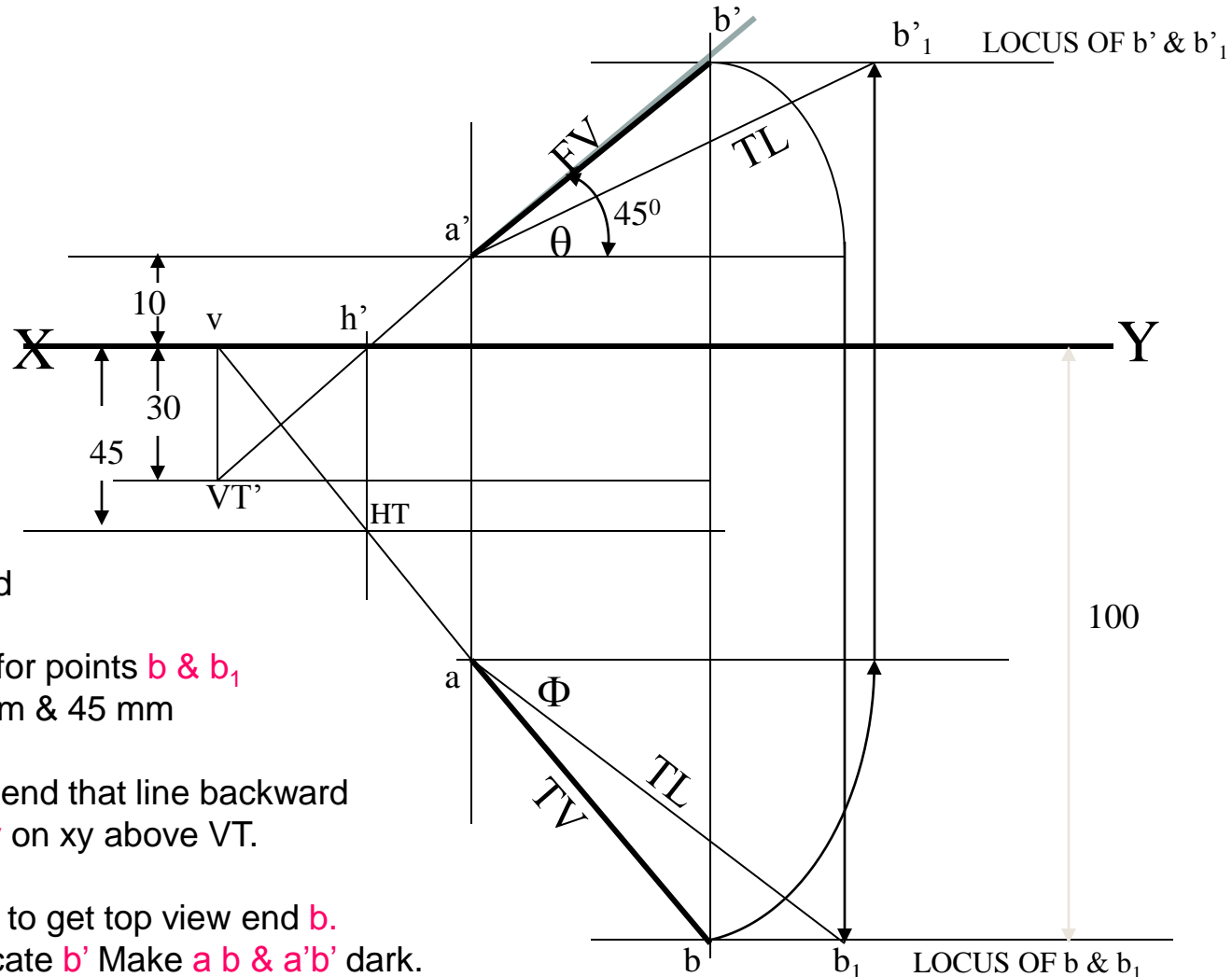


PROBLEM 7 :

One end of line AB is 10mm above Hp and other end is 100 mm in-front of Vp.

It's Fv is 45° inclined to xy while it's HT & VT are 45mm and 30 mm below xy respectively.

Draw projections and find TL with it's inclinations with Hp & VP.



SOLUTION STEPS:-

Draw xy line, one projector and locate a' 10 mm above xy.

Draw locus 100 mm below xy for points b & b_1

Draw loci for VT and HT, 30 mm & 45 mm below xy respectively.

Take 45° angle from a' and extend that line backward to locate h' and VT, & Locate v on xy above VT.

Locate HT below h' as shown.

Then join $v - HT -$ and extend to get top view end b .

Draw projector upward and locate b' Make ab & $a'b'$ dark.

Now as usual rotating views find TL and it's inclinations.

THANK YOU