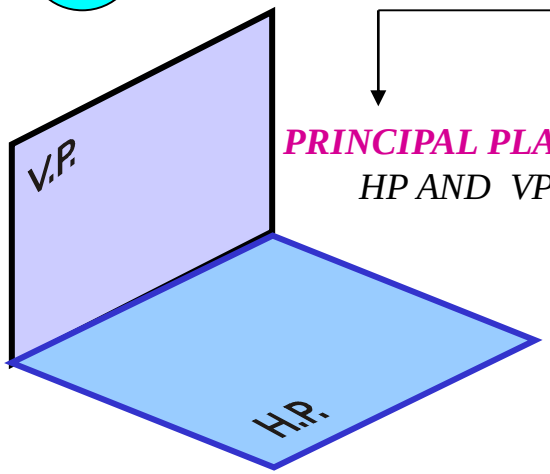
CE111: Engineering Drawing

Lecture 10:

Projection of Planes

1

PLANES

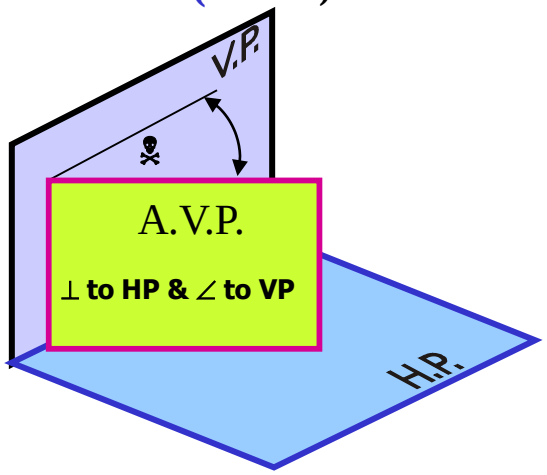


PRINCIPAL PLANES

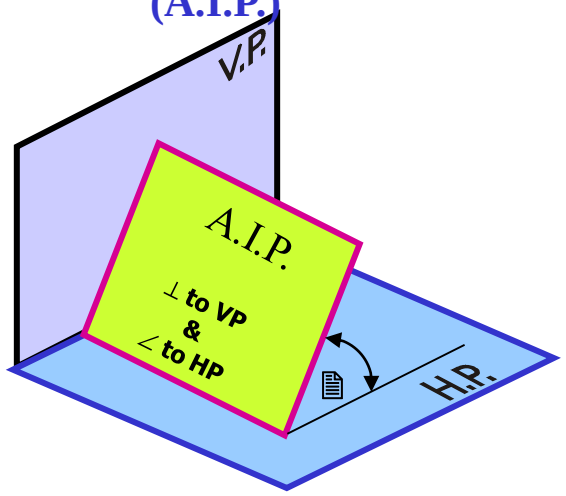
HP AND VP

AUXILIARY PLANES

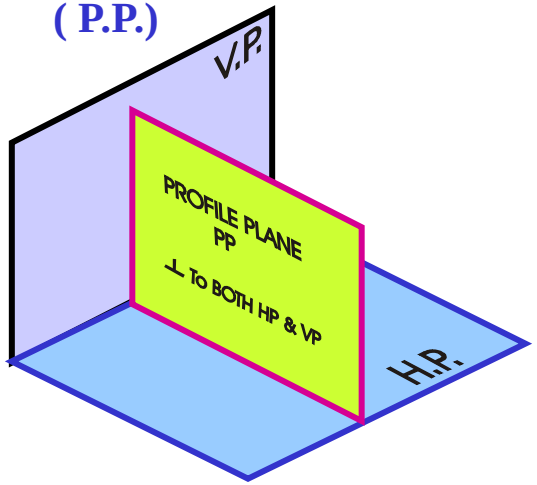
Auxiliary Vertical Plane (A.V.P.)



Auxiliary Inclined Plane (A.I.P.)

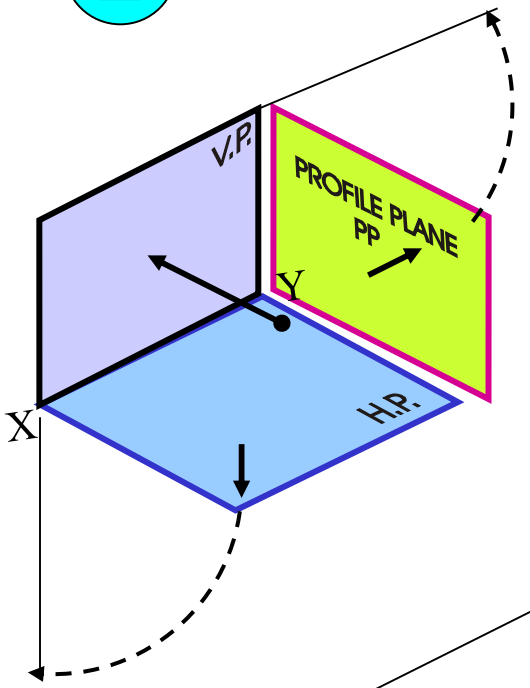


Profile Plane (P.P.)



2

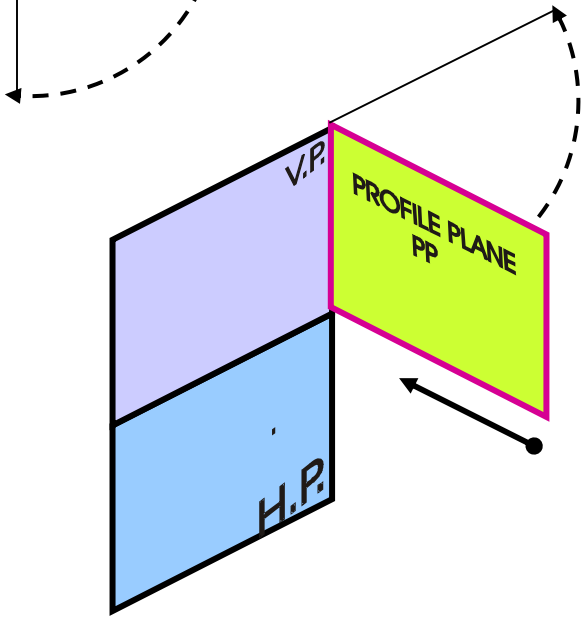
PATTERN OF PLANES & VIEWS (First Angle Method)



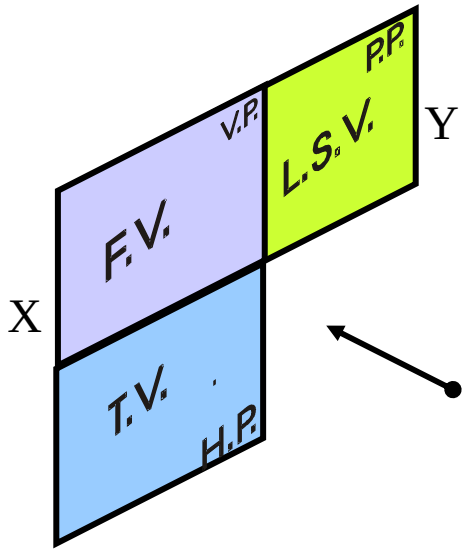
THIS IS A PICTORIAL SET-UP OF ALL THREE PLANES.
ARROW DIRECTION IS A NORMAL WAY OF OBSERVING THE OBJECT.
BUT IN THIS DIRECTION ONLY VP AND A VIEW ON IT (FV) CAN BE SEEN.
THE OTHER PLANES AND VIEWS ON THOSE CAN NOT BE SEEN.

PROCEDURE TO SOLVE ABOVE PROBLEM:-

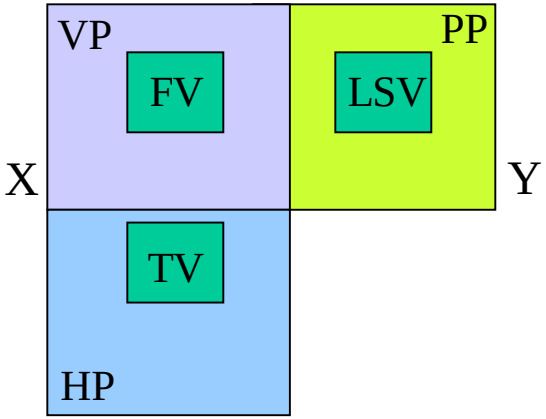
TO MAKE THOSE PLANES ALSO VISIBLE FROM THE ARROW DIRECTION,
A) HP IS ROTATED 90^0 DOUNWARD
B) PP, 90^0 IN RIGHT SIDE DIRECTION.
THIS WAY BOTH PLANES ARE BROUGHT IN THE SAME PLANE CONTAINING VP.



HP IS ROTATED DOWNWARD 90^0
AND
BROUGHT IN THE PLANE OF VP.

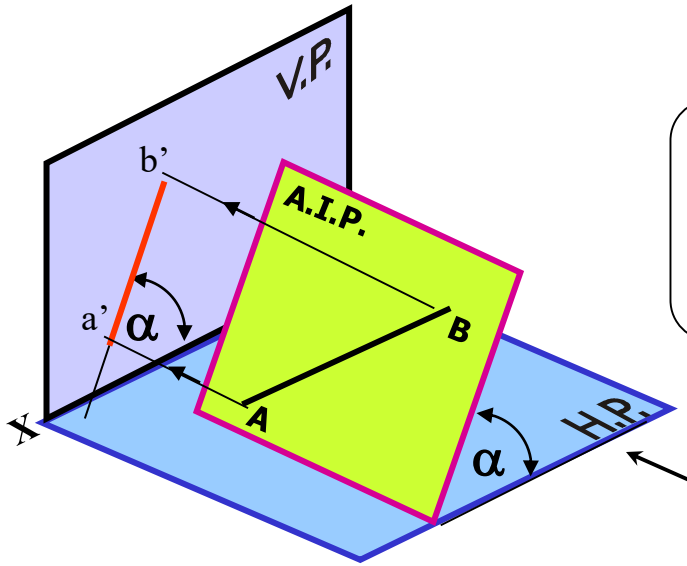


PP IS ROTATED IN RIGHT SIDE 90^0
AND
BROUGHT IN THE PLANE OF VP.

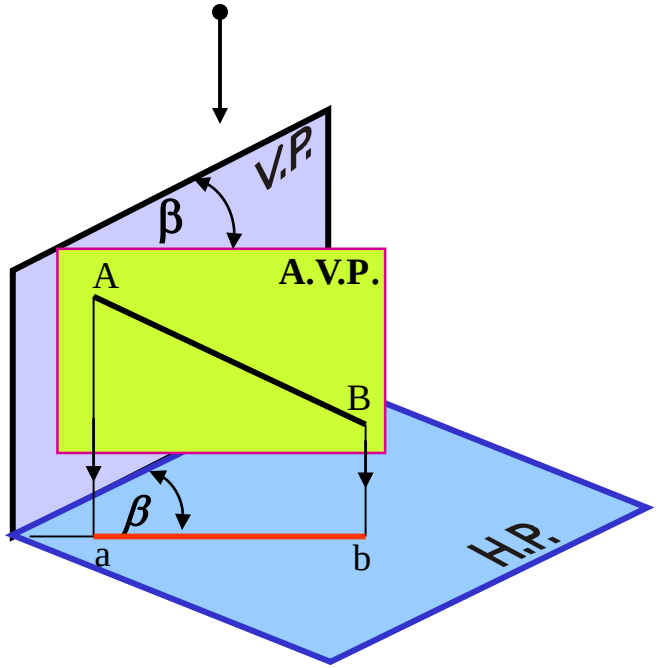


ACTUAL PATTERN OF PLANES & VIEWS
OF ORTHOGRAPHIC PROJECTIONS
DRAWN IN
FIRST ANGLE METHOD OF PROJECTIONS

GROUP (C)
CASES OF THE LINES IN A.V.P., A.I.P. & PROFILE PLANE.

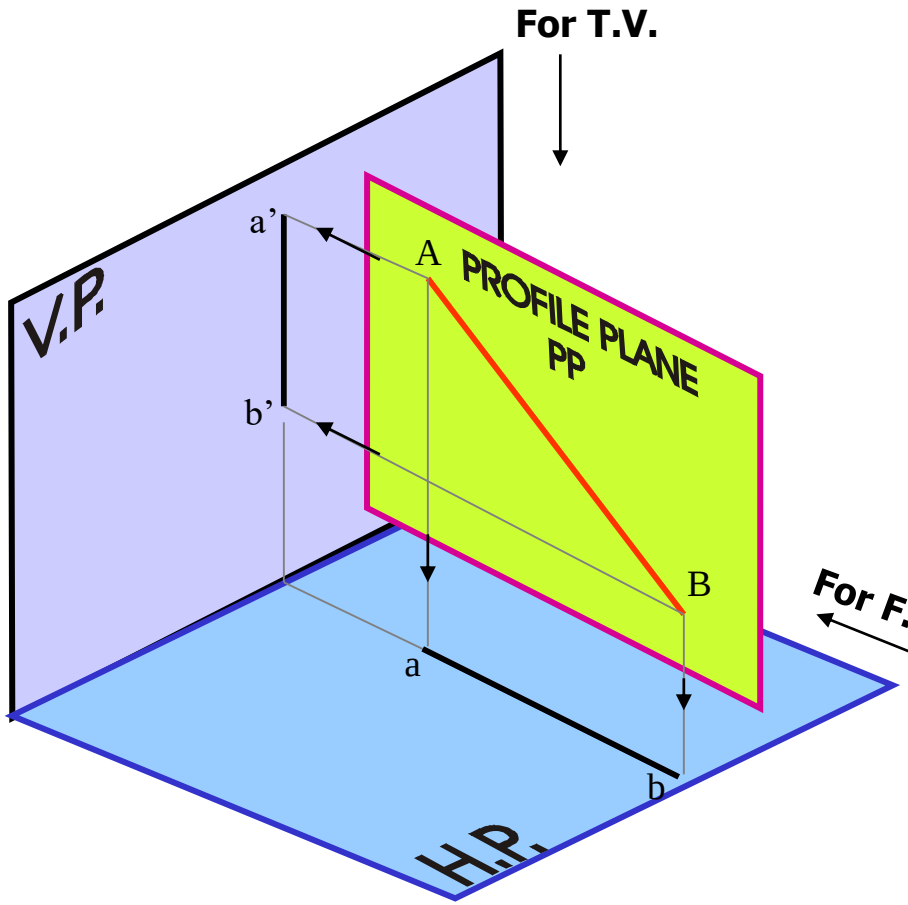


Line AB is in AIP as shown in figure no 1.
It's FV (a'b') is shown projected on VP.(Looking in arrow direction)
Here one can clearly see that the
Inclination of AIP with HP = Inclination of FV with XY line

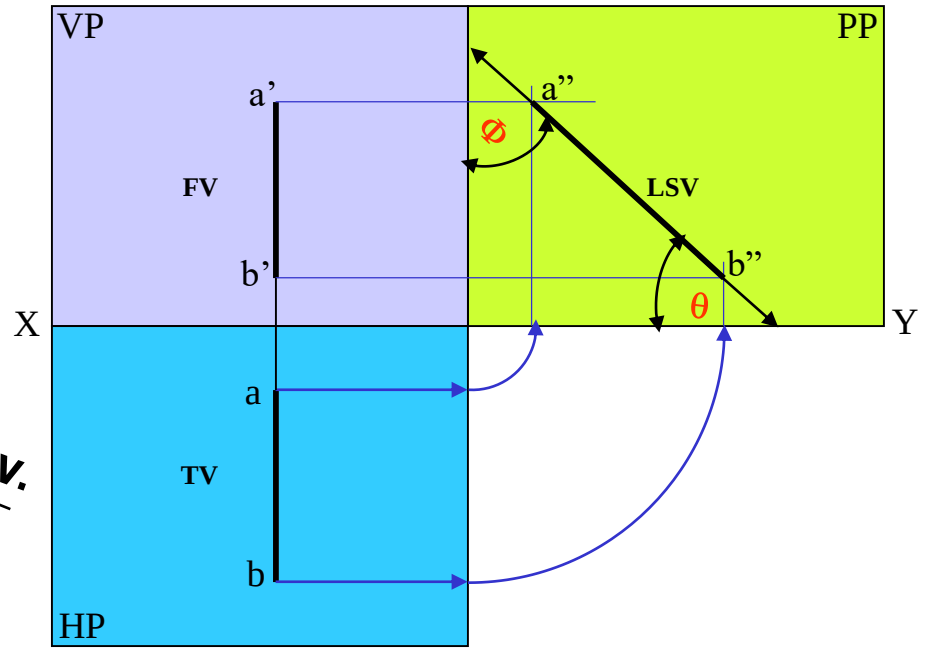


Line AB is in AVP as shown in above figure no 2..
It's TV (a b) is shown projected on HP.(Looking in arrow direction)
Here one can clearly see that the
Inclination of AVP with VP = Inclination of TV with XY line

LINE IN A PROFILE PLANE (MEANS IN A PLANE PERPENDICULAR TO BOTH HP & VP)



ORTHOGRAPHIC PATTERN OF LINE IN PROFILE PLANE



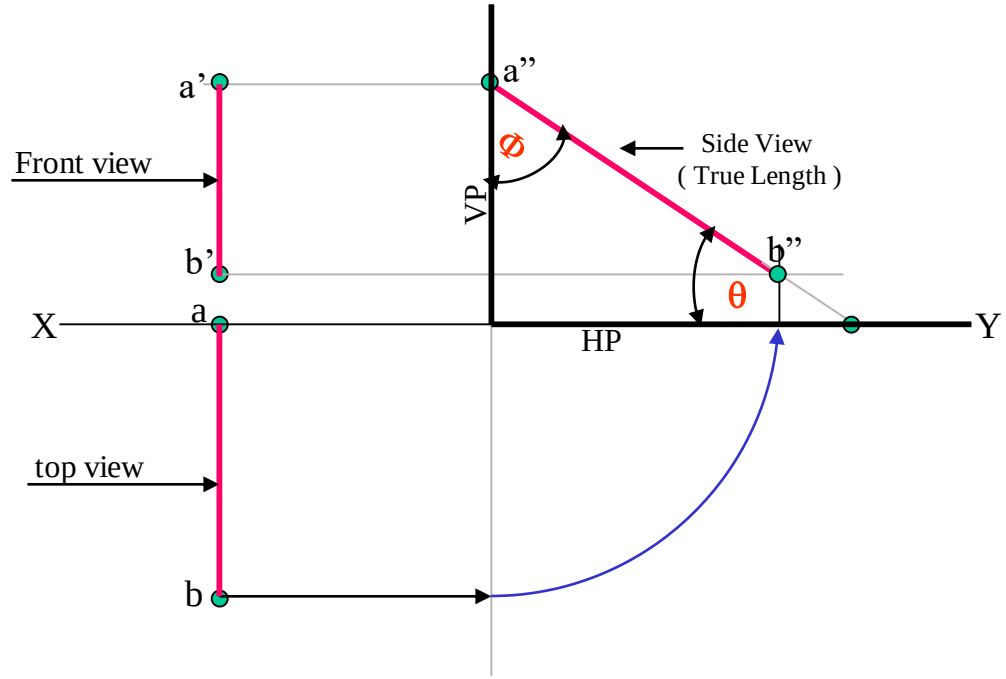
Results:-

1. TV & FV both are vertical, hence arrive on one single projector.
2. It's Side View shows True Length (TL)
3. Sum of it's inclinations with HP & VP equals to 90^0 ($\theta + \Phi = 90^0$)

PROBLEM :- A line AB, 75mm long, has one end A in VP. Other end B is 15 mm above HP and 50 mm in front of VP. Draw the projections of the line when sum of it's Inclinations with HP & VP is 90^0, means it is lying in a profile plane.
Find true angles with ref. planes.

SOLUTION STEPS:-

After drawing xy line and one projector
Locate top view of A i.e. point a on xy as
It is in VP,
Locate FV of B i.e. b'15 mm above xy as
it is above HP and TV of B i.e. b, 50 mm
below xy as it is 50 mm in front of VP
Draw side view structure of VP and HP
and locate SV of point B i.e. b''
From this point cut 75 mm distance on VP and
Mark a'' as A is in VP. From this point draw locus to
left & get a',
Extend SV up to HP. As it is a TV
Rotate it and bring it on projector of b.
Now as discussed earlier SV gives TL of line
and at the same time on extension up to HP & VP
gives inclinations with those panes.



Plane surface (plane/lamina/plate)

- A two dimensional surface having length and breadth with negligible thickness.
- Is formed when any three non-collinear points are joined.
- Is bounded by straight/curved lines and may be either a regular figure or an irregular figure.
- **Regular plane surface** - all the sides are equal.
- **Irregular plane surface** - sides will be unequal

Positioning of a Plane surface

A plane surface may be positioned in space with reference to the three principal planes of projection in any of the following positions:

1. Parallel to one of the principal planes and perpendicular to the other two.
2. Perpendicular to one of the principal planes and inclined to the other two.
3. Inclined to all the three principal planes.

Projections of a Plane surface

- A plane surface held parallel to a plane of projection – it will be perpendicular to the other two planes of projection.
  - The view of the plane surface projected on the plane of projection to which it will be perpendicular will be a line, called the line view of a plane surface.
  - When a plane surface is held with its surface parallel to one of the planes of projection, the view of the plane surface projected on it will be in true shape because all the sides or the edges of the plane surface will be parallel to the plane of projection on which the plane surface is projected.
- A plane surface inclined to a plane of projection - the view of the plane surface projected on it will be in apparent shape, called apparent shape view of the plane surface.

PROJECTIONS OF PLANES

In this topic various plane figures are the objects.

What is usually asked in the problem?

To draw their projections means F.V, T.V. & S.V.

What will be given in the problem?

1. Description of the plane figure.
2. It's position with HP and VP.

In which manner it's position with HP & VP will be described?

1. **Inclination of it's SURFACE with one of the reference planes will be given.**
2. Inclination of one of it's EDGES with other reference plane will be given

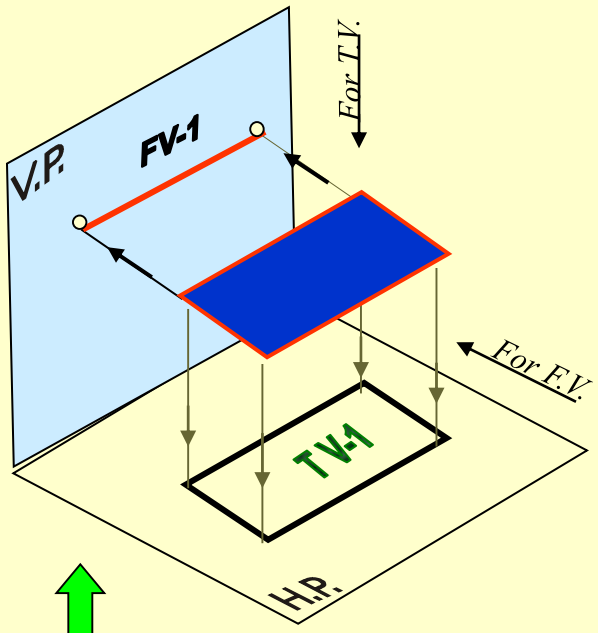
(Hence this will be a case of an object inclined to both reference Planes.)

Study the illustration showing surface & side inclination given on next page.

CASE OF A RECTANGLE – OBSERVE AND NOTE ALL STEPS.

SURFACE **PARALLEL** TO HP

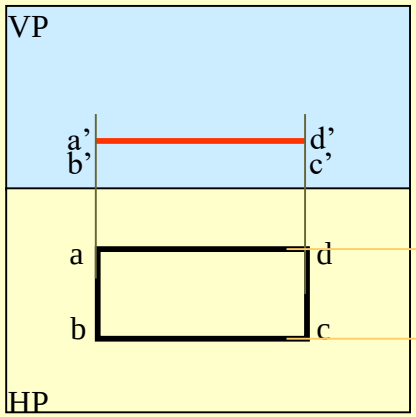
PICTORIAL PRESENTATION



ORTHOGRAPHIC

TV-True Shape

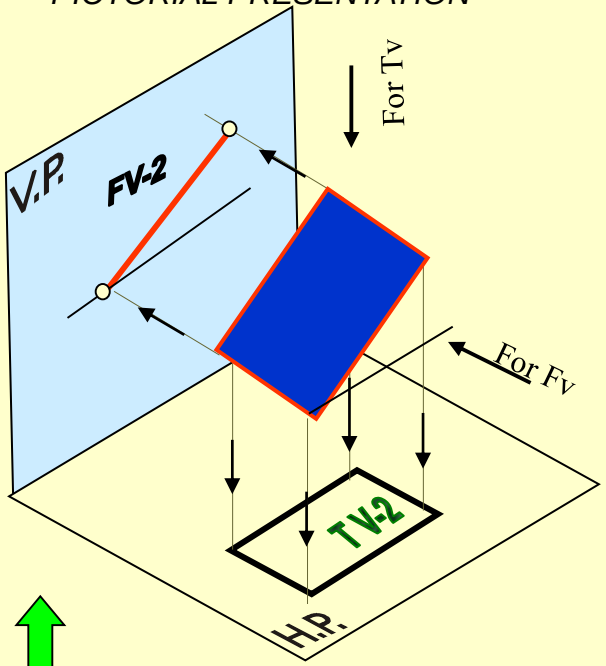
FV- Line // to xy



A

SURFACE **INCLINED** TO HP

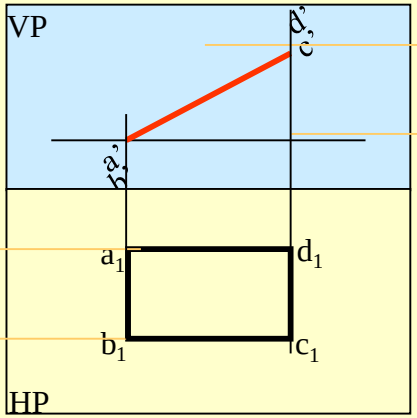
PICTORIAL PRESENTATION



ORTHOGRAPHIC

FV- Inclined to XY

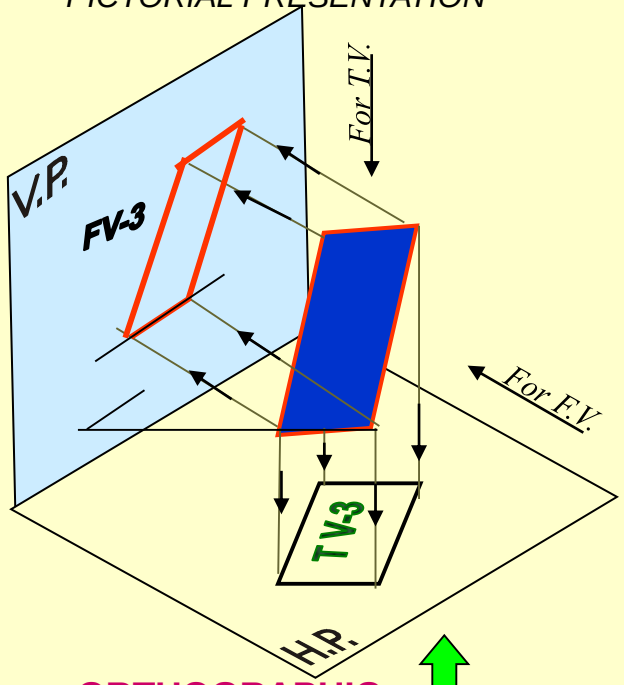
TV- Reduced Shape



B

ONE SMALL SIDE INCLINED TO VP

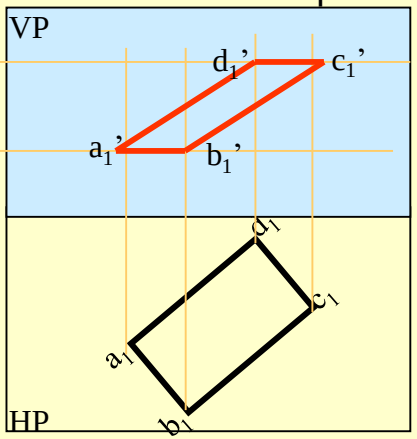
PICTORIAL PRESENTATION



ORTHOGRAPHIC

FV- Apparent Shape

TV-Previous Shape



C

PROCEDURE OF SOLVING THE PROBLEM:

IN THREE STEPS EACH PROBLEM CAN BE SOLVED: **(As Shown In Previous Illustration)**

STEP 1. Assume suitable conditions & draw Fv & Tv of initial position.

STEP 2. Now consider surface inclination & draw 2nd Fv & Tv.

STEP 3. After this,consider side/edge inclination and draw 3rd (final) Fv & Tv.

ASSUMPTIONS FOR INITIAL POSITION:

(Initial Position means assuming surface // to HP or VP)

1.If in problem surface is inclined to HP – assume it // HP

Or If surface is inclined to VP – assume it // to VP

2. Now if surface is assumed // to HP- It's TV will show True Shape.

And If surface is assumed // to VP – It's FV will show True Shape.

3. Hence begin with drawing TV or FV as True Shape.

4. While drawing this True Shape –

keep one side/edge (which is making inclination) perpendicular to xy line

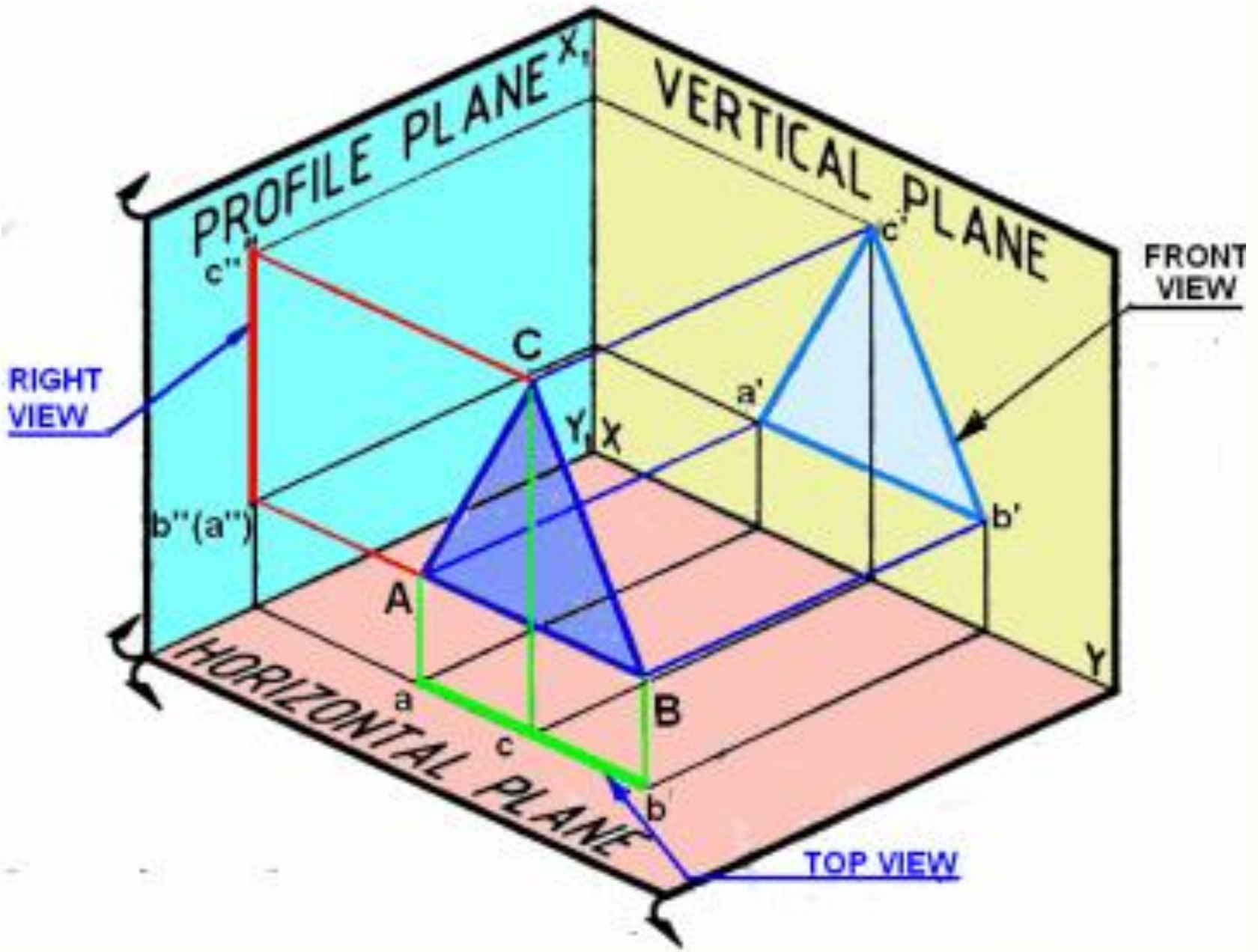
(similar to pair no. A on previous page illustration).

Now Complete STEP 2. By making surface inclined to the resp plane & project it's other view.

(Ref. 2nd pair B ***on previous page illustration***)

Now Complete STEP 3. By making side inclined to the resp plane & project it's other view.

(Ref. 3nd pair C ***on previous page illustration***)

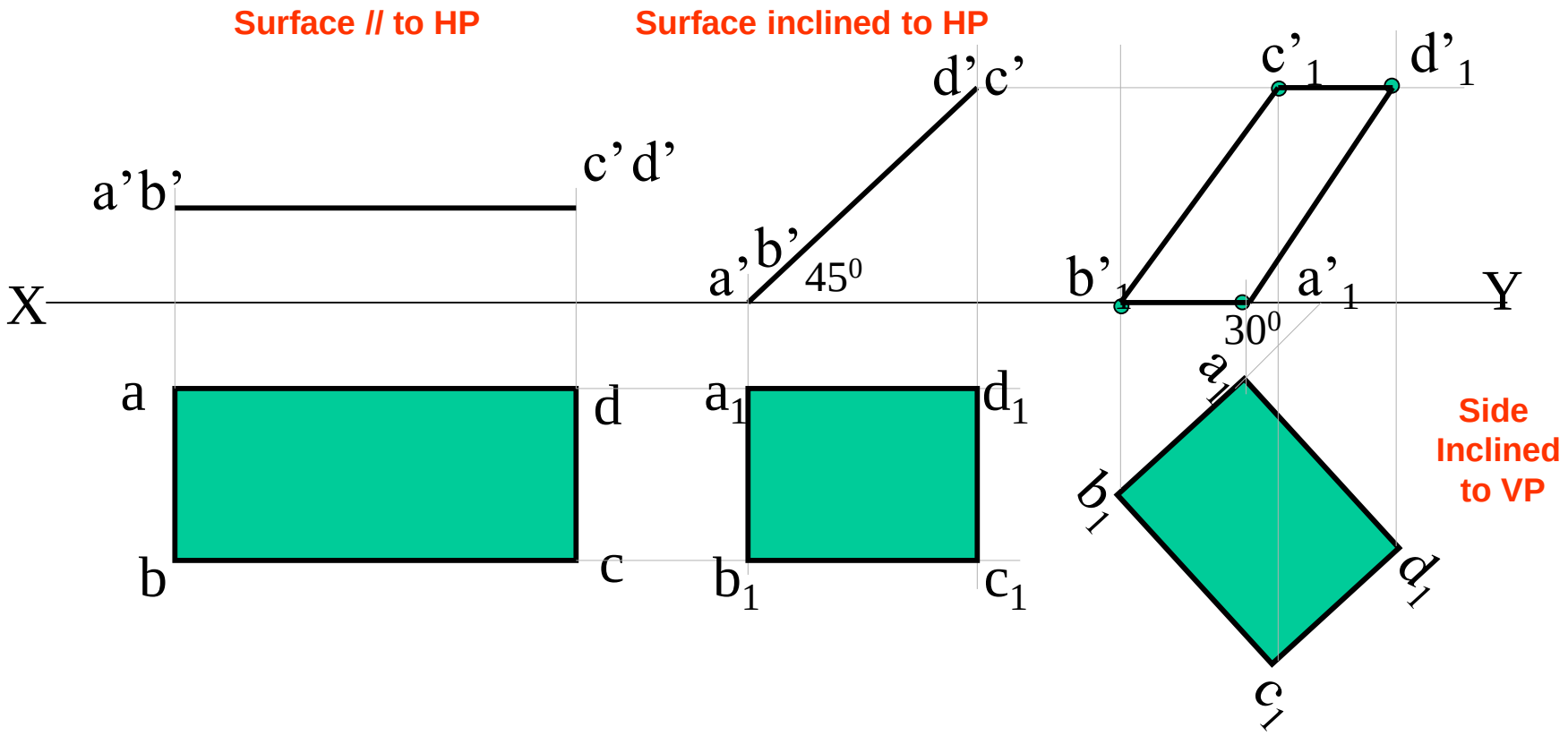

PROFILE PLANE
VERTICAL PLANE
HORIZONTAL PLANE
X1
RIGHT VIEW
FRONT VIEW
TOP VIEW
c''
C
c'
a'
b'
b''(a'')
A
B
a
c
b
Y1
X
Y

Problem :
Rectangle 30mm and 50mm sides is resting on HP on one small side which is 30^0 inclined to VP, while the surface of the plane makes 45^0 inclination with HP. Draw it's projections.

Read problem and answer following questions

1. Surface inclined to which plane? ------- HP
2. Assumption for initial position? ------// to HP
3. So which view will show True shape? --- TV
4. Which side will be vertical? ---One small side.

Hence begin with TV, draw rectangle below X-Y drawing one small side vertical.

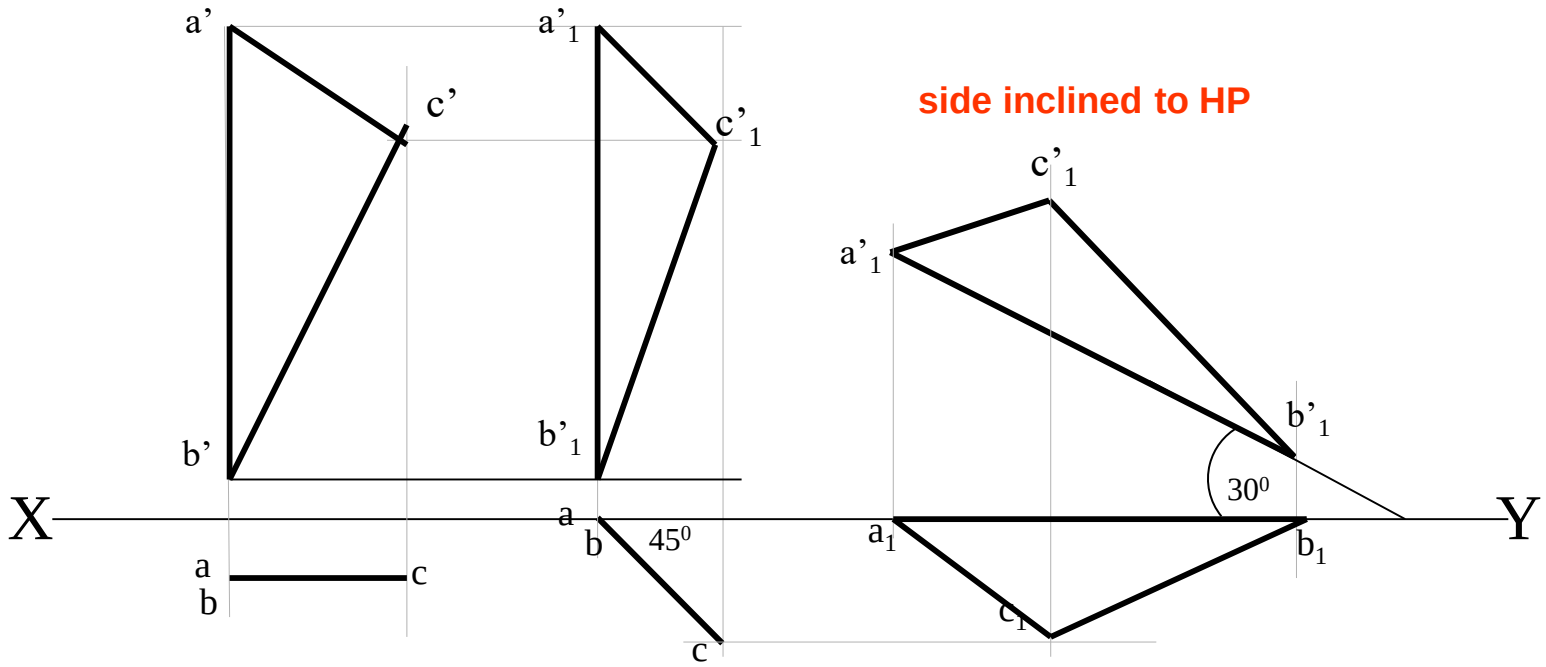


Problem :
A $30^0 – 60^0$ set square of longest side 100 mm long, is in VP and 30^0 inclined to HP while it's surface is 45^0 inclined to VP. Draw it's projections

(Surface & Side inclinations directly given)

Read problem and answer following questions
1 .Surface inclined to which plane? ------- VP
2. Assumption for initial position? ------// to VP
3. So which view will show True shape? --- FV
4. Which side will be vertical? ------longest side.

Hence begin with FV, draw triangle above X-Y keeping longest side vertical.



Surface // to VP **Surface inclined to VP**

Problem 3:

A $30^0 – 60^0$ set square of longest side 100 mm long is in VP and it's surface 45^0 inclined to VP. One end of longest side is 10 mm and other end is 35 mm above HP. Draw it's projections

(Surface inclination directly given. Side inclination indirectly given)

Read problem and answer following questions

1 .Surface inclined to which plane? ------- VP

2. Assumption for initial position? ------// to VP

3. So which view will show True shape? --- FV

4. Which side will be vertical? ------longest side.

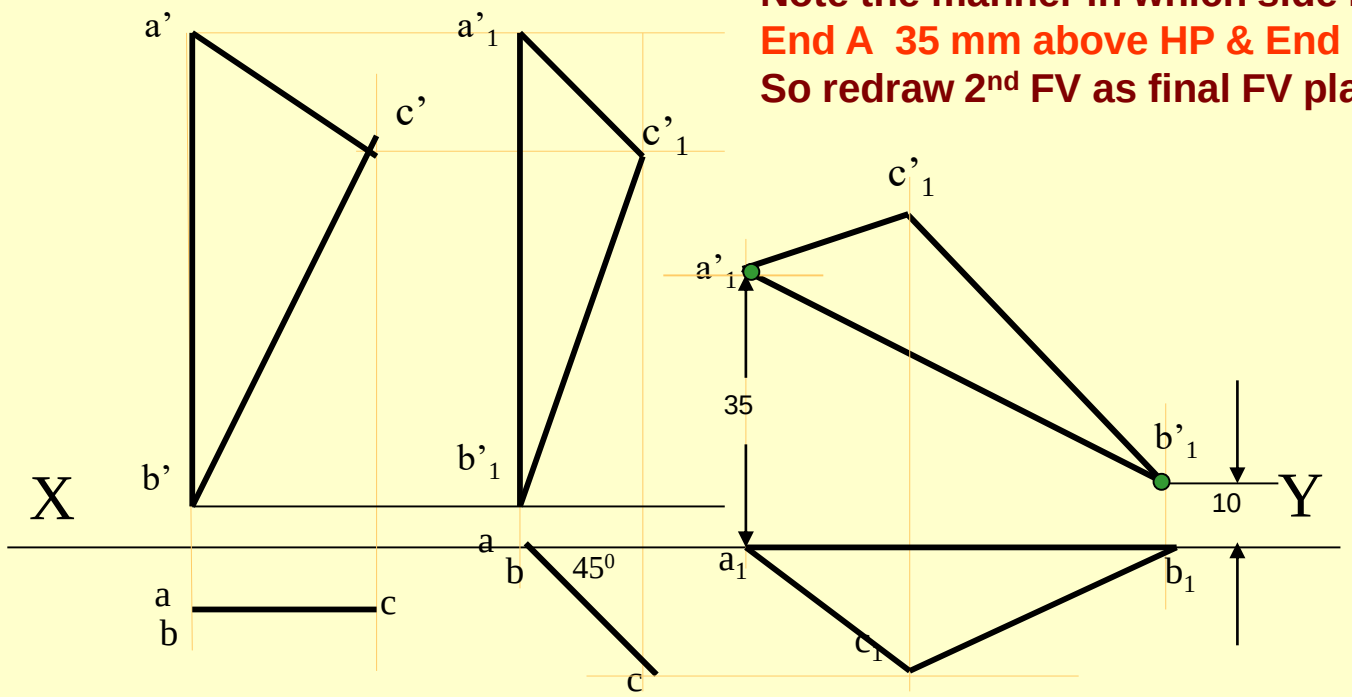
Hence begin with FV, draw triangle above X-Y keeping longest side vertical.

First TWO steps are similar to previous problem.

Note the manner in which side inclination is given.

End A 35 mm above HP & End B is 10 mm above HP.

So redraw 2nd FV as final FV placing these ends as said.



Problem :

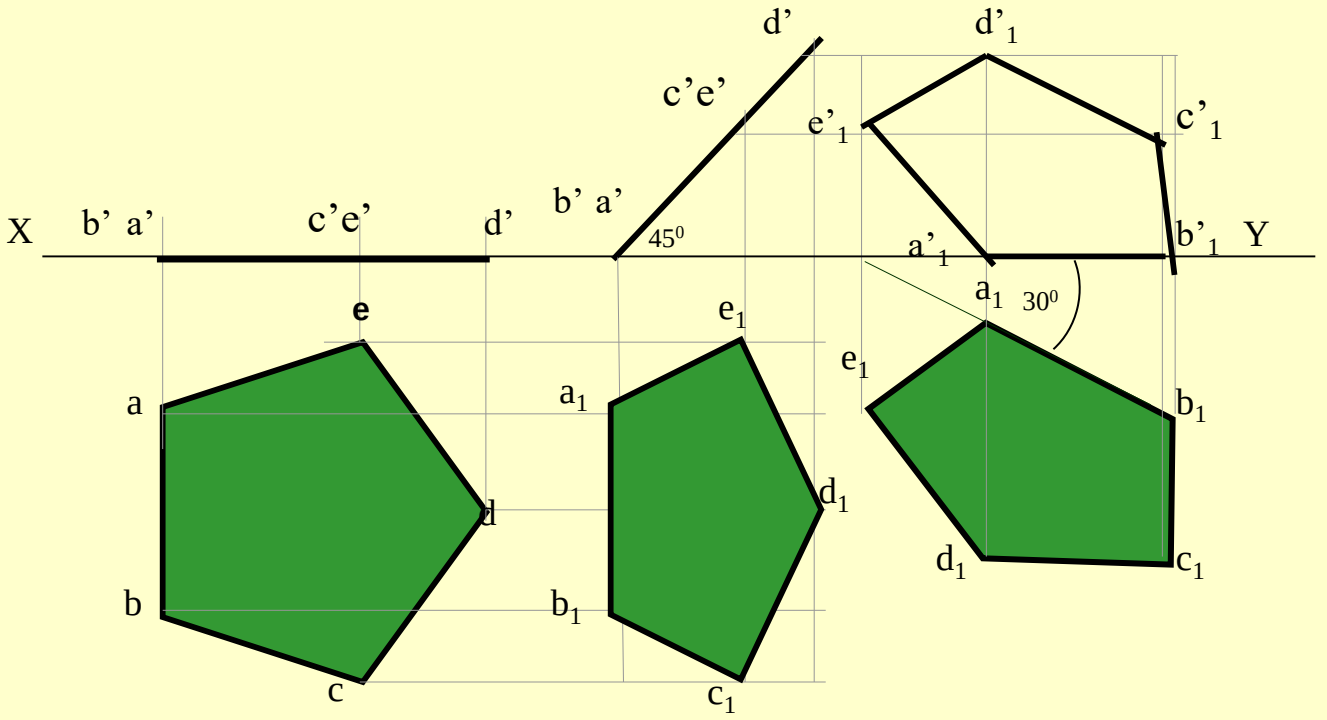
A regular pentagon of 30 mm sides is resting on HP on one of its sides with its surface 45^0 inclined to HP.
Draw its projections when the side in HP makes 30^0 angle with VP

SURFACE AND SIDE INCLINATIONS ARE DIRECTLY GIVEN.

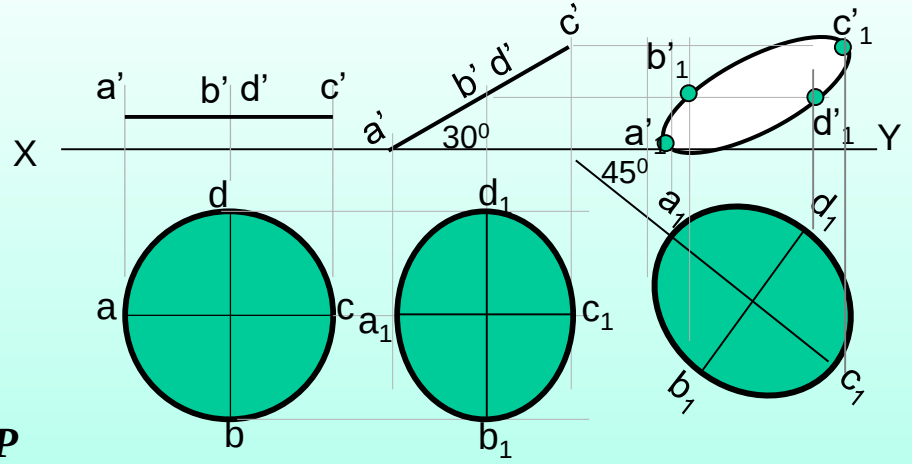
Read problem and answer following questions

1. Surface inclined to which plane? ------- ***HP***
2. Assumption for initial position? ------ ***// to HP***
3. So which view will show True shape? --- ***TV***
4. Which side will be vertical? -------- ***any side.***

Hence begin with TV,draw pentagon below X-Y line, taking one side vertical.



Problem : A circle of 50 mm diameter is resting on HP on end A of its diameter AC which is 30^0 inclined to HP while it's TV is 45^0 inclined to VP. Draw its projections.

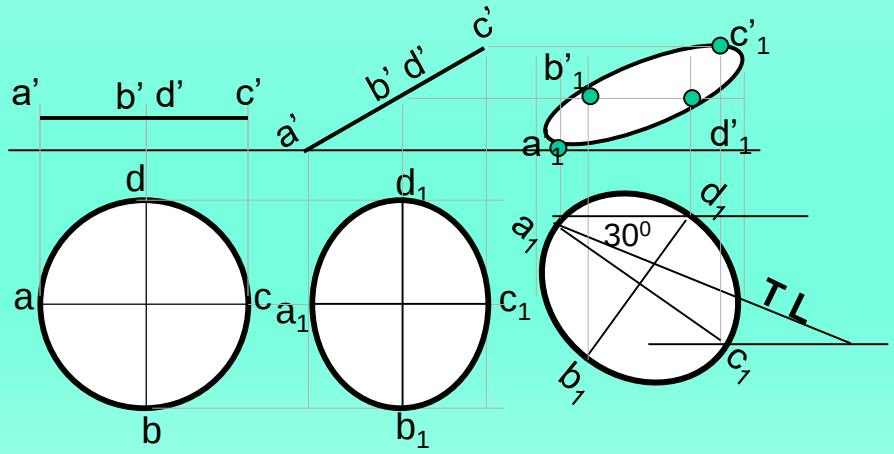


Read problem and answer following questions

1. Surface inclined to which plane? ------- ***HP***
2. Assumption for initial position? ------ ***// to HP***
3. So which view will show True shape? --- ***TV***
4. Which diameter horizontal? ---------- ***AC***

Hence begin with TV,draw rhombus below X-Y line, taking longer diagonal // to X-Y

The difference in these two problems is in step 3 only. In problem no.8 inclination of TV of that AC is given, It could be drawn directly as shown in 3rd step. ***While in no.9 angle of AC itself i.e. it's TL, is given. Hence here angle of TL is taken, locus of c_1 Is drawn and then LTV i.e. a_1 c_1 is marked and final TV was completed. Study illustration carefully.***

Problem : A circle of 50 mm diameter is resting on HP on end A of it's diameter AC which is 30^0 inclined to HP while it makes 45^0 inclined to VP. Draw it's projections.

Note the difference in construction of 3rd step in both solutions.