

FRIENDS OF BISMARCK

MECH 103 Technical Drawing

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DEPARTMENT OF MECHANICAL AND
MANUFACTURING ENGINEERING

UENR, SUNYANI

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OFFICE: New office behind the
computer lab



Course Objectives

- Be able to use technical drawing instruments.
- Be able to employ technical construction techniques in simple geometrical constructions.
- Be able to construct loci for various conditions and constraints.
- Be able to perform free hand sketching of simple objects.
- Be able to produce Orthographic and Isometric projections of a given object.

Instruction Format & Time

Lectures

Renewable	Thursday	AL 3	07.00 – 08.55
Environmental	Thursday	AL 3	07.00 – 08.55
Electrical	Friday	LTS2	09:00 – 10:55
Computer	Thursday	AL 3	07.00 – 08.55

- Proposed meeting days for Practical/Tutorial

Renewable	Wednesday	AL 1	16.00 – 16.55
Environmental	Wednesday	AL 1	16.00 – 16.55
Electrical	Monday	LTS 2	13.00 – 13.55
Computer	Wednesday	AL 1	16.00 – 16.55

Schedule

Week	Subject Category	What to cover (Topic)	Remark
1	Introduction	Introduction to Drawing Instruments and Materials	Assignment on student's ability to draw objects as viewed
2	Geometric Construction and Tangency	Introduction	
3		Line, angles, Circle, Polygons, etc	
4		Tangency Problem	
5		Construction of Loci	
6	Sketching	Free hand sketching of lines, curves and simple objects	
7	Projection	Introduction to Projections	Mid Semester Exam
8	Orthographic Projection	Axonometric Projection	
9			
10		Introduction to Auxiliary Plane/View	
11	Isometric Project	Producing isometric drawing from given orthographic drawing	
12			
13	Missing 3 rd View Determination	Determining the 3 rd view given two views of orthographic drawing.	
14			
15	End of Semester Examination		

ASSESSMENT

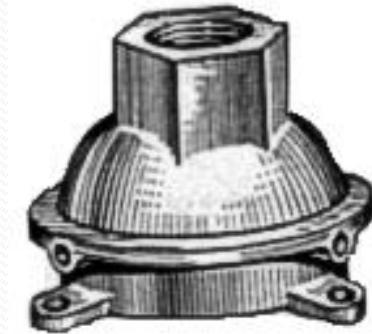
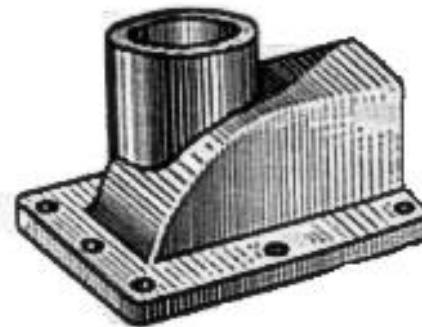
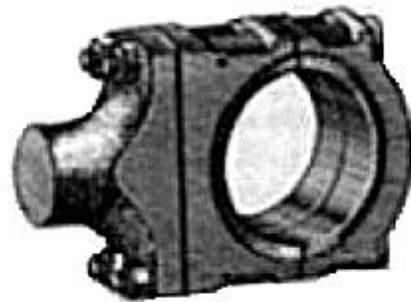
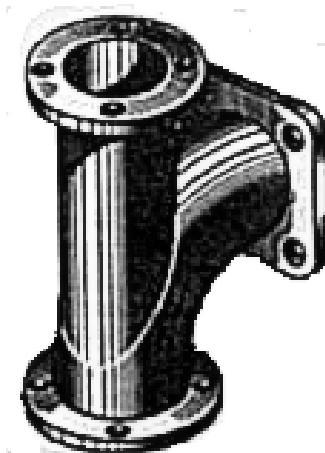
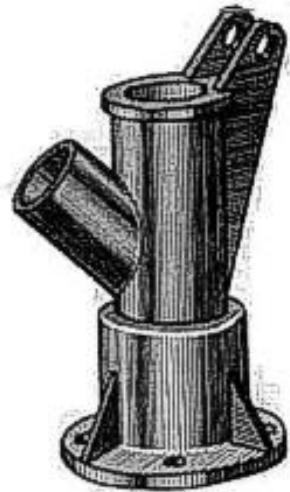
- Random and unannounced quizzes
- Assignments (Weekly)
- Attendance
- Mid Semester Examination
- End of Semester Examination

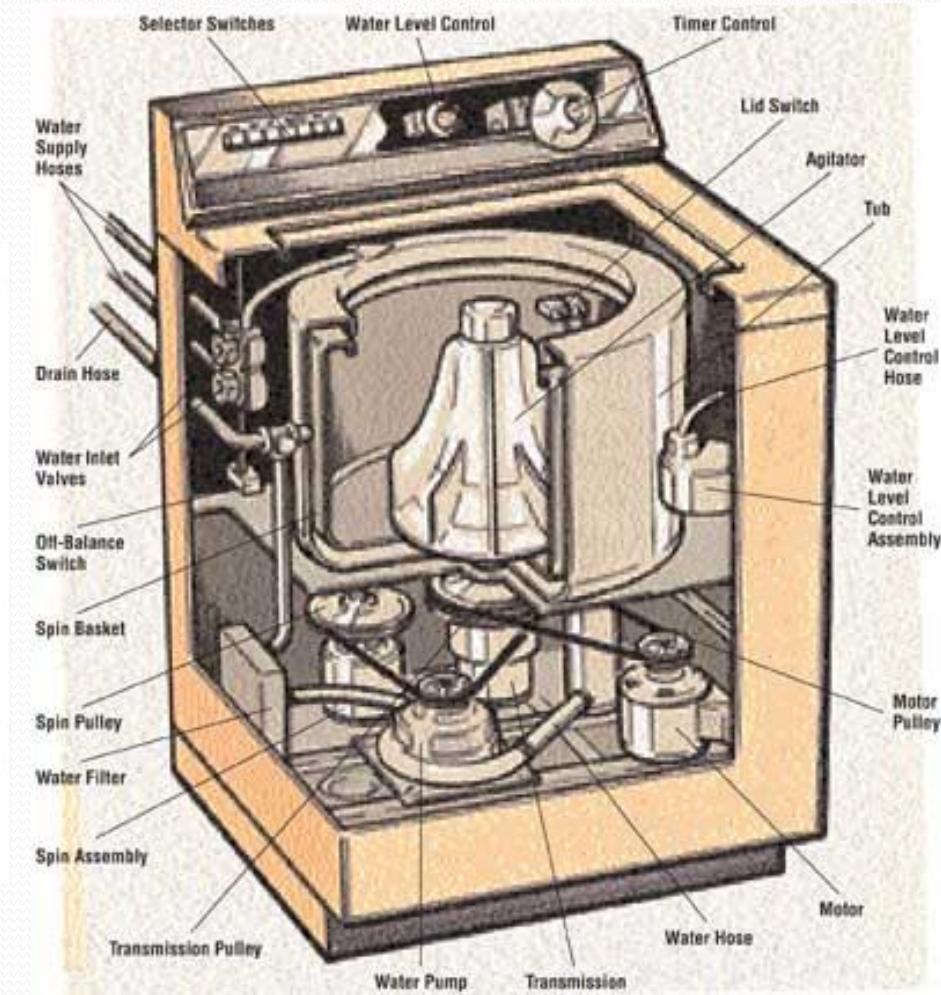
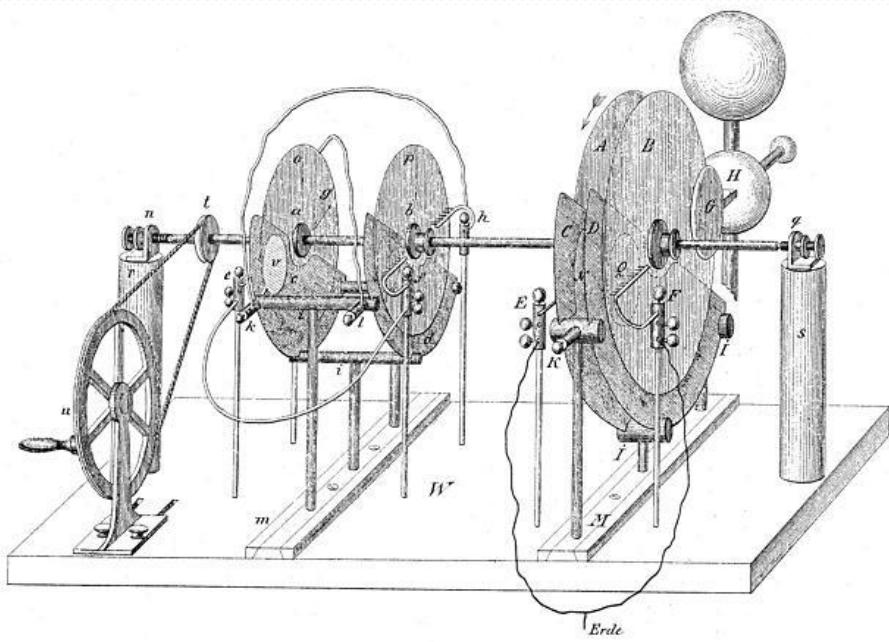
CLASS REGULATIONS

- No lateness beyond **10 minutes**: Student will be turned out.
- **No mobile phone use in class**: the phone will be confiscated for one week on first offence and for the semester on second offence.

References

- Bhatt, N.D. and Panchal V.M.; Engineering Drawing.
- Parker, M.A. and Pickup, F.; Engineering Drawing I.
- Jackson, E and Coll, M. Geometrical and Engineering Drawing.





DRAWINGS

(A Graphical Representation)

The Fact:

**If compared with Verbal or Written Description,
Drawings offer far better understanding about the
Shape, Size & Appearance of any object or
situation or location.**

*Hence it has become the Best Media of Communication
not only in Engineering but in almost all Fields.*

What is Technical Drawing?

- It is a formal and precise way of communicating information about the shape, size, features and precision of physical objects.
- A **universal language of Engineering** used in the design process for solving problems, quickly and accurately visualizing objects, and conducting analysis.
- A graphical representation of objects and structures.
- It can be done by using freehand, mechanical, or computer methods.

Assignment #1 & 2

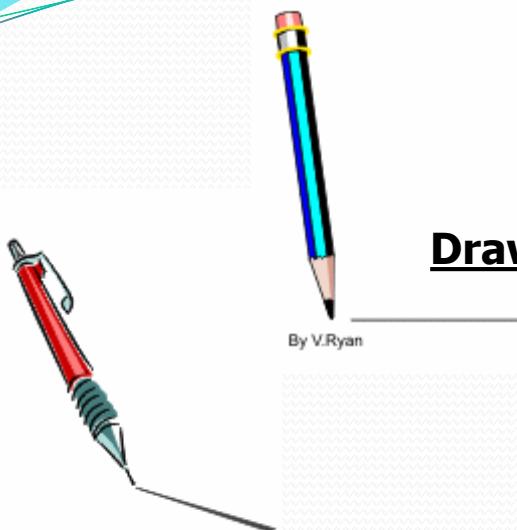
1. History and Development of Technical/Engineering drawing.
(Not more than 2 pages if word processed)

2. Produce a drawing of a Product as you can see it.

Drawing and Sketching

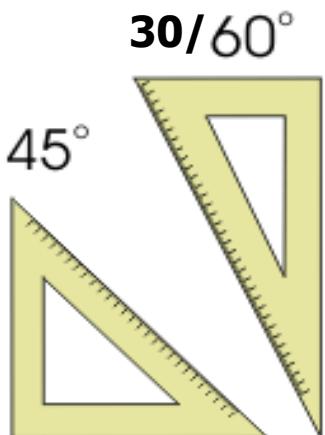
- "Drawing" usually means using drawing instruments, from compasses to computers to bring precision to the drawings.
- "Sketching" generally means freehand drawing.

Drawing Instruments & Materials



Refillable Pencil
0.3 and 0.7mm

By V.Ryan

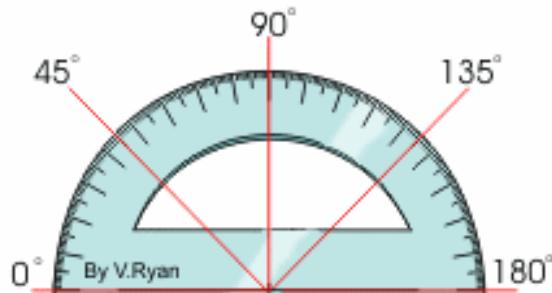


Set Squares



Drawing Pencils

By V.Ryan

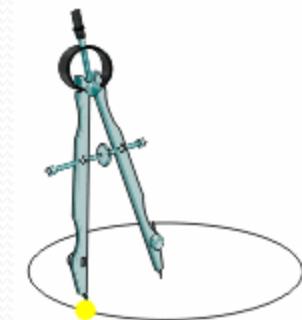


Protractor

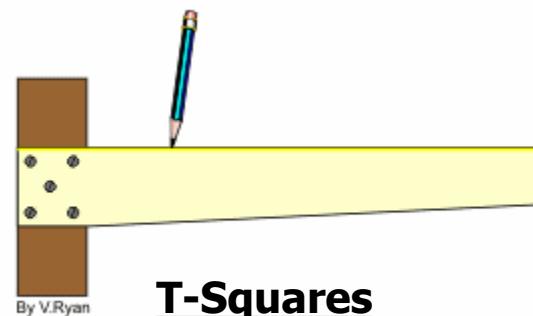


Board clips

MECH 103 TD



Compass & Divider



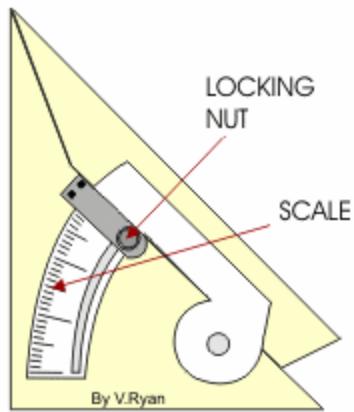
T-Squares

By V.Ryan

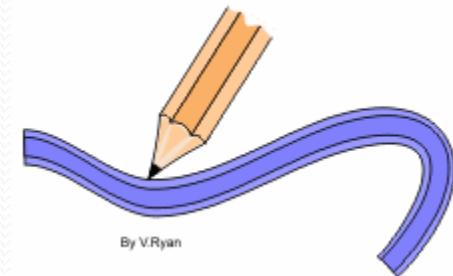
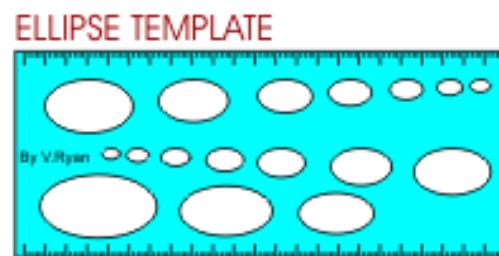
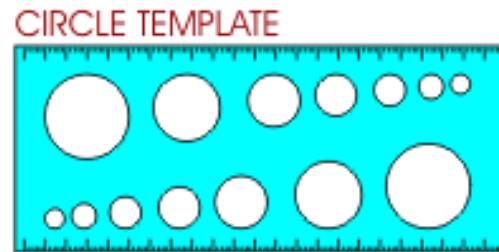


Scale rule

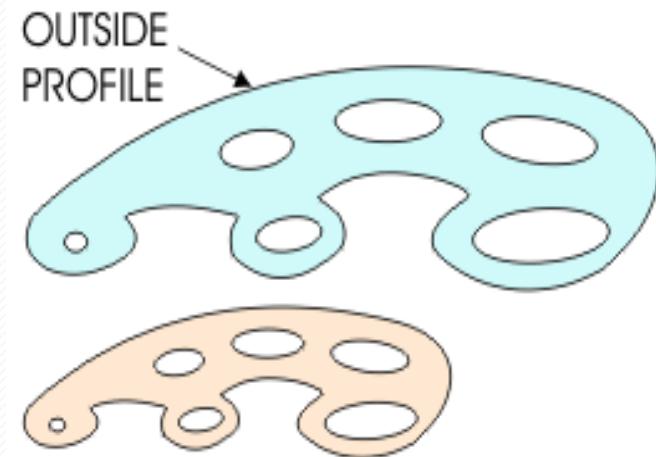
- Drawing Board: 450x650
- Eraser



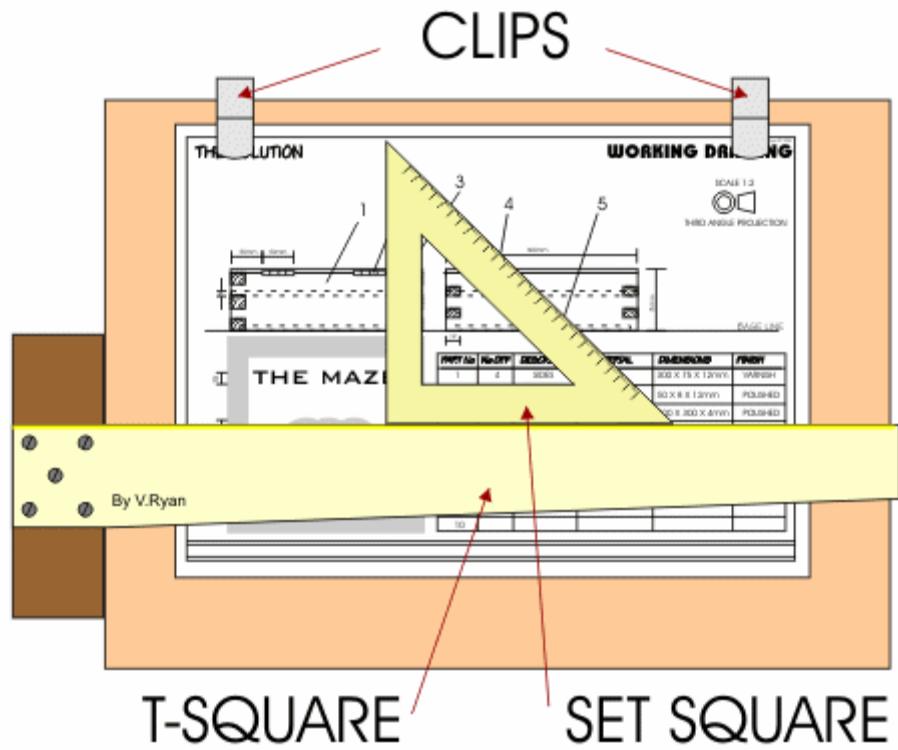
Adjustable Square



Flexi-curve



French Curves



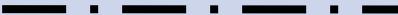
Drawing Sheet

A2

200

UENR: MECHANICAL ENGINEERING			
NAME		LECTURER	
INDEX NO.		DATE	
TITLE		SCALE	
DEPT.		NOTE	

LINE TYPES

		Type of line	Width	
A		Continuous (thick)	0.7	Visible outlines and edges End of Screw
B		Continuous (thin)	0.3	Fictitious outlines and edges Dimension and leader lines Hatching Outlines of adjacent parts Outlines of revolved sections
C		Continuous irregular (thin)	0.3	Limits of partial views or sections when the line is not an axis
D		Short dashes (thin)	0.3	Hidden outlines and edges
E		Chain (thin)	0.3	Centre lines Extreme positions of movable parts
F		Chain (thick at ends and at changes of direction, thin elsewhere)	0.7 0.3	Cutting planes
G		Chain (thick)	0.7	Indication of surfaces which have to meet special requirements

SCALES

DIMENSIONS OF LARGE OBJECTS MUST BE REDUCED TO ACCOMMODATE ON STANDARD SIZE DRAWING SHEET. THIS REDUCTION CREATES A SCALE OF A REDUCTION RATIO, WHICH IS GENERALLY A FRACTION..

**SUCH A SCALE IS CALLED REDUCING SCALE
AND
THAT RATIO IS CALLED REPRESENTATIVE/SCALE FACTOR**

SIMILARLY IN CASE OF TINY/SMALL OBJECTS DIMENSIONS
MUST BE INCREASED

HENCE THIS SCALE IS CALLED ENLARGING SCALE.
HERE THE REPRESENTATIVE FACTOR IS MORE THAN UNITY.

$$\begin{aligned}\text{SCALE FACTOR (S.F.)} &= \frac{\text{DIMENSION OF DRAWING (D)}}{\text{DIMENSION OF OBJECT (A)}} \\ &= \frac{\text{LENGTH OF DRAWING}}{\text{ACTUAL LENGTH}} \\ &= \sqrt{\frac{\text{AREA OF DRAWING}}{\text{ACTUAL AREA}}} \\ &= \sqrt[3]{\frac{\text{VOLUME AS PER DRWG.}}{\text{ACTUAL VOLUME}}}\end{aligned}$$

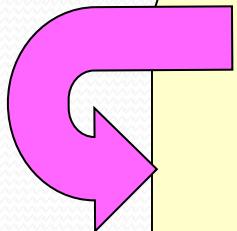
$$\text{SCALE} = \frac{D}{A}$$

$$\text{SCALE} = D : A$$

FULL SIZE SCALE
S.F. = 1 OR (1:1)

DRAWING & OBJECT
ARE OF SAME SIZE.

BE FRIENDLY WITH THESE UNITS.



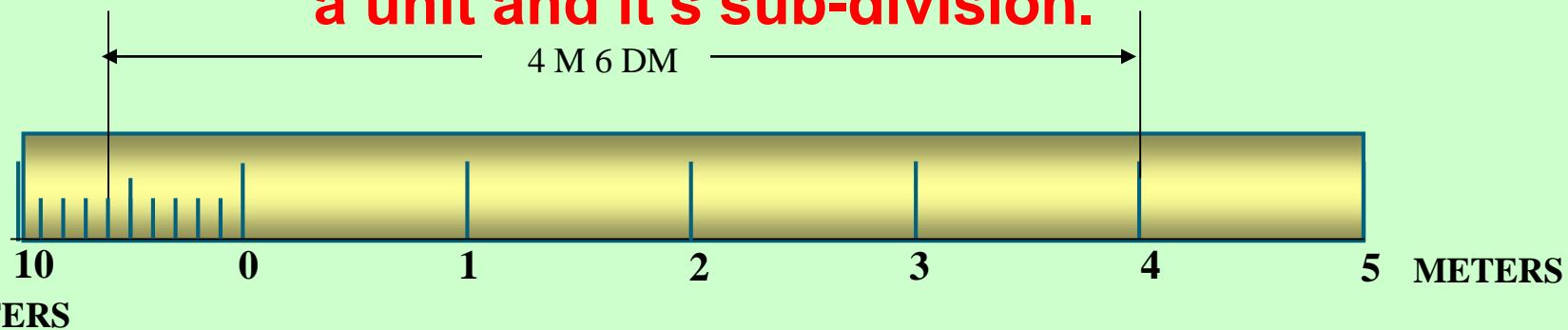
1 KILOMETRE = 10 HECTOMETRES
1 HECTOMETRE = 10 DECAMETRES
1 DECAMETRE = 10 METRES
1 METRE = 10 DECIMETRES
1 DECIMETRE = 10 CENTIMETRES
1 CENTIMETRE = 10 MILIMETRES

TYPES OF SCALES:

- 1. PLAIN SCALES**
- 2. DIAGONAL SCALES**
- 3. VERNIER SCALES**
- 4. COMPARATIVE SCALES**
- 5. SCALE OF CORDS**

PLAIN SCALE

This type of scale represents two units or a unit and it's sub-division.



R.F. = 1/100

PLANE SCALE SHOWING METERS AND DECIMETERS.

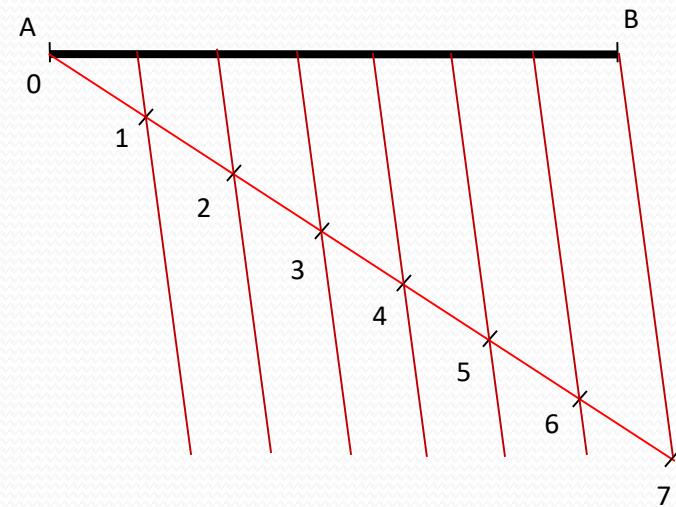
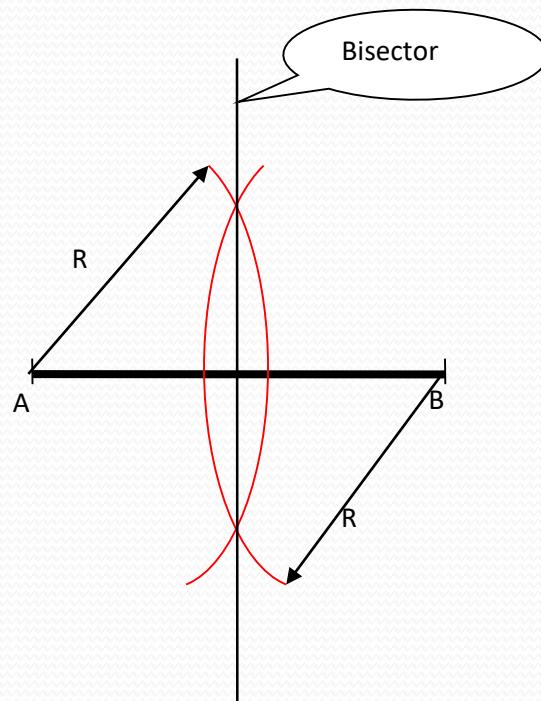
Vernier Scale

Assignment #3

Line types

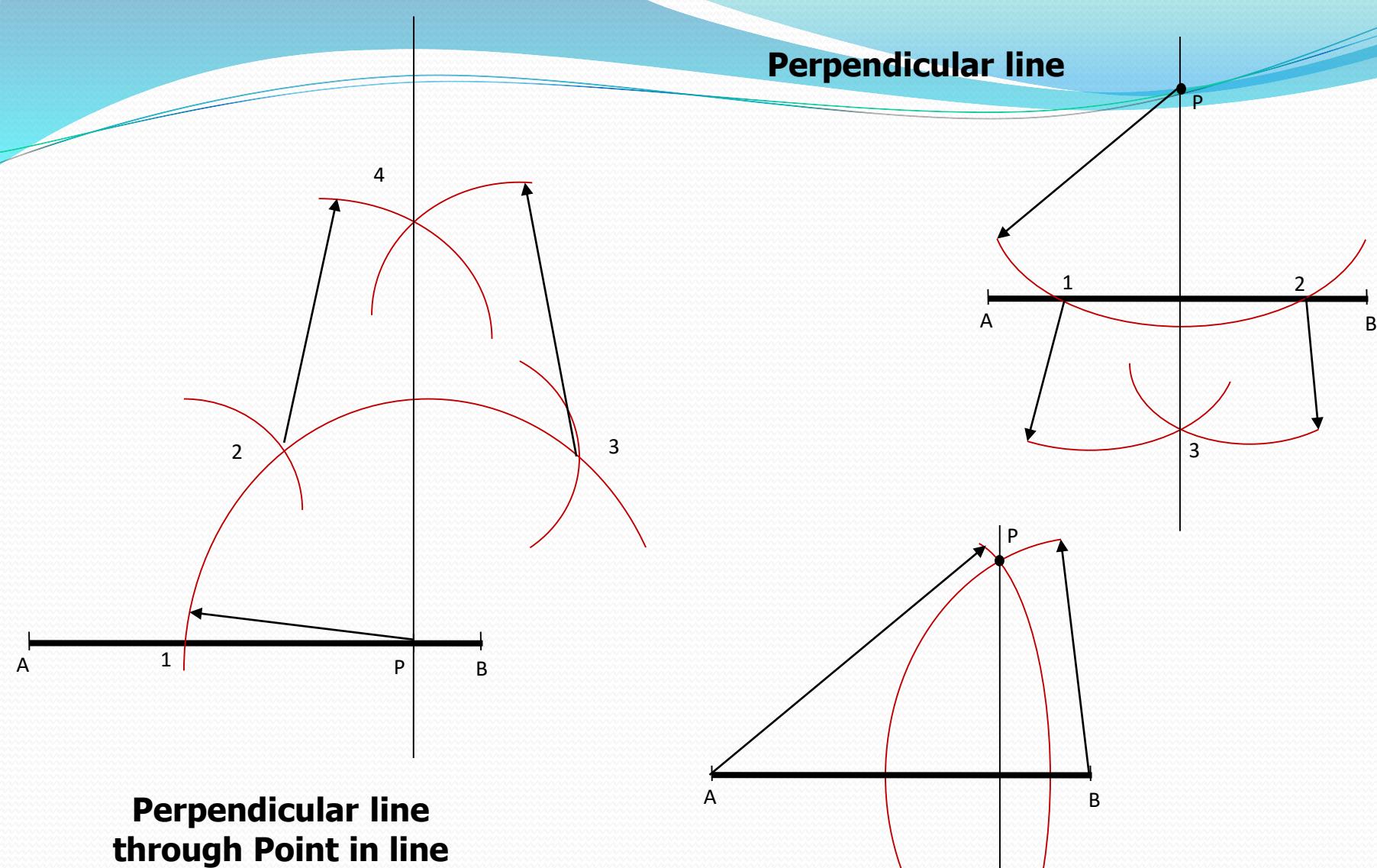
Geometric Construction

- Lines
 - Bisection of line
 - Dividing a line into equal number of parts
 - Constructing perpendicular to a given line through a given point
 - Point on line
 - Point outside line
 - Mid way, close to edge
- Parallel lines
 - Through a given point
 - At a given distance



**Dividing line into equal
number of parts**

Perpendicular line



**Perpendicular line
through Point in line**

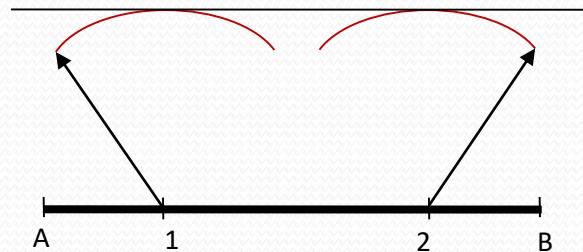
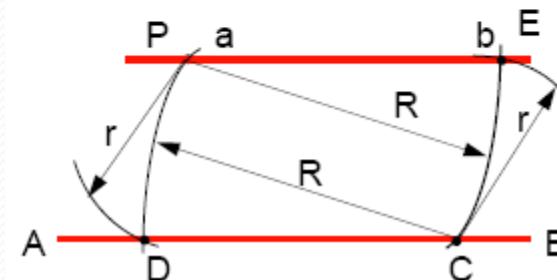
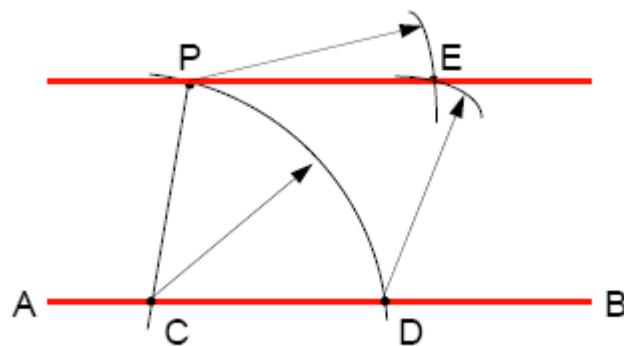
Parallel line

P.

P.

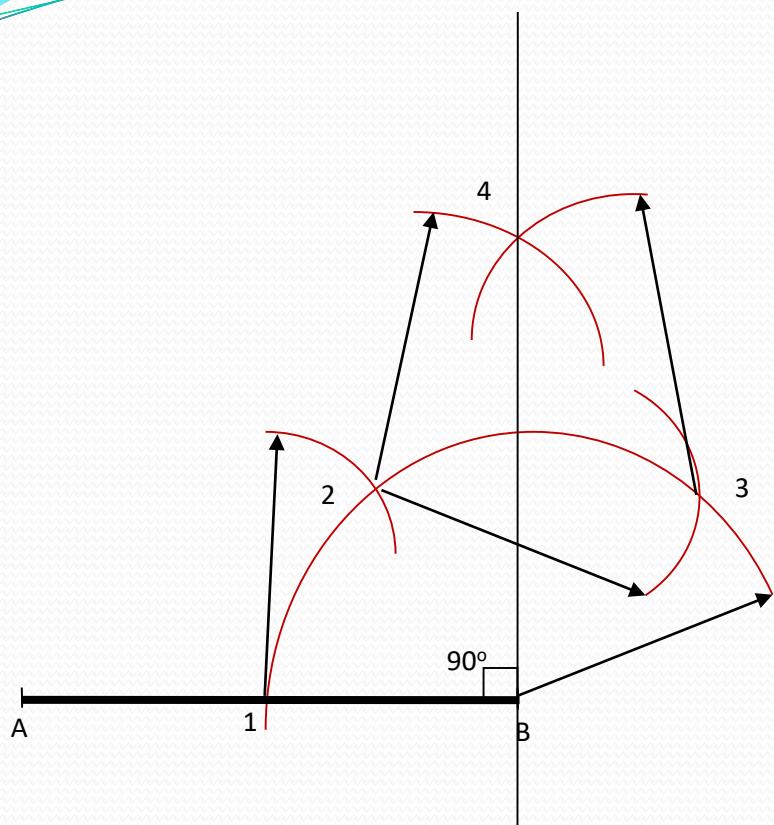
A ————— B

A ————— B

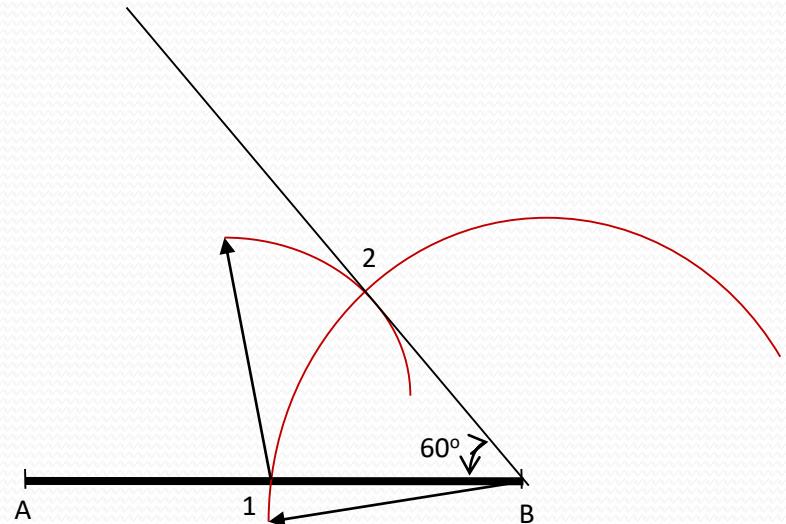


Geometric Construction

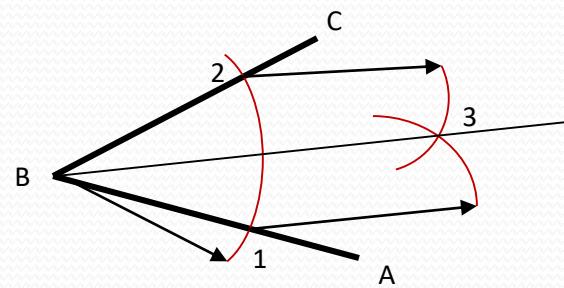
- Angles
 - Constructing 90°
 - Constructing 60°
 - Bisection of Angles
 - Transfer of Angles



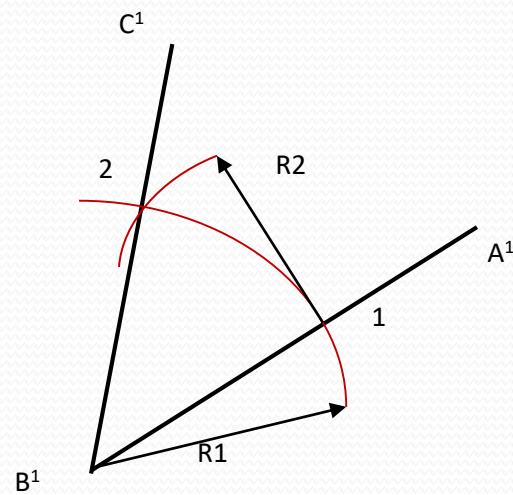
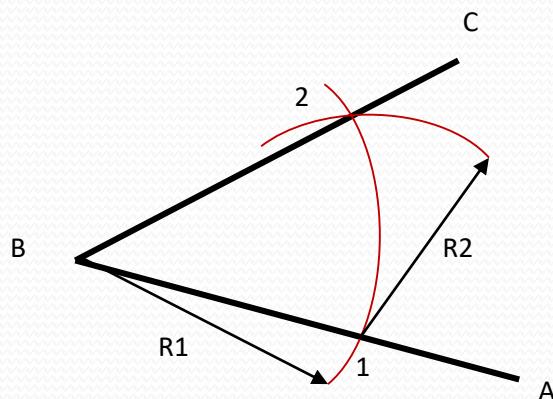
90° construction



60° construction



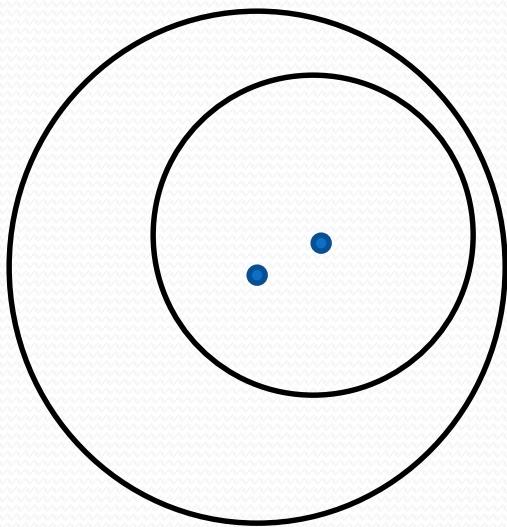
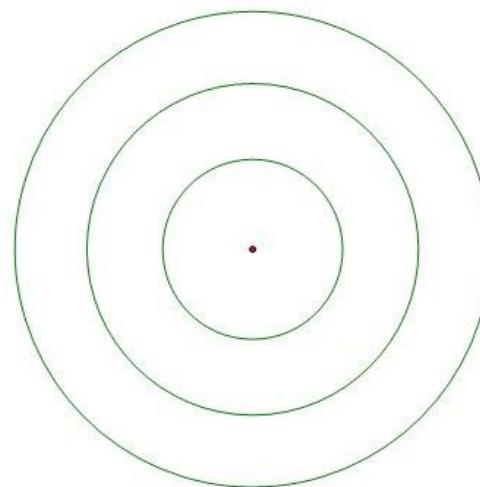
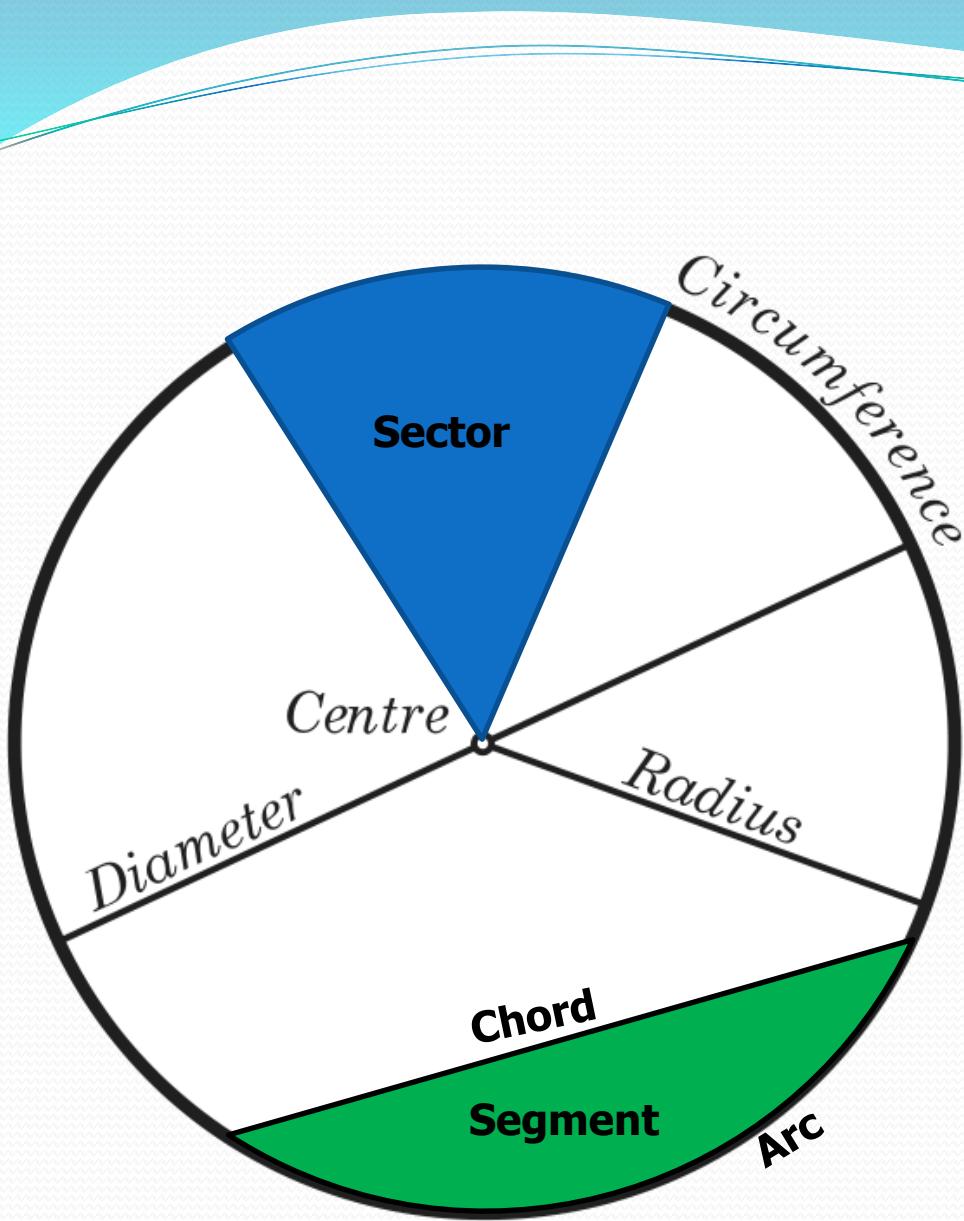
Bisecting Angle

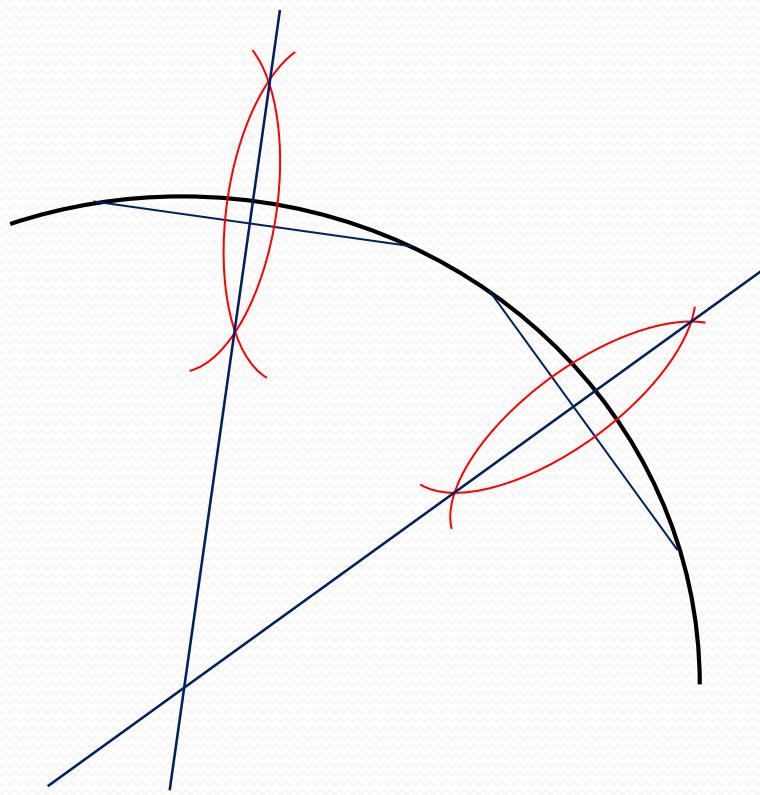


Transferring angles

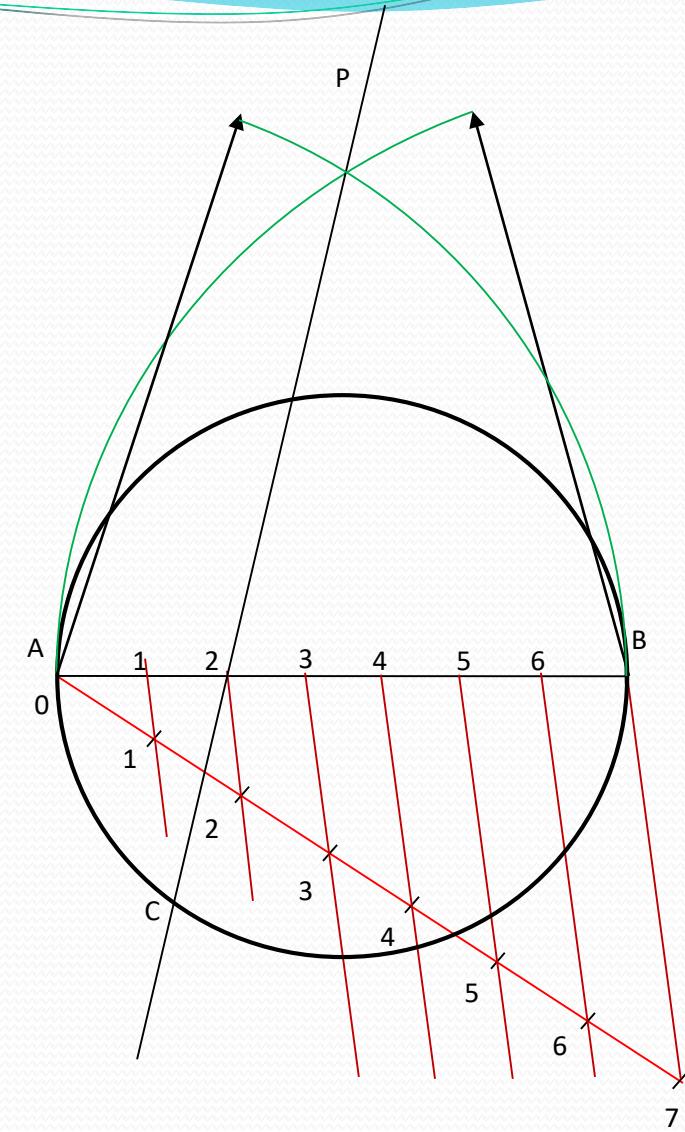
Geometric Construction

- Circles and Arcs
 - Finding centre of a given Arc
 - Dividing circumference of a circle in number of equal parts
 - Determining circumference of circle

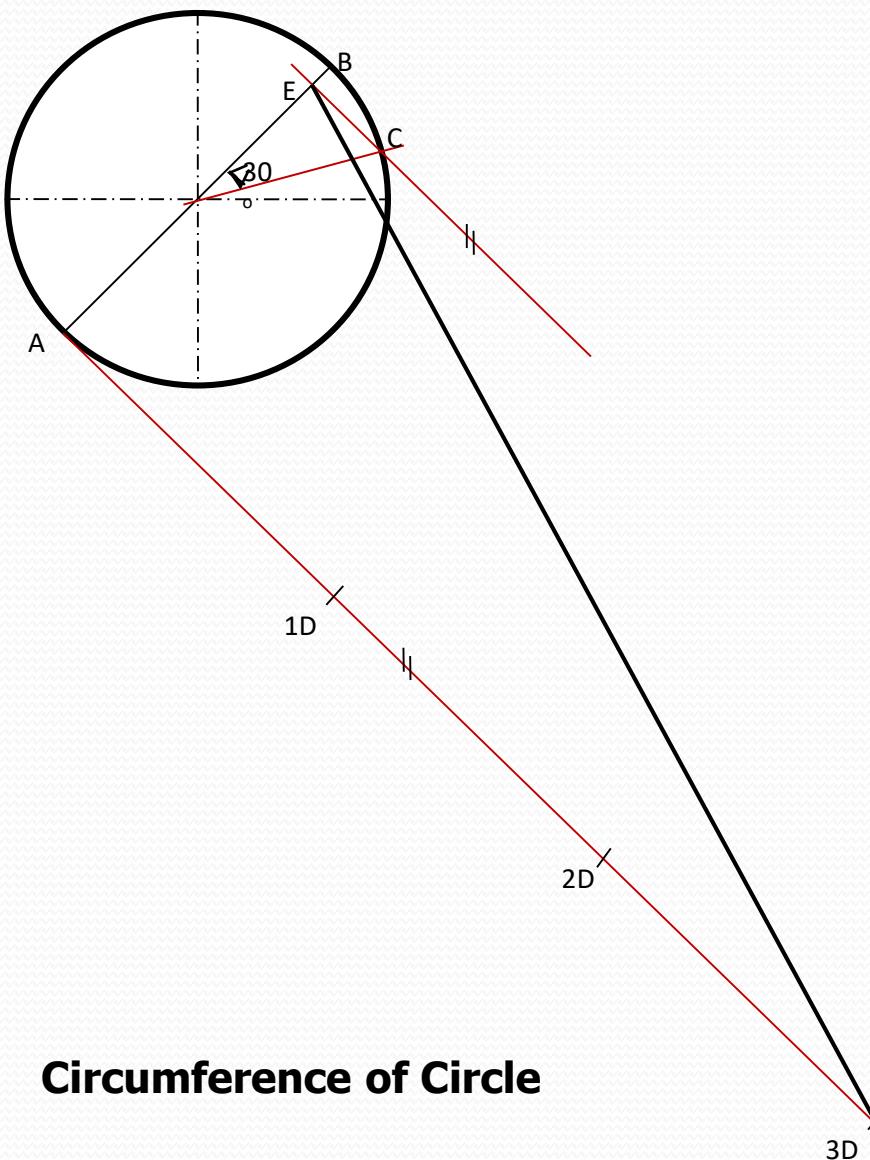




Centre of circle/arc



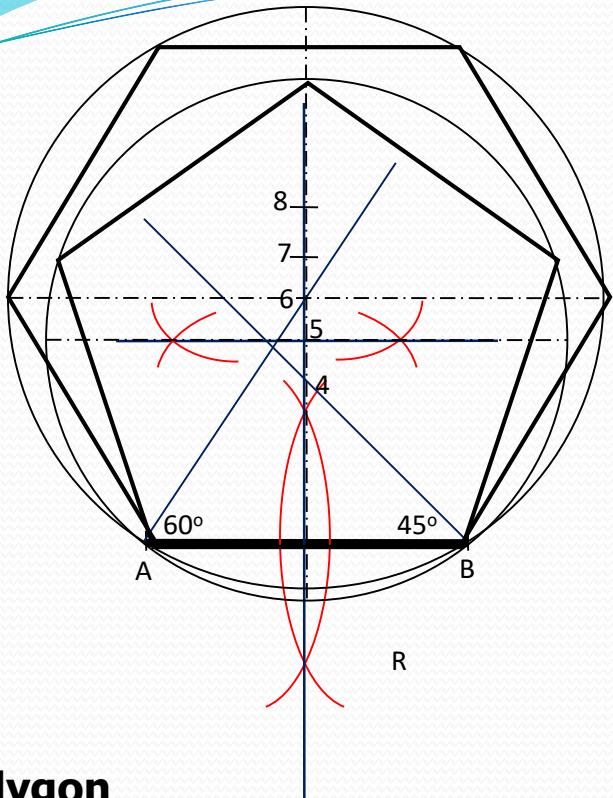
**Dividing Circle into Equal
number parts**



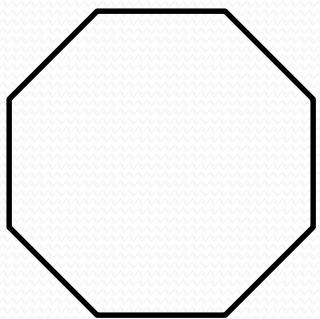
Circumference of Circle

Geometric Construction

- Polygons
 - Constructing regular polygon
 - Circum- centre of given triangle
 - In-centre of given triangle
 - Ex-centre of given triangle
- Inscribed circle of a regular polygon
- Circumscribed circle of a regular polygon

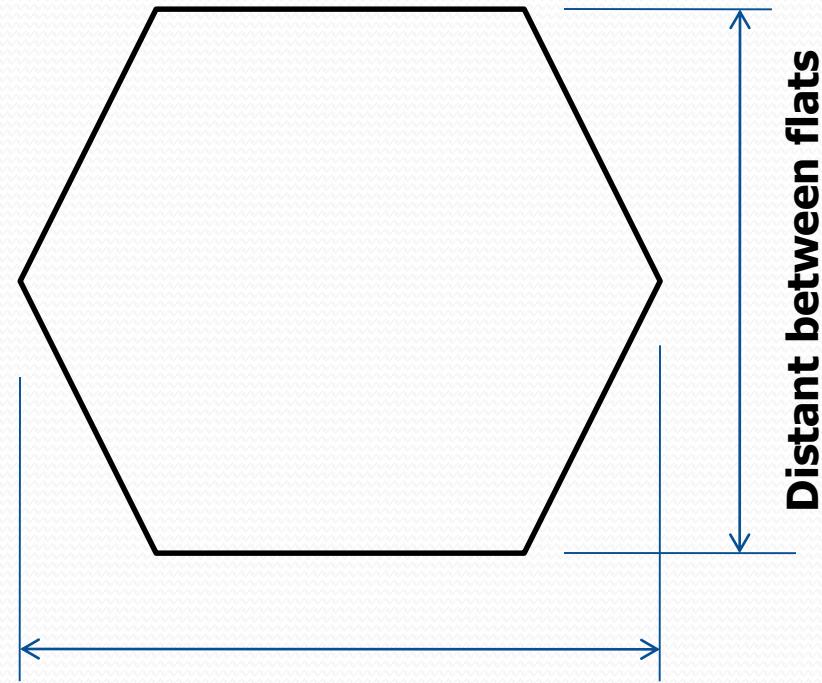


Polygon

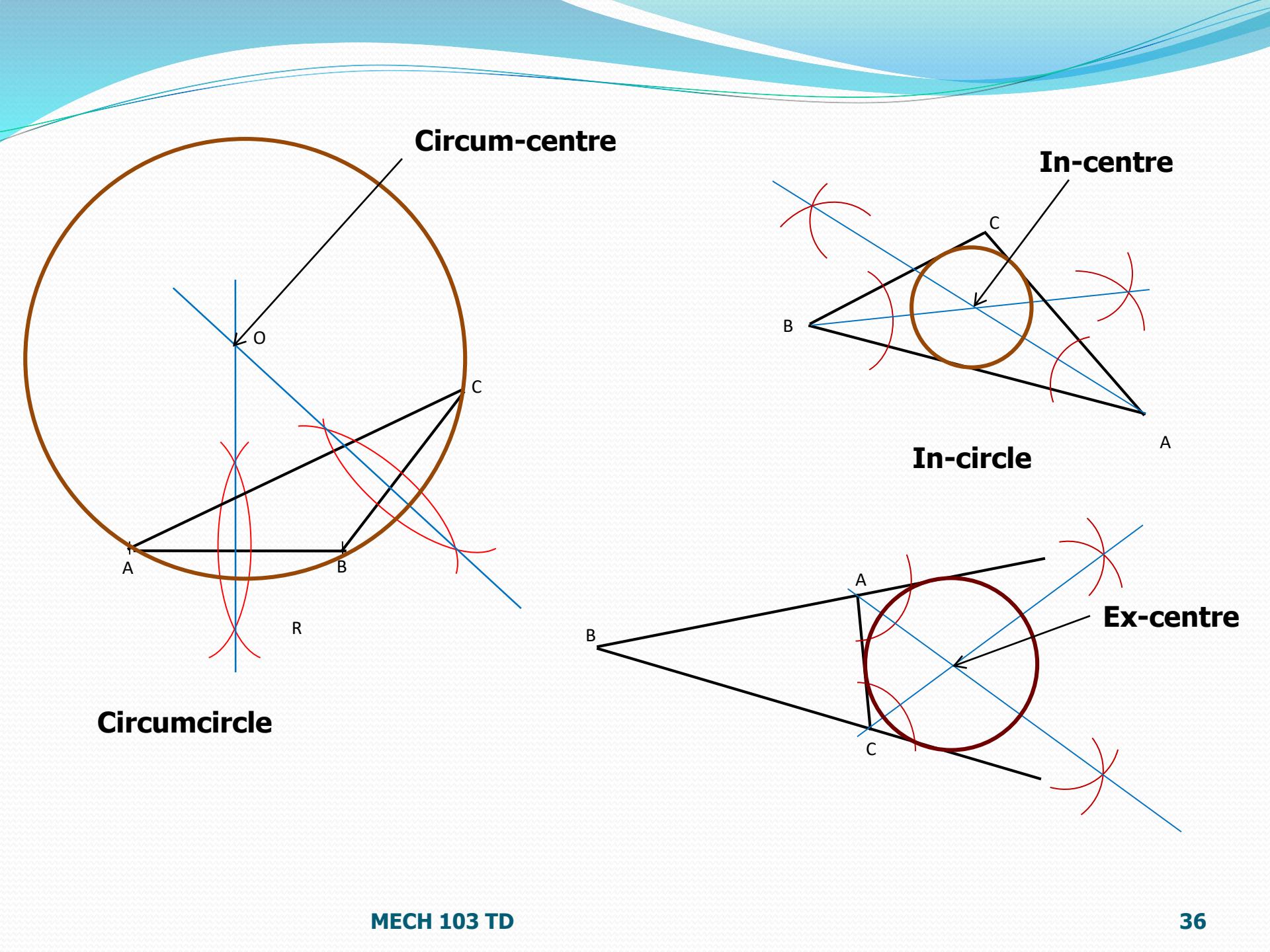


Octagon

To draw regular hexagon given distant between flats



To draw regular hexagon given distant across corners



Assignment #4

Geometric Construction
(Part 1)

ENGINEERING CURVES

Conic Sections

ELLIPSE

1. Concentric Circle Method
2. Rectangle Method
3. Oblong Method
4. Arcs of Circle Method
5. Rhombus Method
6. Basic Locus Method
(Directrix – focus)
7. Four Centres Method

PARABOLA

- 1.Rectangle Method
- 2 Method of Tangents
(Triangle Method)
- 3.Basic Locus Method
(Directrix – focus)

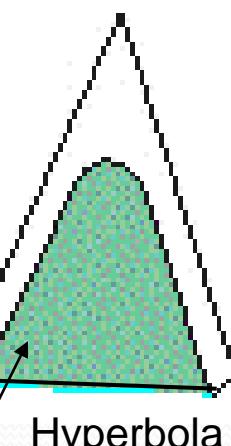
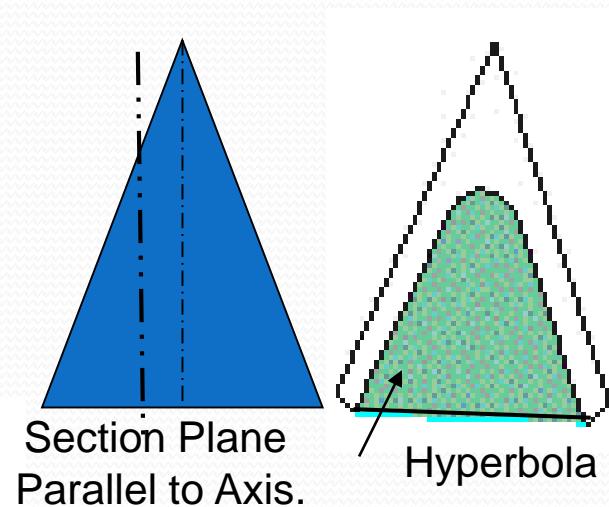
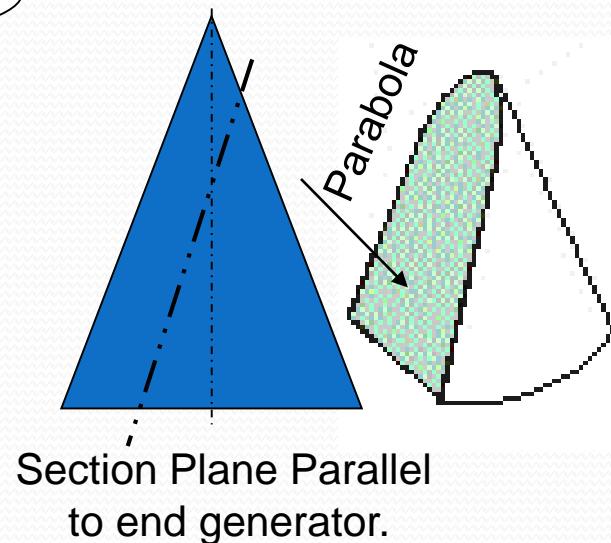
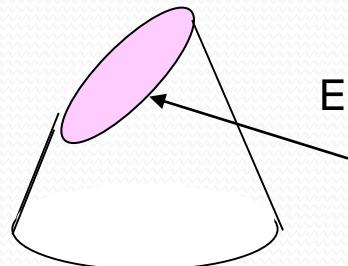
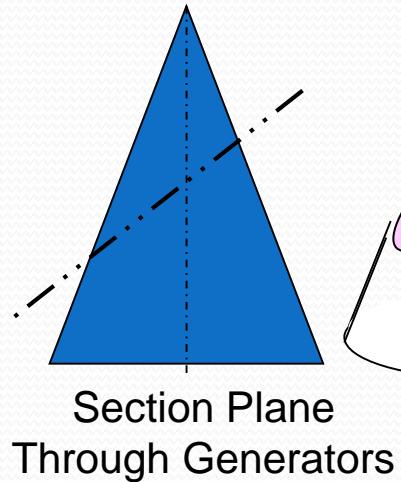
HYPERBOLA

- 1.Rectangular Hyperbola
(coordinates given)
- 2 Rectangular Hyperbola
(P-V diagram - Equation given)
- 3.Basic Locus Method
(Directrix – focus)

Methods of Drawing
Tangents & Normals
To These Curves.

CONIC SECTIONS

**ELLIPSE, PARABOLA AND HYPERBOLA ARE CALLED CONIC SECTIONS
BECAUSE
THESE CURVES APPEAR ON THE SURFACE OF A CONE
WHEN IT IS CUT BY SOME TYPICAL CUTTING PLANES.**



ELLIPSE

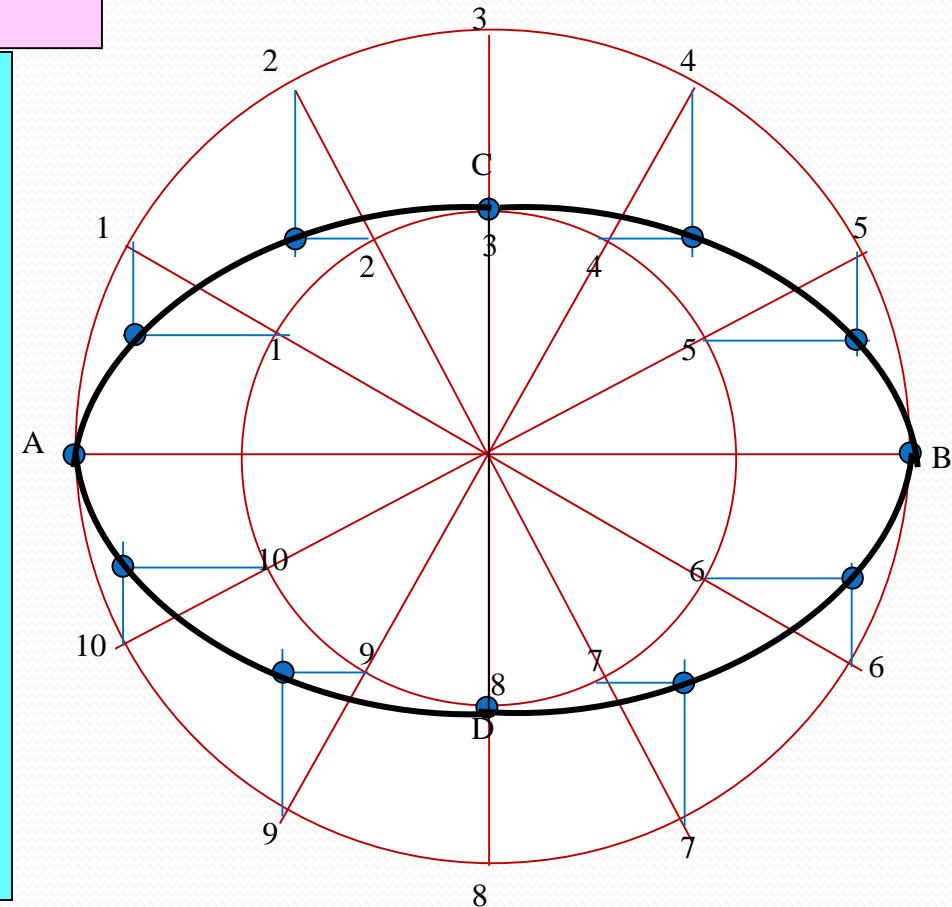
BY CONCENTRIC CIRCLE METHOD

Draw ellipse by concentric circle method.

Take major axis 100 mm and minor axis 70 mm long.

Steps:

1. Draw both axes as perpendicular bisectors of each other & name their ends as shown.
2. Taking their intersecting point as a center, draw two concentric circles considering both as respective diameters.
3. Divide both circles into equal sectors - 12 equal parts & name as shown.
4. Where the sector lines cross the smaller circle, draw horizontal lines towards the bigger circle. Where the sector lines cross the larger circle, draw vertical lines to meet the horizontal lines.
6. Mark all intersecting points properly as those are the points on ellipse.
7. Draw a neat curve through the intersections. It is the required ellipse.

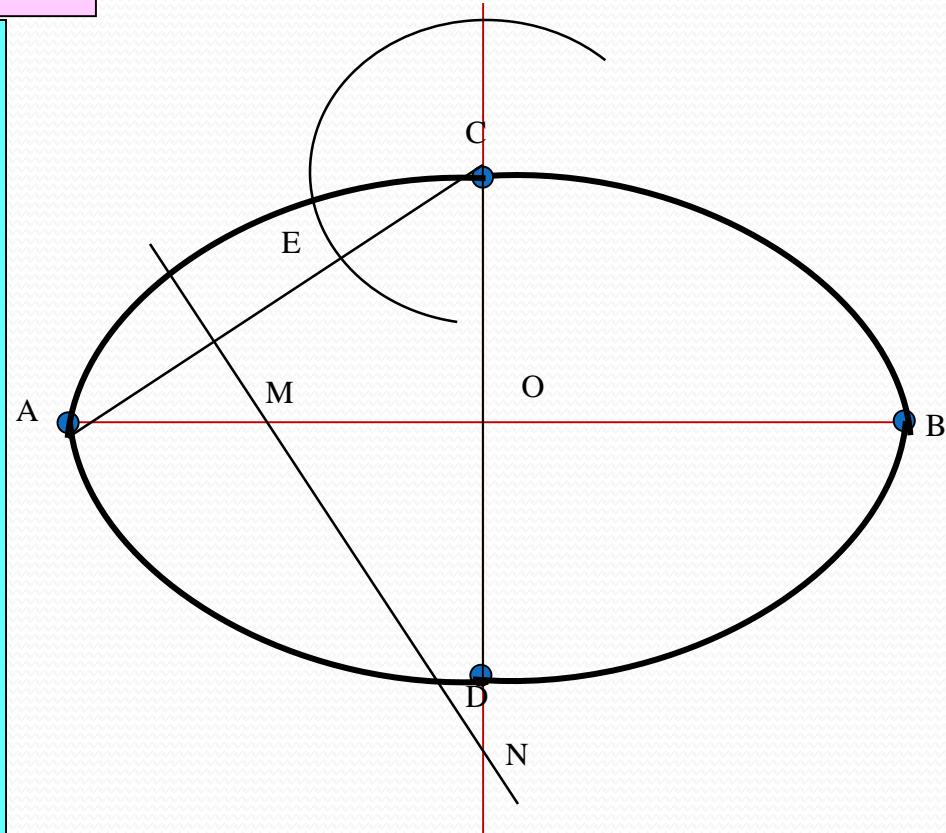


Draw ellipse by Four Centres method.

Take major axis 100 mm and minor axis 70 mm long.

Steps:

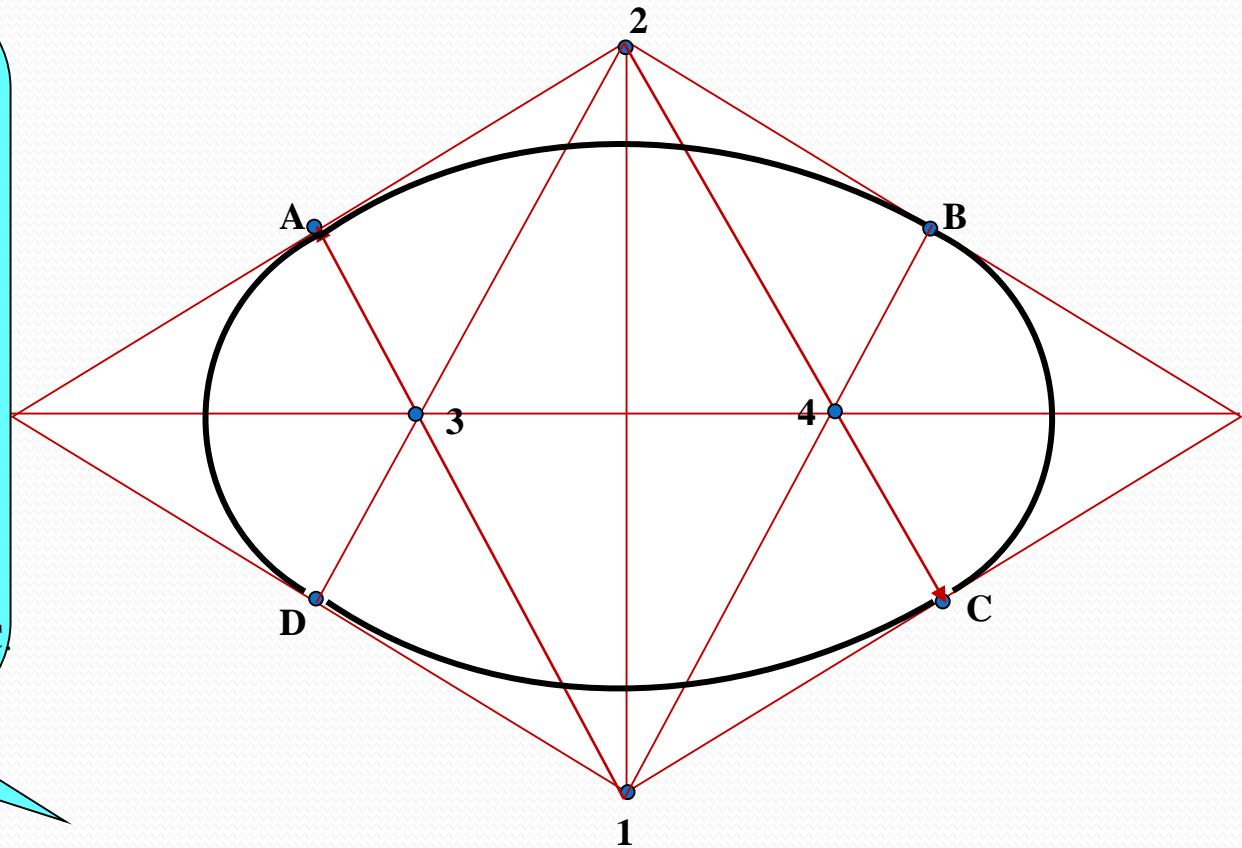
1. Draw both axes as perpendicular bisectors of each other & name their ends as shown.
2. Join A to C with a straight line.
3. With centre C, radius $r = (AO - CO)$, draw arc to intersect line AC at E.
4. Bisect line AE and extend the bisector to intersect line AO at M and OD at N.
5. Points M and N are the centres.
6. Transfer Point M and N. Mark all intersecting points properly as those are the points on ellipse.
7. Join all these points along with the ends of both axes in smooth possible curve. It is required ellipse.



DRAW RHOMBUS OF 100 MM & 70 MM LONG
DIAGONALS AND INSCRIBE AN ELLIPSE IN IT.

STEPS:

1. Draw rhombus of given dimensions.
2. Mark mid points of all sides & name Those A,B,C,& D
3. Join these points to the ends of smaller diagonals.
4. Mark points 1,2,3,4 as four centers.
5. Taking 1 as center and 1-A radius draw an arc AB.
6. Take 2 as center draw an arc CD.
7. Similarly taking 3 & 4 as centers and 3-D radius draw arcs DA & BC



LOCUS

It is a path traced out by a point moving in a plane, in a particular manner, for one cycle of operation.

INVOLUTE

1. Inolute of a circle
 - a) String Length = πD
 - b) String Length > πD
 - c) String Length < πD
2. Pole having Composite shape.
3. Rod Rolling over a Semicircular Pole.

CYCLOID

1. General Cycloid
2. Trochoid (superior)
3. Trochoid (Inferior)
4. Epi-Cycloid
5. Hypo-Cycloid

SPIRAL

1. Spiral of One Convolution.
2. Spiral of Two Convolutions.

HELIX

1. On Cylinder
2. On a Cone

DEFINITIONS

CYCLOID:

IT IS A LOCUS OF A POINT ON THE PERIPHERY OF A CIRCLE WHICH ROLLS ON A STRAIGHT LINE PATH.

INVOLUTE:

IT IS A LOCUS OF A FREE END OF A STRING WHEN IT IS WOUND ROUND A CIRCULAR POLE

SPIRAL:

IT IS A CURVE GENERATED BY A POINT WHICH REVOLVES AROUND A FIXED POINT AND AT THE SAME TIME MOVES TOWARDS IT.

HELIX:

IT IS A CURVE GENERATED BY A POINT WHICH MOVES AROUND THE SURFACE OF A RIGHT CIRCULAR CYLINDER / CONE AND AT THE SAME TIME ADVANCES IN AXIAL DIRECTION AT A SPEED BEARING A CONSTANT RATIO TO THE SPEED OF ROTATION.

SUPERIOR TROCHOID:

IF THE POINT IN THE DEFINITION OF CYCLOID IS OUTSIDE THE CIRCLE

INFERIOR TROCHOID.:

IF IT IS INSIDE THE CIRCLE

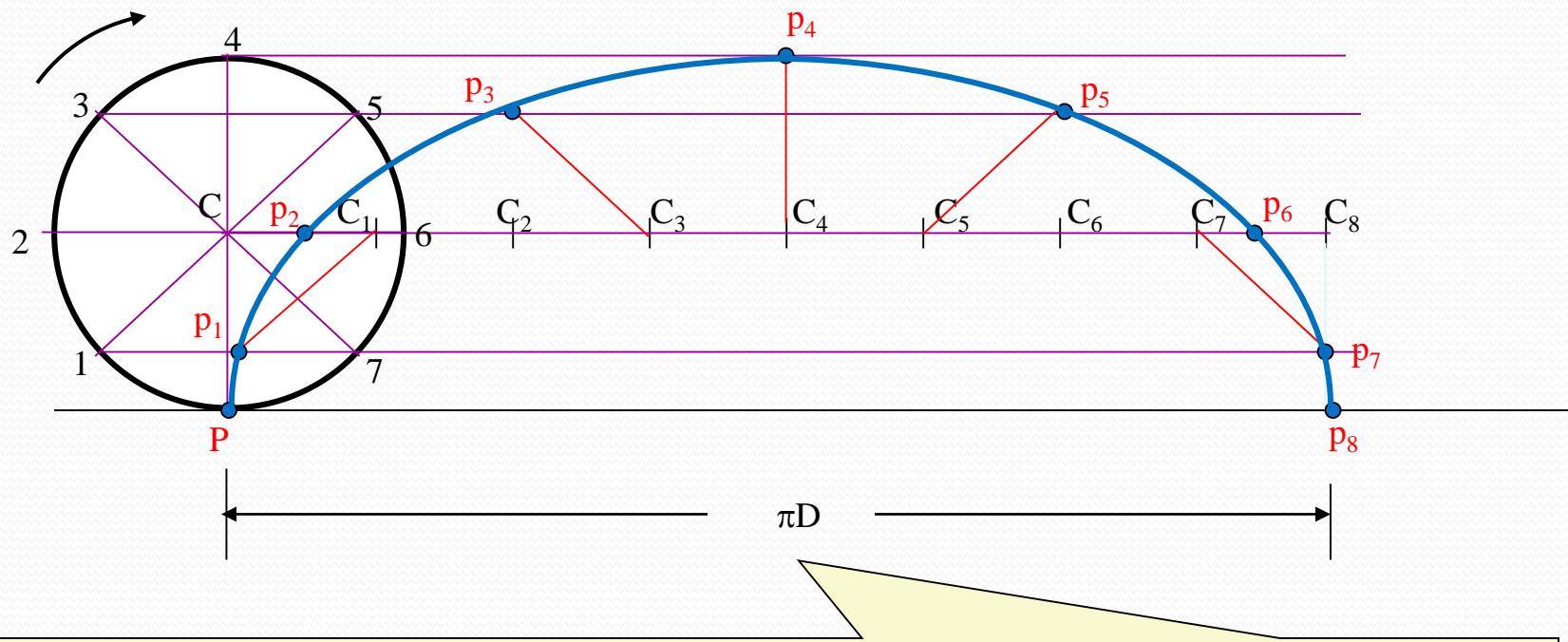
EPI-CYCLOID

IF THE CIRCLE IS ROLLING ON ANOTHER CIRCLE FROM OUTSIDE

HYPOTHYPO-CYCLOID.

IF THE CIRCLE IS ROLLING FROM INSIDE THE OTHER CIRCLE,

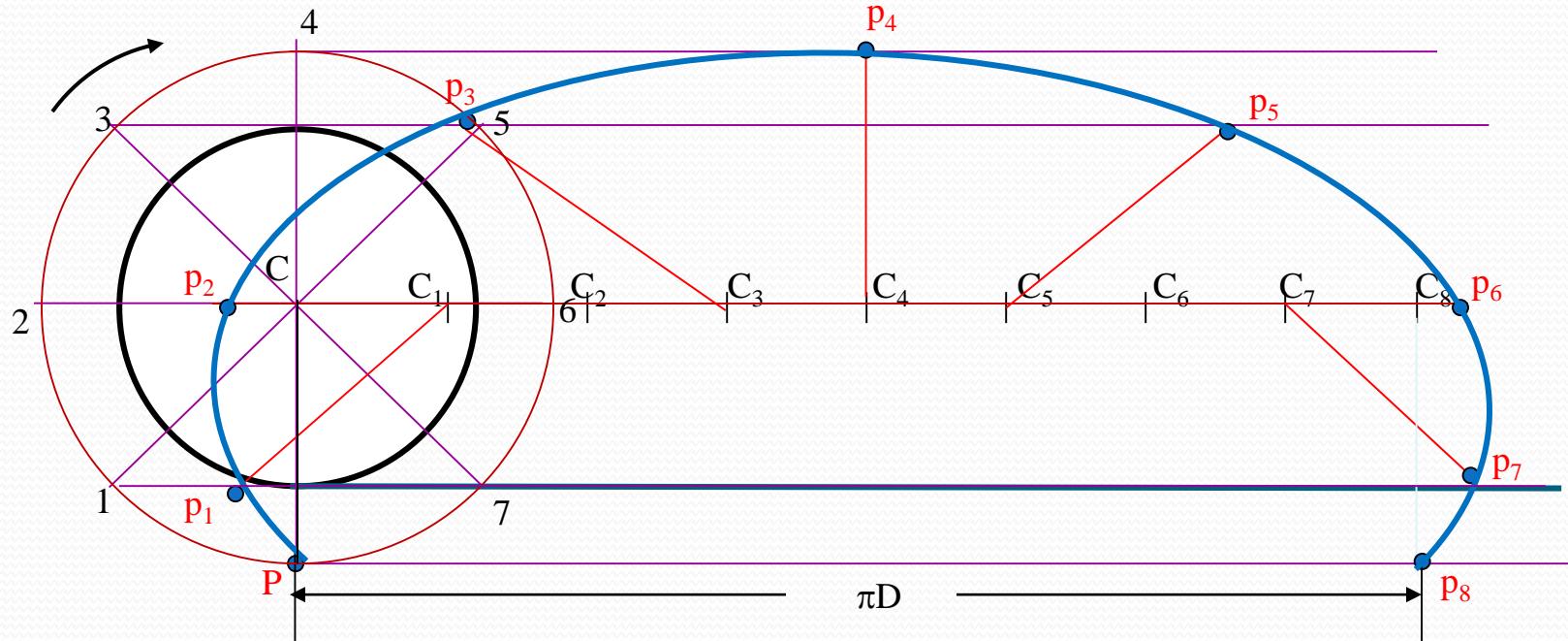
CYCLOID



Solution Steps:

- 1) From center C draw a horizontal line equal to πD distance.
- 2) Divide πD distance into 8 number of equal parts and name them $C_1, C_2, C_3 \dots$ etc.
- 3) Divide the circle also into 8 number of equal parts and in clock wise direction, after P name 1, 2, 3 up to 8.
- 4) From all these points on circle draw horizontal lines. (parallel to locus of C)
- 5) With a fixed distance $C-P$ in compass, C_1 as center, mark a point on horizontal line from 1. Name it P.
- 6) Repeat this procedure from C_2, C_3, C_4 upto C_8 as centers. Mark points P_2, P_3, P_4, P_5 up to P_8 on the horizontal lines drawn from 2, 3, 4, 5, 6, 7 respectively.
- 7) Join all these points by curve. **It is a Cycloid.**

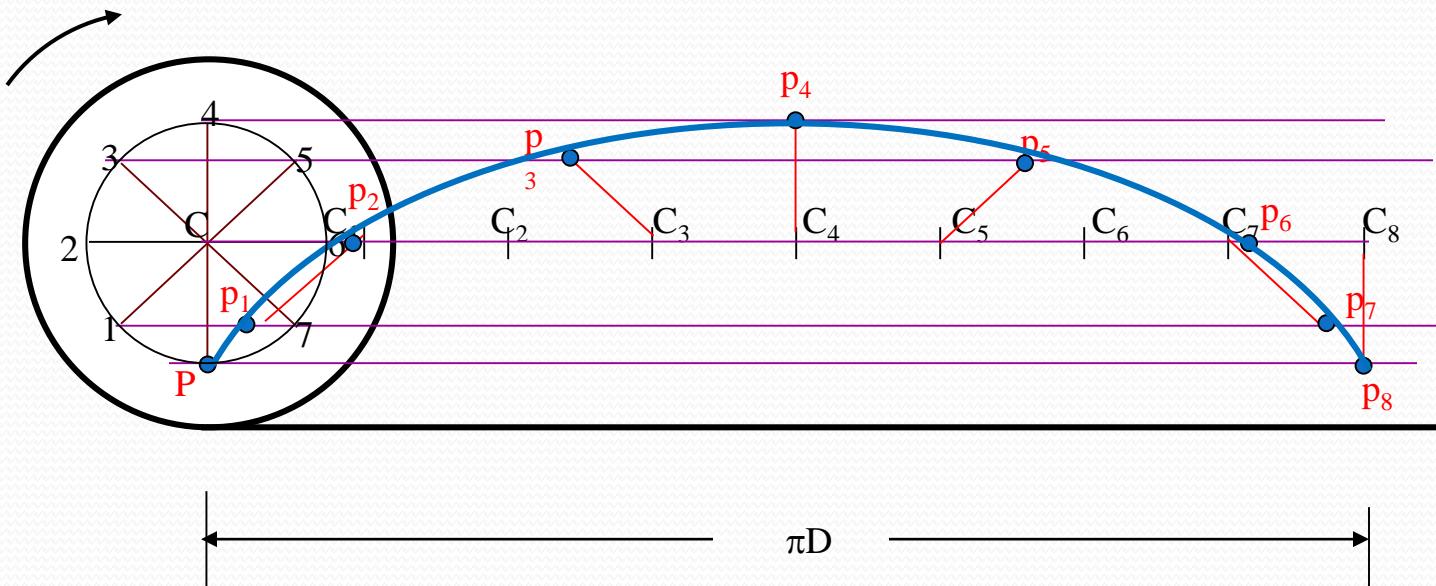
SUPERIOR TROCHOID



Solution Steps:

- 1) Draw circle of given diameter and draw a horizontal line from its center C of length πD and divide it in 8 number of equal parts and name them C_1, C_2, C_3 , up to C_8 .
- 2) Draw circle by CP radius, as in this case CP is larger than radius of circle.
- 3) Now repeat steps as per the previous problem of cycloid, by dividing this new circle into 8 number of equal parts and drawing lines from all these points parallel to locus of C and taking CP radius with different positions of C as centers, cut these lines and get different positions of P and join
- 4) This curve is called **Superior Trochoid**.

INFERIOR TROCHOID



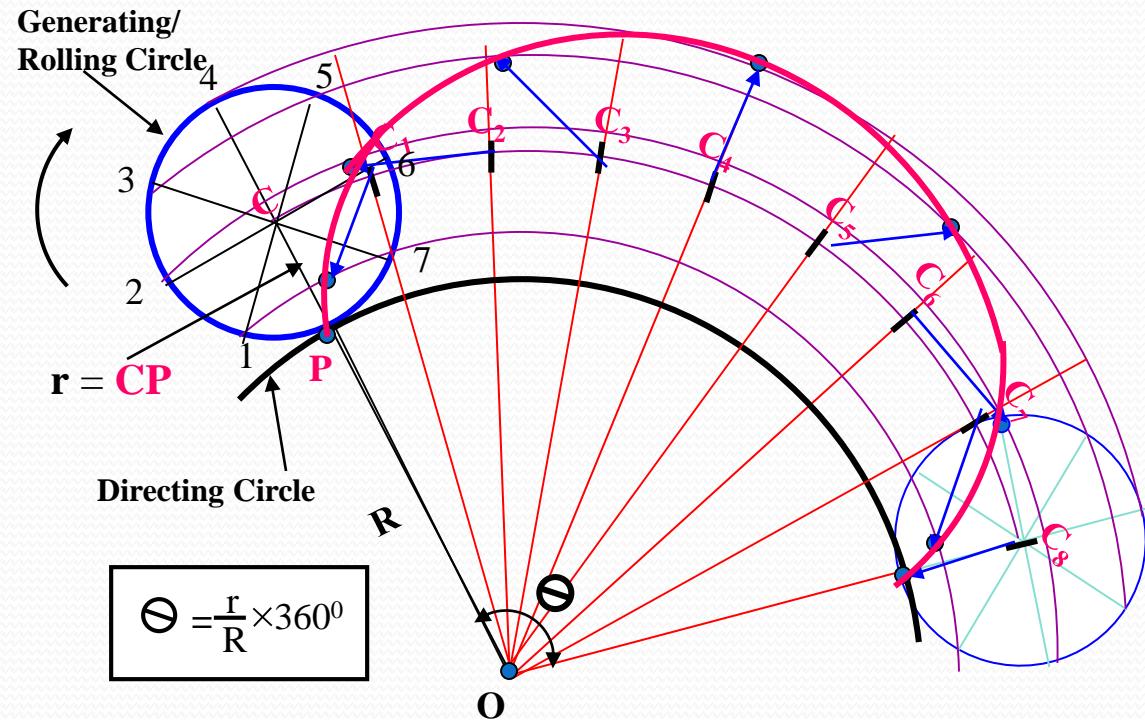
Solution Steps:

- 1) Draw circle of given diameter and draw a horizontal line from its center C of length πD and divide it in 8 number of equal parts and name them C_1, C_2, C_3 , up to C_8 .
- 2) Draw circle by CP radius, as in this case CP is SHORTER than radius of circle.
- 3) Now repeat steps as per the previous problem of cycloid, by dividing this new circle into 8 number of equal parts and drawing lines from all these points parallel to locus of C and taking CP radius with different positions of C as centers, cut these lines and get different positions of P and join those in curvature.
- 4) This curve is called **Inferior Trochoid**.

EPI CYCLOID

Solution Steps:

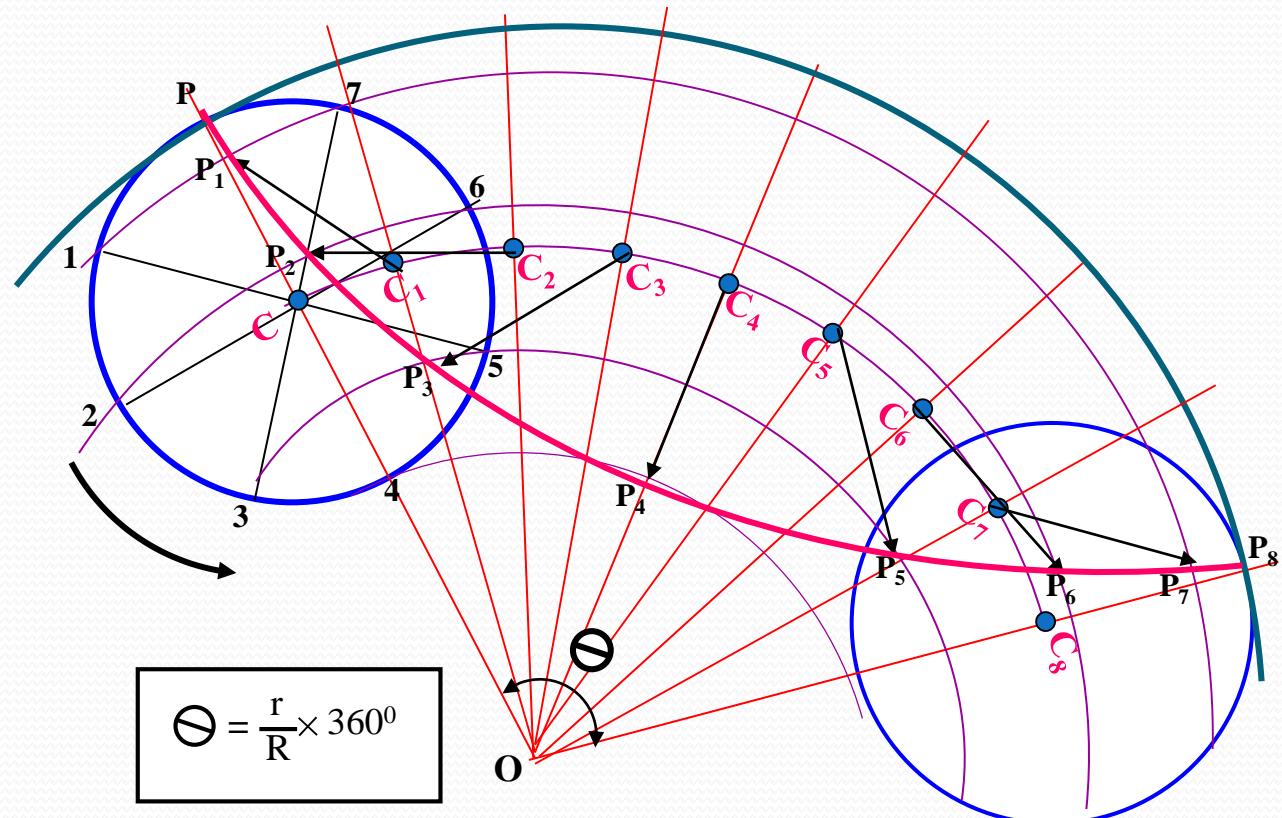
- 1) When smaller circle will roll on larger circle for one revolution it will cover πD distance on arc and it will be decided by including arc angle θ .
- 2) Calculate θ by formula $\theta = (r/R) \times 360^\circ$.
- 3) Construct angle θ with radius OC and draw an arc by taking O as center OC as radius and form sector of angle θ .
- 4) Divide this sector into 8 number of equal angular parts. And from C onward name them C1, C2, C3 up to C8.
- 5) Divide smaller circle (Generating circle) also in 8 number of equal parts. And next to P in clockwise direction name those 1, 2, 3, up to 8.
- 6) With O as center, O-1 as radius draw an arc in the sector. Take O-2, O-3, O-4, O-5 up to O-8 distances with center O, draw all concentric arcs in sector. Take fixed distance C-P in compass, C1 center, cut arc of 1 at P1. Repeat procedure and locate P2, P3, P4, P5 upto P8 (as in cycloid) and join them by smooth curve. This is EPI – CYCLOID.



HYPO CYCLOID

Solution Steps:

- 1) Smaller circle is rolling here, inside the larger circle. It has to rotate anticlockwise to move ahead.
- 2) Same steps should be taken as in case of EPI – CYCLOID. Only change is in numbering direction of 8 number of equal parts on the smaller circle.
- 3) From next to P in anticlockwise direction, name 1,2,3,4,5,6,7,8.
- 4) Further all steps are that of epi – cycloid. **This is called HYPO – CYCLOID.**

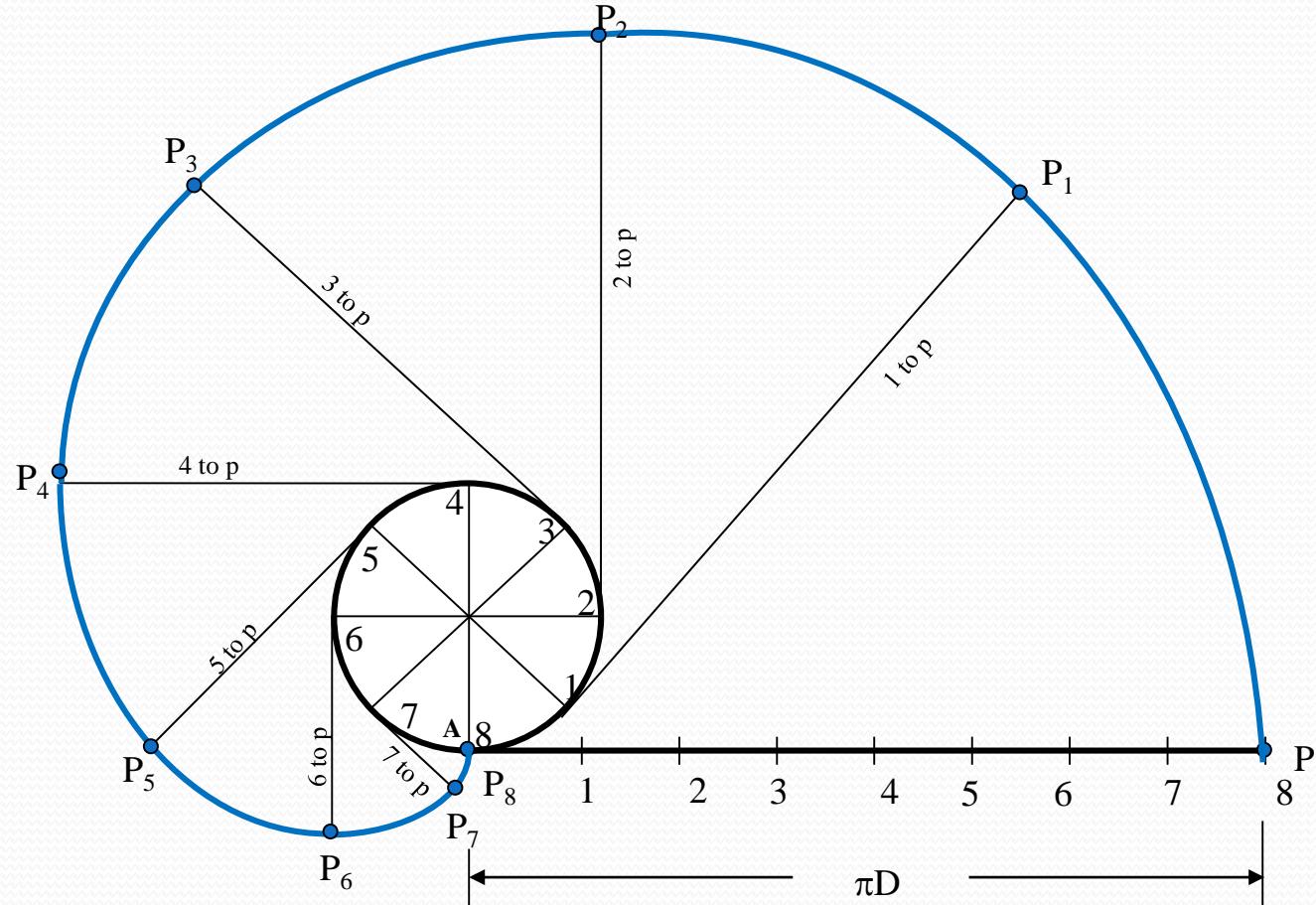


$$\begin{aligned} OC &= R \text{ (Radius of Directing Circle)} \\ CP &= r \text{ (Radius of Generating Circle)} \end{aligned}$$

INVOLUTE OF A CIRCLE

Solution Steps:

- 1) Point or end P of string AP is exactly πD distance away from A. Means if this string is wound round the circle, it will completely cover given circle. B will meet A after winding.
- 2) Divide πD (AP) distance into 8 number of equal parts.
- 3) Divide circle also into 8 number of equal parts.
- 4) Name after A, 1, 2, 3, 4, etc. up to 8 on πD line AP as well as on circle (in anticlockwise direction).
- 5) To radius C-1, C-2, C-3 up to C-8 draw tangents (from 1,2,3,4,etc to circle).
- 6) Take distance 1 to P in compass and mark it on tangent from point 1 on circle (means one division less than distance AP).
- 7) Name this point P1
- 8) Take 2-B distance in compass and mark it on the tangent from point 2. Name it point P2.
- 9) Similarly take 3 to P, 4 to P, 5 to P up to 7 to P distance in compass and mark on respective tangents and locate P3, P4, P5 up to P8 (i.e. A) points and join them in smooth curve it is an INVOLUTE of a given circle.



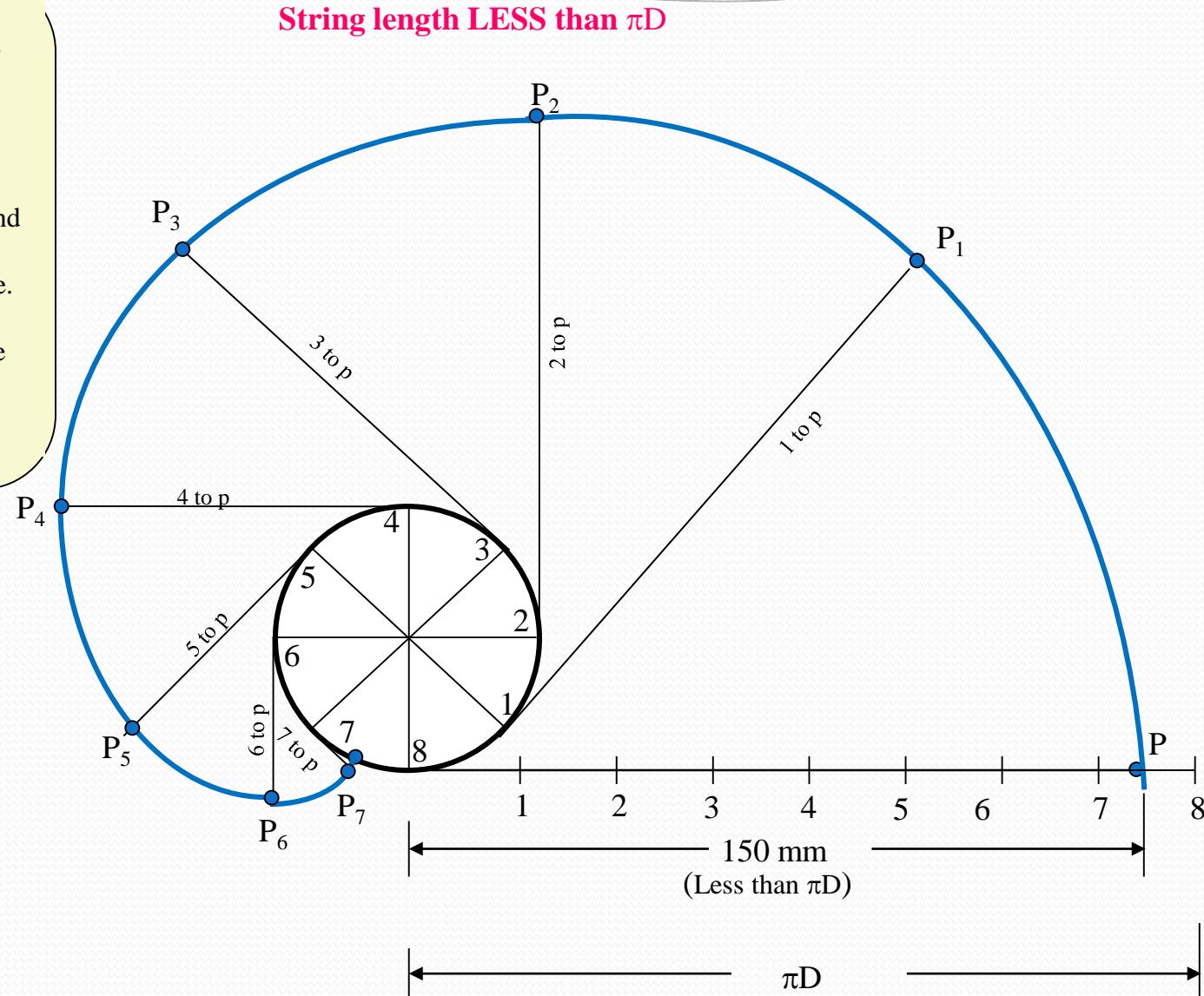
INVOLUTE OF A CIRCLE

Solution Steps:

In this case string length is Less than πD .

But remember!

Whatever may be the length of string, mark πD distance horizontal i.e. along the string and divide it in 8 number of equal parts, and not any other distance. Rest all steps are same as previous INVOLUTE. Draw the curve completely.



INVOLUTE OF COMPOSITE SHAPED POLE

SOLUTION STEPS:

Draw pole shape as per dimensions.

Divide semicircle in 4 parts and name those along with corners of hexagon.

Calculate perimeter length.

Show it as string AP.

On this line mark 30mm from A

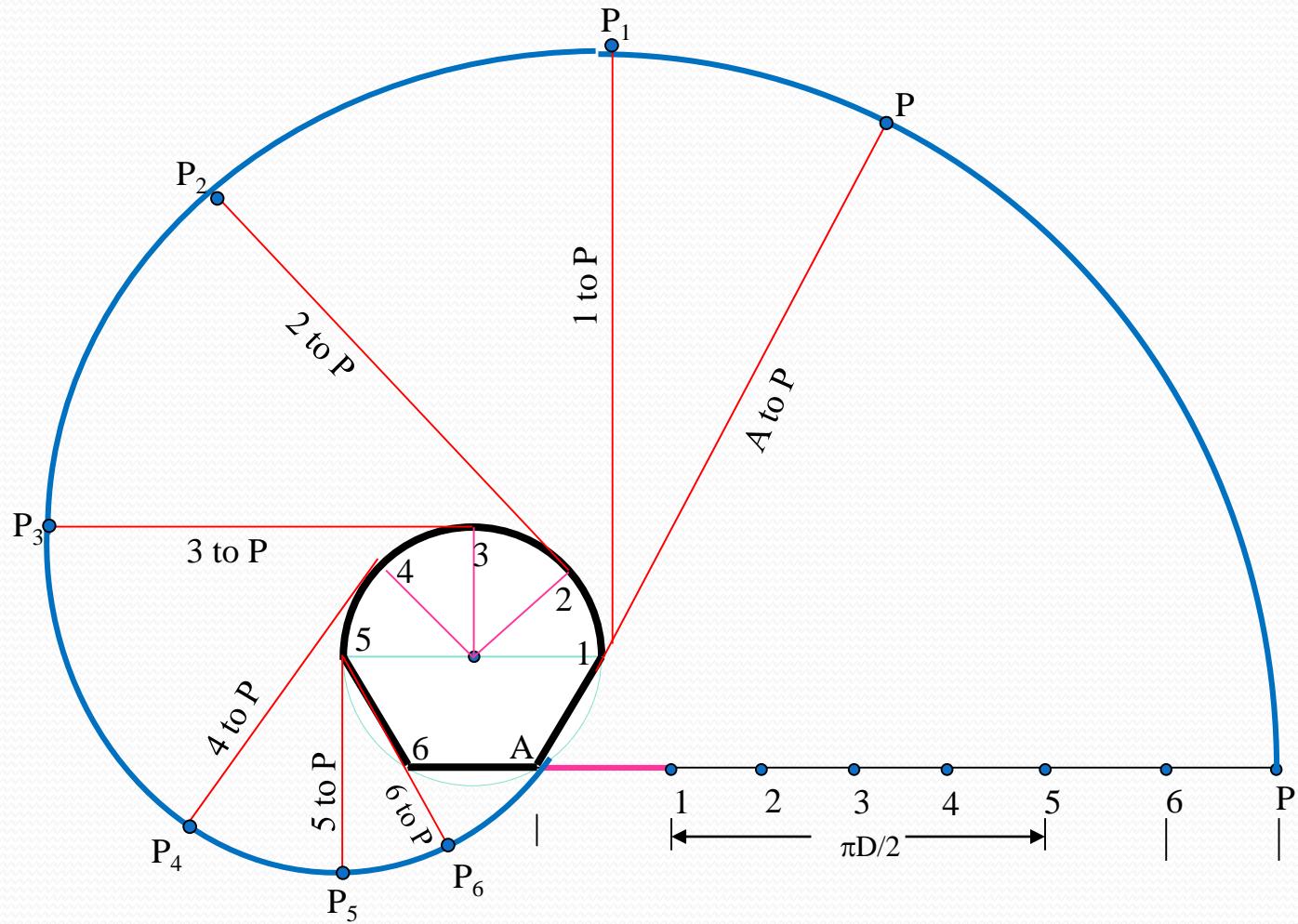
Mark and name it 1

Mark $\pi D/2$ distance on it from 1

And dividing it in 4 parts name 2,3,4,5.

Mark point 6 on line 30 mm from 5

Now draw tangents from all points of pole and proper lengths as done in all previous involute's problems and complete the curve.



HELIX ON A CYLINDER

SOLUTION:

Draw projections of a cylinder.

Divide circle and axis in to same no. of equal parts. (8)

Name those as shown.

Mark initial position of point 'P'

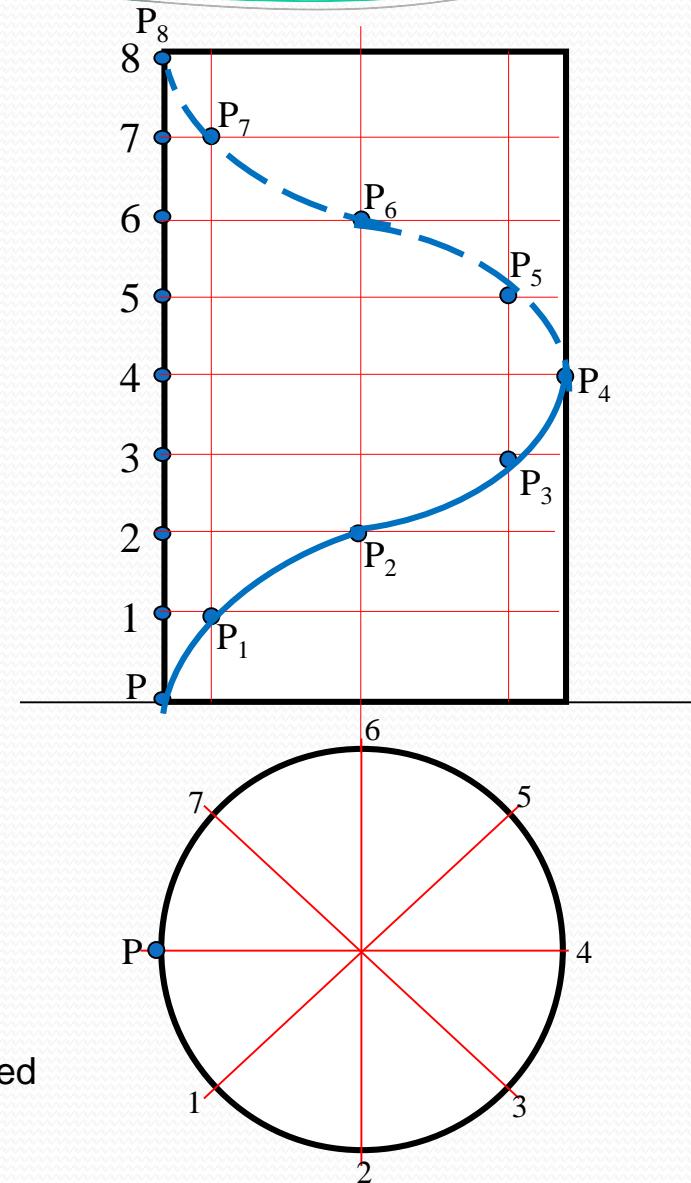
Mark various positions of *P* as shown in animation.

Join all points by smooth possible curve.

Make upper half dotted, as it is going behind the solid

and hence will not be seen from front side.

The axial advance during one complete revolution is called
The *pitch* of the helix



HELIX ON A CONE

SOLUTION:

Draw projections of a cone

Divide circle and axis in to same no.
of equal parts. (8)

Name those as shown.

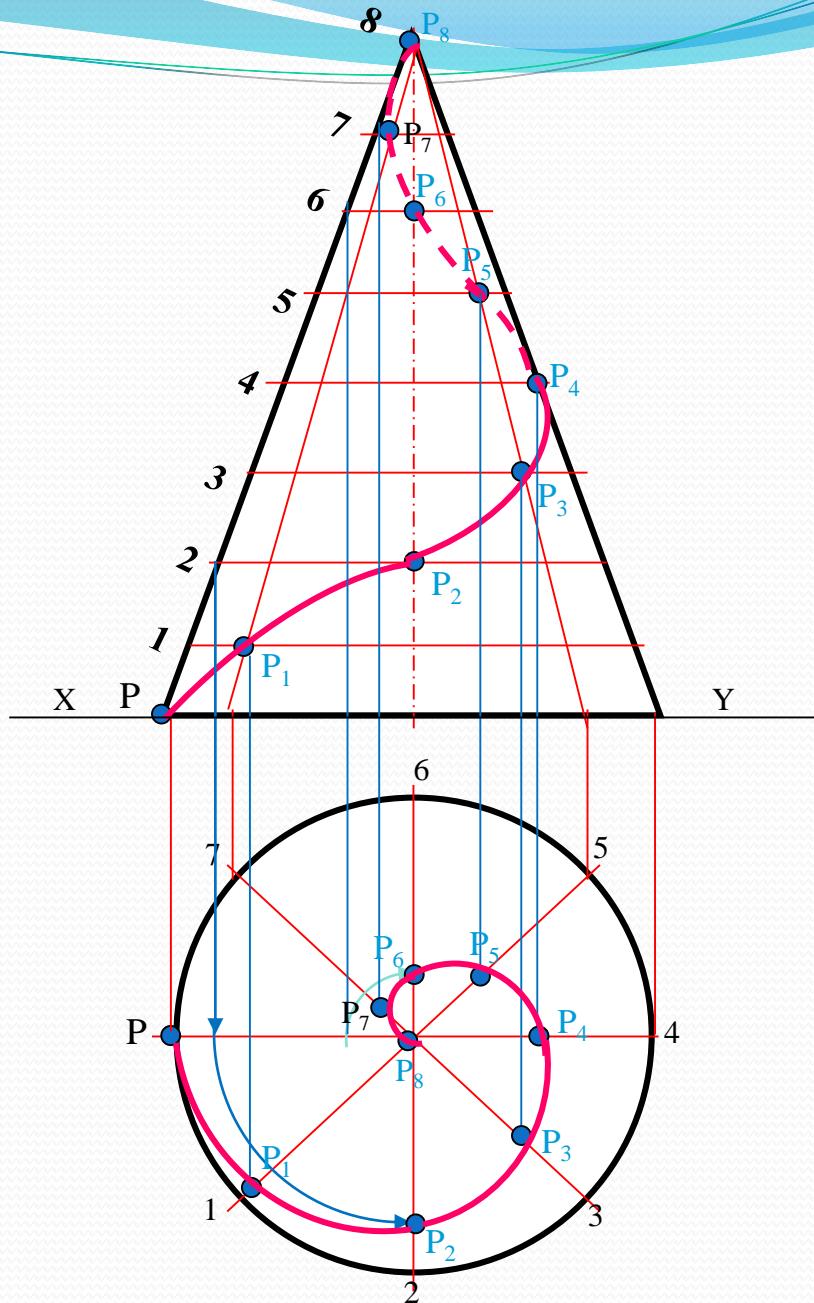
Mark initial position of point 'P'

Mark various positions of *P* as shown
in animation.

Join all points by smooth possible
curve.

Make upper half dotted, as it is going
behind the solid

and hence will not be seen from front
side.



ASSIGNMENT

- 5. A circle of 40 mm diameter rolls outside and along another fixed circle of 120 mm diameter. Draw the locus of a point lying on the circumference of the rolling circle. Name the curve.**

- 6. Draw the locus of a point P on a circle of 40 mm diameter, which rolls inside a fixed circle of 80 mm diameter for one complete revolution. Name the curve.**

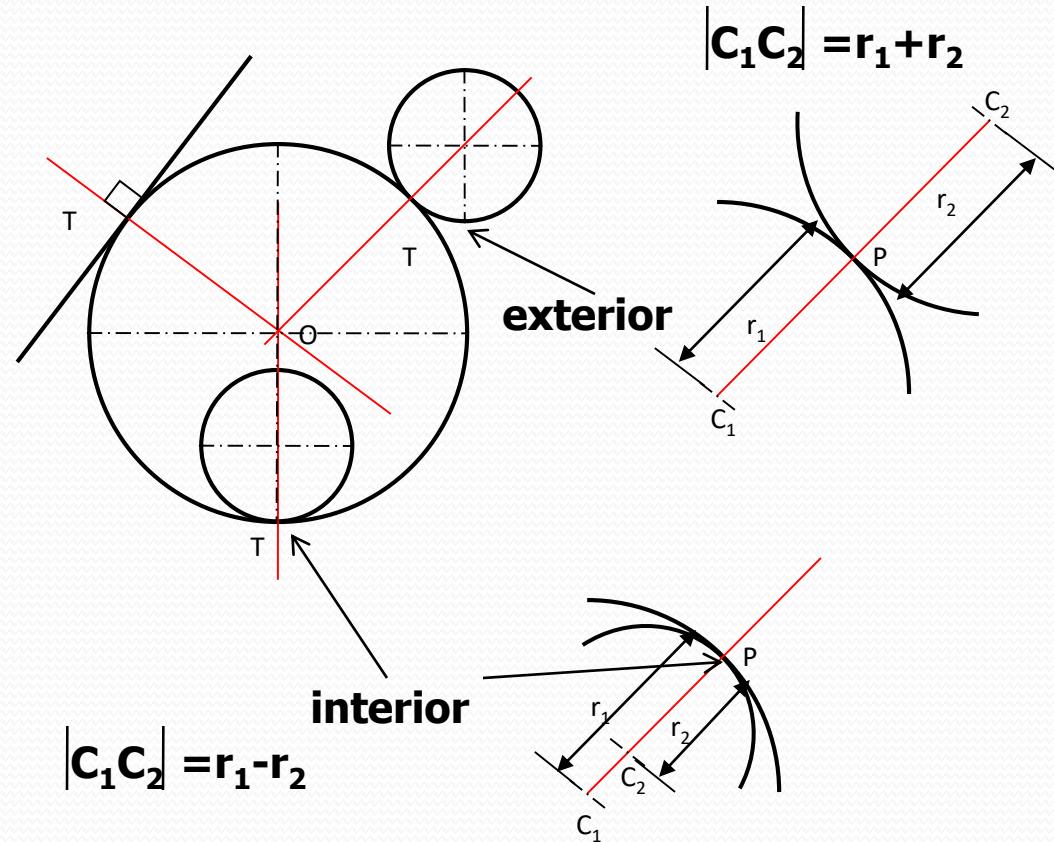
- 7. An inelastic string AB of 110 mm length is tangent to a circular disc of 50 mm diameter at A on the disc. The string is having its end A fixed while end B is free. Draw the locus of the end B if the string is wound over the disc keeping it always taut. Name the curve.**

Assignment #5

Geometric Construction
(Part 2)

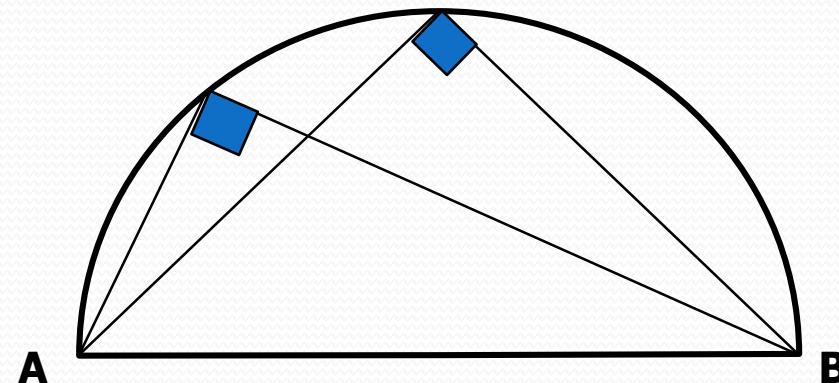
Principles of Tangency

- Line and Circle/Arc
- Two Circle/Arcs

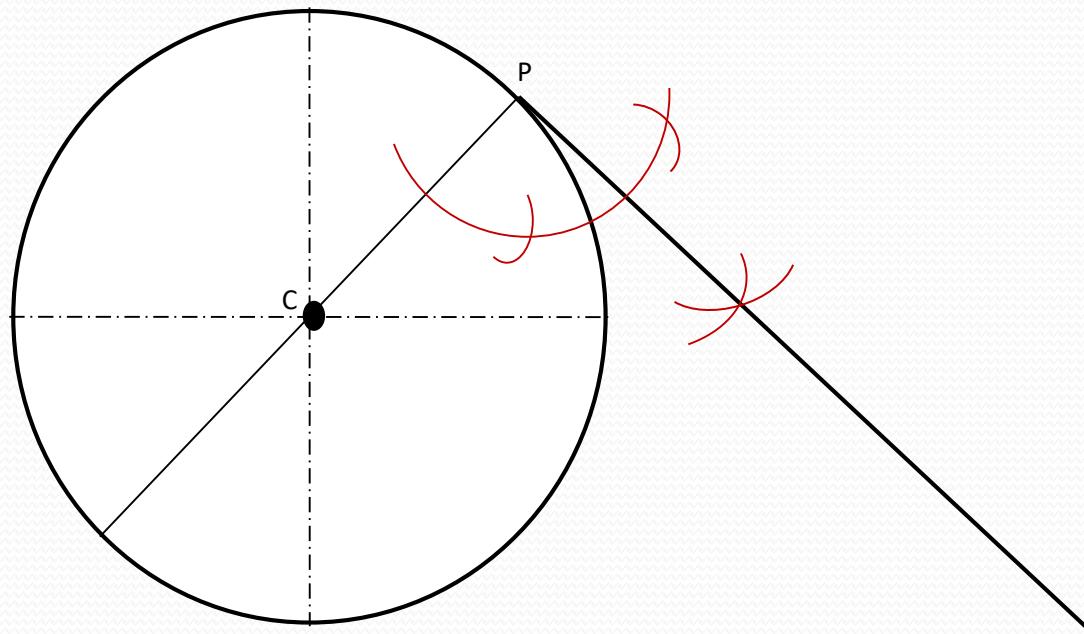


Principles of Tangency

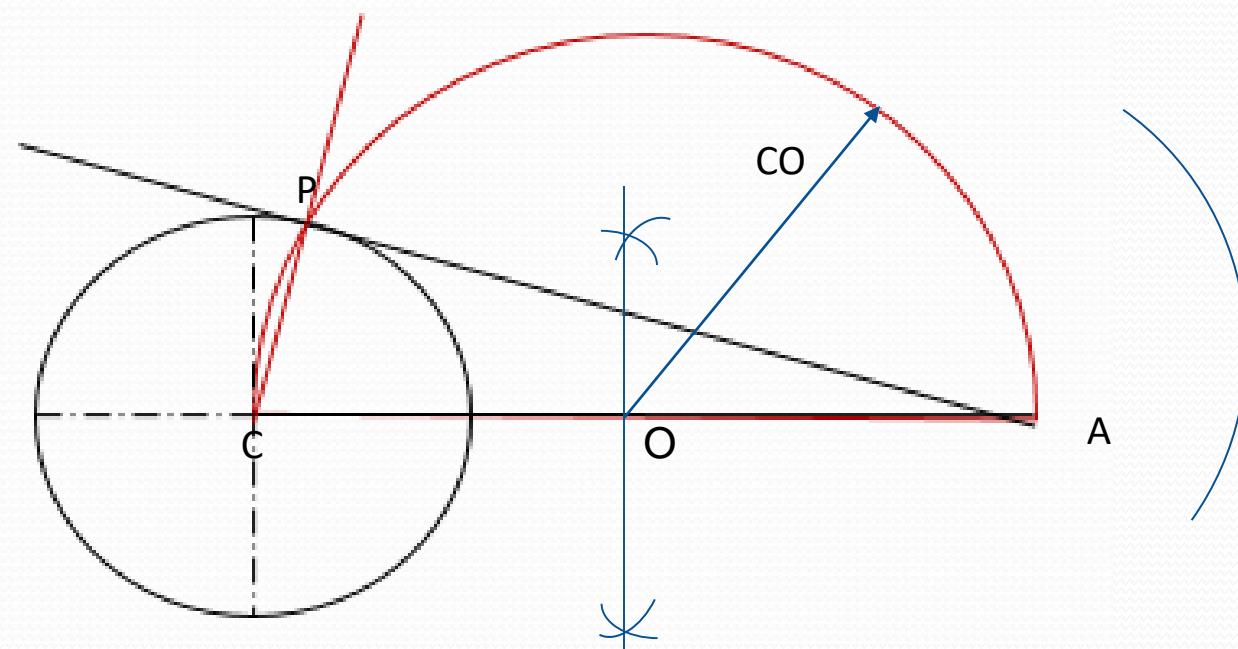
- Semi-Circle Theory
 - Angle by two straight lines within a semi-circle is a right angle.



To construct a tangent to a circle at a point P on the circle



To construct a line tangent to a circle through a point A outside the circle



Assignment #6

Tangency Problem

Sketching

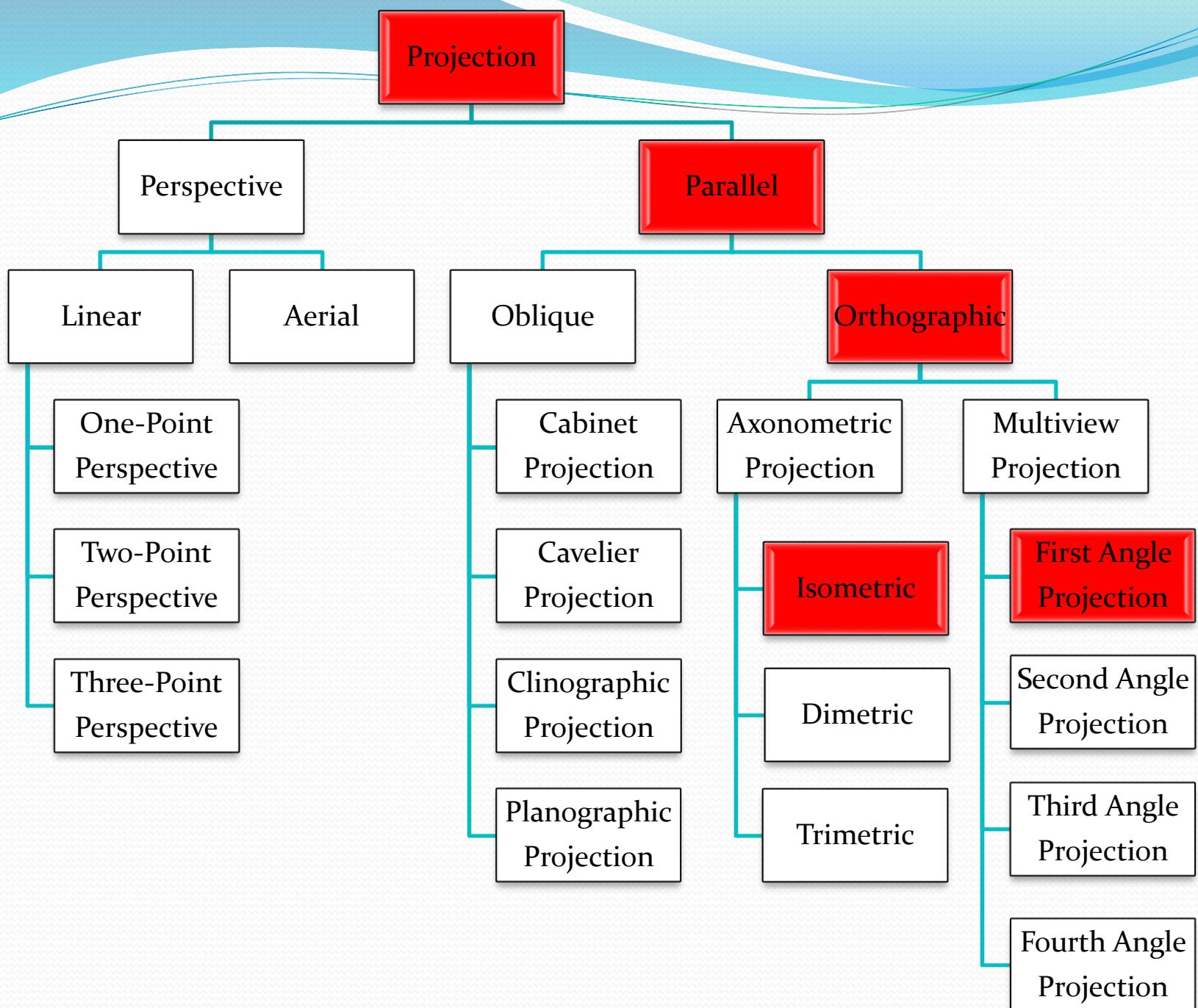
- Lines
- Curves
- Simple Objects

Assignment #6

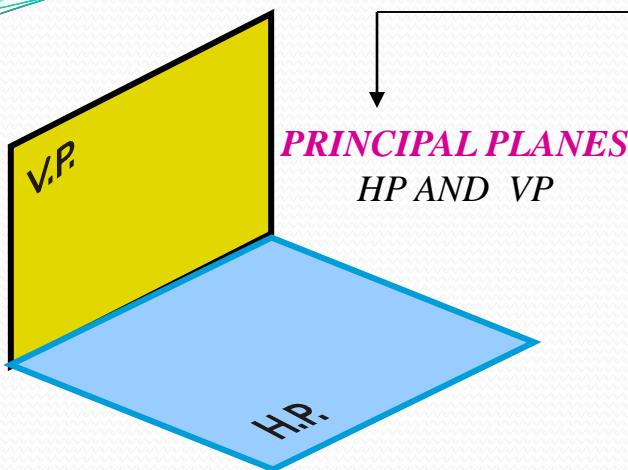
Object Fitting and Sketching

Projection

- Kind of presentation of object on a paper, screen or similar surface by drawing or photography
- Single view Projection (Pictorial)
 - Axonometric Projection
 - Isometric (1 scale)
 - Dimetric (2 scale)
 - Trimetric (3 scale)
 - Oblique Projection
 - Perspective Projection
- Multi-view Projection
 - Orthographic



PLANES



VP = Elevation

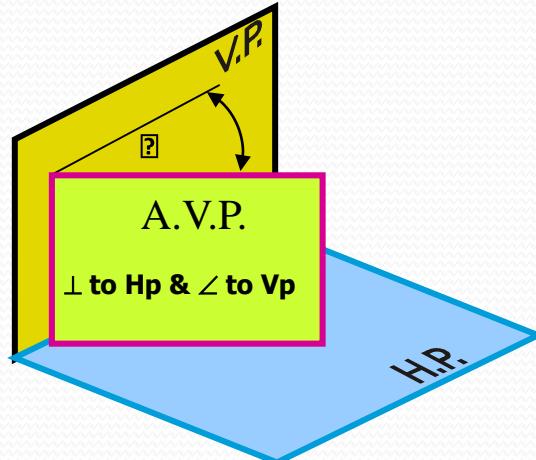
HP = Plan

PP = Side view, AVP

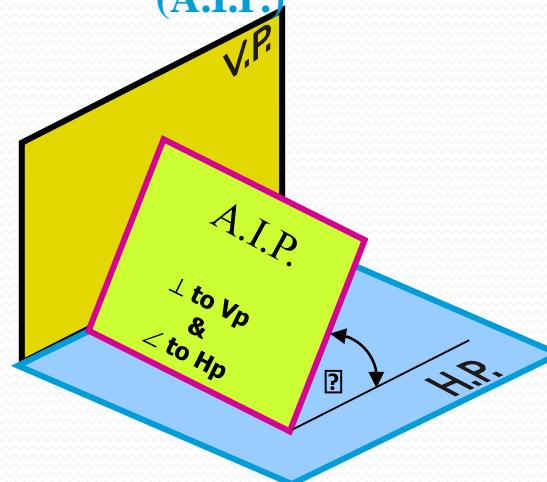
AP = Auxiliary view

AUXILIARY PLANES (AP)

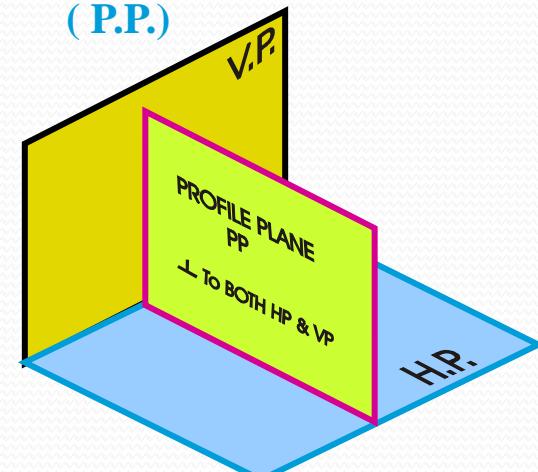
**Auxiliary Vertical Plane
(A.V.P.)**

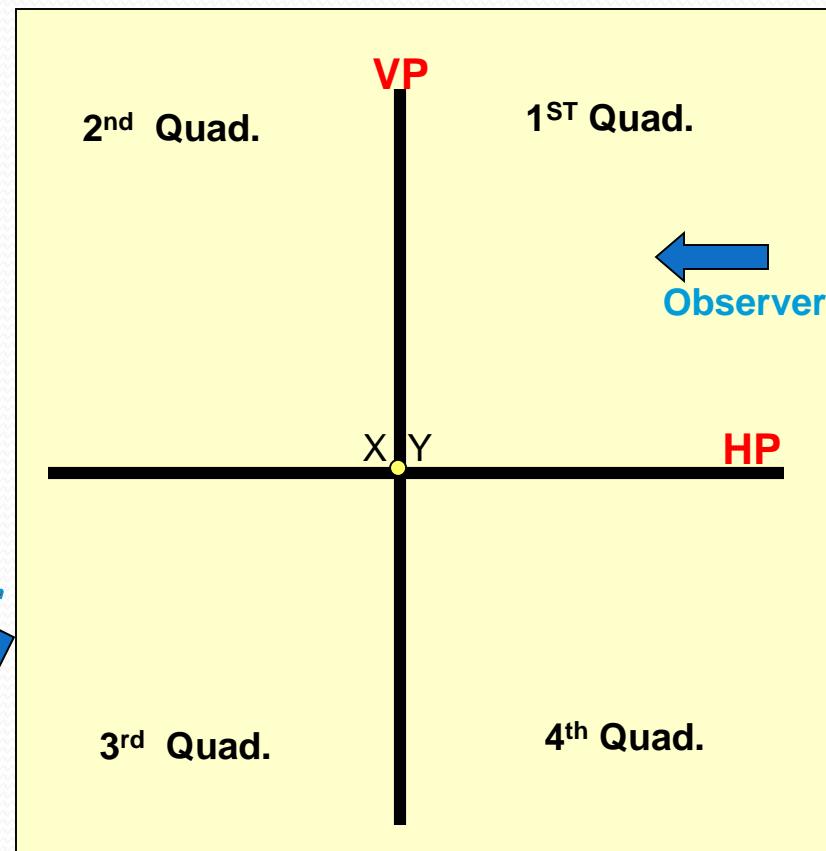
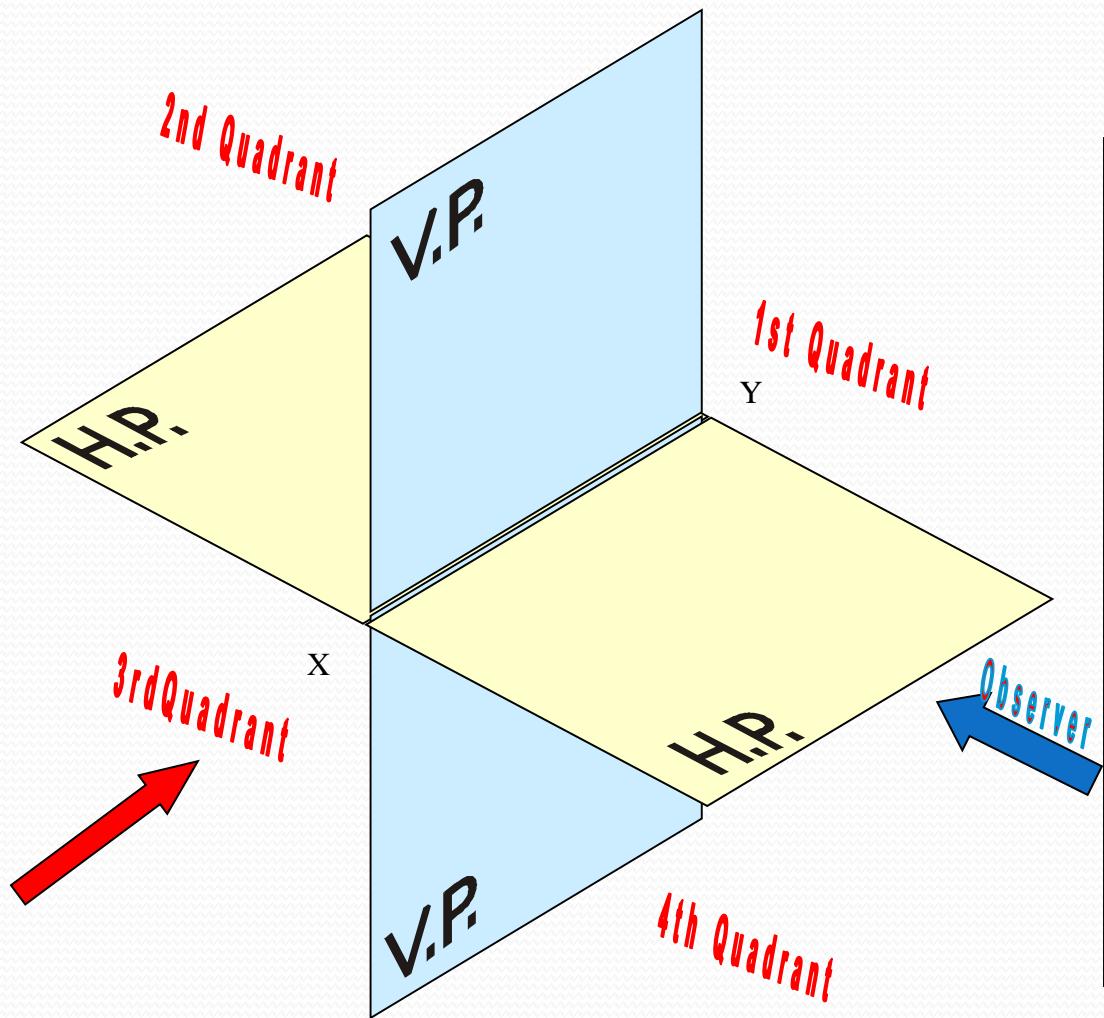


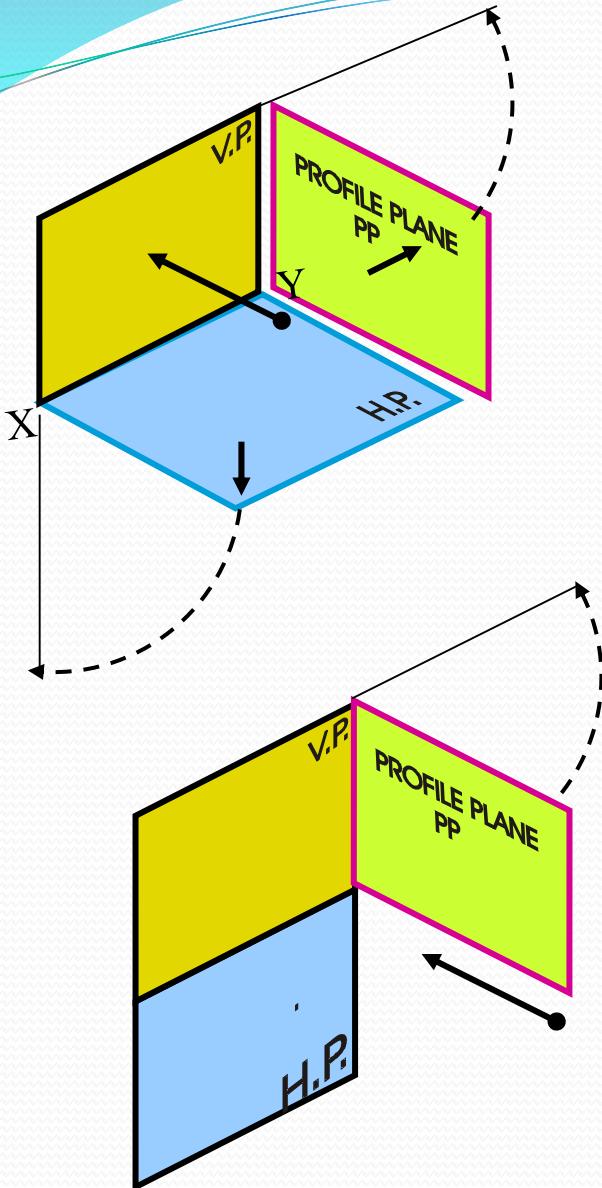
**Auxiliary Inclined Plane
(A.I.P.)**



**Profile Plane
(P.P.)**

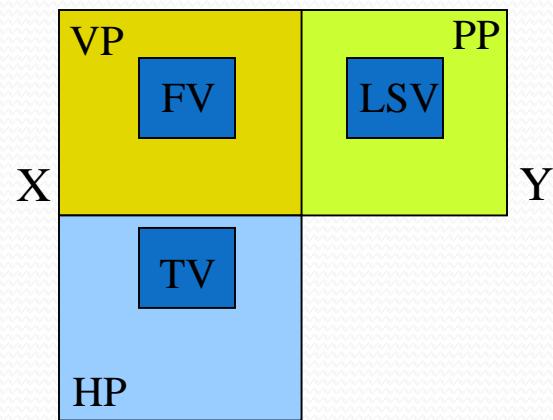
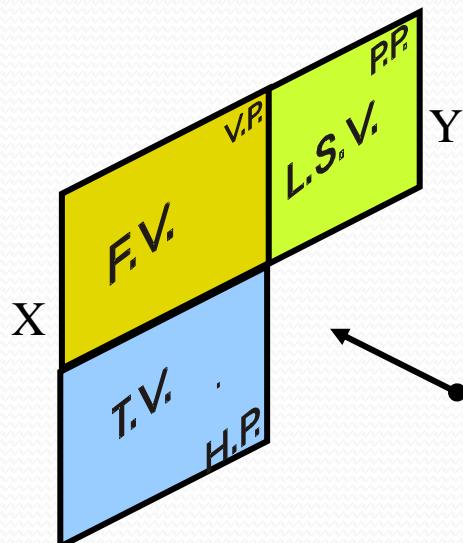






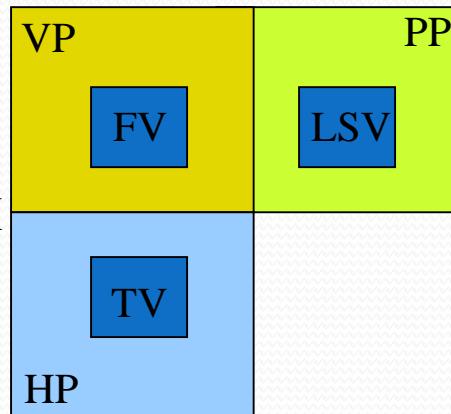
**TO MAKE OTHER PLANES ALSO
VISIBLE FROM THE ARROW
DIRECTION,**

- A) HP IS ROTATED 90° DOWNWARD
- B) PP, 90° IN RIGHT SIDE DIRECTION.
THIS WAY BOTH PLANES ARE
BROUGHT IN THE SAME PLANE
CONTAINING VP.

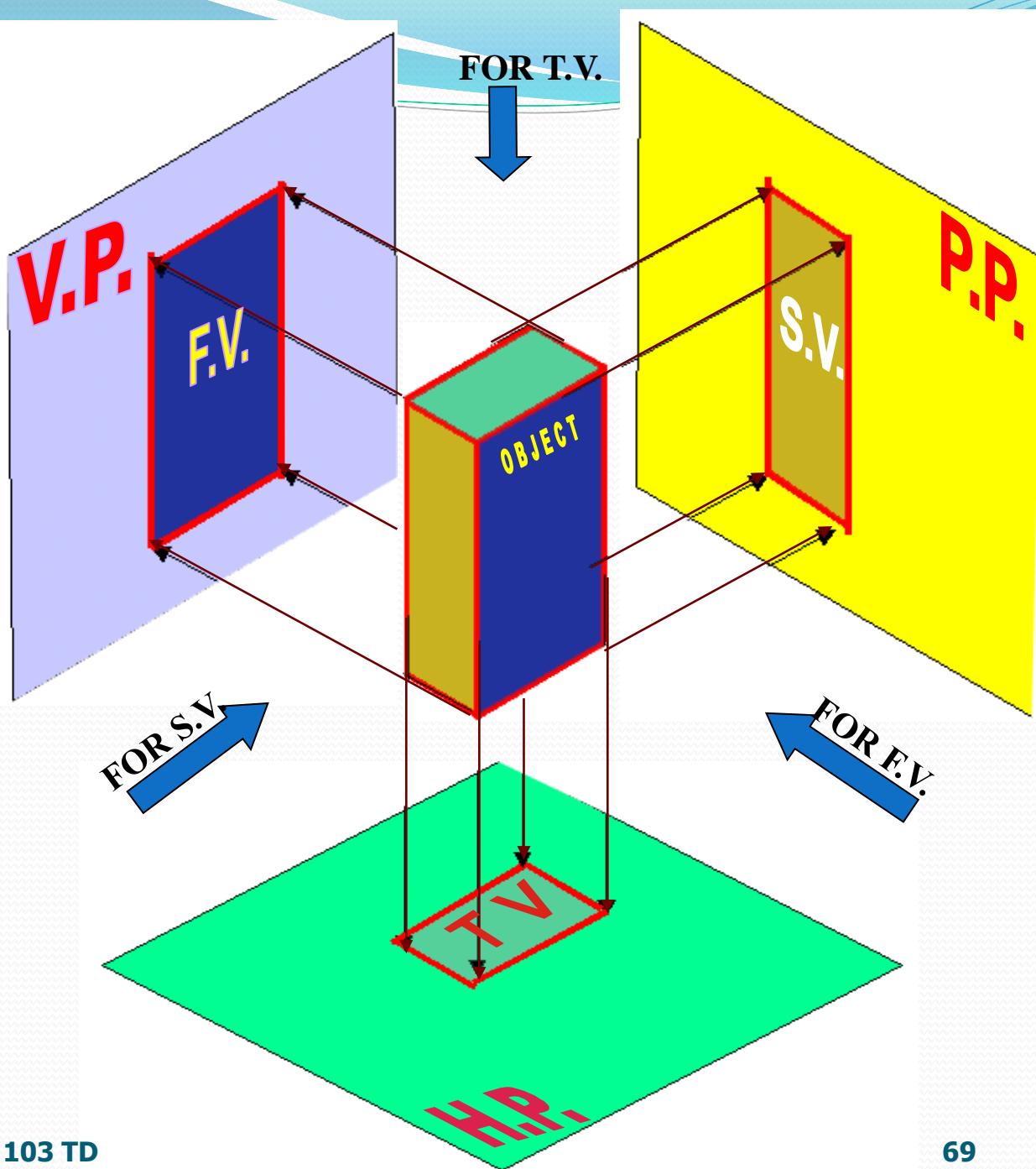


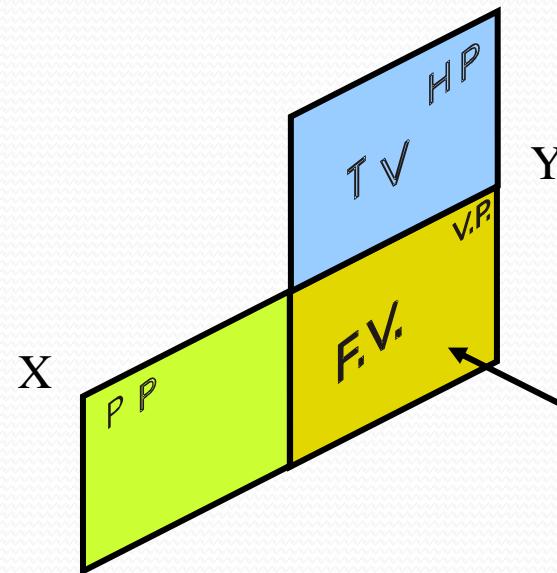
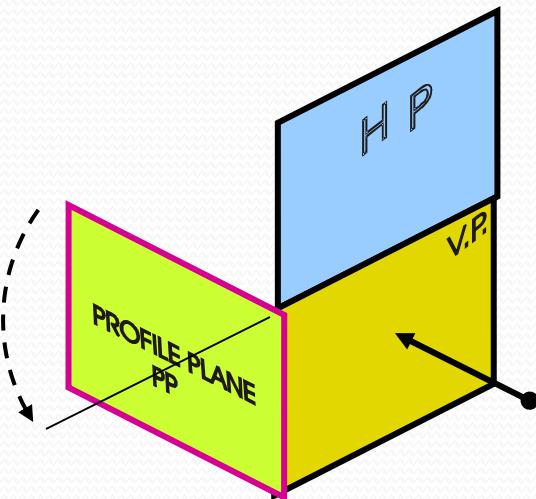
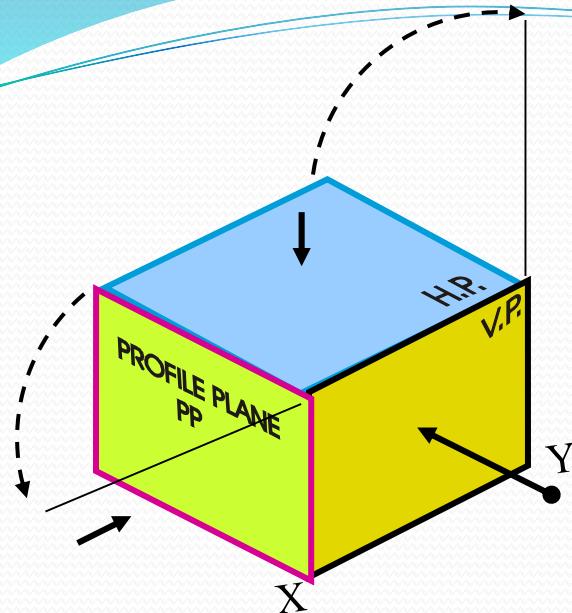
FIRST ANGLE PROJECTION

OBJECT IS ASSUMED TO BE SITUATED IN FIRST QUADRANT



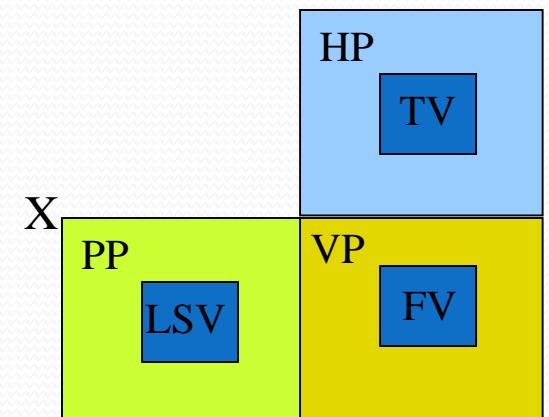
ACTUAL PATTERN OF PLANES & VIEWS IN FIRST ANGLE METHOD OF PROJECTIONS





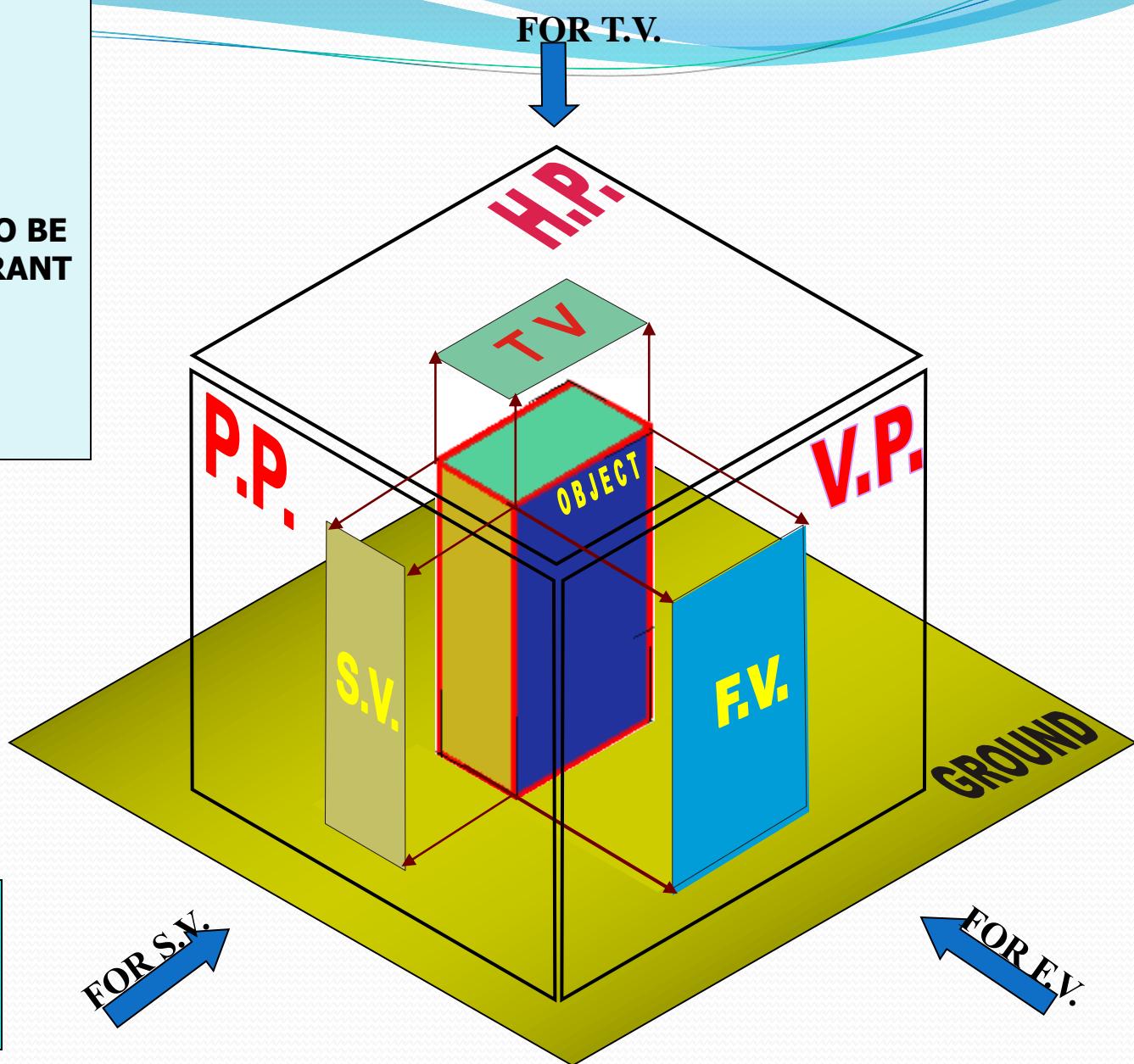
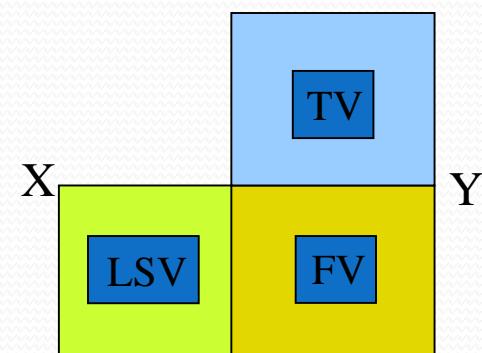
**TO MAKE OTHER PLANES ALSO
VISIBLE FROM THE ARROW
DIRECTION,**

- A) HP IS ROTATED 90^o UPWARD
- B) PP, 90^o IN LEFT SIDE DIRECTION.
THIS WAY BOTH PLANES ARE
BROUGHT IN THE SAME PLANE
CONTAINING VP.



THIRD ANGLE PROJECTION

THE OBJECT IS ASSUMED TO BE SITUATED IN THIRD QUADRANT

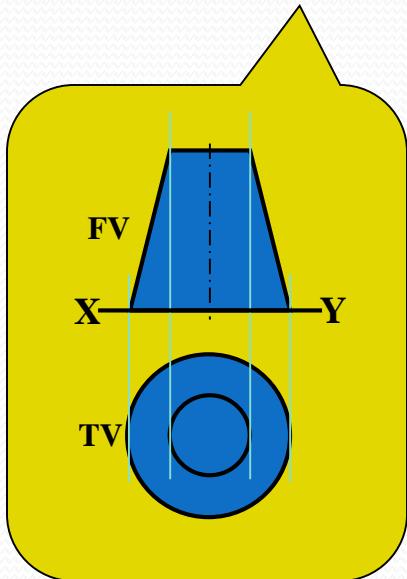


ACTUAL PATTERN OF PLANES & VIEWS OF THIRD ANGLE PROJECTIONS

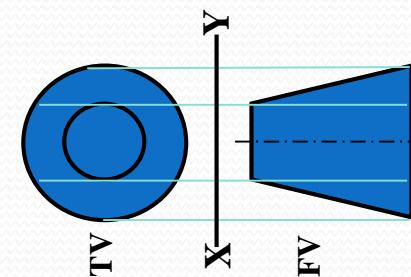
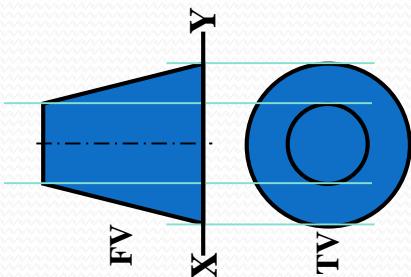
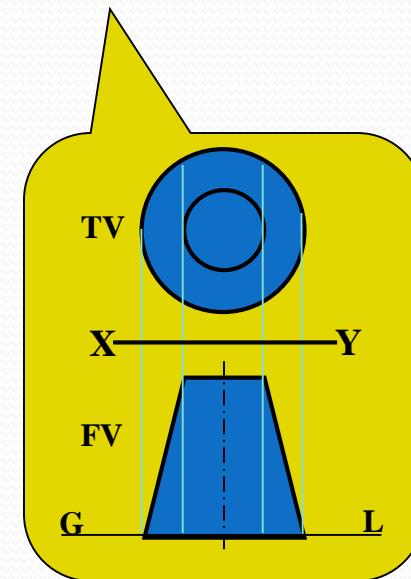
SYMBOLIC PRESENTATION

1st and 3rd Angle Projections

First Angle Projections



Third Angle Projections



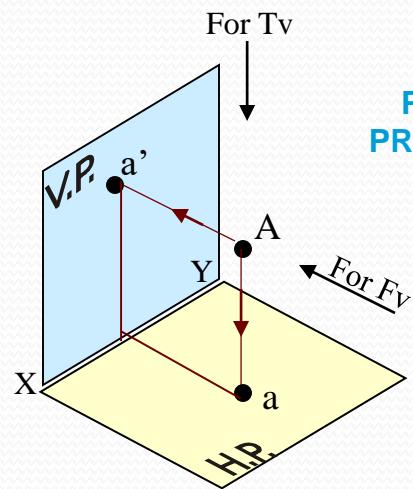
ORTHOGRAPHIC PROJECTIONS

OF

POINTS, LINES AND PLANES

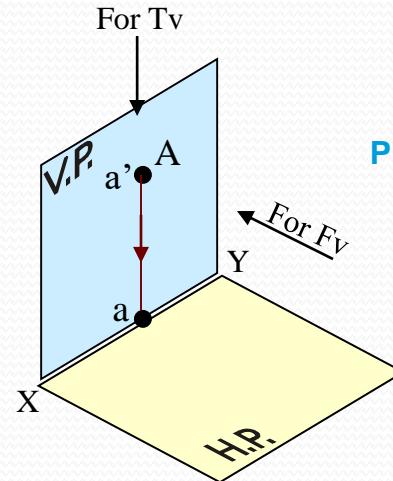
PROJECTIONS OF A POINT IN FIRST QUADRANT.

POINT A ABOVE HP & IN FRONT OF VP



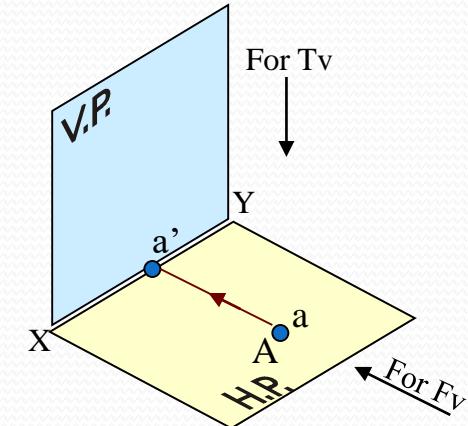
PICTORIAL PRESENTATION

POINT A ABOVE HP & IN VP



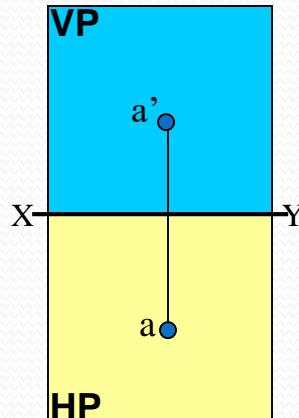
PICTORIAL PRESENTATION

POINT A IN HP & IN FRONT OF VP

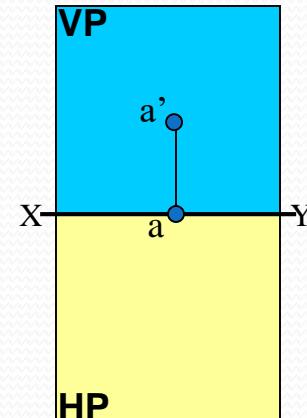


ORTHOGRAPHIC PRESENTATIONS

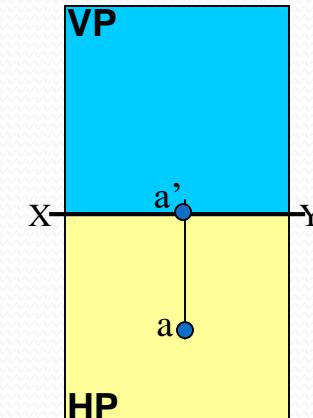
F_v above xy ,
 T_v below xy .



F_v above xy ,
 T_v on xy .

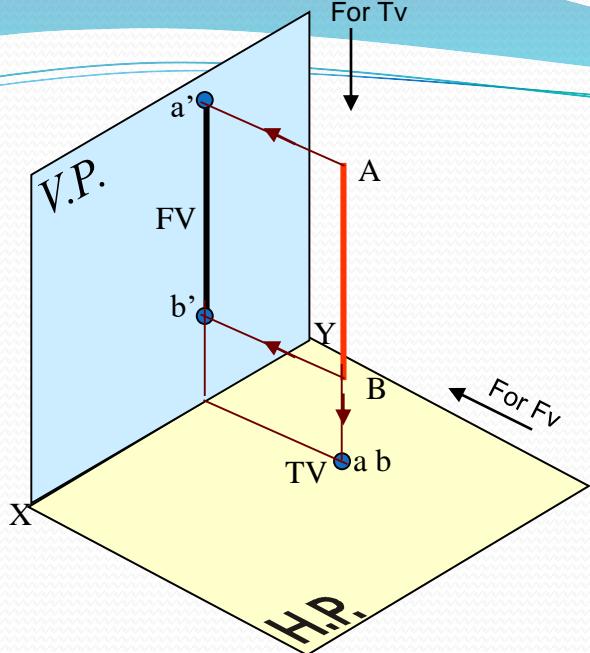


F_v on xy ,
 T_v below xy .

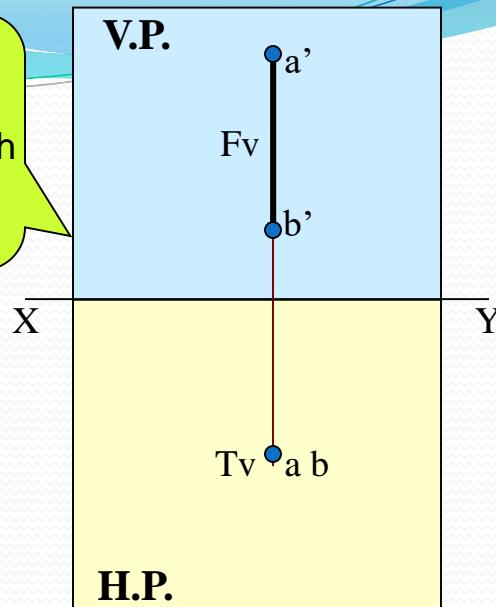


Orthographic Pattern

A Line
perpendicular
to Hp
&
// to Vp

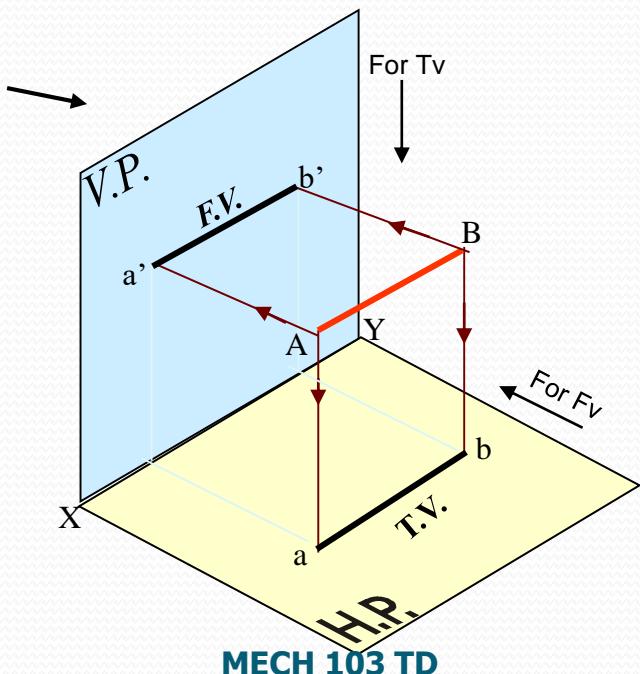


Note:
Fv is a vertical line
Showing True Length
&
Tv is a point.

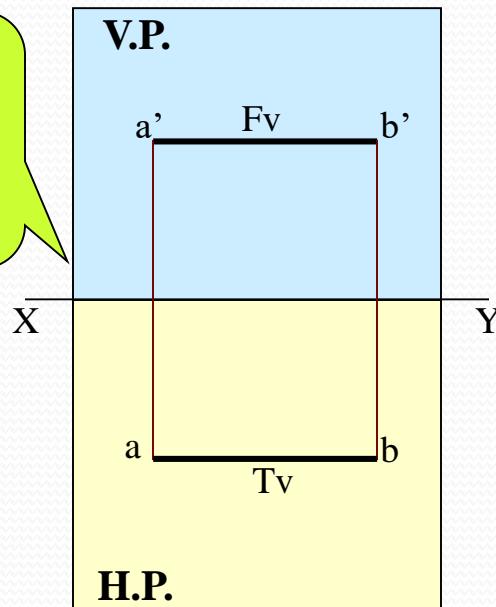


Orthographic Pattern

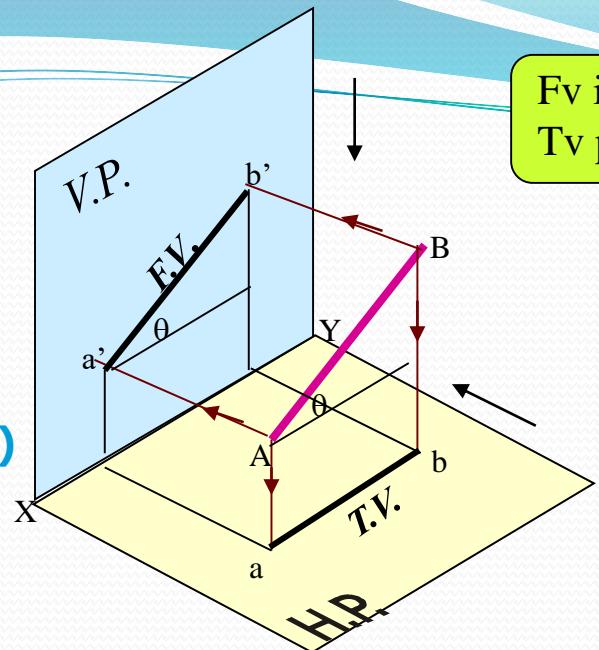
A Line
// to Hp
&
// to Vp



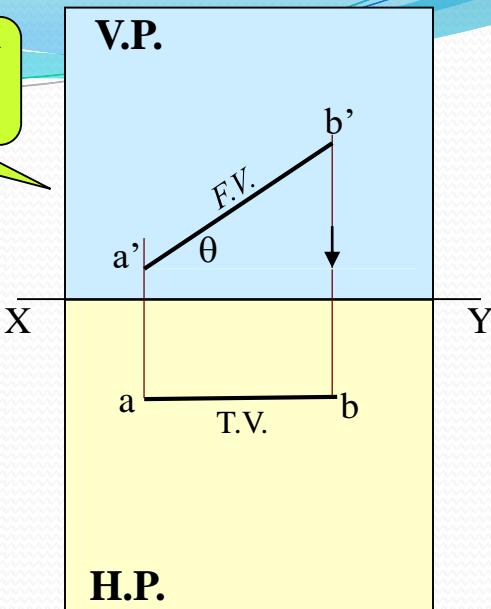
Note:
Fv & Tv both are
// to xy
&
both show T. L.



A Line inclined to Hp
and
parallel to Vp
(Pictorial presentation)

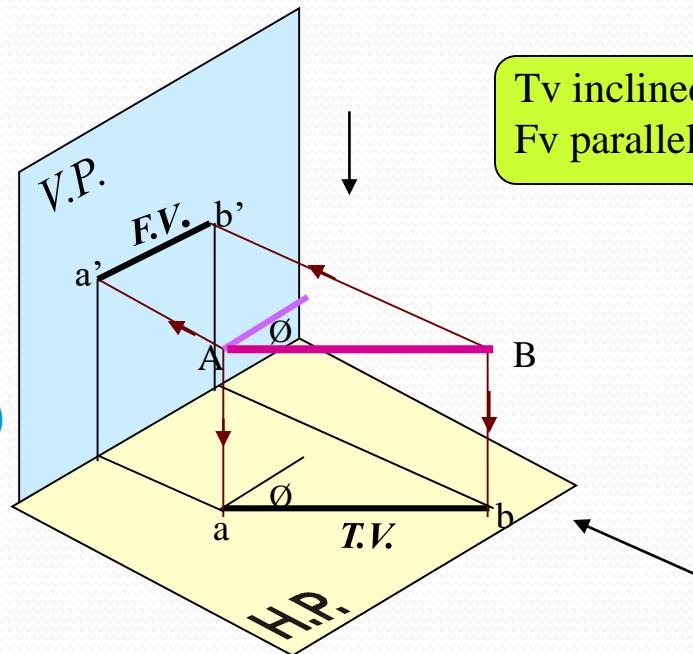


Fv inclined to xy
Tv parallel to xy.

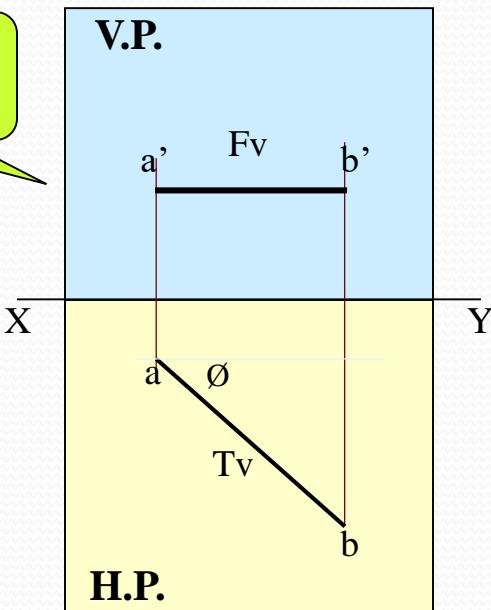


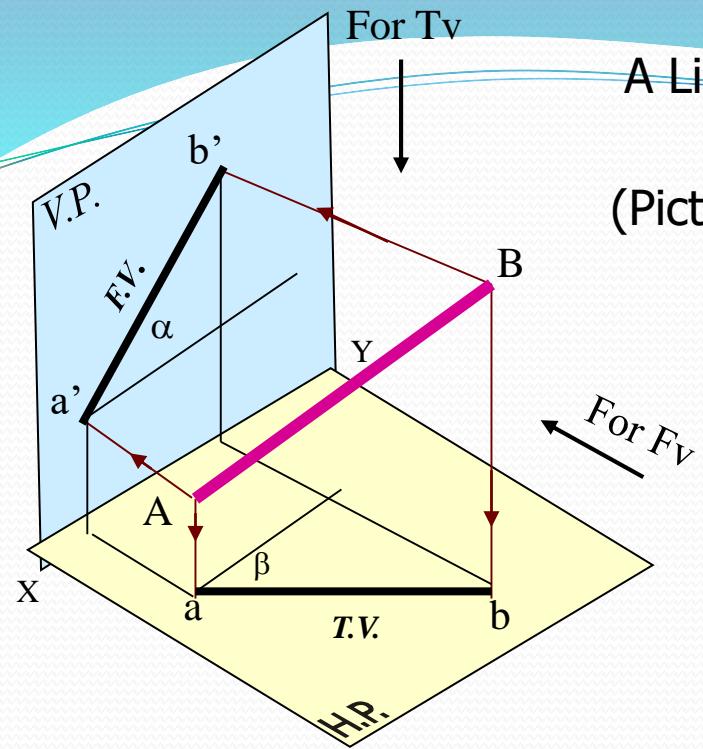
Orthographic Projections

A Line inclined to Vp
and
parallel to Hp
(Pictorial presentation)

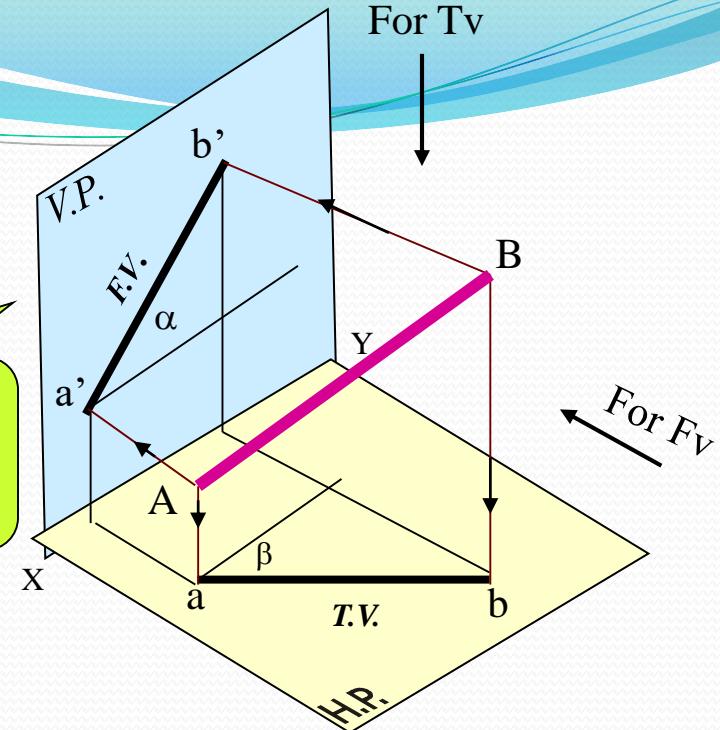


Tv inclined to xy
Fv parallel to xy.

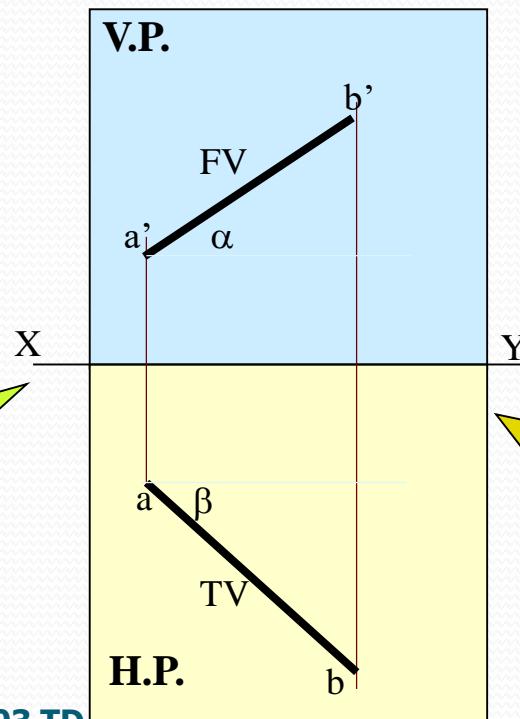




**A Line inclined to both
Hp and Vp
(Pictorial presentation)**

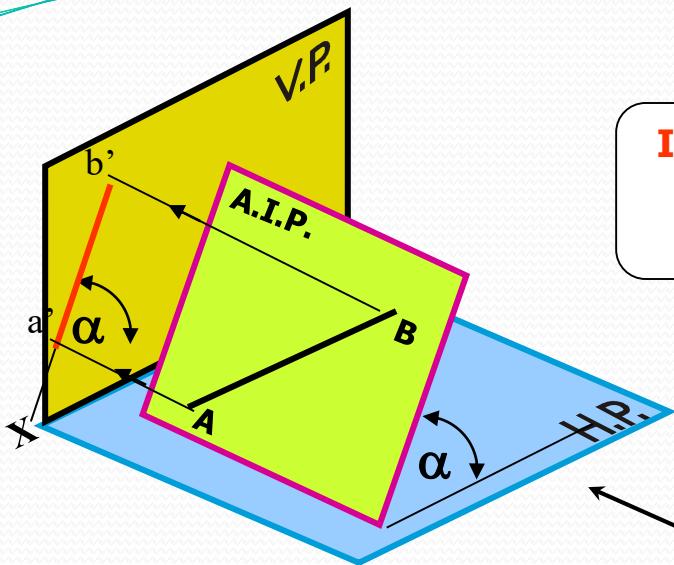


Orthographic Projections
Fv is seen on Vp clearly.
To see Tv clearly, HP is rotated 90° downwards,
Hence it comes below xy.



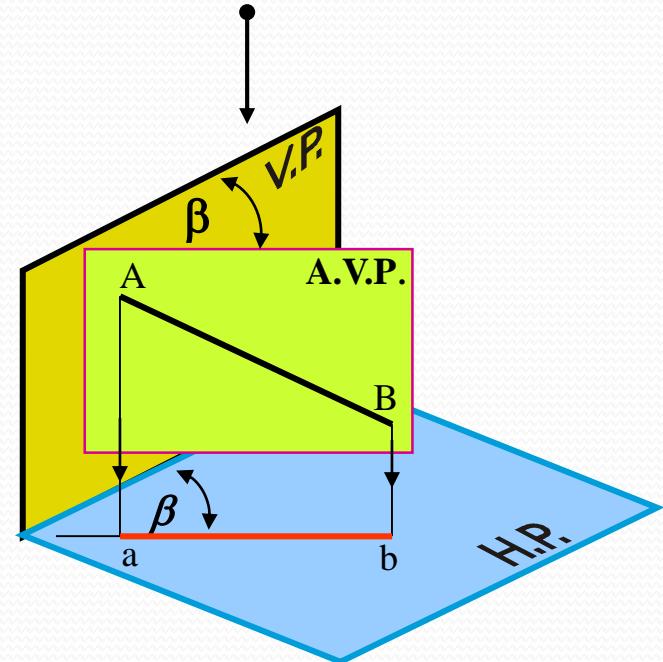
Note These Facts:-
Both Fv & Tv are inclined to xy.
(No view is parallel to xy)
Both Fv & Tv are reduced lengths.
(No view shows True Length)

CASES OF THE LINES IN A.V.P., A.I.P. & PROFILE PLANE

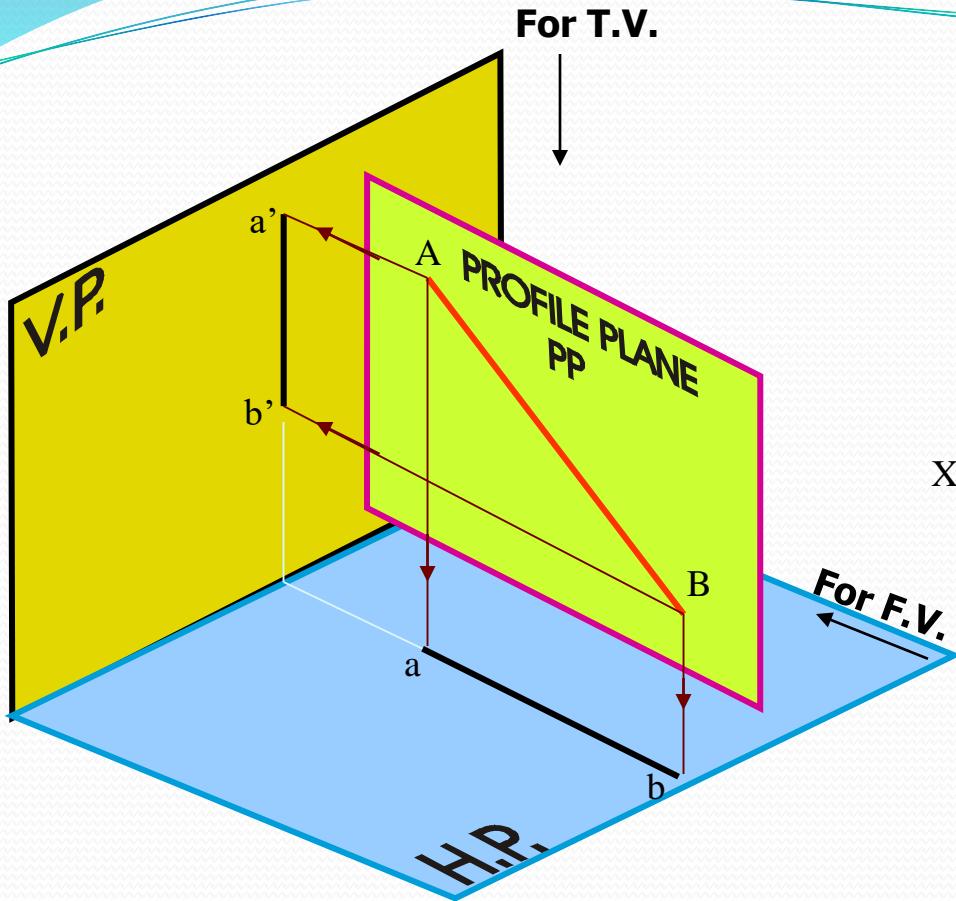


Inclination of AIP with HP = Inclination of FV with XY line

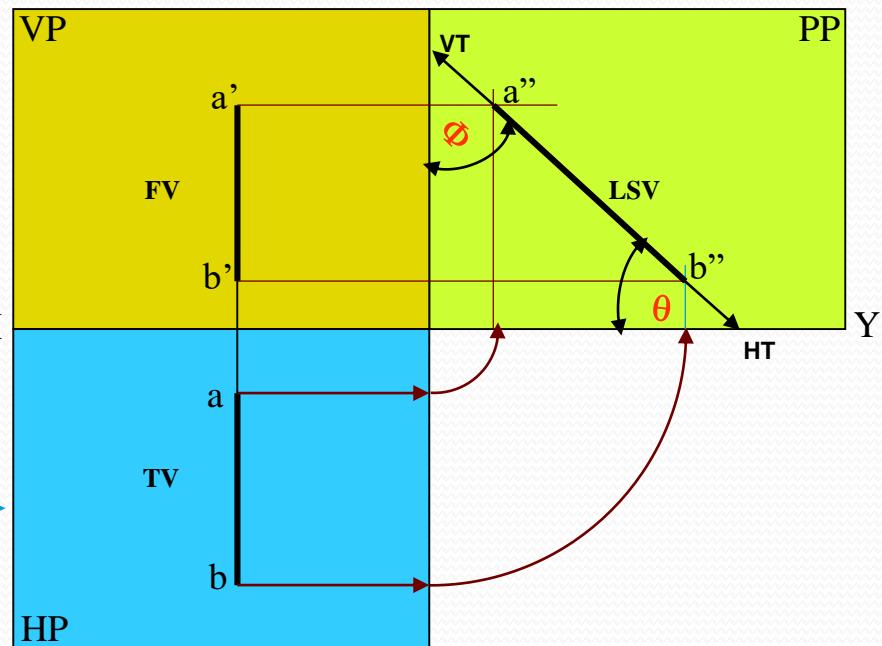
Inclination of AVP with VP = Inclination of TV with XY line



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



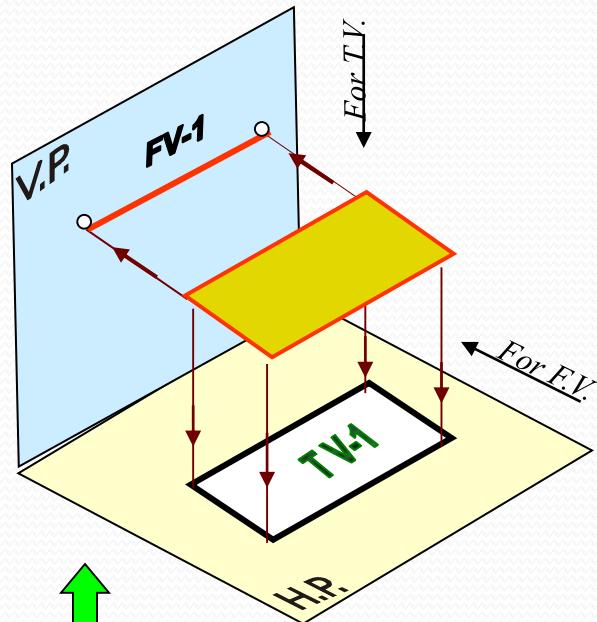
ORTHOGRAPHIC PATTERN OF LINE IN PROFILE PLANE



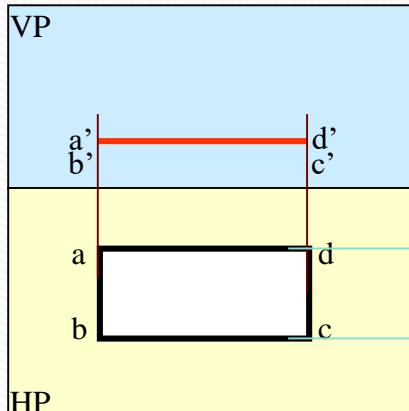
1. TV & FV both are vertical, hence arrive on one single projector.
2. It's Side View shows True Length (TL)
3. Sum of it's inclinations with HP & VP equals to 90° ($\theta + \phi = 90^\circ$)
4. It's HT & VT arrive on same projector and can be easily located From Side View.

RECTANGULAR SURFACE

PARALLEL TO HP

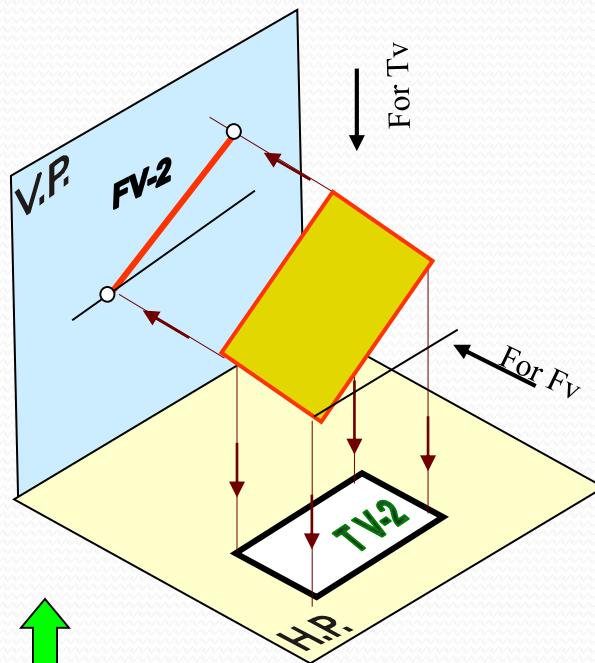


ORTHOGRAPHIC
TV-True Shape
FV- Line // to xy

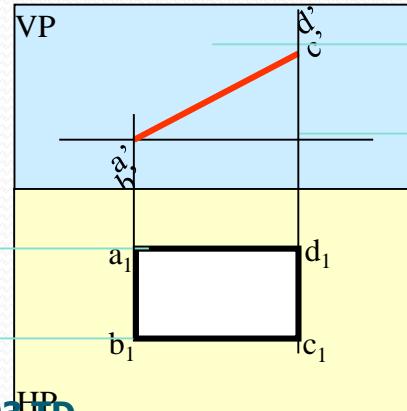


MECH 103 TD

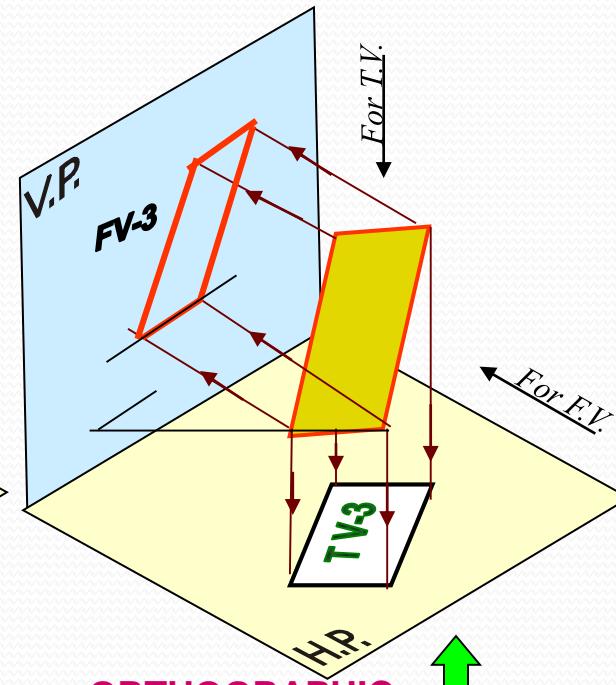
INCLINED TO HP



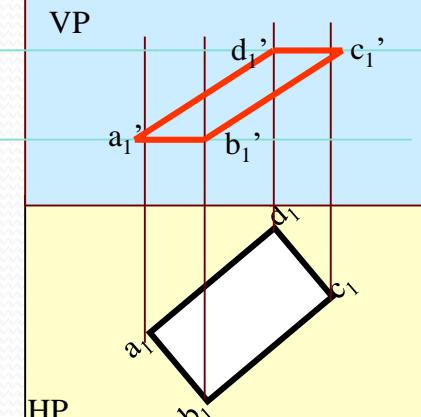
ORTHOGRAPHIC
FV- Inclined to XY
TV- Reduced Shape



ONE SMALL SIDE INCLINED TO VP



ORTHOGRAPHIC
FV- Apparent Shape
TV- Previous Shape

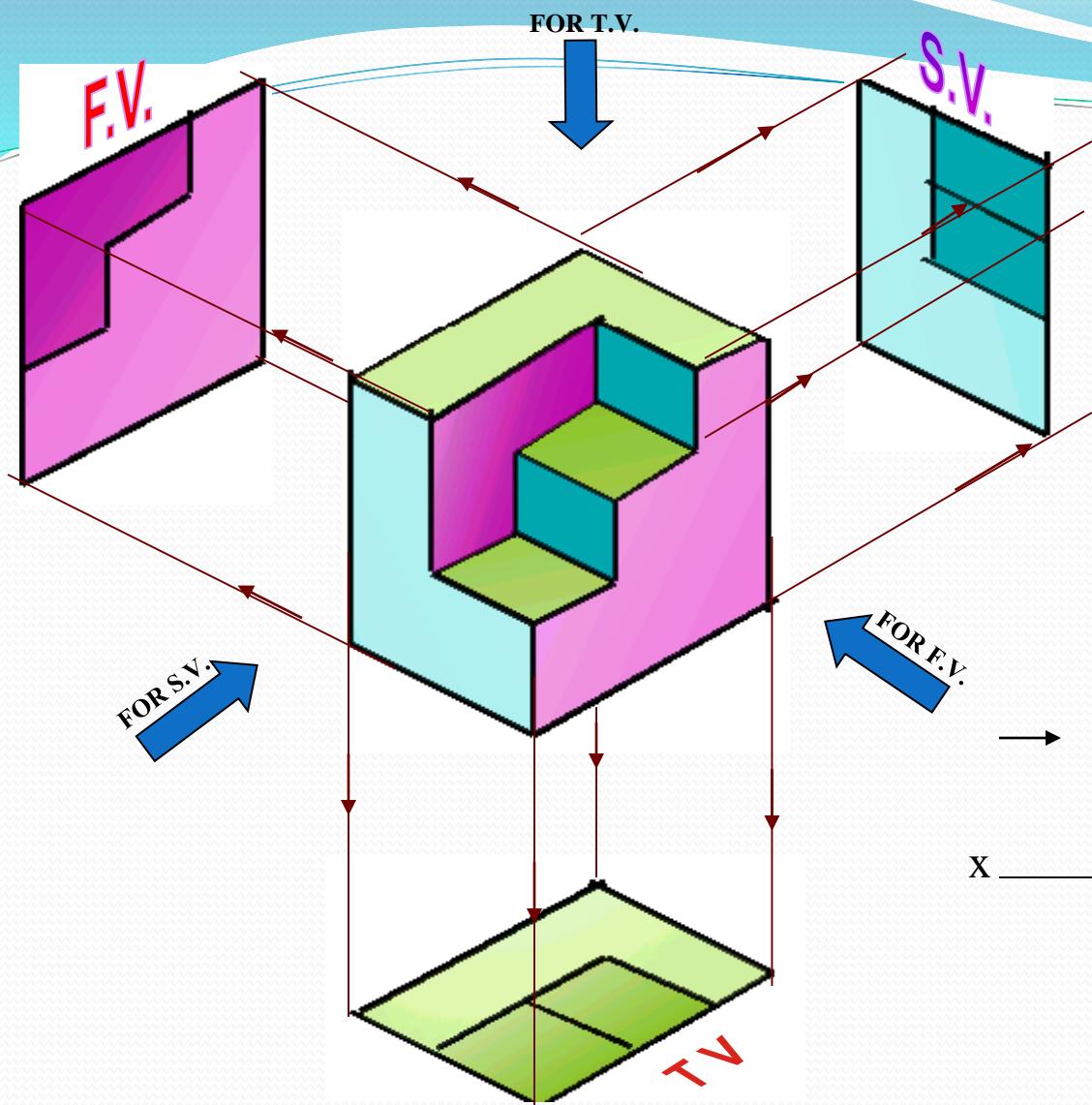


C 80

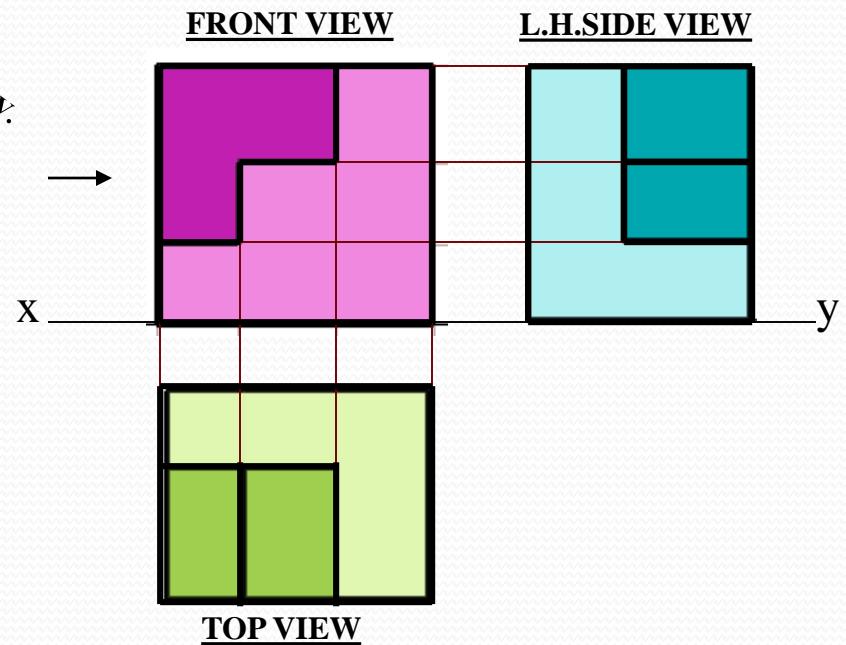
ORTHOGRAPHIC PROJECTIONS (Multiview)

OF

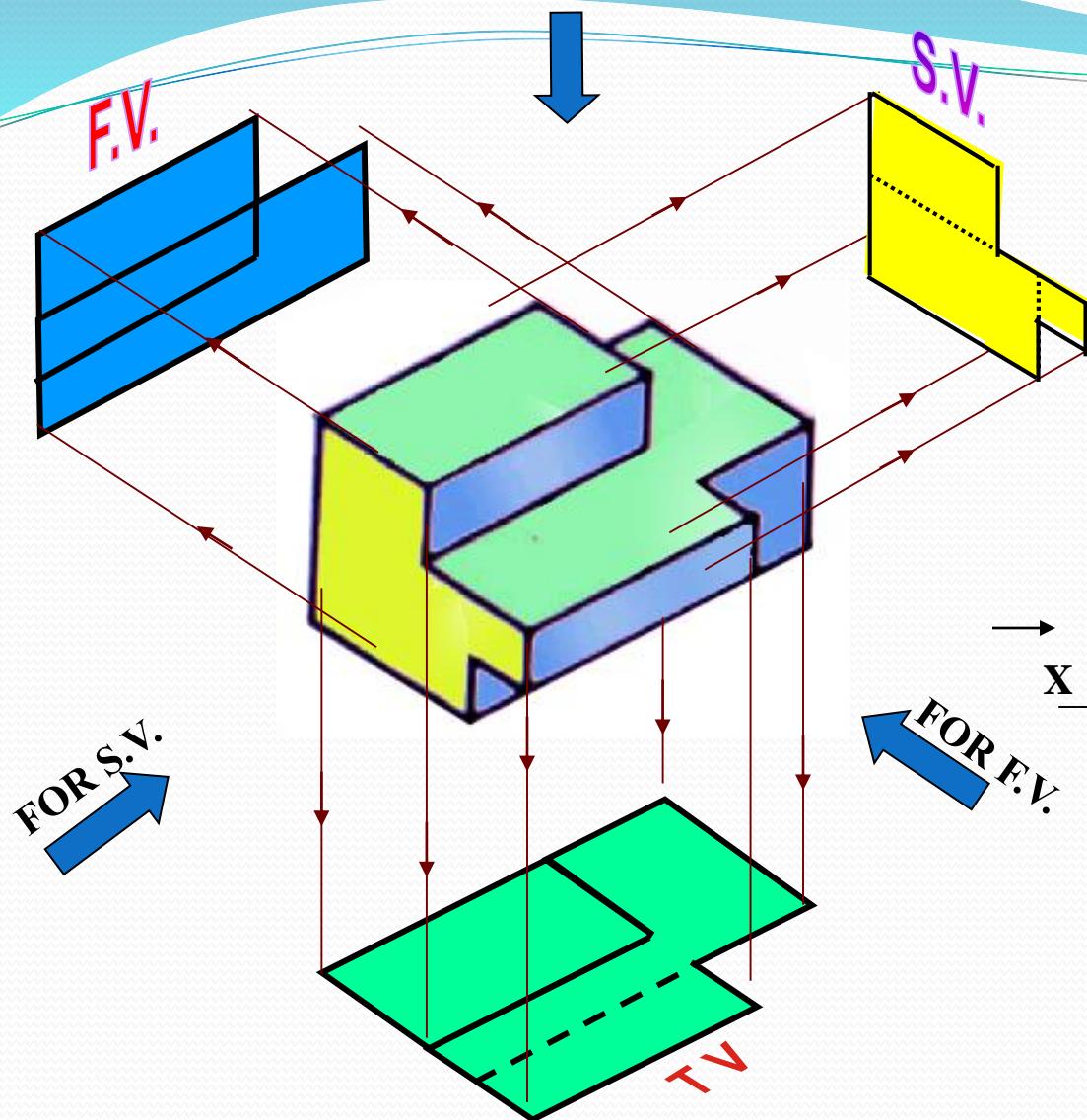
SOLIDS



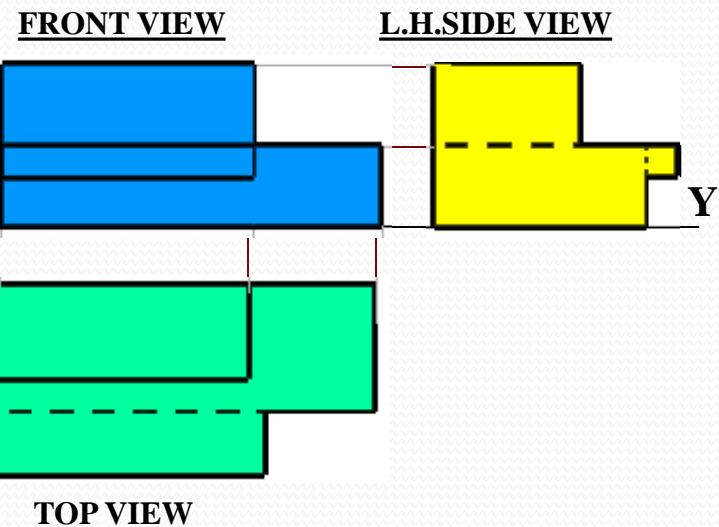
ORTHOGRAPHIC PROJECTIONS

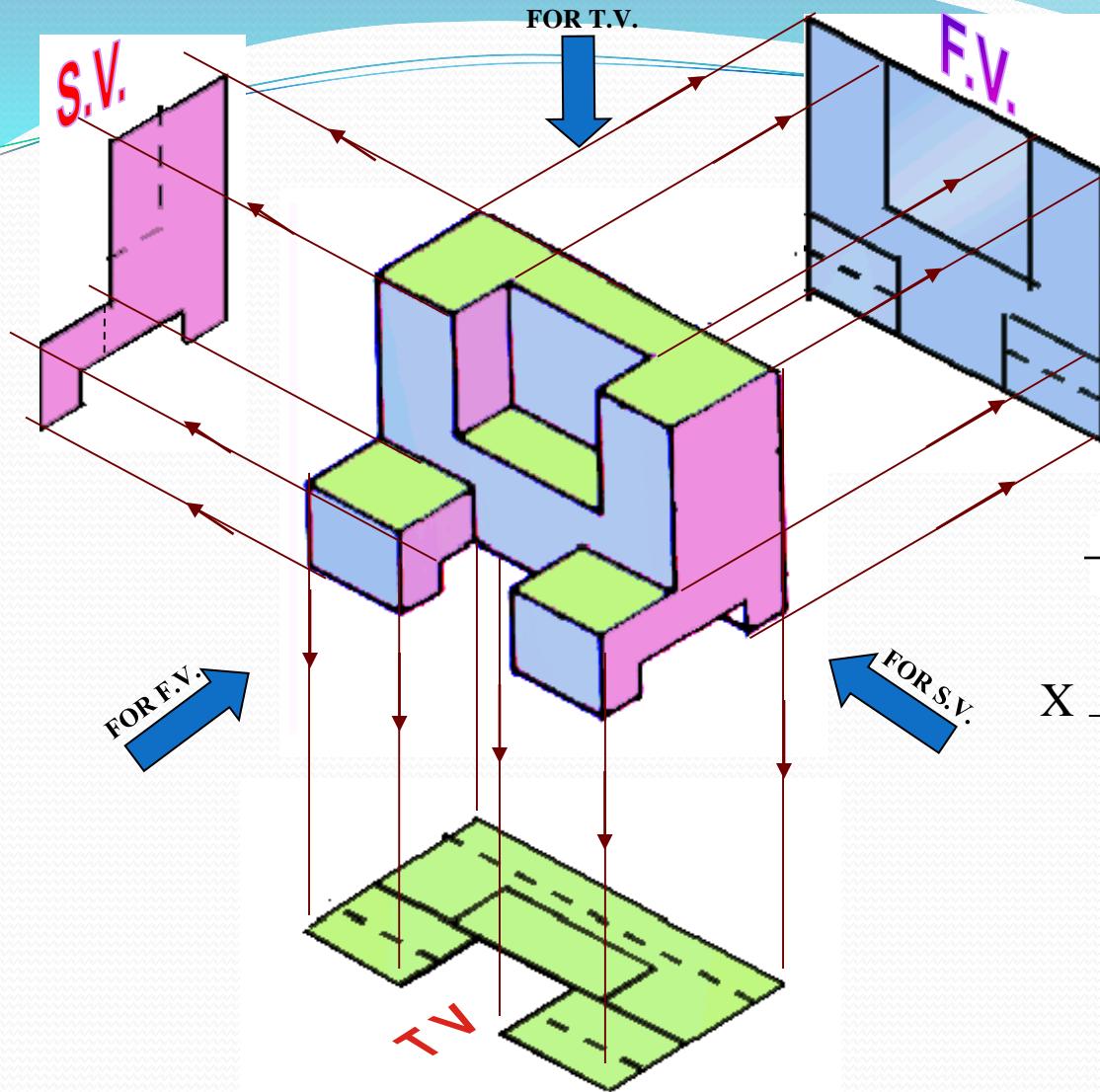


FOR T.V.

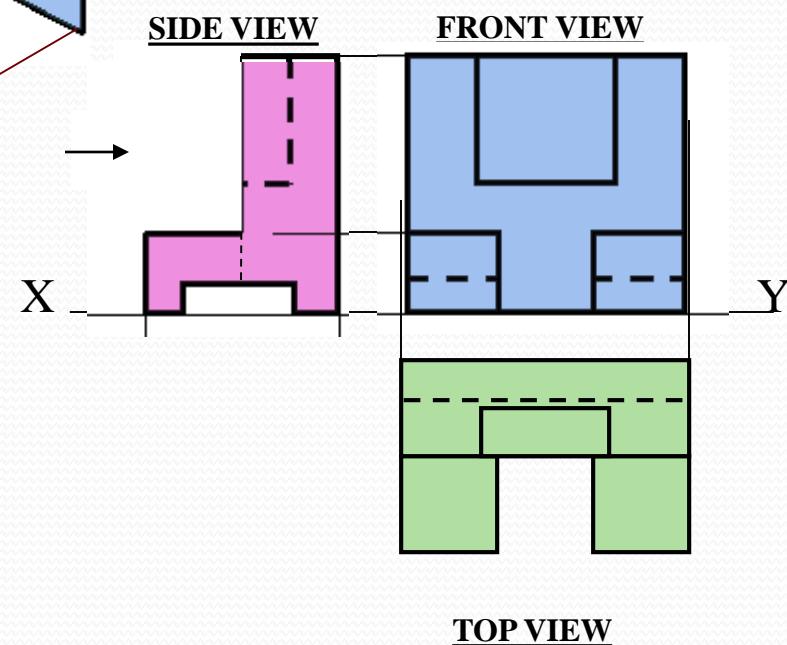


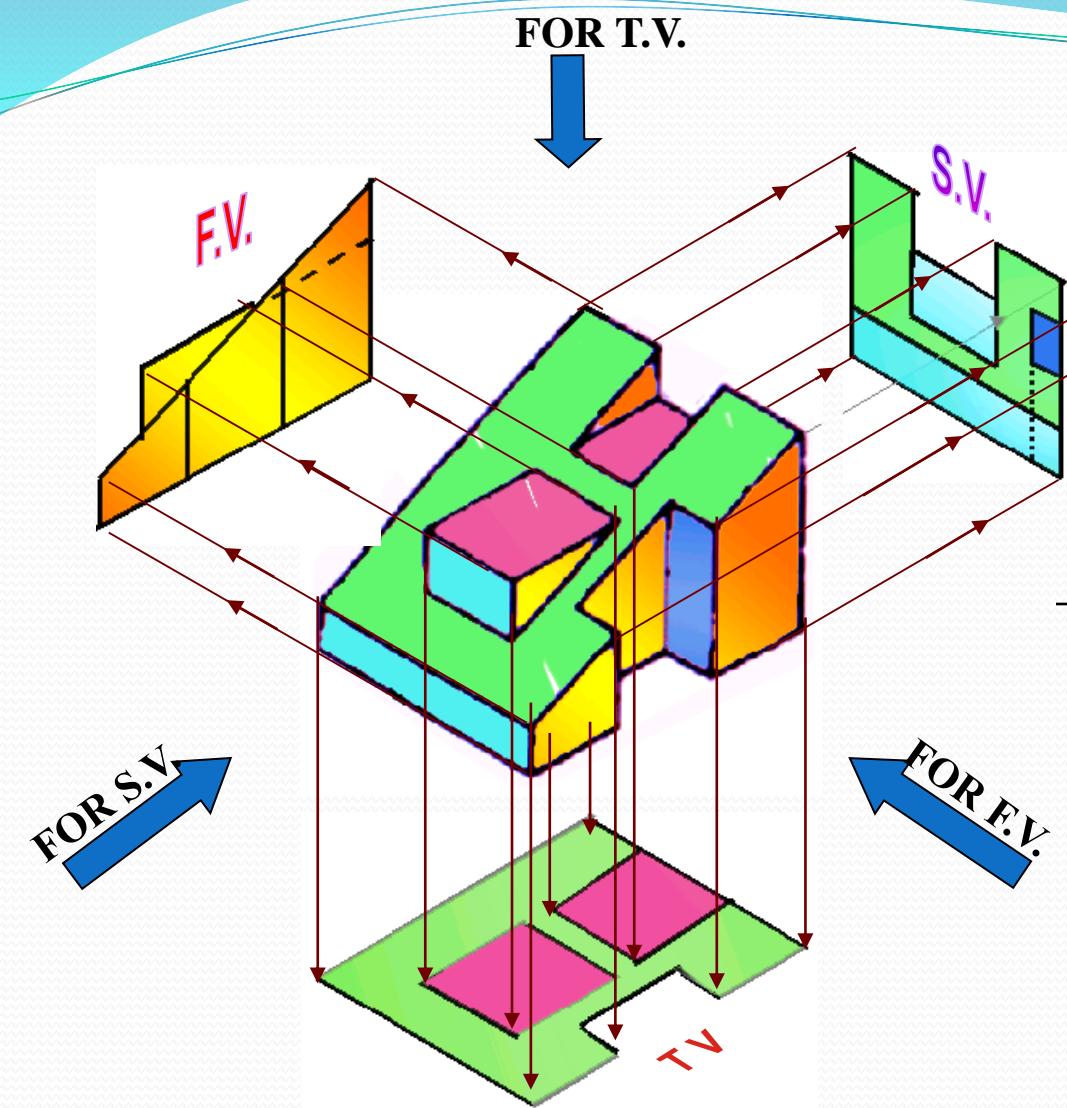
ORTHOGRAPHIC PROJECTIONS





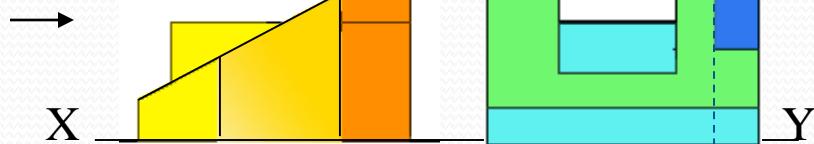
ORTHOGRAPHIC PROJECTIONS



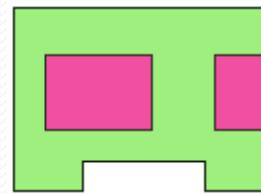


ORTHOGRAPHIC PROJECTIONS

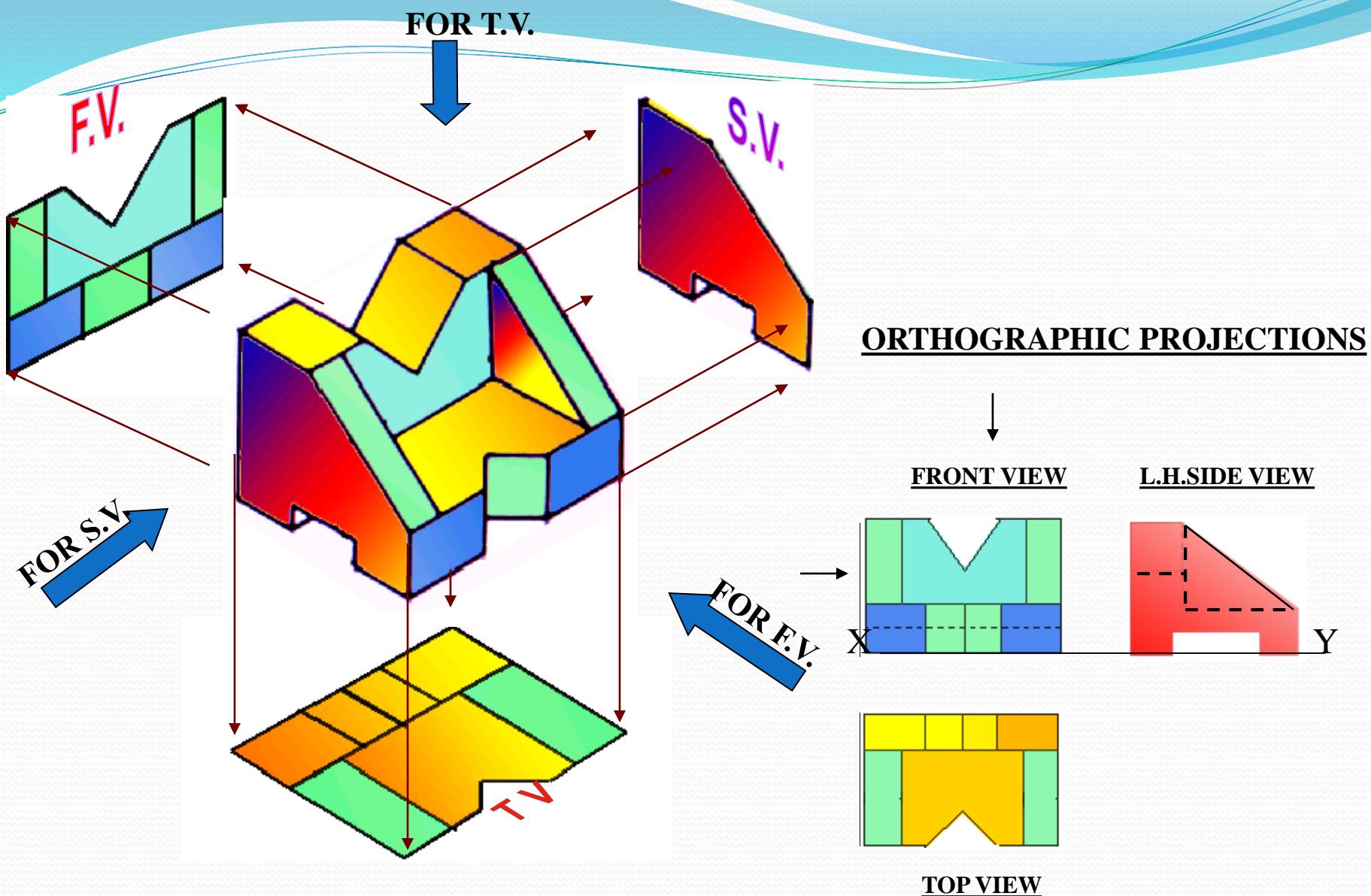
FRONT VIEW

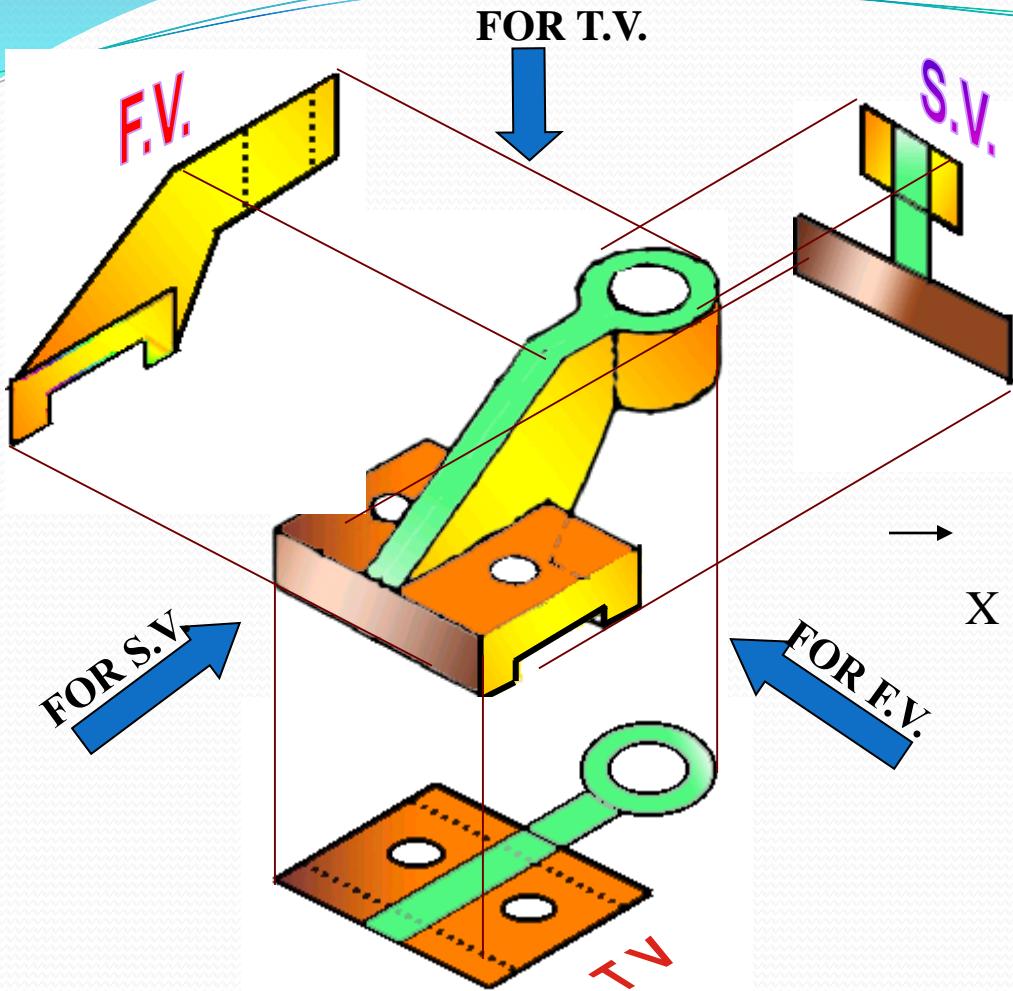


L.H.SIDE VIEW

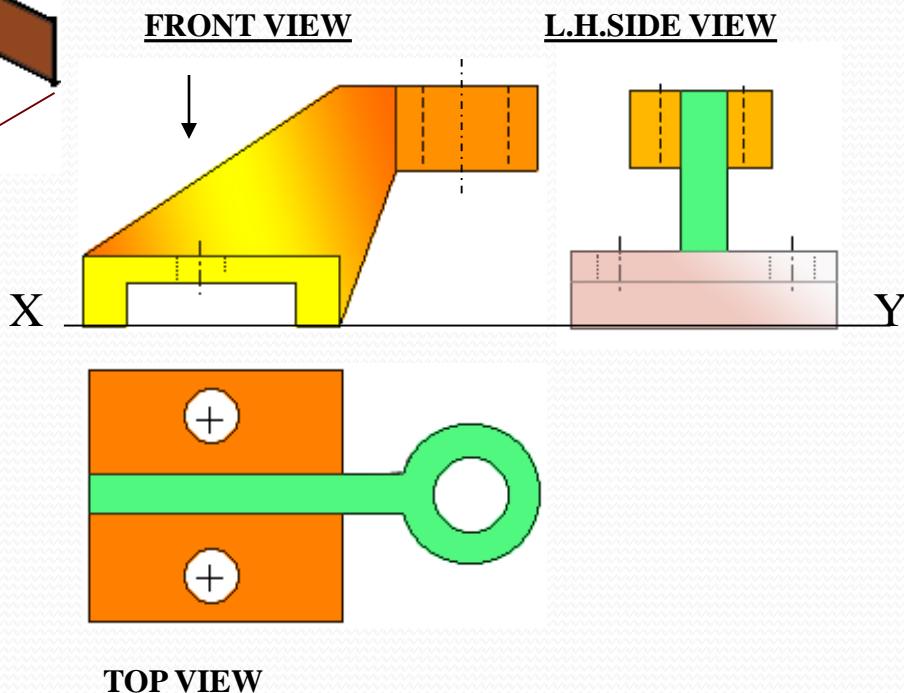


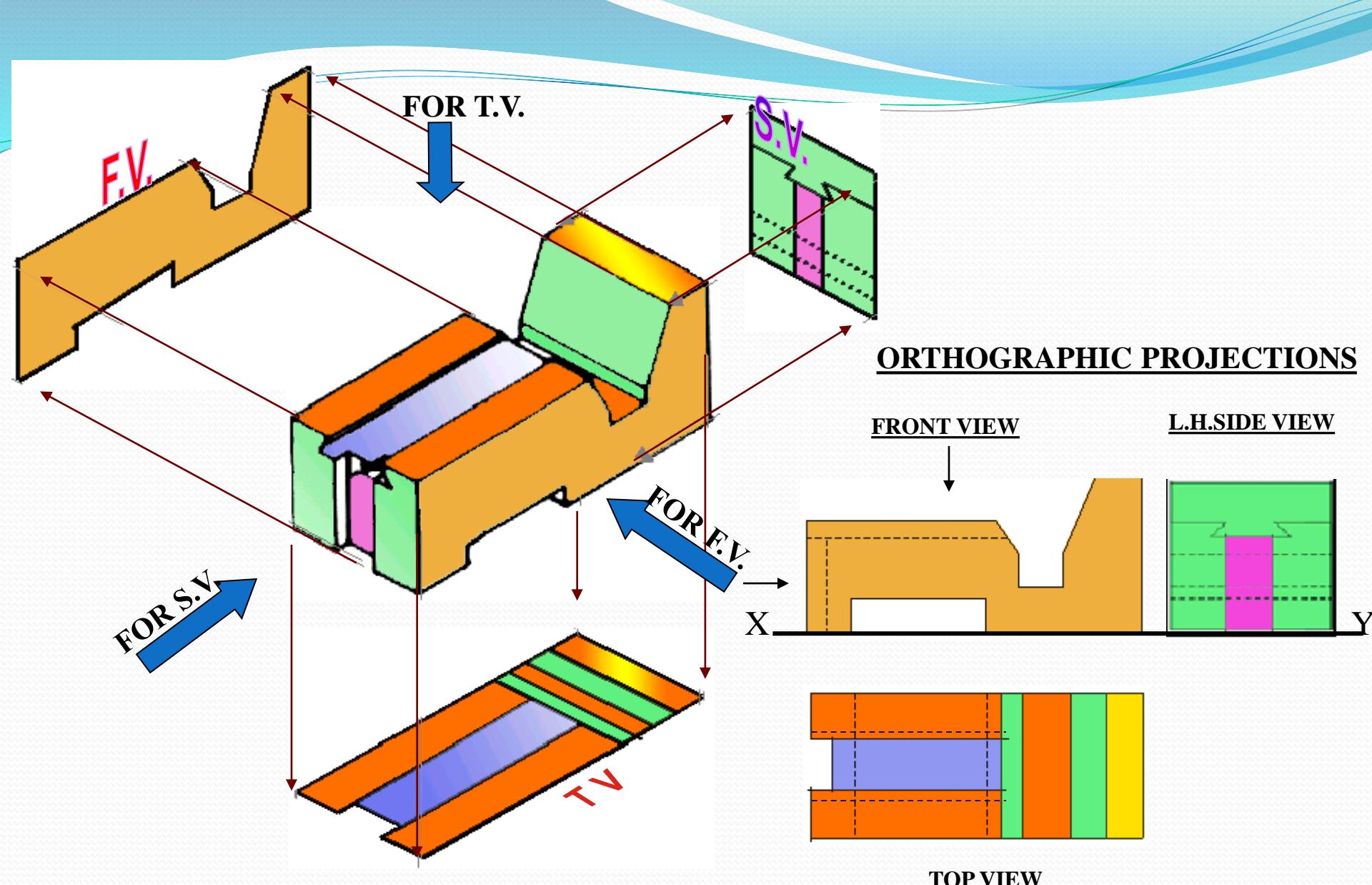
TOP VIEW



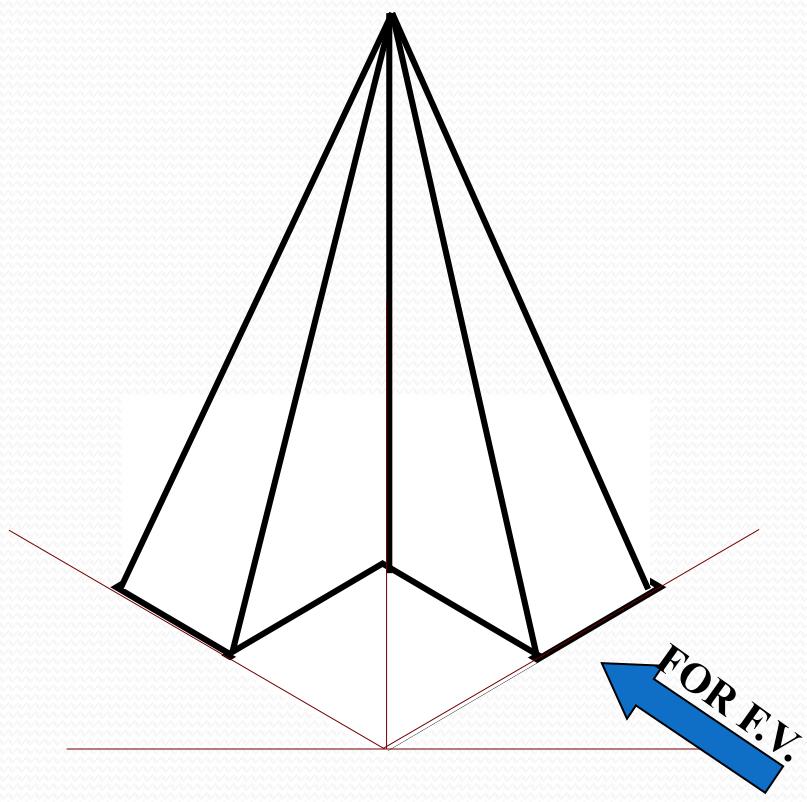


ORTHOGRAPHIC PROJECTIONS



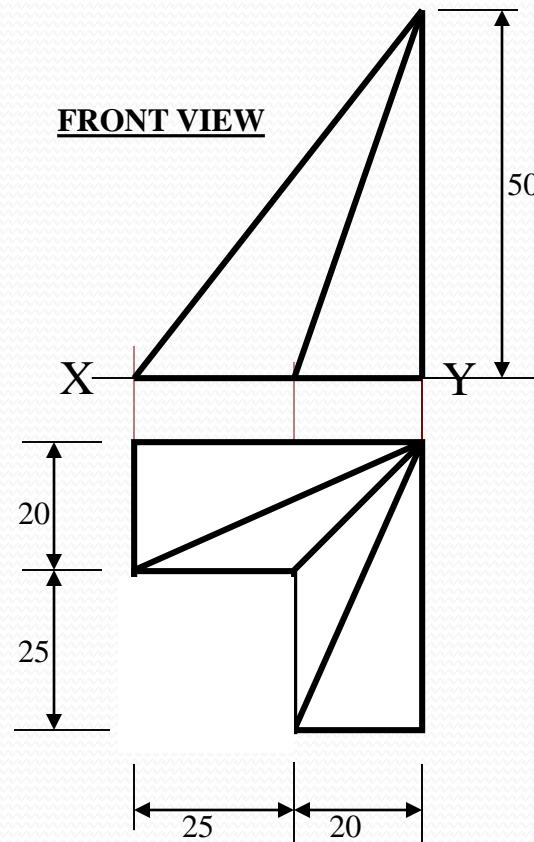


FOR T.V.



ORTHOGRAPHIC PROJECTIONS

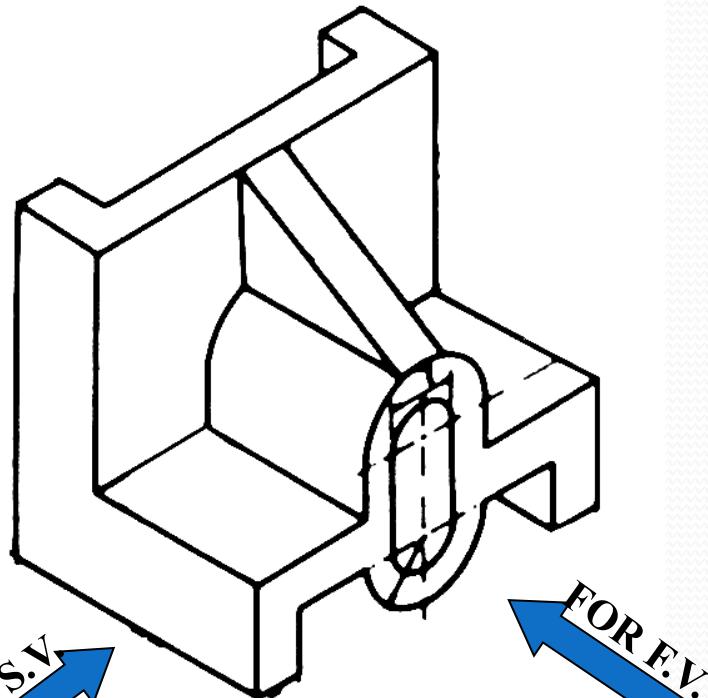
FRONT VIEW



TOP VIEW

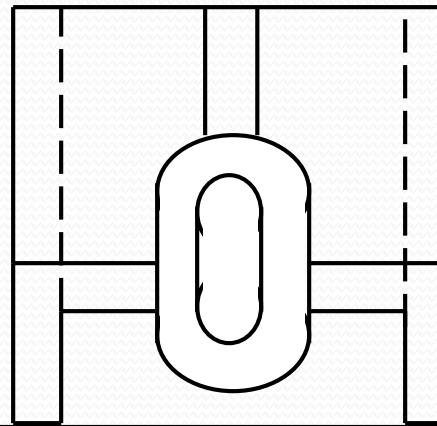


FOR T.V.



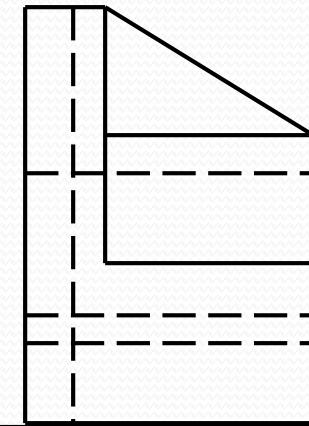
ORTHOGRAPHIC PROJECTIONS

FRONT VIEW

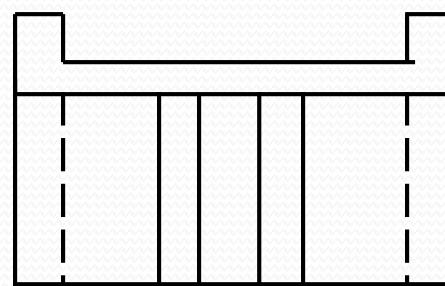


X

L.H.SIDE VIEW

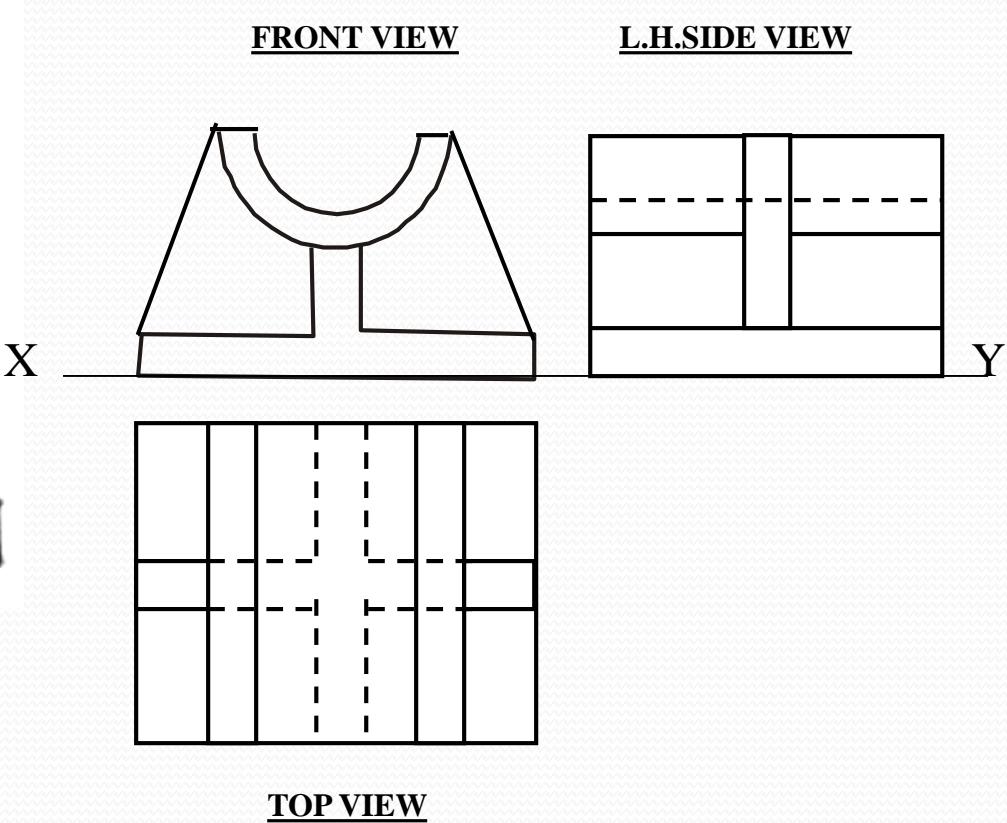
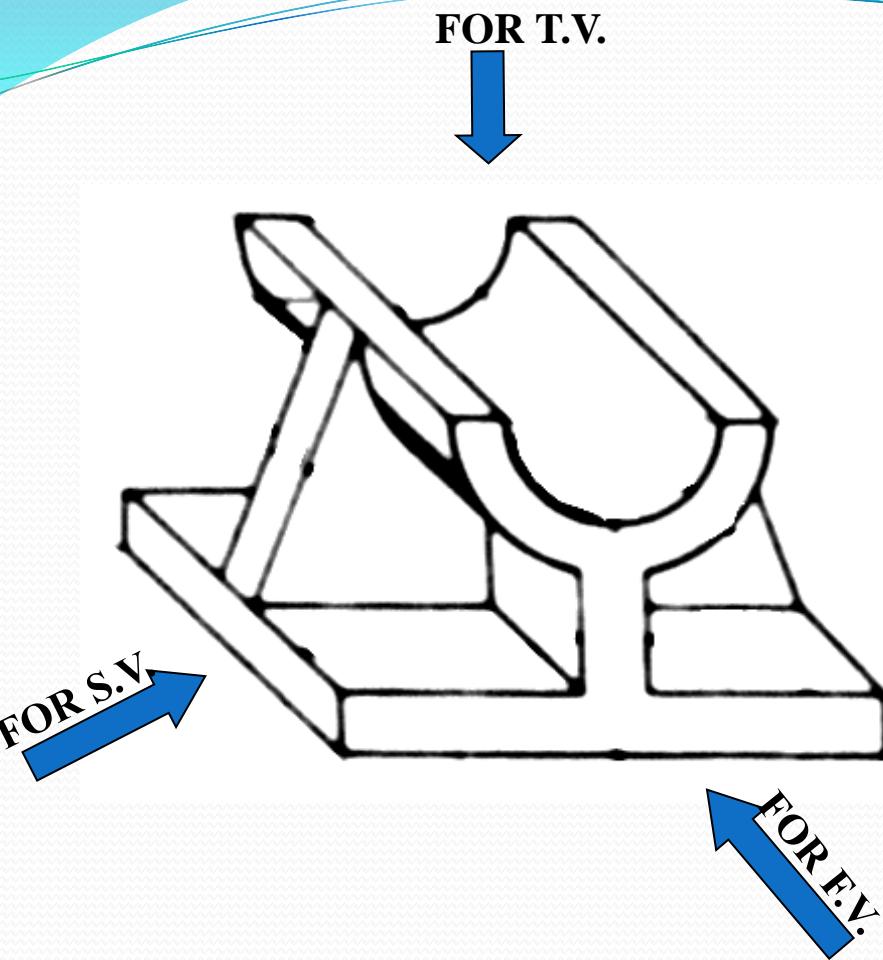


Y



TOP VIEW

ORTHOGRAPHIC PROJECTIONS

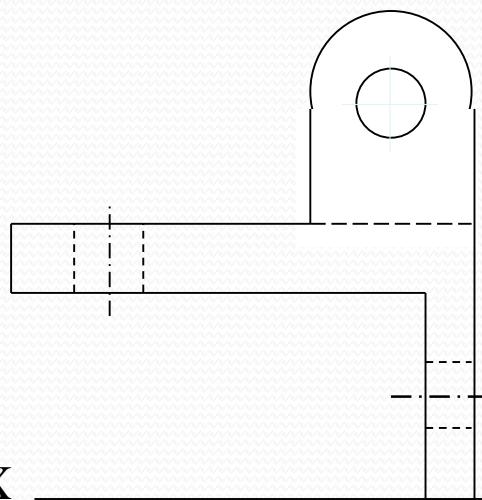


FOR T.V.

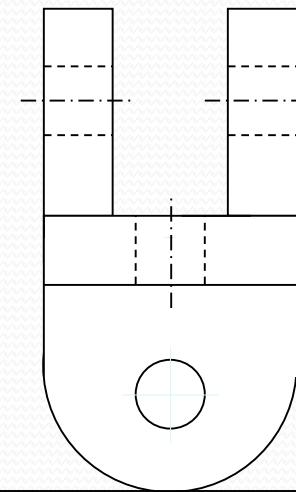


ORTHOGRAPHIC PROJECTIONS

FRONT VIEW

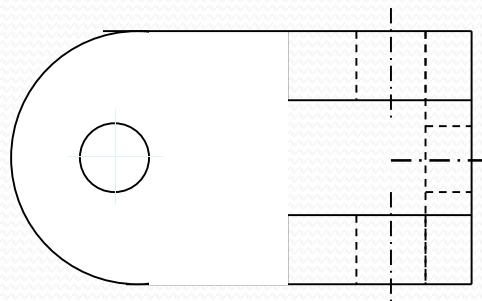


L.H.SIDE VIEW

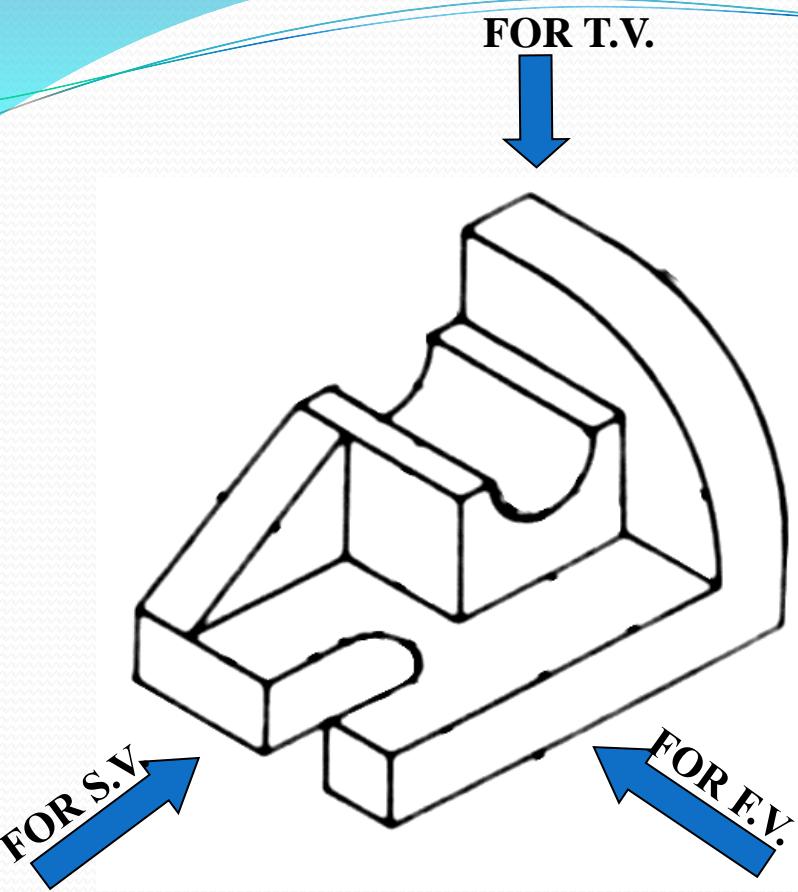


FOR F.V.

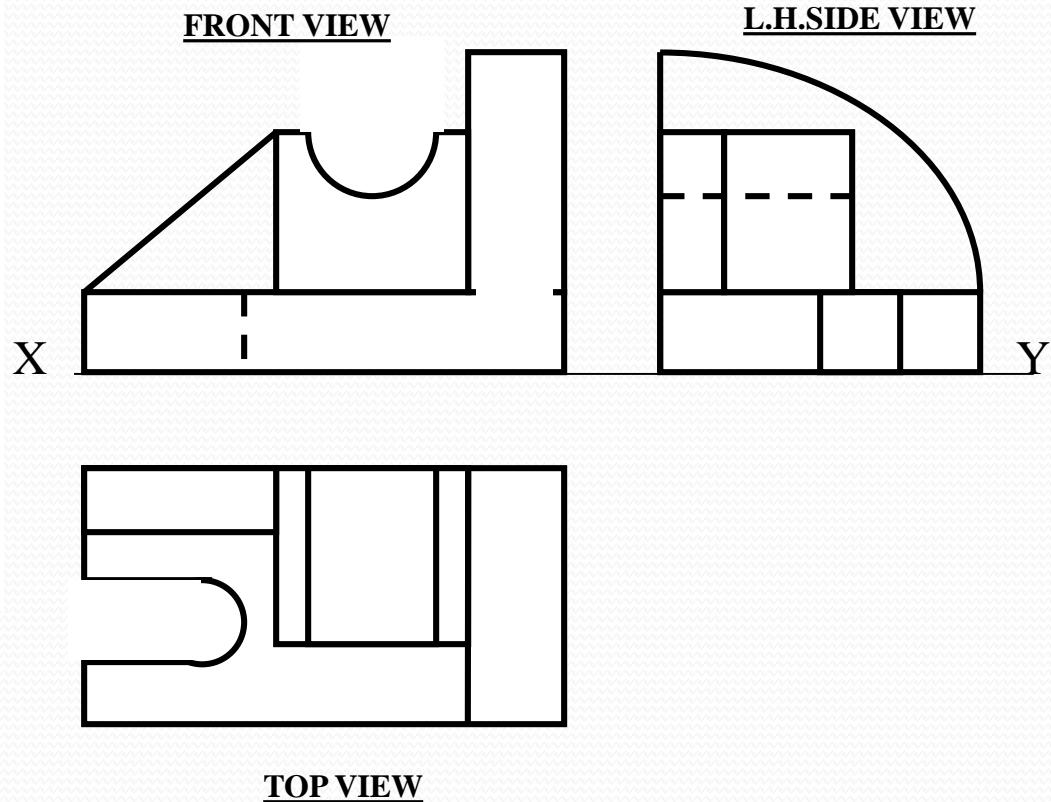
FOR S.V.

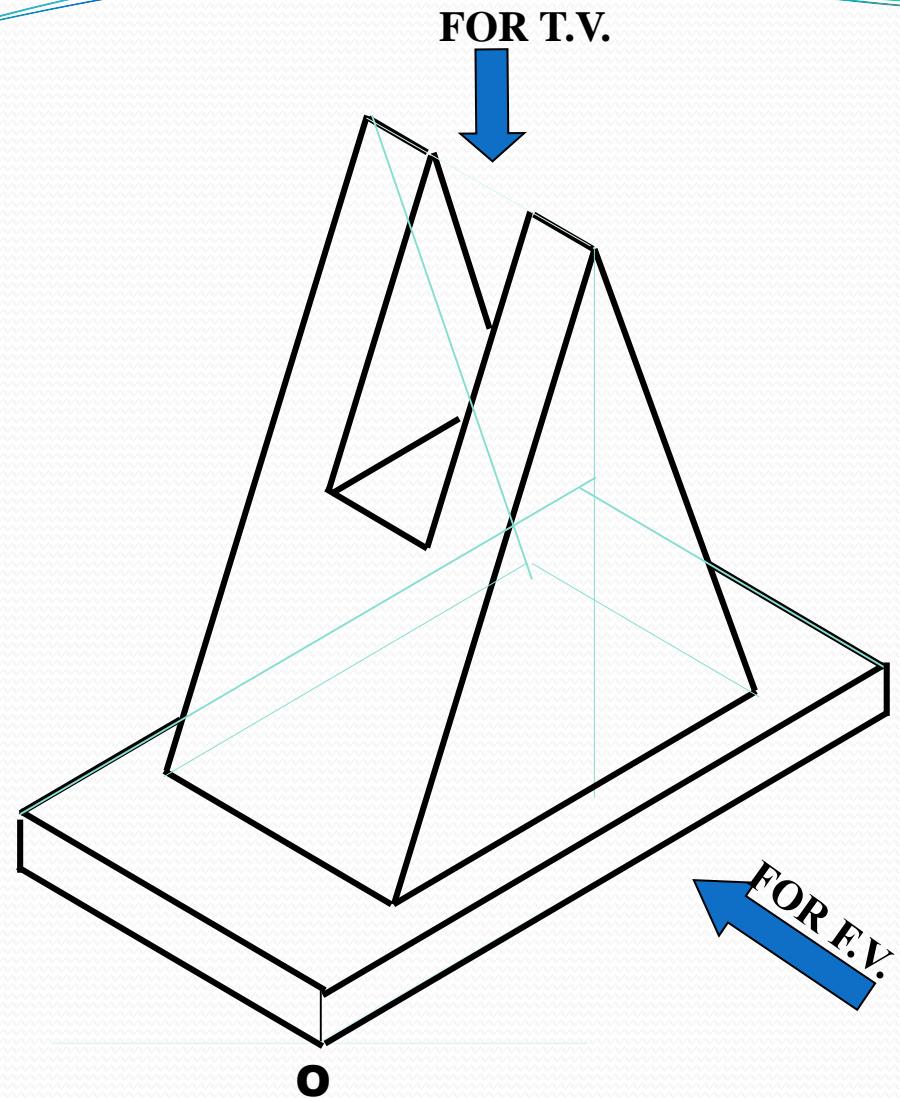


TOP VIEW

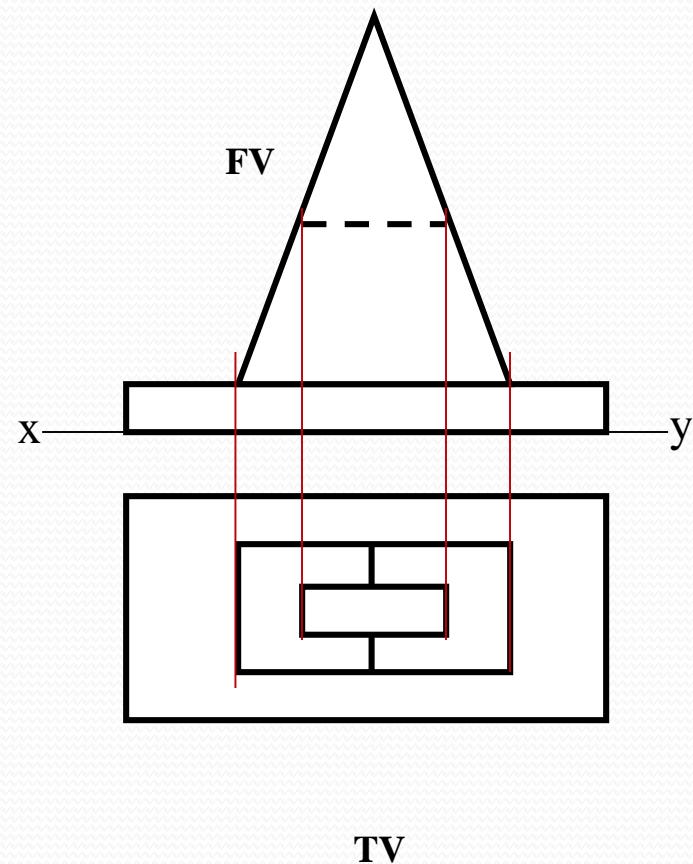


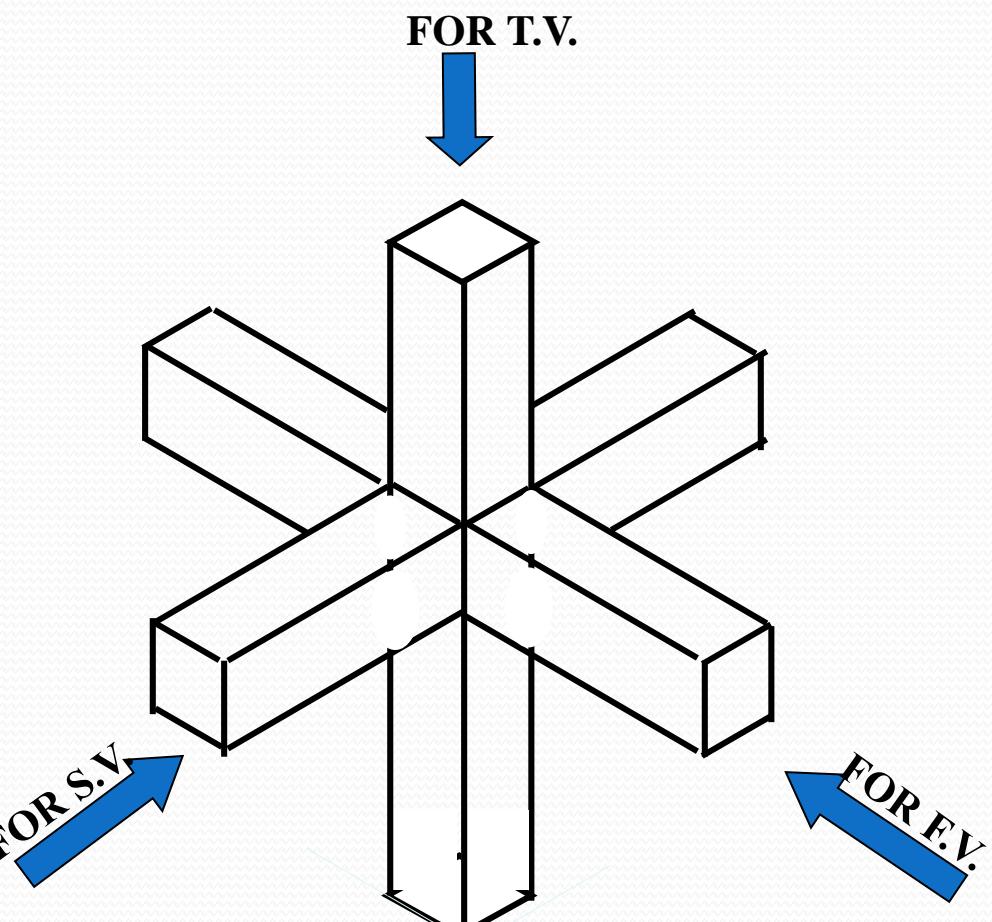
ORTHOGRAPHIC PROJECTIONS



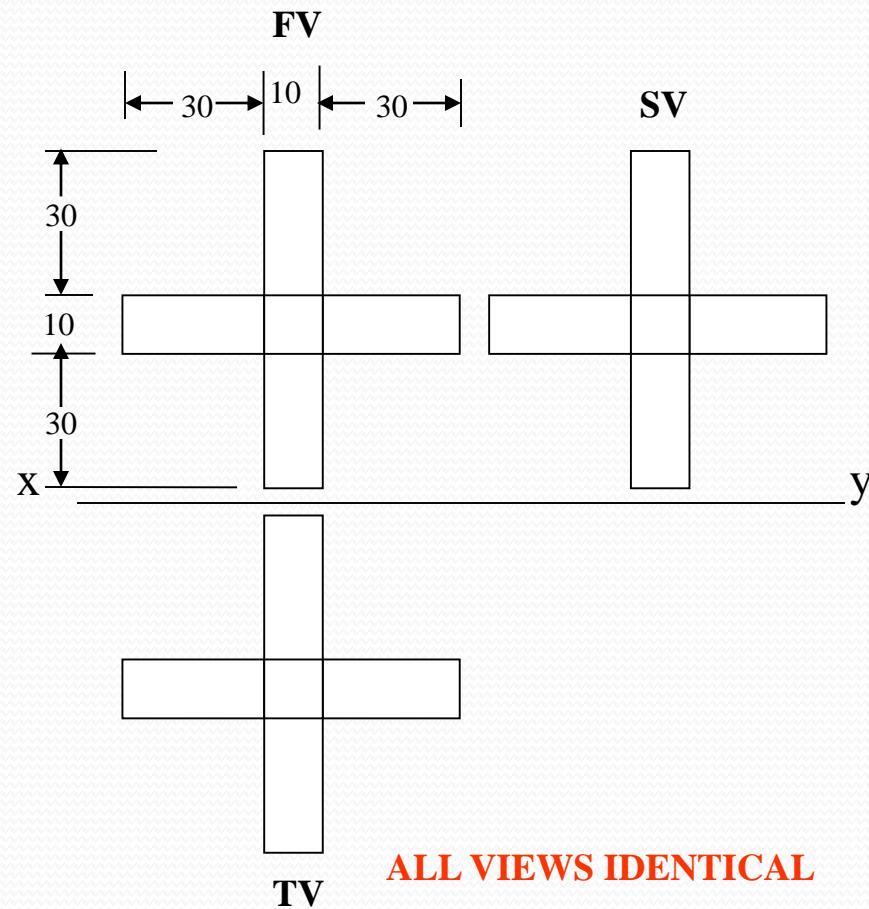


ORTHOGRAPHIC PROJECTIONS

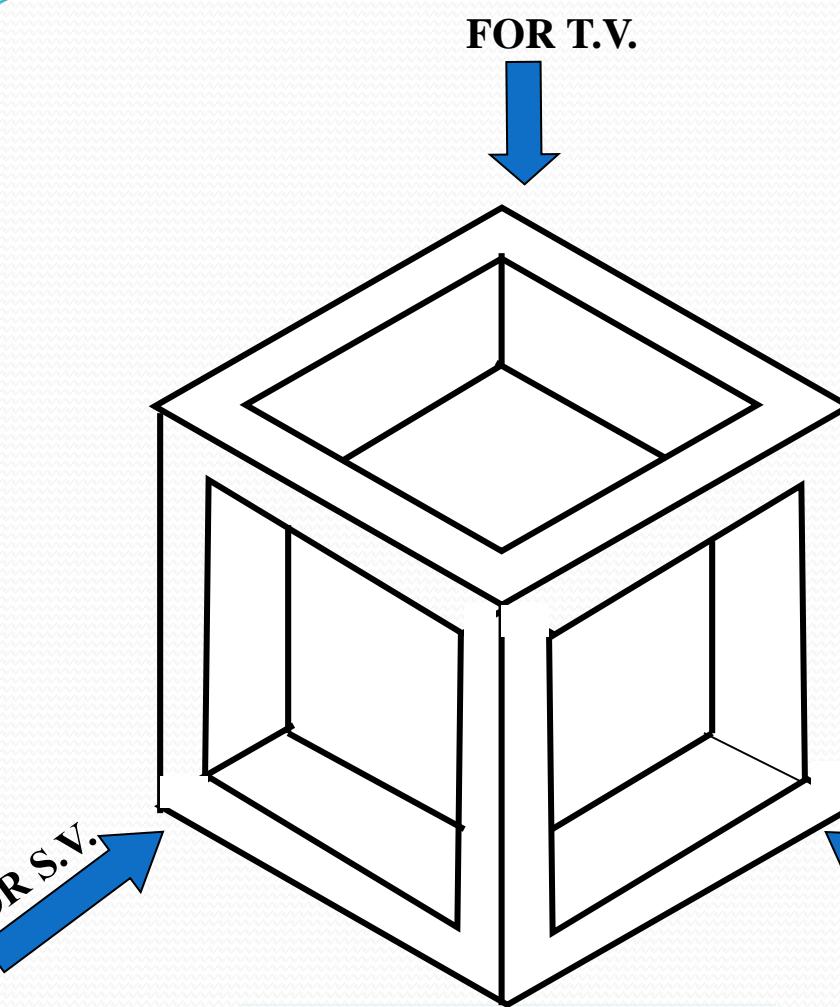




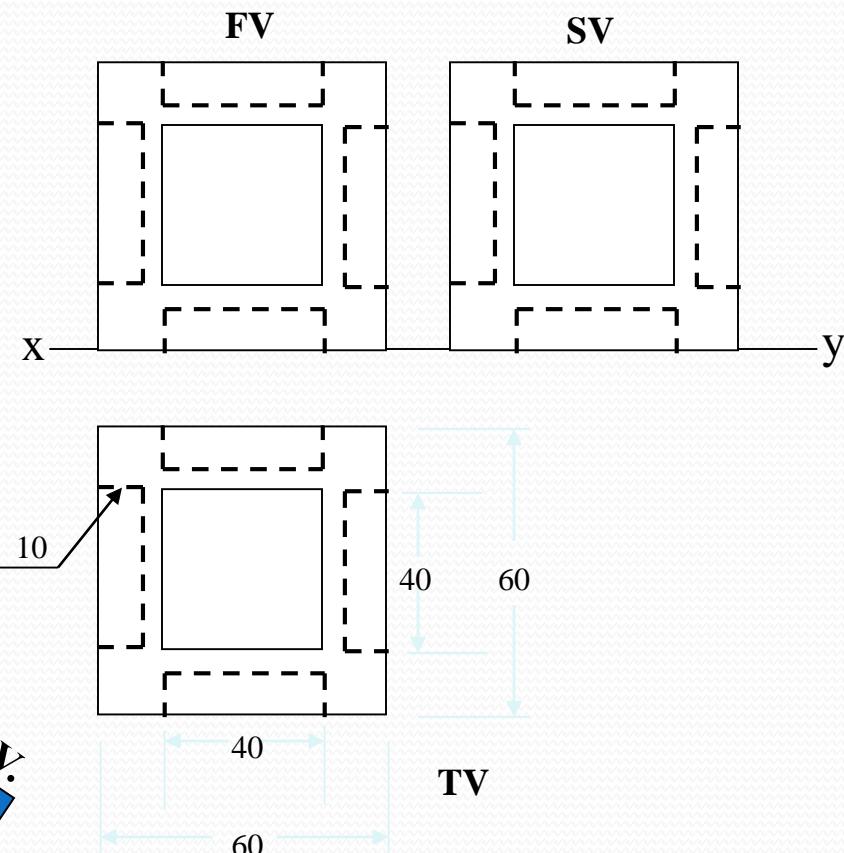
ORTHOGRAPHIC PROJECTIONS



ORTHOGRAPHIC PROJECTIONS



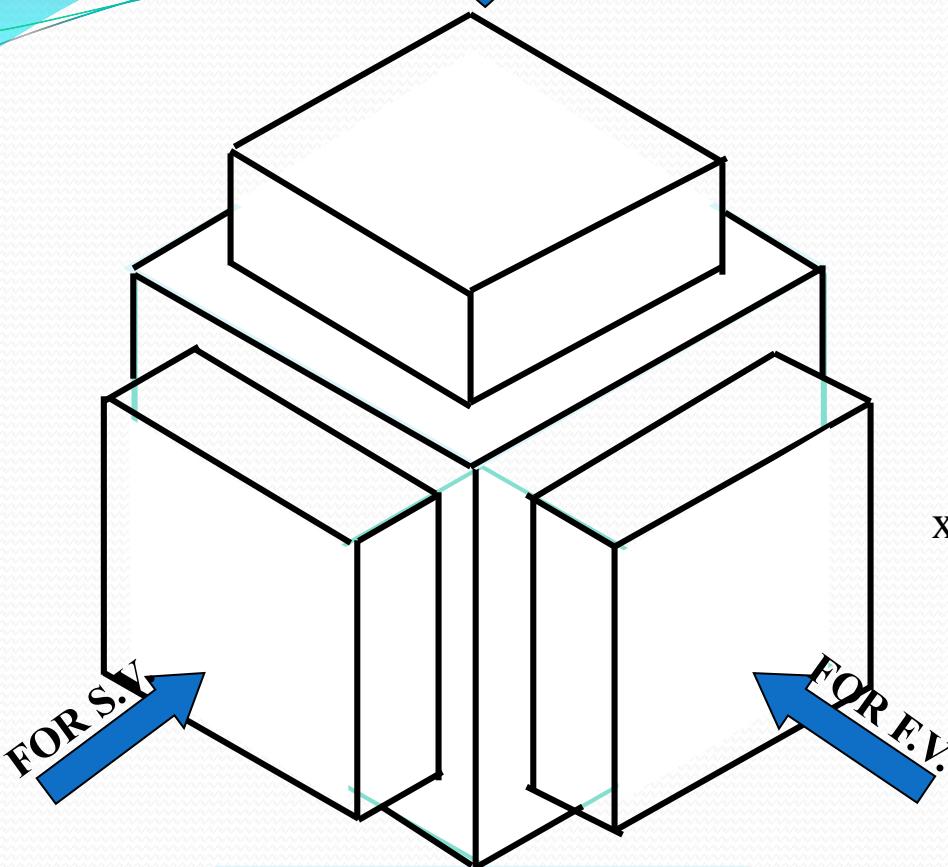
ALL VIEWS IDENTICAL



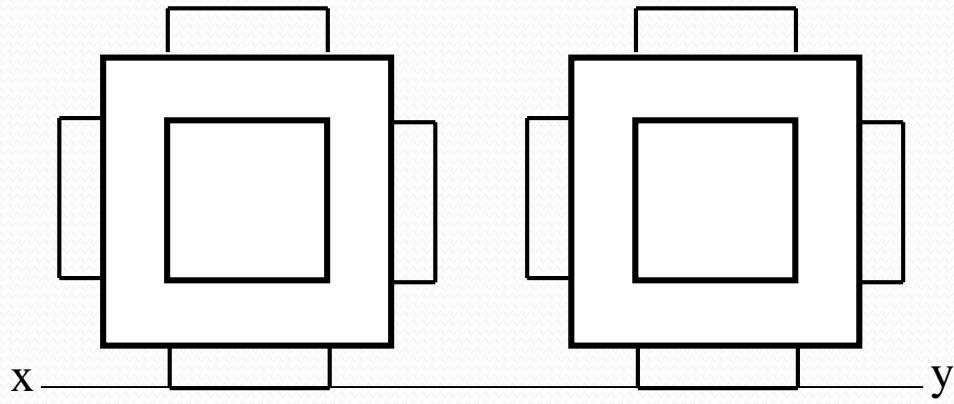
FOR T.V.

ORTHOGRAPHIC PROJECTIONS

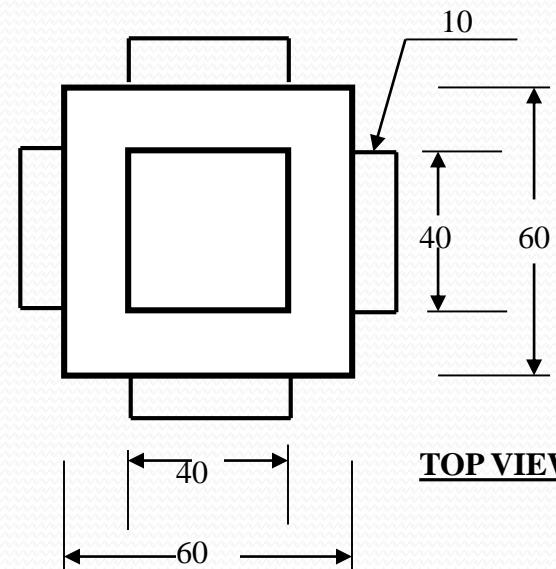
ALL VIEWS IDENTICAL



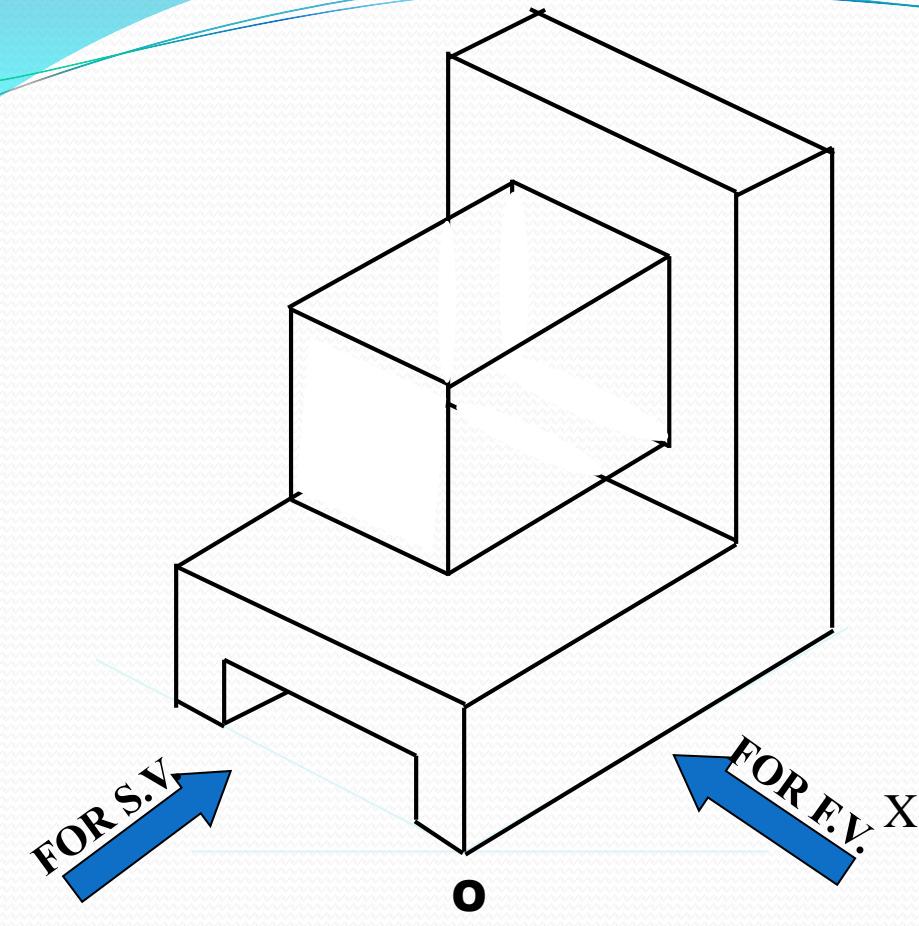
FV



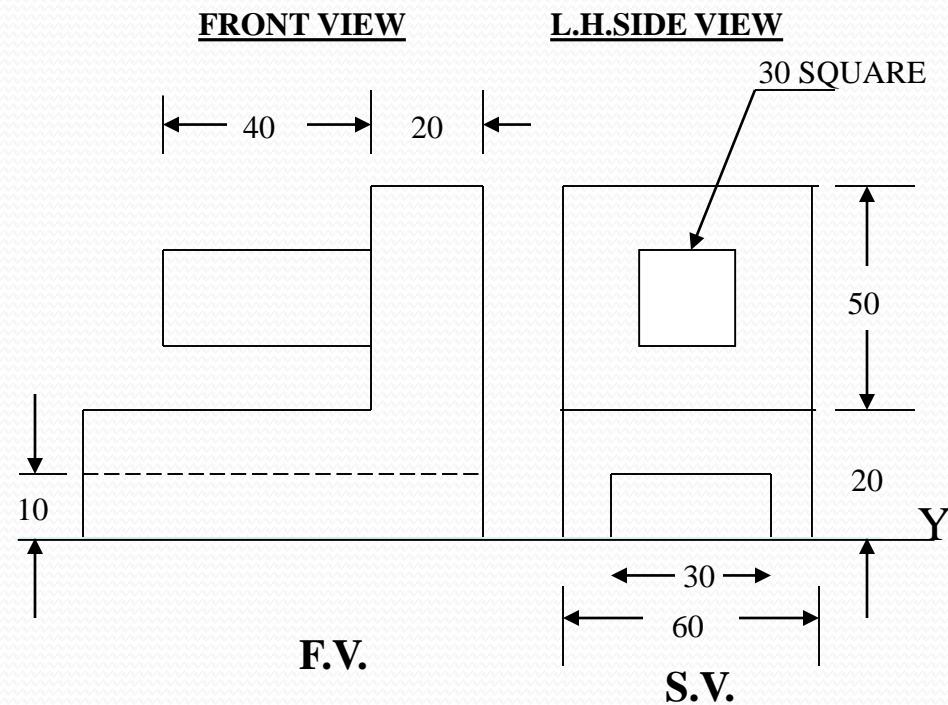
SV



TOP VIEW



ORTHOGRAPHIC PROJECTIONS

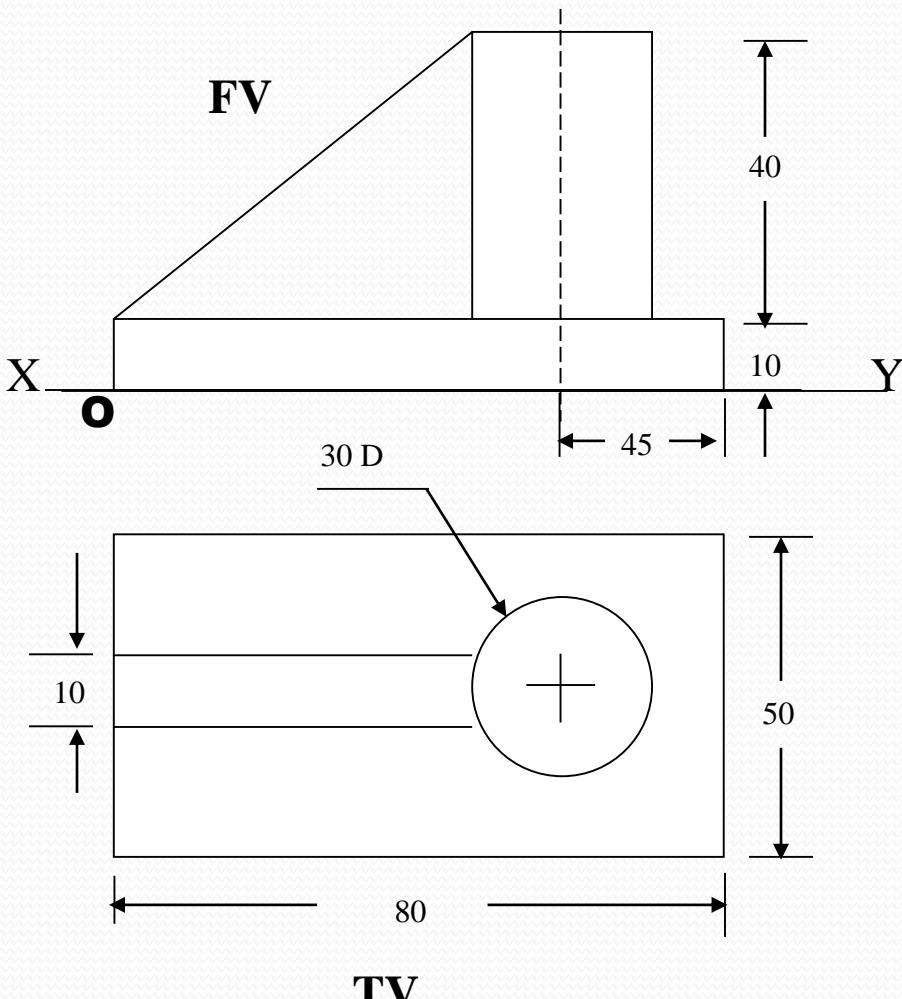


ORTHOGRAPHIC PROJECTIONS

FOR T.V.

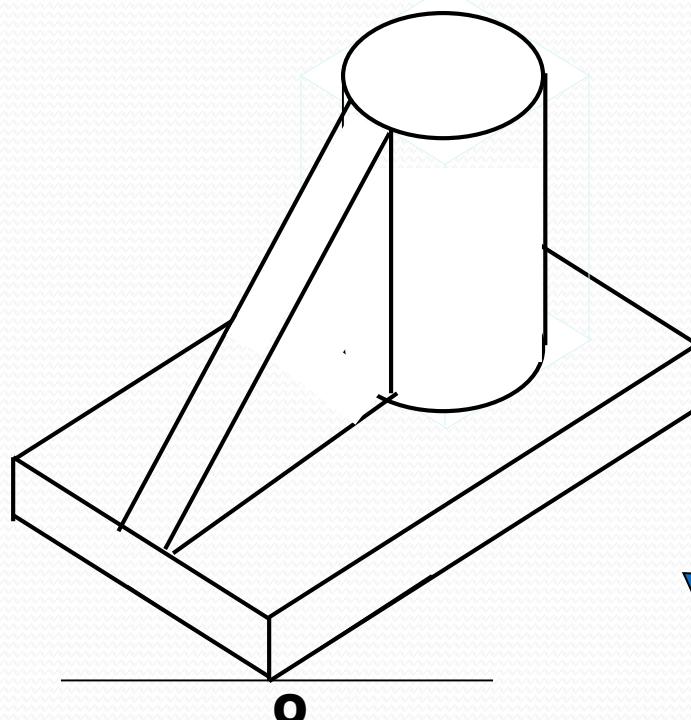


FV

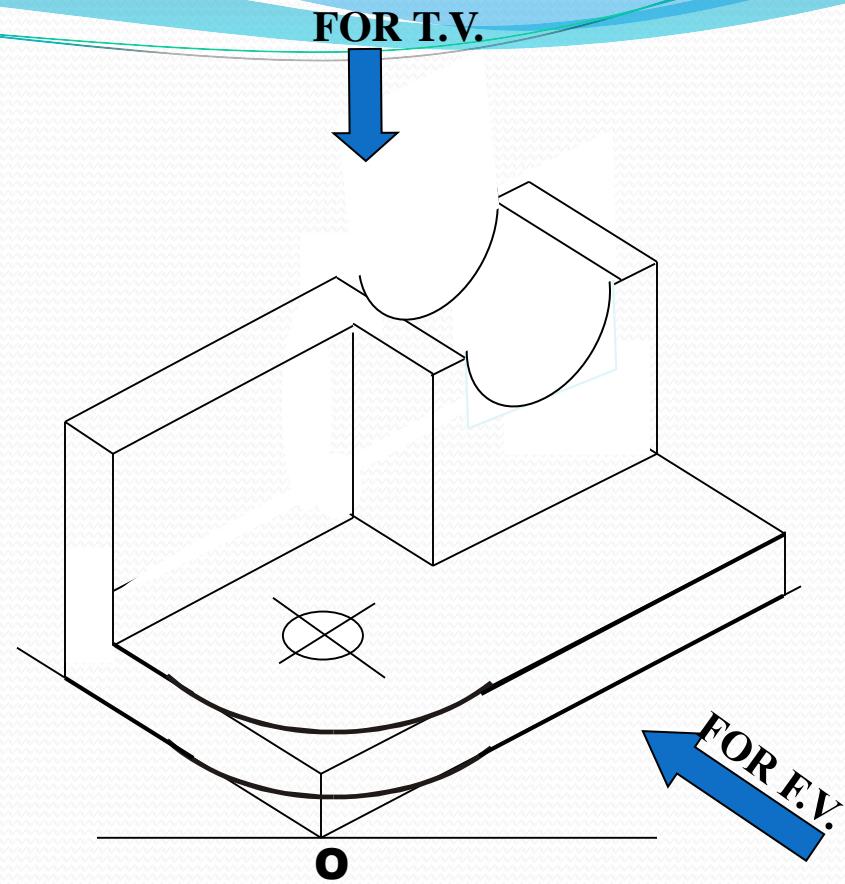
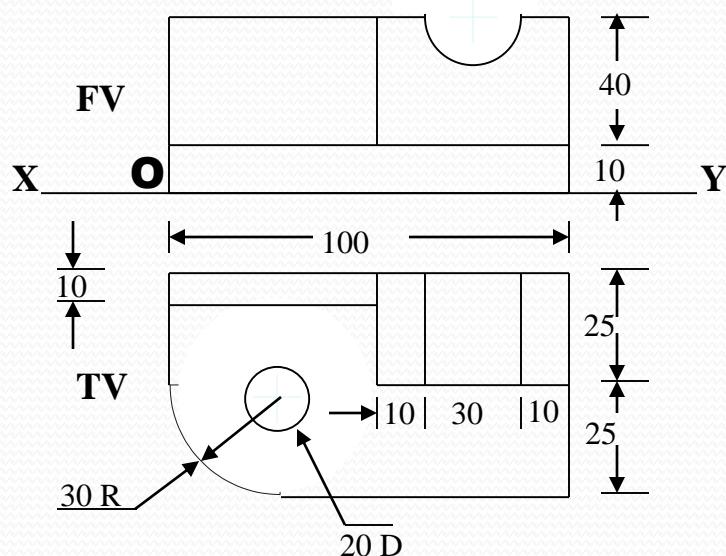


TV

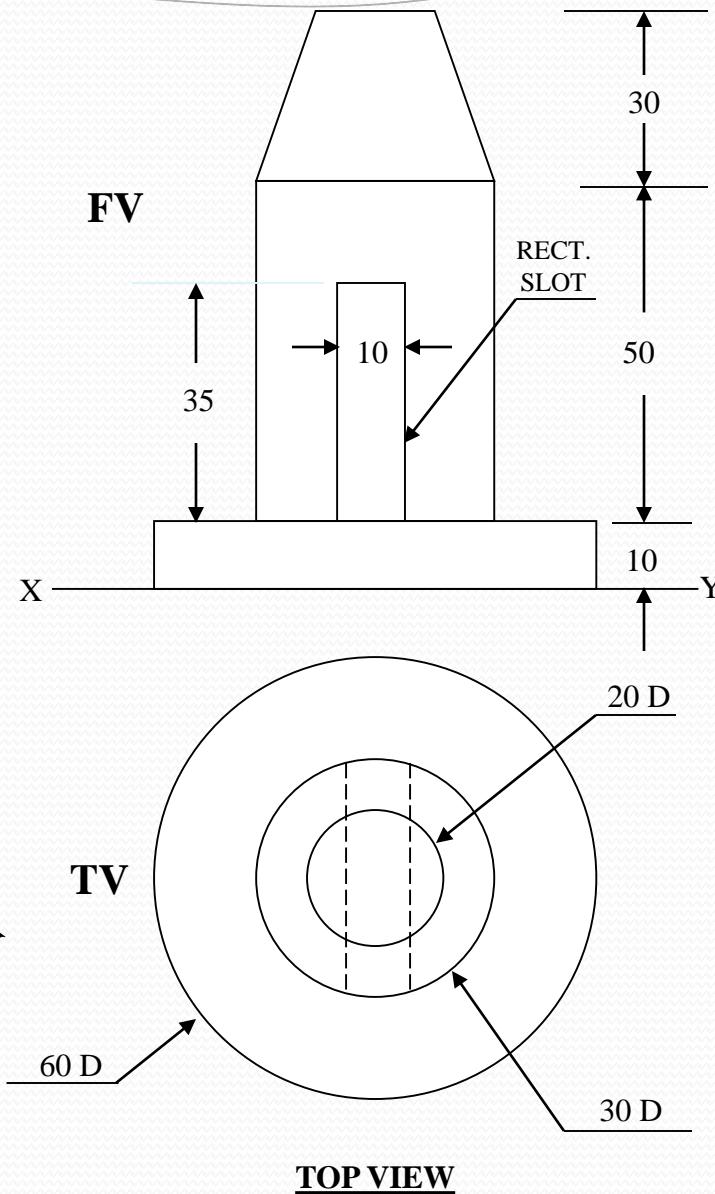
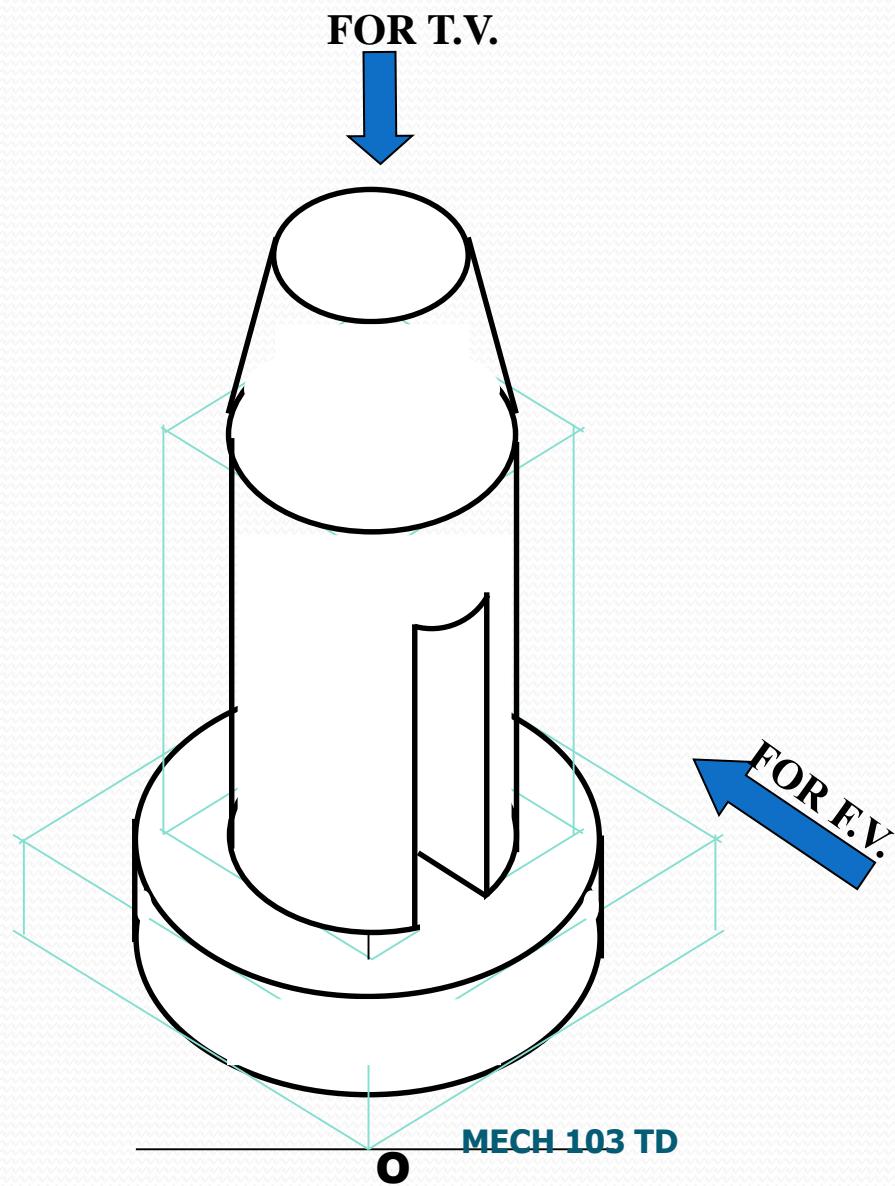
FOR F.V.

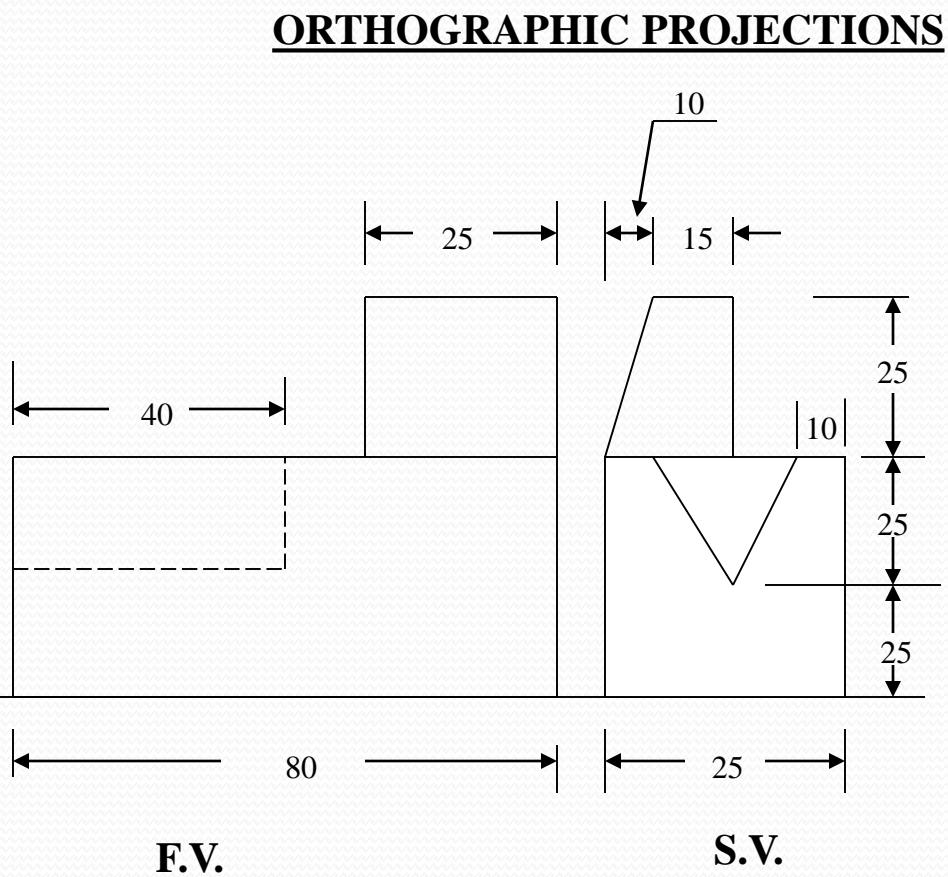
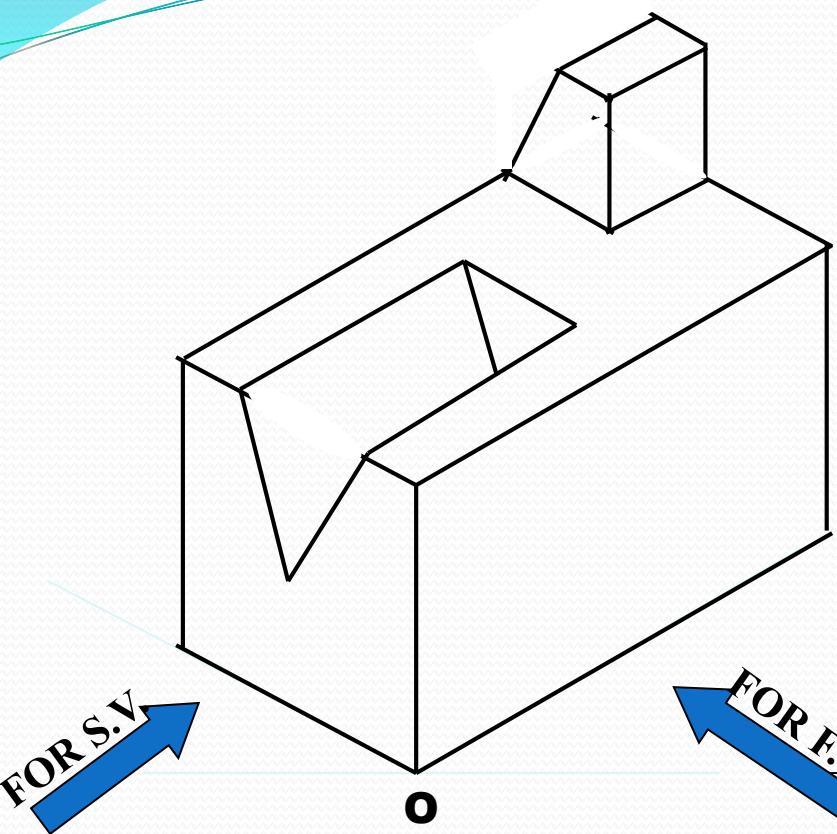


ORTHOGRAPHIC PROJECTIONS

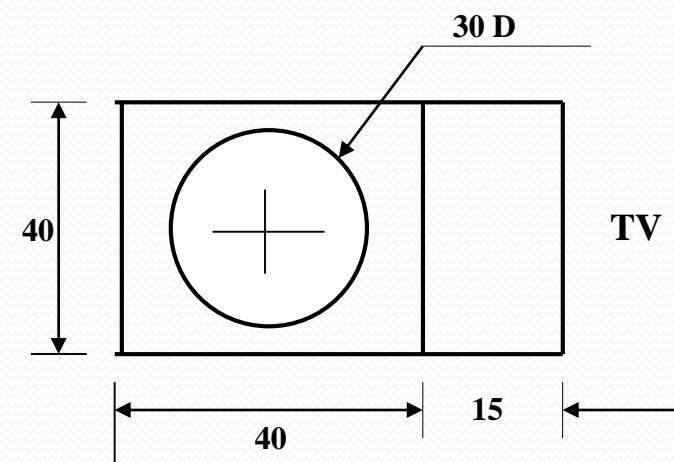
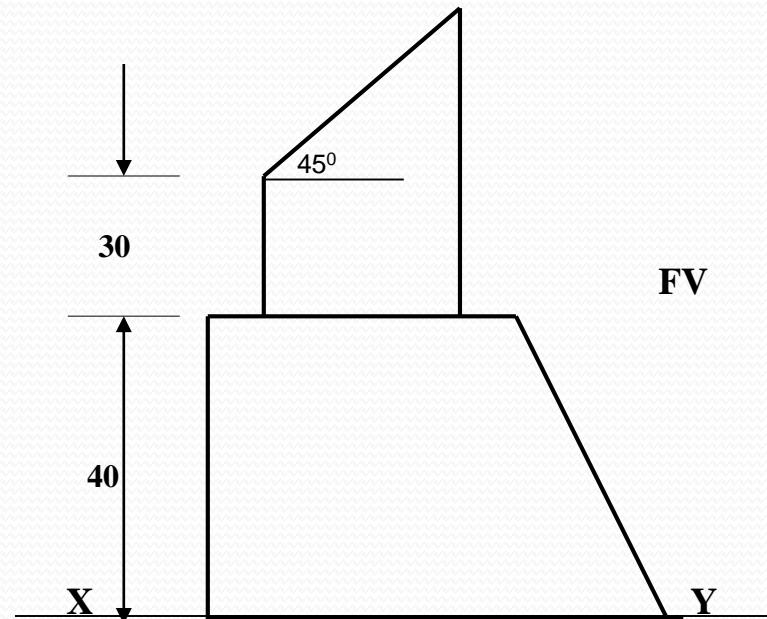
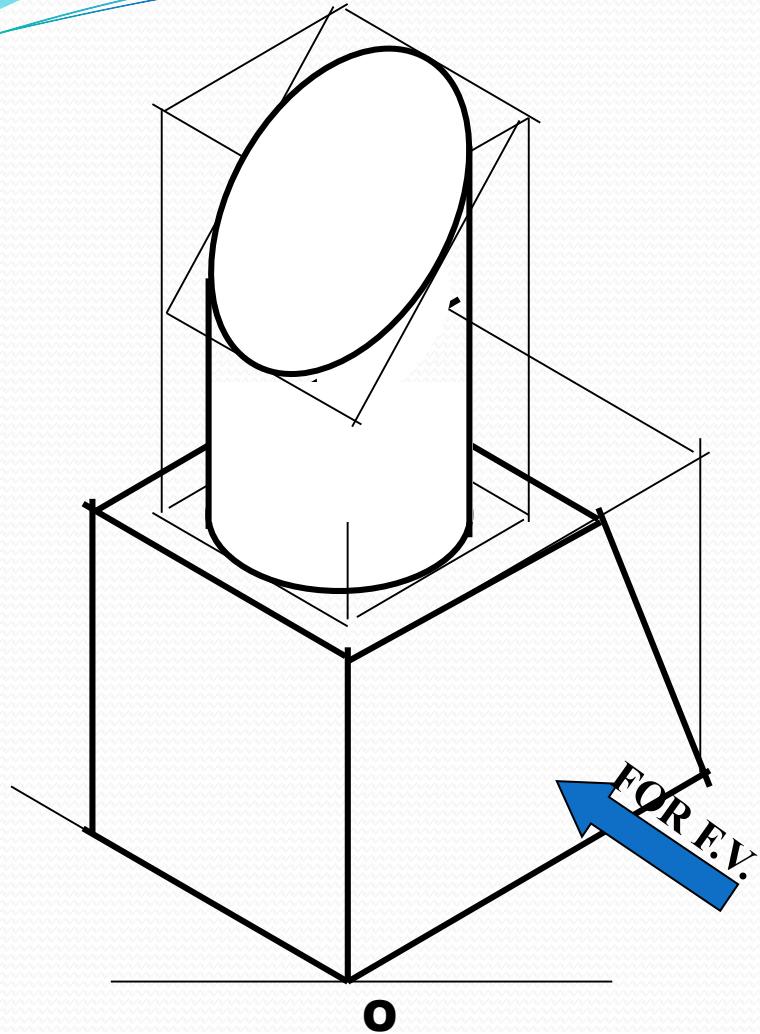


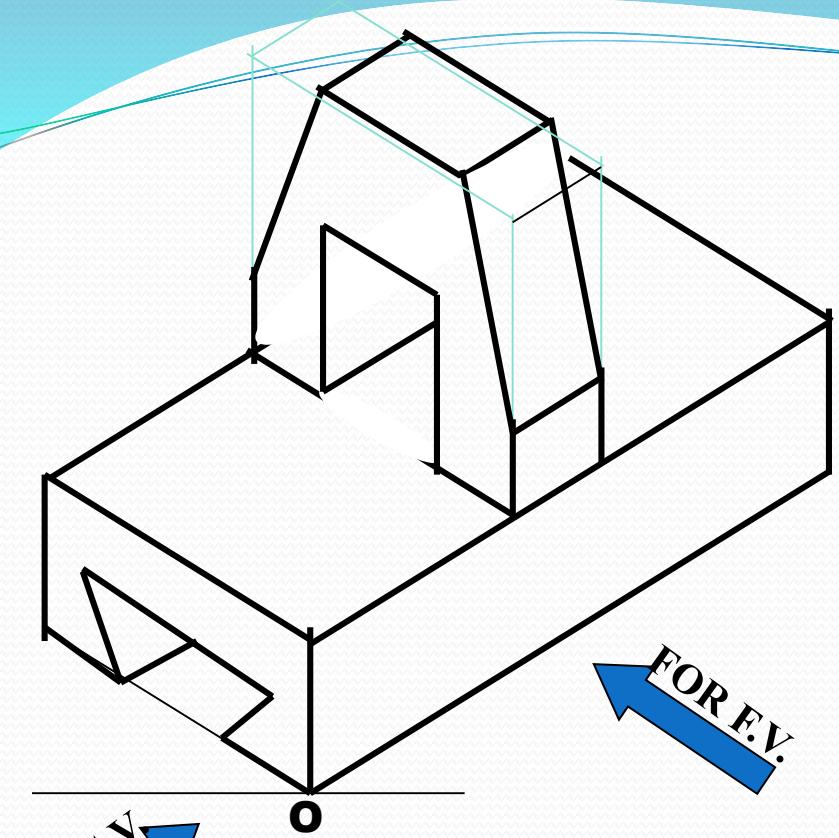
ORTHOGRAPHIC PROJECTIONS



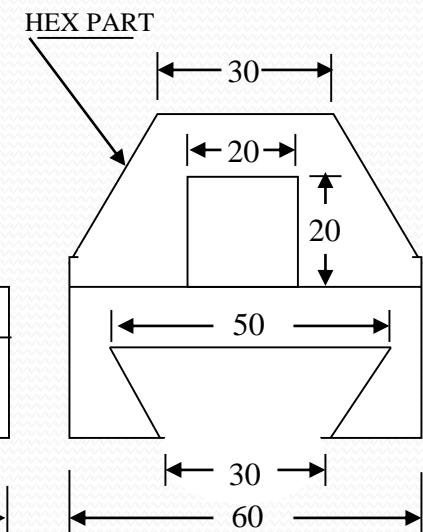
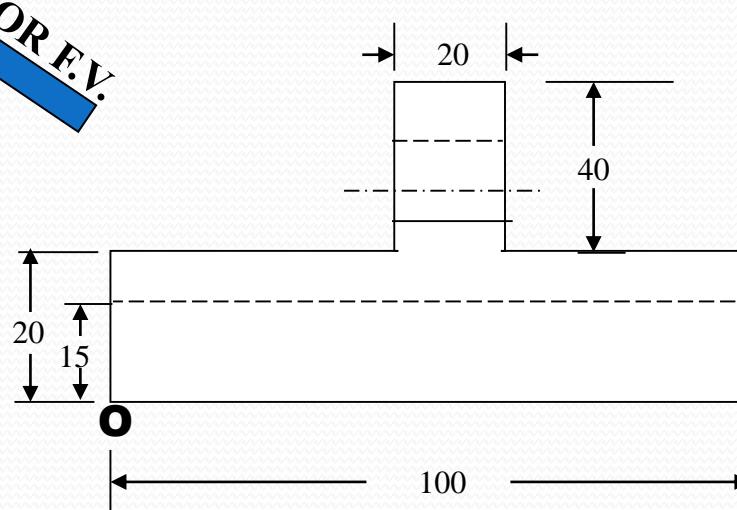


ORTHOGRAPHIC PROJECTIONS

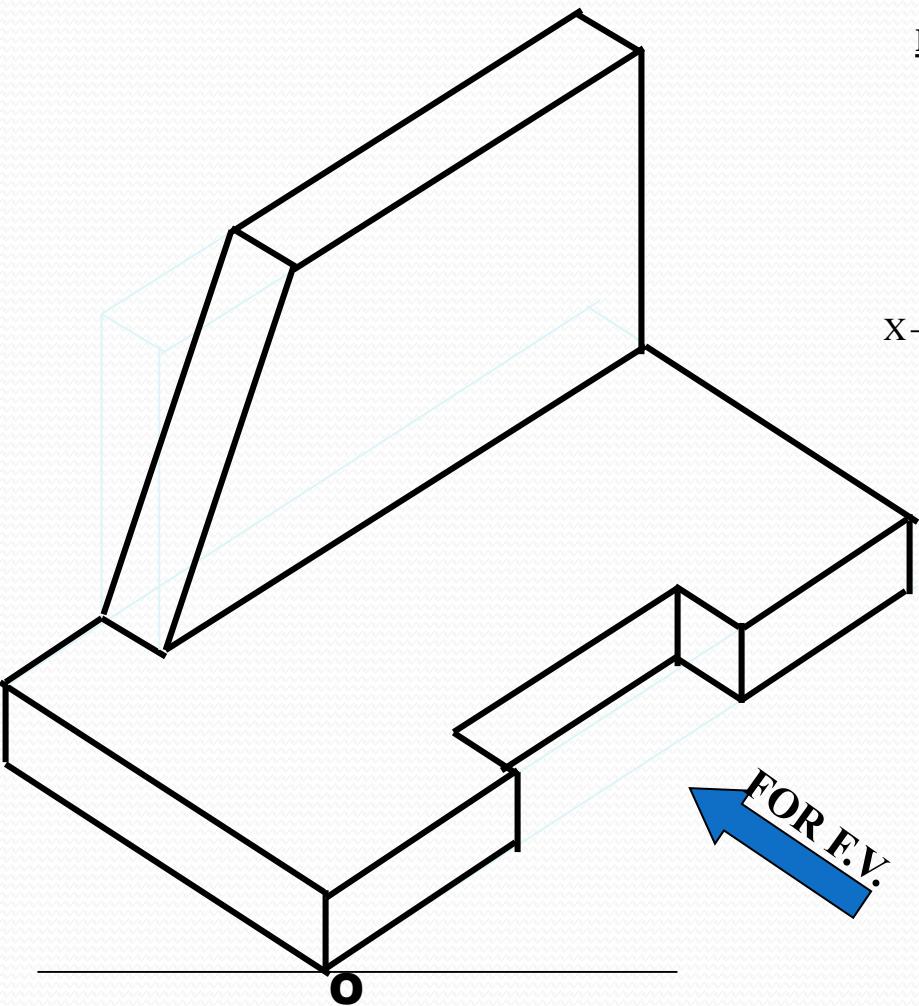




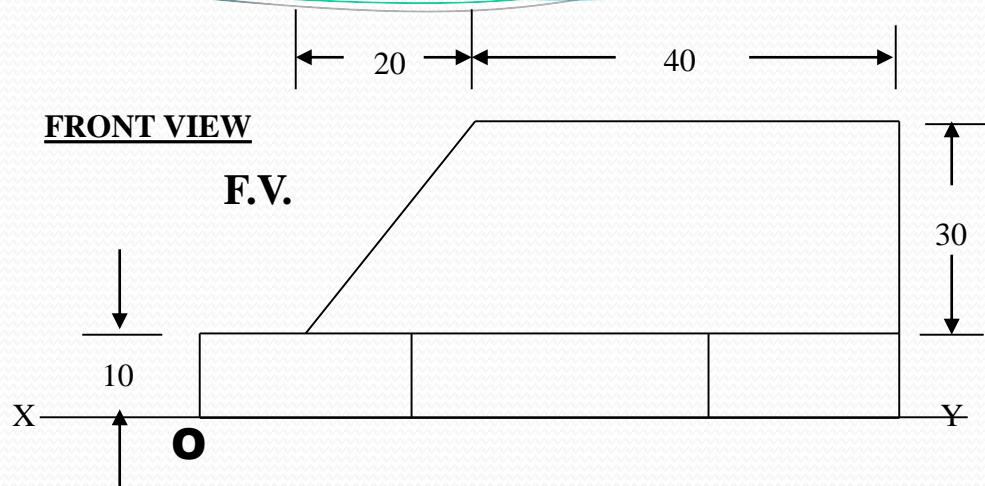
ORTHOGRAPHIC PROJECTIONS



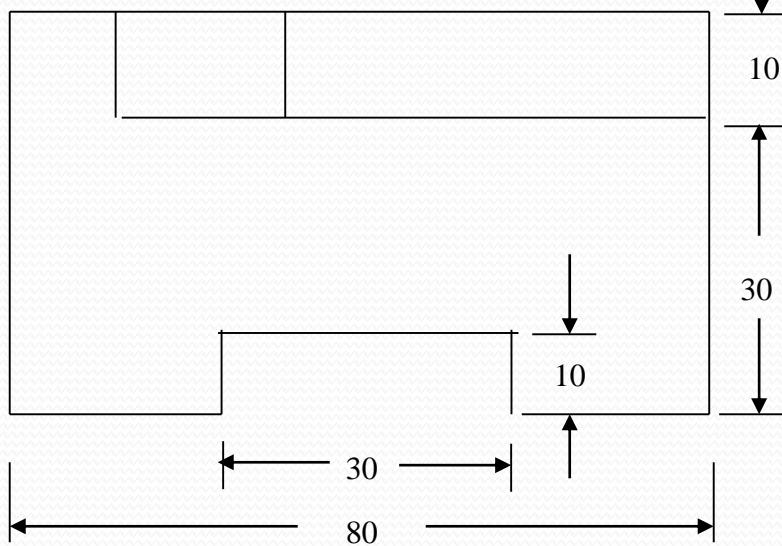
FOR T.V.



FRONT VIEW

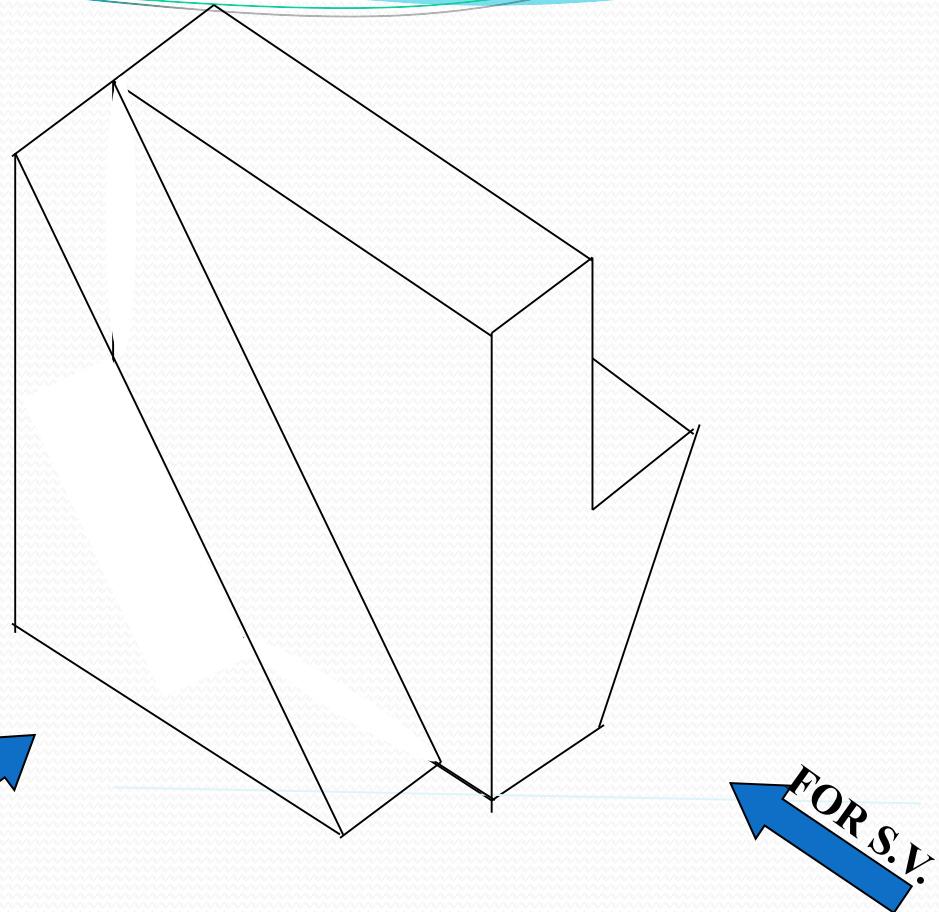
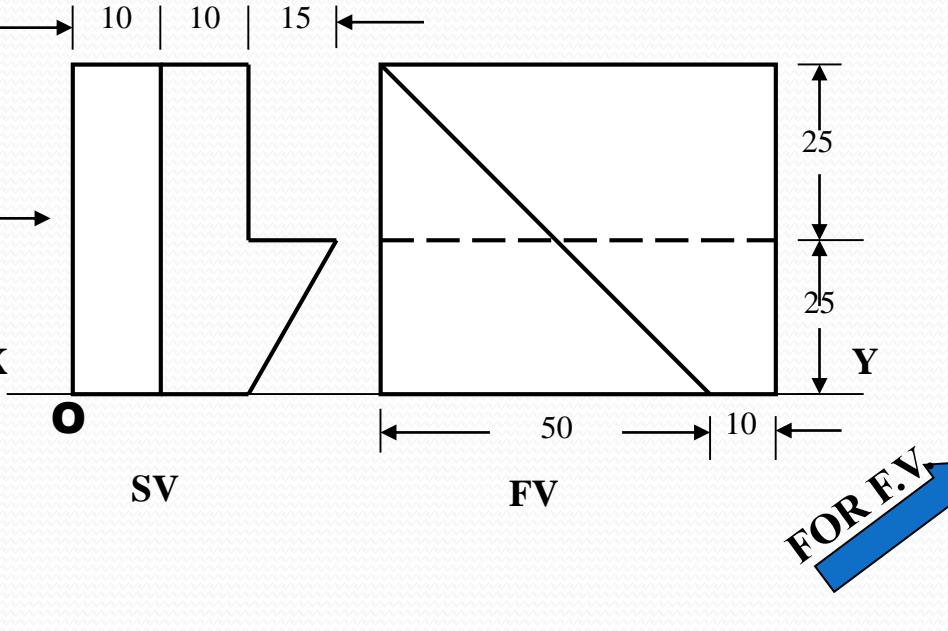


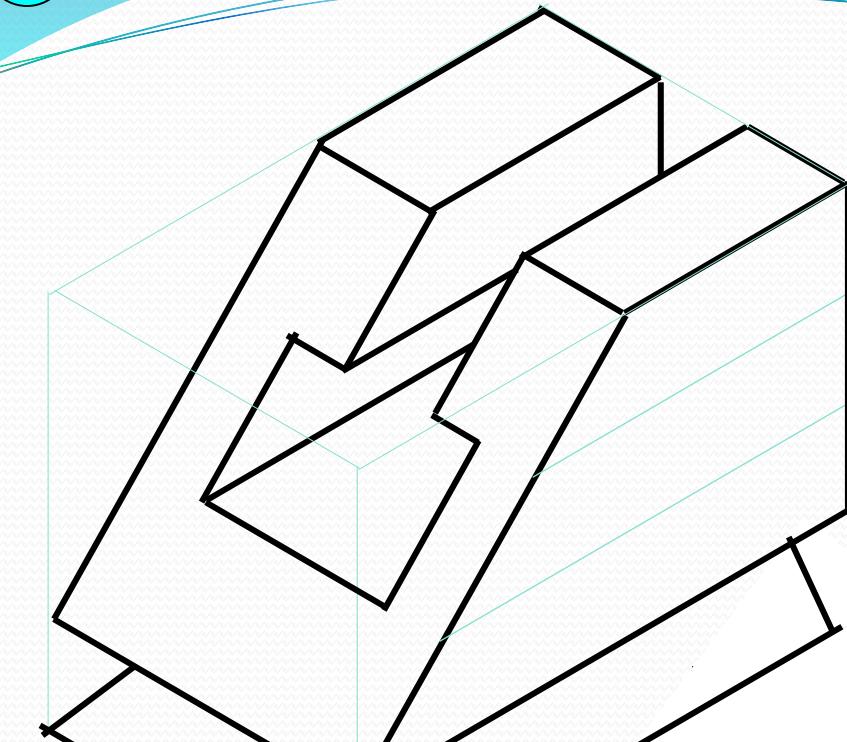
F.V.



T.V. TOP VIEW

ORTHOGRAPHIC PROJECTIONS

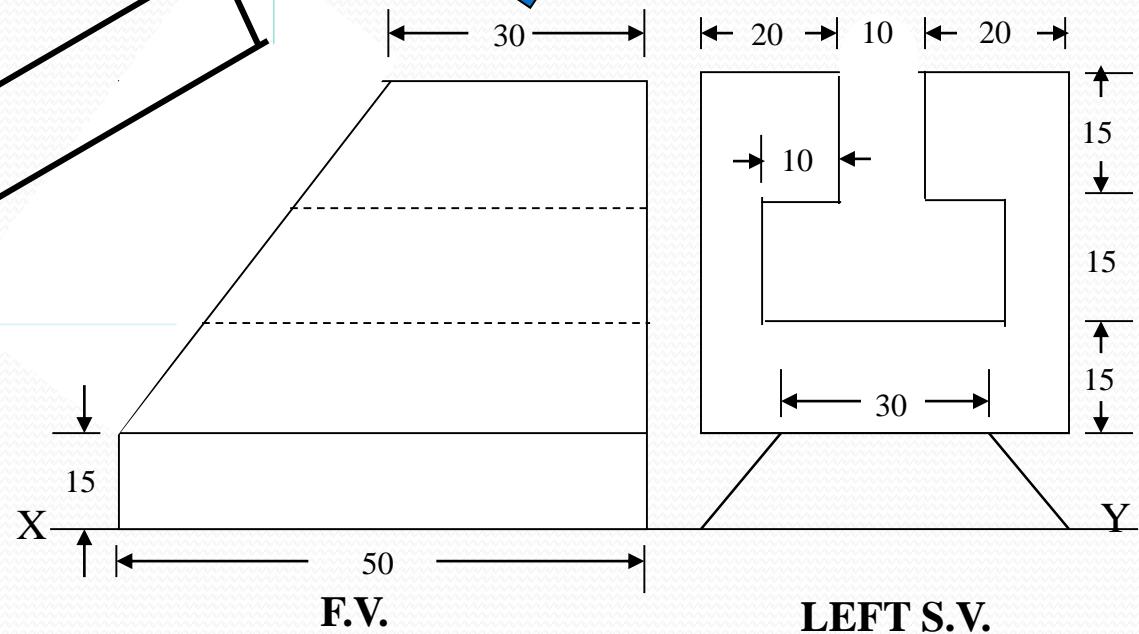




FOR S.V.

ORTHOGRAPHIC PROJECTIONS

FOR F.V.



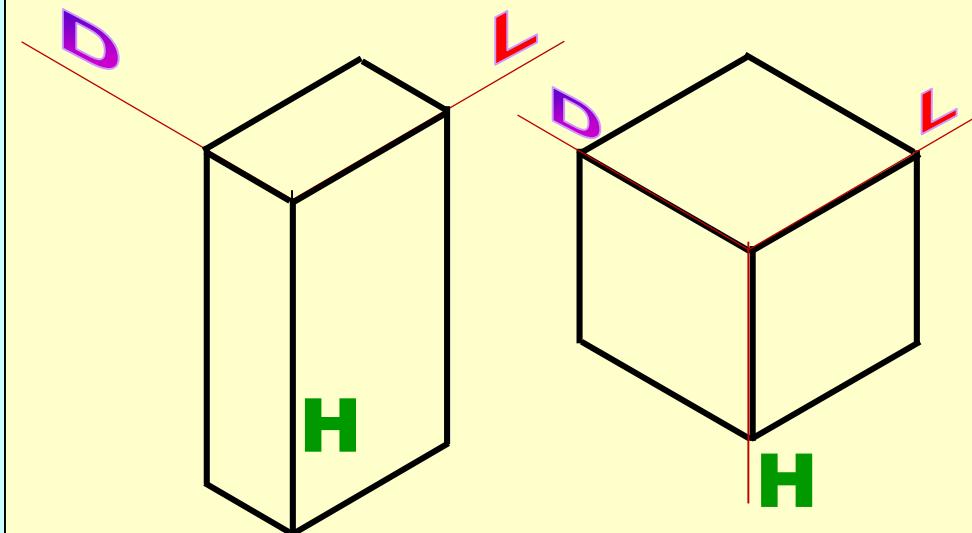
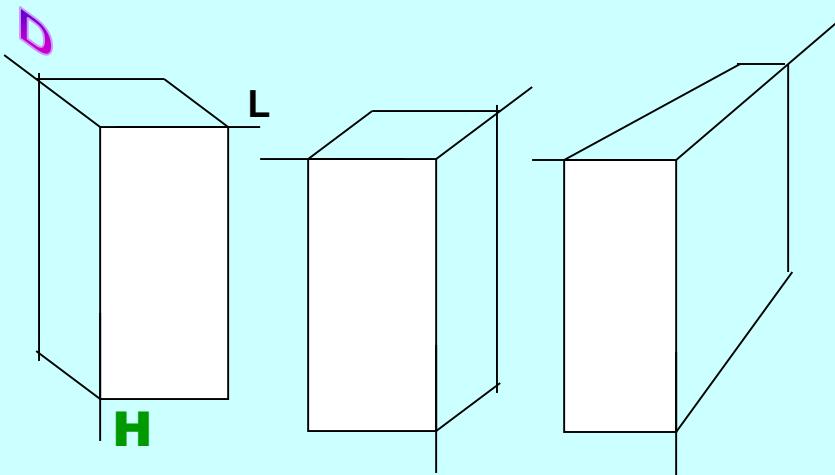
ISOMETRIC PROJECTIONS

**A TYPE OF PICTORIAL PROJECTION
IN WHICH ALL THREE DIMENSIONS OF
AN OBJECT ARE SHOWN IN ONE VIEW**

ISOMETRIC DRAWING

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

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

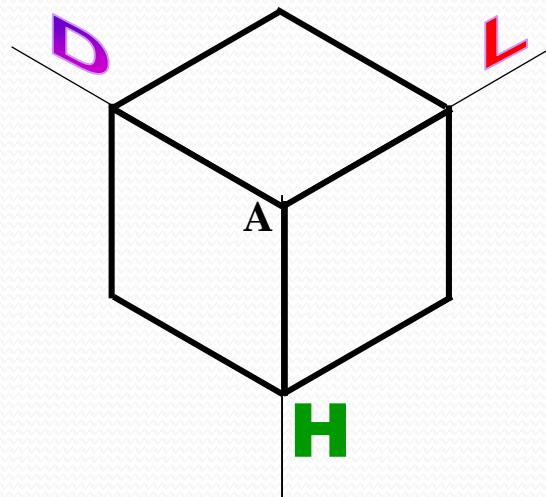


ISOMETRIC AXES, LINES AND PLANES

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 the cube as well as other planes parallel to these planes are called **Isometric Planes**.



SHAPE

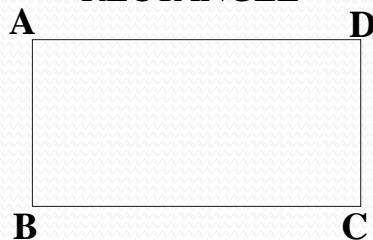
Isometric view

F.V.

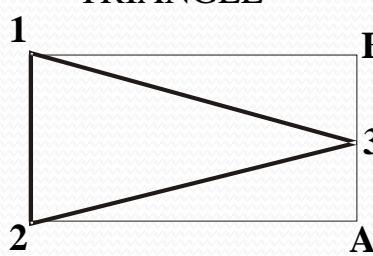
or

T.V.

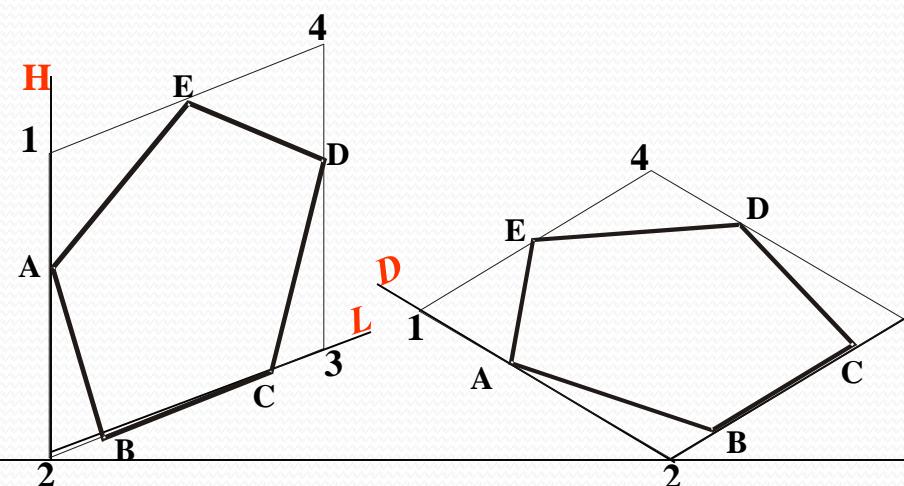
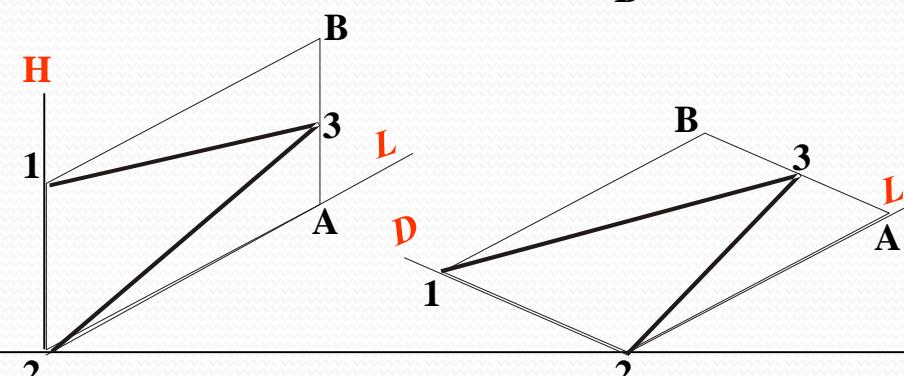
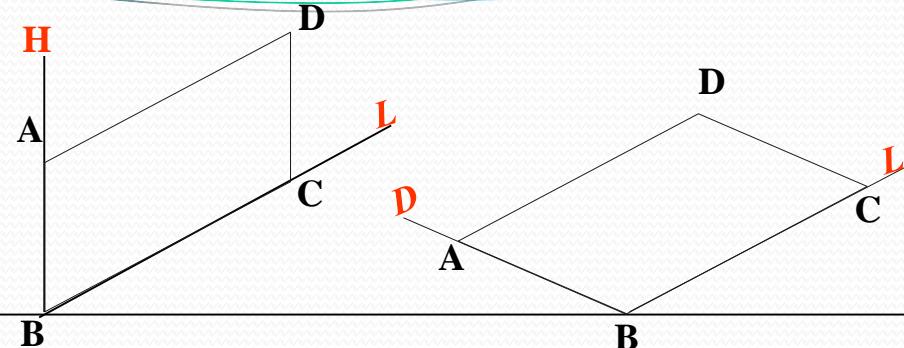
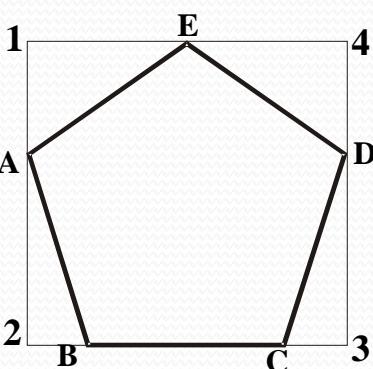
RECTANGLE



TRIANGLE



PENTAGON



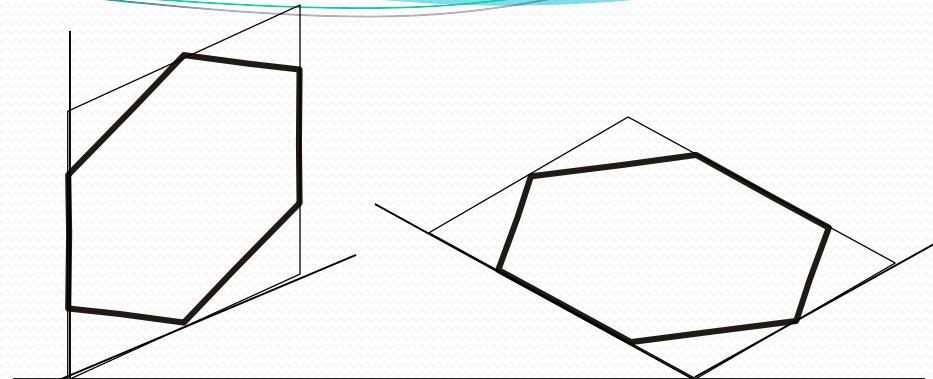
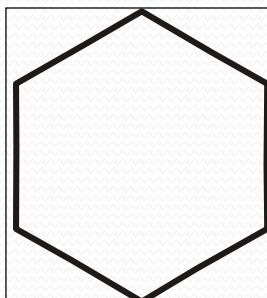
ISOMETRIC OF PLANE FIGURES

SHAPE

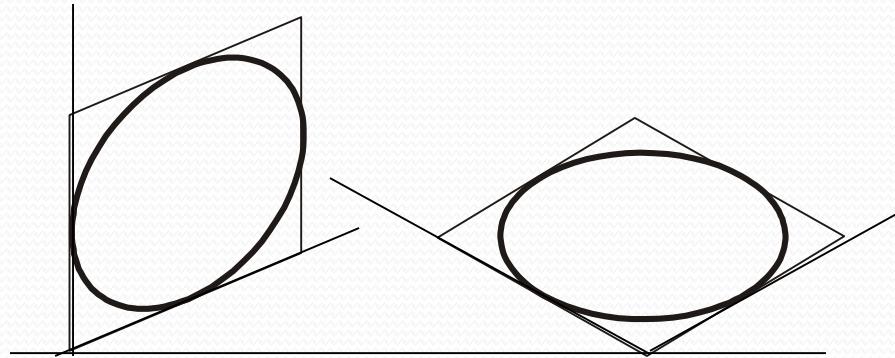
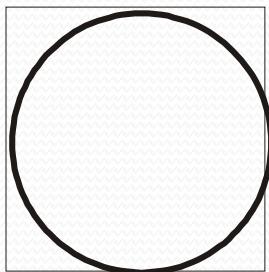
F.V.

T.V.

HEXAGON

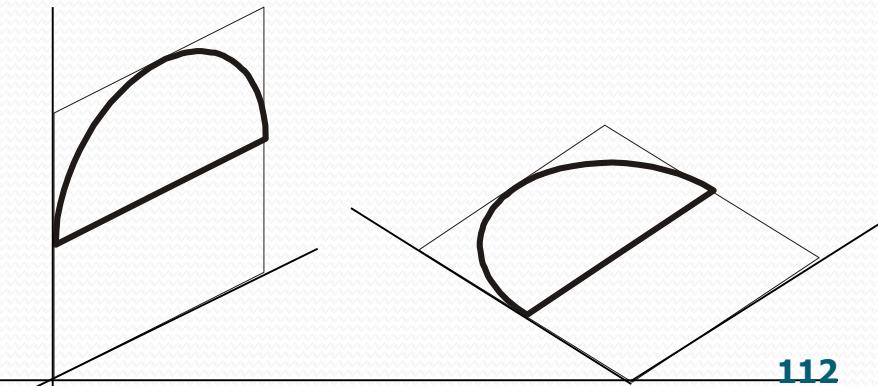
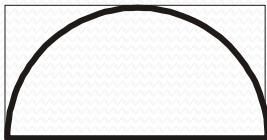


CIRCLE

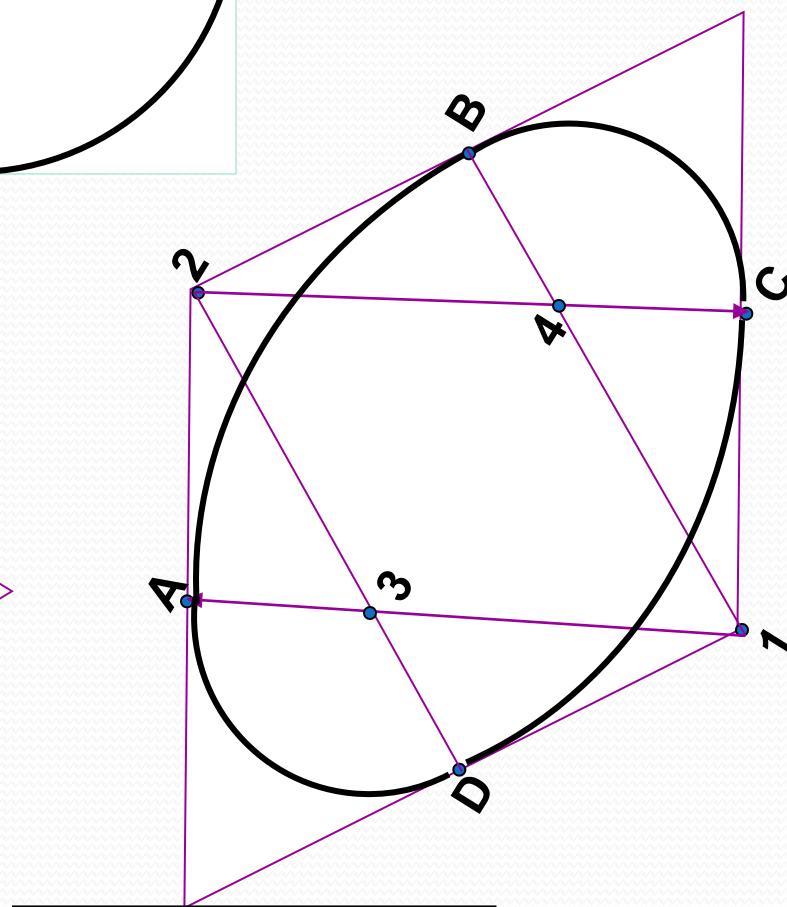
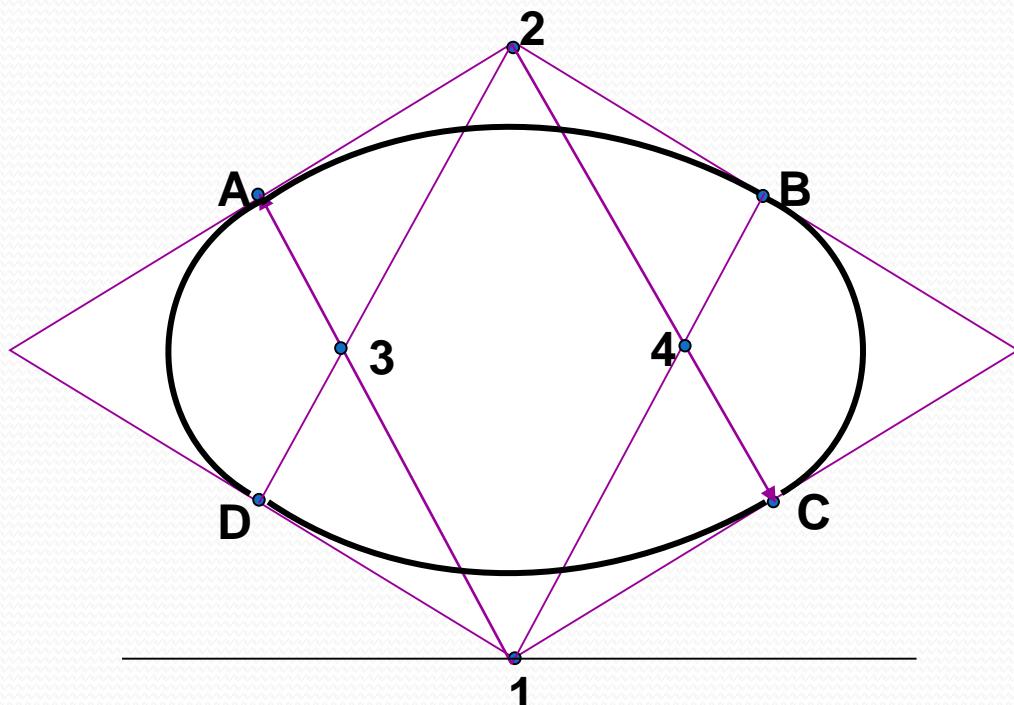
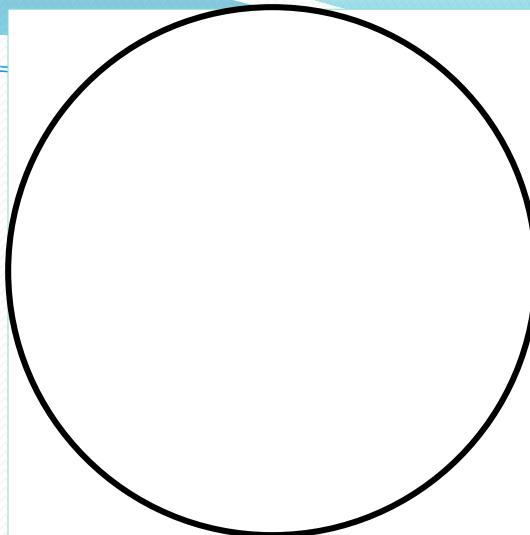


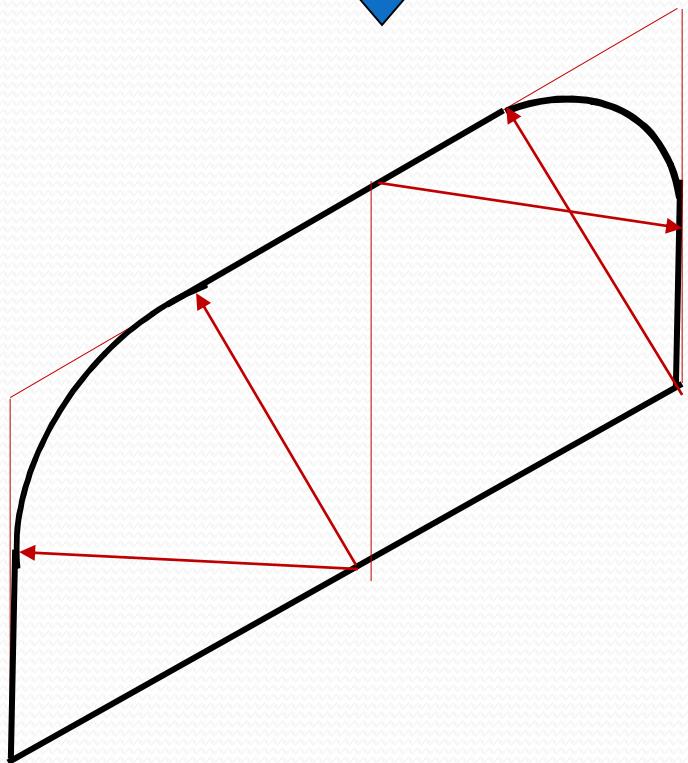
For Isometric of Circle/Semicircle use Rhombus method. Construct Rhombus of sides equal to Diameter of circle always. (Ref. topic ENGG. CURVES.)

SEMI CIRCLE

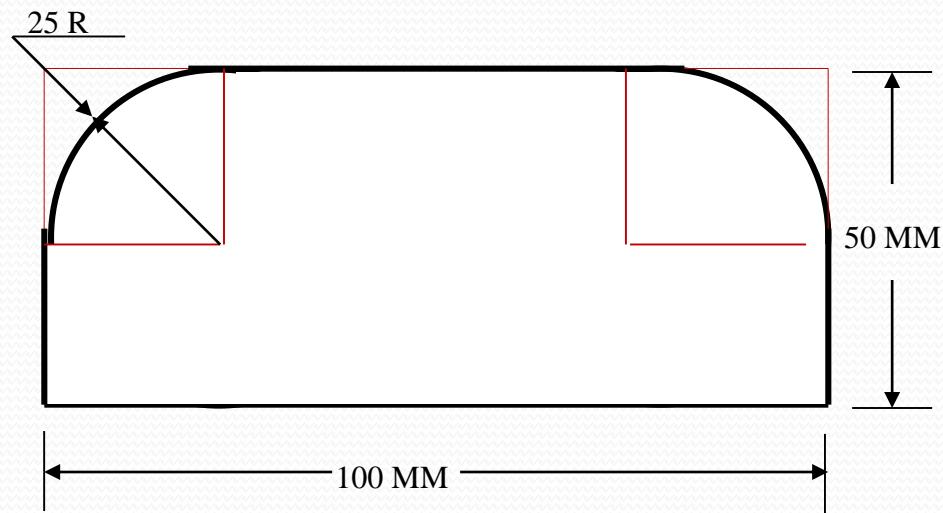


DRAW ISOMETRIC VIEW OF A CIRCLE IF IT IS A TV OR FV.

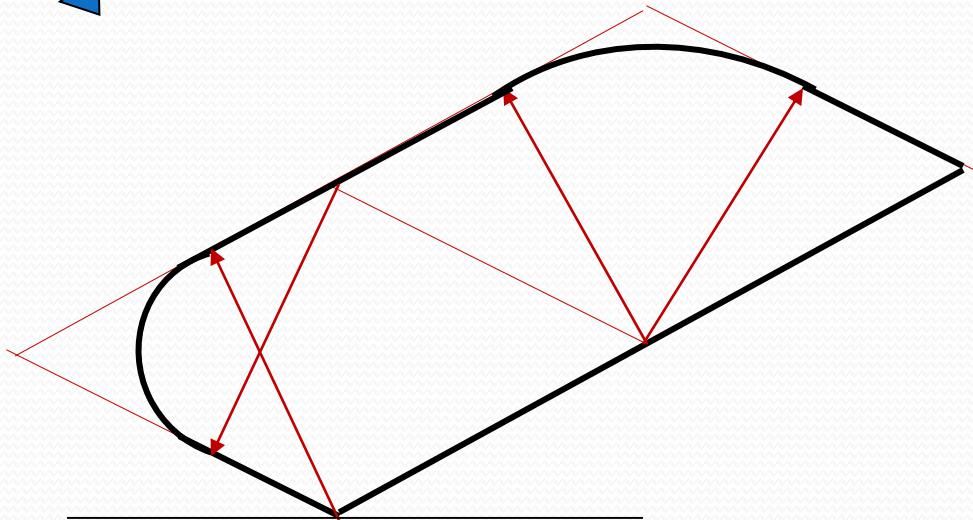




IF FRONT VIEW



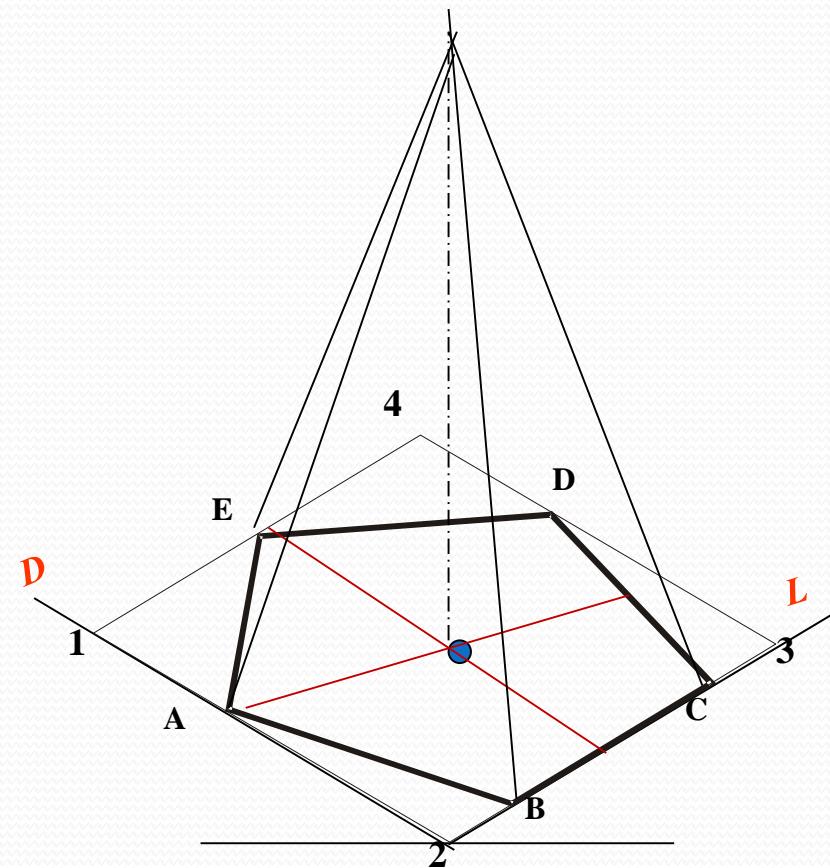
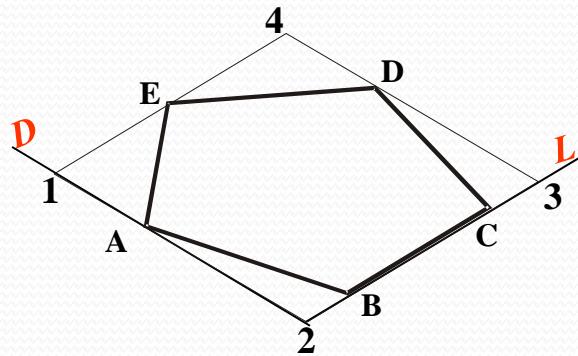
IF TOP VIEW

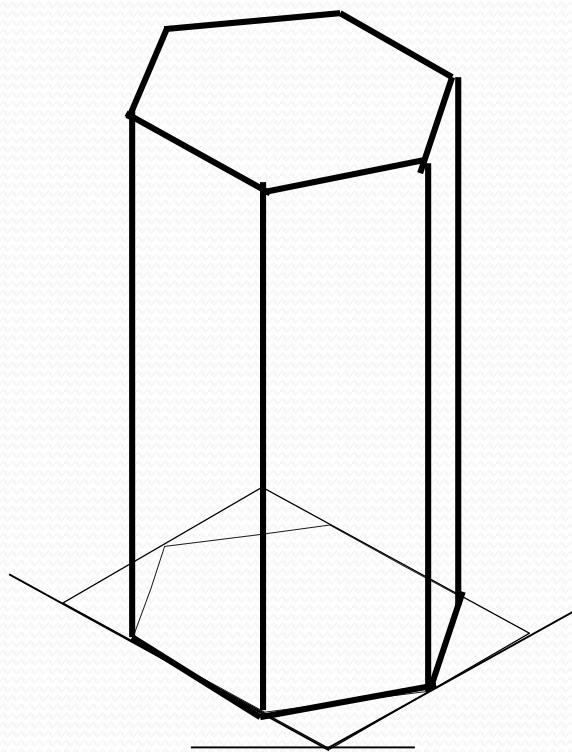


**ISOMETRIC VIEW OF
PENTAGONAL PYRAMID
STANDING ON H.P.**

(Height is added from center of pentagon)

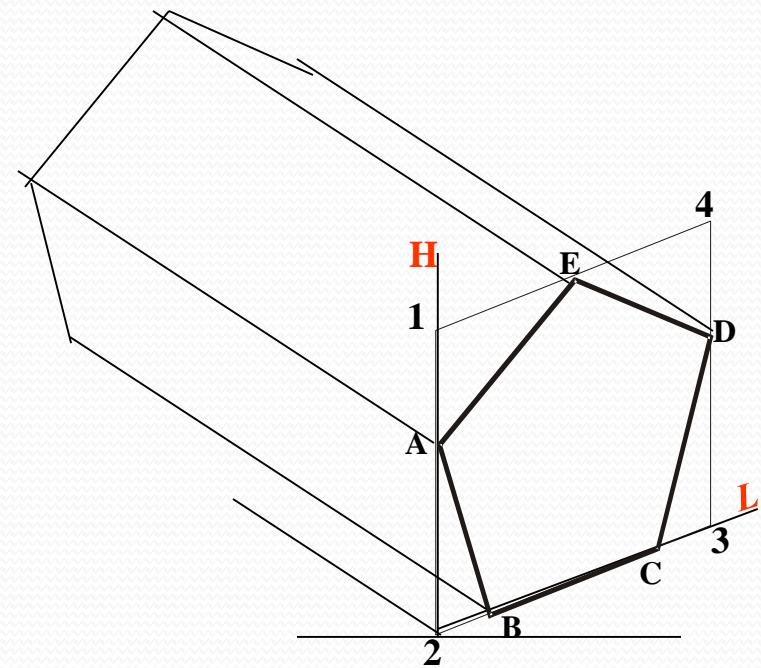
**ISOMETRIC VIEW OF BASE OF
PENTAGONAL PYRAMID
STANDING ON H.P.**



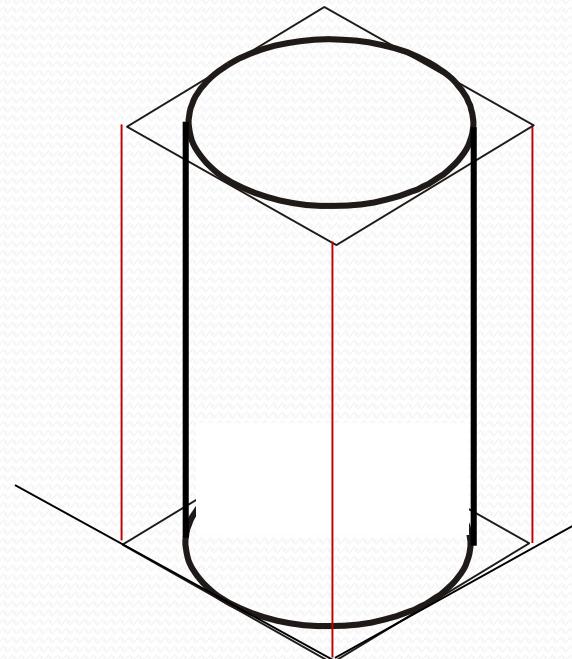
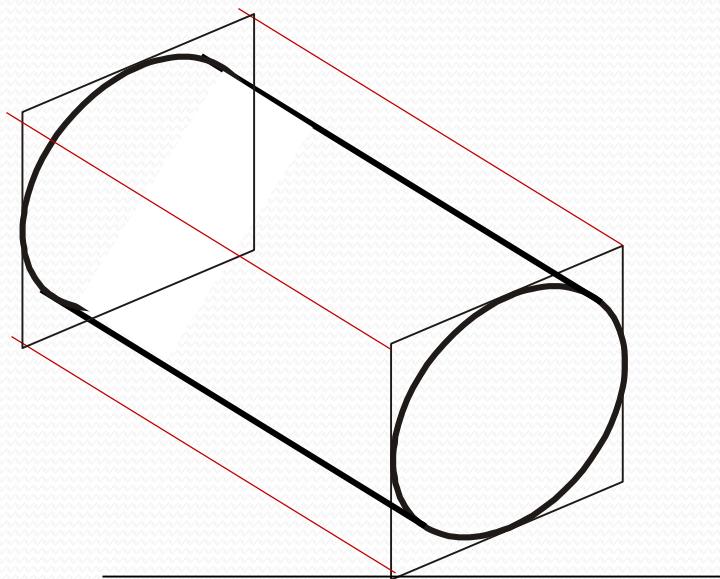


ISOMETRIC VIEW OF
HEXAGONAL PRISM
STANDING ON H.P.

**ISOMETRIC VIEW OF
PENTAGONAL PRISM
LYING ON H.P.**

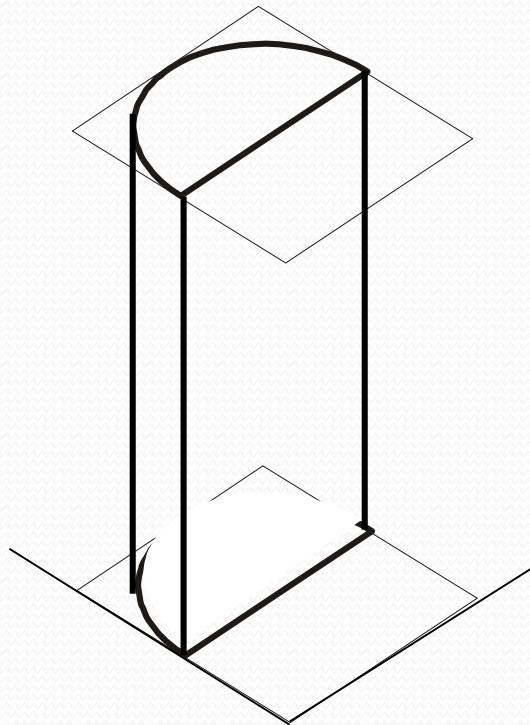
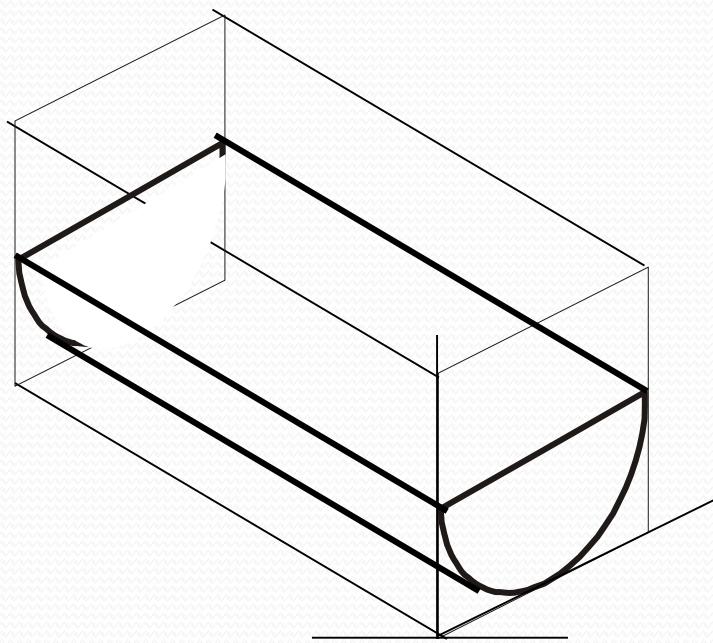


CYLINDER STANDING ON H.P.



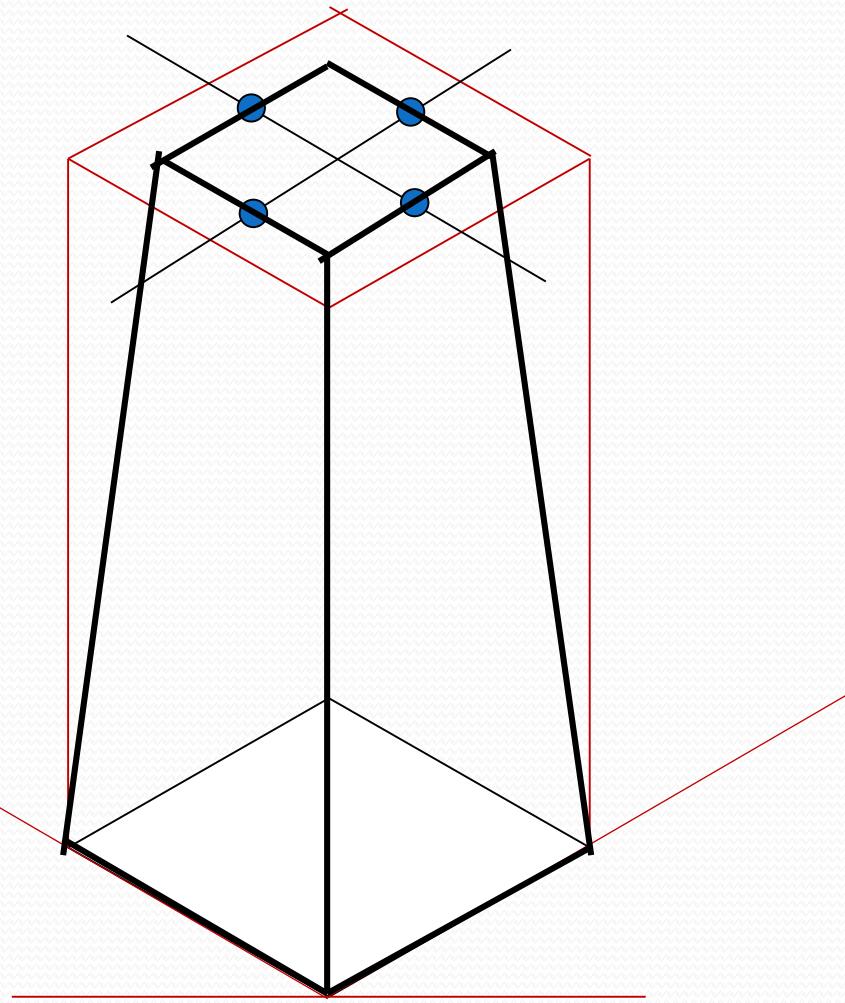
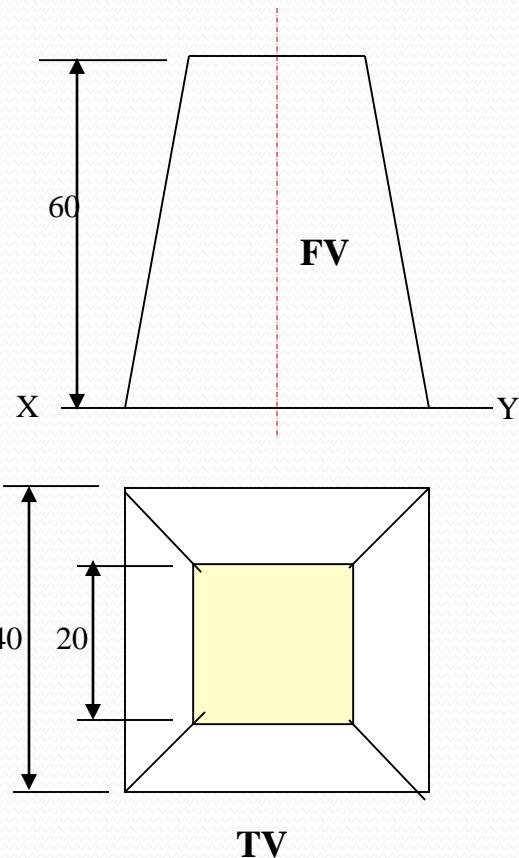
CYLINDER LYING ON H.P.

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

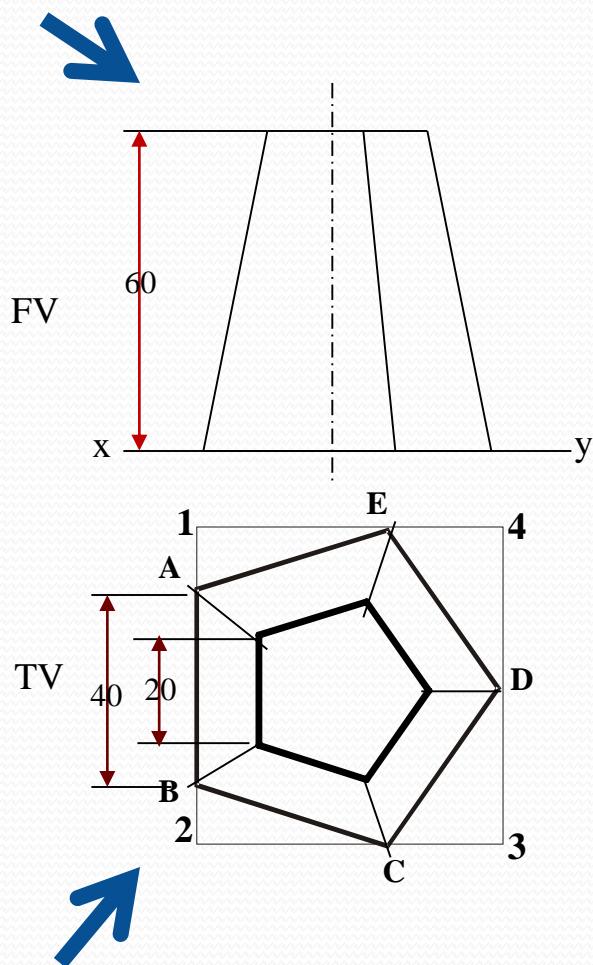


**HALF CYLINDER
LYING ON H.P.
(with flat face // to H.P.)**

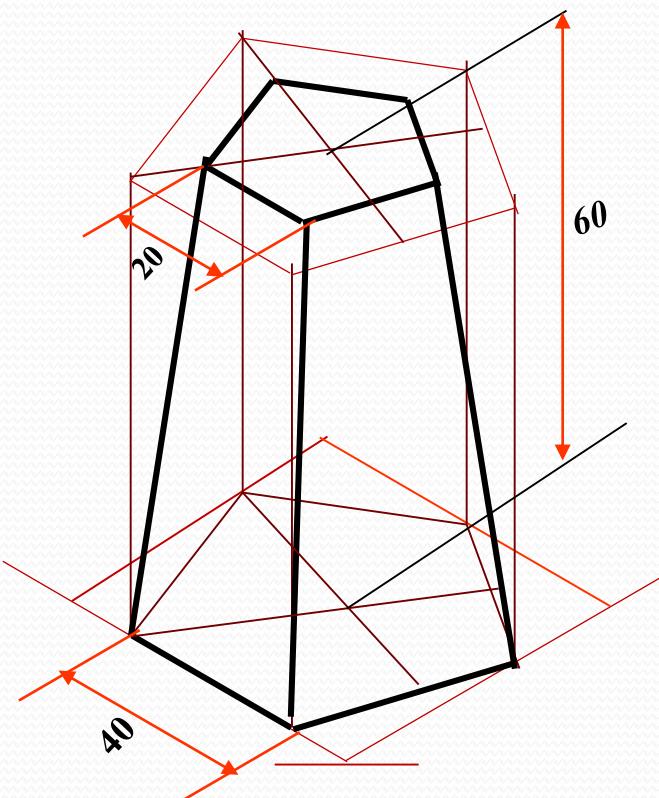
ISOMETRIC VIEW OF
A FRUSTOM OF SQUARE PYRAMID
STANDING ON H.P. ON IT'S LARGER BASE.



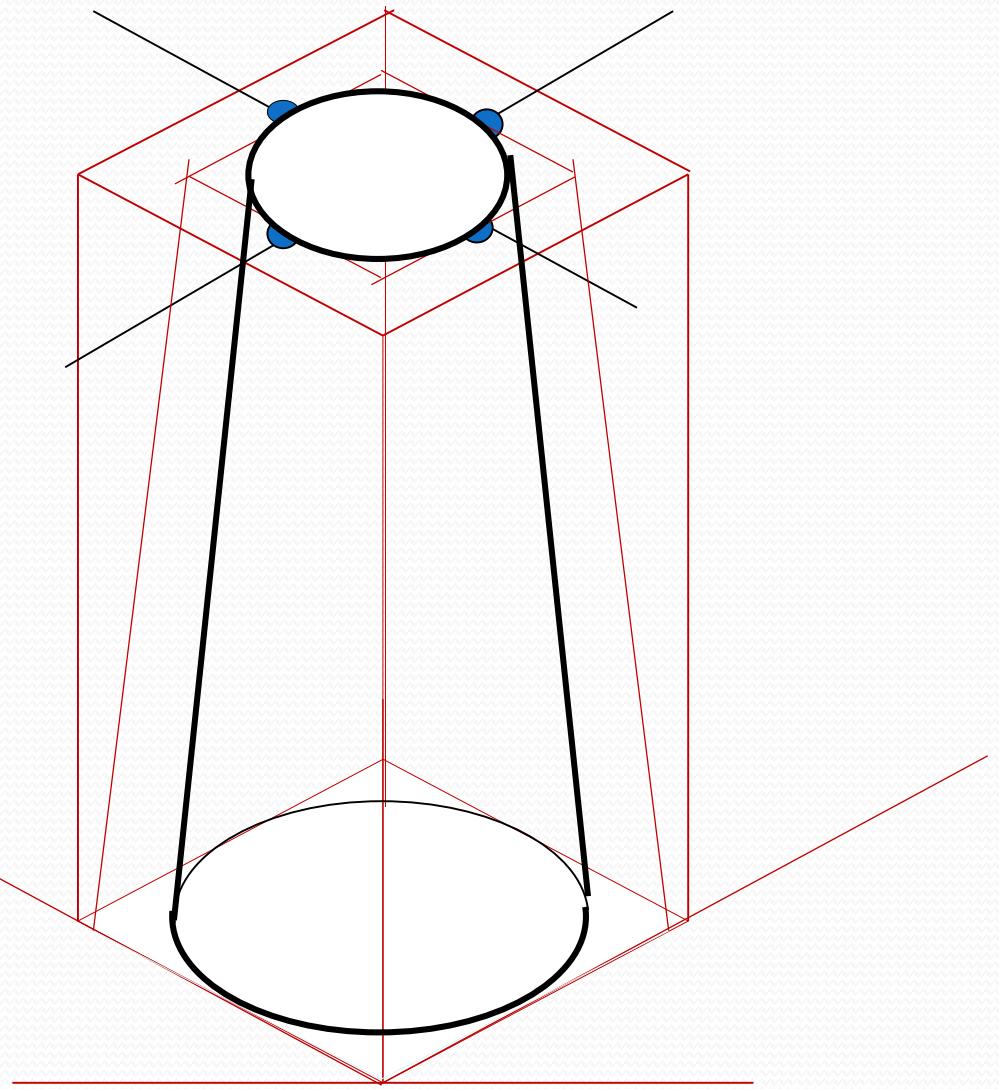
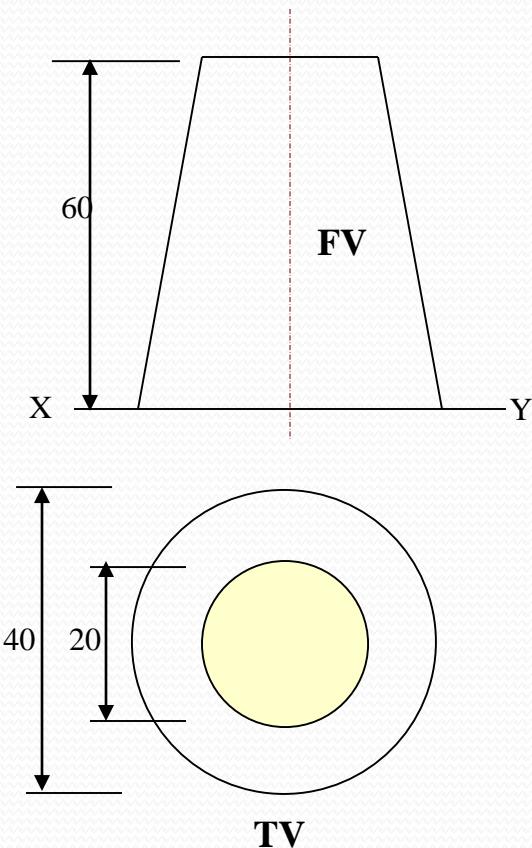
**PROJECTIONS OF FRUSTOM OF PENTAGONAL PYRAMID ARE GIVEN.
DRAW IT'S ISOMETRIC VIEW.**



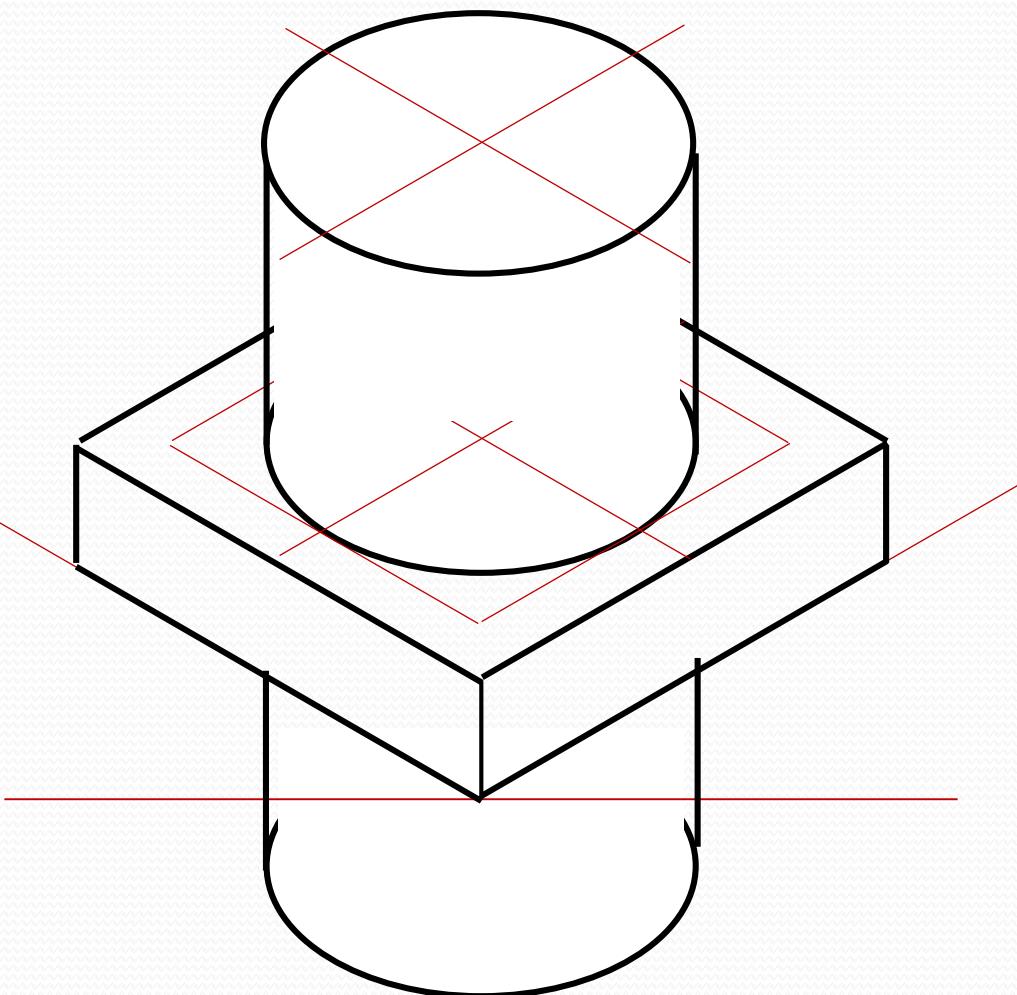
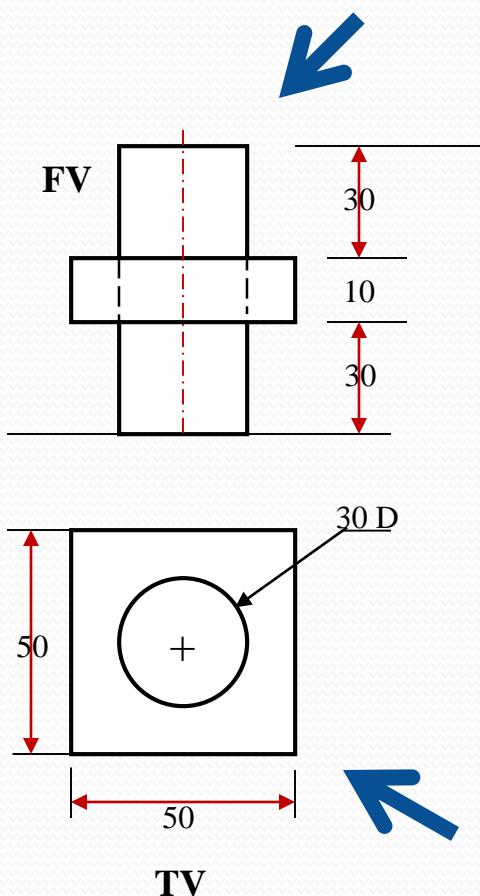
**ISOMETRIC VIEW
OF
FRUSTOM OF PENTAGONAL PYRAMID**

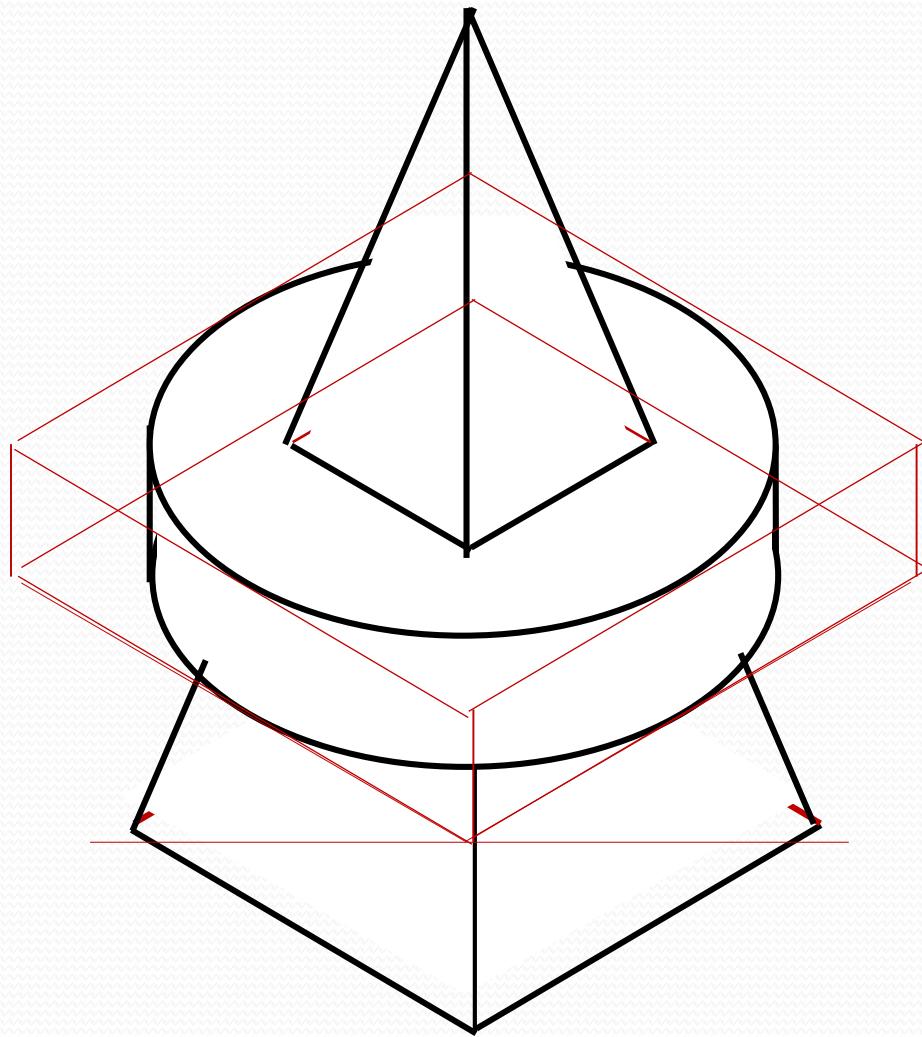
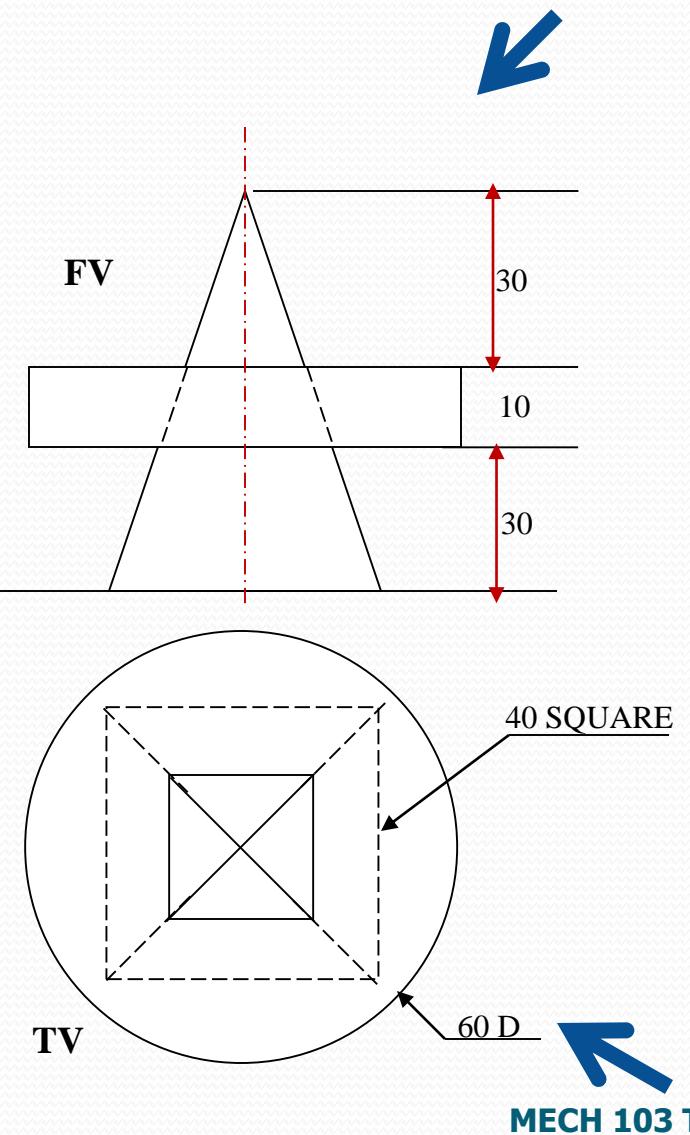


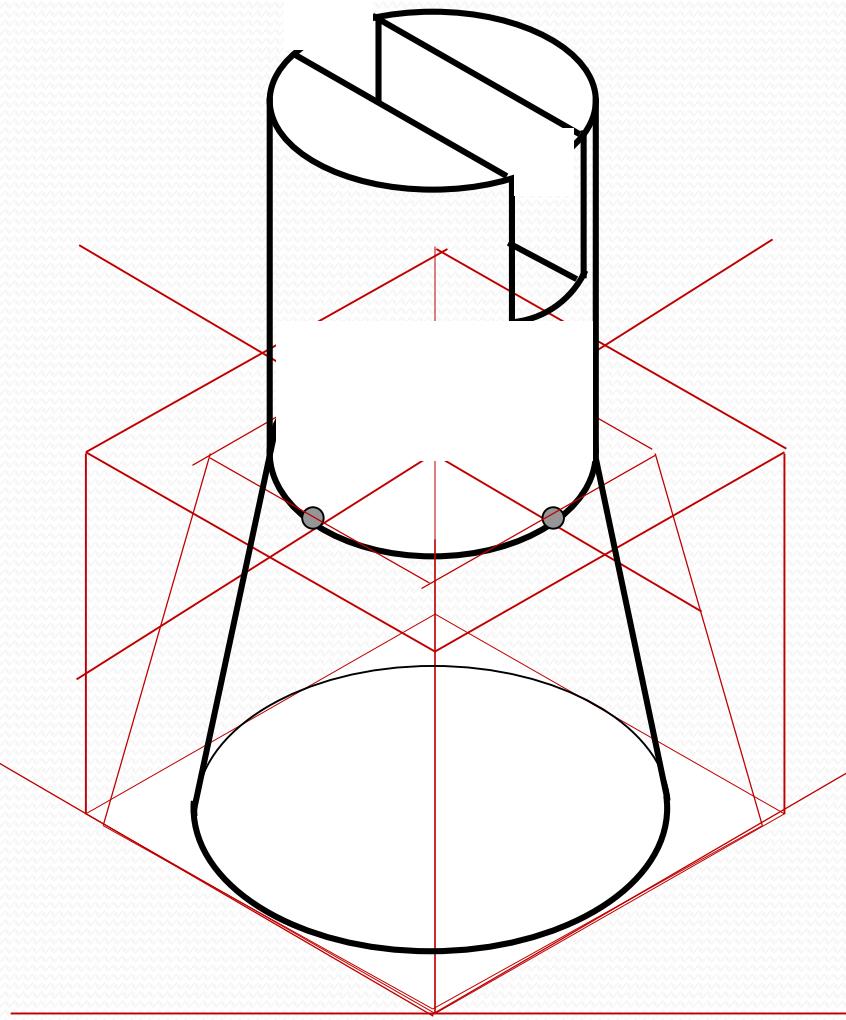
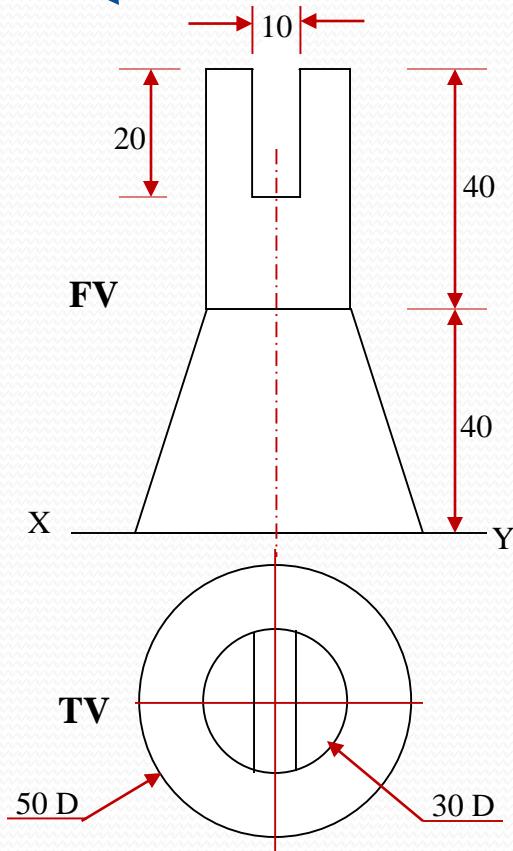
ISOMETRIC VIEW OF A TRUNCATED CONE



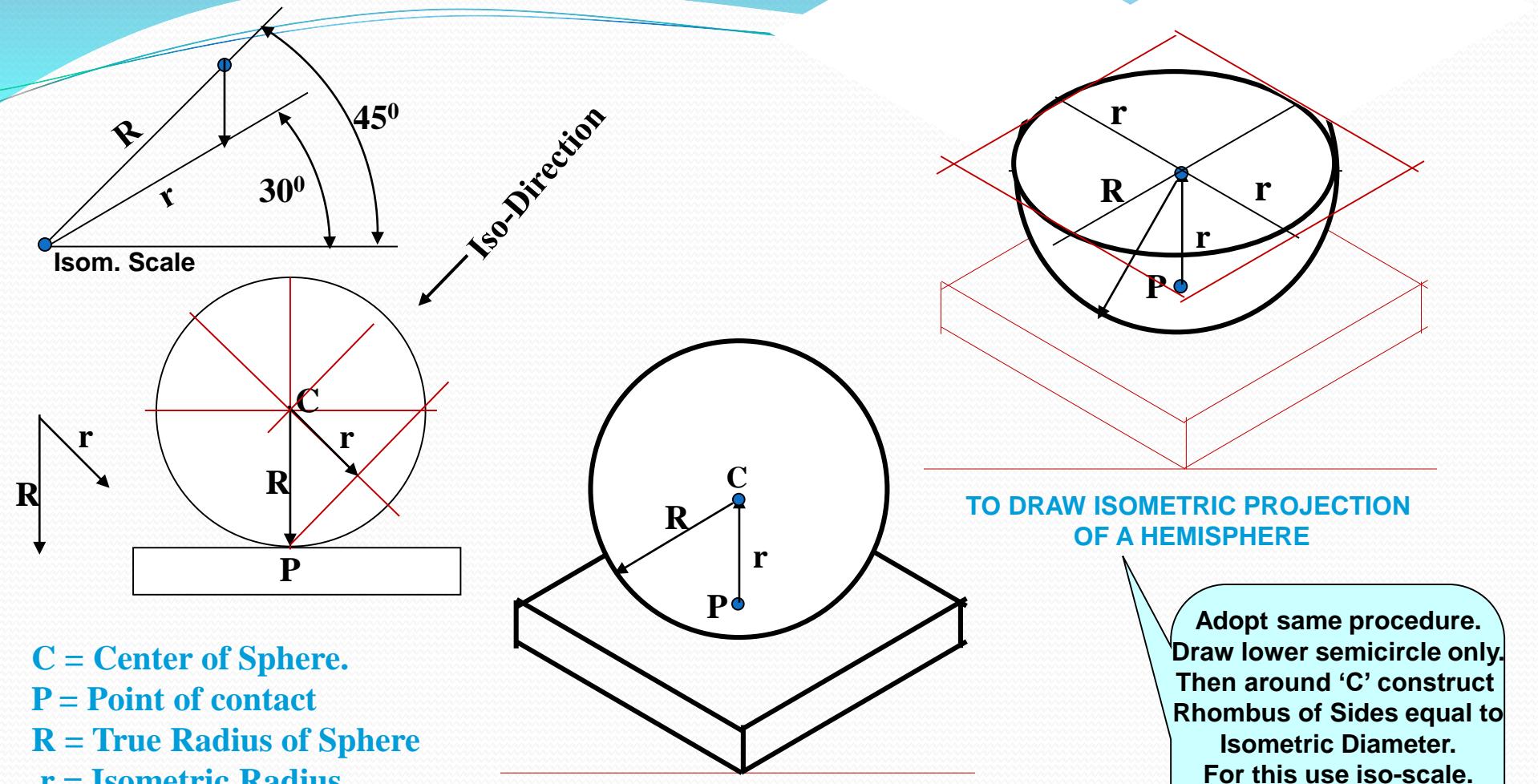
PROBLEM:
A SQUARE PLATE IS PIERCED THROUGH CENTRALLY
BY A CYLINDER WHICH COMES OUT EQUALLY FROM BOTH FACES
OF PLATE. IT'S FV & TV ARE SHOWN. DRAW ISOMETRIC VIEW.







ISOMETRIC PROJECTIONS OF SPHERE & HEMISPHERE



C = Center of Sphere.

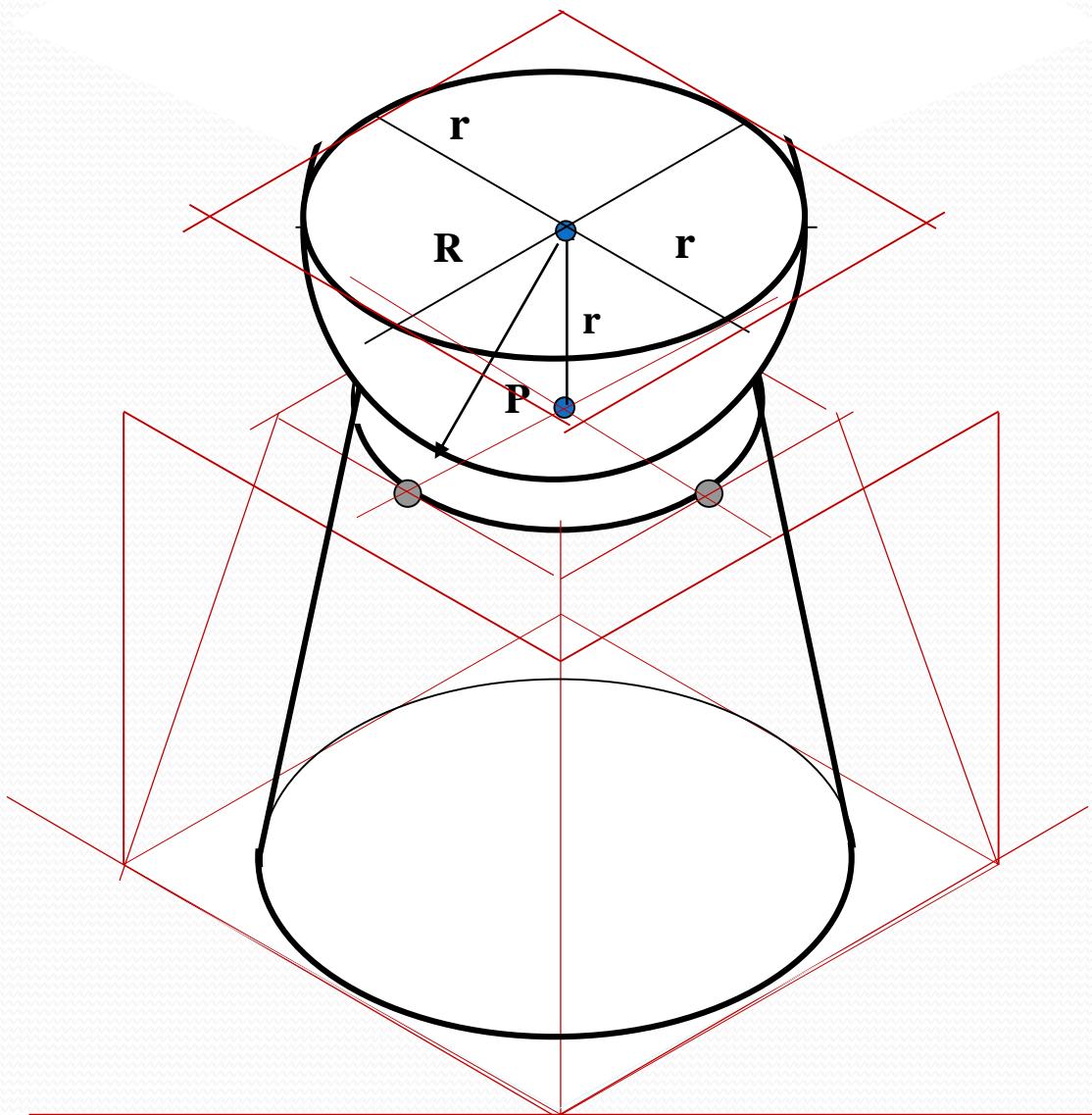
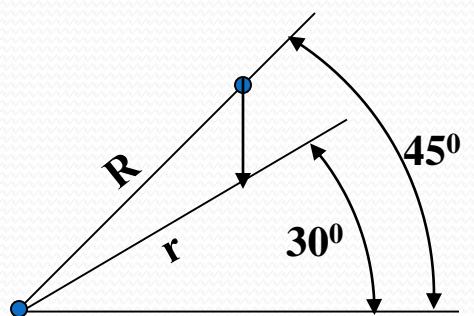
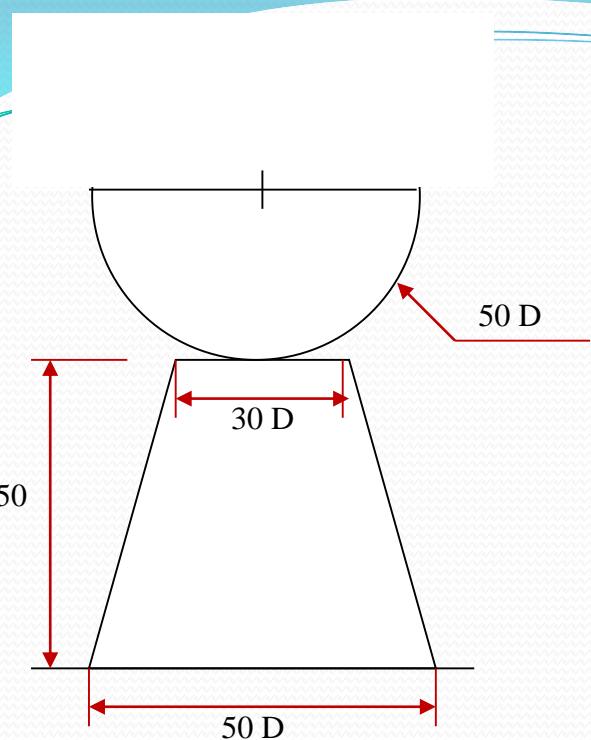
P = Point of contact

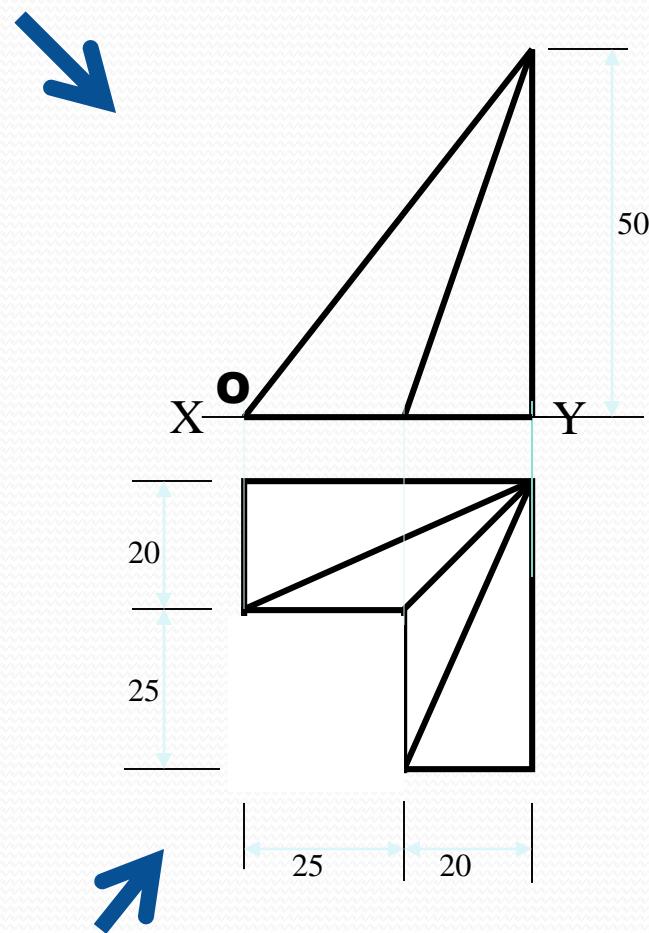
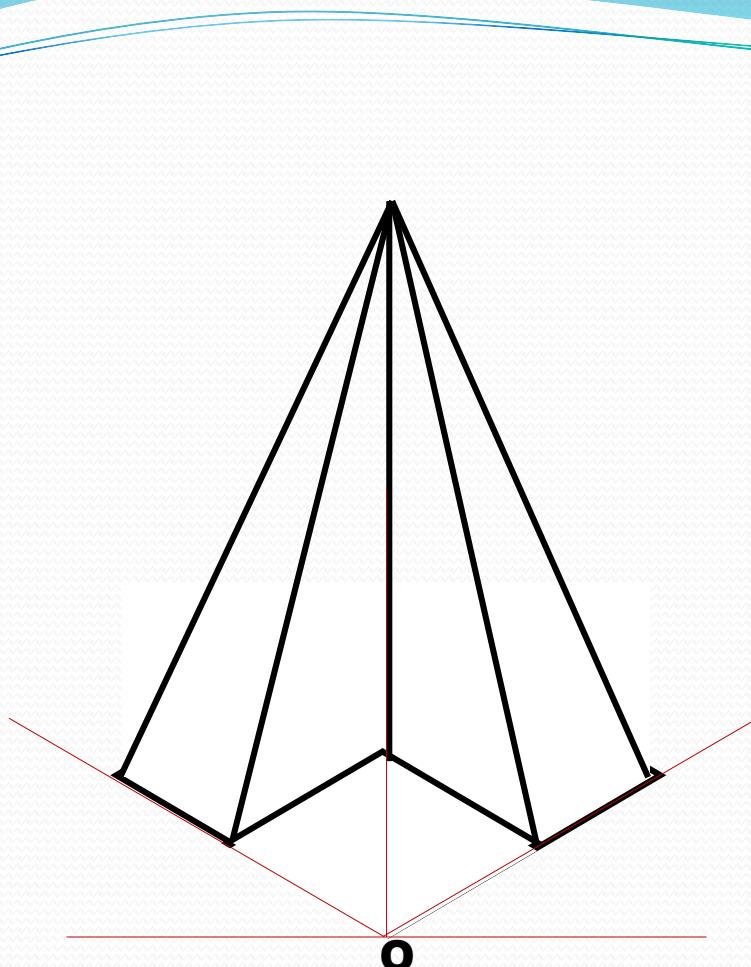
R = True Radius of Sphere

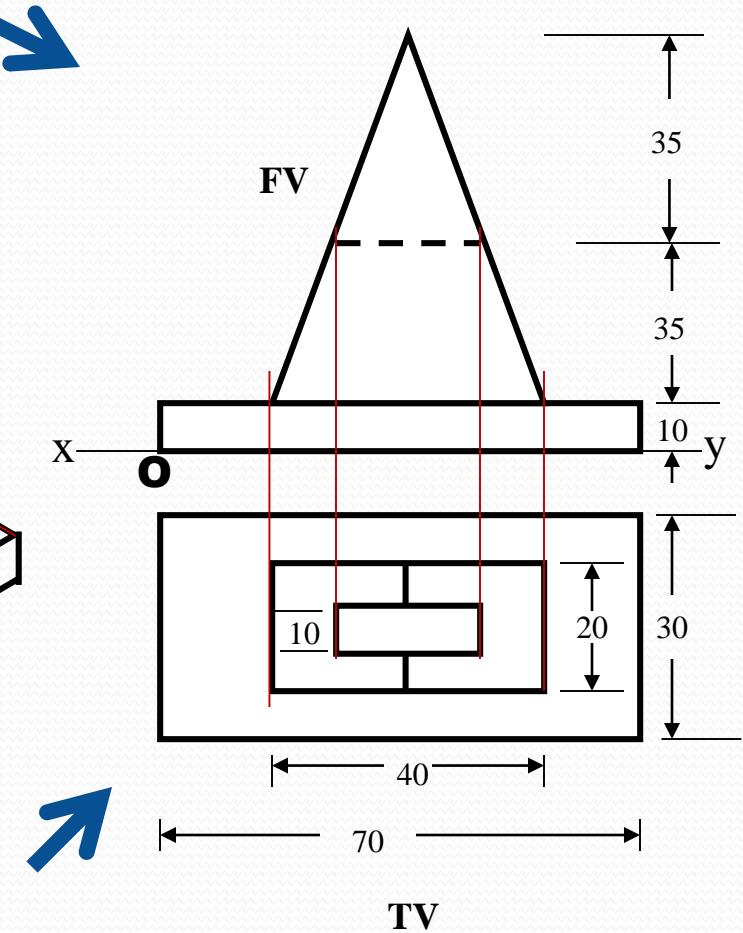
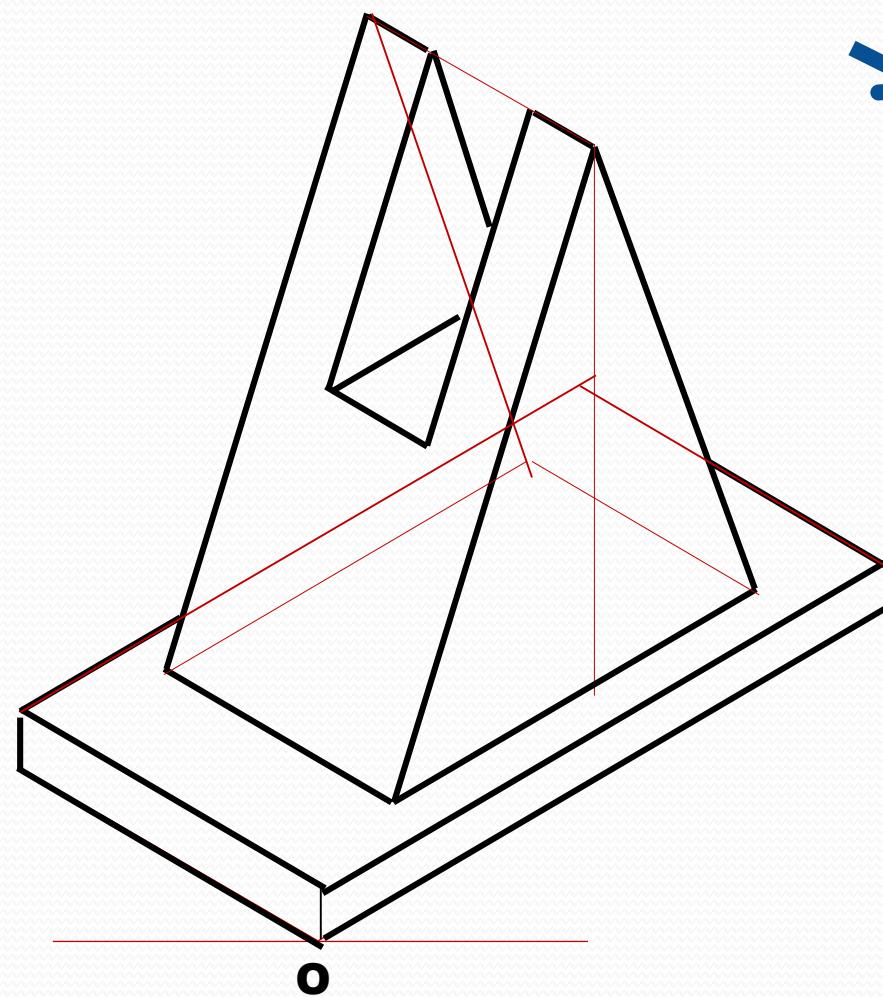
r = Isometric Radius.

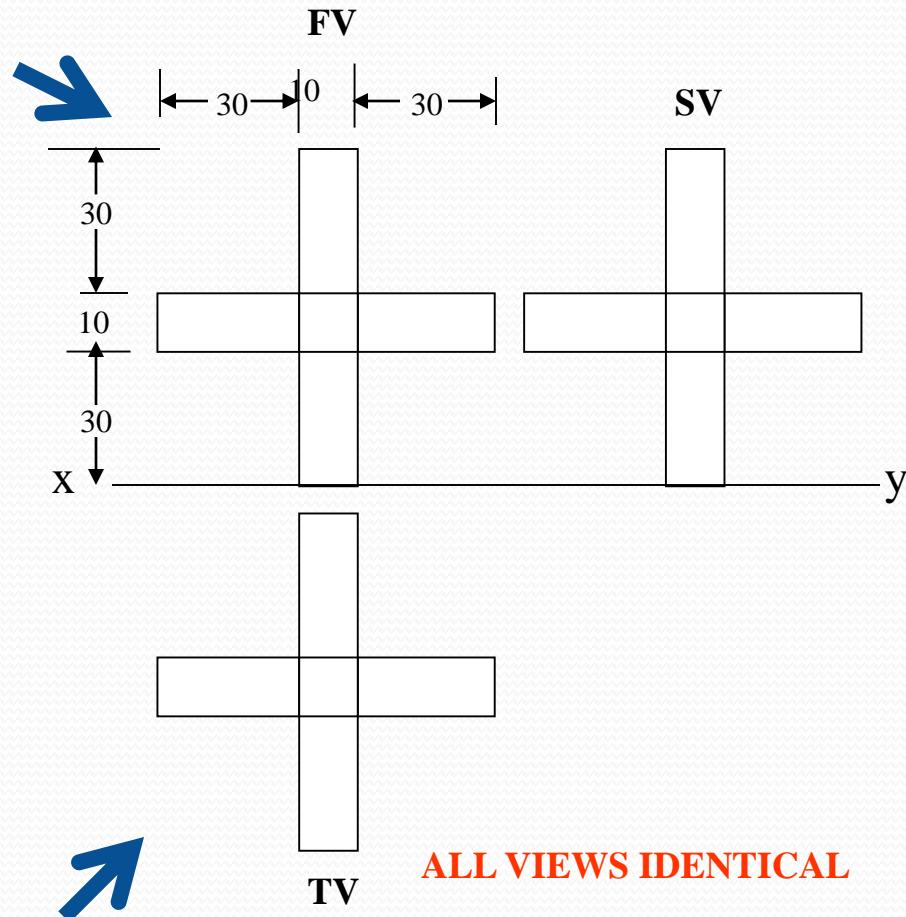
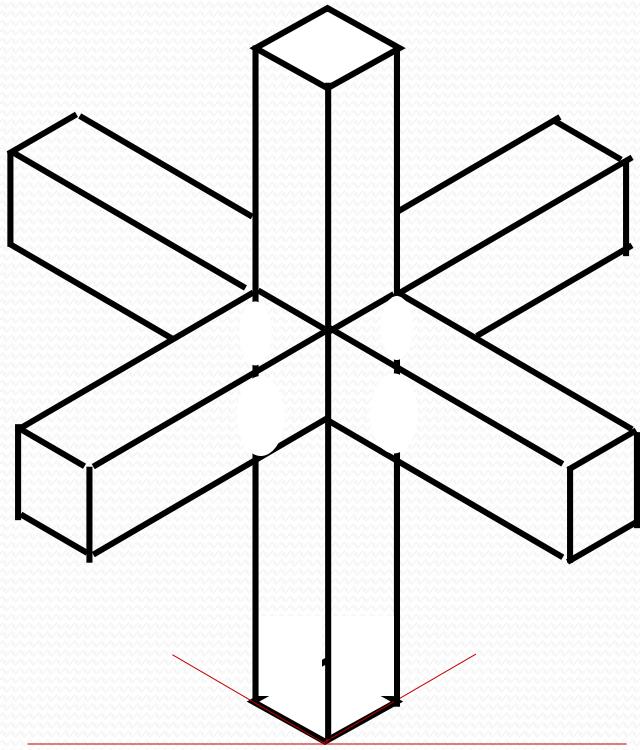
TO DRAW ISOMETRIC PROJECTION
OF A HEMISPHERE

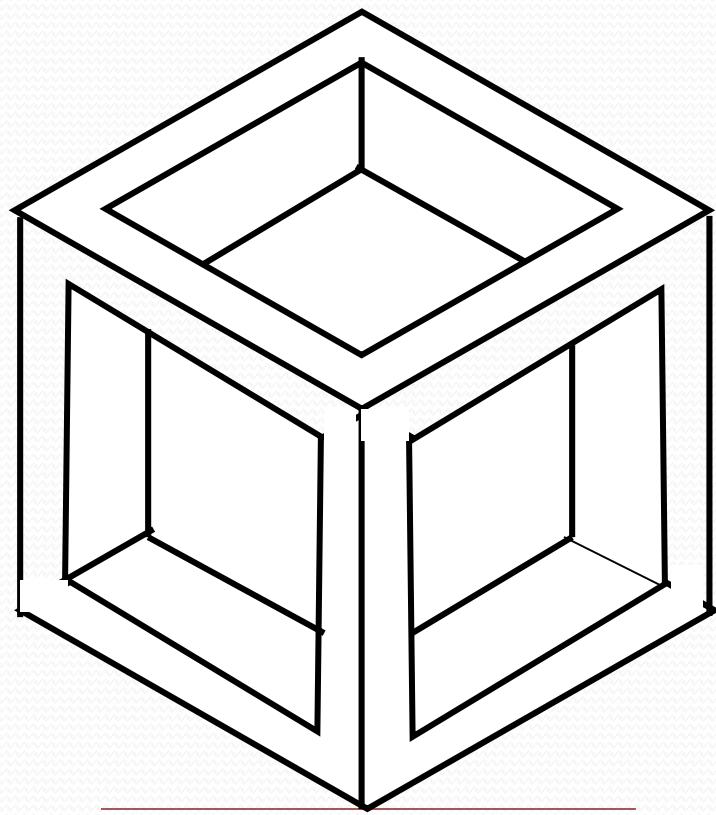
Adopt same procedure.
Draw lower semicircle only.
Then around 'C' construct
Rhombus of Sides equal to
Isometric Diameter.
For this use iso-scale.
Then construct ellipse in
this Rhombus as usual
And Complete
Isometric-Projection
of Hemi-sphere.







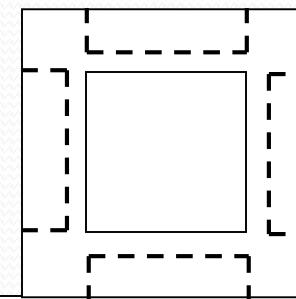




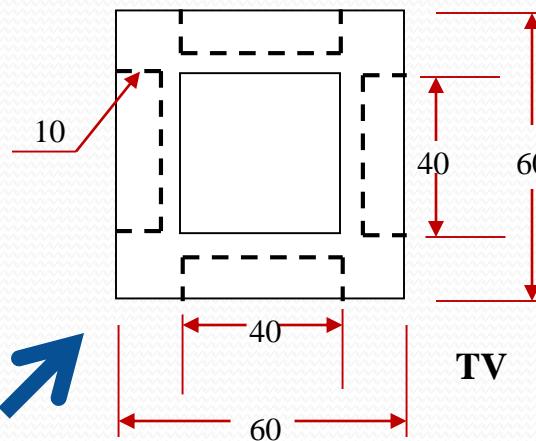
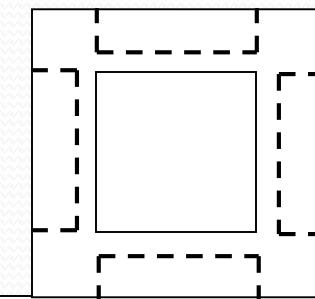
ALL VIEWS IDENTICAL



FV

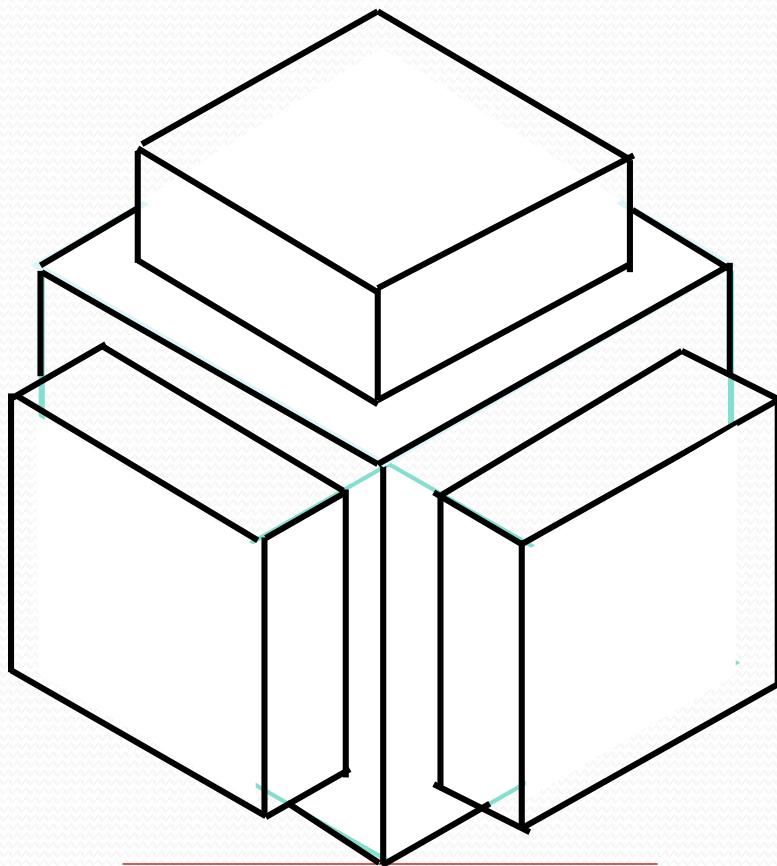


SV

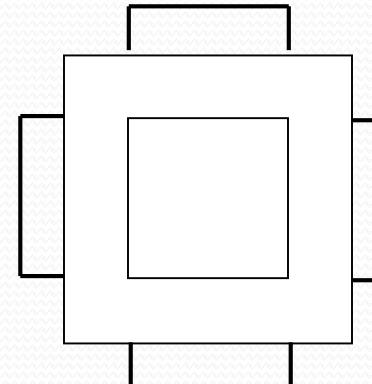


TV

ALL VIEWS IDENTICAL

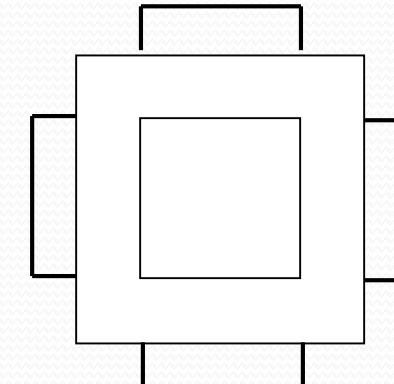


FV

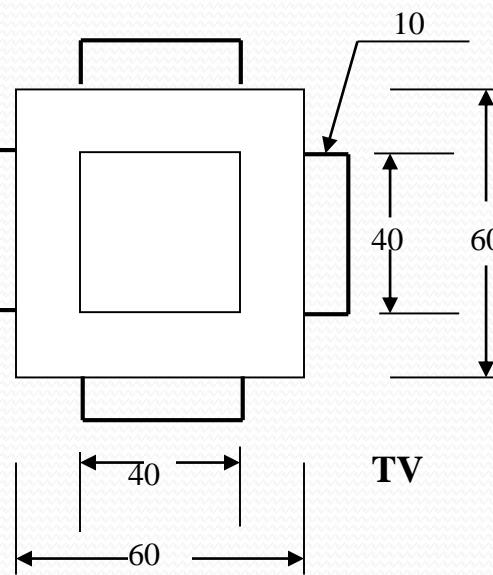


x

SV

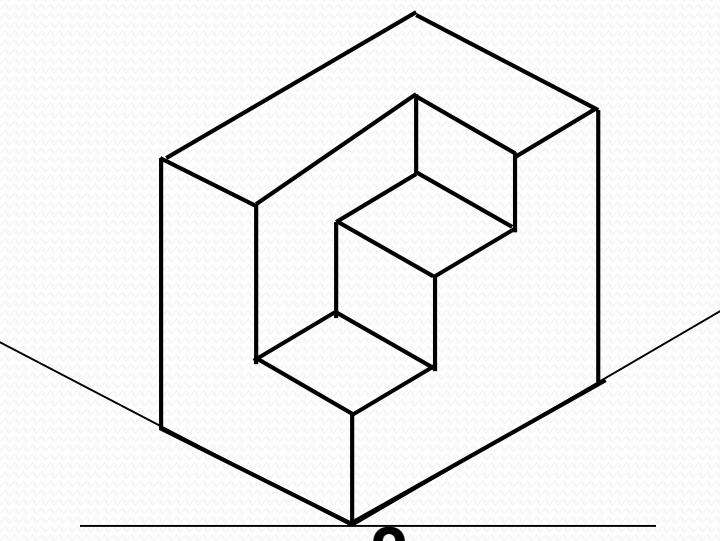
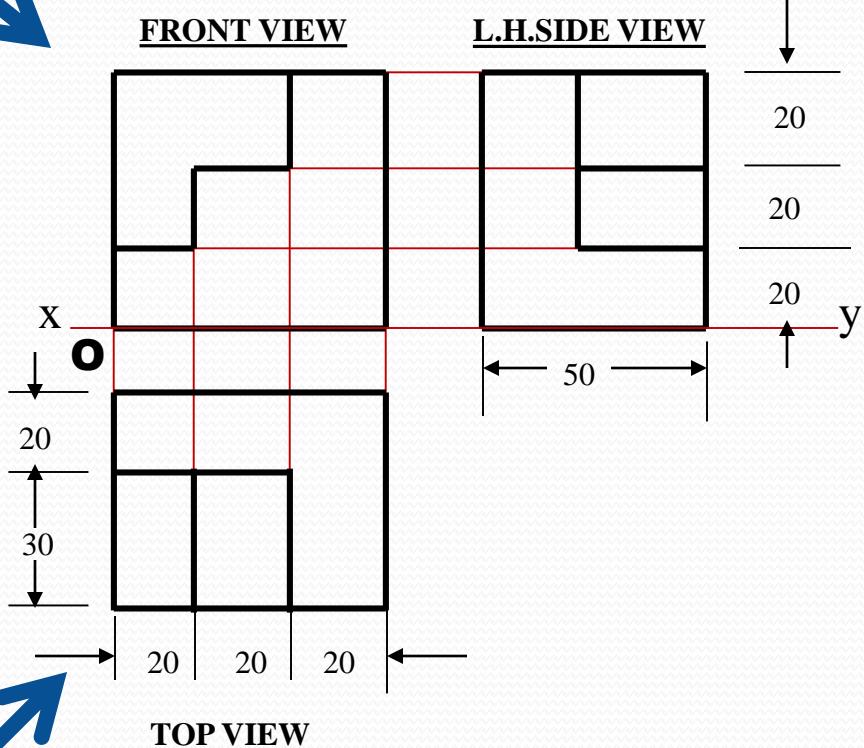


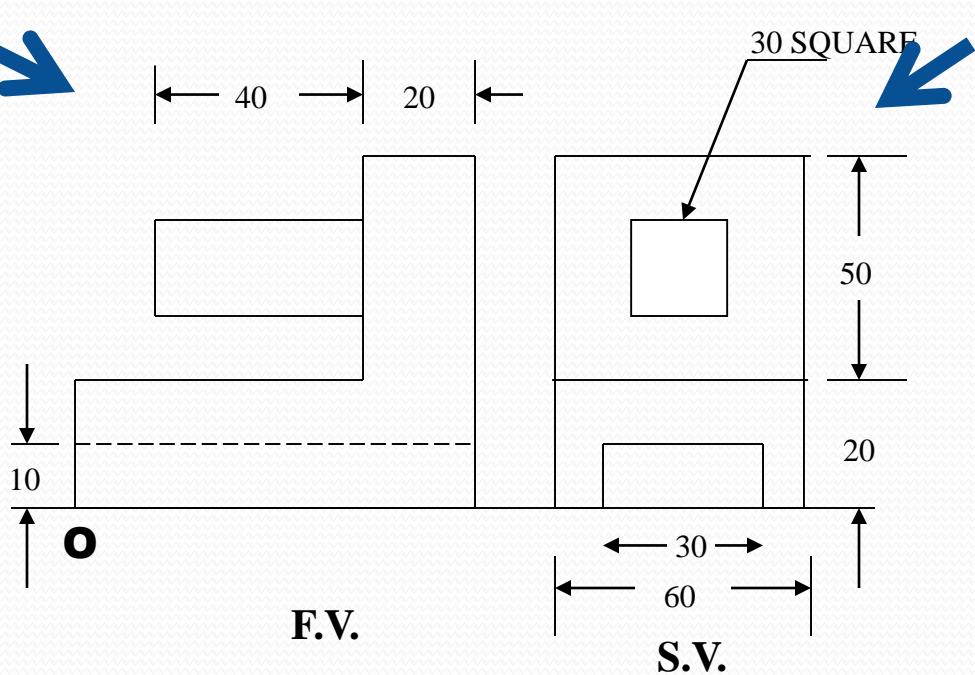
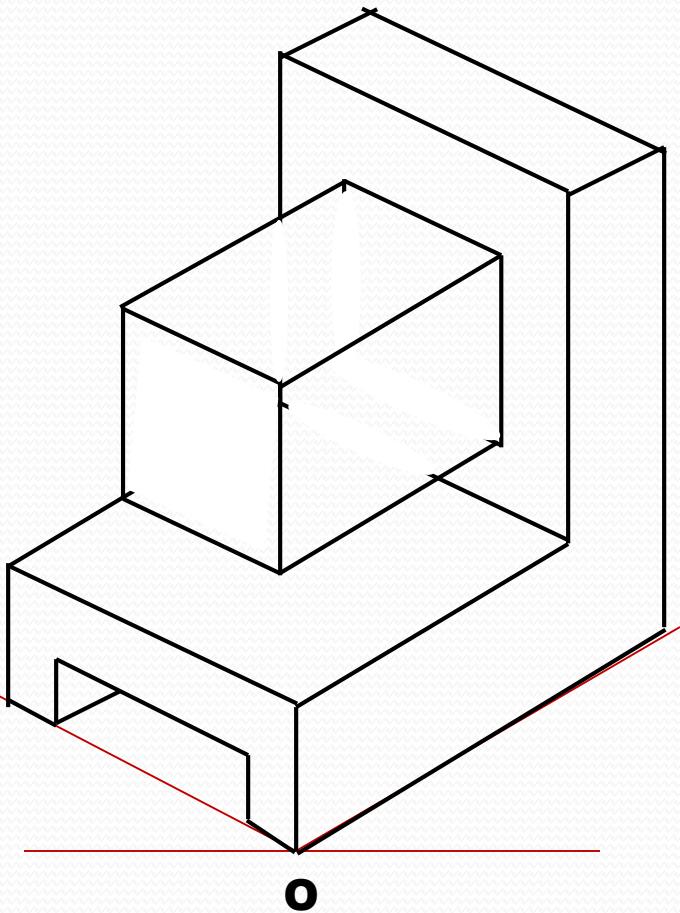
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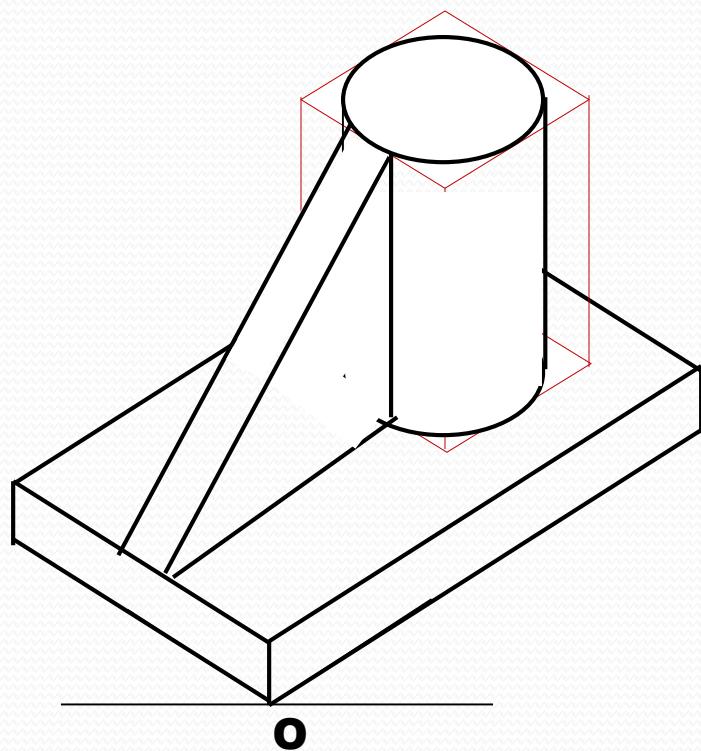
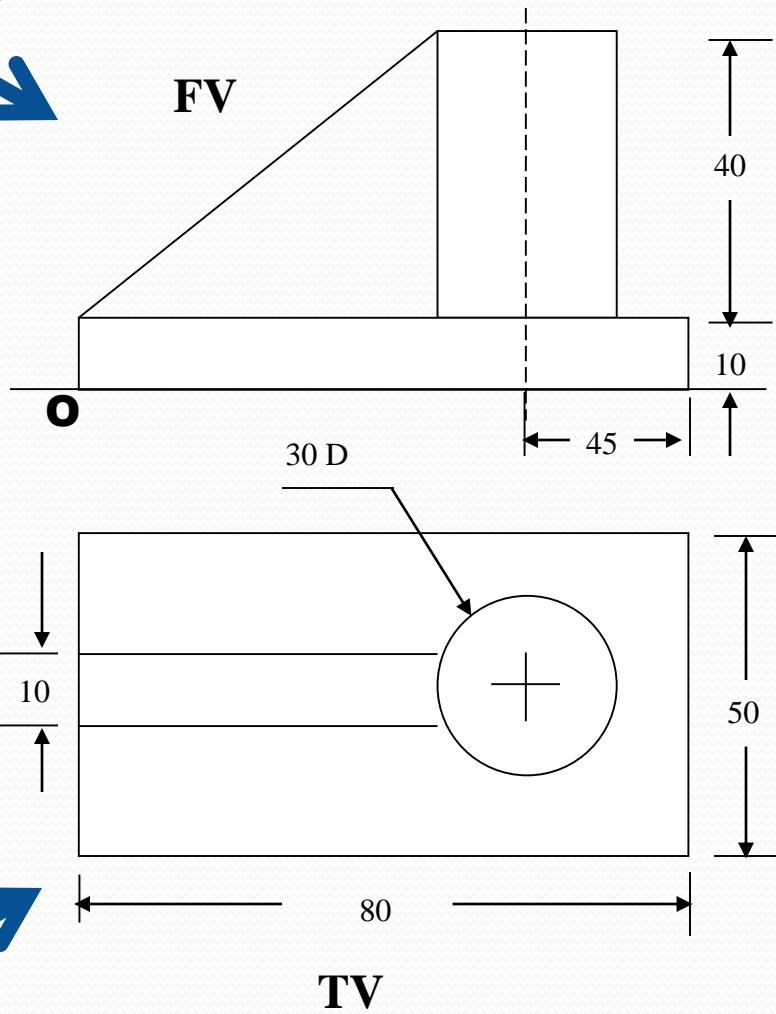


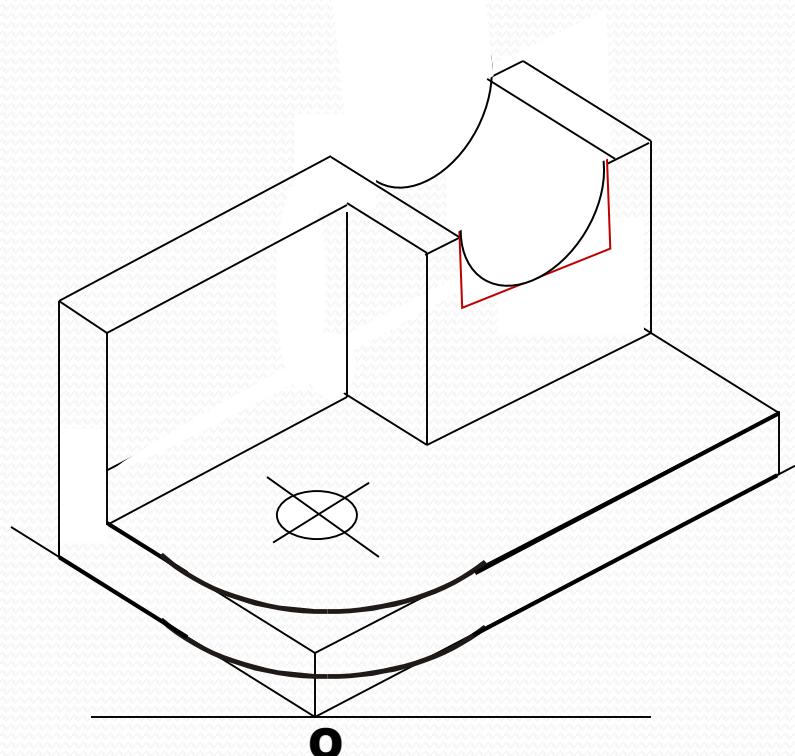
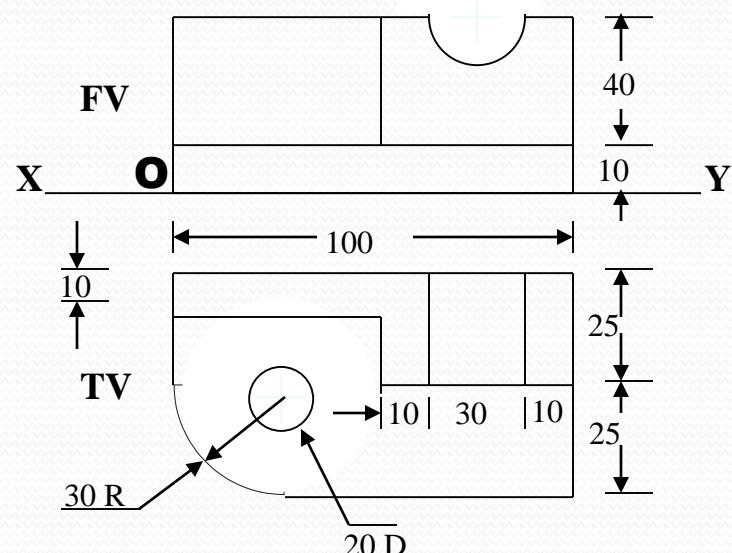
TV

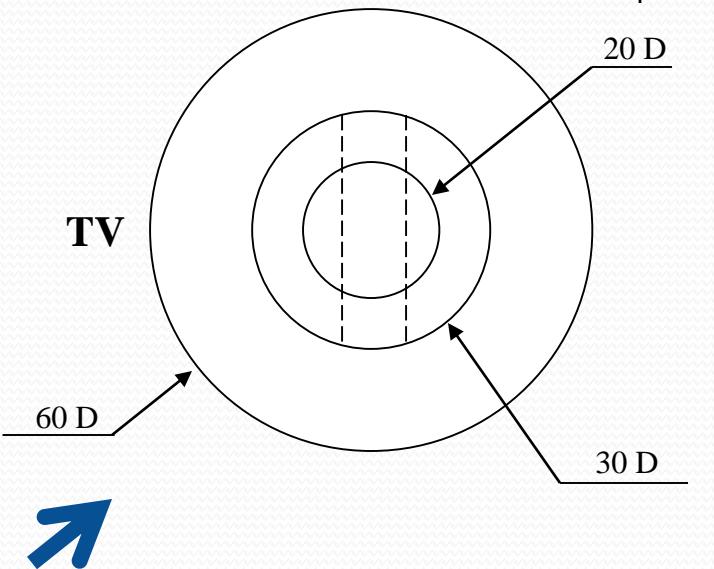
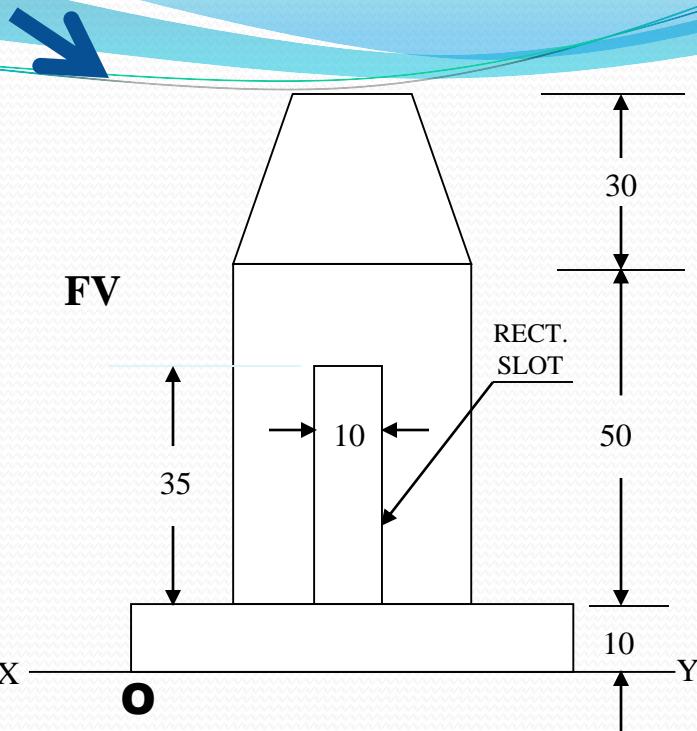
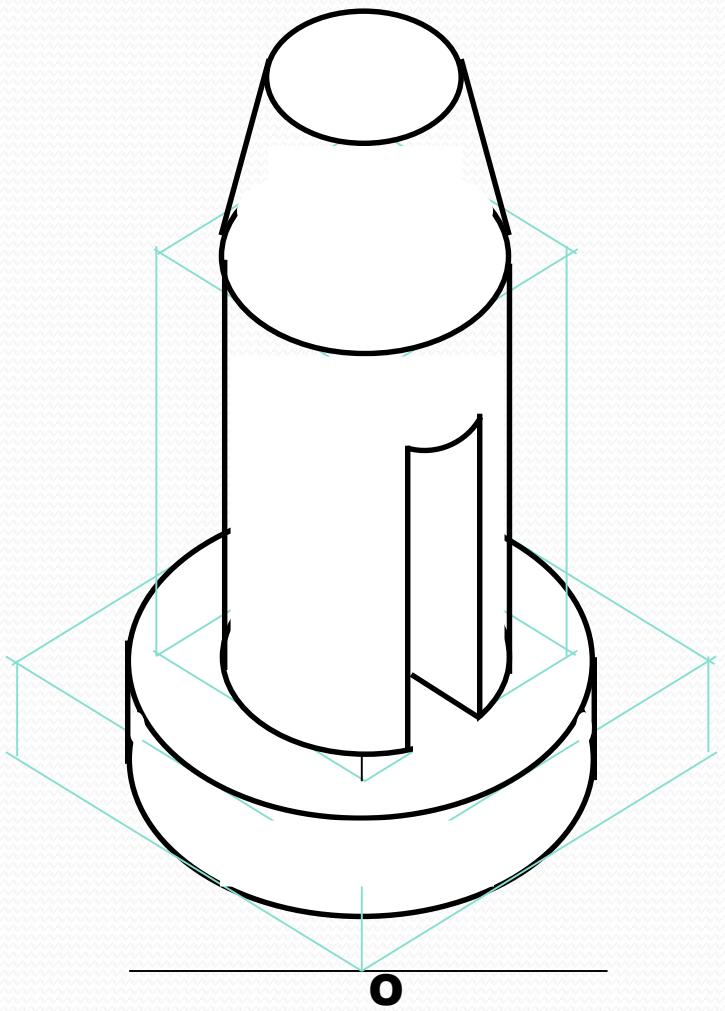
ORTHOGRAPHIC PROJECTIONS

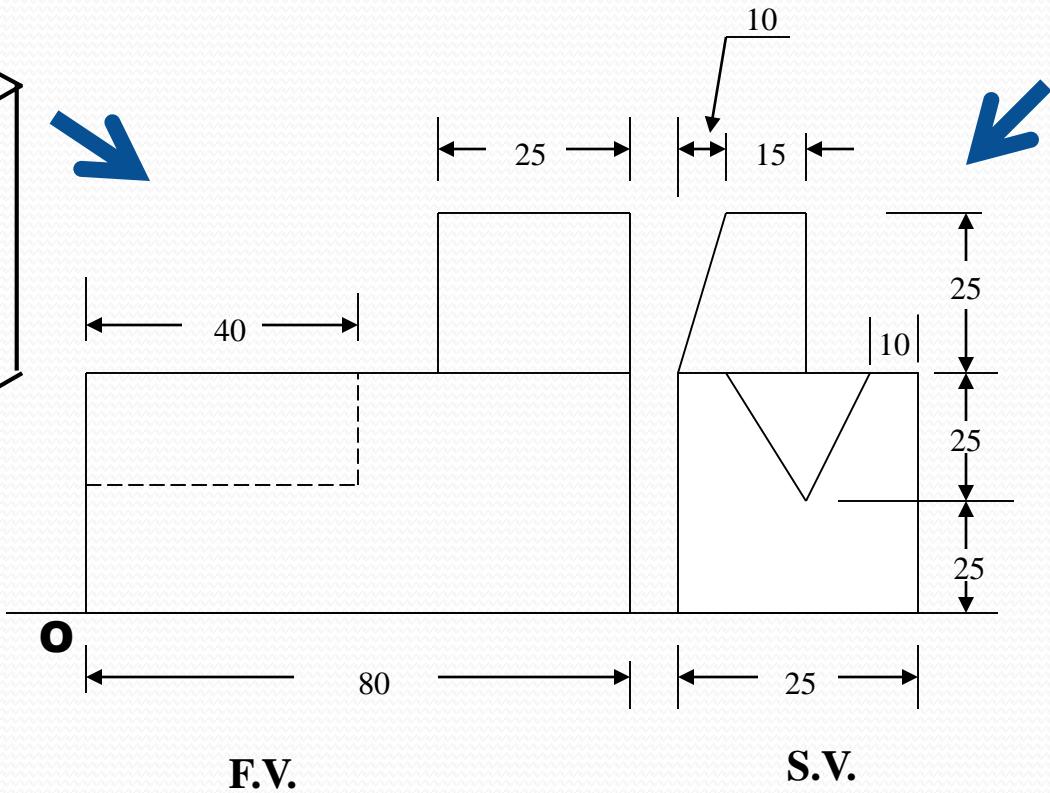
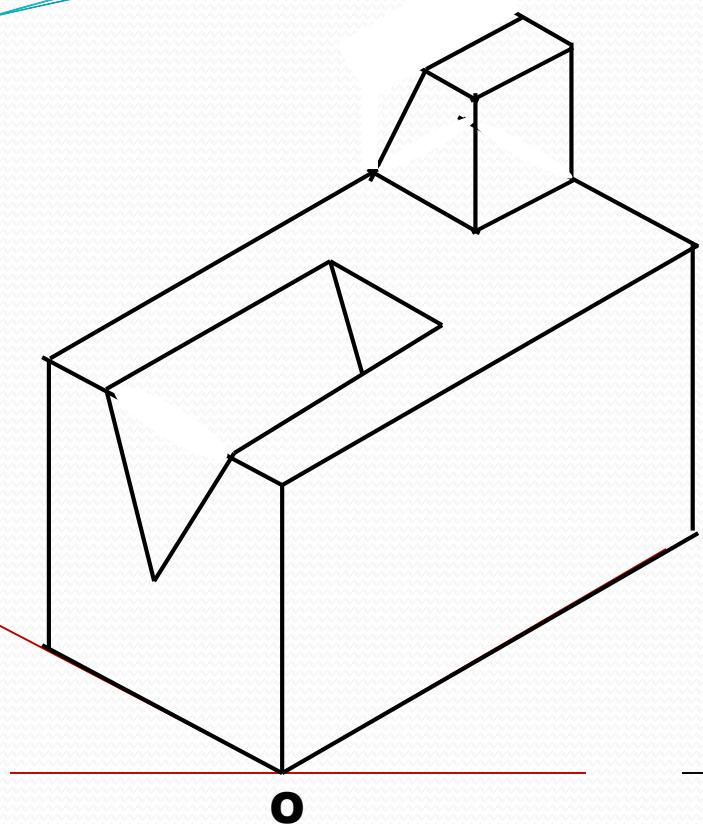


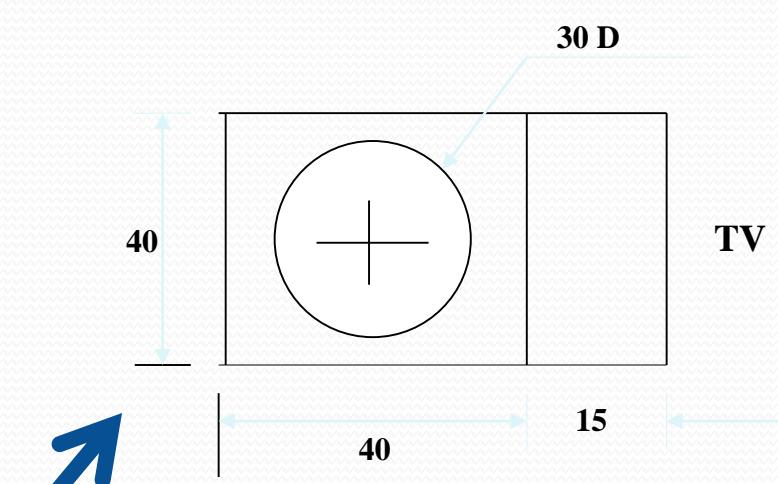
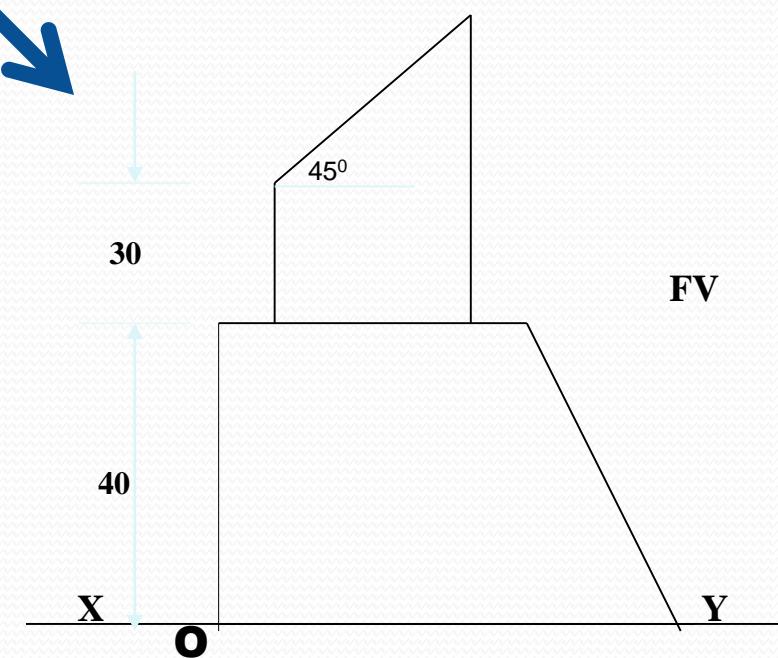
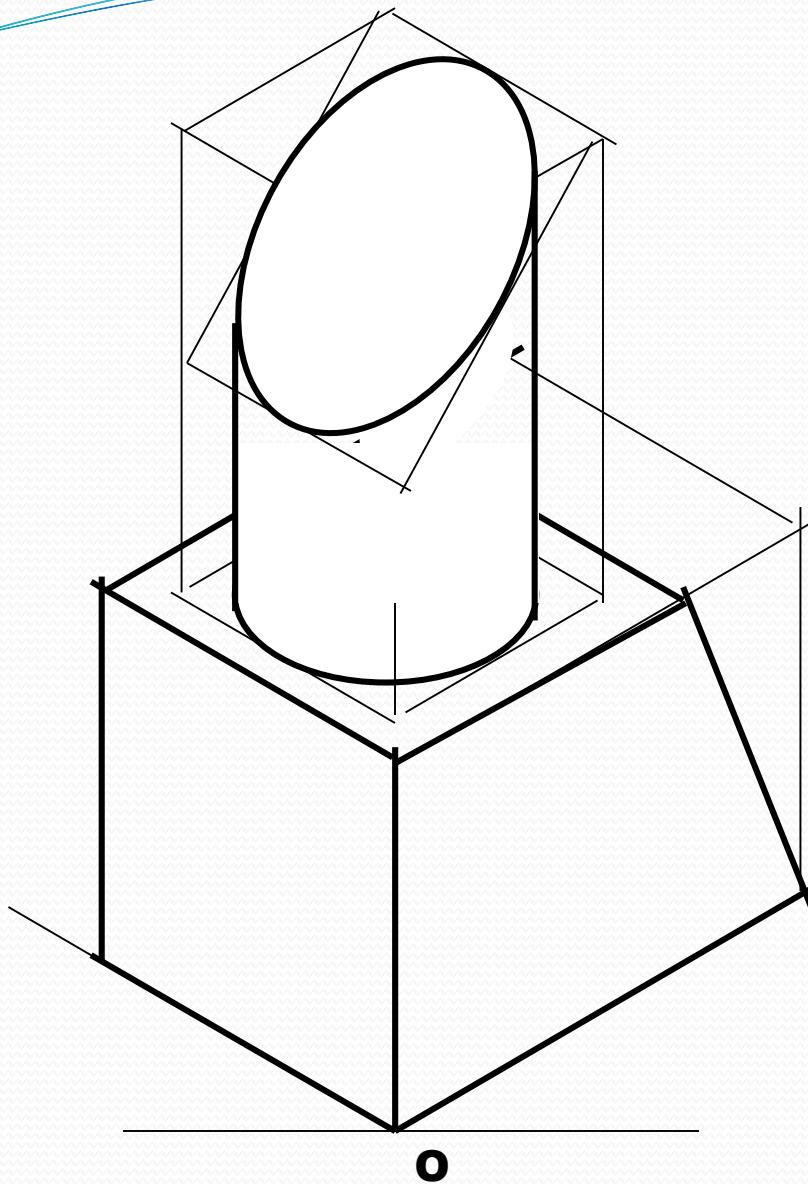


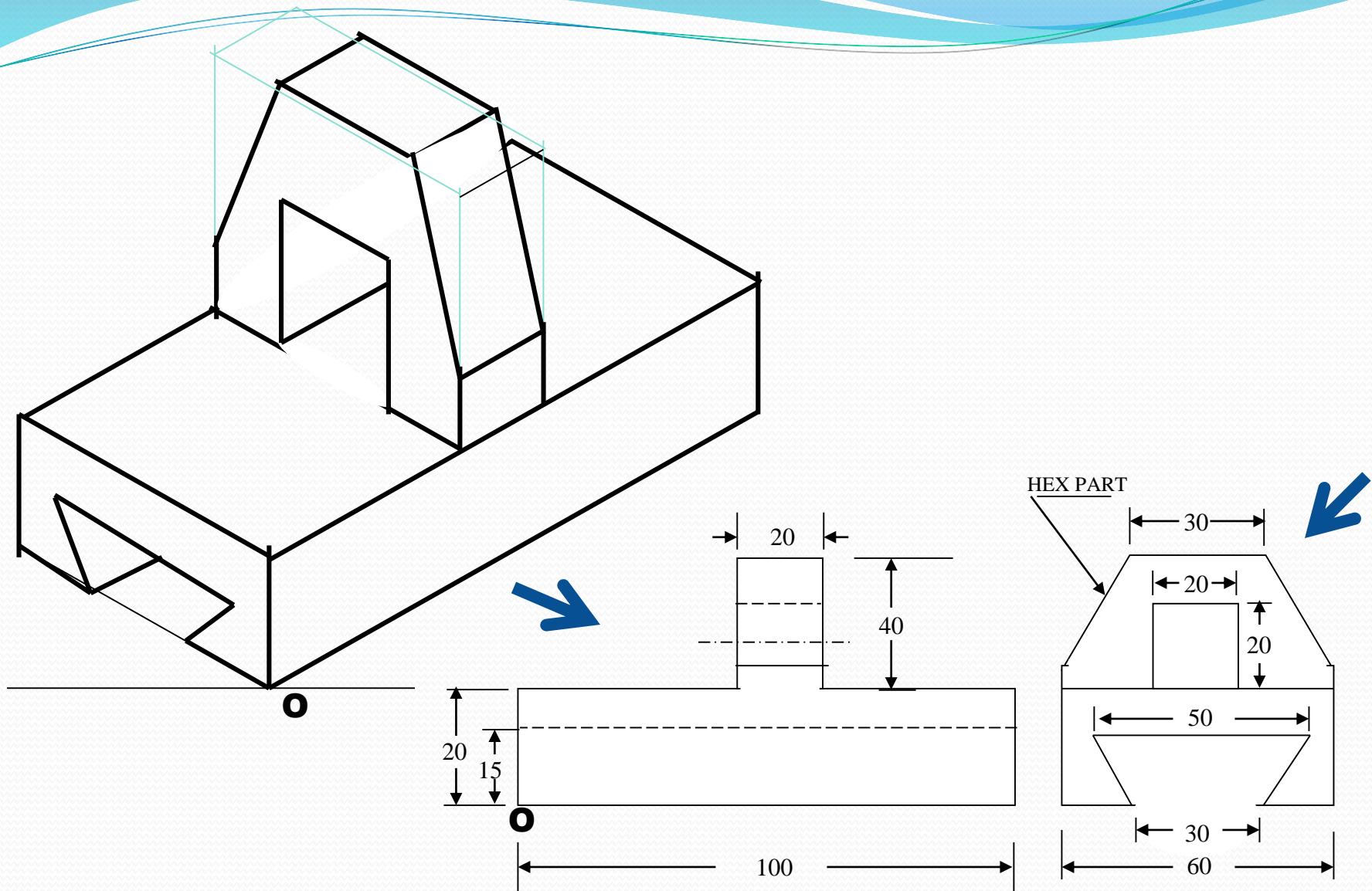


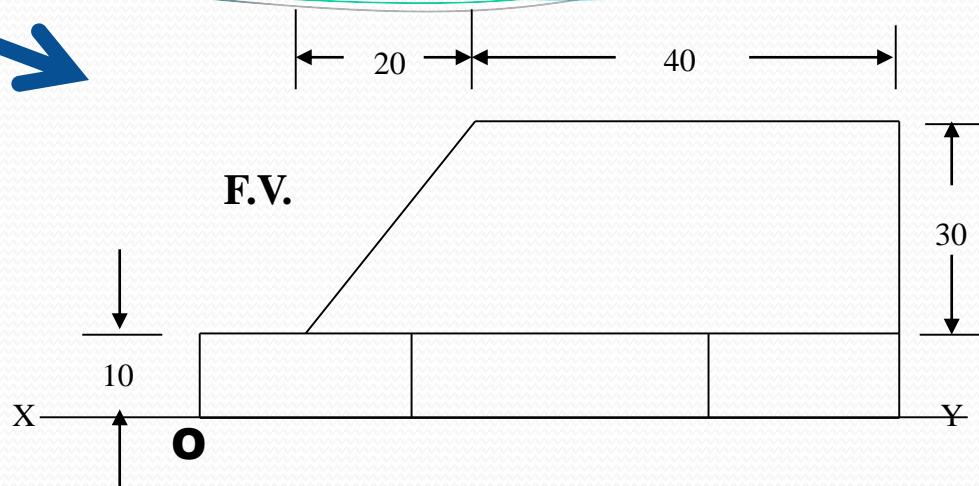
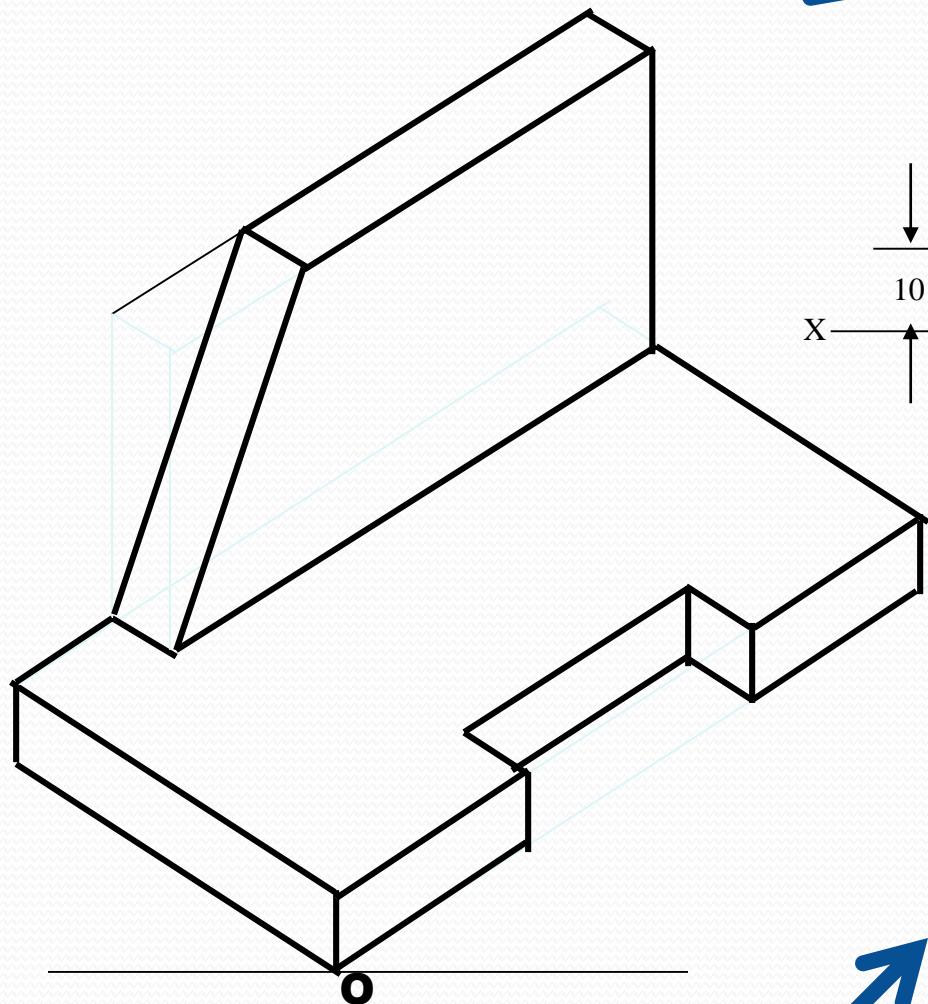








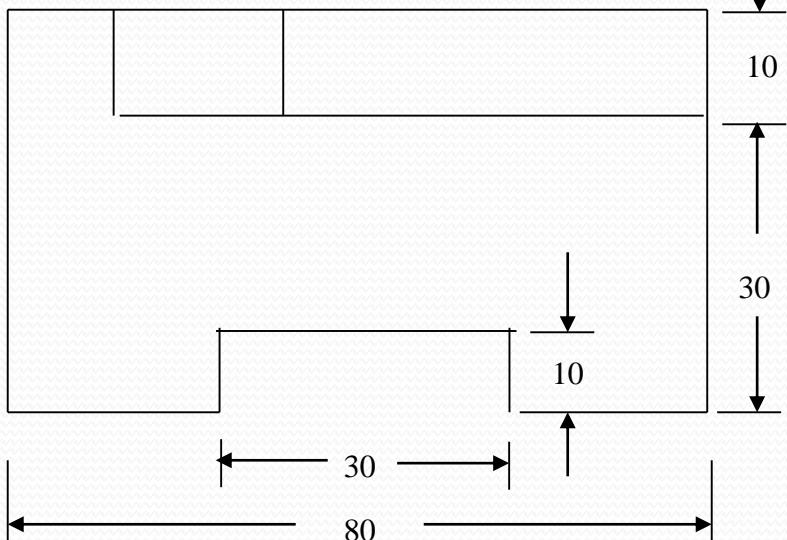




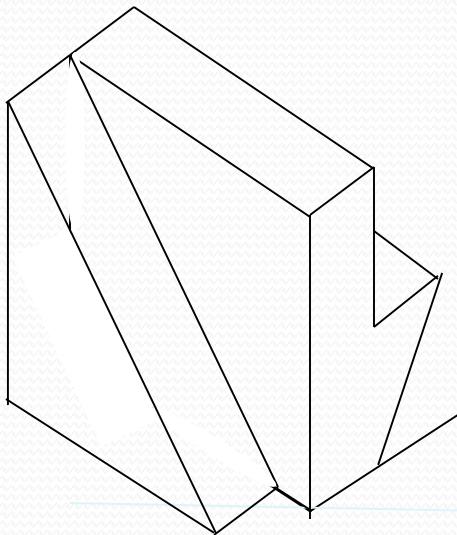
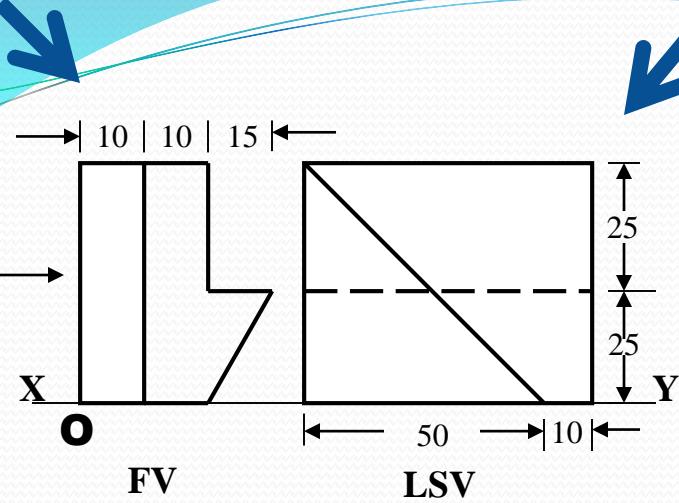
O

10

X



T.V.



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

