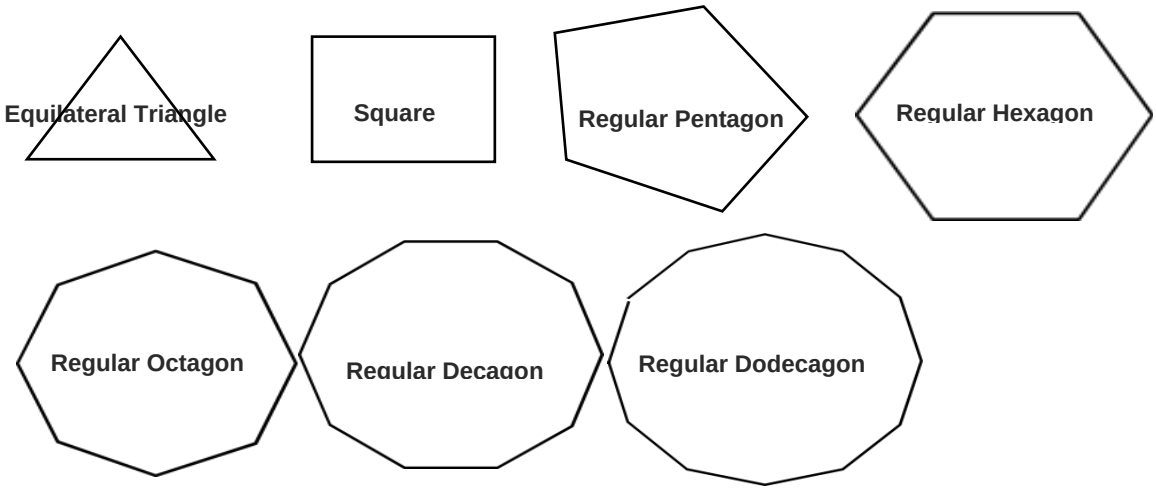
Regular and Irregular Polygons Handout

What is a polygon?

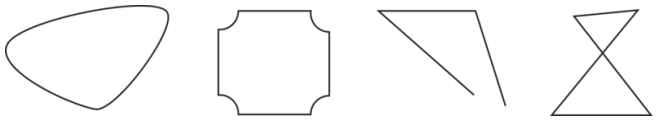
A polygon is a simple closed figure formed by three or more segments. A triangle is a polygon and a quadrilateral are a polygon too. Here are three pictures of polygons.

Polygon You can see that all three of these figures are simple closed figures that are created by three or more-line segments.

Different Types of Polygons



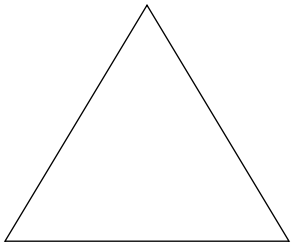
Not a Polygon These figures are not polygons. A polygon does not have a curve in it. The first two figures have curves in them. The third figure is not a closed figure. The last figure has sides that overlap. A polygon does not have sides that overlap.



Distinguish Between Regular and Irregular Polygons

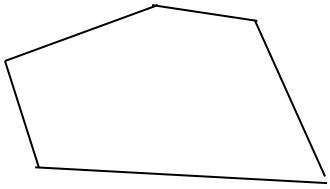
Now that you have been introduced to the different types of polygons, it is time to learn about classifying polygons. All polygons can be classified as regular or irregular polygons. You have to understand the difference between a regular or irregular polygon to classify each shape. Let's learn how we can tell the difference between them.

Regular Polygon A regular polygon is a polygon where all the side lengths are equal, and all of the angle measures are equal. In other words, the polygon is an equilateral polygon where all the side lengths are *congruent*, and an equiangular polygon where all the angles are *congruent*.



Example: This triangle is a regular triangle. All three side lengths are congruent, and all three angles are congruent.

Here is an example of an ***irregular polygon.***



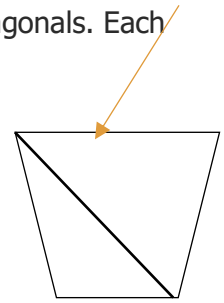
By counting the sides, you can see that this is a five-sided figure. It is a pentagon. However, the sides are not congruent. Therefore, it is an irregular pentagon. Irregular polygons have side lengths that are *not congruent*.

Relate Sides of Polygons to the Number of Diagonals from a Vertex

We can divide polygons into triangles using diagonals. This becomes very helpful when we try to figure out the sum of the interior angles of a polygon other than a triangle or a quadrilateral.

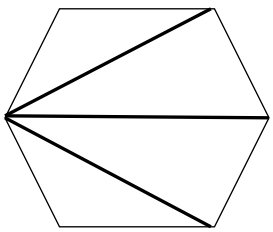
Remember that the sum of the interior angles of a triangle is 180°. The sum of the interior angles of a quadrilateral is

360°. Why is this important? You can divide a quadrilateral into two triangles using diagonals. Each triangle is 180°, so the sum of the interior angles of a quadrilateral is 360°.



Example: Here is one diagonal in the quadrilateral. We can only draw one because otherwise the lines would cross. ***A diagonal is a line segment in a polygon that joins two nonconsecutive vertices.*** A consecutive vertex is one that is next to another one, so a nonconsecutive vertex is a vertex that is not next to another one.

How do we use this with other polygons?

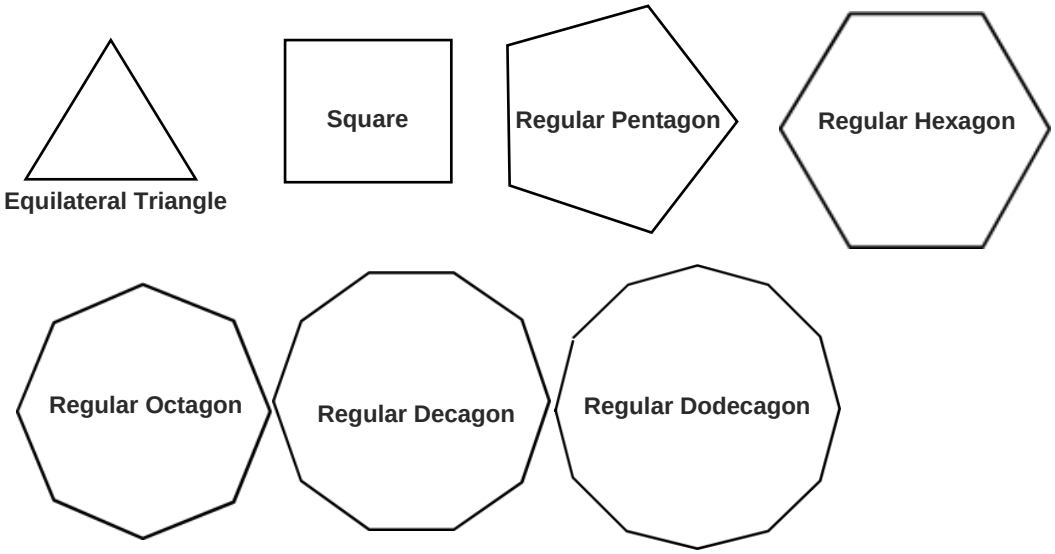


We can divide up other polygons using diagonals and figure out the sum of the interior angles.

Here is a hexagon that has been divided into triangles by the diagonals. You can see here that there are four triangles formed. If sum of the interior angles of each triangle is equal to 180°, and we have four triangles, then the sum of the interior angles of a hexagon is: 4 (180) =720°

Explore the relationship of the number of sides of a regular polygon and the ***Central Angles***.

(Because the polygon is regular, all central angles are equal. It does not matter which side you choose. All central angles would add up to **360°** (a full circle), so the measure of the central angle is 360 divided by the number of sides.)



Name	# of Sides	Measure of a Central Angle	Sum of the Measure of the Central Angles
Equilateral Triangle			
Square			
Regular Pentagon			
Regular Hexagon			
Regular Octagon			
Regular Decagon			
Regular Dodecagon			