DEVELOPMENT OF SURFACES

In industrial world, an engineer is frequently confronted with problems where the development of surfaces of an object has to be made to help him to go ahead with the design and manufacturing processes. For example, in sheet metal work, it plays a vital role, thus enabling a mechanic to cut proper size of the plate from the development and then to fold at proper places to form the desired objects, namely, boilers, boxes, buckets, packing boxes, chimneys, hoppers, air-conditioning ducts.

DEFINITION

- Suppose an object like a square prism is wrapped around by using paper.
- When the wrapper is opened and spread out on a plane surface, the resulting figure is called the development of the surfaces of the solid

DEVELOPMENT OF SURFACES

Development is a graphical method of obtaining the area of the surfaces of a solid. When a solid is opened out and its complete surface is laid on a plane, the surface of the solid is said to be developed. The figure thus obtained is called a development of the surfaces of the solid or simply development. Development of the solid, when folded or rolled, gives the solid. Examples Prism - Made up of same number of rectangles as sides of the base One side: Height of the prism Other side: Side of the base

Cylinder - Rectangle One side: Circumference of the base Other side: Height of the cylinder Pyramid - Number of triangles in contact The base may be included

PRINCIPAL OF DEVELOPMENT

Every line on the development should show the true length of the corresponding line on the surface which is developed.

METHODS USED TO DEVELOP SURFACES

Parallel-line development: Used for prisms, cylinders etc. in which parallel lines are drawn along the surface and transferred to the development.

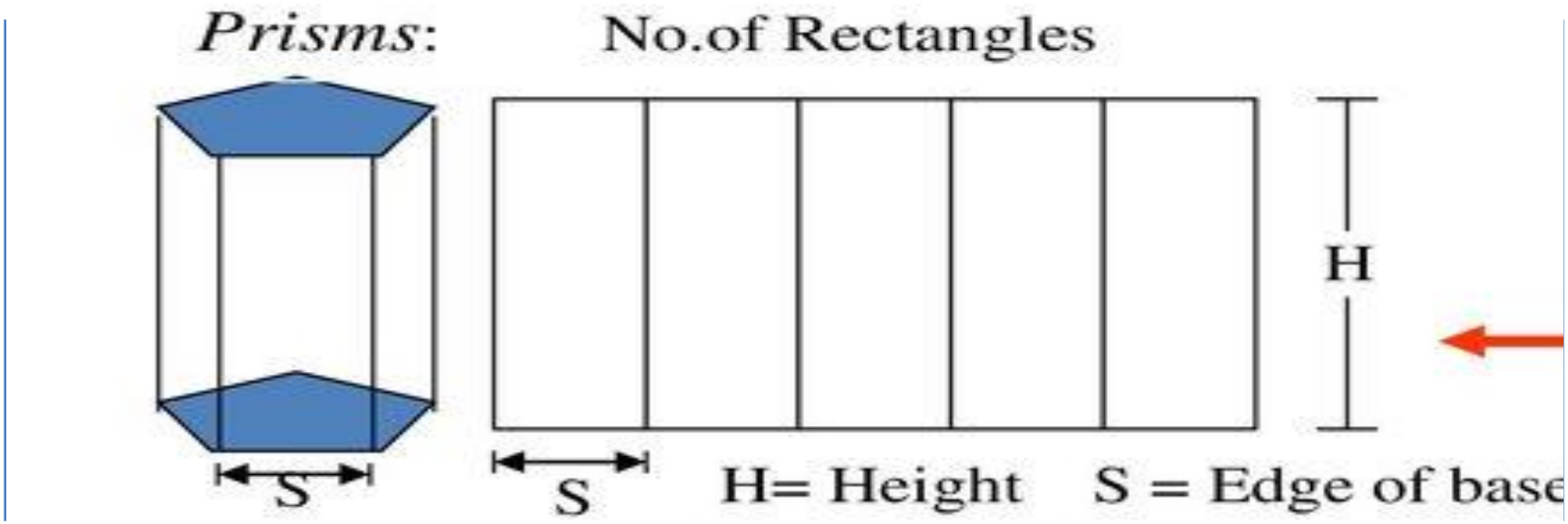
Radial-line development: Used for pyramids, cones etc. in which the true length of the slant edge or generator is used as radius.

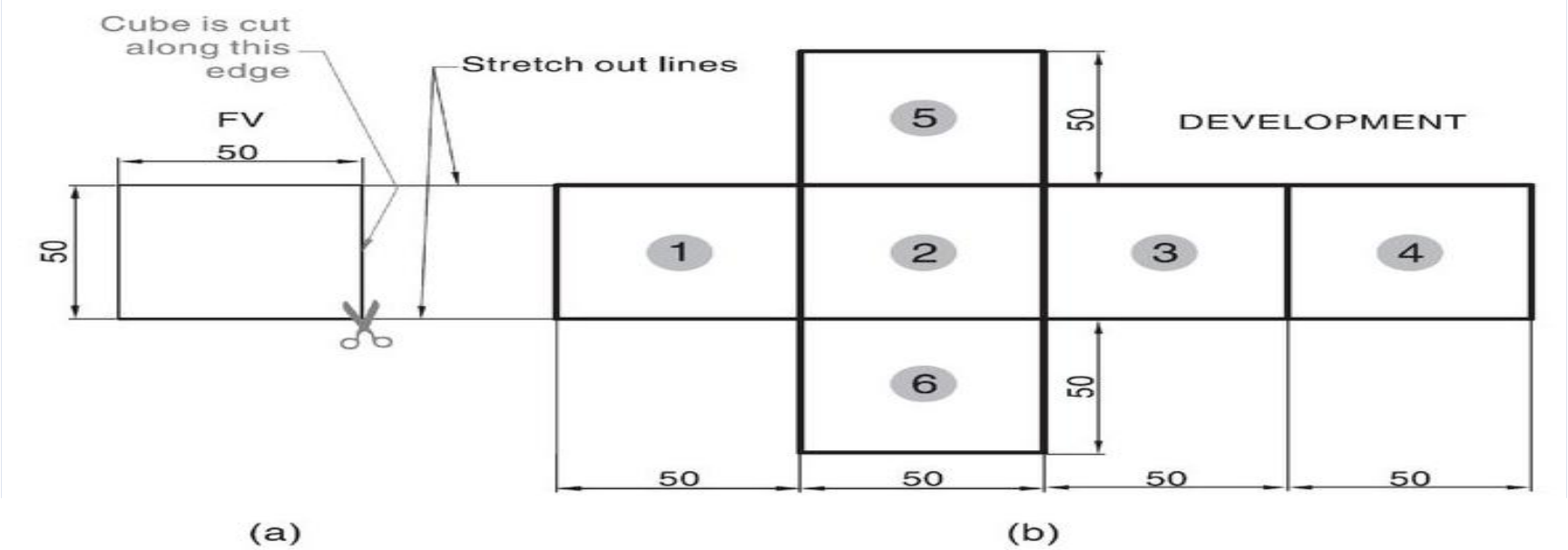
Triangulation development: Complex shapes are divided into a number of triangles and transferred into the development (usually used for transition pieces).

Approximate method: Surface is divided into parts and developed. Used for surfaces such as spheres, paraboloids, ellipsoids etc.

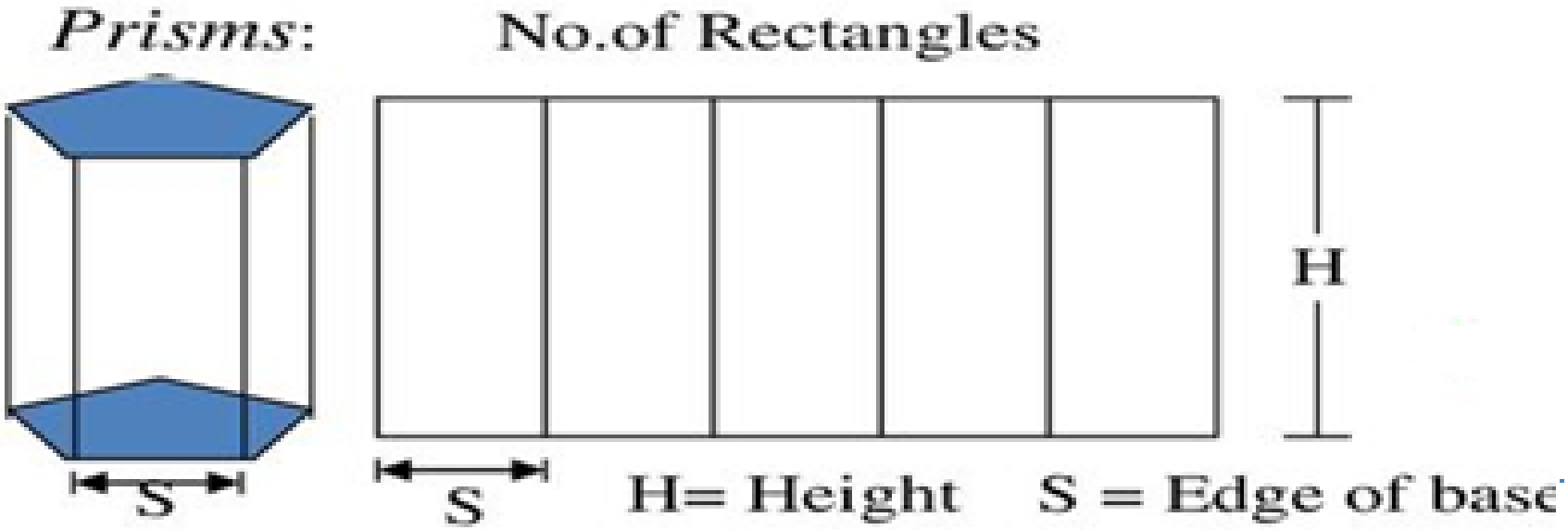
Note:- The surface is preferably cut at the location where the edge will be smallest such that welding or other joining procedures will be minimal.

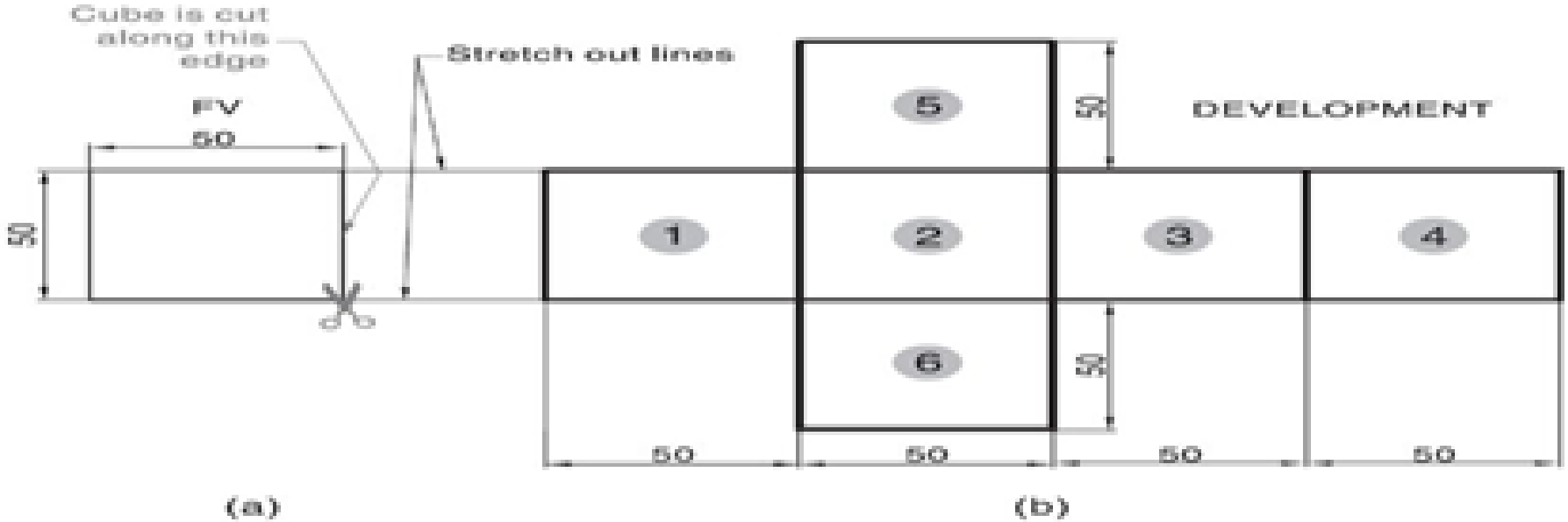
PARALLEL DEVELOPMENT



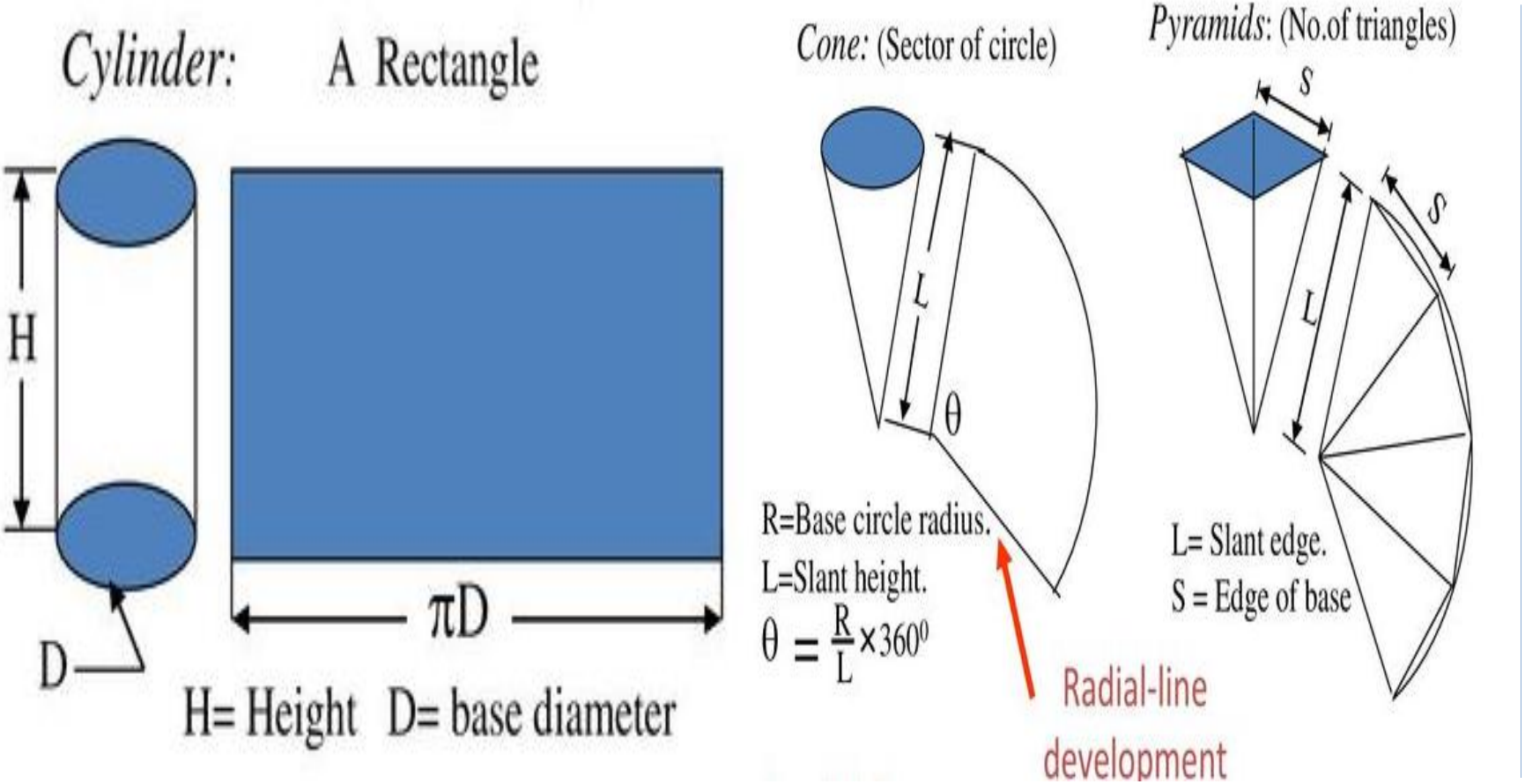


PARALLEL DEVELOPMENT



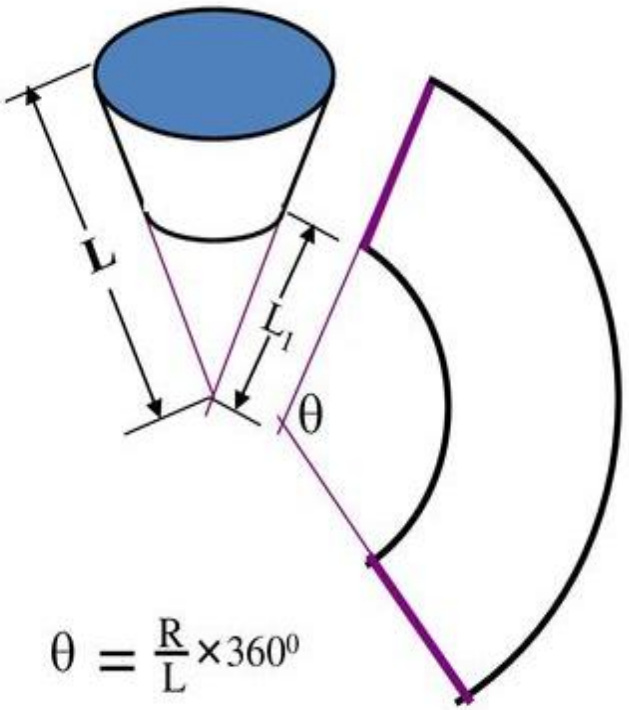


RADIAL -LINE DEVELOPMENT



DEVELOPMENT OF FRUSTUM

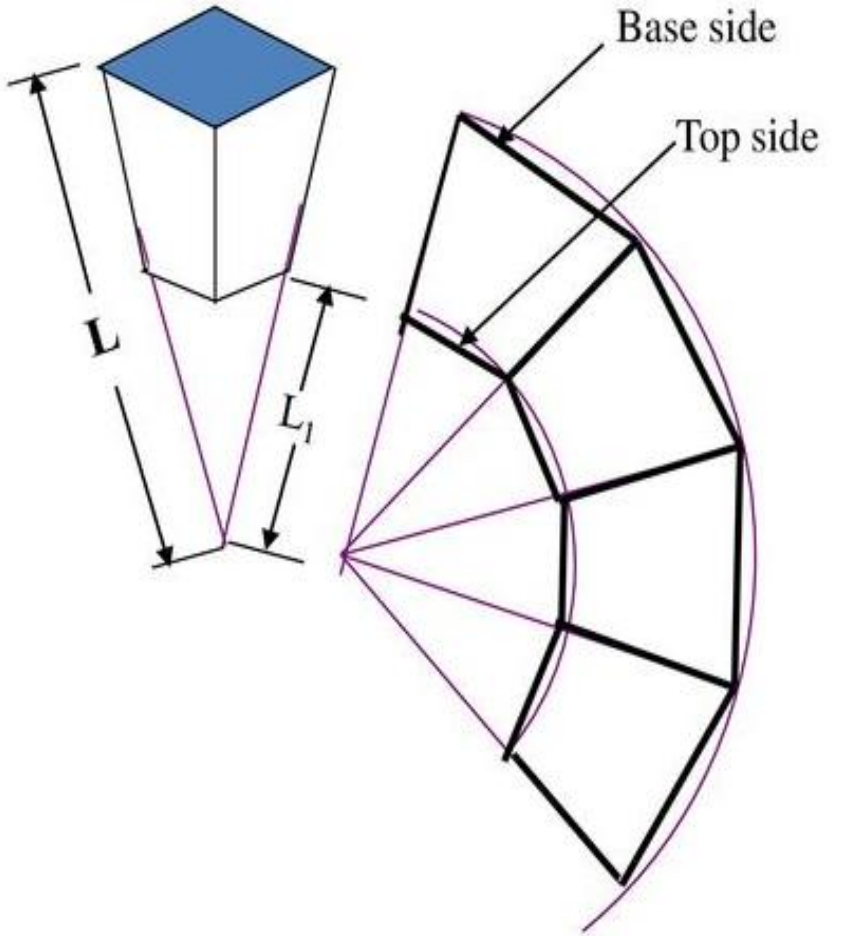
DEVELOPMENT OF
FRUSTUM OF CONE



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

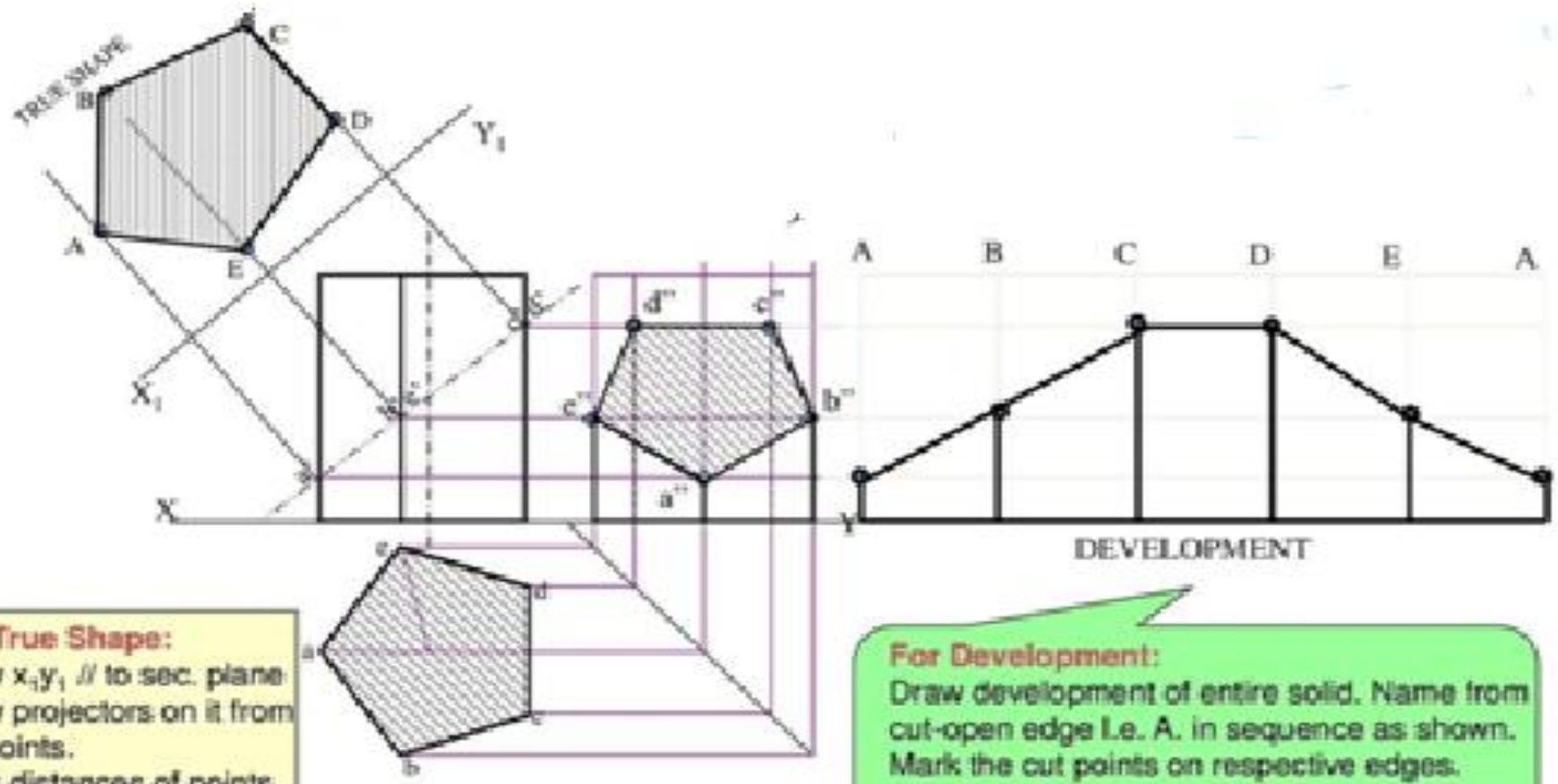
R= Base circle radius of cone
L= Slant height of cone
L_1 = Slant height of cut part.

DEVELOPMENT OF
FRUSTUM OF SQUARE PYRAMID



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

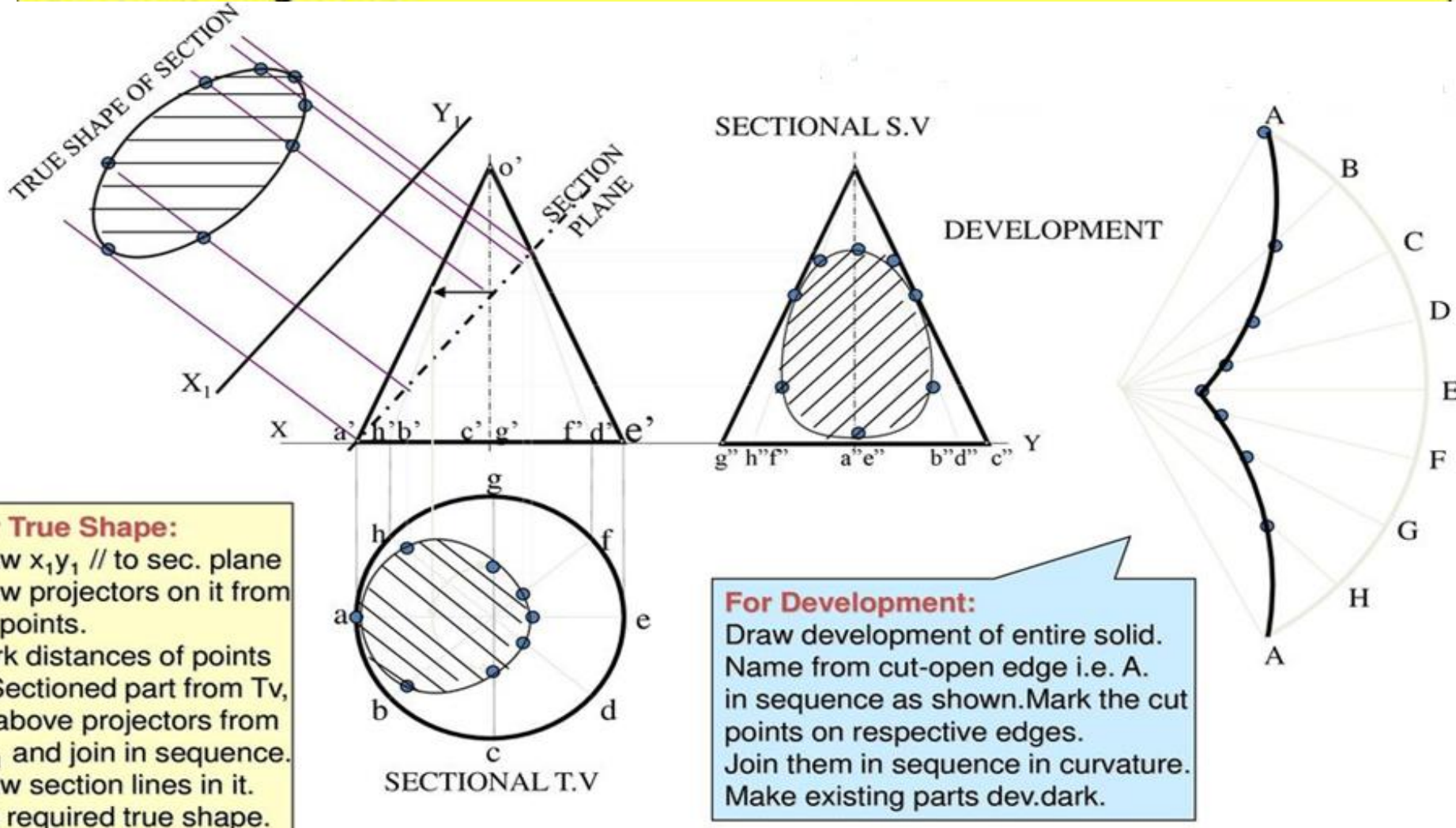
Problem 1: A pentagonal prism , 30 mm base side & 50 mm axis is standing on Hp on it's base with one side of the base perpendicular to VP. It is cut by a section plane inclined at 45° to the HP, through mid point of axis. Draw Fv, sec.Tv & sec. Side view. Also draw true shape of section and Development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



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 abowe 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.



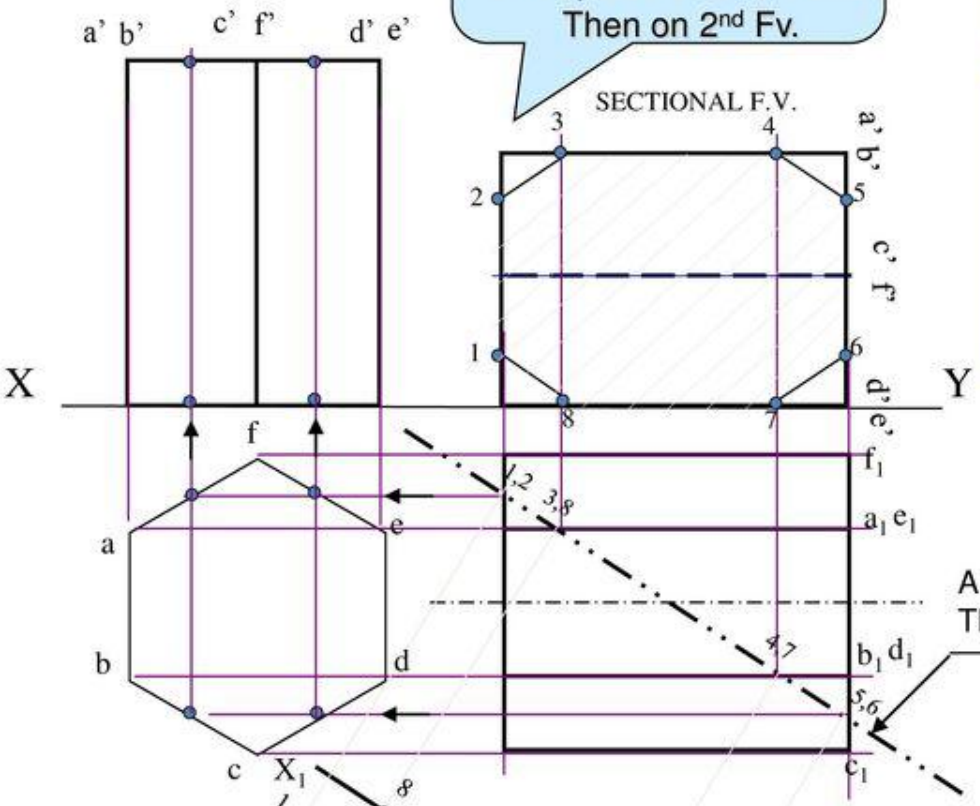
For True Shape:
Draw x_1y_1 // to sec. plane
Draw projectors on it from cut points.
Mark distances of points of Sectioned part from Tv, on above projectors from x_1y_1 and join in sequence.
Draw section lines in it.
It is required true shape.

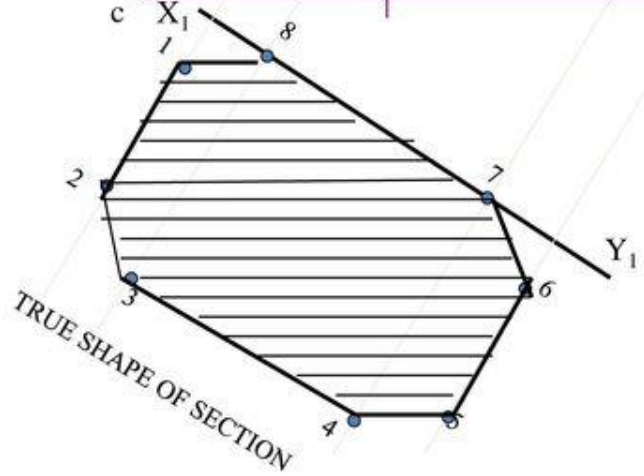
For Development:
Draw development of entire solid.
Name from cut-open edge i.e. A.
in sequence as shown.Mark the cut points on respective edges.
Join them in sequence in curvature.
Make existing parts dev.dark.

Problem 4: A hexagonal prism. 30 mm base side & 55 mm axis is lying on Hp on it's rect.face with axis // to Vp. It is cut by a section plane normal to Hp and 30^0 inclined to Vp bisecting axis.
Draw sec. Views, true shape & development.

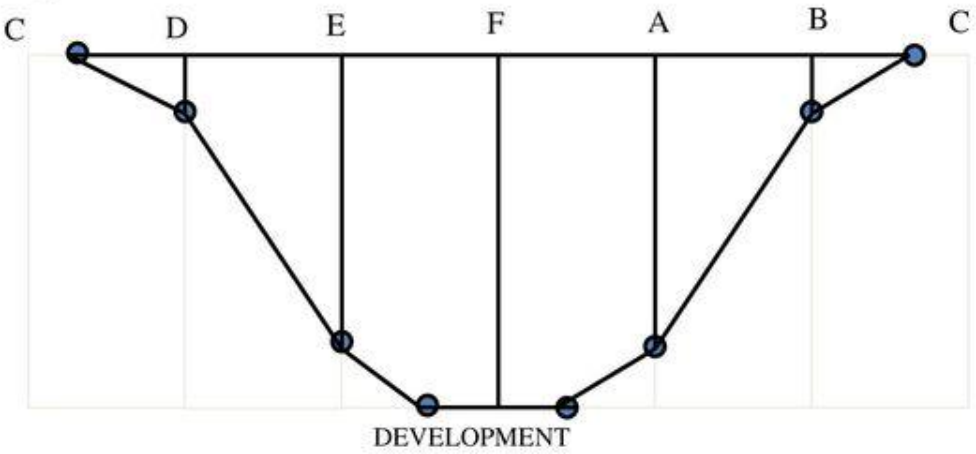
Note the steps to locate Points 1, 2 , 5, 6 in sec.Fv: Those are transferred to 1st TV, then to 1st Fv and Then on 2nd Fv.

Use similar steps for sec.views & true shape.
NOTE: for development, always cut open object from From an edge in the boundary of the view in which sec.plane appears as a line.
Here it is Tv and in boundary, there is c1 edge.Hence it is opened from c and named C,D,E,F,A,B,C.

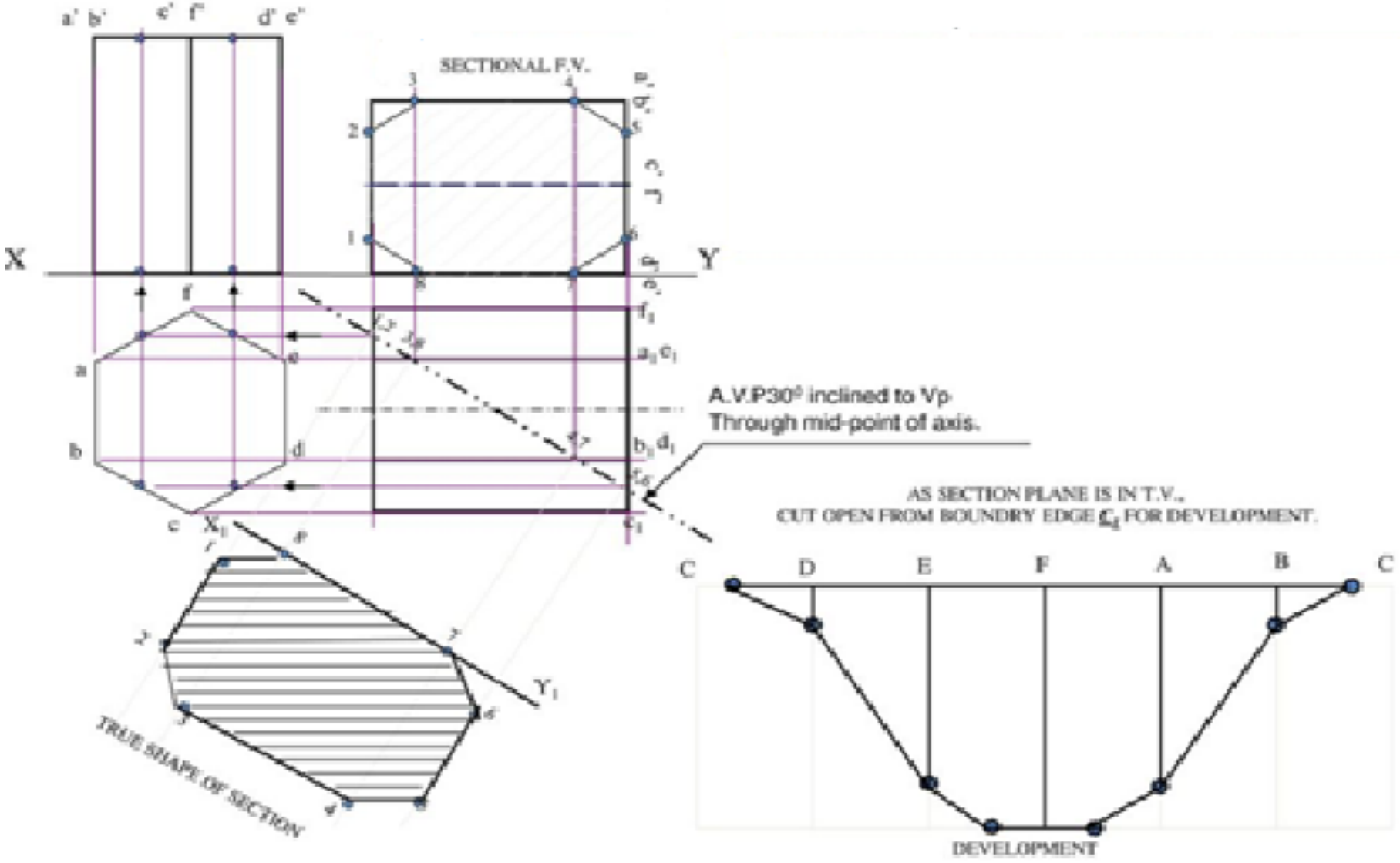




AS SECTION PLANE IS IN T.V.,
CUT OPEN FROM BOUNDRY EDGE $\underline{C_1}$ FOR DEVELOPMENT.

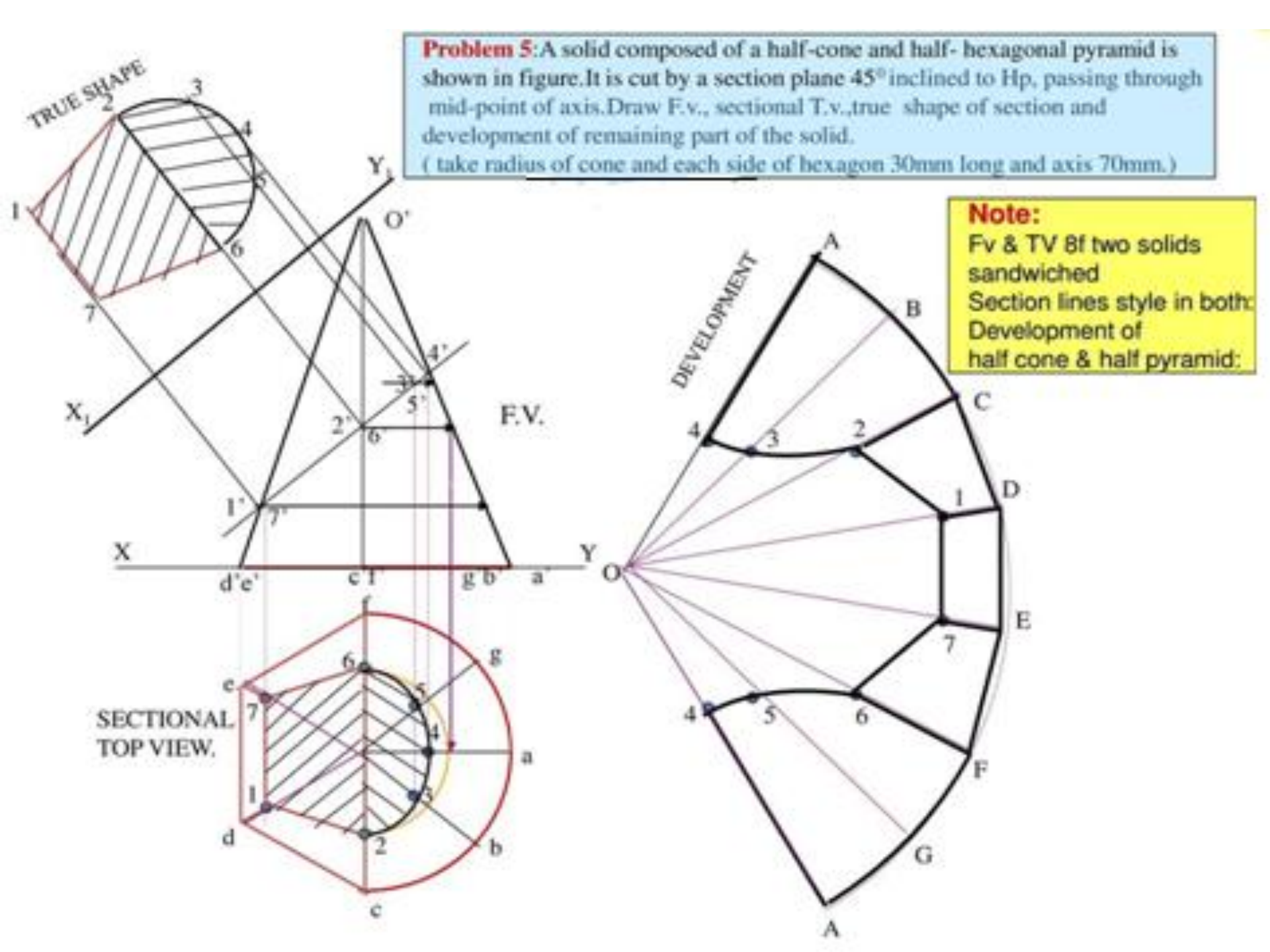


Problem 4: A hexagonal prism. 30 mm base side & 55 mm axis is lying on Hp on it's rect.face with axis // to Vp. It is cut by a section plane normal to Hp and 30° inclined to Vp bisecting axis.
Draw sec. Views, true shape & development.



Problem 5:A solid composed of a half-cone and half- hexagonal pyramid is shown in figure.It is cut by a section plane 45° inclined to Hp, passing through mid-point of axis.Draw F.v., sectional T.v.,true shape of section and development of remaining part of the solid.
(take radius of cone and each side of hexagon 30mm long and axis 70mm.)

Note:
Fv & TV 8f two solids sandwiched
Section lines style in both
Development of
half cone & half pyramid:



ASSIGNMENT

DRAW ALL THE PROBLEMS OF THE PROBLEM SHEET ON DEVELOPMENT OF SURFACES DISTRIBUTED IN THE CLASS