25SCHOOLS
FREE LEARNING NOTES FOR ZAMBIA

FORM 2

Mathematics

Regular and irregular polygons

Lesson notes for learners · Competence-Based Curriculum

INSIDE

1. Regular and irregular polygons
2. Sides and angles of a polygon
3. Working out angles of regular polygons
4. Check yourself

Polygons are all around us: in pavers, road signs, windows, and in the patterns woven into traditional fabrics and crafts. A polygon is a closed two-dimensional shape made of straight lines meeting at angles. In this note you learn how to tell regular and irregular polygons apart and how the sides and angles of a polygon are related.

AFTER THESE NOTES YOU SHOULD BE ABLE TO

- Tell regular polygons from irregular polygons
- Identify interior and exterior angles
- Use the rules for interior and exterior angles of polygons
- Use polygons in designs of everyday objects

KEY WORDS

polygon	a closed two-dimensional shape with straight sides
regular polygon	a polygon with all sides equal and all angles equal
irregular polygon	a polygon whose sides or angles are not all equal
interior angle	an angle inside a polygon at a vertex
exterior angle	the angle formed outside a polygon when one side is extended at a vertex
vertex	a point where two sides meet

1 Regular and irregular polygons

A regular polygon has equal sides, so all sides are the same length. It also has equal angles, so every interior angle is the same size, and it has several lines of symmetry. A square, an equilateral triangle and a regular hexagon are regular polygons. The shapes on a football are an example of regular polygons.

An irregular polygon has unequal sides, with at least two sides of different lengths, or unequal angles. Many shapes on the walls and windows of buildings are irregular polygons.

Feature	Regular polygon	Irregular polygon
Sides	All equal	At least two different
Angles	All equal	Not all equal
Symmetry	Several lines of symmetry	Fewer lines of symmetry
Example	Square, equilateral triangle	Rectangle that is not a square

Figure 1. Regular and irregular polygons compared

2 Sides and angles of a polygon

If you build a polygon with sticks joined at the ends, each stick is a side and each joint is a corner. You will find that the number of sides equals the number of angles.

Extend one side at each vertex to make an exterior angle. At each vertex the interior angle and its exterior angle add up to 180 degrees, because they lie on a straight line. The exterior angles of any polygon always add up to 360 degrees. As the number of sides increases, the interior angles get bigger and the exterior angles get smaller.

3 Working out angles of regular polygons

In a regular polygon all exterior angles are equal. Since they add up to 360 degrees, each one is 360 divided by the number of sides. The interior angle is then 180 degrees minus the exterior angle.

WORKED EXAMPLE

Find the exterior angle and the interior angle of a regular hexagon.

A hexagon has 6 sides

Exterior angle = 360 divided by 6 = 60 degrees

Interior angle = 180 - 60

Interior angle = 120 degrees

TRY THIS

In groups, choose an everyday object such as a window, a paver or a road sign. Draw it on paper using at least two regular polygons and two irregular polygons. Label each polygon. Explain to the class which polygons are regular, which are irregular, and why those shapes are useful.

REMEMBER

- A regular polygon has equal sides and equal angles
- An irregular polygon has unequal sides or angles
- The number of sides equals the number of angles
- Interior angle + exterior angle = 180 degrees at each vertex
- Exterior angles of any polygon add up to 360 degrees
- Regular polygon: exterior angle = 360 divided by the number of sides

? Check yourself

1. What is a regular polygon?
2. What is an irregular polygon?
3. What do the interior angle and exterior angle at one vertex add up to?
4. What is the sum of the exterior angles of any polygon?
5. Find the exterior angle of a regular pentagon and its interior angle.
6. A road sign near a school in Luangwa is in the shape of a regular octagon. (a) How many sides and angles does it have? (b) Find each exterior angle, showing working. (c) Find each interior angle.
7. A builder in Lusaka lays regular hexagon pavers. One paver is cut so that two sides are shorter than the rest. (a) Is the cut paver still a regular polygon? (b) Explain your answer using sides and angles. (c) Find the exterior angle of one of the original regular pavers.

ANSWERS

1. A polygon with all sides equal and all angles equal.
2. A polygon with unequal sides or unequal angles.
3. 180 degrees.
4. 360 degrees.
5. Exterior = 360 divided by 5 = 72 degrees; interior = 180 - 72 = 108 degrees.
6. (a) 8 sides and 8 angles. (b) 360 divided by 8 = 45 degrees. (c) 180 - 45 = 135 degrees.
7. (a) No, it is now irregular. (b) A regular polygon must have all sides equal and all angles equal, and the cut shape does not. (c) 360 divided by 6 = 60 degrees.

Written by 25Schools to follow the Form 2 Mathematics syllabus of the Zambian competence-based curriculum. Free for learners to read, download and share. More notes and quizzes at 25schools.com.