

DEVELOPMENTS

- A layout of the complete surface of an object is called a *development* or *pattern*.
- The layout of only the sides without the top or bottom is called the *lateral surface*.

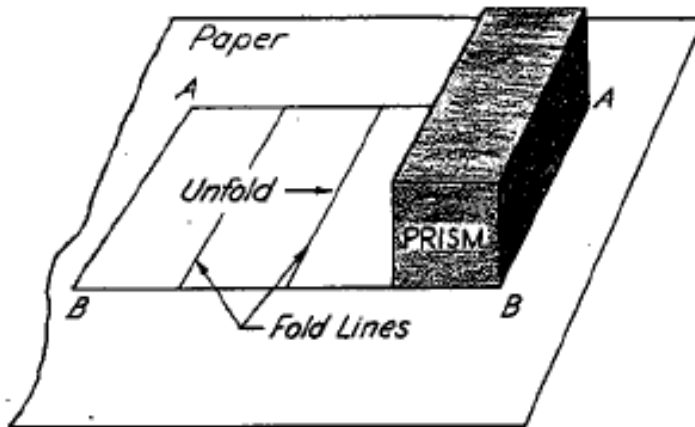


FIG. 10.1 Development of prism.

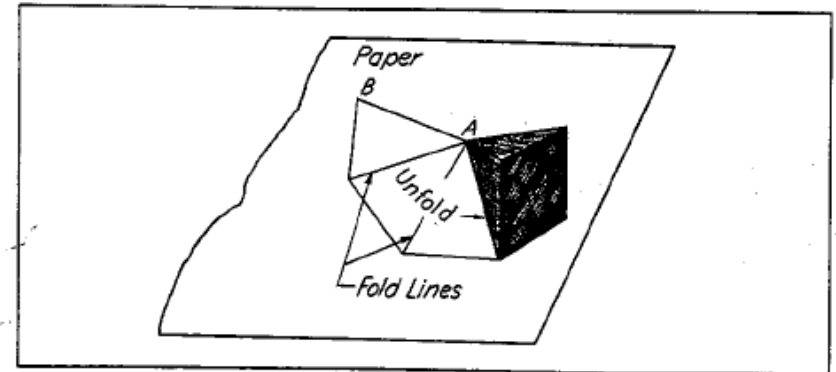


FIG. 10.2 Development of pyramid.

“If the surface of a solid is laid out on a plain surface, the shape thus obtained is called the development of that solid.”

In other words, the development of a solid is the shape of a plain sheet that by proper folding could be converted into the shape of the concerned solid.

The surfaces of an object which are opened out and laid on a flat plane are called the development of surfaces of that object.

Principle of Development

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

Methods of Development

(a) Parallel-line development.

For developing prisms and cylinders.

(b) Radial-line development .

For developing pyramids and cones.

(c) Triangulation development.

For developing transition pieces.

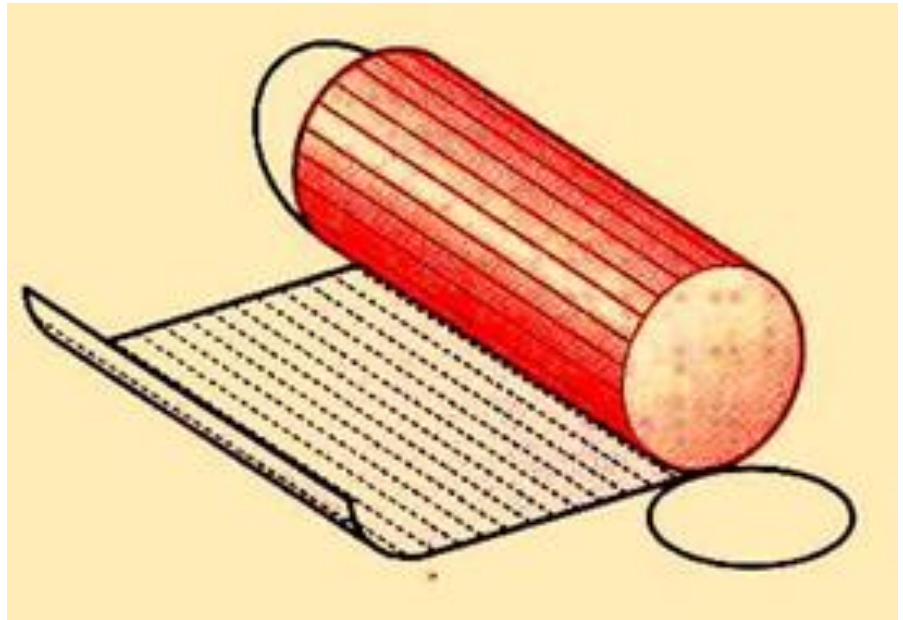
(d) Approximate development.

For developing spheres.

DEV (1)

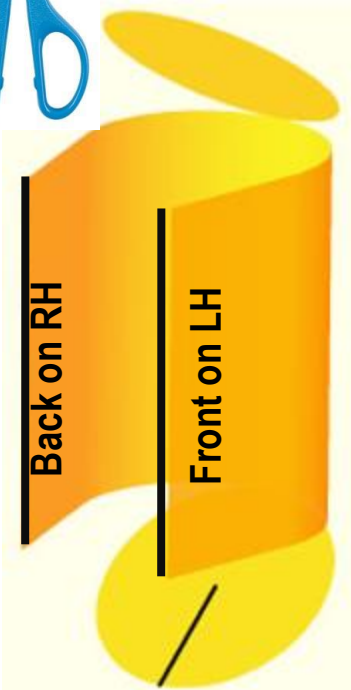
CYLINDER

Draw the development of the complete surface of a cylinder. Diameter is 40 mm and the height is 70 mm.

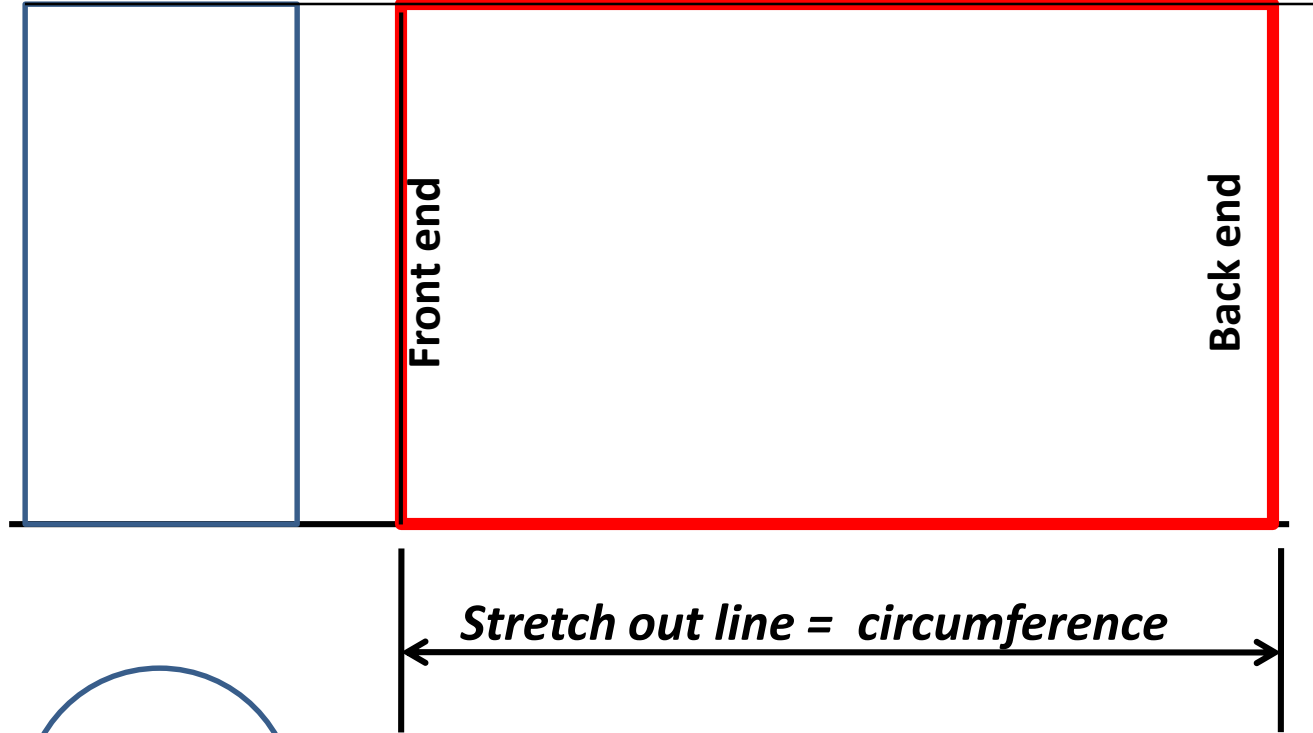


DEV (1)

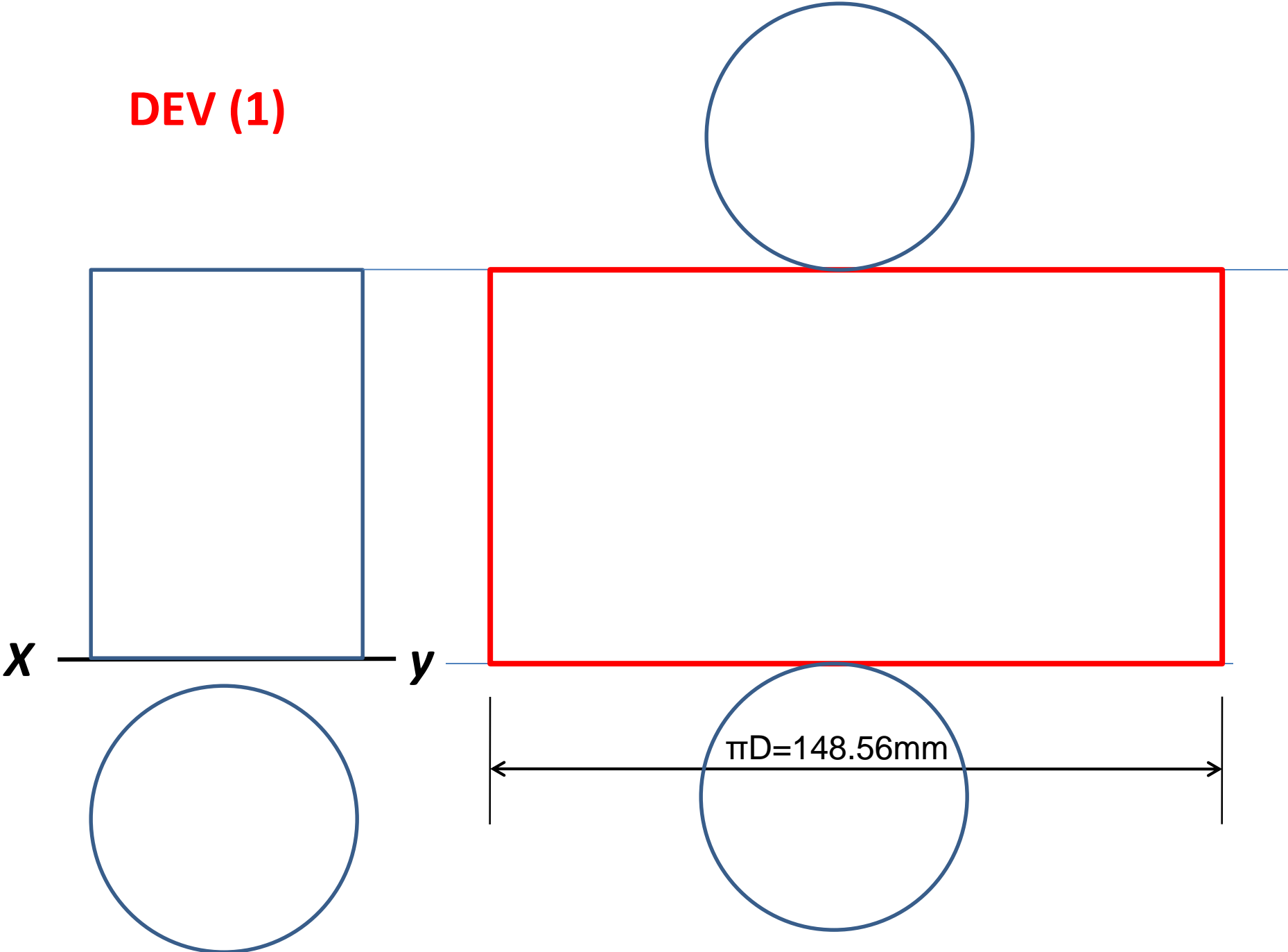
Cut along this generator



Open clockwise



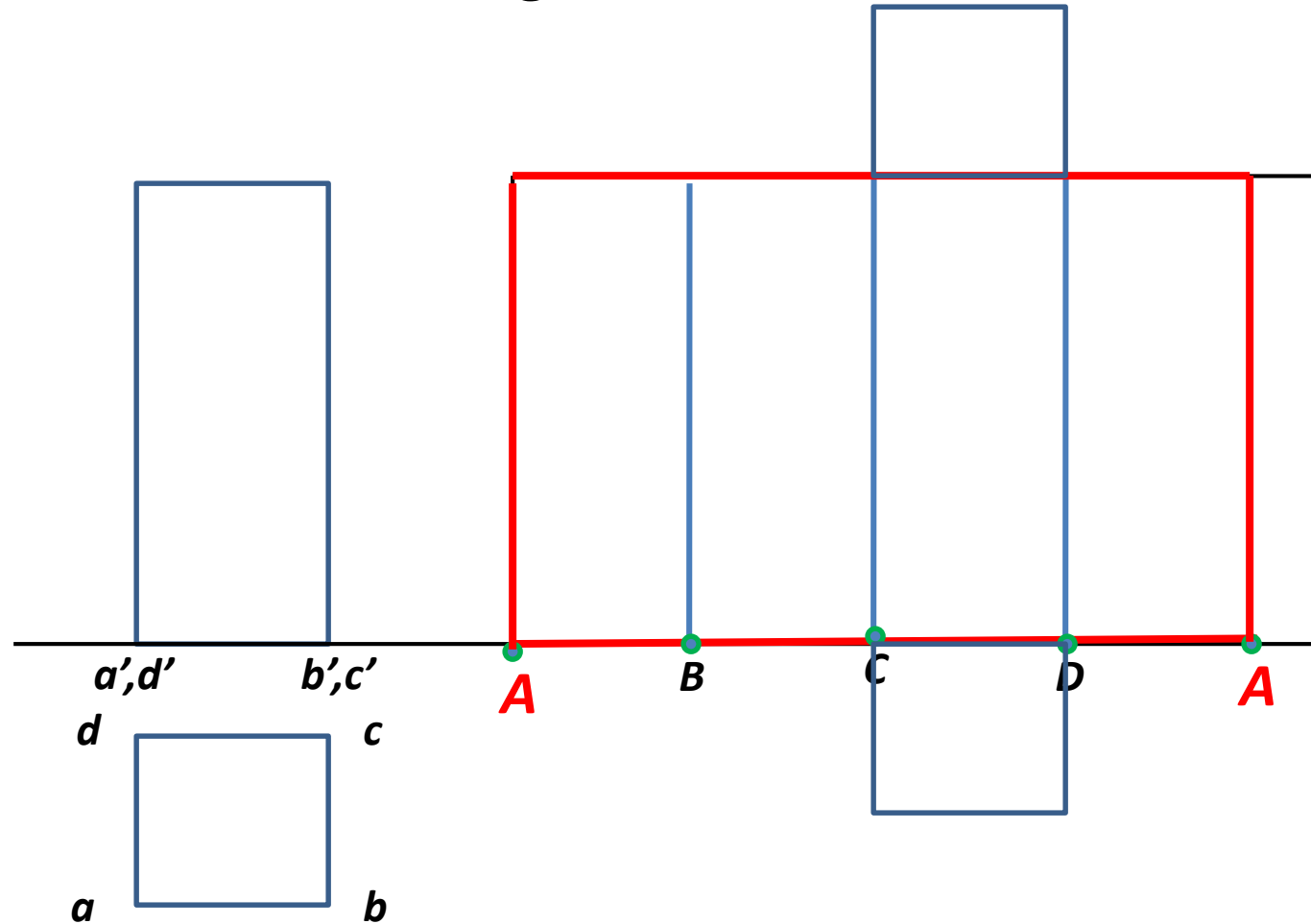
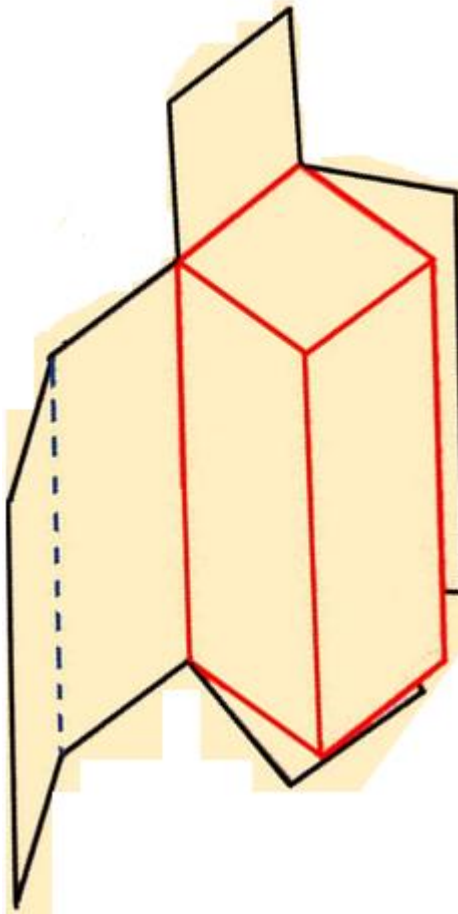
DEV (1)



DEV (2)

PRISM

Develop the complete surface of a square prism of side of base 40 mm and height 80 mm.

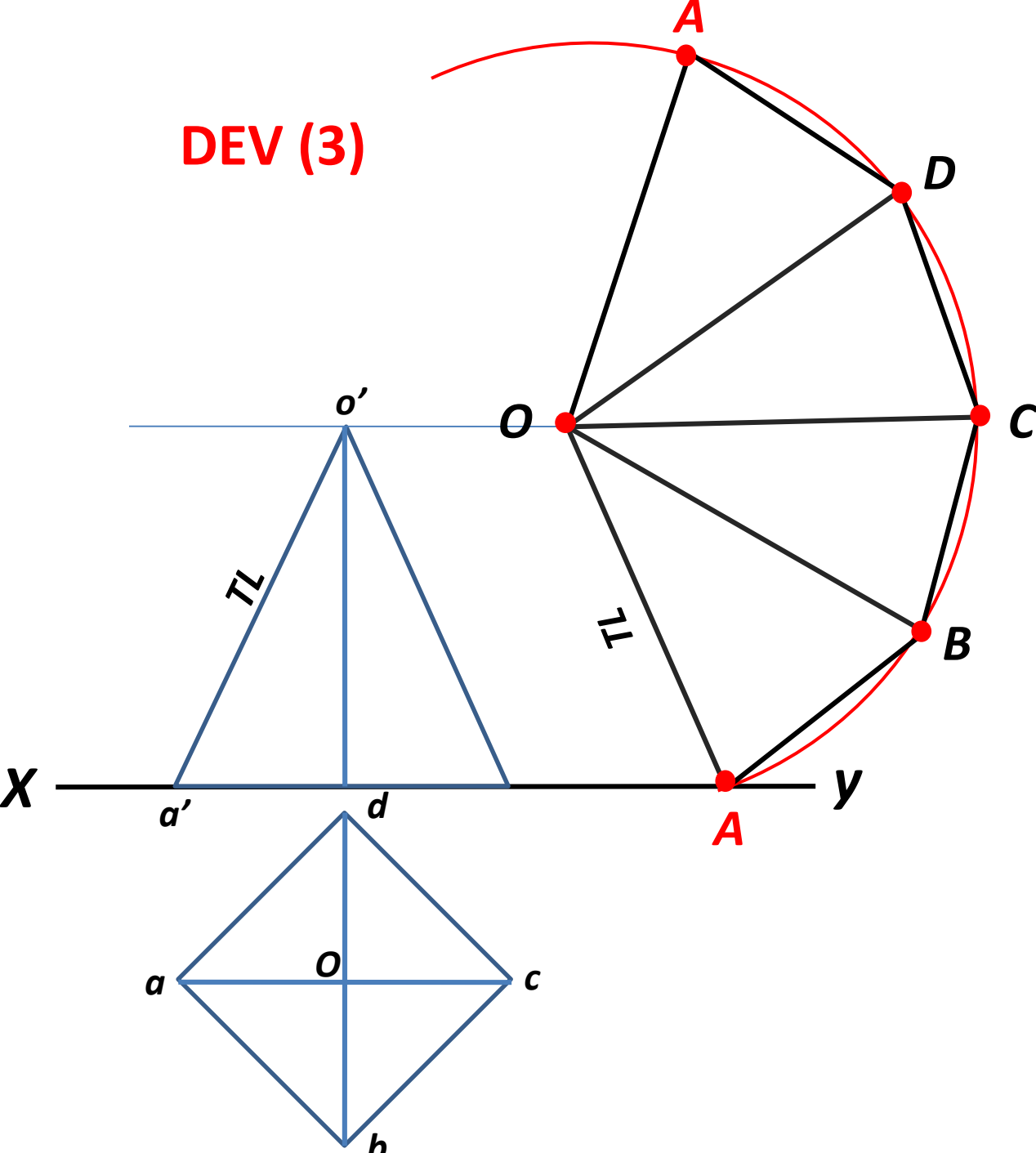


DEV (3)

PYRAMID

Draw the development of the lateral surface of a square pyramid, side of base 30 mm and height 50 mm, resting with its base on H.P. All edge of the base are equally inclined to V.P.

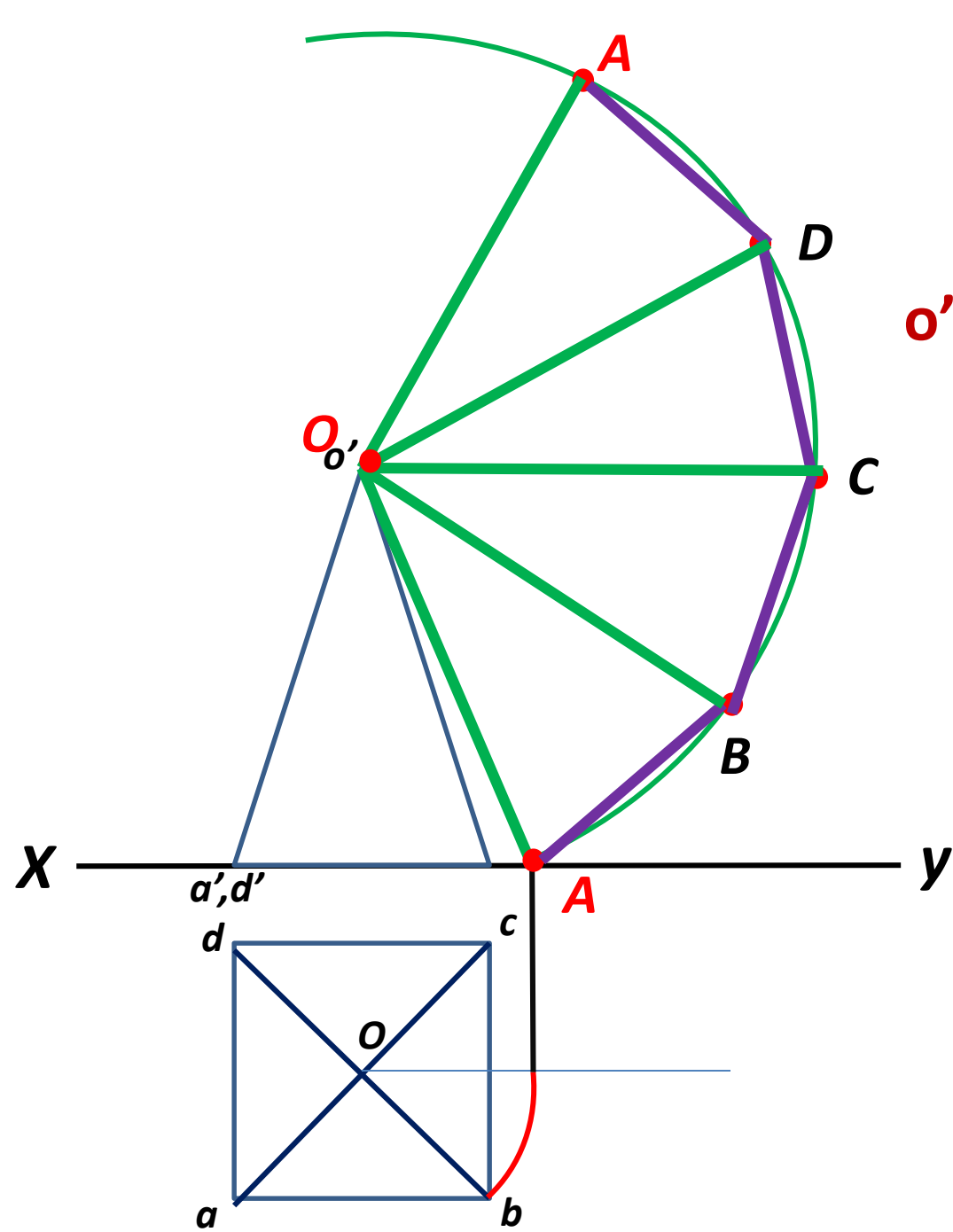
DEV (3)



DEV (3 a)

PYRAMID

Draw the development of the lateral surface of a square pyramid, side of base 30 mm and height 50 mm, resting with its base on H.P. Two of its base edge are equally parallel to V.P.



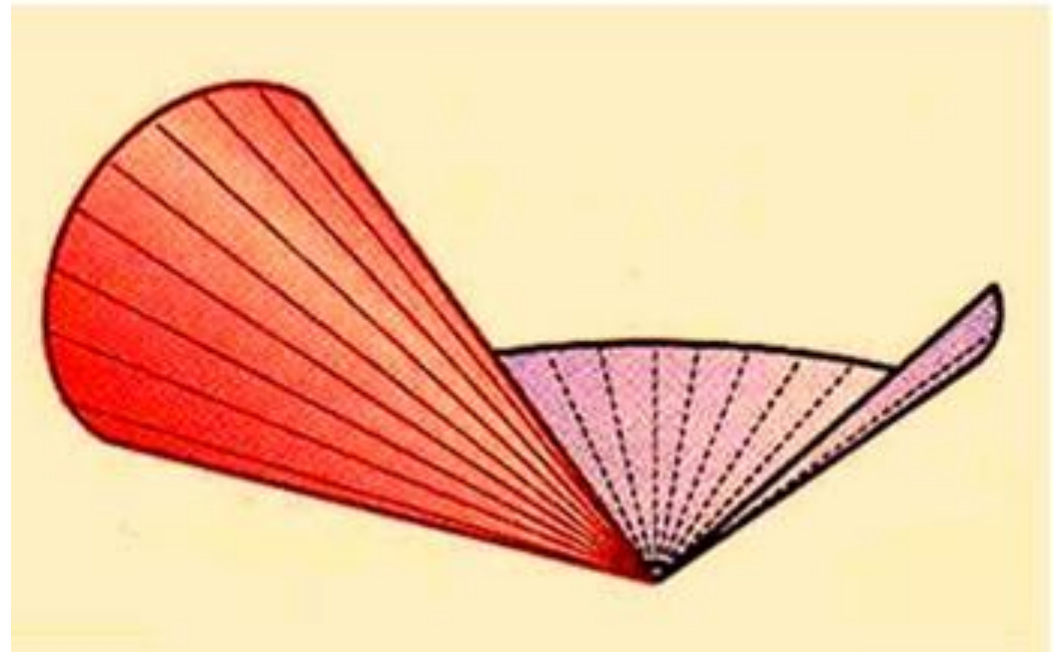
$o' a'$ not equal to TL of OA

TL of OA to be obtained

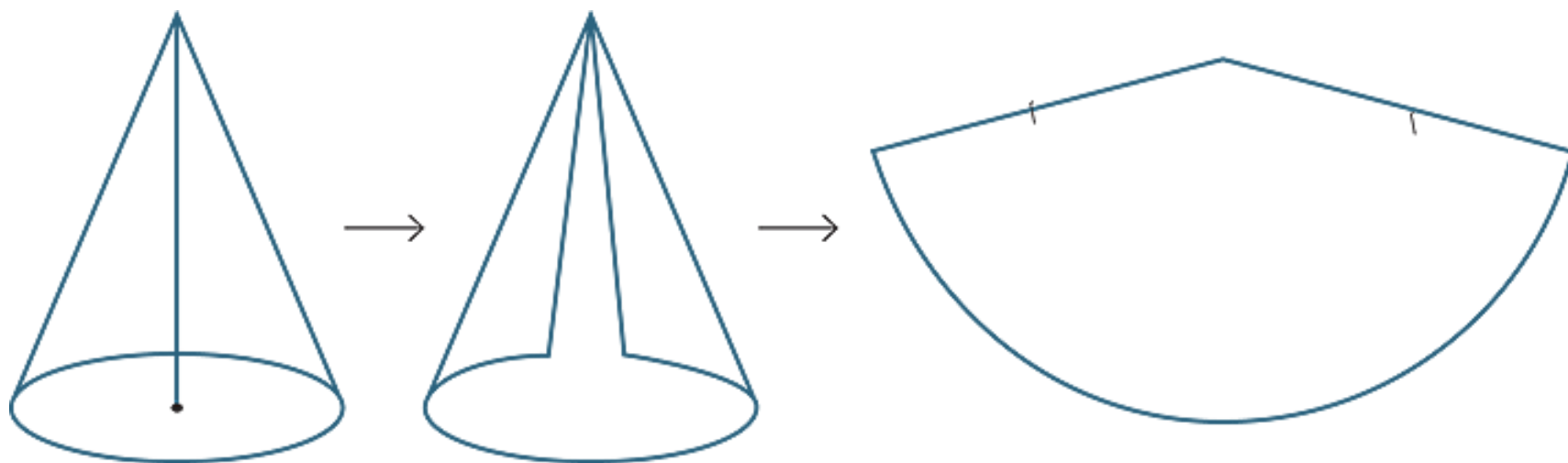
DEV (4)

CONE

Draw the development of the lateral surface of a cone, base diameter 50 mm and height 70 mm, resting with its base on H.P.

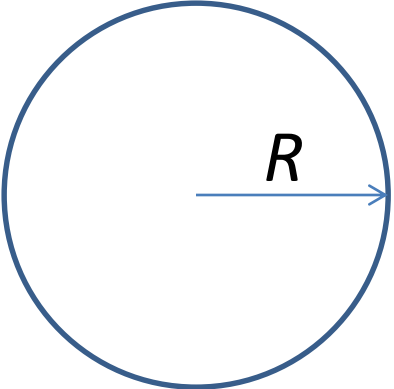
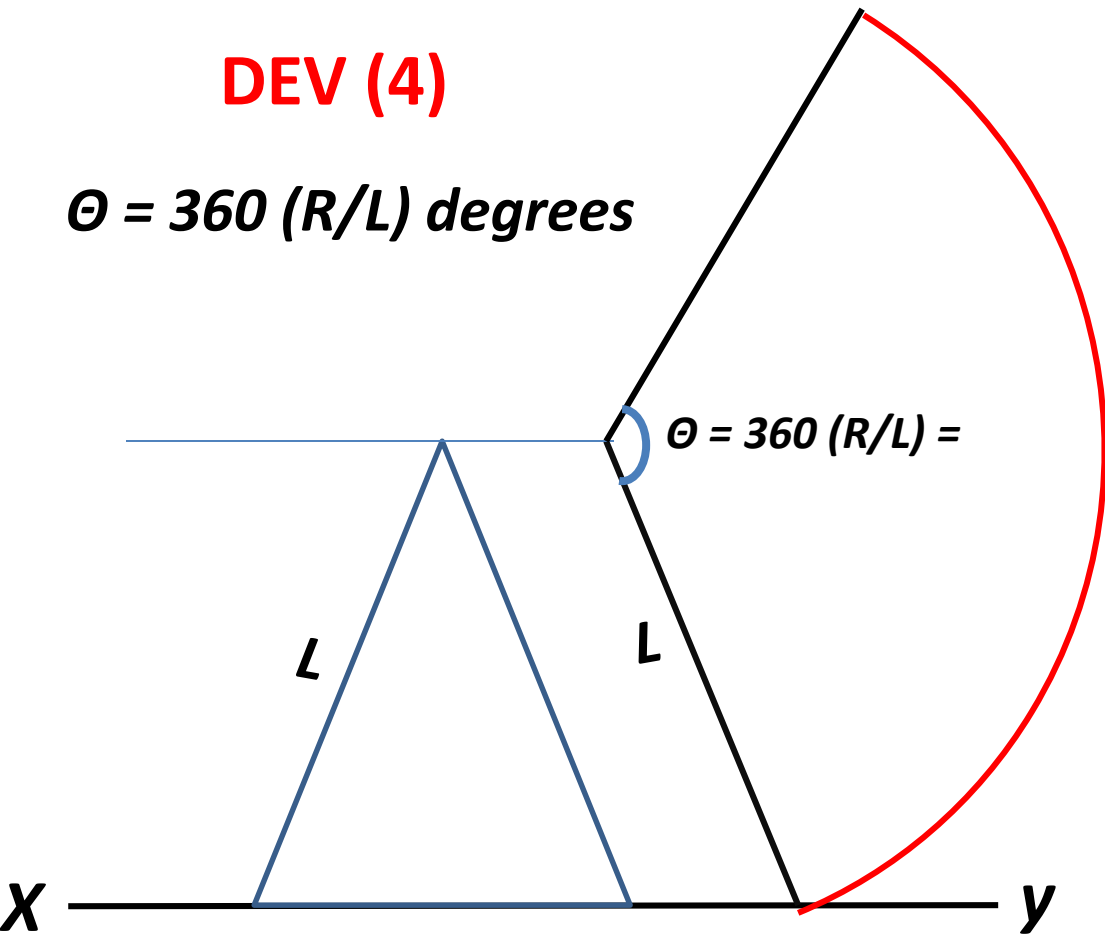


DEV (4)



DEV (4)

$\theta = 360 (R/L) \text{ degrees}$



DEV (5)

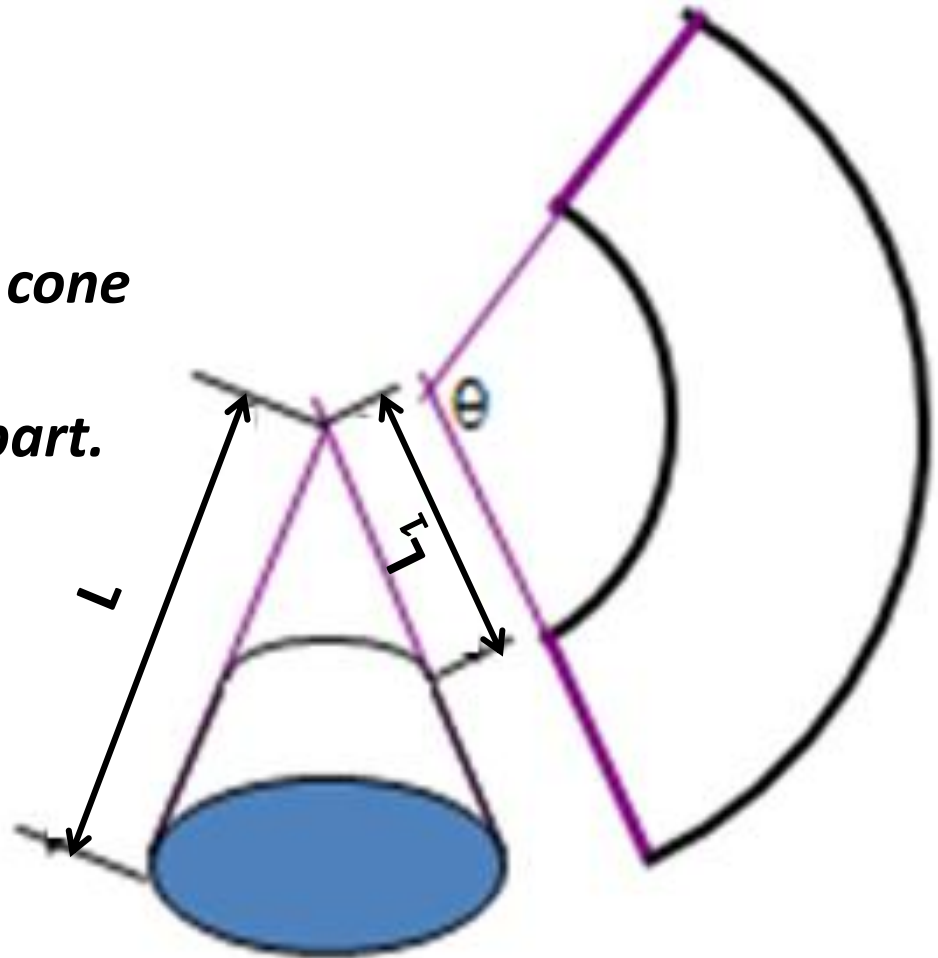
FRUSTUM OF A CONE

$$\theta = 360 \times \frac{R}{L} \quad \text{degrees}$$

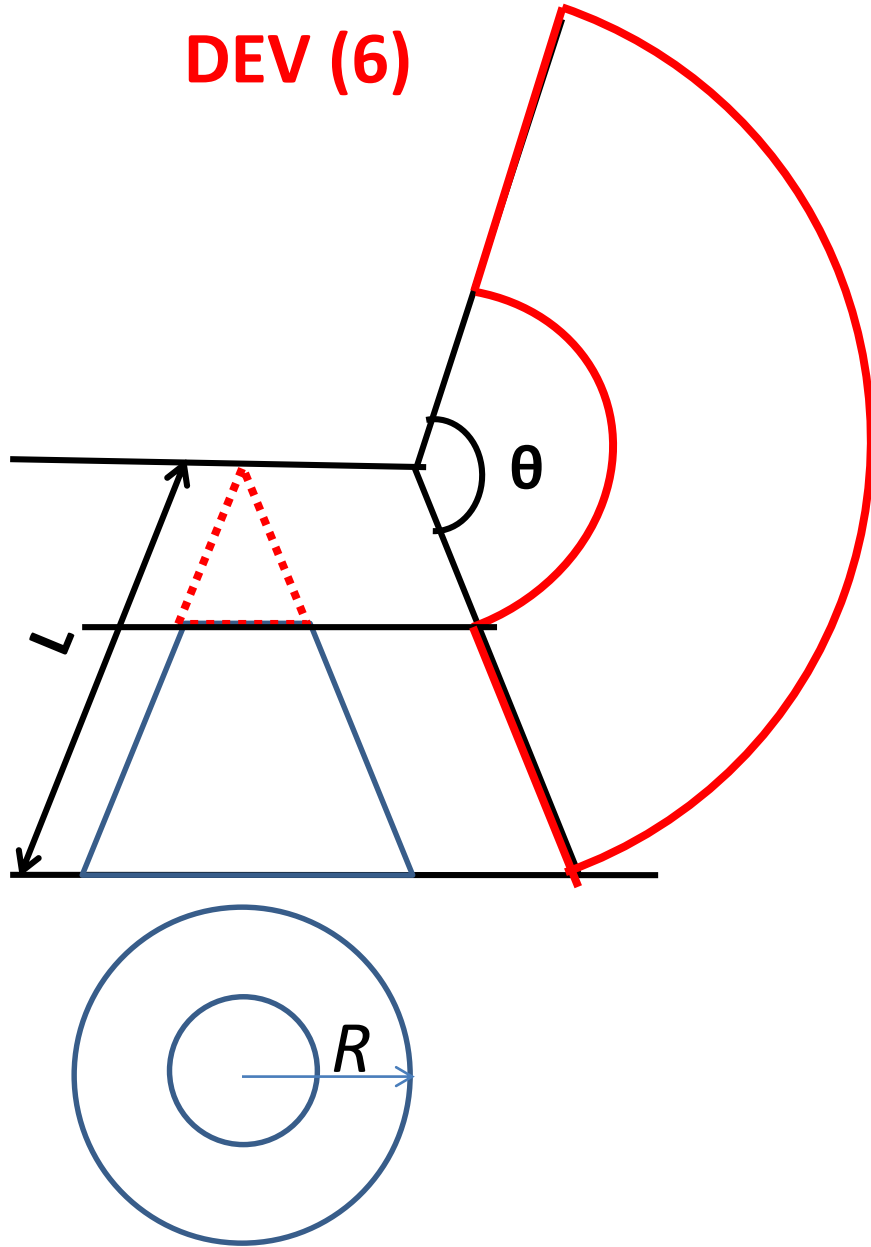
R = Base circle radius of cone

L = Slant height of cone

L₁ = Slant height of cut part.



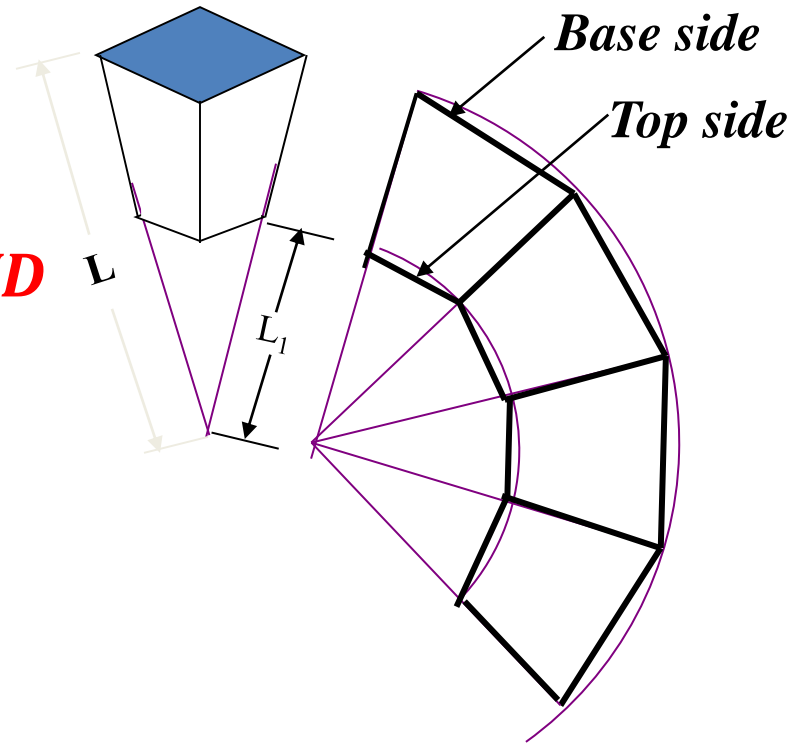
DEV (6)



$$\theta = 360 \times \frac{R}{L} \quad \text{degrees}$$

DEV (7)

DEVELOPMENT OF FRUSTUM OF SQUARE PYRAMID



L = Slant edge of pyramid
L₁ = Slant edge of cut part.

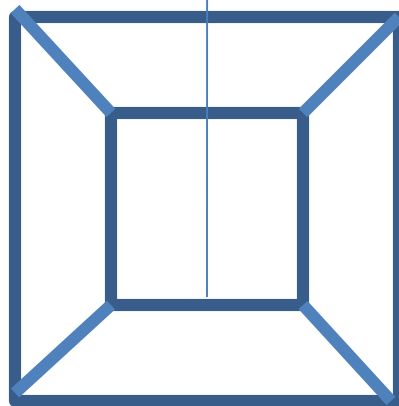
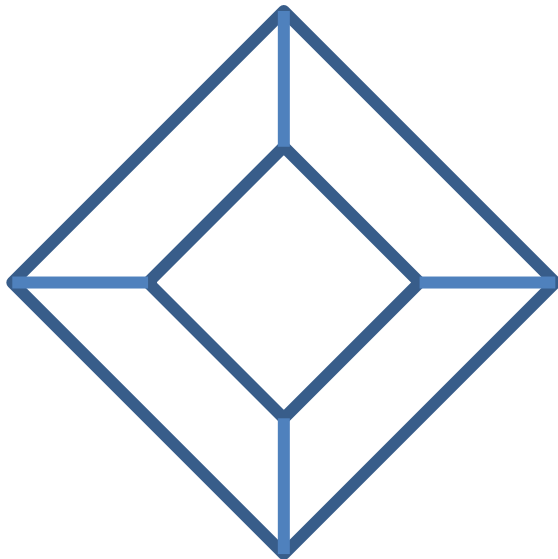
DEV (7)

TL

AL

x

y

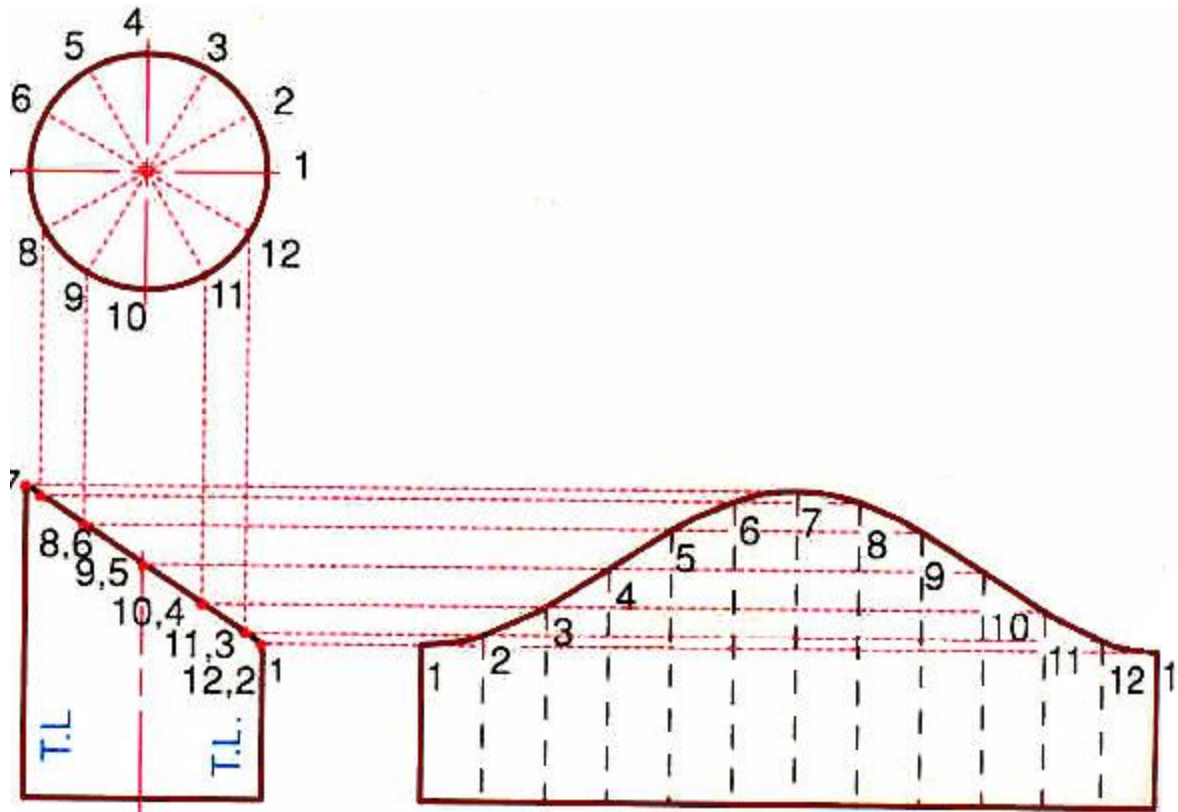


DEV (8)

A cone of base 50 mm diameter and height 65 mm rests with its base on H.P. A section plane perpendicular to V.P and inclined at 30° to H.P bisects the axis of the cone. Draw the development of the lateral surface of the truncated cone.

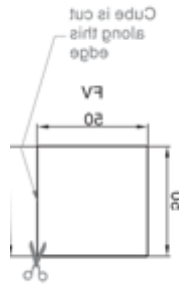
A hexagonal prism, edge of base 20 mm and axis 50 mm long, rests with its base on H.P such that one of its rectangular faces is parallel to V.P. It is cut by a plane perpendicular to V.P, inclined at 45° to H.P and passing through the right corner of the top face of the prism. Draw the sectional top view and develop the lateral surface of the truncated prism.

A pentagonal pyramid, side of base 30 mm and height 60 mm, stands with its base on H.P and an edge of the base is parallel to V.P. It is cut by a plane perpendicular to V.P, inclined at 40° to H.P and passing through a point on the axis, 32 mm above the base. Draw the sectional top view and develop the lateral surface of the truncated pyramid.



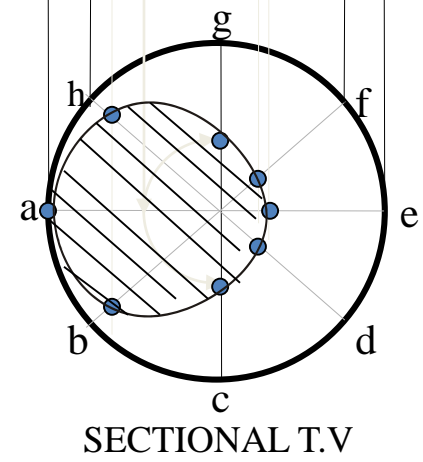
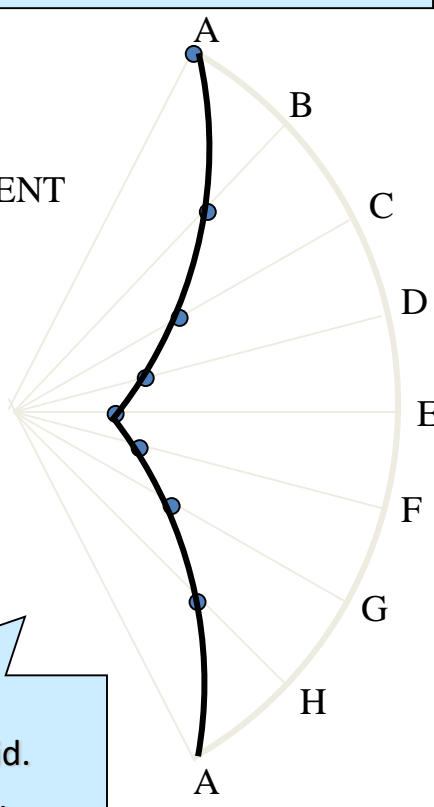
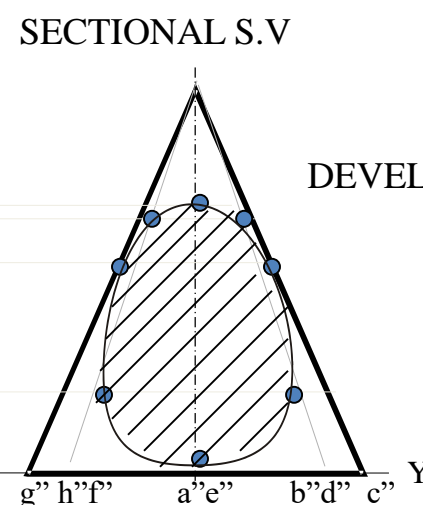
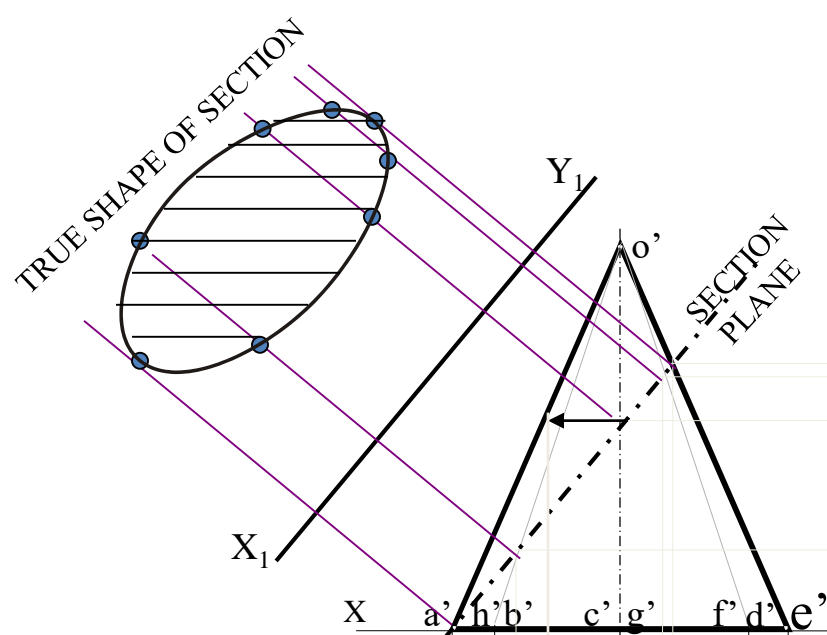
STEP 2

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.



Problem 2: A cone, 50 mm base diameter and 70 mm axis is standing on its base on Hp. It is cut by a section plane 45° inclined to Hp through the base end of an end generator. Draw projections, sectional views, true shape of section and development of surfaces of the 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.

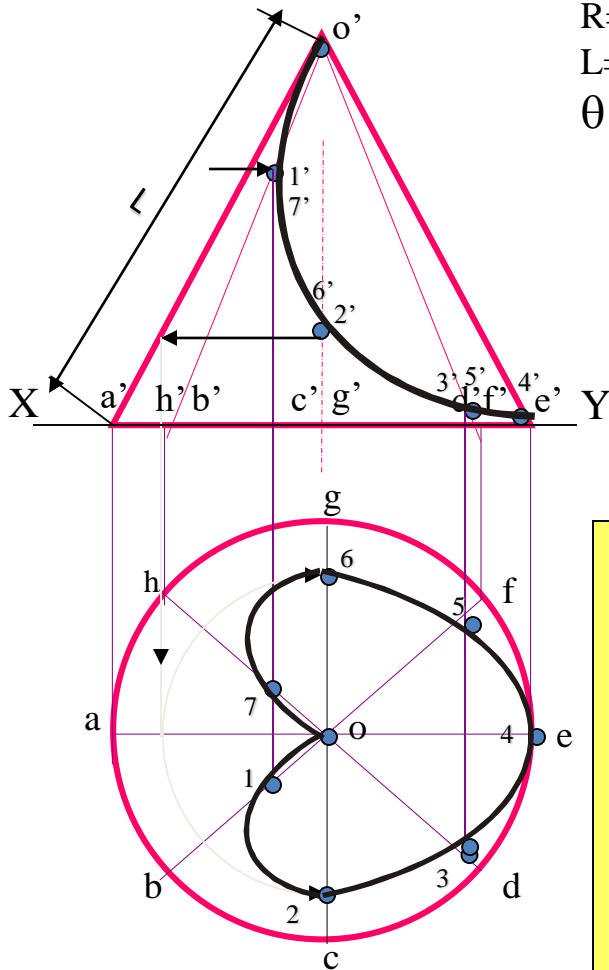


For True Shape:
 Draw x_1y_1 // to sec. plane
 Draw projectors on it from cut points.
 Mark distances of points of Sectioned part from Tv, on above projectors from x_1y_1 and join in sequence.
 Draw section lines in it.
 It is required true shape.

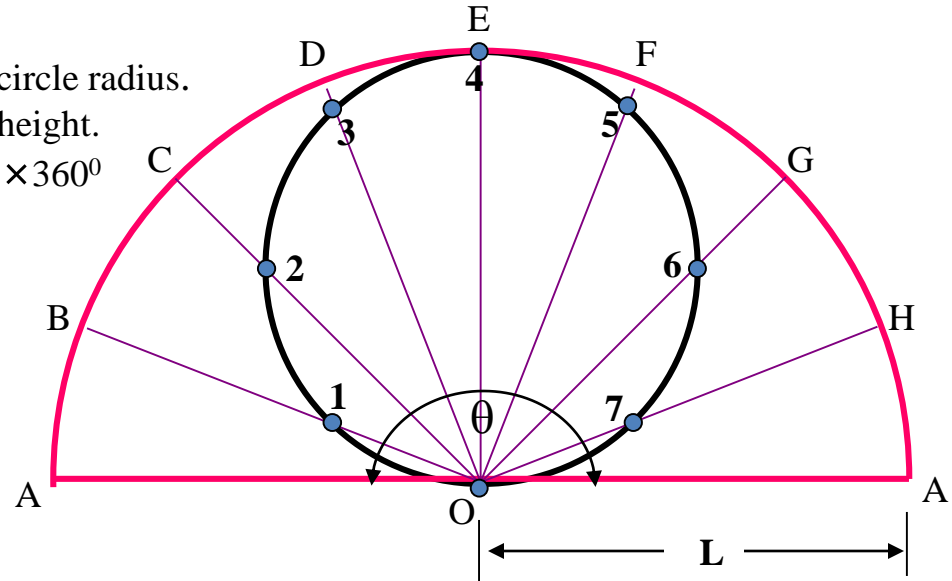
For Development:
 Draw development of entire solid.
 Name from cut-open edge i.e. A.
 in sequence as shown. Mark the cut points on respective edges.
 Join them in sequence in curvature.
 Make existing parts dev. dark.

Problem 6: Draw a semicircle of 100 mm diameter and inscribe in it a largest circle. If the semicircle is development of a cone and inscribed circle is some curve on it, then draw the projections of cone showing that curve.

TO DRAW PRINCIPAL VIEWS FROM GIVEN DEVELOPMENT.



R=Base circle radius.
L=Slant height.
$$\theta = \frac{R}{L} \times 360^\circ$$



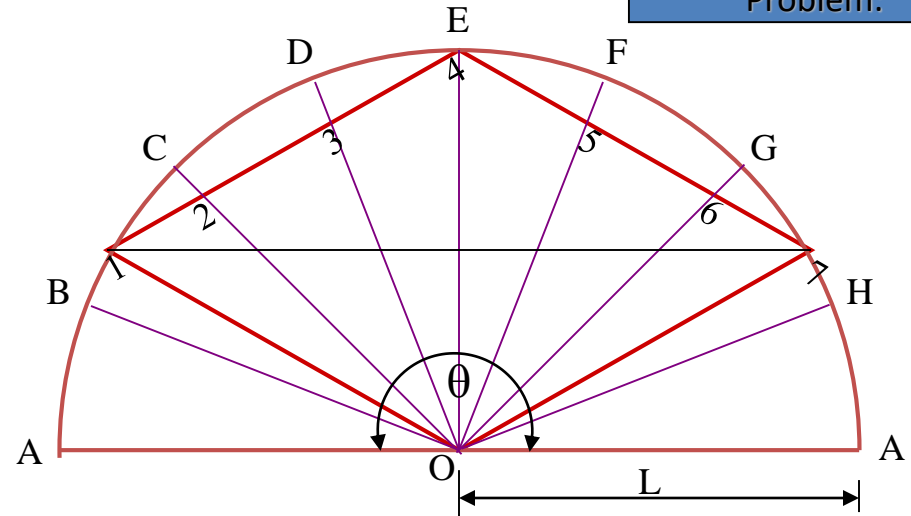
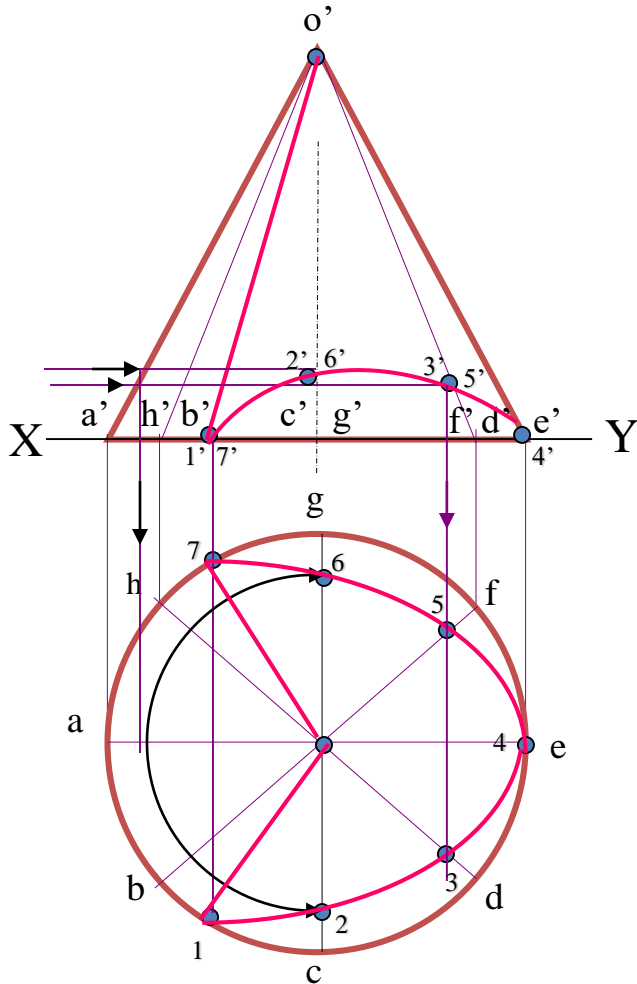
Solution Steps:

Draw semicircle of given diameter, divide it in 8 Parts and inscribe in it a largest circle as shown. Name intersecting points 1, 2, 3 etc. Semicircle being dev. of a cone its radius is slant height of cone. (L) Then using above formula find R of base of cone. Using this data draw Fv & Tv of cone and form 8 generators and name. Take o -1 distance from dev., mark on TL i.e. o'a' on Fv & bring on o'b' and name 1' Similarly locate all points on Fv. Then project all on Tv on respective generators and join by smooth curve.

Problem 7: Draw a semicircle of 100 mm diameter and inscribe in it a largest rhombus. If the semicircle is development of a cone and rhombus is some curve on it, then draw the projections of cone showing that curve.

TO DRAW PRINCIPAL VIEWS FROM GIVEN DEVELOPMENT.

Solution Steps:
Similar to previous Problem:



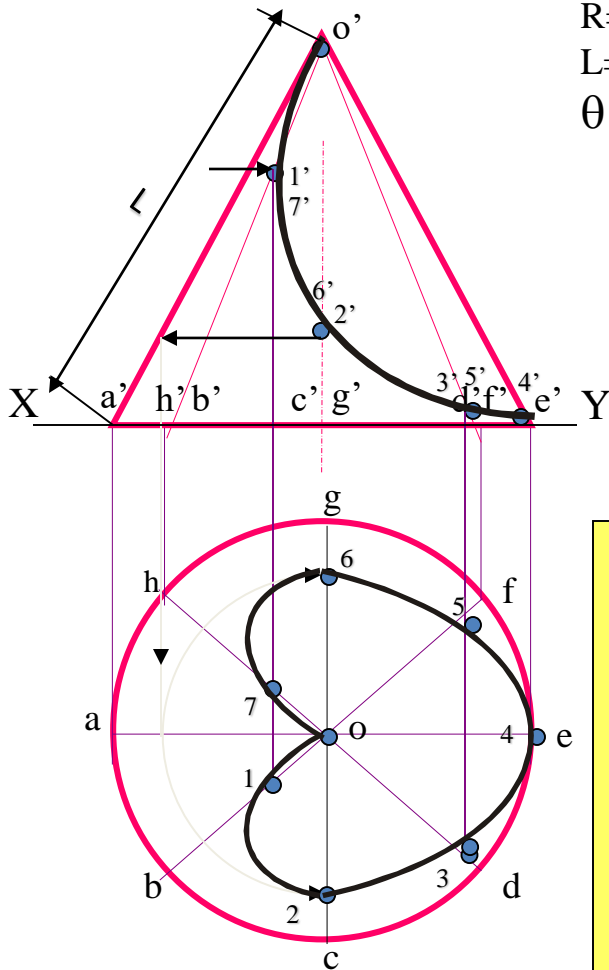
R=Base circle radius.

L=Slant height.

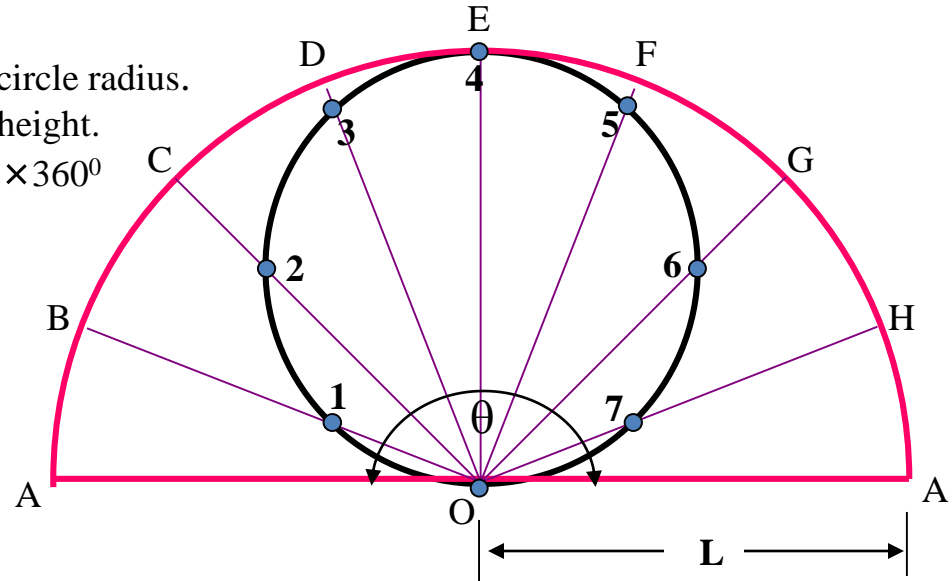
$$\theta = \frac{R}{L} \times 360^\circ$$

Problem 6: Draw a semicircle of 100 mm diameter and inscribe in it a largest circle. If the semicircle is development of a cone and inscribed circle is some curve on it, then draw the projections of cone showing that curve.

TO DRAW PRINCIPAL VIEWS FROM GIVEN DEVELOPMENT.



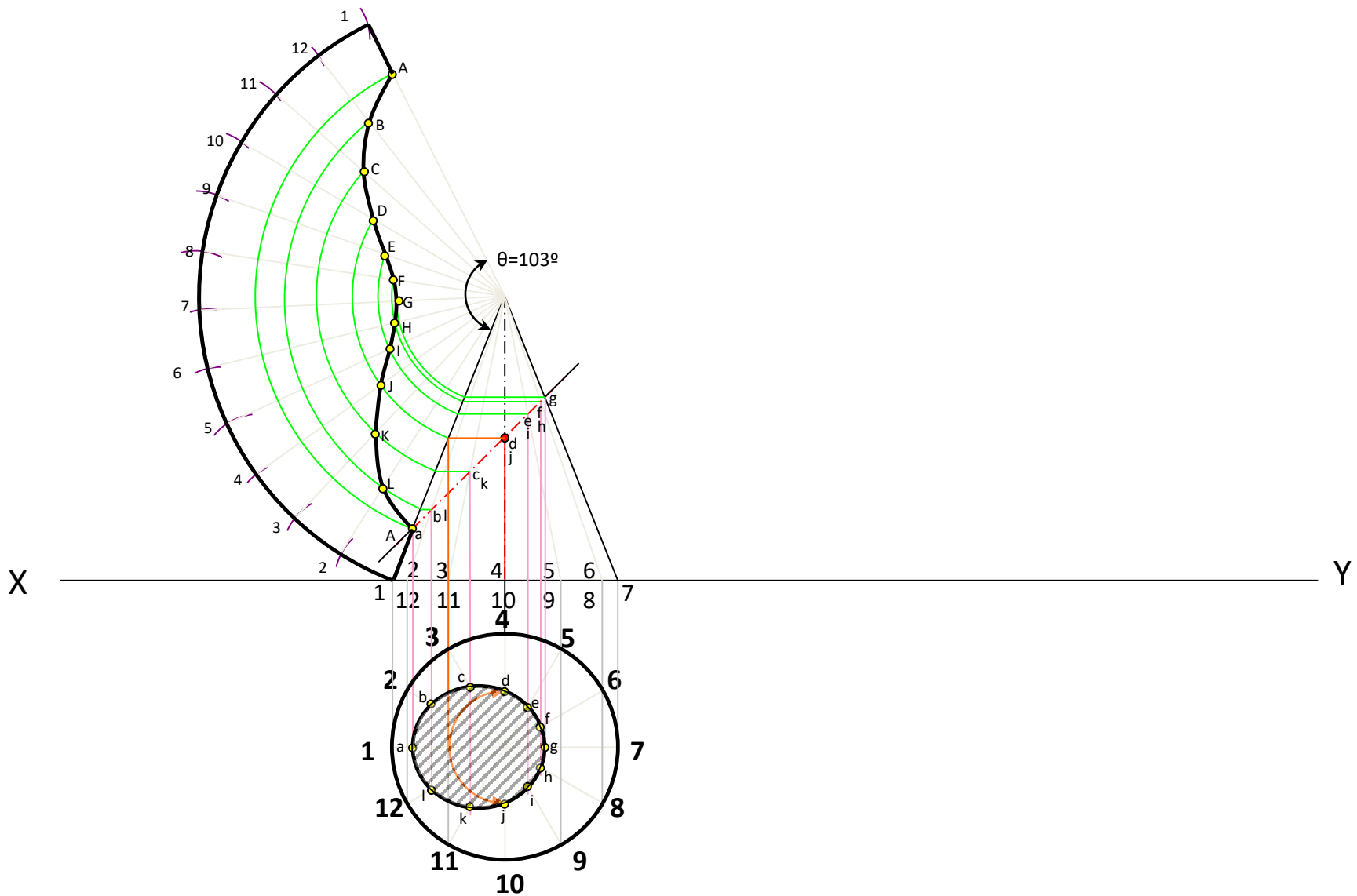
R=Base circle radius.
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 $\theta = \frac{R}{L} \times 360^\circ$

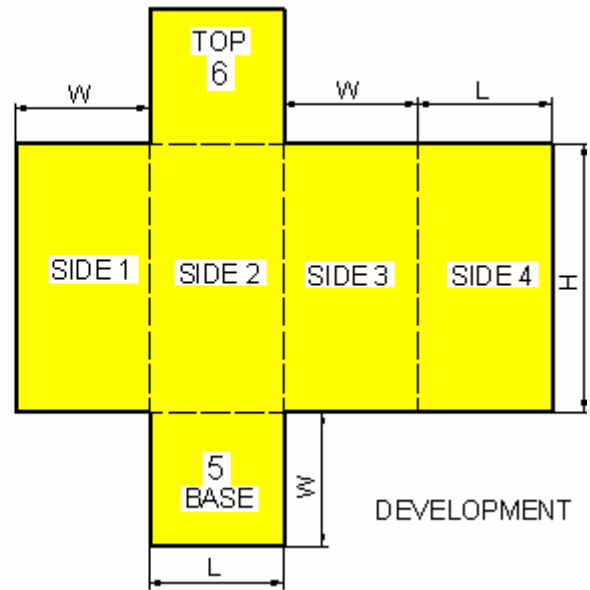
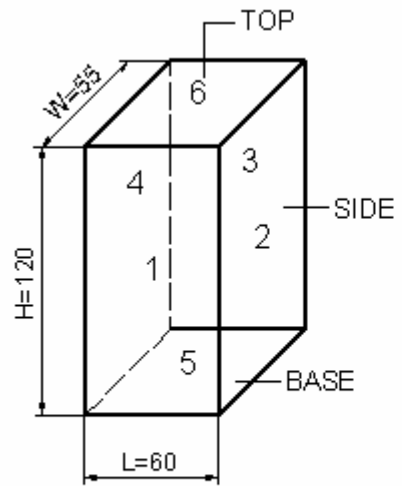


Solution Steps:

Draw semicircle of given diameter, divide it in 8 Parts and inscribe in it a largest circle as shown. Name intersecting points 1, 2, 3 etc. Semicircle being dev. of a cone its radius is slant height of cone. (L) Then using above formula find R of base of cone. Using this data draw Fv & Tv of cone and form 8 generators and name. Take o-1 distance from dev., mark on TL i.e. o'a' on Fv & bring on o'b' and name 1' Similarly locate all points on Fv. Then project all on Tv on respective generators and join by smooth curve.

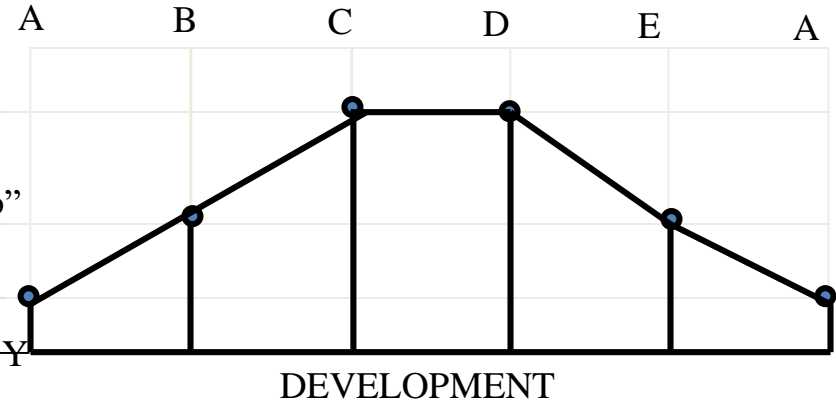
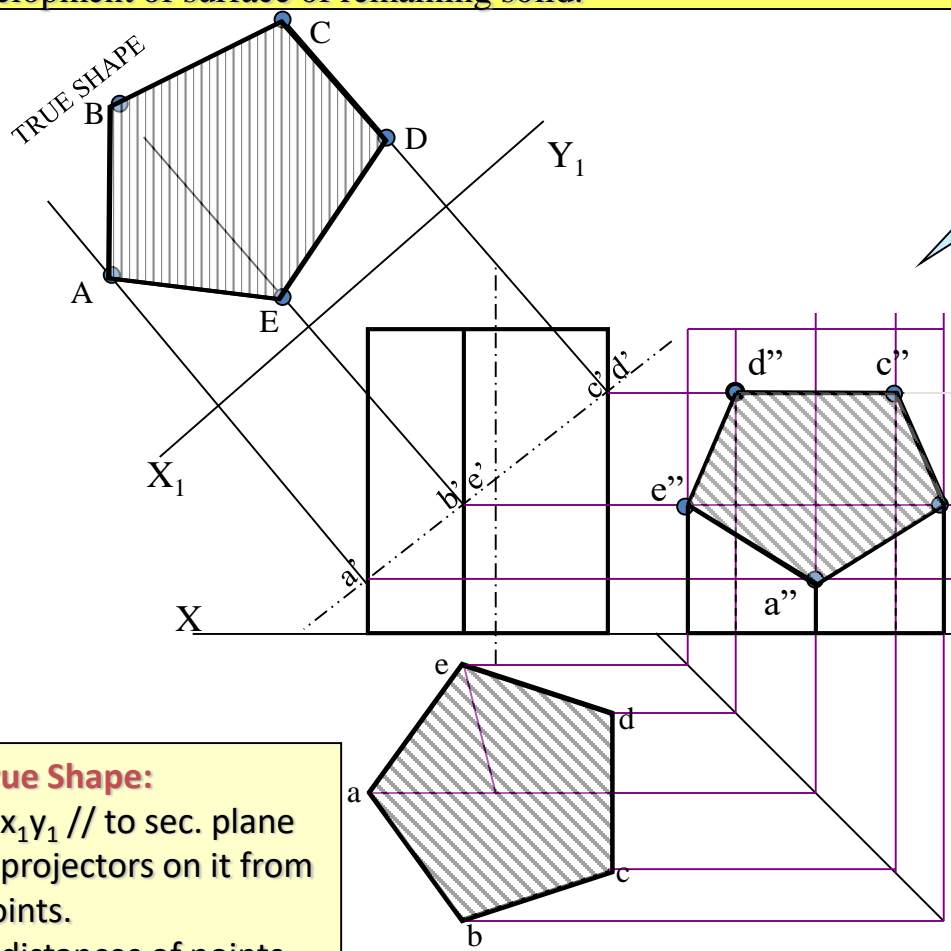
Q 15.26: A right circular cone base 30 mm side and height 50 mm rests on its base on H.P. It is cut by a section plane perpendicular to the V.P., inclined at 45° to the H.P. and bisecting the axis. Draw the projections of the truncated cone and develop its lateral surface.





Problem 1: A pentagonal prism, 30 mm base side & 50 mm axis is standing on Hp on its 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.

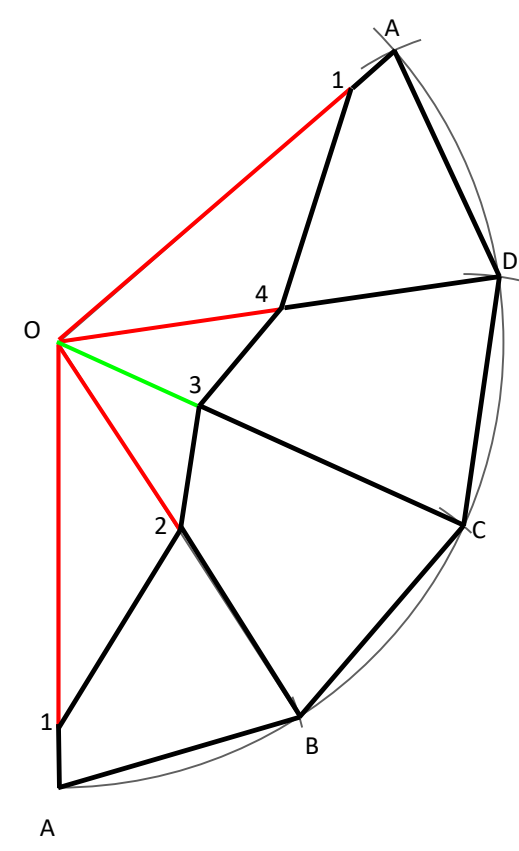
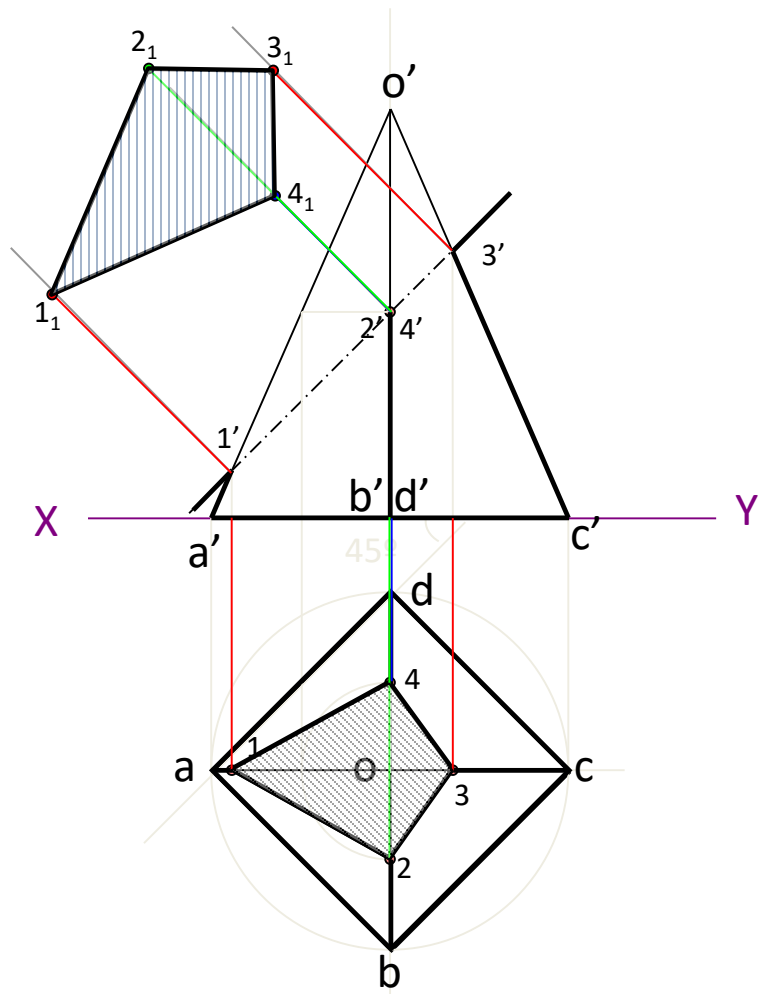
Solution Steps: *for sectional views:*
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 Locate sec. plane in Fv as described.
 Project points where edges are getting cut on Tv & Sv as shown in illustration.
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 Make remaining part of solid dark.



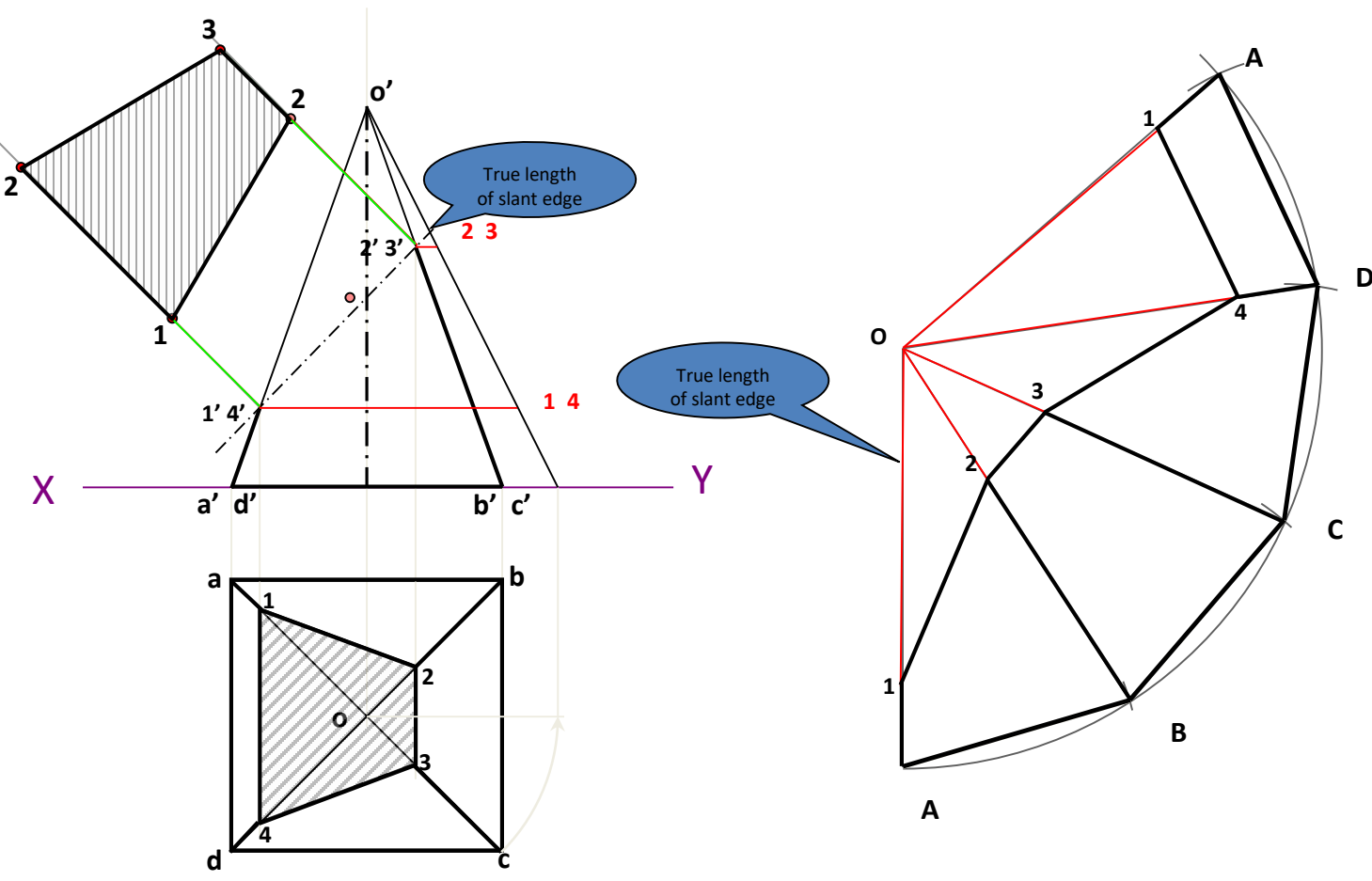
For True Shape:
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 Draw projectors on it from cut points.
 Mark distances of points of Sectioned part from Tv, on above projectors from x_1y_1 and join in sequence.
 Draw section lines in it.
 It is required true shape.

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.

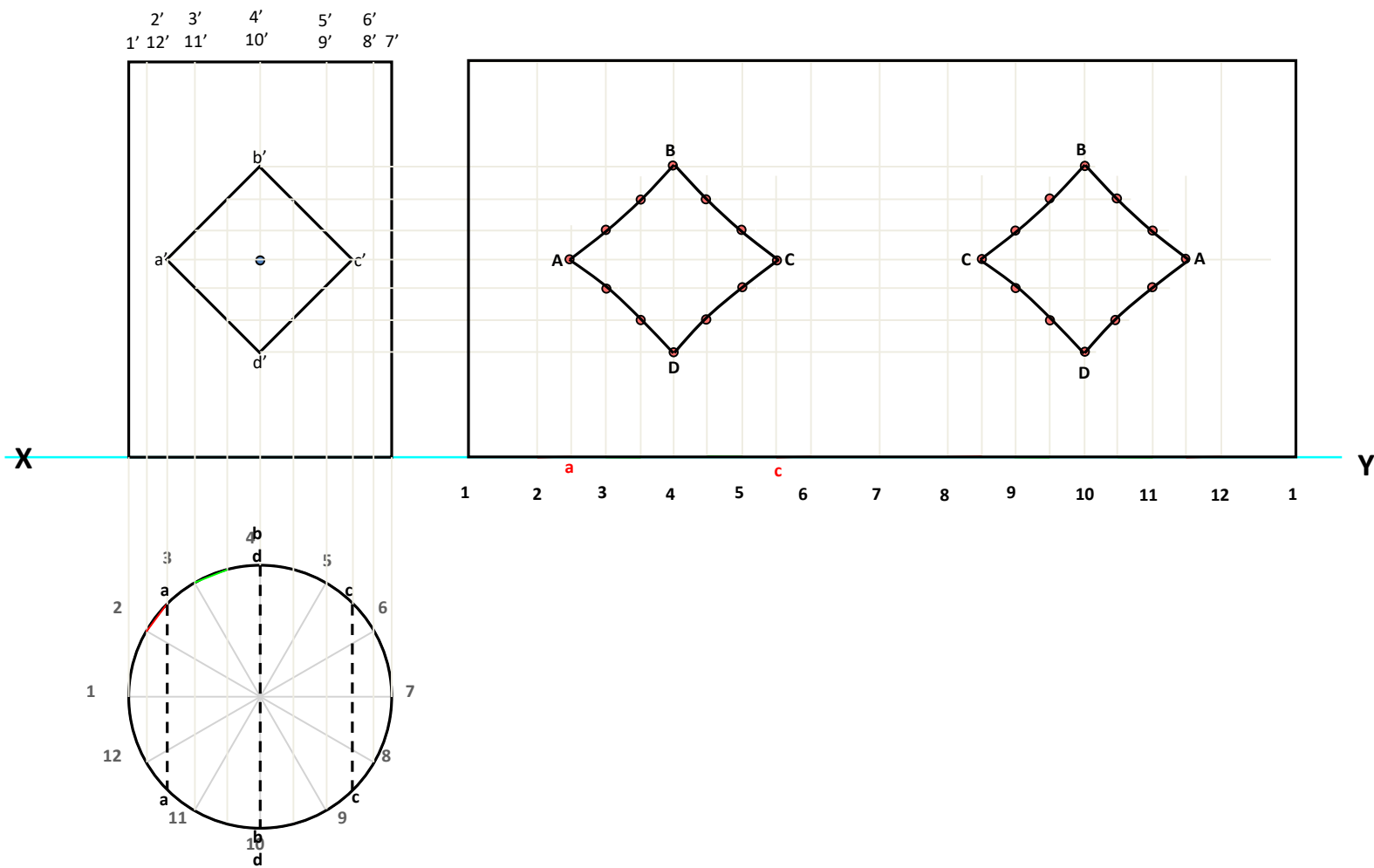
Q 14.11: A square pyramid, base 40 mm side and axis 65 mm long, has its base on the HP and all the edges of the base equally inclined to the VP. It is cut by a section plane, perpendicular to the VP, inclined at 45° to the HP and bisecting the axis. Draw its sectional top view, sectional side view and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



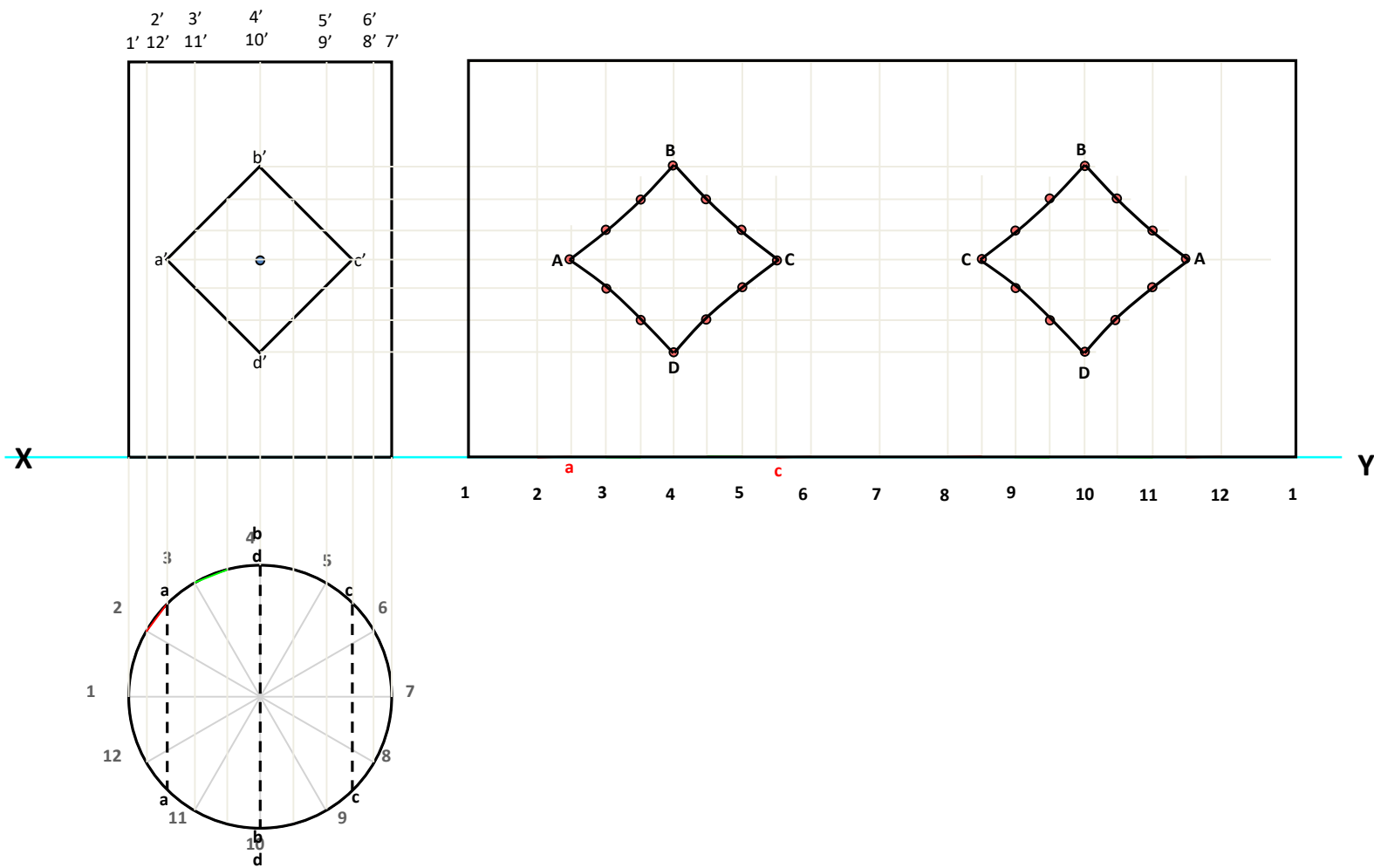
Q 14.11: A square pyramid, base 40 mm side and axis 65 mm long, has its base on the HP with two edges of the base perpendicular to the VP. It is cut by a section plane, perpendicular to the VP, inclined at 45° to the HP and bisecting the axis. Draw its sectional top view and true shape of the section.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



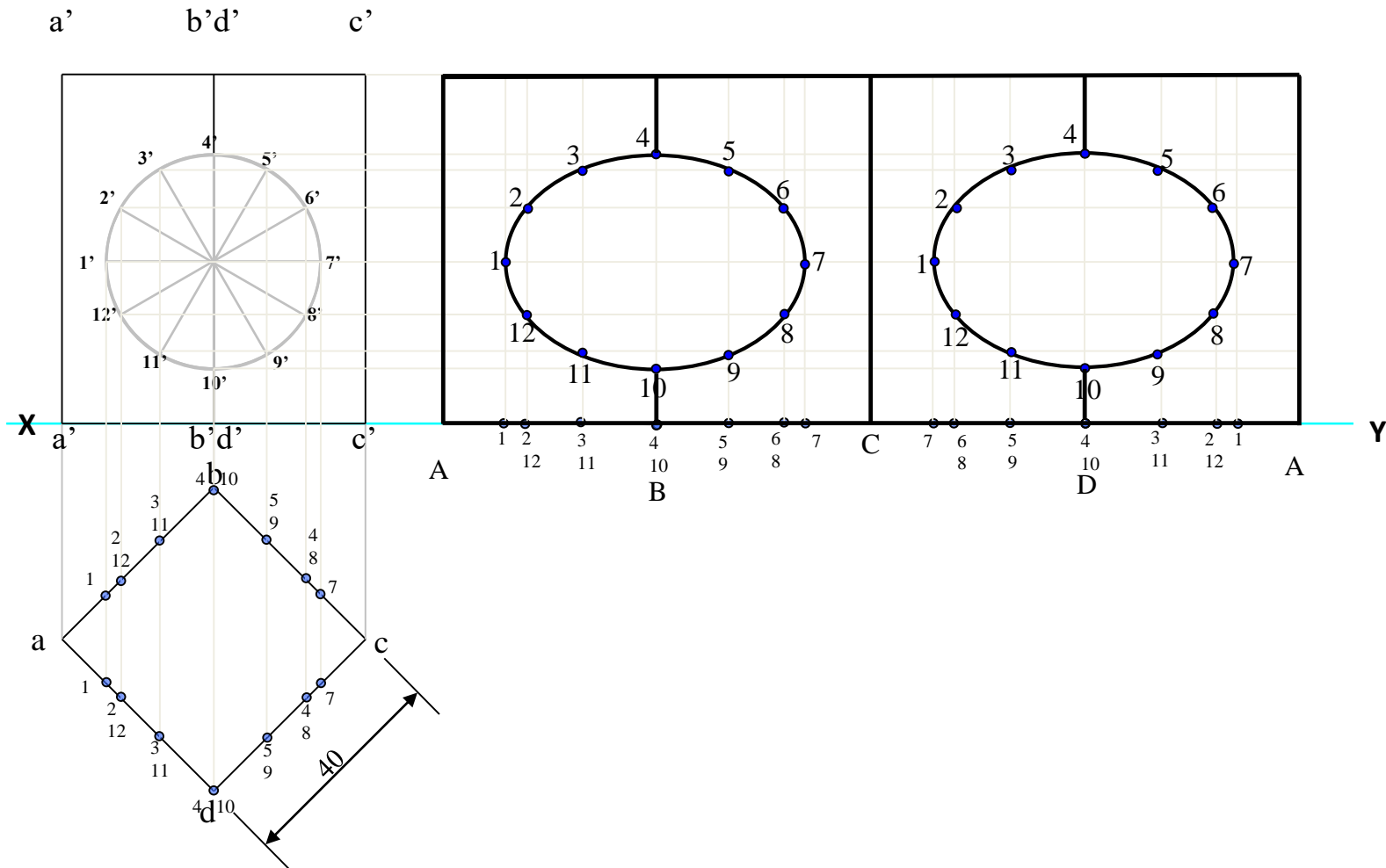
Q.15.11: A right circular cylinder, base 50 mm diameter and axis 60 mm long, is standing on HP on its base. It has a square hole of size 25 in it. The axis of the hole bisects the axis of the cylinder and is perpendicular to the VP. The faces of the square hole are equally inclined with the HP. Draw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



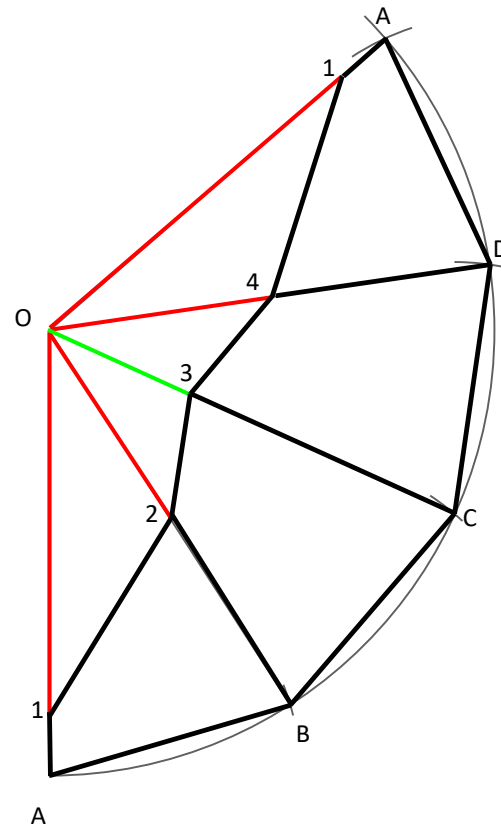
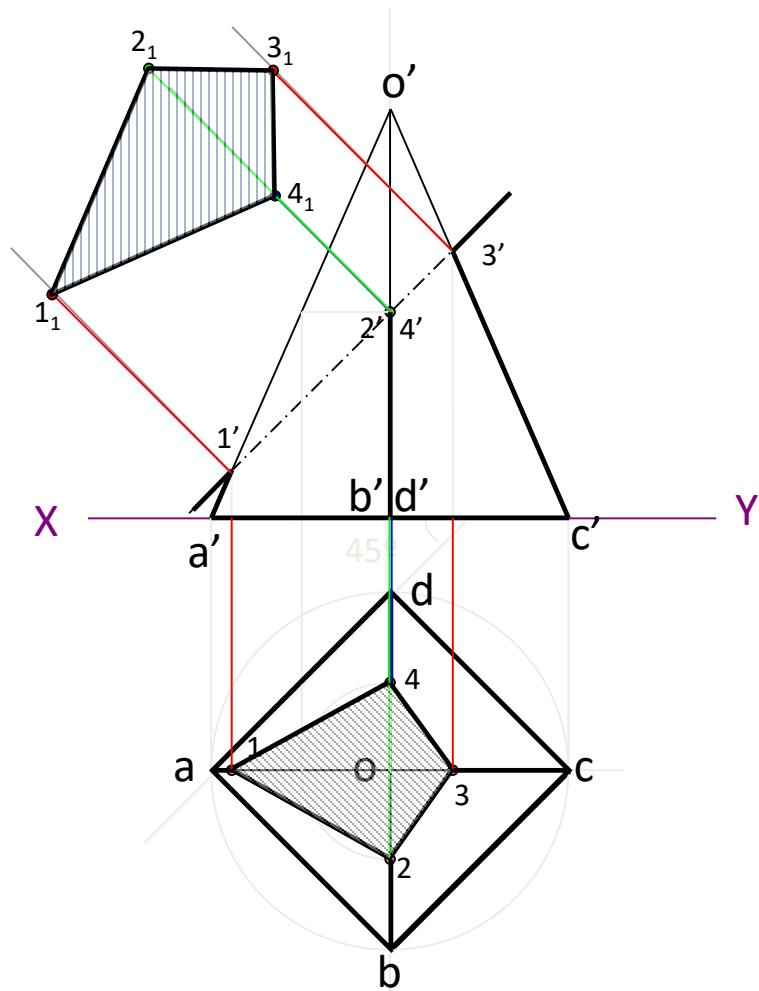
Q.15.11: A right circular cylinder, base 50 mm diameter and axis 60 mm long, is standing on HP on its base. It has a square hole of size 25 in it. The axis of the hole bisects the axis of the cylinder and is perpendicular to the VP. The faces of the square hole are equally inclined with the HP. Draw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



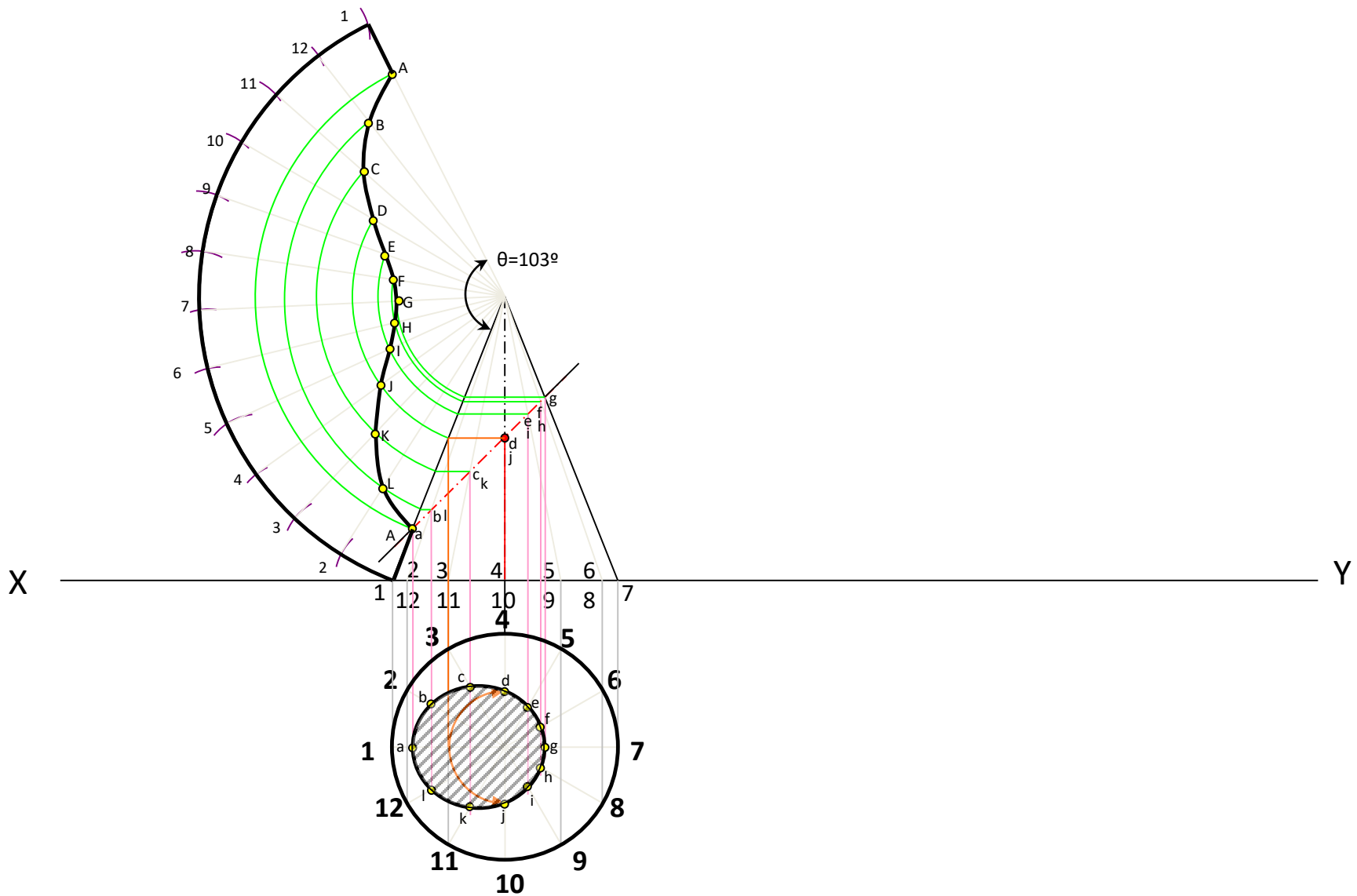
Q: A square prism of 40 mm edge of the base and 65 mm height stands on its base on the HP with vertical faces inclined at 45° with the VP. A horizontal hole of 40 mm diameter is drilled centrally through the prism such that the hole passes through the opposite vertical edges of the prism, draw the development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



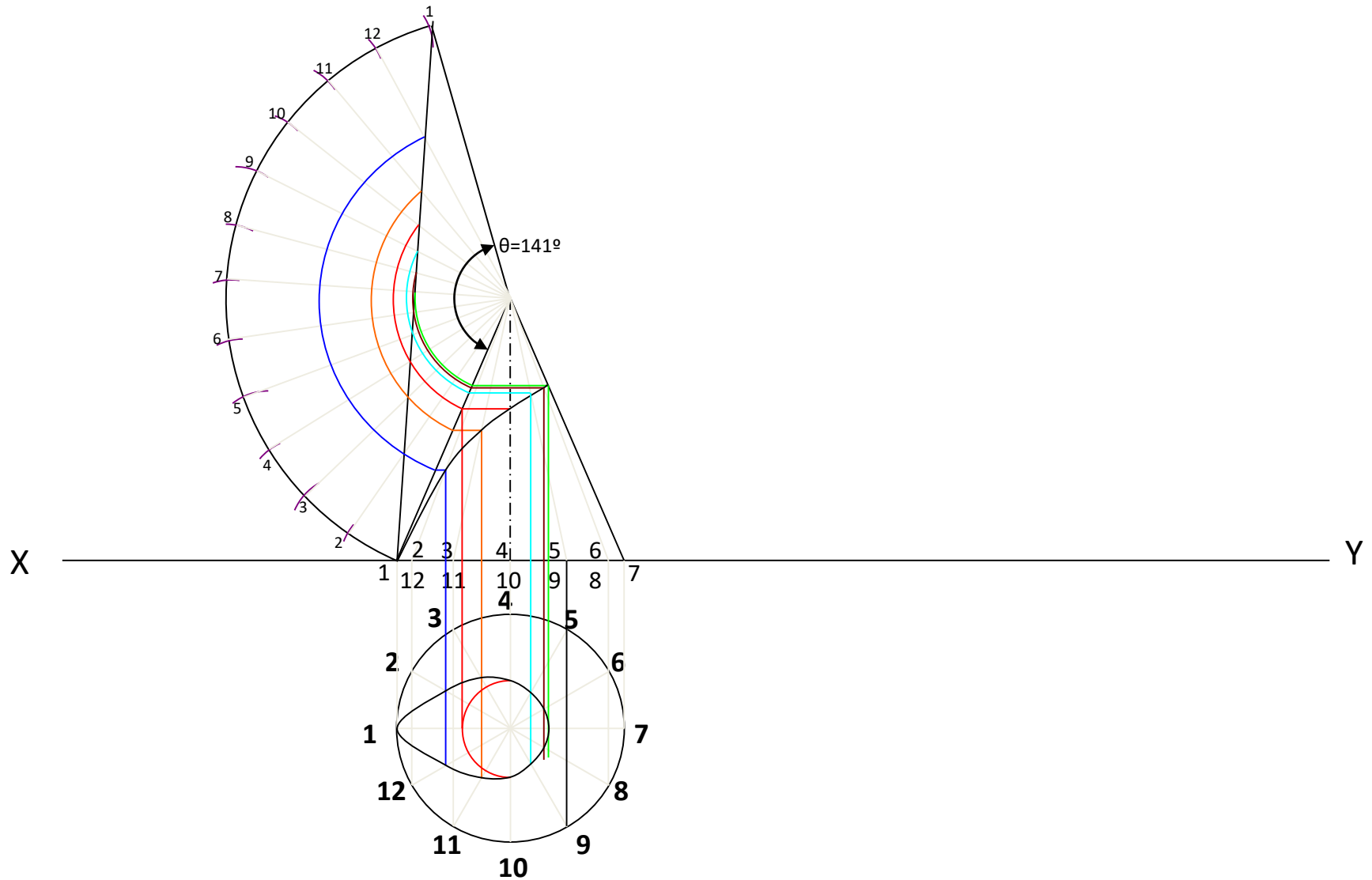
Q 14.11: A square pyramid, base 40 mm side and axis 65 mm long, has its base on the HP and all the edges of the base equally inclined to the VP. It is cut by a section plane, perpendicular to the VP, inclined at 45° to the HP and bisecting the axis. Draw its sectional top view, sectional side view and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



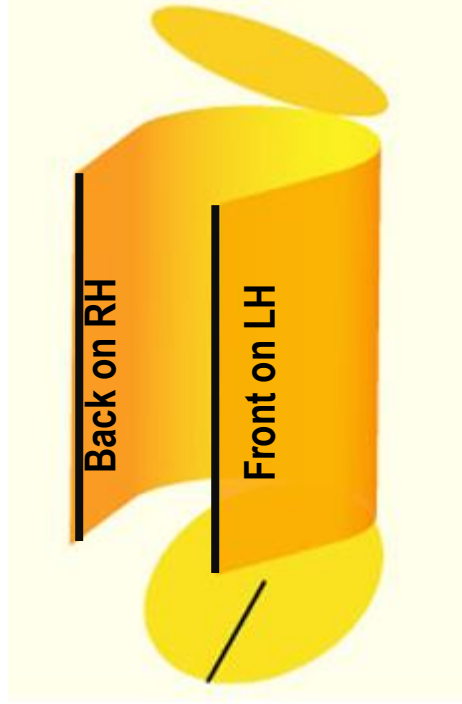
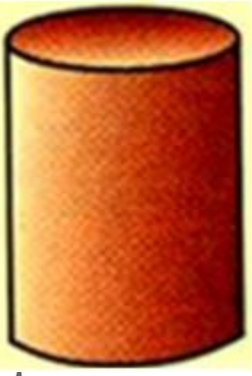
Q 15.26: A right circular cone base 30 mm side and height 50 mm rests on its base on H.P. It is cut by a section plane perpendicular to the V.P., inclined at 45° to the H.P. and bisecting the axis. Draw the projections of the truncated cone and develop its lateral surface.



Q 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 of cone 65 mm diameter ; axis 75 mm long.

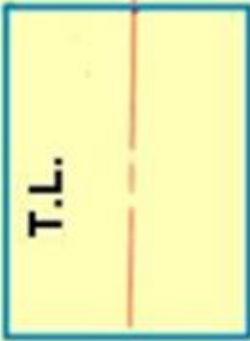
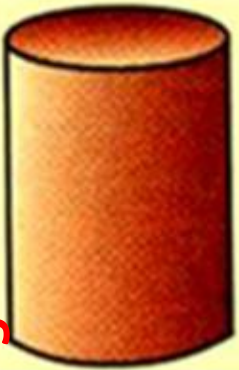


Cut along this generator



Cut along this

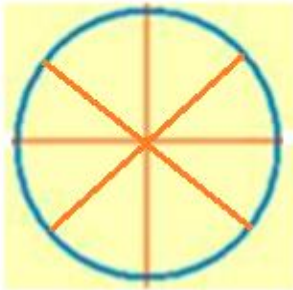
generator



T.L.

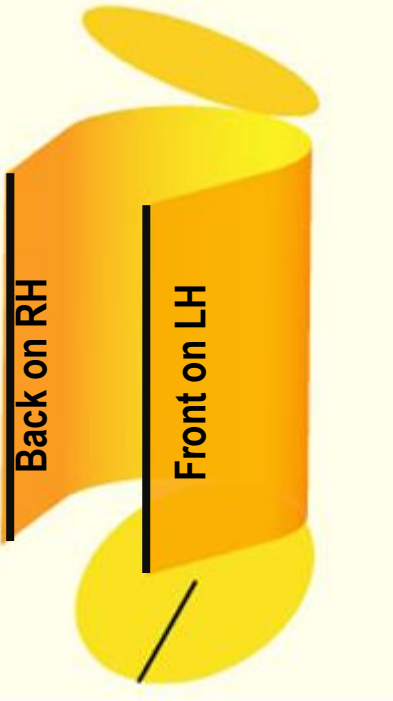


Stretch out line = circumference

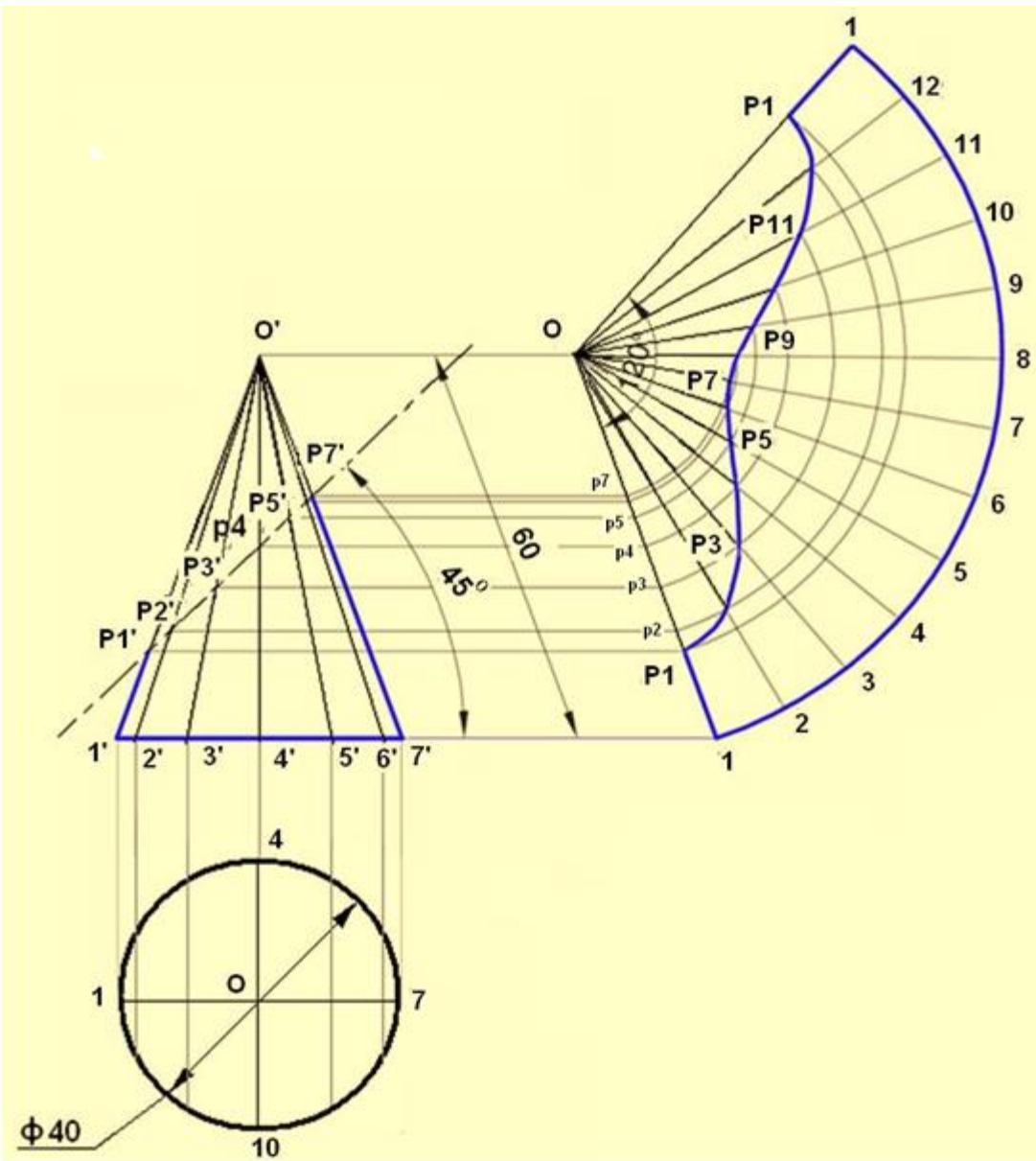


Back on RH

Front on LH



Open clockwise



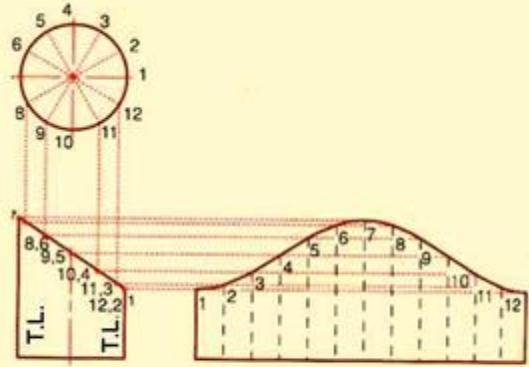


Top view

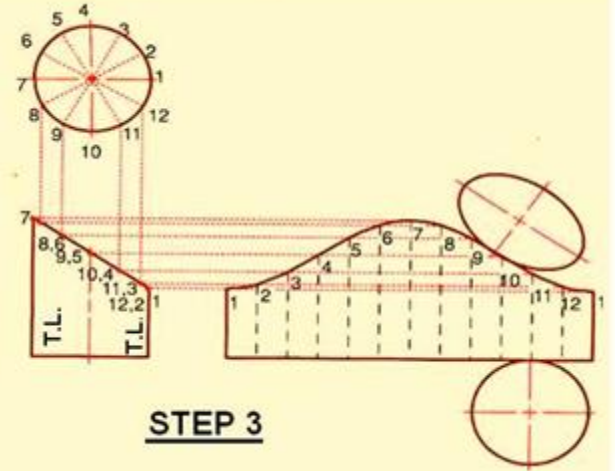


Front view

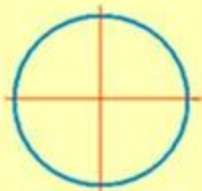
STEP 1



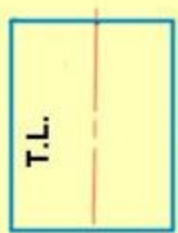
STEP 2



STEP 3



Top view

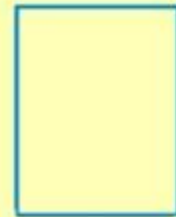


Front View

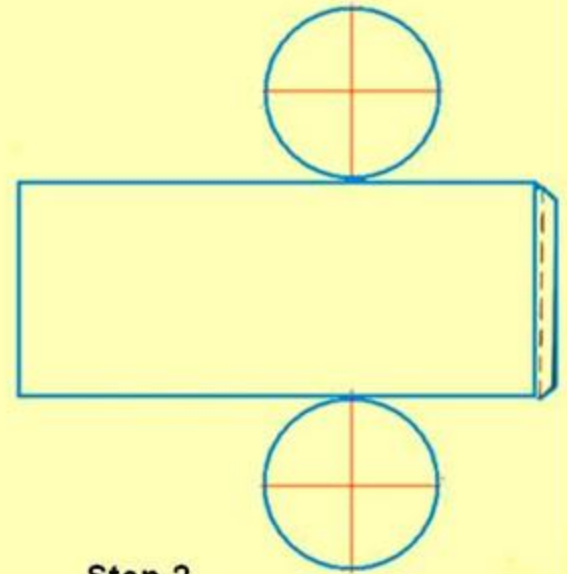


Stretch out line = circumference

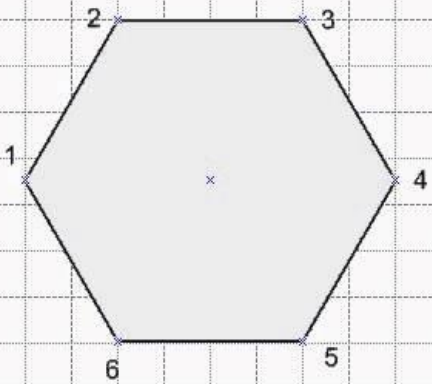
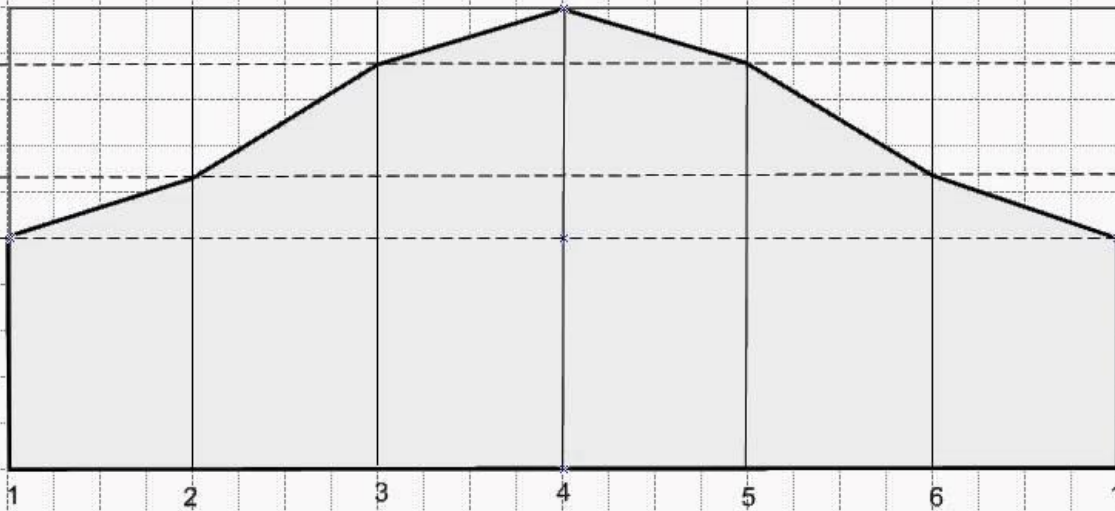
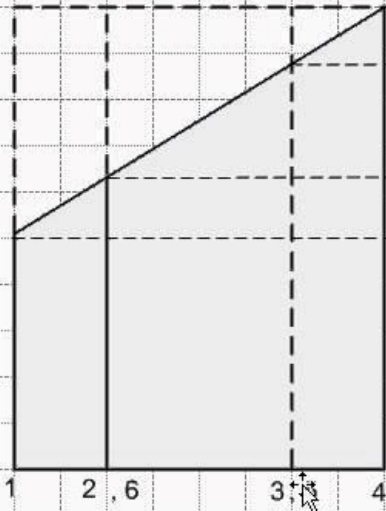
Step 1

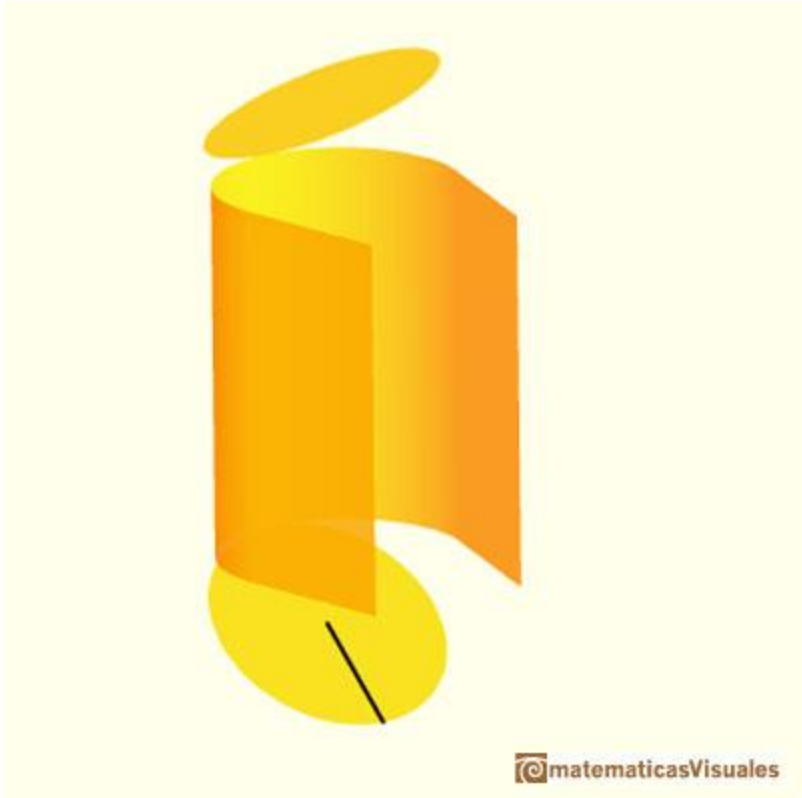


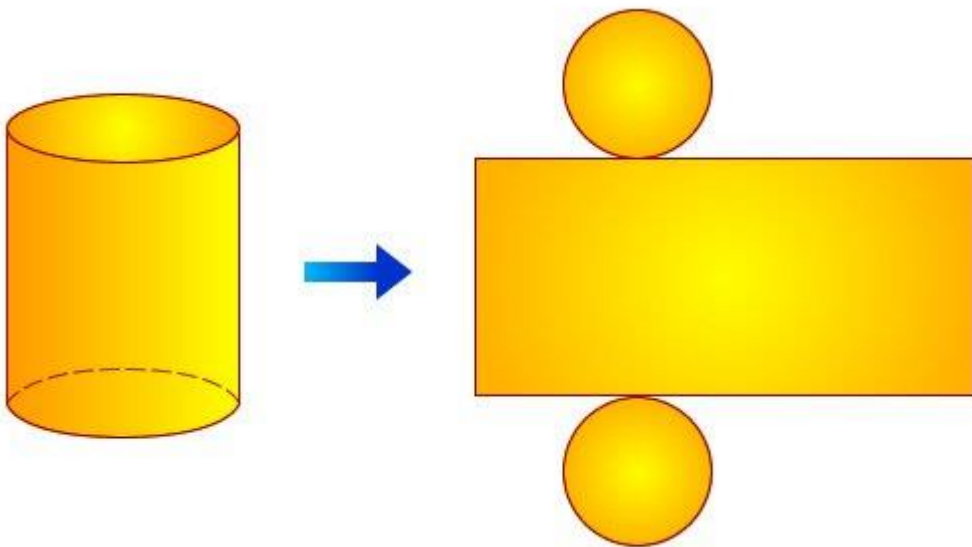
T.L.

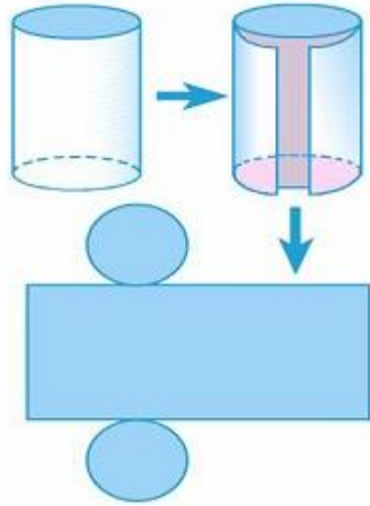


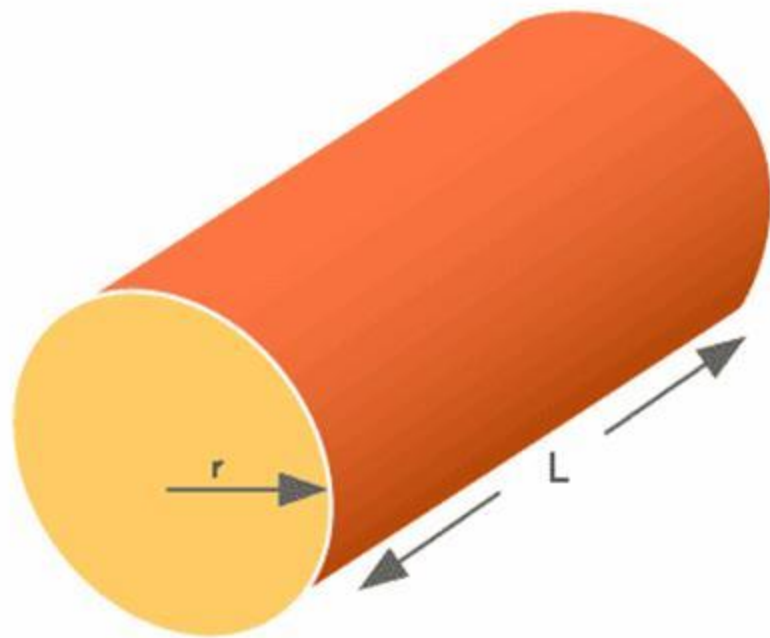
Step 2

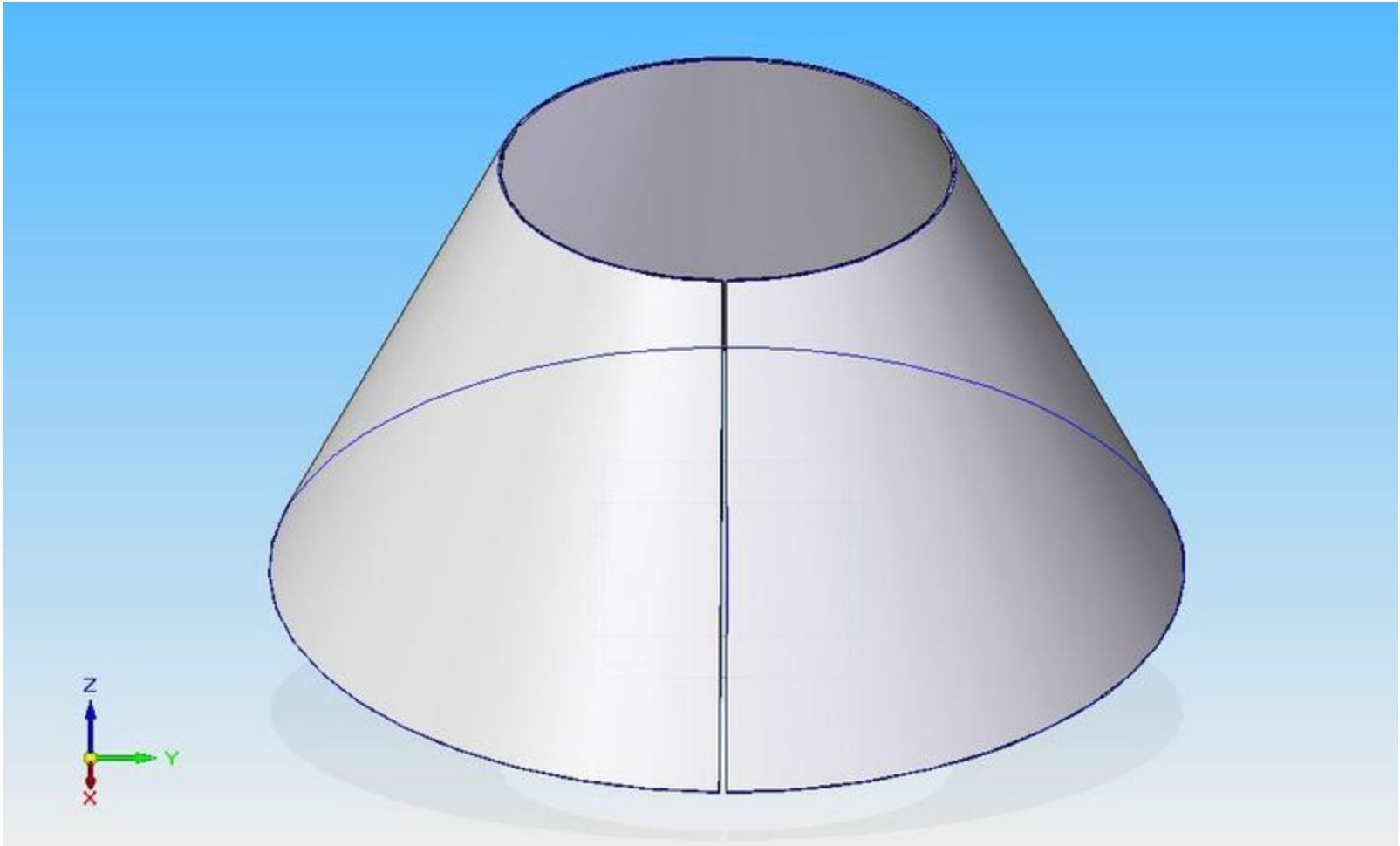


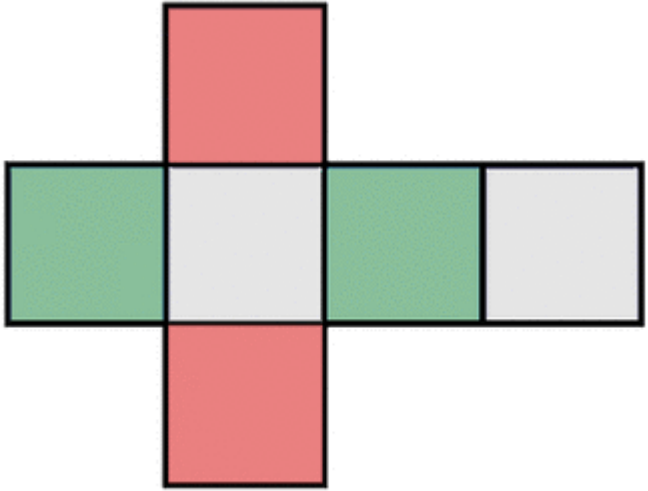


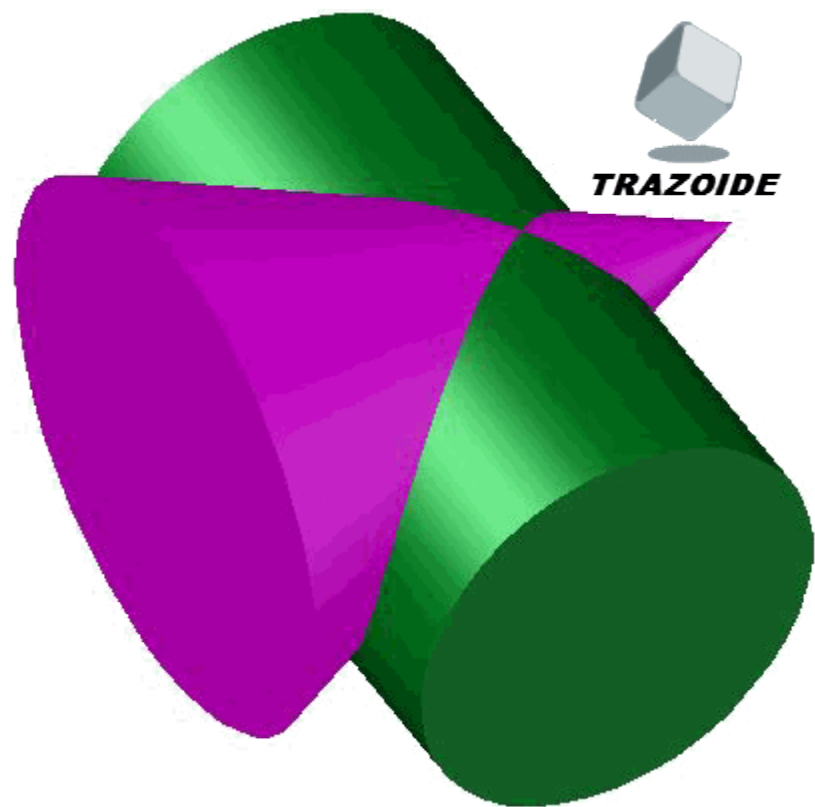






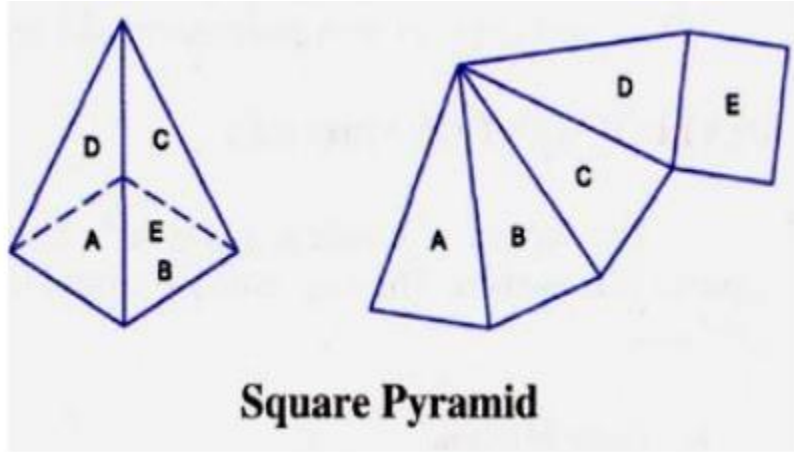




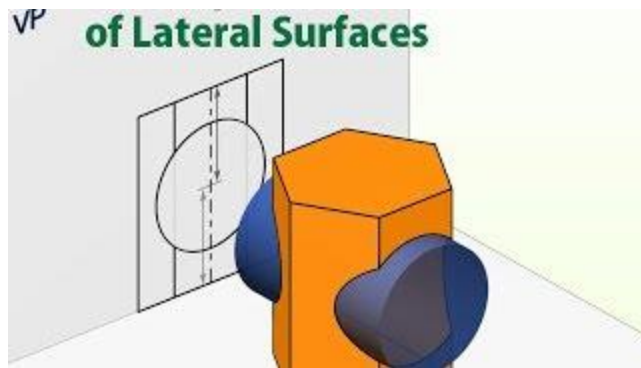


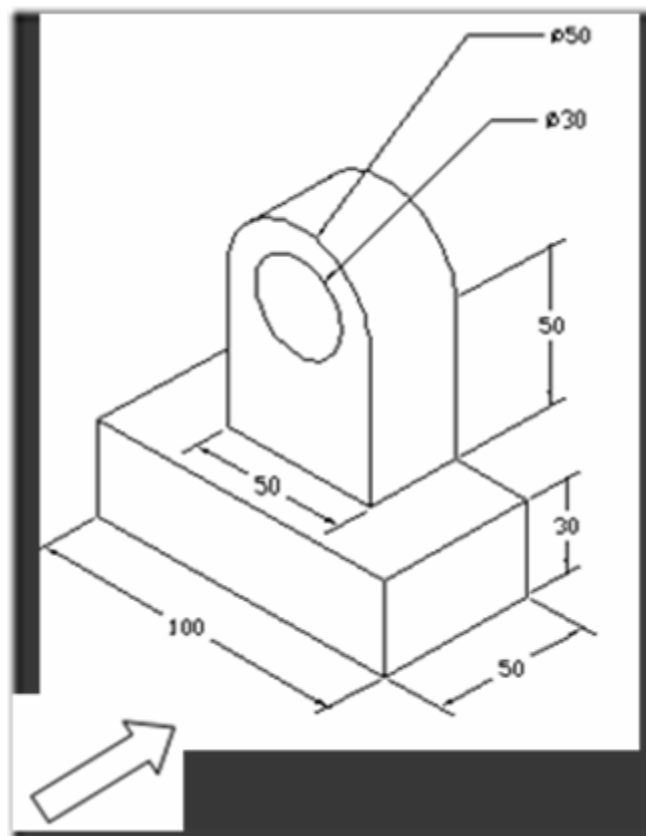


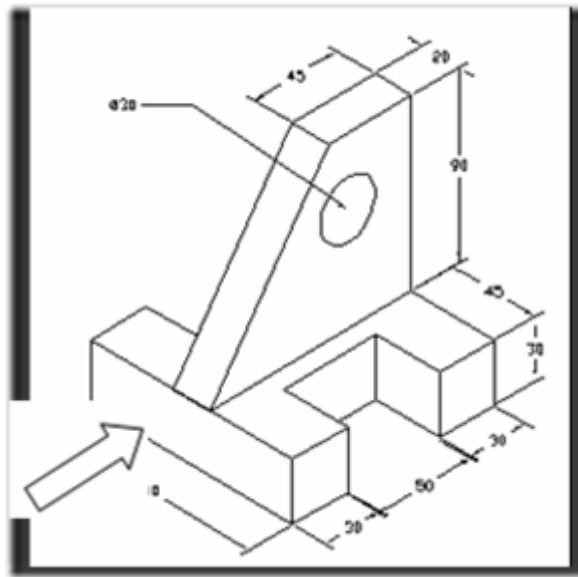
Surface Development
of Truncated Cone

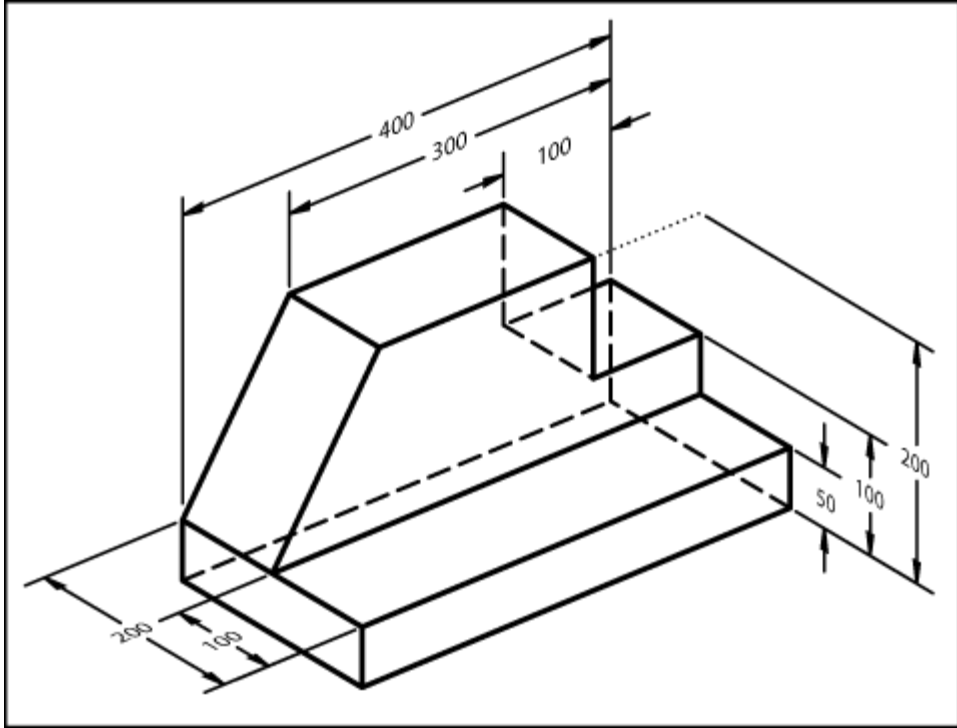


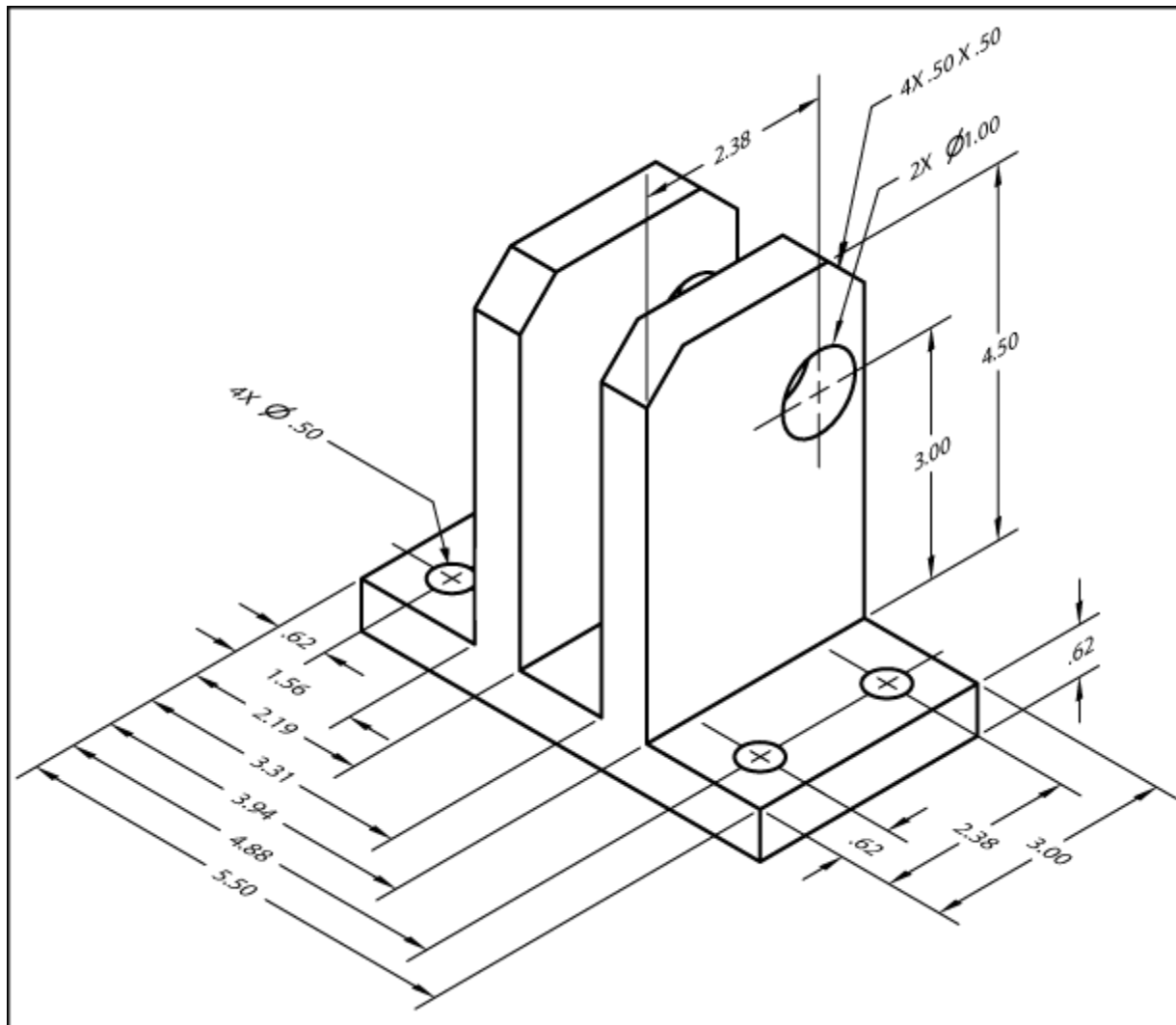
Square Pyramid



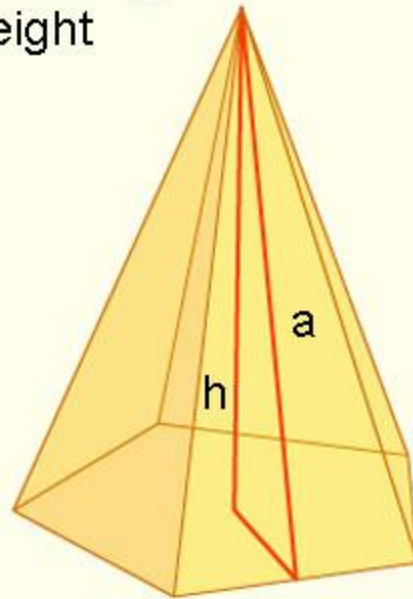


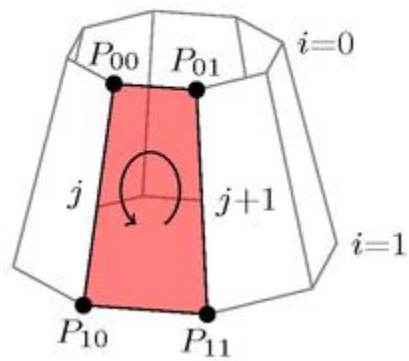
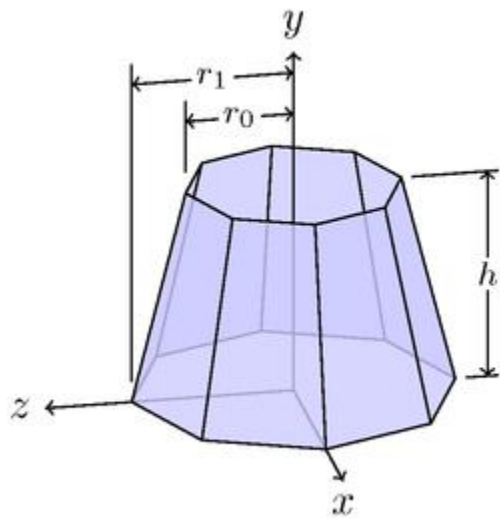


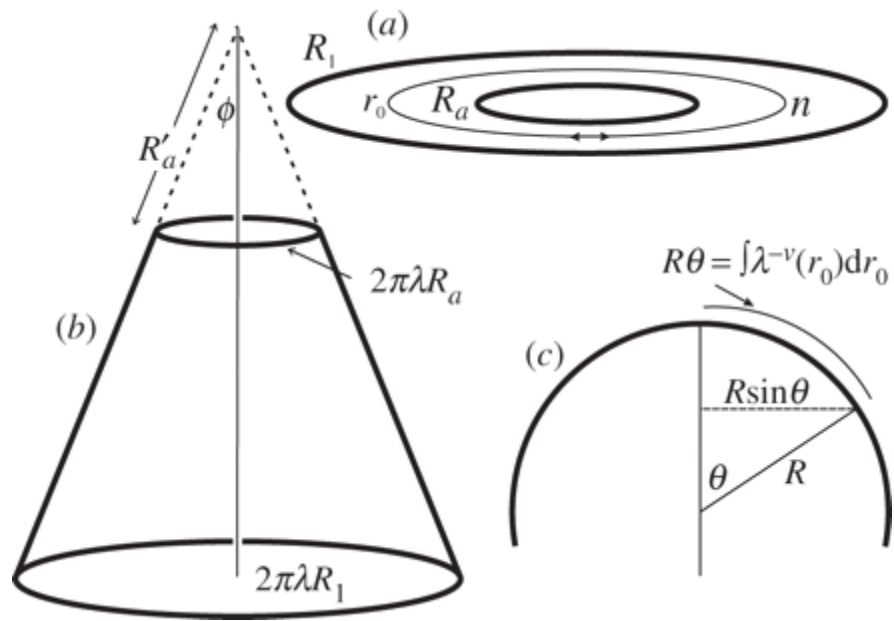


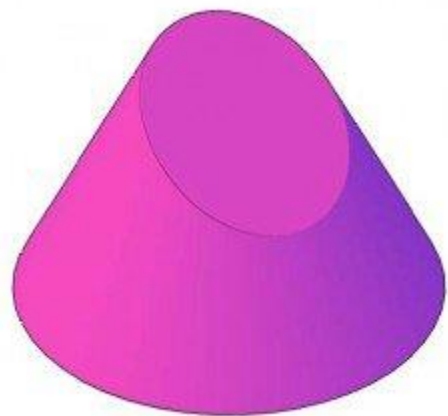


a = slant height
 h = height

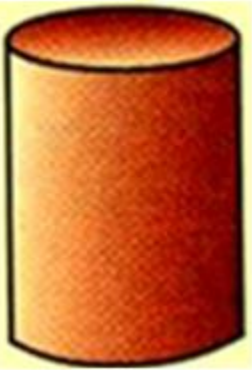








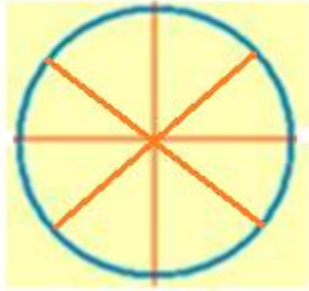
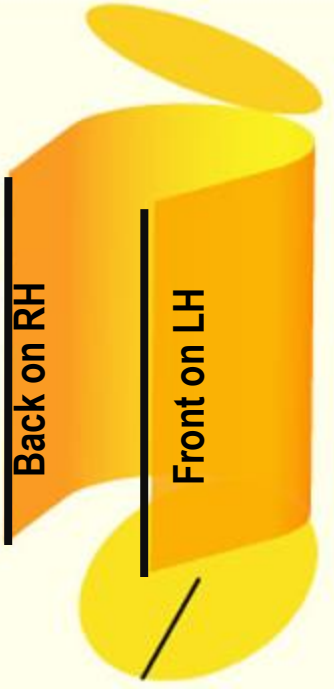
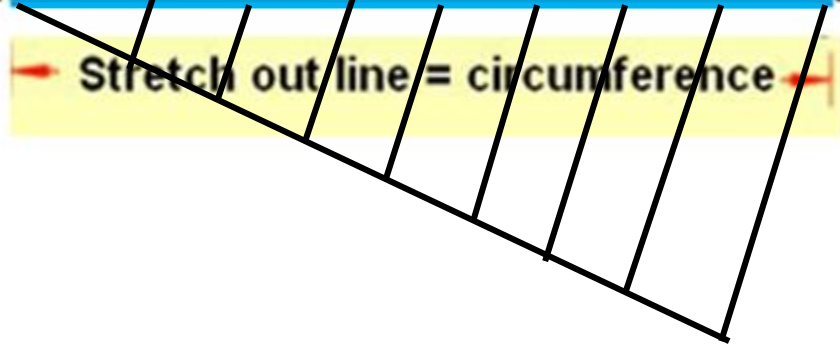
Cut along this generator



T.L.

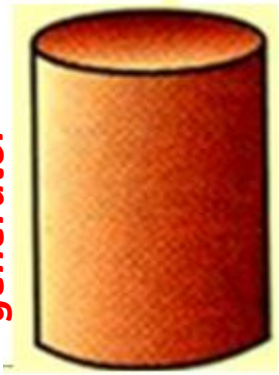


Stretch out line = circumference

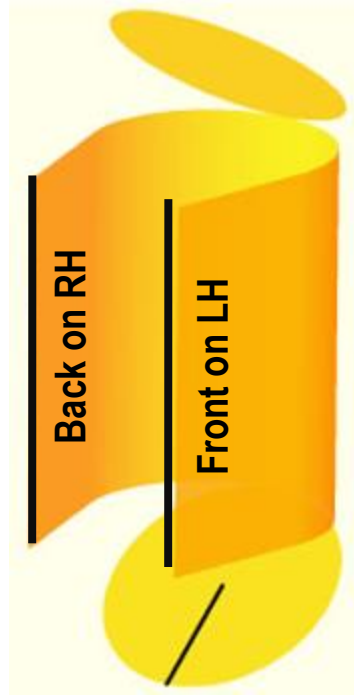


Open clockwise

*Cut along this
generator*



IBSRF



Open clockwise