Tutorial: Interior Angles in a Polygon

Slide 1:

In this tutorial, we are going to learn how to find the sum of the interior angles in a CONVEX polygon; how to find the value of a variable when algebraic expressions are given for the angles in a polygon; and how to find the measure of a specific angle in a polygon.

Slide 2:

Finding the sum of the angles in a polygon

Let's look at two polygons and then we will generalize to find a formula we can use to find the sum of the angles for all polygons. Here we have a quadrilateral, four sides, and a hexagon, six sides. We are going to draw all possible diagonals from one vertex in each polygon.

In the quadrilateral, notice that from one vertex we can only draw one diagonal. This creates two triangles. We know that the sum of the angles in a triangle is 180 degrees, so in the quadrilateral, the sum of the angles is 2 times 180 or 360 degrees.

In the hexagon, notice that from one vertex we can draw three diagonals. This creates four triangles. The sum of the angles is 4 times 180 or 720 degrees.

Do you see a pattern? Can you generalize this based on the number of sides of a polygon?

Slide 3:

Is this the pattern you came up with for the sum of the angles in an n-sided polygon? To find the sum, we subtract 2 from the number of sides and multiply that by 180 degrees.

Can you find the sum of the angles in a 10-sided polygon? Using the formula, we just subtract 2 from 10 and multiply by 180 degrees. This is 8 times 180 degrees, which equals 1440 degrees.

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How would we find the value of x in this pentagon?

To begin with, we must first know the sum of all the angles. We use the formula we just learned and subtract 2 from 5 and multiply by 180 degrees. This gives us 3 times 180 degrees, which equals 540 degrees.

Now we can set up an equation using the expressions for each angle and the fact that they must add up to 540.

 85 plus 6 x plus 6 plus 5 x minus 7 plus 4 x plus 16 plus 6 x minus 1 equals 540.
Simplify this to 21 x plus 99 equals 540.
Subtract 99 from both sides, 21 x equals 441.
And divide by 21 to get x equals 21.

Slide 5:

Once we have found the value of the variable in a figure, we can then find the measure of any angle. What is the measure of the highlighted angle in this figure?

The algebraic expression for this measure of this angle is 4 x plus 16. Substitute 21 for x in the highlighted expression. 4 times 21 plus 16.

Now simplify 84 plus 16 equals 100 degrees.

Slide 6:

Now you try.

1. What is the sum of the interior angles in a 20-sided polygon?

Solution
$(20 - 2)180° = 3240°$

2. What is the measure of angle A? Angle A measures 10 x plus 20 degrees. The other angles measure 85 degrees, 16x degrees, 9x plus 10 degrees, 110 degrees, and 145 degrees.

Solution
$(6 - 2)180° = 720°$
$x = 10$
The measure of angle A equals $[10(10) + 20]° = 120°$

Slide 7:

Remember
Sum of the interior angles of a polygon is defined as S equals the quantity n minus 2 times 180 degrees.
To find the value of a variable, first find the sum of all the angles using the formula, then set up an equation.
You can then find the measure of a given angle by substituting the value into the expression.