

Introduction

Let us define some terms to understand the different three dimensional figures:

1) Solids: In geometry, three dimensional figures are also termed as solid object or shape which is having three dimensions namely length, breadth and height.

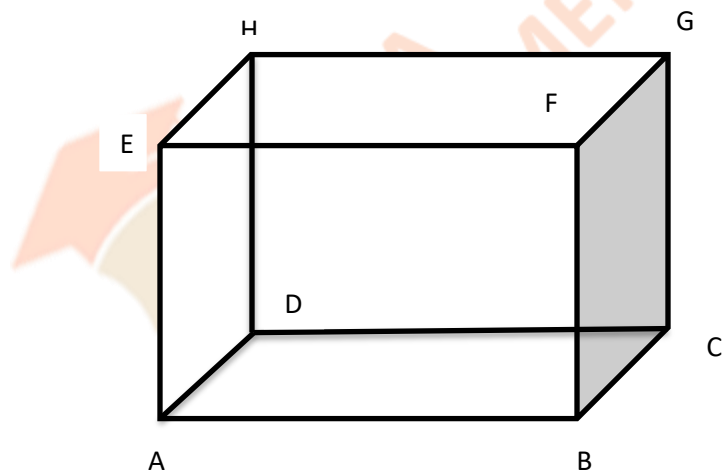
2) Faces: A face is the flat portion of the 3D figure.

3) Vertices: A vertex is the corner where three faces of a solid meet.

4) Edges: An edge is the point where two faces meet in a line.

Some 3D figures:

(a) **Cuboid:** It is a solid that have six rectangular plane faces. For example: A book, a brick etc.



- Cuboid has 6 faces

In the above figure, ABCD, EFGH, ADHE, BCGF, ABFE and DCGH are the 6 faces

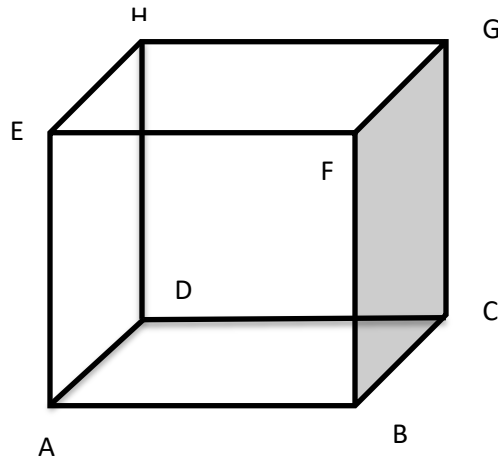
- It has 8 vertices

In the above figure, A, B, C, D, E, F, G and H are vertices.

- It has 12 edges

In the above figure, AB, BC, CD, DA, EF, GF, GH, HE, AE, DH, BF and CG are all edges.

(b) Cube: It is a solid in which length, breadth and height are equal. It is formed by six identical or congruent squares.



- Cube has 6 faces

In the above figure, ABCD, EFGH, ADHE, BCGF, ABFE and DCGH are the 6 faces

- It has 8 vertices

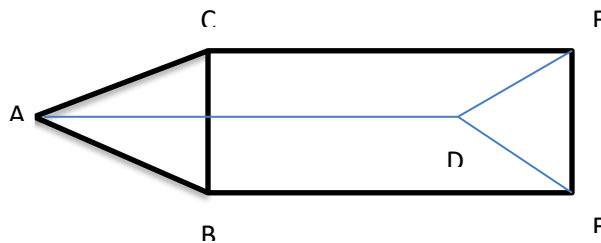
In the above figure, A, B, C, D, E, F, G and H are vertices.

- It has 12 edges

In the above figure, AB, BC, CD, DA, EF, GF, GH, HE, AE, DH, BF and CG are all edges.

(c) Prism: It is a solid in which the side faces are rectangles and two faces are congruent parallel polygons.

Triangular prism: It is a solid having two parallel end-faces each one of which is a triangle and three lateral faces each one is of rectangle.



- Faces: It has 2 triangular faces and 3 rectangular faces.

In the above figure, Rectangular faces are ABED, ADFC and CBEF.

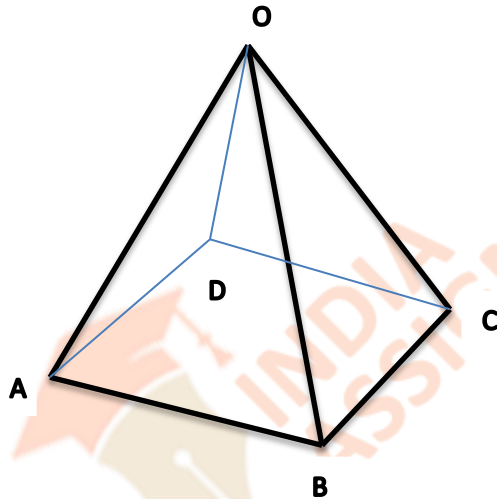
Triangular faces are $\triangle ABC$ and $\triangle DEF$

- Vertices: It has 6 vertices namely A, B, C, D, E, F.
- Edges: It has 9 edges.

In the above figure, edges are AB, BC, CA, DE, DF, EF, AD, CF and BE.

(d) Pyramid: It is a solid whose side faces are triangular having a common vertex and whose base is a plane rectilinear figure.

Square pyramid: It is a solid having side faces as triangles and base as square.



- Vertices: It has 5 vertices.

In the above figure, O, A, B, C and D are vertices

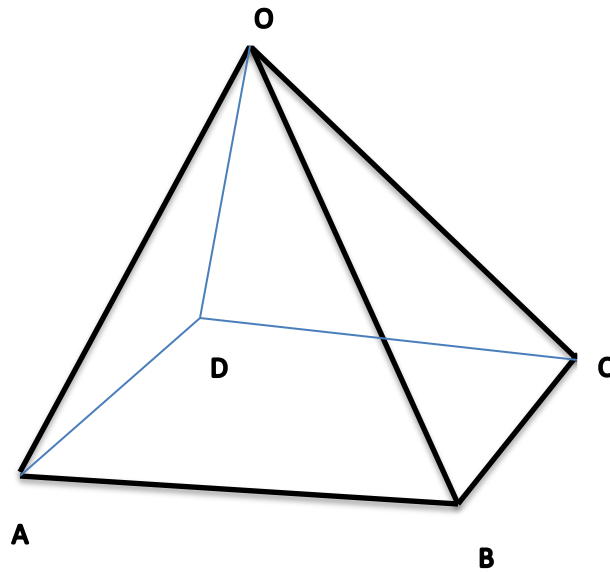
- Faces: It has 5 faces one of which is a square and all other are triangle.

In the above figure, ABCD is a square face.

OAD, ODC, OCB, OAB are triangular faces.

- Edges: It has 8 edges namely AB, BC, CD, AD, OA, OD, OC and OB.

Rectangular pyramid: It is a solid whose side faces are triangular having a common vertex and base is a rectangle.



- Vertices: It has 5 vertices.

In the above figure, O, A, B, C and D are vertices

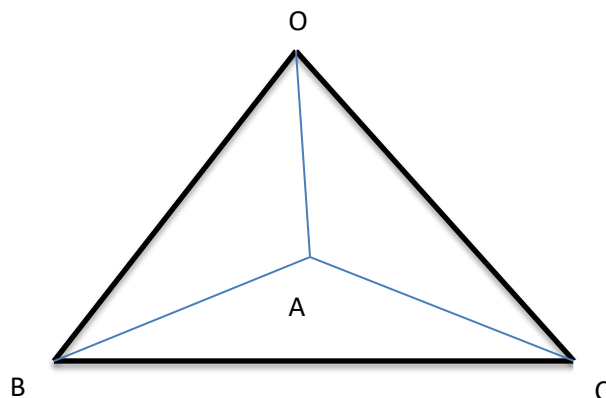
- Faces: It has 5 faces one of which is a rectangle and all other are triangle.

In the above figure, ABCD is a rectangular face.

OAD, ODC, OCB, OAB are triangular faces.

- Edges: It has 8 edges namely AB, BC, CD, AD, OA, OD, OC and OB.

Triangular pyramid: It is a solid whose side faces are triangular having a common vertex and base is a triangle. This solid is also known as Tetrahedron.



- Vertices: It has 4 vertices.

In the above figure, O, A, B, C and are vertices

- Faces: It has 4 faces, all are triangular

In the above figure, OAC, OBC, ACB and OAB are triangular faces.

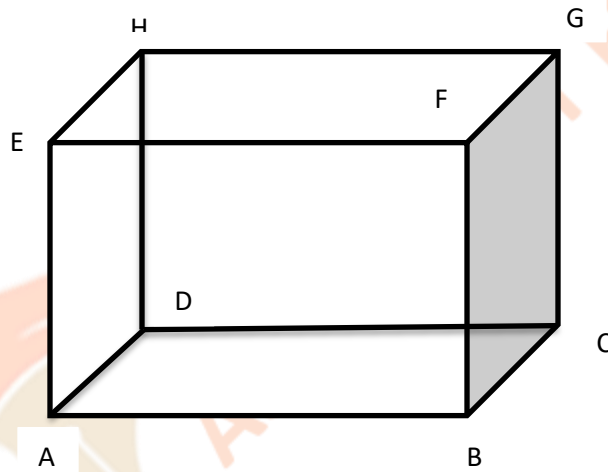
- Edges: It has 6 edges namely AB, BC, AC, OA, OC and OB.

Exercise 19A

Question 1 – Write down the number of faces of each of the following figures:

(a) Cuboid

Solution -

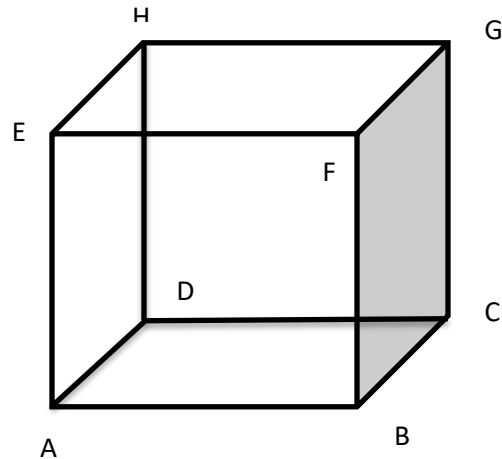


Cuboid has 6 faces

In the above figure, ABCD, EFGH, ADHE, BCGF, ABFE and DCGH are the 6 faces

(b) Cube

Solution -

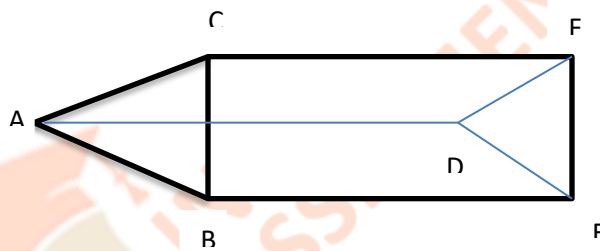


Cube has 6 faces

In the above figure, ABCD, EFGH, ADHE, BCGF, ABFE and DCGH are the 6 faces

(c) Triangular prism

Solution -



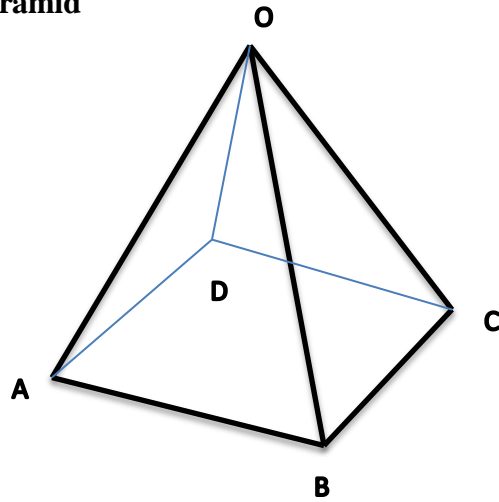
Faces: It has 2 triangular faces and 3 rectangular faces.

In the above figure, Rectangular faces are ABED, ADFC and CBEF.

Triangular faces are $\triangle ABC$ and $\triangle DEF$

(d) Square Pyramid

Solution -



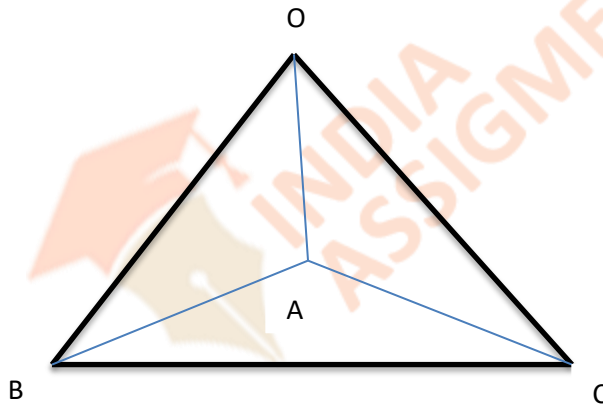
Faces: It has 5 faces one of which is a square and all other are triangle.

In the above figure, ABCD is a square face.

OAD, ODC, OCB, OAB are triangular faces.

(e) Tetrahedron

Solution -



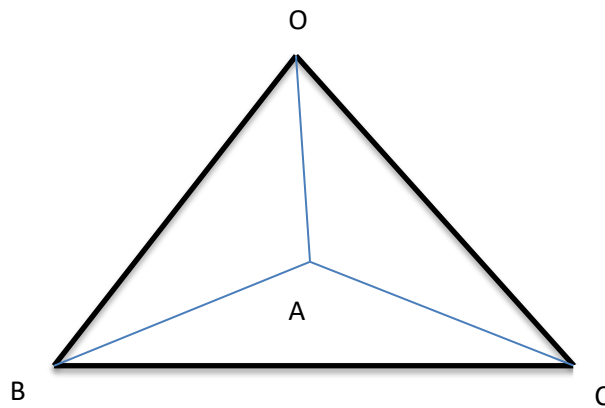
Faces: It has 4 faces, all are triangular

In the above figure, OAC, OBC, ACB and OAB are triangular faces.

Question 2 – Write down the number of edges of each of the following figures:

(a) Tetrahedron

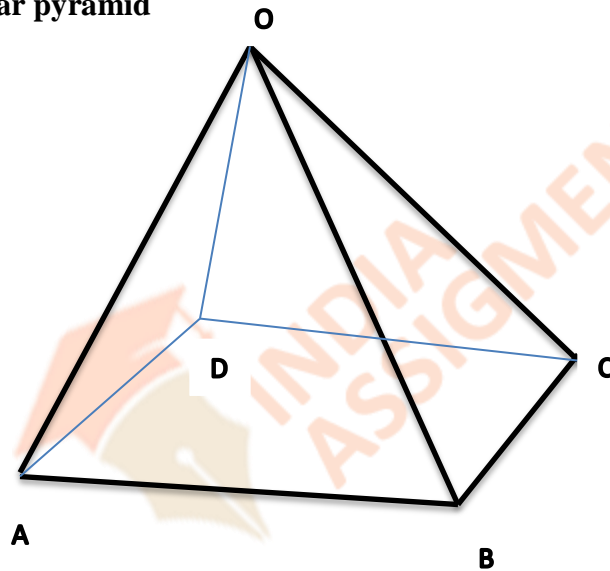
Solution -



It has 6 edges namely AB, BC, AC, OA, OC and OB.

(b) Rectangular pyramid

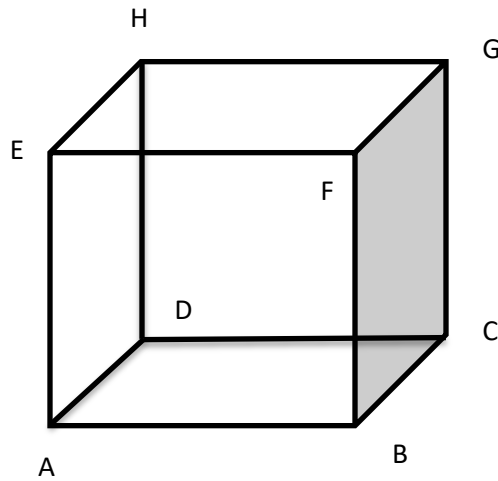
Solution -



It has 8 edges namely AB, BC, CD, AD, OA, OD, OC and OB.

(c) Cube

Solution -

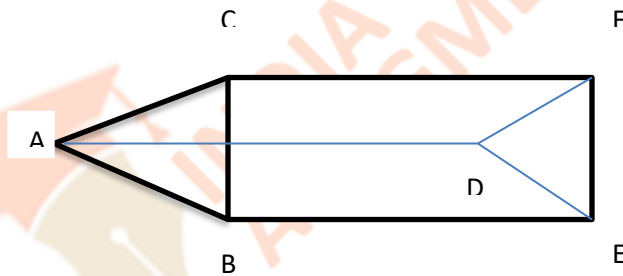


It has 12 edges

In the above figure, AB, BC, CD, DA, EF, GF, GH, HE, AE, DH, BF and CG are all edges.

(d) Triangular prism:

Solution -



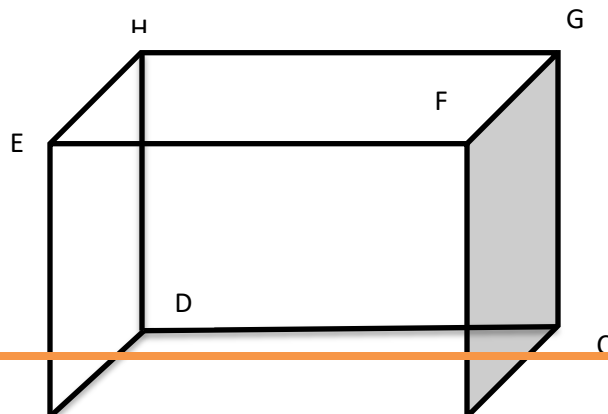
It has 9 edges.

In the above figure, edges are AB, BC, CA, DE, DF, EF, AD, CF and BE.

Question 3 – Write down the number of vertices of each of the following figures:

(a) Cuboid

Solution -

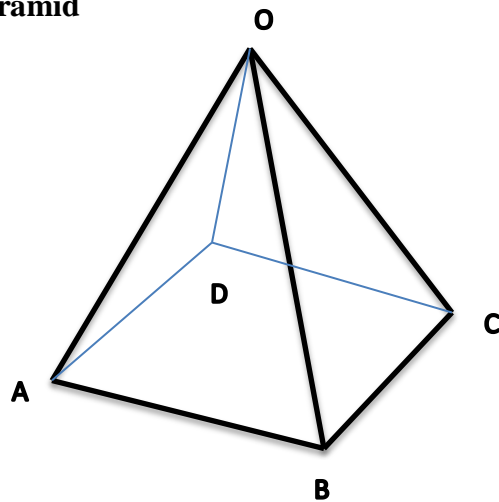


It has 8 vertices

In the above figure, A, B, C, D, E, F, G and H are vertices.

(b) Square pyramid

Solution -

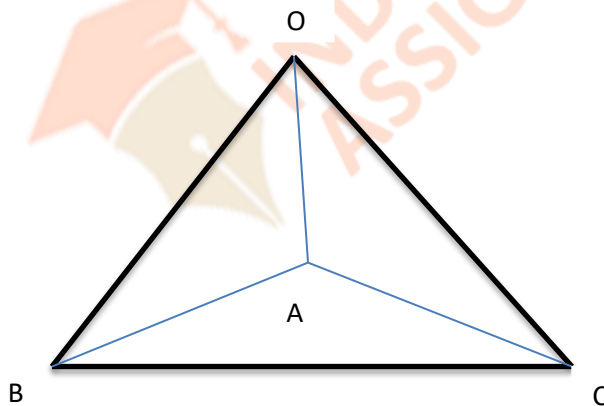


It has 5 vertices.

In the above figure, O, A, B, C and D are vertices

(c) Tetrahedron

Solution -

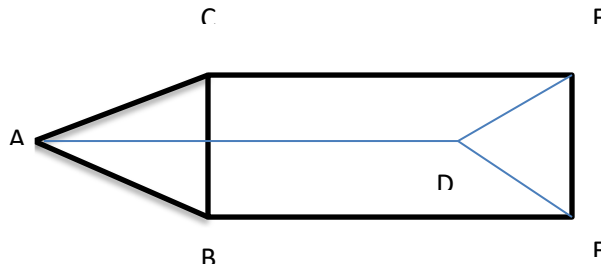


It has 4 vertices.

In the above figure, O, A, B, C and are vertices

(d) Triangular prism

Solution -



It has 6 vertices namely A, B, C, D, E, F.

Question 4 – Fill in the blanks:

- (a) A cube has **8 vertices, 12 edges and 6 faces**.
- (b) The point at which three faces of a figure meet is known as its **vertex**.
- (c) A cuboid is also known as a rectangular **Prism**.
- (d) A triangular pyramid is called a **tetrahedron**.

Exercise 19B

Question 1 – Define Euler’s Relation between the number of faces, number of edges and number of vertices for various 3-dimensional figures

Solution - Euler’s Relation For 3-D figures is given as follows:

$$F - E + V = 2$$

Where, F = Number of faces

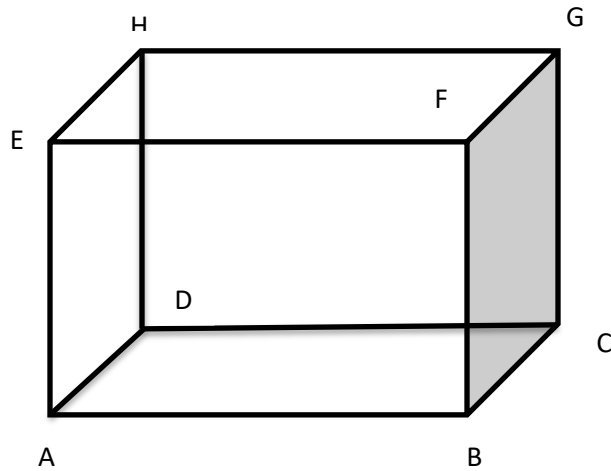
E = Number of edges

V = Number of vertices

Question 2 – How many edges are there in a

(a) Cuboid

Solution -

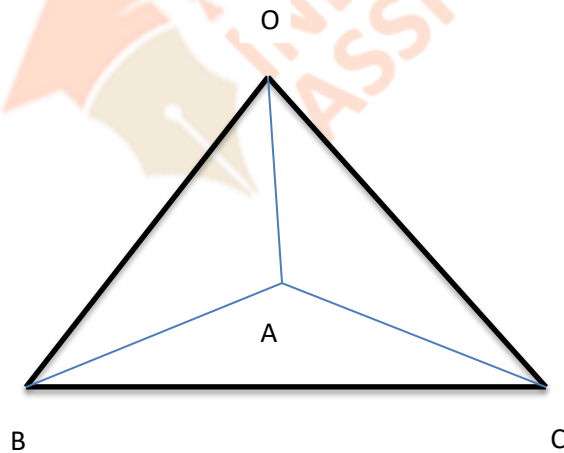


It has 12 edges

In the above figure, AB, BC, CD, DA, EF, GF, GH, HE, AE, DH, BF and CG are all edges.

(b) Tetrahedron

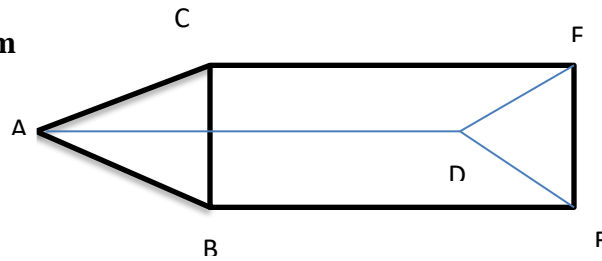
Solution -



It has 6 edges namely AB, BC, AC, OA, OC and OB.

(c) Triangular prism

Solution -

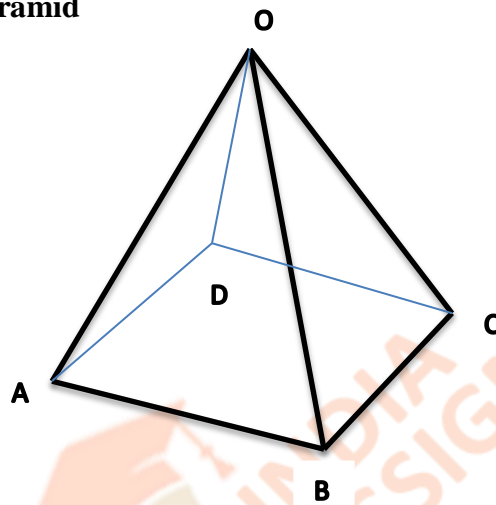


It has 9 edges.

In the above figure, edges are AB, BC, CA, DE, DF, EF, AD, CF and BE.

(d) Square pyramid

Solution -

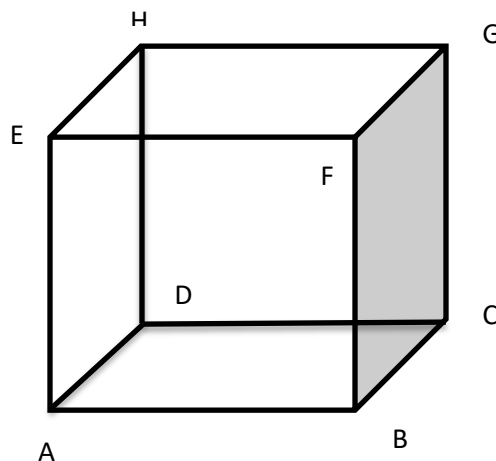


It has 8 edges namely AB, BC, CD, AD, OA, OD, OC and OB.

Question 3 – How many edges are there in a

(a) Cube

Solution -

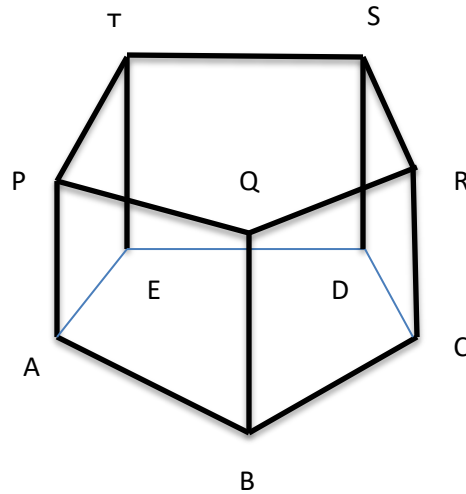


Cube has 6 faces

In the above figure, ABCD, EFGH, ADHE, BCGF, ABFE and DCGH are the 6 faces

(b) Pentagonal prism

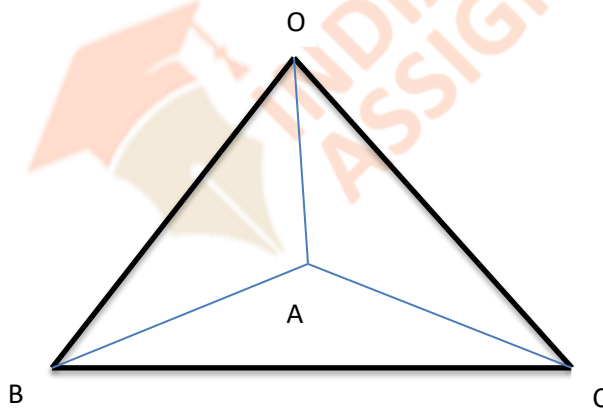
Solution -



Pentagonal prism has 7 faces, 2 pentagons and 5 rectangles, namely PTSRQ, AEDCB, APTE, ABQP, QRCD, SRCB and STED.

(c) Tetrahedron

Solution -

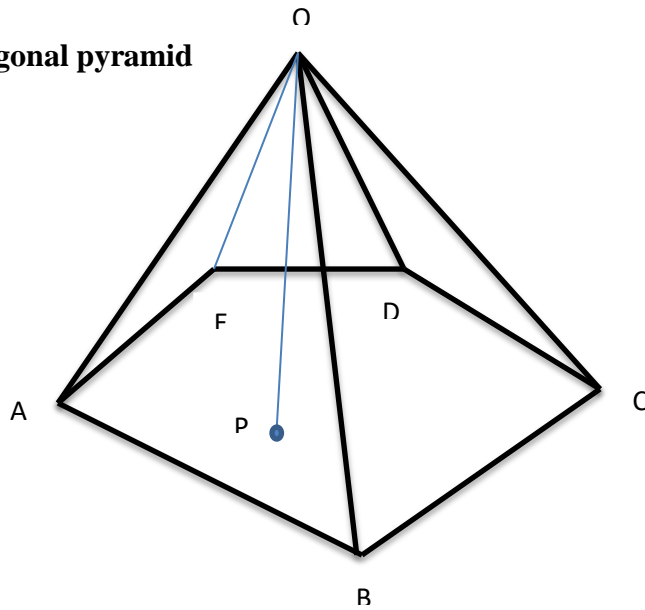


Faces: It has 4 faces, all are triangular

In the above figure, OAC, OBC, ACB and OAB are triangular faces.

(d) Pentagonal pyramid

Solution -

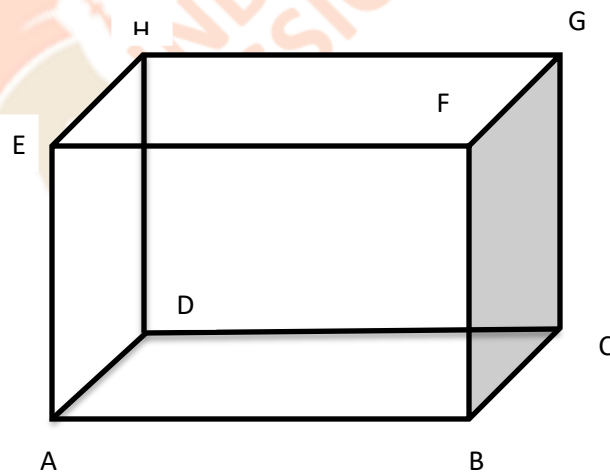


Pentagonal pyramid has 6 faces, 1 pentagon and 5 triangles, namely EDCBA, OEA, ODC, OED, OAB and OCB

Question 4 – How many vertices are there in a

(a) Cuboid

Solution -

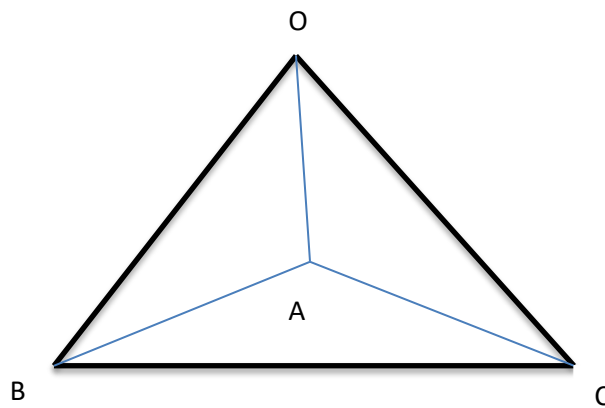


It has 8 vertices

In the above figure, A, B, C, D, E, F, G and H are vertices.

(b) Tetrahedron

Solution -

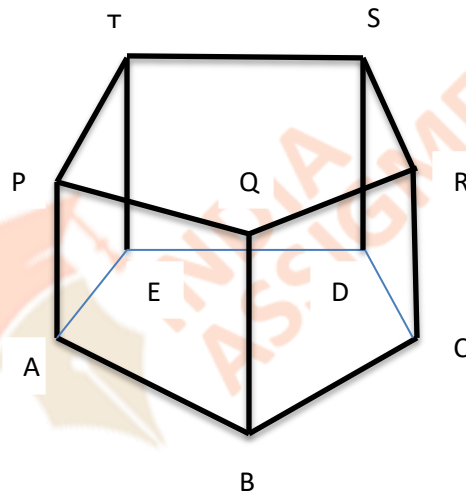


It has 4 vertices.

In the above figure, O, A, B, C and are vertices

(c) Pentagonal prism

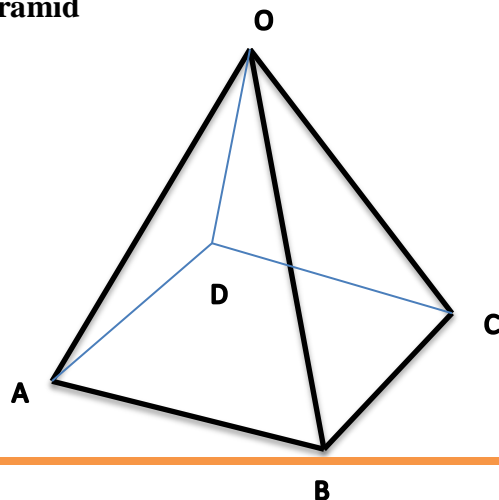
Solution -



Pentagonal prism has 10 vertices, namely A, B, C, D, E, P, Q, R, S and T.

(d) Square pyramid

Solution -



Square pyramid has 5 vertices.

In the above figure, O, A, B, C and D are vertices

Question 5 – Verify Euler’s Relation for each of the following:

(a) A cube

Solution - We know that Euler’s Relation For 3-D figures is:

$$F - E + V = 2$$

Where, F = Number of faces

E = Number of edges

V = Number of vertices

In a Cube, Number of faces (F) = 6

Number of edges (E) = 12

Number of vertices (V) = 8

$$\text{LHS: } F - E + V = 6 - 12 + 8 = -6 + 8 = 2 = \text{RHS}$$

Hence verified

(b) A tetrahedron

Solution - We know that Euler’s Relation For 3-D figures is:

$$F - E + V = 2$$

Where, F = Number of faces

E = Number of edges

V = Number of vertices

In a tetrahedron, Number of faces (F) = 4

Number of edges (E) = 6

Number of vertices (V) = 4

$$\text{LHS: } F - E + V = 4 - 6 + 4 = -2 + 4 = 2 = \text{RHS}$$

Hence verified

(c) A triangular prism

Solution - We know that Euler's Relation For 3-D figures is:

$$F - E + V = 2$$

Where, F = Number of faces

E = Number of edges

V = Number of vertices

In a triangular prism, Number of faces (F) = 5

Number of edges (E) = 9

Number of vertices (V) = 6

$$\text{LHS: } F - E + V = 5 - 9 + 6 = -4 + 6 = 2 = \text{RHS}$$

Hence verified

(d) A square pyramid

Solution - We know that Euler's Relation For 3-D figures is:

$$F - E + V = 2$$

Where, F = Number of faces

E = Number of edges

V = Number of vertices

In a tetrahedron, Number of faces (F) = 5

Number of edges (E) = 8

Number of vertices (V) = 5

$$\text{LHS: } F - E + V = 5 - 8 + 5 = -3 + 5 = 2 = \text{RHS}$$

Hence verified