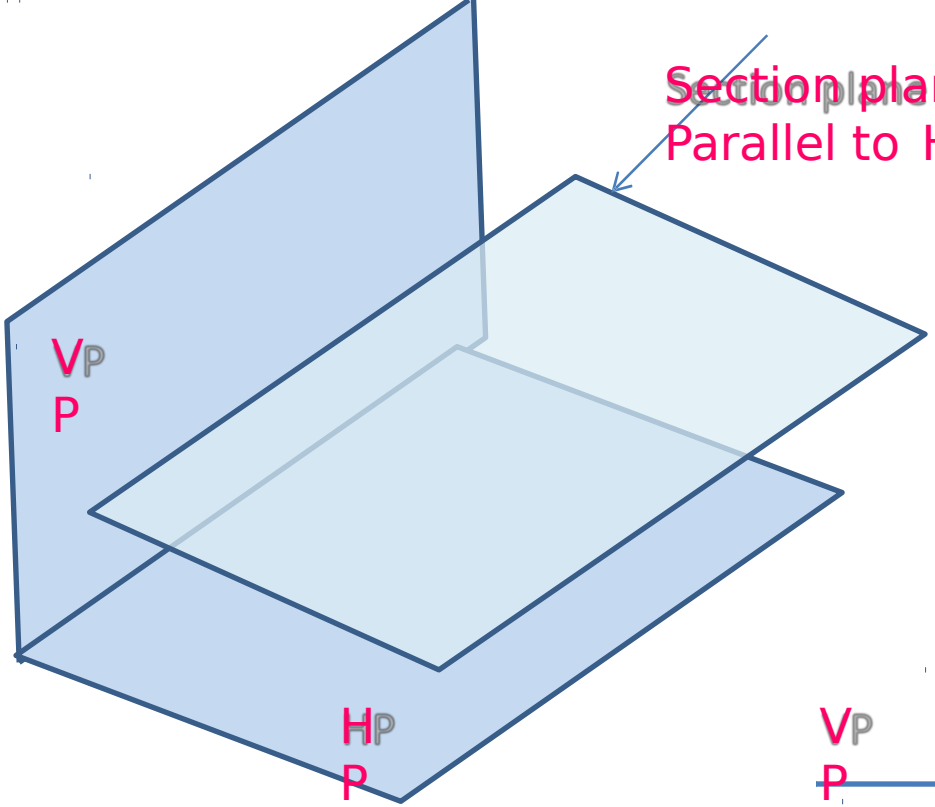
SESSION 5

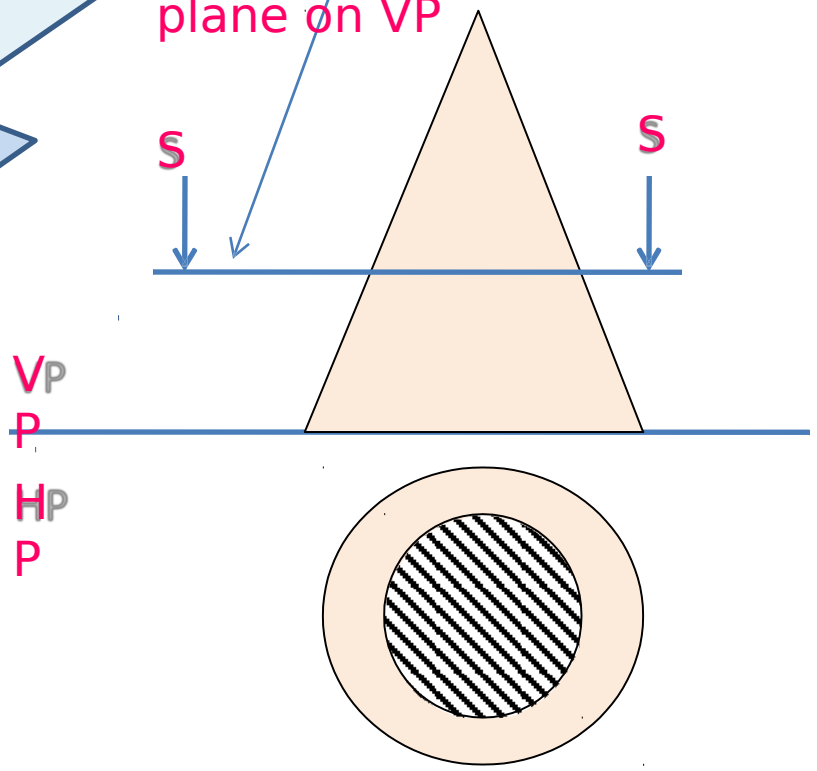
SECTIONS OF SOLIDS & DEVELOPMENT OF SURFACES

S1 ME 2017



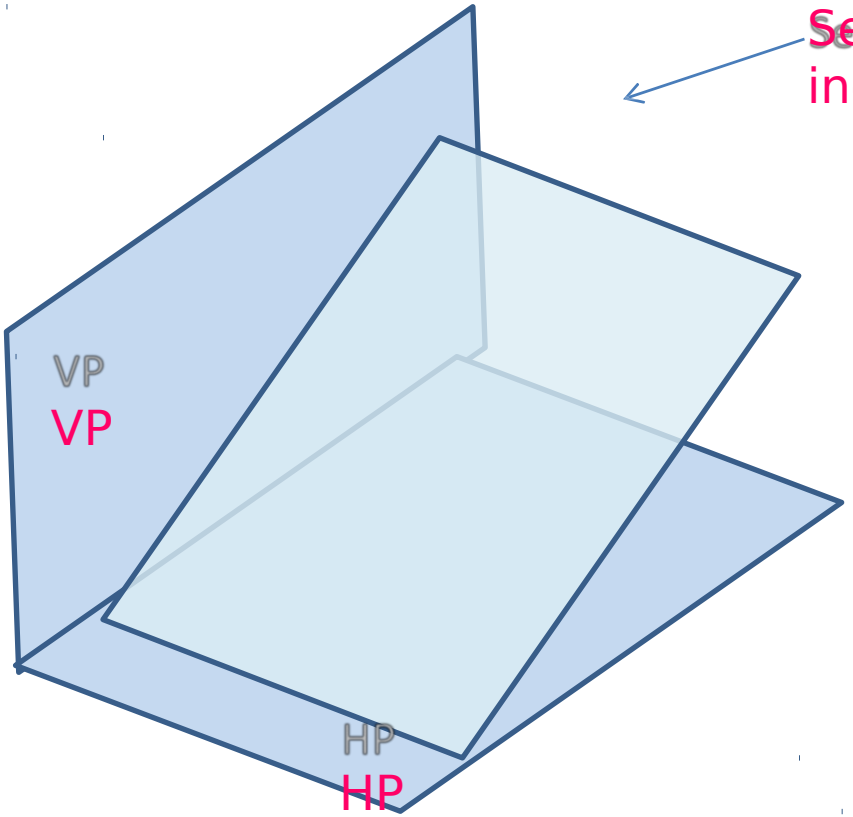
Section plane perpendicular to VP and Parallel to HP

Projection of the section plane on VP



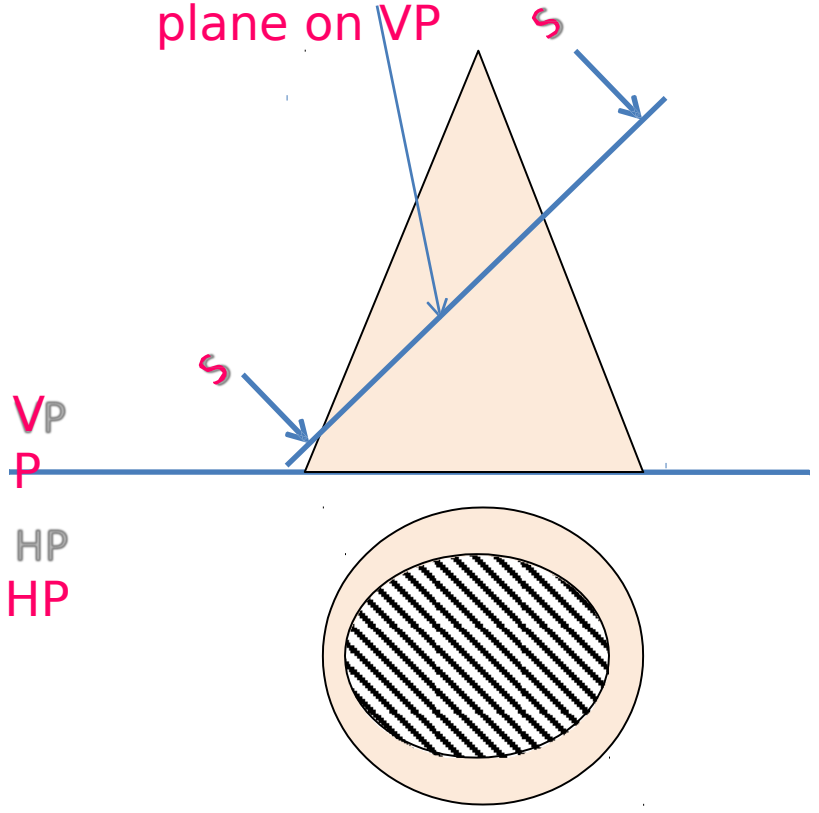
Section plane perpendicular to VP and Parallel to HP

Top View in Section



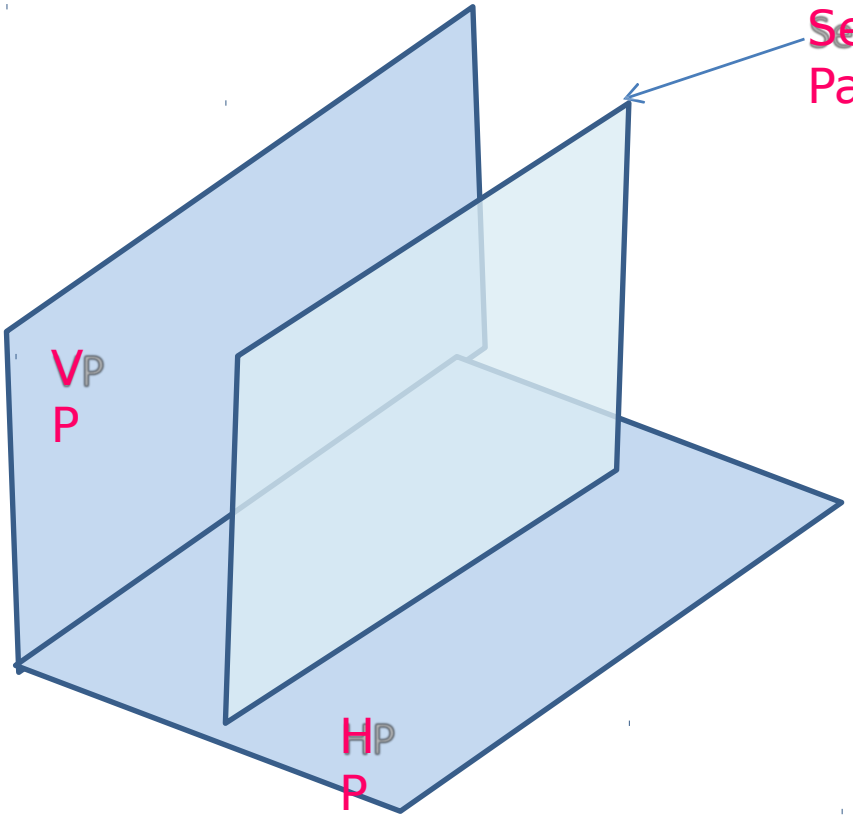
Section plane perpendicular to VP and inclined to HP

Projection of the section plane on VP

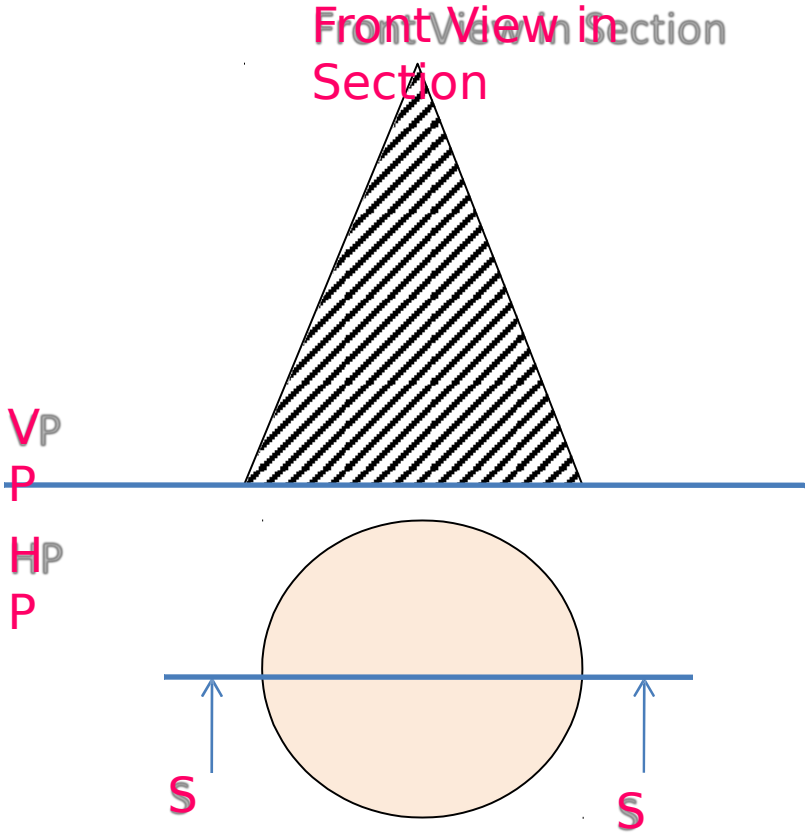


Top View in Section

Section plane perpendicular to VP and Inclined to HP



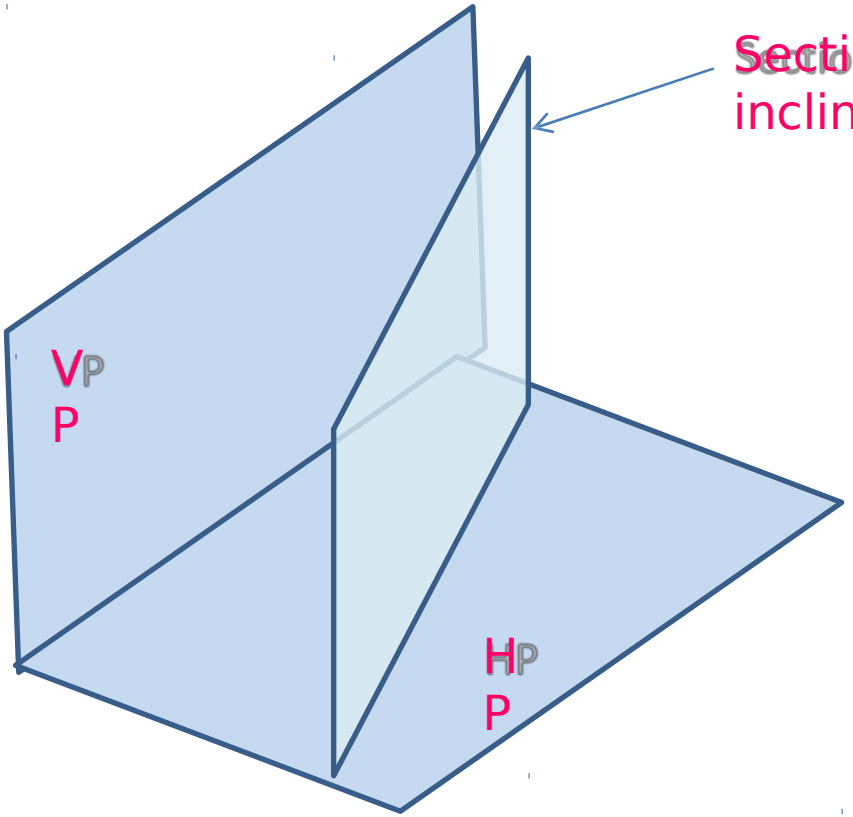
Section plane perpendicular to HP and Parallel to VP



Front View in Section

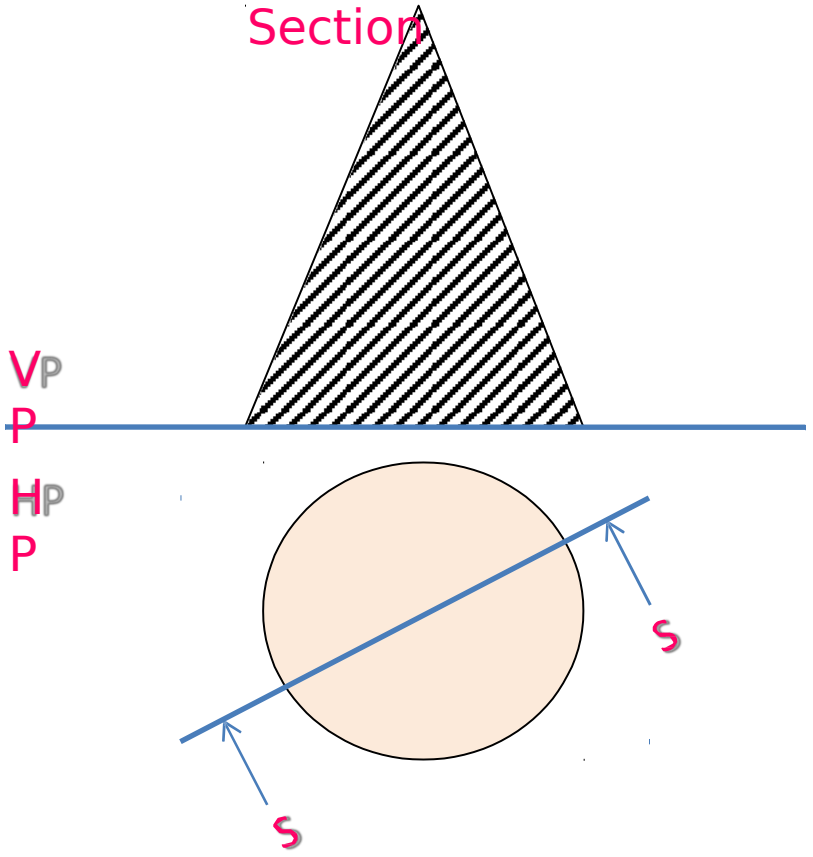
Section plane perpendicular to HP and parallel to VP

Projection of the section plane on HP



Section plane perpendicular to HP and inclined to VP

Front View in Section

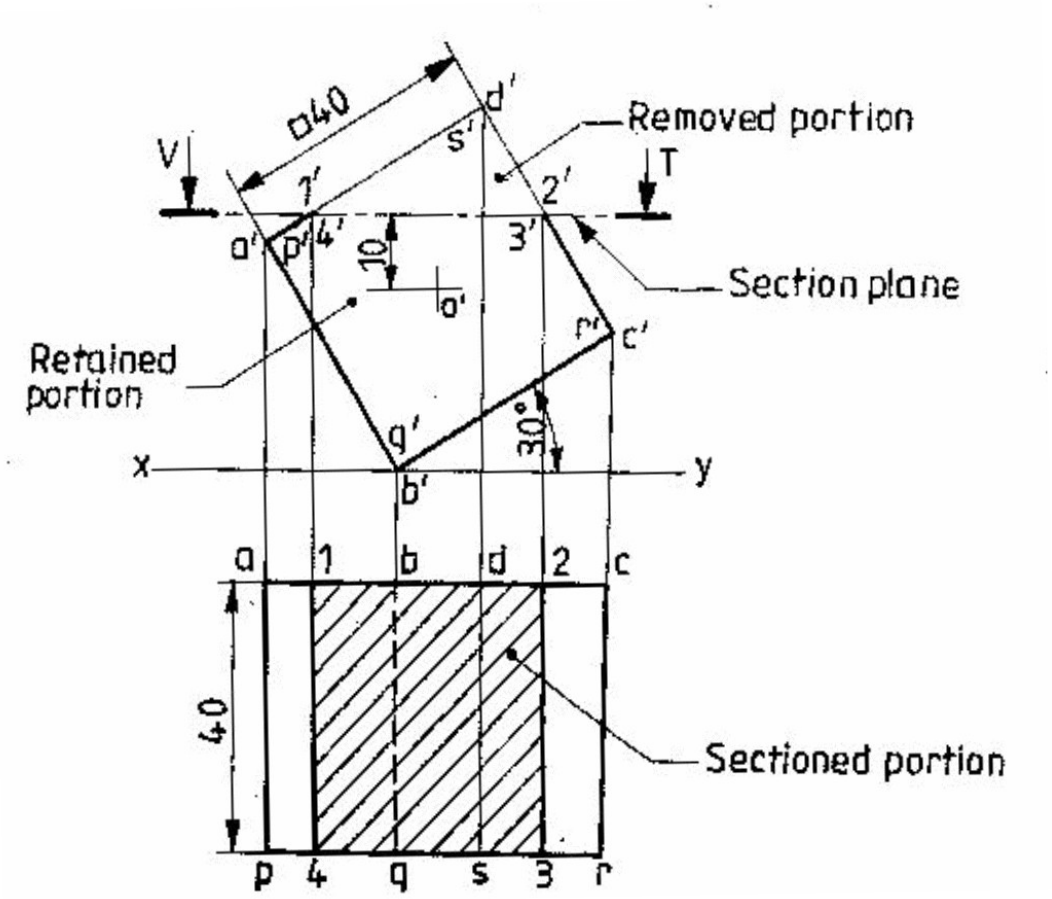


Section plane perpendicular to HP and inclined to VP

Projection of the section plane on HP

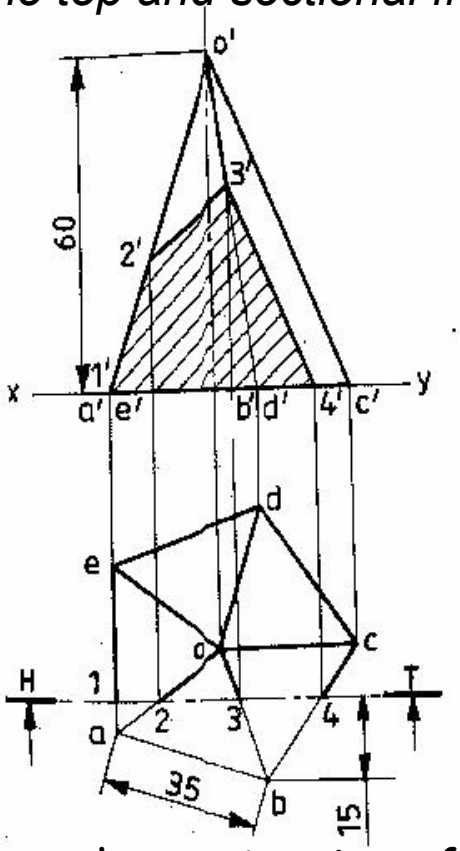
Section plane parallel to H.P:

***Problem**: A cube of 40 edge, is resting on H.P on one of its edges, with a face parallel to V.P. One of the faces containing the resting edge is inclined at 30^0 to H.P. The solid is cut by a section plane, parallel to H.P and 10 above the axis. Draw the projections of the remaining solid.*



Section plane parallel to V.P:

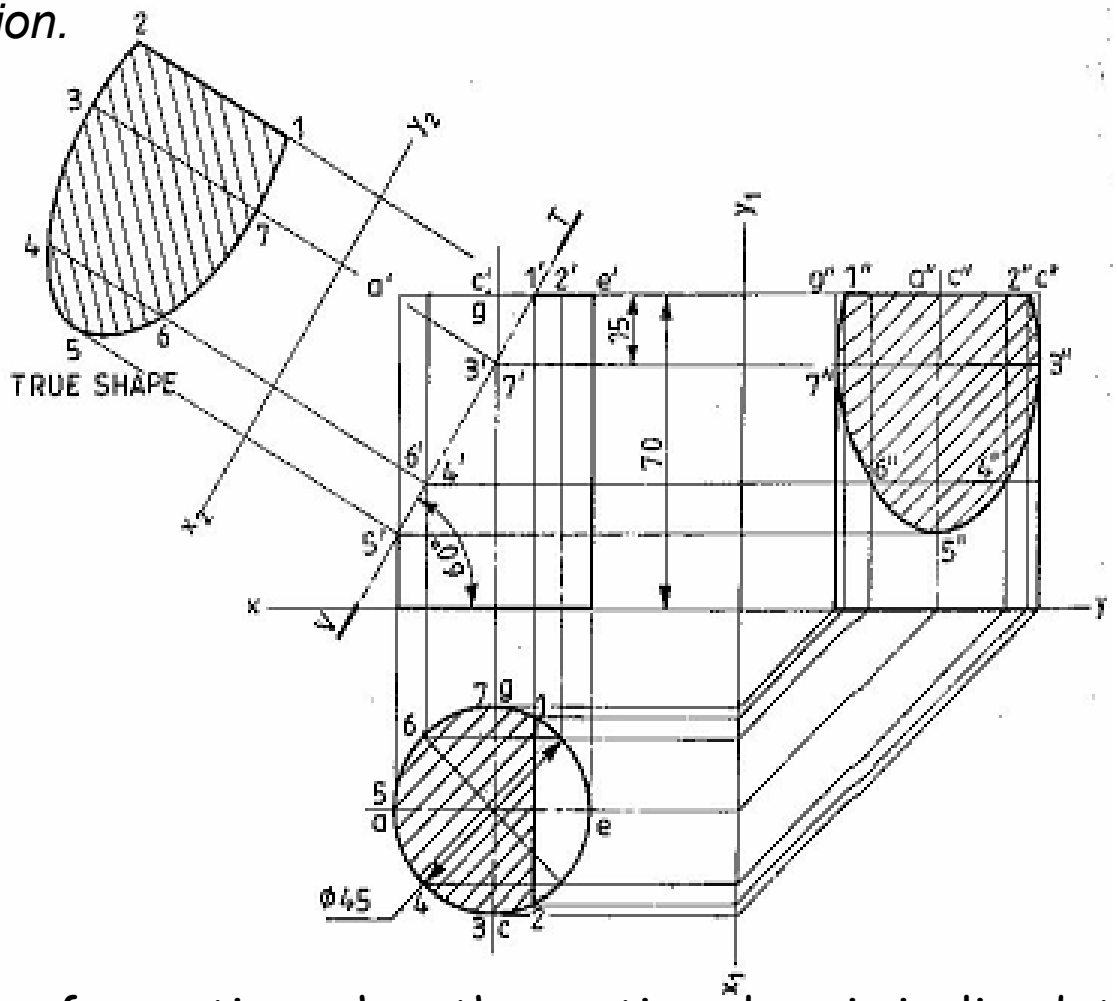
***Problem**: A pentagonal pyramid of side of base 35 and axis 50 long, stands with its base on H.P such that, one of the base edges is perpendicular to V.P. A section plane parallel to V.P cuts the solid at a distance of 15 from the corner of the base which is nearer to the observer. Draw the top and sectional front views of the cut solid.*



NOTE: True shape of a section: the projection of the section on a plane parallel to the section plane, will appear in its true shape of the section. Thus, when the section plane is parallel to H.P, the true shape of the section will be seen in the sectional top view. When it is parallel to V.P, the true shape of the section will appear in the sectional front view.

Section plane inclined to H.P and perpendicular to V.P

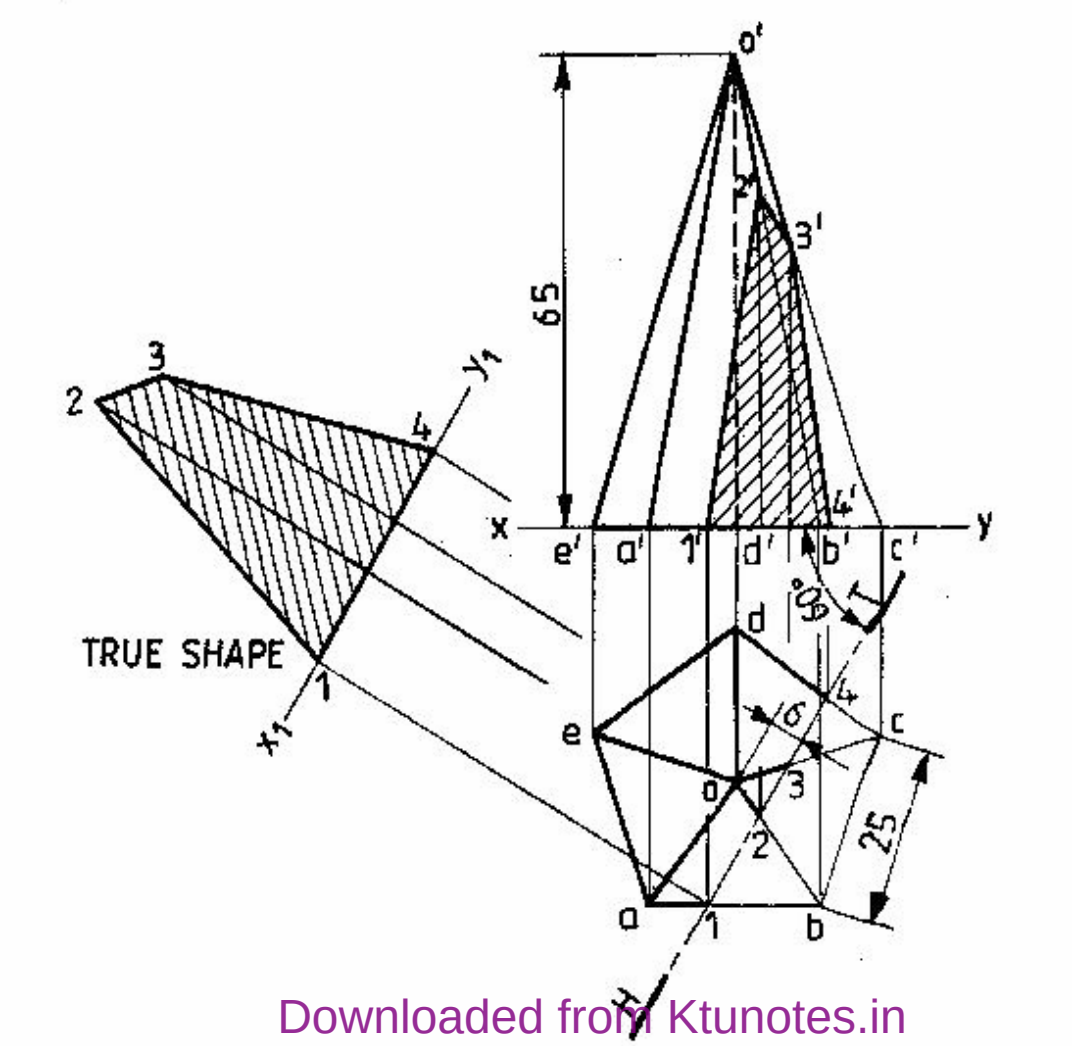
***Problem**: A cylinder of 45 diameter and 70 long, is resting on one of its bases on H.P. It is cut by a section plane, inclined at 60⁰ with H.P and passing through a point on the axis at 15 from one end. Draw the three views of the solid and also obtain the true shape of the section.*



Note: <u>true shape of a section:</u> when the section plane is inclined, the section has to be projected on an auxiliary plane, parallel to the cutting plane, to obtain its true shape.

Section plane inclined to V.P and perpendicular to H.P:

***Problem**: A pentagonal pyramid with edge of base 25 and axis 65 long, is resting on H.P on its base with an edge nearer to the observer, parallel to V.P. It is cut by a section plane, inclined at 60^0 to V.P and at a distance of 6 from the axis. Draw the projections and obtain the true shape of the section.*



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.

utting actions means section planes are recommended.

tion Plane perpendicular to Vp and inclined to Hp.
his is a definition of an Aux. Inclined Plane i.e. A.I.P.)

OTE:- This section plane appears as a straight line in FV.

tion Plane perpendicular to Hp and inclined to Vp.
his is a definition of an Aux. Vertical Plane i.e. A.V.P.)

OTE:- This section plane appears as a straight line in TV.

ember:-

ter launching a section plane
her in FV or TV, the part towards observer
assumed to be removed.
far as possible the smaller part is
sumed to be removed.

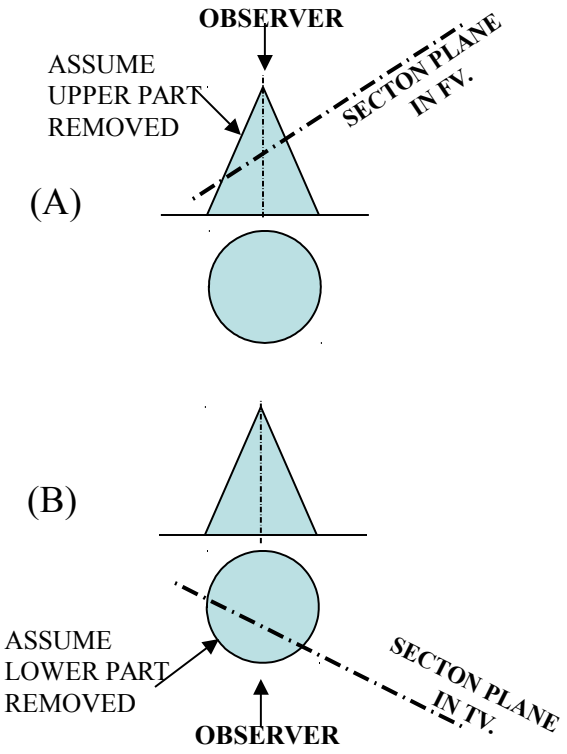
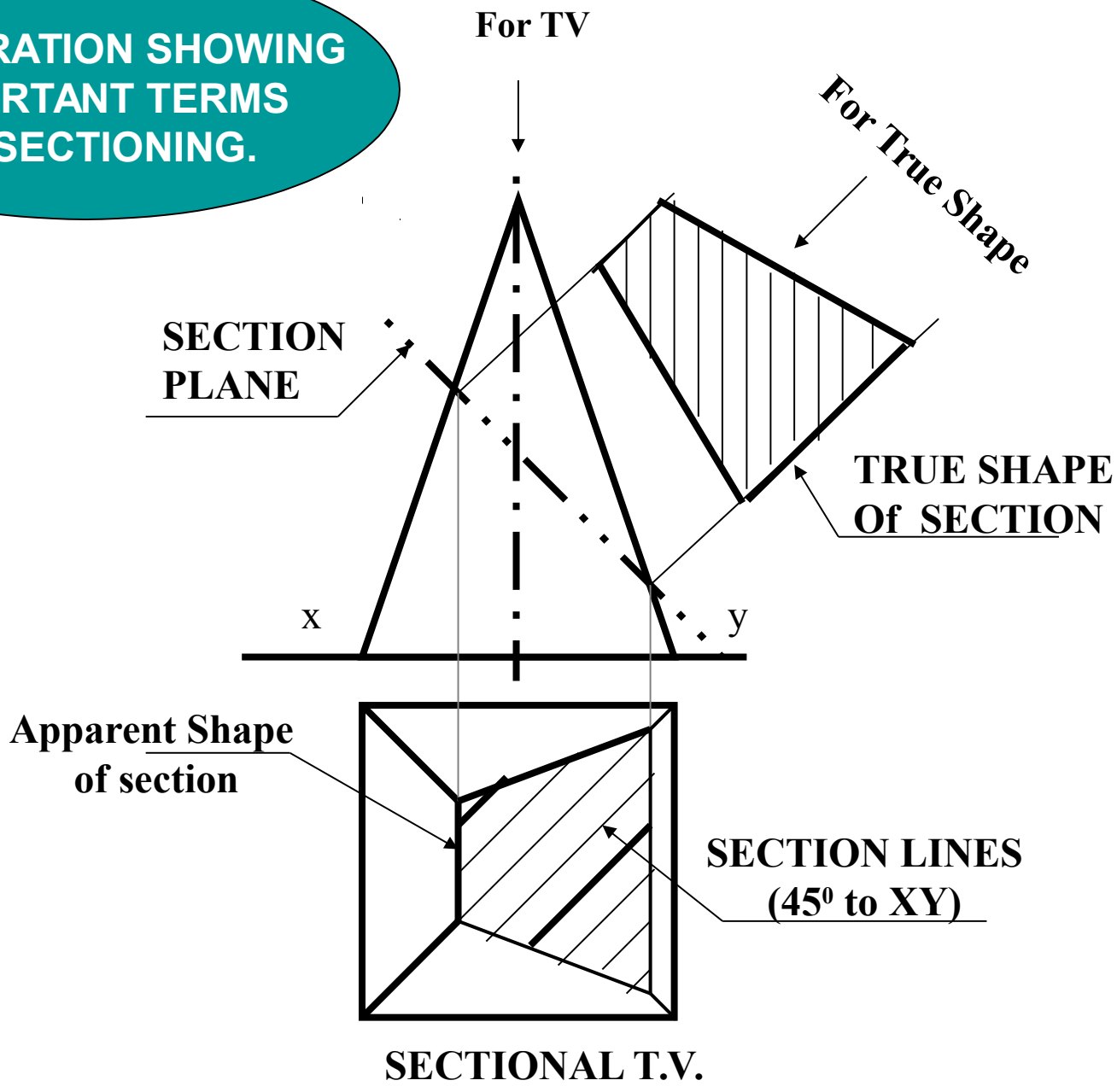
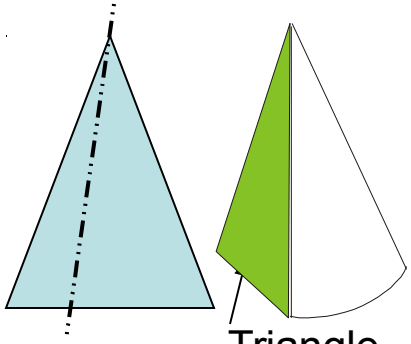


ILLUSTRATION SHOWING IMPORTANT TERMS IN SECTIONING.



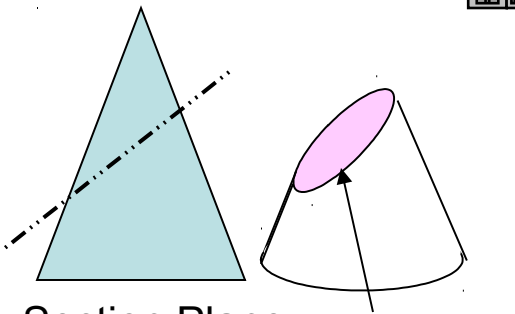
SECTIONAL T.V.

Typical Section Planes & Typical Shapes Of Sections.



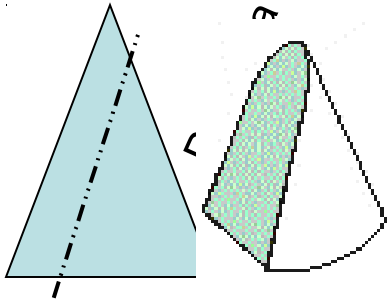
Section Plane Through Apex

Triangle

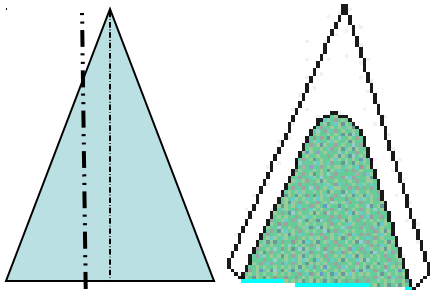


Section Plane Through Generators

Ellipse

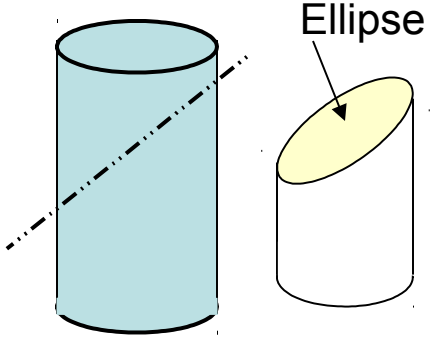


Section Plane Parallel to end generator.



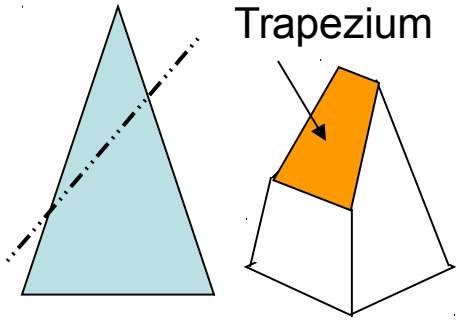
Section Plane Parallel to Axis.

Hyperbola



Cylinder through generators.

Ellipse



Sq. Pyramid through all slant edges

Trapezium

DEVELOPMENT OF SURFACES OF SOLIDS.

MEANING:-

ASSUME OBJECT HOLLOW AND MADE-UP OF THIN SHEET. CUT OPEN IT FROM ONE SIDE AND UNFOLD THE SHEET COMPLETELY. THEN THE SHAPE OF THAT UNFOLDED SHEET IS CALLED **DEVELOPMENT OF LATERLAL SUEFACES** OF THAT OBJECT OR SOLID.

LATERLAL SURFACE IS THE SURFACE EXCLUDING SOLID'S TOP & BASE.

ENGINEERING APLICATION:

THERE ARE SO MANY PRODUCTS OR OBJECTS WHICH ARE DIFFICULT TO MANUFACTURE BY CONVENTIONAL MANUFACTURING PROCESSES, BECAUSE OF THEIR SHAPES AND SIZES. THOSE ARE FABRICATED IN SHEET METAL INDUSTRY BY USING DEVELOPMENT TECHNIQUE. THERE IS A VAST RANGE OF SUCH OBJECTS.

EXAMPLES:-

Boiler Shells & chimneys, Pressure Vessels, Shovels, Trays, Boxes & Cartons, Feeding Hoppers, Large Pipe sections, Body & Parts of automotives, Ships, Aeroplanes and many more.

WHAT IS OUR OBJECTIVE IN THIS TOPIC ?

To learn methods of development of surfaces of different solids, their sections and frustums.

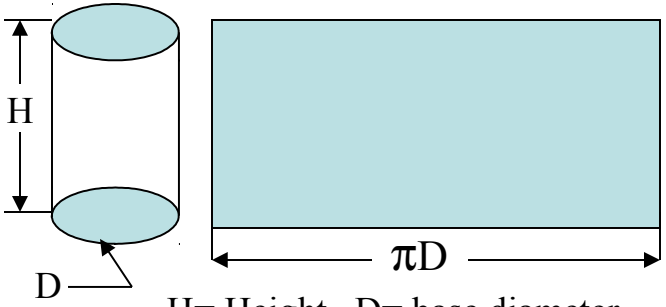
But before going ahead, note following ***Important*** *points.*

1. Development is different drawing than PROJECTIONS.
2. It is a shape showing AREA, means it's a 2-D plain drawing.
3. Hence all dimensions of it must be TRUE dimensions.
4. As it is representing shape of an un-folded sheet, no edges can remain hidden And hence DOTTED LINES are never shown on development.

Study illustrations given on next page carefully.

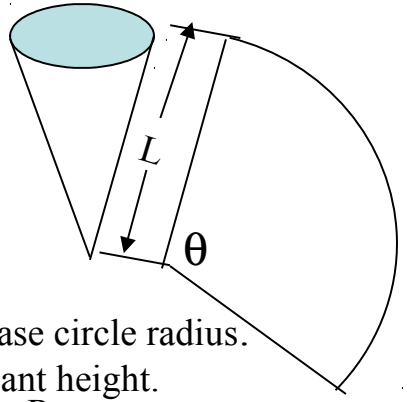
Development of lateral surfaces of different solids.
(Lateral surface is the surface excluding top & base)

Cylinder: A Rectangle



H= Height D= base diameter

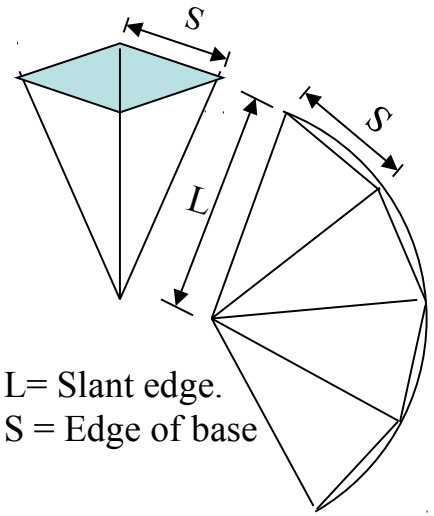
Cone: (Sector of circle)



R=Base circle radius.
L=Slant height.

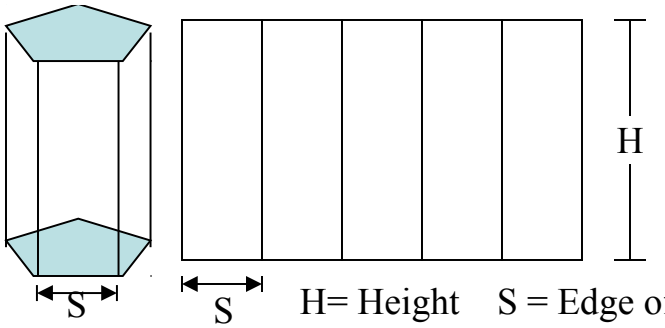
$$\theta = \frac{R}{L} \times 360^0$$

Pyramids: (No.of triangles)



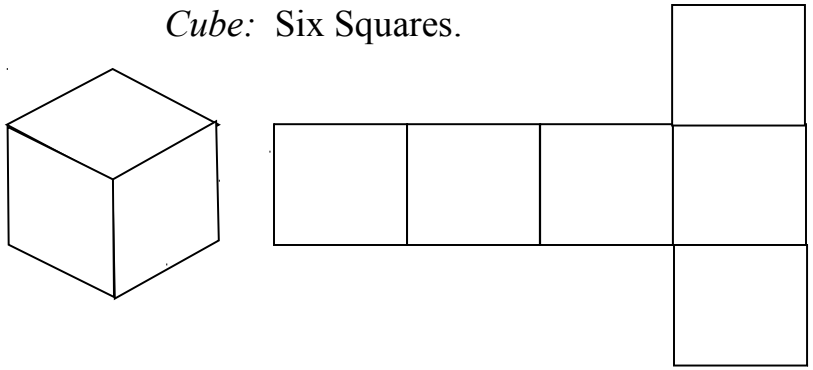
L= Slant edge.
S = Edge of base

Prisms: No.of Rectangles

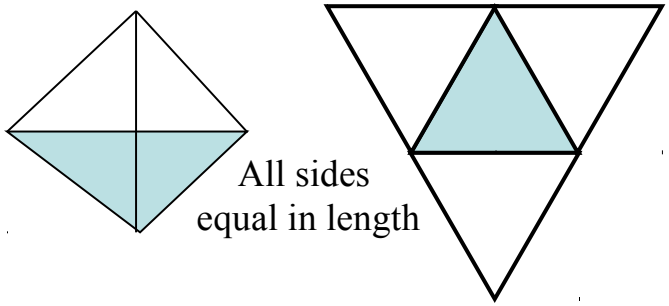


H= Height S = Edge of base

Cube: Six Squares.



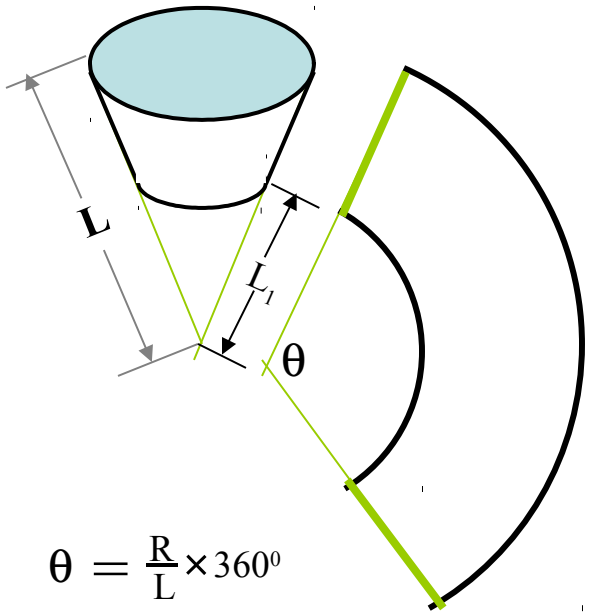
Tetrahedron: Four Equilateral Triangles



All sides
equal in length

FRUSTUMS

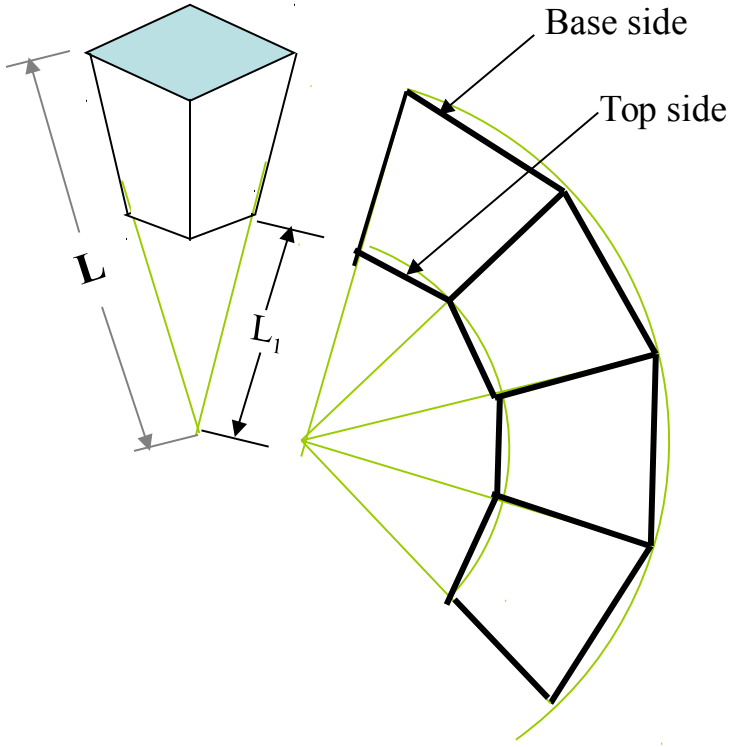
DEVELOPMENT OF
FRUSTUM OF CONE



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

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

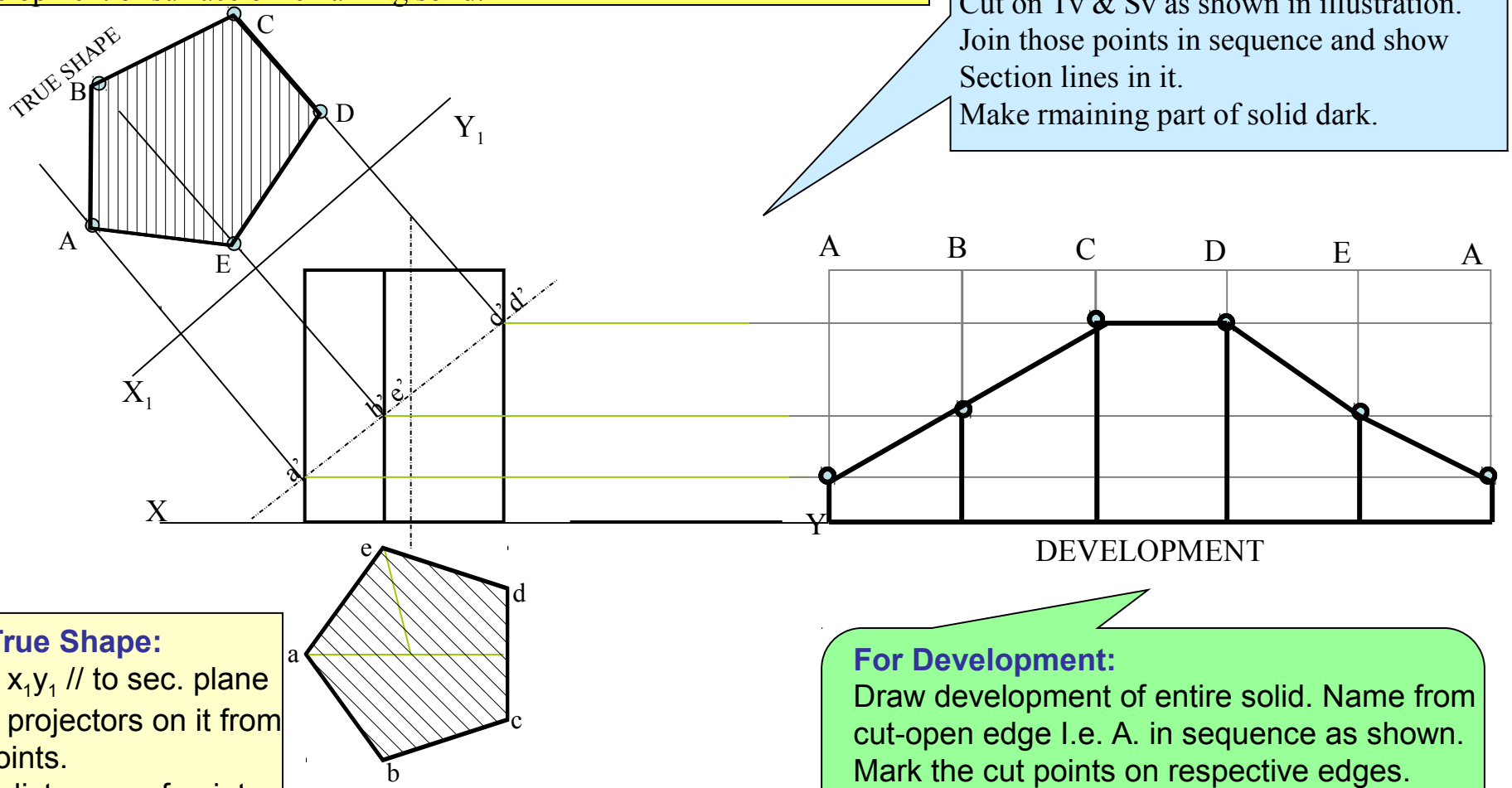
DEVELOPMENT OF
FRUSTUM OF SQUARE PYRAMID



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

Problem 1: A pentagonal prism , 30 mm base side & 50 mm axis is standing on Hp on it's base with one side of the base perpendicular to VP. It is cut by a section plane inclined at 45° to the HP, through mid point of axis. Draw Fv, sec.Tv & sec. Side view. Also draw true shape of section and Development of surface of remaining solid.

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

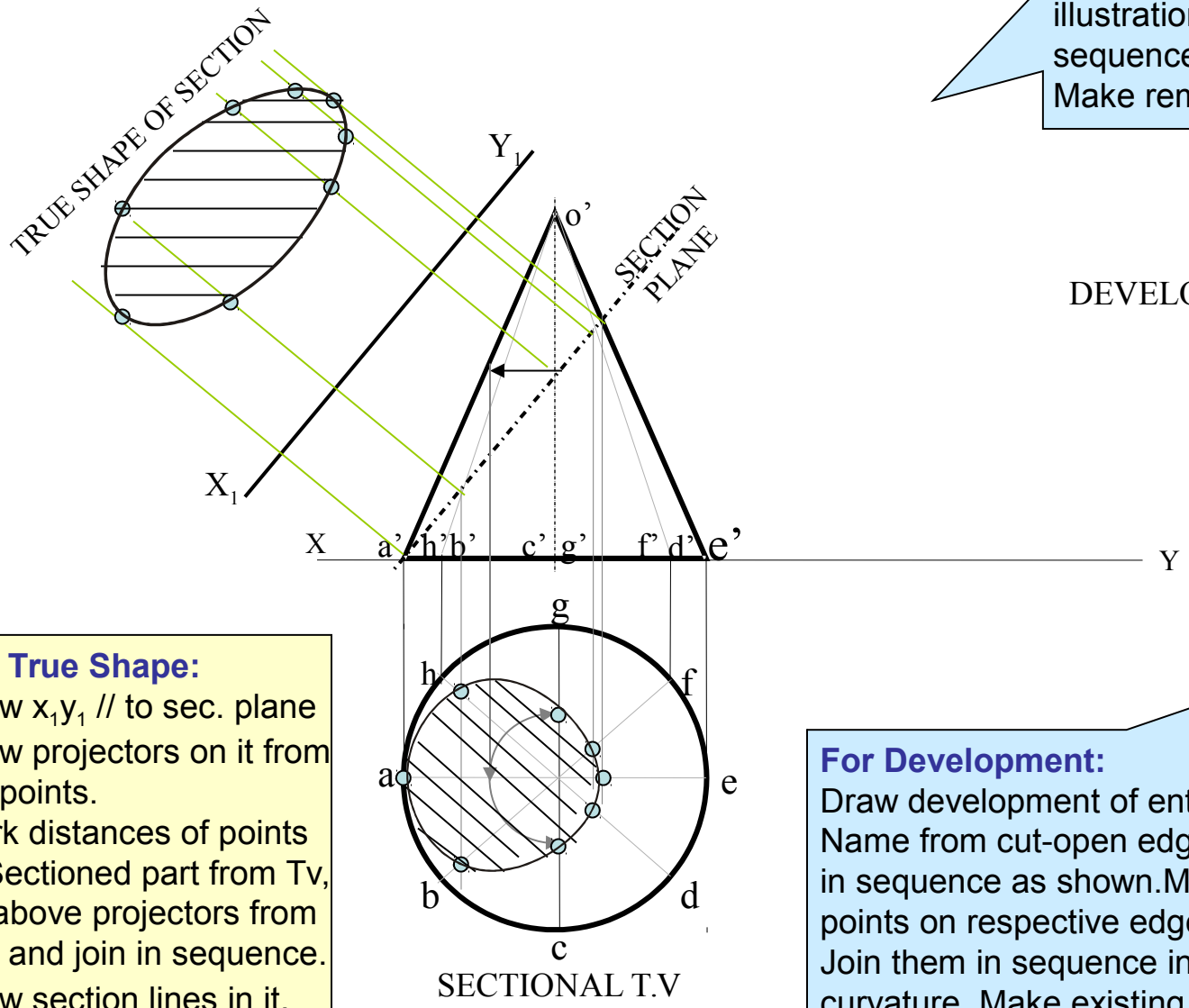


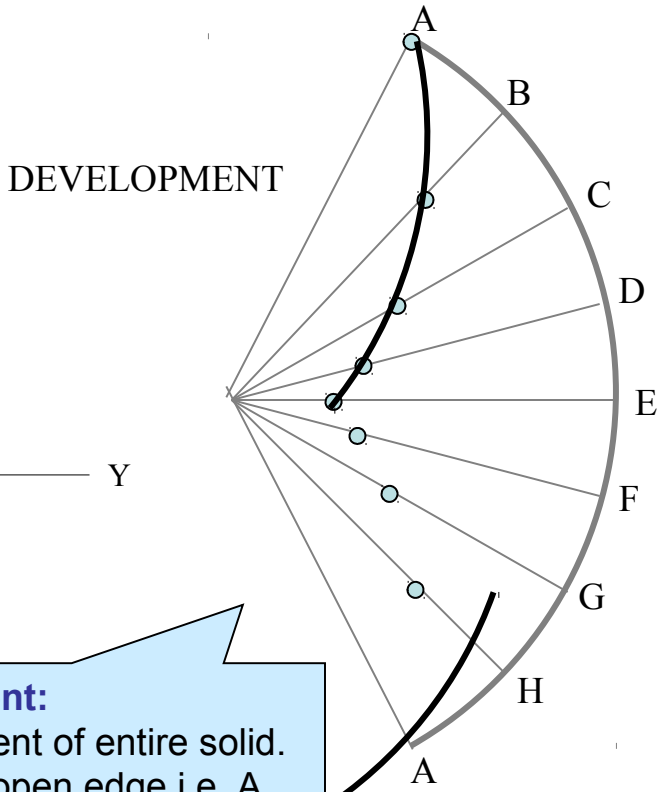
For True Shape:
Draw x_1y_1 // to sec. plane
Draw projectors on it from cut points.
Mark distances of points of Sectioned part from Tv, on above projectors from x_1y_1 and join in sequence.
Draw section lines in it.
It is required true shape.

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 st. lines.
Make existing parts dev.dark.

Problem 2: 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 as shown in illustration.Join those points in sequence and show Section lines in it.
Make remaining part of solid dark.

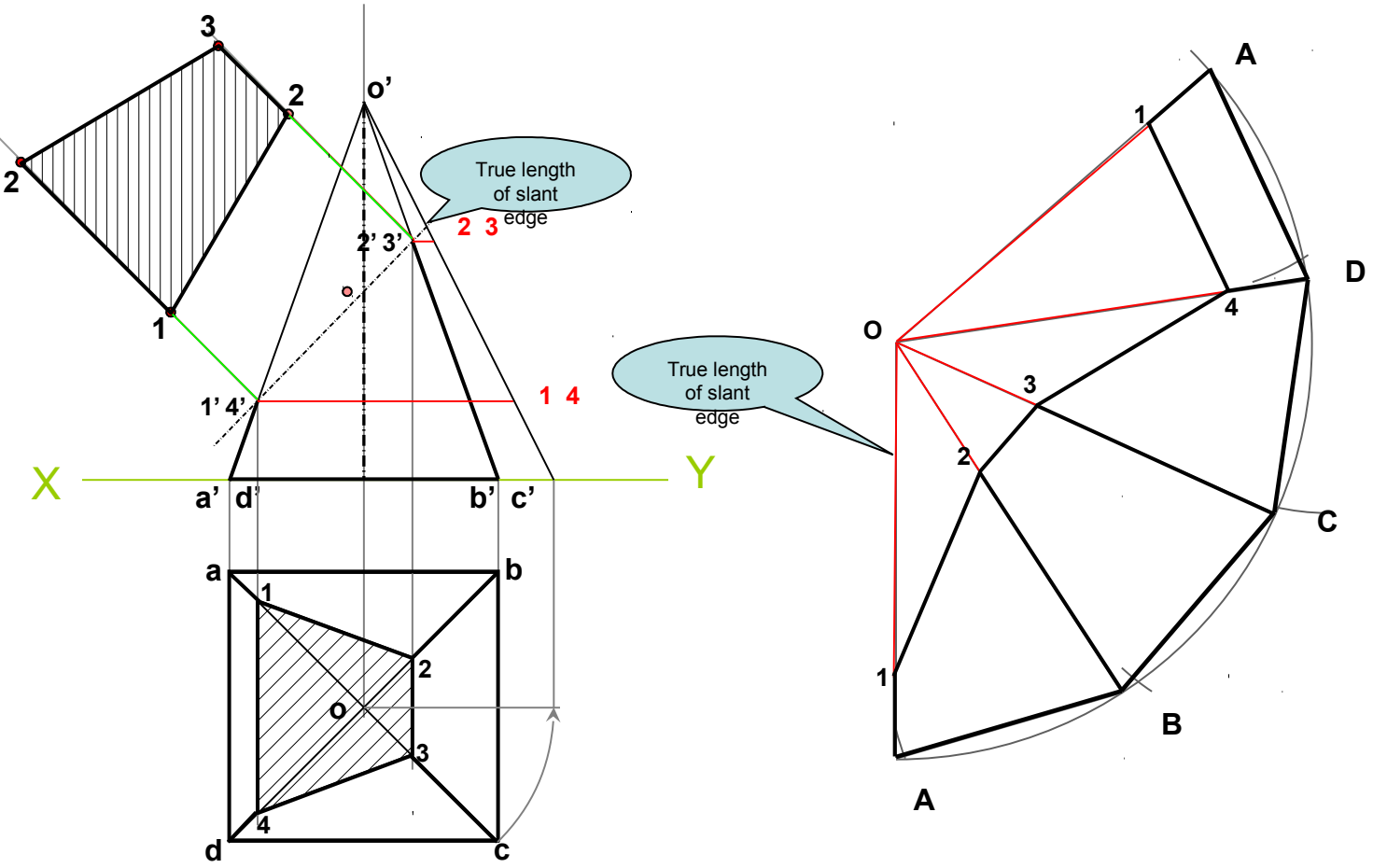




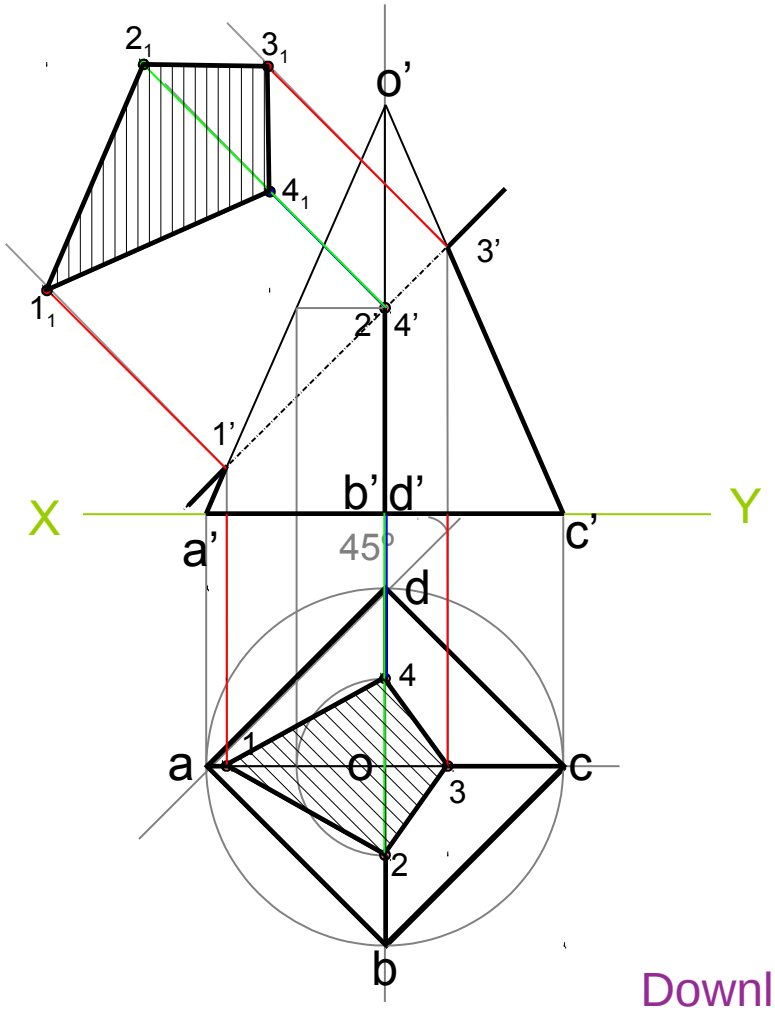
For True Shape:
Draw x_1y_1 // to sec. plane
Draw projectors on it from cut points.
Mark distances of points of Sectioned part from Tv, on above projectors from x_1y_1 and join in sequence.
Draw section lines in it.
It is required true shape.

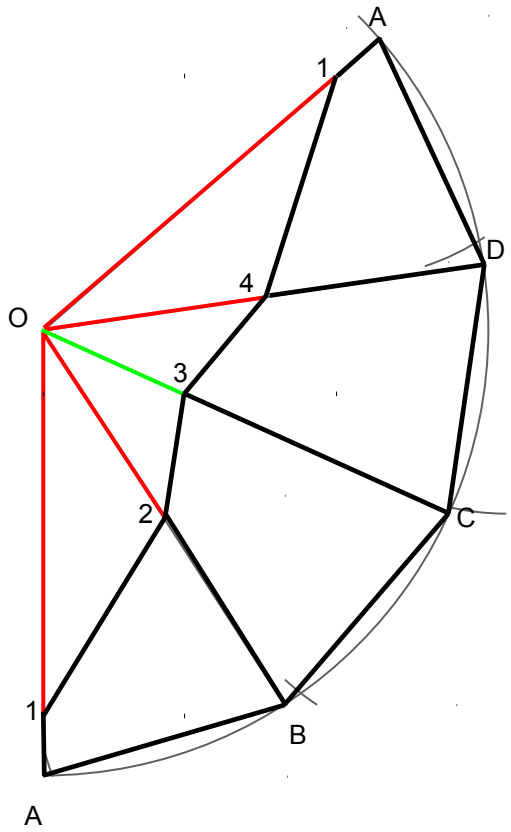
For Development:
Draw development of entire solid.
Name from cut-open edge i.e. A. in sequence as shown.Mark the cut points on respective edges.
Join them in sequence in curvature. Make existing parts dev.dark.

Q 14.11: A square pyramid, base 40 mm side and axis 65 mm long, has its base on the HP with two edges of the base perpendicular to the VP. It is cut by a section plane, perpendicular to the VP, inclined at 45° to the HP and bisecting the axis. Draw its sectional top view and true shape of the section. Also draw its development.

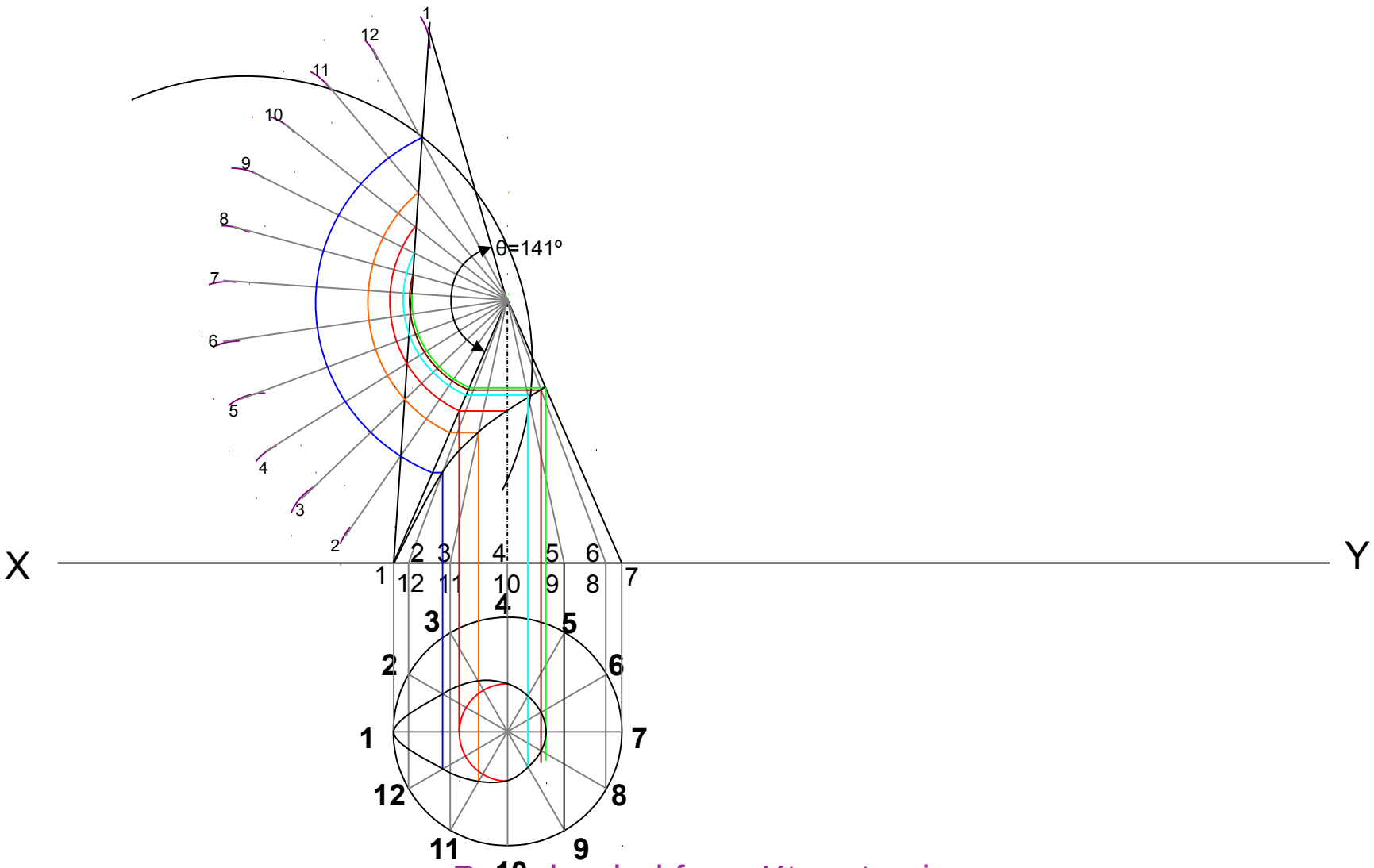


Q 14.11: A square pyramid, base 40 mm side and axis 65 mm long, has its base on the HP and all the edges of the base equally inclined to the VP. It is cut by a section plane, perpendicular to the VP, inclined at 45° to the HP and bisecting the axis. Draw its sectional top view, sectional side view and true shape of the section. Also draw its development.

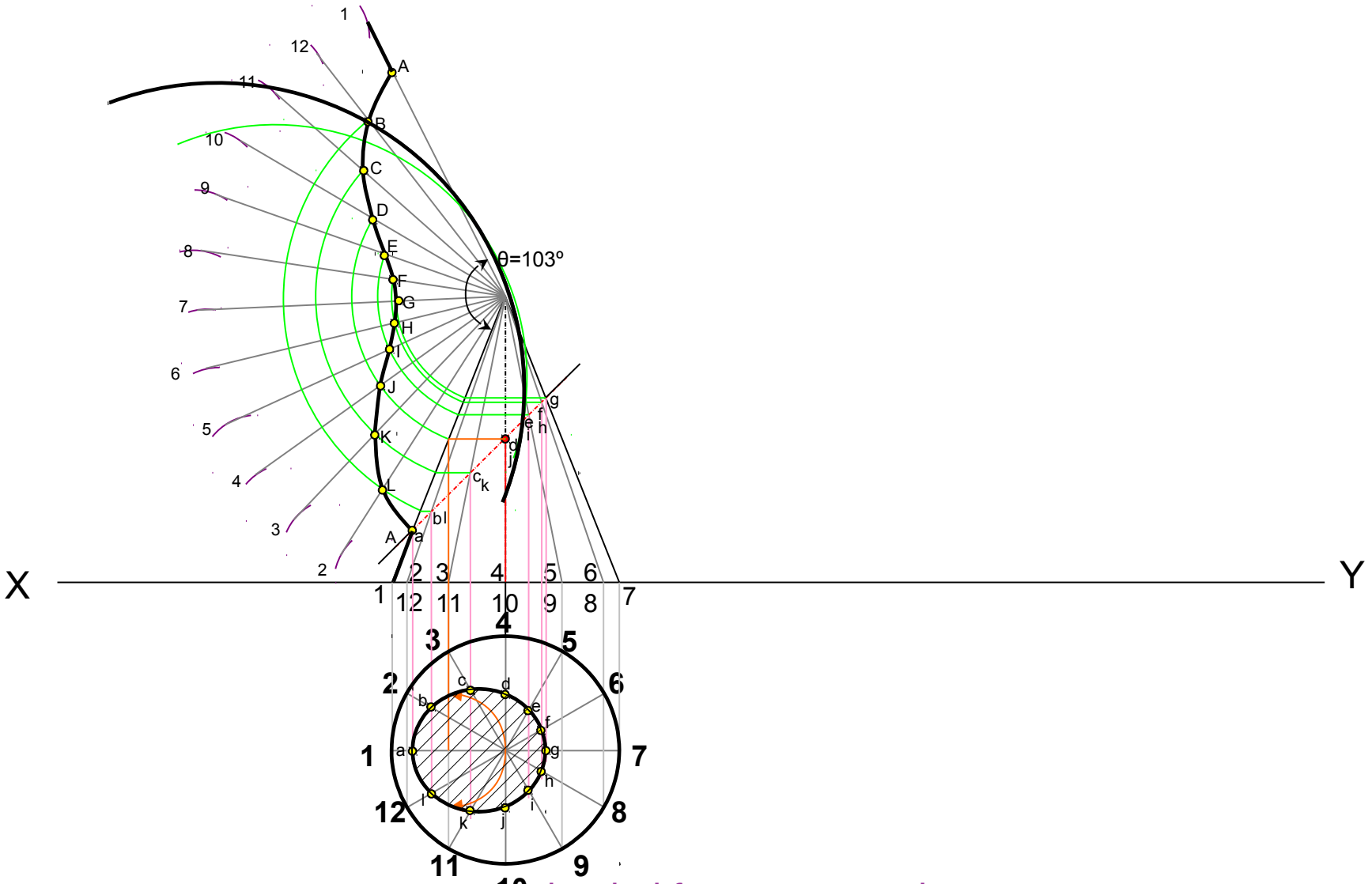




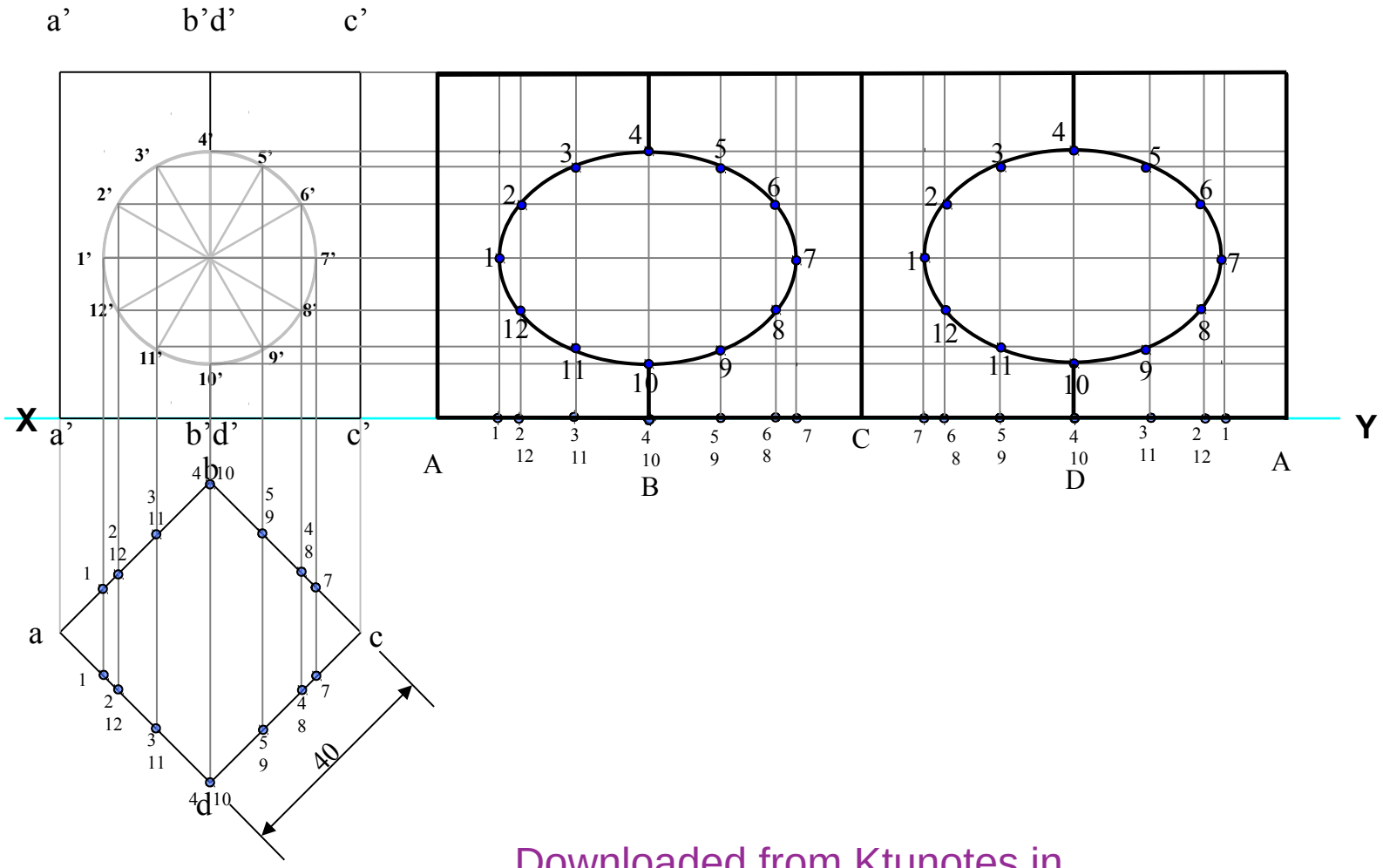
Q 15.26: draw the projections of a cone resting on the ground on its base and show on them, the shortest path by which a point P, starting from a point on the circumference of the base and moving around the cone will return to the same point. Base ofn cone 65 mm diameter ; axis 75 mm long.



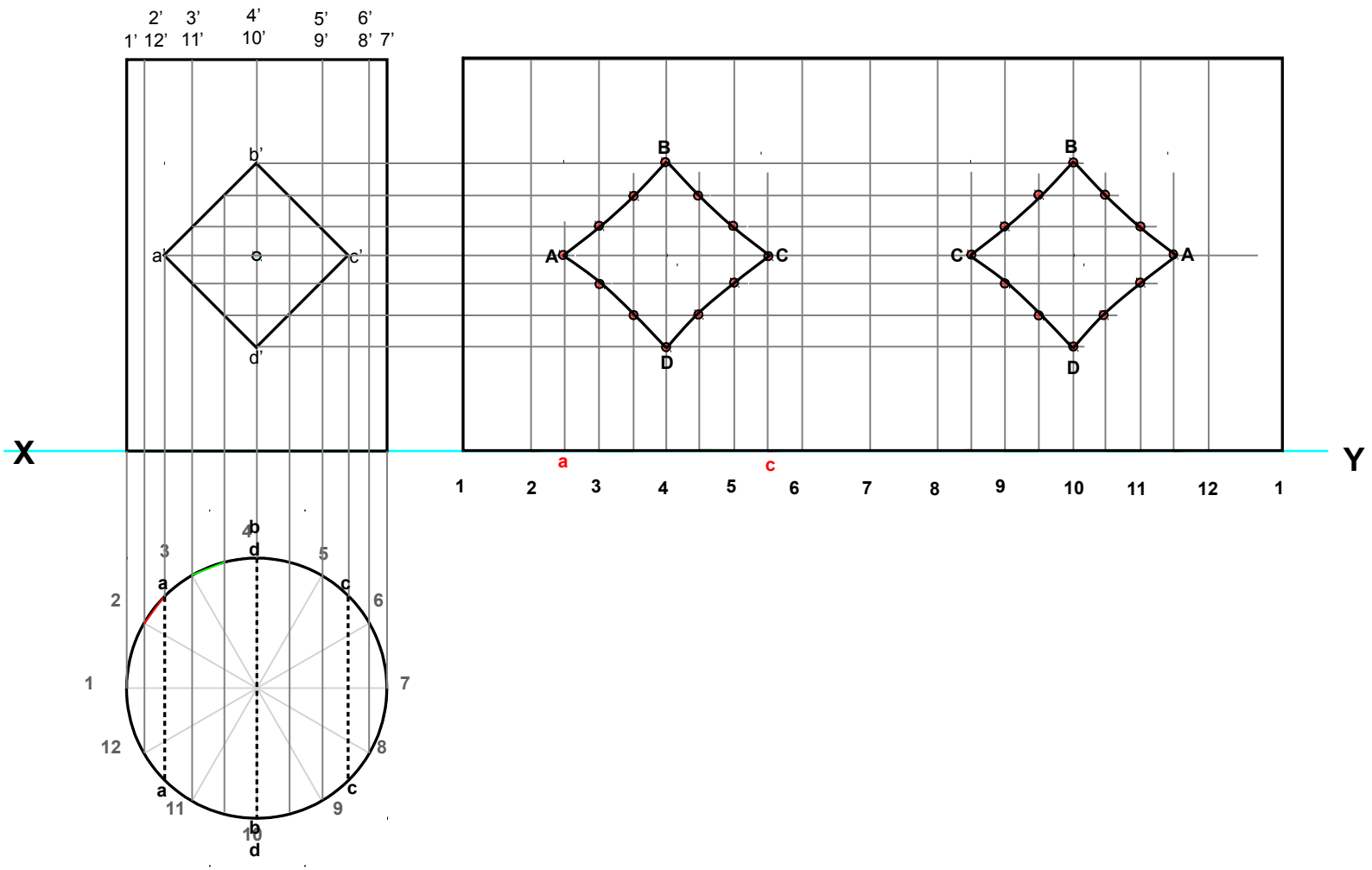
Q 15.26: A right circular cone base 30 mm side and height 50 mm rests on its base on H.P. It is cut by a section plane perpendicular to the V.P., inclined at 45° to the H.P. and bisecting the axis. Draw the projections of the truncated cone and develop its lateral surface.



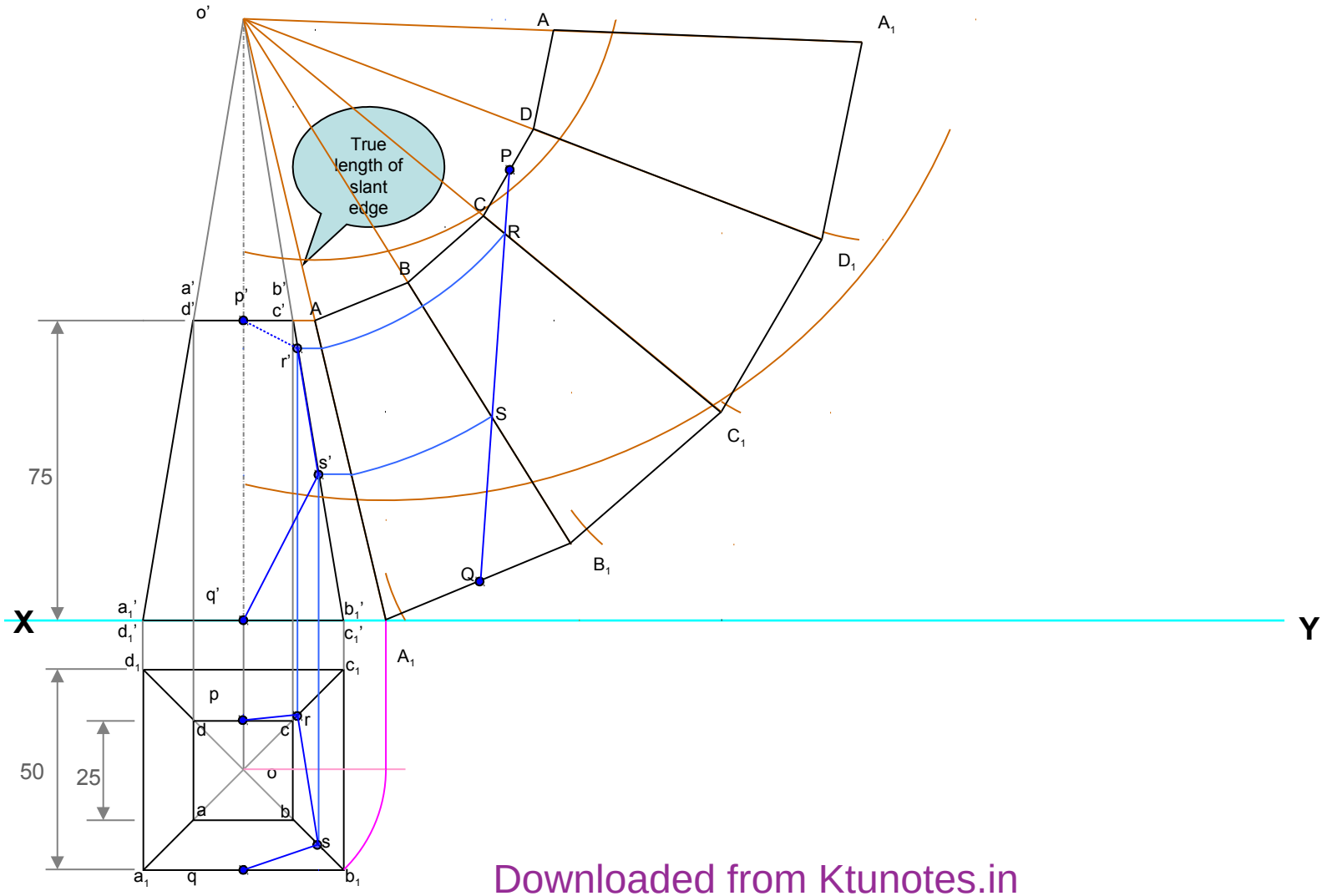
Q: A square prism of 40 mm edge of the base and 65 mm height stands on its base on the HP with vertical faces inclined at 45º with the VP. A horizontal hole of 40 mm diameter is drilled centrally through the prism such that the hole passes through the opposite vertical edges of the prism, draw the development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



Q.15.11: A right circular cylinder, base 50 mm diameter and axis 60 mm long, is standing on HP on its base. It has a square hole of size 25 in it. The axis of the hole bisects the axis of the cylinder and is perpendicular to the VP. The faces of the square hole are equally inclined with the HP. Draw its projections and develop lateral surface of the cylinder.



Q.15.21: A frustum of square pyramid has its base 50 mm side, top 25 mm side and axis 75 mm. Draw the development of its lateral surface. Also draw the projections of the frustum (when its axis is vertical and a side of its base is parallel to the VP), showing the line joining the mid point of a top edge of one face with the mid point of the bottom edge of the opposite face, by the shortest distance.



END OF SESSION 5

SESSION 6
INTERSECTION OF SOLIDS