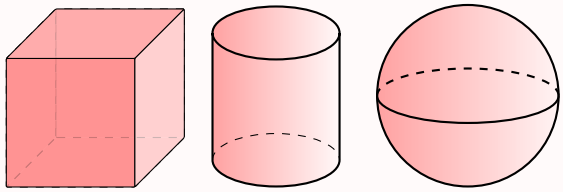
THREE-DIMENSIONAL SHAPES

A THREE-DIMENSIONAL SHAPES

Definition Solid Geometry

In solid geometry, we study **three-dimensional (3D) shapes**, such as cubes, cylinders, and spheres. The diagrams below show some examples of these shapes.



Definition Surface

A **surface** is the outside of a three-dimensional (3D) shape. It is the part of the shape you can touch.

Definition Face

A **face** is a flat surface on a three-dimensional shape.

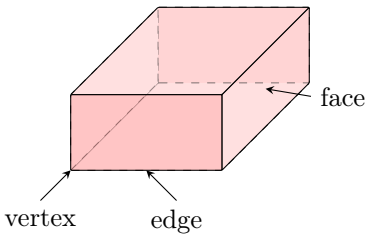
Definition Edge

An **edge** is a straight line where two faces meet.

Definition Vertex

A **vertex** is a corner of a three-dimensional shape. It is a point where two or more edges meet.

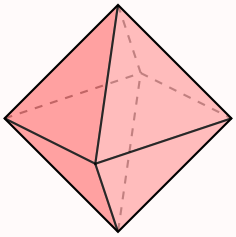
Ex: This box-shaped solid has many faces, edges, and vertices. One example of each is shown.



B POLYHEDRON

Definition Polyhedron

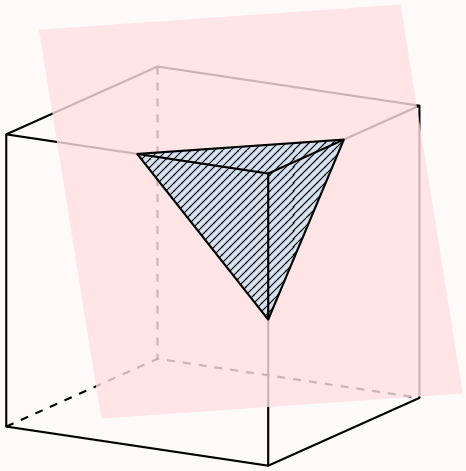
A **polyhedron** is a three-dimensional solid with flat faces that are polygons.



C CROSS SECTIONS

Definition Cross Section

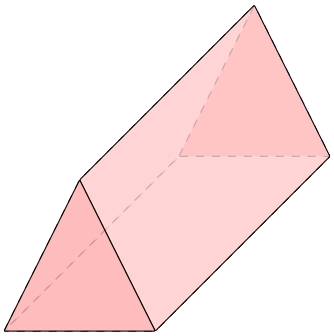
A **cross section** of a solid is the two-dimensional (flat) shape made when a plane cuts through the solid.



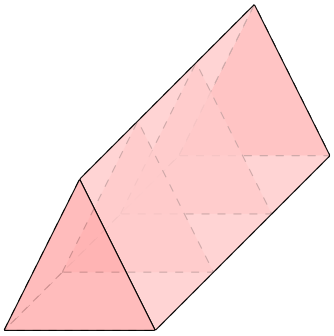
Definition Uniform Cross Section

A **uniform cross section** means that, when you slice the solid in the same direction, the cross section has the same size and shape at every point along its length.

Ex: Does this solid have a uniform cross section?

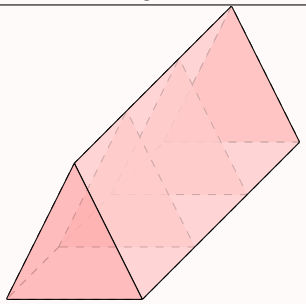
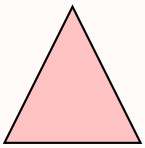
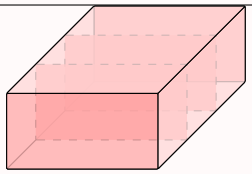
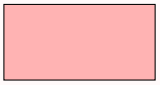


Answer: Yes. When sliced perpendicular to its length, each cross section is a triangle of the same size and shape. So it has a uniform cross section. The solid is a triangular prism.



Definition **Prism**

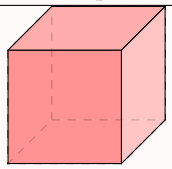
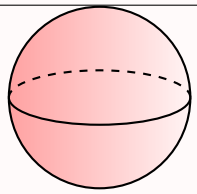
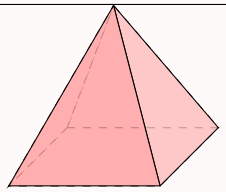
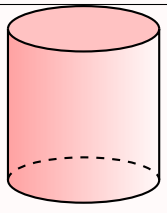
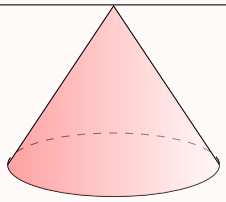
A **prism** is a polyhedron that has a uniform cross section which is a polygon. It has two identical, parallel faces called bases, and all the other faces are rectangles. Prisms are named according to the shape of their base.

Name	Figure	Cross Section
Triangular prism		
Rectangular prism		

D CLASSIFICATION

Definition **Classification**

We can classify 3D shapes by the number of faces, edges, and vertices they have.

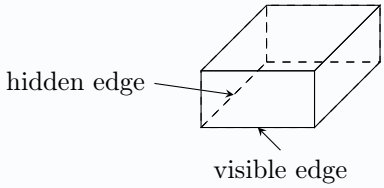
Name	Shape	Faces	Edges	Vertices
Cube (square prism)		6 (flat)	12	8
Sphere		1 (curved)	0	0
Square Pyramid		5 (flat)	8	5
Cylinder		3 (1 curved, 2 flat)	0	0
Cone		2 (1 curved, 1 flat)	0	0

Note: Cylinders, cones, and spheres are solids but they are not polyhedra because they have curved faces.

E DRAWING THREE-DIMENSIONAL SHAPES

Method Drawing 3D Shapes

When we draw 3D (three-dimensional) shapes on paper, we can only see the front of the shape. Some edges are behind and cannot be seen. These are called **hidden edges**. To show that an edge is hidden but still part of the shape, we draw it with dashed lines. Solid lines show the edges we can see.

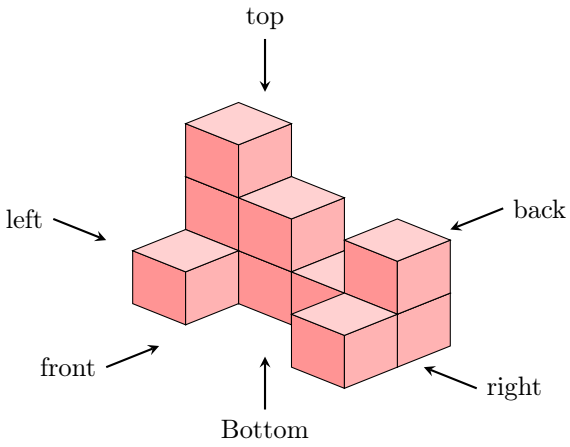


F MULTI-VIEW PROJECTION

Definition Multi-view Projection

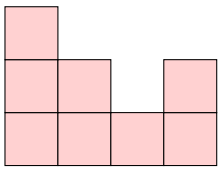
A **multi-view projection** is a way to show a 3D shape using several 2D drawings. Each drawing shows how the shape looks from a different side, such as the front, the right side, or the top. These views help us understand the shape more clearly.

Ex: Draw the front, right, and top views of this solid.

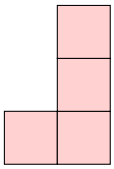


Answer:

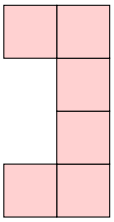
1. Front view:



2. Right view:



3. Top view:



Each small square in a view represents one cube of the solid seen from that side.

G SOLID CONSTRUCTIONS

Definition Net

A **net** of a solid is a flat 2D figure that can be folded along its edges to form a 3D solid. Dashed lines show where to fold.