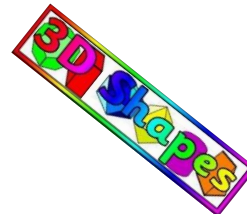




## Grade 9 - Mathematics

### Geometry of 3D Shapes 1



### Memo

1. Soccer balls are often made up of 12 regular hexagons which are usually white and twelve regular pentagons which are usually black. When the ball is inflated, the faces are not flat any longer, and the ball is therefore not a polyhedron.



- a. Explain why a polyhedron with 12 pentagonal and 12 hexagonal faces is not a Platonic solid.  
A Platonic solid has faces which are congruent (same size and shape) regular polygons. If the shape consists of pentagons and hexagons, the faces are not congruent and therefore it cannot be a Platonic solid.

- b. Calculate the size of each internal angle of a regular pentagon.

$$\begin{aligned} \text{Formula for calculating interior angles in a regular polygon: } & [(n - 2) \times 180^\circ] \div n \\ & [(5 - 2) \times 180^\circ] \div 5 \\ & = (3 \times 180^\circ) \div 5 \\ & = 540^\circ \div 5 \\ & = 108^\circ \end{aligned}$$

- c. Calculate the size of each internal angle of a regular hexagon.

$$\begin{aligned} \text{Formula for calculating interior angles in a regular polygon: } & [(n - 2) \times 180^\circ] \div n \\ & [(6 - 2) \times 180^\circ] \div 6 \\ & = (4 \times 180^\circ) \div 6 \\ & = 720^\circ \div 6 \\ & = 120^\circ \end{aligned}$$

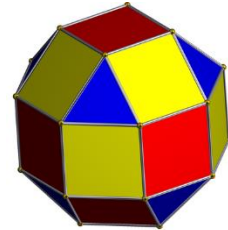
- d. Calculate the sum of the angles which meet at each vertex.

$$\begin{aligned} \text{Where hexagons meet: } & 120^\circ \times 3 = 360^\circ \\ \text{Where 2 hexagons and a pentagon meet: } & (120^\circ \times 2) + 108^\circ = 348^\circ \end{aligned}$$



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2. The image shows a semiregular polyhedron. These polyhedron are also called Archimedean solids. Archimedean solids have faces which are regular polygons, but they are not all the same.



- a. Name the regular polygons that are faces of this Archimedean solid.

Squares and triangles

- b. Calculate the size of each internal angle of each of the different regular polygons.

Square:

$$[(4 - 2) \times 180^\circ] \div 4$$

$$= [2 \times 180^\circ] \div 4$$

$$= 360^\circ \div 4$$

$$= 90^\circ$$

Triangle:

$$[(3 - 2) \times 180^\circ] \div 3$$

$$= [1 \times 180^\circ] \div 3$$

$$= 180^\circ \div 3$$

$$= 60^\circ$$

- c. Calculate the sum of the angles at each vertex.

Each vertex = 3 square and 1 triangle

$$= (3 \times 90^\circ) + 60^\circ$$

$$= 270^\circ + 60^\circ$$

$$= 330^\circ$$



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