

Interior angles of polygons

- Draw a convex polygon with at least four sides. Choose one vertex, and draw diagonals from that vertex to the other vertices of the polygon.
 - The segments you drew divided the polygon into several smaller figures. What kind of figures are they?
 - What is the sum of the measures of the angles in each of the figures?
 - An **interior angle** of a polygon is an angle inside the polygon where two sides meet. Use your answers above to find the sum of the interior angles of your polygon.
 - Explain why the sum of the interior angles is going to be the same for any convex polygon with the same number of sides.
- Complete the following table. If necessary, draw an example of each polygon and use problem 1 to help you.

Convex polygon name	Number of sides	Sum of interior angles
Triangle	3	
Quadrilateral	4	
Pentagon	5	
Hexagon	6	
Heptagon	7	
Octagon	8	
Nonagon	9	
Decagon	10	

- Find a pattern in the numbers above. Then describe a quick way to find the sum of the interior angles of a convex polygon when you know the number of sides.
- Explain why your rule will work for every polygon.
- A **regular** polygon is a polygon in which every interior angle has the same measure and every side has the same length. What is the measure of an interior angle of
 - a regular (equilateral) triangle?
 - a regular quadrilateral (square)?
 - a regular octagon?
- Describe how to find the measure of an interior angle of a regular polygon when you know the number of sides.

To test if a polygon is convex, imagine connecting each vertex to every other vertex. If all connecting segments stay inside the polygon, it is convex.

convex



not convex
(concave)



Answers

- Triangles
 - Answer depends on the polygon drawn.
 - Answer depends on the polygon drawn.
 - For a convex polygon with the same number of sides, there will be the same number of triangles inside. Each triangle has a sum of 180° , so the sum of all the triangles' angle measures—which is also the sum of the polygon's interior angles—will be the same.

Polygon name	Number of sides	Sum of interior angles
Triangle	3	180
Quadrilateral	4	360
Pentagon	5	540
2. Hexagon	6	720
Heptagon	7	900
Octagon	8	1080
Nonagon	9	1260
Decagon	10	1440

- Possible answer: Subtract two from the number of sides and multiply by 180.
- Possible answer: The number of vertices is the same as the number of sides. When you draw the diagonals, you draw to all but three of the vertices—the vertex you're drawing from, plus the two adjacent ones. One diagonal divides the polygon into two regions; drawing another adds one to the number of regions. So you get one more region (triangle) than the number of diagonals you draw, giving two fewer triangles than you have sides. Since each triangle has an angle sum of 180° , you get 180 times two less than the number of sides for the interior angle sum of the polygon.
- 60°
 - 90°
 - 135°
- Possible answer: Divide the sum of the interior angles by the number of sides.