Lesson #1: Regular/Irregular Polygons & Interior/Exterior Angles of a Polygon (2 Days)

Objectives

Students will be able to…

- Identify regular/irregular polygons.
- Identify interior and exterior angles of a polygon.
- Construct a regular hexagon shape.

Common Core Standards

LS 11-12.6
RSIT 11-12.2
RLST 11-12.2
Writing 9-10.5
Problem Solving/Critical Thinking 5.4
Health and Safety 6.2, 6.3, 6.6, 6.12
Responsibility and Leadership 7.4, 9.3
Residential and Commercial Construction Pathway D2.1, D3.1, D3.7
CCSS.MATH.PRACTICE.MP6
CCSS.MATH.PRACTICE.MP2
CCSS.MATH.PRACTICE.MP1

Materials

Regular and Irregular Polygons Handout
Constructing a hexagon inside a circle worksheet
Interior Angles of a Polygon Worksheet
Exterior Angles of a Polygon Worksheet

Lesson Sequence

- Pass out the ***Regular and Irregular Polygons Handout.*** Review as a class. Have students highlight important information and fill in the chart at the end. Answer any questions. (25 minutes)
- Pass out the ***Constructing A Hexagon Inside A Circle Worksheet.*** Go through this activity together as a class. Model for students. Answer any questions. (25 minutes)

- Pass out the ***Interior Angles of a Polygon Worksheet.*** Review together as a class. Answer any questions as needed. (25 minutes)
- Pass out the ***Exterior Angles of a Polygon Worksheet***. Review together as a class. Answer any questions as needed. (25 minutes)

Assessment
Check for student understanding through questioning. Be sure to call on random students and clarify any mis understandings as needed. Collect worksheets to grade based on student following whole class discussion.

Accommodations / Modifications
One on One Support Check for Understanding Provide Additional Visuals as Needed

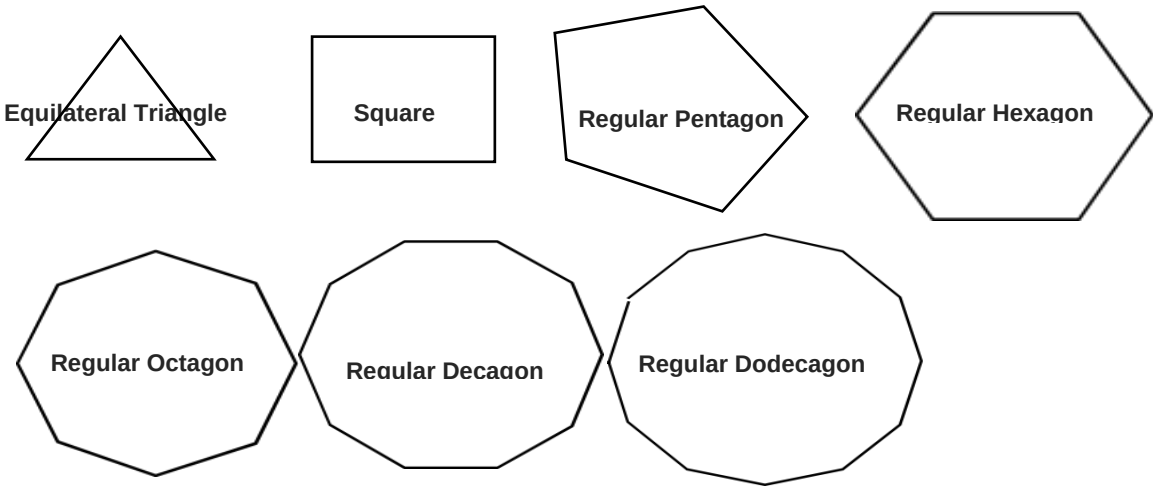
Regular and Irregular Polygons Handout

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

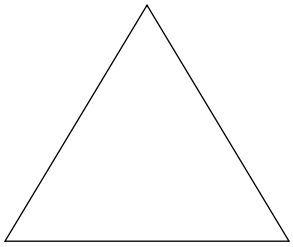


Not a Polygon These figures are not polygons. A polygon does not have a curve in it. The first two figures have curves in them. The third figure is not a closed figure. The last figure has sides that overlap. A polygon does not have sides that overlap.

Distinguish Between Regular and Irregular Polygons

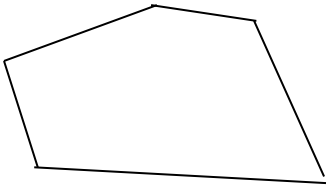
Now that you have been introduced to the different types of polygons, it is time to learn about classifying polygons. All polygons can be classified as regular or irregular polygons. You have to understand the difference between a regular or irregular polygon to classify each shape. Let's learn how we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



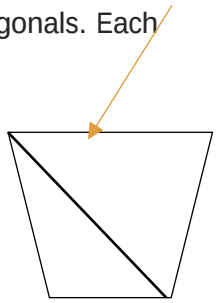
By counting the sides, you can see that this is a five-sided figure. It is a pentagon. However, the sides are not congruent. Therefore, it is an irregular pentagon. Irregular polygons have side lengths that are *not congruent*.

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.

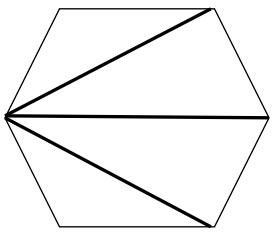
Remember that the sum of the interior angles of a triangle is 180º. The sum of the interior angles of a quadrilateral is

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



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?

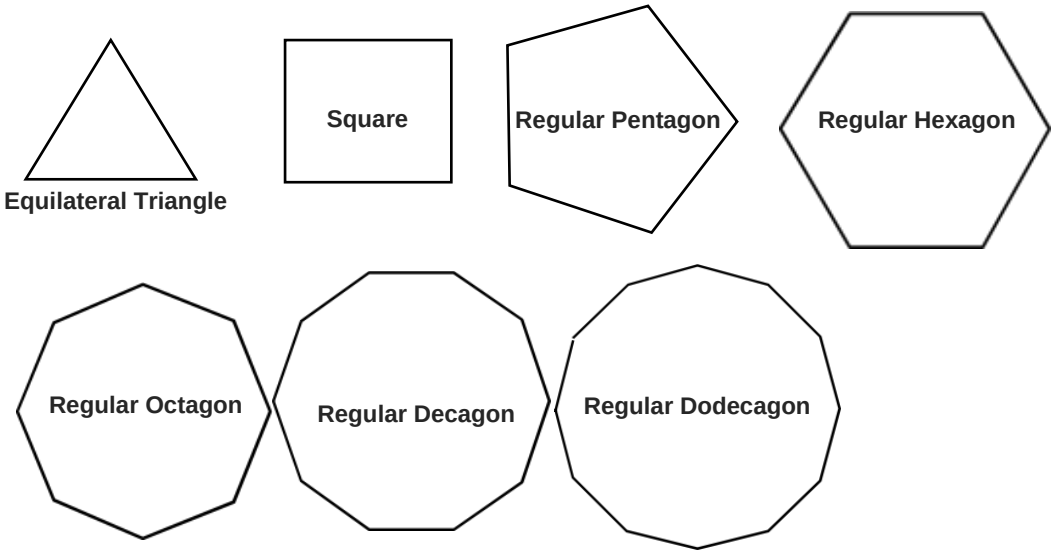


We can divide up other polygons using diagonals and figure out the sum of the interior angles.

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 180º, and we have four triangles, then the sum of the interior angles of a hexagon is: 4 (180) =720º

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.)

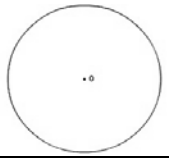
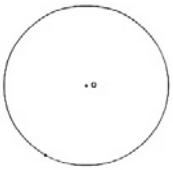
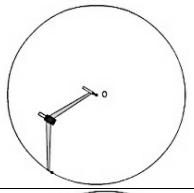
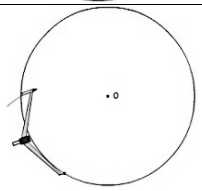
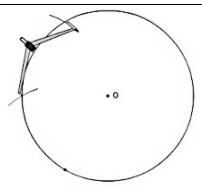
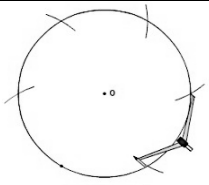
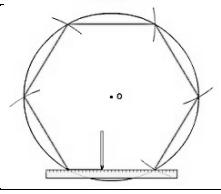


Name	# of Sides	Measure of a Central Angle	Sum of the Measure of the Central Angles
Equilateral Triangle			
Square			
Regular Pentagon			
Regular Hexagon			
Regular Octagon			
Regular Decagon			
Regular Dodecagon			

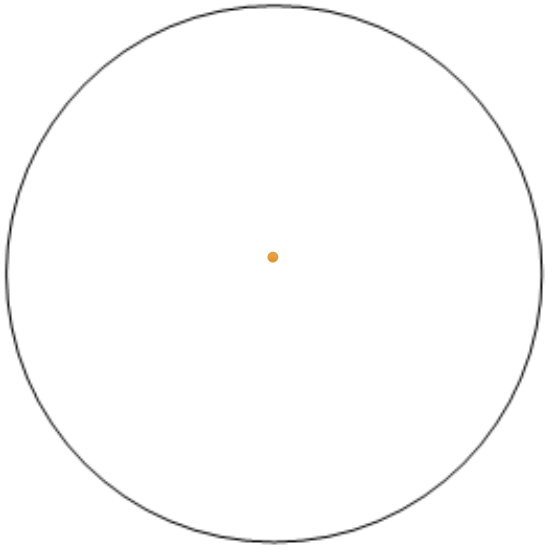
Constructing a Hexagon Inside a Circle Worksheet

A Hexagon is ANY shape composed of 6 intersecting lines. A regular hexagon is a 6-sided shape where ALL lines are the same length and ALL angles are equal in size.

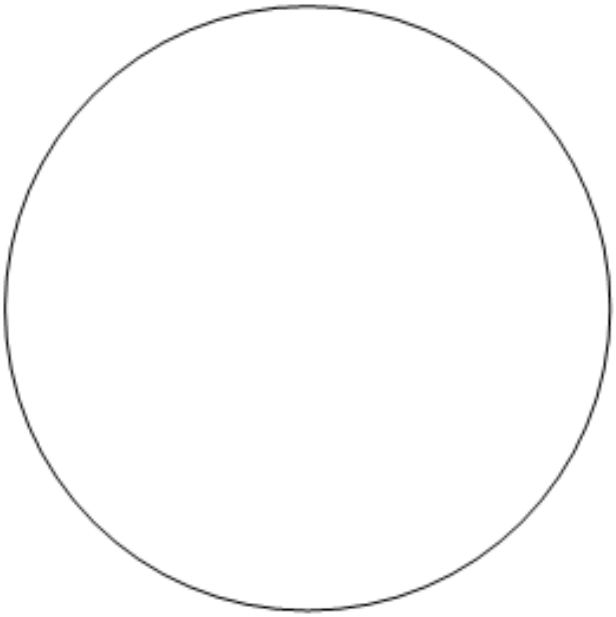
A Regular Hexagon is identified by a combination of the number of sides to the shape, the length of the sides AND the size of its angles. A Regular Hexagon has Six Sides equal in length ... and Six Angles equal in size (all are 120 degrees).

After doing this	Your work should look like this
We start with the given circle, center O.	
Mark a point anywhere on the circle. This will be the first vertex of the hexagon.	
Set the compasses on this point and set the width of the compasses to the center of the circle. The compasses are now set to the radius of the circle	
Make an arc across the circle. This will be the next vertex of the hexagon. (It turns out that the side length of a hexagon is equal to its circumradius - the distance from the center to a vertex).	
Move the compasses on to the next vertex and draw another arc. This is the third vertex of the hexagon.	
Continue in this way until you have all six vertices.	
Draw a line between each successive pairs of vertices, for a total of six lines.	

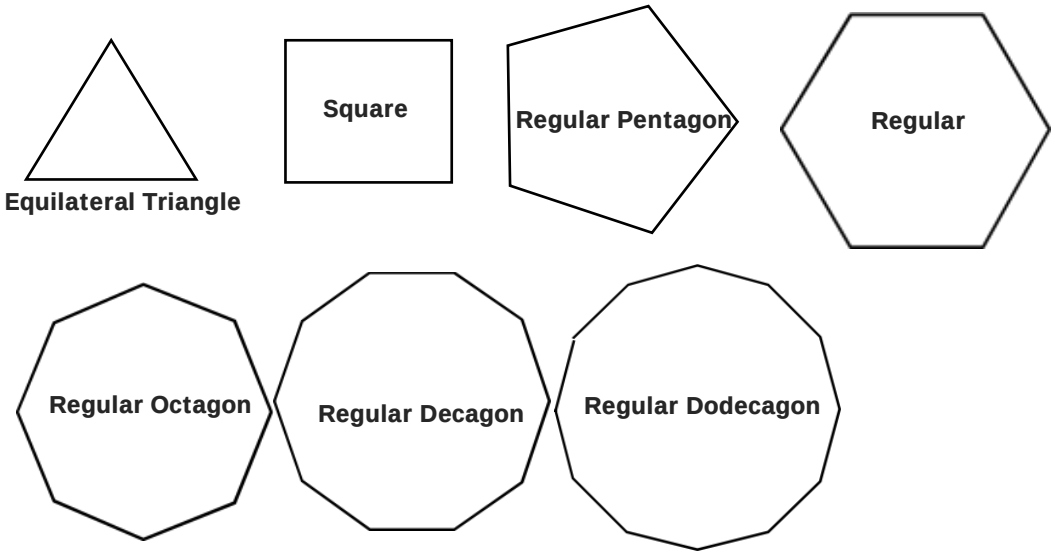
1. Construct the largest regular hexagon that will fit in the circle below.



2. Find the center of the circle below and construct a hexagon inscribed in the circle.



Interior Angles of a Polygon Worksheet



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

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

Write an assumption about ***Interior Angles*** of a Regular Polygon. Think about breaking apart the polygon into triangles as shown below.

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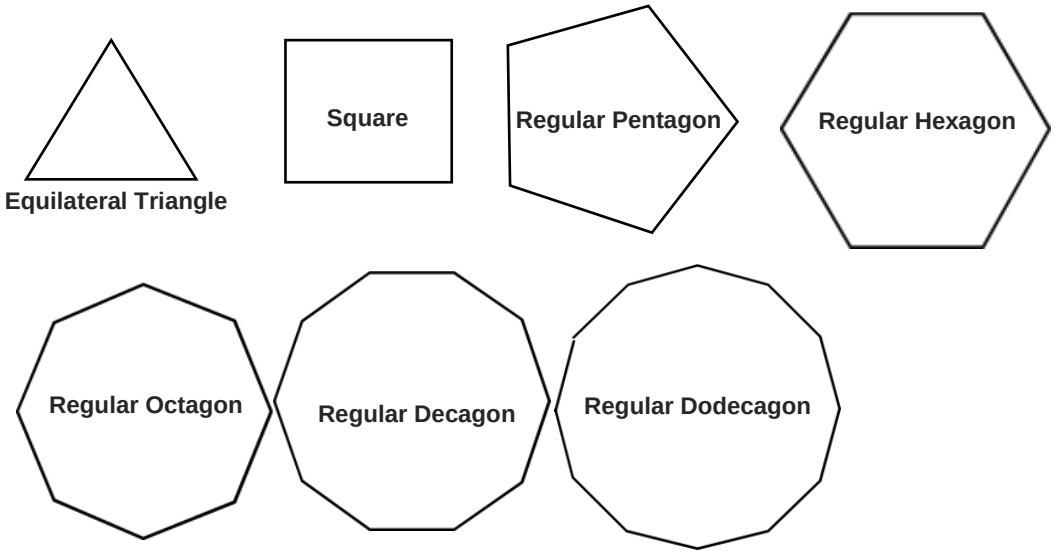
Interior Angles of a Polygon Worksheet – *Answer Key*

Name	# of Sides	Measure of an Interior Angle	Sum of the Measure of the Interior Angles
Equilateral Triangle	**3**	**60°**	**180°**
Square	**4**	**90°**	**360°**
Regular Pentagon	**5**	**108°**	**540°**
Regular Hexagon	**6**	**120°**	**720°**
Regular Octagon	**8**	**135°**	**1080°**
Regular Decagon	**10**	**144°**	**1440°**
Regular Dodecagon	**12**	**150°**	**1800°**

Exterior Angles of a Polygon Worksheet



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

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

Write an assumption about ***Exterior Angles*** of a Regular Polygon. Think about breaking apart the polygon into triangles as shown below.

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Exterior Angles of a Polygon Worksheet – Answer Key

Name	# of Sides	Measure of an Exterior Angle	Sum of the Measure of the Exterior Angles
Equilateral Triangle	**3**	**120°**	**360°**
Square	**4**	**90°**	**360°**
Regular Pentagon	**5**	**72°**	**360°**
Regular Hexagon	**6**	**60°**	**360°**
Regular Octagon	**8**	**45°**	**360°**
Regular Decagon	**10**	**36°**	**360°**
Regular Dodecagon	**12**	**30°**	**360°**