PROJECTIONS OF PLANES

PROJECTIONS OF PLANES

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.

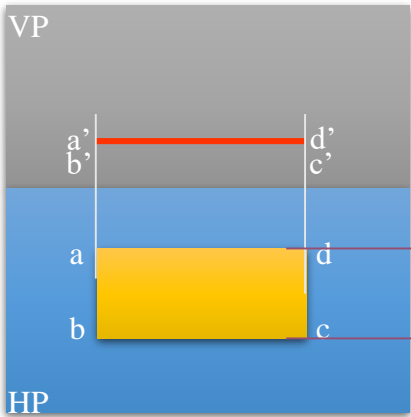**In which manner it's position with HP & VP will be described?**

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.)

CASE OF A RECTANGLE – OBSERVE AND NOTE ALL STEPS.
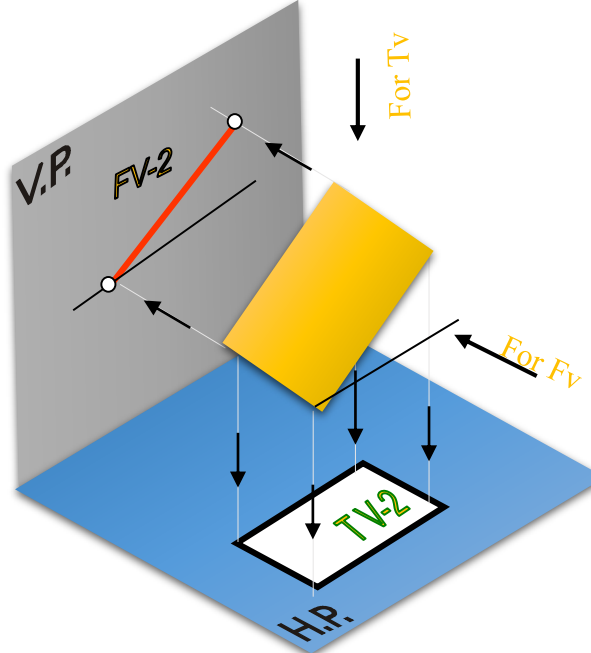
SURFACE **PARALLEL** TO HP
PICTORIAL PRESENTATION

SURFACE **INCLINED** TO HP
PICTORIAL PRESENTATION

ONE SMALL SIDE INCLINED TO VP
PICTORIAL PRESENTATION
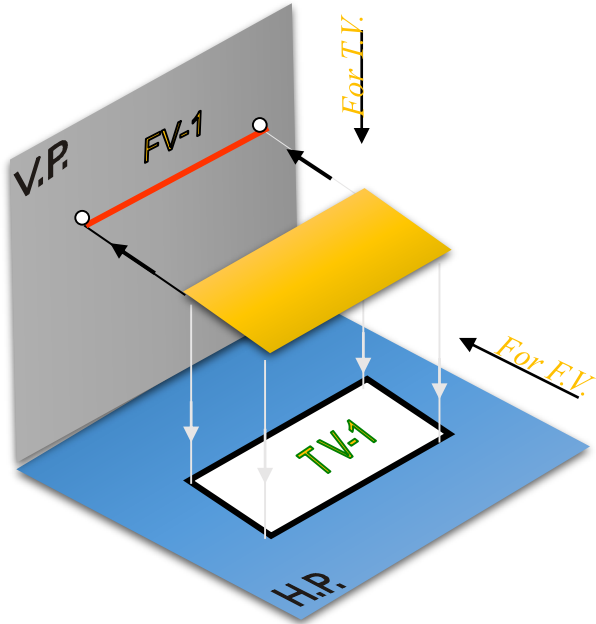
ORTHOGRAPHIC
TV-True Shape
FV- Line // to xy

A

ORTHOGRAPHIC
FV- Inclined to XY
TV- Reduced Shape

B
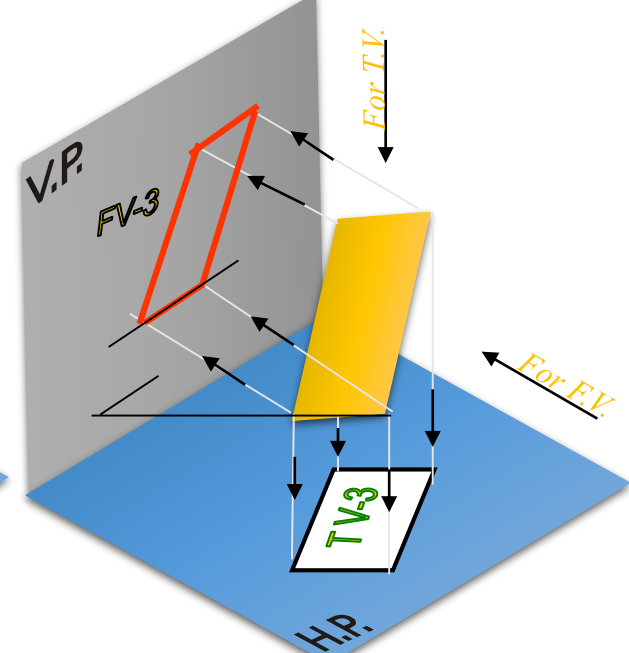
ORTHOGRAPHIC
FV- Apparent Shape
TV-Previous Shape
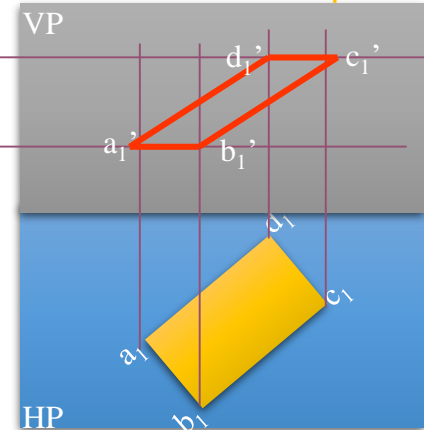
C

PROCEDURE OF SOLVING THE PROBLEM:

IN THREE STEPS EACH PROBLEM CAN BE SOLVED
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.
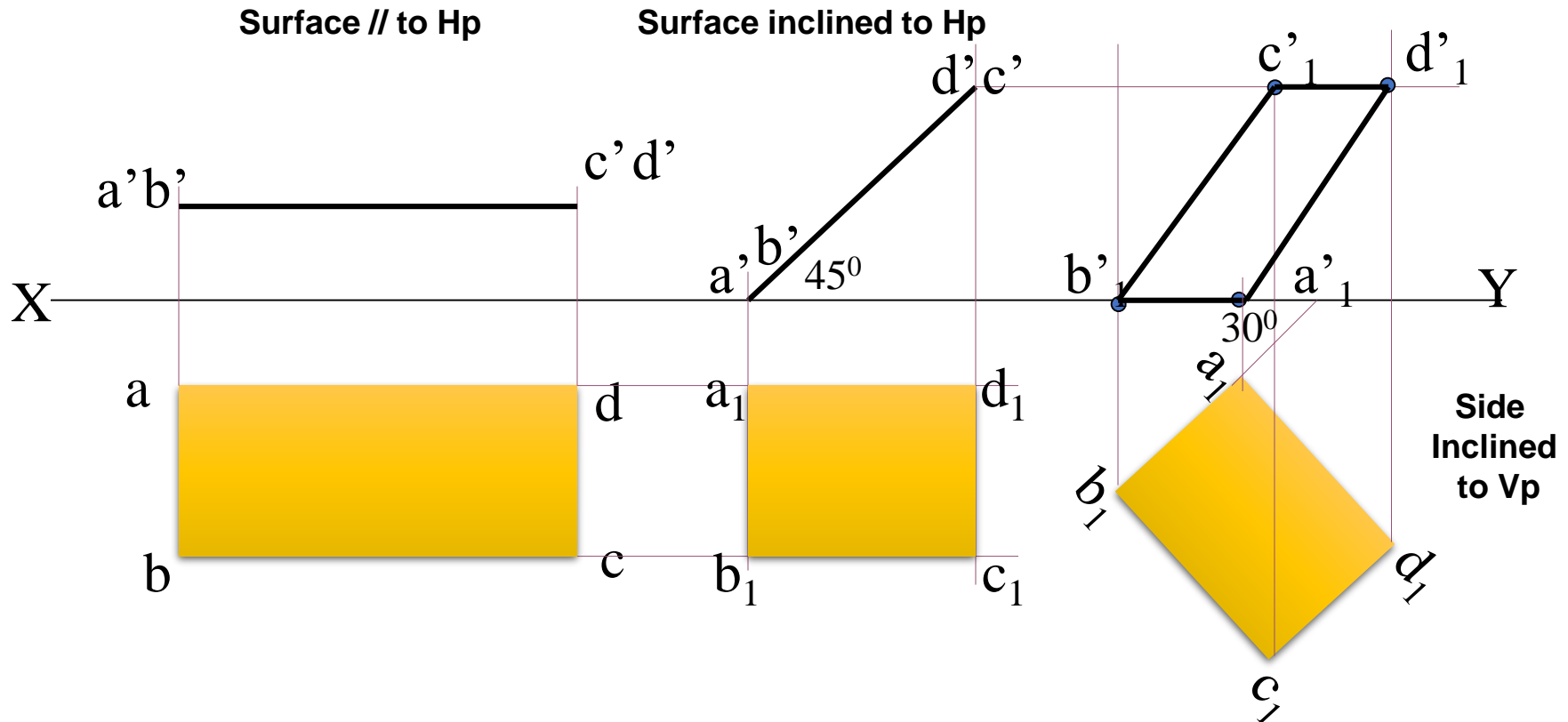*(Ref. 3rd pair   C   on previous page illustration)*

Problem 1:

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.

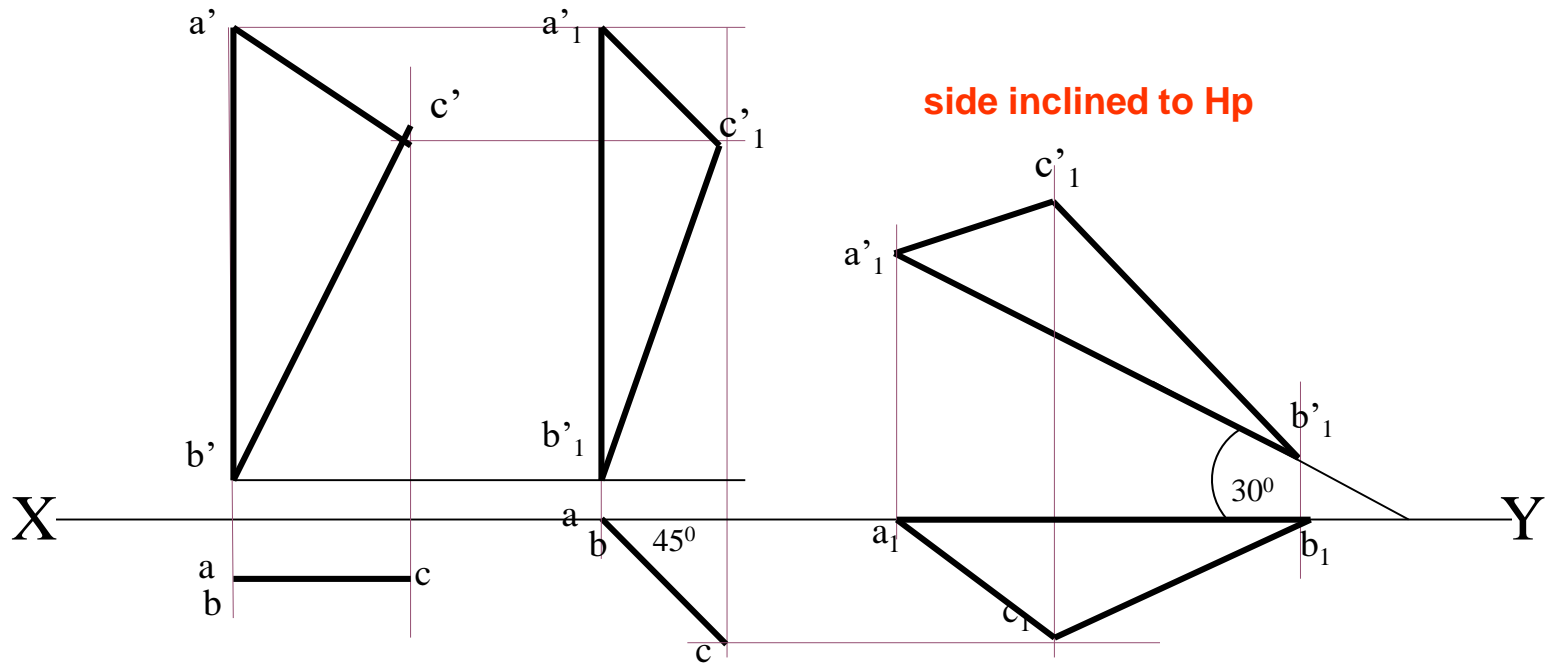**Surface // to Hp**

Surface inclined to Hp

$d'c'$

$c'd'$

$a'b'$

a' b' 45^0

d' c' $_1$ d' $_1$

b' $_1$ a' $_1$

30^0

X $\qquad$ Y

a

d a_1 d_1

a_1

b

c b_1 c_1

b_1

c_1

d_1

Side Inclined to Vp

Problem 2:
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)

__Hence begin with FV, draw triangle above X-Y__
__keeping longest side vertical.__

side inclined to Hp

30^0

45^0

X ——— Y

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
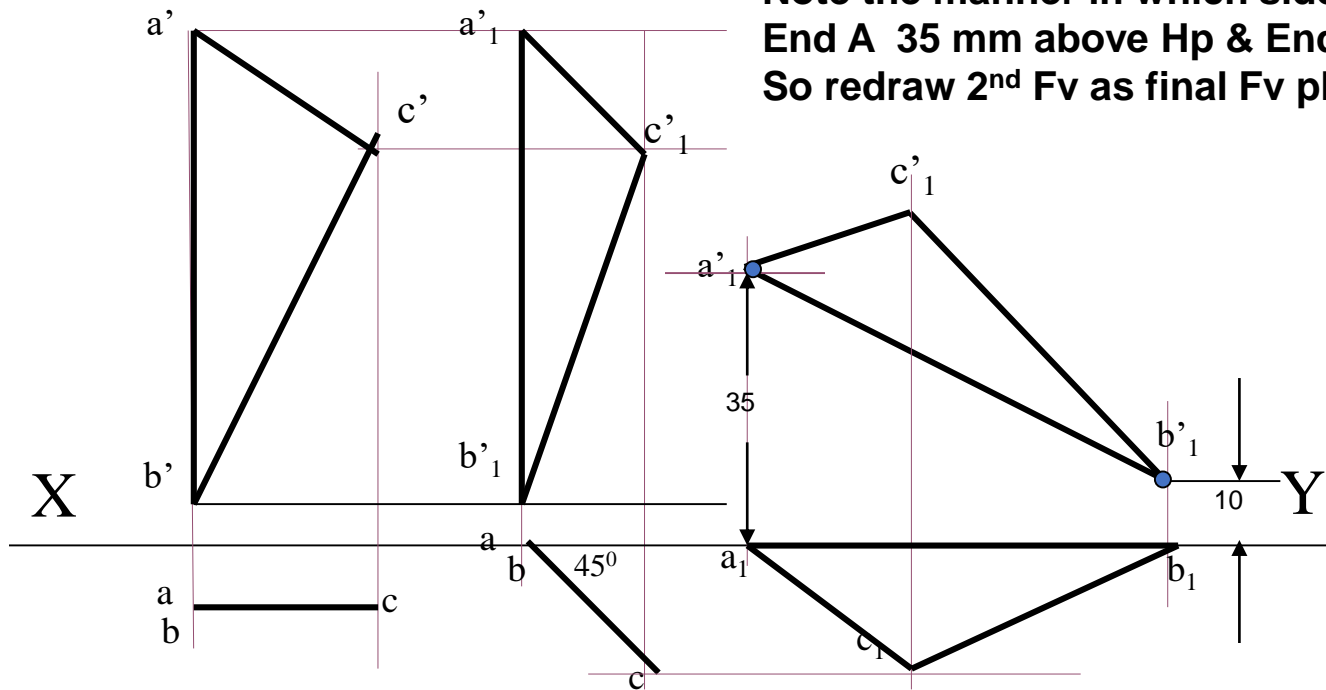
(Surface inclination directly given. Side inclination indirectly given)

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 4:

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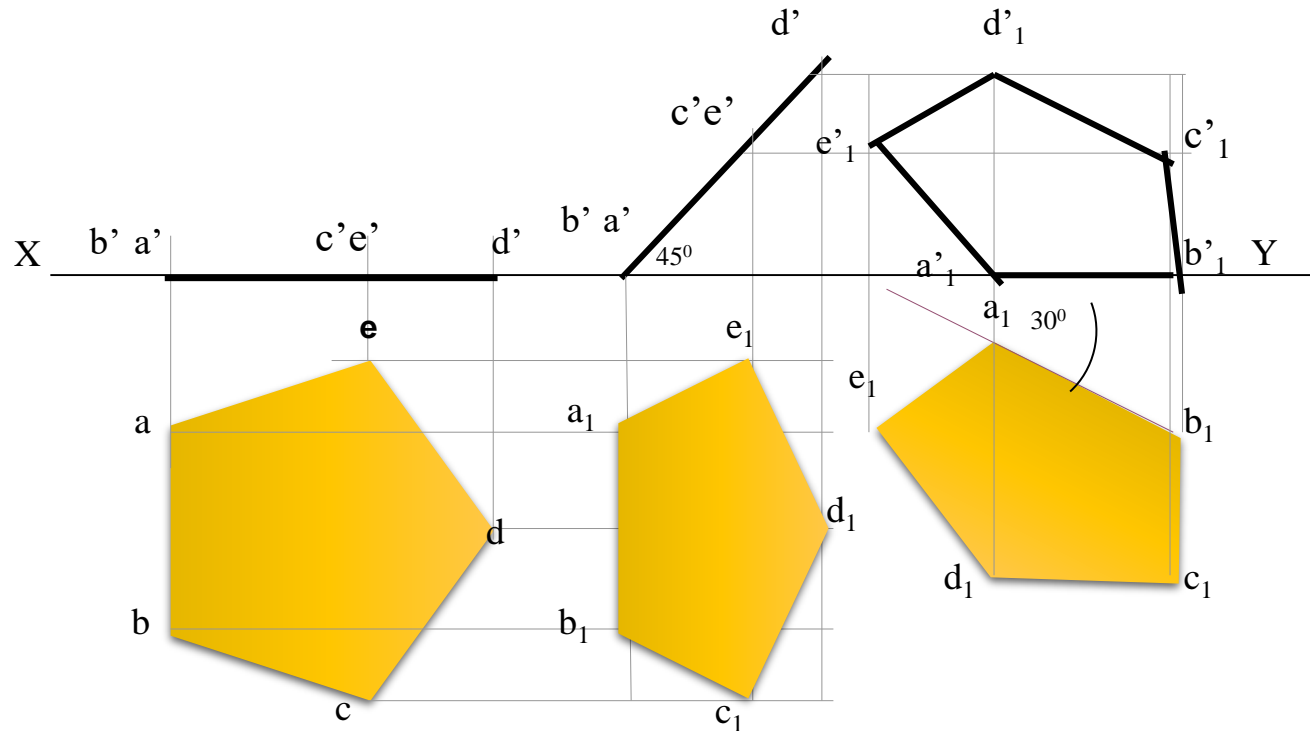
Draw it's projections when the side in HP makes 30^0 angle with VP

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 5:

A regular pentagon of 30 mm sides is resting on HP on one of it's sides while it's opposite vertex (corner) is 30 mm above HP.
Draw projections when side in HP is 30⁰ inclined to VP.
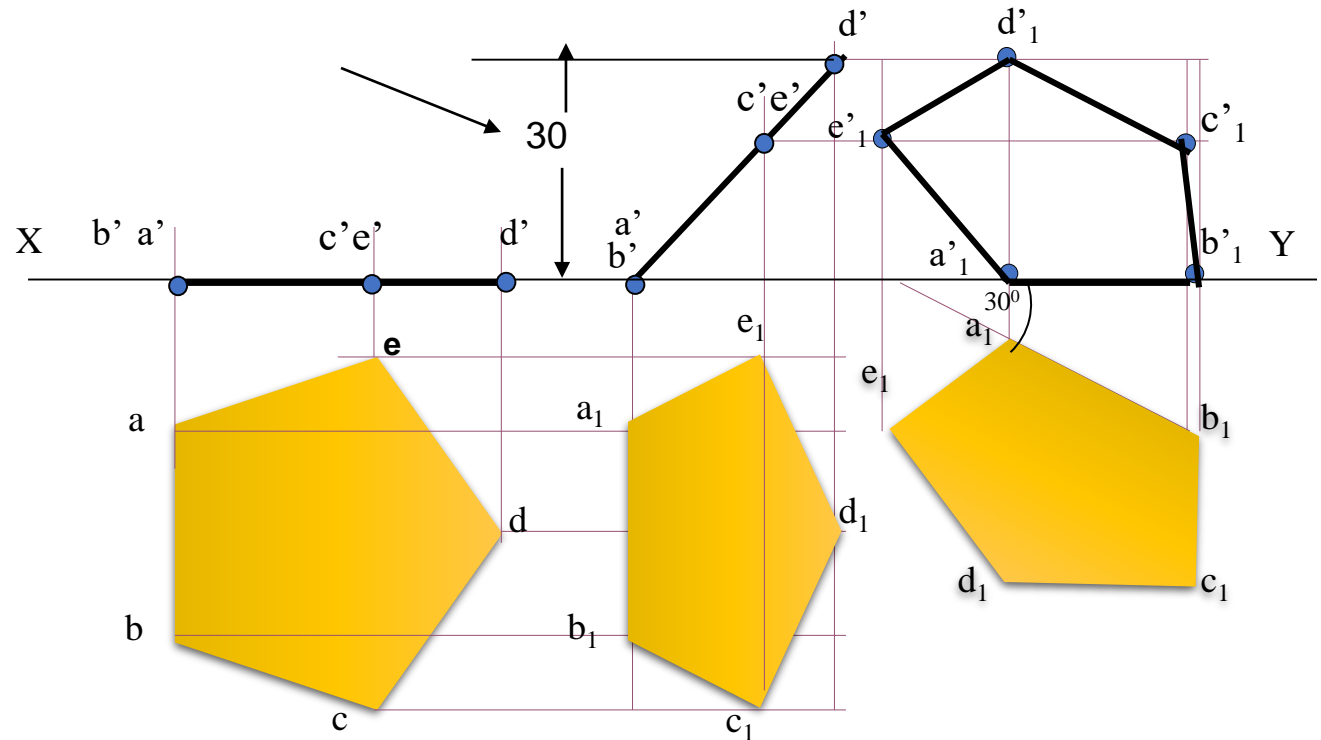
SURFACE INCLINATION INDIRECTLY GIVEN
SIDE INCLINATION DIRECTLY GIVEN:

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.

ONLY CHANGE is the manner in which surface inclination is described:
One side on Hp & it's opposite corner 30 mm above Hp.
Hence redraw 1st Fv as a 2nd Fv making above arrangement.
Keep a'b' on xy & d' 30 mm above xy.

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's Tv is 45^0 inclined to Vp.Draw it's projections.
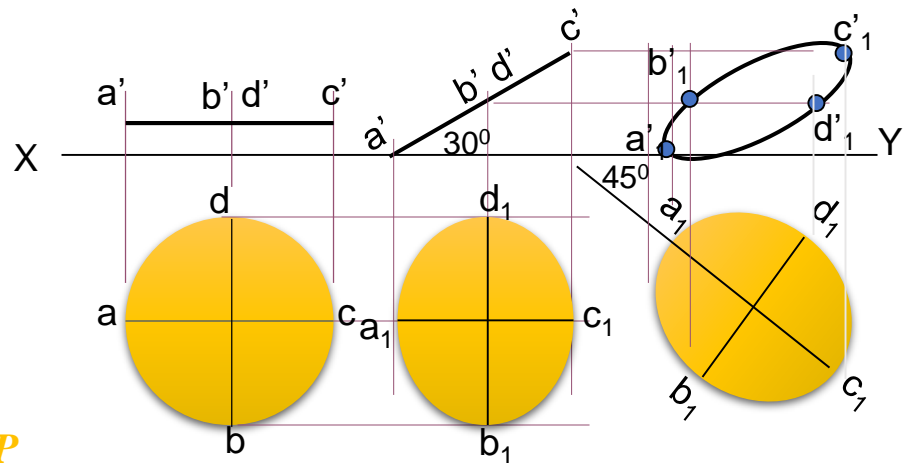
Read problem and answer following questions
1. Surface inclined to which plane? ------- **HP**
2. Assumption for initial position? ------ **// to HP**
3. So which view will show True shape? --- **TV**
4. Which diameter horizontal? ---------- **AC**
   Hence begin with TV,draw rhombus below
   X-Y line, taking longer diagonal // to X-Y

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.

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 10: End A of diameter AB of a circle is in HP
And end B is in VP.Diameter AB, 50 mm long is
30^0 & 60^0 inclined to HP & VP respectively.
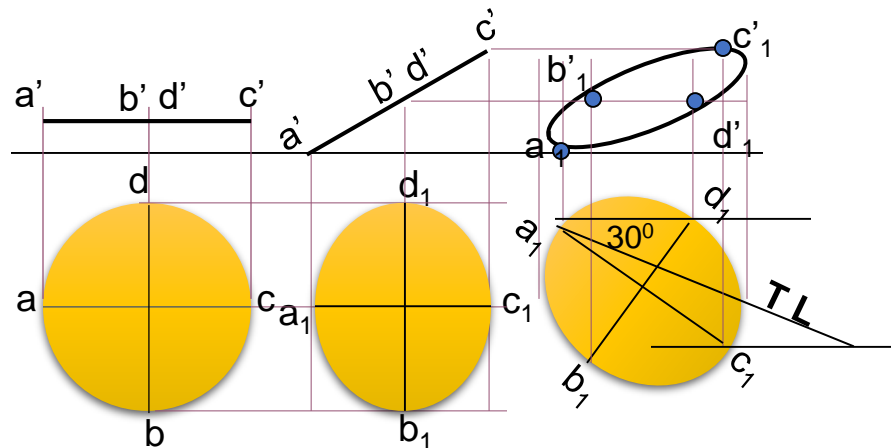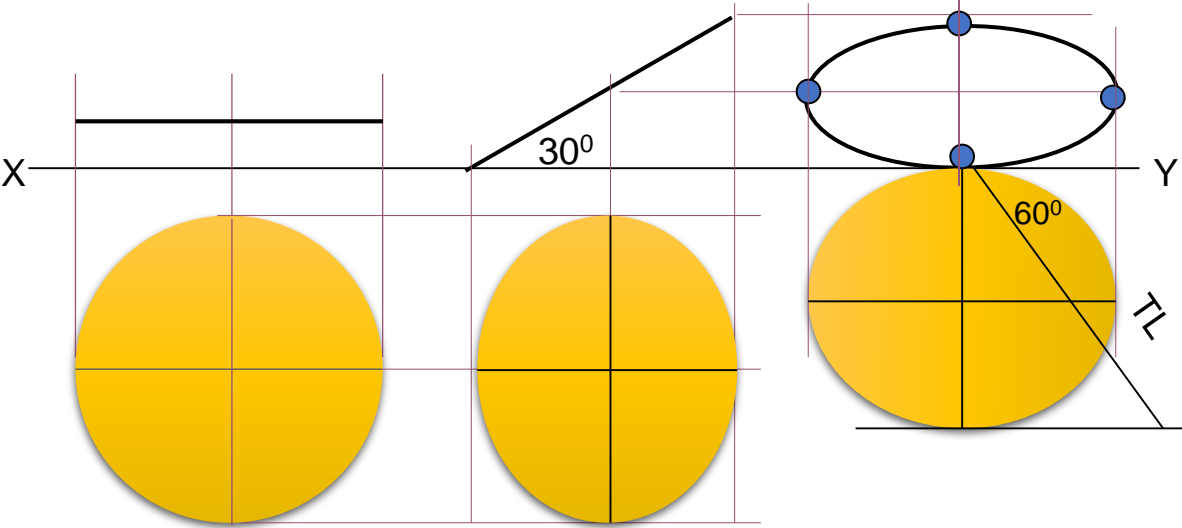Draw projections of circle.

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? ---------- *AB*
   Hence begin with TV,draw CIRCLE below
   X-Y line, taking DIA. AB // to X-Y

The problem is similar to previous problem of circle – no.9.
But in the 3rd step there is one more change.
Like 9th problem True Length inclination of dia.AB is definitely expected
but if you carefully note - the the SUM of it's inclinations with HP & VP is 90^0.
Means Line AB lies in a Profile Plane.
Hence it's both Tv & Fv must arrive on one single projector.

So do the construction accordingly AND ***note the case carefully***..

30^0

60^0

X ——————— Y

TL

SOLVE SEPARATELY
ON DRAWING SHEET
GIVING NAMES TO VARIOUS
POINTS AS USUAL,
AS THE CASE IS IMPORTANT

Problem 11:
A hexagonal lamina has its one side in HP and
Its apposite parallel side is 25mm above Hp and
In Vp. Draw it's projections.
Take side of hexagon 30 mm long.

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*
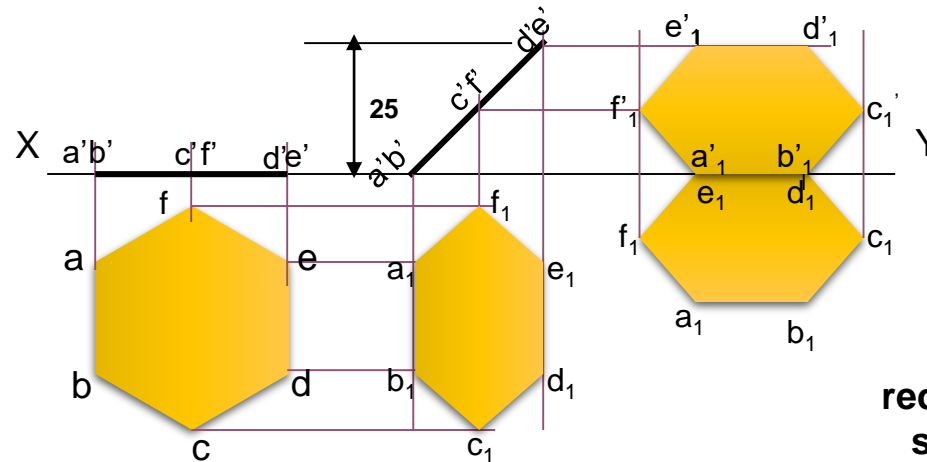4. Which diameter horizontal?   ----------   *AC*
   Hence begin with TV,draw rhombus below
   X-Y line, taking longer diagonal // to X-Y

ONLY CHANGE is the manner in which surface inclination
is described:
One side on Hp & it's opposite side 25 mm above Hp.
Hence redraw 1st Fv as a 2nd Fv making above arrangement.
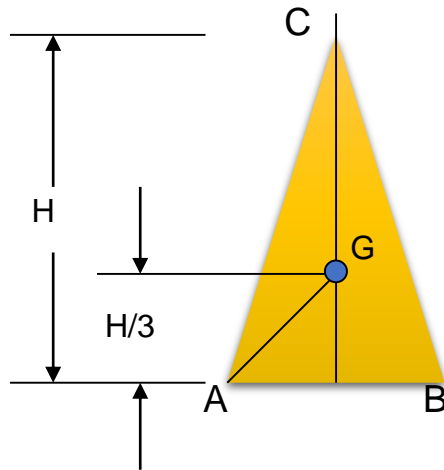Keep a'b' on xy & d'e' 25 mm above xy.

25

As 3rd step
redraw 2nd Tv keeping
side DE on xy line.
Because it is in VP
as said in problem.

FREELY SUSPENDED CASES.

IMPORTANT POINTS

1. In this case the plane of the figure always remains *perpendicular to Hp.*
2. It may remain parallel or inclined to Vp.
3. Hence *TV* in this case will be always a *LINE view.*
4. Assuming surface // to Vp, draw true shape in suspended position as FV. (Here keep *line joining **point of contact & centroid of fig. vertical** *)
5. Always begin with FV as a True Shape but in a suspended position. AS shown in 1st FV.
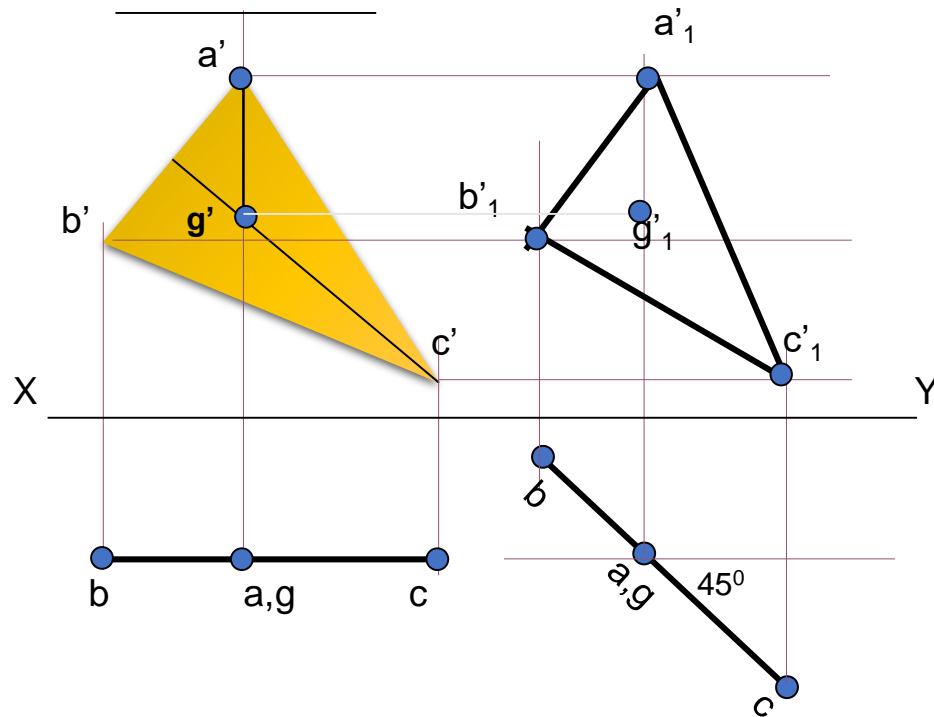
Problem 12:

An isosceles triangle of 40 mm long base side, 60 mm long altitude Is freely suspended from one corner of Base side. It's plane is 45⁰ inclined to Vp. Draw it's projections.

First draw a given triangle With given dimensions, Locate it's centroid position And join it with point of suspension.

Problem 13
:A semicircle of 100 mm diameter
is suspended from a point on its
straight edge 30 mm from the midpoint
of that edge so that the surface makes
an angle of 45⁰ with VP.
Draw its projections.

1.In this case the plane of the figure always remains *perpendicular to Hp.*
2.It may remain parallel or inclined to Vp.
3.Hence *TV* in this case will be always a *LINE view.*
4.Assuming surface // to Vp, draw true shape in suspended position as FV.
 (Here keep *line joining **point of contact & centroid of fig. vertical** *)
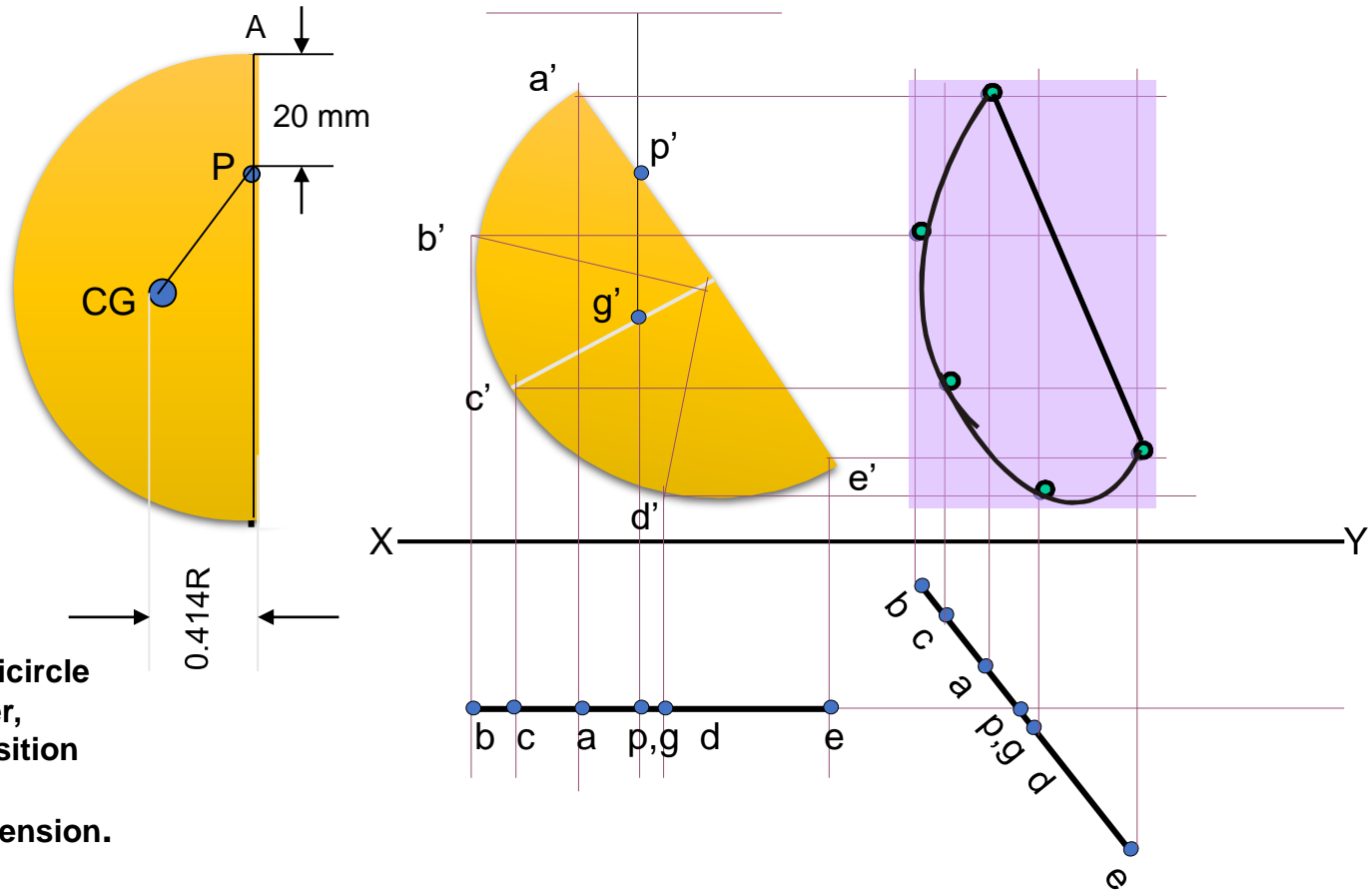5.Always begin with FV as a True Shape but in a suspended position.
 AS shown in 1ˢᵗ FV.

A
20 mm
P
CG
0.414R

First draw a given semicircle
With given diameter,
Locate it's centroid position
And
join it with point of suspension.

a'
p'
b'
g'
c'
e'
d'
X
Y
b c a p,g d e
b c a p,g d e

To determine true shape of plane figure when it's projections are given.
BY USING AUXILIARY PLANE METHOD

WHAT WILL BE THE PROBLEM?
Description of final Fv & Tv will be given.
You are supposed to determine true shape of that plane figure.

Follow the below given steps:
1.   Draw the given Fv & Tv as per the given information in problem.
2.   Then among all lines of Fv & Tv select a line showing True Length (T.L.)
        (It's other view must be // to xy)
3.   Draw x_1-y_1 perpendicular to this line showing T.L.
4.   Project view on x_1-y_1 (it must be a line view)
5.   Draw x_2-y_2 // to this line view & project new view on it.
   It will be the required answer i.e. True Shape.

The facts you must know:-
If you carefully study and observe the solutions of all previous problems,
You will find
IF ONE VIEW IS A LINE VIEW & THAT TOO PARALLEL TO XY LINE,
THEN AND THEN IT'S OTHER VIEW WILL SHOW TRUE SHAPE:

NOW FINAL VIEWS ARE ALWAYS SOME SHAPE, NOT LINE VIEWS:
SO APPLYING ABOVE METHOD:
WE FIRST CONVERT ONE VIEW IN INCLINED LINE VIEW .(By using x1y1 aux.plane)
THEN BY MAKING IT // TO X2-Y2 WE GET TRUE SHAPE.

Study Next Four Cases

Problem 14 Tv is a triangle abc. Ab is 50 mm long, angle cab is 300 and angle cba is 650.
a'b'c' is a Fv. a' is 25 mm, b' is 40 mm and c' is 10 mm above Hp respectively. Draw projections
of that figure and find it's true shape.

As per the procedure-

1. First draw Fv & Tv as per the data.
2. In Tv line ab is // to xy hence it's other view a'b' is TL. So draw x_1y_1 perpendicular to it.
3. Project view on x1y1.
   a) First draw projectors from a'b' & c' on x_1y_1.
   b) from xy take distances of a,b & c(Tv) mark on these projectors from x_1y_1. Name points a1b1 & c1.
   c) This line view is an Aux.Tv. Draw x_2y_2 // to this line view and project Aux. Fv on it.
      for that from x_1y_1 take distances of a'b' & c' and mark from $x_2y=$ on new projectors.
4. Name points a'$_1$ b'$_1$ & c'$_1$ and join them. This will be the required true shape.
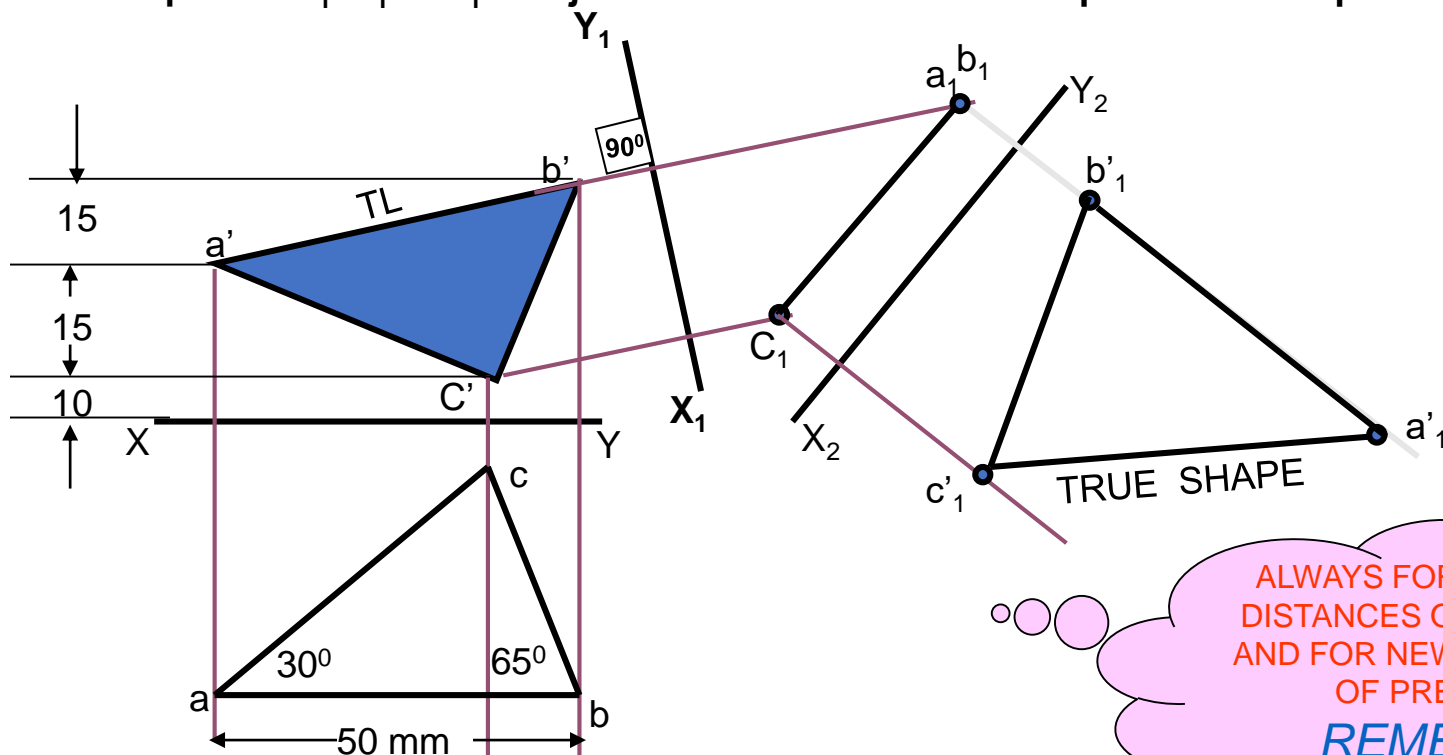
ALWAYS FOR NEW FV TAKE
DISTANCES OF PREVIOUS FV
AND FOR NEW TV, DISTANCES
OF PREVIOUS TV
REMEMBER!!

Problem 15: Fv & Tv of a triangular plate are shown.
Determine it's true shape.
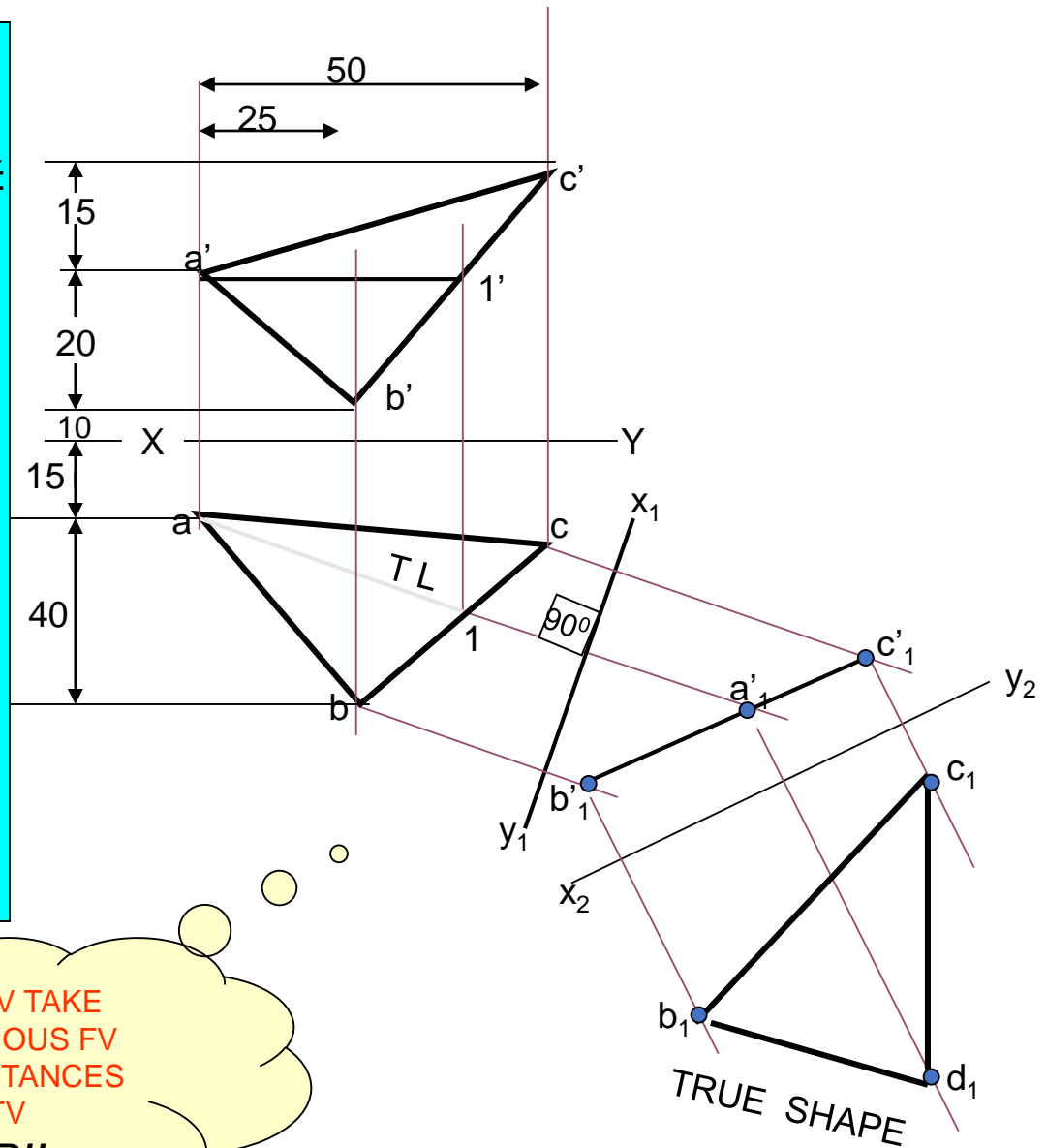
USE SAME PROCEDURE STEPS
OF PREVIOUS PROBLEM:
BUT THERE IS ONE DIFFICULTY:

NO LINE IS // TO XY IN ANY VIEW.
MEANS NO TL IS AVAILABLE.

IN SUCH CASES DRAW ONE LINE
// TO XY IN ANY VIEW & IT'S OTHER
VIEW CAN BE CONSIDERED AS TL
FOR THE PURPOSE.

HERE a' 1' line in Fv is drawn // to xy.
HENCE it's Tv a-1 becomes TL.

THEN FOLLOW SAME STEPS AND
DETERMINE TRUE SHAPE.
(STUDY THE ILLUSTRATION)

50

25

15

20

10   X

15

40

c'

a'

1'

b'

Y

x_1

a

c

T L

90^0

1

b

c'_1

a'_1

y_2

b'_1

y_1

c_1

x_2

b_1

d_1

TRUE SHAPE

ALWAYS FOR NEW FV TAKE
DISTANCES OF PREVIOUS FV
AND FOR NEW TV, DISTANCES
OF PREVIOUS TV
REMEMBER!!

PROBLEM 16: Fv & Tv both are circles of 50 mm diameter. Determine true shape of an elliptical plate.

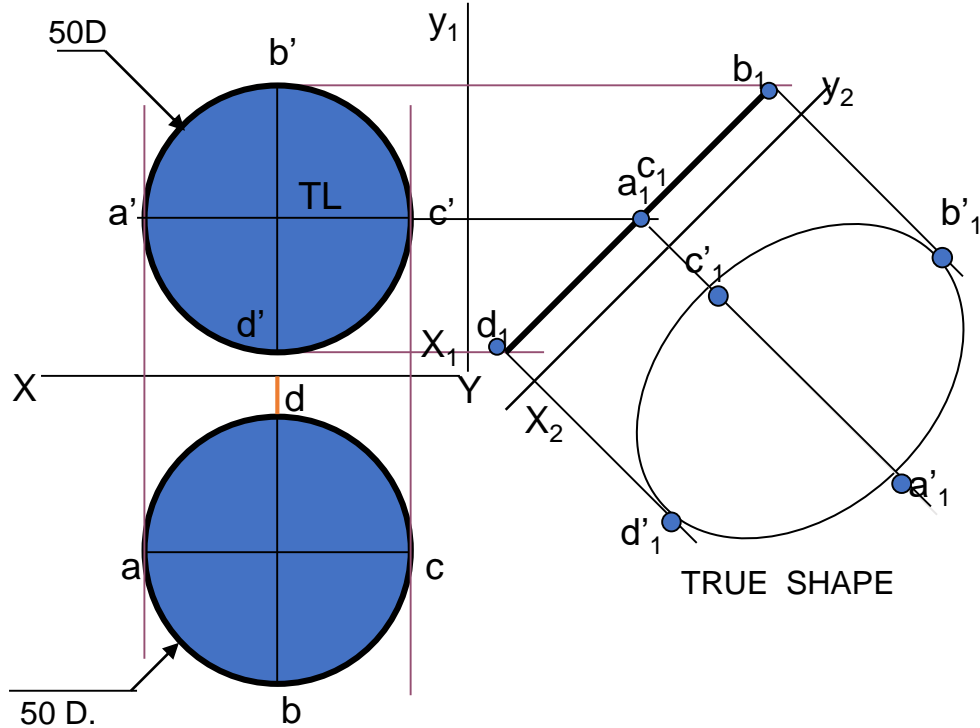ADOPT SAME PROCEDURE.
a c is considered as line // to xy.
Then a'c' becomes TL for the purpose.
Using steps properly true shape can be
Easily determined.

Study the illustration.

ALWAYS, FOR NEW FV
TAKE DISTANCES OF
PREVIOUS FV AND
FOR NEW TV, DISTANCES
OF PREVIOUS TV
REMEMBER!!

50D

b'

y_1

b_1

y_2

$a_1^{c_1}$

TL

a'

c'

b'_1

c'_1

d'

X_1

d_1

X

d

Y

X_2

a

c

a'_1

d'_1

TRUE SHAPE

50 D.

b

Problem 17 : Draw a regular pentagon of
30 mm sides with one side 30^0 inclined to xy.
This figure is Tv of some plane whose Fv is
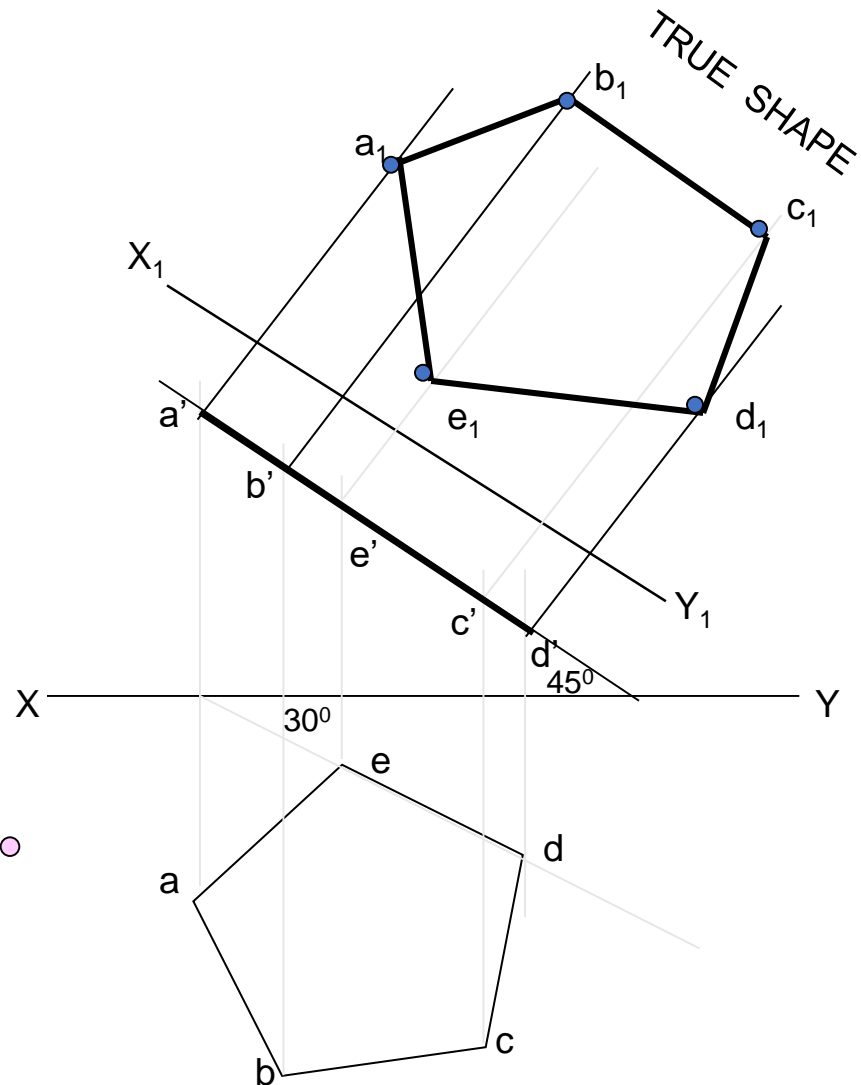A line 45^0 inclined to xy.
Determine it's true shape.

IN THIS CASE ALSO TRUE LENGTH
IS NOT AVAILABLE IN ANY VIEW.

BUT ACTUALLY WE DONOT REQUIRE
TL TO FIND IT'S TRUE SHAPE, AS ONE
VIEW (FV) IS ALREADY A LINE VIEW.
SO JUST BY DRAWING X1Y1 // TO THIS
VIEW WE CAN PROJECT VIEW ON IT
AND GET TRUE SHAPE:

STUDY THE ILLUSTRATION..

ALWAYS FOR NEW FV
TAKE DISTANCES OF
PREVIOUS FV AND FOR
NEW TV, DISTANCES OF
PREVIOUS TV
REMEMBER!!

TRUE SHAPE

b_1

a_1

c_1

X_1

a'

e_1

d_1

b'

e'

Y_1

c'

d'

45^0

X ——————————————————— Y

30^0

e

d

a

b

c

Thank You