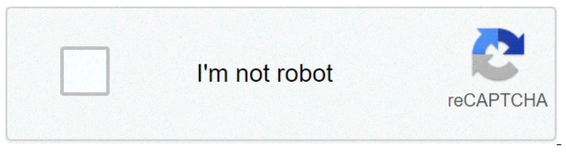

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Measure of one interior angle of a regular pentagon

Polygons are like the little houses of two-dimensional geometry world. They create insides, called the interior, and outsides, called the exterior. You can measure interior angles and exterior angles. You can also add up the sums of all interior angles, and the sums of all exterior angles, of regular polygons. Our formula works on triangles, squares, pentagons, hexagons, quadrilaterals, octagons and more. What Is A Regular Polygon? For a polygon to be a regular polygon, it must fulfill these four requirements: Be two-dimensional Enclose a space, creating an interior and exterior Use only line segments for sides Have all sides equal in length to one another, and all interior angles equal in measure to one another Sum of Interior Angles of a Polygon Regular polygons exist without limit (theoretically), but as you get more and more sides, the polygon looks more and more like a circle. The regular polygon with the fewest sides -- three -- is the equilateral triangle. The regular polygon with the most sides commonly used in geometry classes is probably the dodecagon, or 12-gon, with 12 sides and 12 interior angles: Pretty fancy, isn't it? But just because it has all those sides and interior angles, do not think you cannot figure out a lot about our dodecagon. Suppose, for instance, you want to know what all those interior angles add up to, in degrees? Sum of Interior Angles Triangles are easy. Their interior angles add to 180°. Likewise, a square (a regular quadrilateral) adds to 360° because a square can be divided into two triangles. The word "polygon" means "many angles," though most people seem to notice the sides more than they notice the angles, so they created words like "quadrilateral," which means "four sides." Regular polygons have as many interior angles as they have sides, so the triangle has three sides and three interior angles. Square? Four of each. Pentagon? Five, and so on. Our dodecagon has 12 sides and 12 interior angles. Sum of Interior Angles Formula The formula for the sum of that polygon's interior angles is refreshingly simple. Let n equal the number of sides of whatever regular polygon you are studying. Here is the formula: Sum of interior angles = (n - 2) × 180° Sum of angles in a triangle You can do this. Try it first with our equilateral triangle: (n - 2) × 180° (3 - 2) × 180° Sum of interior angles = 180° Sum of angles of a square And again, try it for the square: (n - 2) × 180° (4 - 2) × 180° 2 × 180° Sum of interior angles = 360° How To Find One Interior Angle To find the measure of a single interior angle, then, you simply take that total for all the angles and divide it by n, the number of sides or angles in the regular polygon. The new formula looks very much like the old formula: One interior angle = (n - 2) × 180°n Again, test it for the equilateral triangle: (3 - 2) × 180°3 180°3 One interior angle = 60° And for the square: (4 - 2) × 180°4 2 × 180°4 360°4 One interior angle = 90° Hey! It works! And it works every time. Let's tackle that dodecagon now. Interior Angles Examples Remember what the 12-sided dodecagon looks like? Let's find the sum of the interior angles, as well as one interior angle: Find the sum of interior angles of a dodecagon (n - 2) × 180° (12 - 2) × 180° 10 × 180° Sum of interior angles = 1,800° Now, let's find one interior angle (n - 2) × 180°n (12 - 2) × 180°12 10 × 180°12 1,800°12 One interior angle = 150° Awesome! Sum of Exterior Angles Every regular polygon has exterior angles. These are not the reflex angle (greater than 180°) created by rotating from the exterior of one side to the next. That is a common misunderstanding. For instance, in an equilateral triangle, the exterior angle is not 360° - 60° = 300°, as if we were rotating from one side all the way around the vertex to the other side. Exterior angles are created by extending one side of the regular polygon past the shape, and then measuring in degrees from that extended line back to the next side of the polygon. Since you are extending a side of the polygon, that exterior angle must necessarily be supplementary to the polygon's interior angle. Together, the adjacent interior and exterior angles will add to 180°. For our equilateral triangle, the exterior angle of any vertex is 120°. For a square, the exterior angle is 90°. Exterior Angle Formula If you prefer a formula, subtract the interior angle from 180°: Exterior angle = 180° - interior angle Exterior Angles Examples What do we have left in our collection of regular polygons? That dodecagon! We know any interior angle is 150°, so the exterior angle is: 180° - 150° Exterior angle = 30° Checking Your Work Look carefully at the three exterior angles we used in our examples: Triangle = 120° Square = 90° Dodecagon = 30° Prepare to be amazed. Multiply each of those measurements times the number of sides of the regular polygon: Triangle = 120° × 3 = 360° Square = 90° × 4 = 360° Dodecagon = 30° × 12 = 360° Every time you add up (or multiply, which is fast addition) the sums of exterior angles of any regular polygon, you always get 360°. It looks like magic, but the geometric reason for this is actually simple: to move around these shapes, you are making one complete rotation, or turn, of 360°. Still, this is an easy idea to remember: no matter how fussy and multi-sided the regular polygon gets, the sum of its exterior angles is always 360°. Lesson Summary After working through all that, now you are able to define a regular polygon, measure one interior angle of any polygon, and identify and apply the formula used to find the sum of interior angles of a regular polygon. You also can explain to someone else how to find the measure of the exterior angles of a regular polygon, and you know the sum of exterior angles of every regular polygon. Next Lesson: Ratios and Proportions The sum of the measures of the interior angles of a convex polygon with n sides is $ (n-2)\cdot180^{\circ} $ Shape Formula Sum Interior Angles $$ \red 3 $$ sided polygon (triangle) $$ (\red 3-2) \cdot180 $$ $$ 180^{\circ} $$ $$ \red 4 $$ sided polygon (quadrilateral) $$ (\red 4-2) \cdot 180 $$ $$ 360^{\circ} $$ $$ \red 6 $$ sided polygon (hexagon) $$ (\red 6-2) \cdot 180 $$ $$ 720^{\circ} $$ What is the total number degrees of all interior angles of a triangle? 180° You can also use Interior Angle Theorem:$$ (\red 3 -2) \cdot 180^{\circ} = (1) \cdot 180^{\circ}= 180 ^{\circ} $$ What is the total number of degrees of all interior angles of the polygon ? What is the sum measure of the interior angles of the polygon (a pentagon) ? What is sum of the measures of the interior angles of the polygon (a hexagon) ? A regular polygon is simply a polygon whose sides all have the same length and angles all have the same measure. You have probably heard of the equilateral triangle, which are the two most well-known and most frequently studied types of regular polygons. Regular Hexagon Regular Pentagon More on regular polygons here . Shape Formula Sum interior Angles Regular Pentagon $$ (\red 3-2) \cdot180 $$ $$ 180^{\circ} $$ $$ \red 4 $$ sided polygon (quadrilateral) $$ (\red 4-2) \cdot 180 $$ $$ 360^{\circ} $$ $$ \red 6 $$ sided polygon (hexagon) $$ (\red 6-2) \cdot 180 $$ $$ 720^{\circ} $$ In order to find the measure of a single interior angle of a regular polygon (a polygon with sides of equal length and angles of equal measure) with n sides, we calculate the sum interior anglesor $$ (\red n-2) \cdot 180 $$ and then divide that sum by the number of sides or $$ \red n$$. The Formula The measure of any interior angle of a regular polygon with $$ \red n $$ sides is $ \text {any angle}^{\circ} = \frac{ (\red n -2) \cdot 180^{\circ} }{\red n} $ Let's look at an example you're probably familiar with-- the good old triangle $$\triangle$$. Now, remember this new rule above only applies to regular polygons. So, the only type of triangle we could be talking about is an equilateral one like the one pictured below. You might already know that the sum of the interior angles of a triangle measures $$ 180^{\circ}$$ and that in the special case of an equilateral triangle, each angle measures exactly $$ 60^{\circ}$$. $ \text{Using our new formula} \\ \text {any angle}^{\circ} = \frac{ (\red n -2) \cdot 180^{\circ} }{\red n} \\ \text{ For a triangle , (} \red 3 \text{ sides)} \\ \frac{ (\red 3 -2) \cdot 180^{\circ} }{\red 3} \\ \frac{ (1) \cdot 180^{\circ} }{\red 3} \\ \frac{180^{\circ}} {\red 3} = \fbox{60} $ So, our new formula for finding the measure of an angle in a regular polygon is consistent with the rules for angles of triangles that we have known from past lessons. Example 2 To find the measure of an interior angle of a regular octagon, which has 8 sides, apply the formula above as follows: $ \text{Using our new formula} \\ \text {any angle}^{\circ} = \frac{ (\red n -2) \cdot 180^{\circ} }{\red n} \\ \frac{(\red8-2) \cdot 180}{ \red 8} = 135^{\circ} $ What is the measure of 1 interior angle of a pentagon? This question cannot be answered because the shape is not a regular polygon. You can only use the formula to find a single interior angle if the polygon is regular! Consider, for instance, the irregular pentagon below. You can tell, just by looking at the picture, that $$ \angle A and \angle B $$ are not congruent. The moral of this story- While you can use our formula to find the sum of the interior angles of any polygon (regular or not), you can not use this page's formula for a single angle measure--except when the polygon is regular. Exterior Angles of a Polygon Formula for sum of exterior angles: The sum of the measures of the exterior angles of a polygon, one at each vertex, is 360°. Formula to find 1 angle of a regular convex polygon of n sides = $$ \angle1 + \angle2 + \angle3 = 360° $$ $$ \angle1 + \angle2 + \angle3 + \angle4 = 360° $$ $$ \angle1 + \angle2 + \angle3 + \angle4 + \angle5 = 360° $$ Practice Problems What is the measure of 1 exterior angle of a pentagon? This question cannot be answered because the shape is not a regular polygon. Although you know that sum of the exterior angles is 360, you can only use formula to find a single exterior angle if the polygon is regular! Consider, for instance, the pentagon pictured below. Even though we know that all the exterior angles add up to 360 °, we can see, by just looking, that each $$ \angle A \text{ and } and \angle B $$ are not congruent.. Determine Number of Sides from Angles It's possible to figure out how many sides a polygon has based on how many degrees are in its exterior or interior angles. If each exterior angle measures 80°, how many sides does this polygon have? There is no solution to this question. When you use formula to find a single exterior angle to solve for the number of sides , you get a decimal (4.5), which is impossible. Think about it: How could a polygon have 4.5 sides? A quadrilateral has 4 sides. A pentagon has 5 sides. Call Now to Set Up Tutoring: (888) 888-0446 What is a Pentagon?In simple mathematics, a polygon can be defined as any 2-dimensional shape that is formed with straight lines. In the case of quadrilaterals or triangles and pentagons, they are all perfect examples of polygons.The interesting aspect is that the name of any kind of polygon highlights the number of sides the polygon possesses.Is it a Pentagon?A pentagon has 5 straight sides and the shape must also be closed (all the lines should connect to each other):Types of Pentagon-Regular PolygonIrregular PolygonConcave polygonConvex PolygonThe General RuleEach time we add a side (triangle to quadrilateral, quadrilateral to pentagon, etc), we add another 180° to the total sum.:What is a Regular Polygon?If all the sides of a polygon are equal and all the angles of a polygon are equal then the polygon is known as a regular polygon.Different Shapes, Number of Sides, Sum of Interior Angles and the Measure of each Angle-ShapeSidesSum of Interior AnglesEach AngleTriangle3 sides180 degrees60 degreesQuadrilateral4 sides360 degrees90 degresPentagon5 sides540 degrees108 degreesHexagon6 sides720 degrees120 degreesHeptagon (or Septagon)7 sides900 degrees128.57 degreesOctagon8 sides1080 degrees135 degreesNonagon9 sides1260 degrees140 degreesGeneral RuleSum of Interior Angles of a polygon =180 ×(n−2) degrees, where n is number of sidesMeasure of each of the Angle (in a Regular Polygon) = 180 degrees ×(n−2) / n, where n is the number of sides/.PropertiesA regular pentagon has the following properties:Interior angles that measure 108°Exterior angles that measure 72°A regular pentagon has an area of approximately 1.7204774 × s2 (where s is equal to the side length)Any pentagon has the following properties:Sum of Interior Angles of measure 540°Number of diagonals is five.Sum of Angles in a Pentagon: [Image will be Uploaded Soon]To find the sum of the angles in a pentagon, divide the pentagon into different triangles. There are three angles in a triangle. Since the sum of the angles of the triangles is equal to 180 degrees.3 x 180 = 540 degreesTherefore, the sum of angles in a pentagon is 540 degrees.Regular Pentagons:The properties of Regular Pentagons- [Image will be Uploaded Soon]All the sides are of the same length (congruent, that is they are equal) and all the interior angles are of the same size (congruent).Now to find the measure of the interior angles of the pentagon, we know that the sum of all the angles in a pentagon is equal to 540 degrees (from the above figure)and there are five angles. (540/5 = 108 degrees)So, the measure of the interior angle of a regular pentagon is equal to 108 degrees.How to Measure the Central Angles of a Regular Pentagon? [Image will be Uploaded Soon]To find the measure of the central angle of a regular pentagon,we need to make a circle in the middle of the pentagon.We know that a circle is 360 degrees around. Now ,divide that by five angles. Now the measure of each central angle is equal to 360/5 = 72 degrees.So, the measure of the central angle of a regular pentagon is equal to 72 degrees.Pentagon with Right AngleA pentagon has five sides.A regular pentagon has no right angles (It has interior angles each equal to 108 degrees).An irregular pentagon has at most three right angles, because a fourth would leave 180 degrees to be used for the final angle that is (540 degrees - 360 degrees), which is a straight line.For a pentagon to have any right angles however, the pentagon has to be uneven,since the sum of all interior angles of a pentagon always sums up to 540 degrees.Convex Pentagon and Concave PentagonIf all the vertices of a pentagon are pointing outwards, then the pentagon can be known as a convex pentagon. If a pentagon has at least one vertex pointing inside, then the pentagon can be known as a concave pentagon. [Image will be Uploaded Soon]Questions to be Solved-Question 1) Is the Diagram Given Below a Pentagon? [Image will be Uploaded Soon]Answer) The figure given below cannot be known as a pentagon because from the properties of a pentagon we know that it should be a closed figure. But the figure given above is open therefore, it is not a pentagon.