

Platonic Solids

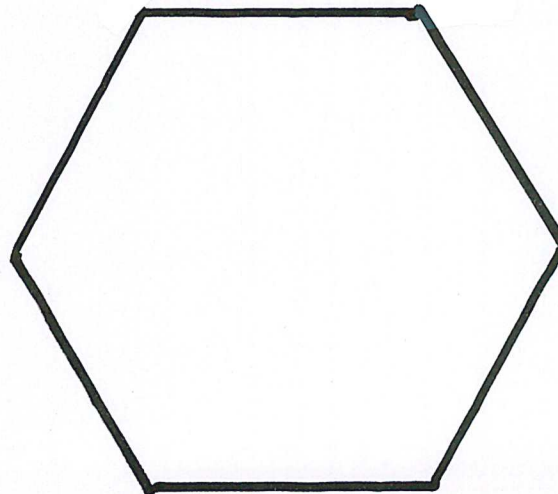
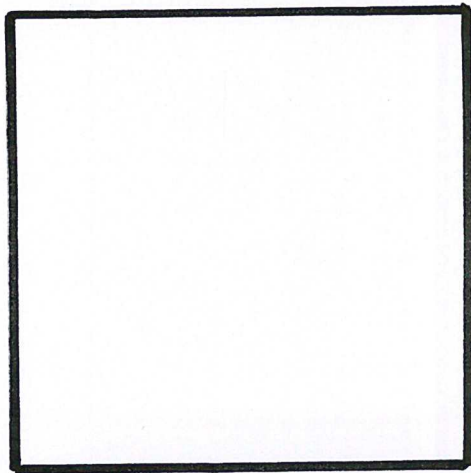
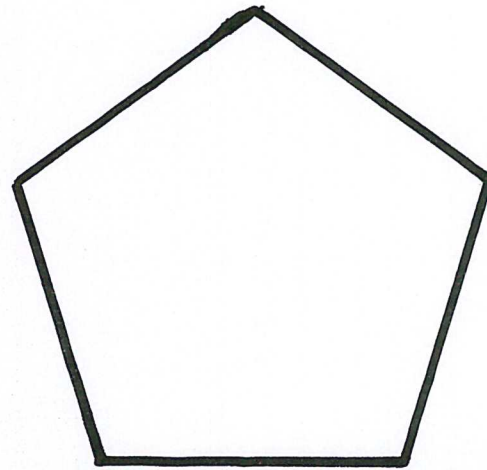
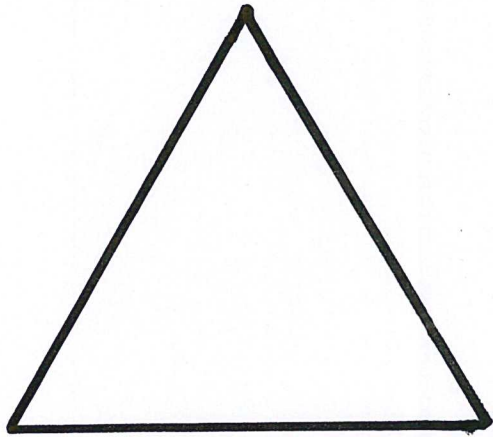


Recall: Regular Polygons

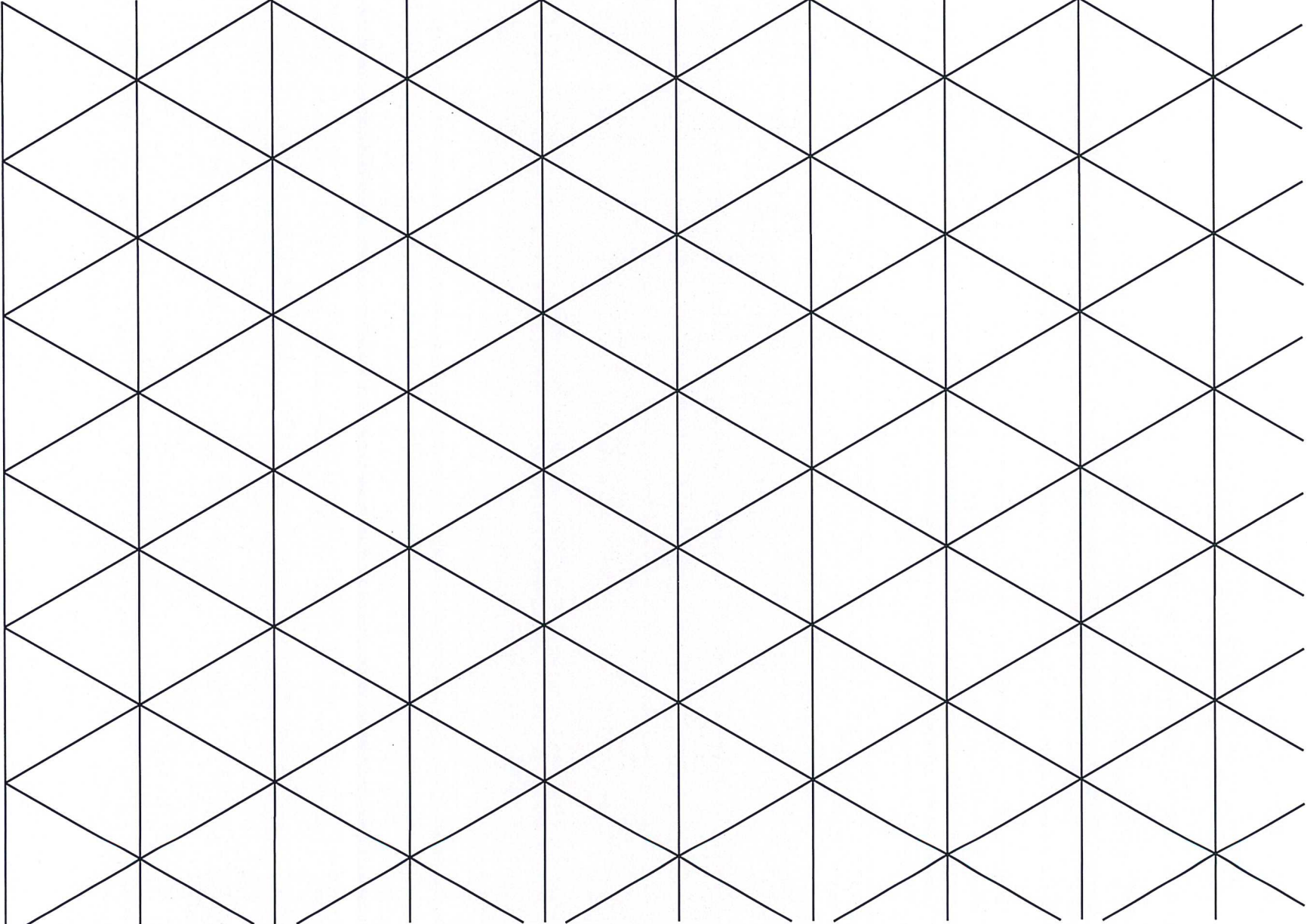
A **regular polygon** is a polygon that has the properties:

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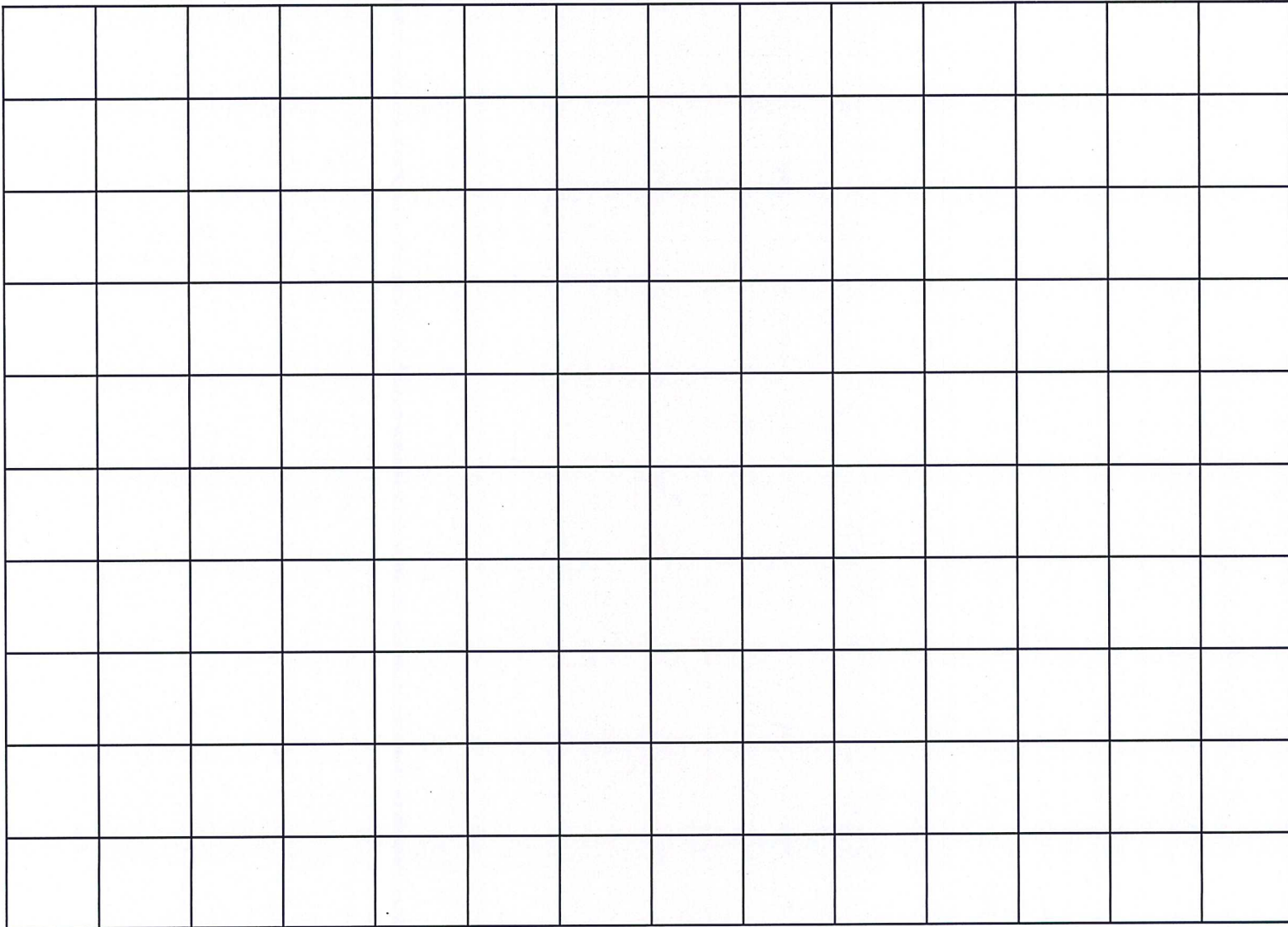
Examples Of Regular Polygons



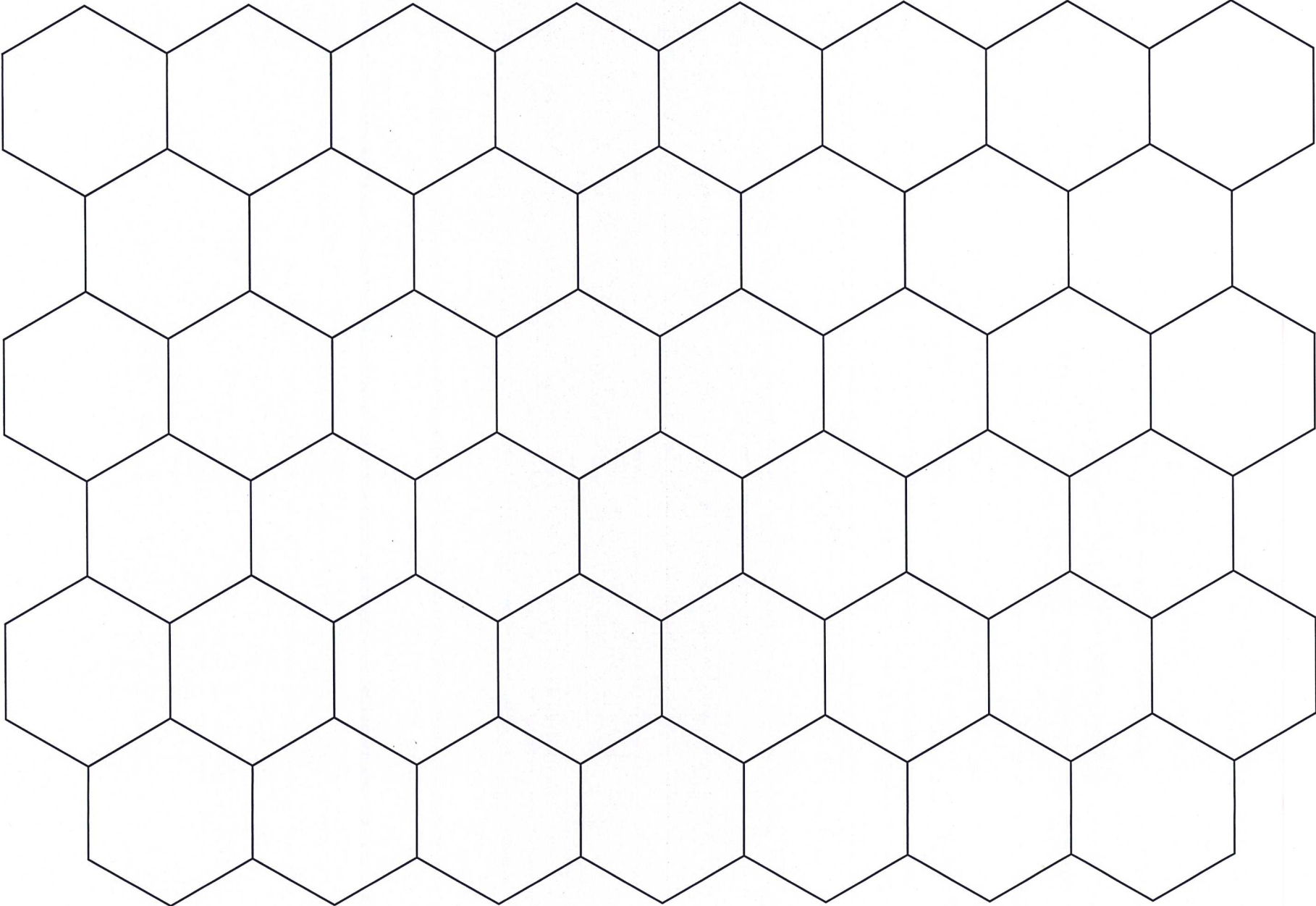
Regular Planar Tilings



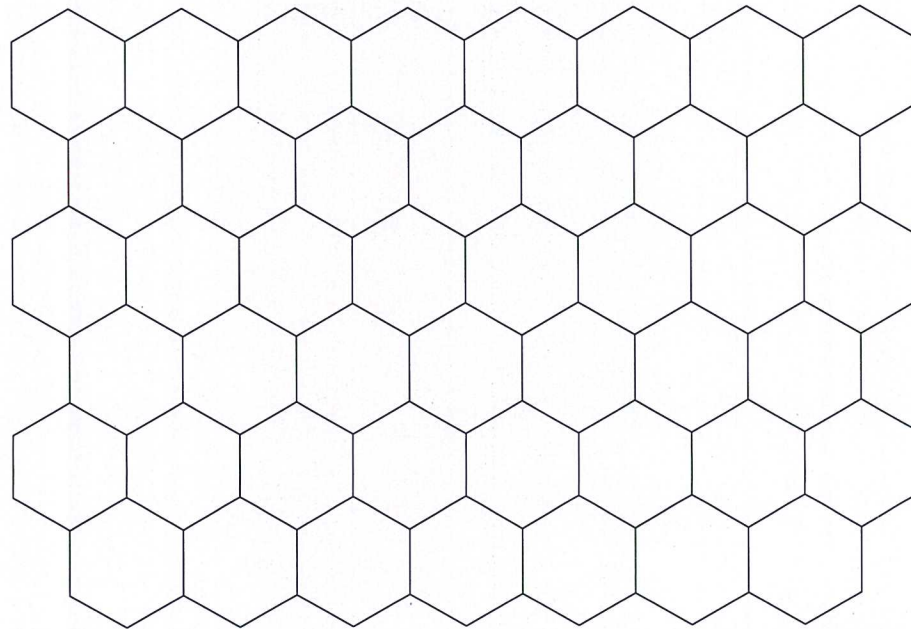
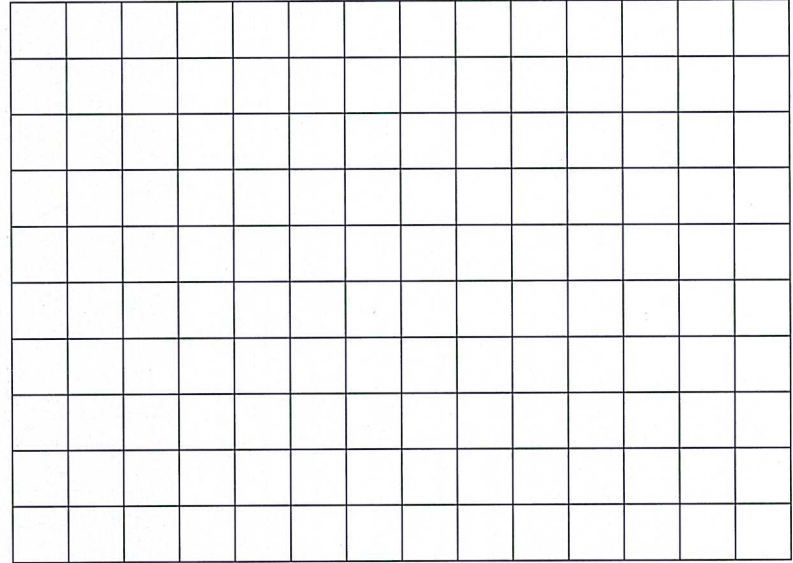
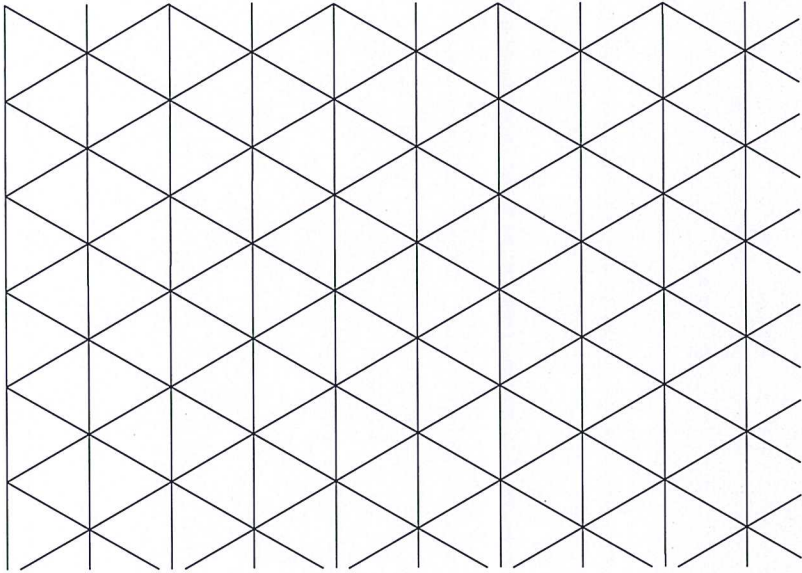
Regular Planar Tilings



Regular Planar Tilings



Why are there only 3 regular tilings?



Convex Objects (page 197 of text)

An object is **convex** if for any two points in that object the line segment between the two points is

Examples:

- A solid cube is

- An empty box is

Regular Polyhedron (page 198 of text)

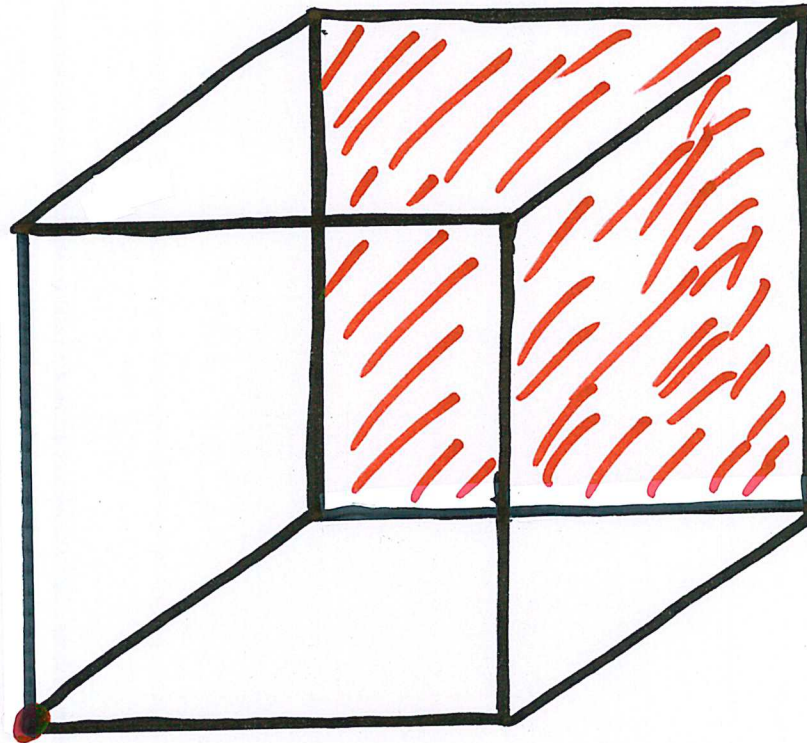
A convex polyhedron is **regular** if all the bounding polygons are congruent regular polygons and if each vertex is

The Platonic Solids

A regular convex polyhedron is known as a **Platonic Solid**.

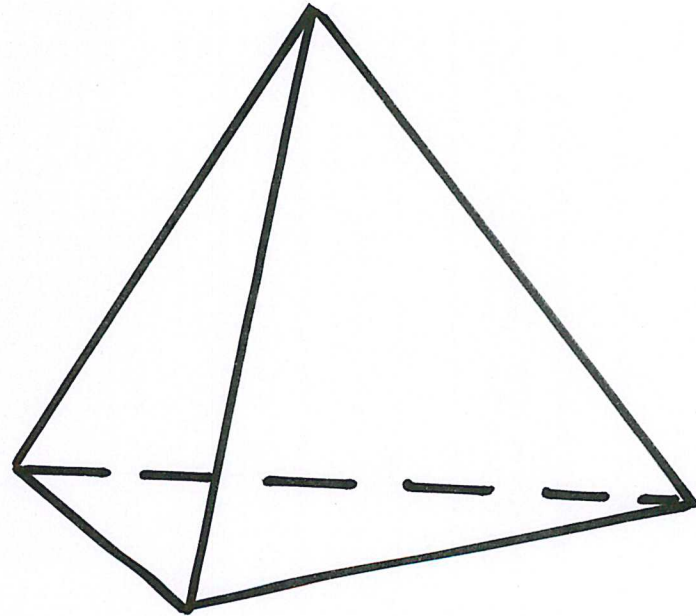
There are 5 Platonic solids.

Parts of Polyhedra



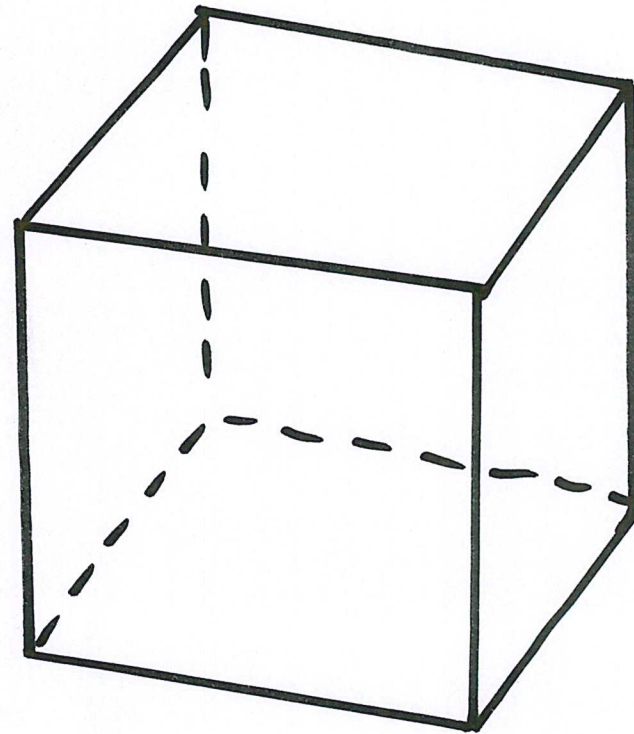
Platonic Solid: Tetrahedron

- Shape of faces:
- Number of faces:
- Number of vertices:
- Number of edges:



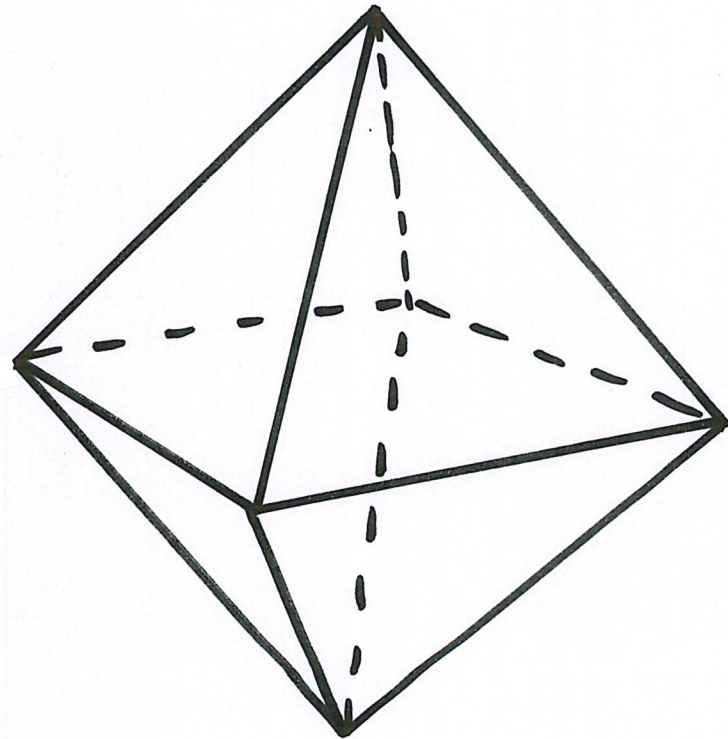
Platonic Solid: Cube

- Shape of faces:
- Number of faces:
- Number of vertices:
- Number of edges:



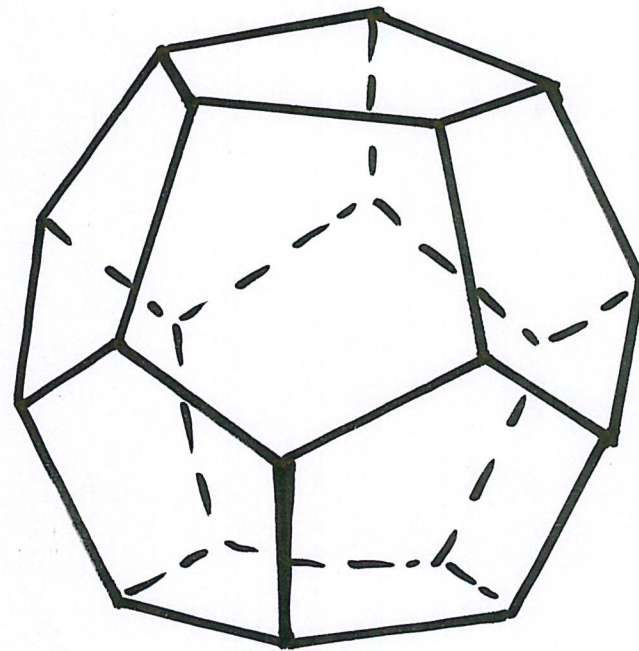
Platonic Solid: Octahedron

- Shape of faces:
- Number of faces:
- Number of vertices:
- Number of edges:



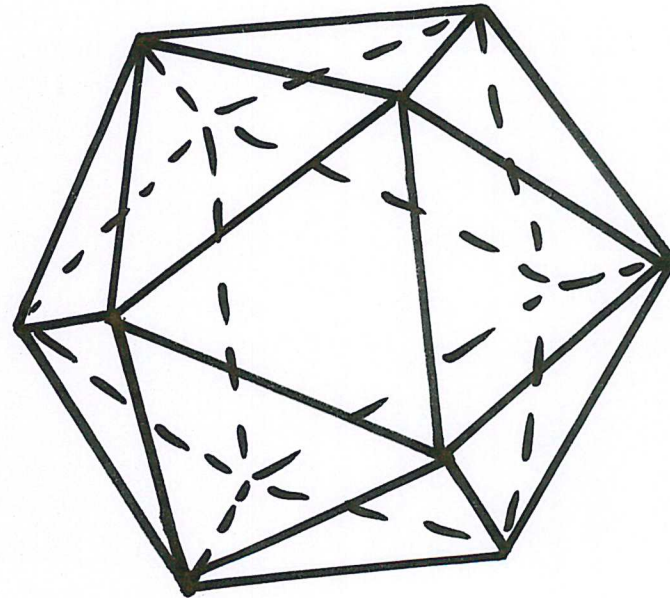
Platonic Solid: Dodecahedron

- Shape of faces:
- Number of faces:
- Number of vertices:
- Number of edges:

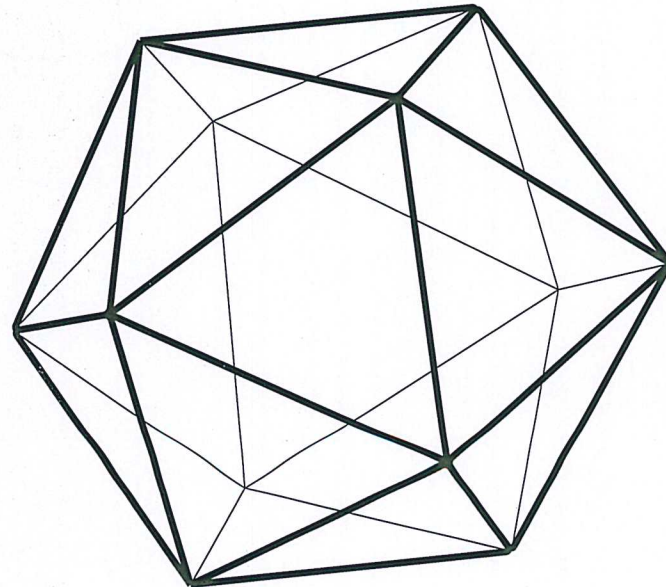
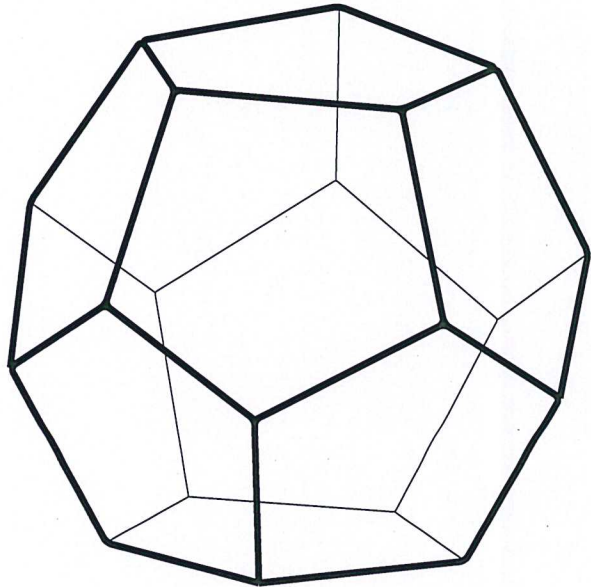
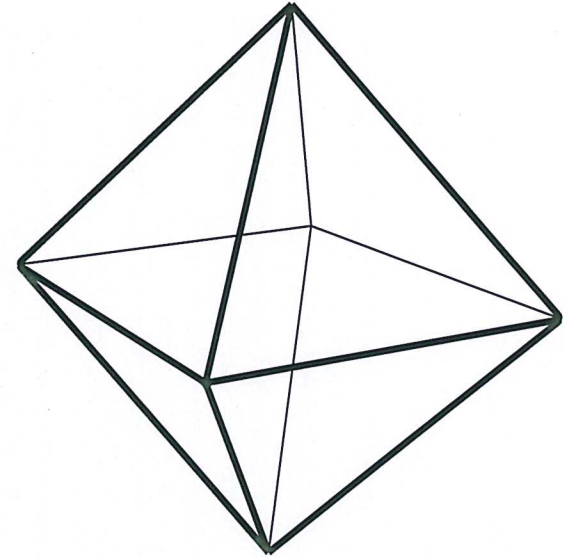
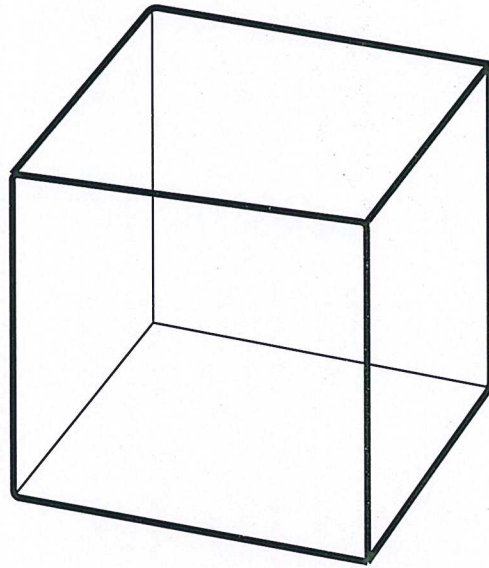
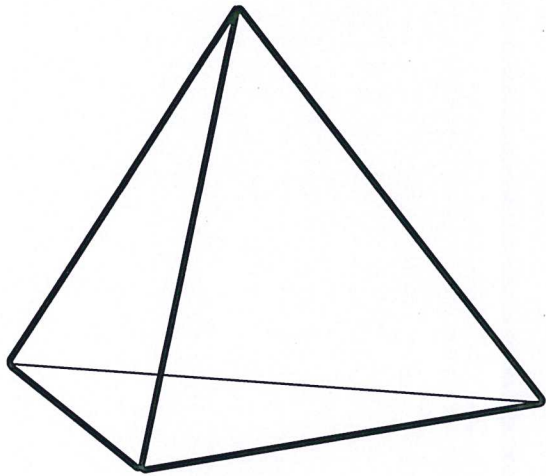


Platonic Solid: Icosahedron

- Shape of faces:
- Number of faces:
- Number of vertices:
- Number of edges:



Why are there only 5 Platonic solids?



Euler Characteristic

If

- F is the number of faces of a polyhedron;
- E is the number of edges;
- V is the number of vertices,

then the value

is called the **Euler Characteristic** of the polyhedron.

A look at the Euler characteristic of Platonic solids

Solid	Faces	Edges	Vertices	Euler characteristic
tetrahedron				
cube				
octahedron				
dodecahedron				
icosahedron				

Euler Characteristic

The Euler characteristic of all convex polyhedra is

Semiregular Polyhedra (page 200 of text)

A convex polyhedron is **semiregular** if all of the bounding polygons are regular polygons (possibly more than one type) with edges the same length and if each vertex is adjacent to the same number of bounding polygons, and there exists a fixed cyclic order of the types of polygons around all the vertices.

Archimedean Solids (page 201–203 of text)

There are 13 Archimedean solids which are semiregular polyhedra.

Example Question

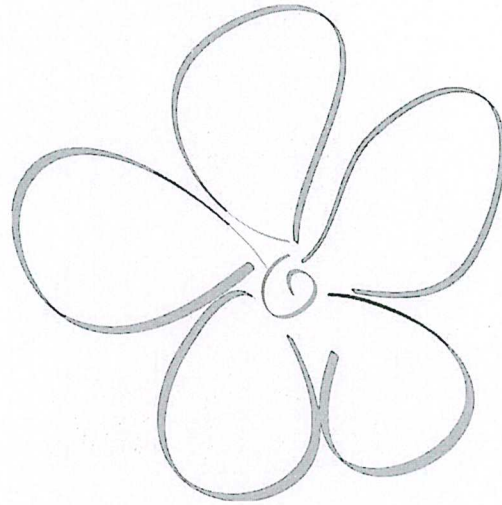
A rhombicuboctahedron is an Archimedean solid. It has 24 vertices, each which meets 3 squares and one triangle. How many faces does it have? How many edges does it have?

Example Question

A truncated icosidodecahedron is an Archimedean solid. It has 30 square faces, 20 hexagonal faces and 12 decagonal faces. How many vertices does it have? How many edges does it have?

Resource: Make Your Own Polyhedra Models

<http://www.korthalsaltes.com/>



QUESTIONS???