VISUALISING SOLID SHAPES

EULER'S FORMULA

EULER'S FORMULA

Leonhard Euler was Swiss mathematician. One of his most remarkable observation gave a relationship among the number of vertices (V), edges (E) and faces (F) of a polyhedron. To understand Euler's formula we study the following figures :









	F	V	F + V	Е	$\mathbf{F} + \mathbf{V} - \mathbf{E}$
Tetrahedron	4	4	8	6	2
Cube	6	8	14	12	2
Octahedron	8	6	14	12	2
Pentagonal Prism	7	10	17	15	2

Explanation

Let us build the prism by successively adding faces to the base of the prism shown above.









- (i) First put the base.
- (ii) Now add the second face. In adding a second face there are two vertices, and one edge is common with the first so that the number of new edges is one more than the new vertices. But we have added one face.

V - E + F = 1 is true for two faces joined along one edge.

- (iii) Add a new face. The number of new edges is one more than the number of new vertices and one face is added.
- (iv) The formula V E + F = 1 remains true for each added face.
- (v) When the last face is added, no new edges or vertices are added but one face is added and the formula becomes: V E + F = 2 or F + V = E + 2

REMEMBER

- The figures having only two dimensions are called plane figures or 2-dimensional figures.
- The figures having three dimensions (length, breadth and height) are called solid figures or 3-dimensional figures.
- 3. Prisms are solid figures which have a uniform cross-section. A prism is named according to its cross-section.
- 4. A pyramid has a plane figure for a base and all other sides are triangles meeting at one point. A pyramid is named according to the shape of its non-triangular face. If all its faces are triangular, then it is called a triangular pyramid.
- 5. A solid shape made up of polygonal regions is called a polyhedron.
- 6. The concept of convex polyhedron is similar to the concept of convex polygons.
- A polyhedron is said to be regular, if its faces are made up of regular polygons and the same number of faces meet at each vertex.
- 8. For every simple polyhedron F E + V = 2, where F, E and V denote the number of faces, edges and vertices respectively of the polyhedron. This is called Euler's formula.