

Calculating angles related to polygons

School Grade: K10

Table of contents

Polygons 3

Interior angles of a Polygon 4

Triangles 5

Quadrilaterals (Squares, etc) 6

Pentagon 7

The General Rule 8

Exterior angles of polygons9

Remember 10

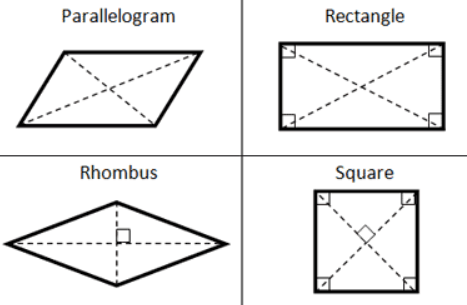
Examples 11

[References](#_heading=h.2et92p0) 13

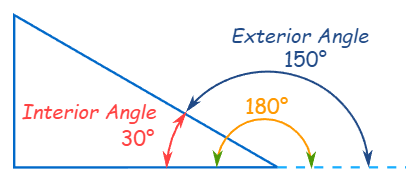
# Polygons

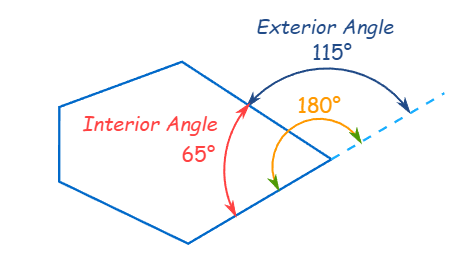
A polygon is a closed flat shape made up of straight lines. The polygon is not about the sides only. There may be scenarios when you have more than one shape with the same number of sides.

The simplest example is that both rectangle and a parallelogram have 4 sides each, with opposite sides are parallel and equal in length. The difference lies in angles, where a rectangle has 90-degree angles on its all 4 sides while a parallelogram has opposite angles of equal measure.



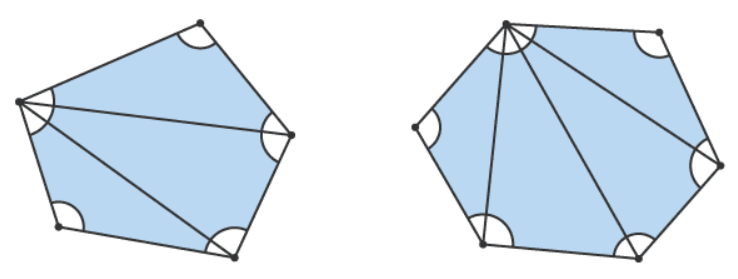
**Interior angles of a Polygon**





We know that a polygon is a two-dimensional multi-sided figure made up of straight-line segments. The sum of angles of a polygon is the total measure of all interior angles of a polygon.

To find the sum of the interior angles in a polygon, divide the polygon into triangles.



The sum of the angles in a triangle is 180°. To find the sum of the interior angles of a polygon, multiply the number of triangles in the polygon by 180°.

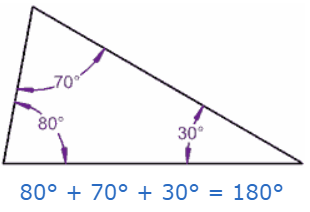
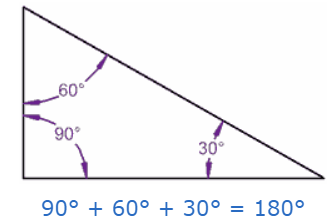
Since all the angles inside the regular polygons are the same. Therefore, the formula for finding the angles of a regular polygon is given by;

Sum of interior angles = 180° \* (n – 2)

Where n = the number of sides of a polygon.

**Triangles**

The Interior Angles of a Triangle add up to 180°



A triangle has 3 sides, therefore,

n = 3

Substitute n = 3 into the formula of finding the angles of a polygon.

Sum of interior angles = 180° \* (n – 2)

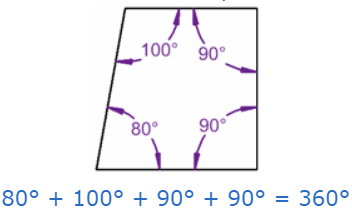
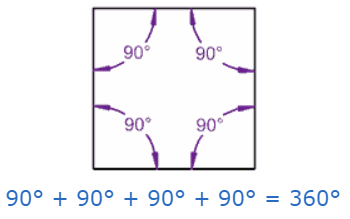
= 180° \* (3 – 2)

= 180° \* 1

= 180°

**Quadrilaterals (Squares, etc)**

A Quadrilateral has 4 straight sides.



The Interior Angles of a Quadrilateral add up to 360°, because there are 2 triangles in a square.

Obrázok, na ktorom je text, zariadenie

Automaticky generovaný popis

The interior angles in a triangle add up to 180° and for the square they add up to 360° because the square can be made from two triangles.

n = 4.

By substitution, sum of angles = 180° \* (n – 2)

= 180° \* (4 – 2)

= 180° \* 2

= 360°

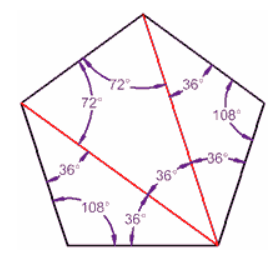
**Pentagon**

A pentagon has 5 sides, and can be made from three triangles,

so its interior angles add up to 3 × 180° = 540°

And when it is regular (all angles the same), then each angle is 540° / 5 = 108°

If the angle formed between two rays is exactly 90° then it is called a right angle or a 90° angle.



A pentagon is a 5 – sided polygon.

n = 5

Substitute.

Sum of interior angles = 180° \* (n – 2)

=180° \* (5 – 2)

= 180° \* 3

= 540°

**The General Rule**

Each time we add a side (triangle to quadrilateral, quadrilateral to pentagon, etc), we add another 180° to the total:

If it is a Regular Polygon (all sides are equal, all angles are equal)

Obrázok, na ktorom je stôl

Automaticky generovaný popis

So the **general rule** is:

Sum of Interior Angles = (n−2) × 180°

Each Angle (of a Regular Polygon) = (n−2) × 180° / n

**Exterior angles of polygons**

If the side of a polygon is extended, the angle formed outside the polygon is the exterior angle.

The sum of the exterior angles of a polygon is 360°.

Obrázok, na ktorom je obloha, doplnok

Automaticky generovaný popis

The formula for calculating the size of an exterior angle of a regular polygon is:

Exterior angle of a regular polygon = 360 ∕ number of sides.

Remember the interior and exterior angle add up to 180°.

**Remember**

The sum of the angles in a triangle is 180°. To find the sum of the interior angles of a polygon, multiply the number of triangles in the polygon by 180°.

The formula for calculating the sum of the interior angles in a polygon is (n-2) x 180° where “n” is the number of sides.

All the interior angles in a regular polygon are equal. The formula for calculating the size of an interior angle in a regular polygon is: the sum of interior angles number of sides.

The sum of the exterior angles of a polygon is 360°.

The formula for calculating the size of an exterior angle in a regular polygon is: 360 number of sides.

If you know the exterior angle you can find the interior angle using the formula: interior angle + exterior angle = 180°

**Examples**

1) Find the sum of the degree of the measures of the interior angles of a regular polygon that has 8 sides.

2) How would you find the measure of ONE interior angle?

3) Find the number of sides in a polygon whose sum of the interior angles is 1440.

4) Find the sum of the degree of the measures of the interior angles of a regular polygon that has 16 sides.

5)What is the measure of 1 angle (assuming the polygon is regular)?

6)Find the number of sides in a polygon whose sum of the interior angles is 1800.

7)What is the measure of 1 angle (assuming the polygon is regular)?

Problems II

Problem A

#1) Find the sum of the degree of the measures of the interior angles of a regular polygon that has 13 sides.

#2) What is the measure of one interior angle?

Problem B

#1) Find the sum of the degree measures of the interior angles of a regular polygon that has 17 sides.

#2) What is the measure of one interior angle?

Problem C

Find the number of sides in a polygon whose sum of the interior angles is 2700.

Problem D

#1) Find the sum of the degree measures of the interior angles of a regular polygon that has 15 sides.

#2) What is the measure of one interior angle?

Obrázok, na ktorom je text

Automaticky generovaný popis

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# References

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