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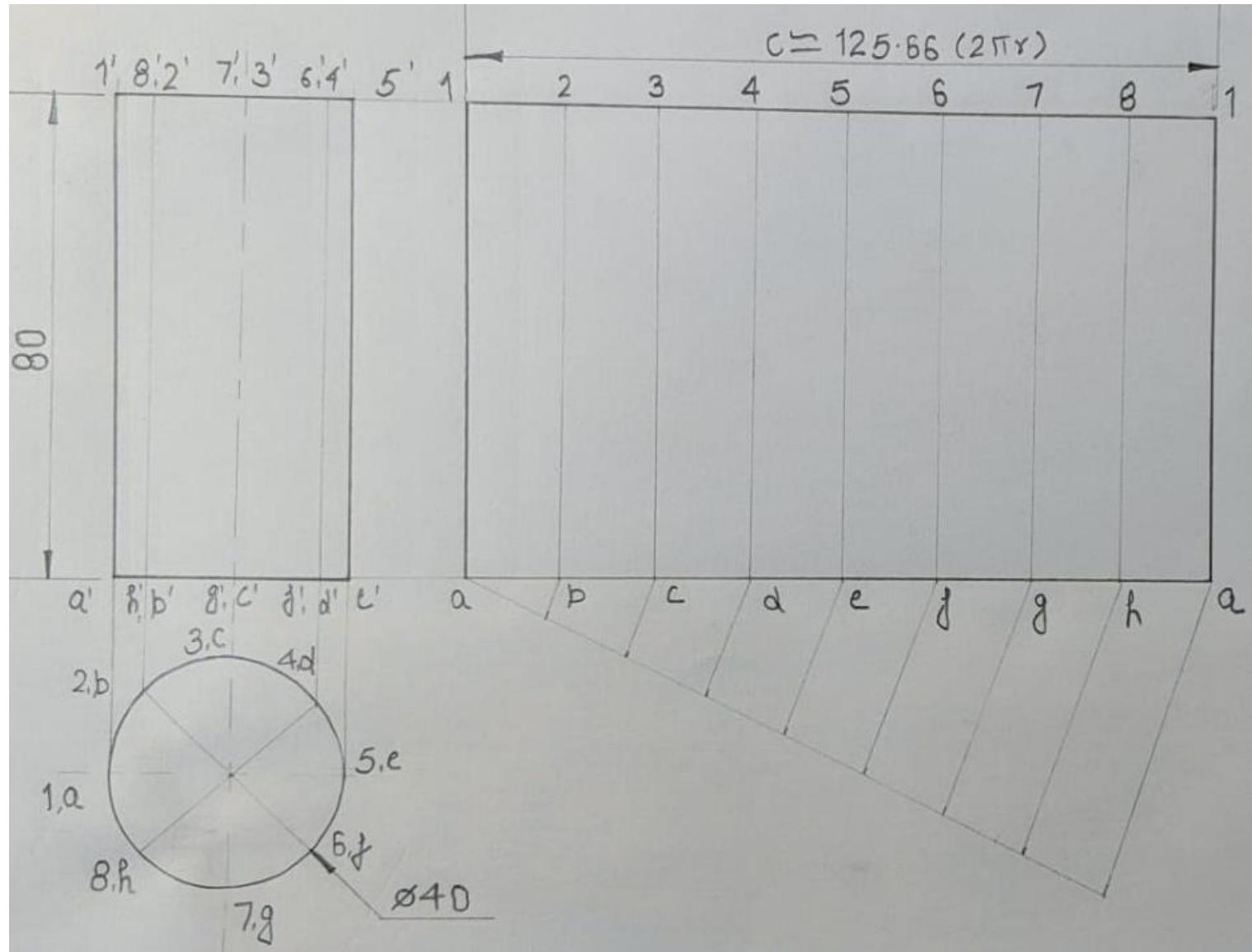
# **Unit 6 - Development of Surfaces**

## **Examples**

**Engineering Graphics**  
**(MEC103)**

# PARALLEL LINE METHOD

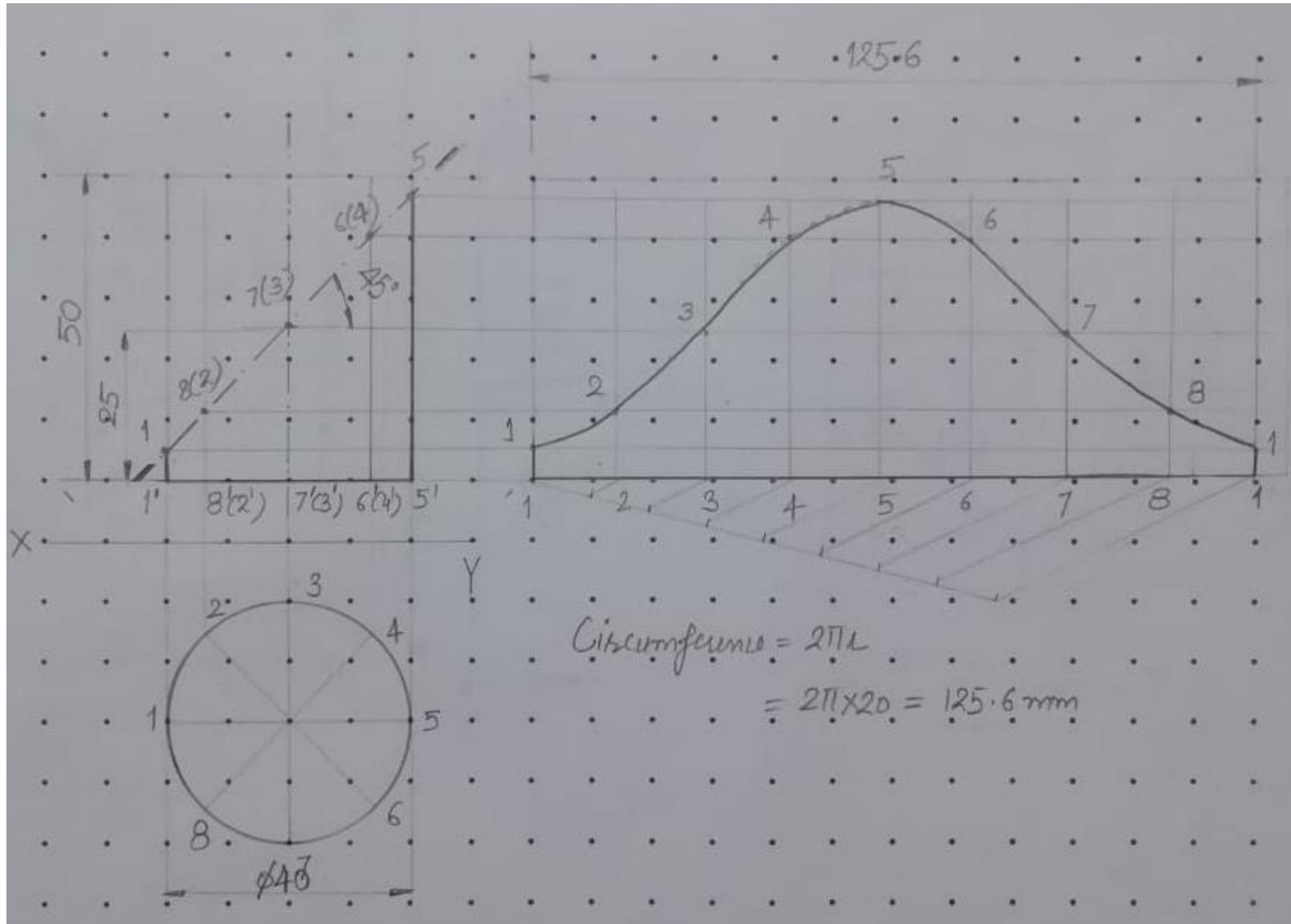
# Development of Cylinder



# Development of Truncated Cylinder



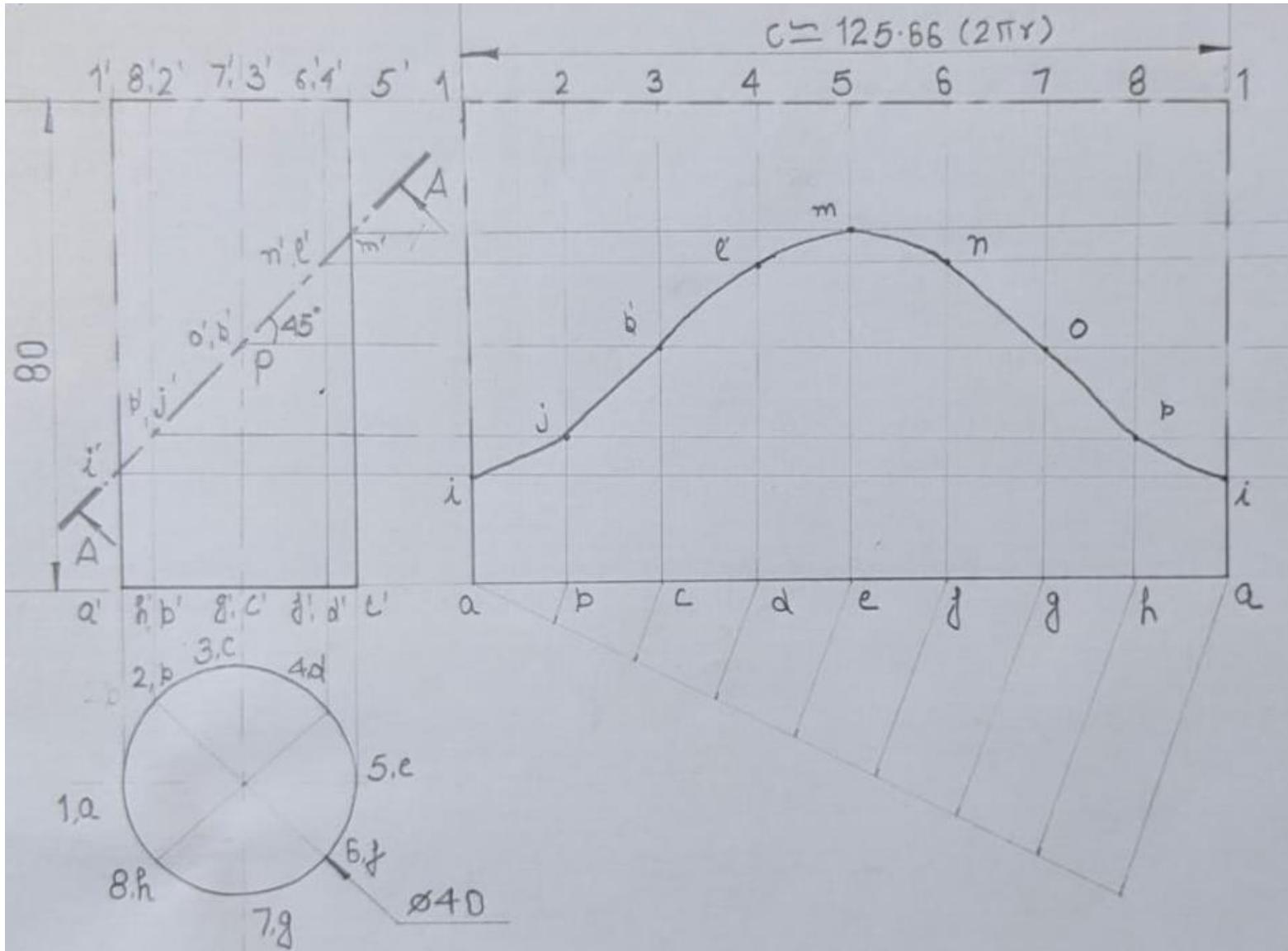
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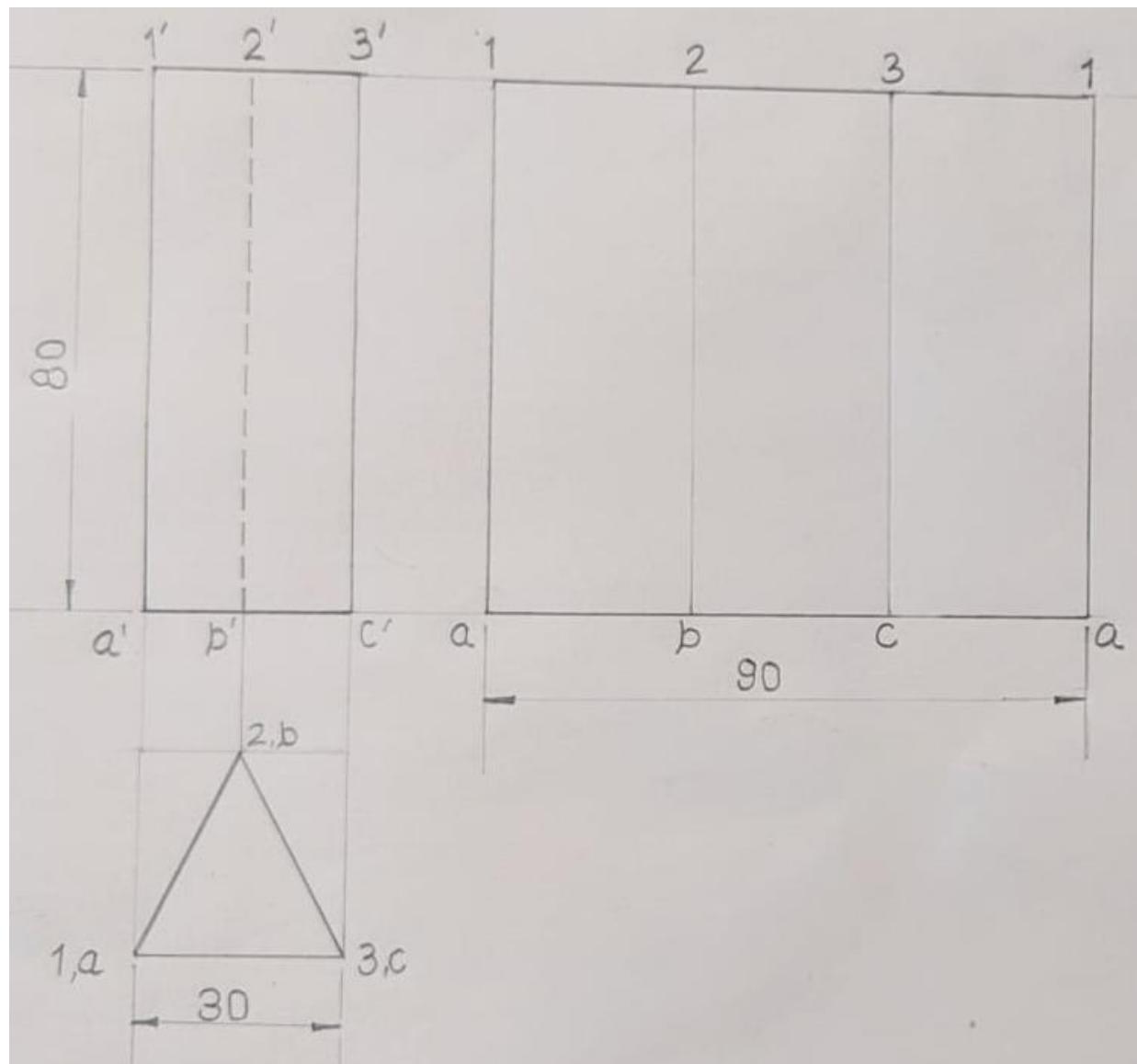
# Development of Truncated Cylinder



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# Development of Triangular Prism

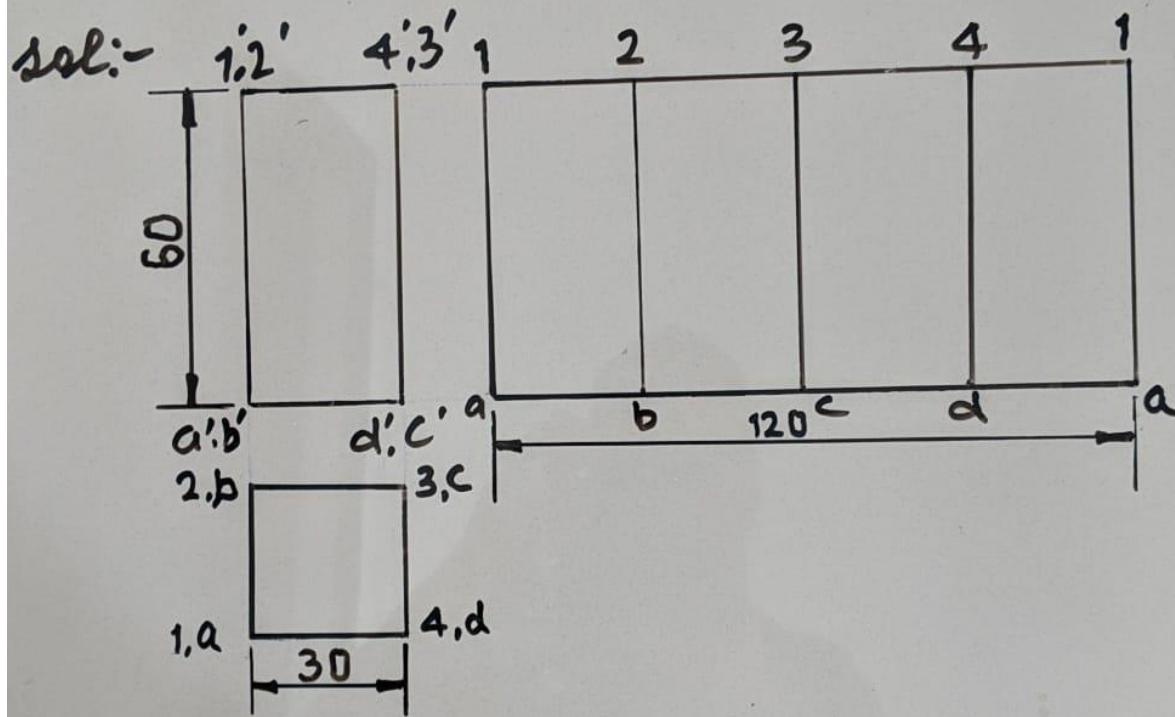


# Development of Square Prism



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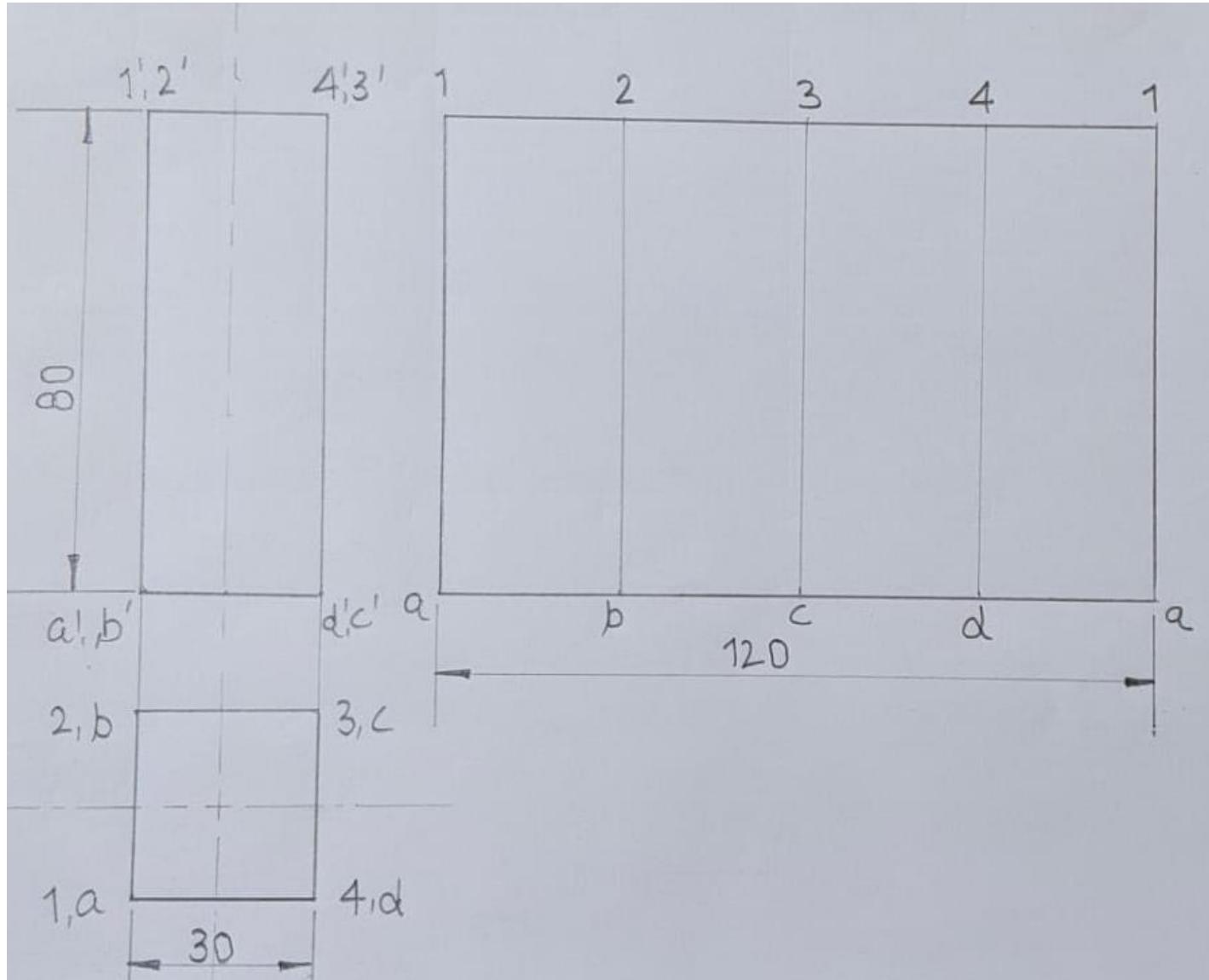
Develop the lateral surface area  
of square prism of base side 30mm  
and height 60mm.



# Development of Square Prism



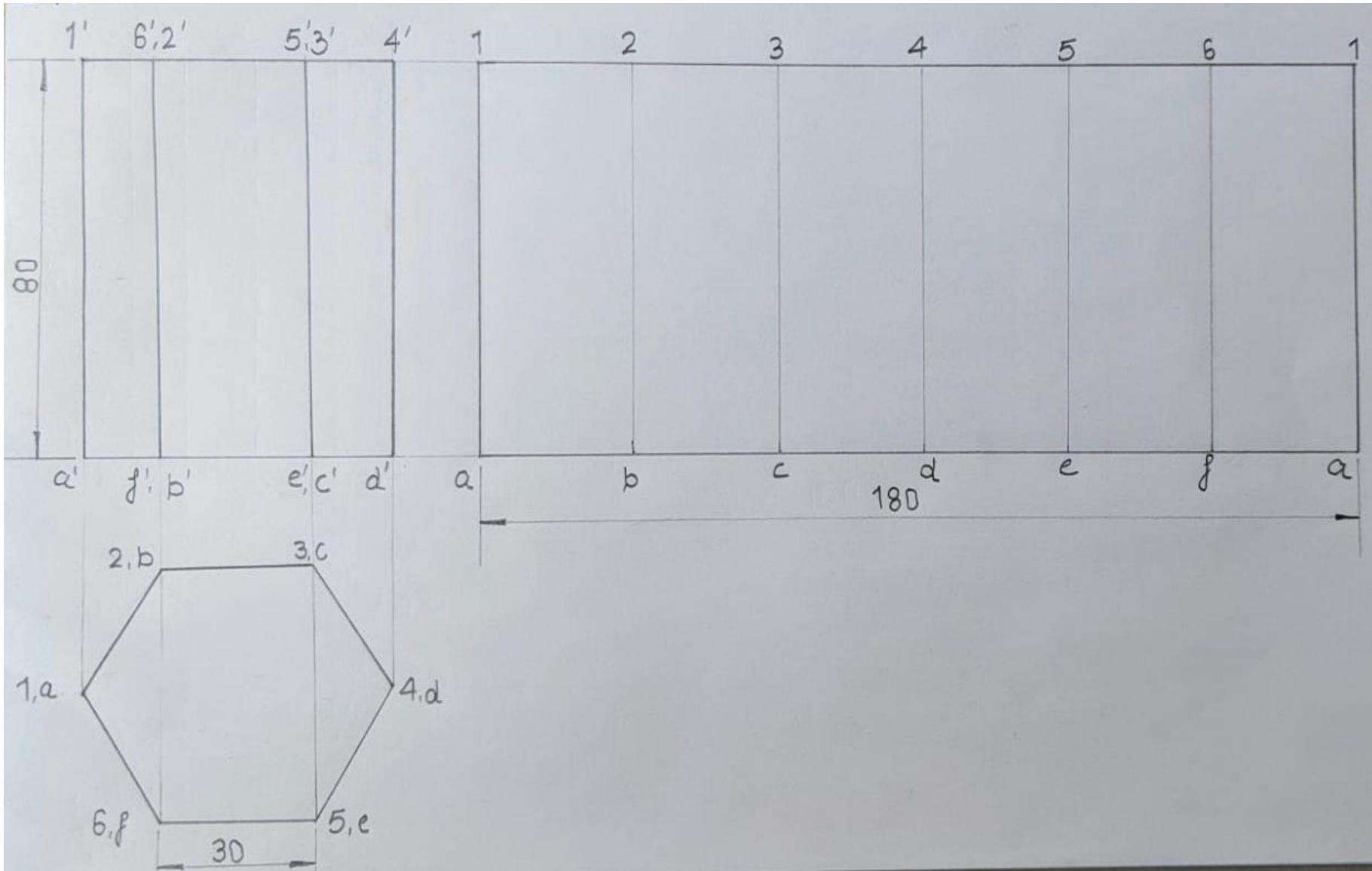
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# Development of Hexagonal Prism



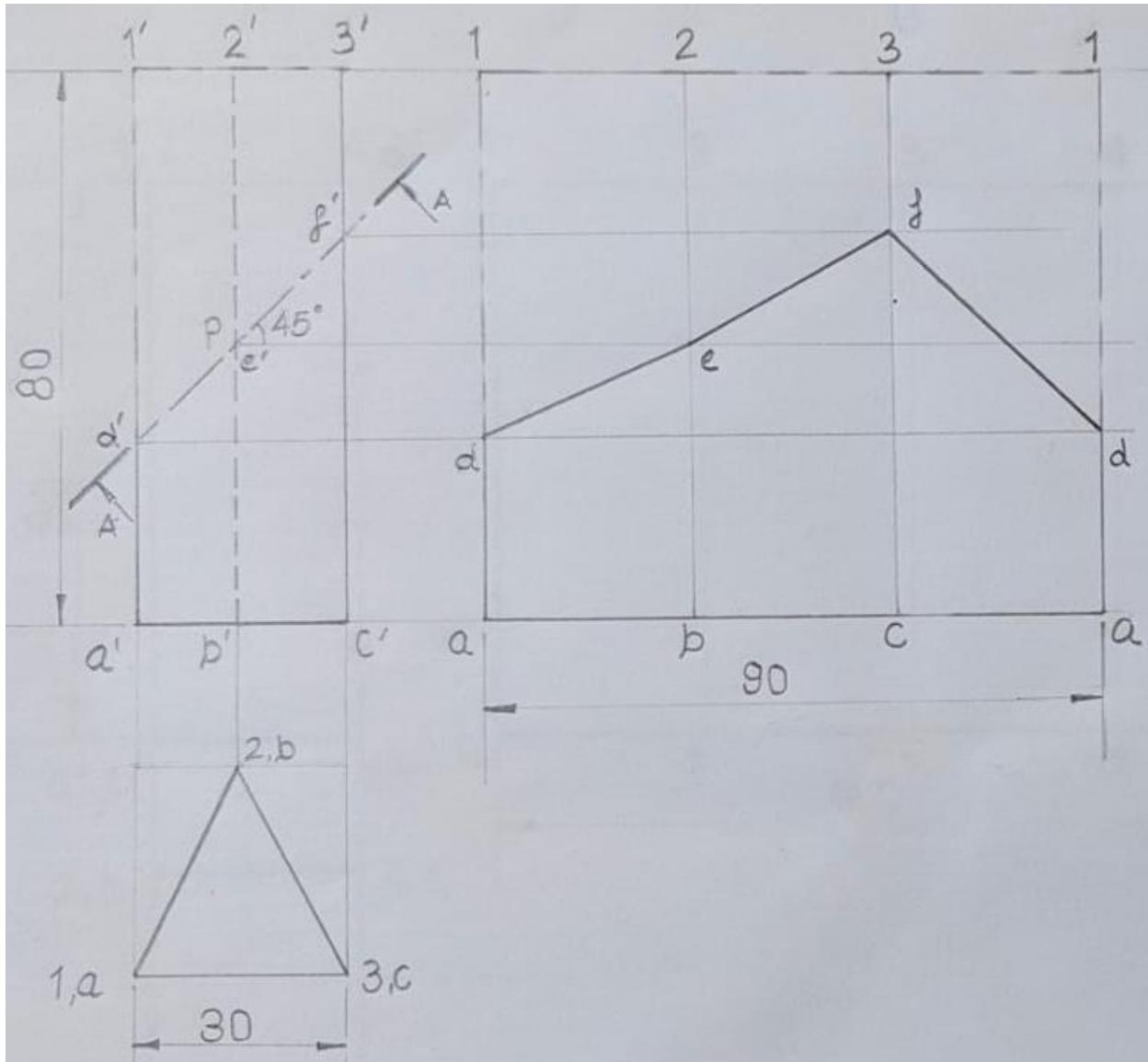
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# Development of Truncated Triangular Prism



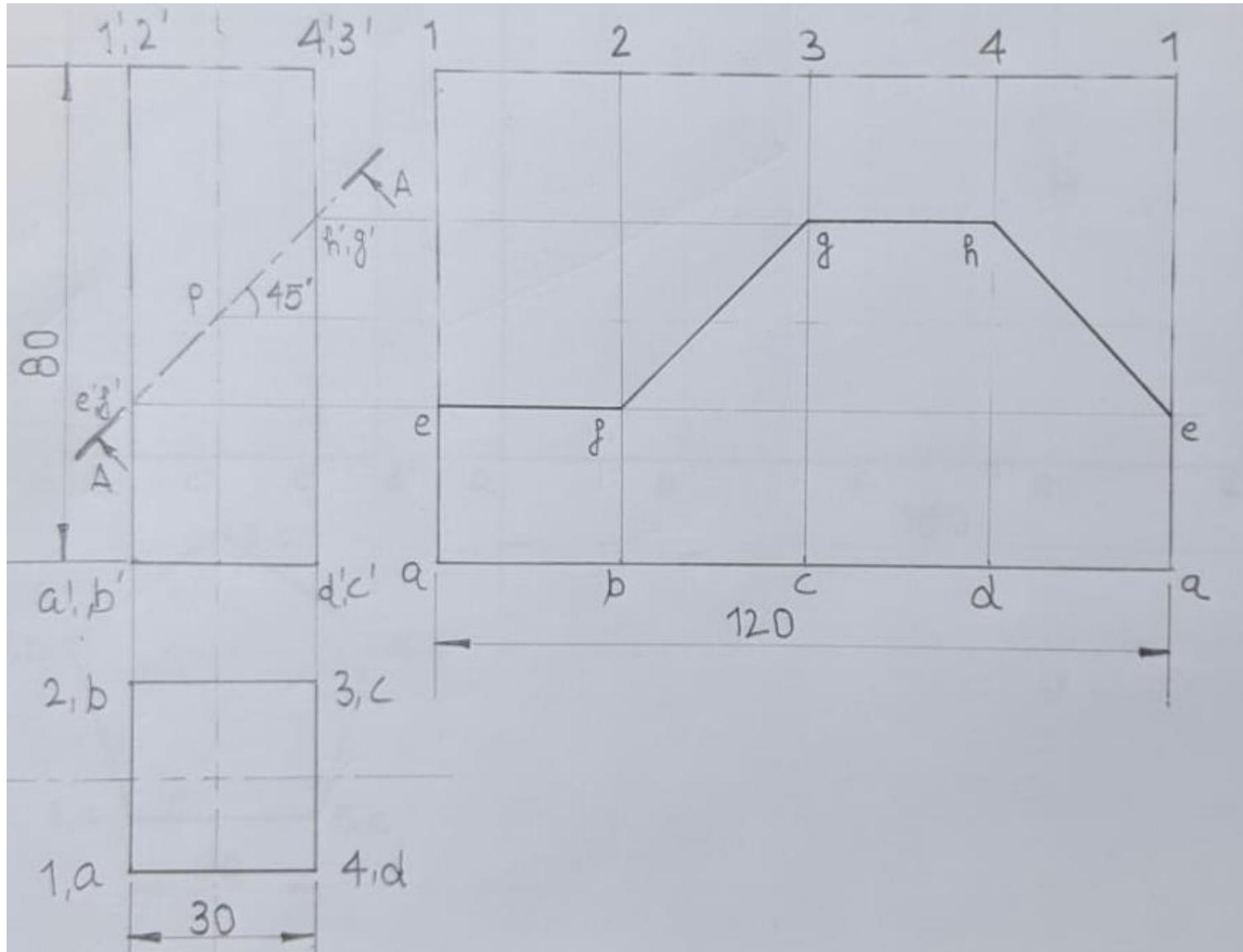
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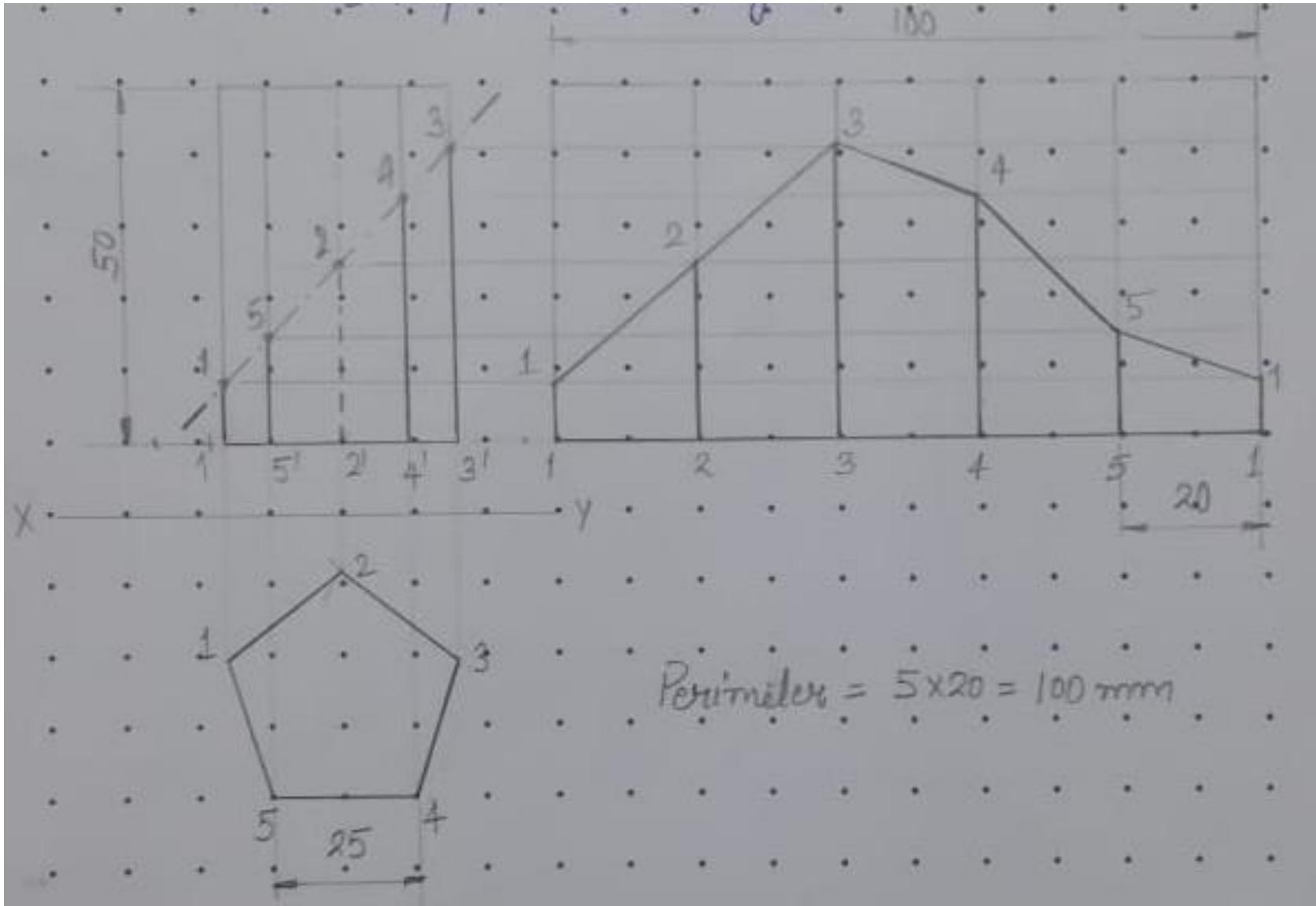
# Development of Truncated Square Prism



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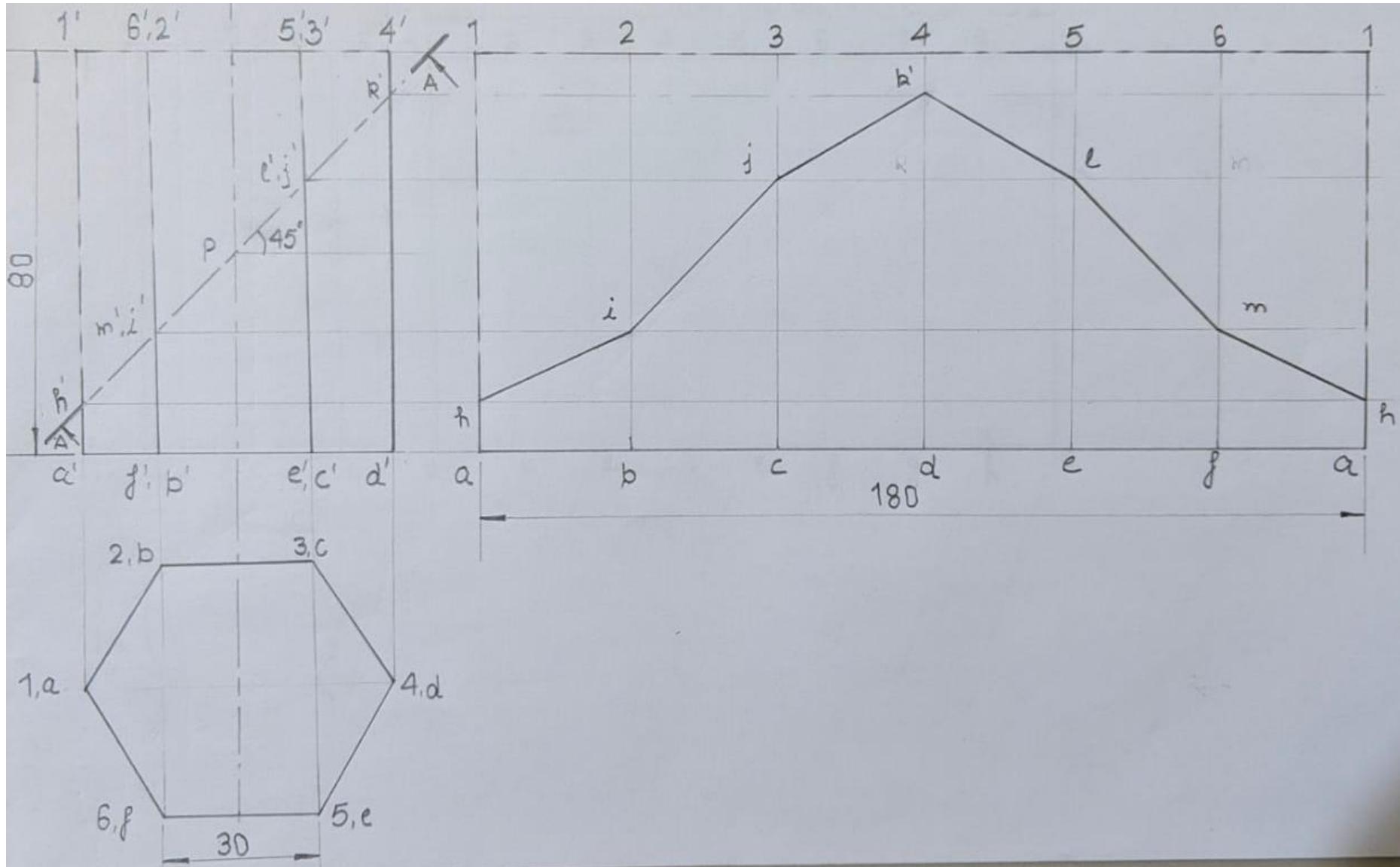
# Development of Truncated Pentagonal Prism



# Development of Truncated Hexagonal Prism

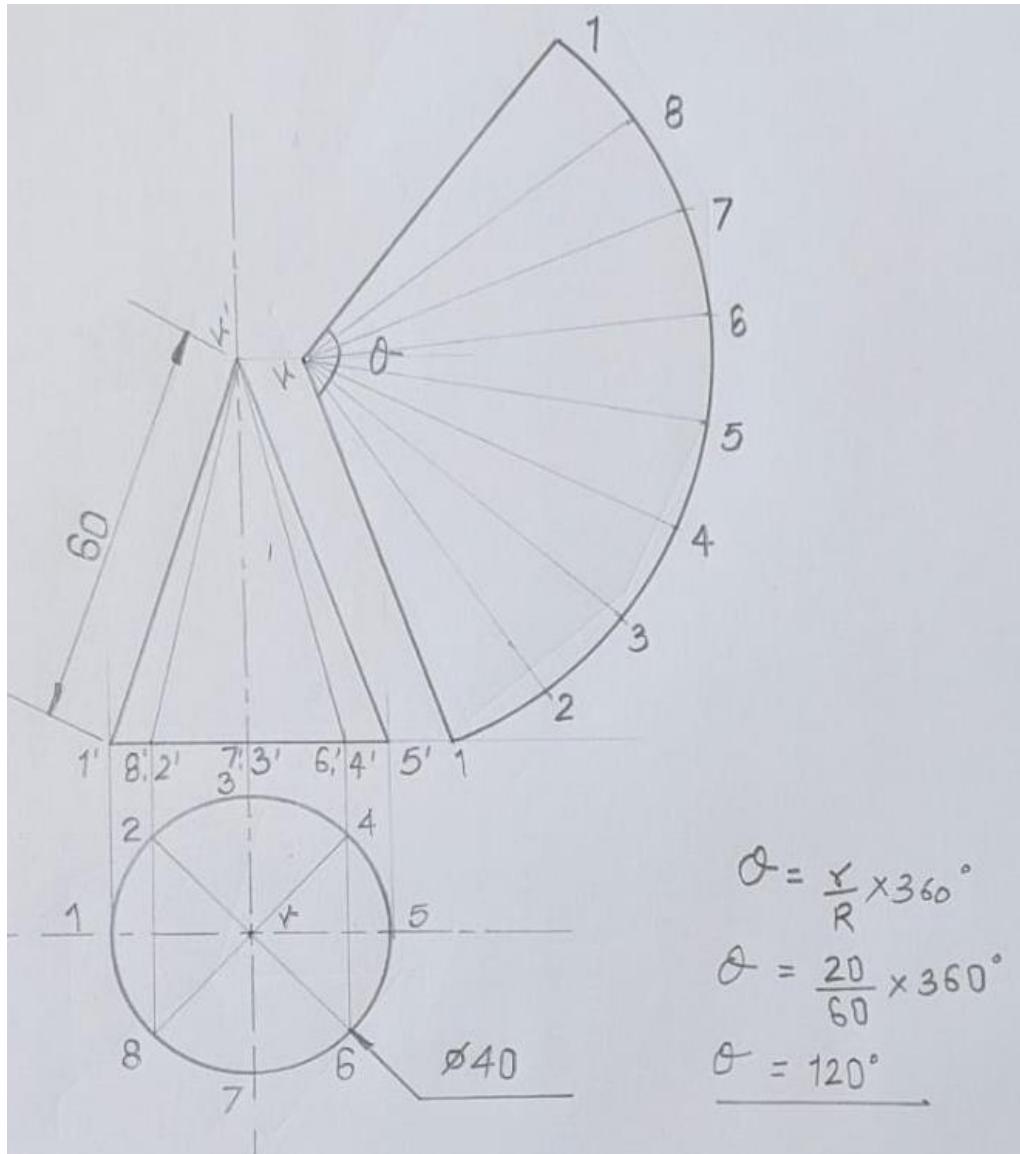


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# RADIAL LINE METHOD

# Development of Cone



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

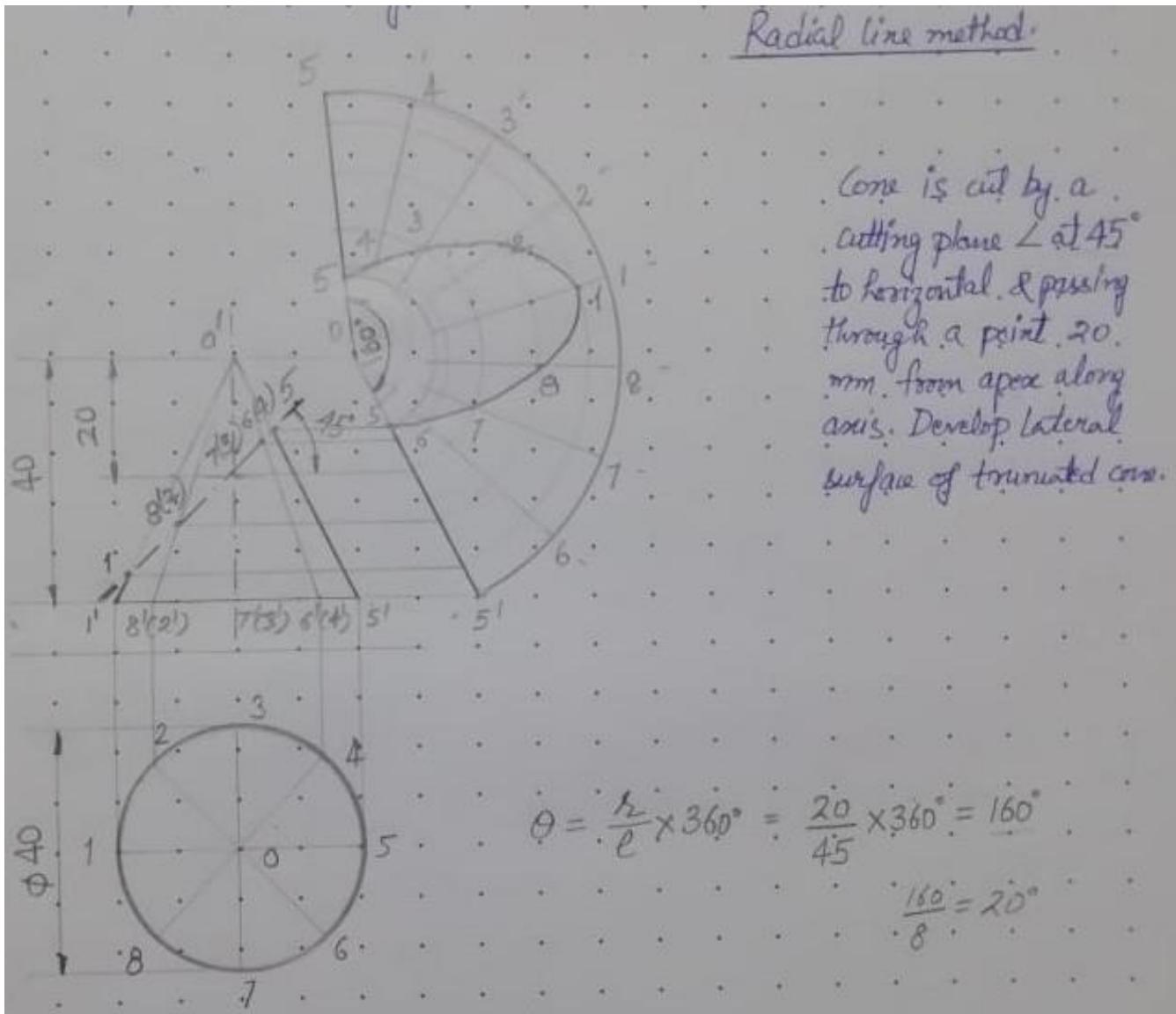
$$\theta = \frac{20}{60} \times 360^\circ$$

$$\theta = 120^\circ$$

# Development of Truncated Cone



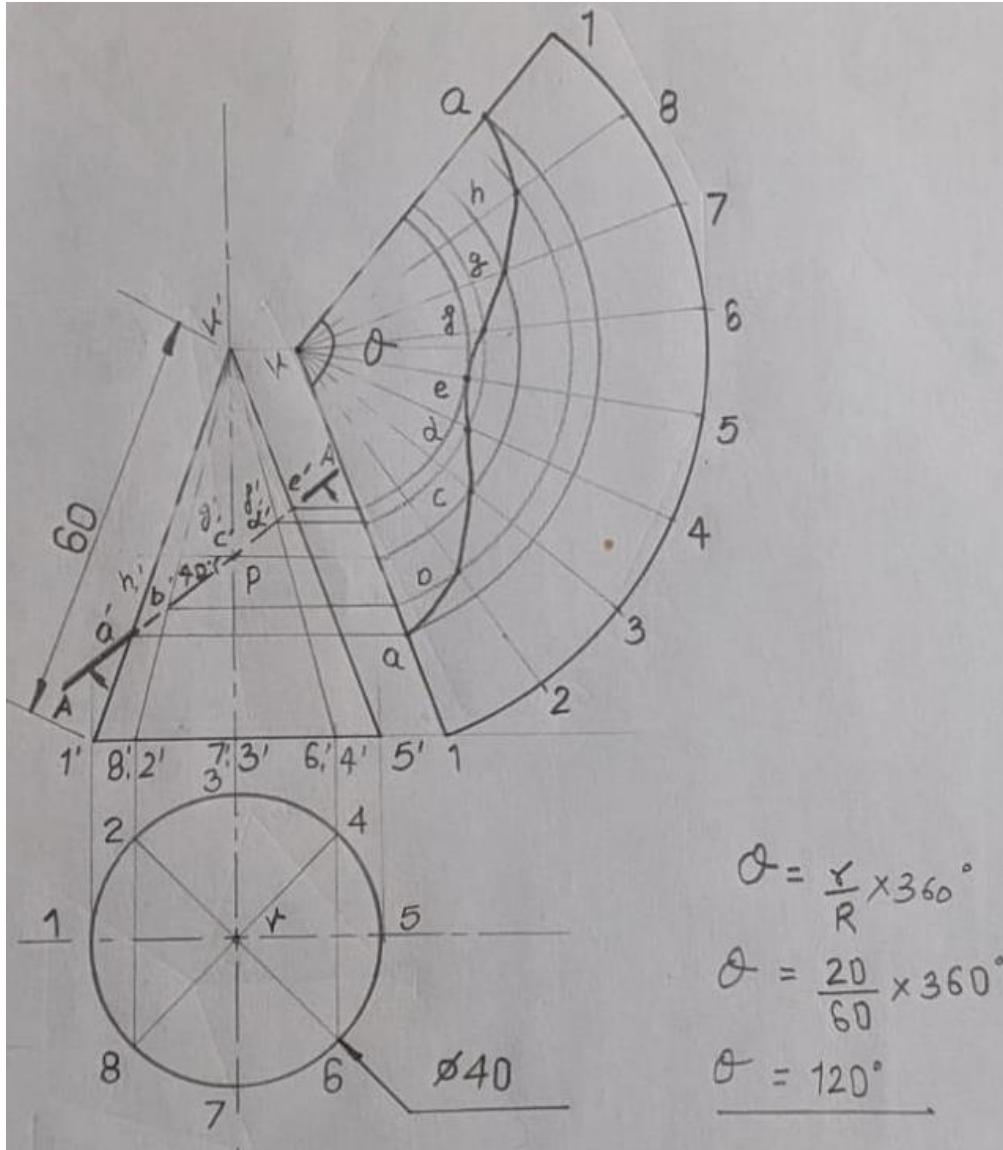
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# Development of Truncated Cone



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

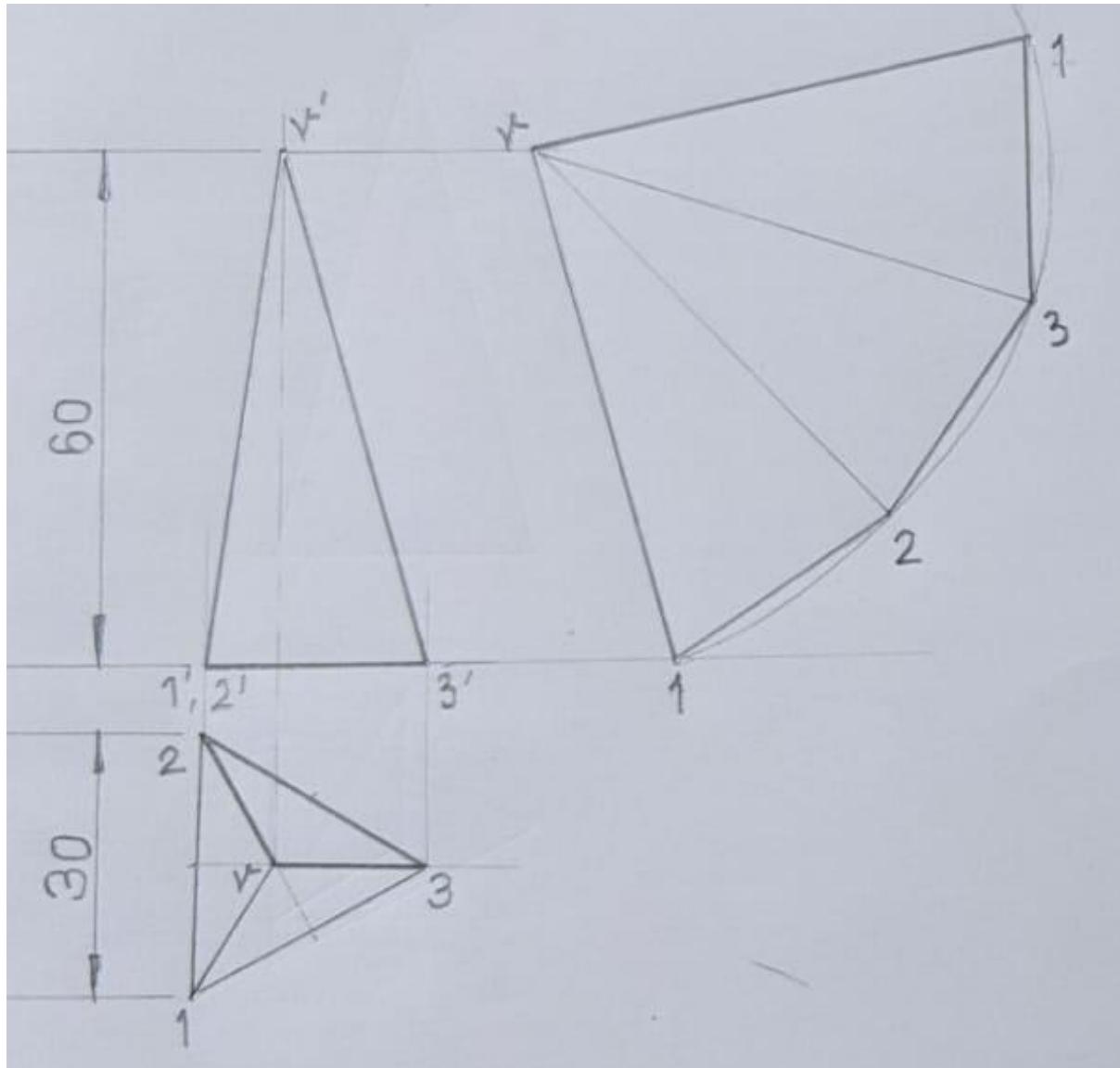
$$\theta = \frac{20}{60} \times 360^\circ$$

$$\theta = 120^\circ$$

# Development of Triangular Pyramid



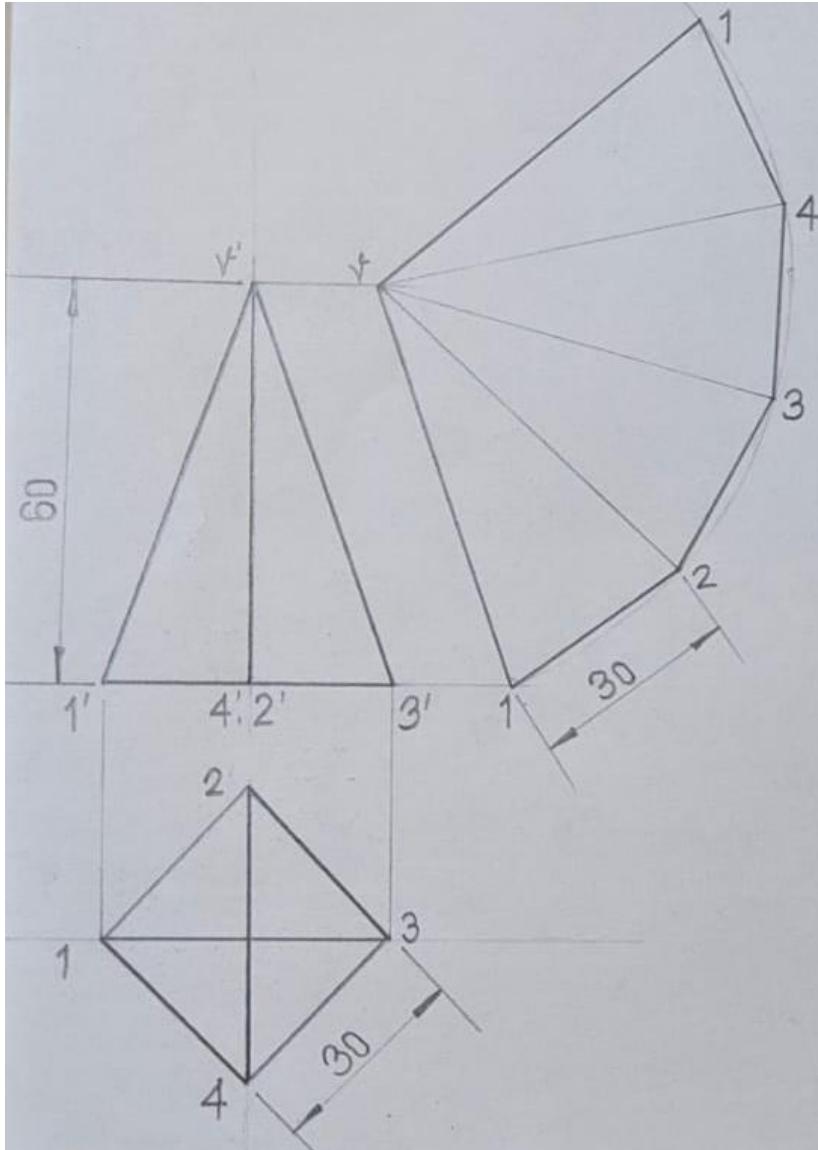
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# Development of Square Pyramid



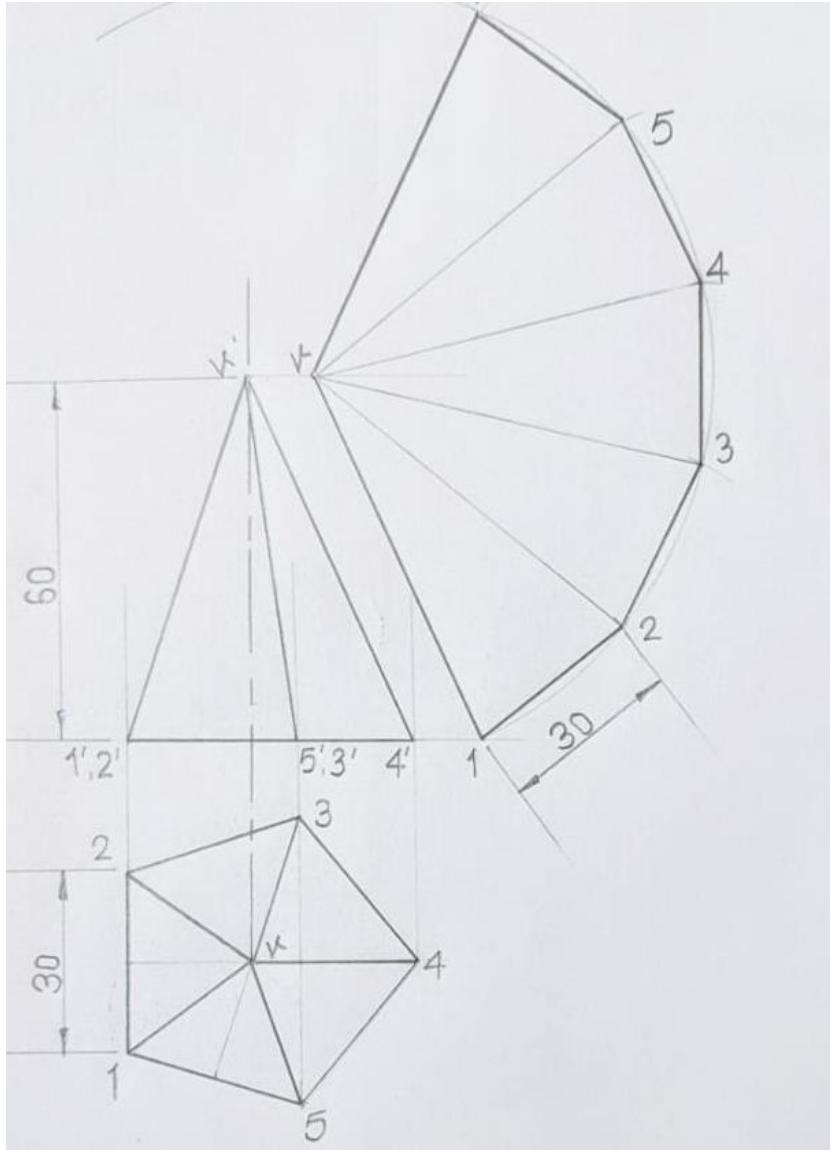
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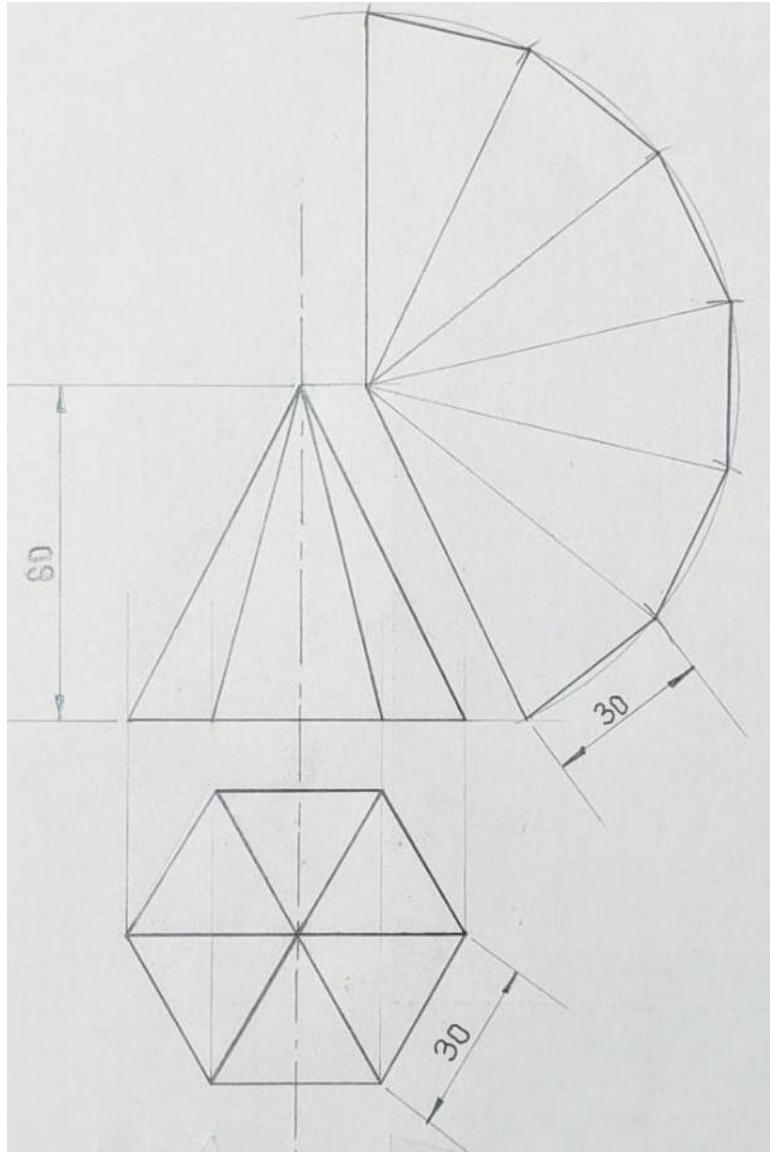
# Development of Pentagonal Pyramid



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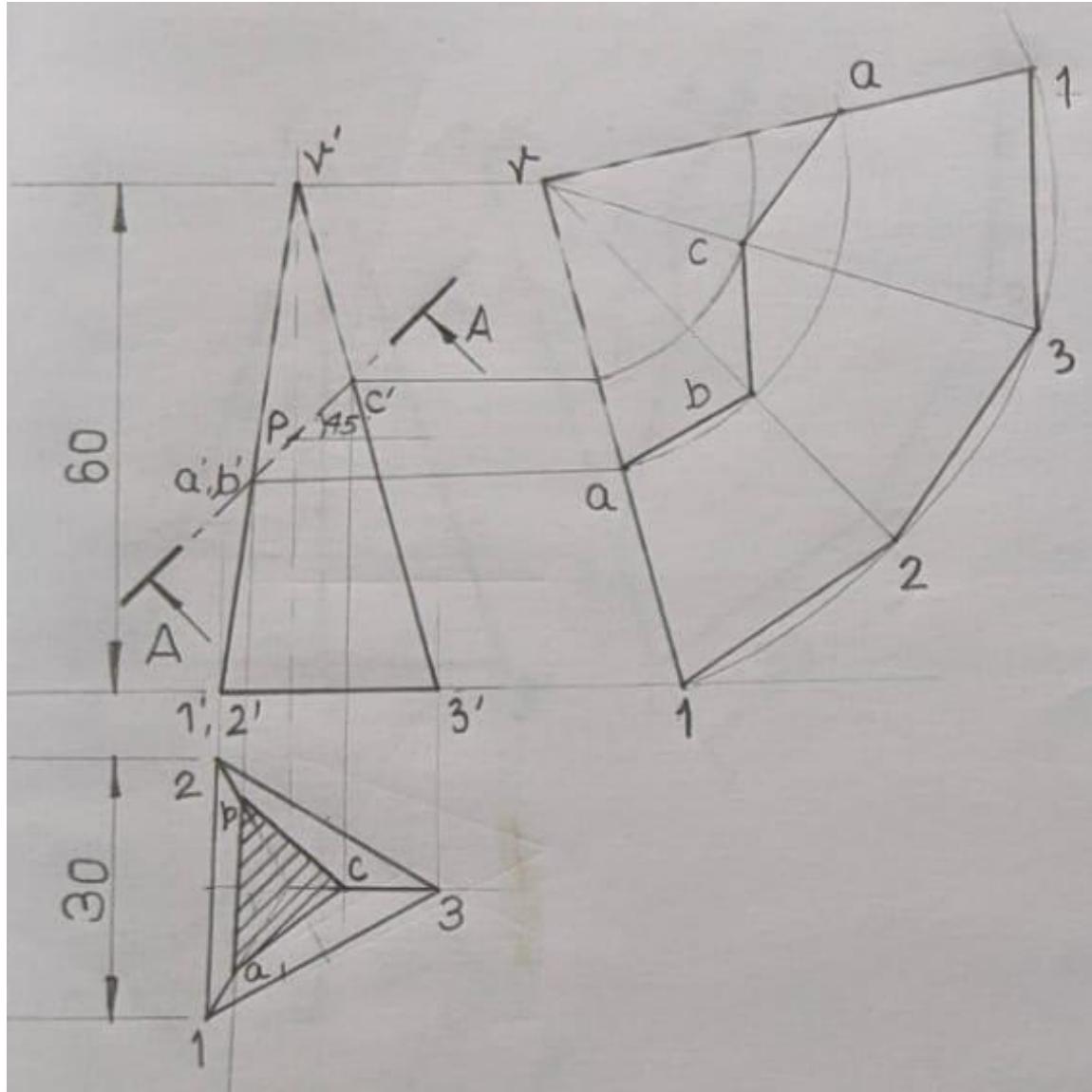
# Development of Hexagonal Pyramid



# Development of Truncated Triangular Pyramid



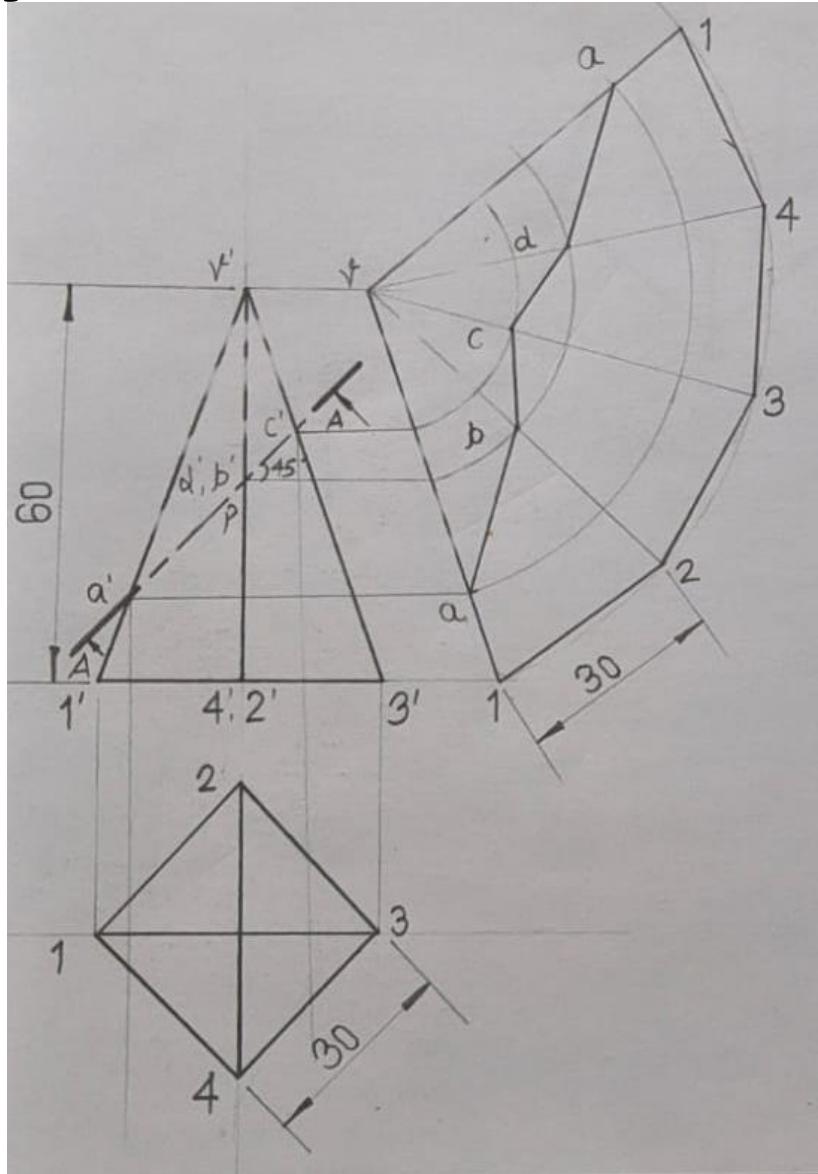
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# Development of Truncated Square Pyramid



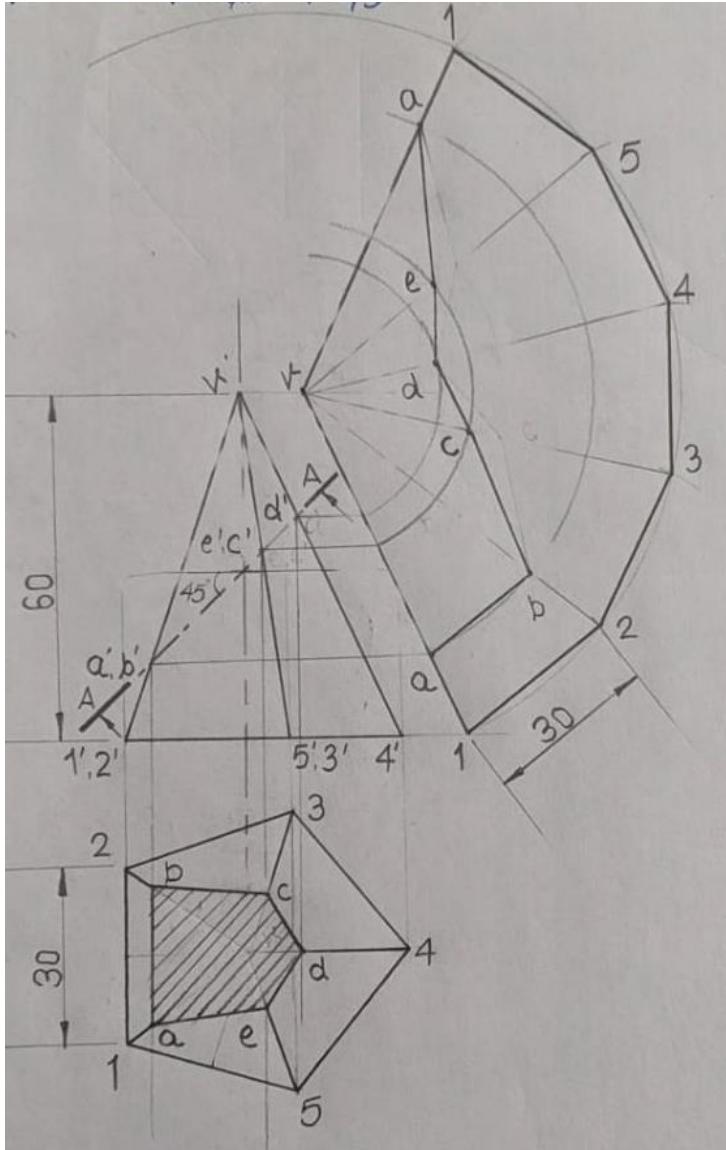
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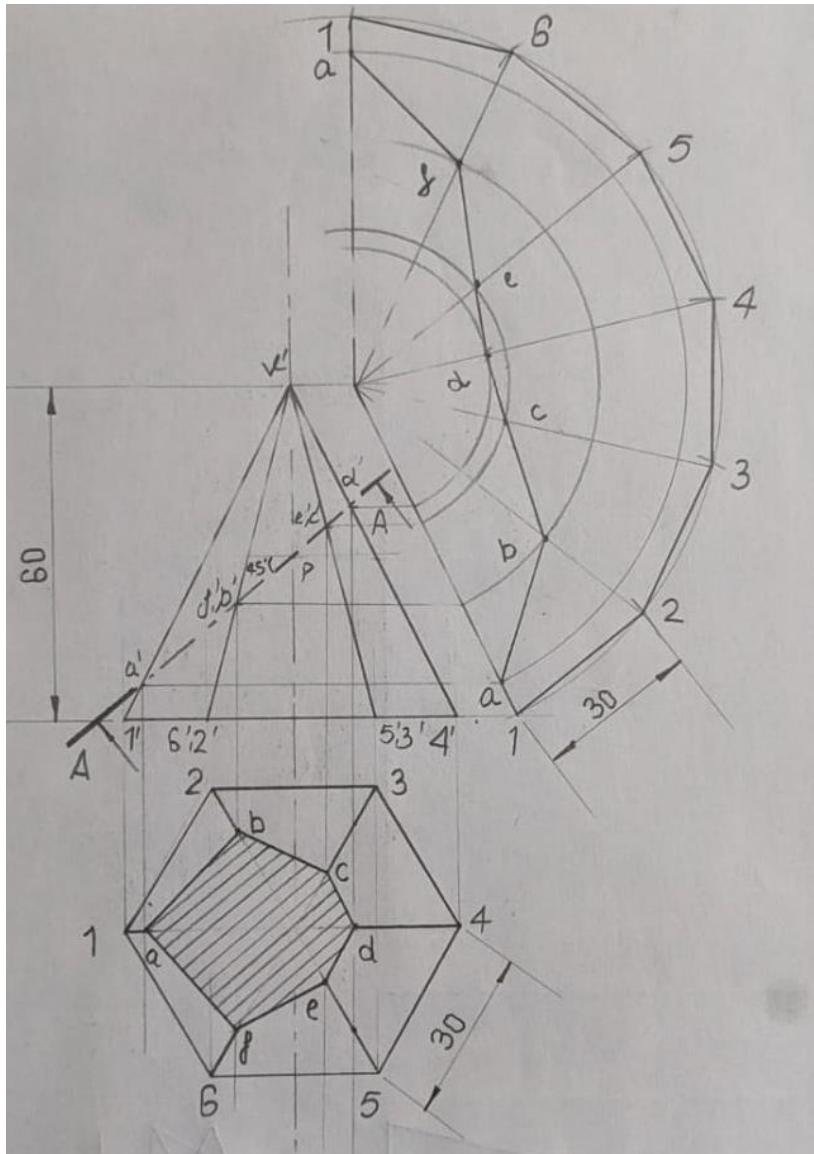
# Development of Truncated Pentagonal Pyramid



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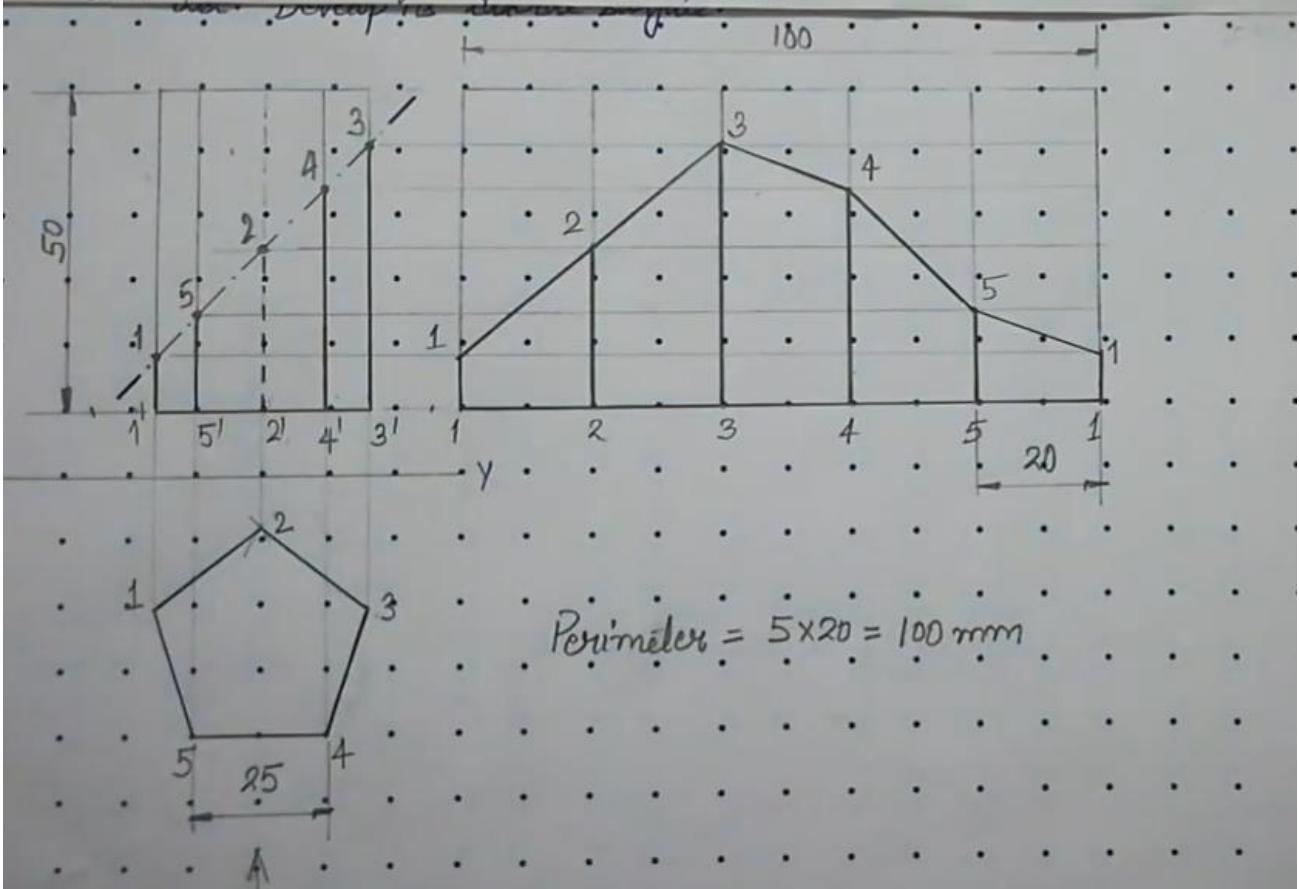


# Development of Truncated Hexagonal Pyramid



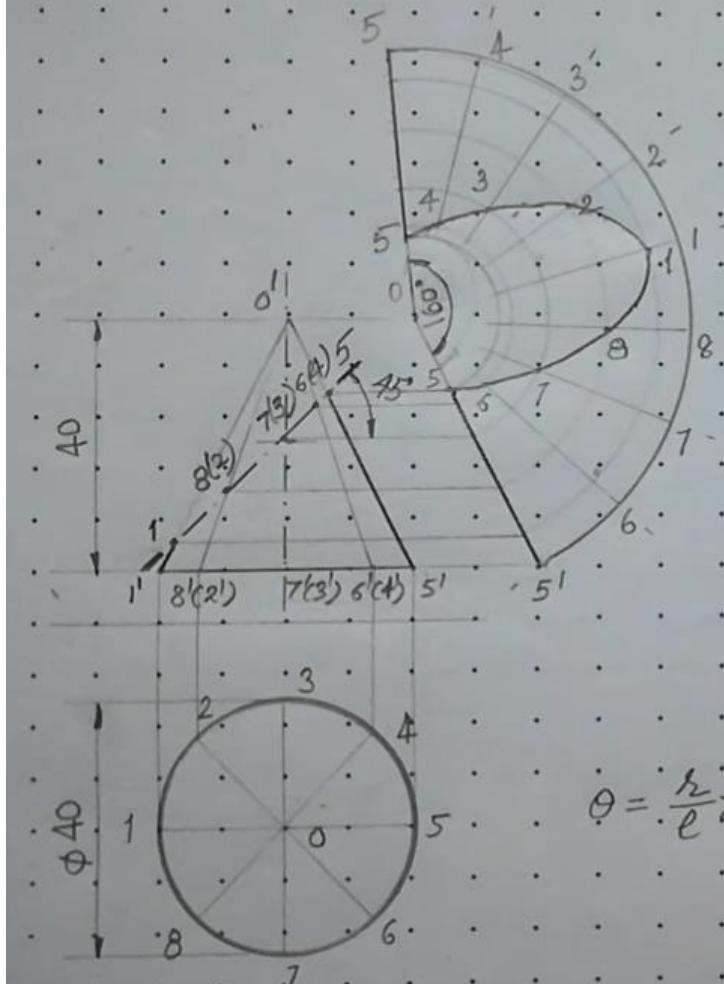
# THANKS

Q1. A pentagonal prism of base edge 20mm and height 50mm is resting on its base. It is cut by a cutting plane inclined at  $45^\circ$  to horizontal & it bisects the axis. Develop lateral surface of truncated prism.



Q1. A cone of  $\phi 40\text{mm}$  & height  $40\text{mm}$  is resting on its base.  
Develop its lateral surface.

Radial line method,

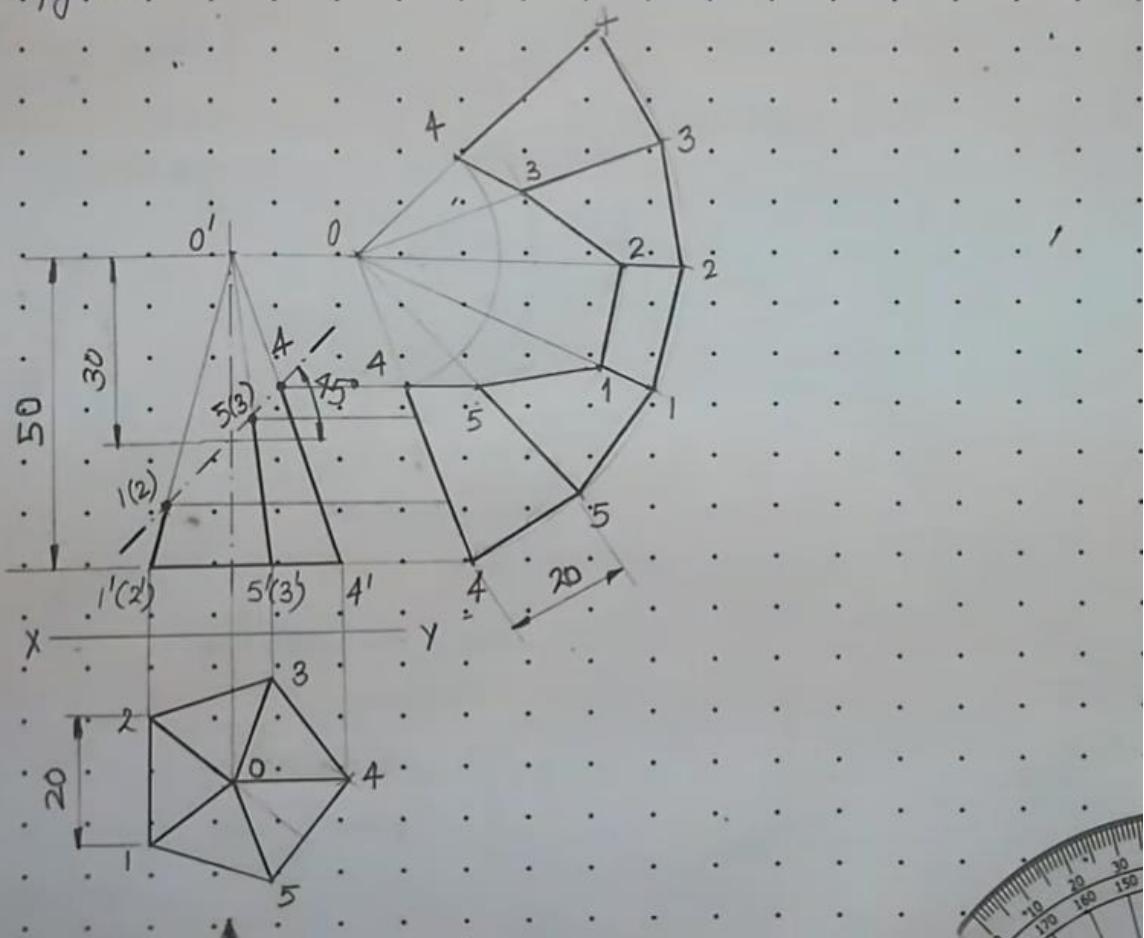


Cone is cut by a cutting plane  $L$  at  $45^\circ$  to horizontal & passing through a point 20 mm from apex along axis. Develop Lateral surface of truncated cone.

$$\theta = \frac{r}{l} \times 360^\circ = \frac{20}{45} \times 360^\circ = 160^\circ$$

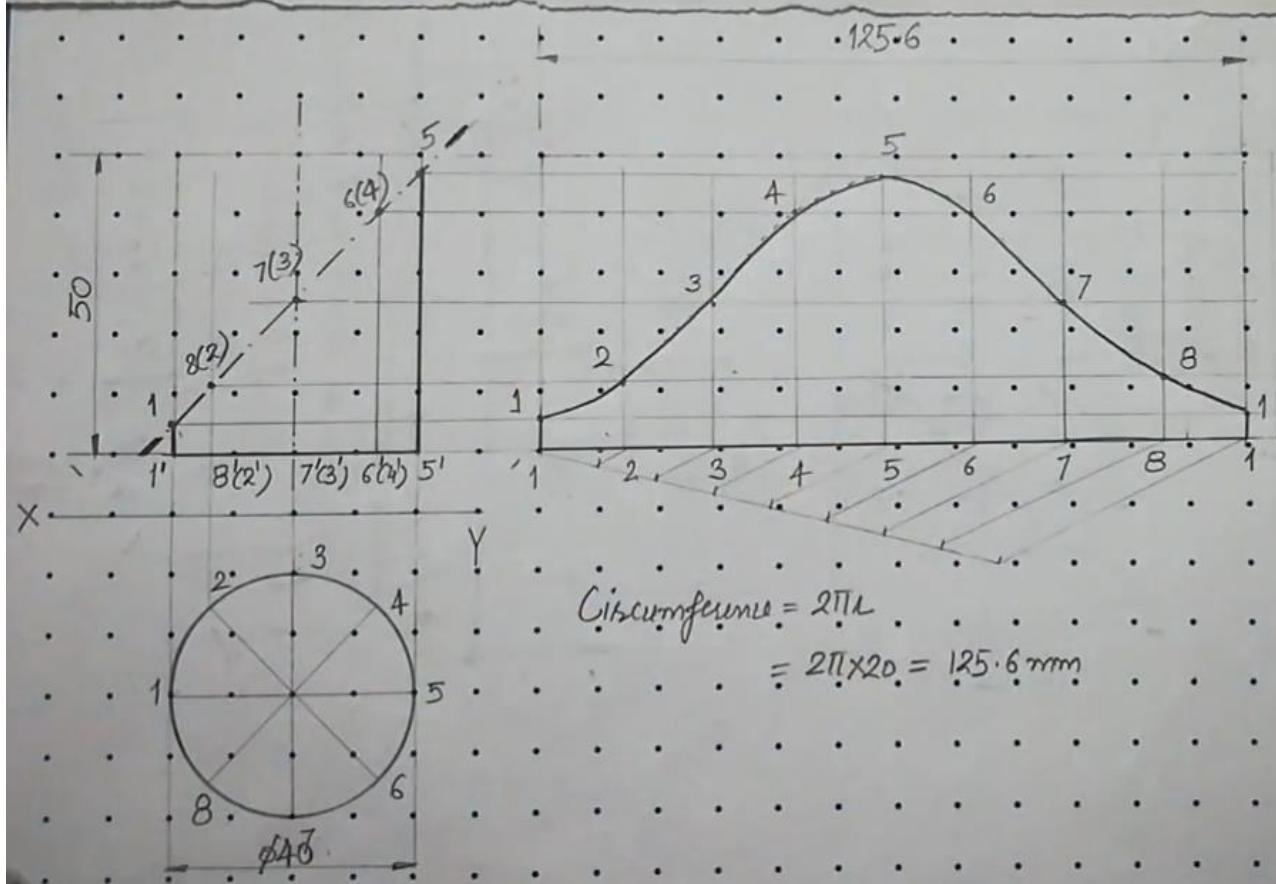
$$\frac{160}{8} = 20^\circ$$

Q1: A pentagonal pyramid of base 20 mm & height 50 mm is cut by a cutting plane inclined at  $45^\circ$  to HP & passing through a point 30 mm from apex along axis. Develop lateral surface of truncated pyramid.



Q1. A cylinder of  $\phi 40\text{mm}$  and height  $50\text{mm}$  is resting on its base.

It is cut by a cutting plane inclined at  $45^\circ$  to horizontal and it bisects the axis of cylinder. Develop lateral surface of truncated cylinder.



# Engineering Graphics (MEC103)

## Unit 6 - Development of Surfaces

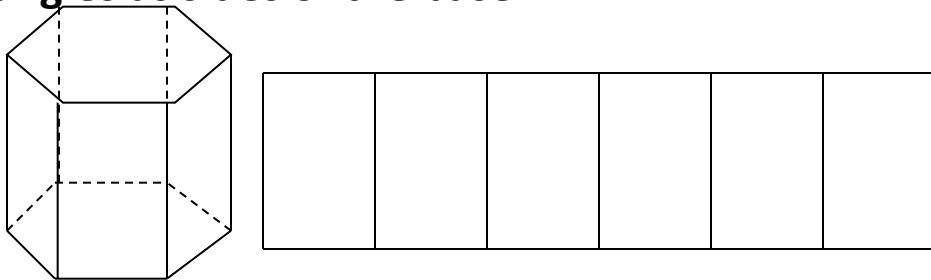
**Development is a graphical method of obtaining the area of the surfaces of a solid.**  
**When a solid is opened out and its complete surface is laid on a plane, the surface of the solid is said to be developed. The figure thus obtained is called a *development of the surfaces of the solid* or simply *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

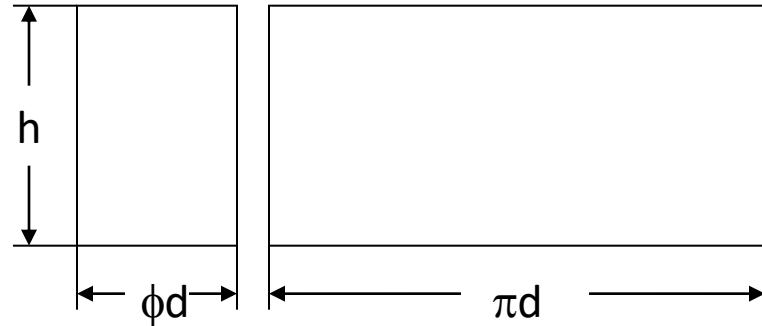
Other side: Side of the base



**Cylinder – Rectangle**

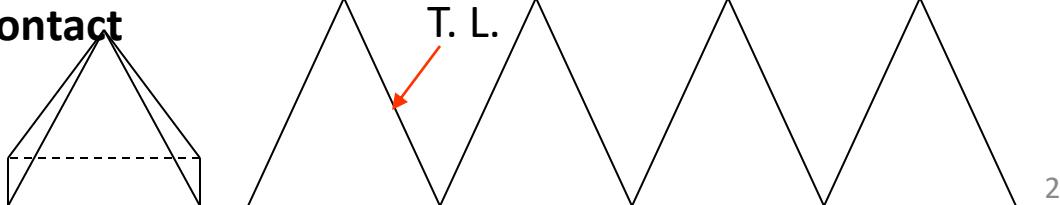
One side: Circumference of the base

Other side: Height of the cylinder



**Pyramid – Number of triangles in contact**

The base may be included  
 if present

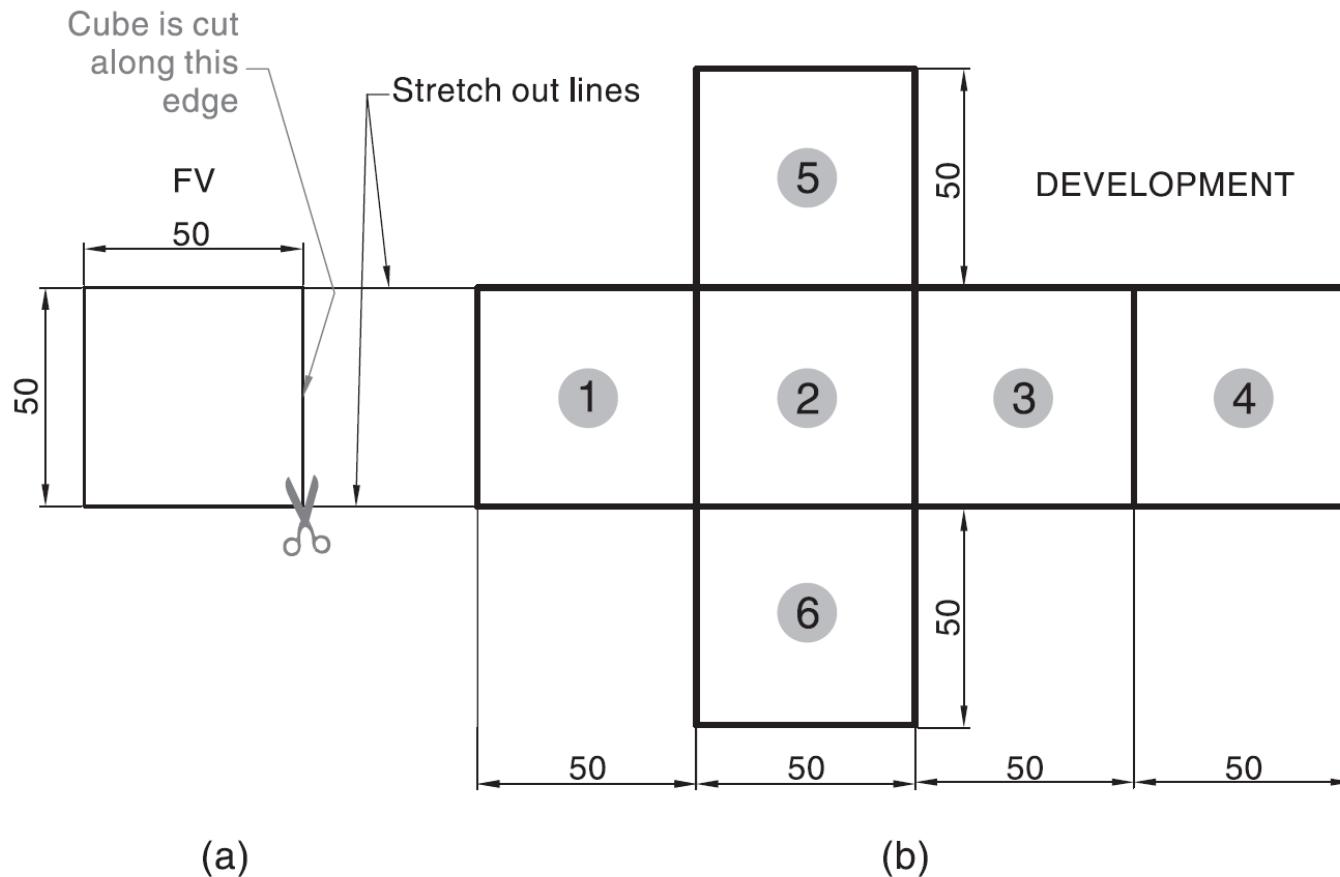


# Methods used to develop surfaces

1. **Parallel-line development:** Used for prisms, cylinders etc. in which parallel lines are drawn along the surface and transferred to the development.
2. **Radial-line development:** Used for pyramids, cones etc. in which the true length of the slant edge or generator is used as radius.
3. **Triangulation development:** Complex shapes are divided into a number of triangles and transferred into the development (usually used for transition pieces).
4. **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.

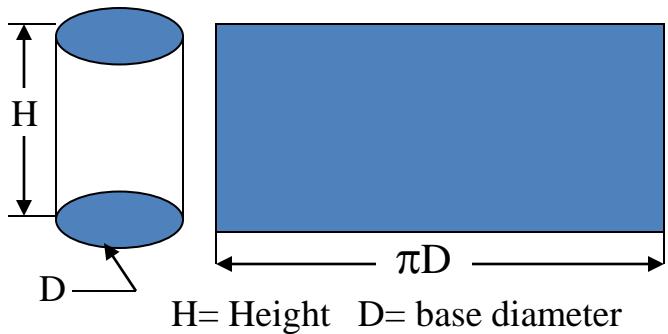
**Parallel line development:** This method is employed to develop the surfaces of prisms and cylinders. Two parallel lines (called *stretch-out lines*) are drawn from the two ends of the solids and the lateral faces are located between these lines.



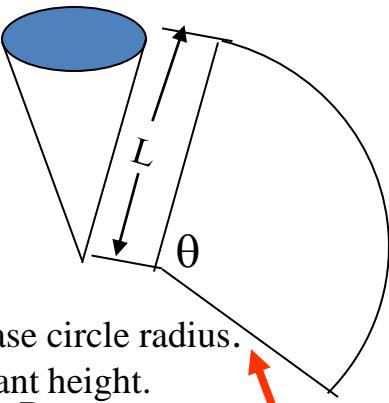
# Development of lateral surfaces of different solids.

(Lateral surface is the surface excluding top & base)

*Cylinder:* A Rectangle



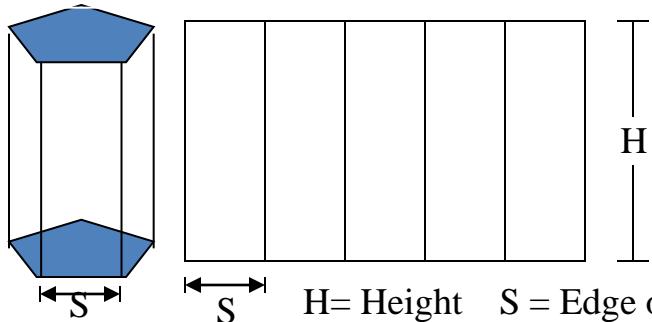
*Cone:* (Sector of circle)



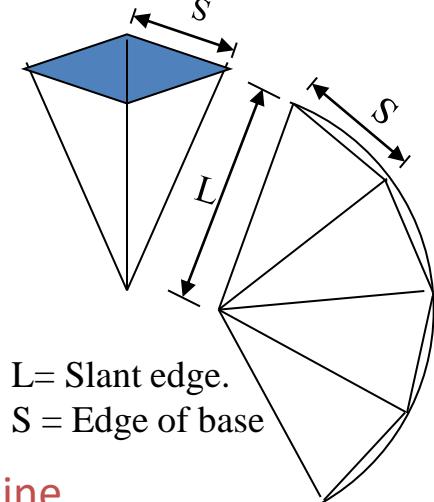
$R = \text{Base circle radius.}$   
 $L = \text{Slant height.}$   
 $\theta = \frac{R}{L} \times 360^{\circ}$

**Parallel-line development**

*Prisms:* No.of Rectangles

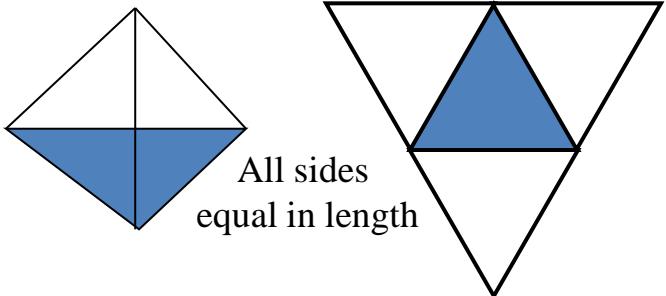


*Pyramids:* (No.of triangles)

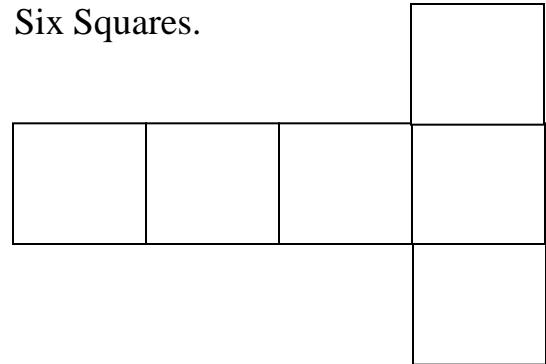


$L = \text{Slant edge.}$   
 $S = \text{Edge of base}$

*Tetrahedron:* Four Equilateral Triangles



*Cube:* Six Squares.

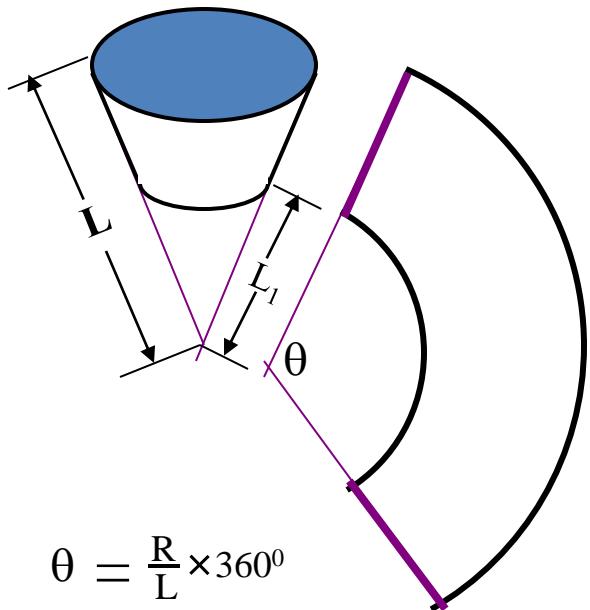


# FRUSTUMS



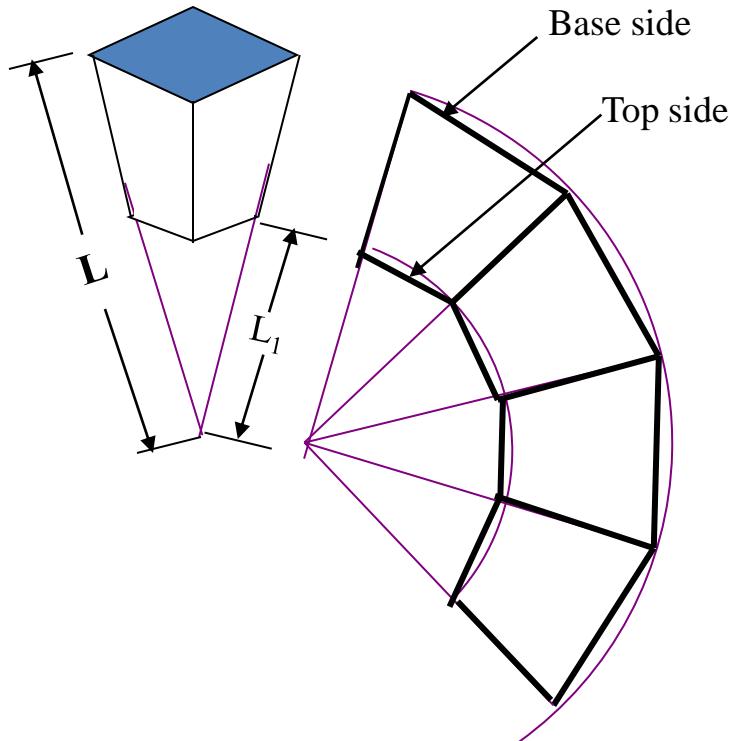
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## DEVELOPMENT OF FRUSTUM OF CONE



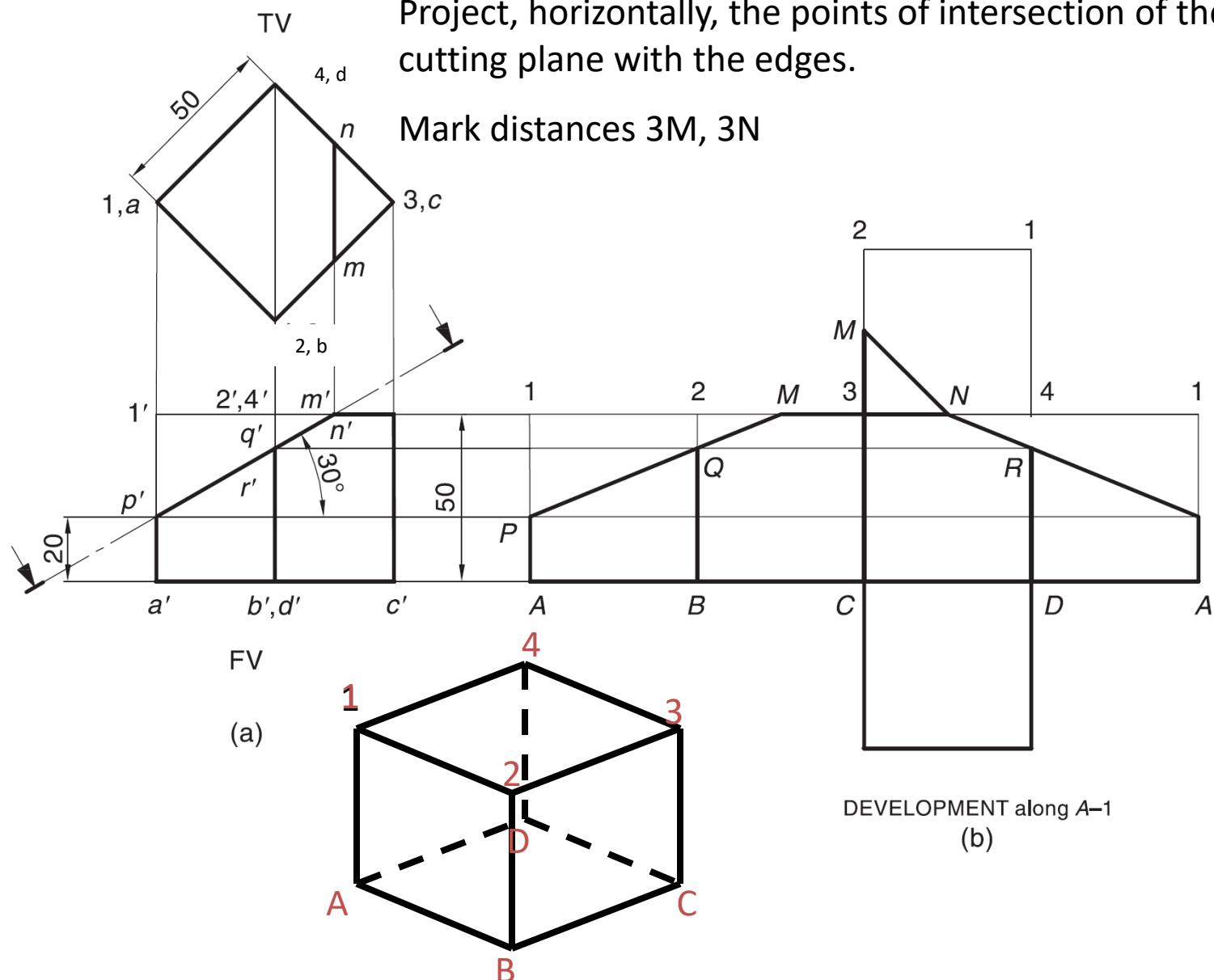
R= Base circle radius of cone  
L= Slant height of cone  
 $L_1$  = Slant height of cut part.

## DEVELOPMENT OF FRUSTUM OF SQUARE PYRAMID



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

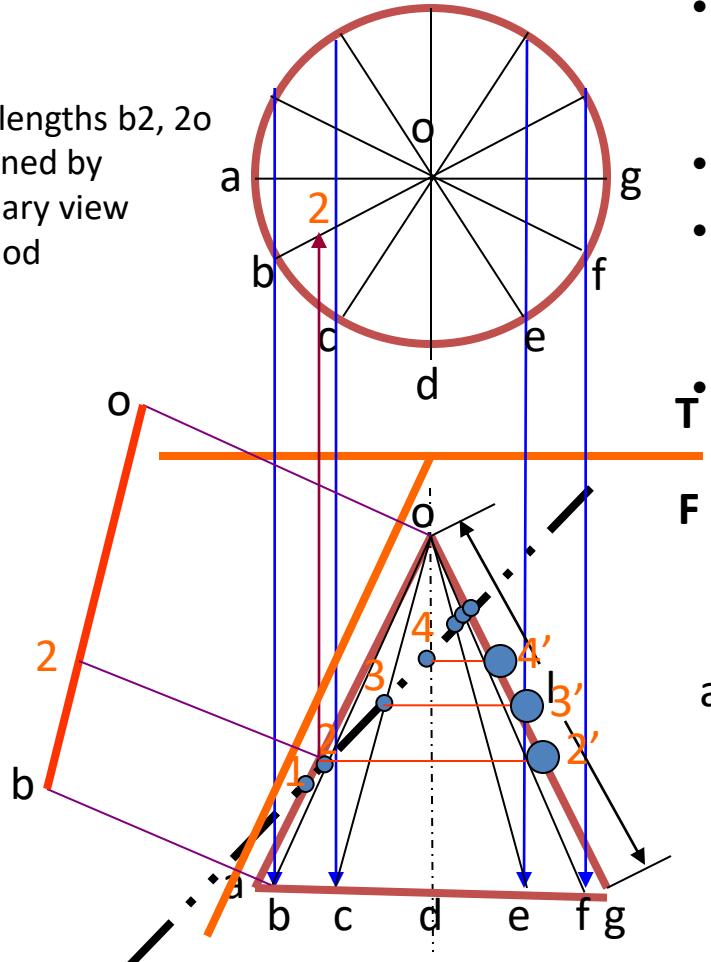
## Cube cut by section plane



Draw the development of the lower portion of the cone surface cut by a plane. Cone base diameter is 40 mm and height is 50 mm. The cutting plane intersects the cone axis at an angle of  $45^\circ$  and 20 mm below the vertex

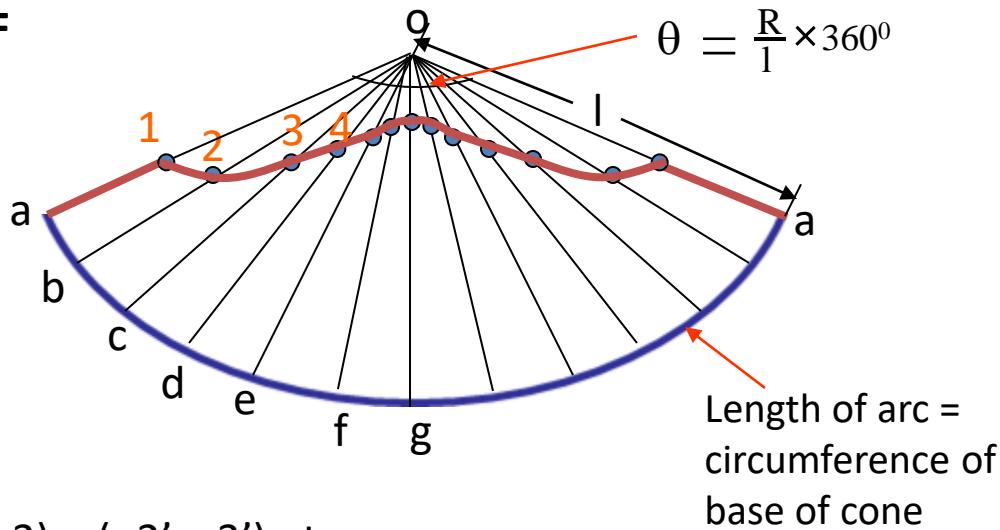
Radius of cone = R

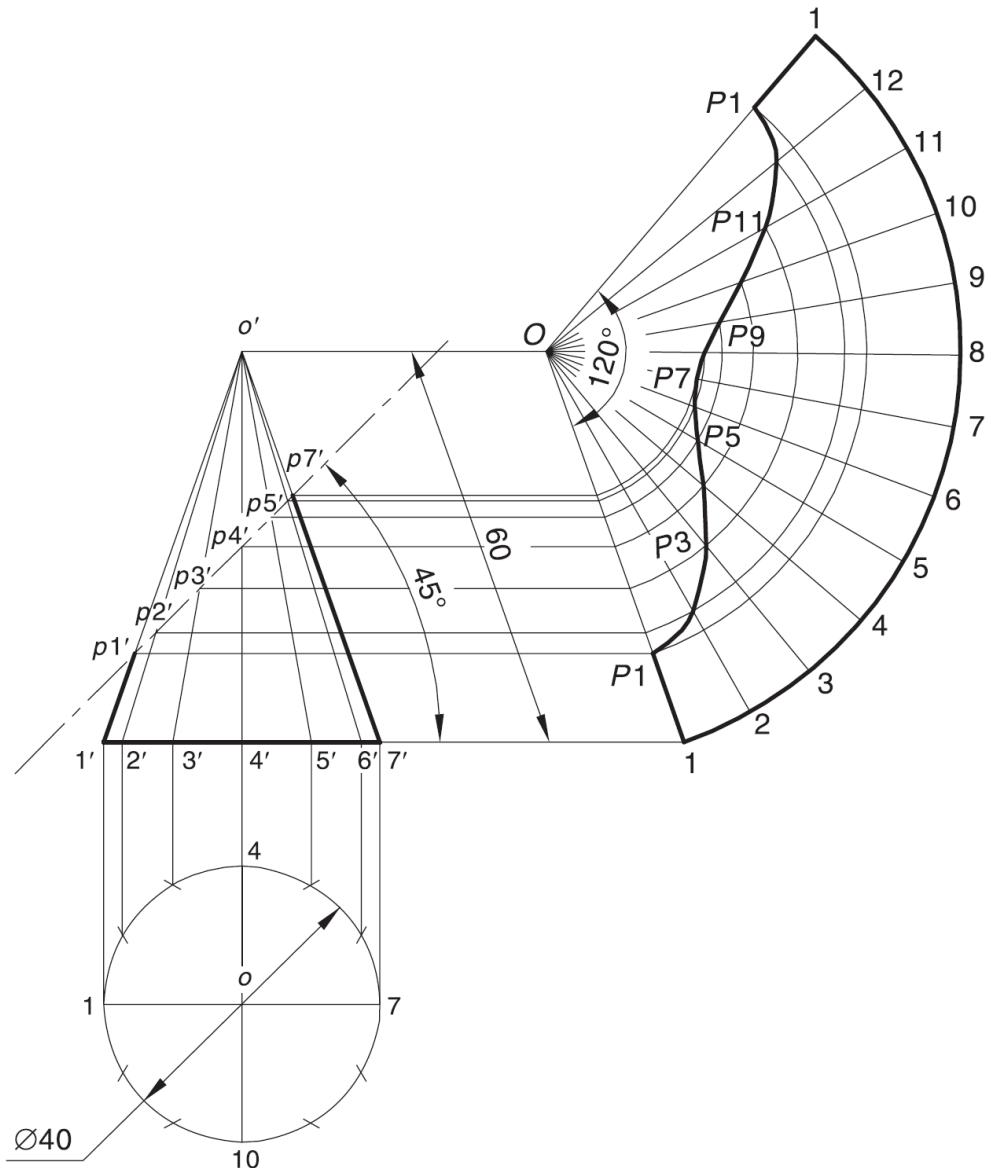
True lengths b<sub>2</sub>, 2o obtained by auxiliary view method



True length of (o<sub>2</sub>, o<sub>3</sub>) = (o<sub>2'</sub>, o<sub>3'</sub>) etc.

- Divide the cone in the top view and project the corresponding generator lines in the front view
- Develop the complete surface of the cone by drawing an arc with radius = length of side generator of cone and length of arc = circumference of cone base
- Draw the corresponding generator lines
- Obtain true lengths of o<sub>1</sub>, o<sub>2</sub> etc. by auxiliary view, rotation method OR by projecting onto one of the side generators (which are in true length)
- Mark the distances (true lengths) o<sub>1</sub>, o<sub>2</sub>...etc. in the development and join them to get the development of the lower portion of the cone





If  $R = 2r$  then  $\theta = 180^\circ$ , i.e., if the slant height of a cone is equal to its diameter of base then its development is a semicircle of radius equal to the slant height.

# THANKS