JYOTHISHMATHI INSTITUTE OF TECHNOLOGY AND SCIENCE,

NUSTULAPUR, KARRIMNAGAR-27

CONIC SECTIONS

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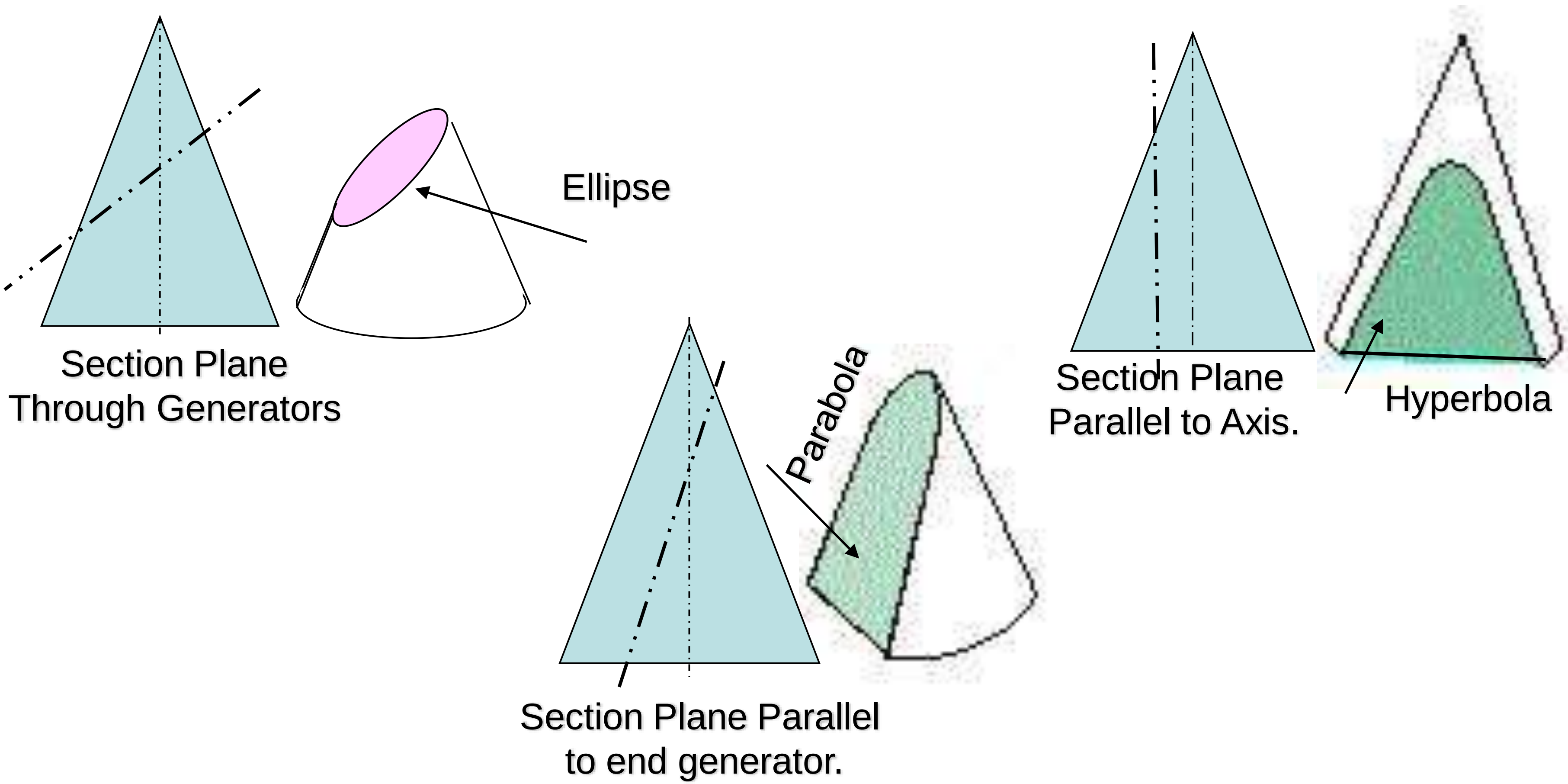
CONIC SECTIONS

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

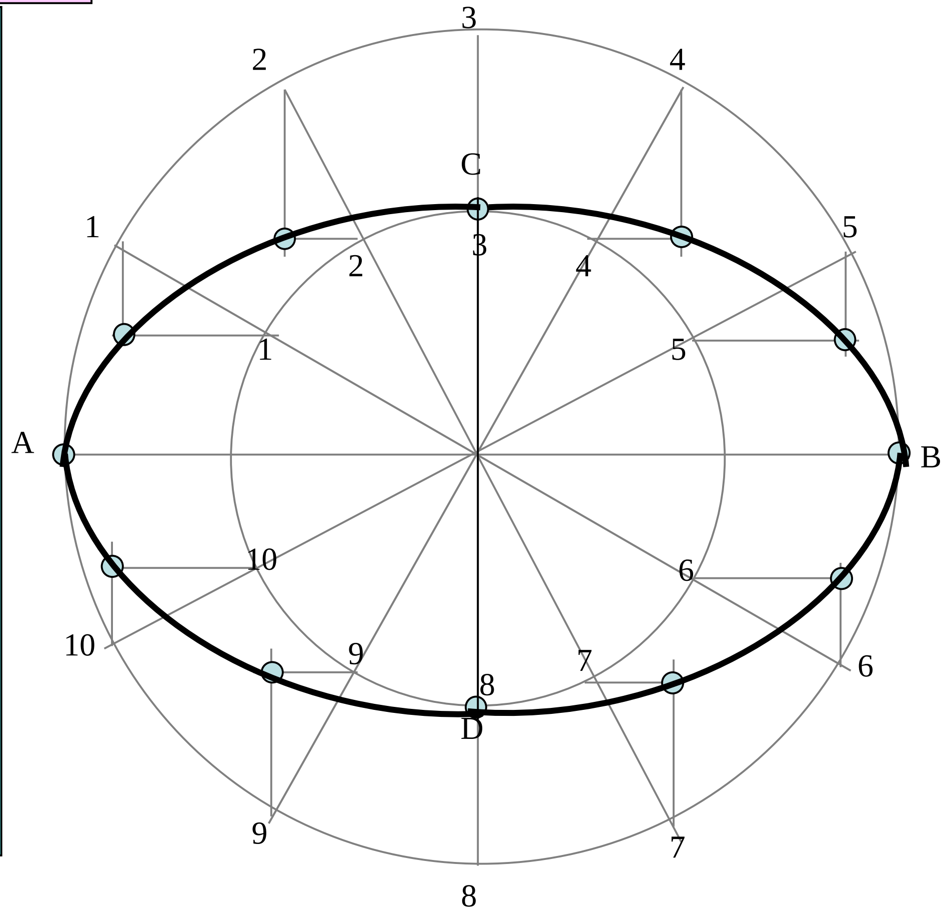
Problem :-

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 in 12 equal parts & name as shown.
4. From all points of outer circle draw vertical lines downwards and upwards respectively.
5. From all points of inner circle draw horizontal lines to intersect those vertical lines.
6. 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.



ELLIPSE

BY RECTANGLE METHOD

Problem :-

Draw ellipse by **Rectangle** *method.*

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

Steps:

1 Draw a rectangle taking major and minor axes as sides.

2. In this rectangle draw both axes as perpendicular bisectors of each other..

3. For construction, select upper left part of rectangle. Divide vertical small side and horizontal long side into same number of equal parts.(here divided in four parts)

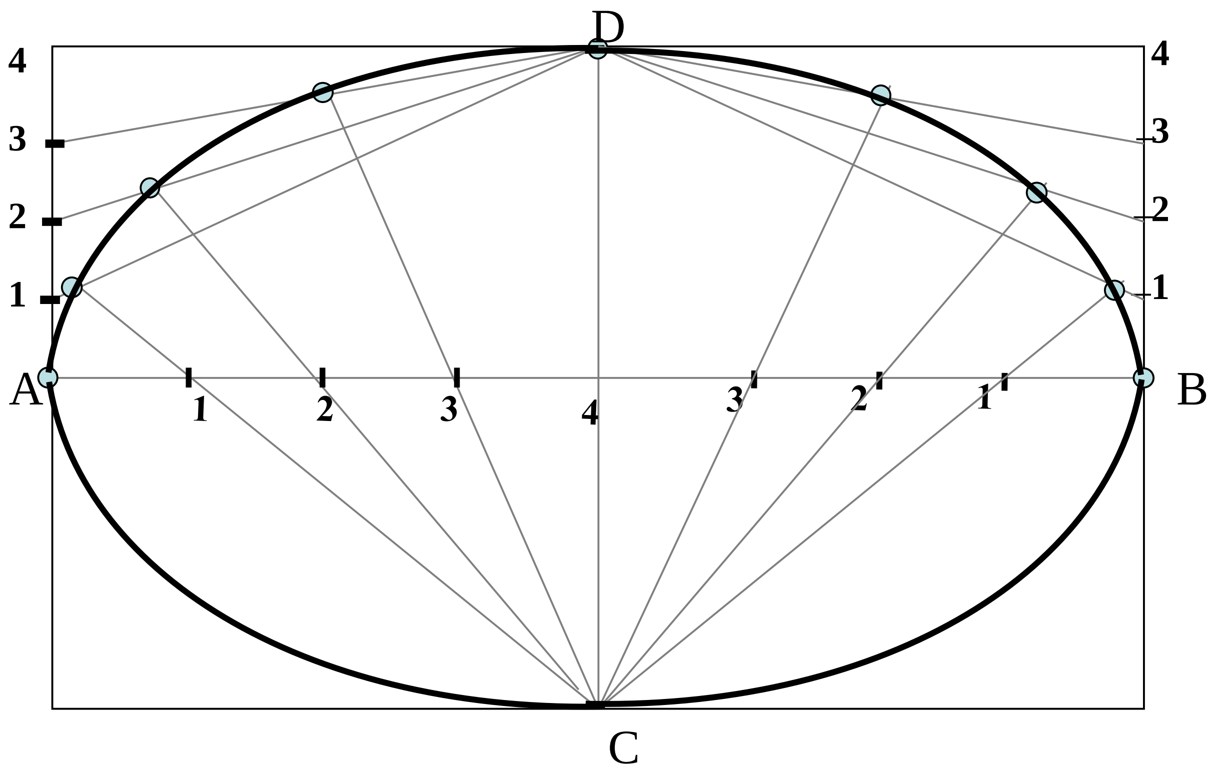
4. Name those as shown..

5. Now join all vertical points 1,2,3,4, to the upper end of minor axis. And all horizontal points i.e.1,2,3,4 to the lower end of minor axis.

6. Then extend C-1 line upto D-1 and mark that point. Similarly extend C-2, C-3, C-4 lines up to D-2, D-3, & D-4 lines.

7. Mark all these points properly and join all along with ends A and D in smooth possible curve. Do similar construction in right side part.along with lower half of the rectangle.Join all points in smooth curve.

It is required ellipse.



PROBLEM : A BALL THROWN IN AIR ATTAINS 100 M HIEGHT AND COVERS HORIZONTAL DISTANCE 150 M ON GROUND. Draw the path of the ball (projectile)-

PARABOLA
RECTANGLE METHOD

STEPS:
1. Draw rectangle of above size and divide it in two equal vertical parts
2. Consider left part for construction. Divide height and length in equal number of parts and name those 1,2,3,4,5& 6
3. Join vertical 1,2,3,4,5 & 6 to the top center of rectangle
4. Similarly draw upward vertical lines from horizontal1,2,3,4,5 And wherever these lines intersect previously drawn inclined lines in sequence Mark those points and further join in smooth possible curve.
5. Repeat the construction on right side rectangle also.Join all in sequence. **This locus is Parabola.**

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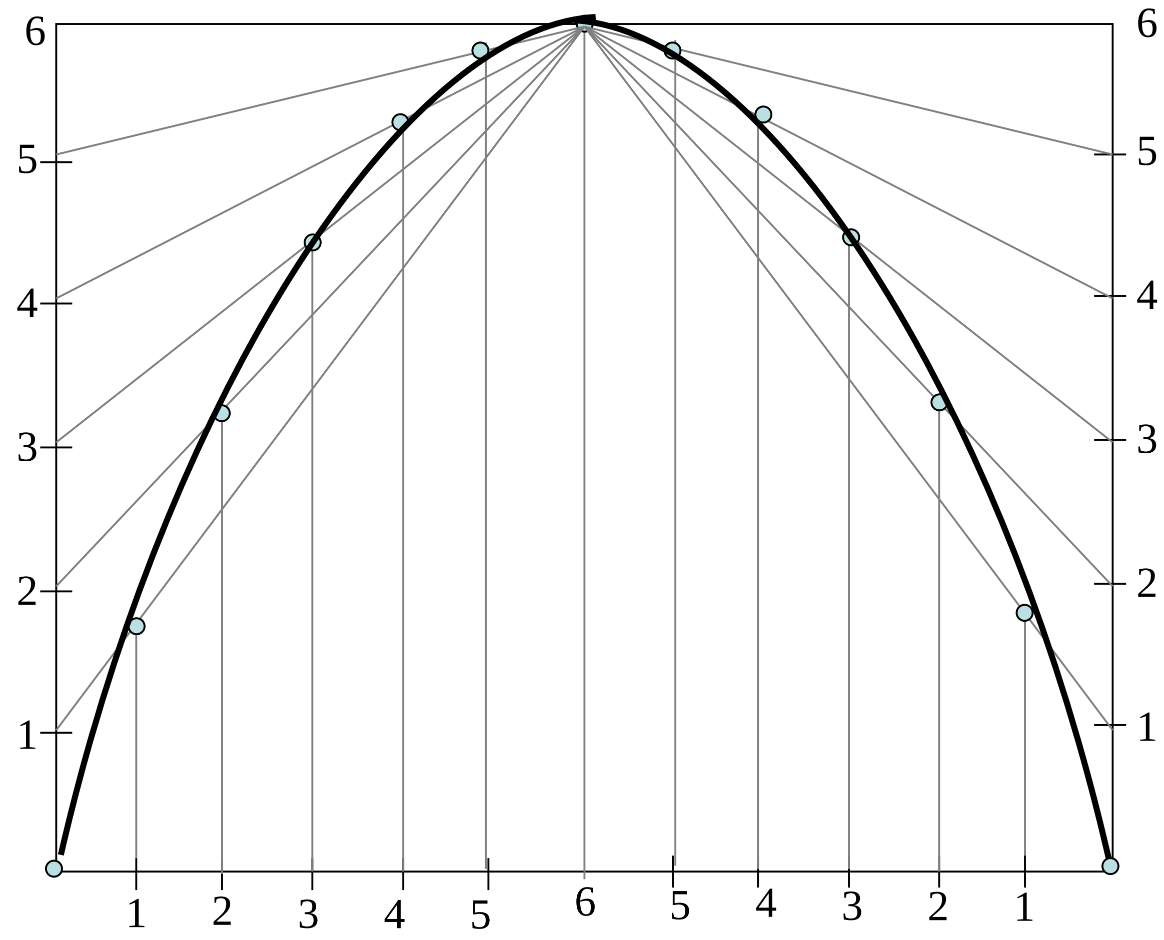
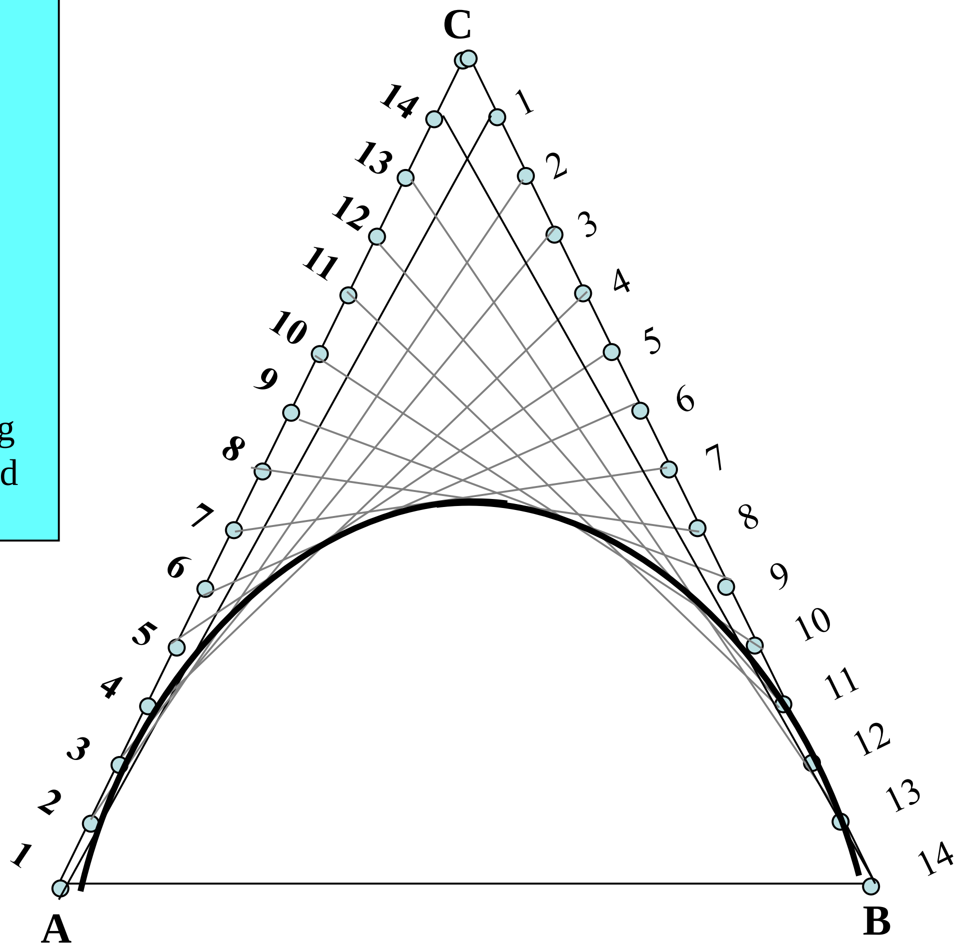


Problem: Draw an isosceles triangle of 100 mm long base and 110 mm long altitude.Inscribe a parabola in it by method of tangents.

PARABOLA
METHOD OF TANGENTS

Solution Steps:

1. Construct triangle as per the given dimensions.
2. Divide it's both sides in to same no.of equal parts.
3. Name the parts in ascending and descending manner, as shown.
4. Join 1-1, 2-2,3-3 and so on.
5. Draw the curve as shown i.e.tangent to all these lines. The above all lines being tangents to the curve, it is called method of tangents.



Problem: Point P is 40 mm and 30 mm from horizontal and vertical axes respectively.Draw Hyperbola through it.

HYPERBOLA

THROUGH A POINT OF KNOWN CO-ORDINATES

SSolution Steps:

Extend horizontal line from P to right side.

2Extend vertical line from P upward.

3 On horizontal line from P, mark some points taking any distance and name them after P-1, 2,3,4 etc.

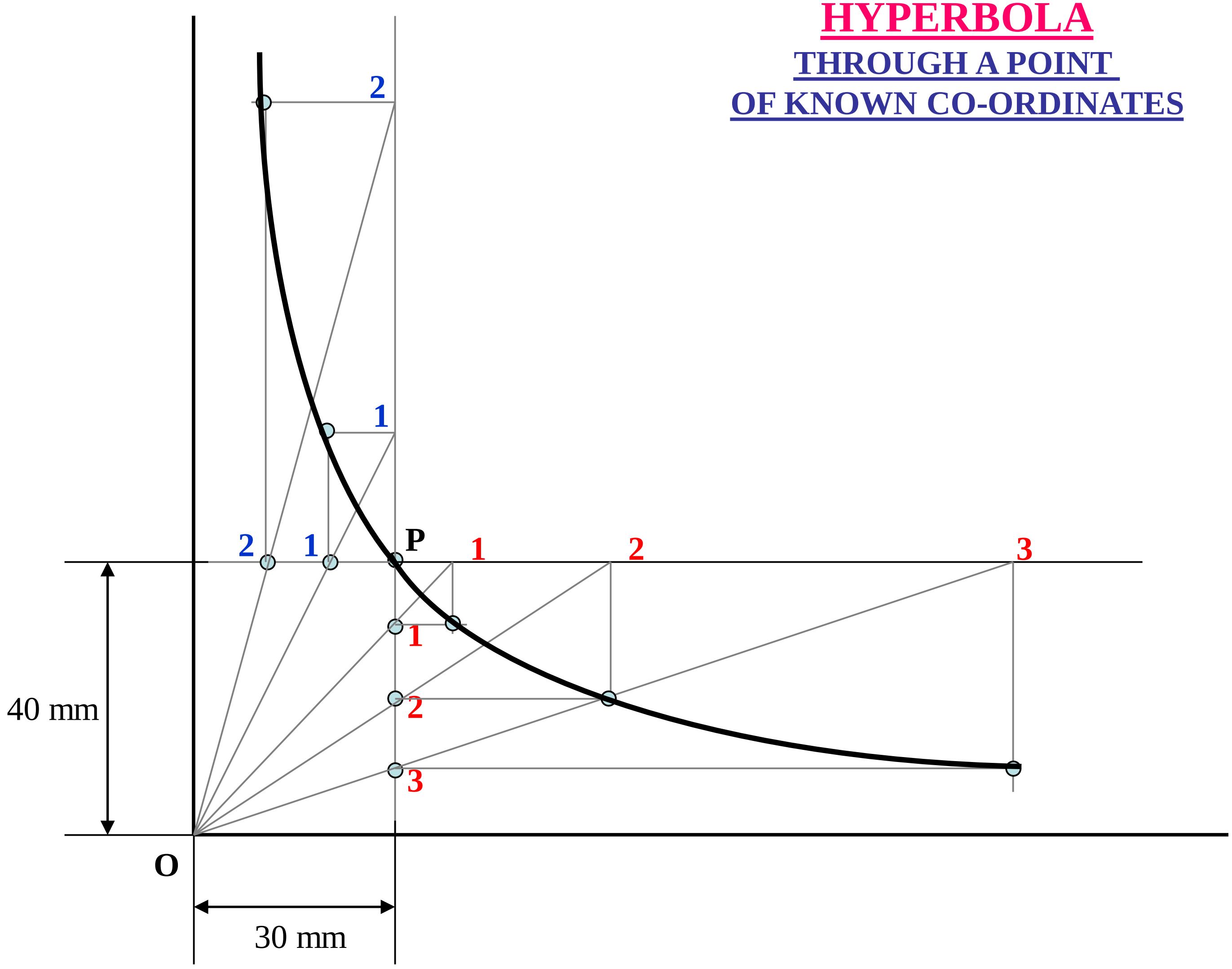
4 Join 1-2-3-4 points to pole O. Let them cut part [P-B] also at 1,2,3,4 points.

5From horizontal 1,2,3,4 draw vertical lines downwards and

6From vertical 1,2,3,4 points [from P-B] draw horizontal lines.

7Line from 1 horizontal and line from 1 vertical will meet at P_1.Similarly mark P_2, P_3, P_4 points.

8Repeat the procedure by marking four points on upward vertical line from P and joining all those to pole O. Name this points P_6, P_7, P_8 etc. and join them by smooth curve.

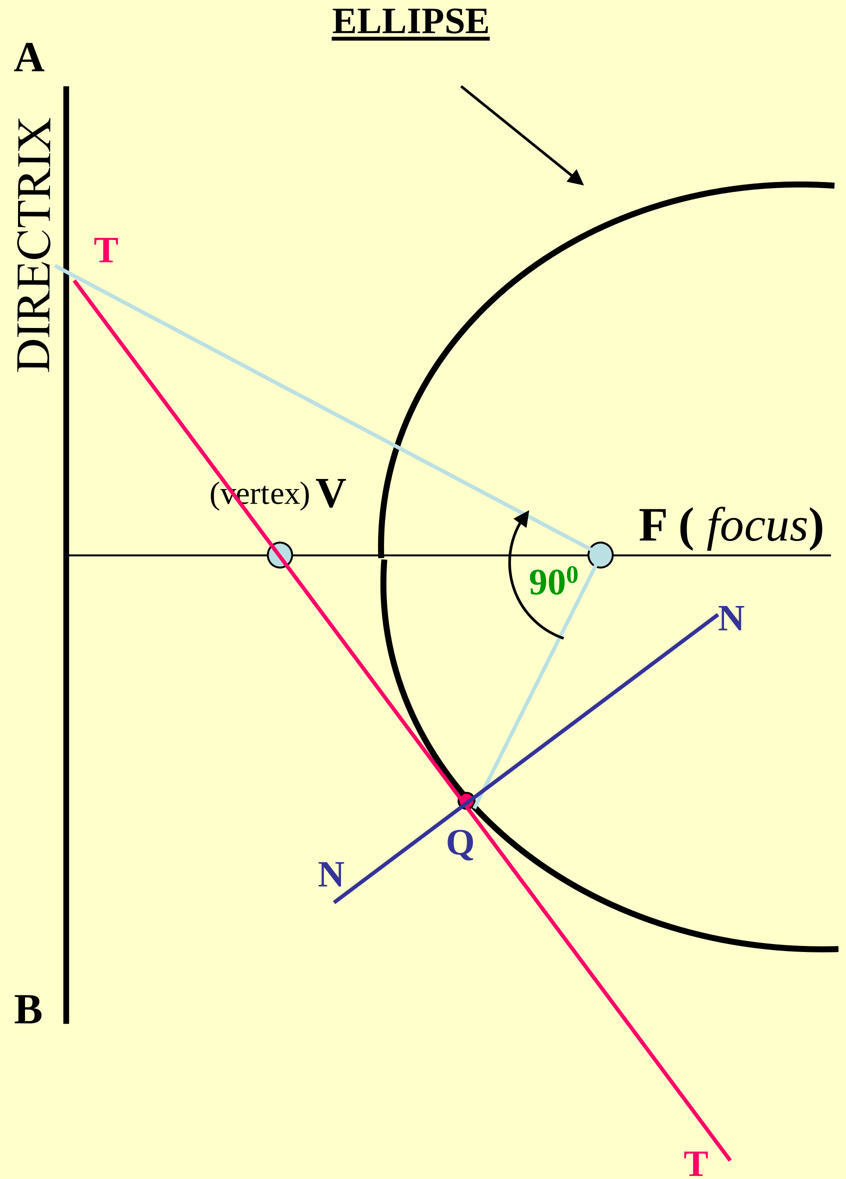


ELLIPSE

TANGENT & NORMAL

TO DRAW TANGENT & NORMAL TO THE CURVE FROM A GIVEN POINT (Q)

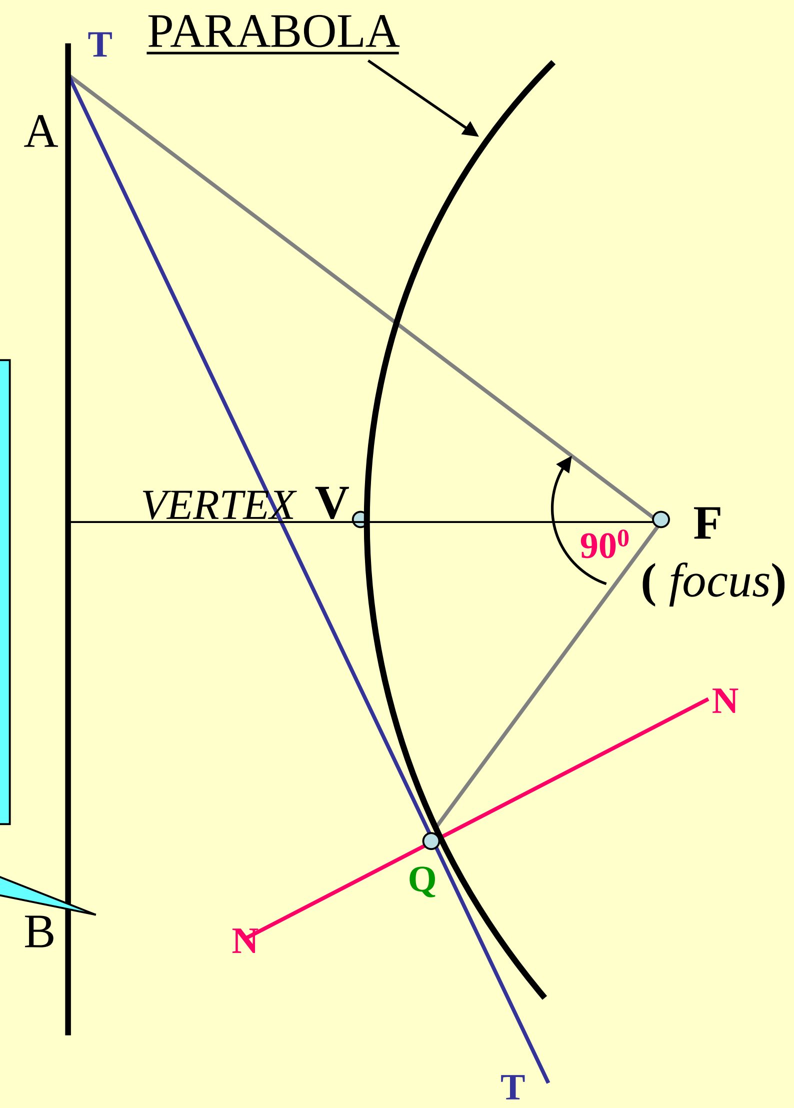
1.JOIN POINT **Q** TO **F.**
2.CONSTRUCT 900 ANGLE WITH THIS LINE AT POINT **F**
3.EXTEND THE LINE TO MEET DIRECTRIX AT **T**
4. JOIN THIS POINT TO Q AND EXTEND. THIS IS TANGENT TO ELLIPSE FROM Q
5.TO THIS TANGENT DRAW PERPENDICULAR LINE FROM Q. IT IS NORMAL TO CURVE.



PARABOLA
TANGENT & NORMAL

TO DRAW TANGENT & NORMAL TO THE CURVE FROM A GIVEN POINT (Q)

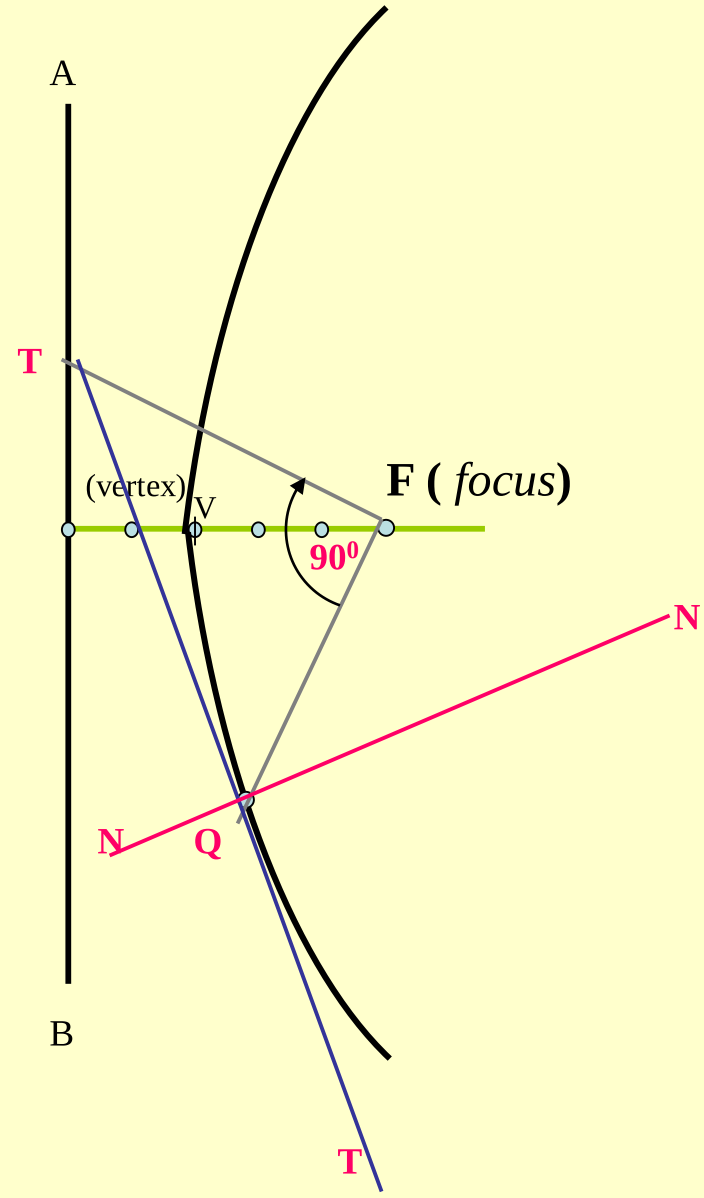
1.JOIN POINT **Q** TO **F.**
2.CONSTRUCT **90^0** ANGLE WITH THIS LINE AT POINT **F**
3.EXTEND THE LINE TO MEET DIRECTRIX AT **T**
4. JOIN THIS POINT TO Q AND EXTEND. THIS IS TANGENT TO THE CURVE FROM Q
5.TO THIS TANGENT DRAW PERPENDICULAR LINE FROM Q. IT IS NORMAL TO CURVE.



HYPERBOLA
TANGENT & NORMAL

TO DRAW TANGENT & NORMAL TO THE CURVE FROM A GIVEN POINT (Q)

1.JOIN POINT **Q** TO **F.**
2.CONSTRUCT 90^0 ANGLE WITH THIS LINE AT POINT **F**
3.EXTEND THE LINE TO MEET DIRECTRIX AT **T**
4. JOIN THIS POINT TO **Q** AND EXTEND. THIS IS TANGENT TO CURVE FROM **Q**
5.TO THIS TANGENT DRAW PERPENDICULAR LINE FROM **Q**. IT IS NORMAL TO CURVE.

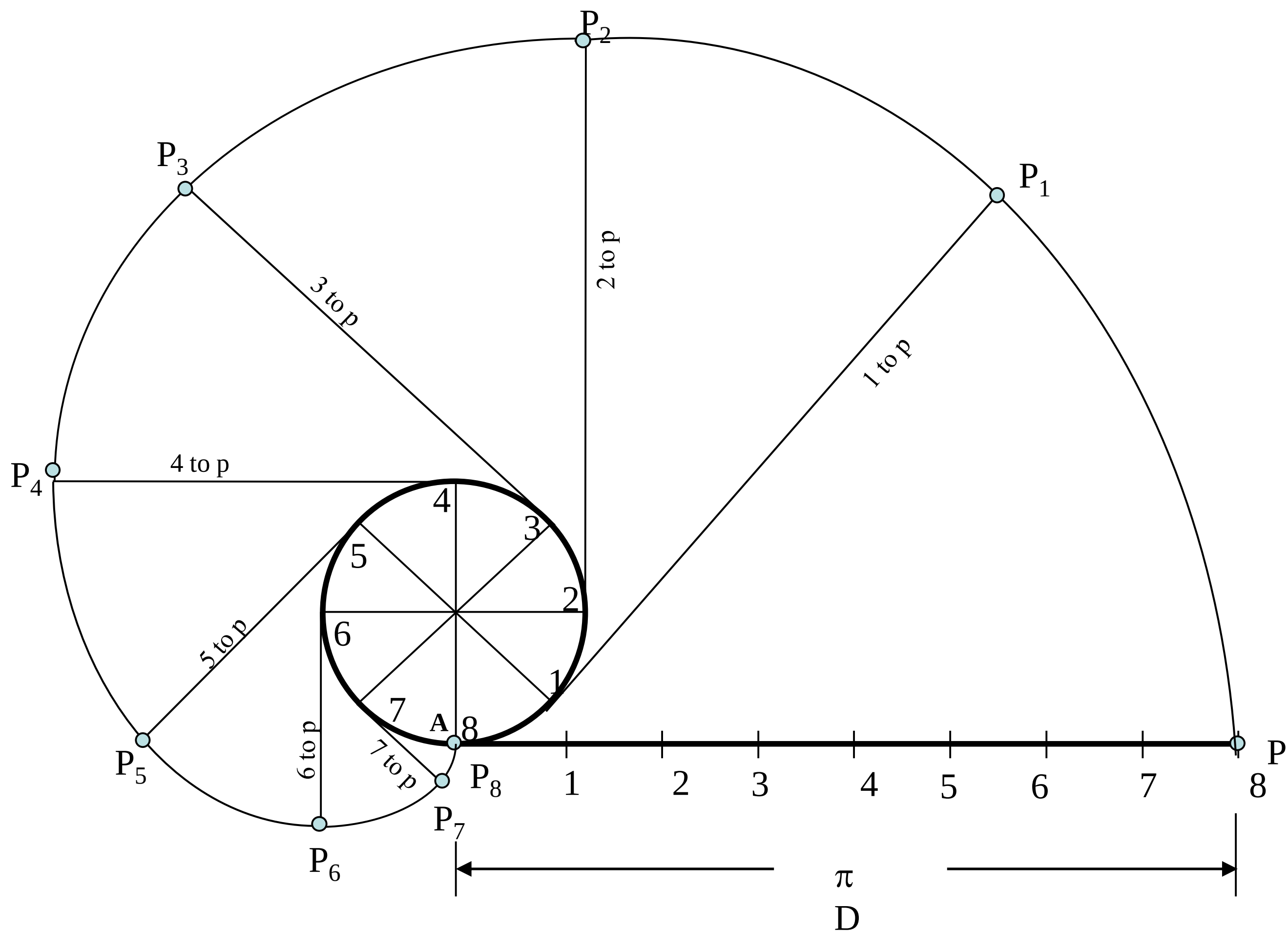


INVOLUTE OF A CIRCLE

Problem : Draw Involute of a circle.
String length is equal to the circumference of 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.

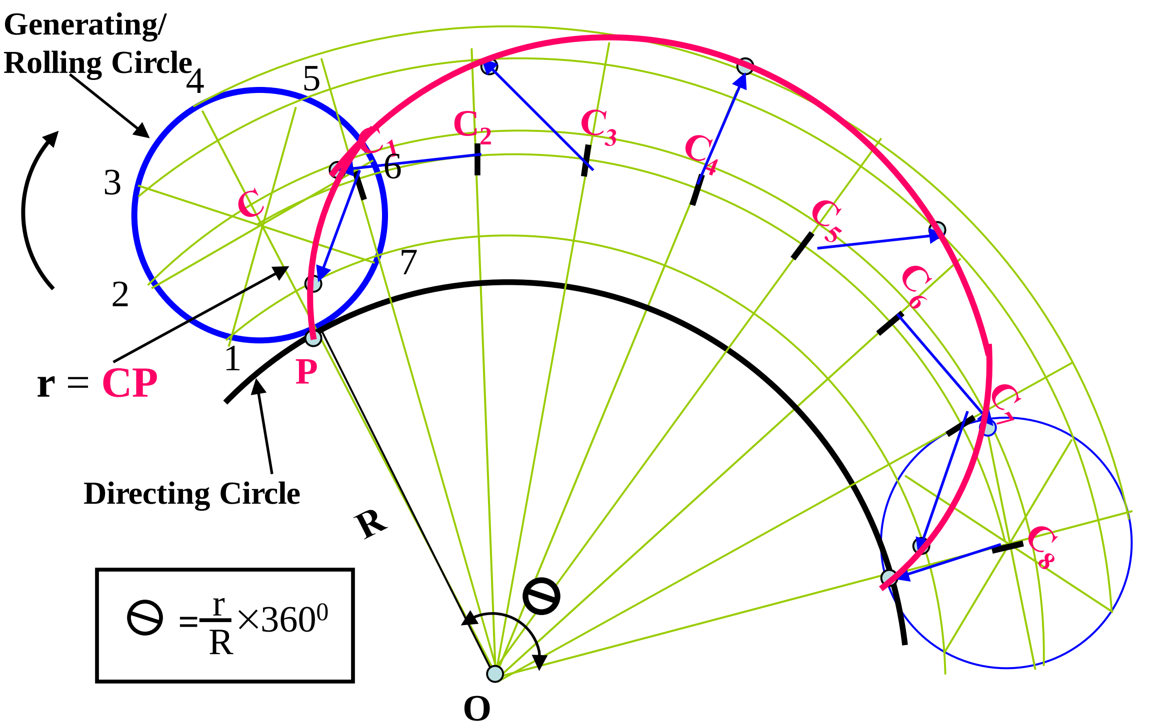


PROBLEM : DRAW LOCUS OF A POINT ON THE PERIPHERY OF A CIRCLE WHICH ROLLS ON A CURVED PATH. **Take diameter of rolling Circle 50 mm And radius of directing circle i.e. curved path, 75 mm.**

Solution Steps:

1) When smaller circle will roll on larger circle for one revolution it will cover Π D distance on arc and it will be decided by included arc angle θ.
2) Calculate θ by formula $\theta = (r/R) \times 3600$.
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 unto P8 (as in cycloid) and join them by smooth curve. This is EPI – CYCLOID.

EPI CYCLOID :

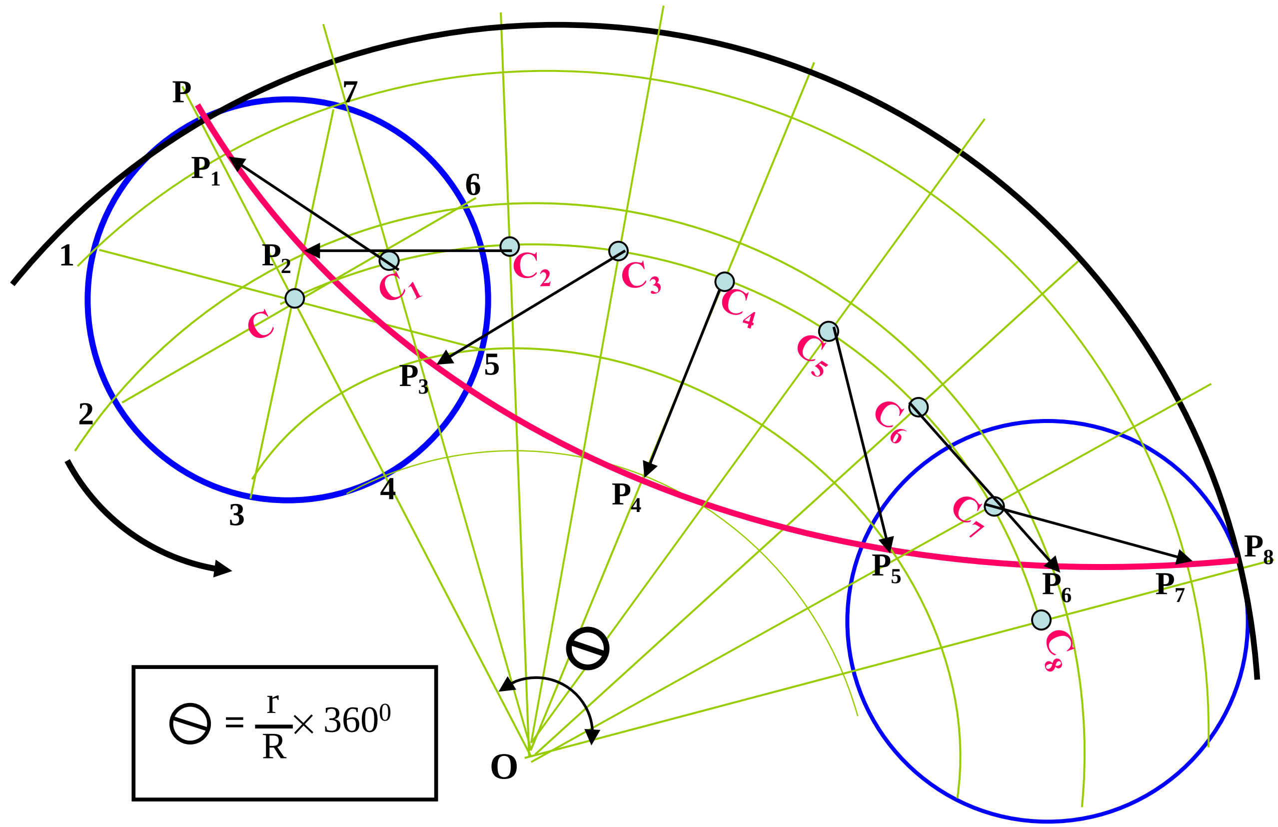


PROBLEM : DRAW LOCUS OF A POINT ON THE PERIPHERY OF A CIRCLE WHICH ROLLS FROM THE INSIDE OF A CURVED PATH. **Take diameter of rolling circle 50 mm and radius of directing circle (curved path) 75 mm.**

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**.



$$\ominus = \frac{r}{R} \times 360^0$$

OC = R (Radius of Directing Circle)

CP = r (Radius of Generating Circle)

Involute
Method of Drawing
Tangent & Normal

STEPS:
DRAW INVOLUTE AS USUAL.

MARK POINT **Q** ON IT AS DIRECTED.

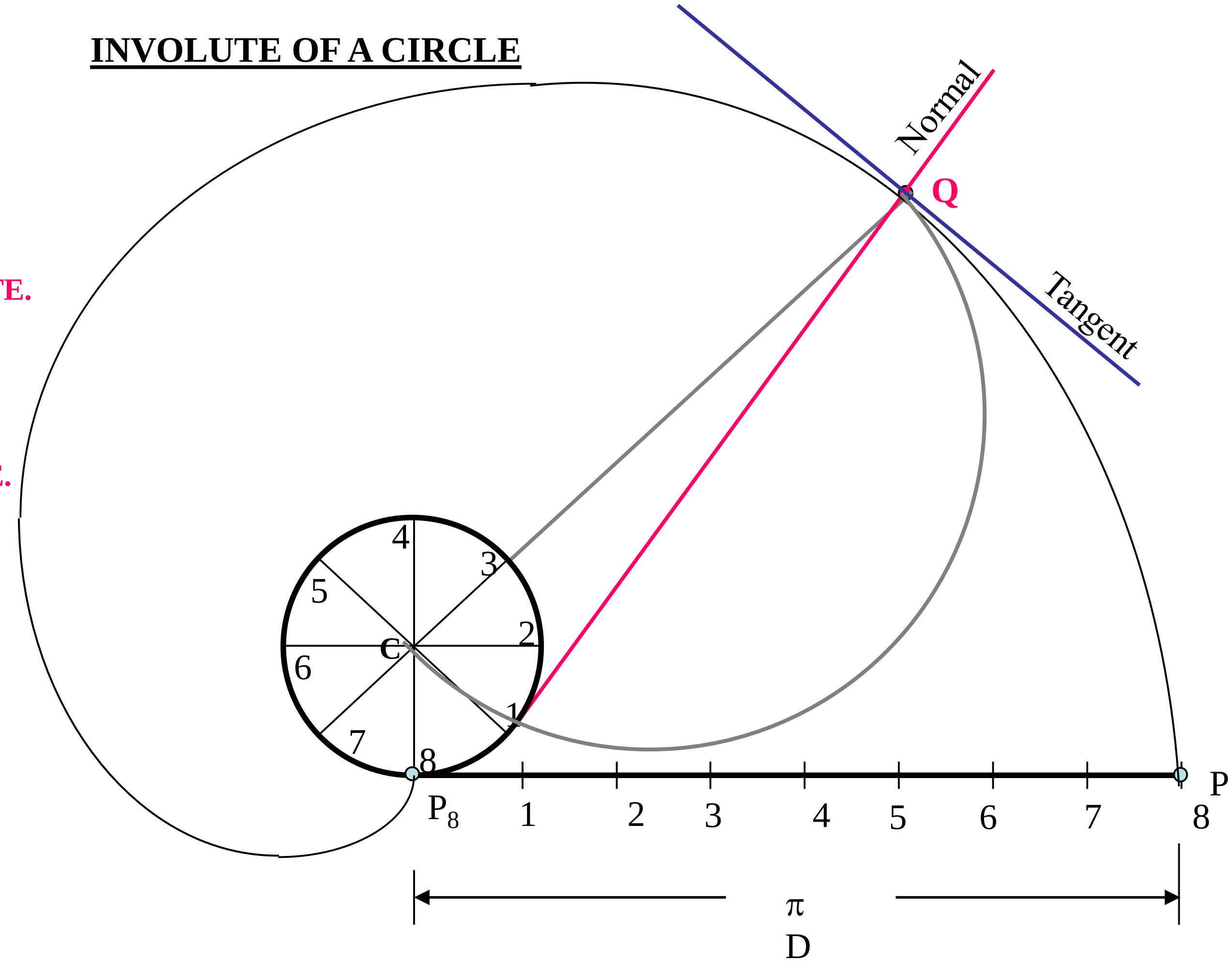
JOIN **Q** TO THE CENTER OF CIRCLE **C**.
CONSIDERING **CQ** DIAMETER, DRAW
A SEMICIRCLE AS SHOWN.

MARK POINT OF INTERSECTION OF
THIS SEMICIRCLE AND POLE CIRCLE
AND JOIN IT TO **Q.**

THIS WILL BE **NORMAL TO INVOLUTE.**

DRAW A LINE AT RIGHT ANGLE TO
THIS LINE FROM **Q.**

IT WILL BE TANGENT TO INVOLUTE.



CYCLOID
Method of Drawing
Tangent & Normal

STEPS:
DRAW CYCLOID AS USUAL.
MARK POINT **Q** ON IT AS DIRECTED.

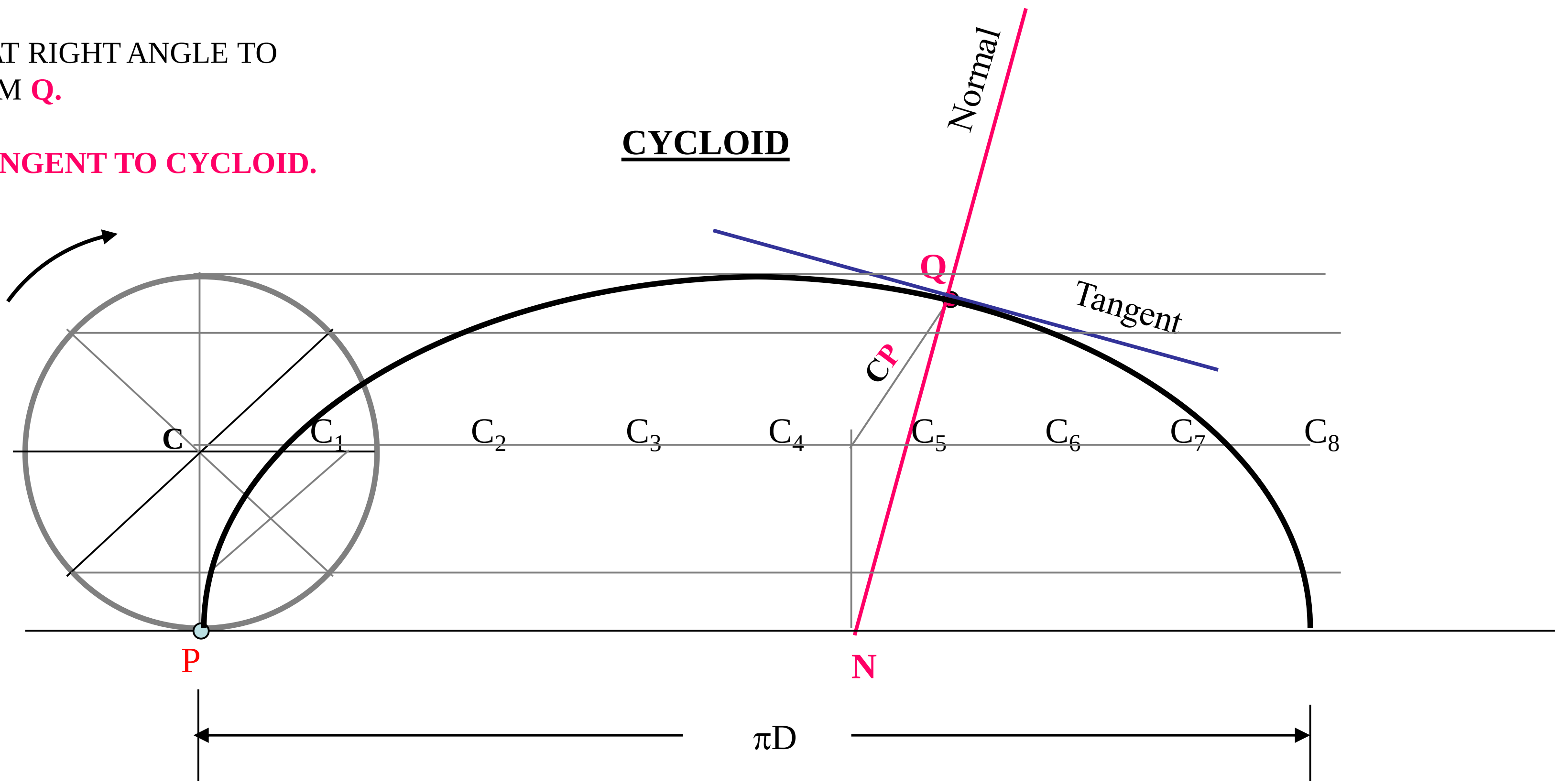
WITH CP DISTANCE, FROM **Q.** CUT THE POINT ON LOCUS OF **C** AND JOIN IT TO **Q.**

FROM THIS POINT DROP A PERPENDICULAR ON GROUND LINE AND NAME IT N

JOIN N WITH Q.THIS WILL BE **NORMAL TO CYCLOID.**

DRAW A LINE AT RIGHT ANGLE TO THIS LINE FROM **Q.**

IT WILL BE TANGENT TO CYCLOID.



SCALES

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SCALES

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

SUCH A SCALE IS CALLED REDUCING SCALE

AND

THAT RATIO IS CALLED REPRESENTATIVE FACTOR.

SIMILARLY IN CASE OF TINY OBJECTS DIMENSIONS MUST BE INCREASED FOR ABOVE PURPOSE. HENCE THIS SCALE IS CALLED ENLARGING SCALE. HERE THE RATIO CALLED REPRESENTATIVE FACTOR IS MORE THAN UNITY.

FOR FULL SIZE SCALE R.F.=1 OR (1:1) MEANS DRAWING & OBJECT ARE OF SAME SIZE.
Other RFs are described as
1:10, 1:100,
1:1000, 1:1,00,000

USE FOLLOWING FORMULAS FOR THE CALCULATIONS IN THIS TOPIC.

A REPRESENTATIVE FACTOR (R.F.) =

$$\frac{\text{DIMENSION OF DRAWING}}{\text{DIMENSION OF OBJECT}}$$

$$= \frac{\text{LENGTH OF DRAWING}}{\text{ACTUAL LENGTH}}$$

$$= \sqrt{\frac{\text{AREA OF DRAWING}}{\text{ACTUAL AREA}}}$$

$$= \sqrt[3]{\frac{\text{VOLUME AS PER DRWG.}}{\text{ACTUAL VOLUME}}}$$

B LENGTH OF SCALE = R.F. X MAX. LENGTH TO BE MEASURED.

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 (FOR DIMENSIONS UP TO SINGLE DECIMAL)
2. DIAGONAL SCALES (FOR DIMENSIONS UP TO TWO DECIMALS)
3. VERNIER SCALES (FOR DIMENSIONS UP TO TWO DECIMALS)
4. COMPARATIVE SCALES (FOR COMPARING TWO DIFFERENT UNITS)
5. SCALE OF CORDS (FOR MEASURING/CONSTRUCTING ANGLES)

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

PROBLEM :- Draw a scale 1 cm = 1m to read decimeters, to measure maximum distance of 6 m.
Show on it a distance of 4 m and 6 dm.

CONSTRUCTION:-

a) Calculate $\text{R.F.} = \dfrac{\text{DIMENSION OF DRAWING}}{\text{DIMENSION OF OBJECT}}$

R.F.= 1cm/ 1m = 1/100

Length of scale = R.F. X max. distance

= 1/100 X 600 cm

= 6 cms

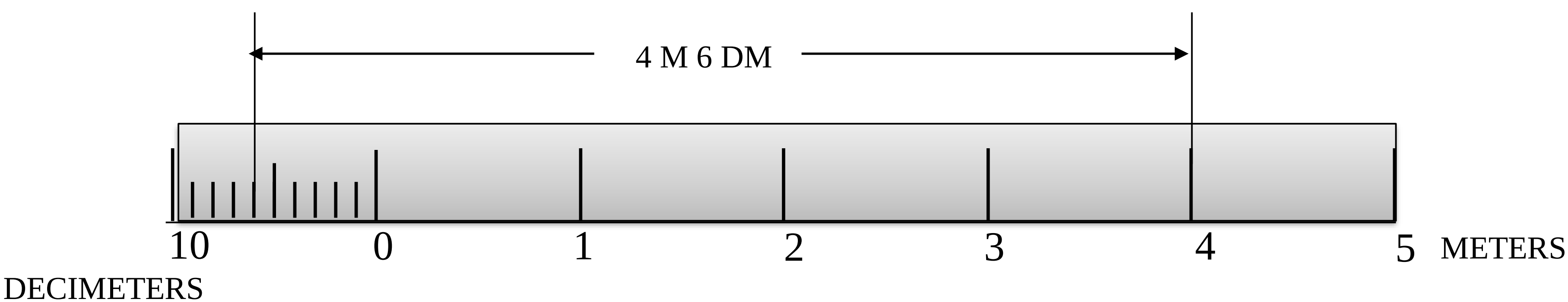
b) Draw a line 6 cm long and divide it in 6 equal parts. Each part will represent larger division unit.

c) Sub divide the first part which will represent second unit or fraction of first unit.

d) Place (0) at the end of first unit. Number the units on right side of Zero and subdivisions on left-hand side of Zero. Take height of scale 5 to 10 mm for getting a look of scale.

e) After construction of scale mention it's RF and name of scale as shown.

f) Show the distance 4 m 6 dm on it as shown.



R.F. = 1/100

PLANE SCALE SHOWING METERS AND DECIMETERS.

PROBLEM :- In a map a 36 km distance is shown by a line 45 cms long. Calculate the R.F. and construct a plain scale to read kilometers and hectometers, for max. 12 km. Show a distance of 8.3 km on it.

CONSTRUCTION:-

a) Calculate R.F.

R.F.= 45 cm/ 36 km = 45/ 36 . 1000 . 100 = 1/ 80,000

Length of scale = R.F. $\times$ max. distance

= 1/ 80000 $\times$ 12 km

= 15 cm

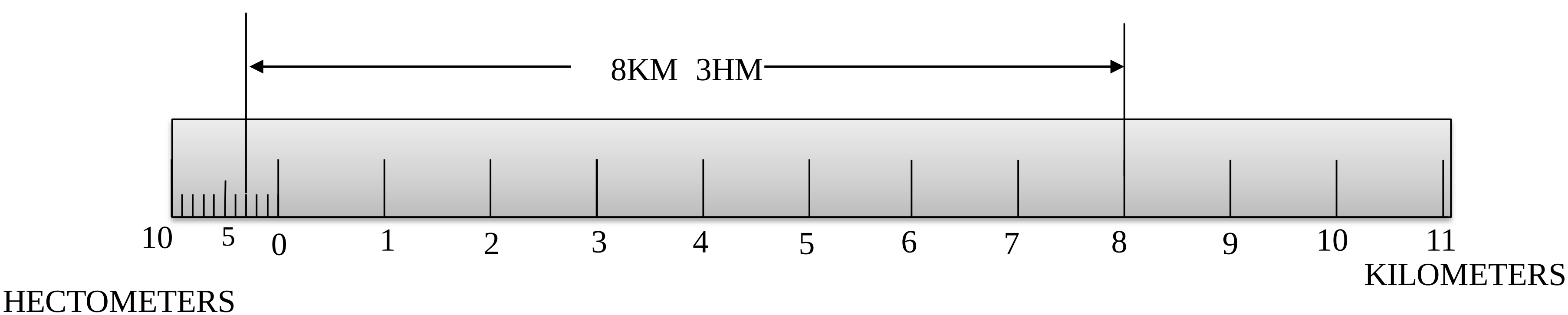
b) Draw a line 15 cm long and divide it in 12 equal parts. Each part will represent larger division unit.

c) Sub divide the first part which will represent second unit or fraction of first unit.

d) Place (0) at the end of first unit. Number the units on right side of Zero and subdivisions on left-hand side of Zero. Take height of scale 5 to 10 mm for getting a look of scale.

e) After construction of scale mention it's RF and name of scale as shown.

f) Show the distance 8.3 km on it as shown.



R.F. = 1/80,000

PLANE SCALE SHOWING KILOMETERS AND HECTOMETERS

PROBLEM :. Draw a diagonal scale of R.F. 1: 2.5, showing centimeters and millimeters and long enough to measure up to 20 centimeters.

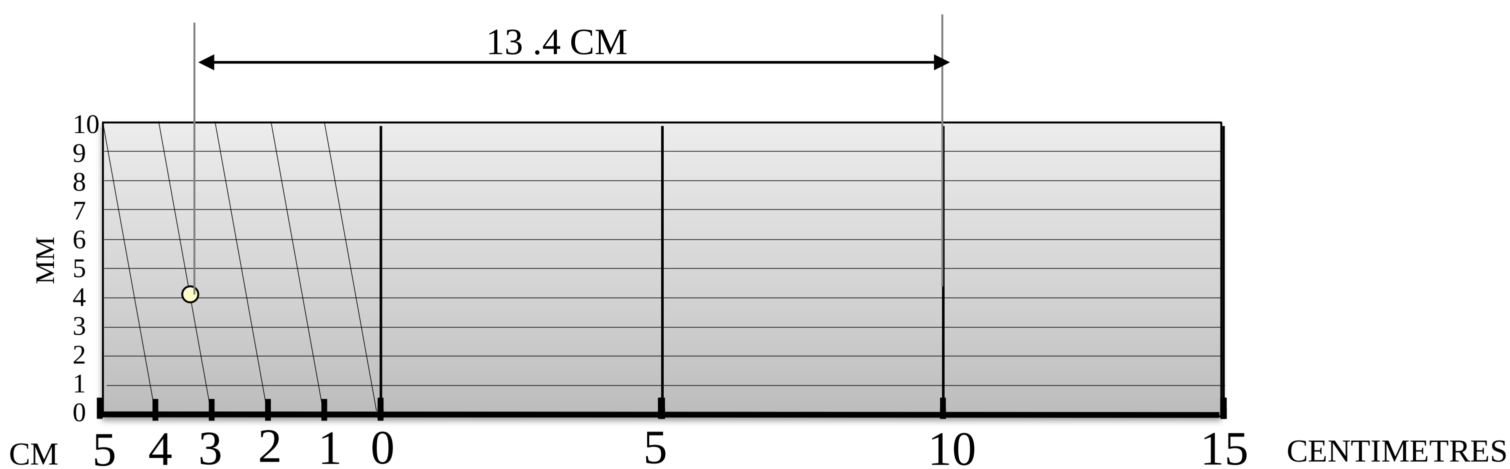
SOLUTION STEPS:

R.F. = 1 / 2.5

Length of scale = 1 / 2.5 X 20 cm.

= 8 cm.

1.Draw a line 8 cm long and divide it in to 4 equal parts.
(Each part will represent a length of 5 cm.)
2.Divide the first part into 5 equal divisions.
(Each will show 1 cm.)
3.At the left hand end of the line, draw a vertical line and on it step-off 10 equal divisions of any length.
4.Complete the scale as explained in previous problems.
Show the distance 13.4 cm on it.



R.F. = 1 / 2.5

DIAGONAL SCALE SHOWING CENTIMETERS.

NOTATIONS

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

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

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

PROJECTION OF POINTS,LINES AND PLANES

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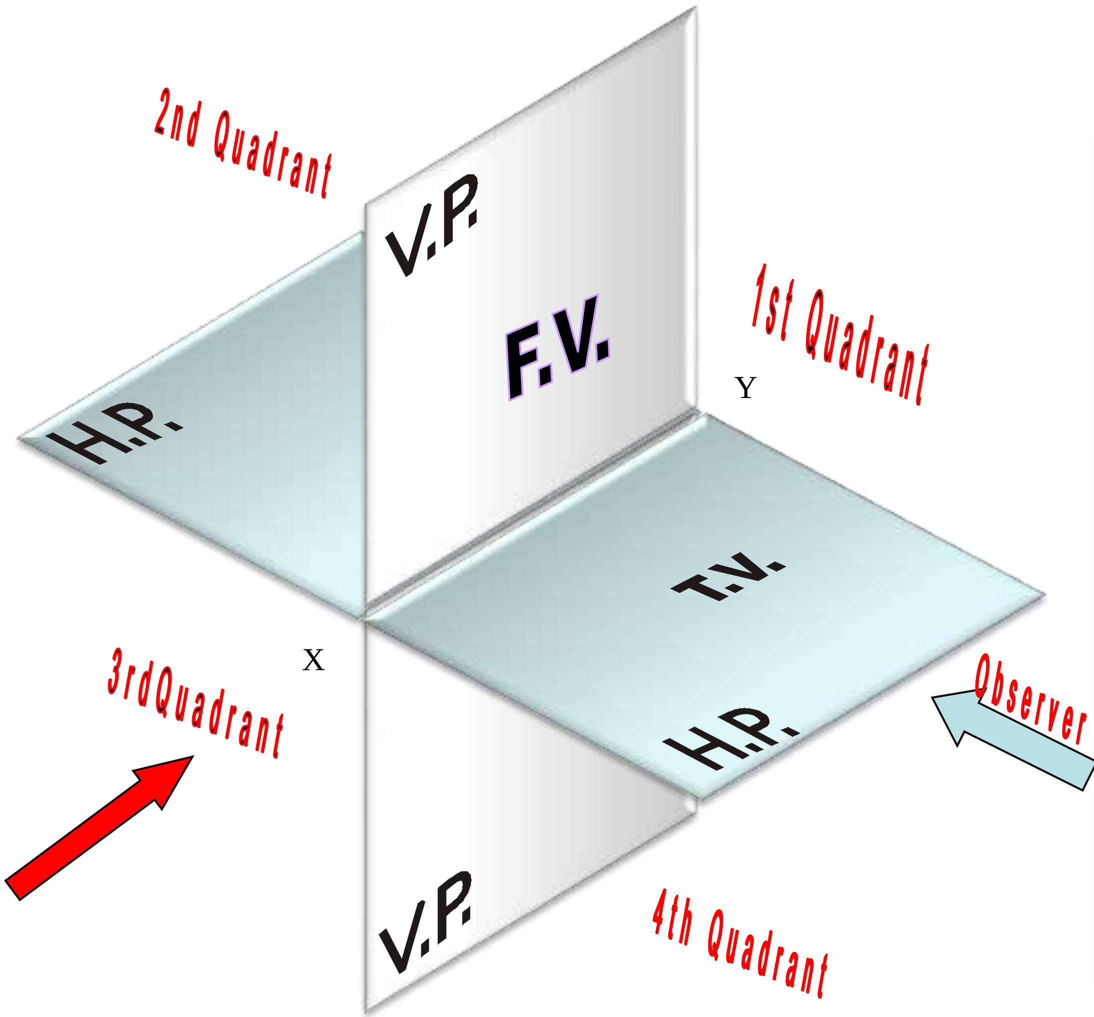
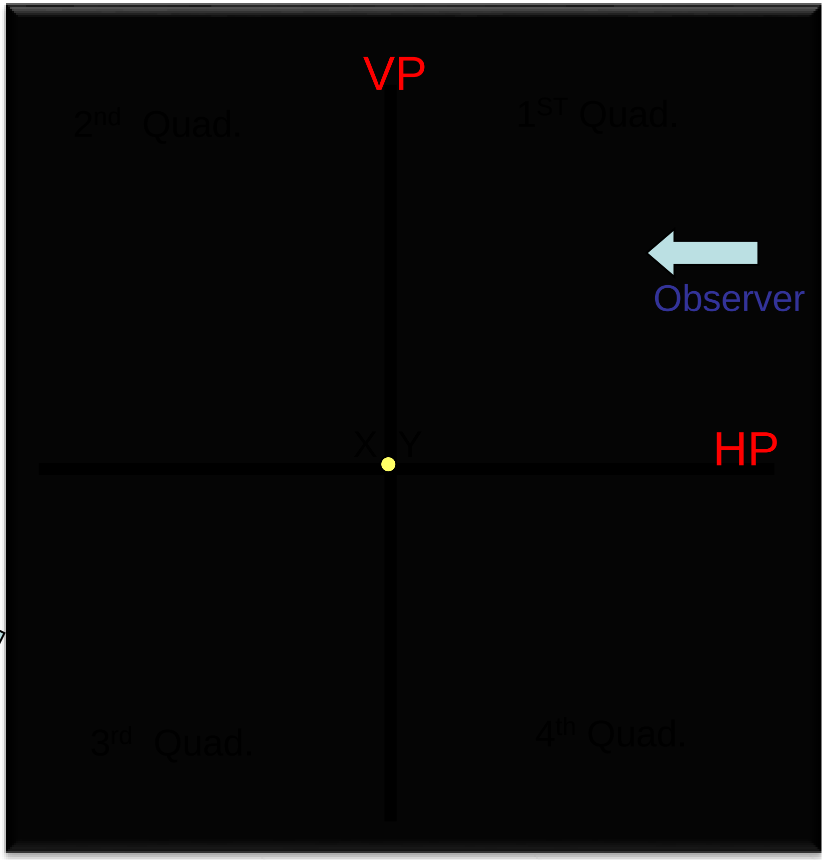
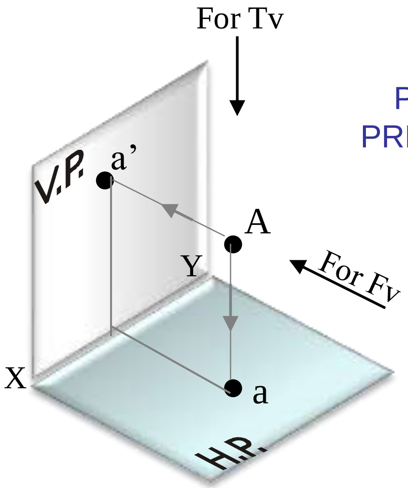




THIS QUADRANT PATTERN,
IF OBSERVED ALONG X-Y LINE (IN RED ARROW DIRECTION)
WILL EXACTLY APPEAR AS SHOWN ON RIGHT SIDE AND HENCE,
IT IS FURTHER USED TO UNDERSTAND ILLUSTRATION PROPERLLY.

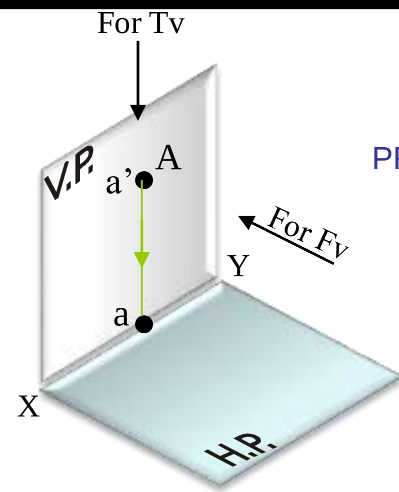
PROJECTIONS OF A POINT IN FIRST QUADRANT.

POINT A ABOVE HP
& INFRONT OF VP



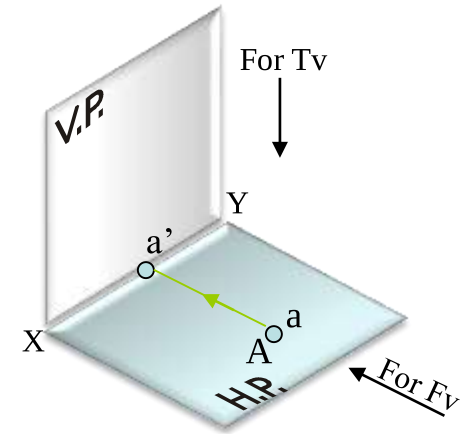
PICTORIAL
PRESENTATION

POINT A ABOVE HP
& IN VP



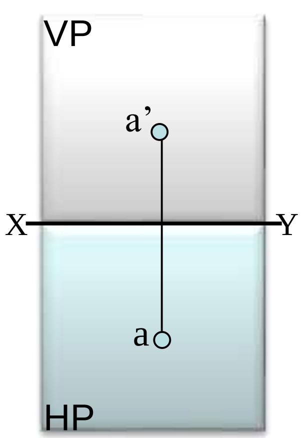
PICTORIAL
PRESENTATION

POINT A IN HP
& INFRONT OF VP

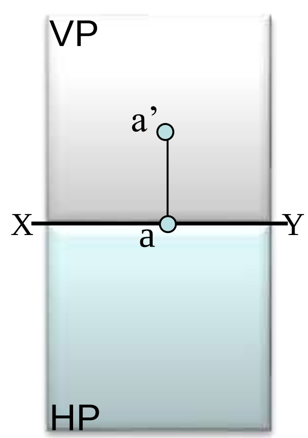


ORTHOGRAPHIC PRESENTATIONS
OF ALL ABOVE CASES.

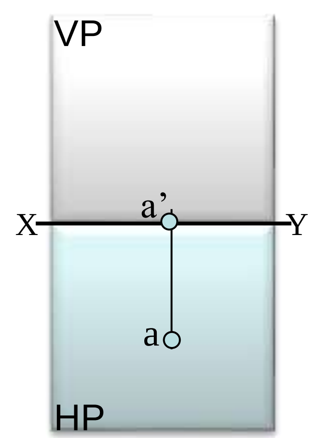
Fv above xy,
Tv below xy.



Fv above xy,
Tv on xy.



Fv on xy,
Tv below xy.



PROJECTIONS OF STRAIGHT LINES.

INFORMATION REGARDING A LINE *means*
IT'S LENGTH,
POSITION OF IT'S ENDS WITH HP & VP
IT'S INCLINATIONS WITH HP & VP WILL BE GIVEN.
AIM:- TO DRAW IT'S PROJECTIONS - MEANS FV & TV.

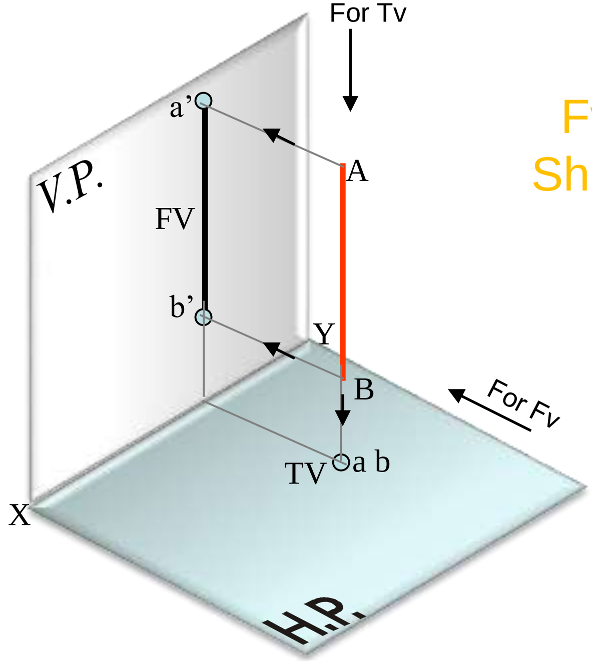
SIMPLE CASES OF THE LINE

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

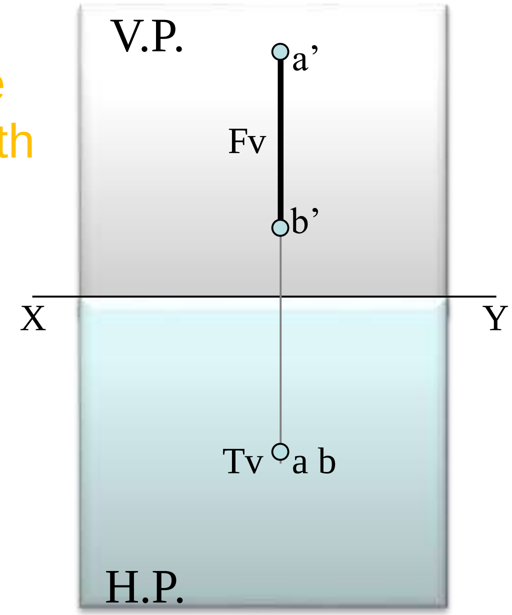
STUDY ILLUSTRATIONS GIVEN ON NEXT PAGE SHOWING CLEARLY THE NATURE OF FV & TV OF LINES LISTED ABOVE AND NOTE RESULTS.

1.

A Line
perpendicular
to Hp
&
// to Vp

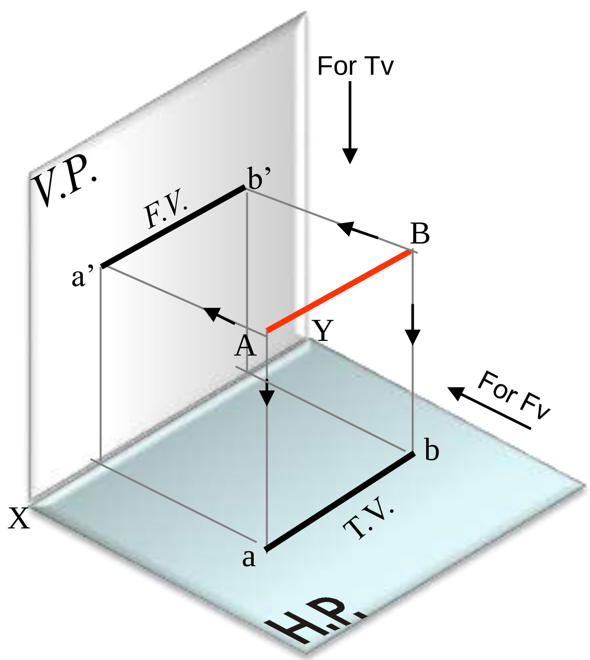


Fv is a vertical line
Showing True Length
&
Tv is a point

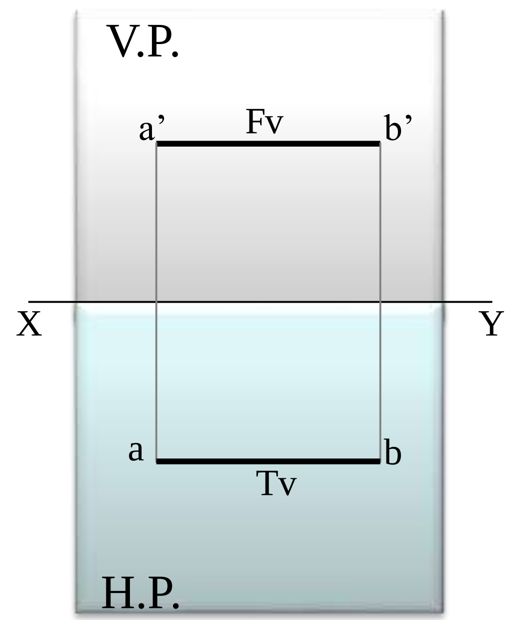


2.

A Line
// to Hp
&
// to Vp

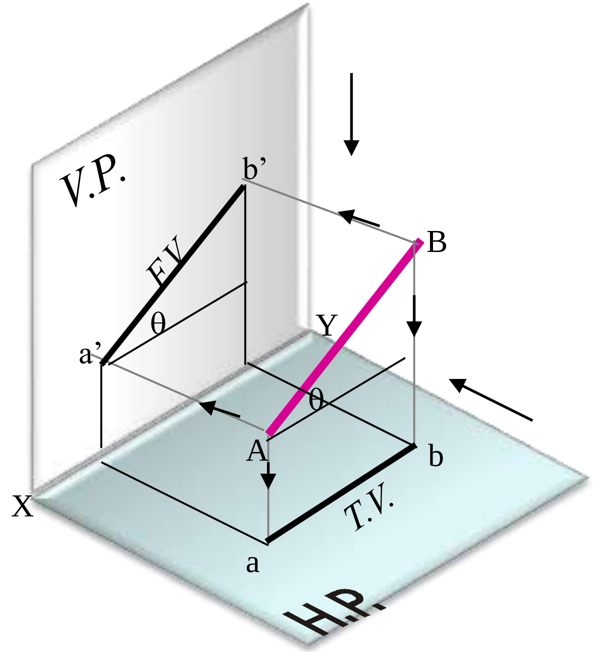


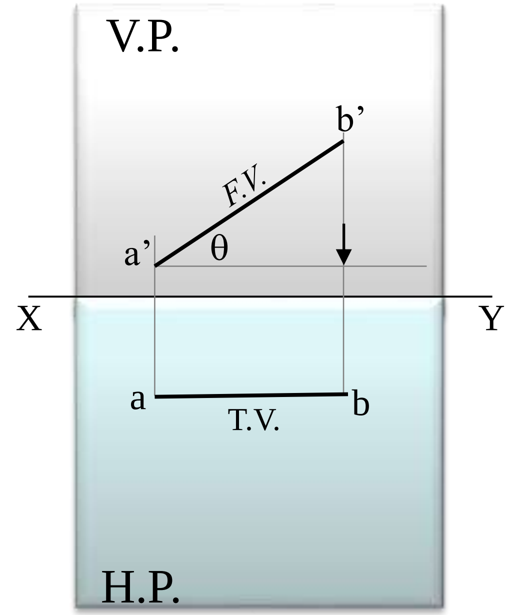
Fv & Tv both are
// to xy
&
both show T. L.



3.

A Line inclined to Hp
and
parallel to Vp

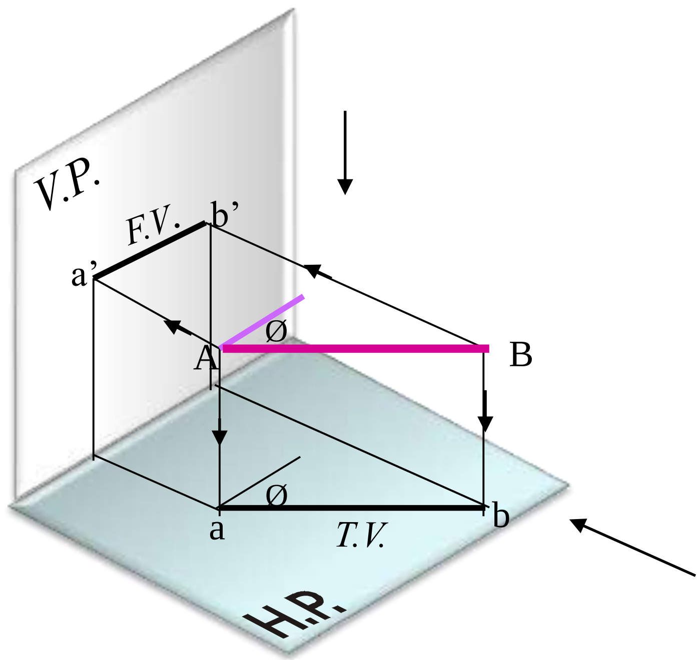


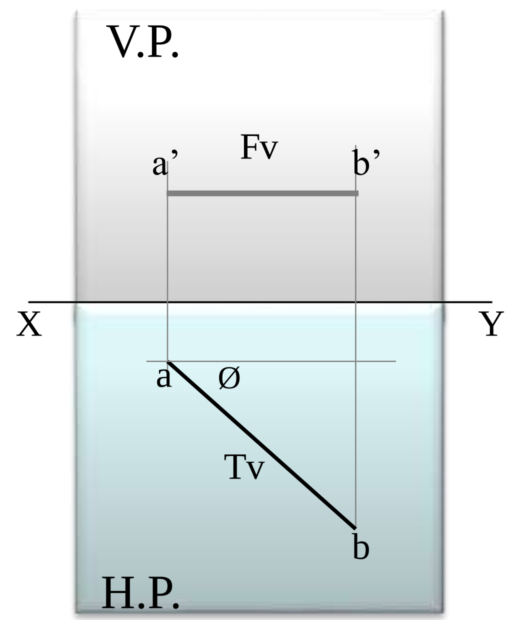


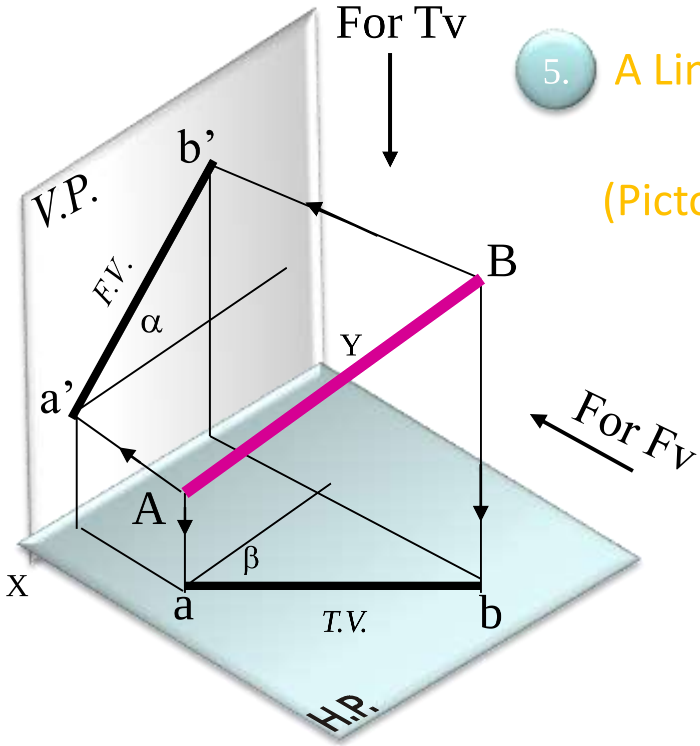
Orthographic Projections

4.

A Line inclined to Vp
and
parallel to Hp

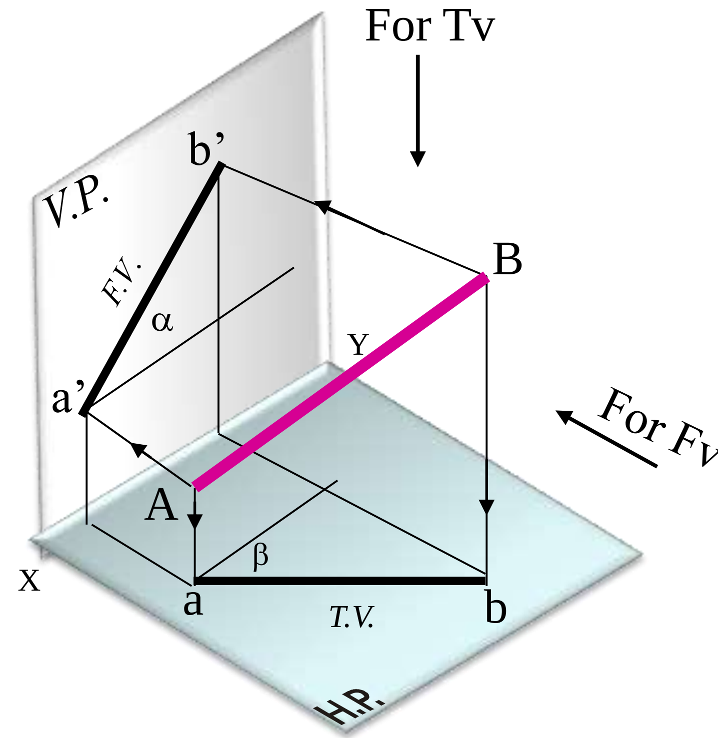


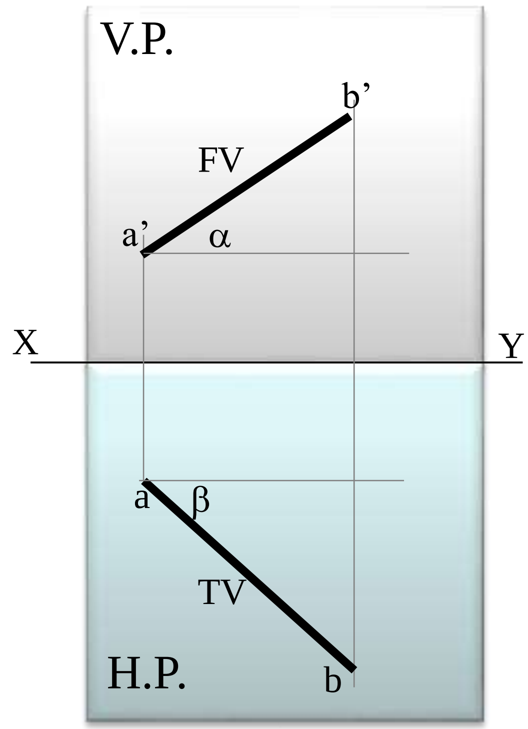




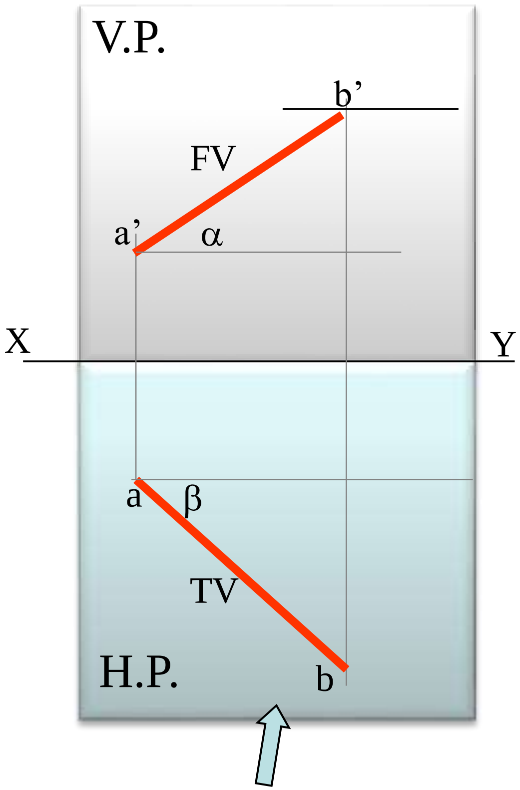
5. A Line inclined to both Hp and Vp

(Pictorial presentation)



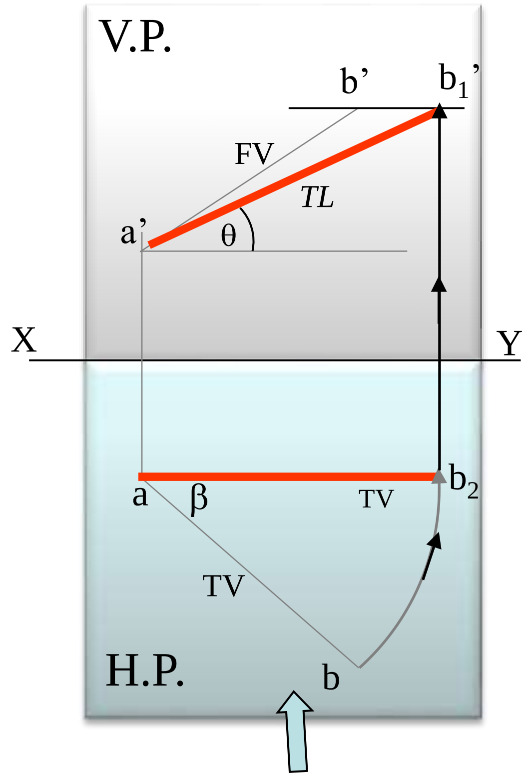


Orthographic Projections
Means Fv & Tv of Line AB
are shown below,
with their apparent Inclinations
α & β



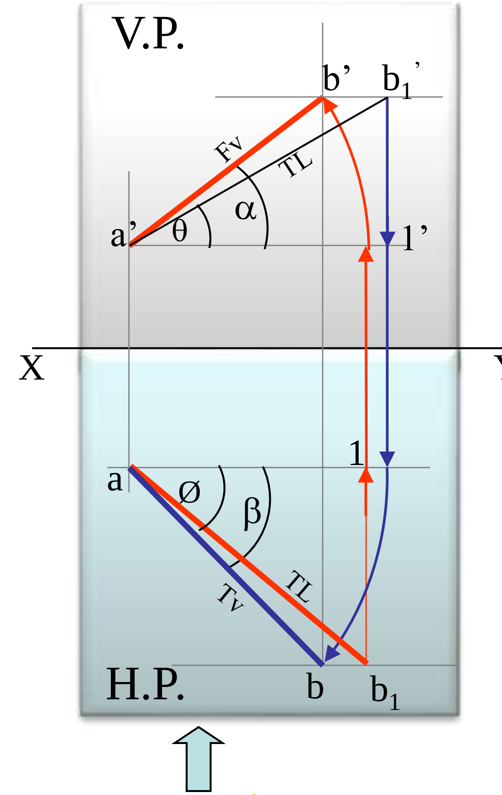
Here TV (ab) is not // to XY line
Hence it’s corresponding FV
a’ b’ is not showing
True Length &
True Inclination with Hp.

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



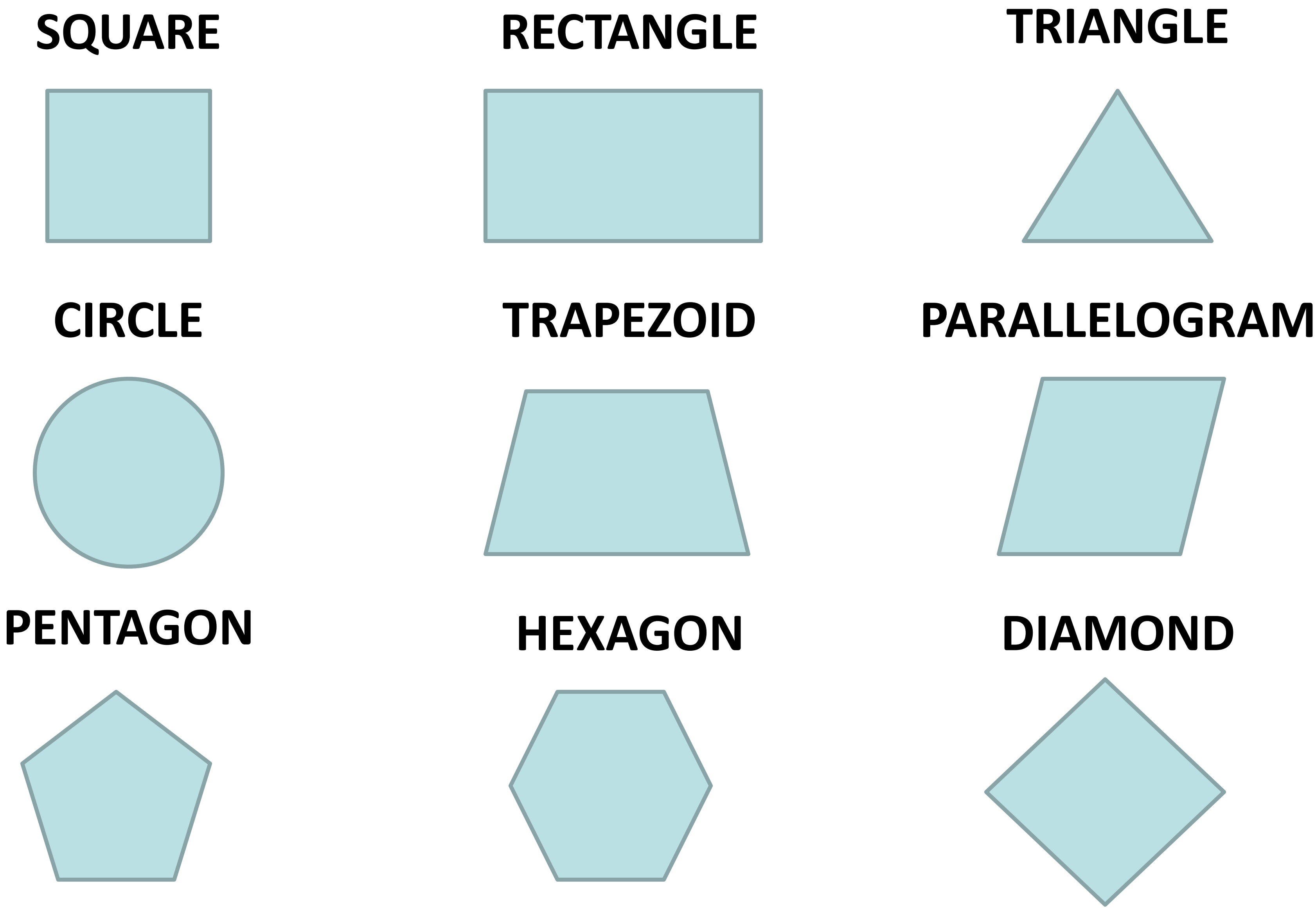
In this sketch, TV is rotated
and made // to XY line.
Hence it’s corresponding
FV a’ b_1’Is showing
True Length
&
True Inclination with Hp.

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



Here a -1 is component
of TL ab_1 gives length of Fv.
Hence it is brought Up to
Locus of a’ and further rotated
to get point b’. a’ b’ will be Fv.
Similarly drawing component
of other TL(a’ b1‘) Tv can be drawn.

TYPES OF PLANE FIGURES



TYPES OF PLANES

PERPENDICULAR PLANES

Planes which are perpendicular to one of the principal planes of projection and inclined or parallel to the other

OBLIQUE PLANES

Planes inclined to both the reference planes

TRACE OF PLANE

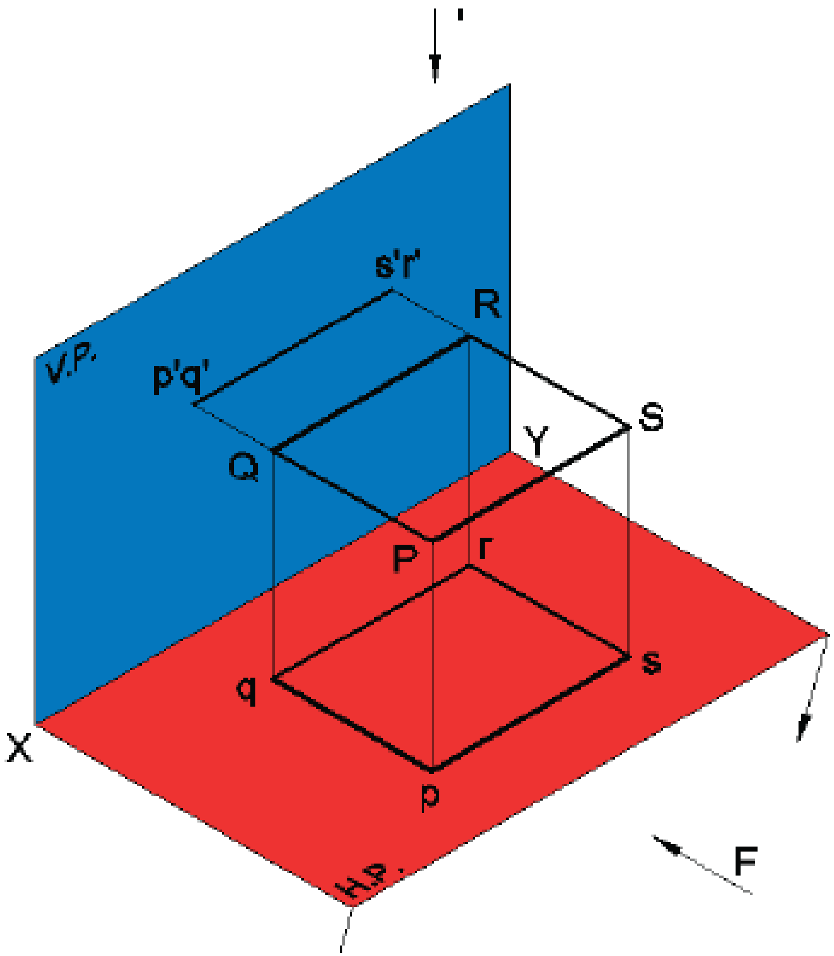
HORIZONTAL TRACE

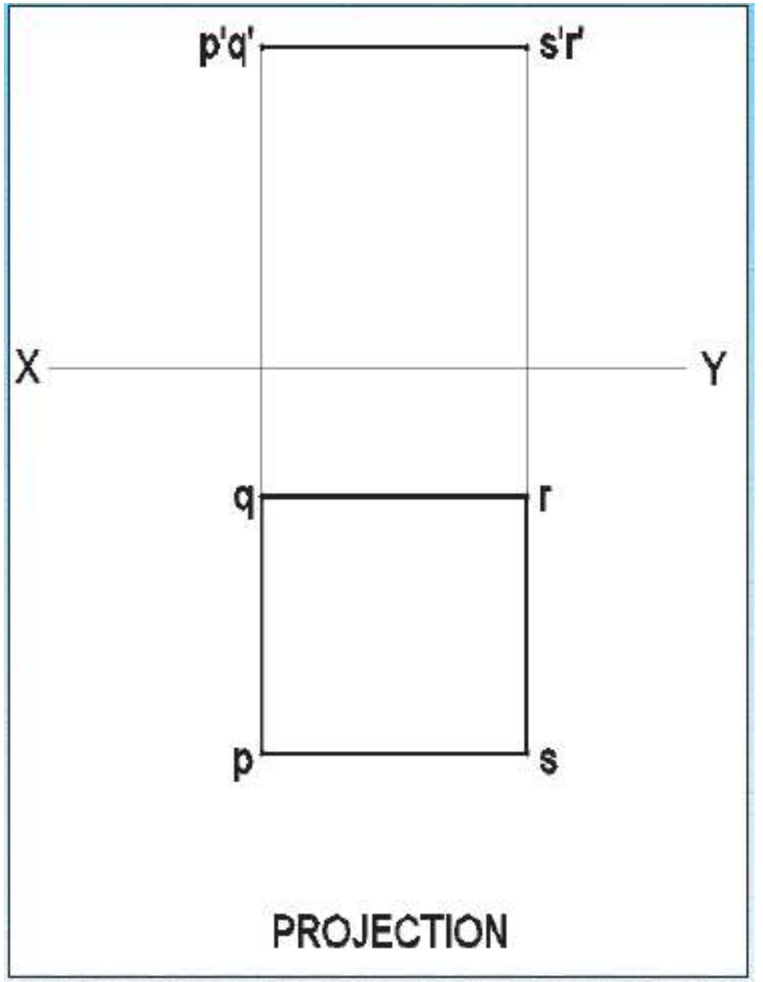
The intecsection line of the plane surface with H.P

VERTICAL TRACE

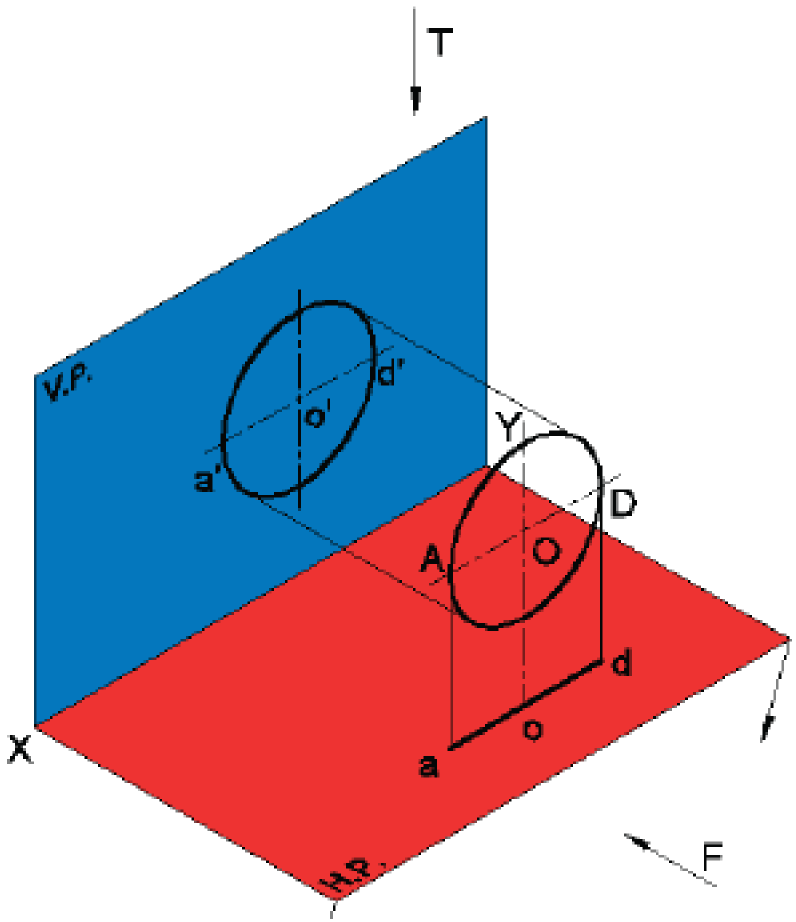
The intecsection line of the plane surface with V.P

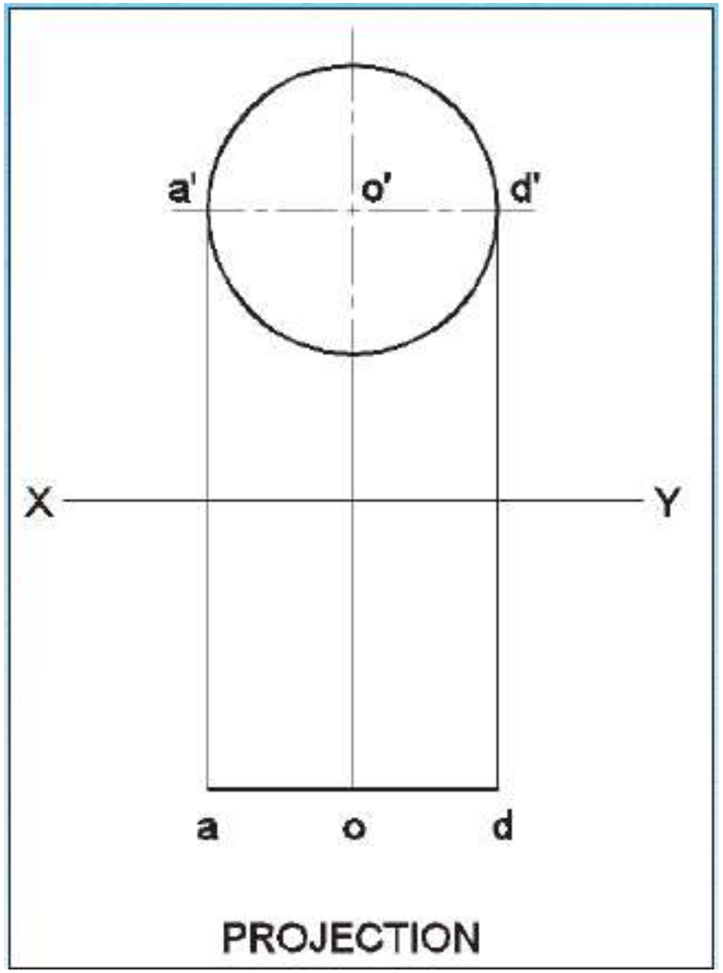
PROJECTION OF PLANE **PERPENDICULAR** TO **V.P** AND **PARALLEL** TO **H.P**



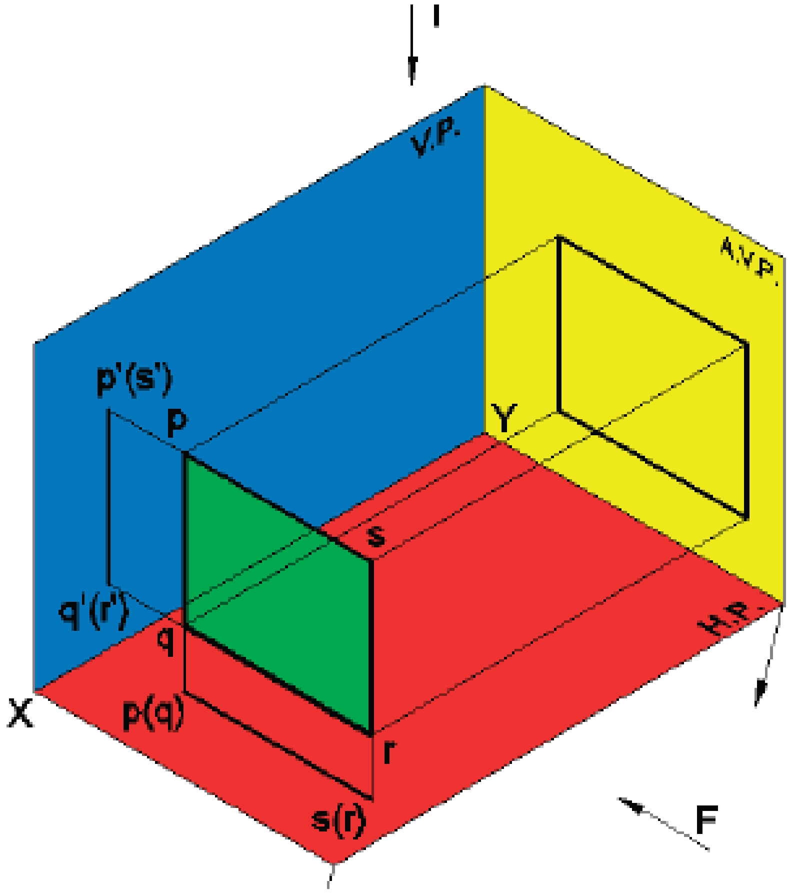


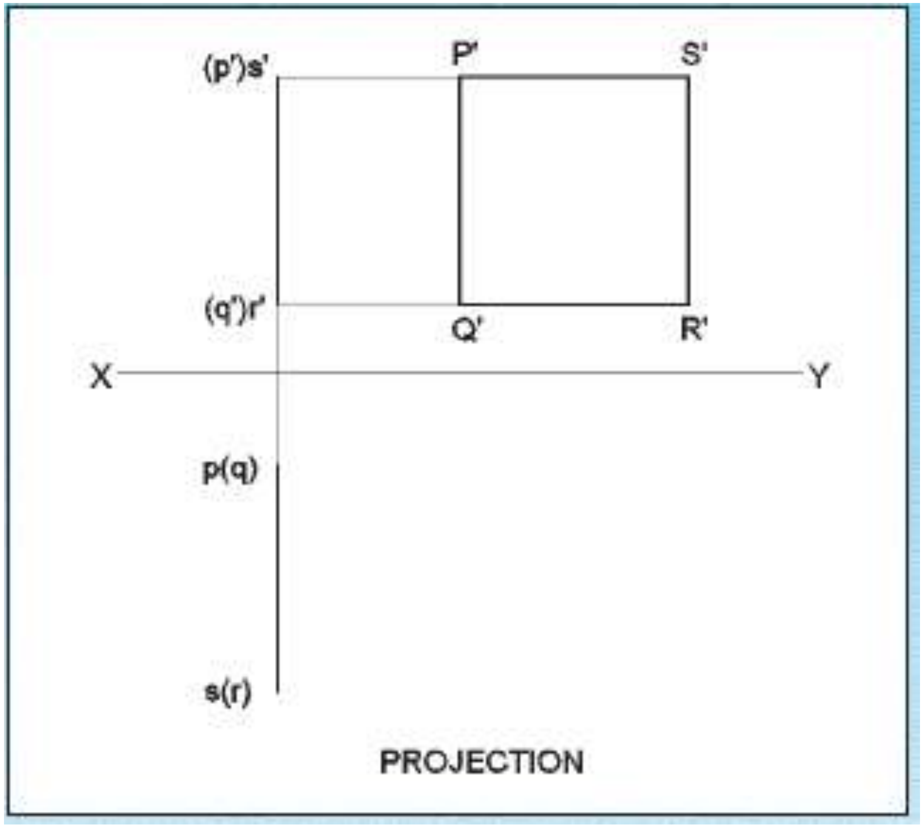
PROJECTION OF PLANE **PERPENDICULAR** TO **H.P** AND **PARALLEL** TO **V.P**





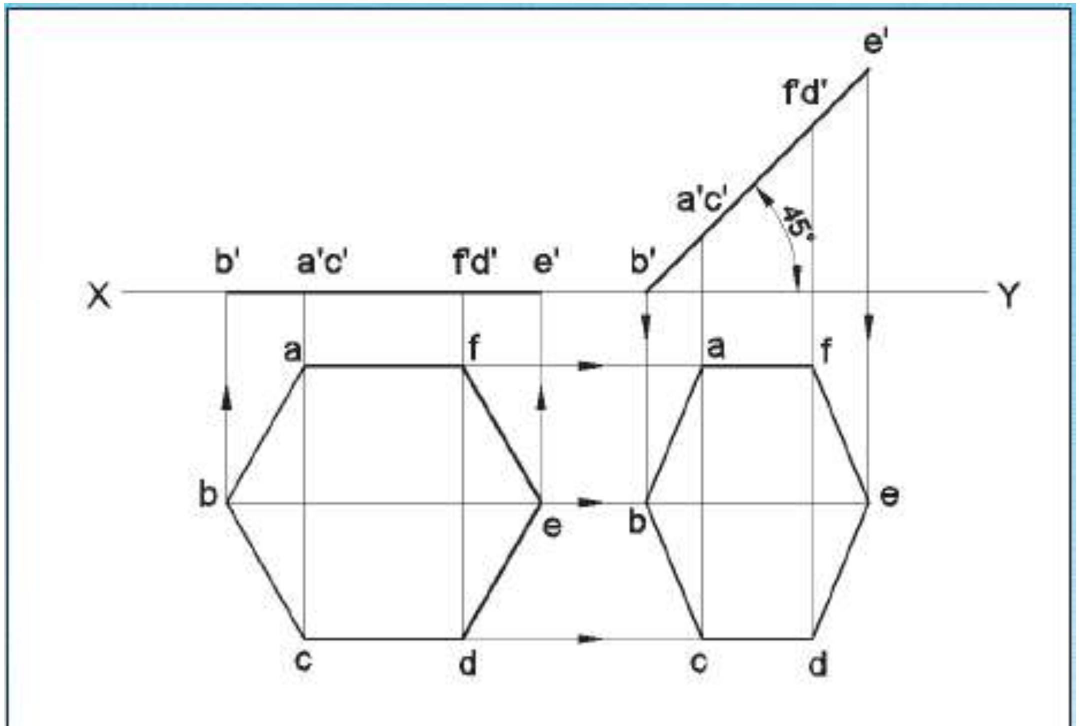
PROJECTION OF PLANE **PERPENDICULAR** TO BOTH **H.P** AND **V.P**





EXAMPLE:-

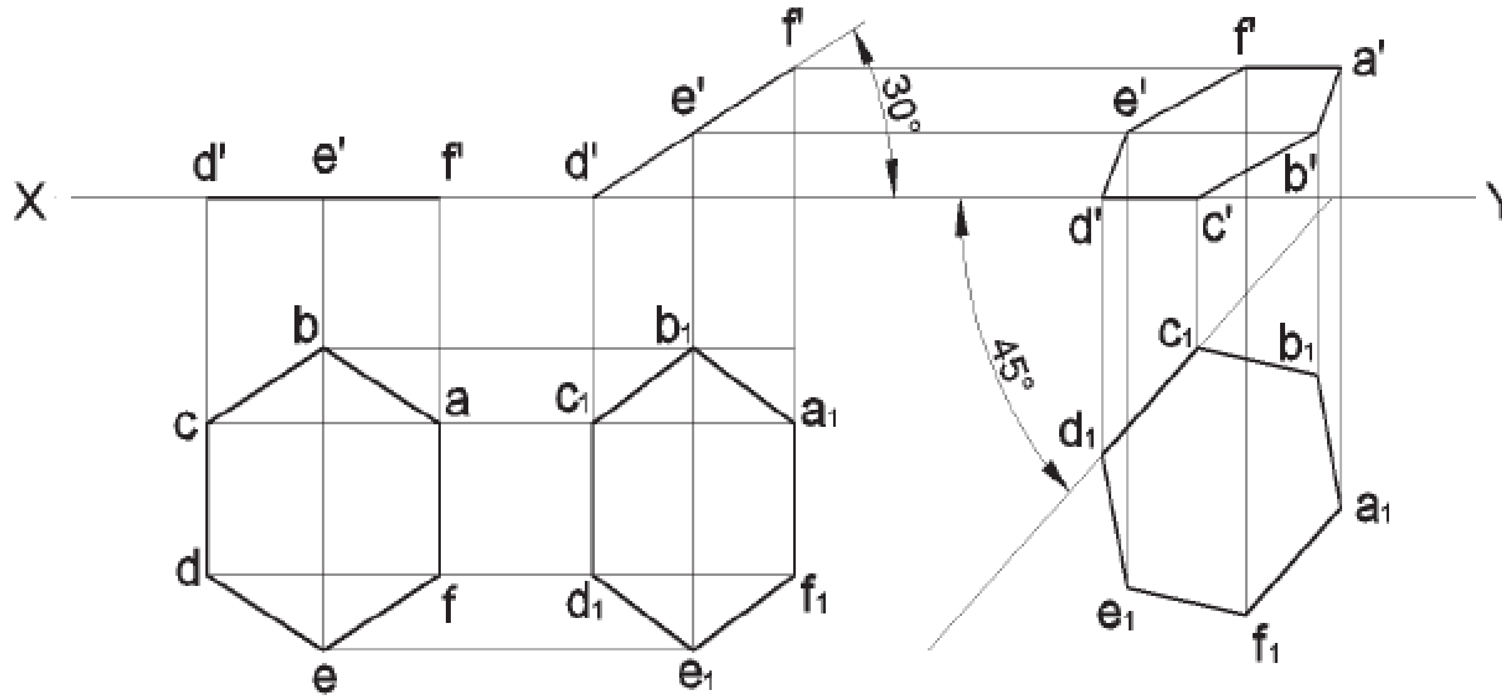
A thin horizontal plate of 15 mm sides is inclined at 45° to the H.P and perpendicular to V.P, two of its parallel edges is parallel to V.P, the plate is 10 mm above H.P and 15 mm infront of V.P



(FIRST ANGLE PROJECTION)

EXAMPLE:-

Draw the projections of a regular hexagon of 20 mm side, having one of its sides in the H.P and inclined at 45° to the V.P; and its surface making an angle of 30° with the H.P



PROJECTION OF SOLIDS

Prepared by
K. Mahesh
Asst. proff
Dept: mechanical

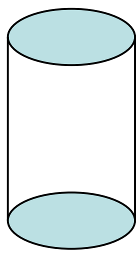
SOLIDS

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

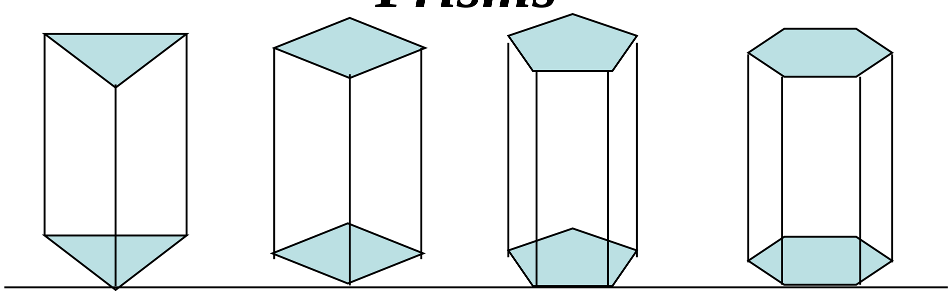
Group A

Solids having top and base of same shape

Cylinder



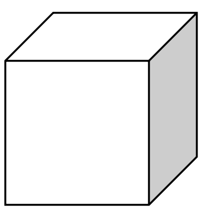
Prisms



Triangular Square Pentagonal Hexagonal

Cube

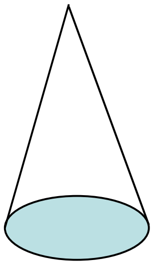
(A solid having six square faces)



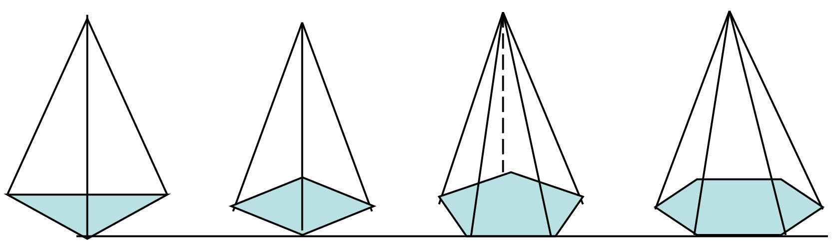
Group B

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

Cone



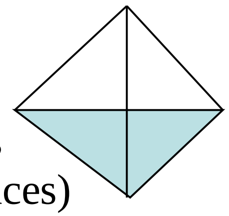
Pyramids



Triangular Square Pentagonal Hexagonal

Tetrahedron

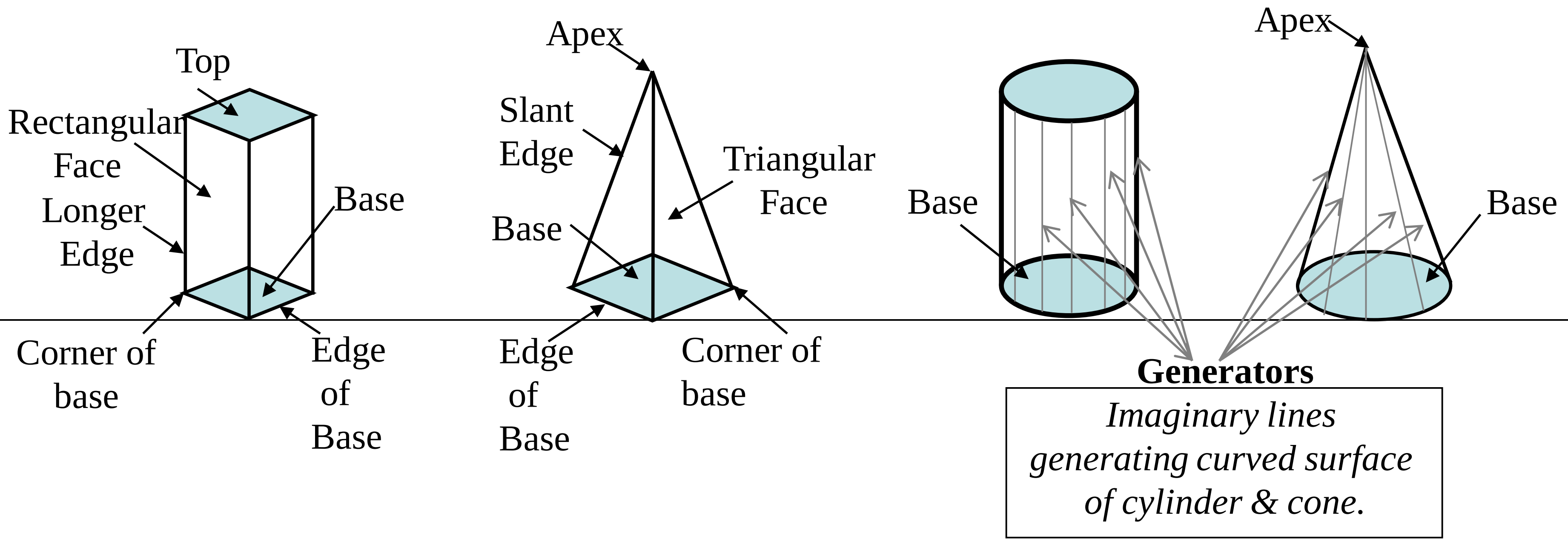
(A solid having Four triangular faces)

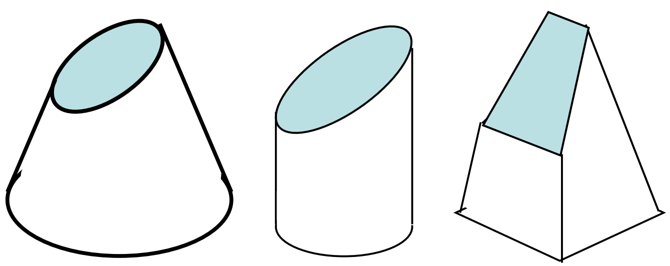


SOLIDS

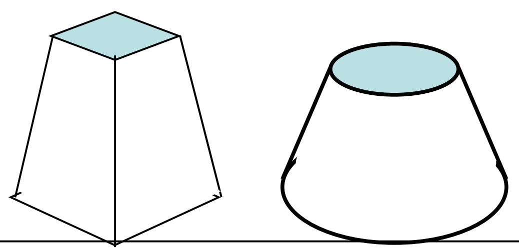
Dimensional parameters of different solids.

Square Prism **Square Pyramid** **Cylinder** **Cone**





Sections of solids(top & base not parallel)

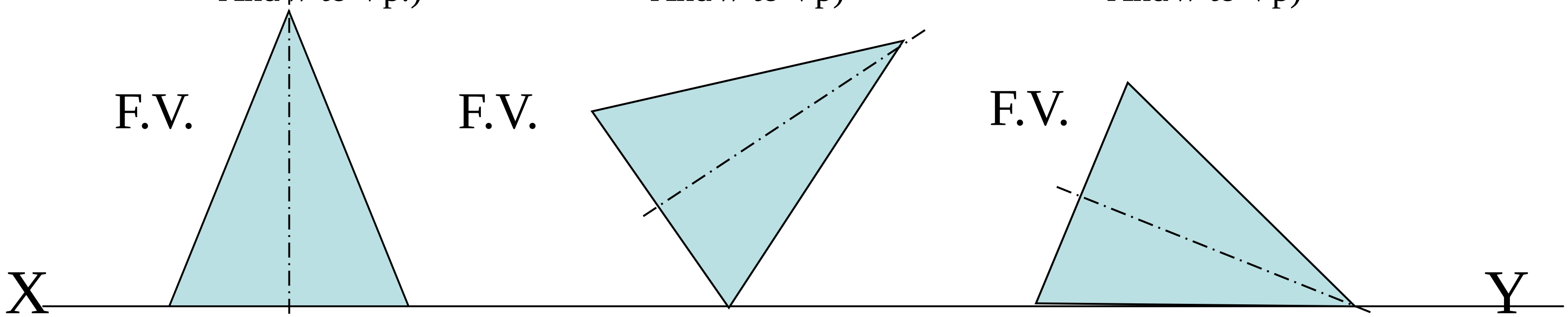


Frustum of cone & pyramids.
(top & base parallel to each other)

STANDING ON H.P
On it’s base.
(Axis perpendicular to Hp
And // to Vp.)

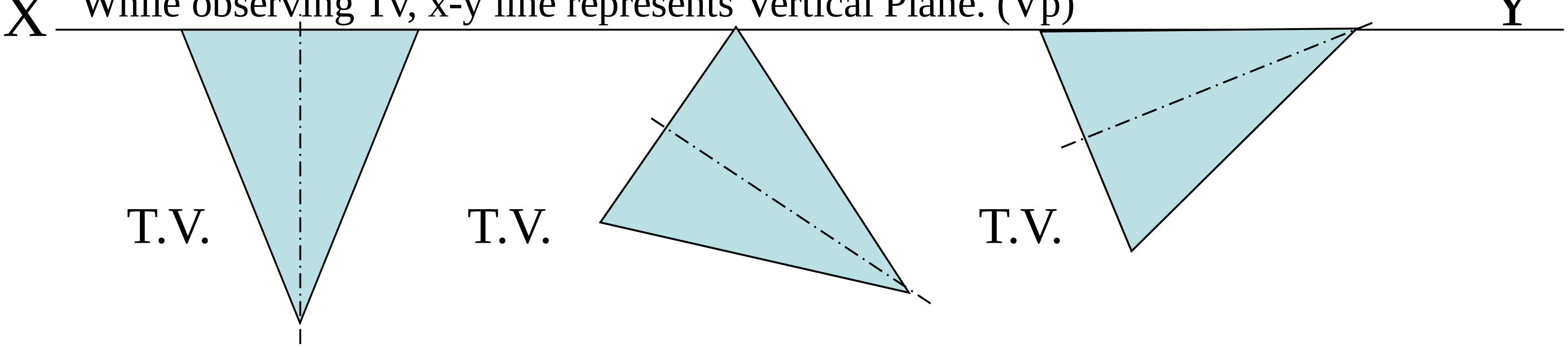
RESTING ON H.P
On one point of base circle.
(Axis inclined to Hp
And // to Vp)

LYING ON H.P
On one generator.
(Axis inclined to Hp
And // to Vp)



While observing Fv, x-y line represents Horizontal Plane. (Hp)

While observing Tv, x-y line represents Vertical Plane. (Vp)

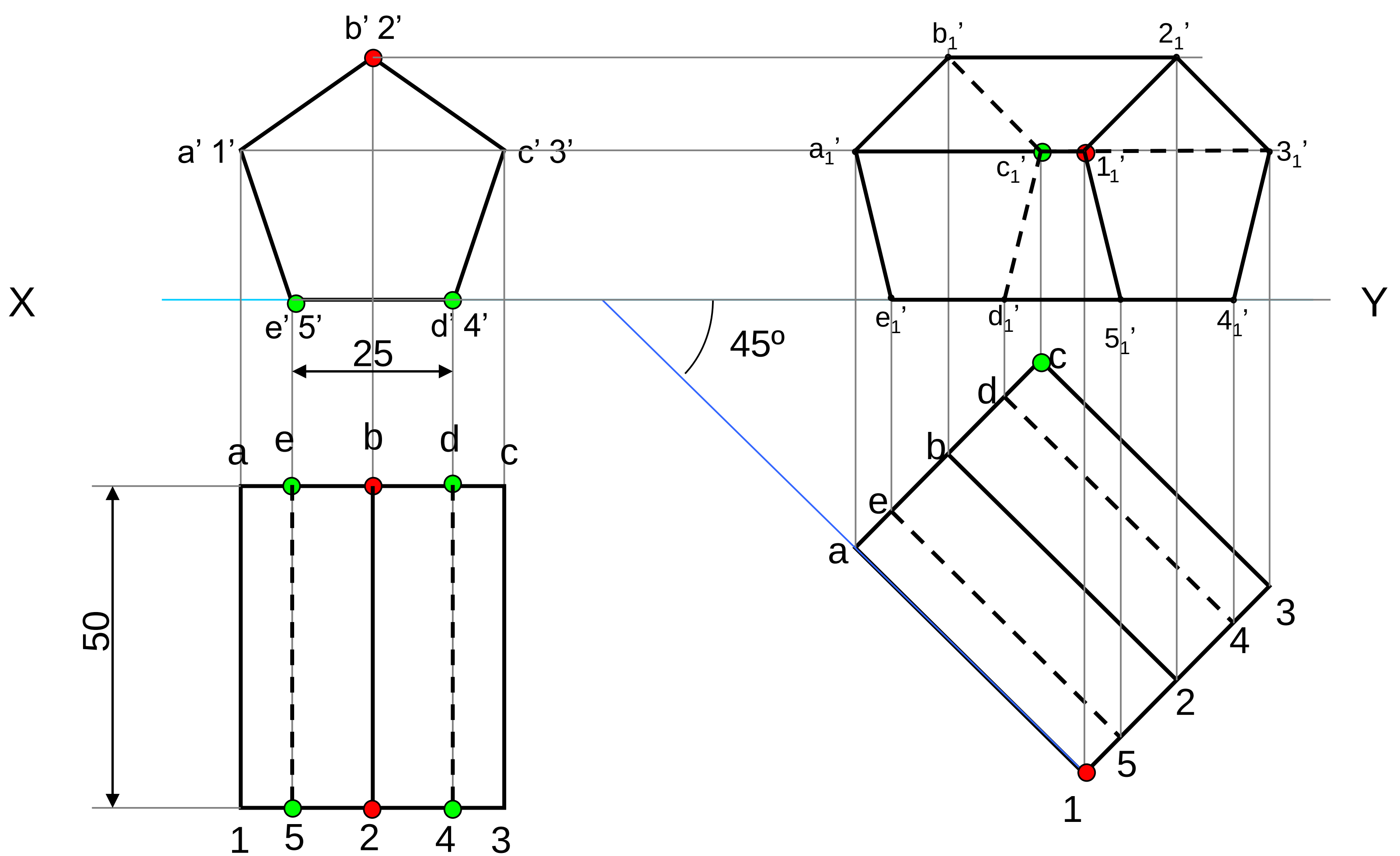


STANDING ON V.P
On it’s base.
Axis perpendicular to Vp
And // to Hp

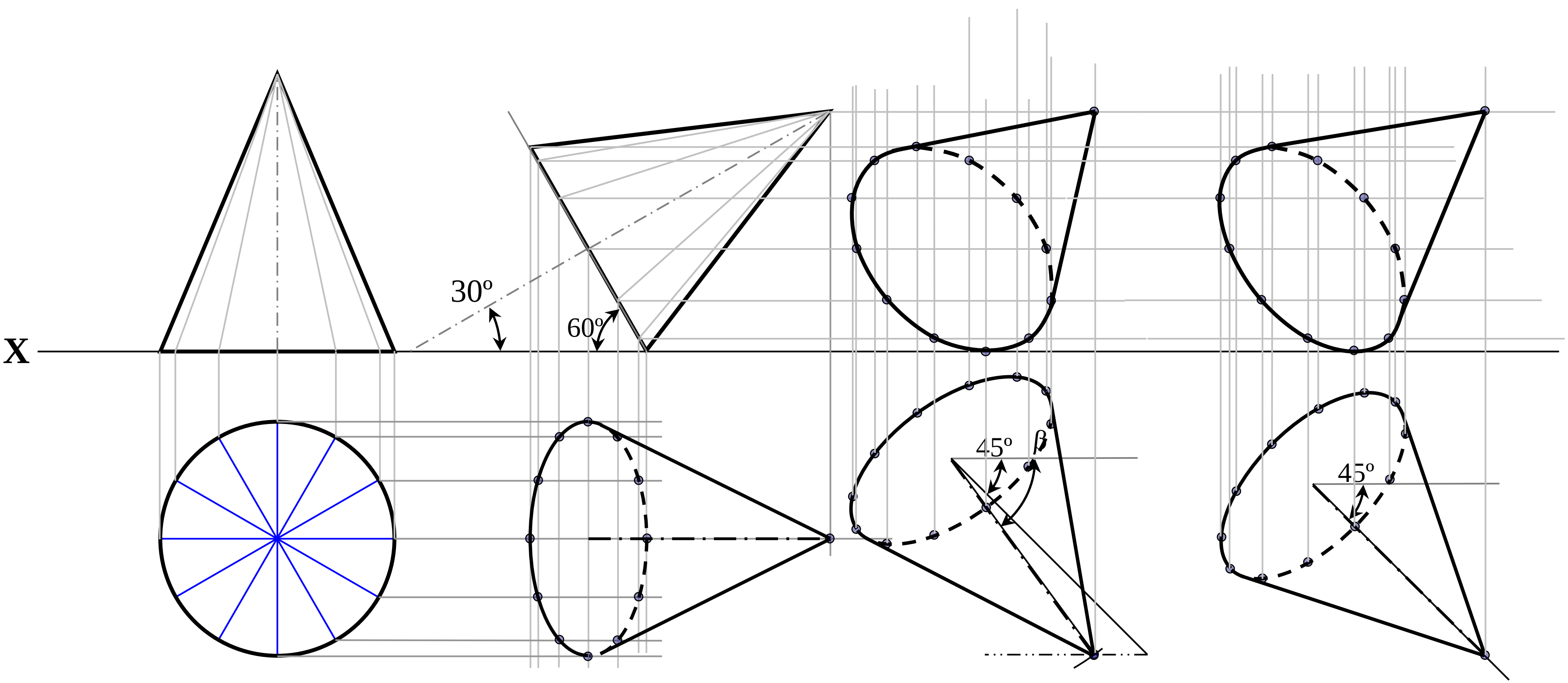
RESTING ON V.P
On one point of base circle.
Axis inclined to Vp
And // to Hp

LYING ON V.P
On one generator.
Axis inclined to Vp
And // to Hp

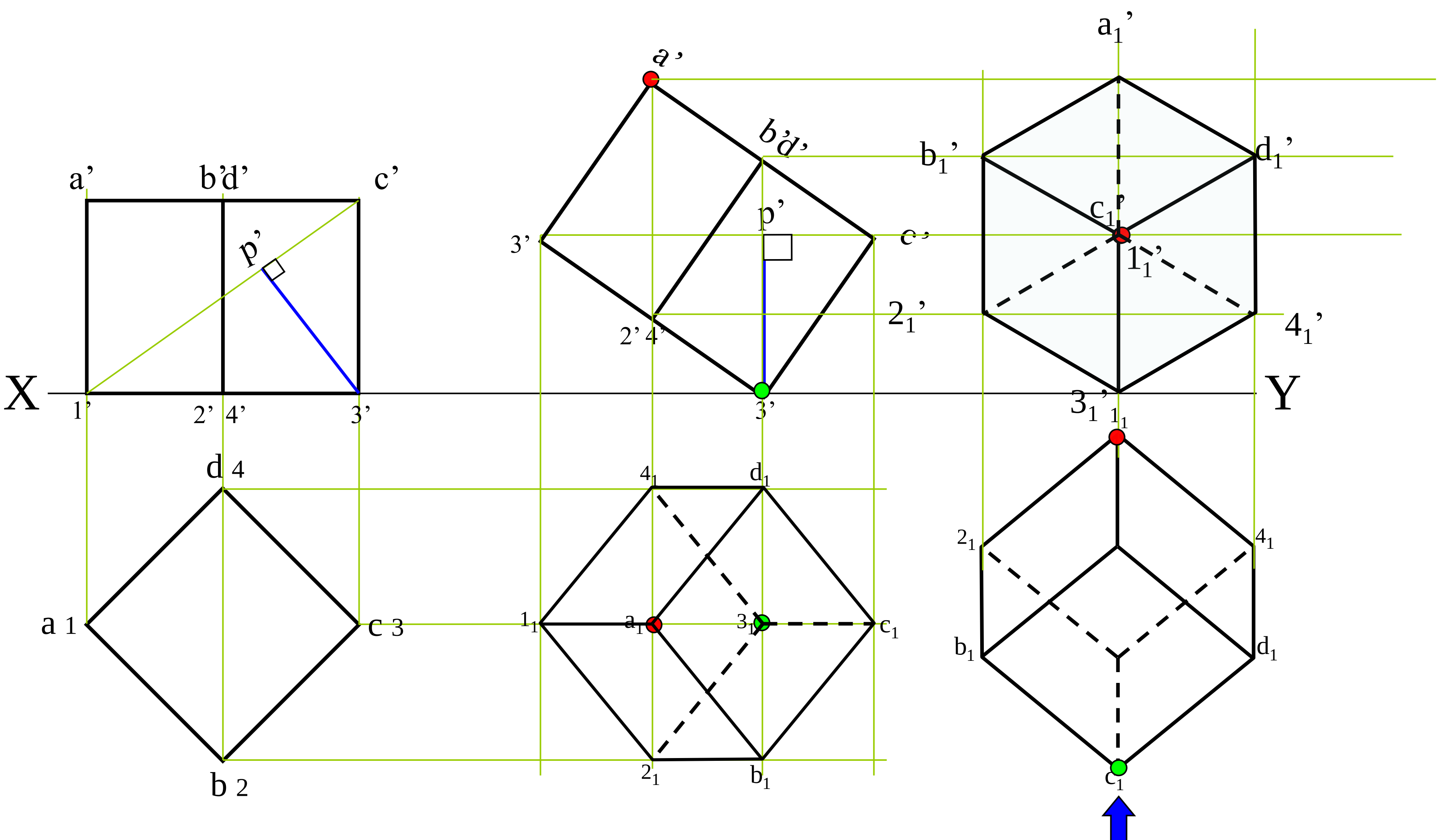
Q Draw the projections of a pentagonal prism , base 25 mm side and axis 50 mm long, resting on one of its rectangular faces on the H.P. with the axis inclined at 45º to the V.P.



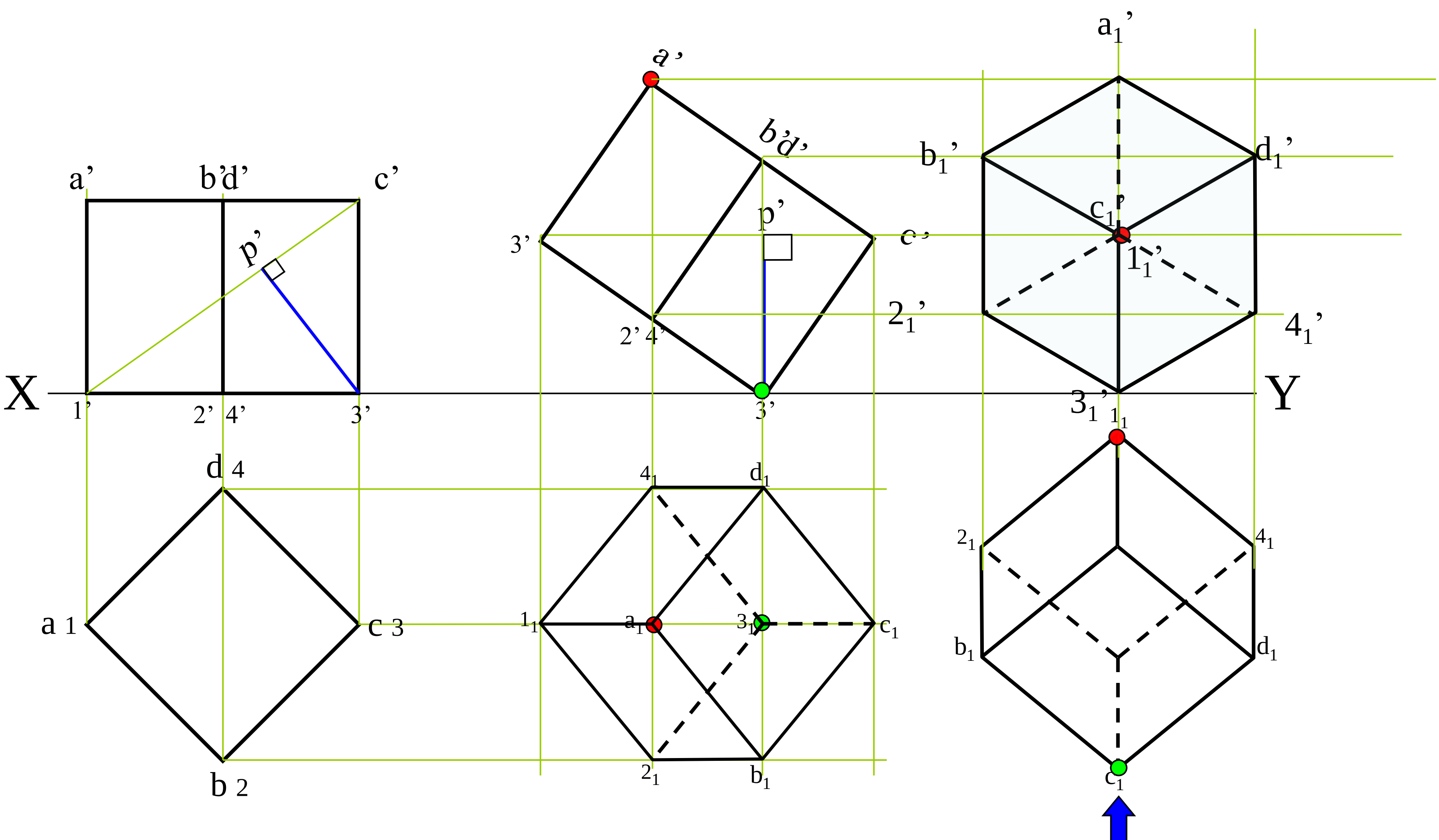
Problem : Draw the projections of a cone, base 45 mm diameter and axis 50 mm long, when it is resting on the ground on a point on its base circle with **(a)** the axis making an angle of 30º with the HP and 45º with the VP **(b)** the axis making an angle of 30º with the HP and its top view making 45º with the VP



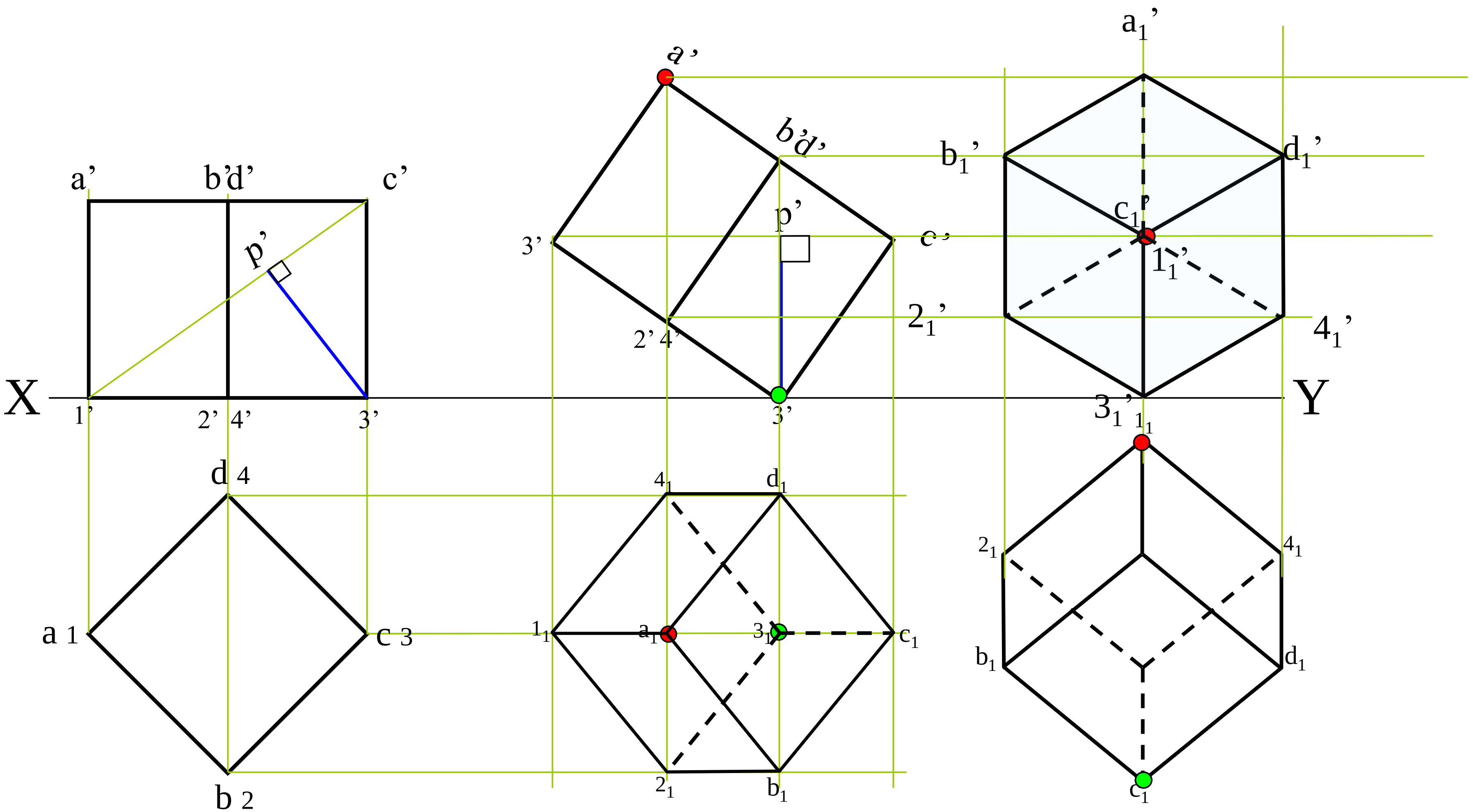
Problem : A cube of 50 mm long edges is so placed on HP on one corner that a body diagonal is parallel to HP and perpendicular to
VP Draw it's projections.



Problem : 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.



Problem : 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.



SECTION OF SOLID AND DEVELOPMENT OF SURPHASES

Prepared by

K. Mahesh

Asst. proff

Dept: mechanical

Sectional Views

- The internal hidden details of the object are shown in orthographic views by dashed lines.
- The intensity of dashed lines in orthographic views depends on the complexity of internal structure of the object.
- If there are many hidden lines, it is difficult to visualize the shape of the object
  - **unnecessarily complicated and confusing.**
- Therefore, the general practice is to draw sectional views for complex objects in addition to or instead of simple orthographic views.
- A sectional view, as the name suggests, is obtained by taking the section of the object along a particular plane. An imaginary cutting plane is used to obtain the section of the object.

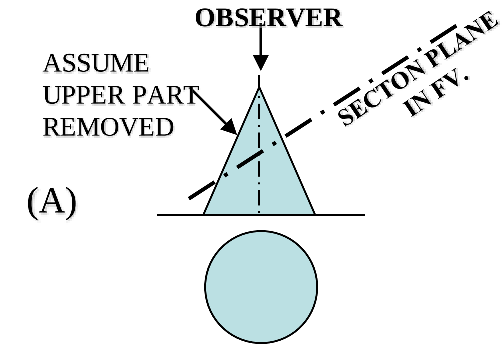
SECTIONING A SOLID.

An object (here a solid) is cut by some imaginary cutting plane to understand internal details of that object.

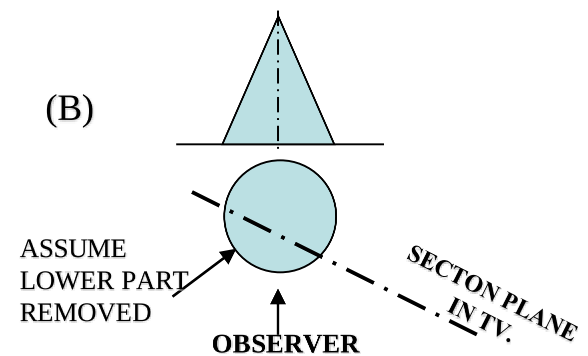
The action of cutting is called SECTIONING a solid & The plane of cutting is called SECTION PLANE.

Two cutting actions means section planes are recommended.

A) Section Plane perpendicular to Vp and inclined to Hp.
(This is a definition of an Aux. Inclined Plane i.e. A.I.P.)
NOTE:- This section plane appears as a straight line in FV.



B) Section Plane perpendicular to Hp and inclined to Vp.
(This is a definition of an Aux. Vertical Plane i.e. A.V.P.)
NOTE:- This section plane appears as a straight line in TV.

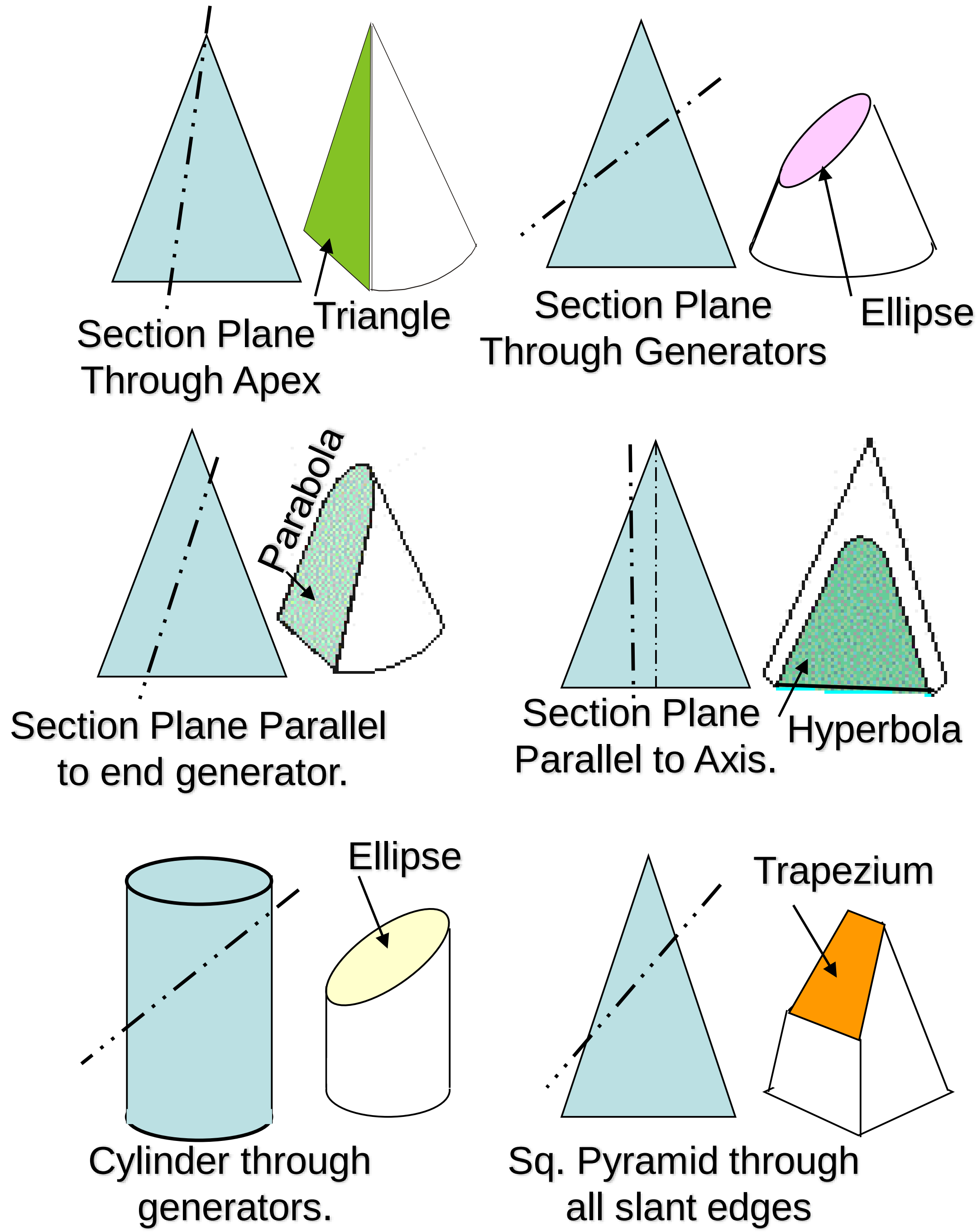


Remember:-

1. After launching a section plane either in FV or TV, the part towards observer is assumed to be removed.

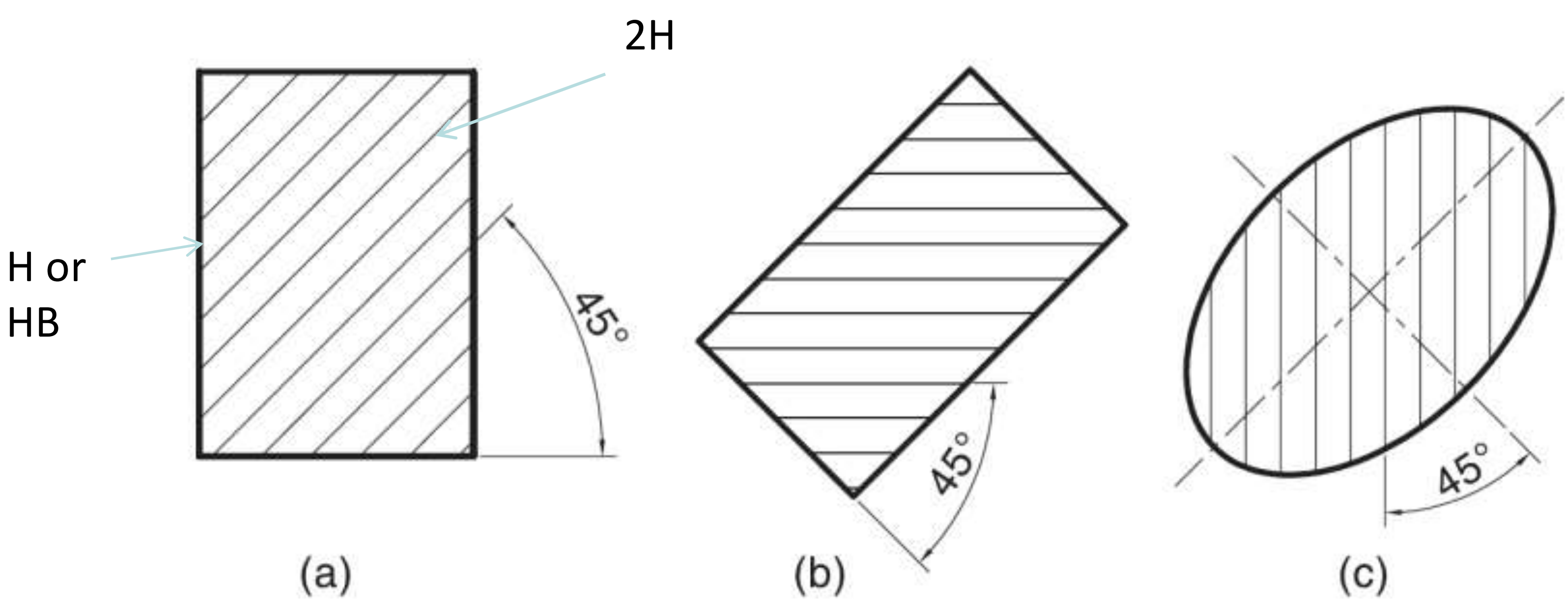
2. As far as possible the smaller part is assumed to be removed.

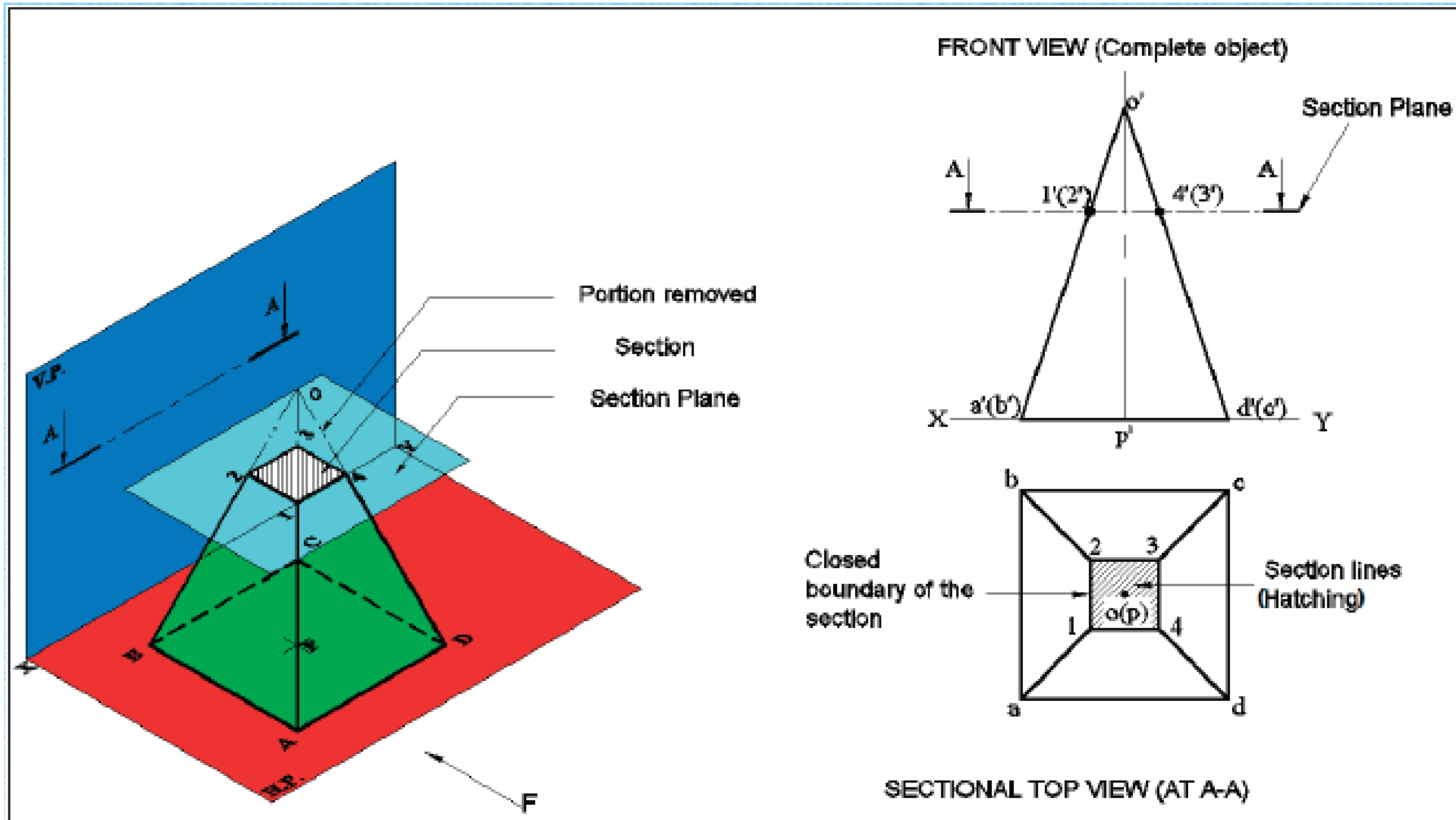
Typical Section Planes
&
Typical Shapes
Of
Sections.



Hatching of the Sections

- The surface created by cutting the object by a section plane is called as *section*.
- The section is indicated by drawing the hatching lines (section lines) within the sectioned area.
- The hatching lines are drawn at 45° to the principal outlines or the lines of symmetry of the section
- The spacing between hatching lines should be uniform and in proportion to the size of the section.

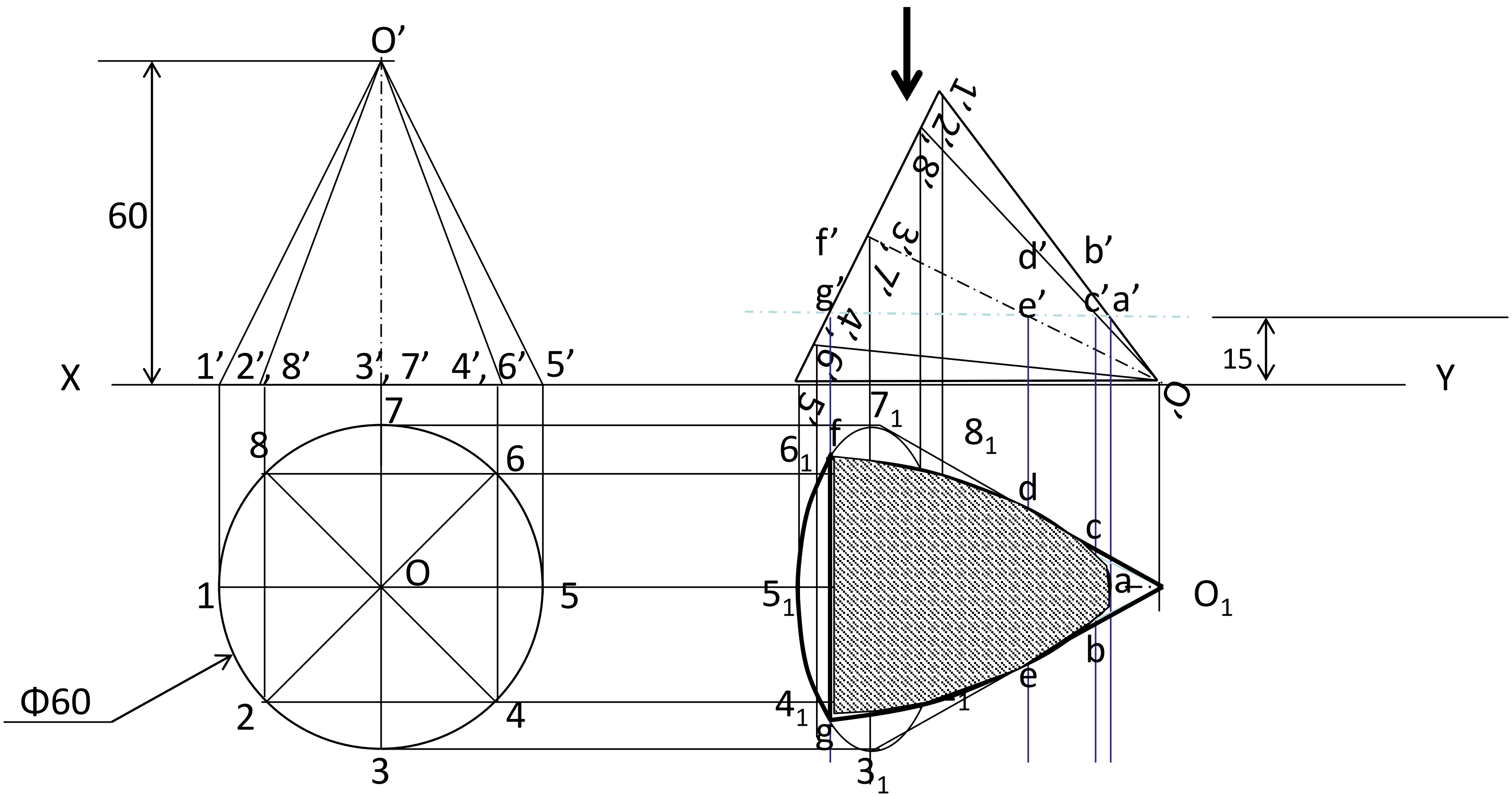




(A) Pictorial view

(B) Orthographic views

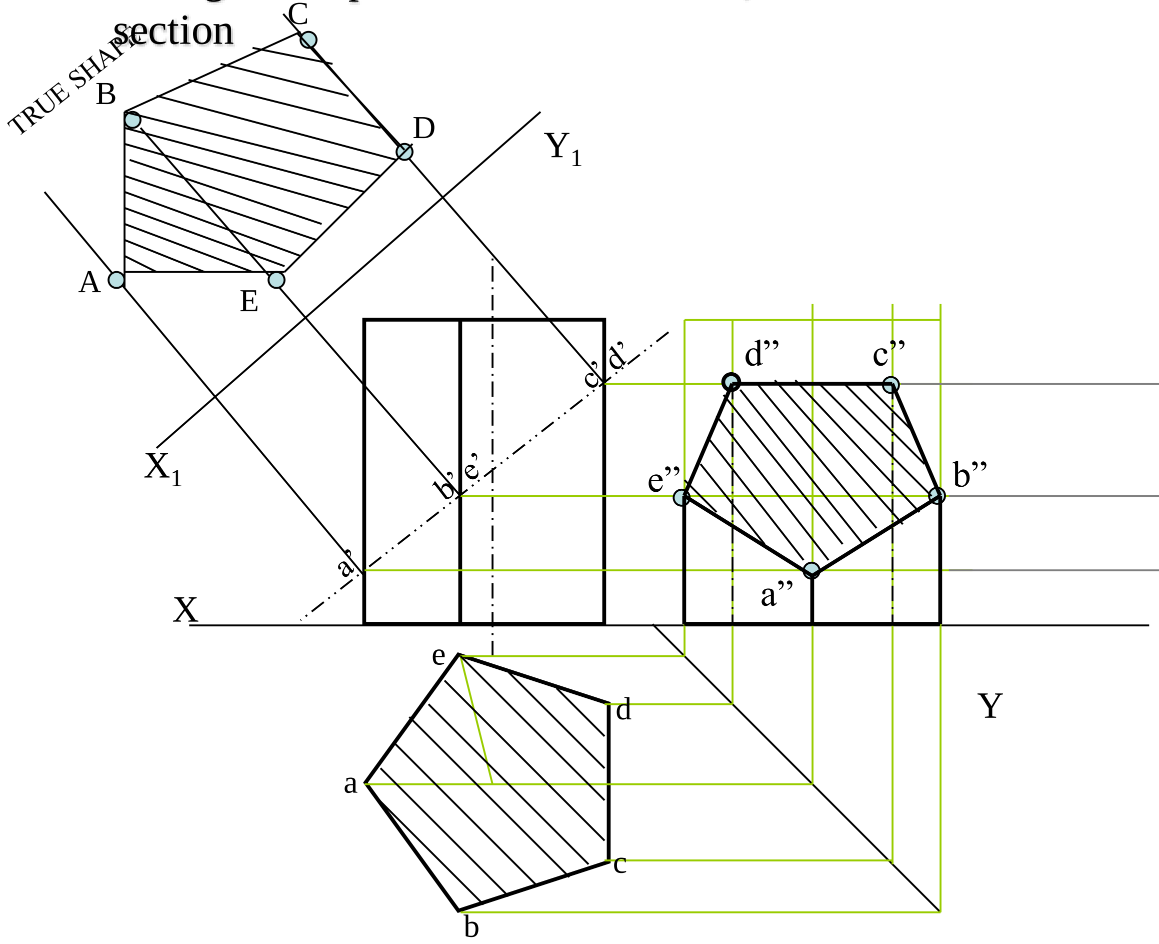
Problem: -A cone of diameter 60 mm and height 60 mm is resting on HP on one of its generators. A section plane whose VT is parallel to HP and 15 mm above HP, cuts the solid removing the top portion. Draw the front view and sectional top view of the solid.



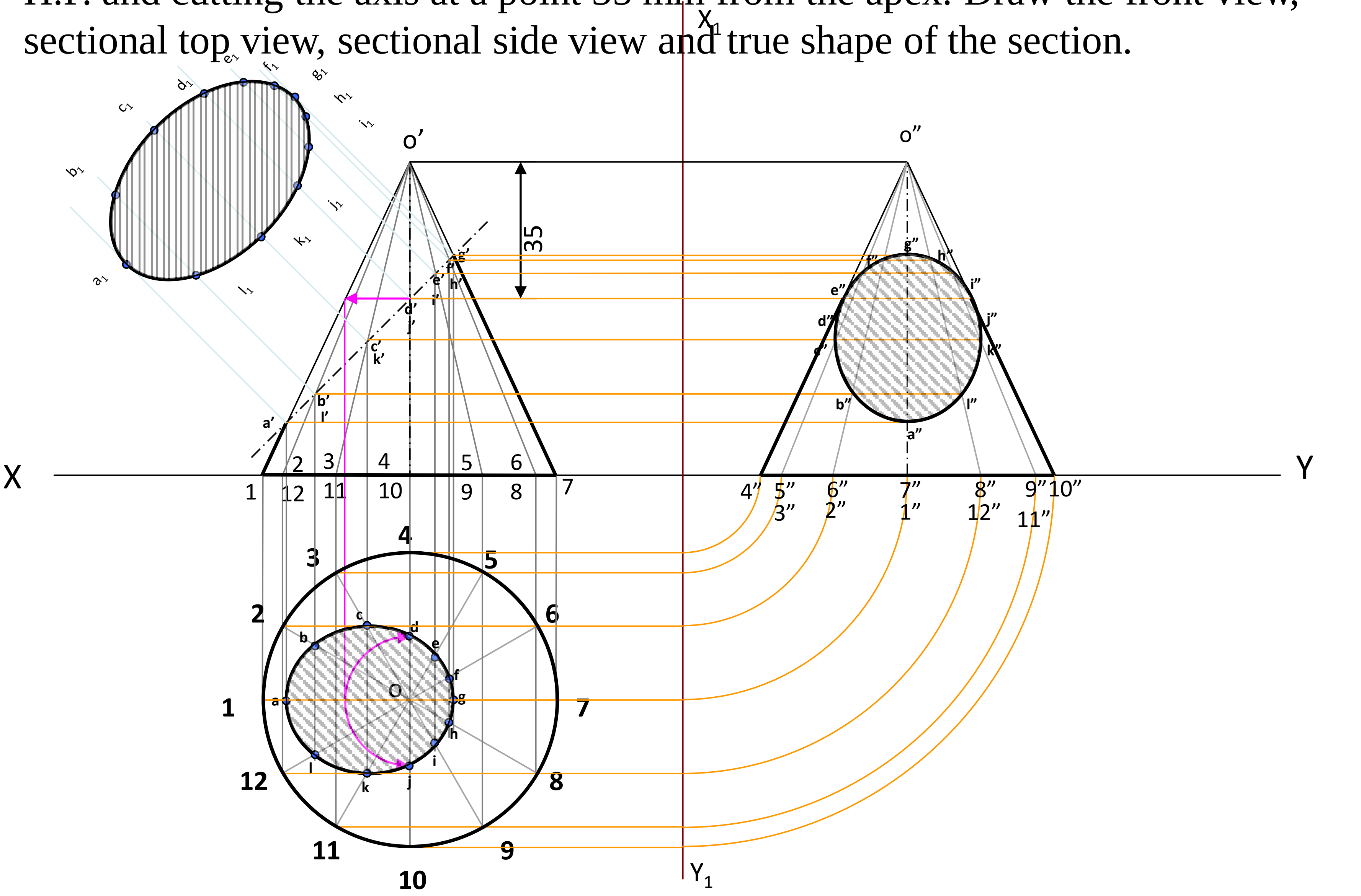
Assume cone is resting on HP

Tilt cone about its corner

Problem: A pentagonal prism , 30 mm base side & 50 mm axis is standing on Hp on it's base whose one side is perpendicular to Vp.It is cut by a section plane 45^0 inclined to Hp, through mid point of axis.Draw Fv, sec.Tv & sec. Side view. Also draw true shape of section

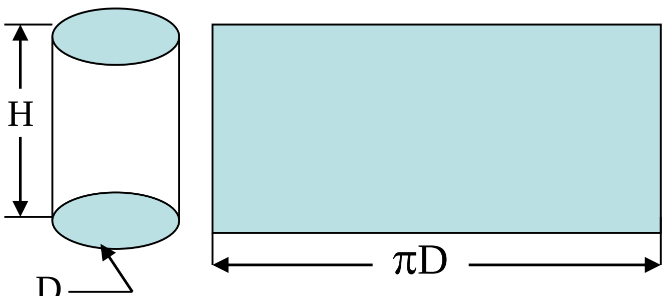


Problem: A Cone base 75 mm diameter and axis 80 mm long is resting on its base on H.P. It is cut by a section plane perpendicular to the V.P., inclined at 45° to the H.P. and cutting the axis at a point 35 mm from the apex. Draw the front view, sectional top view, sectional side view and true shape of the section.



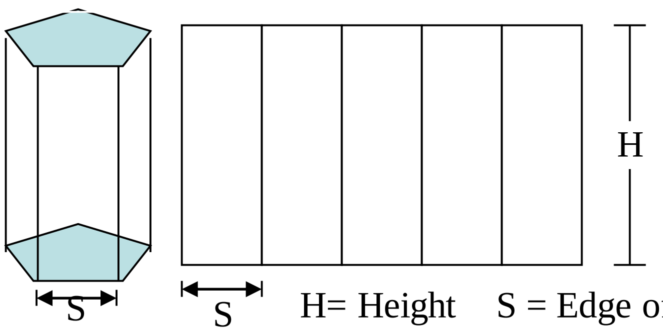
Development of lateral surfaces of different solids.
(Lateral surface is the surface excluding top & base)

Cylinder: A Rectangle



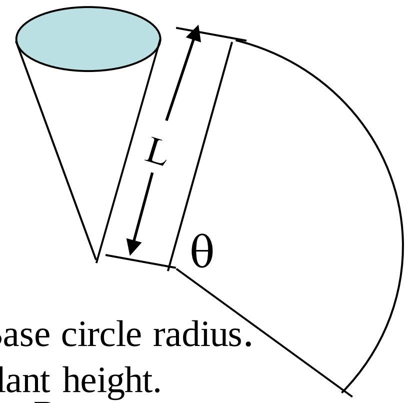
H= Height D= base diameter

Prisms: No.of Rectangles



H= Height S = Edge of base

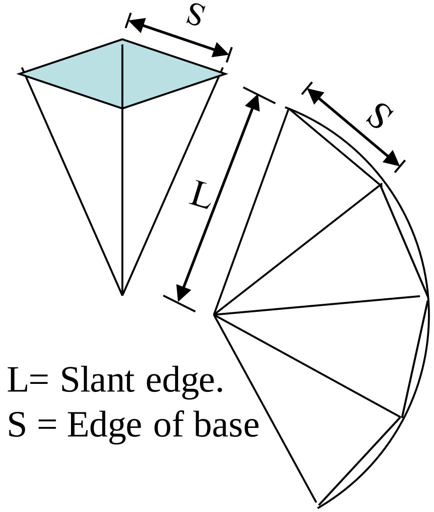
Cone: (Sector of circle)



R=Base circle radius.
L=Slant height.

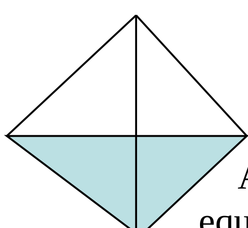
$$\theta = \frac{R}{L} \times 360^0$$

Pyramids: (No.of triangles)

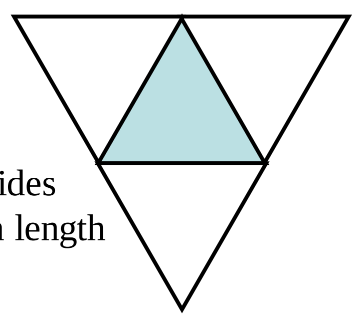


L= Slant edge.
S = Edge of base

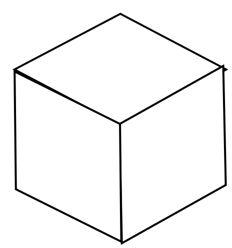
Tetrahedron: Four Equilateral Triangles

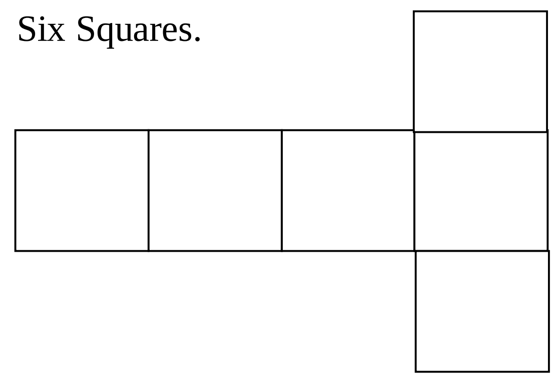


All sides
equal in length



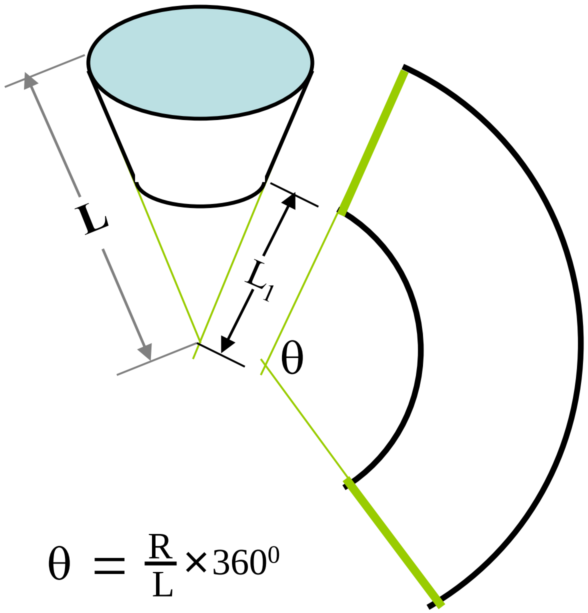
Cube: Six Squares.





FRUSTUMS

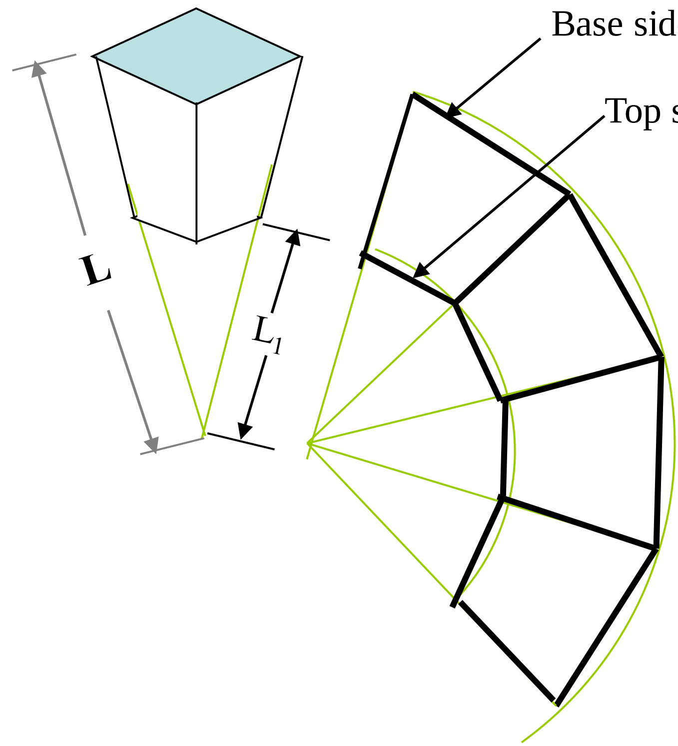
DEVELOPMENT OF
FRUSTUM OF CONE



$$\theta = \frac{R}{L} \times 360^0$$

R= Base circle radius of cone
L= Slant height of cone
L_1 = Slant height of cut part.

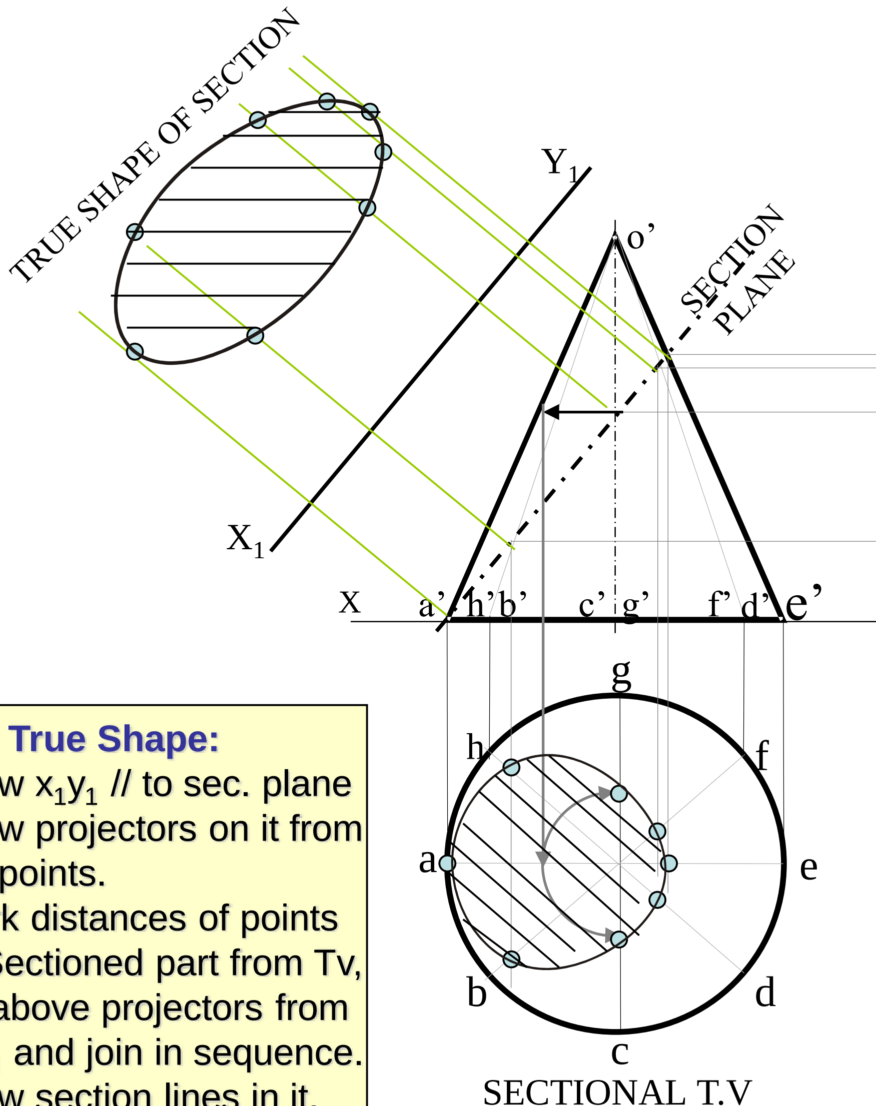
DEVELOPMENT OF
FRUSTUM OF SQUARE PYRAMID

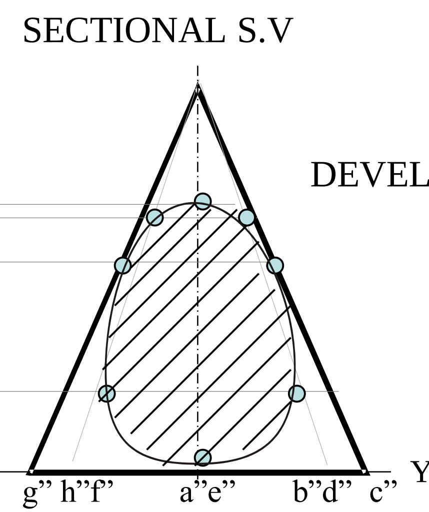


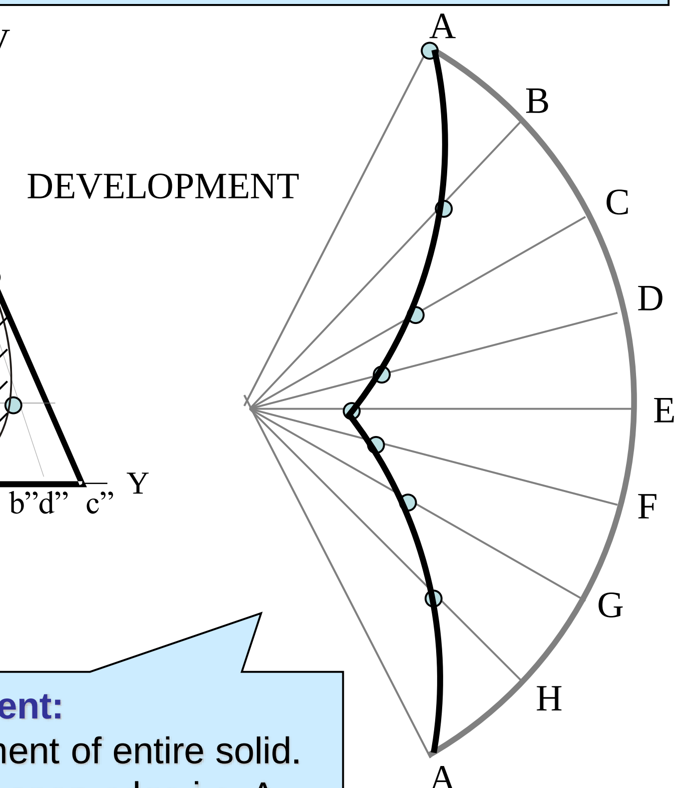
L= Slant edge of pyramid
L_1 = Slant edge of cut part.

Problem : A cone, 50 mm base diameter and 70 mm axis is standing on it's base on Hp. It cut by a section plane 45^0 inclined to Hp through base end of end generator.Draw projections, sectional views, true shape of section and development of surfaces of remaining solid.

Solution Steps: *for sectional views:*
Draw three views of standing cone.
Locate sec.plane in Fv as described.
Project points where generators are getting Cut on Tv & Sv as shown in illustration.Join those points in sequence and show Section lines in it.
Make remaining part of solid dark.



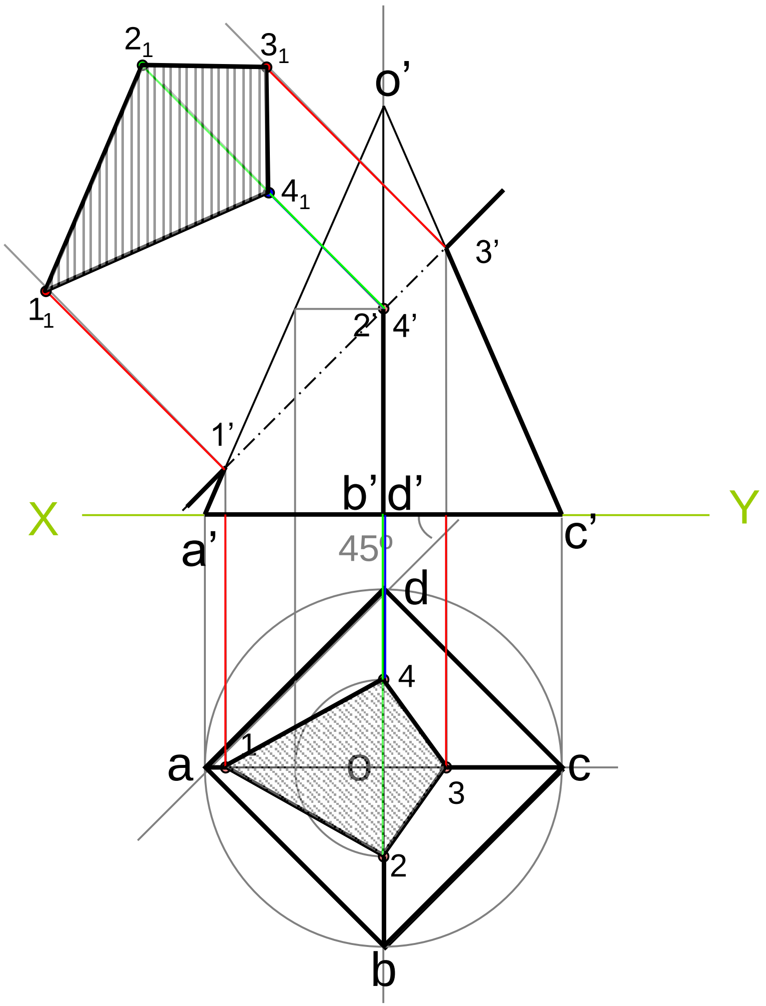


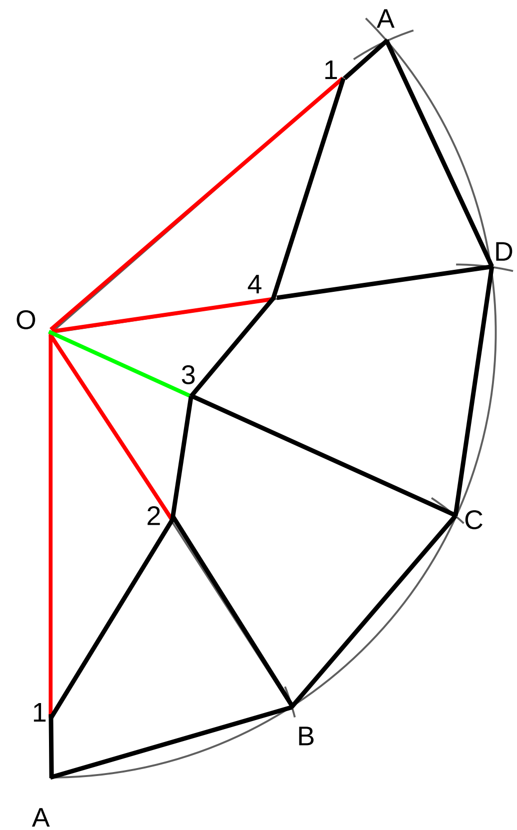


For True Shape:
Draw x_1y_1 // to sec. plane
Draw projectors on it from cut points.
Mark distances of points of Sectioned part from Tv, on above projectors from x_1y_1 and join in sequence.
Draw section lines in it.
It is required true shape.

For Development:
Draw development of entire solid.
Name from cut-open edge i.e. A.
in sequence as shown.Mark the cut points on respective edges.
Join them in sequence in curvature.
Make existing parts dev.dark.

Q : A square pyramid, base 40 mm side and axis 65 mm long, has its base on the HP and all the edges of the base equally inclined to the VP. It is cut by a section plane, perpendicular to the VP, inclined at 45º to the HP and bisecting the axis. Draw its sectional top view, sectional side view and true shape of the section. Also draw its development.





Q: A square prism of 40 mm edge of the base and 65 mm height stands on its base on the HP with vertical faces inclined at 45° with the VP. A horizontal hole of 40 mm diameter is drilled centrally through the prism such that the hole passes through the opposite vertical edges of the prism, draw the development og the surfaces of the prism.