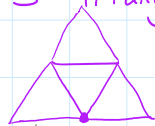


Regular Polyhedra: all faces are congruent regular polygons, the same number of faces meet at each vertex at the same angles.

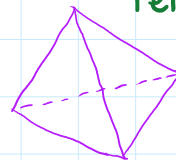
How many regular polyhedra are there?

[PLATONIC SOLIDS]

• Triangular faces: 3 triangles per vertex

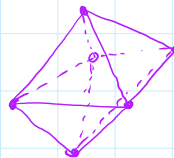
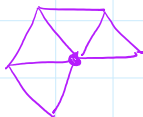


fold up



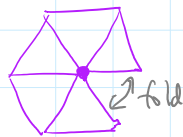
Tetrahedron

4 faces per vertex



Octahedron

5 triangles per vertex

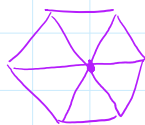


fold

Icosahedron

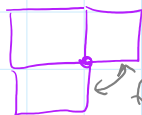
20 triangular faces

6 triangles?

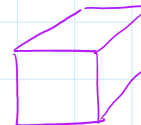


no room to fold!

• Square faces: 3 squares per vertex



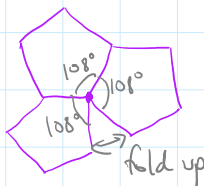
fold up



Cube

6 faces

• Pentagon faces: 3 pentagons per vertex



fold up

Dodecahedron

12 pentagonal faces

.. | ^ ? -

• Hexagonal faces?

fold up

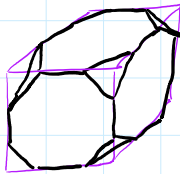
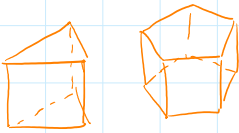


No room to fold!

Semi-regular Polyhedra: require identical edges and vertices, but allow more than one type of regular polygons as faces

example: soccer ball, cube with sanded corners, pentagons & triangles?

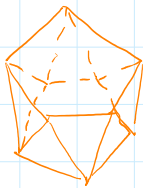
prisms



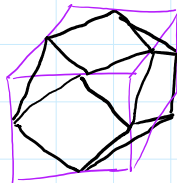
faces: 6 octagons, 8 triangles

triangles and squares — cuboctahedron

antiprisms

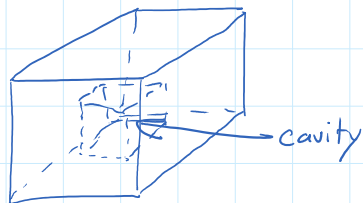
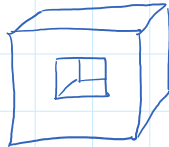
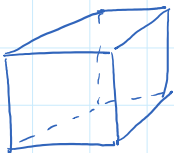


e.g. 2 pentagons, 10 triangles



6 squares
8 triangles

Which of the following are polyhedra?

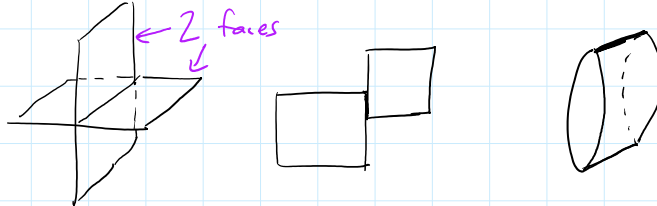


DEFINITION OF A POLYHEDRON

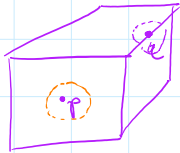
A polyhedron is composed of polygonal faces and satisfies three requirements:

1. **Intersection Condition:** Any two faces may only intersect at a single vertex or along a single edge.

not allowed:



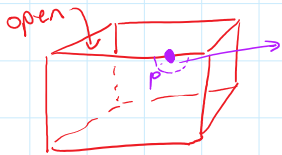
2. **Local Topology:** Every point p on the surface of a polyhedron has a neighborhood homeomorphic to an open disk.



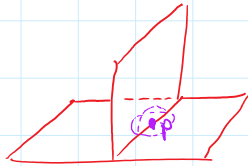
set of points on the polyhedron within some small distance of p .

Two surfaces are homeomorphic if they can be continuously deformed into each other.

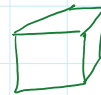
not allowed:



not homeomorphic to



examples:



and are homeomorphic



and are not homeomorphic

3. to be continued...