



# **Unit 6 - Development of Surfaces**

## **Examples**

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

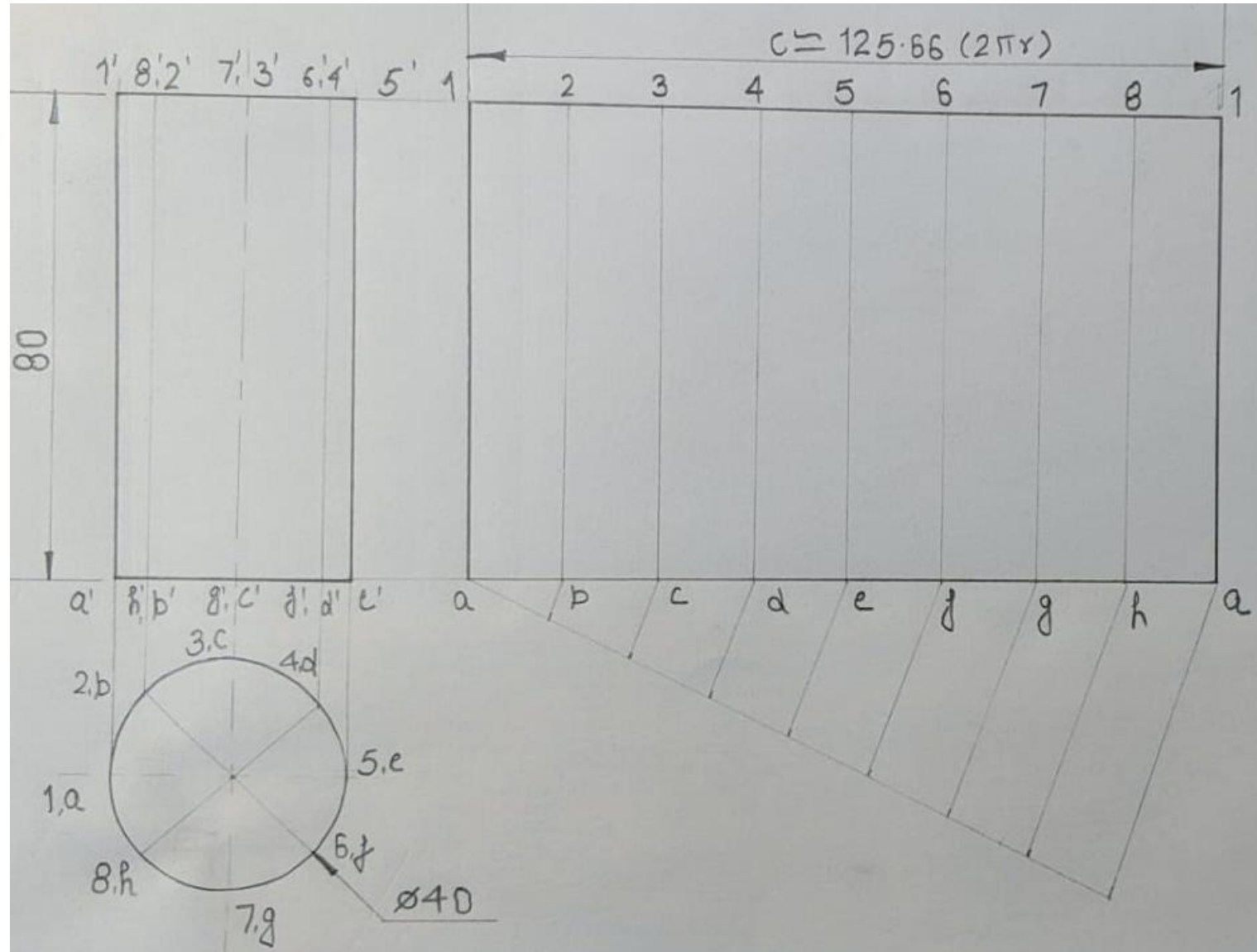


# PARALLEL LINE METHOD

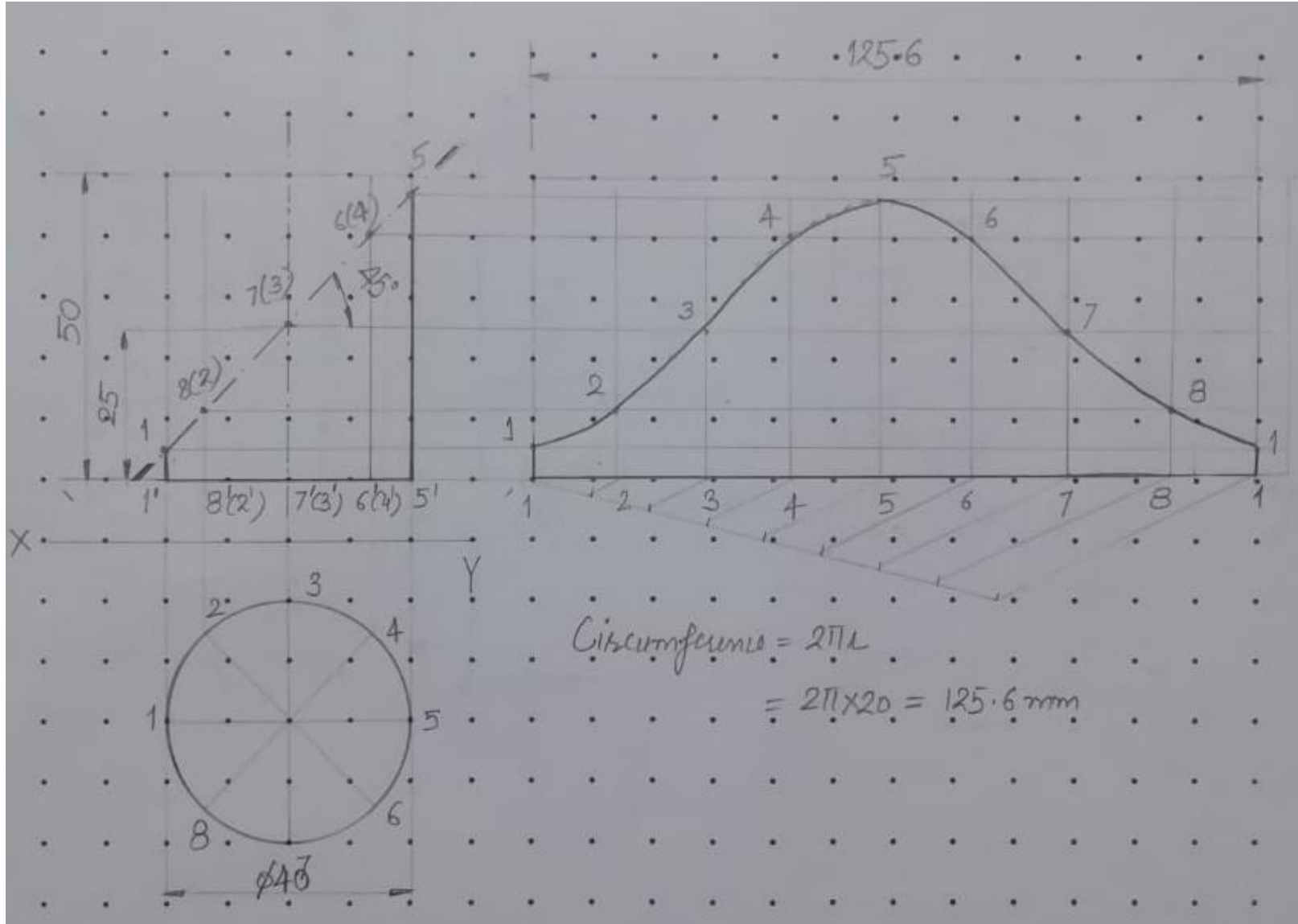
# Development of Cylinder



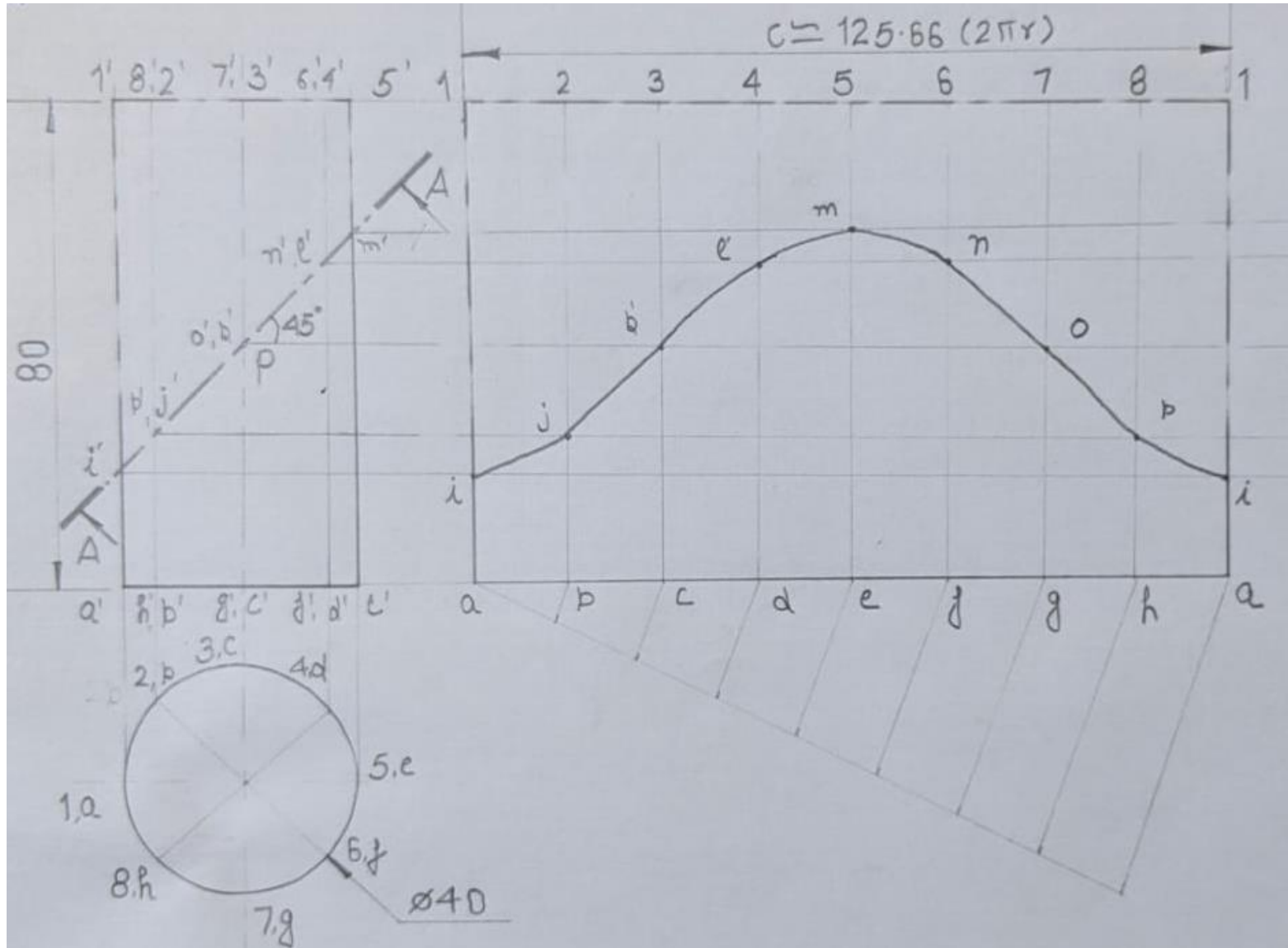
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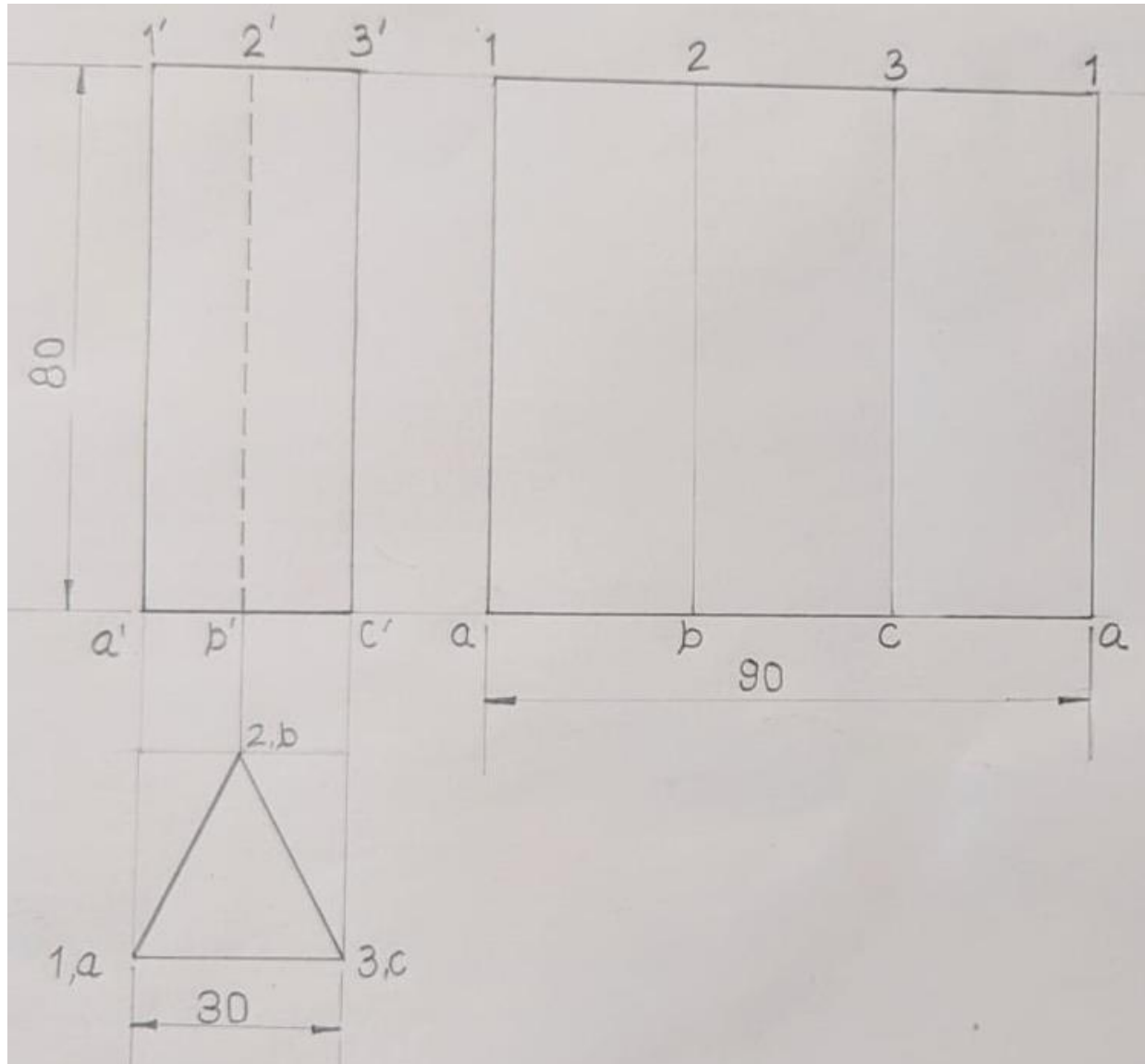
# Development of Truncated Cylinder



# Development of Truncated Cylinder



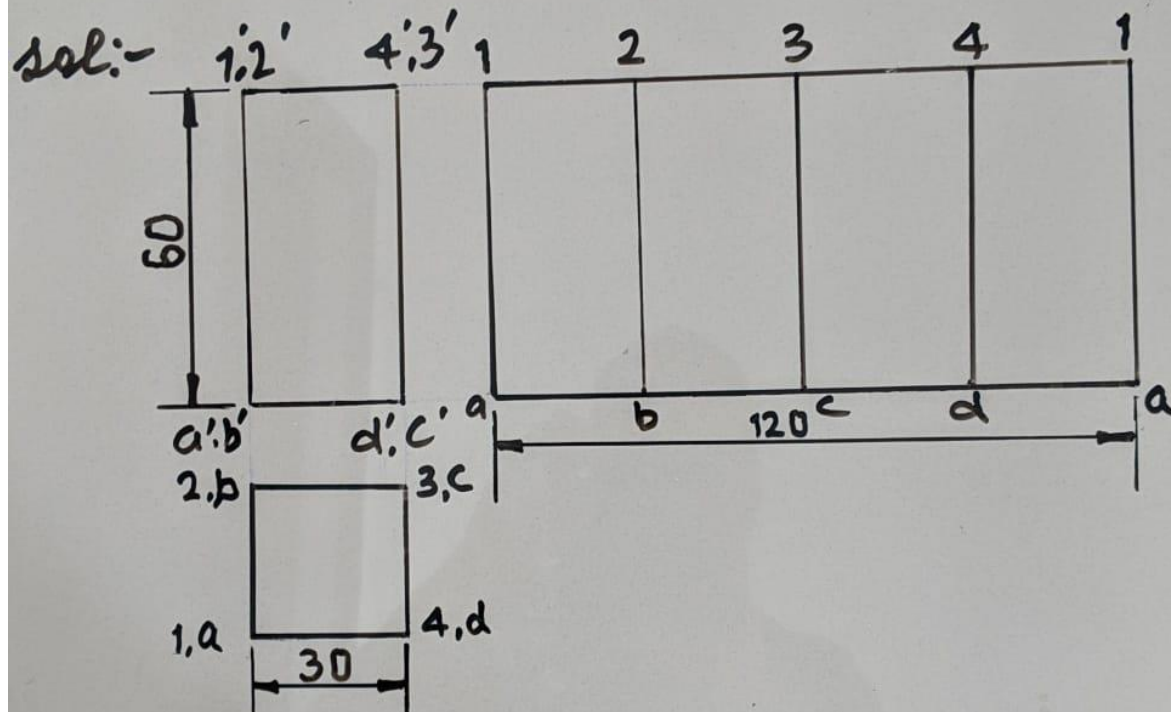
# Development of Triangular Prism



# Development of Square Prism



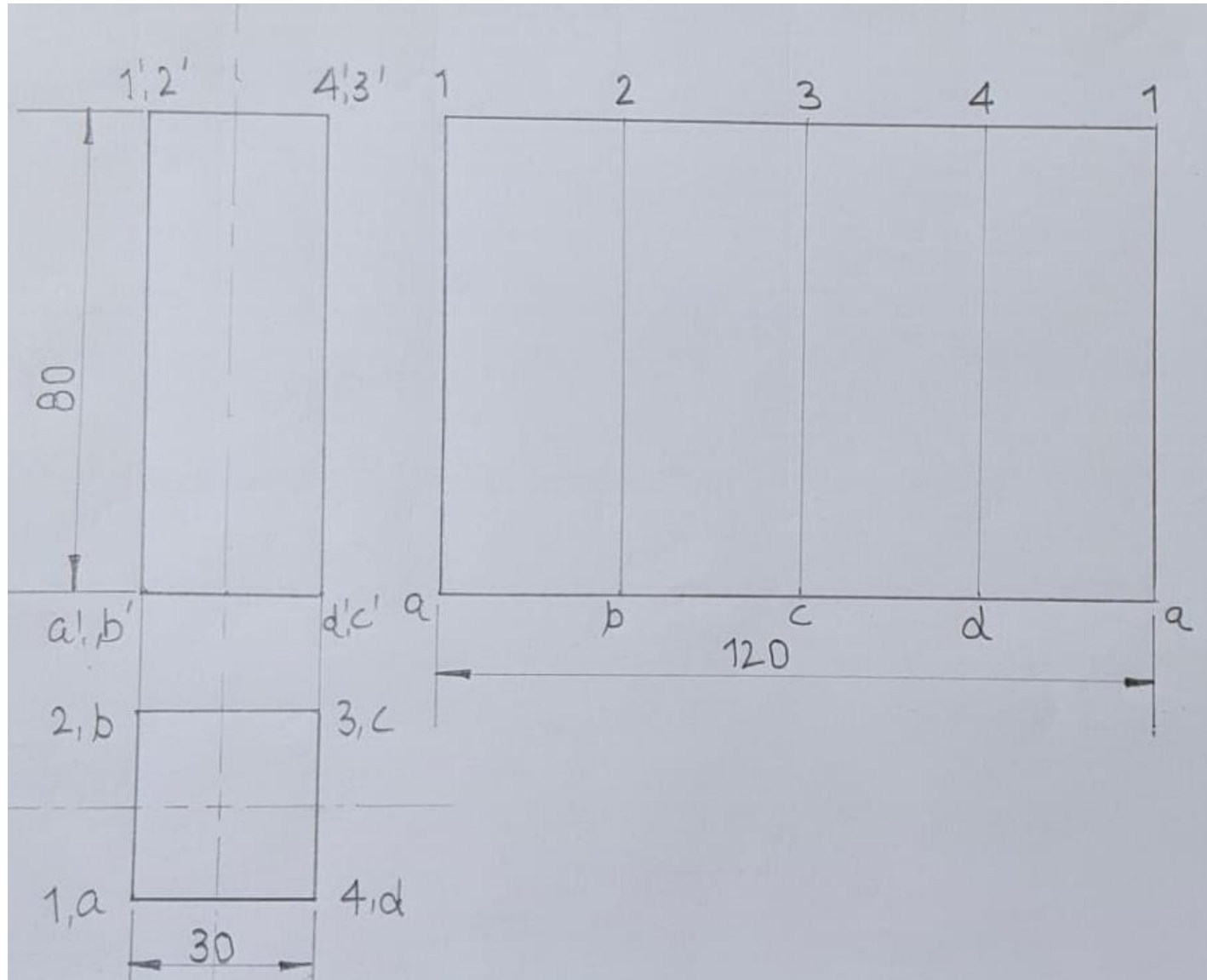
Develop the lateral surface area  
of square prism of base side 30mm  
and height 60mm.



# Development of Square Prism



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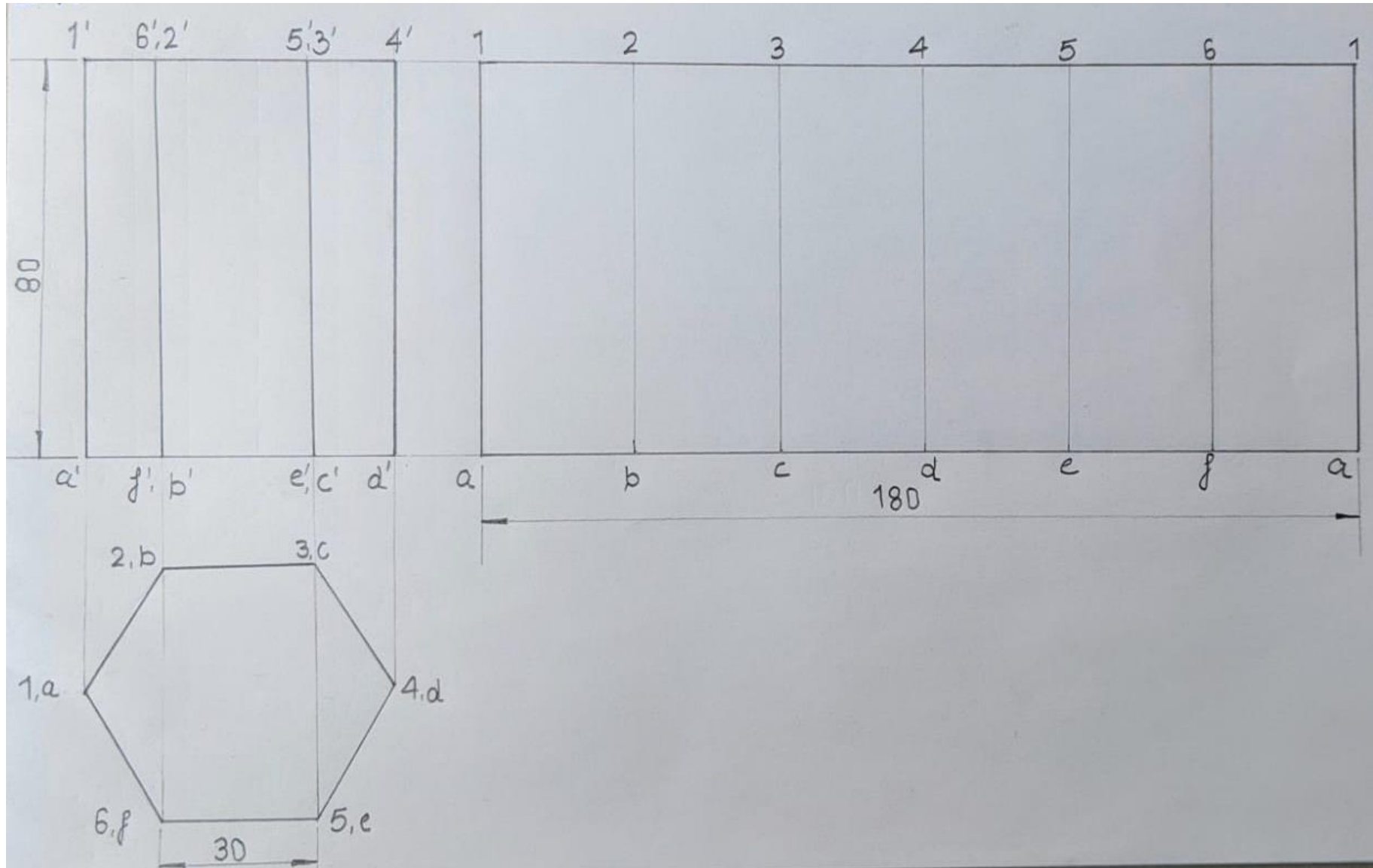




# Development of Hexagonal Prism



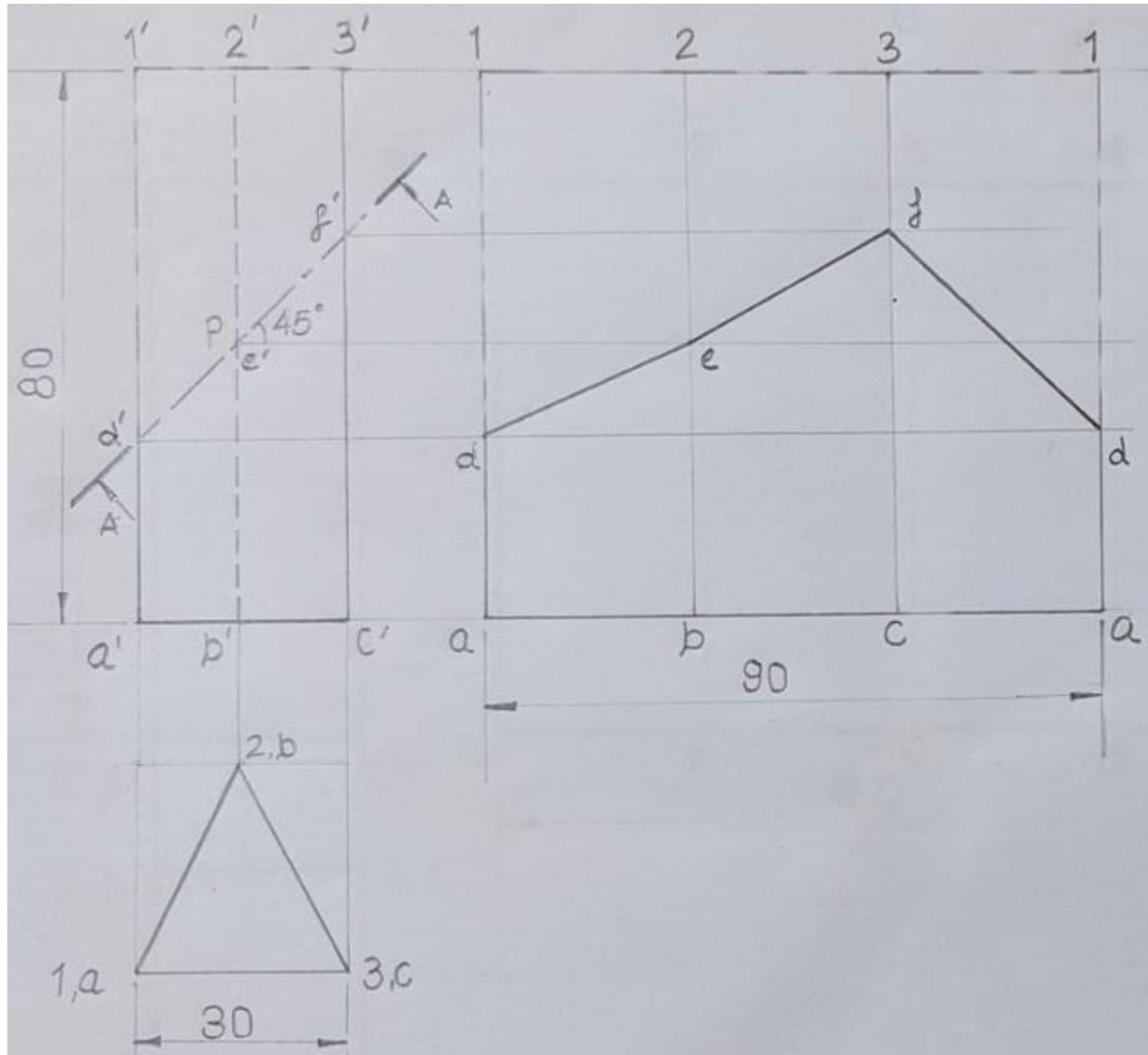
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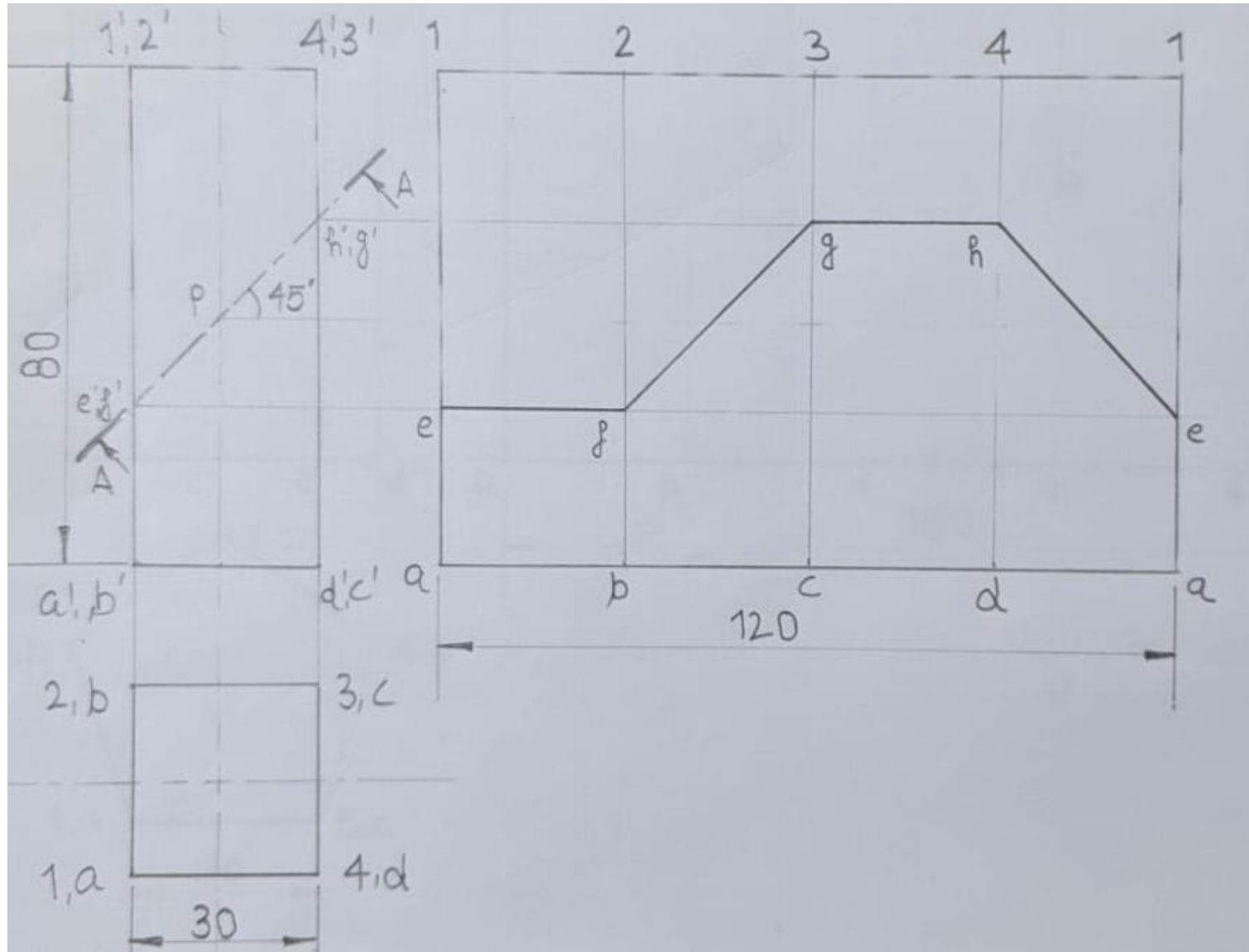
# Development of Truncated Triangular Prism



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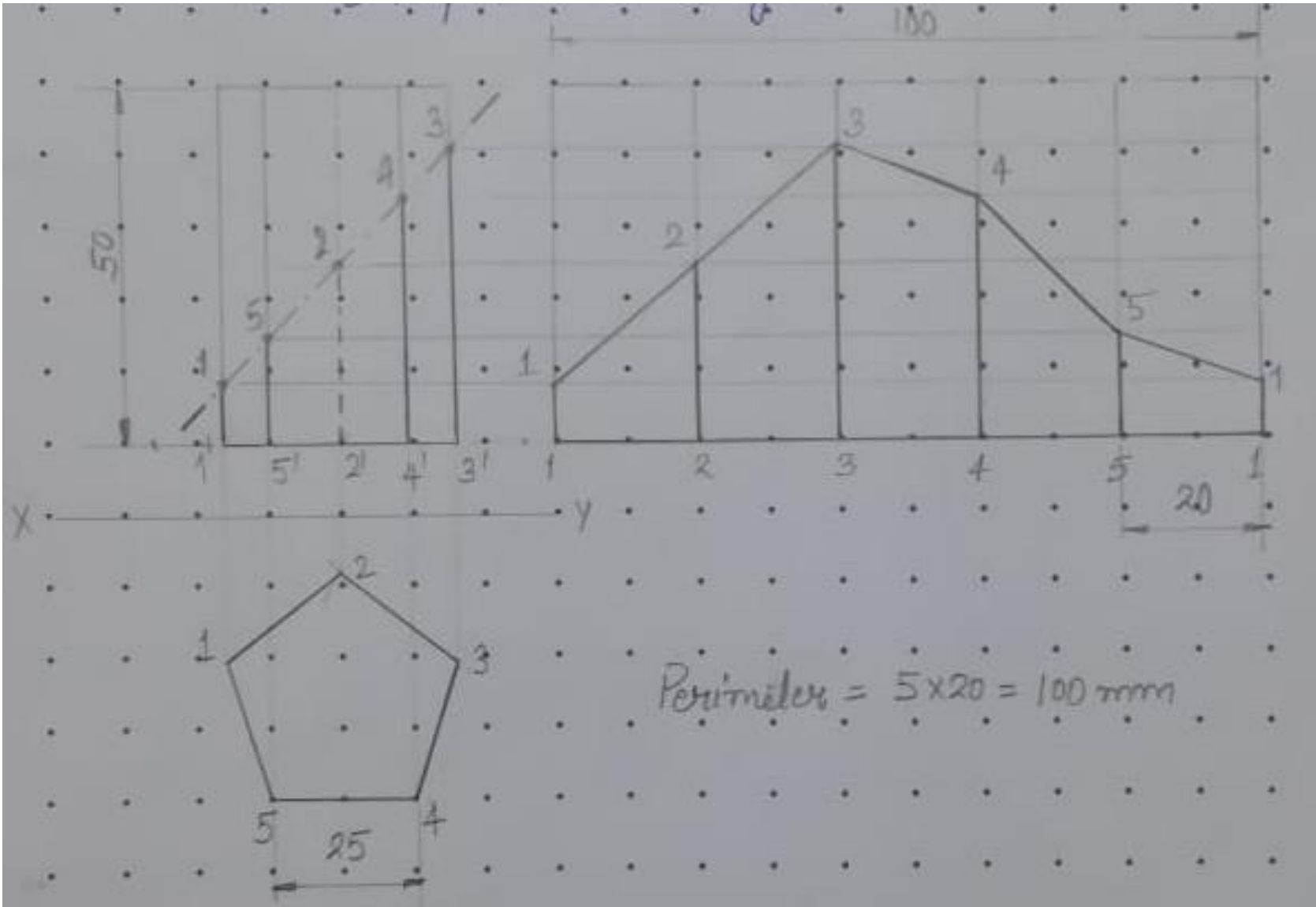
# Development of Truncated Square Prism



# Development of Truncated Pentagonal Prism



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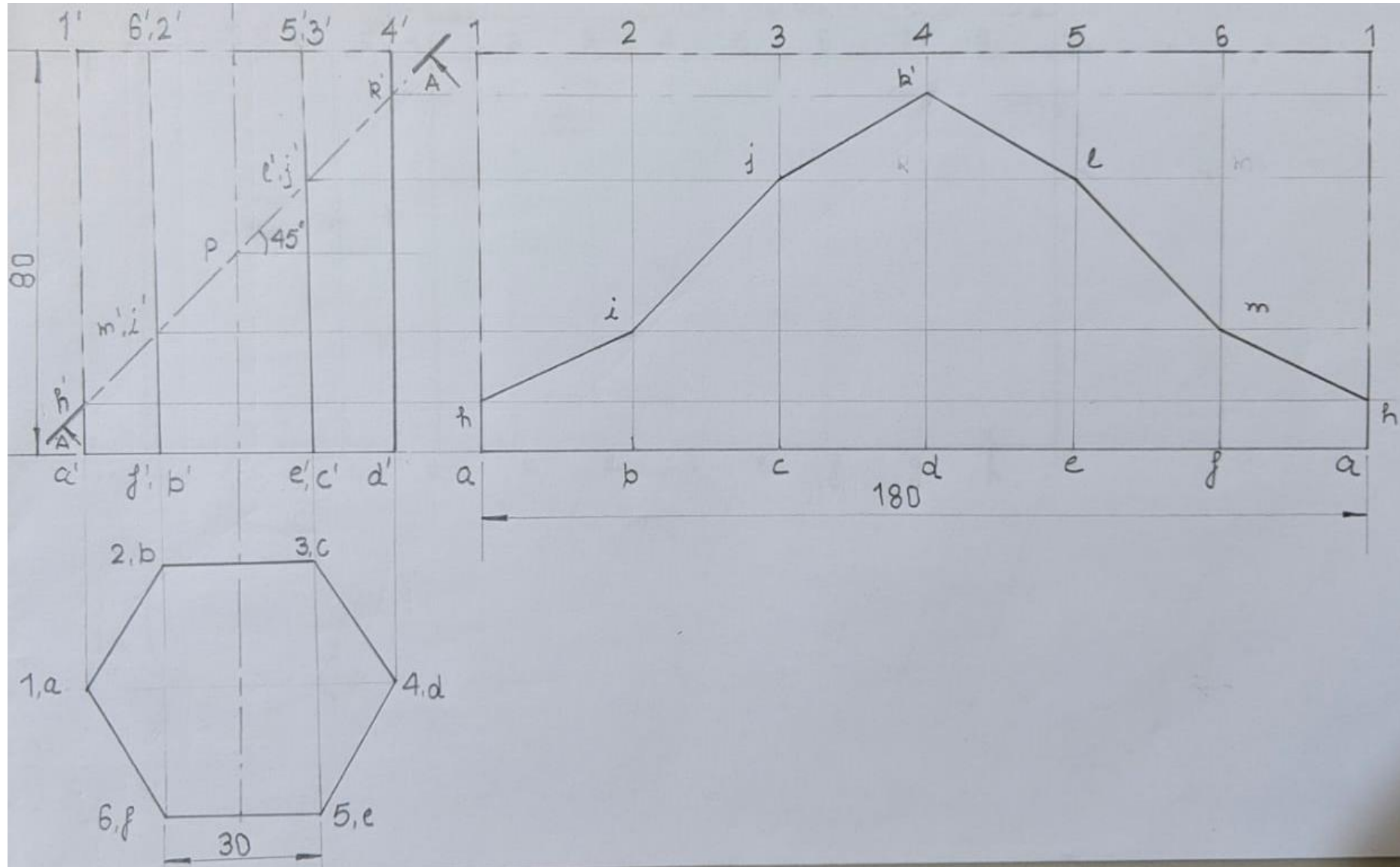


$$\text{Perimeter} = 5 \times 20 = 100 \text{ mm}$$

# Development of Truncated Hexagonal Prism



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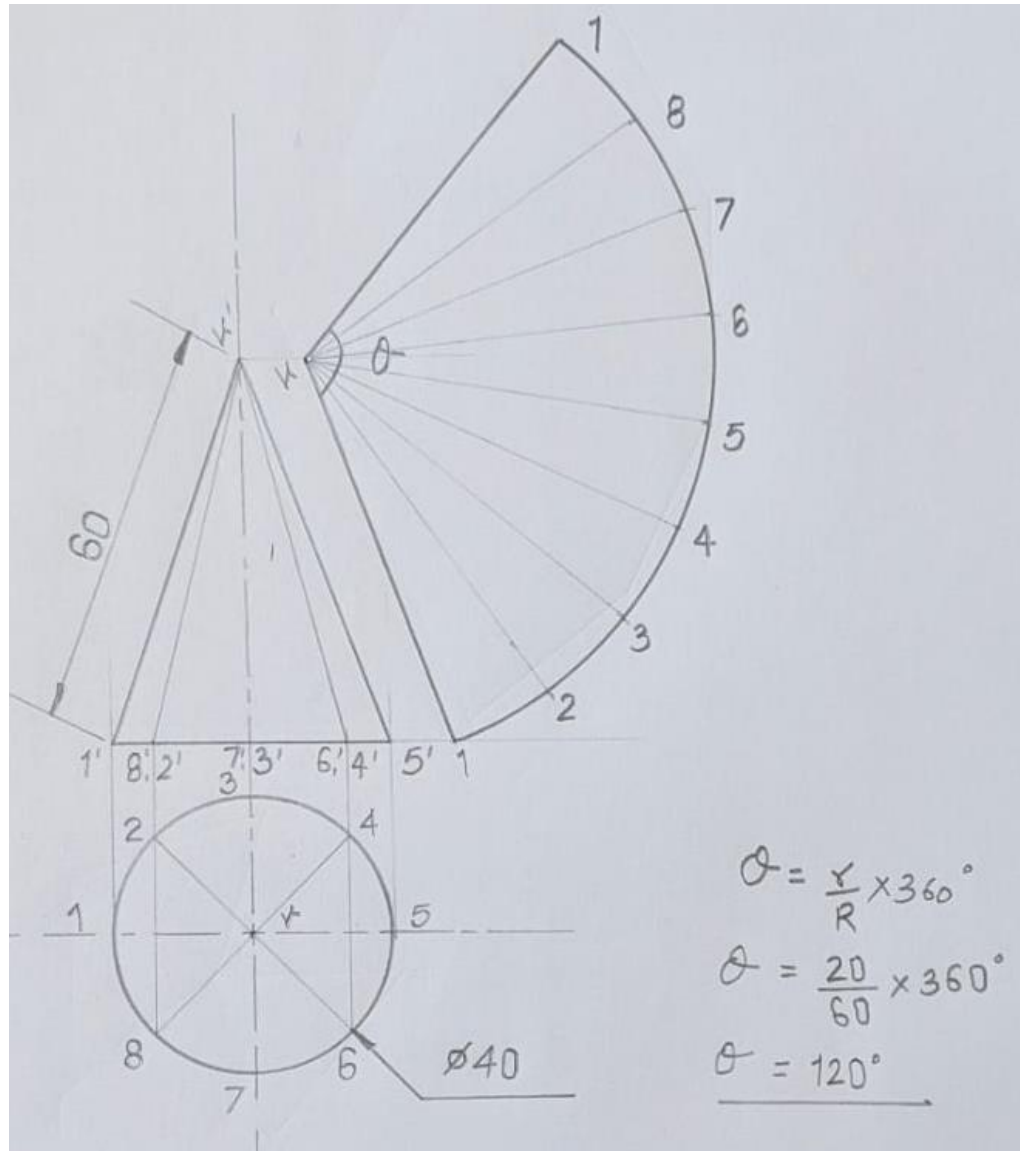
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# **RADIAL LINE METHOD**

# Development of Cone

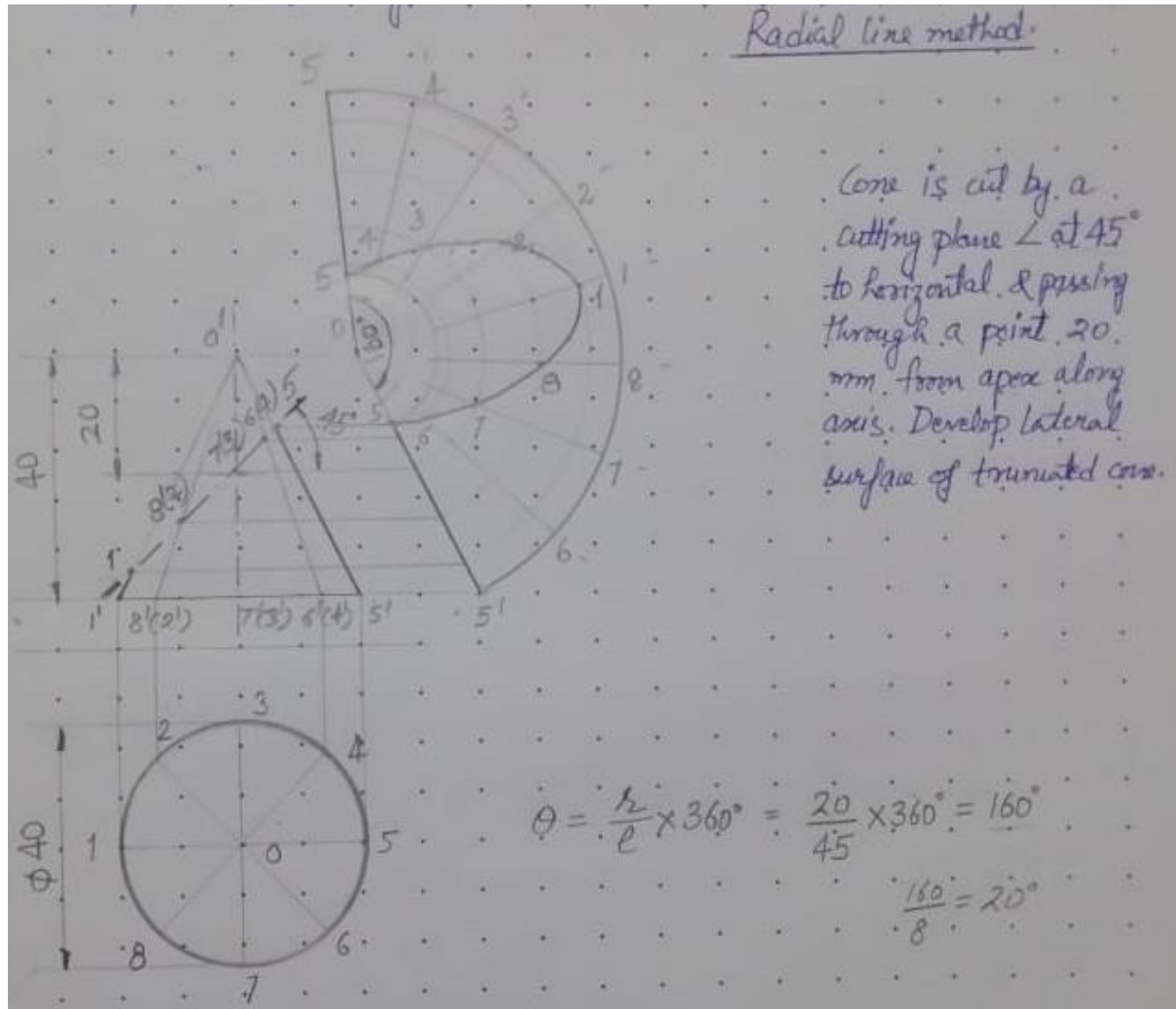


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# Development of Truncated Cone

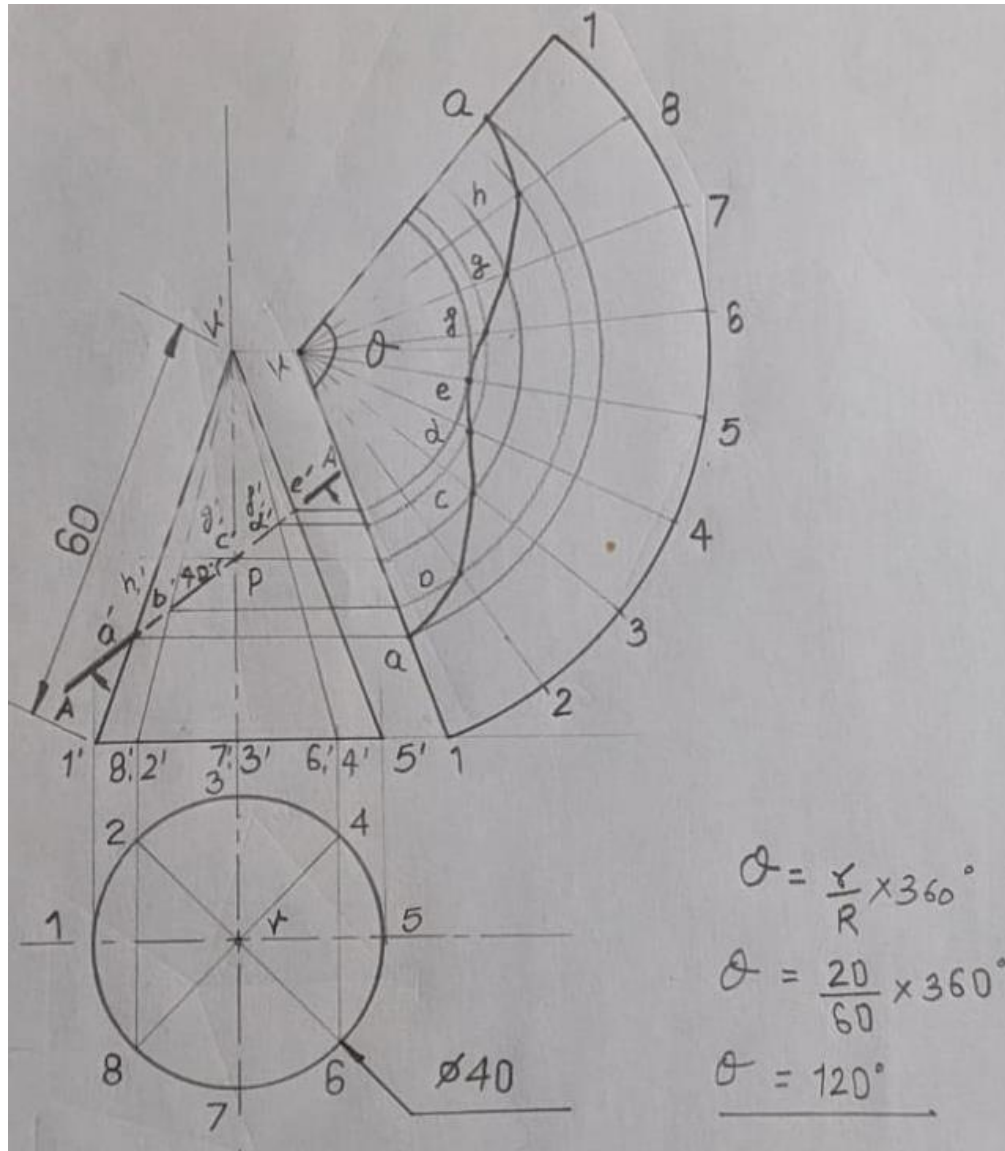




# Development of Truncated Cone



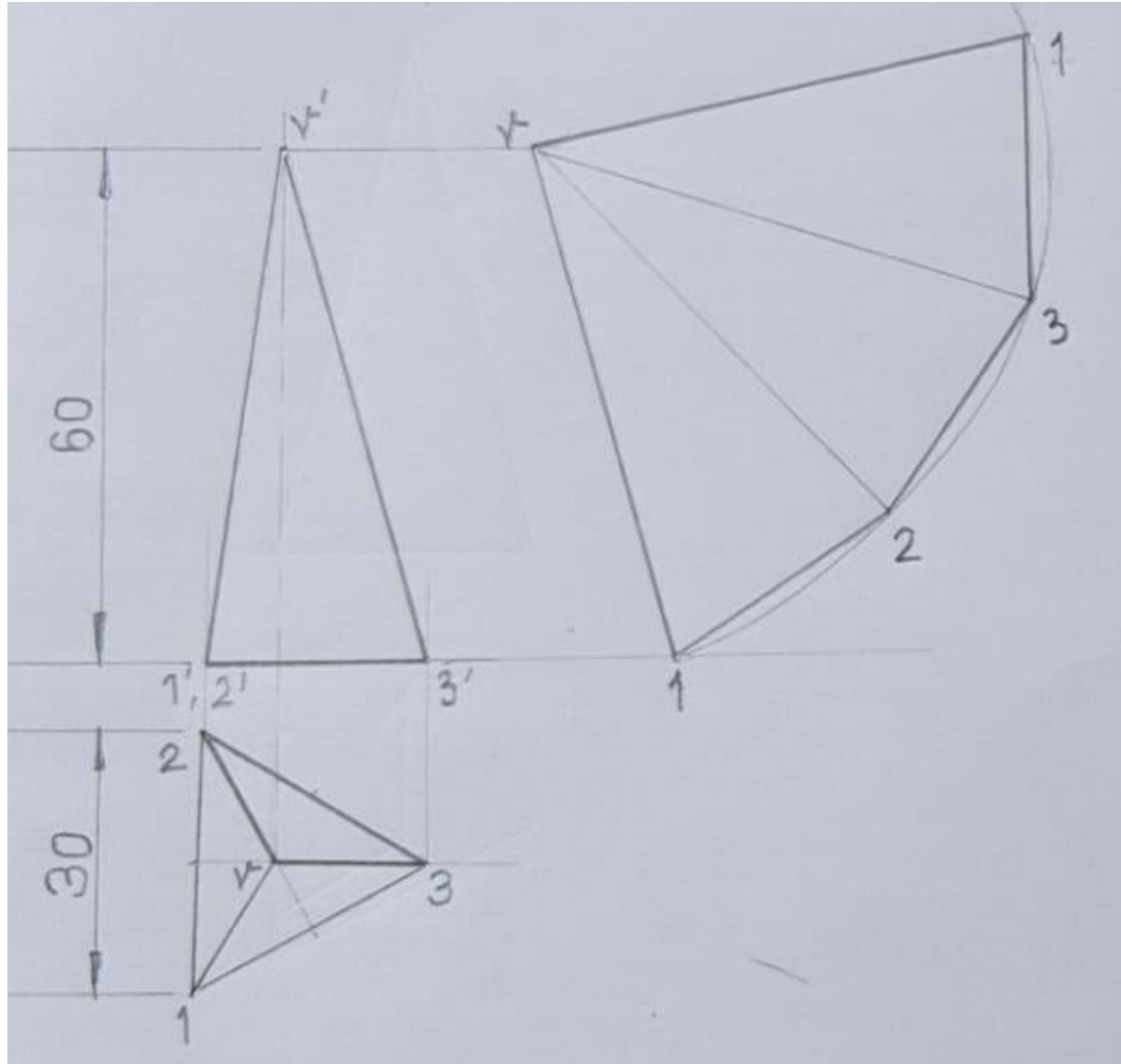
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# Development of Triangular Pyramid



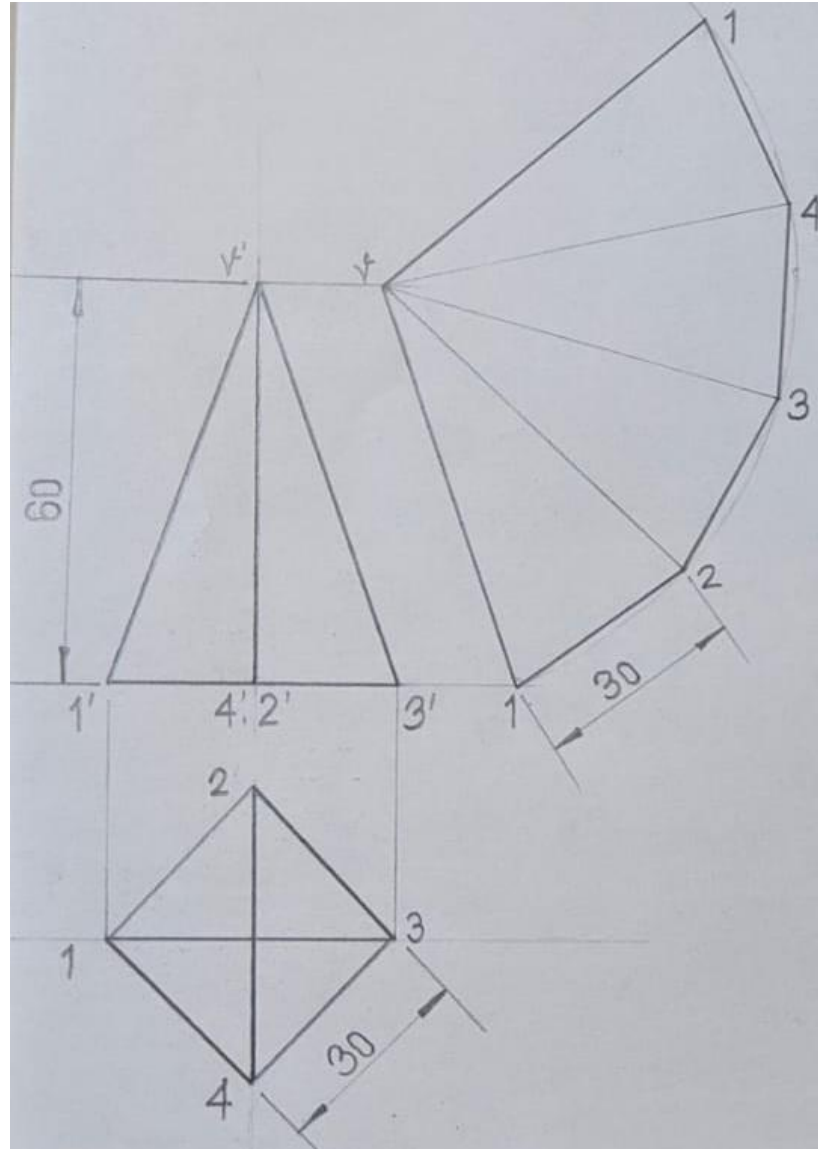
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# Development of Square Pyramid



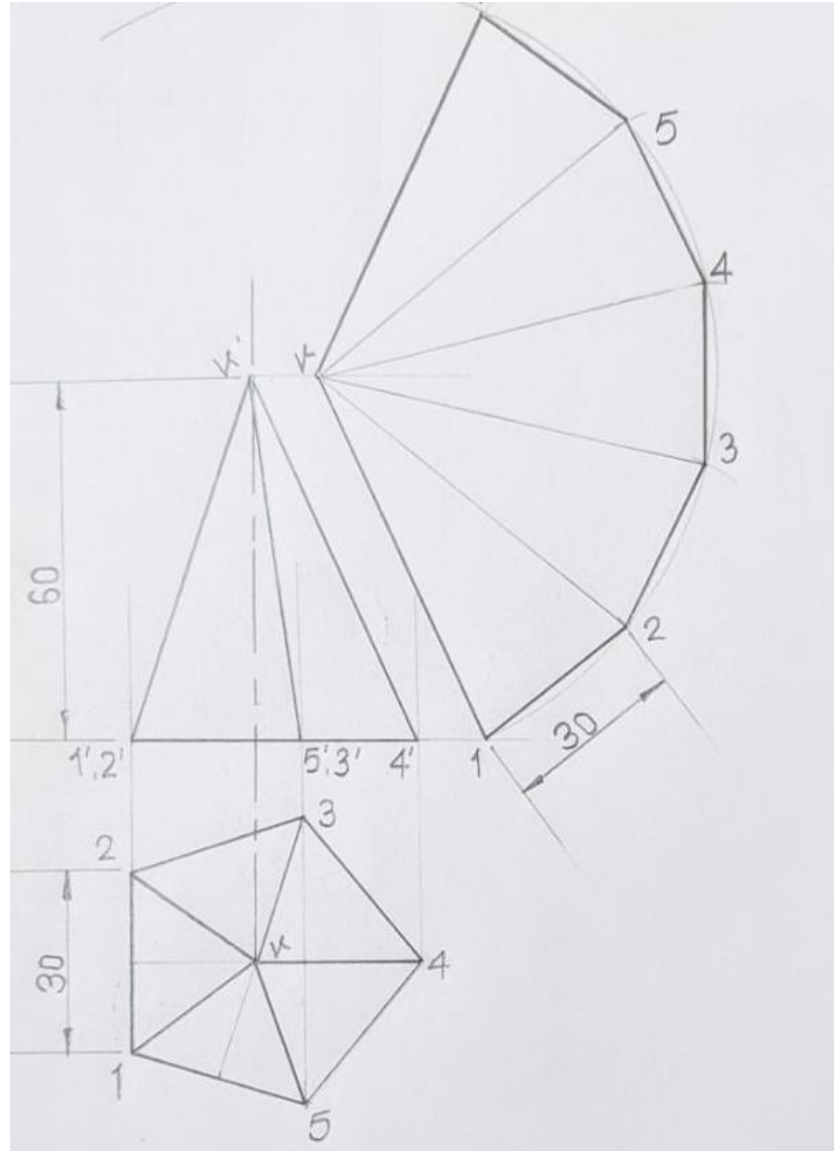
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# Development of Pentagonal Pyramid



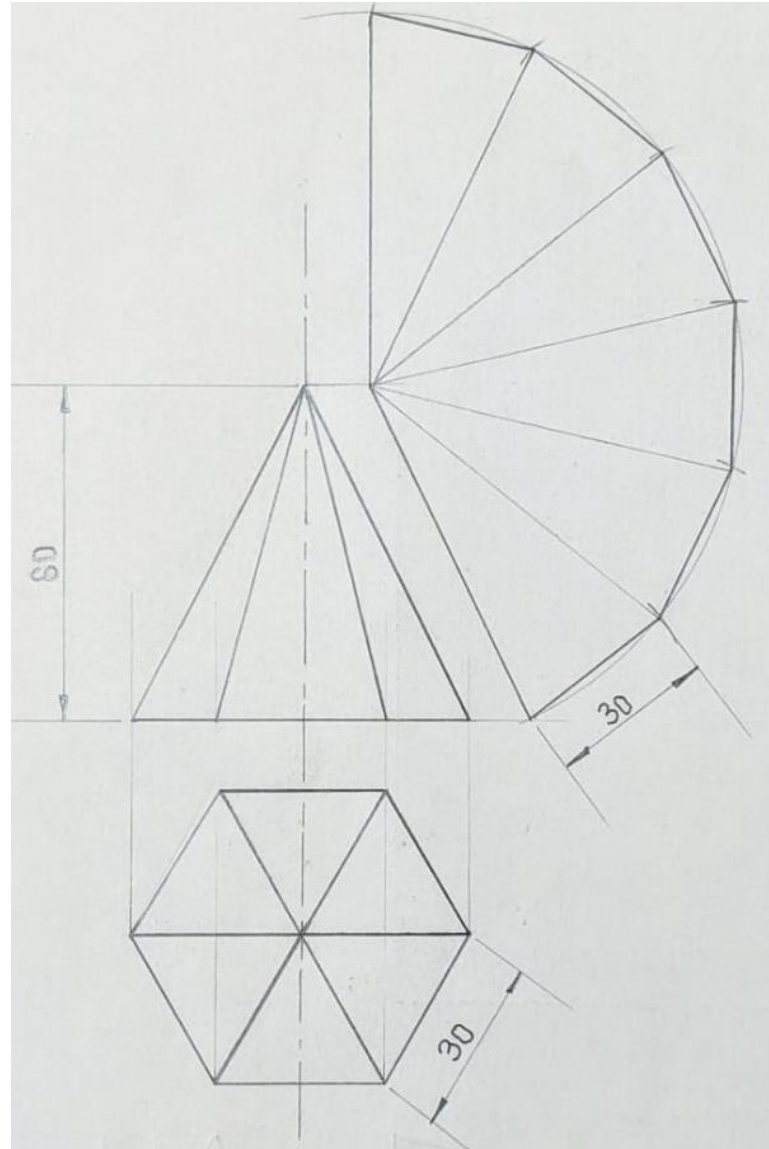
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# Development of Hexagonal Pyramid



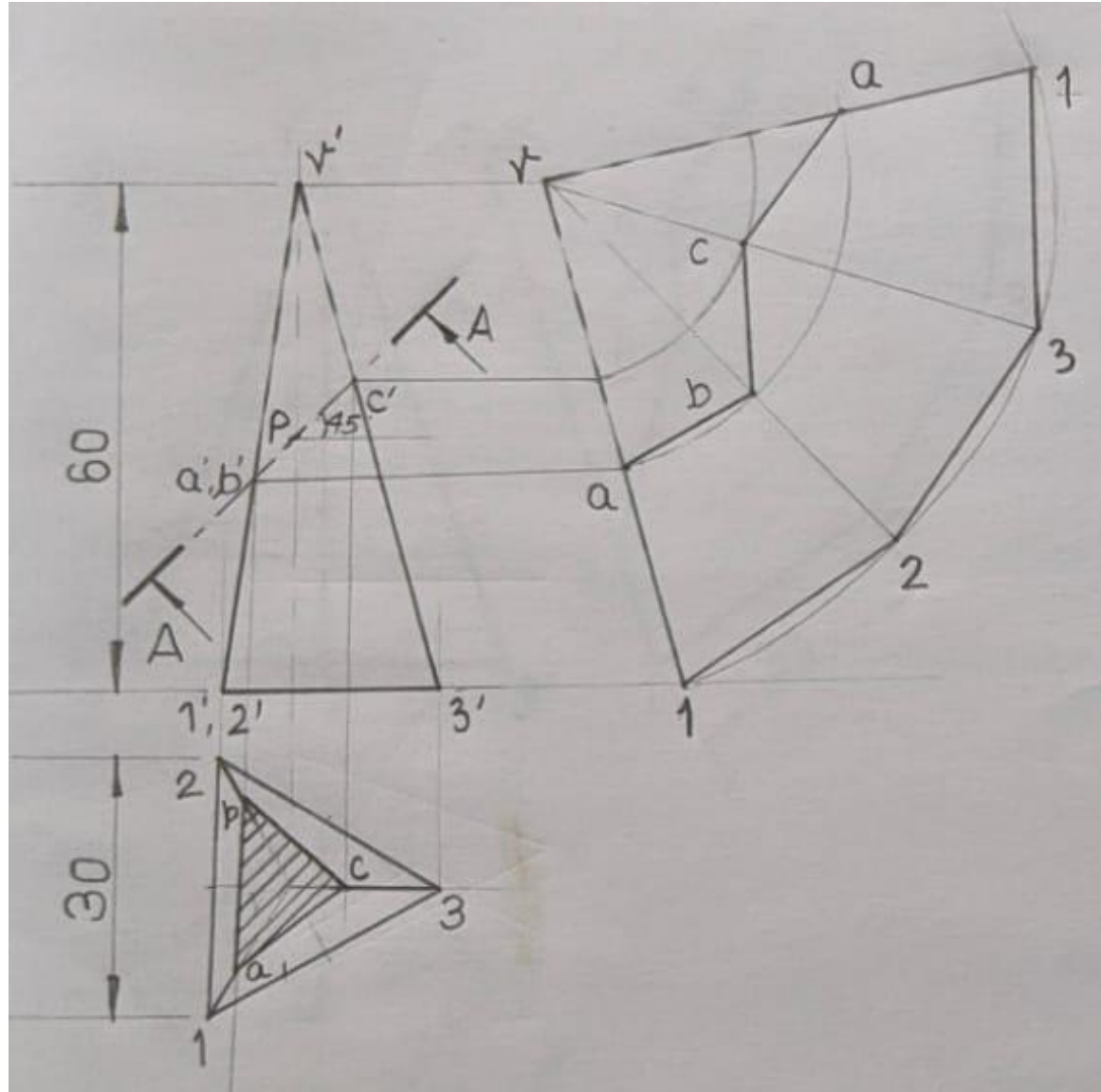
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# Development of Truncated Triangular Pyramid



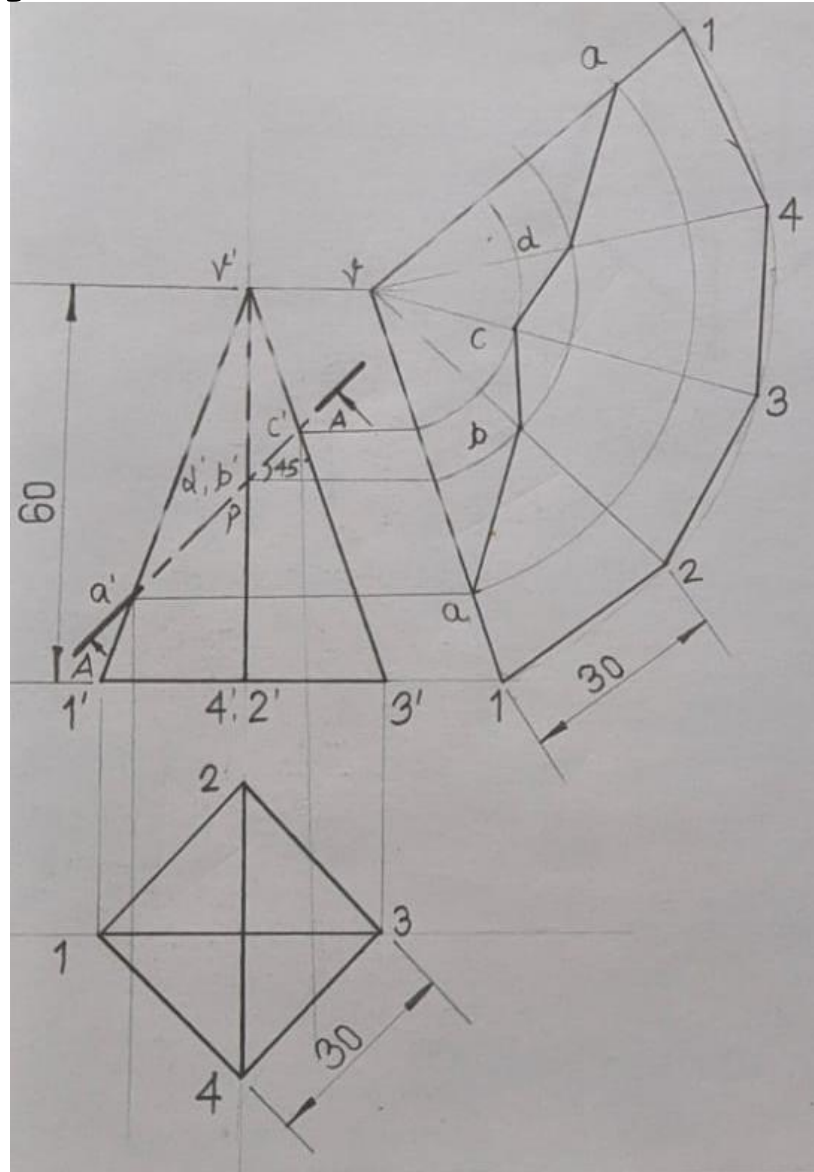
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# Development of Truncated Square Pyramid



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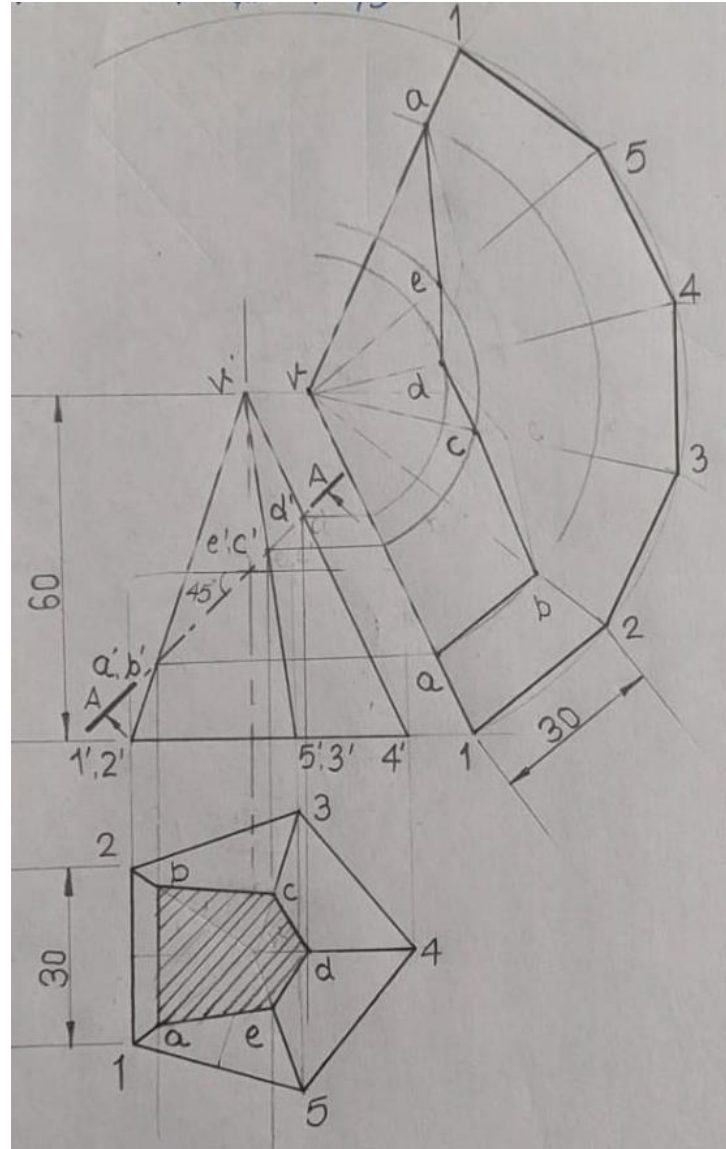




# Development of Truncated Pentagonal Pyramid

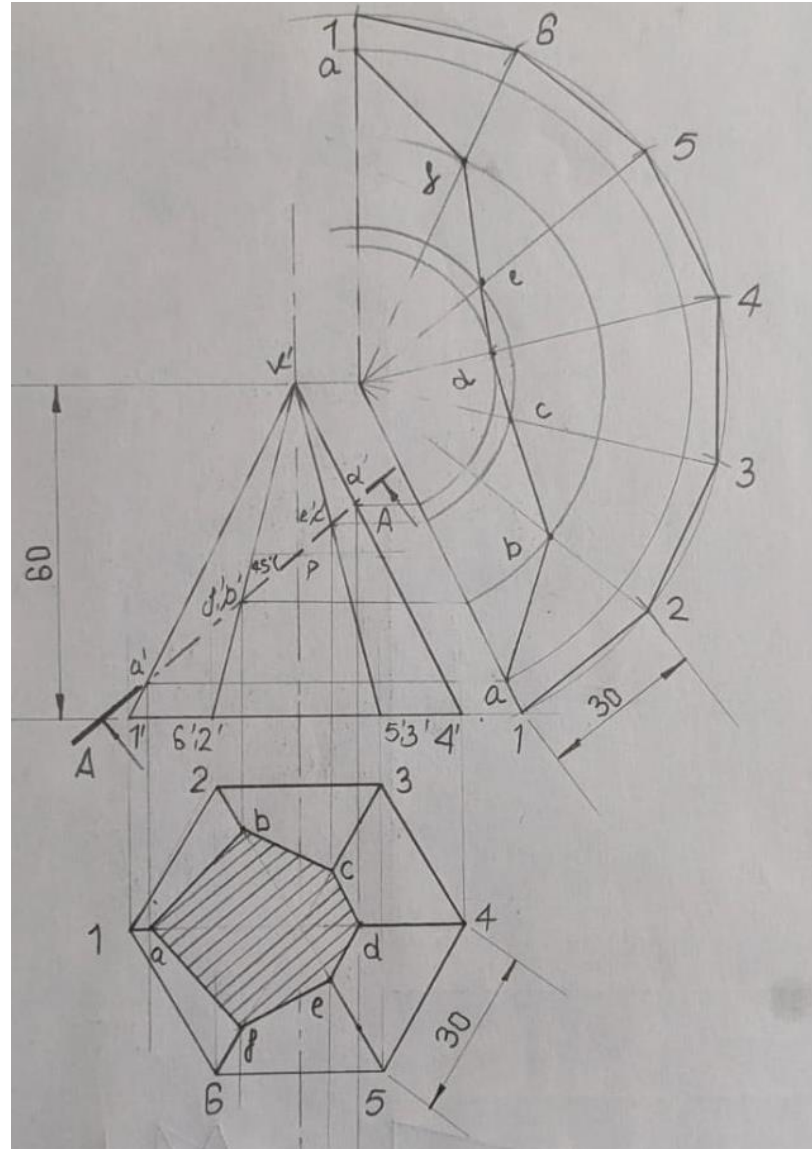


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# Development of Truncated Hexagonal Pyramid

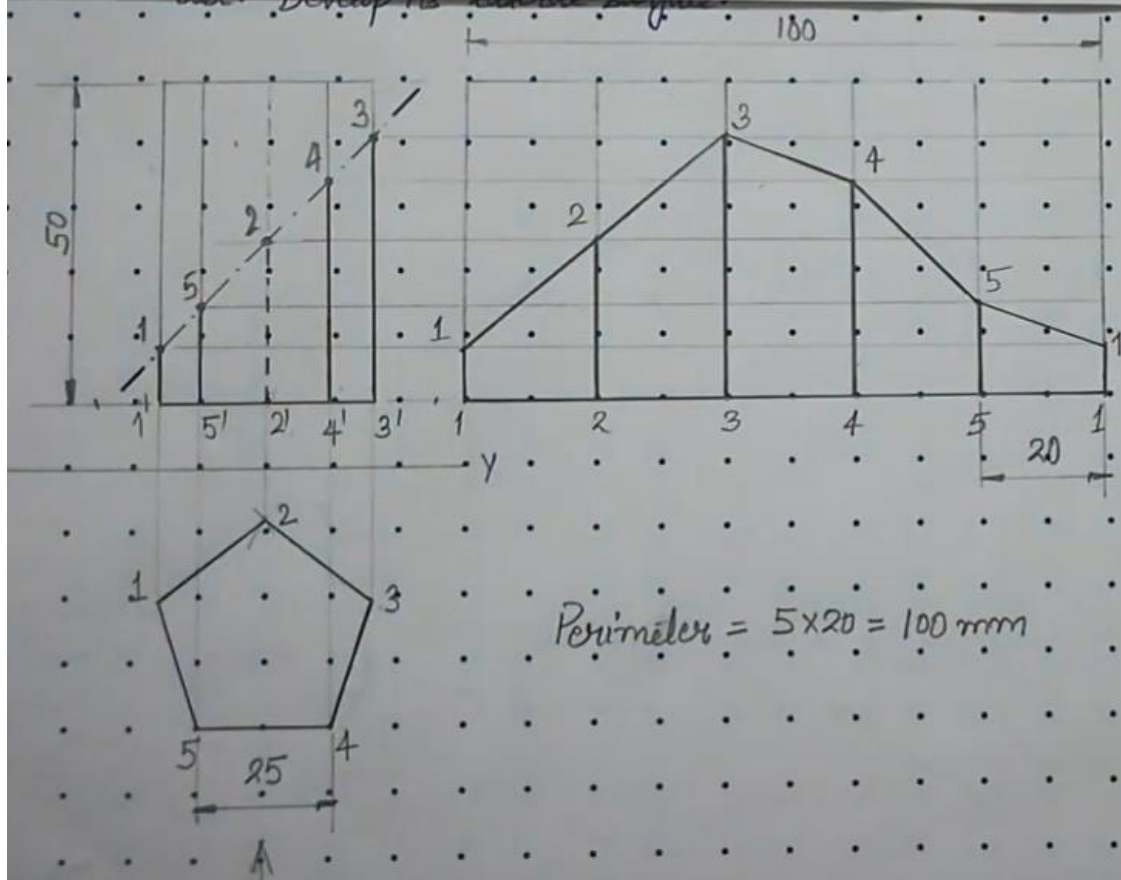




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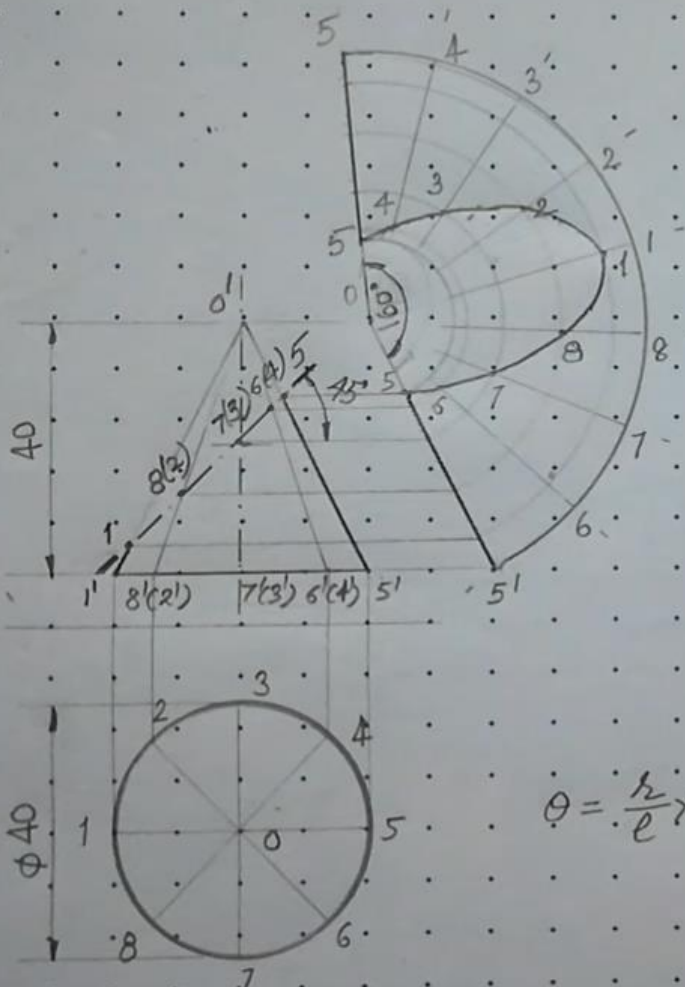
**THANKS**

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,

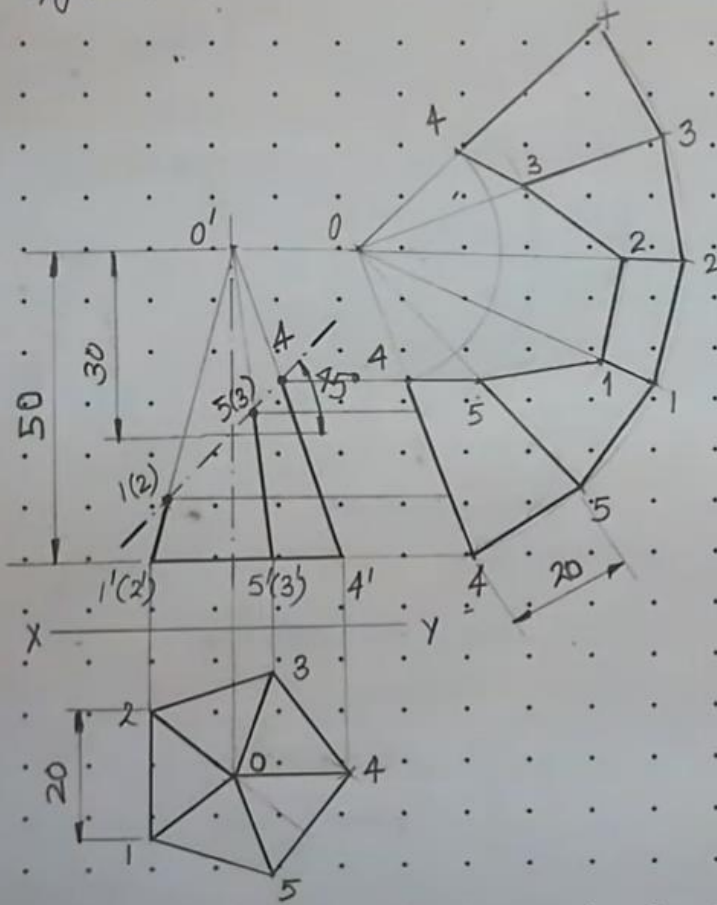


Cone is cut by a cutting plane  $\angle$  at  $45^\circ$  to horizontal & passing through a point  $20\text{ mm}$  from apex along axis. Develop lateral surface of truncated cone.

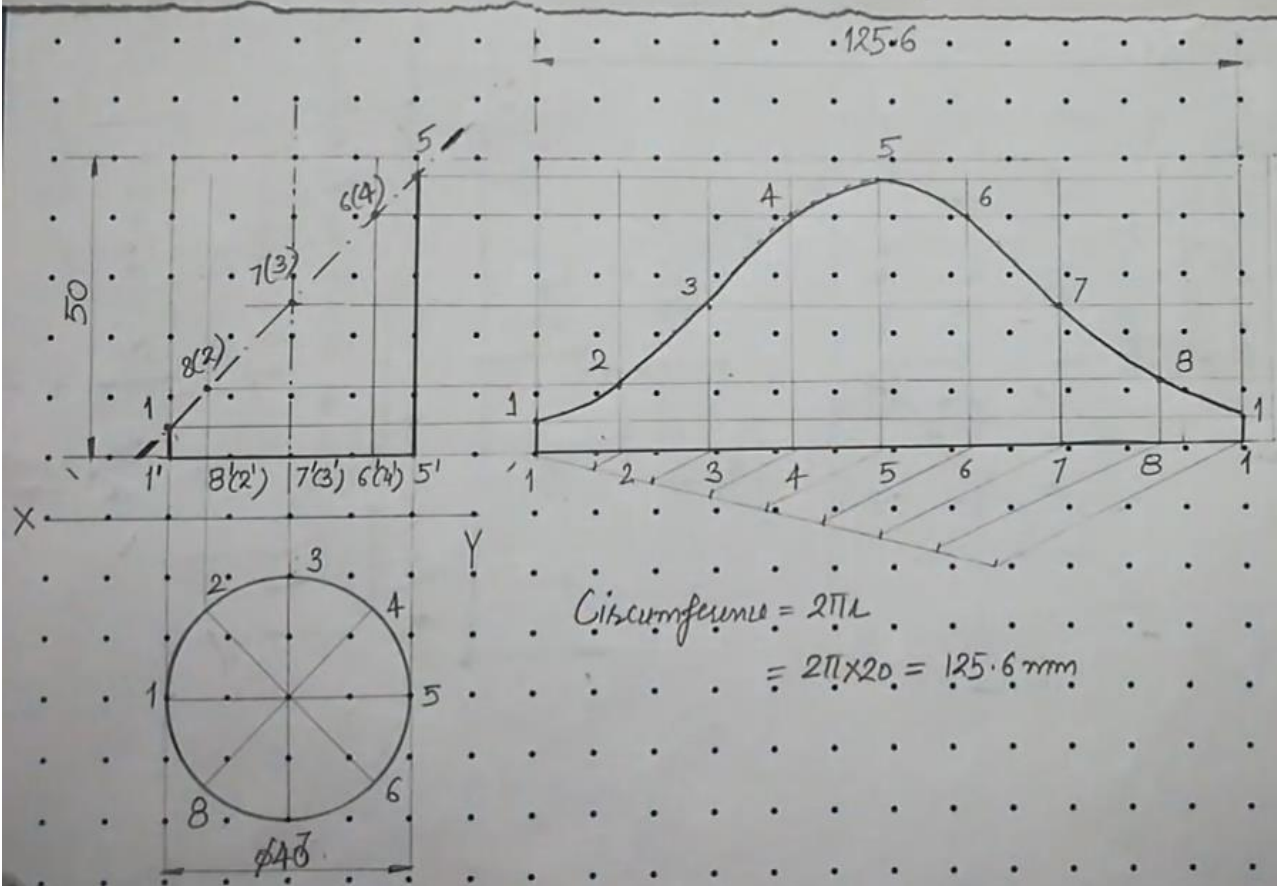
$$\theta = \frac{h}{l} \times 360^\circ = \frac{20}{45} \times 360^\circ = 160^\circ$$

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

Q1: A pentagonal pyramid of base 20 mm & height <sup>50</sup> 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**



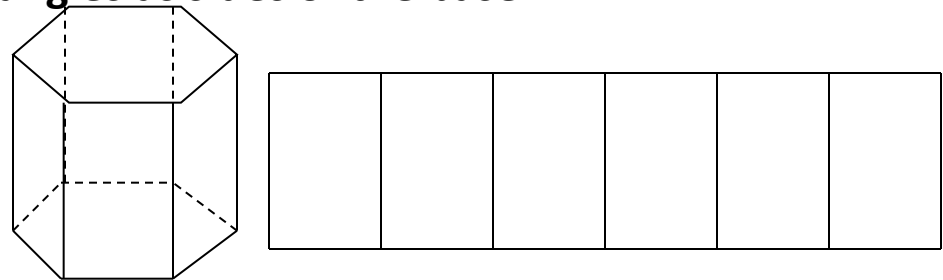
**Development is a graphical method of obtaining the area of the surfaces of a solid. When a solid is opened out and its complete surface is laid on a plane, the surface of the solid is said to be developed. The figure thus obtained is called a *development of the surfaces of the solid* or simply *development*.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

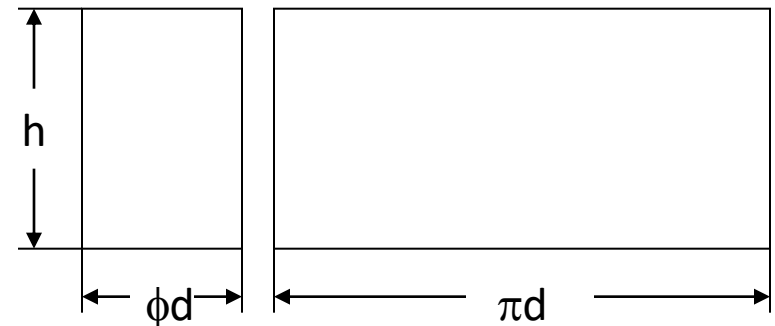
Other side: Side of the base



**Cylinder – Rectangle**

One side: Circumference of the base

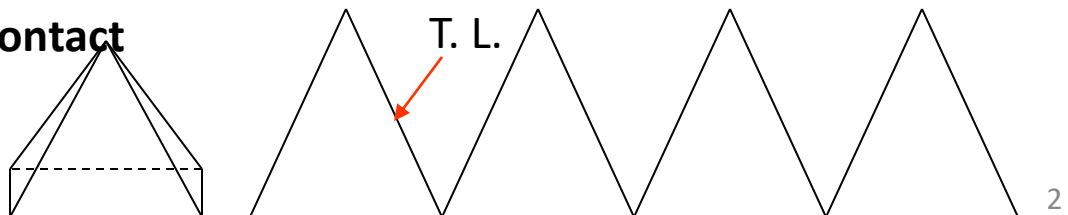
Other side: Height of the cylinder



**Pyramid – Number of triangles in contact**

The base may be included

if present



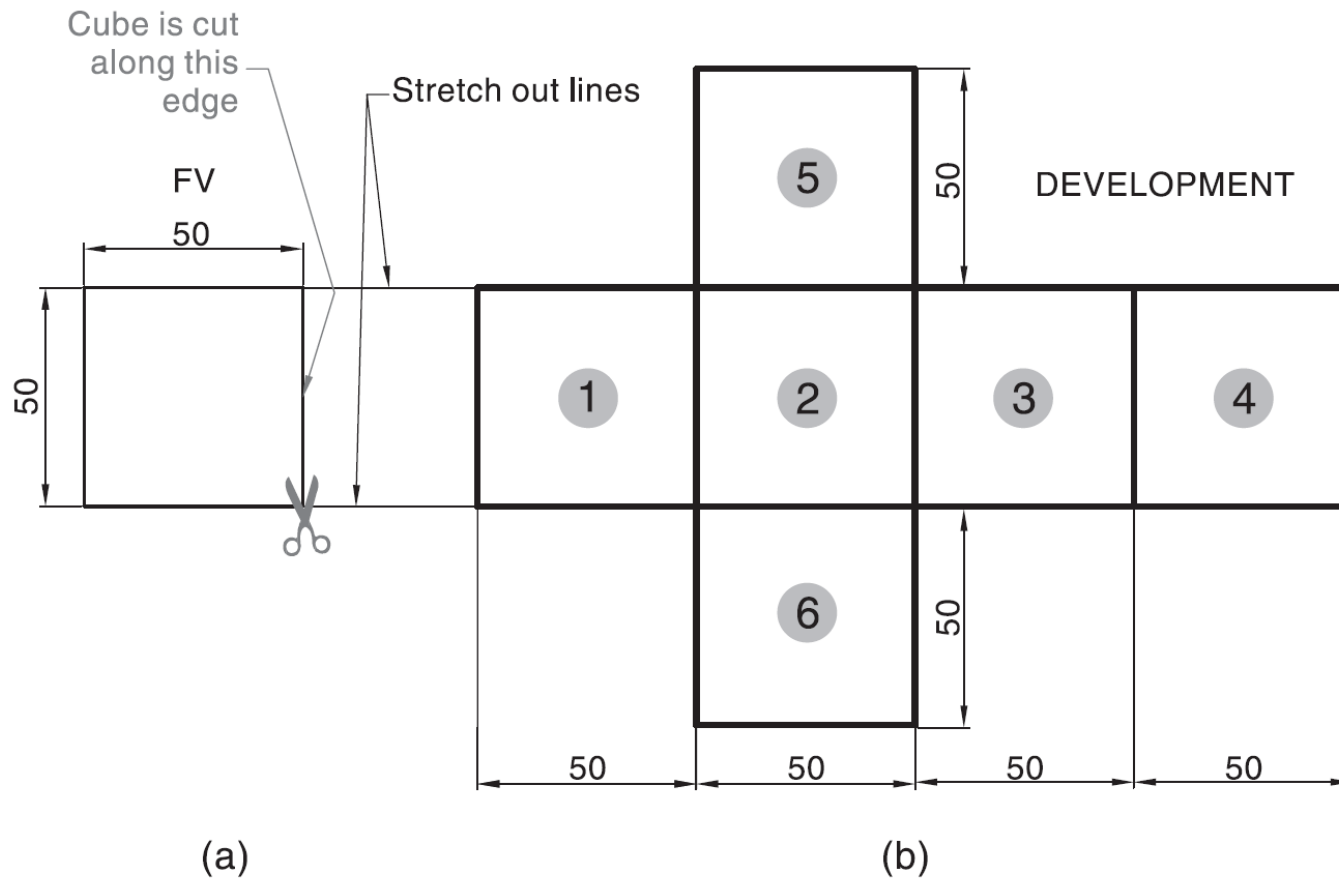


# Methods used to develop surfaces

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.

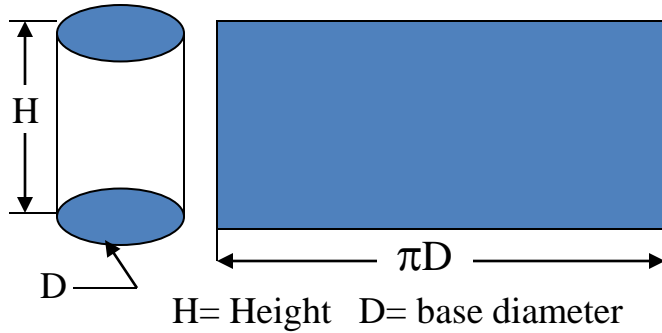
**Parallel line development:** This method is employed to develop the surfaces of prisms and cylinders. Two parallel lines (called *stretch-out lines*) are drawn from the two ends of the solids and the lateral faces are located between these lines.



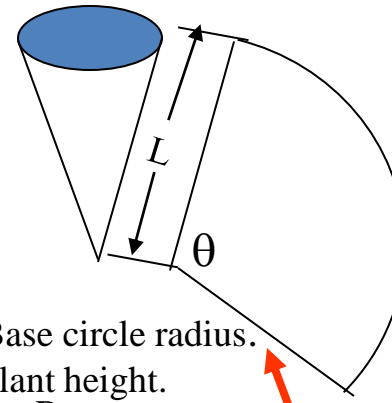
# Development of lateral surfaces of different solids. (Lateral surface is the surface excluding top & base)



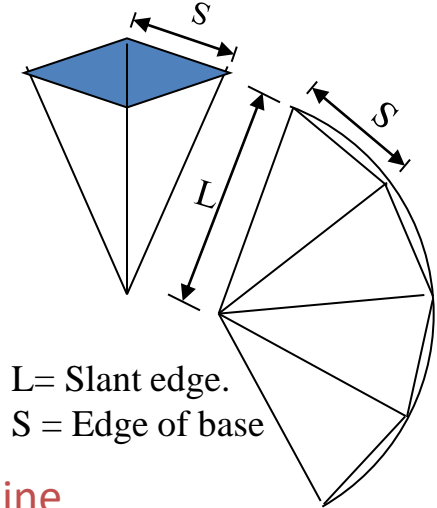
*Cylinder:* A Rectangle



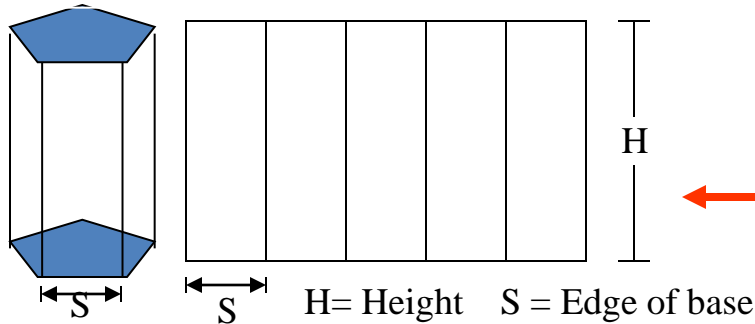
*Cone:* (Sector of circle)



*Pyramids:* (No. of triangles)



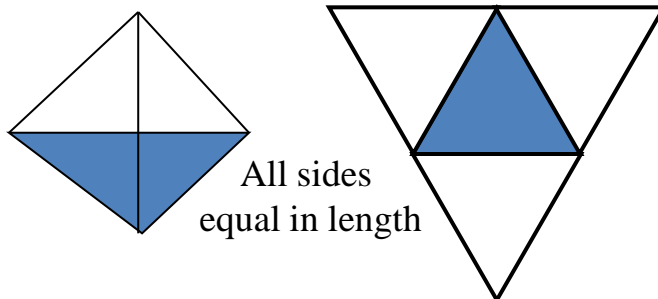
*Prisms:* No. of Rectangles



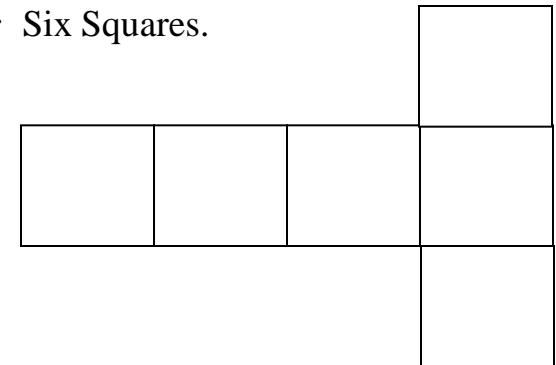
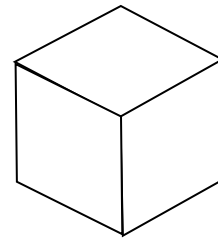
Radial-line  
development

Parallel-line  
development

*Tetrahedron:* Four Equilateral Triangles

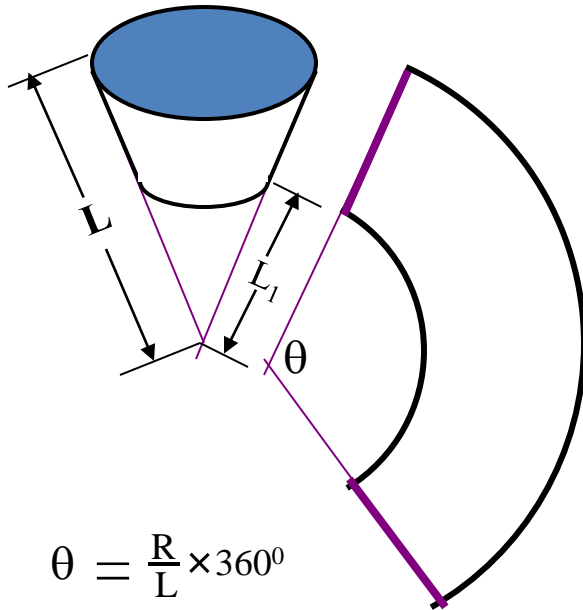


*Cube:* Six Squares.



# FRUSTUMS

## DEVELOPMENT OF FRUSTUM OF CONE



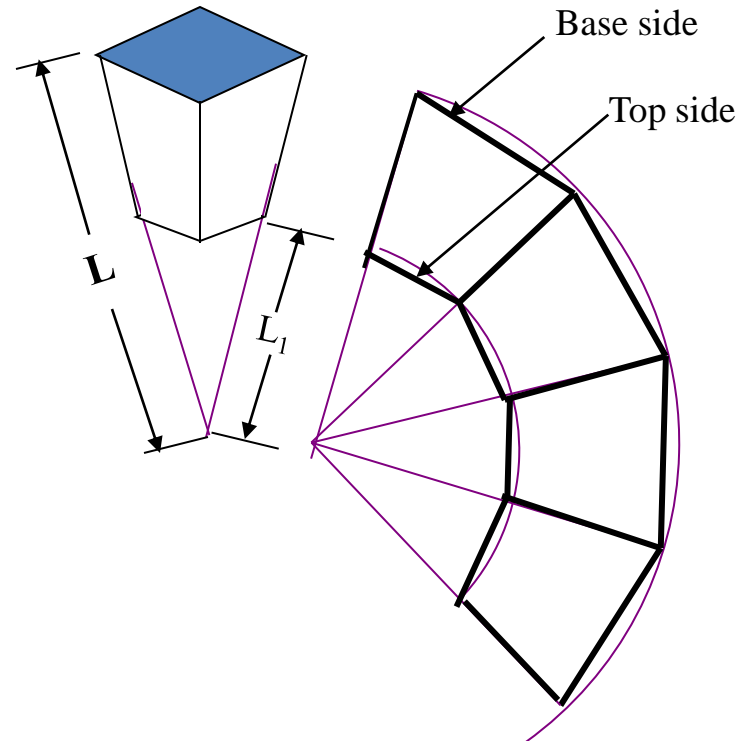
$$\theta = \frac{R}{L} \times 360^\circ$$

R= Base circle radius of cone

L= Slant height of cone

$L_1$  = Slant height of cut part.

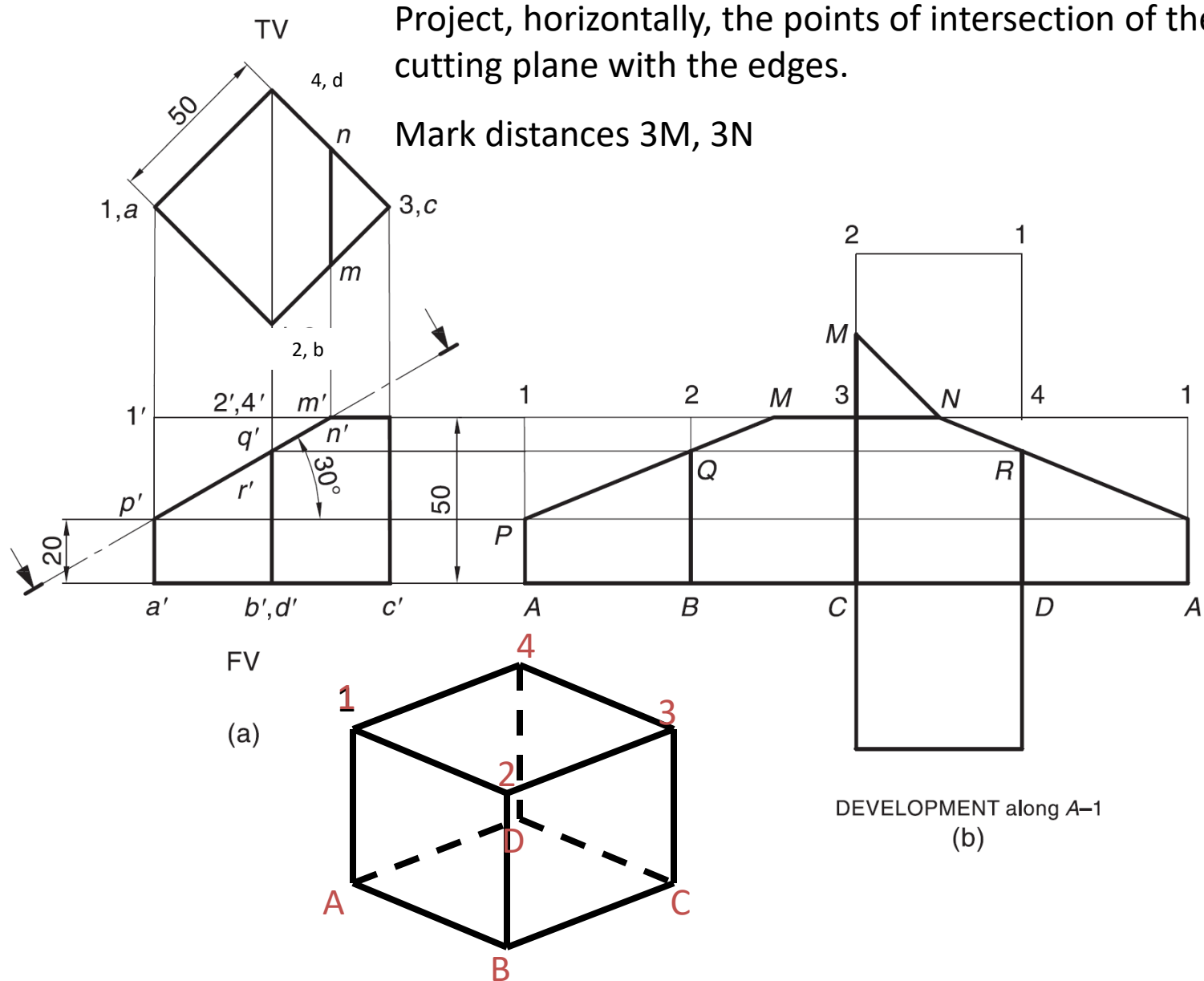
## DEVELOPMENT OF FRUSTUM OF SQUARE PYRAMID



L= Slant edge of pyramid

$L_1$  = Slant edge of cut part.

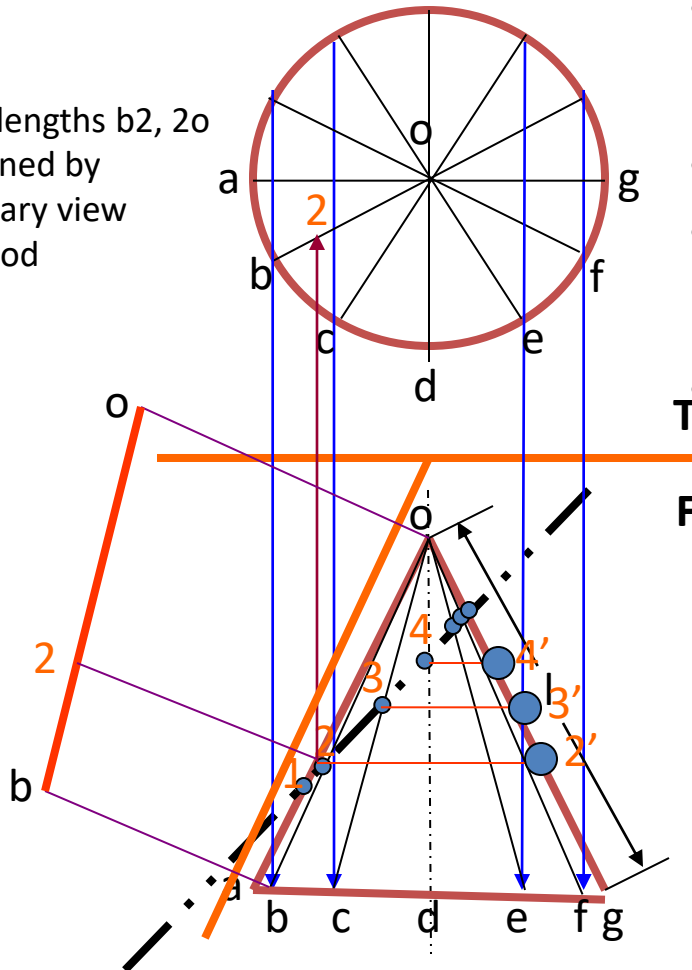
## Cube cut by section plane



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

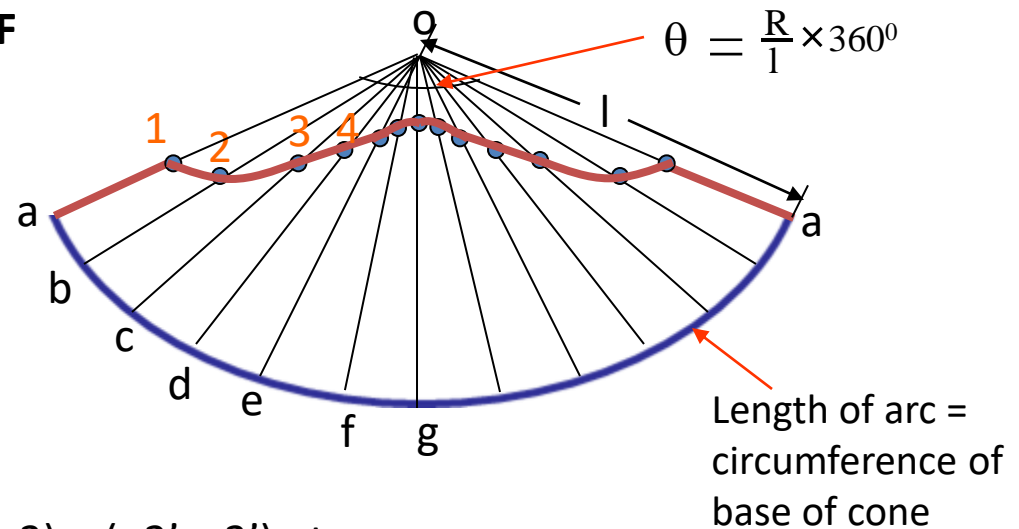
Radius of cone = R

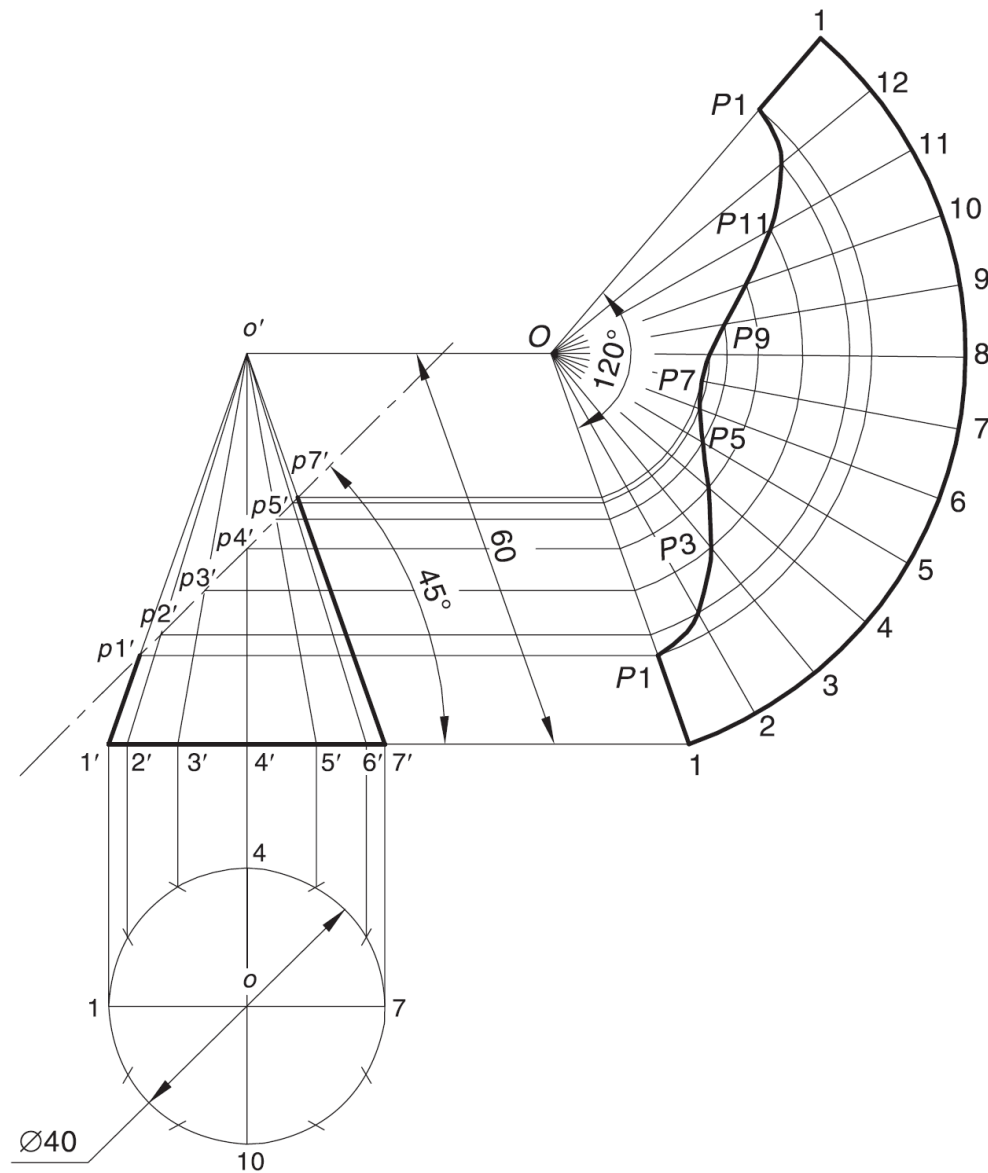
True lengths  $b_2, 2o$   
obtained by  
auxiliary view  
method



True length of  $(o_2, o_3) = (o_2', o_3')$  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  $o_1, o_2$  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)  $o_1, o_2$ ...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