

Development of Surfaces

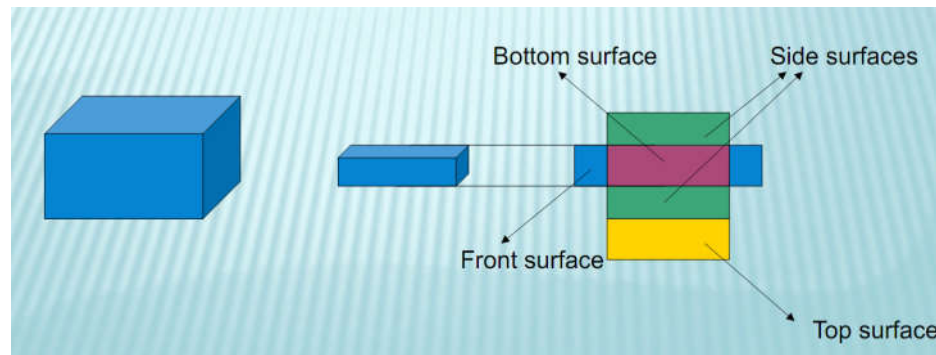
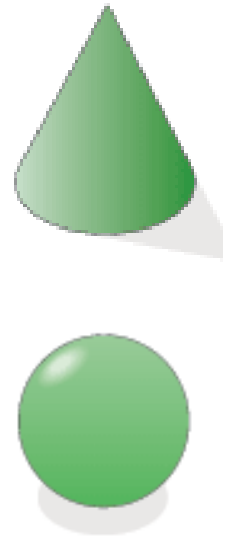
Lecture – 8

Vivek Sangwan

Based on Slides by Prof. Salil S. Kulkarni

Introduction

- **Geometric surface** – surface generated by a motion of a straight line (ruled surface)
or by a motion of a curve (doubly curved surface)
- **Types of Geometric Solids**
 1. Solids bounded by plane surfaces (prism, pyramid, etc)
 2. Solids bounded by single-curved surfaces (cone, cylinder)
 3. Solids bounded by doubly-curved surfaces (sphere, torus, etc)
- **Development:** A development is the un-folded / unrolled flat / plane figure of a 3-D object. It is also called a pattern where the plane may show the true size of each area of the object. When the pattern is cut, it can be rolled or folded back into the original object



Motivation

Sheet metal components/thin plates are widely used in wide variety of industry – automobile, aerospace, home appliances, ship building, oil and gas



<http://www.industrial-lasers.com/articles/2009/02/why-so-little-laser-welding.html>

<http://www.primemachine.com/files/pvessel.html>

Components have to be fabricated with good degree of accuracy

The fabrication is usually done by bending sheet metal flat plates

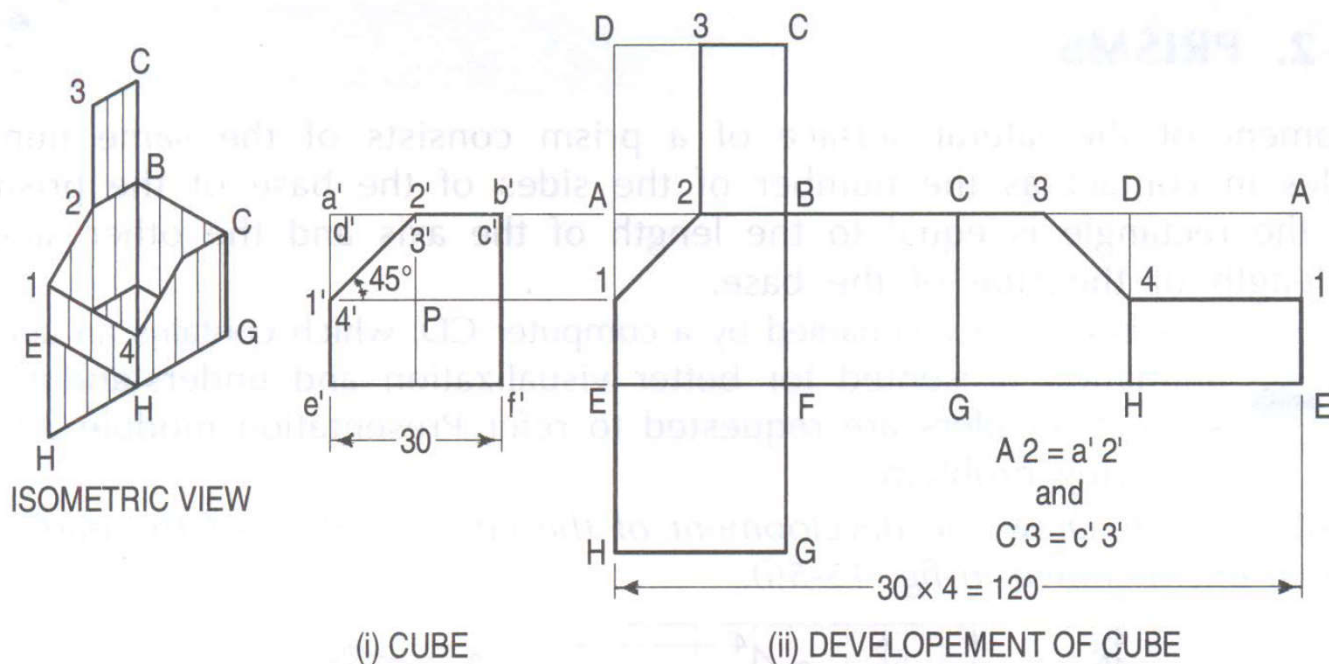
Therefore essential to know what size and shape of flat plates to start with

Most Important Point to Remember

In the development, all the lengths must be true lengths

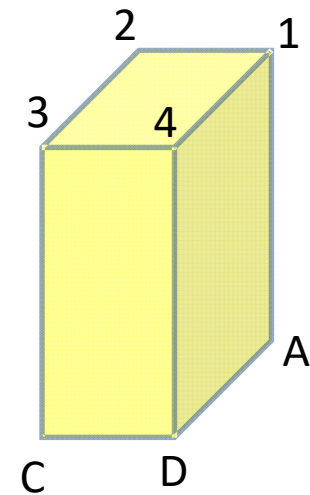
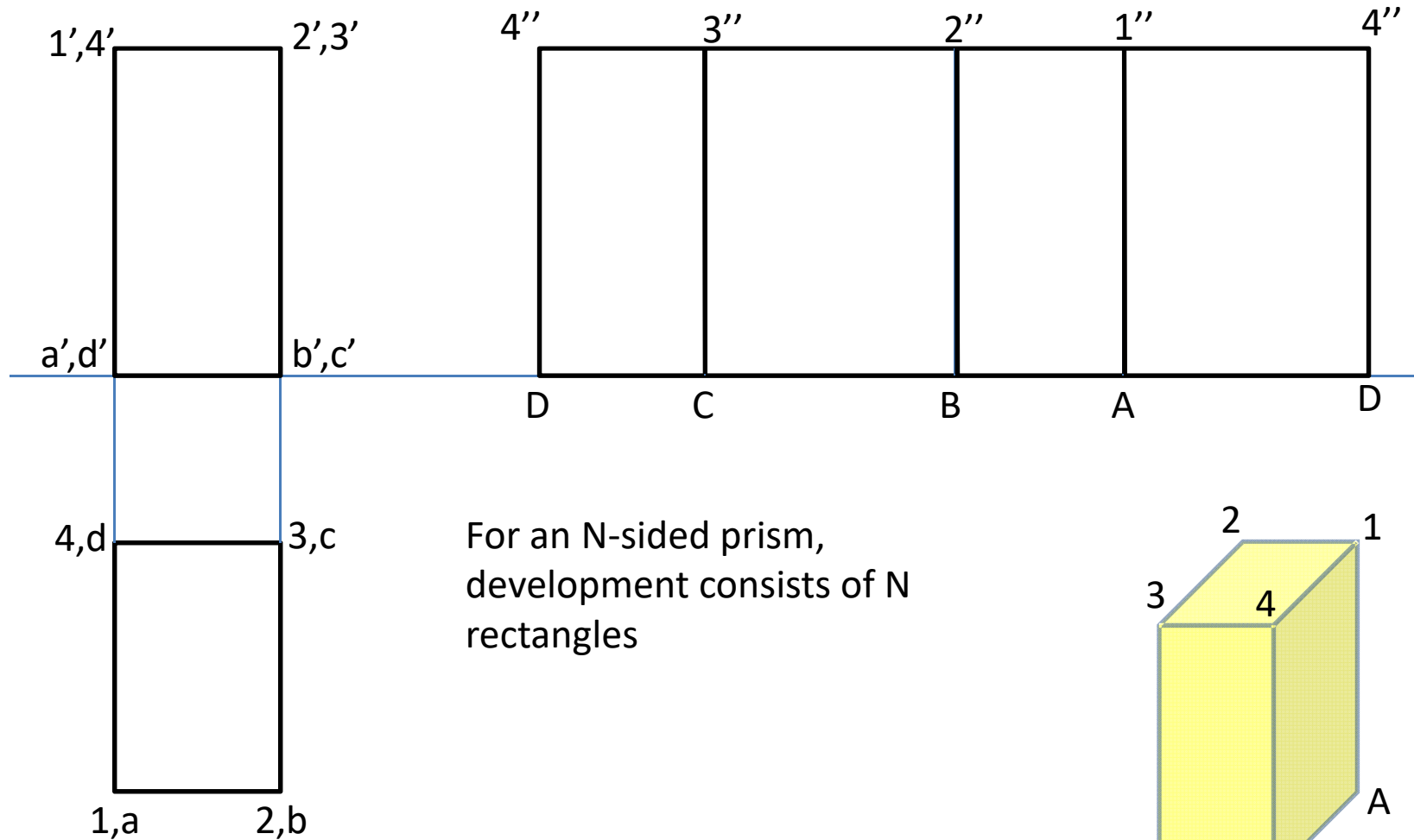
Identify the correct size and shape of the base

Identify the true length of the edges/generators

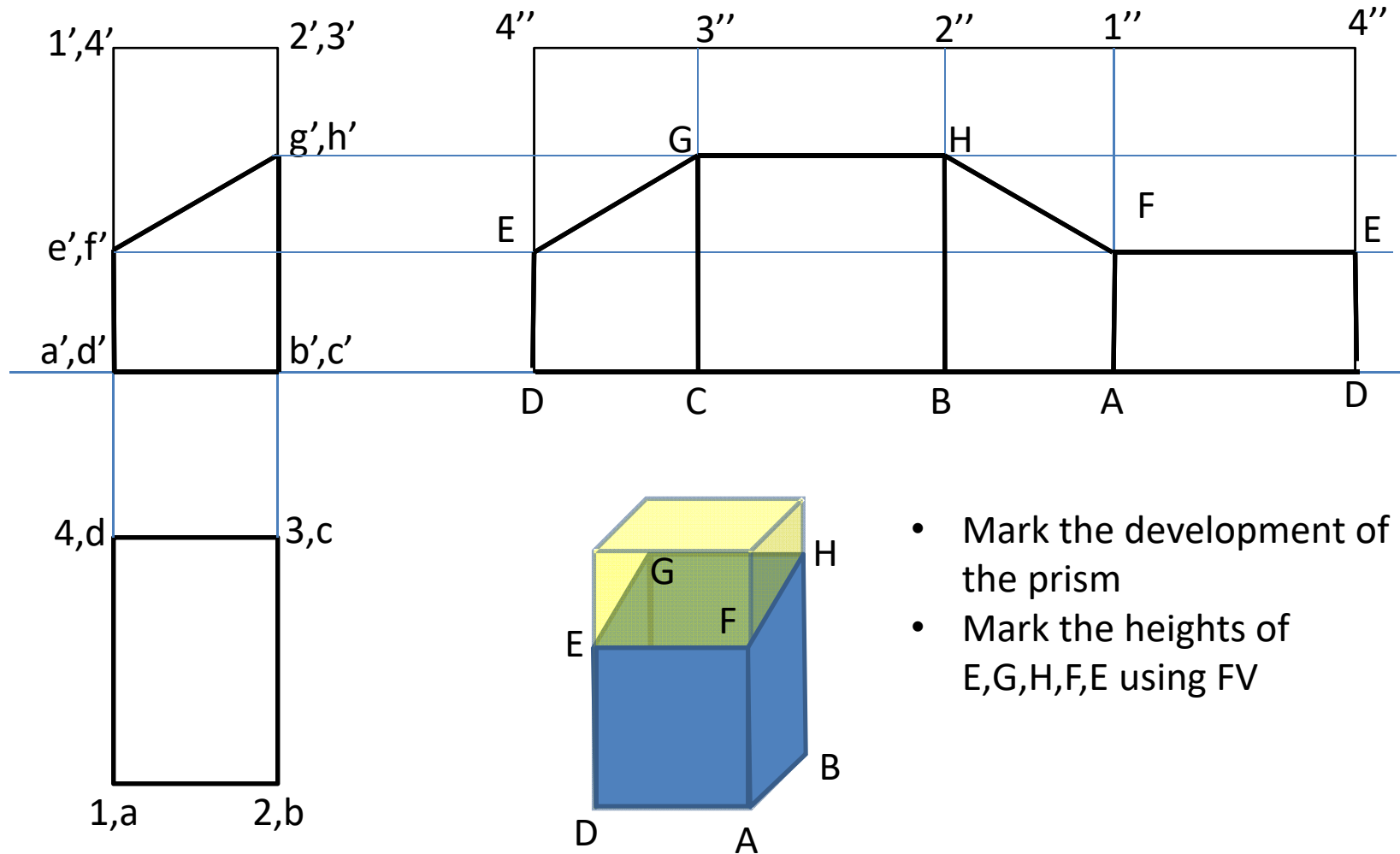


Development of Square Prism

Axis is perpendicular to the base

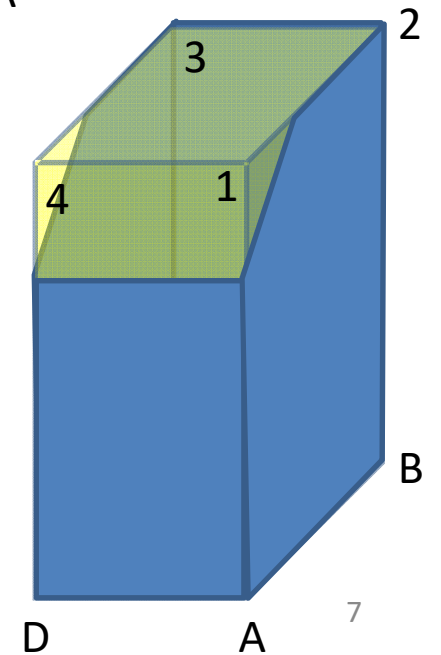
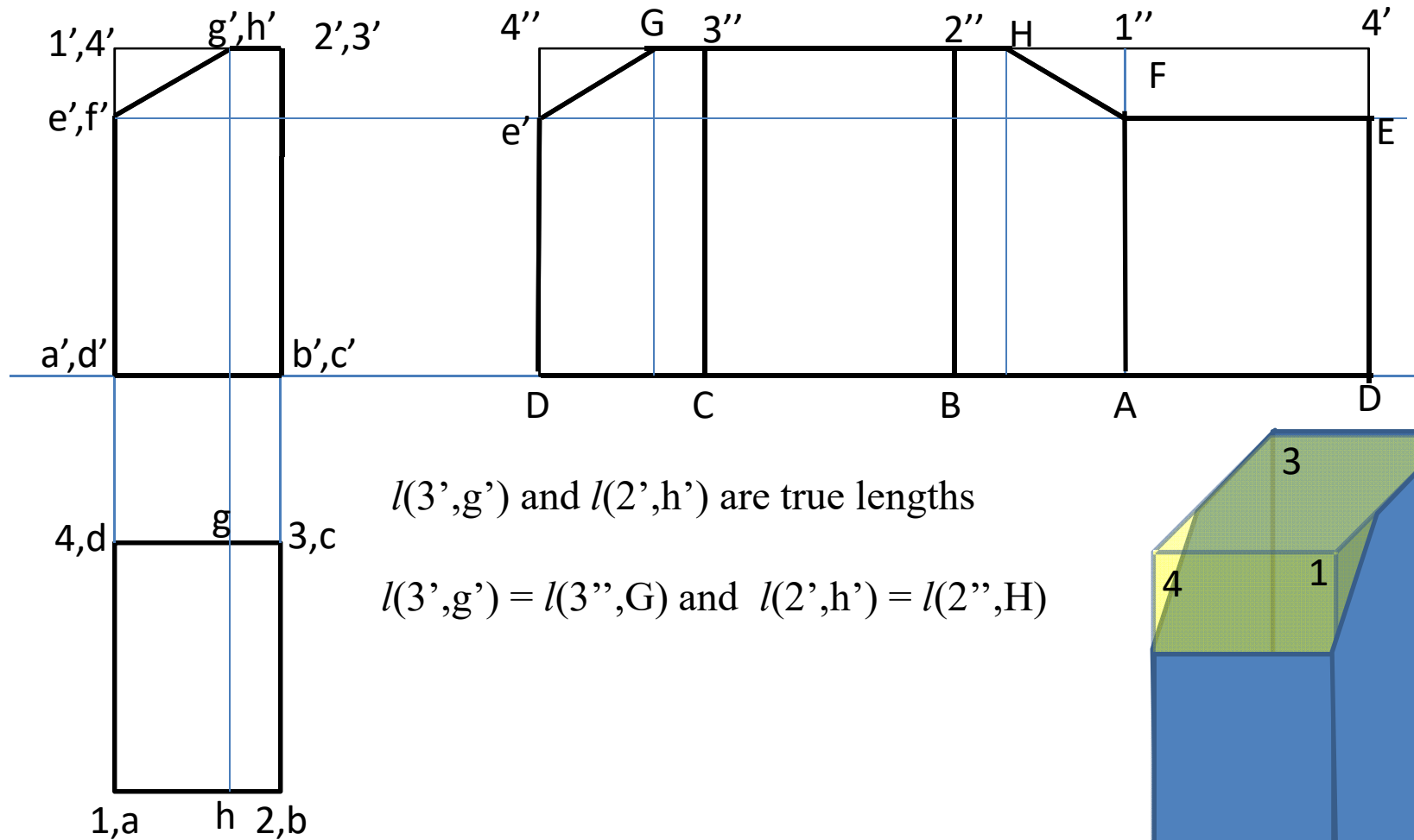


Development of Truncated Right Prism

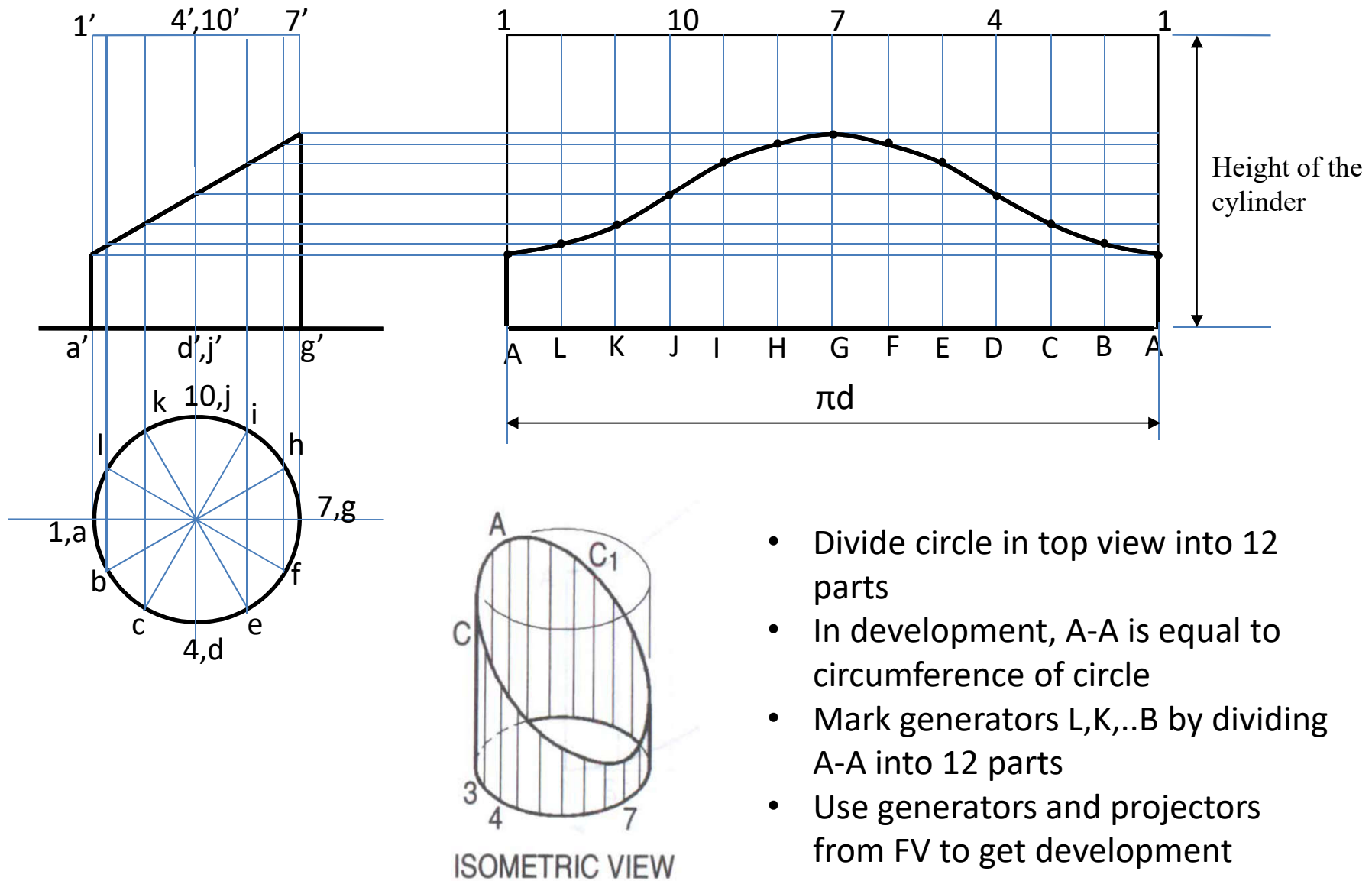


- Mark the development of the prism
- Mark the heights of E,G,H,F,E using FV

Development of Truncated Right Prism

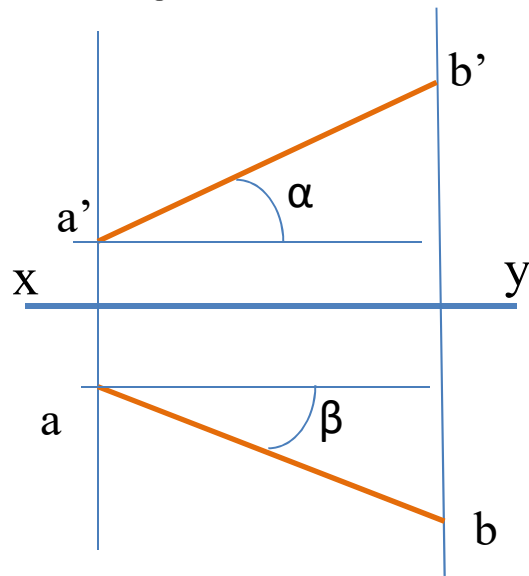


Development of Truncated Right Cylinder

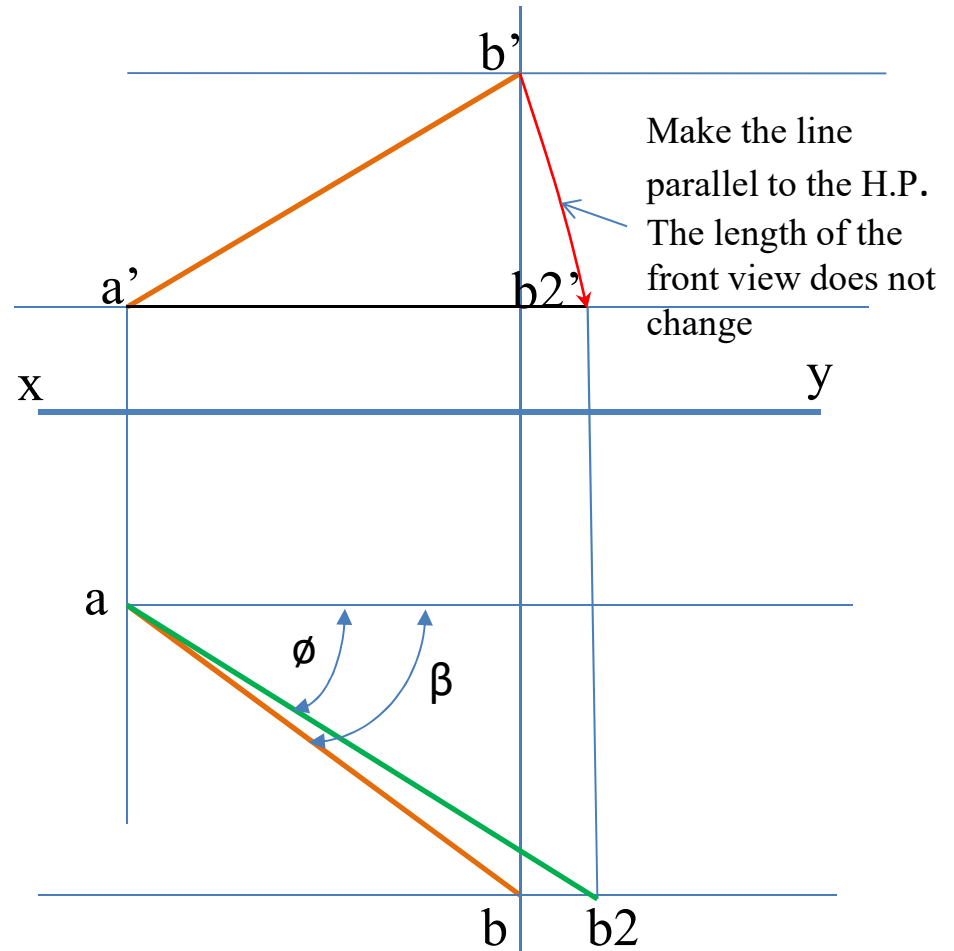


- Divide circle in top view into 12 parts
- In development, A-A is equal to circumference of circle
- Mark generators L,K,..B by dividing A-A into 12 parts
- Use generators and projectors from FV to get development

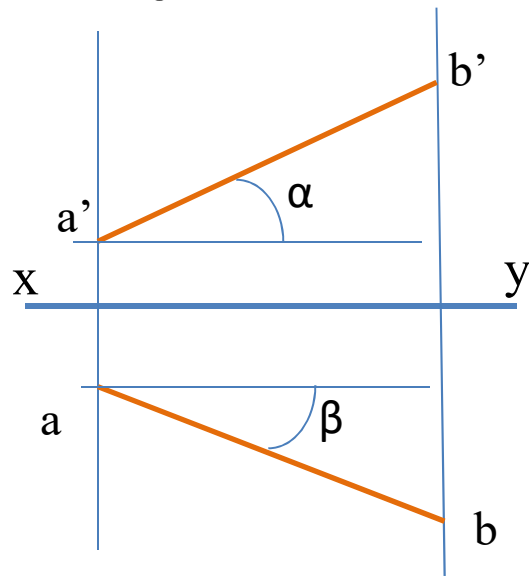
Projections of a line inclined to both H.P. and the V.P.



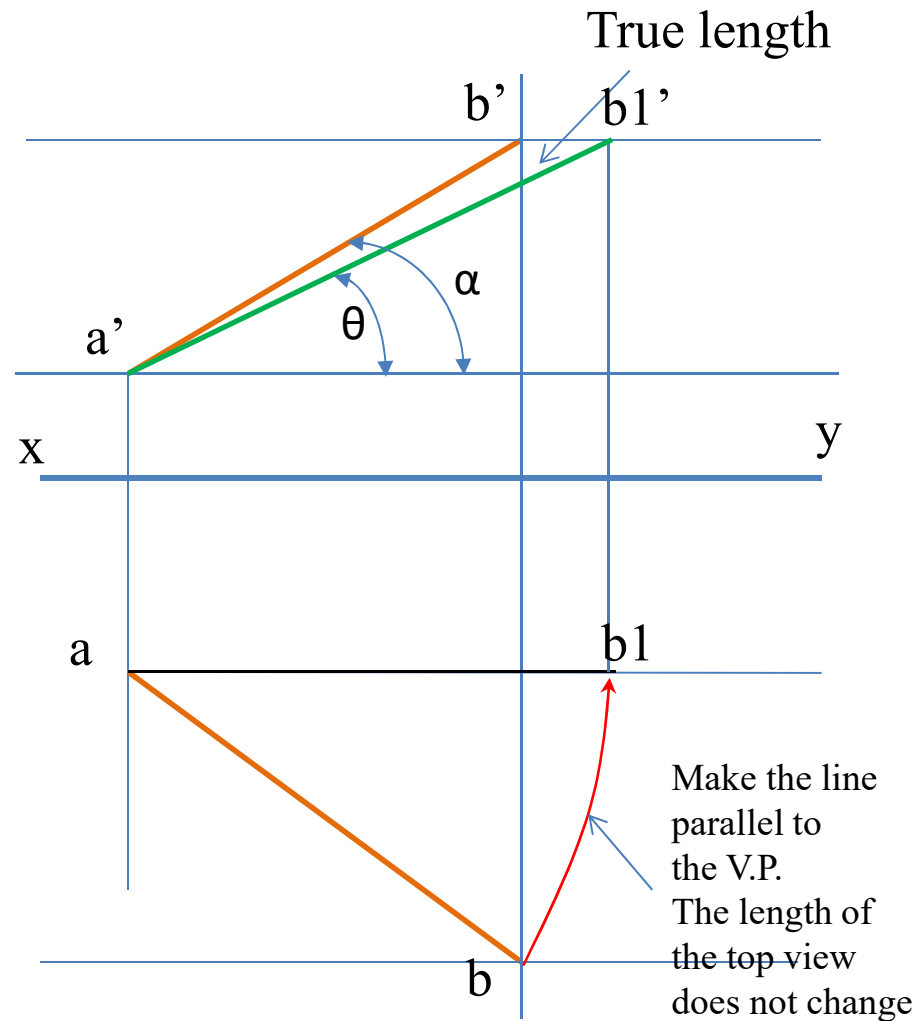
- The top view and the front view are inclined to the xy line
- The length of the line in the top view and the front view is less than the true length
- α and β are the apparent angle of inclination with the H.P. and the V.P. and are greater than the true angles of inclination



Projections of a line inclined to both H.P. and the V.P.

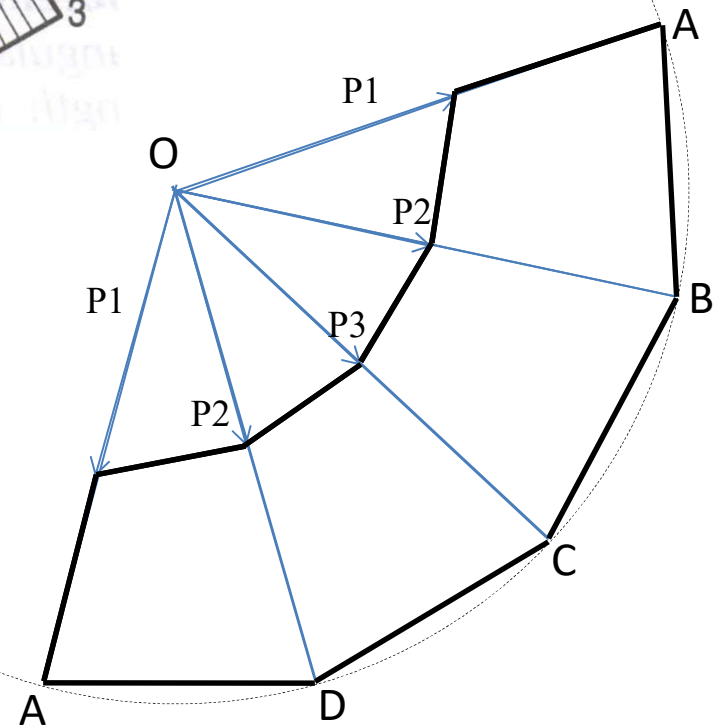
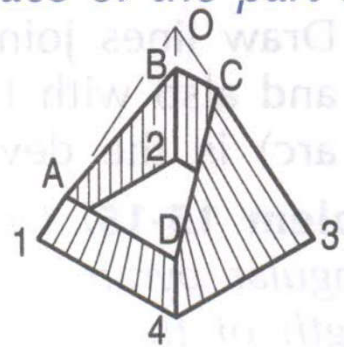
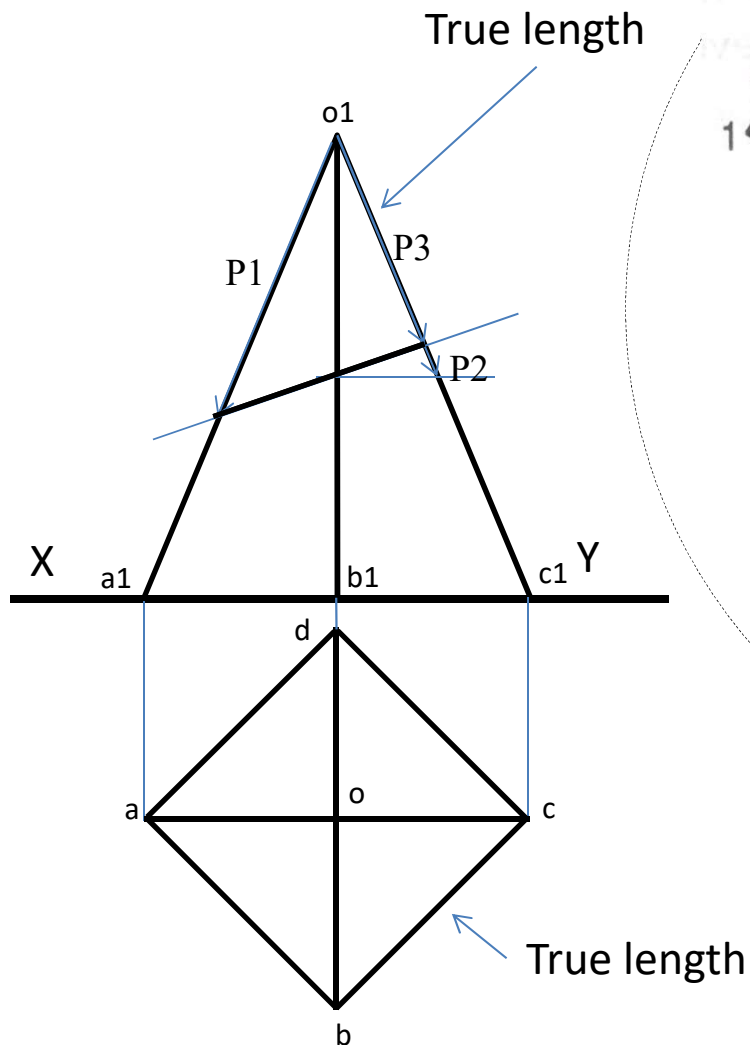


- The top view and the front view are inclined to the xy line
- The length of the line in the top view and the front view is less than the true length
- α and β are the apparent angle of inclination with the H.P. and the V.P. and are greater than the true angles of inclination



Development of Truncated Right Pyramid

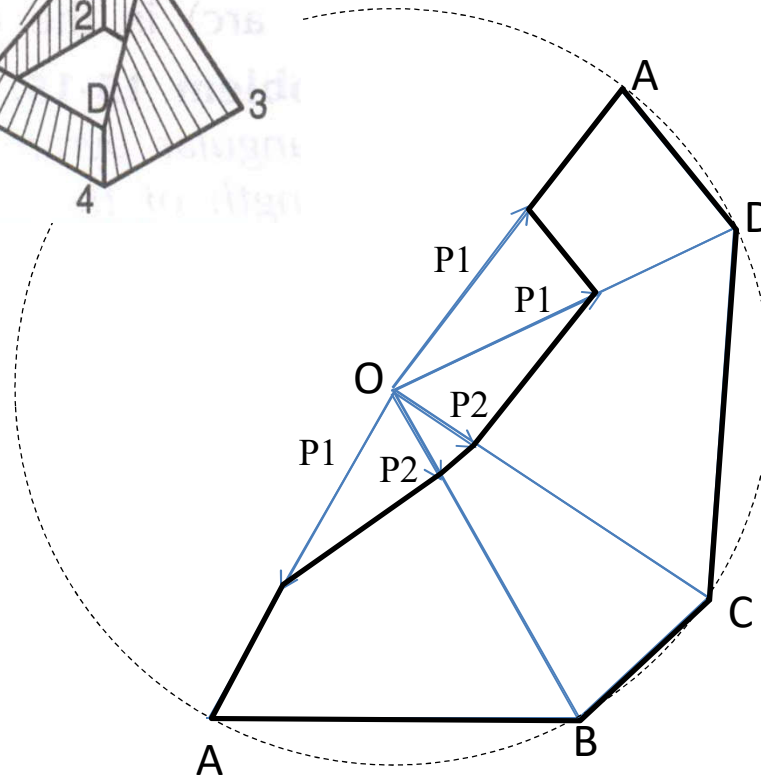
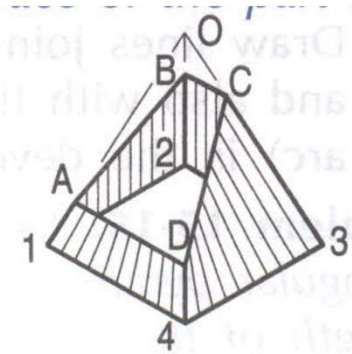
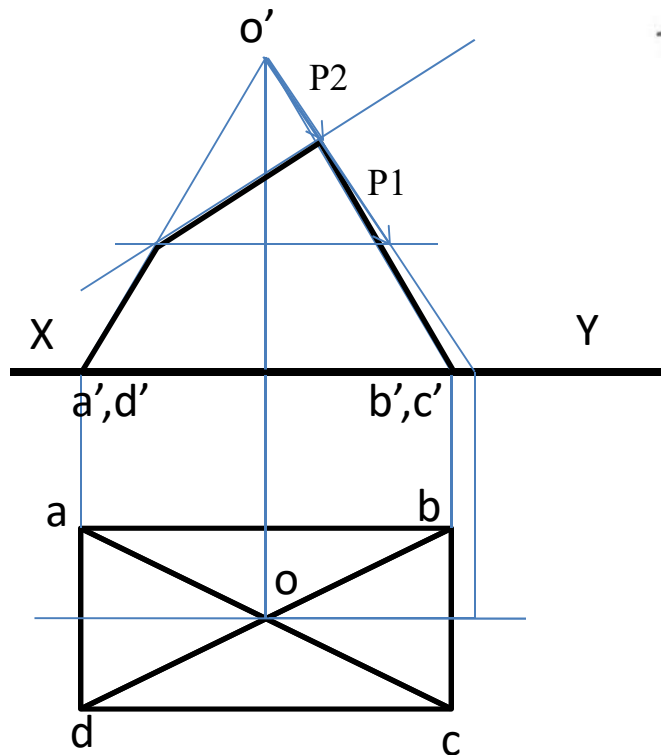
- Symmetry of pyramid can be used to get true length O-P2



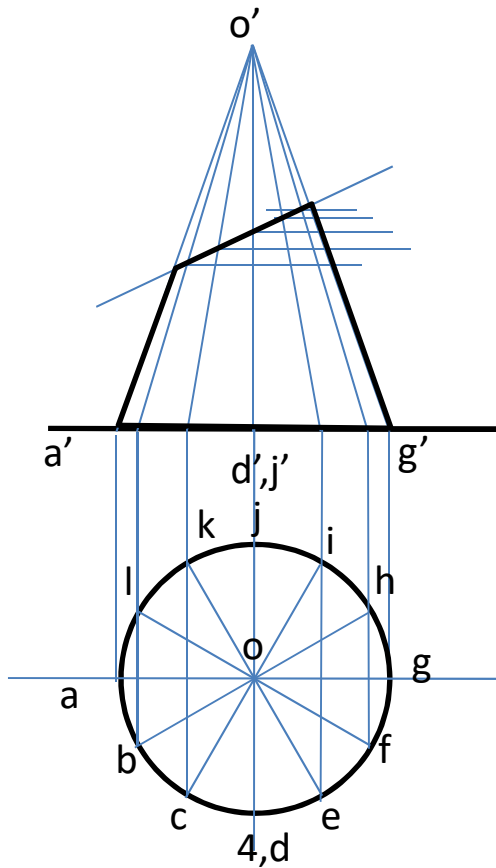
- Use generators (edges from the tip) to mark points on development

Development of Truncated Right Pyramid

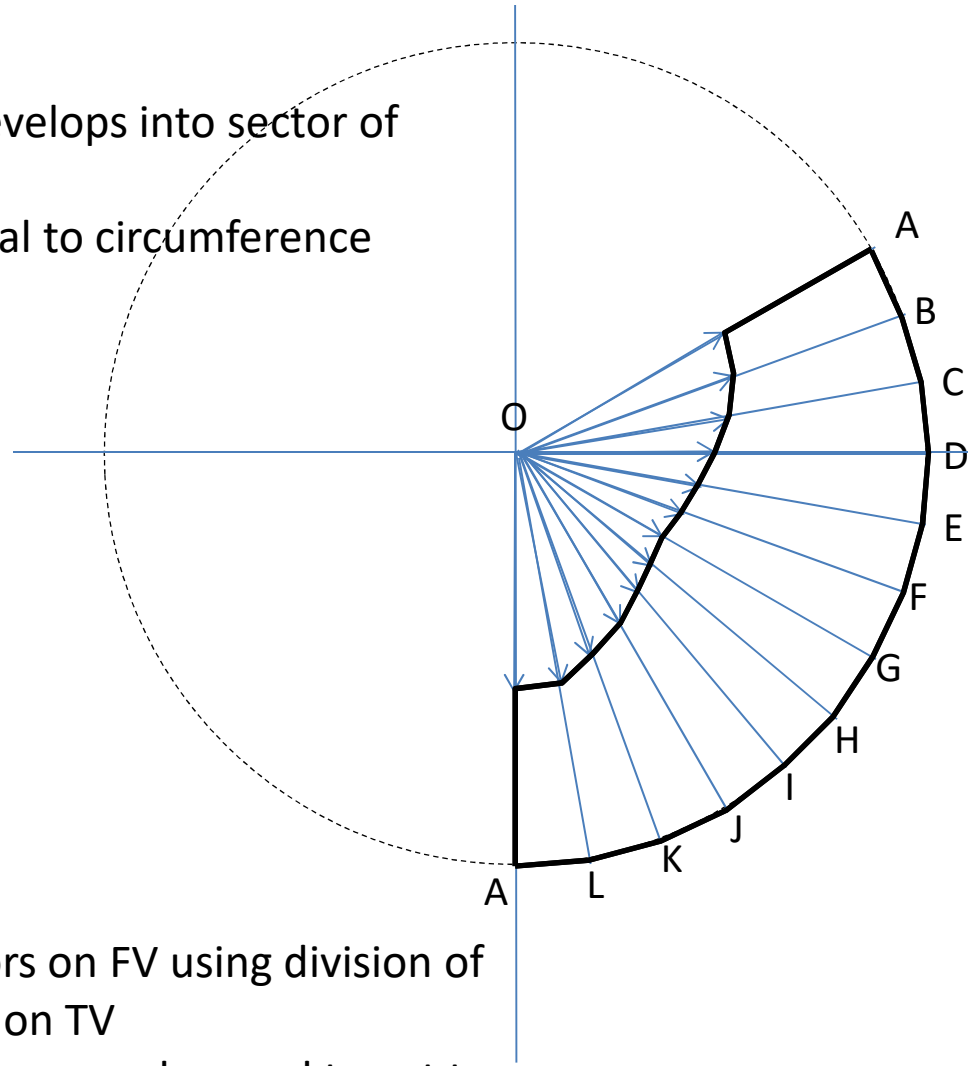
Need to rotate top view to get true length of ob



Development of Truncated Right Cone



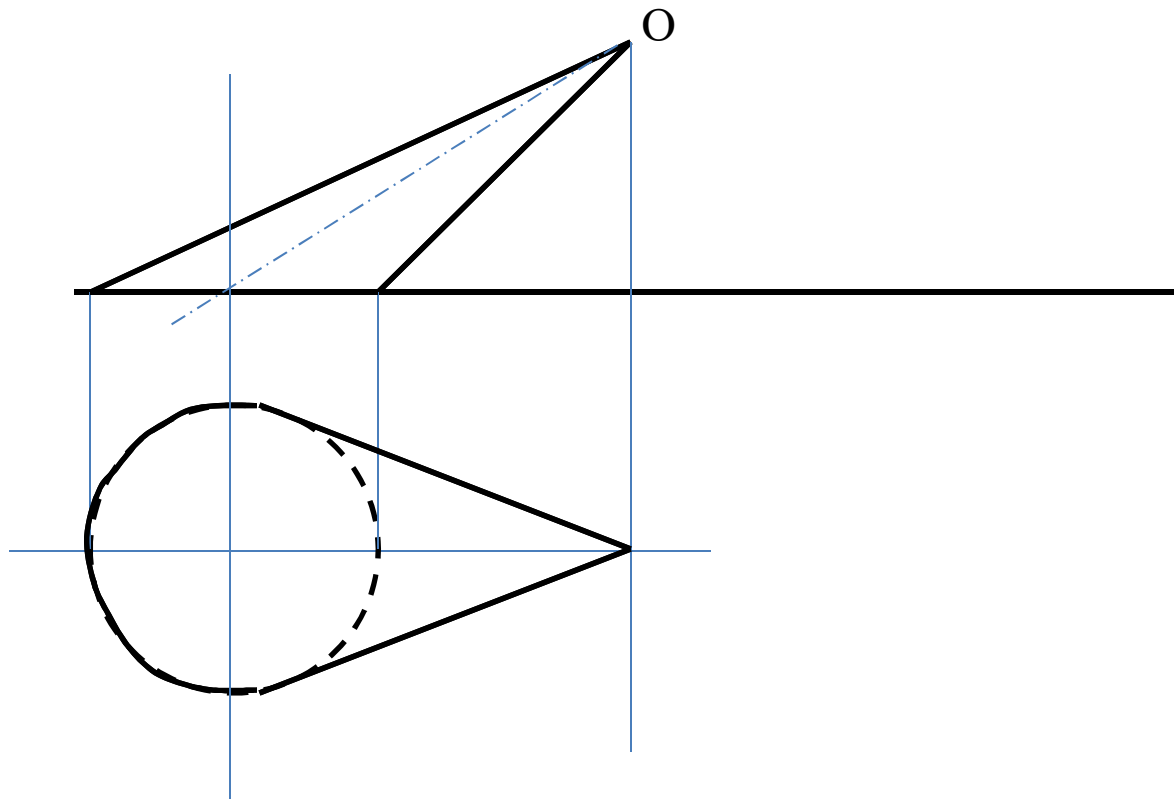
- Cone develops into sector of a circle
- A-A equal to circumference of base



- Draw generators on FV using division of circumference on TV
- Symmetry of cone can be used to get true lengths

Development of Oblique Cone

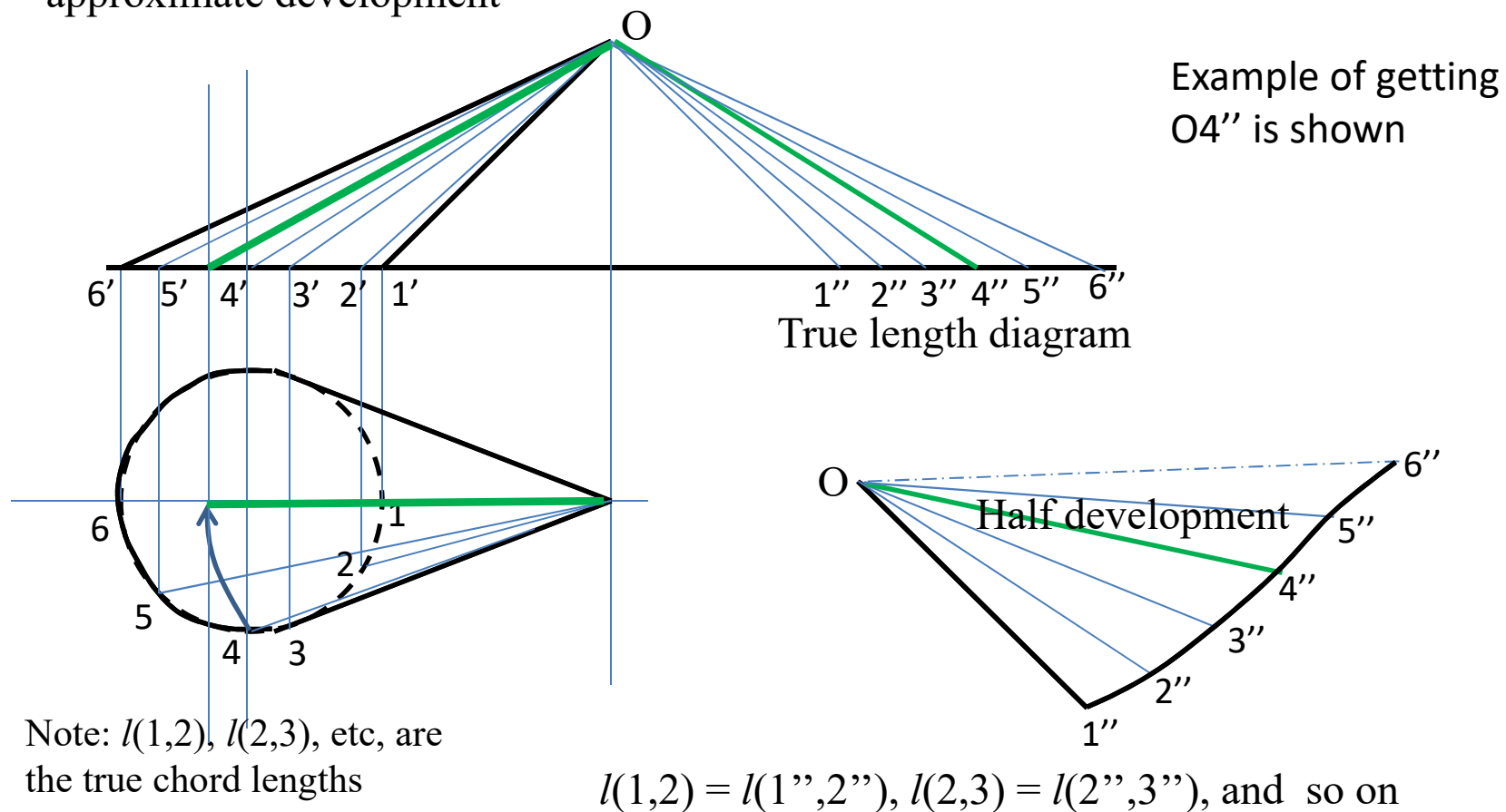
Oblique – Axis of the cone nor perpendicular to its base



Development of Oblique Cone

Triangulation method – Approximate method to develop surfaces

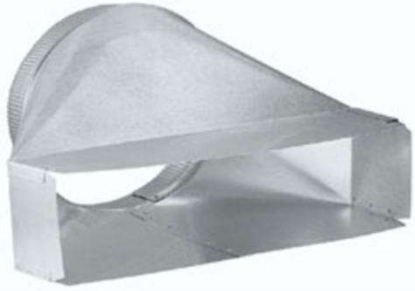
- Cover the lateral surface with numerous small triangles that approximately lie on the surface
- These triangles when drawn with their true size with their common edges joined produce an approximate development



Transition Pieces

Transition Piece – A special pipe joint used to connect two or more pipes of different shapes and sizes

Round to Rectangular



Round to Oval



Oval to Oval



Round to Rectangular



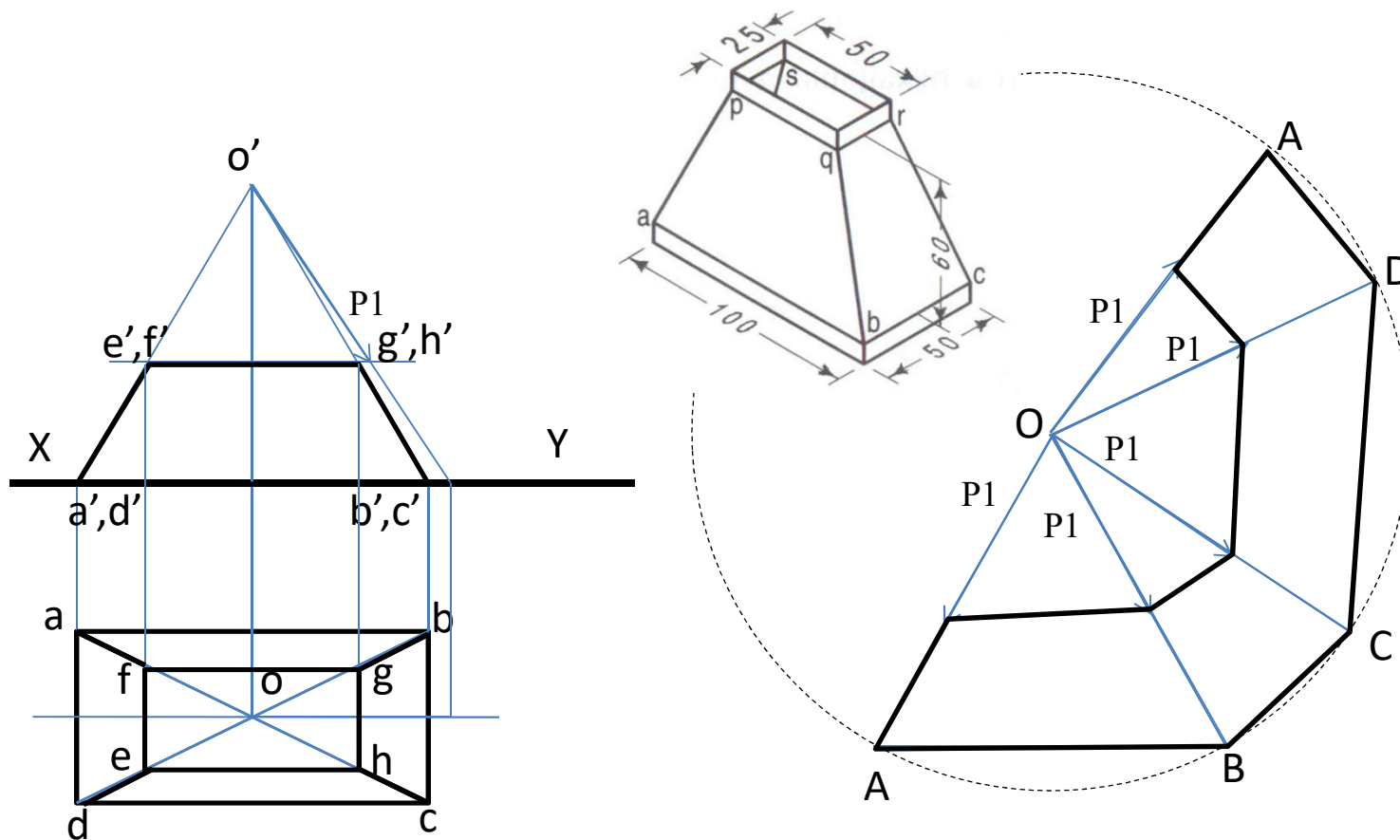
<http://www.salaair.com/ductwork.htm>

<http://www.gaf.com/Other-Building-Products/Ductwork/In-Wall-Duct-Systems.aspx>

Typical Transitional pieces

- Connecting two rectangular pipes of different sizes on different axes
- Connecting two circular pipes on different axes
- Connecting a square and a circular pipe

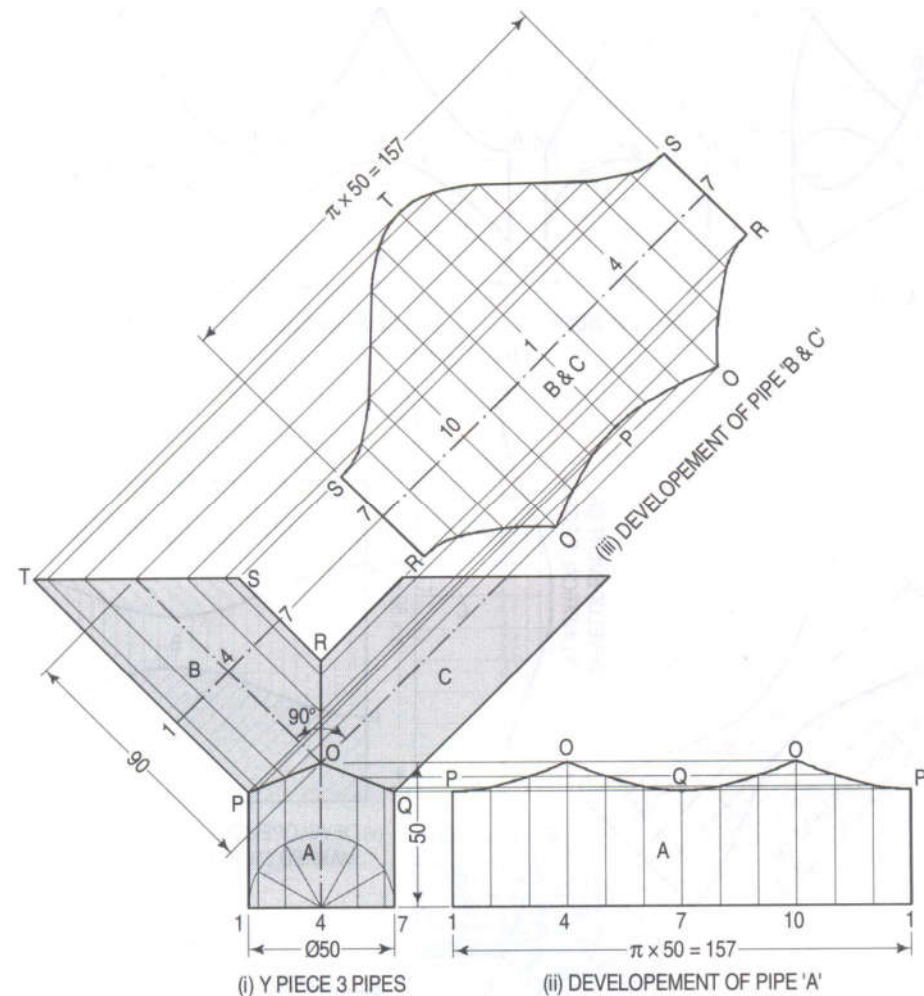
Development of Transition Piece connecting Two Rectangular Pieces



Development of Intersecting Pipes

Three cylindrical pipes of 50 mm diameter form a Y-piece as shown. Draw the development of the surface of each pipe

- All 3 pipes are essentially truncated cylinders
 - Therefore their development will lie on a rectangle
- Generators of the 3 pipes can be obtained from the same top view
- Projection on Auxiliary plane may be used to develop the branch



END