ENGINEERING DRAWING

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→ PROJECTIONS OF SOLIDS
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CHAPTER-10

PROJECTIONS OF PLANES

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

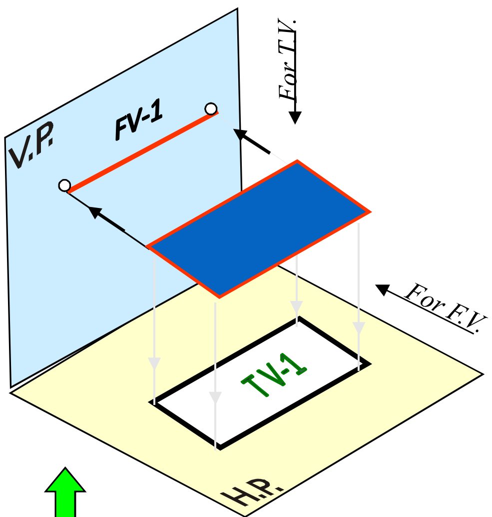
(Hence this will be a case of an object inclined to both reference Planes.)

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

CASE OF A RECTANGLE – OBSERVE AND NOTE ALL STEPS.

SURFACE **PARALLEL** TO HP

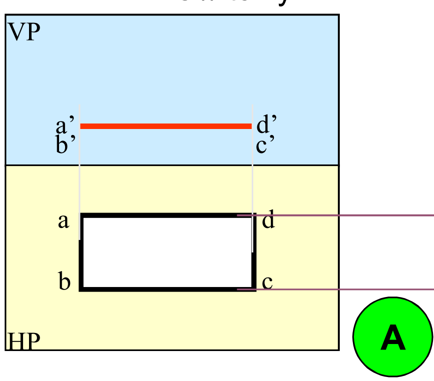
PICTORIAL PRESENTATION



ORTHOGRAPHIC

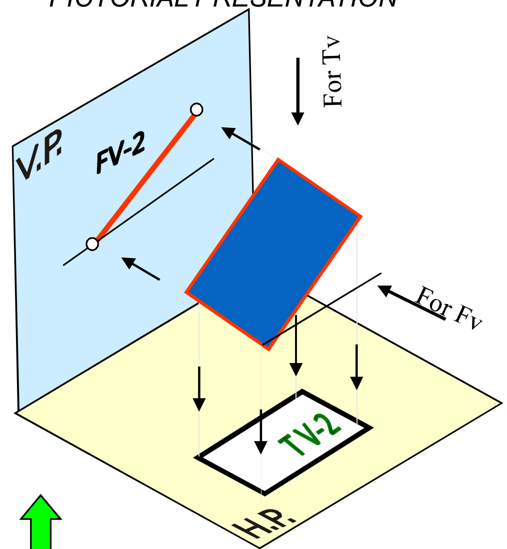
TV-True Shape

FV- Line // to xy



SURFACE **INCLINED** TO HP

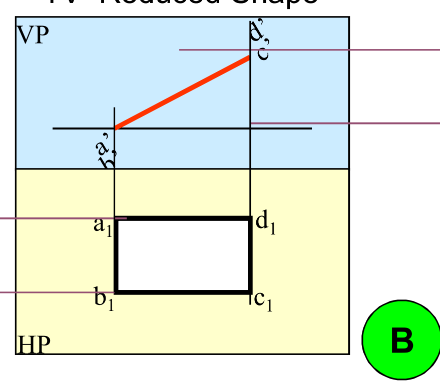
PICTORIAL PRESENTATION



ORTHOGRAPHIC

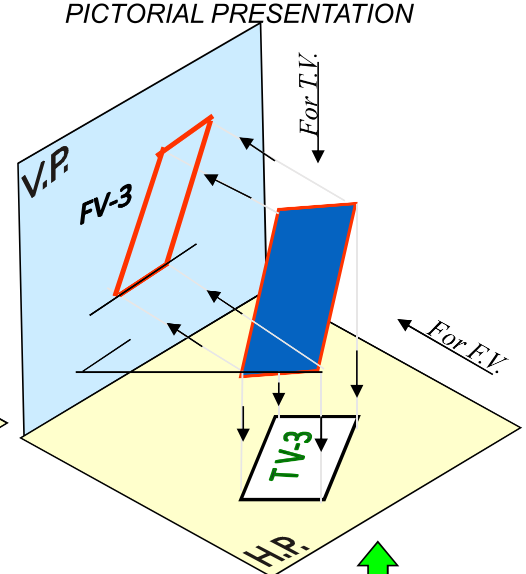
FV- Inclined to XY

TV- Reduced Shape



ONE SMALL SIDE INCLINED TO VP

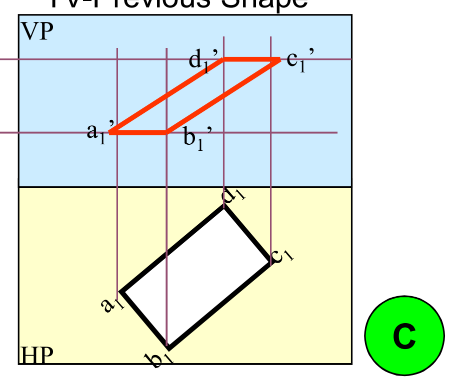
PICTORIAL PRESENTATION



ORTHOGRAPHIC

FV- Apparent Shape

TV-Previous Shape



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)

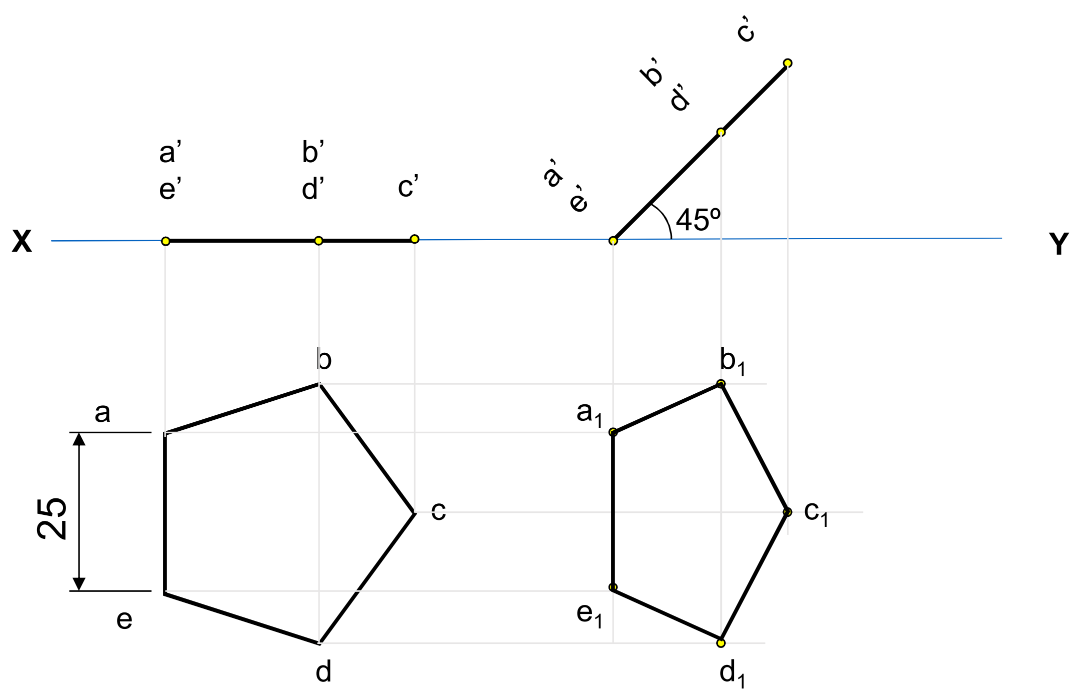
Now Complete STEP 3. By making side inclined to the resp plane & project it's other view.

(Ref. 3rd pair C on previous page illustration)

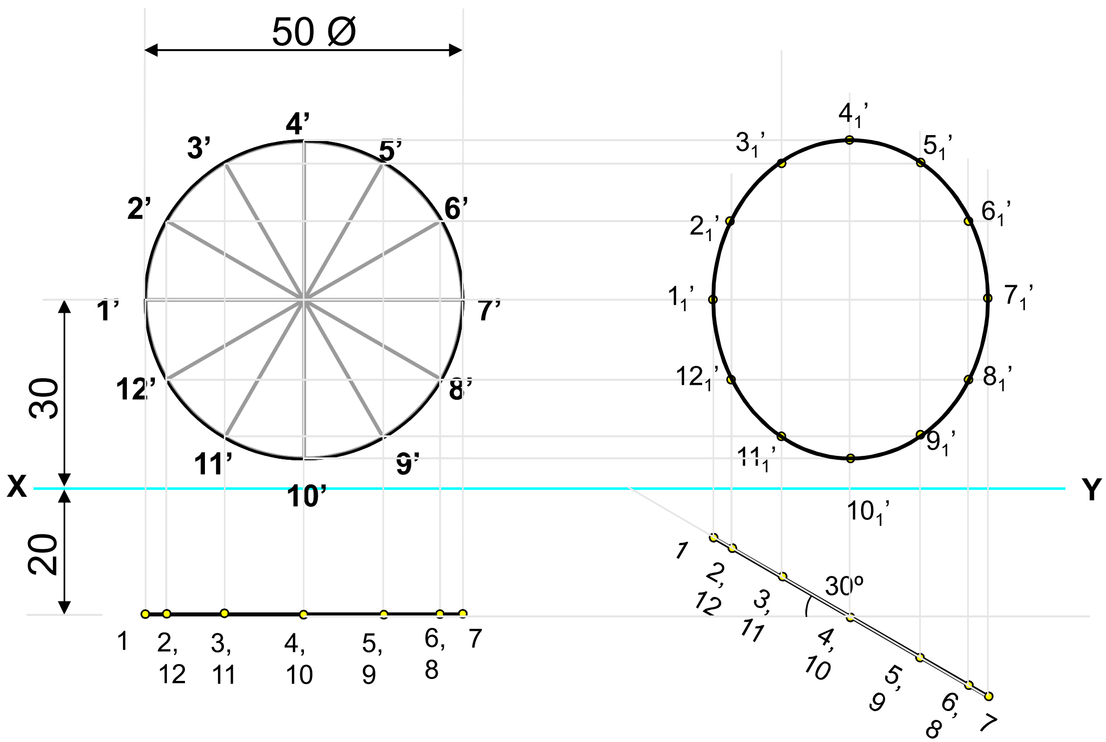
APPLY SAME STEPS TO SOLVE NEXT *ELEVEN* PROBLEMS

Q.1.: A regular pentagon of 25mm side has one side on the ground. Its plane is inclined at 45º to the HP and perpendicular to the VP. Draw its projections and show its traces

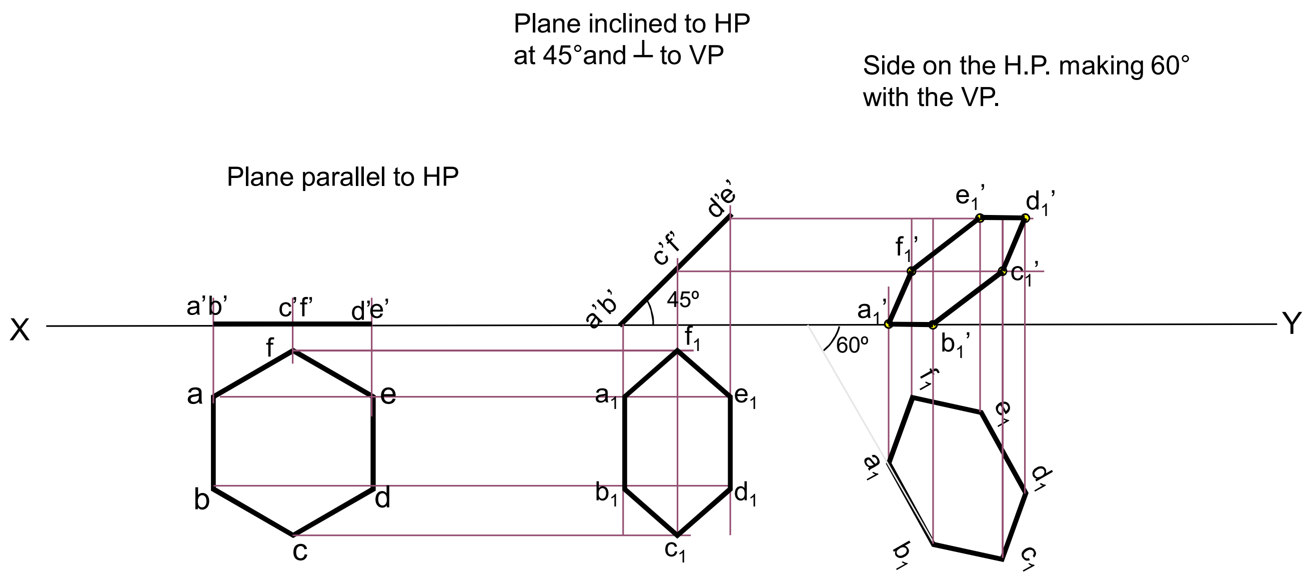
Hint: As the plane is inclined to HP, it should be kept parallel to HP with one edge perpendicular to VP



Q.2.:Draw the projections of a circle of 5 cm diameter having its plane vertical and inclined at 30º to the V.P. Its centre is 3cm above the H.P. and 2cm in front of the V.P. Show also its traces



Q.3.: Draw the projections of a regular hexagon of 25mm sides, having one of its side in the H.P. and inclined at 60 to the V.P. and its surface making an angle of 45º with the H.P.

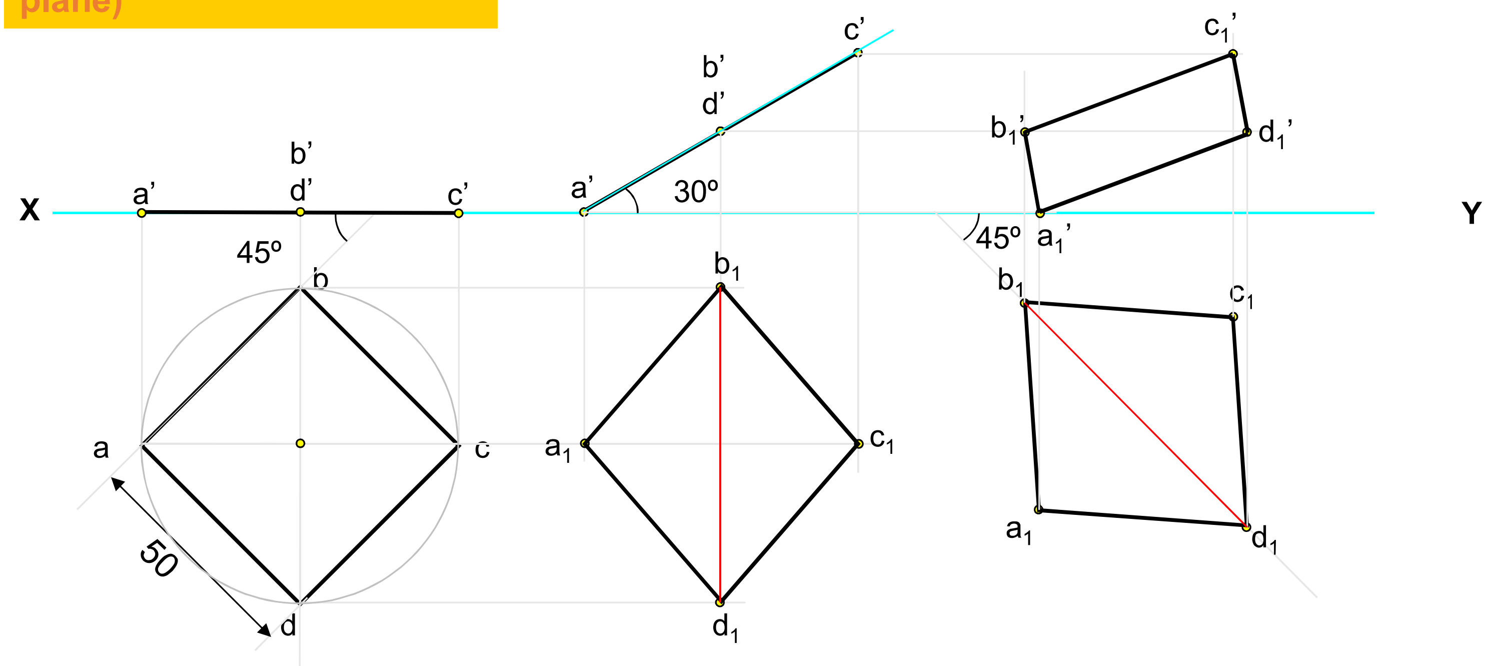


Q.4.: A square ABCD of 50 mm side has its corner A in the H.P., its diagonal AC inclined at 30º to the H.P. and the diagonal BD inclined at 45º to the V.P. and parallel to the H.P. Draw its projections.

Keep AC parallel to the H.P. & BD perpendicular to V.P. (considering inclination of AC as inclination of the plane)

Incline AC at 30º to the H.P. i.e. incline the edge view (FV) at 30º to the HP

Incline BD at 45º to the V.P.

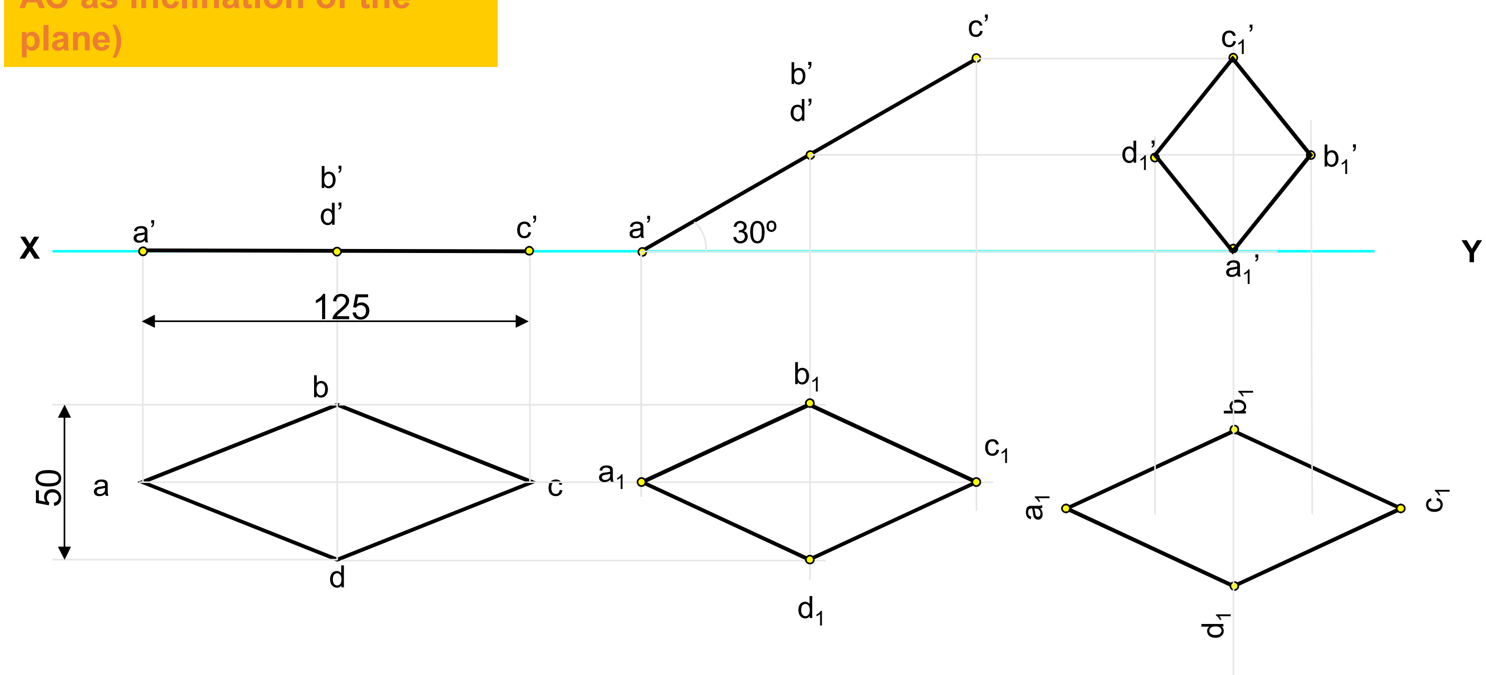


Q.5.: Draw projections of a rhombus having diagonals 125 mm and 50 mm long, the smaller diagonal of which is parallel to both the principal planes, while the other is inclined at 30º to the H.P.

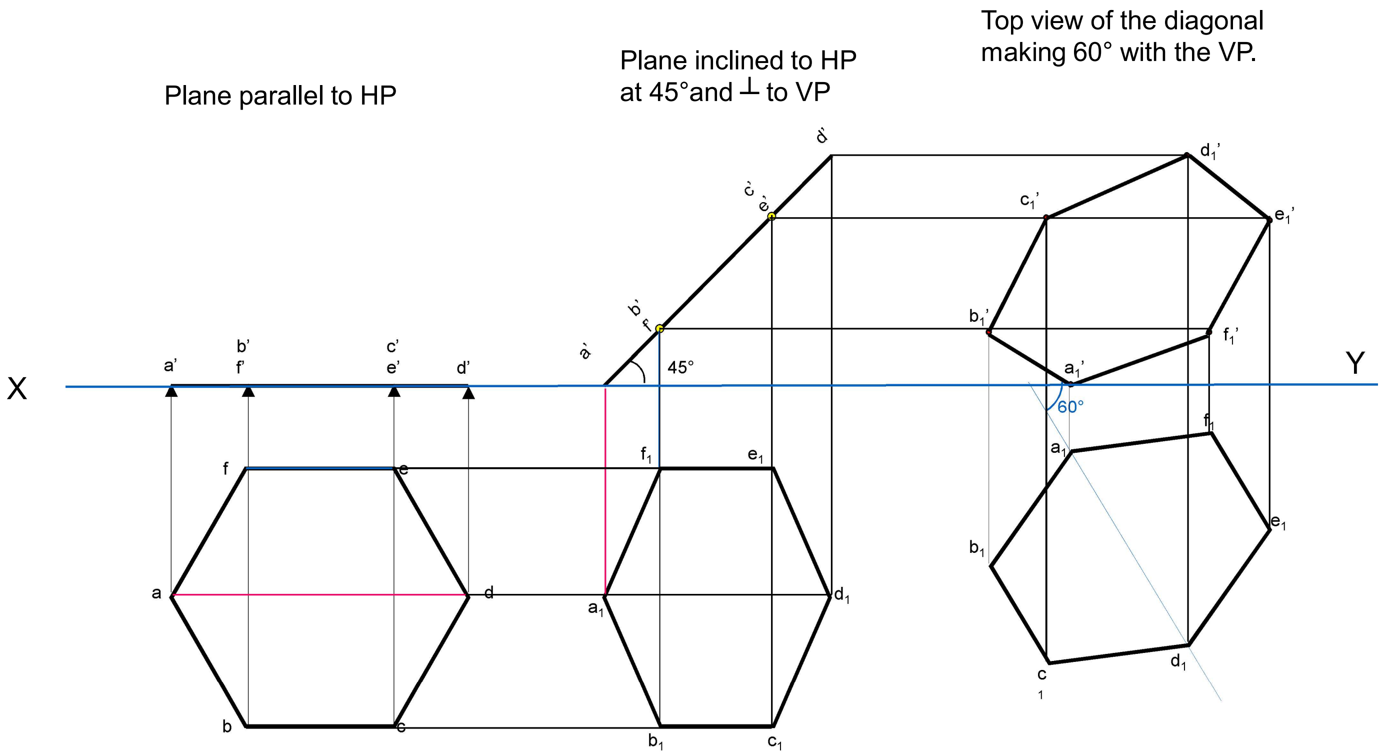
Keep AC parallel to the H.P. & BD perpendicular to V.P. (considering inclination of AC as inclination of the plane)

Incline AC at 30º to the H.P.

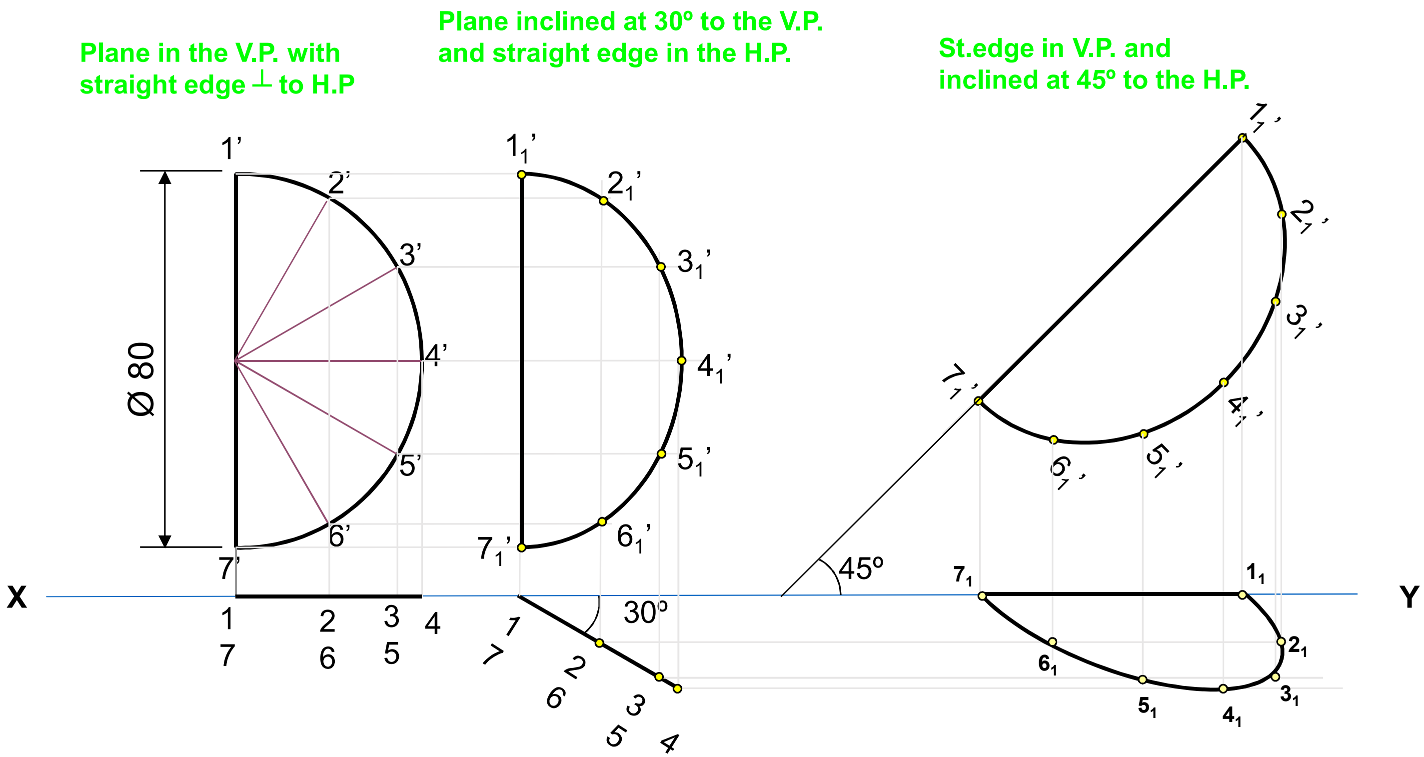
Make BD parallel to XY



Q.6.:A regular hexagon of 40mm side has a corner in the HP. Its surface inclined at45° to the HP and the top view of the diagonal through the corner which is in the HP makes an angle of 60° with the VP. Draw its projections.



Q.7.:A semicircular plate of 80mm diameter has its straight edge in the VP and inclined at 45 to HP. The surface of the plate makes an angle of 30 with the VP. Draw its projections.

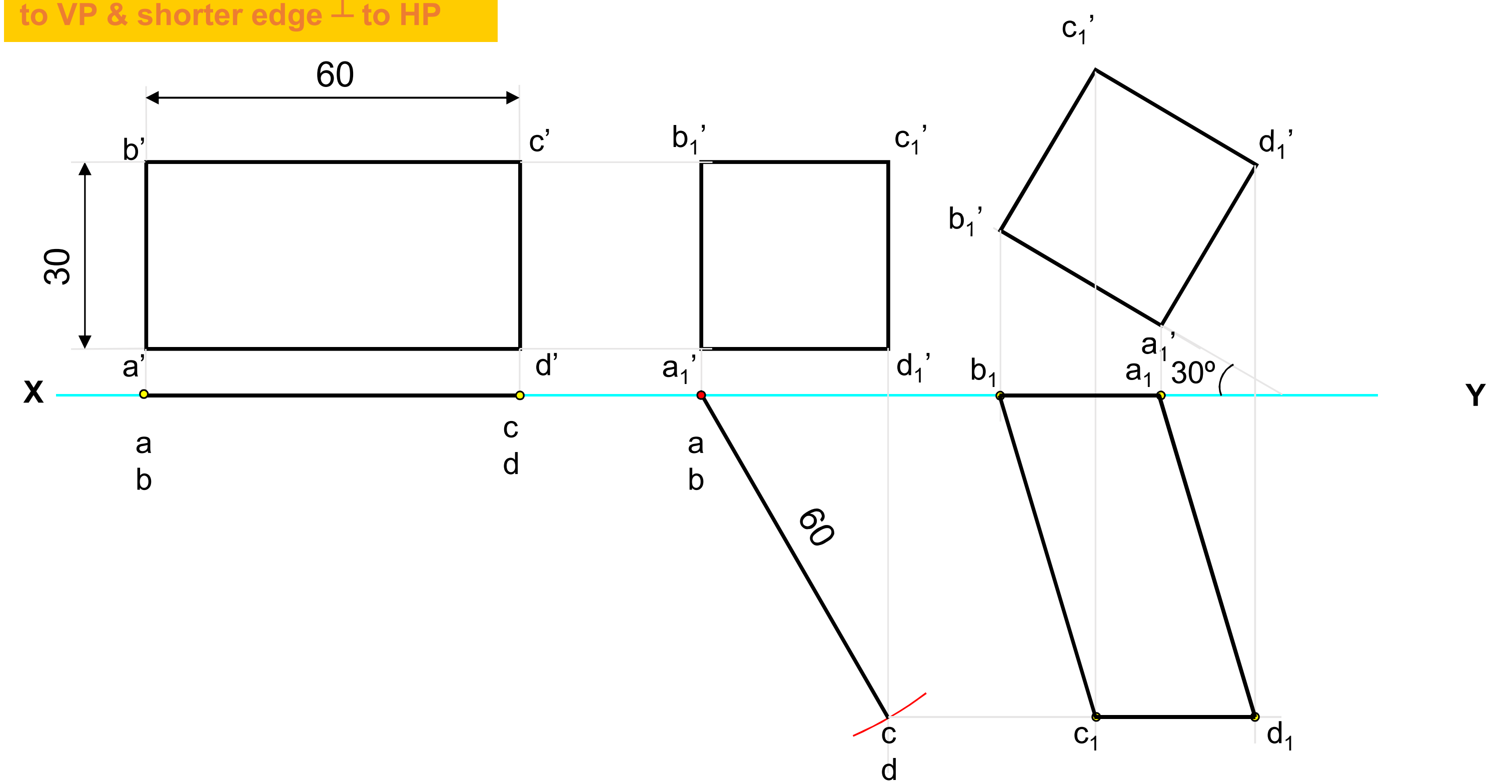


Q.8.: A thin rectangular plate of sides 60 mm X 30 mm has its shorter side in the V.P. and inclined at 30º to the H.P. Project its top view if its front view is a square of 30 mm long sides

A rectangle can be seen as a square in the F.V. only when its surface is inclined to VP. So for the first view keep the plane // to VP & shorter edge ⊥ to HP

F.V. (square) is drawn first

Incline a_1'b_1' at 30º to the H.P.

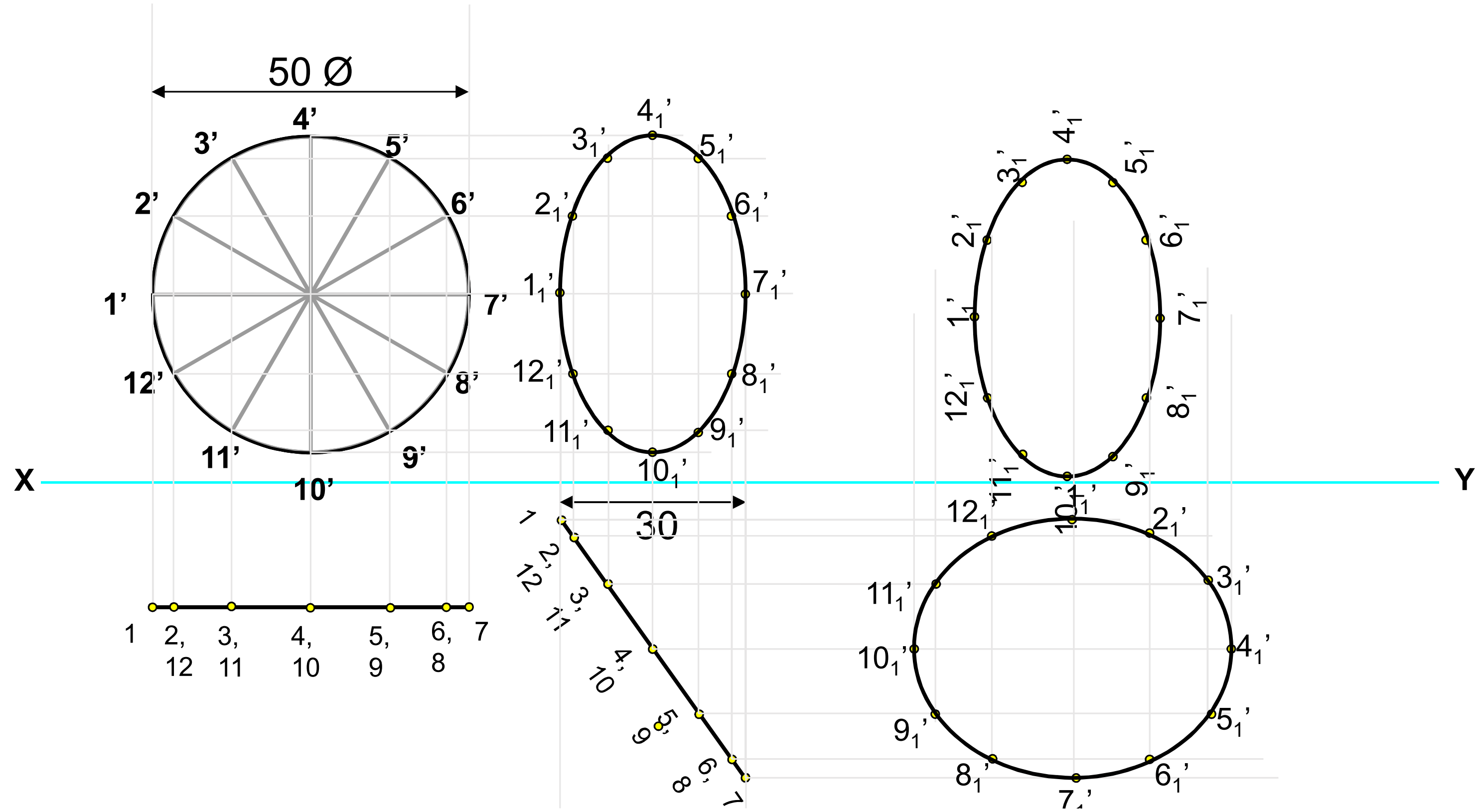


Q.9.: A circular plate of negligible thickness and 50 mm diameter appears as an ellipse in the front view, having its major axis 50 mm long and minor axis 30 mm long. Draw its top view when the major axis of the ellipse is horizontal.

A circle can be seen as a ellipse in the F.V. only when its surface is inclined to VP. So for the first view keep the plane // to VP.

Incline the T.V. till the distance between the end projectors is 30 mm

Incline the F.V. till the major axis becomes horizontal



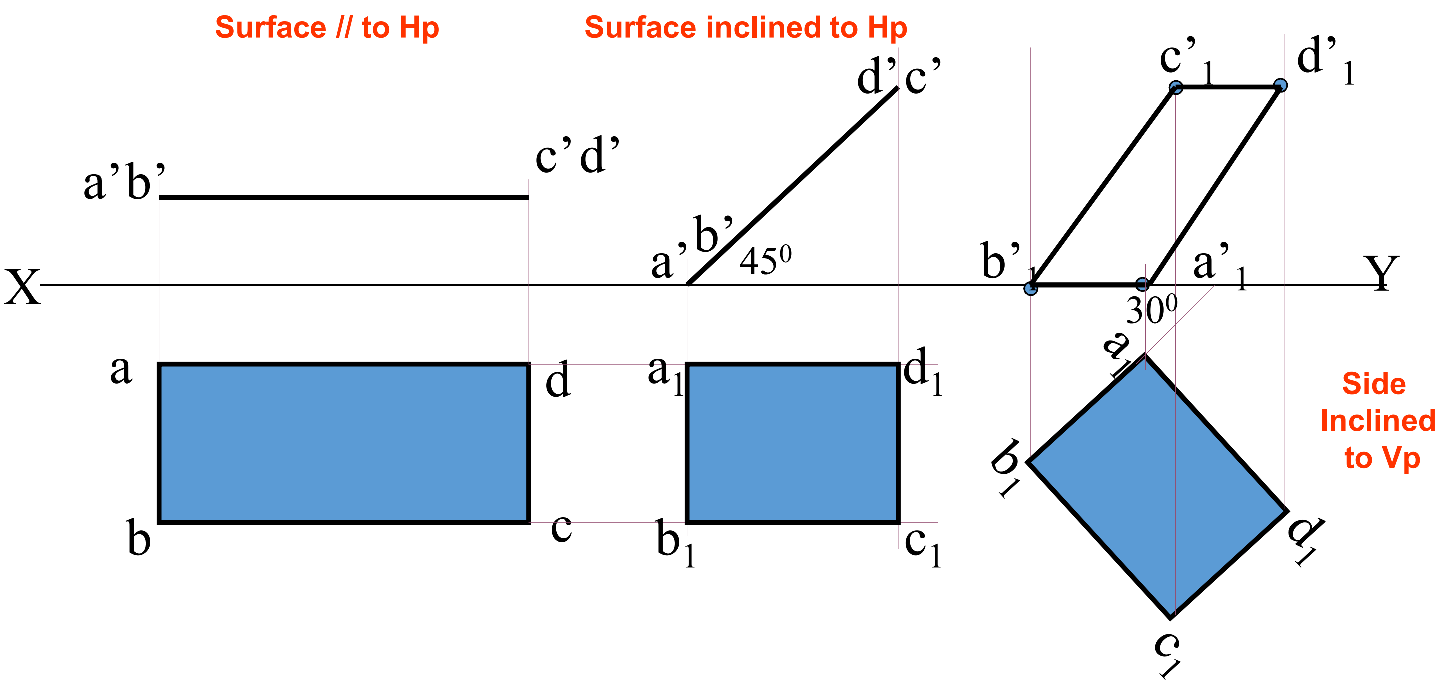
Problem 1:

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.

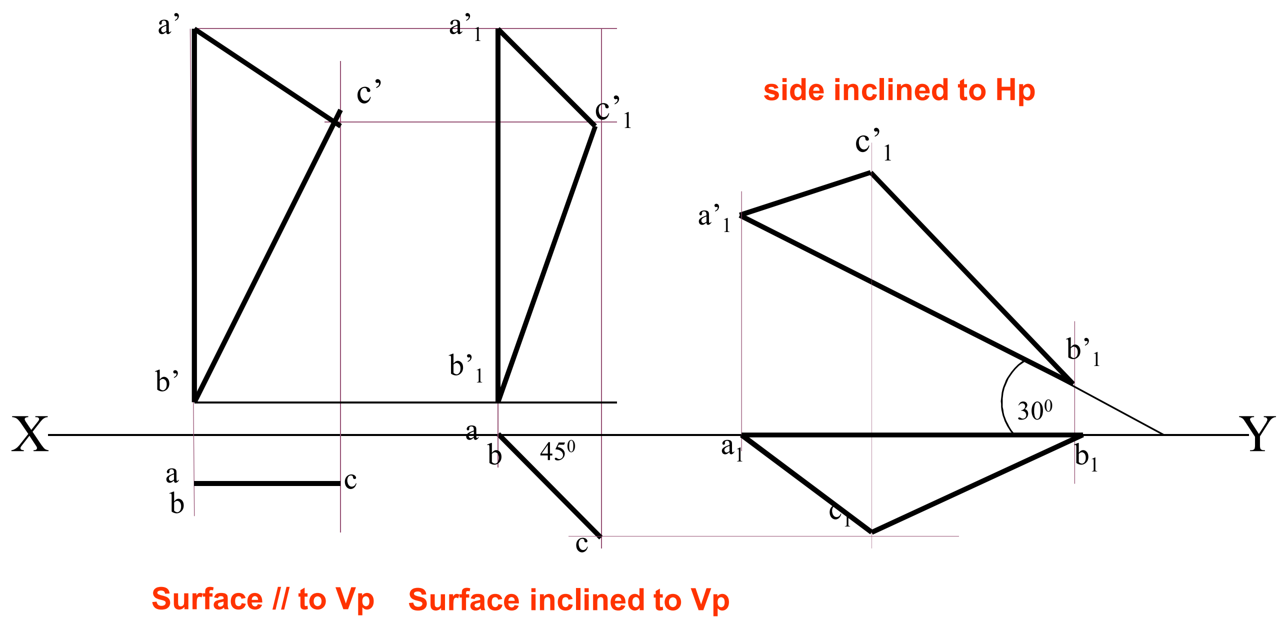


Problem 2:
A $30^0 - 60^0$ set square of longest side 100 mm long, is in VP and 30^0 inclined to HP while it's surface is 45^0 inclined to VP. Draw it's projections

(Surface & Side inclinations directly given)

<u>Read problem and answer following questions</u>
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.

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



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.

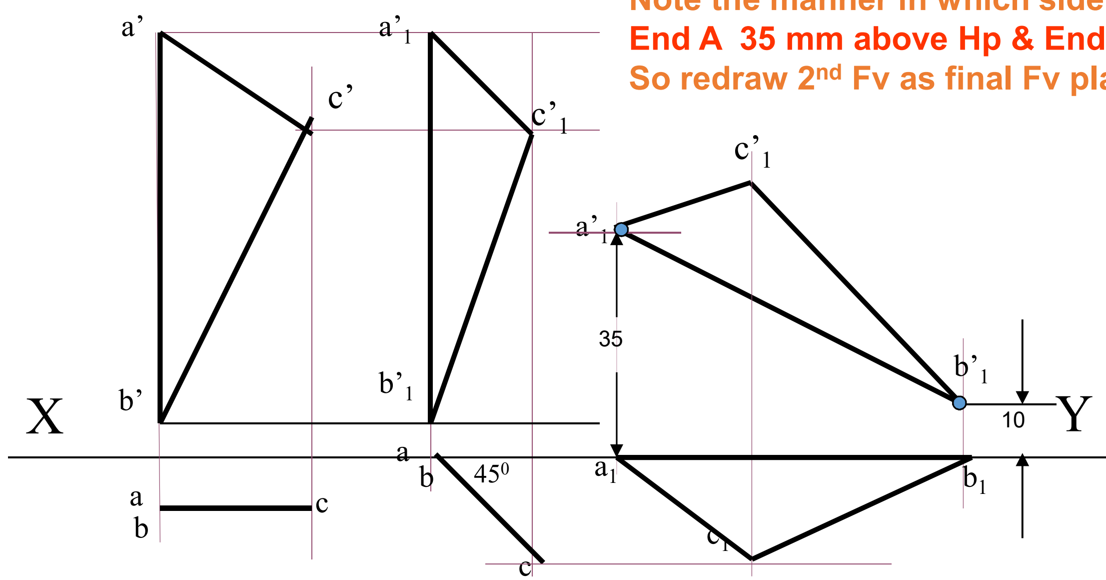
Hence begin with FV, draw triangle above X-Y keeping longest side vertical.

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 2^{nd} Fv as final Fv placing these ends as said.



Problem 4:

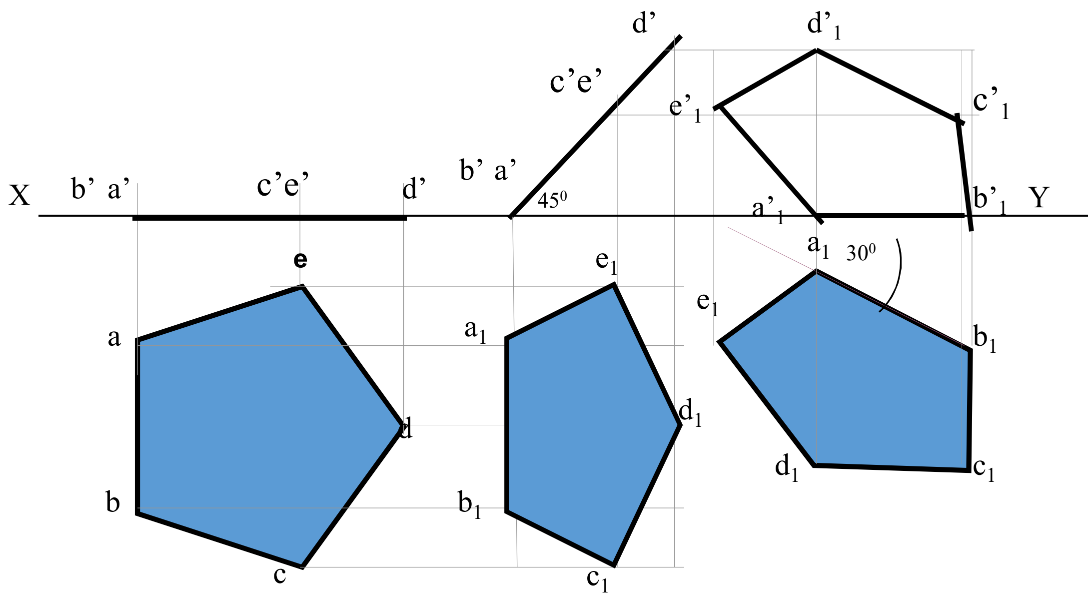
A regular pentagon of 30 mm sides is resting on HP on one of it's sides with it's surface 45^0 inclined to HP.
Draw it's projections when the side in HP makes 30^0 angle with VP

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 30^0 inclined to VP.

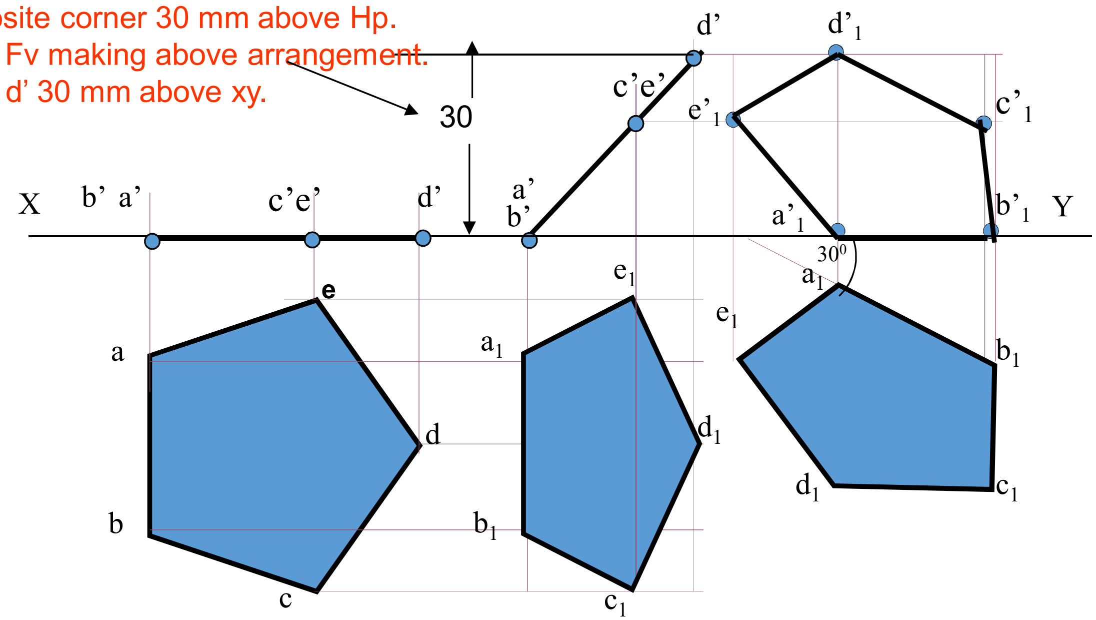
SURFACE INCLINATION INDIRECTLY GIVEN
SIDE INCLINATION DIRECTLY GIVEN:

Read problem and answer following questions

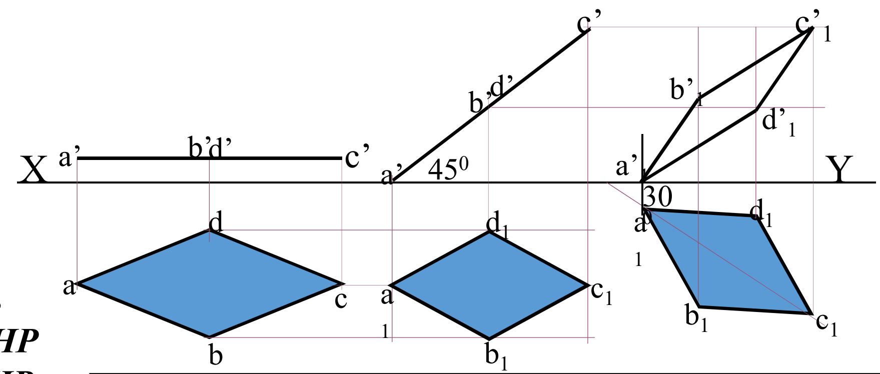
1. Surface inclined to which plane? ------- ***HP***
2. Assumption for initial position? ------ ***// to HP***
3. So which view will show True shape? --- ***TV***
4. Which side will be vertical? --------***any side.***

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 6: A rhombus of diagonals 40 mm and 70 mm long respectively has one end of it's longer diagonal in HP while that diagonal is 35^0 inclined to HP. If the top-view of the same diagonal makes 40^0 inclination with VP, draw it's projections.



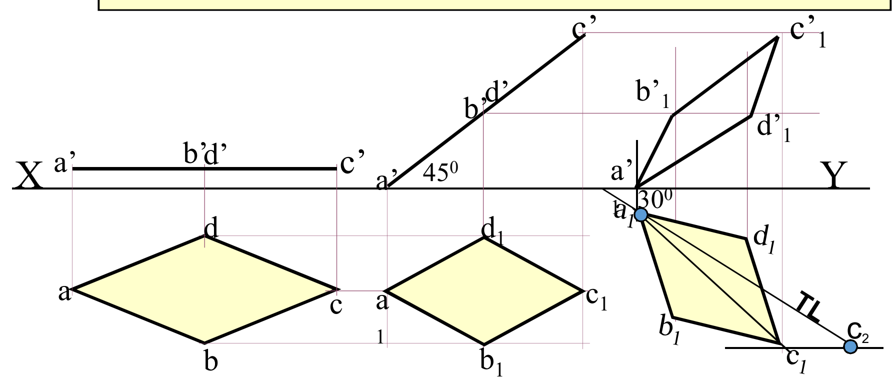
Read problem and answer following questions
1. Surface inclined to which plane? ------- ***HP***
2. Assumption for initial position? ------ ***// to HP***
3. So which view will show True shape? --- ***TV***
4. Which diagonal horizontal? ---------- ***Longer***

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

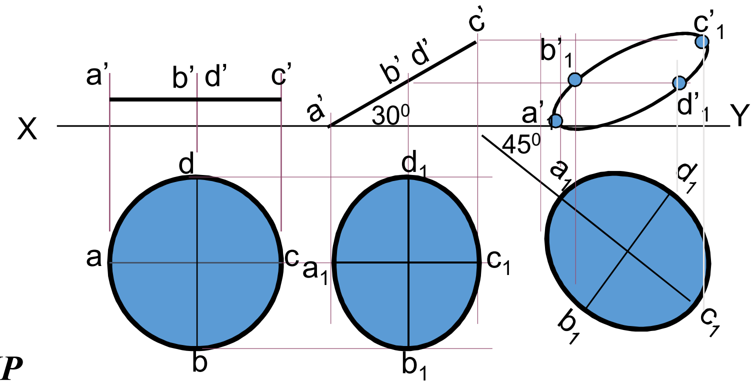
The difference in these two problems is in step 3 only.
In problem no.6 inclination of Tv of that diagonal is given,It could be drawn directly as shown in 3rd step.
While in no.7 angle of diagonal itself I.e. it's TL, is given. Hence here angle of TL is taken,locus of c_1 Is drawn and then LTV I.e. a1 c1 is marked and final TV was completed.Study illustration carefully.

Problem 7: A rhombus of diagonals 40 mm and 70 mm long respectively having one end of it's longer diagonal in HP while that diagonal is 35^0 inclined to HP and makes 40^0 inclination with VP. Draw it's projections.

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



Problem 8: 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

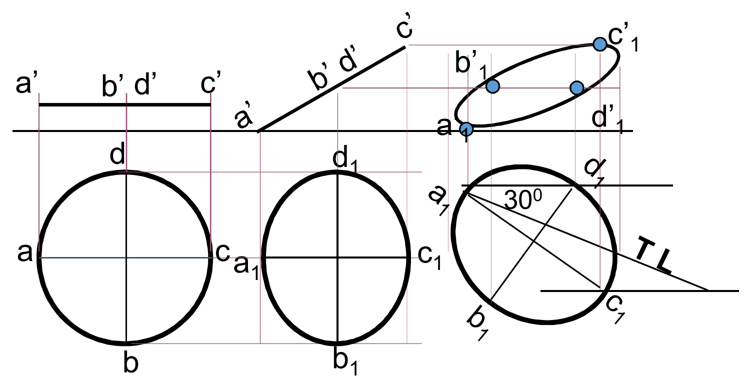
1. Surface inclined to which plane? ------- ***HP***
2. Assumption for initial position? ------ ***// to HP***
3. So which view will show True shape? --- ***TV***
4. Which diameter horizontal? ---------- ***AC***

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

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 9: 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.



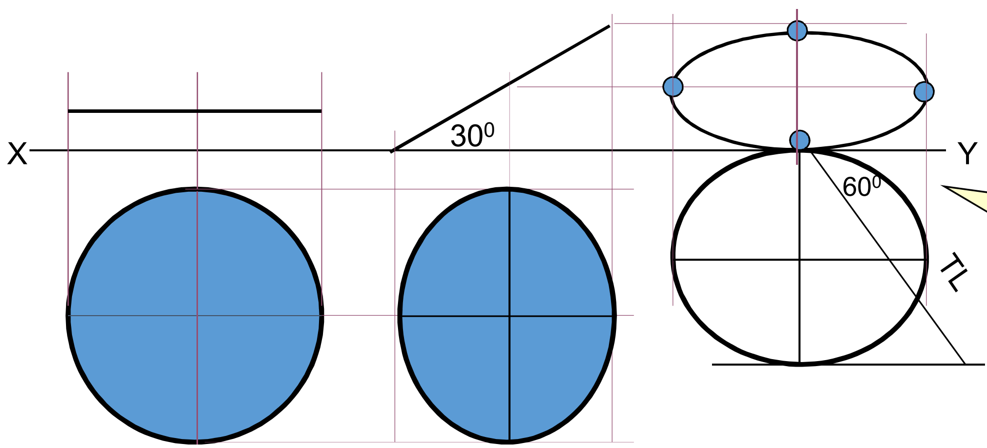
Problem 10: End A of diameter AB of a circle is in HP A nd end B is in VP.Diameter AB, 50 mm long is 30^0 & 60^0 inclined to HP & VP respectively. Draw projections of circle.

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***..



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

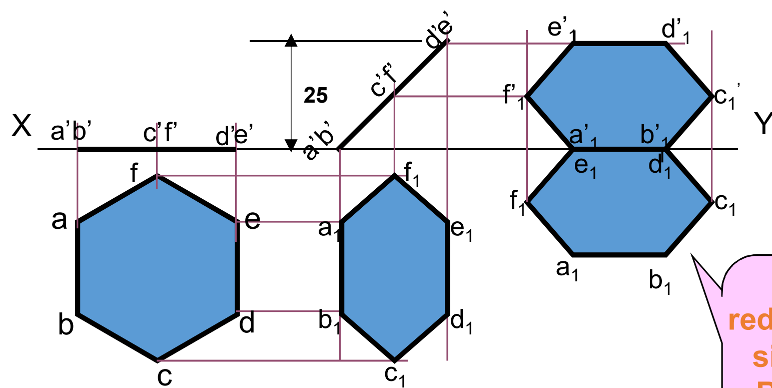
Problem 11:

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.

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.

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



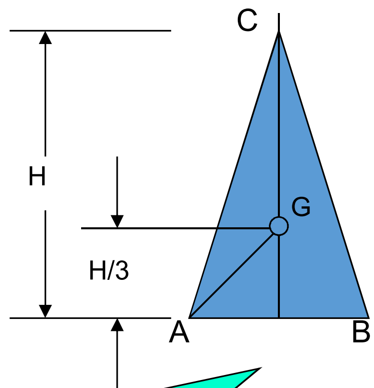
As 3rd step redraw 2nd Tv keeping side DE on xy line. Because it is in VP as said in problem.

FREELY SUSPENDED CASES.

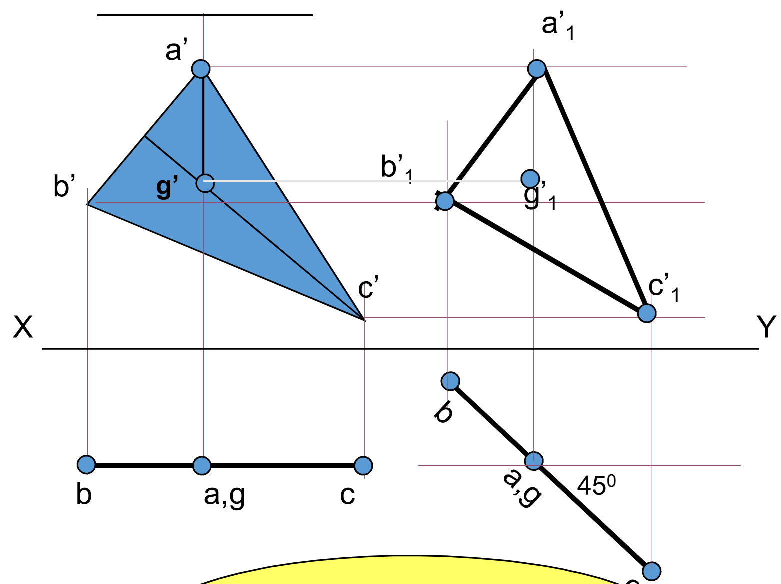
Problem 12:
An isosceles triangle of 40 mm long base side, 60 mm long altitude Is freely suspended from one corner of Base side.It's plane is 45^0 inclined to Vp. Draw it's projections.

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.



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



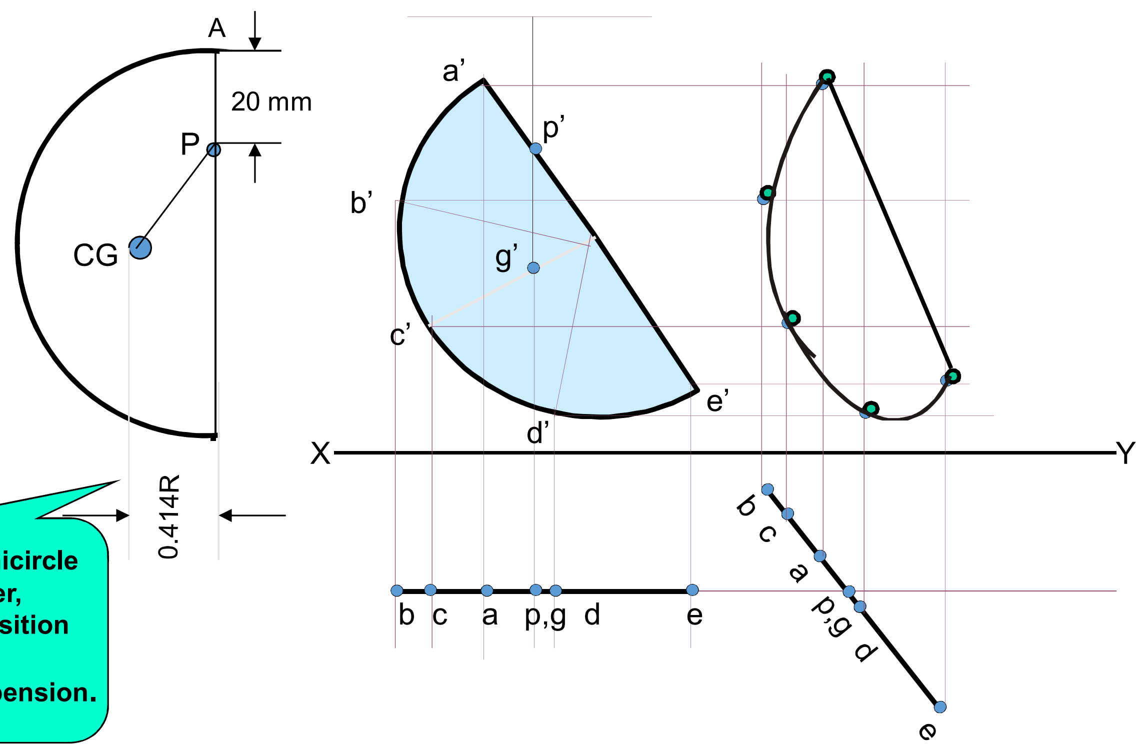
Similarly solve next problem of Semi-circle

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 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 45^0 with VP.
Draw its projections.



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

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:

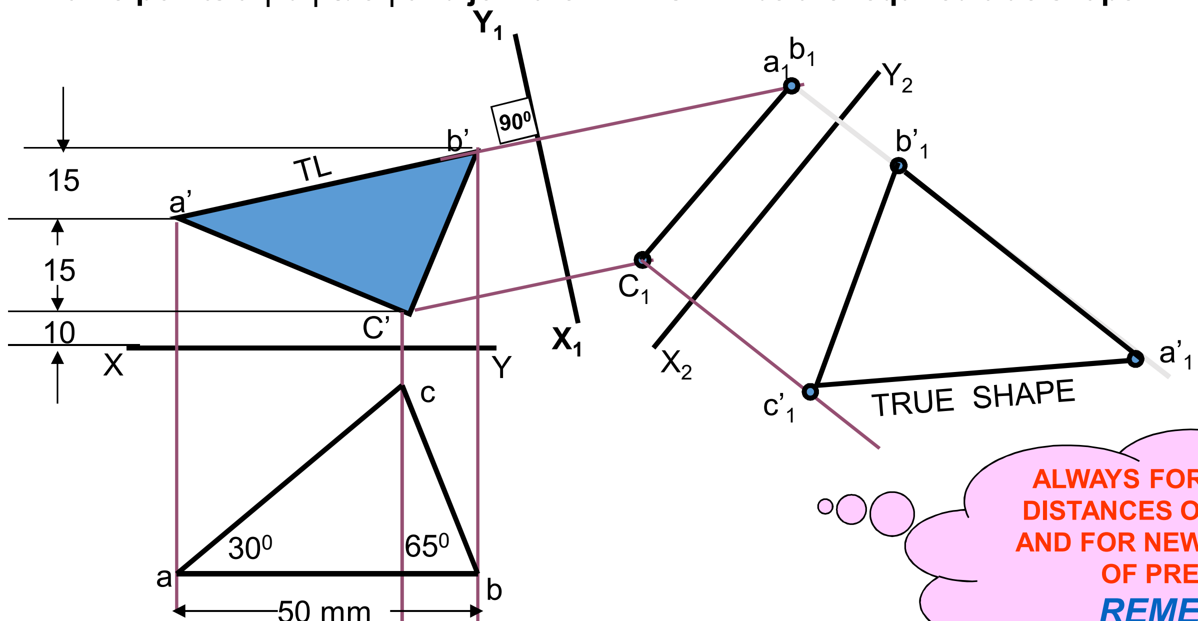
NOW FINAL VIEWS ARE ALWAYS SOME SHAPE, NOT LINE VIEWS:
SO APPLYING ABOVE METHOD:
WE FIRST CONVERT ONE VIEW IN INCLINED LINE VIEW .(By using x1y1 aux.plane)
THEN BY MAKING IT // TO X2-Y2 WE GET TRUE SHAPE.

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.

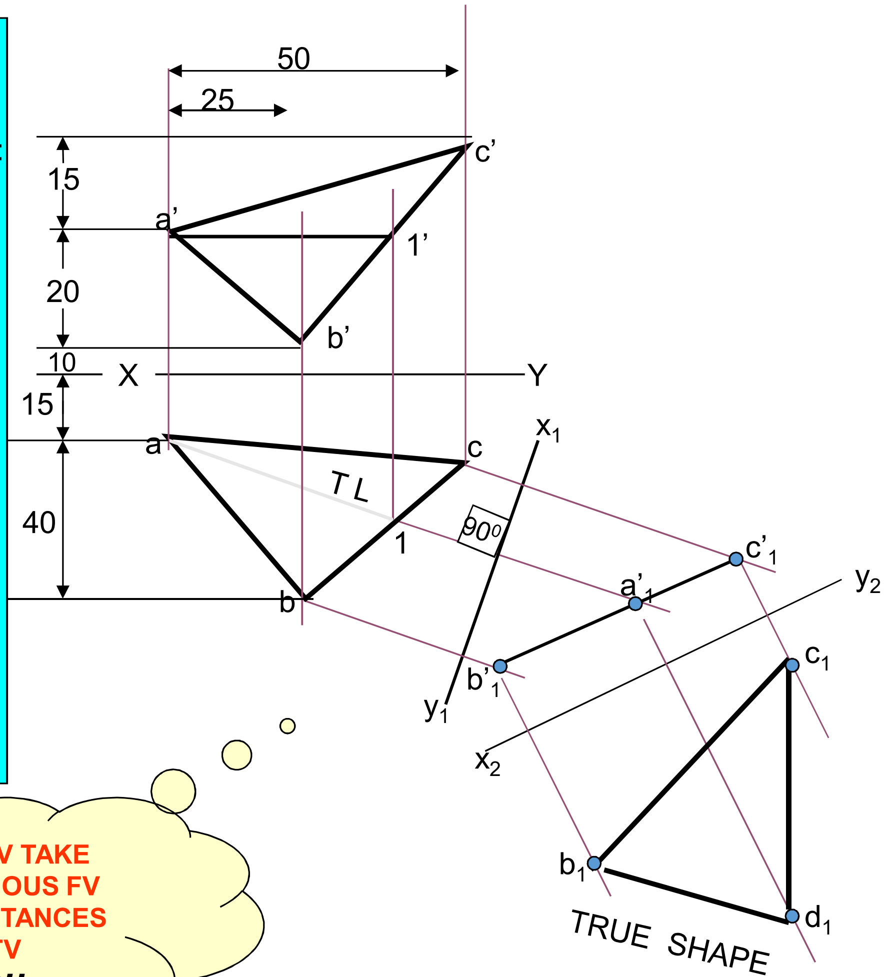
USE SAME PROCEDURE STEPS
OF PREVIOUS PROBLEM:
BUT THERE IS ONE DIFFICULTY:

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)

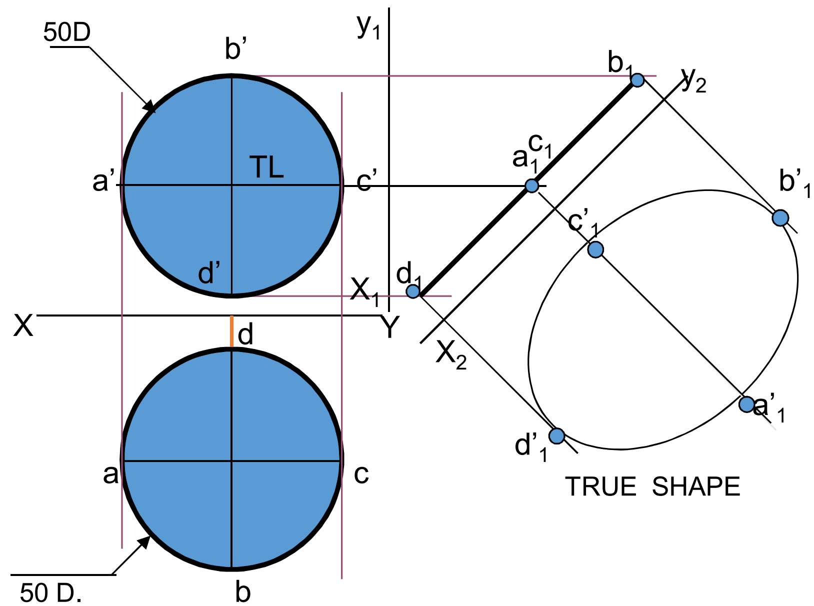


ALWAYS FOR NEW FV TAKE
DISTANCES OF PREVIOUS FV
AND FOR NEW TV, DISTANCES
OF PREVIOUS TV
REMEMBER!!

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!!

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.

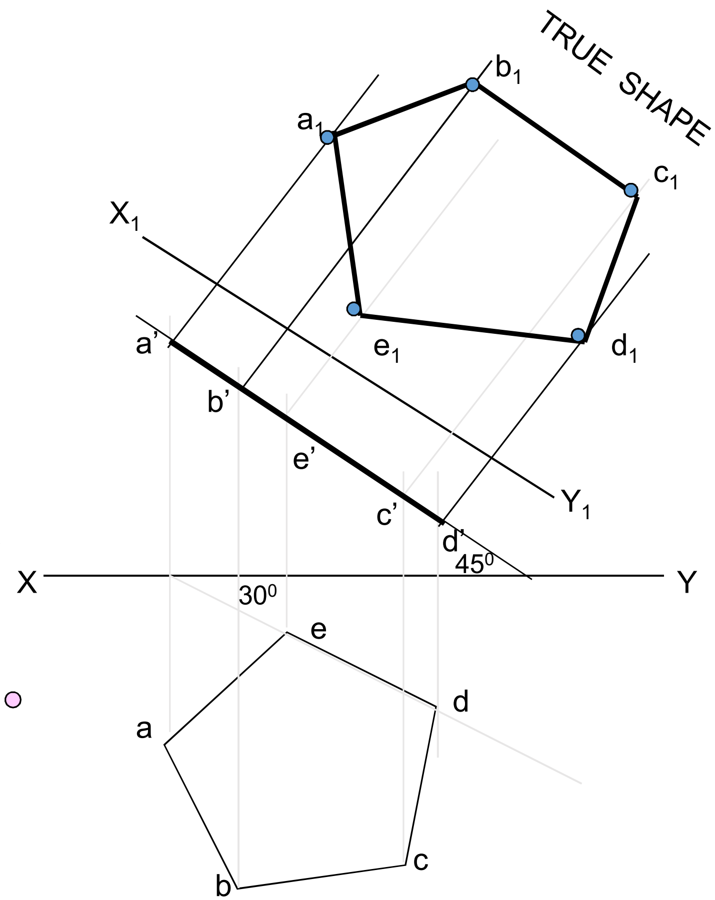
IN THIS CASE ALSO TRUE LENGTH IS NOT AVAILABLE IN ANY VIEW.

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!!



CHAPTER-11

PROJECTIONS OF SOLIDS

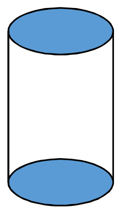
SOLIDS

To understand and remember various solids in this subject properly,
those are classified & arranged in to two major groups.

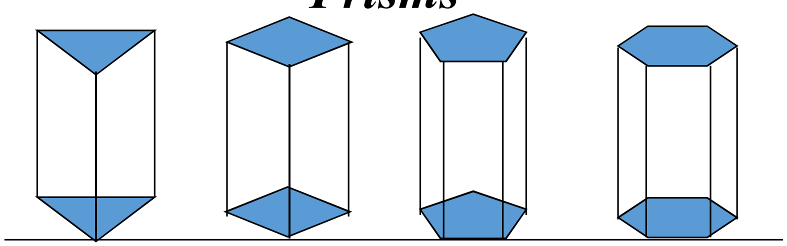
Group A

Solids having top and base of same shape

Cylinder

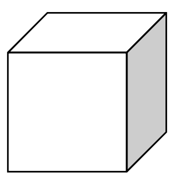


Prisms



Triangular Square Pentagonal Hexagonal

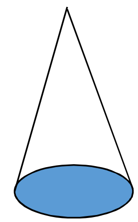
Cube
(A solid having
six square faces)



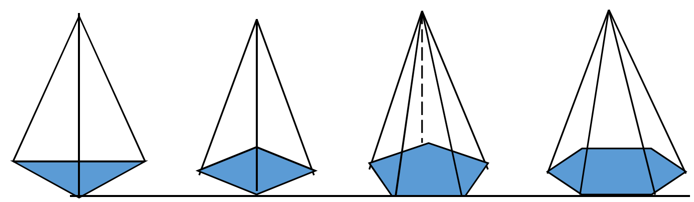
Group B

Solids having base of some shape
and just a point as a top, called apex.

Cone

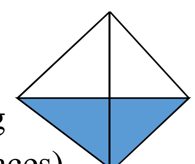


Pyramids



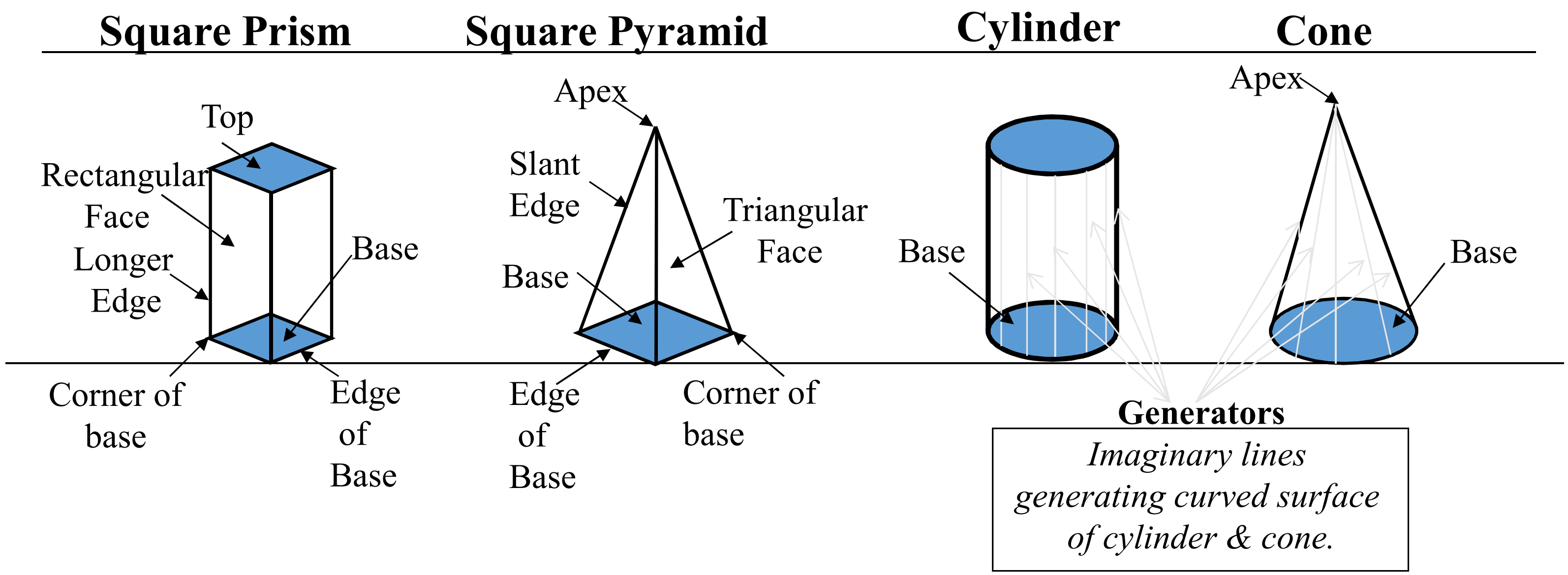
Triangular Square Pentagonal Hexagonal

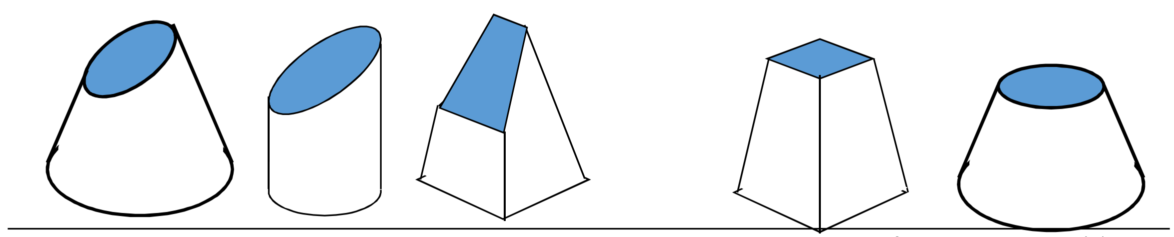
Tetrahedron
(A solid having
Four triangular faces)



SOLIDS

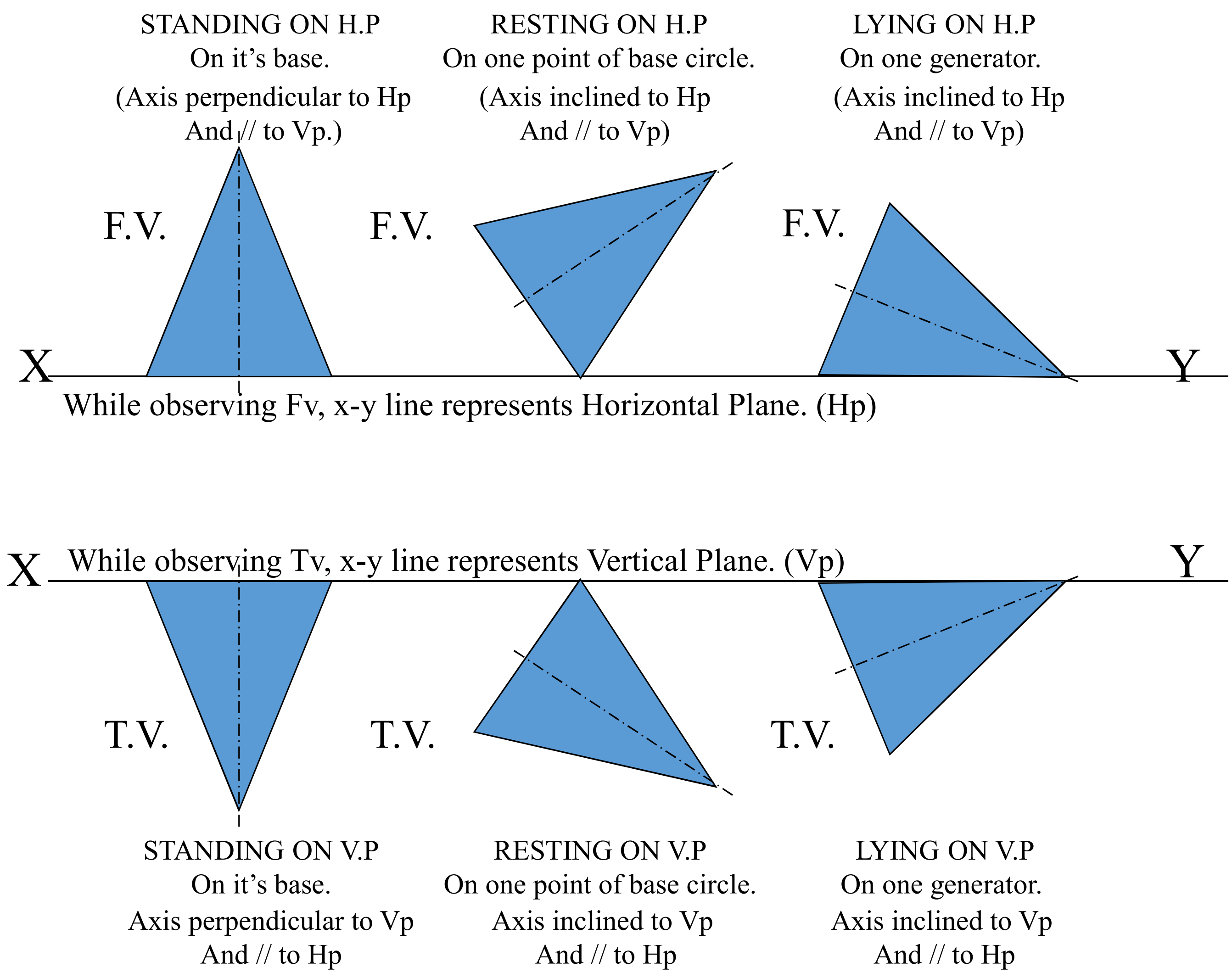
Dimensional parameters of different solids.





Sections of solids(top & base not parallel)

Frustum of cone & pyramids.
(top & base parallel to each other)


STANDING ON H.P
On it's base.
(Axis perpendicular to Hp
And // to Vp.)
RESTING ON H.P
On one point of base circle.
(Axis inclined to Hp
And // to Vp)
LYING ON H.P
On one generator.
(Axis inclined to Hp
And // to Vp)
F.V.
F.V.
F.V.
X
Y
While observing Fv, x-y line represents Horizontal Plane. (Hp)
X
While observing Tv, x-y line represents Vertical Plane. (Vp)
Y
T.V.
T.V.
T.V.
STANDING ON V.P
On it's base.
Axis perpendicular to Vp
And // to Hp
RESTING ON V.P
On one point of base circle.
Axis inclined to Vp
And // to Hp
LYING ON V.P
On one generator.
Axis inclined to Vp
And // to Hp

STEPS TO SOLVE PROBLEMS IN SOLIDS

Problem is solved in three steps:

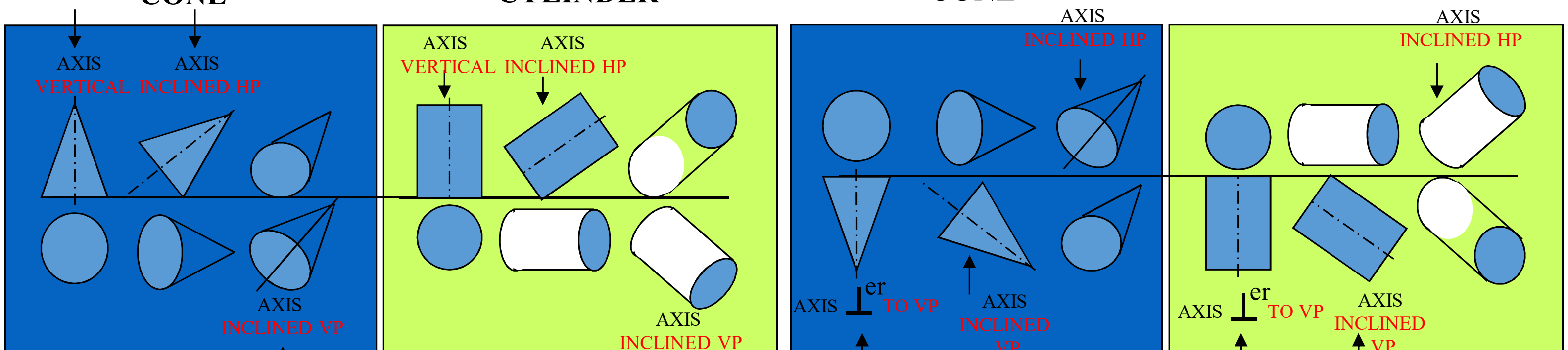
STEP 1: ASSUME SOLID STANDING ON THE PLANE WITH WHICH IT IS MAKING INCLINATION.
(IF IT IS INCLINED TO HP, ASSUME IT STANDING ON HP)
(IF IT IS INCLINED TO VP, ASSUME IT STANDING ON VP)
IF STANDING ON HP - IT'S TV WILL BE TRUE SHAPE OF IT'S BASE OR TOP:
IF STANDING ON VP - IT'S FV WILL BE TRUE SHAPE OF IT'S BASE OR TOP.
BEGIN WITH THIS VIEW:
IT'S OTHER VIEW WILL BE A RECTANGLE (IF SOLID IS *CYLINDER OR ONE OF THE PRISMS)*:
IT'S OTHER VIEW WILL BE A TRIANGLE (IF SOLID IS ***CONE OR ONE OF THE PYRAMIDS):***
DRAW FV & TV OF THAT SOLID IN STANDING POSITION:

STEP 2: CONSIDERING SOLID'S INCLINATION (AXIS POSITION) DRAW IT'S FV & TV.

STEP 3: IN LAST STEP, CONSIDERING REMAINING INCLINATION, DRAW IT'S FINAL FV & TV.

GENERAL PATTERN (THREE STEPS) OF SOLUTION:

GROUP B SOLID. CONE | **GROUP A SOLID. CYLINDER** | **GROUP B SOLID. CONE** | **GROUP A SOLID. CYLINDER**



Three steps If solid is inclined to Hp | **Three steps If solid is inclined to Hp** | **Three steps If solid is inclined to Vp** | **Three steps If solid is inclined to Vp**

Study Next *Twelve* Problems and Practice them separately !!

CATEGORIES OF ILLUSTRATED PROBLEMS!

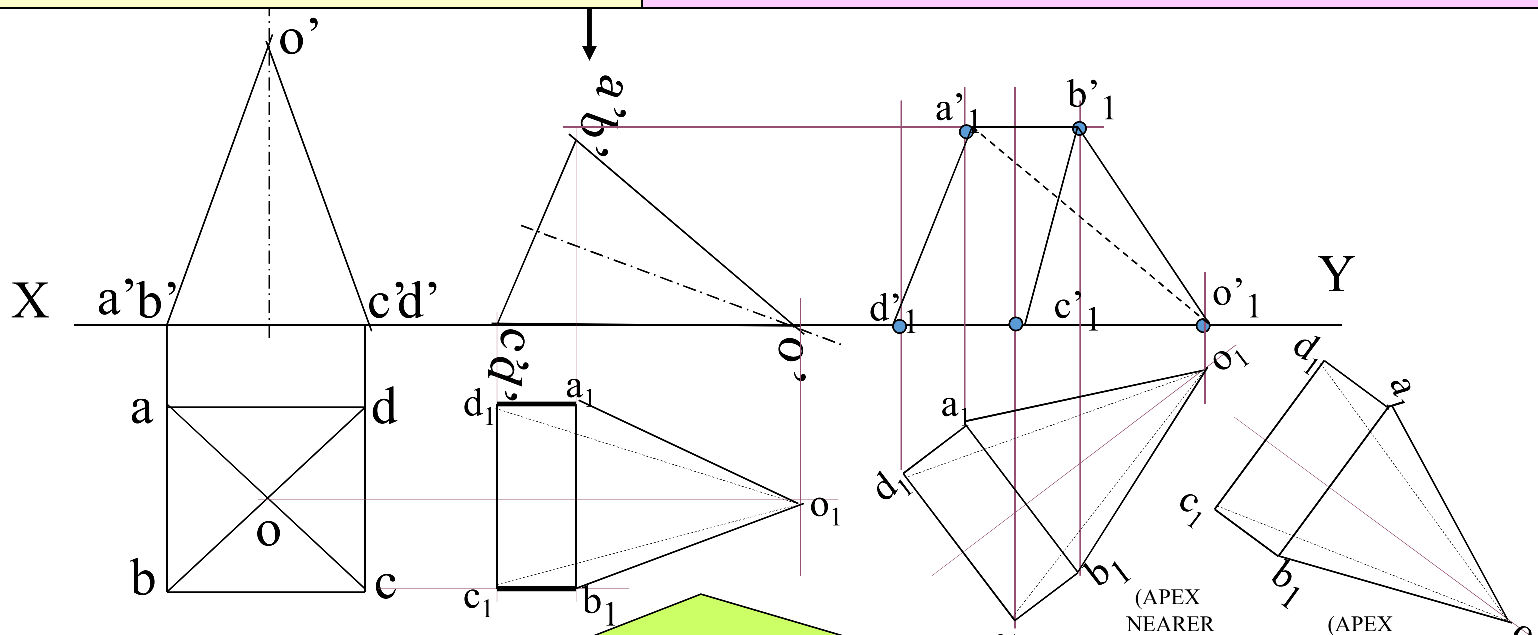
PROBLEM NO.1, 2, 3, 4	GENERAL CASES OF SOLIDS INCLINED TO HP & VP
PROBLEM NO. 5 & 6	CASES OF CUBE & TETRAHEDRON
PROBLEM NO. 7	CASE OF FREELY SUSPENDED SOLID WITH SIDE VIEW.
PROBLEM NO. 8	CASE OF CUBE (WITH SIDE VIEW)
PROBLEM NO. 9	CASE OF TRUE LENGTH INCLINATION WITH HP & VP.
PROBLEM NO. 10 & 11	CASES OF COMPOSITE SOLIDS. (AUXILIARY PLANE)
PROBLEM NO. 12	CASE OF A FRUSTUM (AUXILIARY PLANE)

Problem 1. A square pyramid, 40 mm base sides and axis 60 mm long, has a triangular face on the ground and the vertical plane containing the axis makes an angle of 45^0 with the VP. Draw its projections. Take apex nearer to VP

Solution Steps :

Triangular face on Hp , means it is lying on Hp:

1.Assume it standing on Hp.
2.It's Tv will show True Shape of base(square)
3.Draw square of 40mm sides with one side vertical Tv & taking 50 mm axis project Fv. (a triangle)
4.Name all points as shown in illustration.
5.Draw 2nd Fv in lying position I.e.o'c'd' face on xy. And project it's Tv.
6.Make visible lines dark and hidden dotted, as per the procedure.
7.Then construct remaining inclination with Vp (Vp containing axis ic the center line of 2nd Tv.Make it 45^0 to xy as shown take apex near to xy, as it is nearer to Vp) & project final Fv.

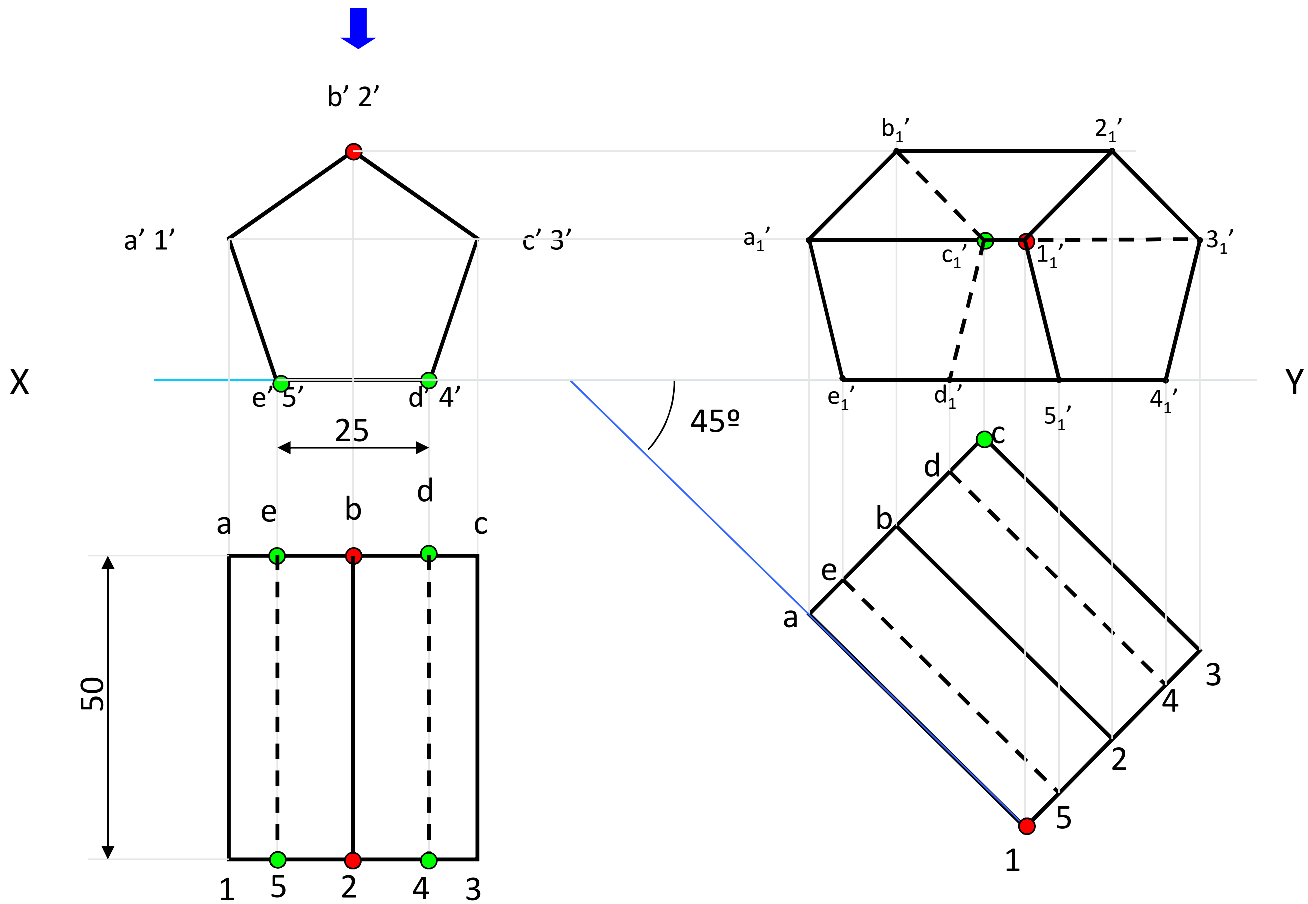


For dark and dotted lines

1.Draw proper outline of new view DARK. 2. Decide direction of an observer.
3. Select nearest point to observer and draw all lines starting from it-dark.
4. Select farthest point to observer and draw all lines (remaining)from it- dotted.

Q Draw the projections of a pentagonal prism , base 25 mm side and axis 50 mm long, resting on one of its rectangular faces on the H.P. with the axis inclined at 45º to the V.P.

As the axis is to be inclined with the VP, in the first view it must be kept perpendicular to the VP i.e. true shape of the base will be drawn in the FV with one side on XY line



Problem 2:

A cone 40 mm diameter and 50 mm axis is resting on one generator on Hp which makes 30^0 inclination with Vp Draw it's projections.

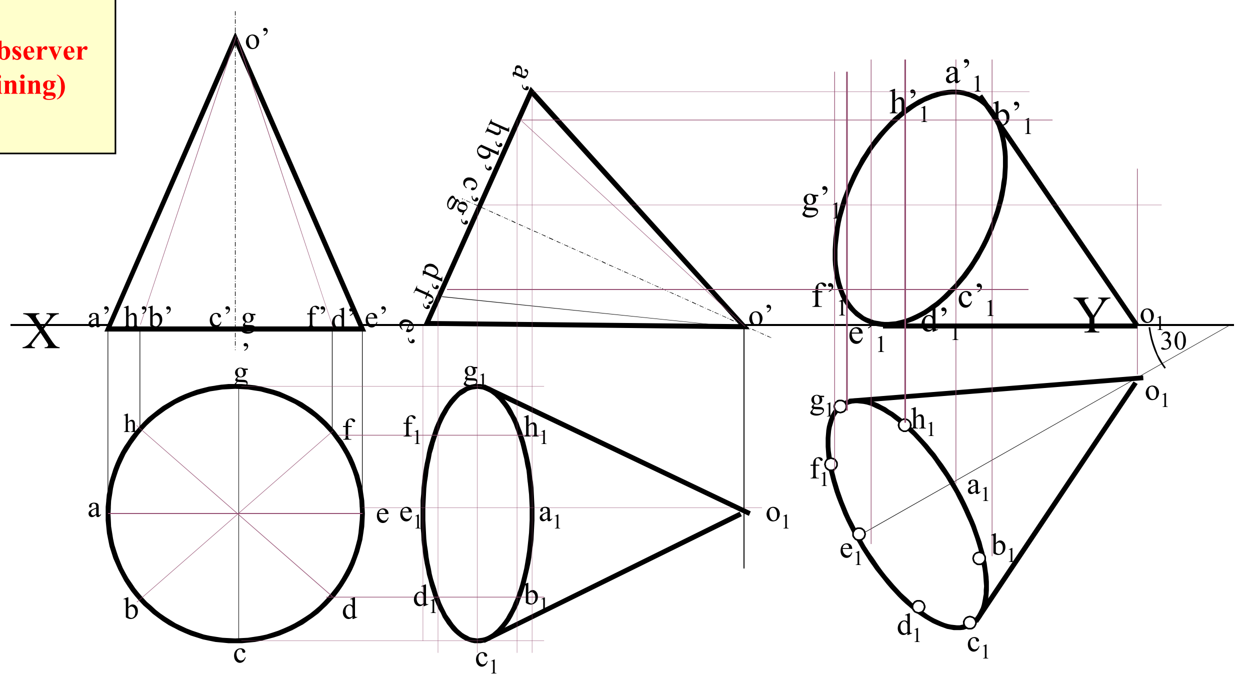
For dark and dotted lines

1. Draw proper outline of new vie DARK.
2. Decide direction of an observer.
3. Select nearest point to observer and draw all lines starting from it-dark.
4. Select farthest point to observer and draw all lines (remaining) from it- dotted.

Solution Steps:

Resting on Hp on one generator, means lying on Hp:

1. Assume it standing on Hp.
2. It's Tv will show True Shape of base(circle)
3. Draw 40mm dia. Circle as Tv & taking 50 mm axis project Fv. (a triangle)
4. Name all points as shown in illustration.
5. Draw 2^{nd} Fv in lying position I.e.o'e' on xy. And project it's Tv below xy.
6. Make visible lines dark and hidden dotted, as per the procedure.
7. Then construct remaining inclination with Vp (generator o_1e_1 30^0 to xy as shown) & project final Fv.



Problem 3:

A cylinder 40 mm diameter and 50 mm axis is resting on one point of a base circle on Vp while it's axis makes 45^0 with Vp and Fv of the axis 35^0 with Hp. Draw projections..

Solution Steps:

Resting on Vp on one point of base, means inclined to Vp:

1.Assume it standing on Vp

2.It's Fv will show True Shape of base & top(circle)

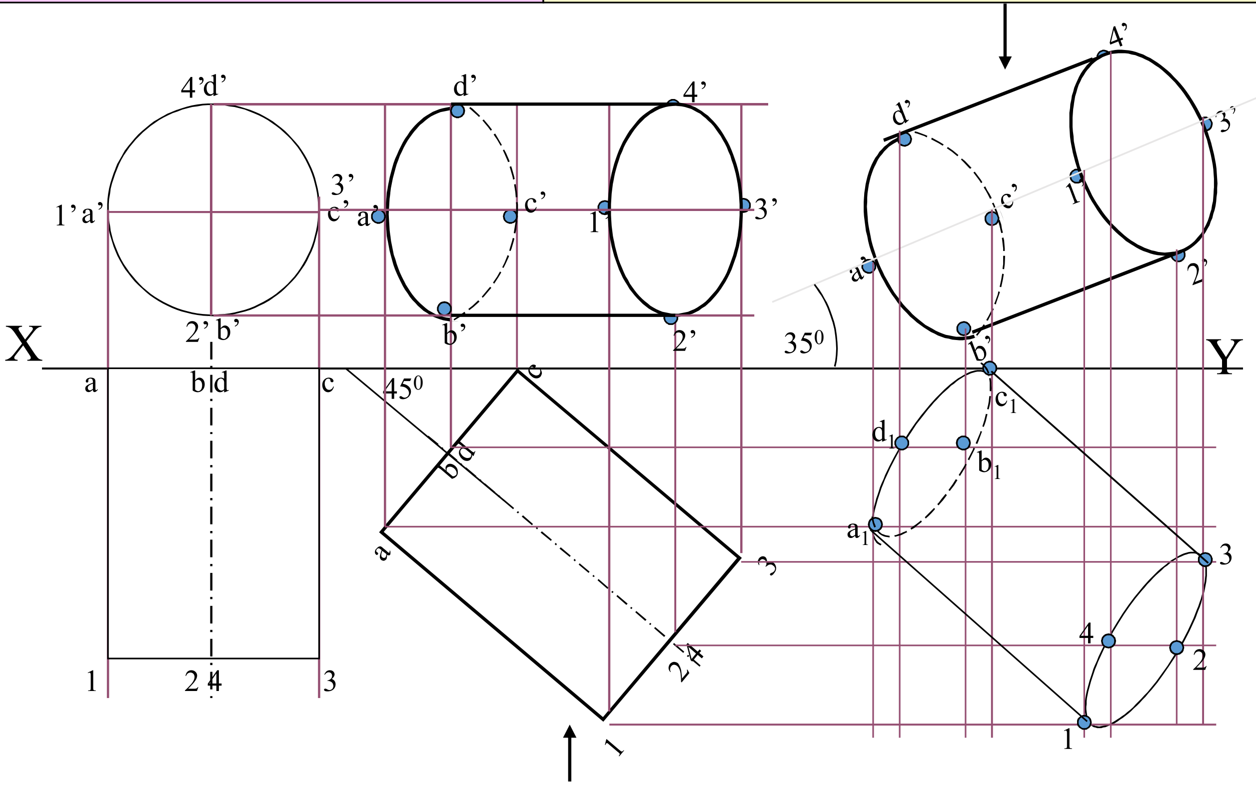
3.Draw 40mm dia. Circle as Fv & taking 50 mm axis project Tv. (a Rectangle)

4.Name all points as shown in illustration.

5.Draw 2nd Tv making axis 45^0 to xy And project it's Fv above xy.

6.Make visible lines dark and hidden dotted, as per the procedure.

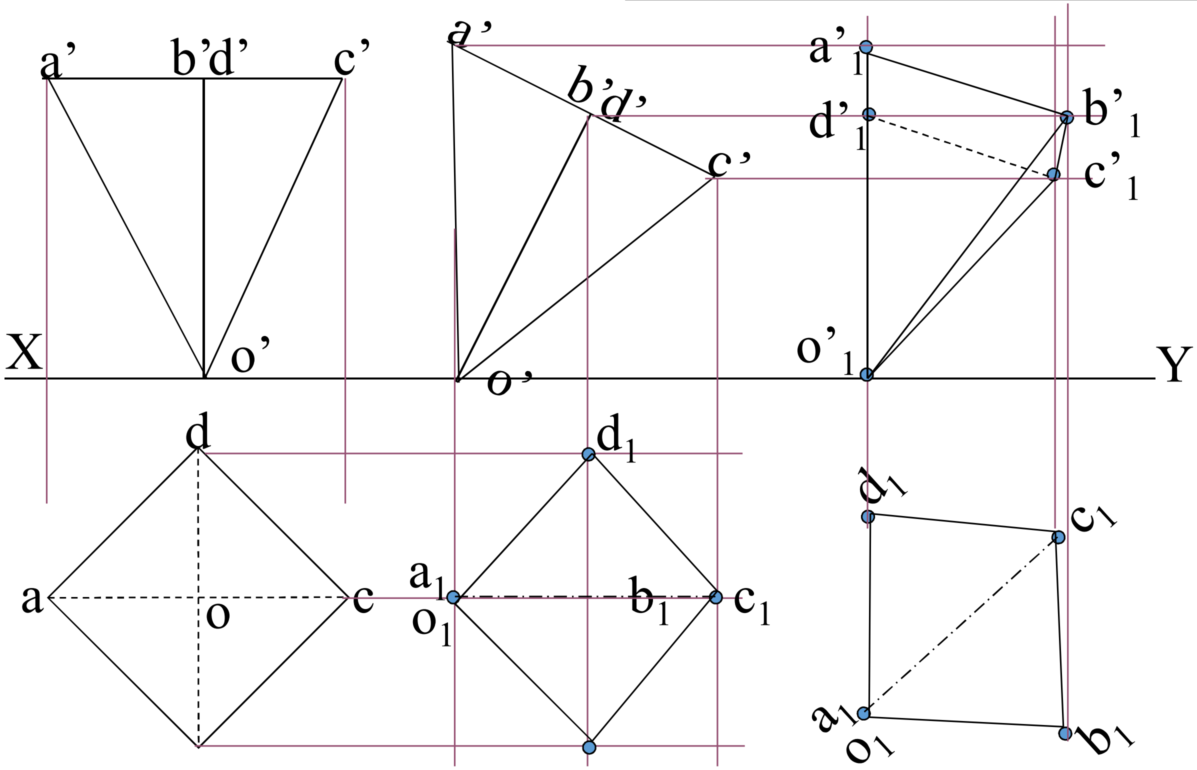
7.Then construct remaining inclination with Hp (Fv of axis I.e. center line of view to xy as shown) & project final Tv.



Problem 4: A square pyramid 30 mm base side and 50 mm long axis is resting on it's apex on Hp, such that it's one slant edge is vertical and a triangular face through it is perpendicular to Vp. Draw it's projections.

Solution Steps :

1. Assume it standing on Hp but as said on apex.(inverted).
2. It's Tv will show True Shape of base(square)
3. Draw a corner case square of 30 mm sides as Tv(as shown) Showing all slant edges dotted, as those will not be visible from top.
4. taking 50 mm axis project Fv. (a triangle)
5. Name all points as shown in illustration.
6. Draw 2nd Fv keeping o'a' slant edge vertical & project it's Tv
7. Make visible lines dark and hidden dotted, as per the procedure.
8. Then redrew 2nd Tv as final Tv keeping $a_1o_1d_1$ triangular face perpendicular to Vp I.e.xy. Then as usual project final Fv.



Problem 5: A cube of 50 mm long edges is so placed on Hp on one corner that a body diagonal is parallel to Hp and perpendicular to Vp Draw it's projections.

Solution Steps:

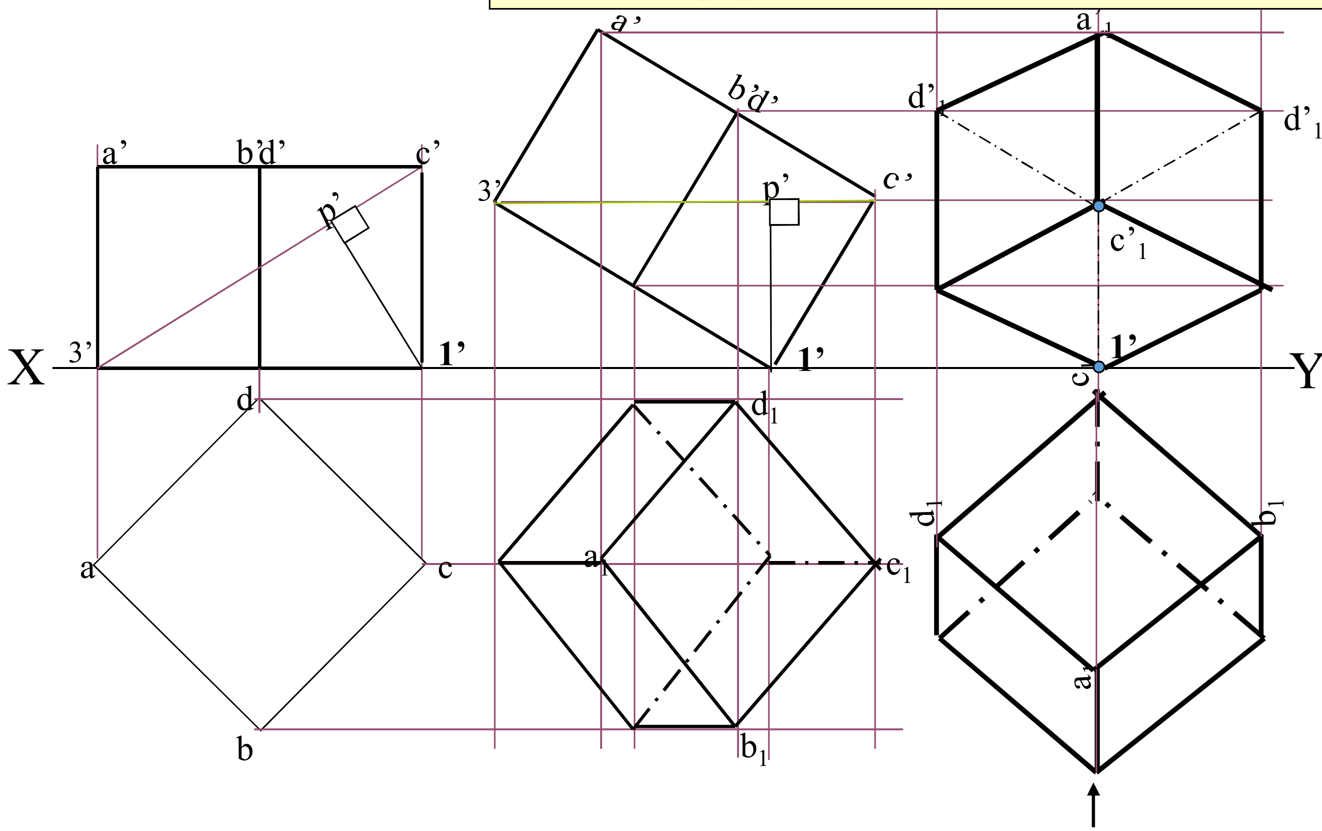
1.Assuming standing on Hp, begin with Tv,a square with all sides equally inclined to xy.Project Fv and name all points of FV & TV.

2.Draw a body-diagonal joining c' with 3'(This can become // to xy)

3.From 1' drop a perpendicular on this and name it p'

4.Draw 2nd Fv in which 1'-p' line is vertical ***means*** c'-3' diagonal must be horizontal. .Now as usual project Tv..

6.In final Tv draw same diagonal is perpendicular to Vp as said in problem. Then as usual project final FV.



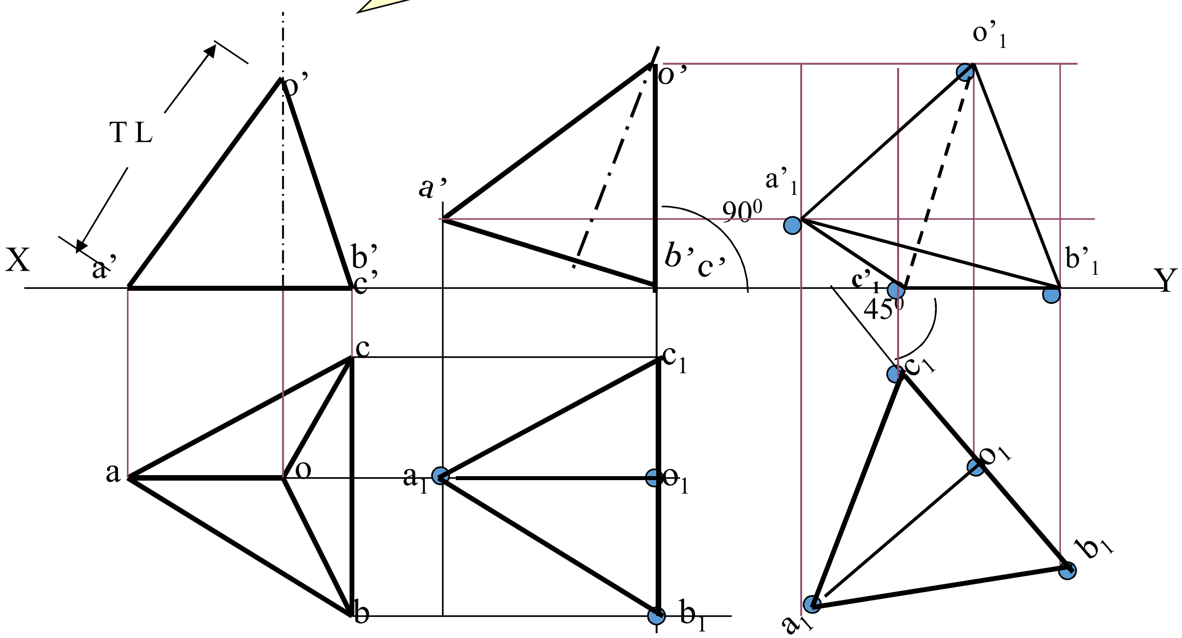
Problem 6: A tetrahedron of 50 mm long edges is resting on one edge on Hp while one triangular face containing this edge is vertical and 45^0 inclined to Vp. Draw projections.

IMPORTANT:

Tetrahedron is a special type of triangular pyramid in which base sides & slant edges are equal in length.
Solid of four faces.
Like cube it is also described by One dimension only..
Axis length generally not given.

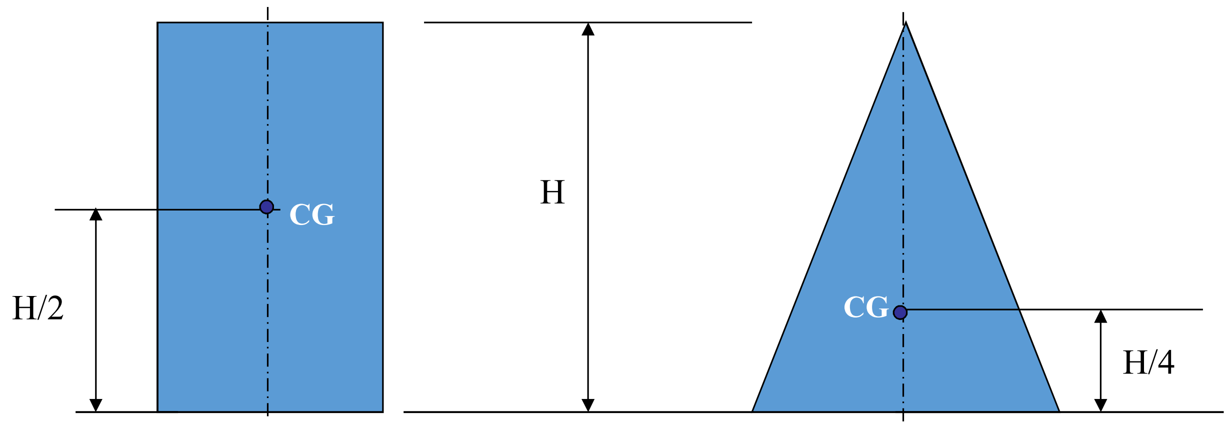
Solution Steps

As it is resting assume it standing on Hp.
Begin with Tv , an equilateral triangle as side case as shown:
First project base points of Fv on xy, name those & axis line.
From a' with TL of edge, 50 mm, cut on axis line & mark o'
(as axis is not known, o' is finalized by slant edge length)
Then complete Fv.
In 2^{nd} Fv make face o'b'c' vertical as said in problem.
And like all previous problems solve completely.



FREELY SUSPENDED SOLIDS:

Positions of CG, on axis, from base, for different solids are shown below.



GROUP A SOLIDS
(Cylinder & Prisms)

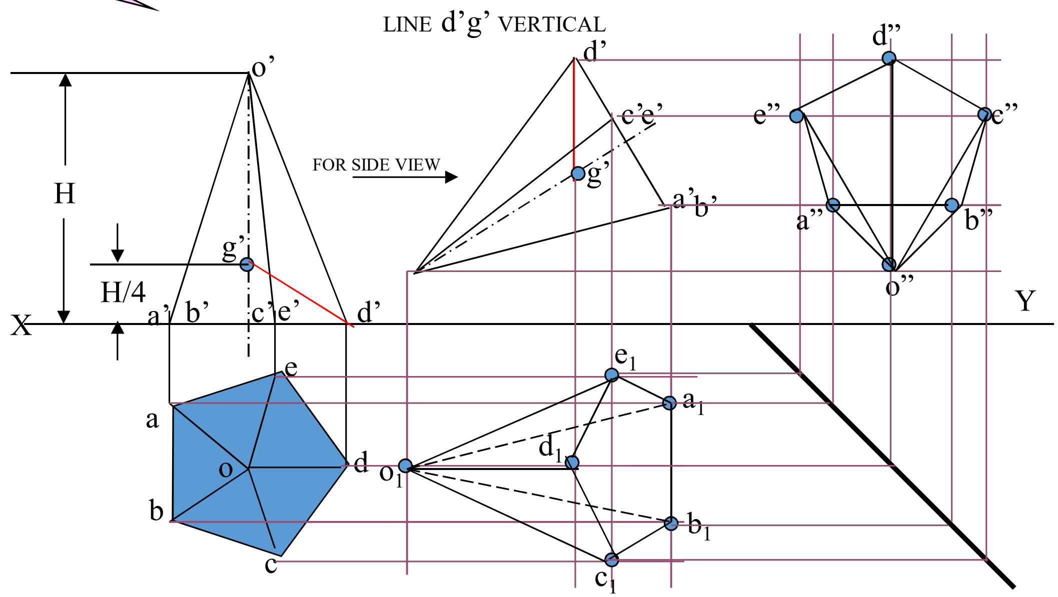
GROUP B SOLIDS
(Cone & Pyramids)

Problem 7: A pentagonal pyramid 30 mm base sides & 60 mm long axis, is freely suspended from one corner of base so that a plane containing it's axis remains parallel to Vp.
Draw it's three views.

Solution Steps:

In all suspended cases axis shows inclination with Hp.

1. Hence assuming it standing on Hp, drew Tv - a regular pentagon,corner case.
2. Project Fv & locate CG position on axis – (¼ H from base.) and name g' and Join it with corner d'
3. As 2[nd] Fv, redraw first keeping line g'd' vertical.
4. As usual project corresponding Tv and then Side View looking from.



IMPORTANT:

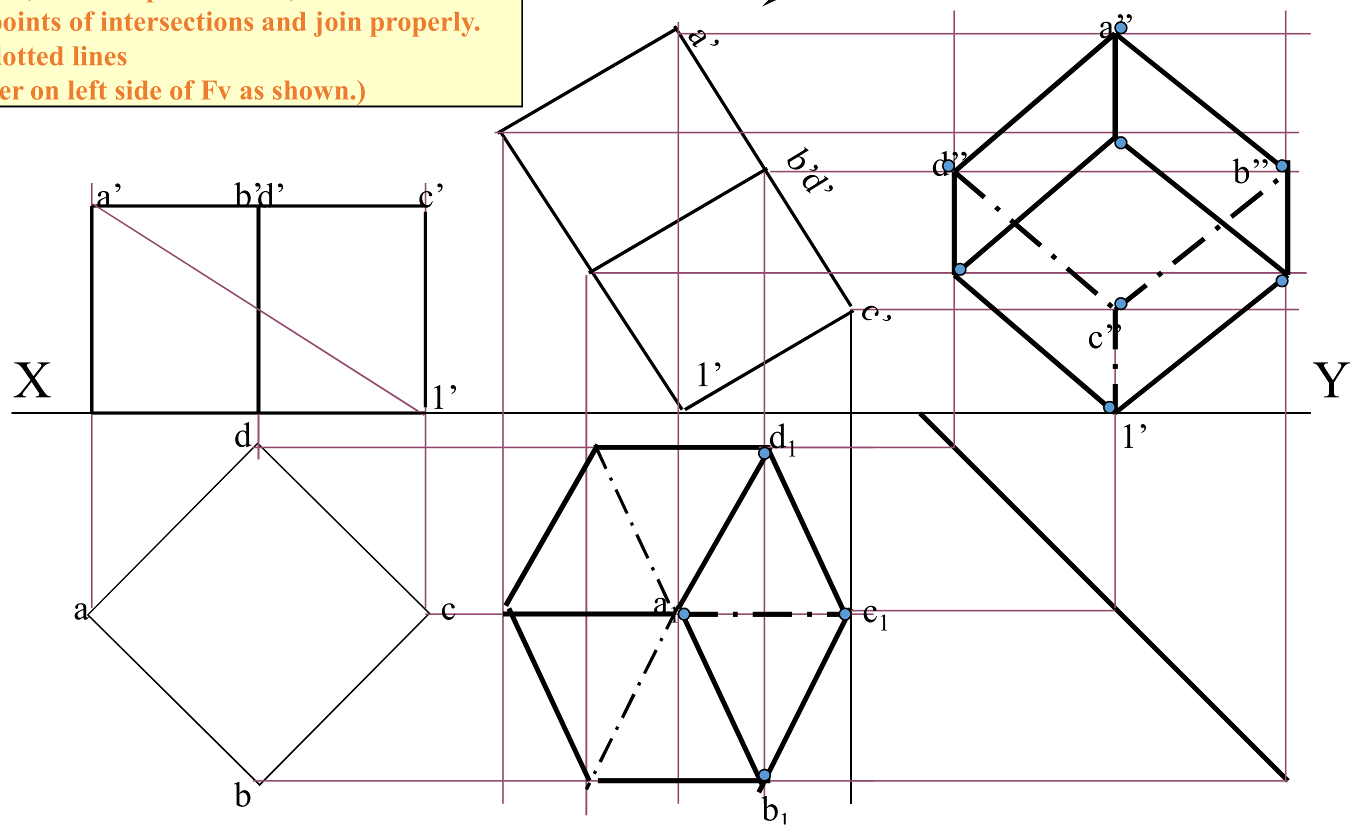
When a solid is freely suspended from a corner, then line joining point of contact & C.G. remains vertical.
(Here axis shows inclination with Hp.)
So in all such cases, assume solid standing on Hp initially.)

Solution Steps:

1.Assuming it standing on Hp begin with Tv, a square of corner case.
2.Project corresponding Fv.& name all points as usual in both views.
3.Join a'1' as body diagonal and draw 2nd Fv making it vertical (I' on xy)
4.Project it's Tv drawing dark and dotted lines as per the procedure.
5.With standard method construct Left-hand side view.

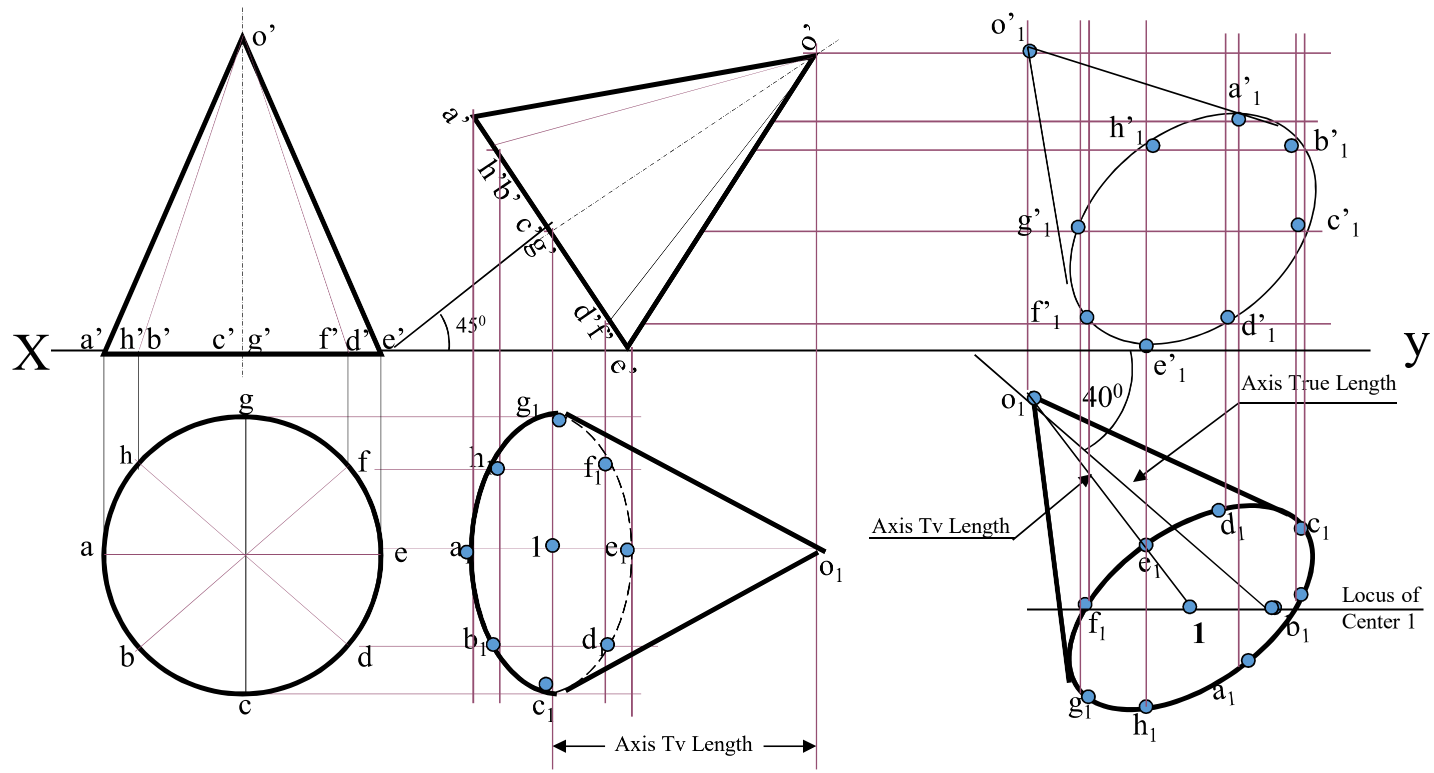
(Draw a 45^0 inclined Line in Tv region (below xy). Project horizontally all points of Tv on this line and reflect vertically upward, above xy.After this, draw horizontal lines, from all points of Fv, to meet these lines. Name points of intersections and join properly. For dark & dotted lines locate observer on left side of Fv as shown.)

Problem 8:
A cube of 50 mm long edges is so placed on Hp on one corner that a body diagonal through this corner is perpendicular to Hp and parallel to Vp Draw it's three views.



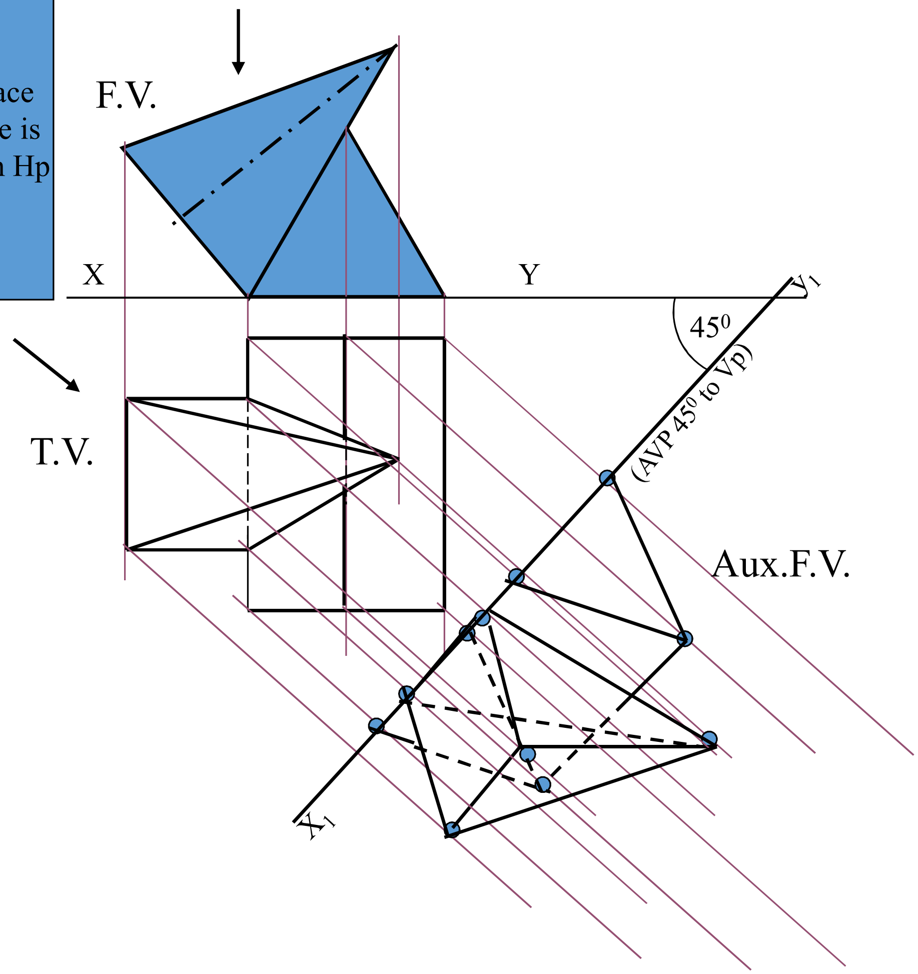
Problem 9: A right circular cone, 40 mm base diameter and 60 mm long axis is resting on Hp on one point of base circle such that it's axis makes 45^0 inclination with Hp and 40^0 inclination with Vp. Draw it's projections.

This case resembles to **problem no.7 & 9 from projections of planes** topic.
In previous all cases 2^{nd} inclination was done by a parameter not showing TL.Like Tv of axis is inclined to Vp etc. But here it is clearly said that the axis is 40^0 inclined to Vp. Means here TL inclination is expected. So the same construction done in those Problems is done here also. See carefully the final Tv and inclination taken there.
So assuming it standing on HP begin as usual.



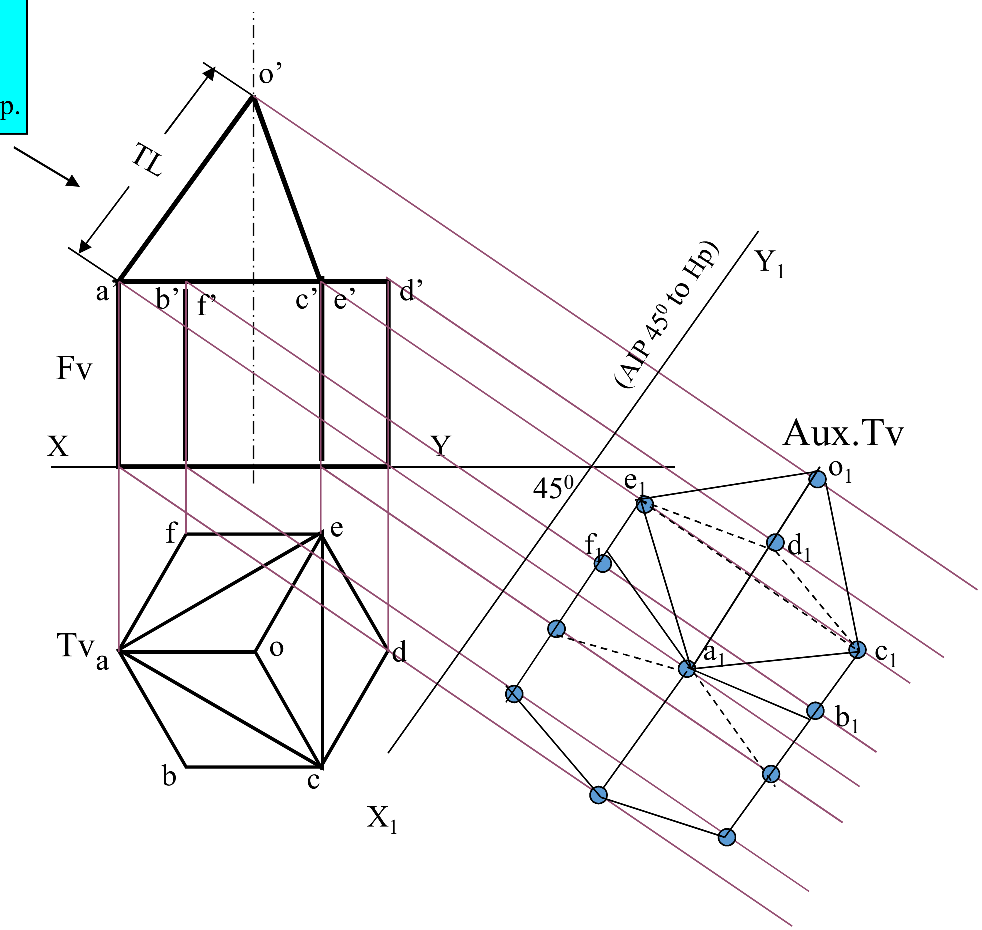
Problem 10: A triangular prism,
40 mm base side 60 mm axis
is lying on Hp on one rectangular face
with axis perpendicular to Vp.
One square pyramid is leaning on it's face
centrally with axis // to vp. It's base side is
30 mm & axis is 60 mm long resting on Hp
on one edge of base.Draw FV & TV of
both solids.Project another FV
on an AVP 45^0 inclined to VP.

Steps :
Draw Fv of lying prism
(an equilateral Triangle)
And Fv of a leaning pyramid.
Project Tv of both solids.
Draw x_1y_1 45^0 inclined to xy
and project aux.Fv on it.
Mark the distances of first FV
from first xy for the distances
of aux. Fv from x_1y_1 line.
Note the observer's directions
Shown by arrows and further
steps carefully.

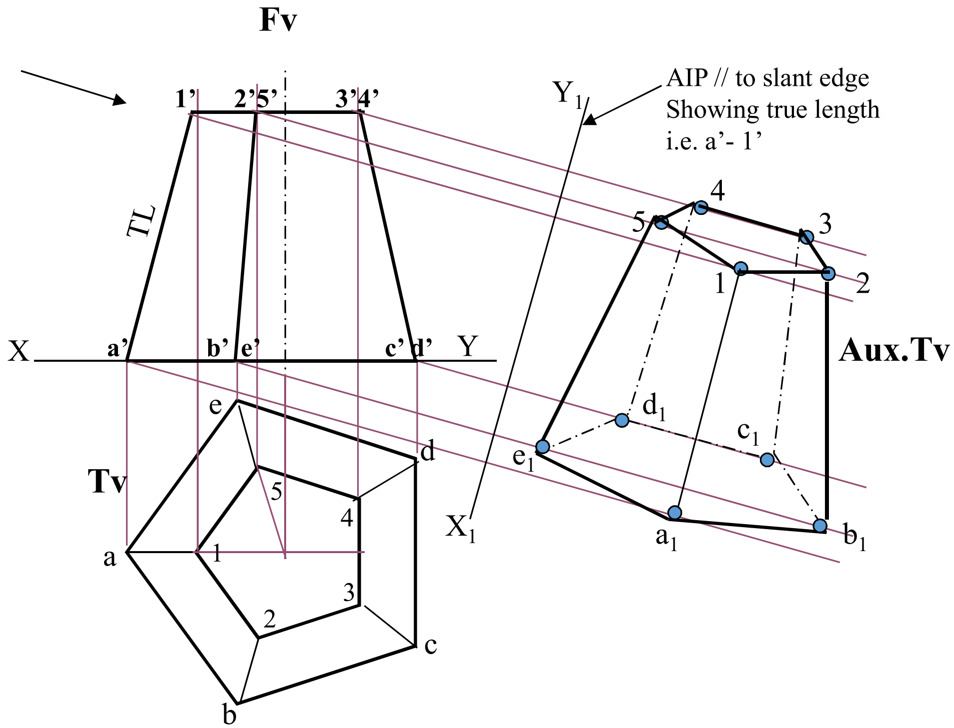


Problem 11:A hexagonal prism of base side 30 mm longand axis 40 mm long, is standing on Hp on it's base with one base edge // to Vp. A tetrahedron is placed centrally on the top of it.The base of tetrahedron is a triangle formed by joining alternate corners of top of prism..Draw projections of both solids. Project an auxiliary Tv on AIP 45^0 inclined to Hp.

STEPS:
Draw a regular hexagon as Tv of standing prism With one side // to xy and name the top points.Project it's Fv – a rectangle and name it's top.
Now join it's alternate corners a-c-e and the triangle formed is base of a tetrahedron as said.
Locate center of this triangle & locate apex o
Extending it's axis line upward mark apex o'
By cutting TL of edge of tetrahedron equal to a-c. and complete Fv of tetrahedron.
Draw an AIP (x1y1) 45^0 inclined to xy And project Aux.Tv on it by using similar Steps like previous problem.



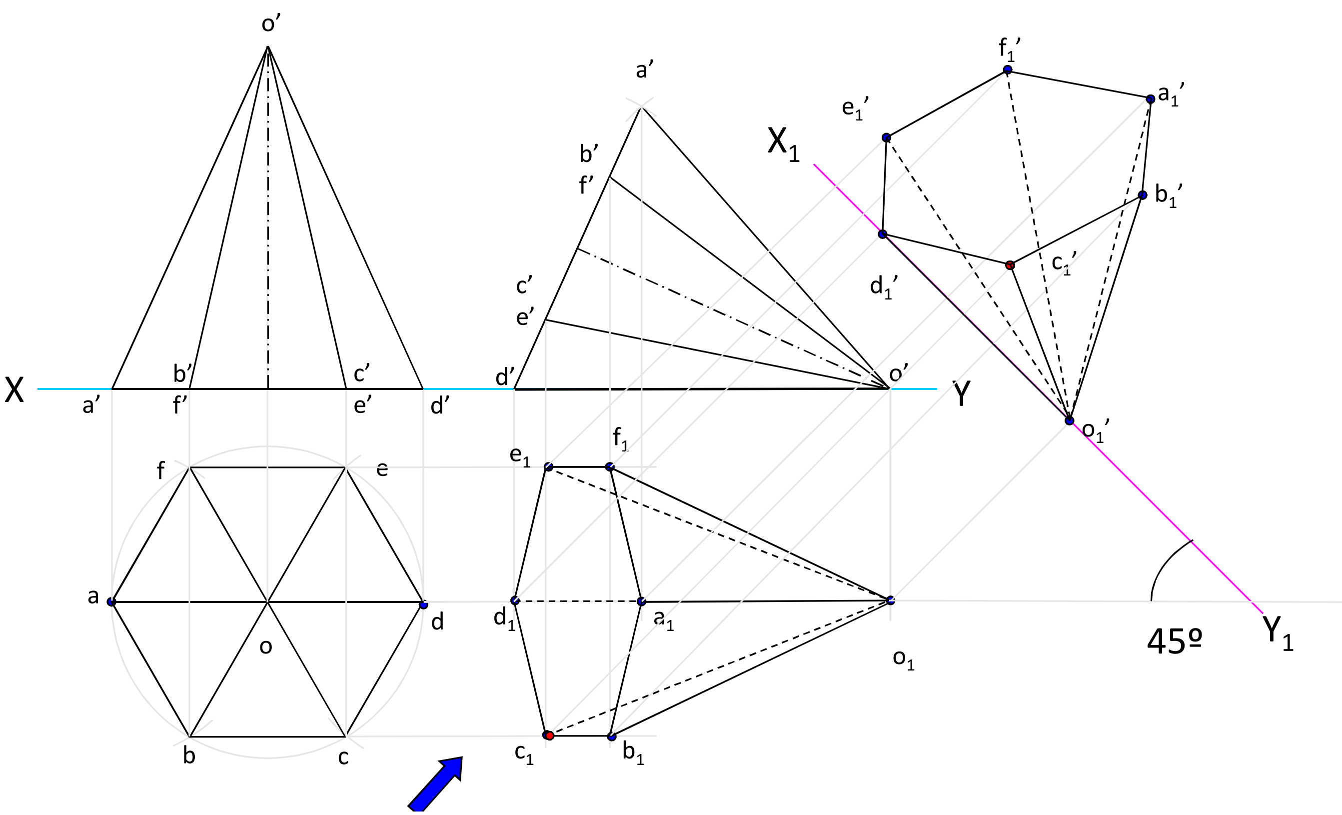
Problem 12: A frustum of regular hexagonal pyrami is standing on it's larger base On Hp with one base side perpendicular to Vp.Draw it's Fv & Tv.
Project it's Aux.Tv on an AIP parallel to one of the slant edges showing TL.
Base side is 50 mm long , top side is 30 mm long and 50 mm is height of frustum.



Q..: A hexagonal pyramid base 25 mm side and axis 55 mm long has one of its slant edge on the ground. A plane containing that edge and the axis is perpendicular to the H.P. and inclined at 45º to the V.P. Draw its projections when the apex is nearer to the V.P. than the base.

The inclination of the axis is given indirectly in this problem. When the slant edge of a pyramid rests on the HP its axis is inclined with the HP so while deciding first view the axis of the solid must be kept perpendicular to HP i.e. true shape of the base will be seen in the TV. Secondly when drawing hexagon in the TV we have to keep the corners at the extreme ends.

The vertical plane containing the slant edge on the HP and the axis is seen in the TV as o_1d_1 for drawing auxiliary FV draw an auxiliary plane X_1Y_1 at 45º from d_1o_1 extended. Then draw projectors from each point i.e. a_1 to f_1 perpendicular to X_1Y_1 and mark the points measuring their distances in the FV from old XY line.



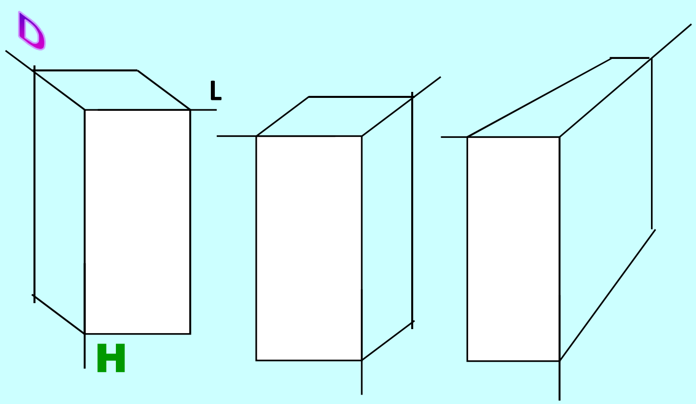
CHAPTER-12

ISOMETRIC PROJECTIONS

ISOMETRIC DRAWING

IT IS A TYPE OF PICTORIAL PROJECTION
IN WHICH ALL THREE DIMENSIONS OF
AN OBJECT ARE SHOWN IN ONE VIEW AND
IF REQUIRED, THEIR ACTUAL SIZES CAN BE
MEASURED DIRECTLY FROM IT.

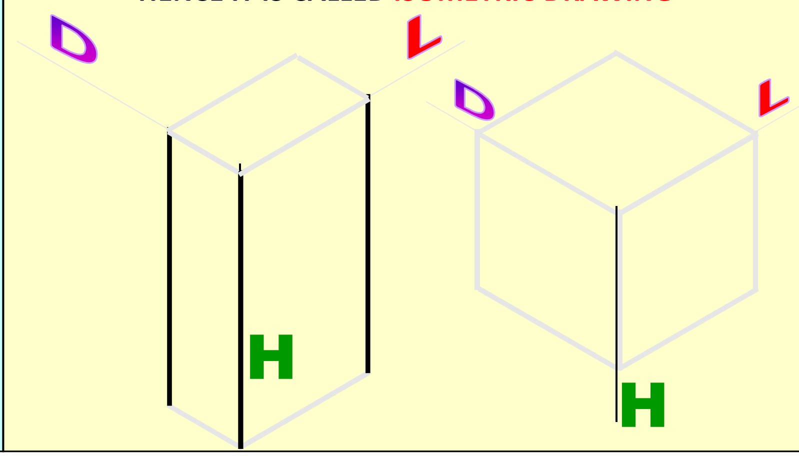
3-D DRAWINGS CAN BE DRAWN
IN NUMEROUS WAYS AS SHOWN BELOW.
ALL THESE DRAWINGS MAY BE CALLED
3-DIMENSIONAL DRAWINGS,
OR PHOTOGRAPHIC
OR PICTORIAL DRAWINGS.
HERE NO SPECIFIC RELATION
AMONG H, L & D AXES IS MENTAINED.



TYPICAL CONDITION.

IN THIS 3-D DRAWING OF AN OBJECT,
ALL THREE DIMENSIONAL AXES ARE
MENTAINED AT EQUAL INCLINATIONS
WITH EACH OTHER.(120^0)

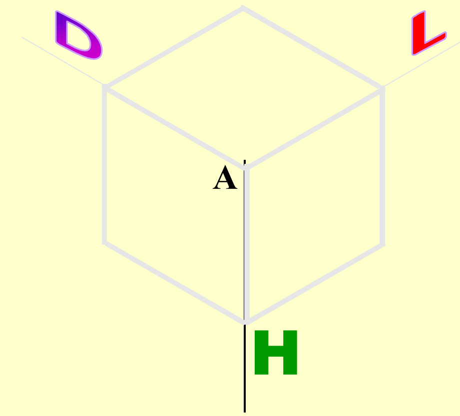
NOW OBSERVE BELOW GIVEN DRAWINGS.
ONE CAN NOTE SPECIFIC INCLINATION
AMONG H, L & D AXES.
ISO MEANS SAME, SIMILAR OR EQUAL.
HERE ONE CAN FIND
EDUAL INCLINATION AMONG H, L & D AXES.
EACH IS 120^0 INCLINED WITH OTHER TWO.
HENCE IT IS CALLED ISOMETRIC DRAWING



PURPOSE OF ISOMETRIC DRAWING IS TO UNDERSTAND
OVERALL SHAPE, SIZE & APPEARANCE OF AN OBJECT PRIOR TO IT'S PRODUCTION.

SOME IMPORTANT TERMS:

ISOMETRIC AXES, LINES AND PLANES:



The three lines AL, AD and AH, meeting at point A and making 120^0 angles with each other are termed *Isometric Axes.*

The lines parallel to these axes are called *Isometric Lines*.

The planes representing the faces of of the cube as well as other planes parallel to these planes are called *Isometric Planes*.

ISOMETRIC SCALE:
When one holds the object in such a way that all three dimensions are visible then in the process all dimensions become proportionally inclined to observer's eye sight and hence appear apparent in lengths.

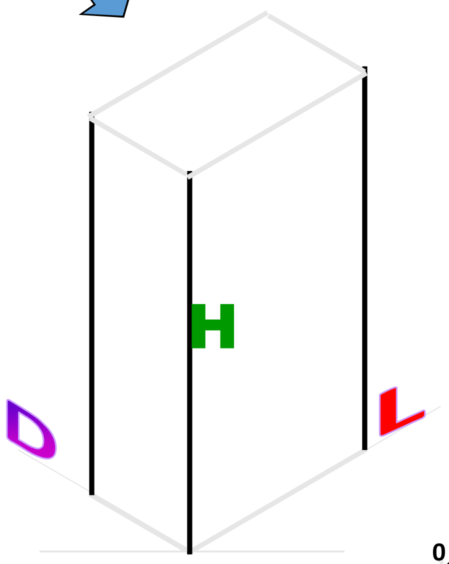
This reduction is 0.815 or 9 / 11 (approx.) It forms a reducing scale which Is used to draw isometric drawings and is called *Isometric scale.*

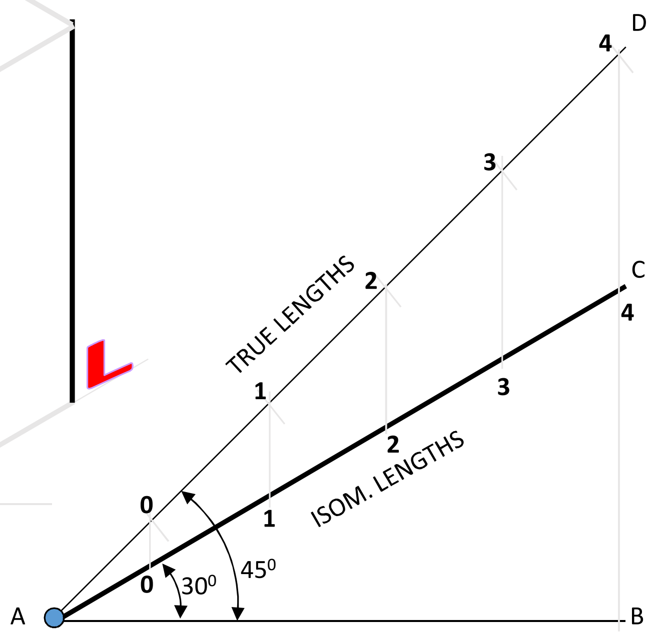
In practice, while drawing isometric projection, it is necessary to convert true lengths into isometric lengths for measuring and marking the sizes. This is conveniently done by constructing an isometric scale as described on next page.

TYPES OF ISOMETRIC DRAWINGS

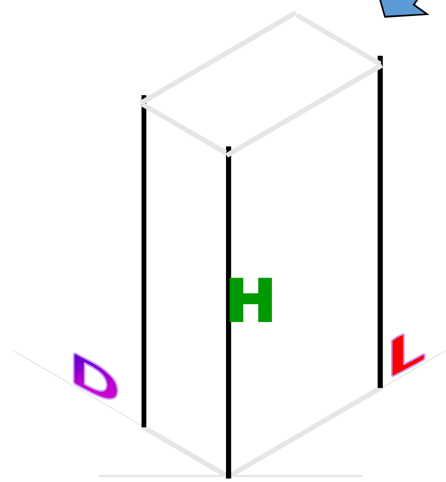
ISOMETRIC VIEW
Drawn by using True scale
(True dimensions)

ISOMETRIC PROJECTION
Drawn by using Isometric scale
(Reduced dimensions)





Isometric scale [Line AC]
required for Isometric Projection



CONSTRUCTION OF ISOM.SCALE.
From point A, with line AB draw 30^0 and 45^0 inclined lines AC & AD resp on AD.
Mark divisions of true length and from each division-point draw vertical lines upto AC line.
The divisions thus obtained on AC give lengths on isometric scale.

1

ISOMETRIC OF PLANE FIGURES

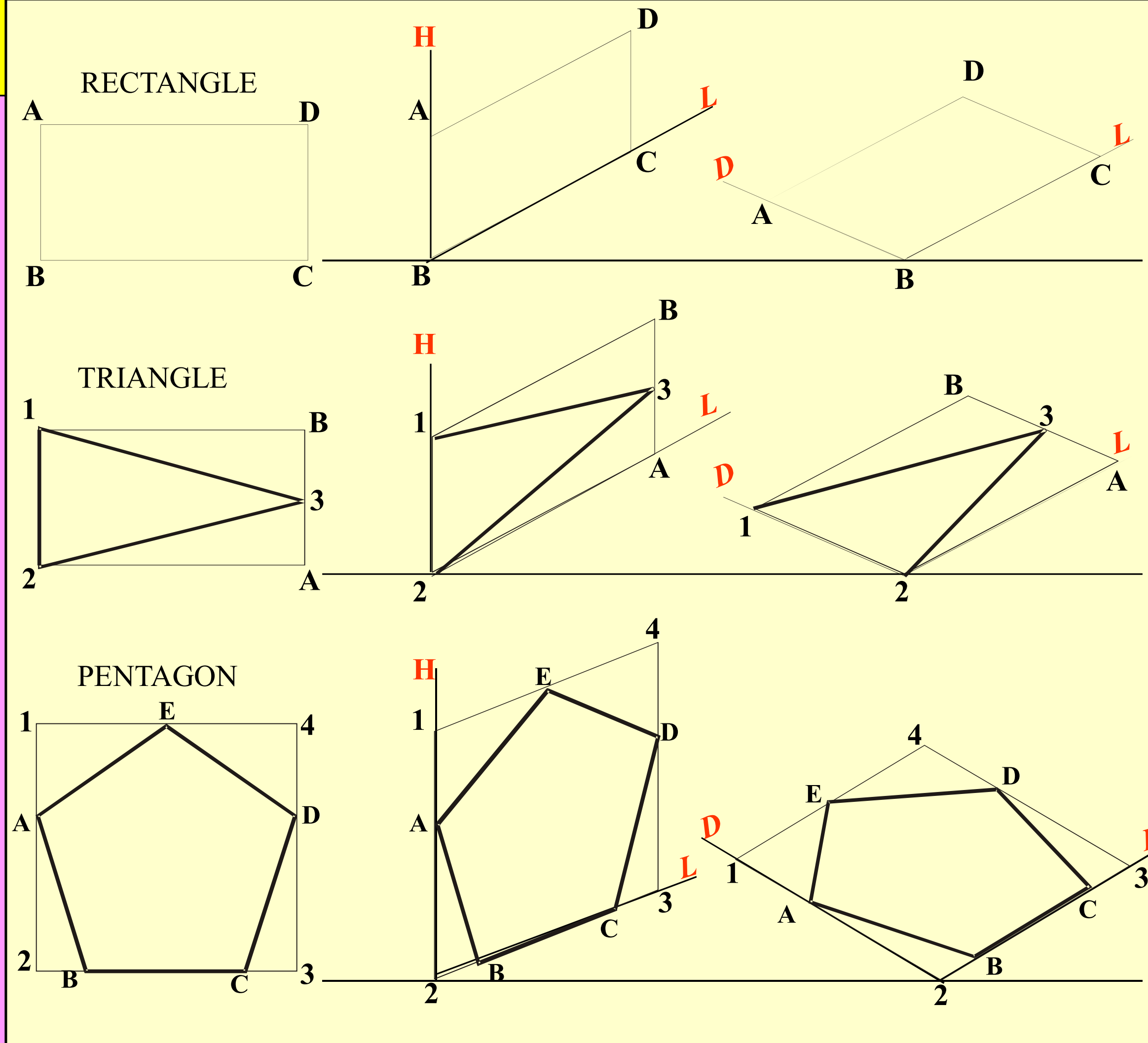
AS THESE ALL ARE 2-D FIGURES WE REQUIRE ONLY TWO ISOMETRIC AXES.

IF THE FIGURE IS FRONT VIEW, H & L AXES ARE REQUIRED.

IF THE FIGURE IS TOP VIEW, D & L AXES ARE REQUIRED.

Shapes containing Inclined lines should be enclosed in a rectangle as shown. Then first draw isom. of that rectangle and then inscribe that shape as it is.

SHAPE	Isometric view if the Shape is F.V. or T.V.



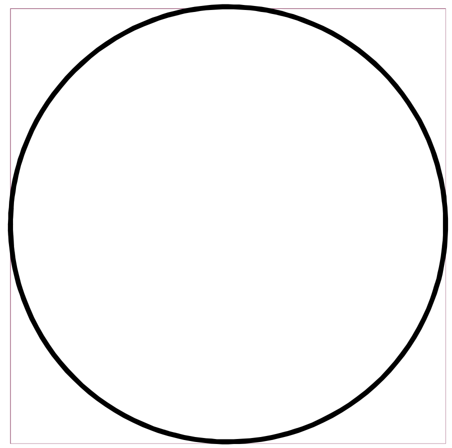
STUDY
ILLUSTRATIONS

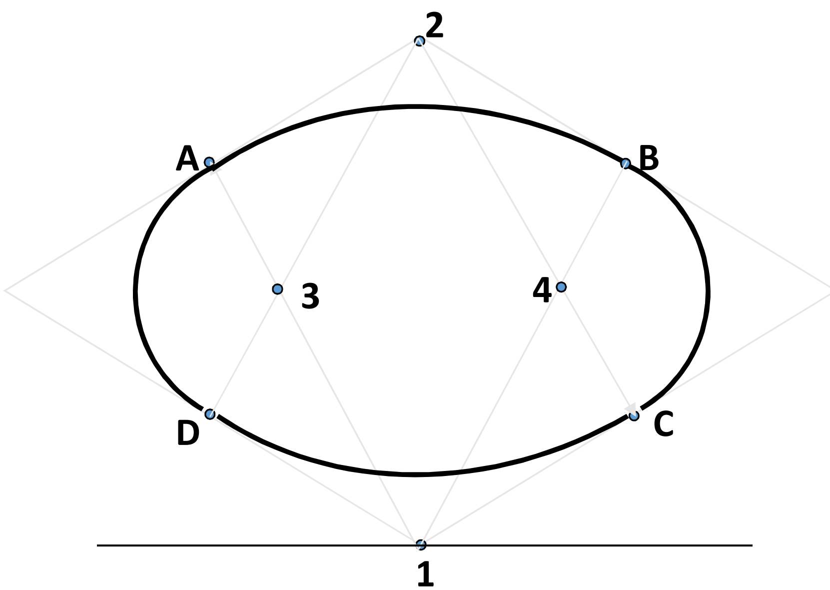
7

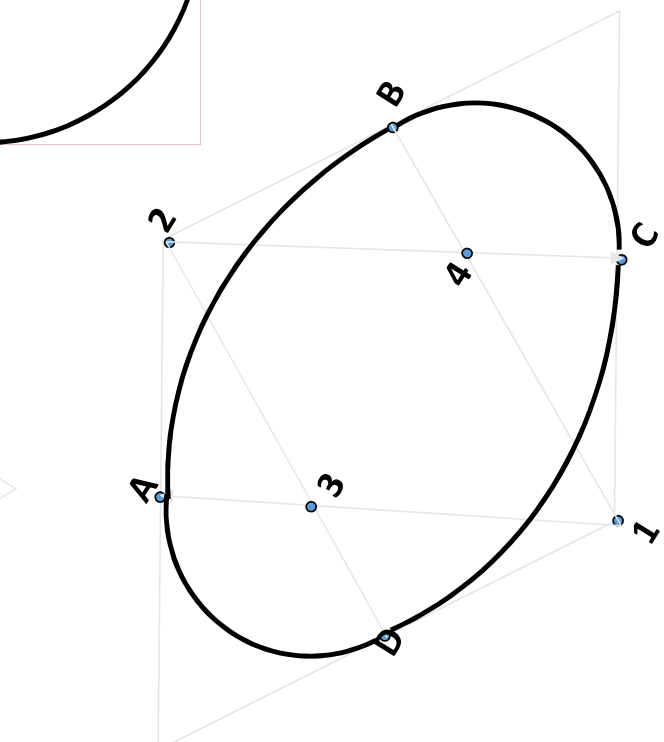
2

DRAW ISOMETRIC VIEW OF A
CIRCLE IF IT IS A TV OR FV.

FIRST ENCLOSE IT IN A SQUARE.
IT'S ISOMETRIC IS A RHOMBUS WITH
D & L AXES FOR TOP VIEW.
THEN USE H & L AXES FOR ISOMETRIC
WHEN IT IS FRONT VIEW.
FOR CONSTRUCTION USE RHOMBUS
METHOD SHOWN HERE. STUDY IT.



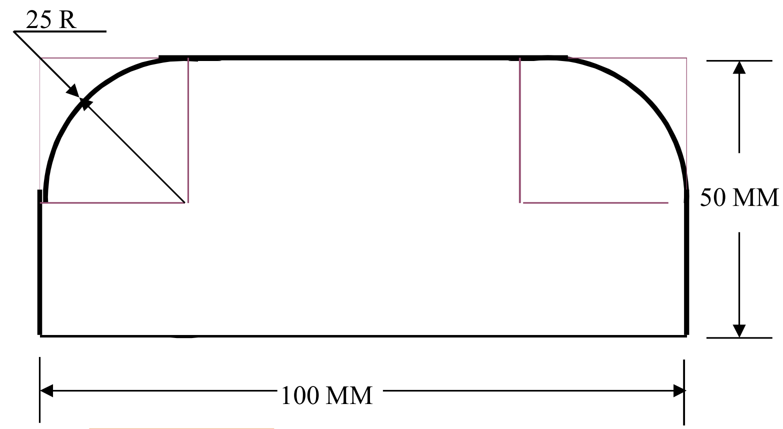




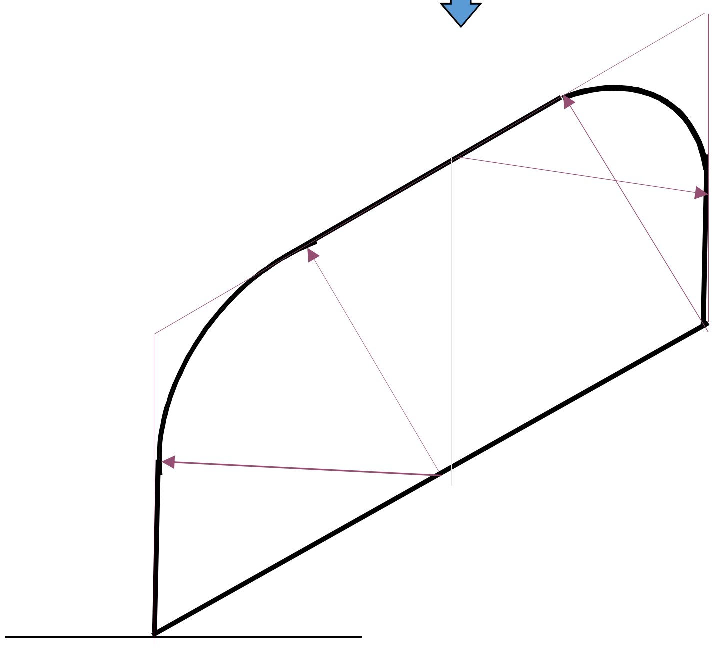
STUDY ILLUSTRATIONS

3

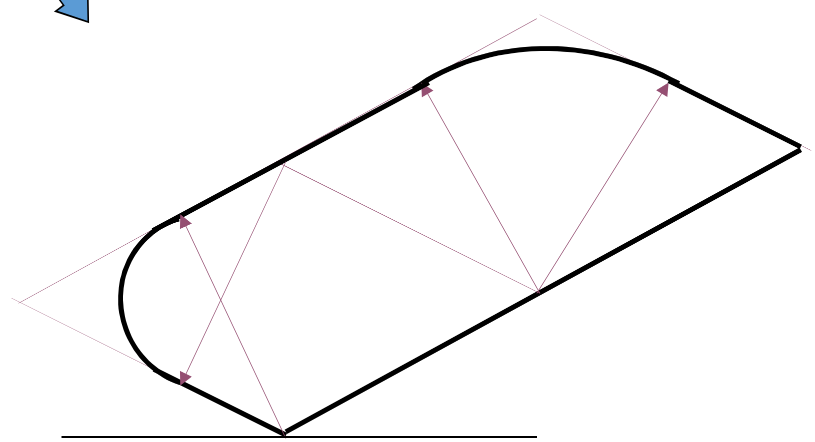
DRAW ISOMETRIC VIEW OF THE FIGURE SHOWN WITH DIMENTIONS (ON RIGHT SIDE) CONSIDERING IT FIRST AS F.V. AND THEN T.V.



IF FRONT VIEW



IF TOP VIEW



ISOMETRIC OF PLANE FIGURES

AS THESE ALL ARE 2-D FIGURES WE REQUIRE ONLY TWO ISOMETRIC AXES.

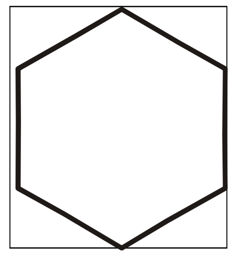
IF THE FIGURE IS FRONT VIEW, H & L AXES ARE REQUIRED.

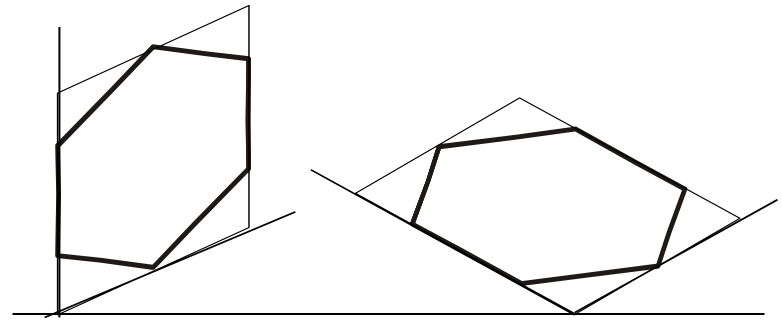
IF THE FIGURE IS TOP VIEW, D & L AXES ARE REQUIRED.

For Isometric of Circle/Semicircle use Rhombus method. Construct it of sides equal to diameter of circle always. (Ref. Previous two pages.)

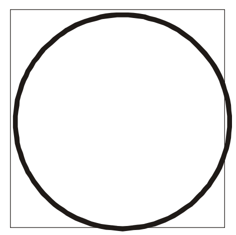
SHAPE	IF F.V.	IF T.V.

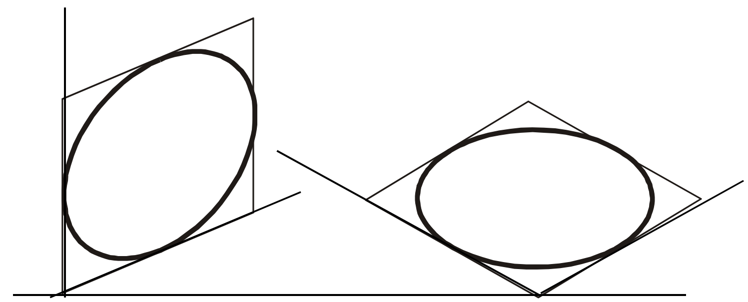
HEXAGON





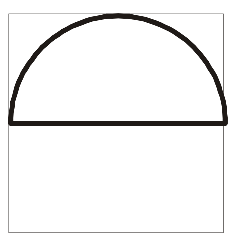
CIRCLE

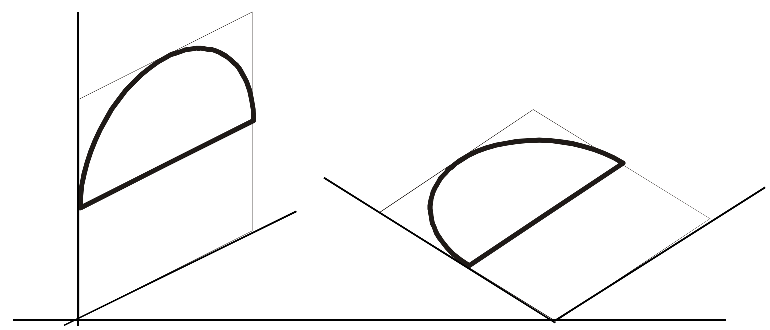




***For Isometric of Circle/Semicircle use* Rhombus method. *Construct Rhombus of sides equal to Diameter of circle always.* (Ref. topic ENGG. CURVES.)**

SEMI CIRCLE



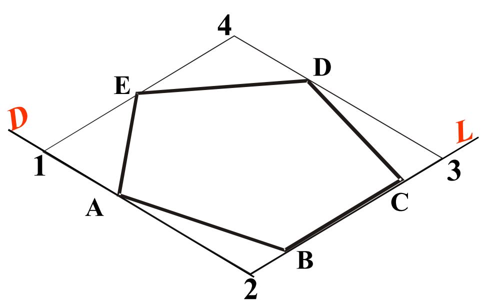


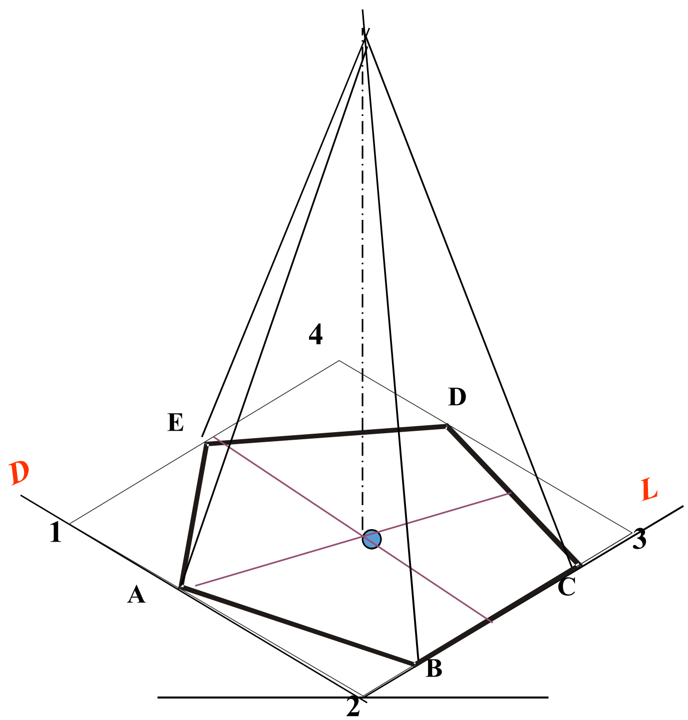
STUDY
ILLUSTRATIONS

ISOMETRIC VIEW OF PENTAGONAL PYRAMID STANDING ON H.P.

(Height is added from center of pentagon)

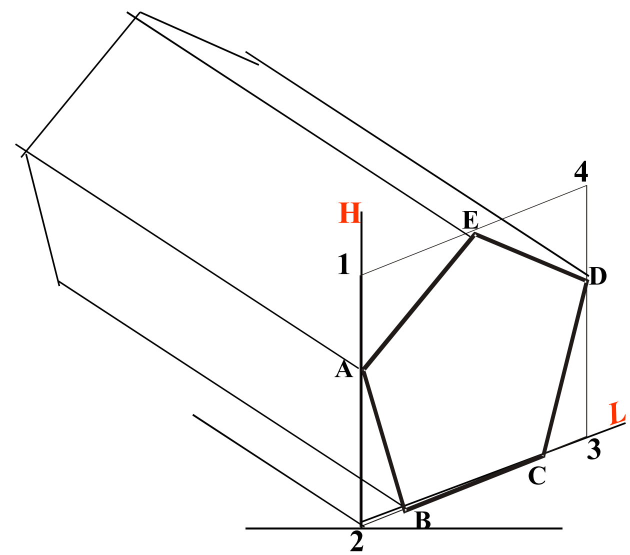
ISOMETRIC VIEW OF BASE OF PENTAGONAL PYRAMID STANDING ON H.P.

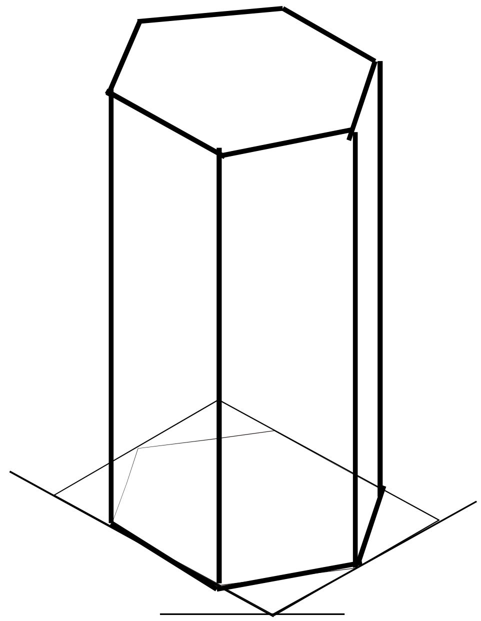




STUDY ILLUSTRATIONS

ISOMETRIC VIEW OF
PENTAGONALL PRISM
LYING ON H.P.



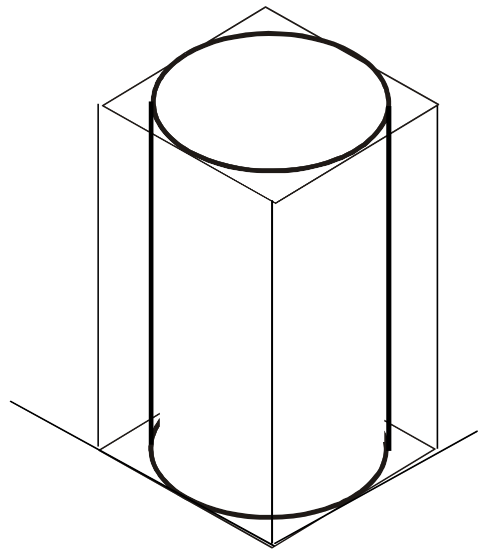


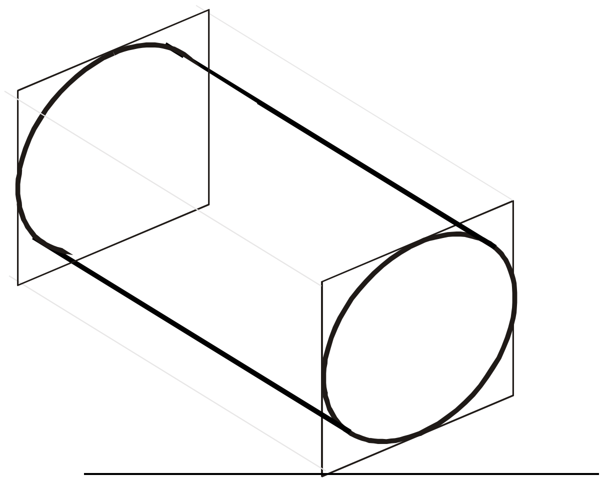
ISOMETRIC VIEW OF
HEXAGONAL PRISM
STANDING ON H.P.

STUDY ILLUSTRATIONS

Z

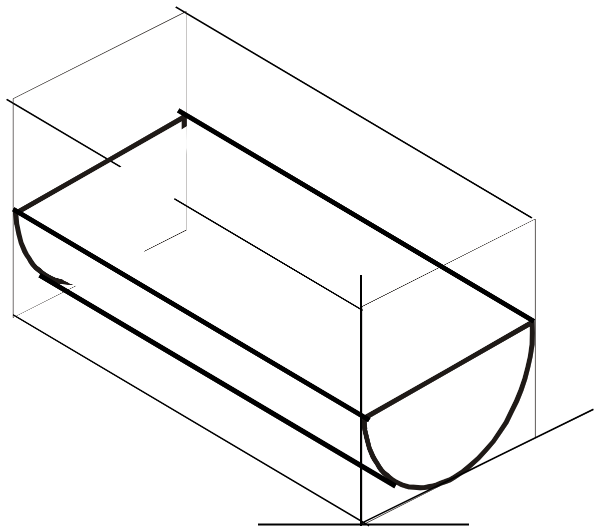
CYLINDER STANDING ON H.P.





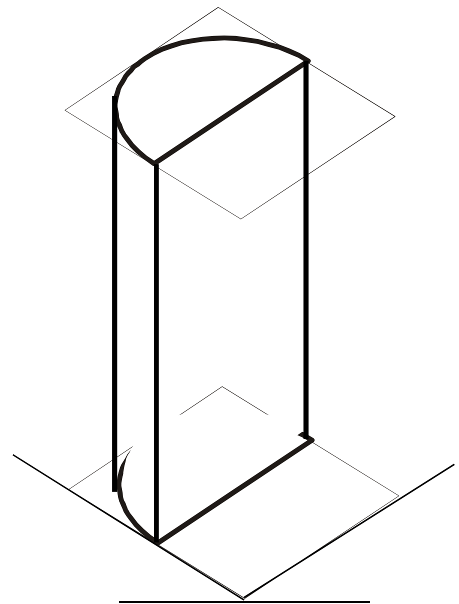
CYLINDER LYING ON H.P.

STUDY
ILLUSTRATIONS



HALF CYLINDER
LYING ON H.P.
(with flat face // to H.P.)

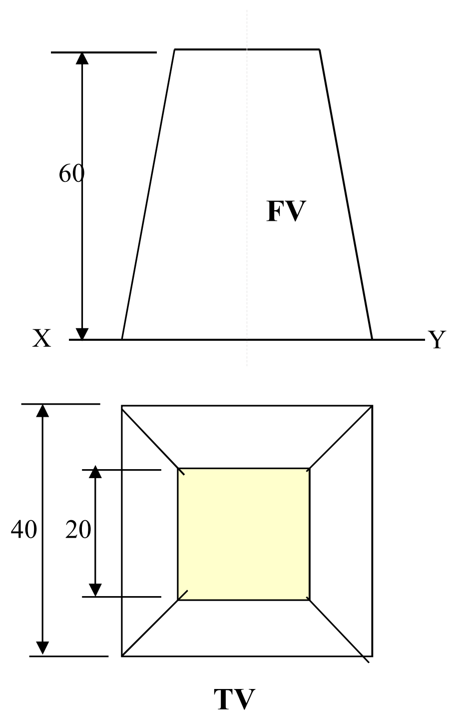
HALF CYLINDER
STANDING ON H.P.
(ON IT'S SEMICIRCULAR BASE)

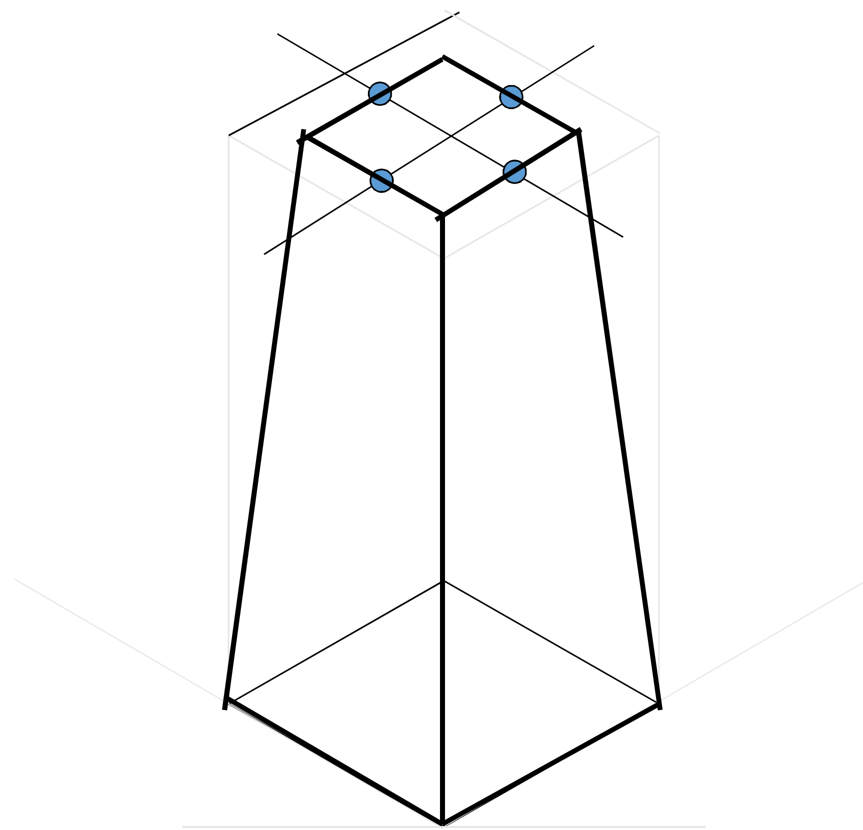


STUDY
Z
ILLUSTRATIONS

9

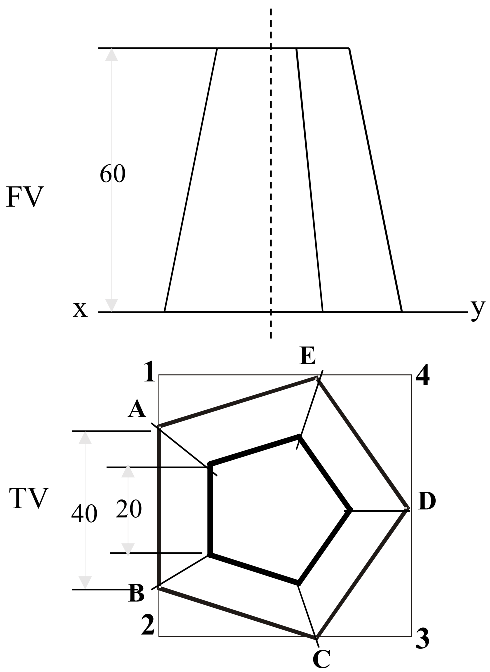
ISOMETRIC VIEW OF A
FRUSTOM OF SQUARE PYRAMID
STANDING ON H.P. ON IT'S LARGER BASE.





STUDY ILLUSTRATION

PROJECTIONS OF FRUSTOM OF PENTAGONAL PYRAMID ARE GIVEN. DRAW IT'S ISOMETRIC VIEW.



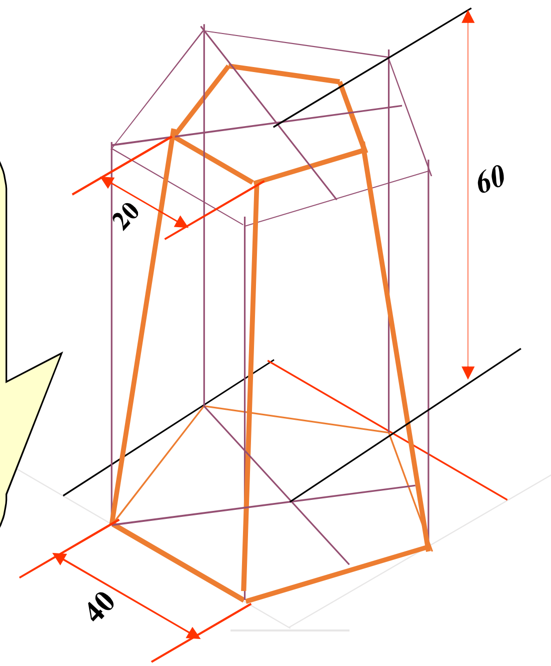
SOLUTION STEPS:

FIRST DRAW ISOMETRIC OF IT'S BASE.

THEN DRAWSAME SHAPE AS TOP, 60 MM ABOVE THE BASE PENTAGON CENTER.

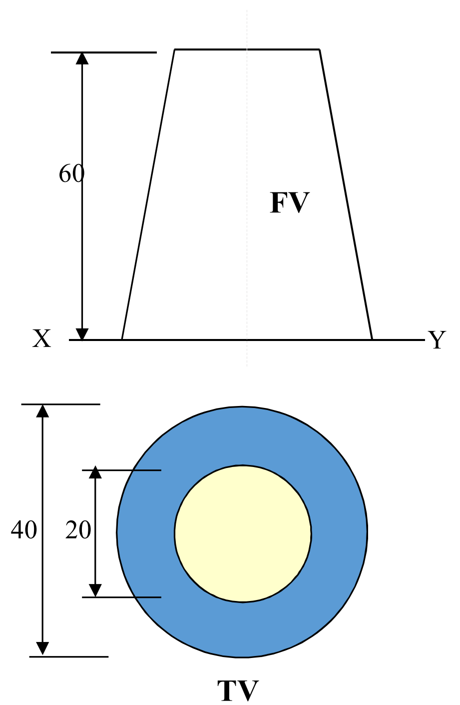
THEN REDUCE THE TOP TO 20 MM SIDES AND JOIN WITH THE PROPER BASE CORNERS.

ISOMETRIC VIEW OF FRUSTOM OF PENTAGONAL PYRAMID



STUDY ILLUSTRATIONS

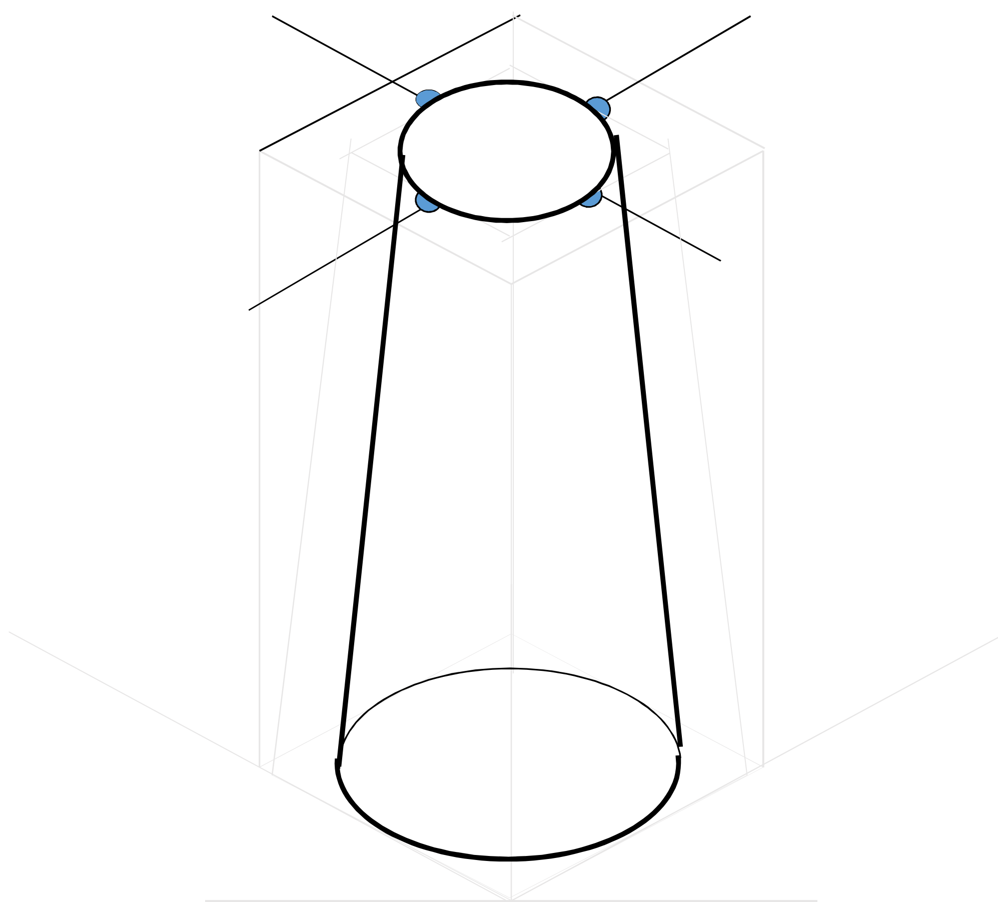
Z



ISOMETRIC VIEW OF

FRUSTOM OF CONE STANDING ON H.P. ON IT'S LARGER BASE.

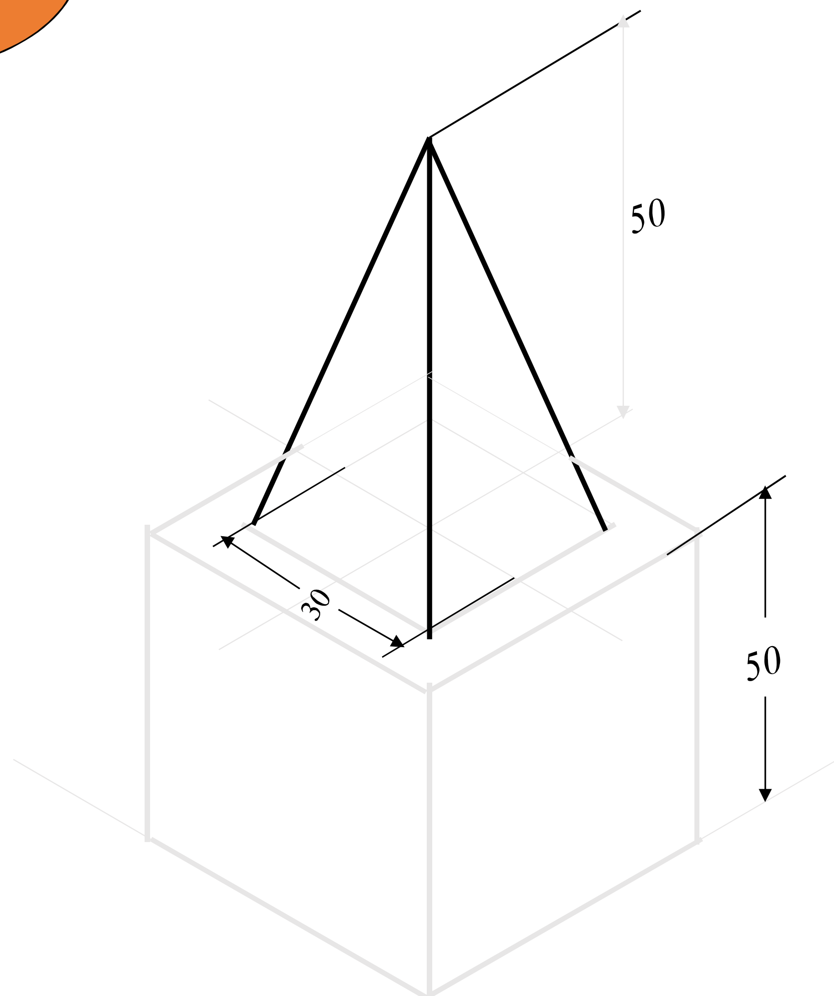
A 11



STUDY
Z
ILLUSTRATIONS

12

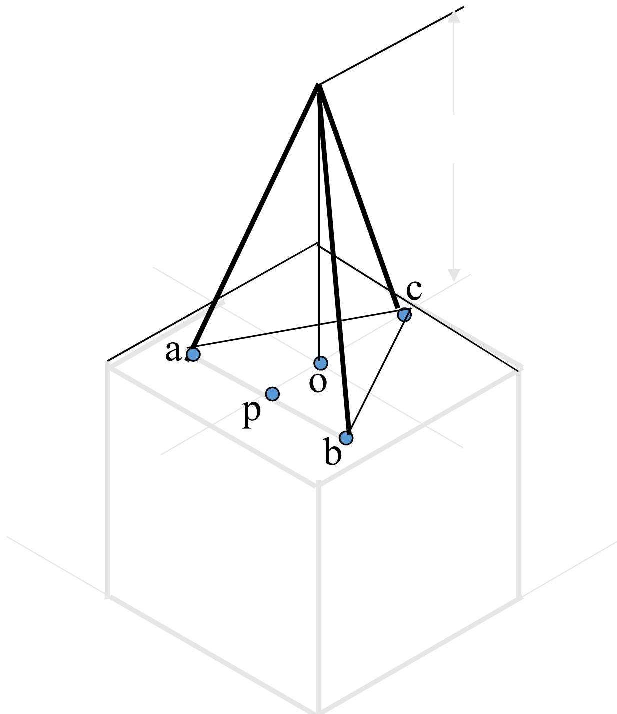
PROBLEM: A SQUARE PYRAMID OF 30 MM BASE SIDES AND 50 MM LONG AXIS, IS CENTRALLY PLACED ON THE TOP OF A CUBE OF 50 MM LONG EDGES.DRAW ISOMETRIC VIEW OF THE PAIR.

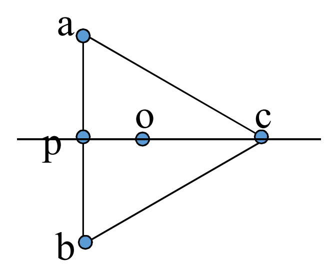


STUDY ILLUSTRATIONS

13

PROBLEM: A TRIANGULAR PYRAMID OF 30 MM BASE SIDES AND 50 MM LONG AXIS, IS CENTRALLY PLACED ON THE TOP OF A CUBE OF 50 MM LONG EDGES.
DRAW ISOMETRIC VIEW OF THE PAIR.





SOLUTION HINTS.

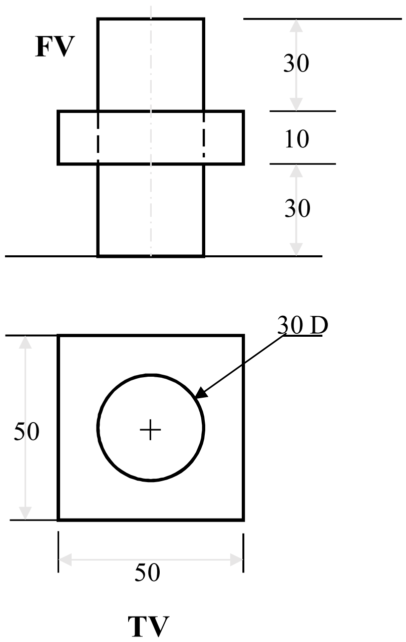
TO DRAW ISOMETRIC OF A CUBE IS SIMPLE. DRAW IT AS USUAL.

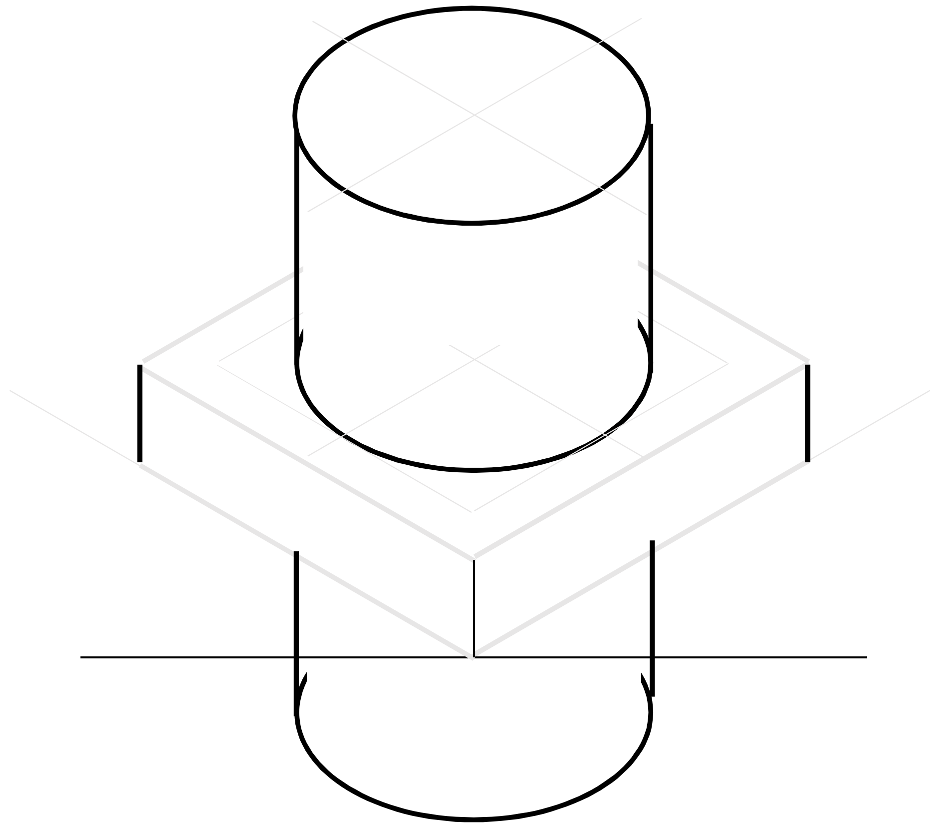
BUT FOR PYRAMID AS IT'S BASE IS AN EQUILATERAL TRIANGLE, IT CAN NOT BE DRAWN DIRECTLY.SUPPORT OF IT'S TV IS REQUIRED.

SO DRAW TRIANGLE AS A TV, SEPARATELY AND NAME VARIOUS POINTS AS SHOWN.
AFTER THIS PLACE IT ON THE TOP OF CUBE AS SHOWN.
THEN ADD HEIGHT FROM IT'S CENTER AND COMPLETE IT'S ISOMETRIC AS SHOWN.

STUDY ILLUSTRATIONS

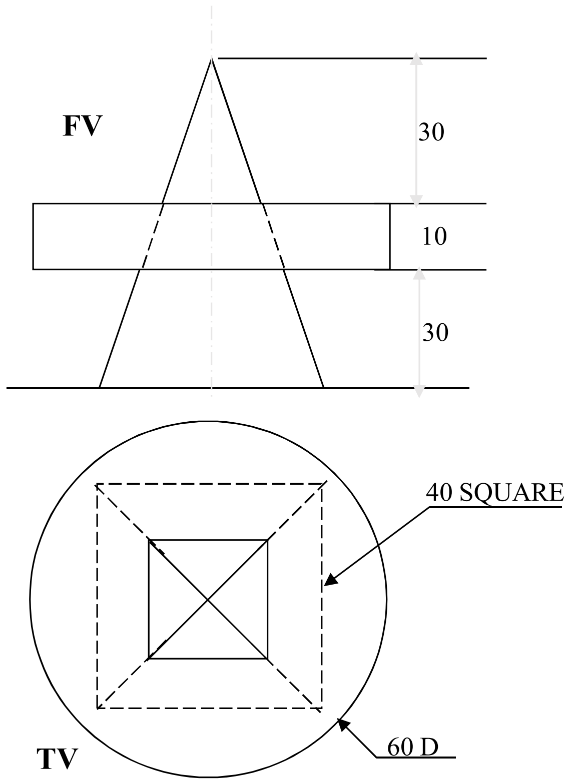
PROBLEM:
A SQUARE PLATE IS PIERCED THROUGH CENTRALLY BY A CYLINDER WHICH COMES OUT EQUALLY FROM BOTH FACES OF PLATE. IT'S FV & TV ARE SHOWN. DRAW ISOMETRIC VIEW.

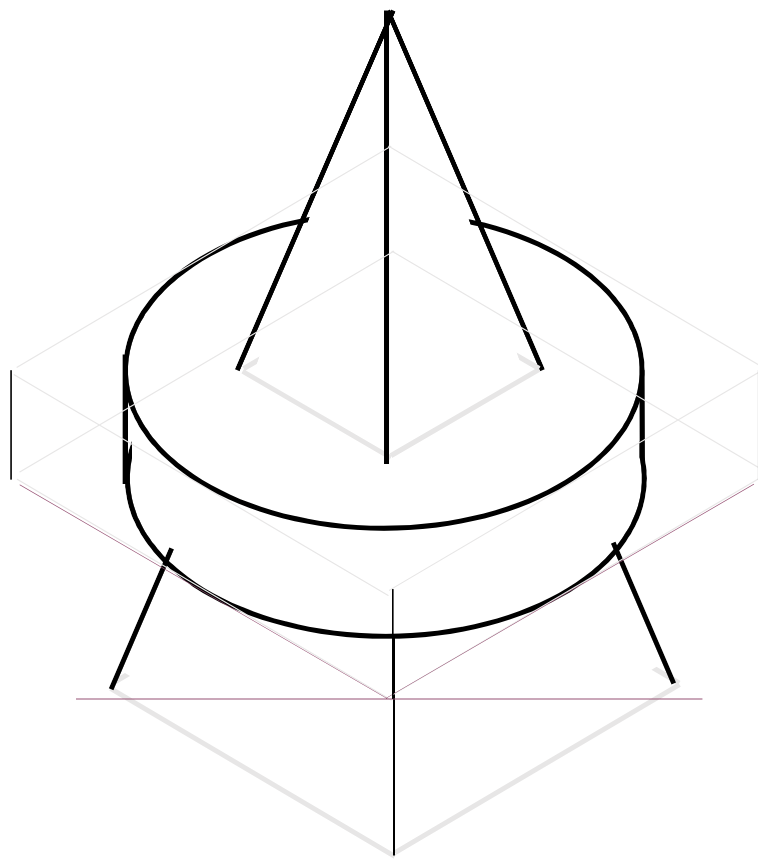




STUDY ILLUSTRATIONS

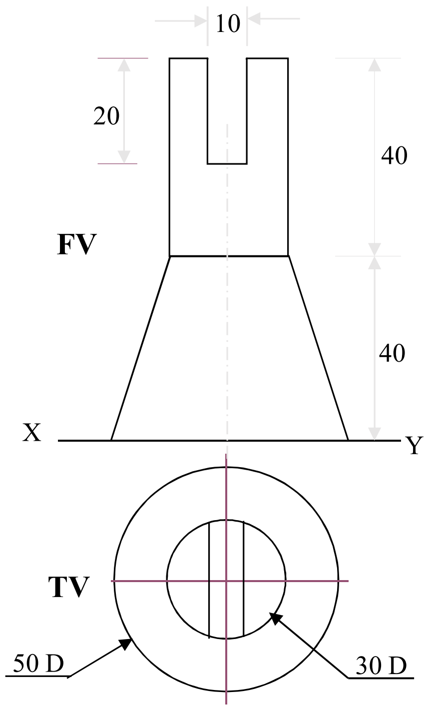
PROBLEM:
A CIRCULAR PLATE IS PIERCED THROUGH CENTRALLY
BY A SQUARE PYRAMID WHICH COMES OUT EQUALLY FROM BOTH FACES
OF PLATE. IT'S FV & TV ARE SHOWN. DRAW ISOMETRIC VIEW.

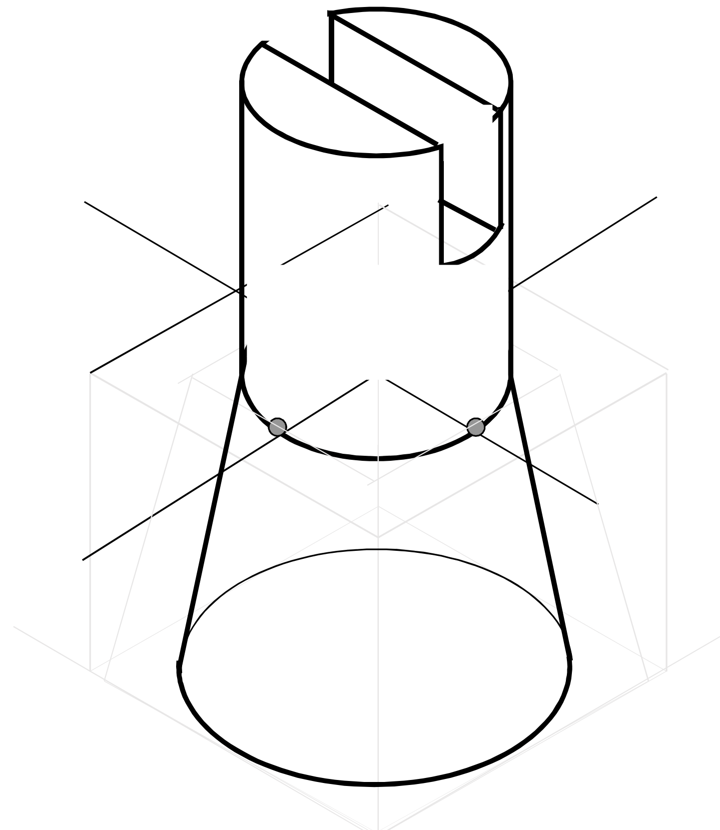




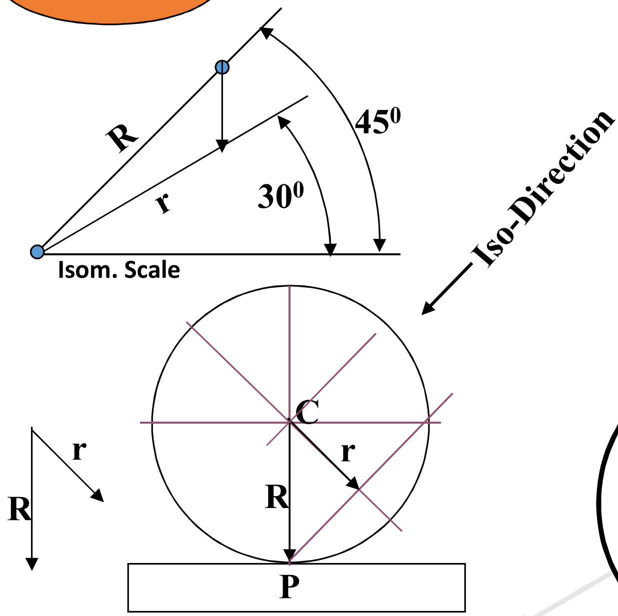
STUDY Z ILLUSTRATIONS

F.V. & T.V. of an object are given. Draw it's isometric view.

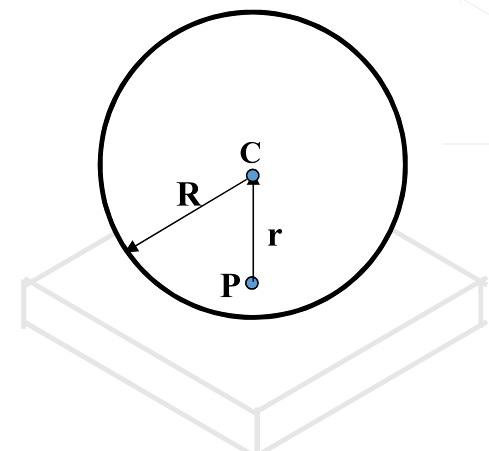


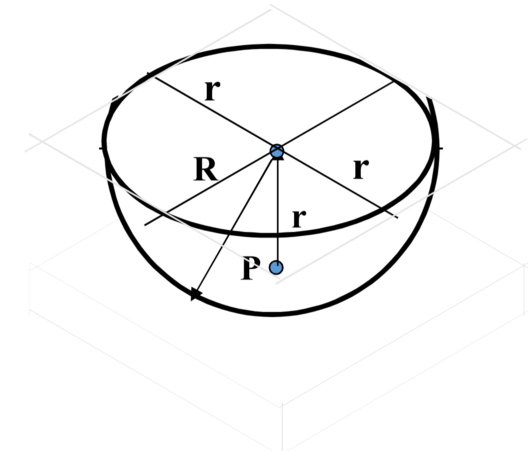


ISOMETRIC PROJECTIONS OF SPHERE & HEMISPHERE



C = Center of Sphere.
P = Point of contact
R = True Radius of Sphere
r = Isometric Radius.





TO DRAW ISOMETRIC PROJECTION
OF A HEMISPHERE

Adopt same procedure.
Draw lower semicircle only.
Then around 'C' construct
Rhombus of Sides equal to
Isometric Diameter.
For this use iso-scale.
Then construct ellipse in
this Rhombus as usual
And Complete
Isometric-Projection
of Hemi-sphere.

TO DRAW ISOMETRIC PROJECTION OF A SPHERE

1. FIRST DRAW ISOMETRIC OF SQUARE PLATE.
2. LOCATE IT'S CENTER. NAME IT P.
3. FROM PDRAW VERTICAL LINE UPWARD, LENGTH ' r mm'
   AND LOCATE CENTER OF SPHERE "C"
4. 'C' AS CENTER, WITH RADIUS 'R' DRAW CIRCLE.
   THIS IS ISOMETRIC PROJECTION OF A SPHERE.

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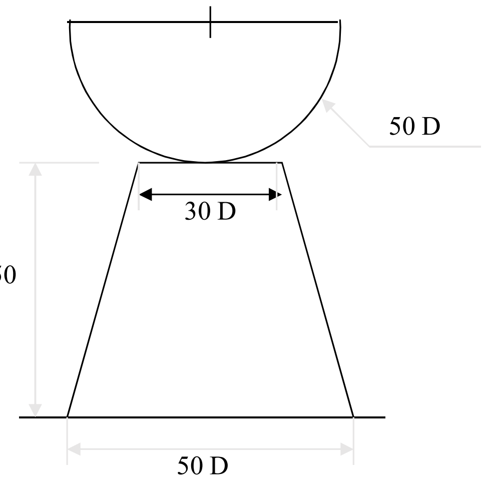
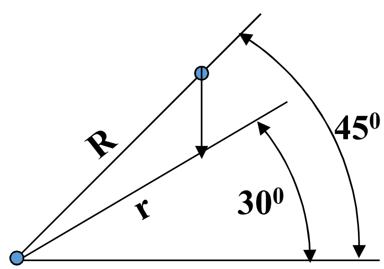
STUDY ILLUSTRATIONS

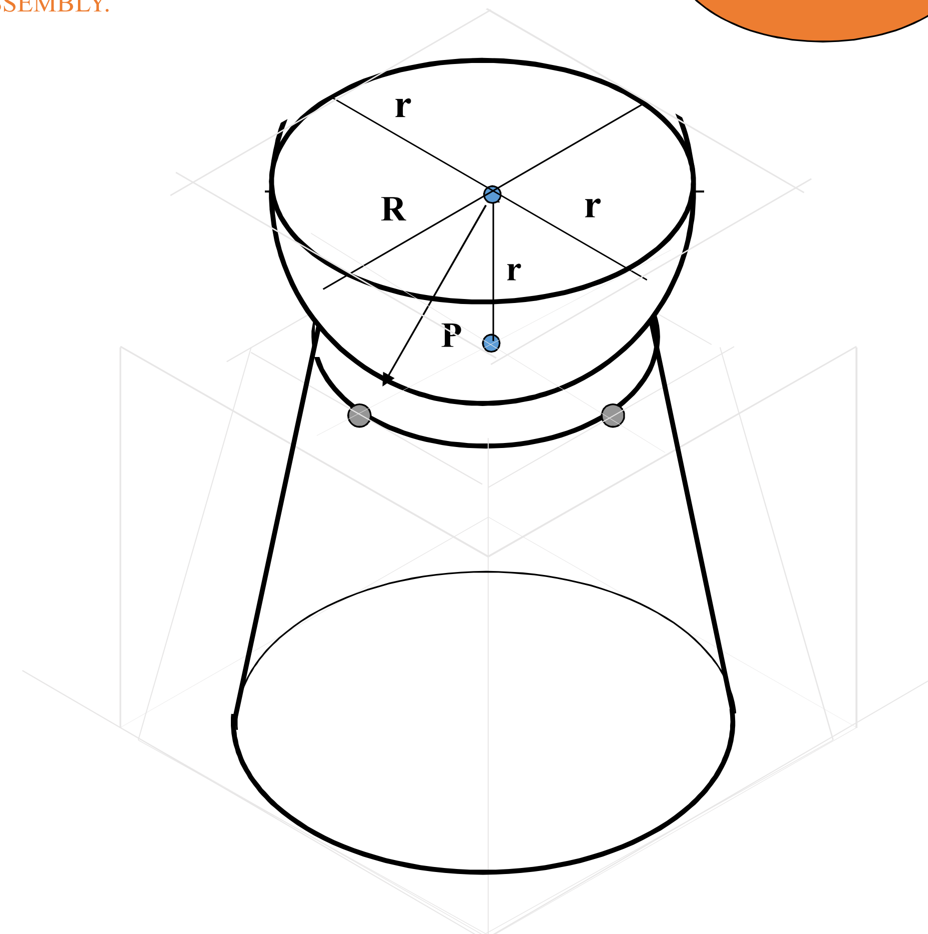
PROBLEM:

A HEMI-SPHERE IS CENTRALLY PLACED
ON THE TOP OF A FRUSTOM OF CONE.
DRAW ISOMETRIC PROJECTIONS OF THE ASSEMBLY.



FIRST CONSTRUCT ISOMETRIC SCALE.
USE THIS SCALE FOR ALL DIMENSIONS
IN THIS PROBLEM.

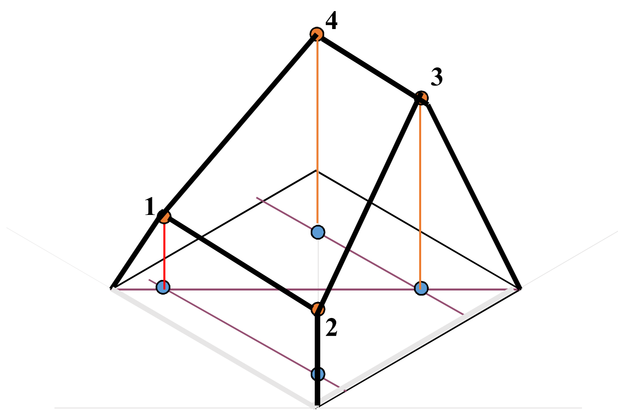


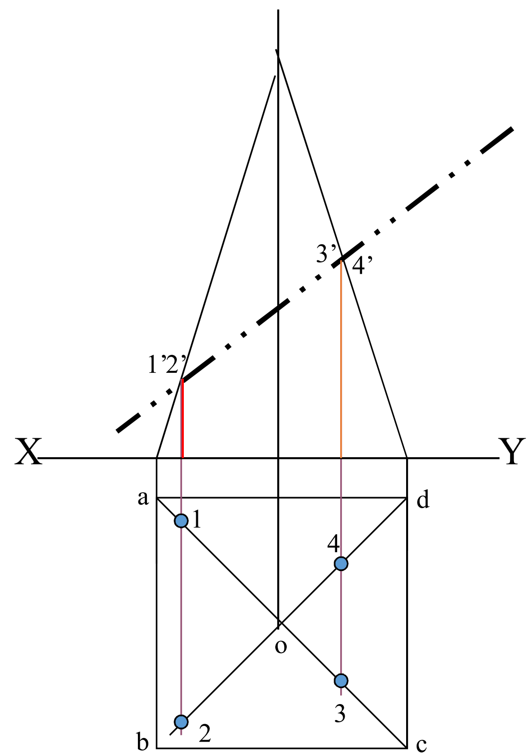


STUDY ILLUSTRATIONS

19

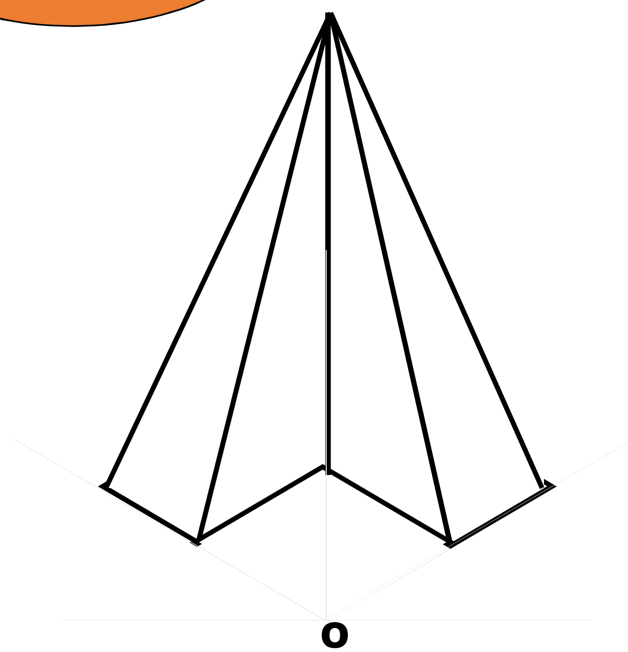
A SQUARE PYRAMID OF 40 MM BASE SIDES AND 60 MM AXIS IS CUT BY AN INCLINED SECTION PLANE THROUGH THE MID POINT OF AXIS AS SHOWN.DRAW ISOMETRIC VIEW OF SECTION OF PYRAMID.

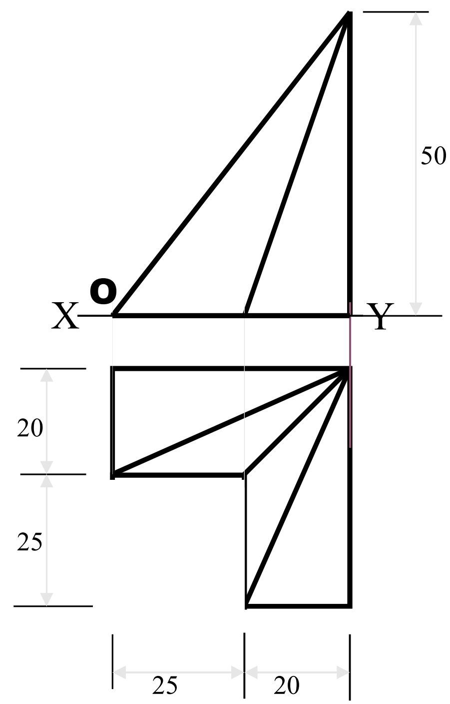




STUDY ILLUSTRATIONS

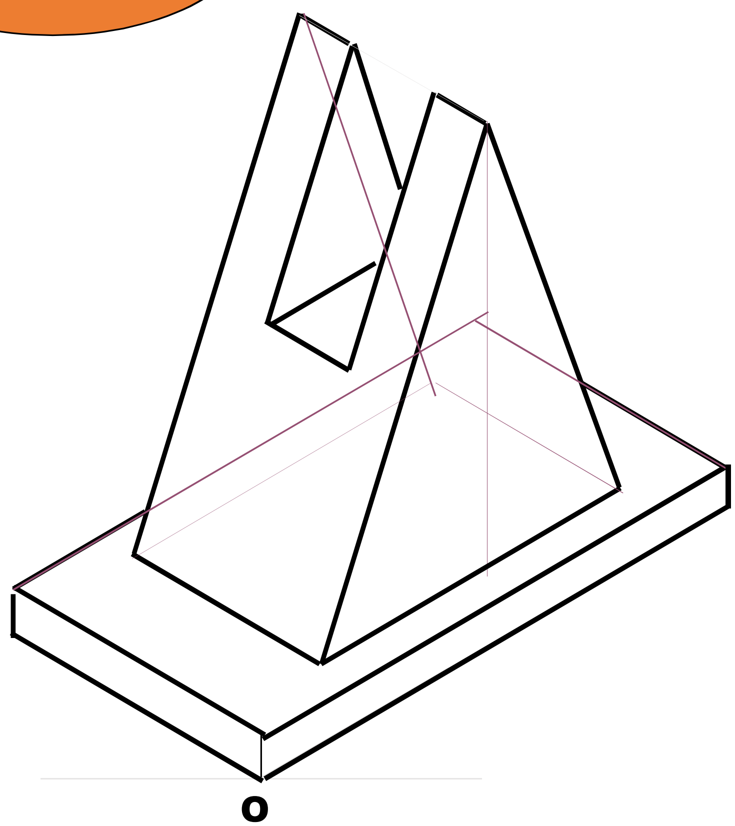
F.V. & T.V. of an object are given. Draw it's isometric view.

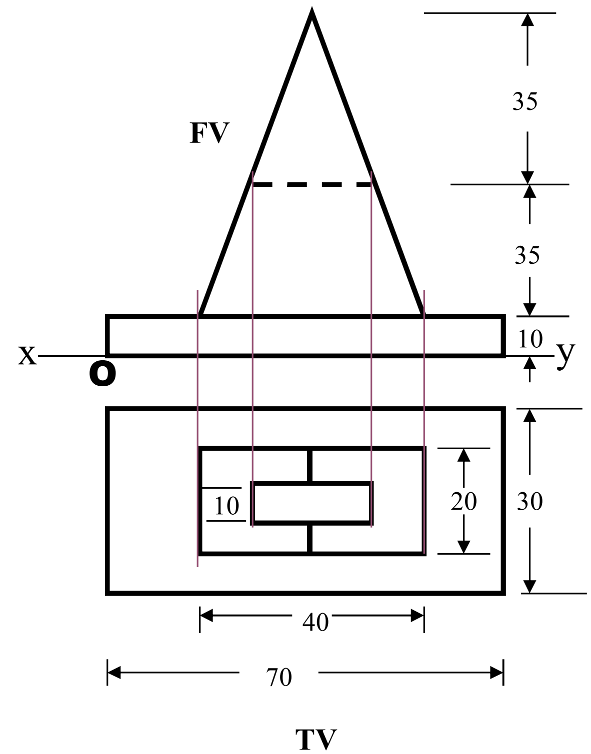




STUDY ILLUSTRATIONS

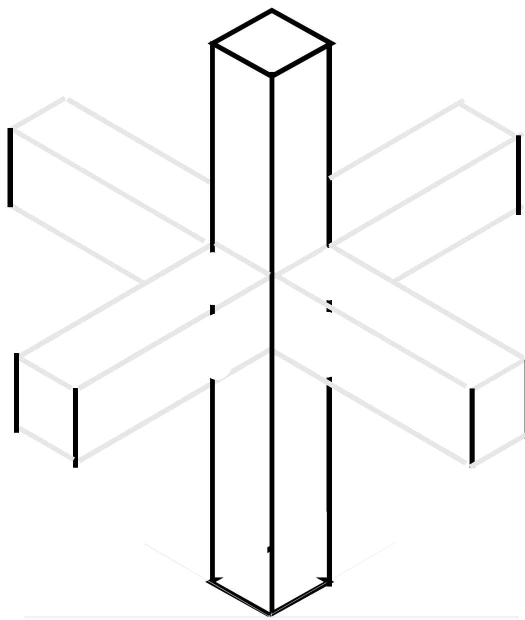
F.V. & T.V. of an object are given. Draw it's isometric view.

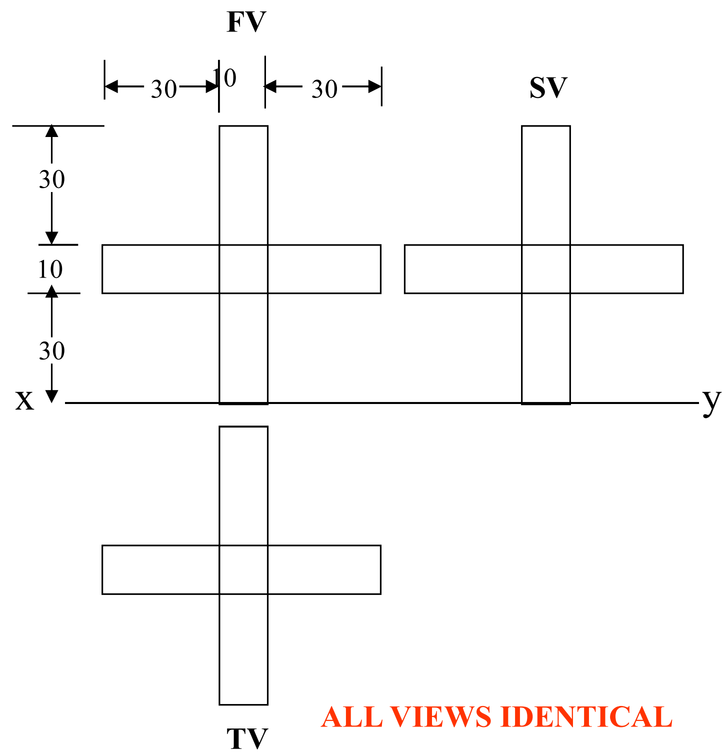




STUDY ILLUSTRATIONS

F.V. & T.V. and S.V.of an object are given. Draw it's isometric view.

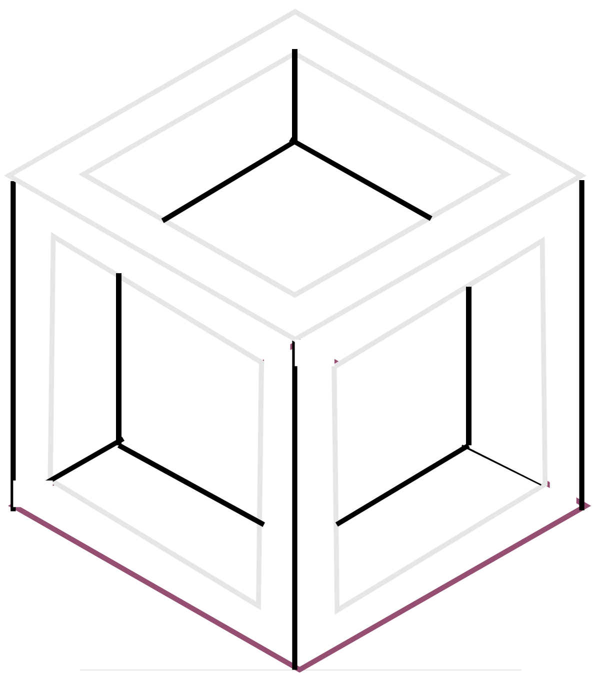


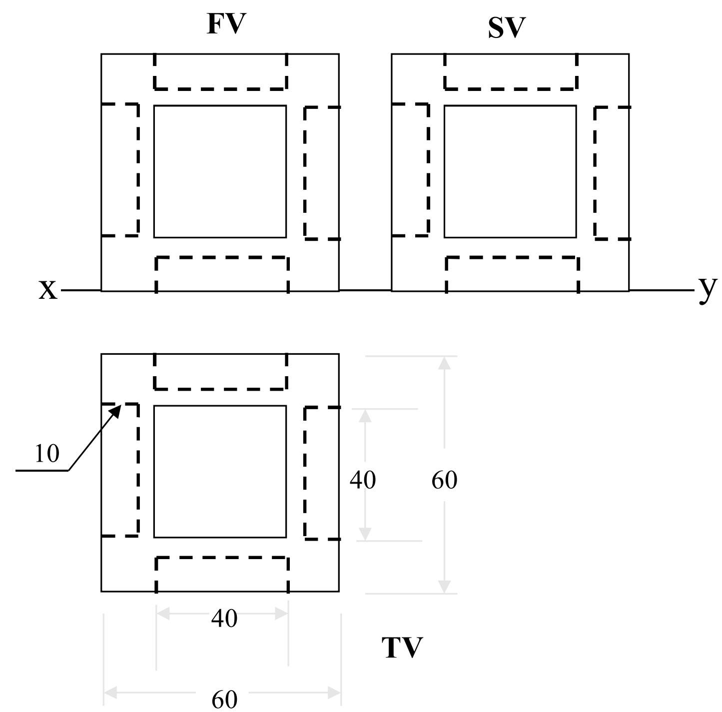


STUDY ILLUSTRATIONS

F.V. & T.V. and S.V.of an object are given. Draw it's isometric view.

ALL VIEWS IDENTICAL





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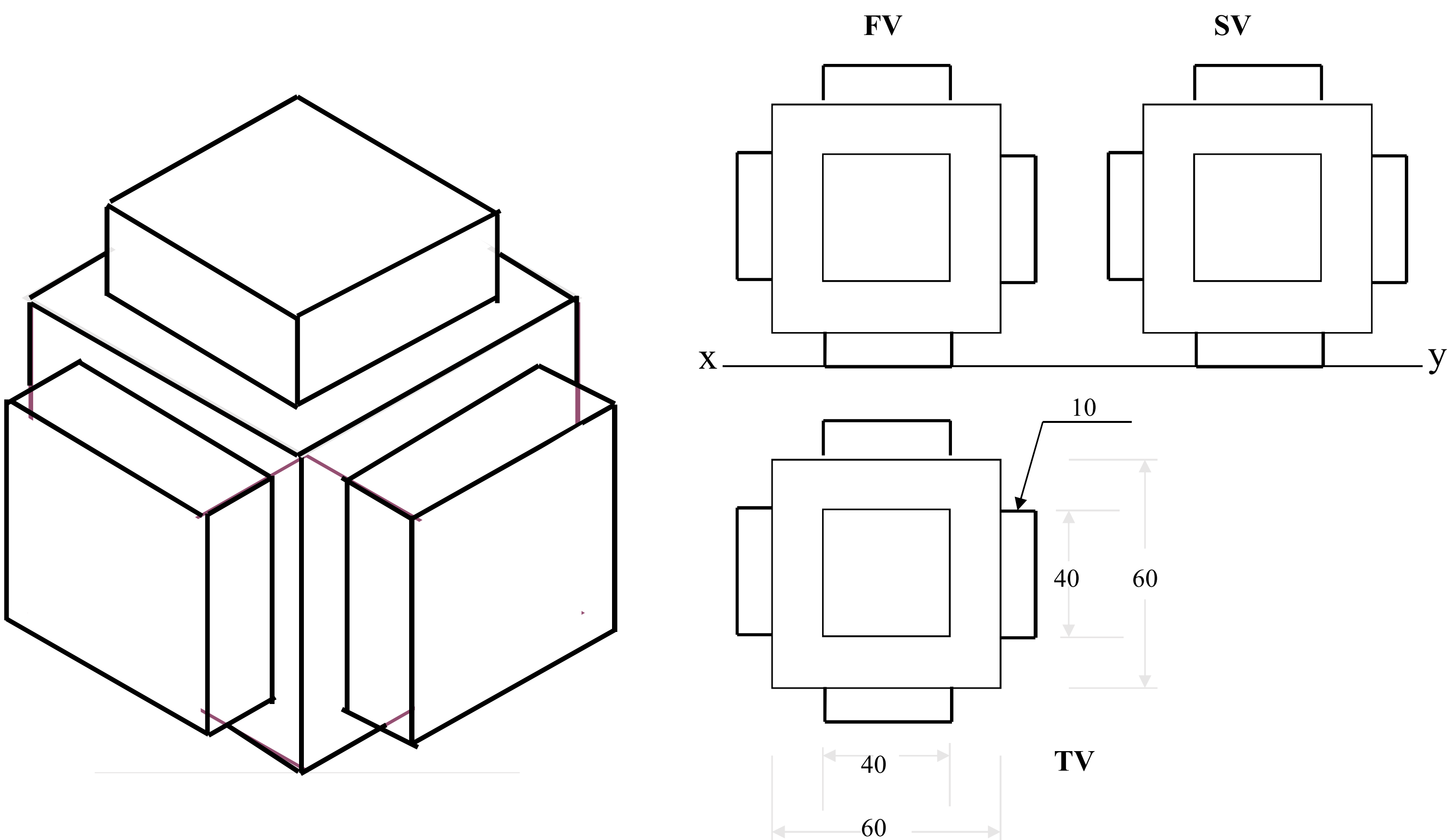

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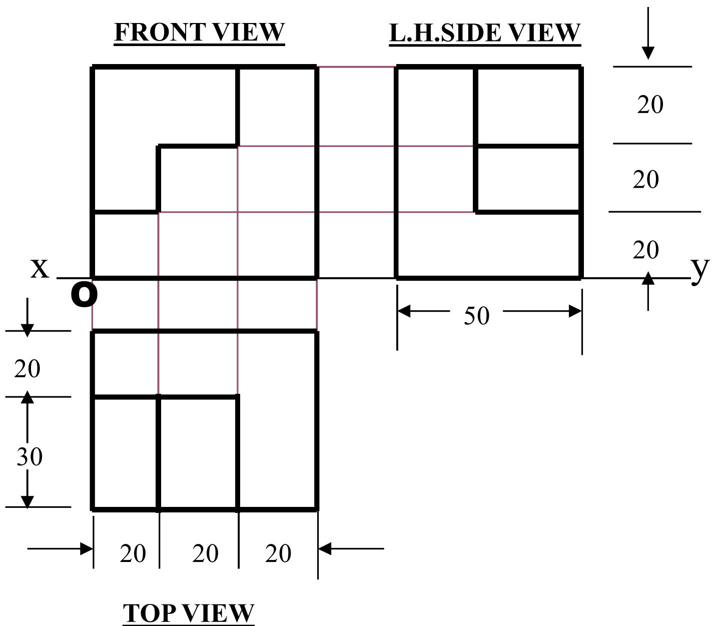
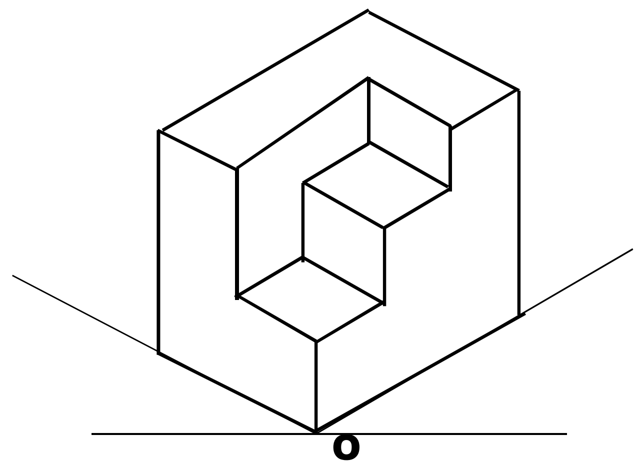
STUDY ILLUSTRATIONS

ORTHOGRAPHIC PROJECTIONS





STUDY
ILLUSTRATIONS

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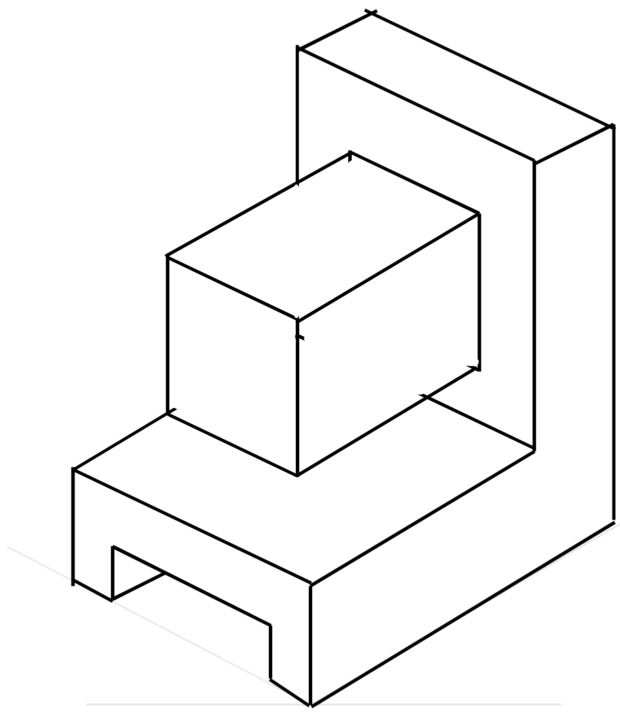
Draw it's isometric view.



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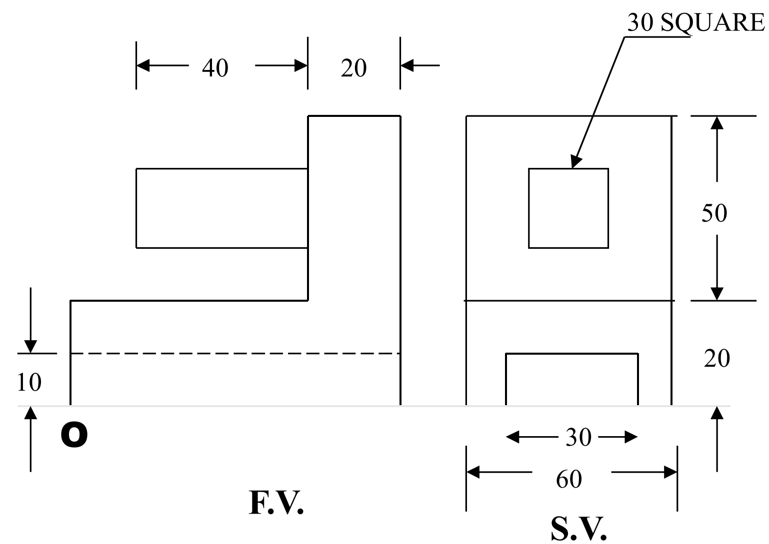

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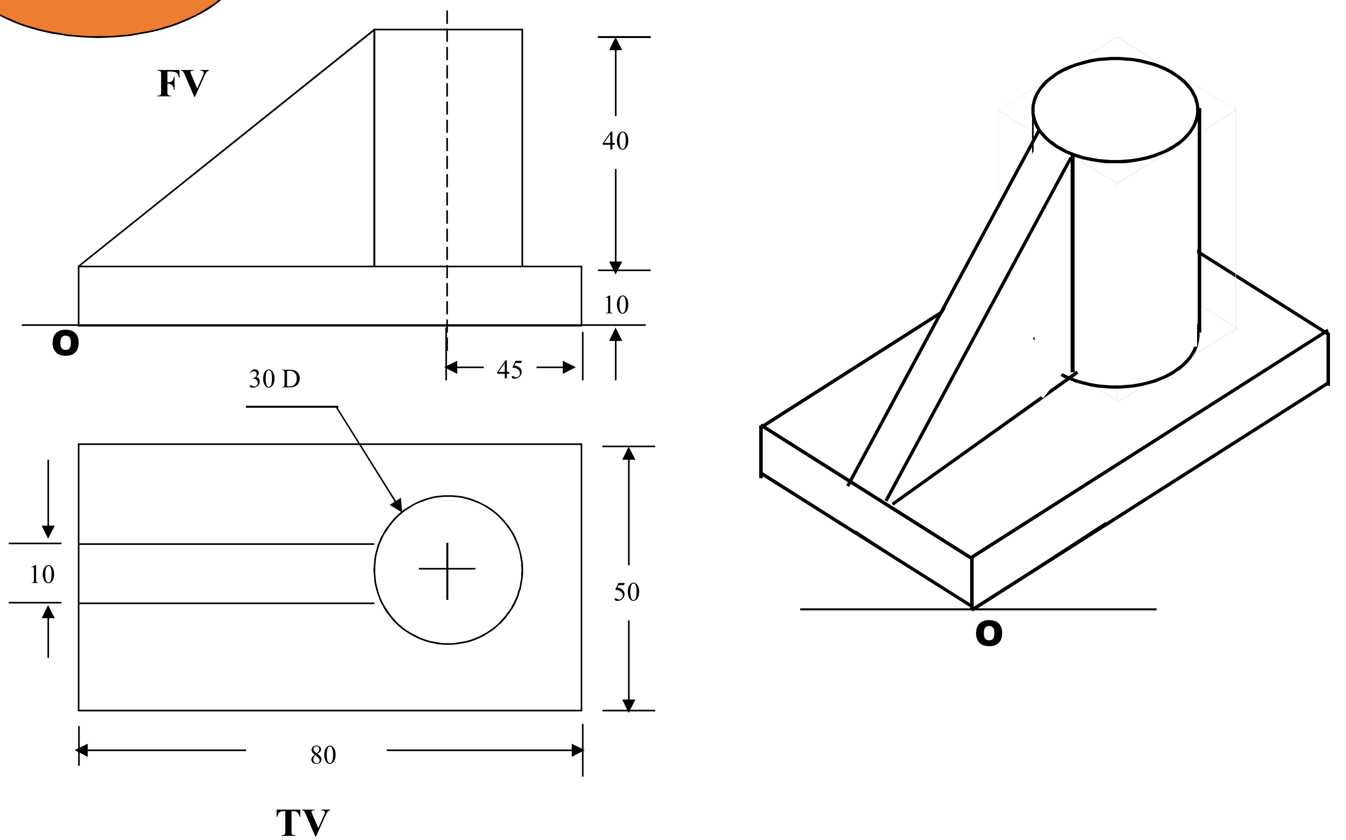

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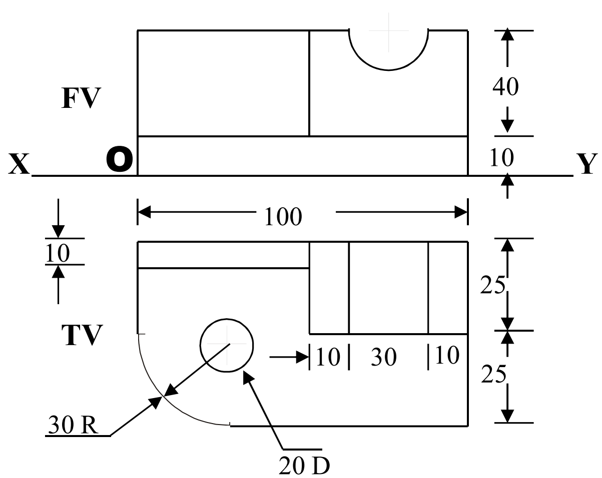
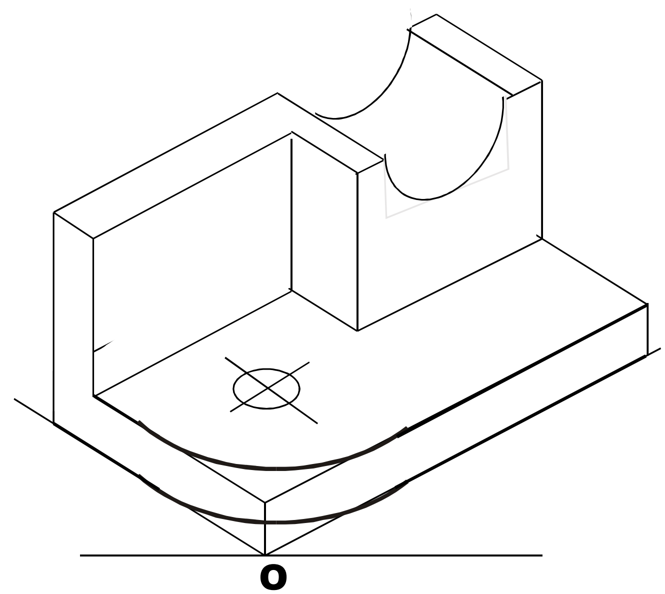
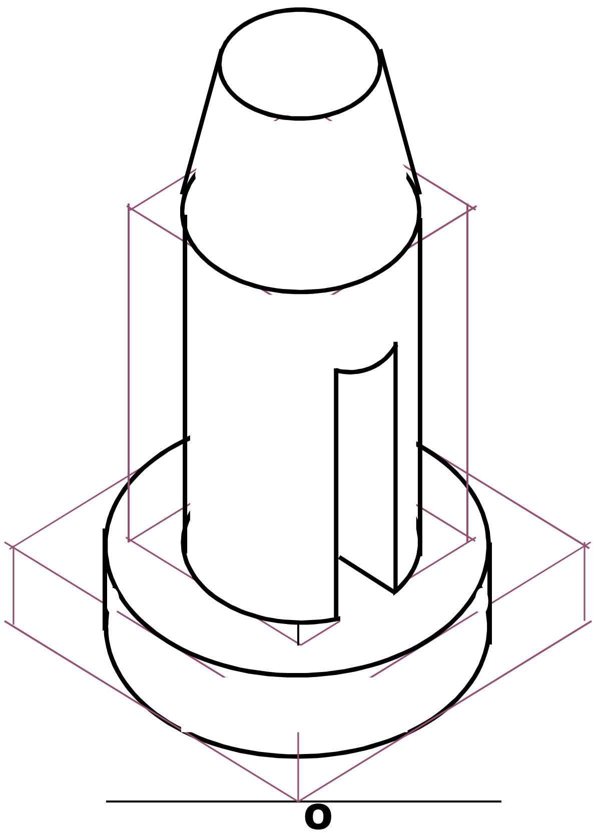


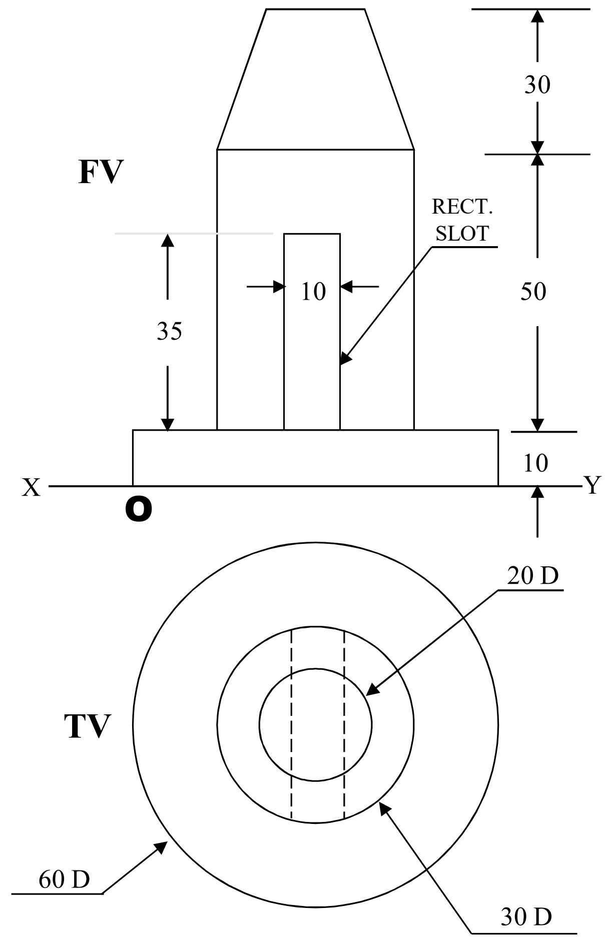


STUDY
ILLUSTRATIONS

F.V. & T.V. of an object are given. Draw it's isometric view.

30





STUDY ILLUSTRATIONS

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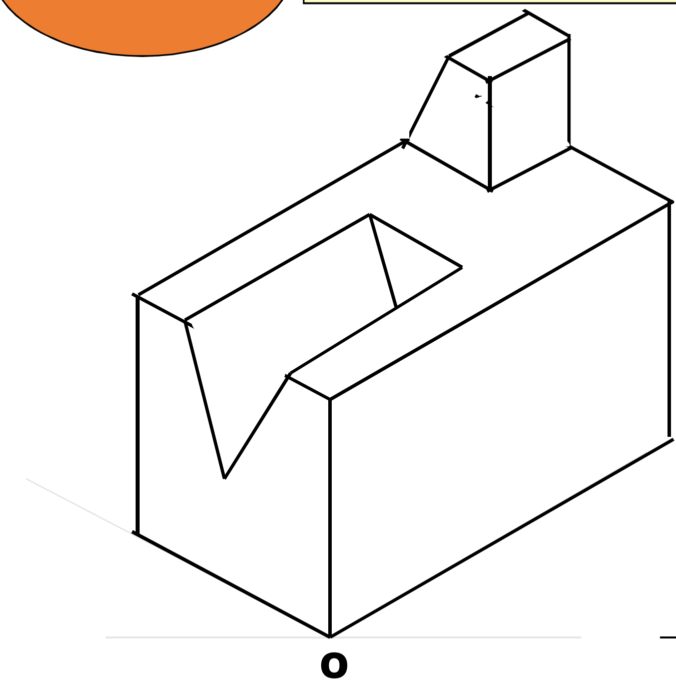

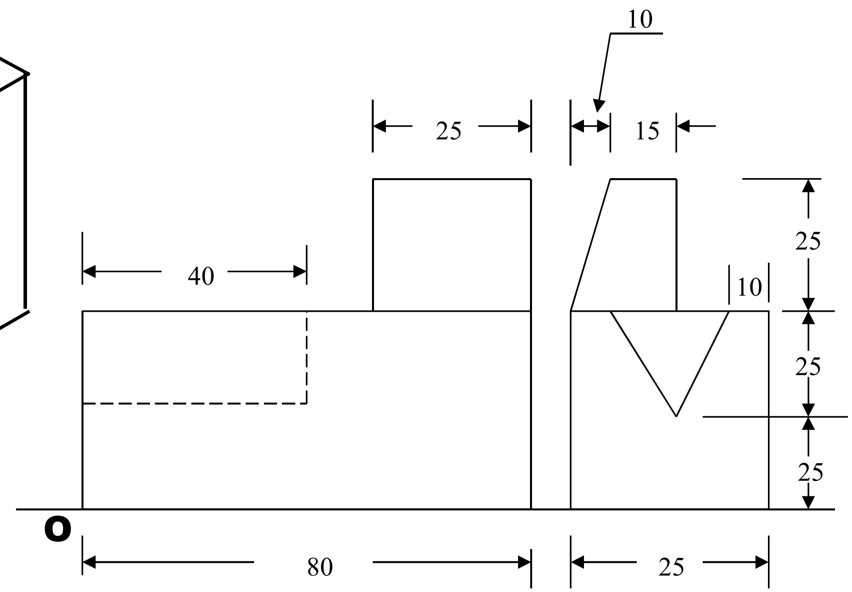

F.V.

S.V.

STUDY ILLUSTRATIONS

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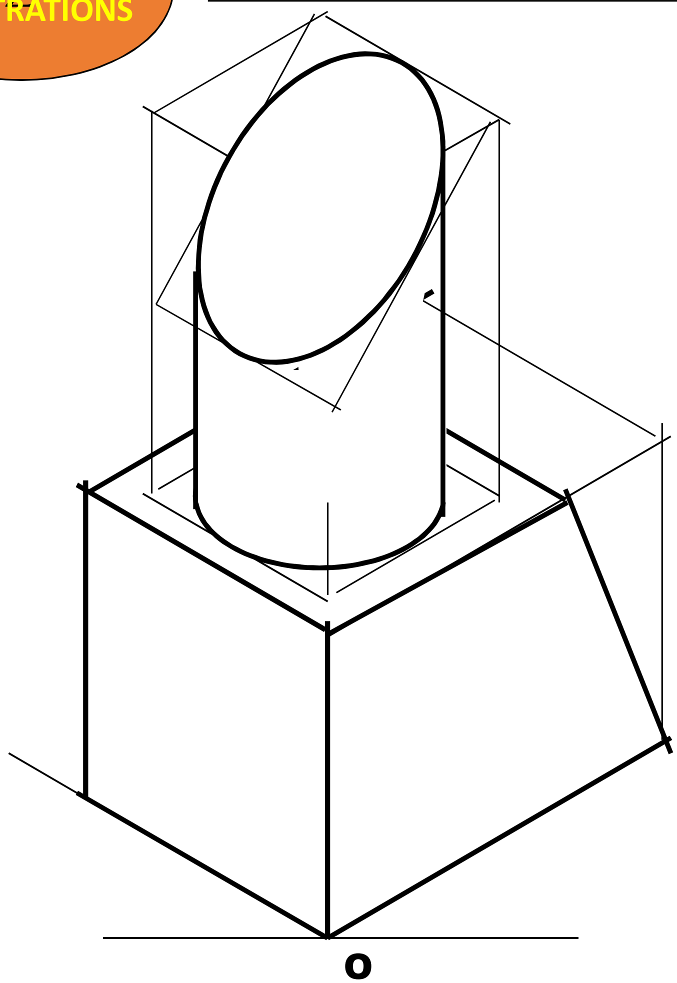

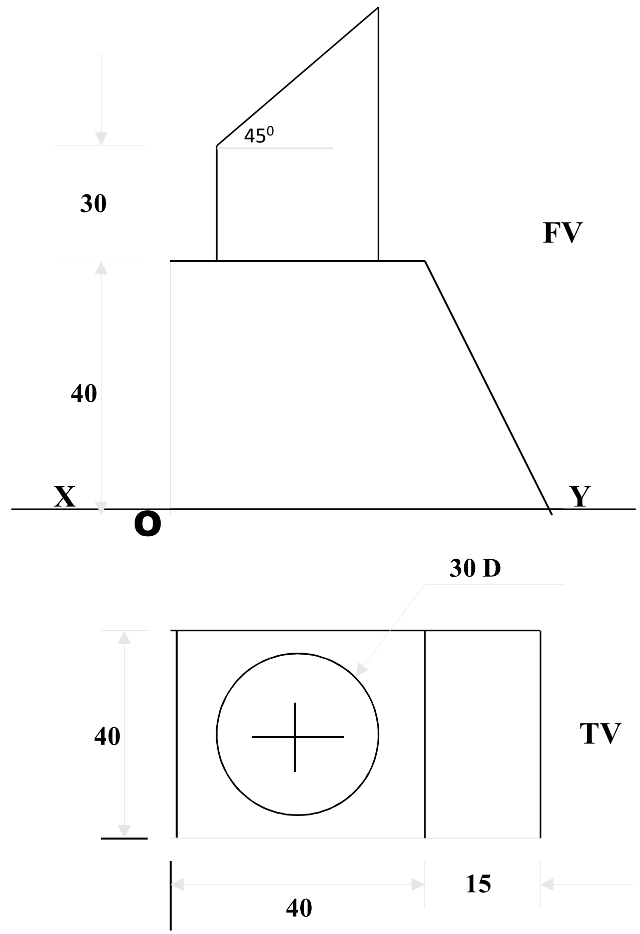

STUDY ILLUSTRATIONS

33

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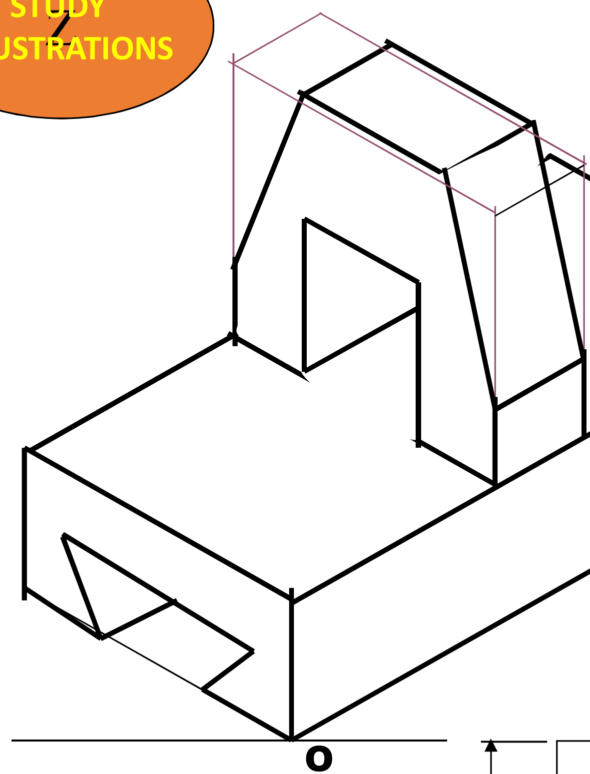
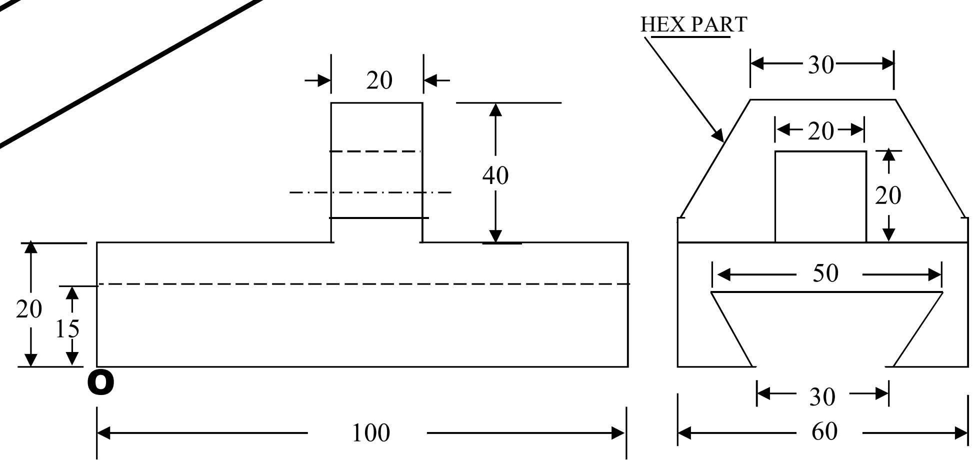
Draw it's isometric view.





STUDY
ILLUSTRATIONS

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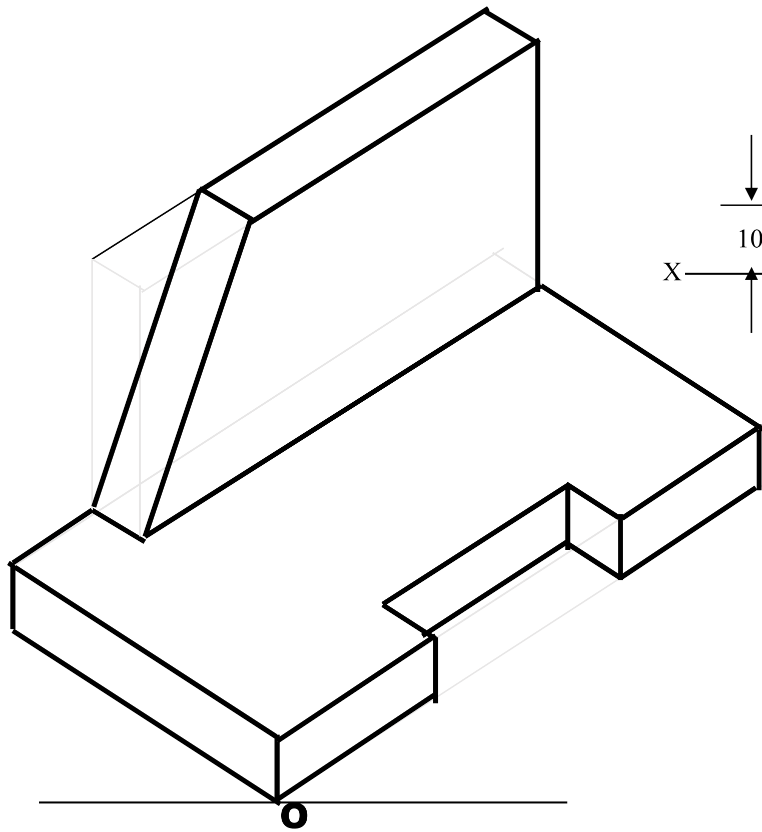
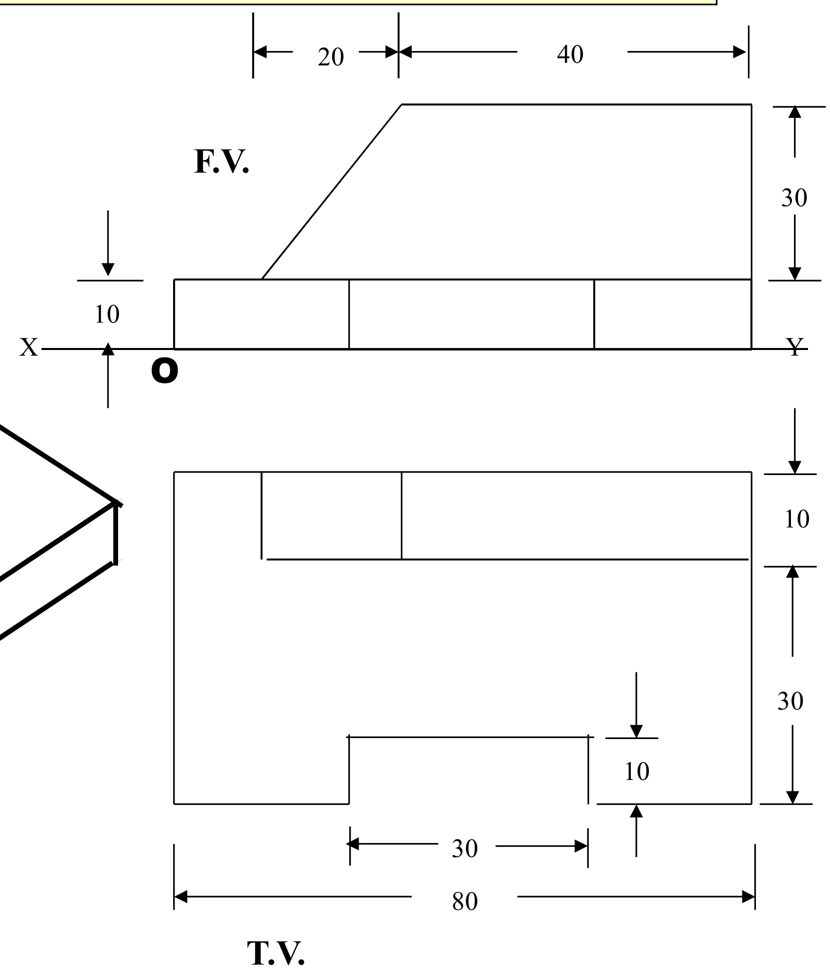
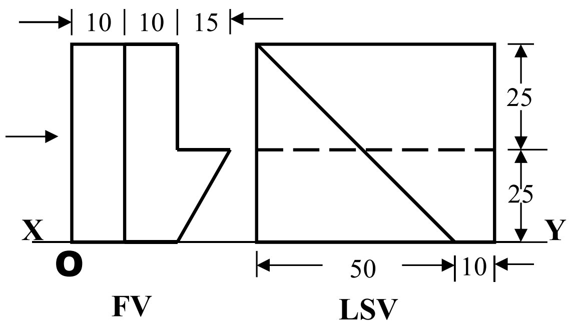


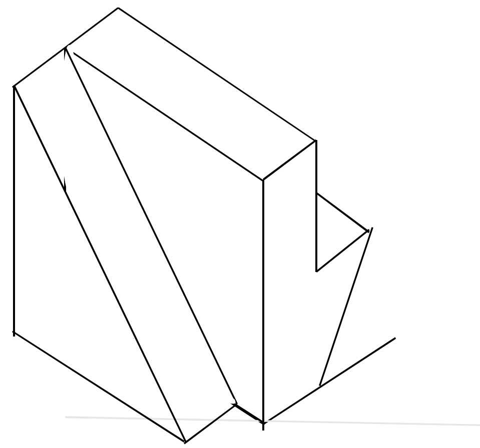


F.V. and S.V.of an object are given.
Draw it’s isometric view.

35

STUDY ILLUSTRATIONS





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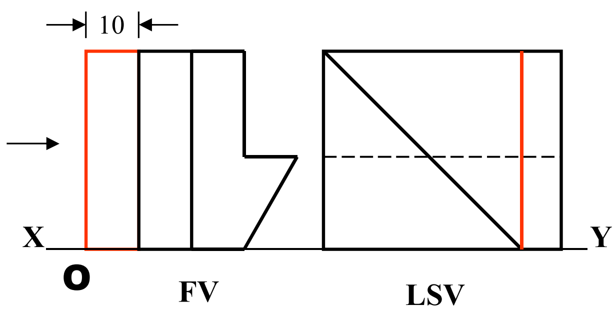
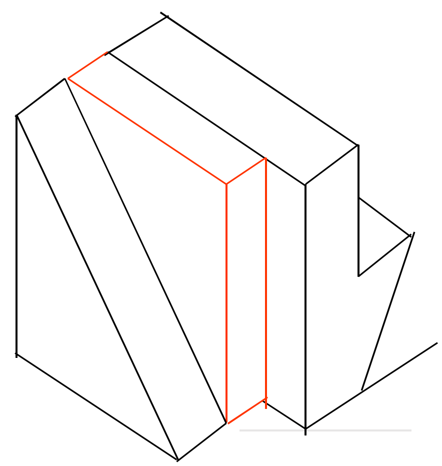
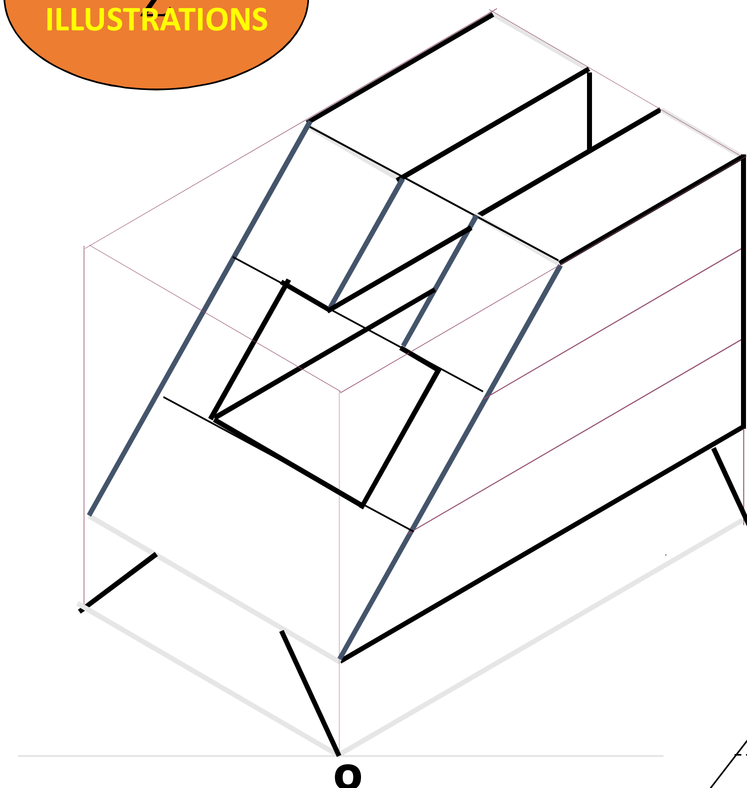
NOTE THE SMALL CHZNGE IN 2ND FV & SV.
DRAW ISOMETRIC ACCORDINGLY.





STUDY ILLUSTRATIONS



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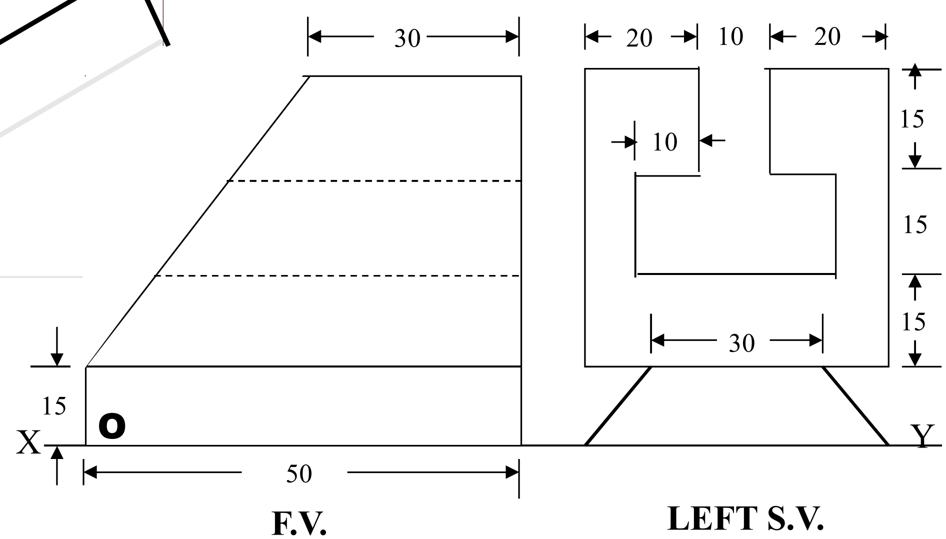

STUDY
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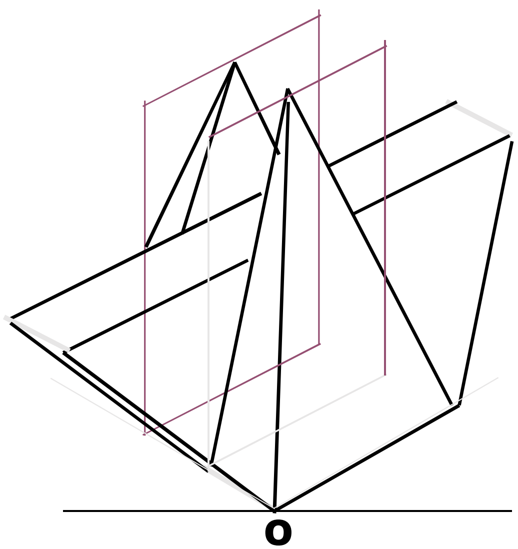

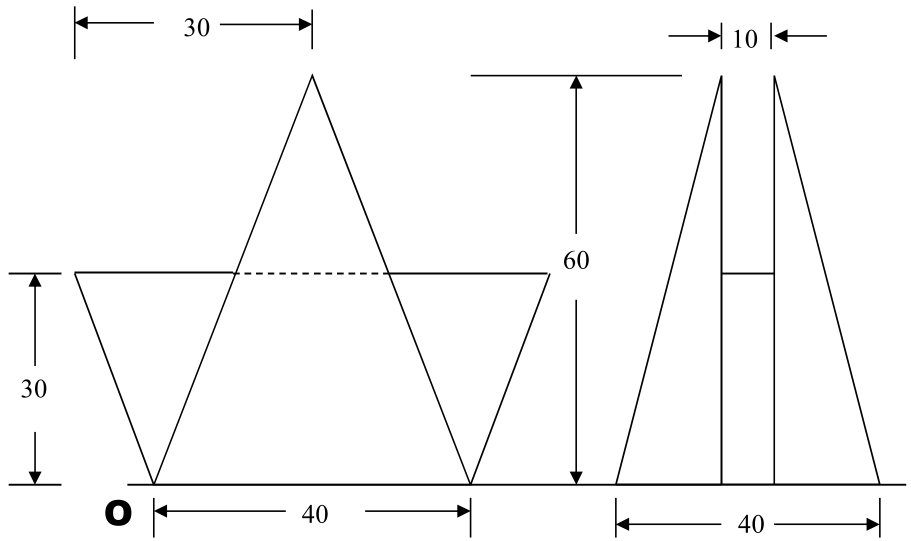

F.V.

S.V.

THANK YOU