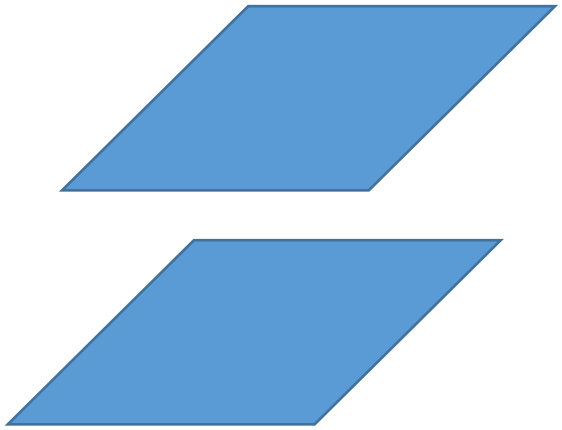
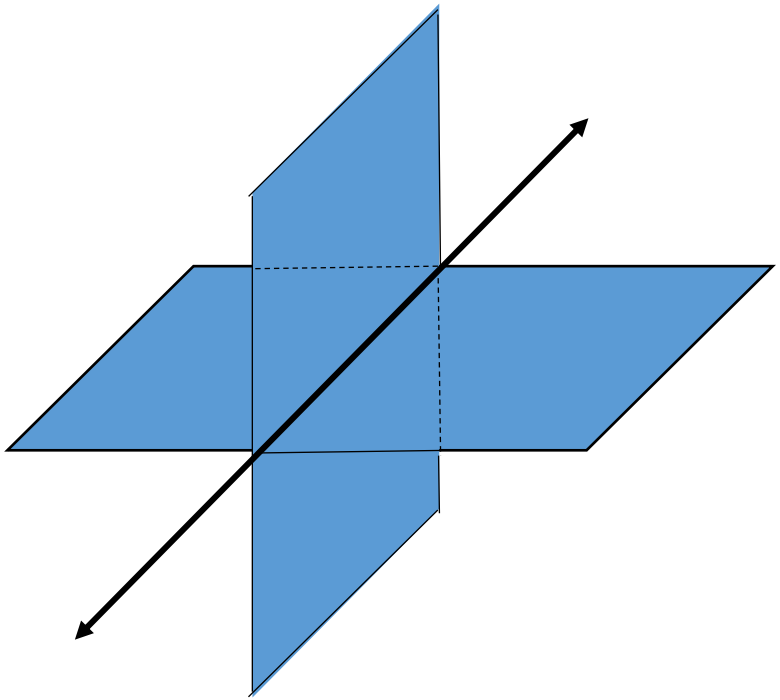
Three-dimensional Shapes:

Planes in space:



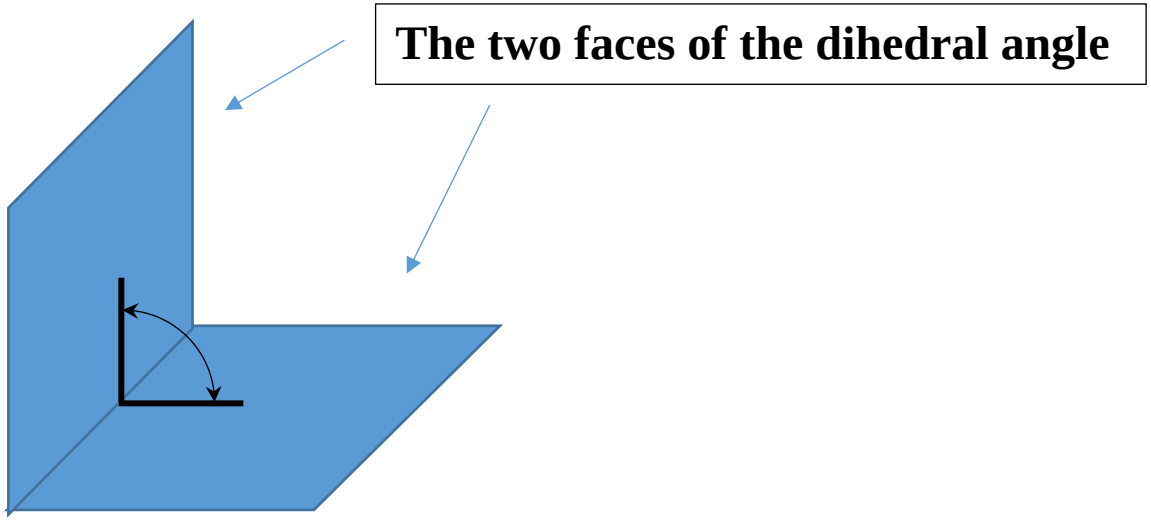
parallel planes



intersecting planes

Dihedral Angle:

It's formed by the union of two polygonal regions in space that share an edge.

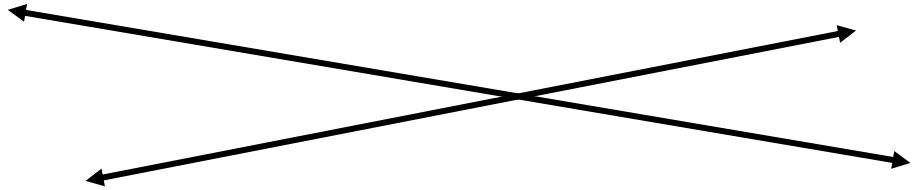


A dihedral angle is measured using segments in the faces that are perpendicular to the line of intersection of the two polygonal regions.

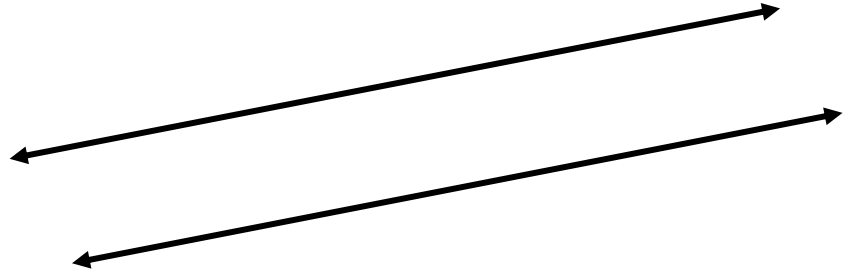
Lines in Space:

Two lines in space can

Intersect, i.e. have a single point in common.



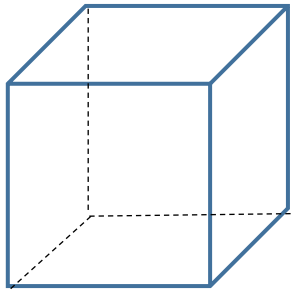
Be parallel, i.e. have no points in common but maintain a constant perpendicular distance.

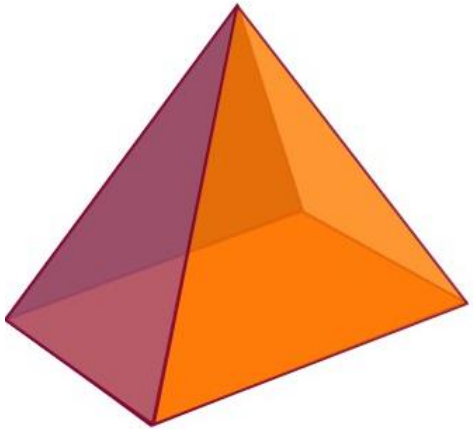


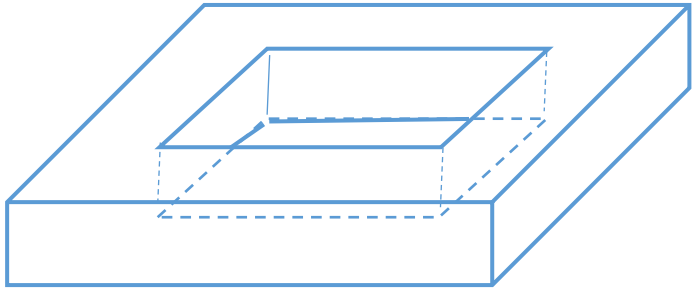
Be skew, i.e. have no points in common, but not be parallel.

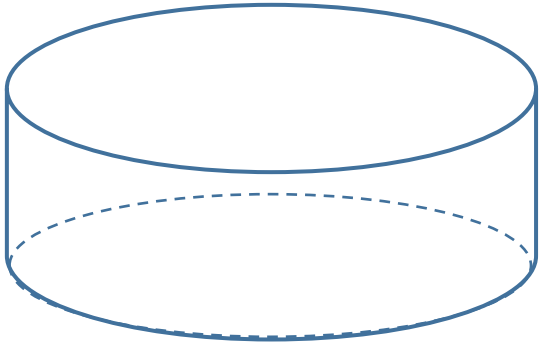
Polyhedron:

It's the union of polygonal regions, any two of which have at most one side in common, that encloses a finite connected region of space without holes.

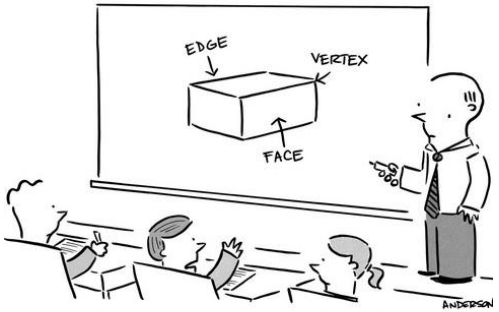






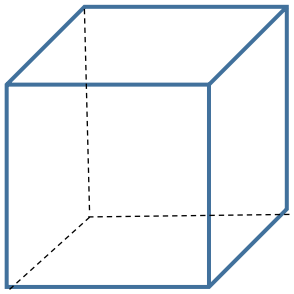


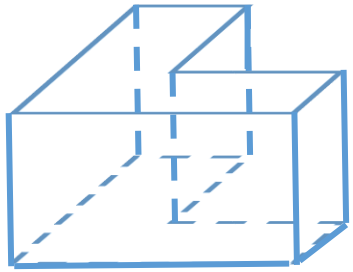
The polygonal regions are called the <u>faces</u> of the polyhedron. The segments common to a pair of faces are called the <u>edges</u> of the polyhedron. The points where three or more edges intersect are called the <u>vertices</u> of the polyhedron.



"That's fine, but you haven't told us the most important part - what's *in* it?!"

A polyhedron is <u>convex</u> if every line segment joining two of its points is contained inside the polyhedron or on one of the faces.

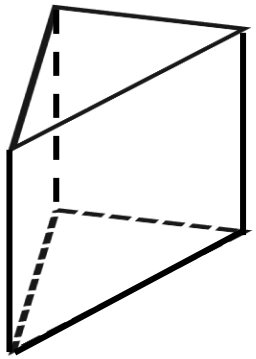


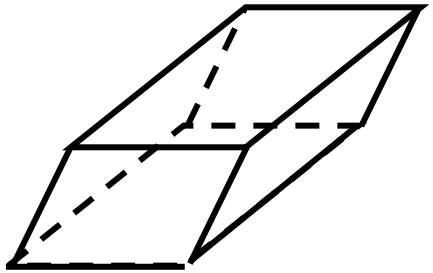


Types of Polyhedra:

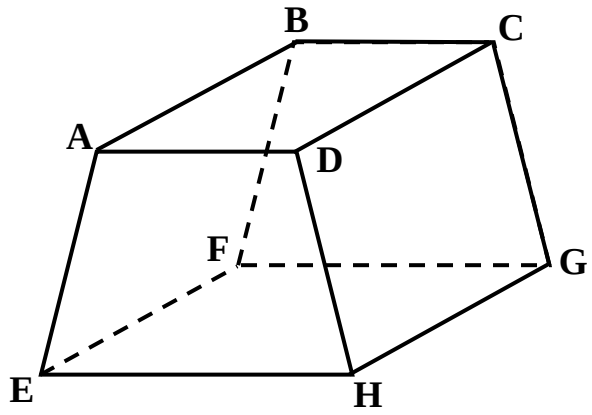
Prism:

It's a polyhedron with two opposite faces that are identical polygonal regions called the bases. The vertices of the bases are joined with segments to form the lateral faces which are parallelograms. If the lateral faces are rectangles, the prism is called a right prism, otherwise, it's called an oblique prism.





The following polyhedron is a right trapezoidal prism.



1) Describe the shape of the two bases.

2) Describe the shape of the four lateral faces.

3) How many faces does the prism have? 4) How many edges does the prism have?

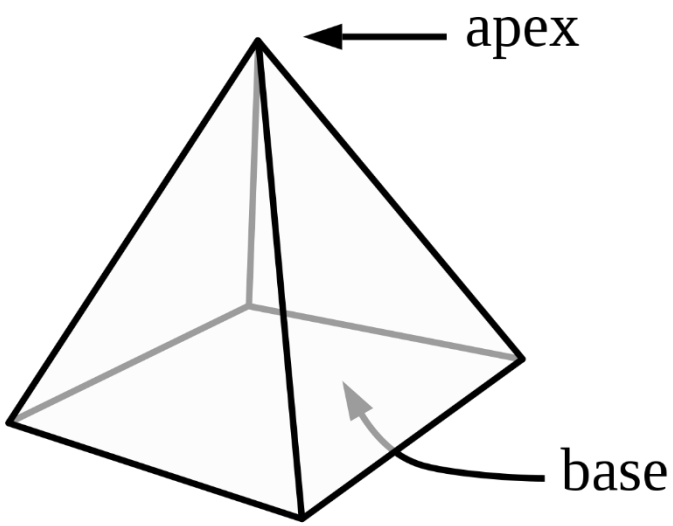
5) How many vertices does the prism have?

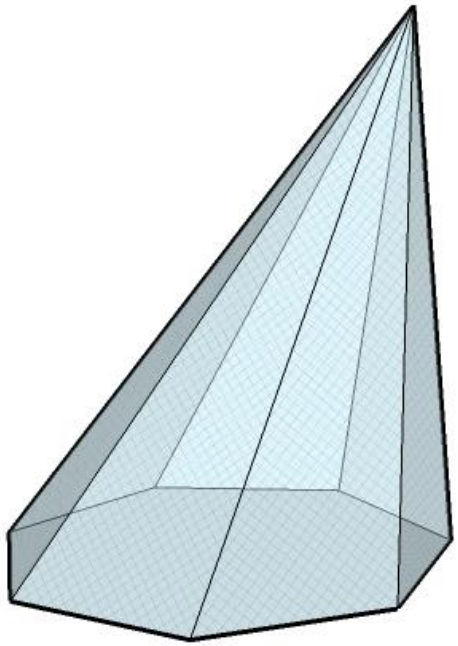
7) If $m(\angle DAE)=110°, m(\angle ADH)=110°, m(\angle AEH)=70°$**, then find the measure of the dihedral angle between the face DCGH and the face EFGH.**

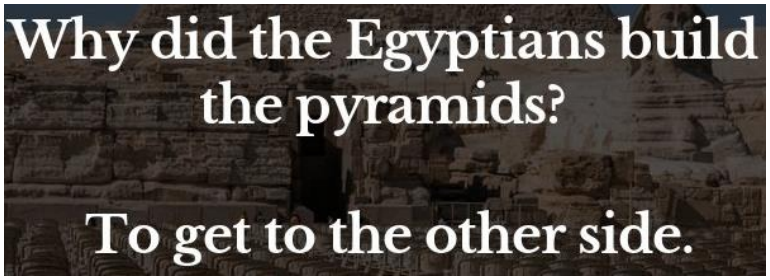
Pyramid:

It's a polyhedron formed by connecting the vertices of a polygonal region called the base to another point not in the plane of the base called the apex using segments. Pyramids whose bases are regular polygonal regions are classified into two groups:

If the lateral faces are isosceles triangles, then it's a right regular pyramid. Otherwise, it's an oblique regular pyramid.



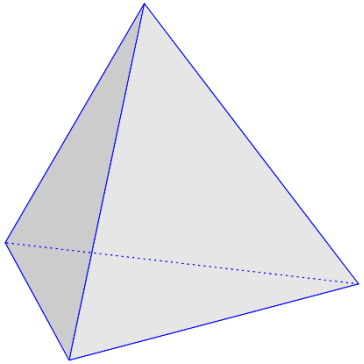




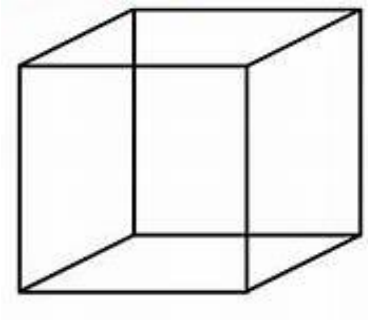
Regular Polyhedron:

It's a polyhedron in which all the faces are identical regular polygonal regions and all dihedral angles have the same measure.

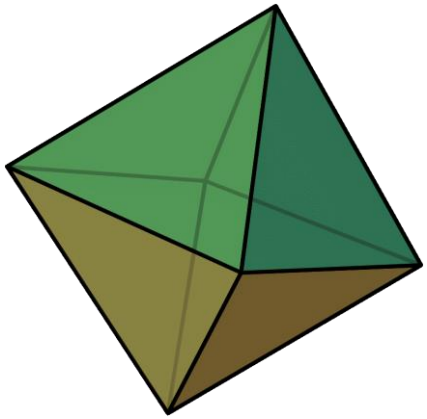
The ancient Greeks were able to show that there are exactly five regular convex polyhedra, called the Platonic solids.



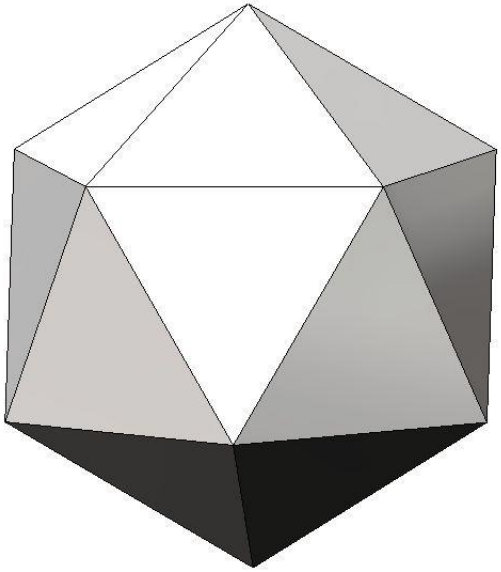
tetrahedron



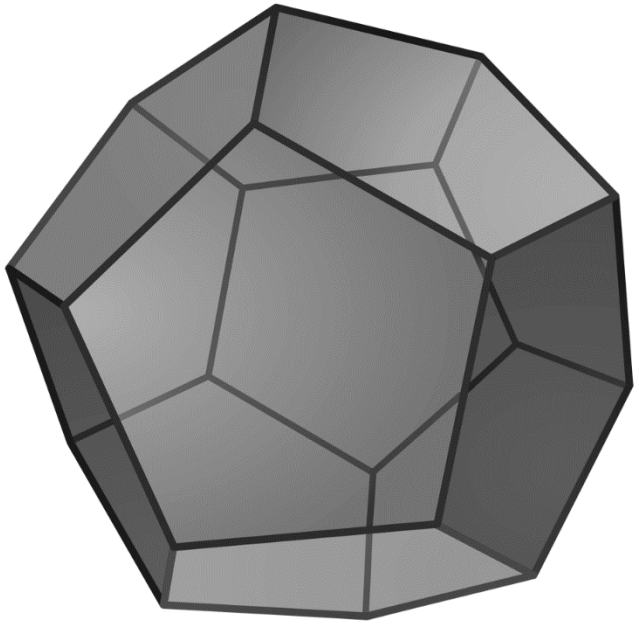
cube



octahedron



icosahedron



dodecahedron

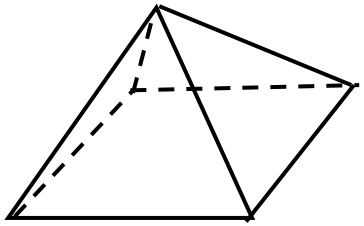
The famous mathematician, Leonhard Euler, proved that a certain equation must be true for all convex polyhedra: $F + V = E + 2$, i.e. the number of faces added to the number of vertices must equal the number of edges plus 2. It's called Euler's formula.

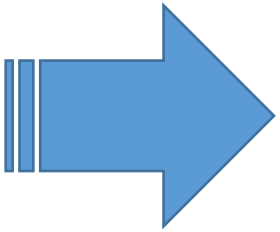
Verify Euler's formula for some of the polyhedra that we've looked at.

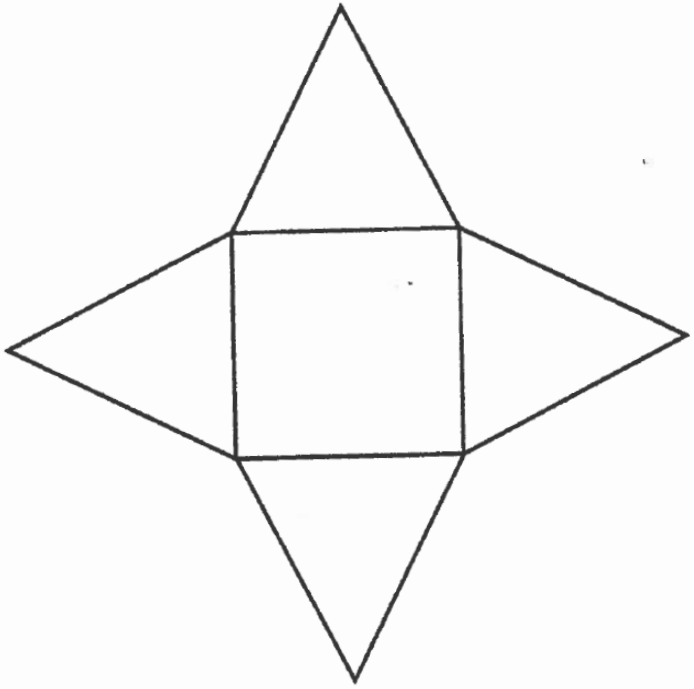
Nets:

3-dimensional figures have two dimensional representations called nets. Think of a net as cutting along some edges and unfolding a 3-dimensional figure in order to lay it out flat.

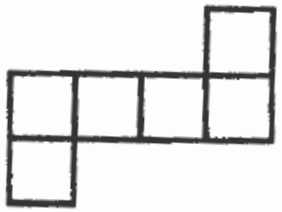
Example:



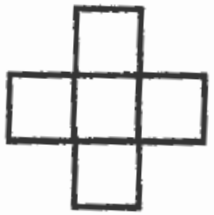




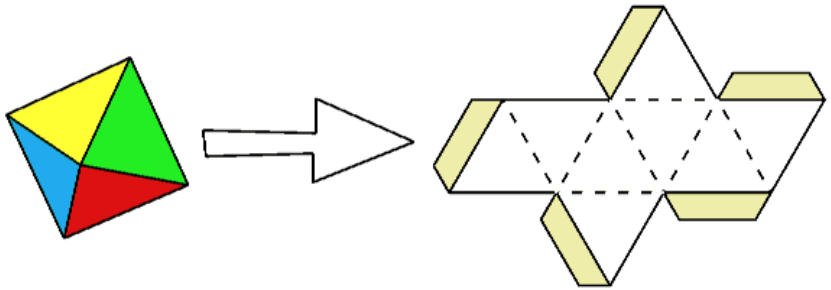
Which of the following could be a net for a cube?

A. 

B. 

C. 

How many squares would the net need to have?



Dodecahedron