



Department of Civil and Environmental Engineering (CEED)
Fall 2017

EEE 154

Computer Aided Drawing (CAD)
for Engineers

Lecture 2

Plane Geometry

Development and Concept of Shapes - Using Drawing Instruments

- **Geometry of Straight-line Figs**
- **Regular Solids**
- **Prisms/ Pyramids**
- **Geometry of Curved-line Figs**
- **Cylinders/ Cones**

Class Task 2

Development of Geometric Shapes

- **Prepare Drawing Sheet**
- **Provide Reference Grid**
- **Provide Title Block**
- **Draw Geometric Shapes with Reference Line and Dimension**

Geometry of Straight-line Figs

Lines

- **Single Lines – Draw a linear object of 20 ft long**
- **Parallel Lines – Draw parallel lines of length 15 ft, 5 ft apart to each other and 30 degree aligned**
- **Perpendicular Lines – Draw a perpendicular object line of length 15 ft**

Geometry of Straight-line Figs

Angles

- **Acute Angles – 30 and 45 degree angular shape with sides of length 15 ft and 10 ft**

Geometry of Straight-line Figs

Triangles

- **Draw an Equilateral Triangle shape with sides of 15 ft long**

Geometry of Straight-line Figs

Quadrilaterals

- **Draw a square shape with side 12.5 ft long**
- **Draw a Rhomboid shape with sides 15 ft and 5 ft as inclined 45 degree**

Geometry of Straight-line Figs

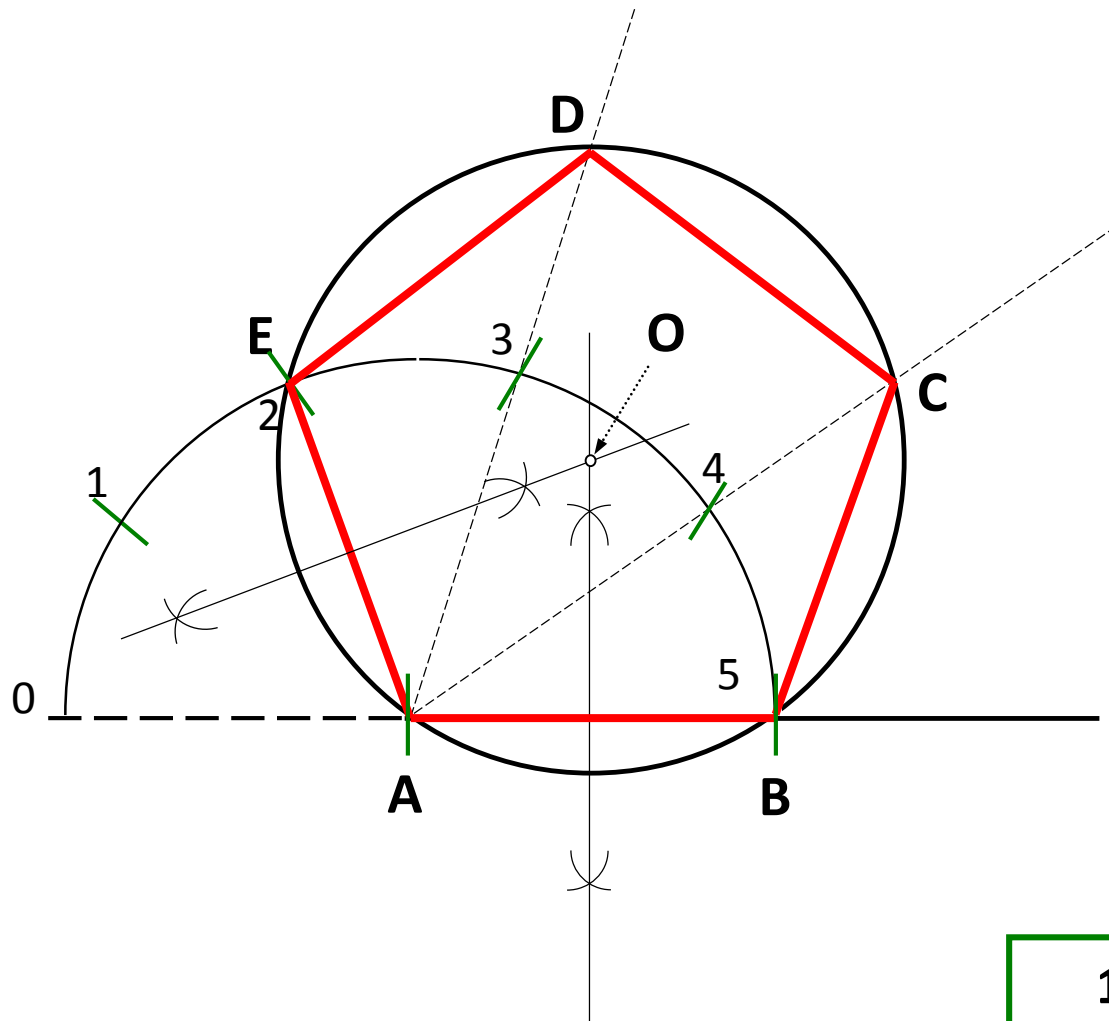
Polygons

- Draw a regular hexagonal shape with side 7.5 ft long

hint: $(n-2)*180/n$

$$\alpha = 120$$

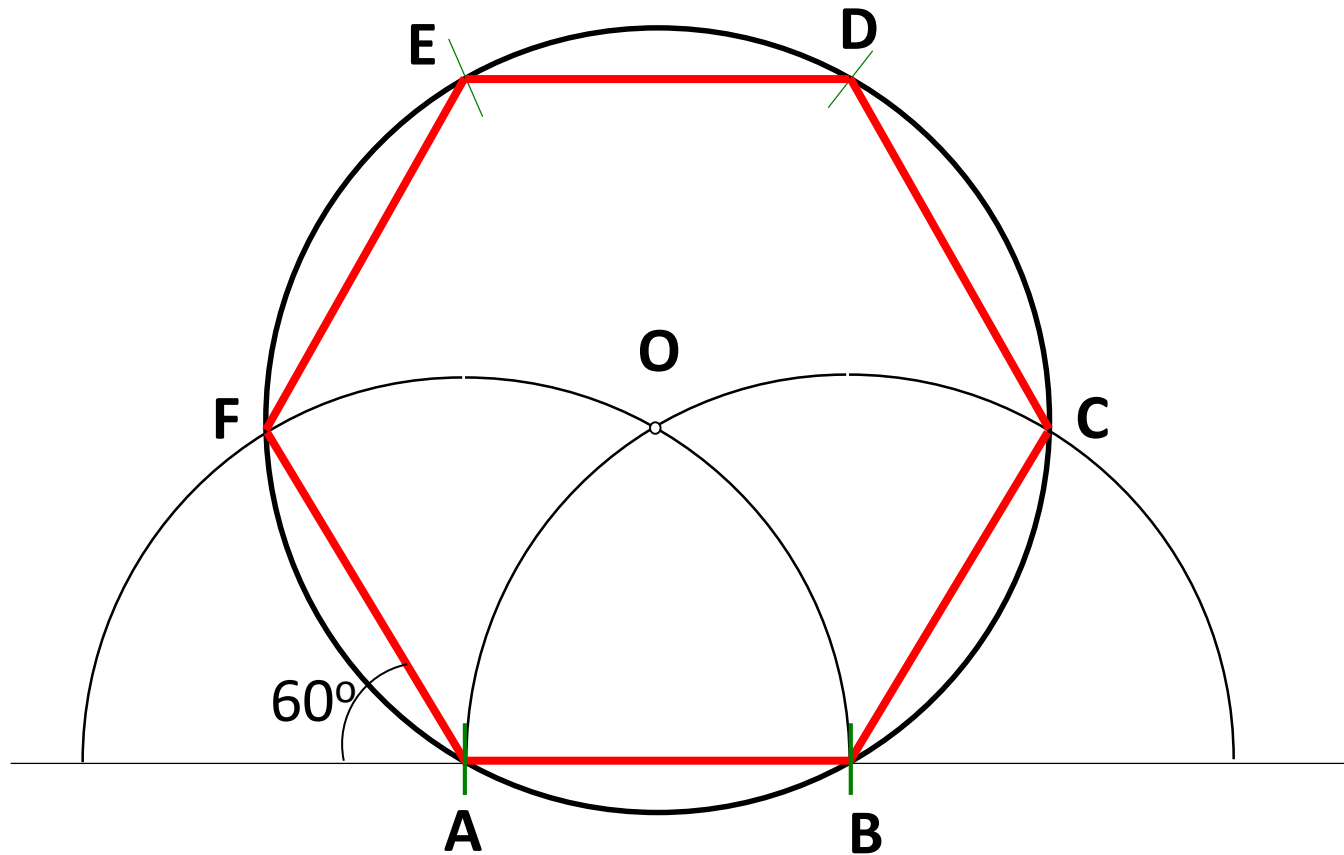
REGULAR PENTAGON



SCALE : AB = 2 "

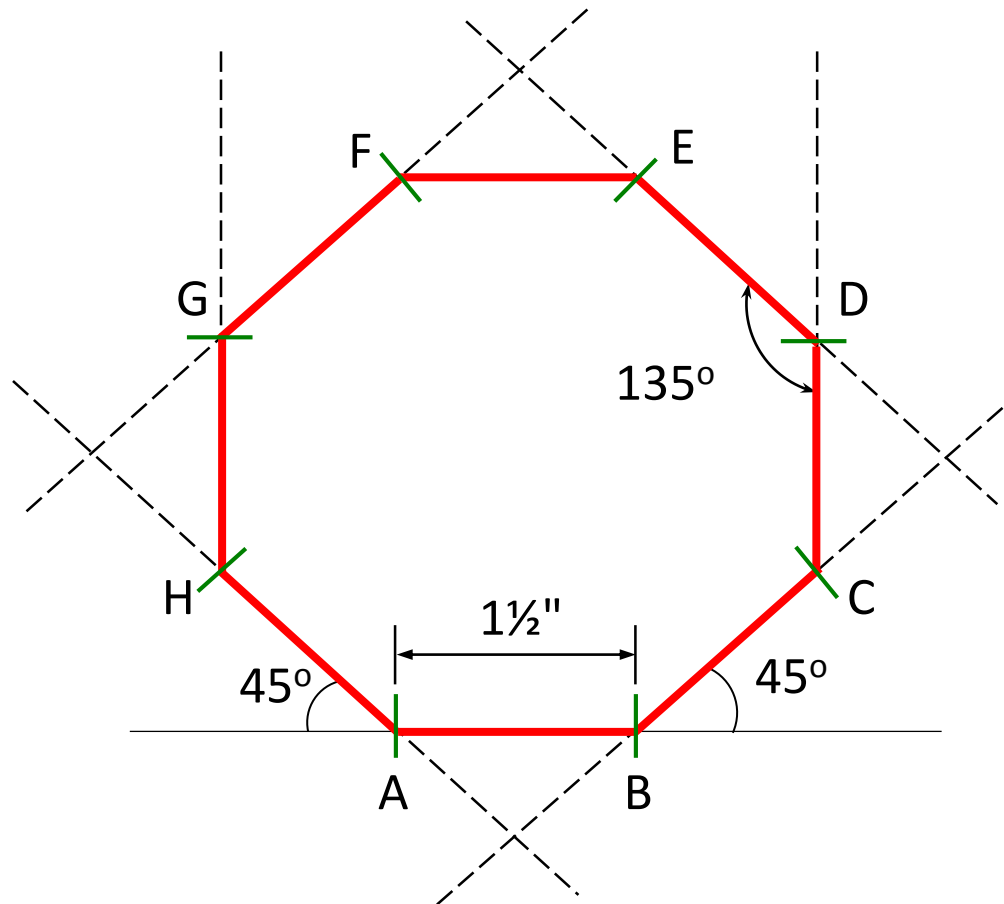
$$180^\circ/5 = 36^\circ$$

REGULAR HEXAGON



SCALE : $AB = 2''$

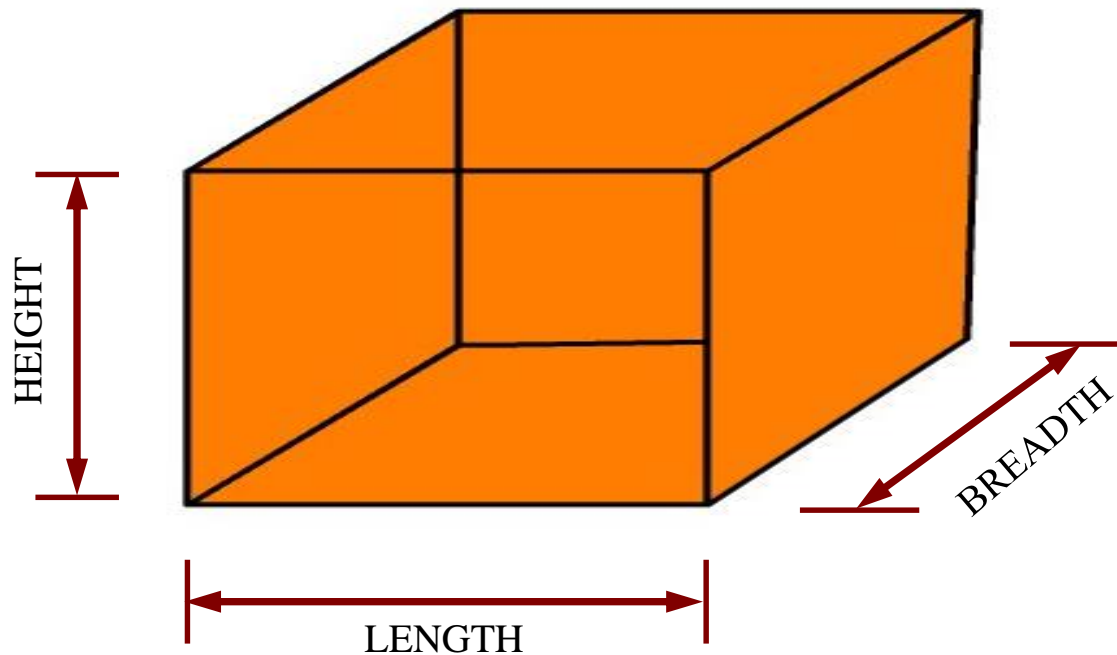
REGULAR OCTAGON



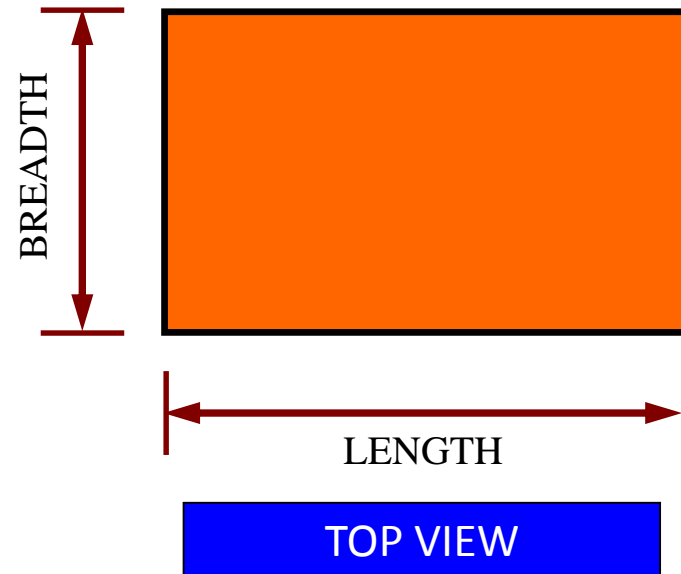
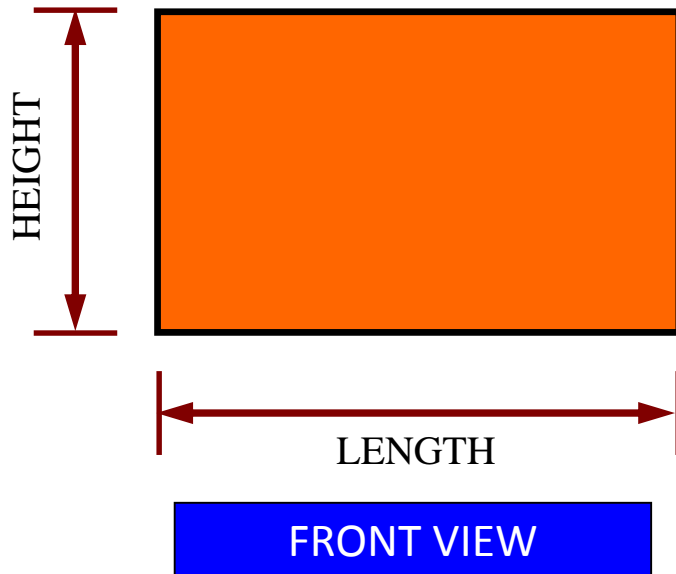
SCALE : AB = 1.5 "

WHAT IS SOLID?

An object having three dimensions, i.e., length, breadth and height or thickness is called a **SOLID**.

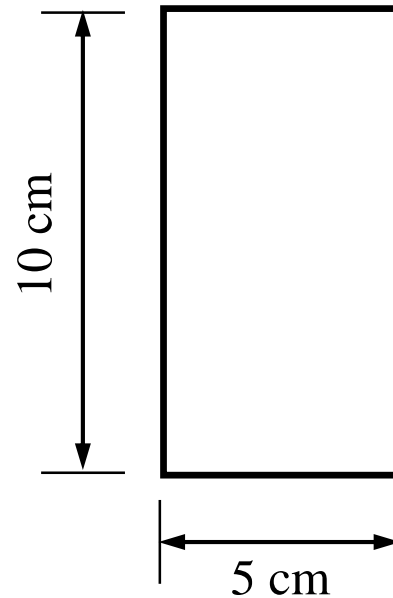
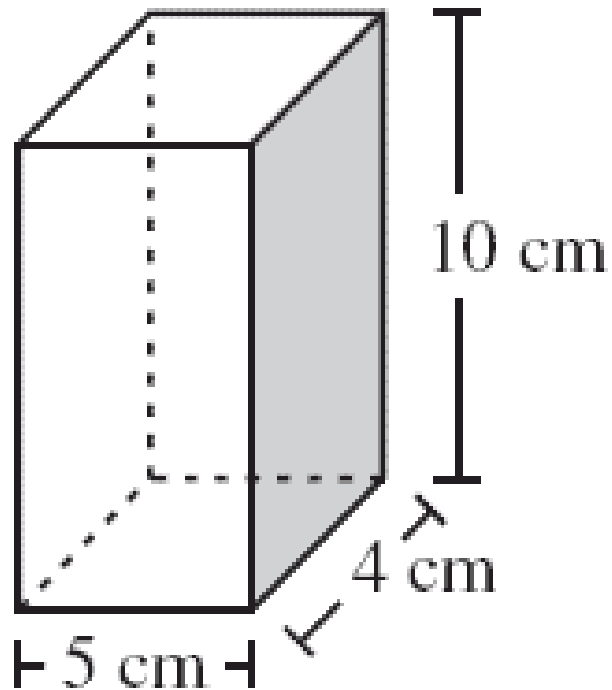


WHAT IS FRONT VIEW & TOP VIEW?

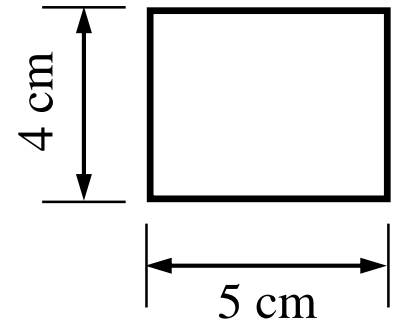


To represent a solid in the orthographic projection, at least two views are necessary; one view to represent length and height, called **FRONT VIEW** and the other view to represent length and breadth, called **TOP VIEW**.

Draw Front and Top view for the following object.



FRONT VIEW



TOP VIEW

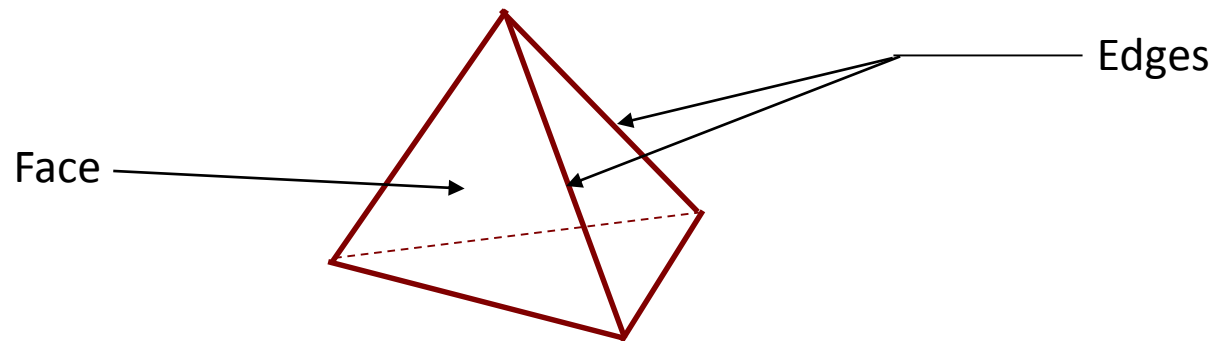
POLYHEDRON

The solid which is bounded by plane surfaces or faces is called **Polyhedron**. The polyhedra are further sub-divided into three groups:

- Regular Polyhedra
- Prisms
- Pyramids

REGULAR POLYHEDRA

A polyhedron is regular if each of its plane surfaces is a **Regular Polygon**. The regular plane surfaces which form the surfaces of the polyhedra are called **Faces**. The lines at which two faces intersect are called **Edges**.

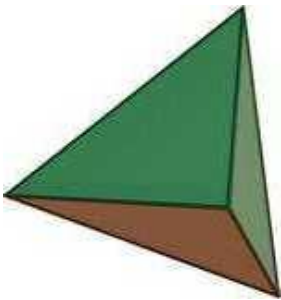


Tetrahedron

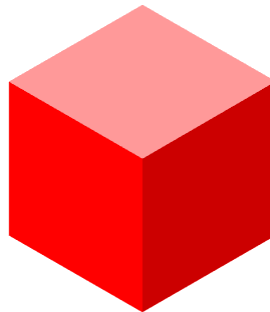
TYPES OF POLYHEDRA

The **Three** important regular polyhedra are:

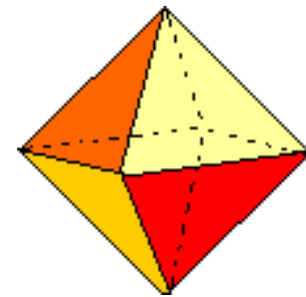
- Tetrahedron — 4 equal regular triangles
- Cube or Hexahedron — 6 equal regular squares
- Octahedron — 8 equal equilateral triangles



Tetrahedron



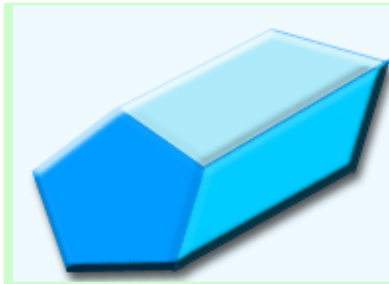
Cube or Hexahedron



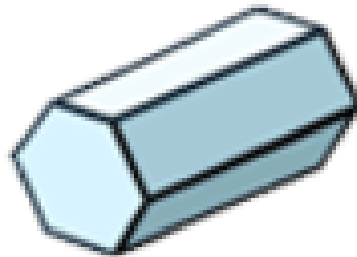
Octahedron

WHAT IS PRISM?

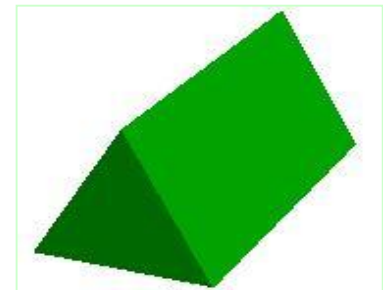
A solid figure whose bases or ends have the same size and shape and are parallel to one another, and each of whose sides is a parallelogram



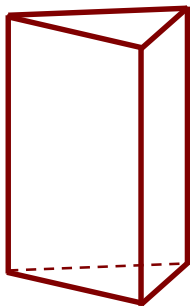
Pentagonal Prism



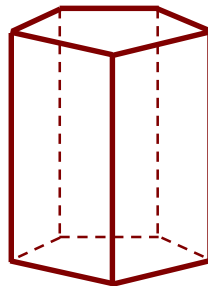
Hexagonal Prism



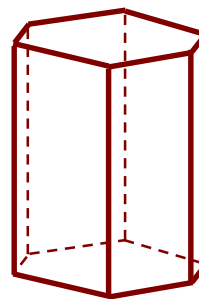
Triangular Prism



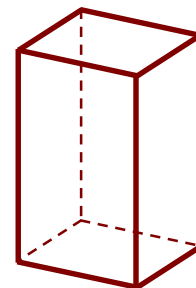
Triangular Prism



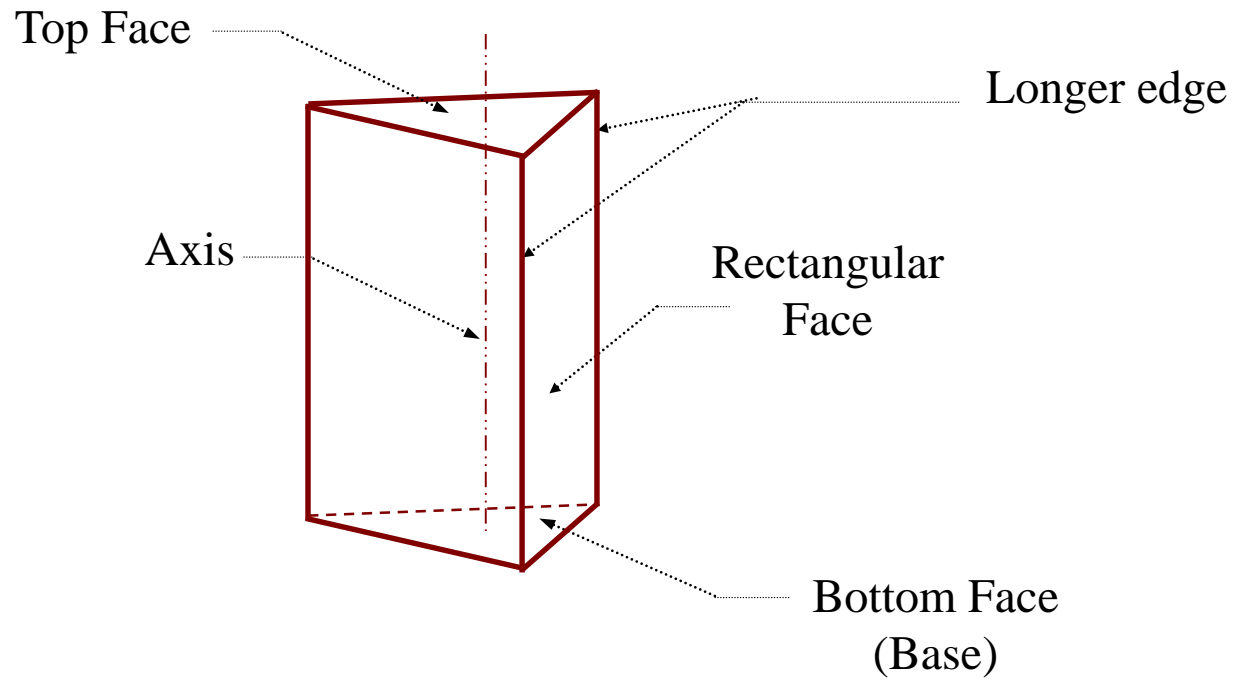
Pentagonal Prism



Hexagonal Prism



Rectangular Prism



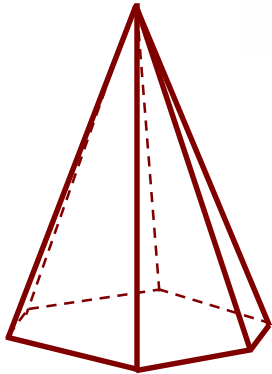
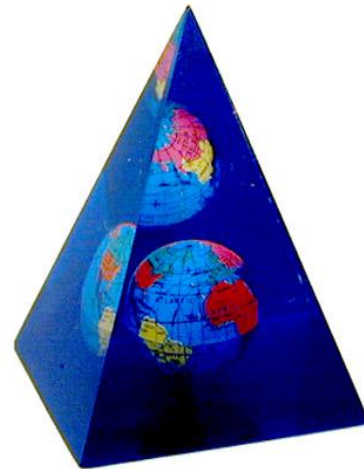
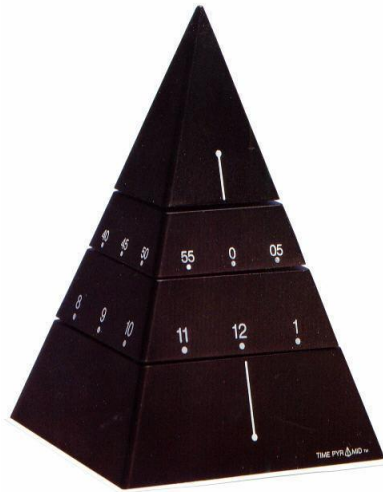
PYRAMID



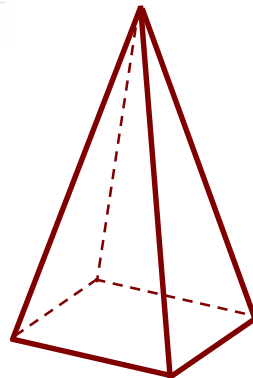
A massive monument of ancient Egypt having a rectangular base and four triangular faces culminating in a single apex, built over or around a crypt or tomb

WHAT IS PYRAMID?

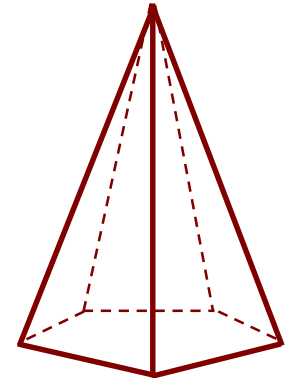
A solid figure with a polygonal base and triangular faces that meet at a common point



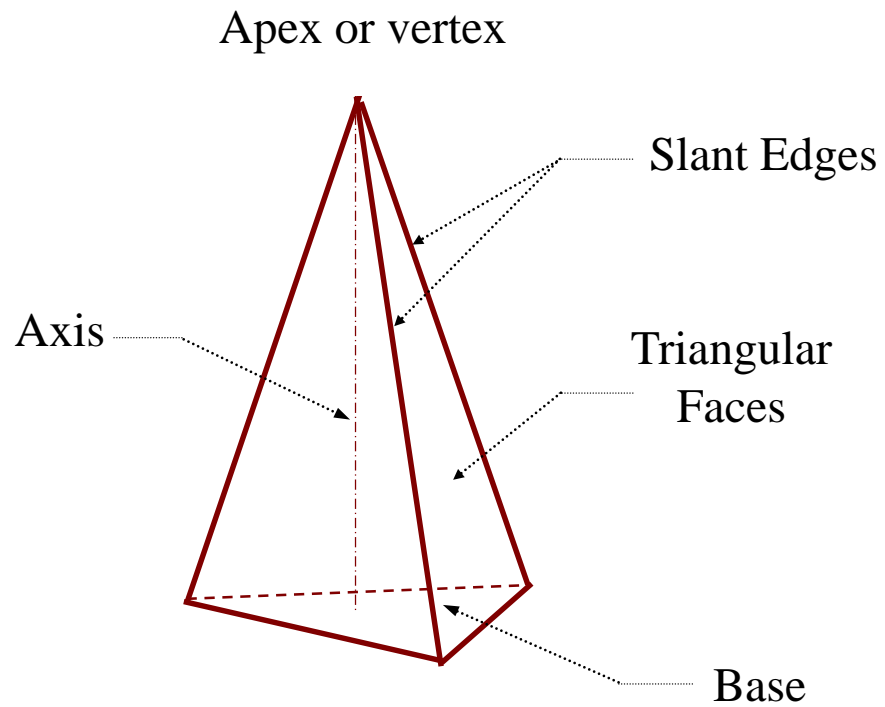
Hexagonal Pyramid



Square Pyramid



Pentagonal Pyramid



FRUSTUM & TRUNCATED

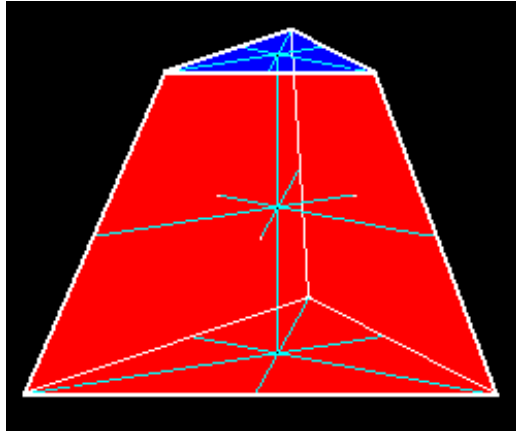


Fig: Frustum

When a solid (prism/cylinder/pyramid/cone) is cut by a cutting plane inclined to its base (not parallel), the remaining portion thus obtained after removing the top portion is called the Truncated Solid.

When a pyramid or a cone is cut by a cutting plane parallel to its base, the remaining portion thus obtained after removing the top portion is called the Frustum.

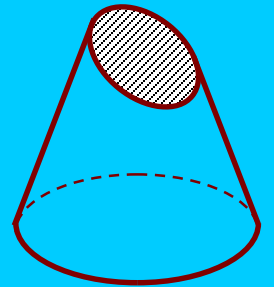


Fig: Truncated Cone

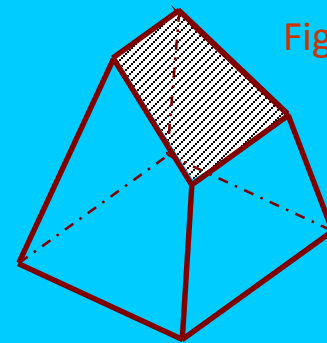


Fig: Truncated Pyramid

PRINCIPLES OF SURFACE DEVELOPMENT

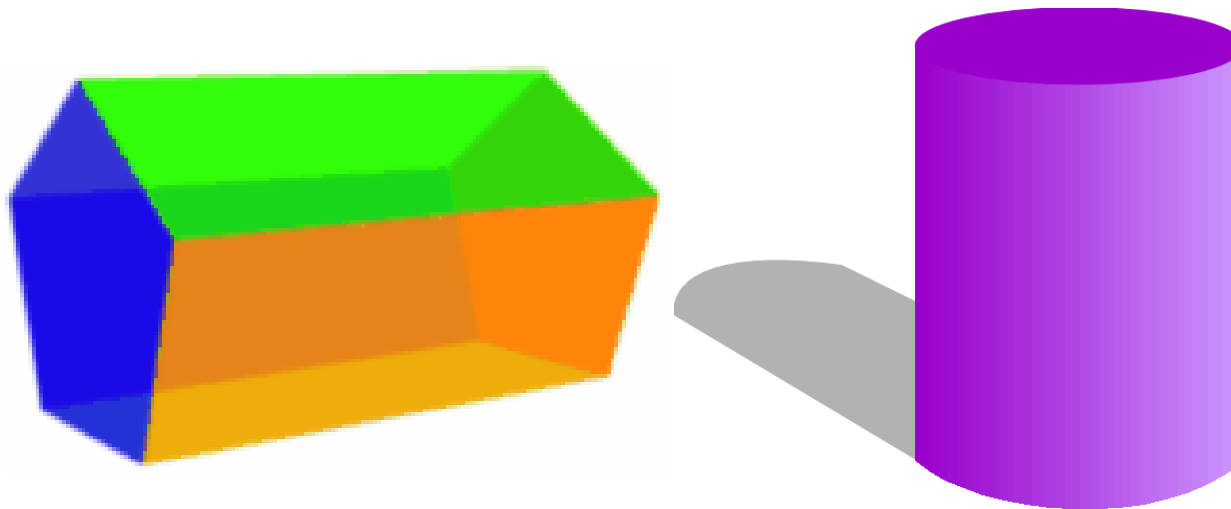
Every line on the development should show the true length of the corresponding line on the surface which is developed.

METHODS OF DEVELOPMENT

- ☐ Parallel-line development
- ☐ Radial-line development
- ☐ Triangulation development
- ☐ Approximate development

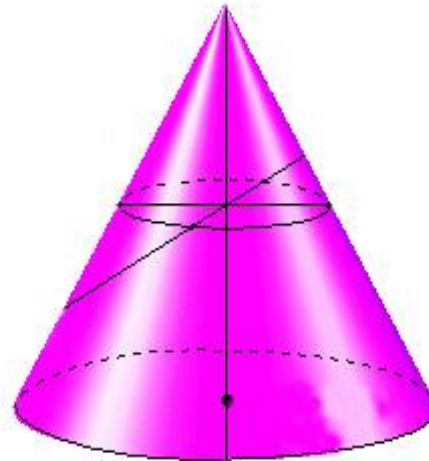
PARALLEL-LINE DEVELOPMENT

It is used for developing **Prisms** and single curved surfaces like **Cylinders**, in which all the edges/generation of lateral surfaces are parallel in each other.



RADIAL-LINE DEVELOPMENT

It is employed for **Pyramids** and single curved surfaces like **Cones** in which the apex is taken as centre and the slant edge or generator as radius of its development.



TRIANGULATION DEVELOPMENT

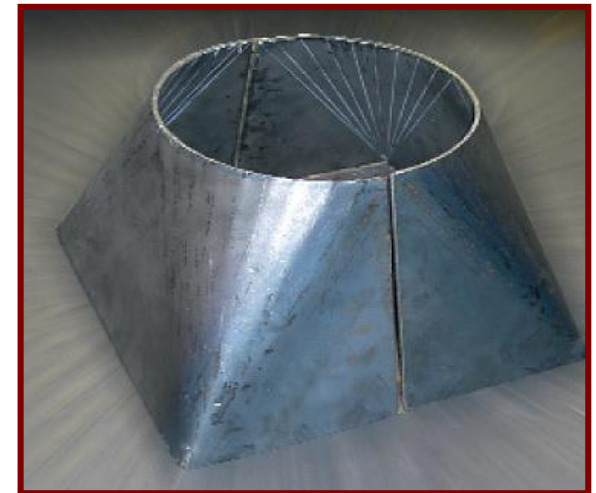
It is used for developing **transition pieces**.

❑ Transition pieces are usually made to connect two different forms, such as round pipes to square pipes.

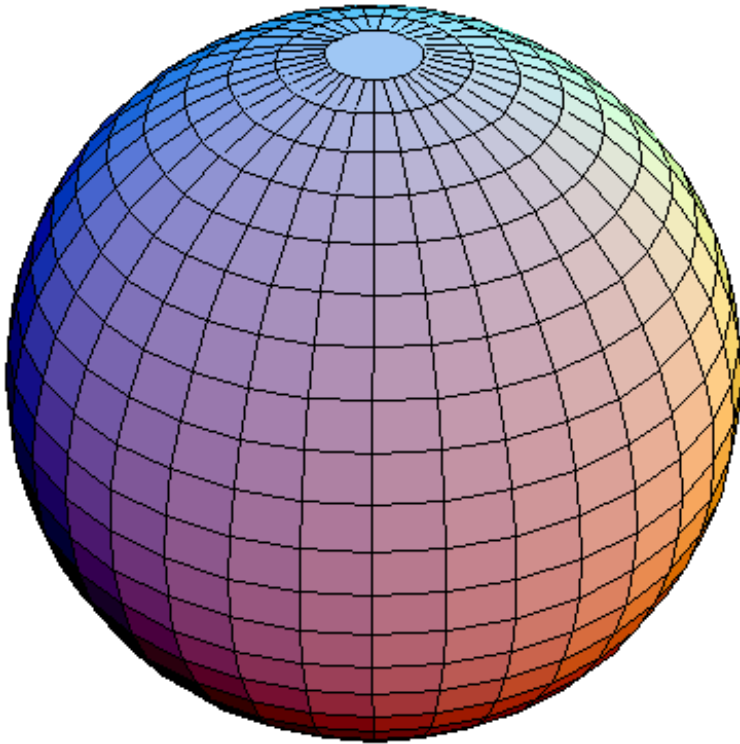
❑ These transition pieces will usually fit the definition of a non developable surface that must be developed by an approximation.

❑ This is done by assuming the surface to be made from a series of triangular surfaces laid side-by-side to form the development.

❑ This form of development is known as **Triangulation**



APPROXIMATE DEVELOPMENT



It is employed for double curved surfaces like **Spheres**, as they are theoretically not possible to develop. The surface of the sphere is developed by approximate method. When the surface is cut by a series of cutting planes, the cut surfaces is called a zone.