

Regular Polygons I

Learning regular polygons concepts

School Grade: K7/K8

Table of contents

[Regular polygons definition and classification 3](#_Toc125408552)

[Regular polygons formula 5](#_Toc125408553)

[Perimeter 5](#_Toc125408554)

[Fixed Number 6](#_Toc125408555)

[Area constant 6](#_Toc125408556)

[Area of regular polygons 6](#_Toc125408557)

[Regular polyhedron definition and classification 6](#_Toc125408558)

[Regular Tetrahedron 8](#_Toc125408559)

[Volume 8](#_Toc125408560)

[Total surface area 8](#_Toc125408561)

[Cube 8](#_Toc125408562)

[Volume 8](#_Toc125408563)

[Total surface area 8](#_Toc125408564)

[References 9](#_Toc125408565)

# Regular polygons definition and classification

Regular polygons are special plane geometric figures that have all angles and all sides equal. Regular polygons are equilateral and equiangular.

If we denote by N the number of sides of a generic regular polygon, it will also have N angles of constant amplitude. Thanks to this number N we can classify regular polygons.

|  |  |  |  |
| --- | --- | --- | --- |
| **Number of sides - *N*** | **Name of the regular polygon** | **Shape** | **Angle** |
| 3 | Equilateral Triangle |  | 60° |
| 4 | Square |  | 90° |
| 5 | Regular Pentagon |  | 108° |
| 6 | Regular Hexagon |  | 120° |
| 7 | Regular Heptagon |  | 128,5° |
| 8 | Regular Octagon |  | 135° |

linked to regular polygons there are 3 fundamental quantities: apothem, fixed number, and area constant, whose definitions are given below.

The **apothem** of a regular polygon is equivalent to the radius of the circle inscribed inside the regular polygon

Immagine che contiene testo, interni, silhouette, cielo notturno

Descrizione generata automaticamente

The fixed number of a regular polygon f, is the ratio of the length of the apothem to the length of the side. The fixed number of a regular polygon has the property of being constant and does not depend on the size of the regular polygon but only on the number of its sides.

where **f** is the fixed number of the regular polygon, **a** is the length of its apothem, and **L** is the length of its side.

|  |  |  |
| --- | --- | --- |
| **Number of sides - *N*** | **Name of the regular polygon** | **Fixed number** |
| 3 | Equilateral Triangle | 0,289 |
| 4 | Square | 0,5 |
| 5 | Regular Pentagon | 0,688 |
| 6 | Regular Hexagon | 0,866 |
| 7 | Regular Heptagon | 1,038 |
| 8 | Regular Octagon | 1,207 |

The area constant of a regular polygon , is the ratio of the area to the square of the side. The area constant such as the fixed number, does not depend on the size of the polygon but only on the number of its sides.

where , is the area constant of the regular polygon, A is the surface of the area, and L is the length of its side.

|  |  |  |
| --- | --- | --- |
| **Number of sides - *N*** | **Name of the regular polygon** | **Area Constant** |
| 3 | Equilateral Triangle | 0,433 |
| 4 | Square | 1 |
| 5 | Regular Pentagon | 1,720 |
| 6 | Regular Hexagon | 2,598 |
| 7 | Regular Heptagon | 3,634 |
| 8 | Regular Octagon | 4,828 |

# Regular polygons formula

## Perimeter

The length of the perimeter p is equal to N (number of sides) times L (side length)

 The inverse formula are:

## Fixed Number

## Area constant

## Area of regular polygons

The area of a regular polygon A is given by the length of the perimeter p multiplied by the apothem a and divided by 2.

# Regular polyhedron definition and classification

Regular polyhedron or platonic polyhedron are polyhedron with faces given by regular polygons and all equal to each other. There are 5 different platonic solids: the regular tetrahedron, the cube, the regular octahedron, the regular dodecahedron, and the regular icosahedron.

The **edge** of a polyhedron is any side of any face that make up the surface of the polyhedron.

The **vertex** of a polyhedron the point where at least three faces of a polyhedron converge. The vertex is formed by the intersection of three or more different edges.

The **dihedral angle** of a tetrahedron is the portion of space between two faces having a common prong.

As anticipated, Platonic solids have faces made up of regular polygons and specifically: triangles, squares, and pentagons.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Faces** | **Vertex** | **Edge** | **Name of the regular polyhedron** | **Face** | **Shape** |
| 4 | 4 | 6 | Regular tetrahedron |  | Immagine che contiene testo, accessorio, clipart  Descrizione generata automaticamente |
| 6 | 8 | 12 | Cube |  |  |
| 8 | 6 | 12 | Regular octahedron |  | Immagine che contiene accessorio, ombrello, clipart, aquilone acrobatico  Descrizione generata automaticamente |
| 12 | 20 | 30 | Regular dodecahedron |  |  |
| 20 | 12 | 30 | Regular icosahedron |  |  |

## Regular Tetrahedron

The regular tetrahedron is a polyhedron formed by 4 vertices, 6 edges and 4 faces consisting of equilateral triangles equal to each other, edges all congruent and dihedral angles equal to 70°32'.

Indicating with **V** the volume of a tetrahedron, with **Stot** the total surface area, with **L** the length of an edge we have that:

### Volume

### Total surface area

## Cube

The cube is a polyhedron consisting of 8 vertices, 12 edges, and 6 faces consisting of squares equal to each other and dihedral angles equal to 90°.

### Volume

### Total surface area

# References

<https://en.wikipedia.org/wiki/Regular_polygon>

<https://www.youtube.com/watch?v=qetSusATv2w>