Lesson - Angles and polygons

Year: Year 5

Hello, I am Otto! An angle tells us how much something turns. We see angles in opening doors, the hands of a clock and the corners of buildings. Polygons are flat shapes with straight sides. In Year 5 you measure and compare angles in degrees, find missing angles on a straight line and around a point, and meet regular and irregular polygons.

Starter activity

Stand up and face the board. Turn a quarter of the way round to your right. You have turned through a right angle, which is 90 degrees. Turn another quarter turn. Now you have made a half turn, 180 degrees. Four quarter turns bring you back to the start, a full turn of 360 degrees. Use your body to check each fact as you read.

Measuring turns in degrees

Definition: angle and degree

An **angle** measures an amount of turn. We measure it in **degrees**, written with the symbol °. The two straight lines that form an angle are its **arms**, and the point where they meet is the **vertex**.

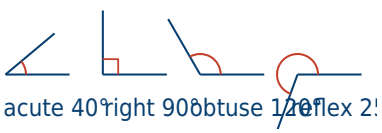
Key fact: turns

A full turn is 360°, a half turn is 180° and a quarter turn is 90°. A clock hand moves 30° each hour because 360 ÷ 12 = 30.

Types of angle

Definition: types of angle

An **acute** angle is less than 90°. A **right angle** is exactly 90°. An **obtuse** angle is between 90° and 180°. A **straight angle** is 180°. A **reflex** angle is between 180° and 360°.



Example 1

What type of angle is 135°? And 250°?

135° is more than 90° and less than 180°, so it is **obtuse**. 250° is more than 180° and less than 360°, so it is **reflex**.

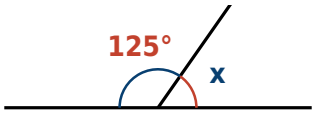
Method: measuring an angle with a protractor

1. Place the centre of the protractor on the vertex of the angle.
2. Line up the 0° line with one arm of the angle.
3. Read the scale that starts at 0° on that arm.
4. Check your answer with an estimate: is the angle acute or obtuse? Does the number match?

Angles on a straight line and at a point

Rule: angles on a straight line

Angles on a straight line add up to **180°**. If one angle is known, subtract it from 180° to find the other.



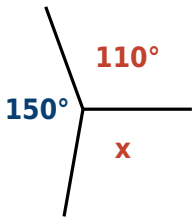
Example 2

Two angles lie on a straight line. One is 125°. Find the other angle, x.

Angles on a straight line add to 180°. x = 180° − 125° = **55°**.

Rule: angles at a point

Angles around a point add up to **360°**, a full turn. To find a missing angle, add the known angles and subtract the total from 360°.



Example 3

Three angles meet at a point: 110°, 150° and x. Find x.

110° + 150° = 260°. x = 360° − 260° = **100°**.

Watch out

Do not mix up 180° and 360°. Straight line: 180°. Whole turn around a point: 360°. A quick way to remember is that a straight line is half of a turn.

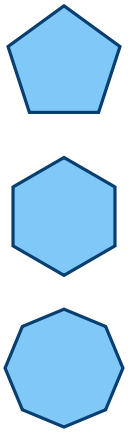
Polygons

Definition: polygon

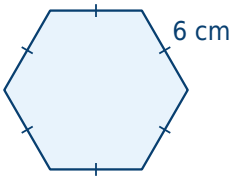
A **polygon** is a closed flat shape with straight sides. The corners are called **vertices**. Polygons are named by the number of sides: triangle (3), quadrilateral (4), pentagon (5), hexagon (6), heptagon (7), octagon (8), nonagon (9) and decagon (10).

Definition: regular and irregular polygons

A **regular** polygon has all its sides the same length and all its angles equal. A polygon that is not regular is **irregular**. A square is a regular quadrilateral; a rectangle that is not a square is irregular.



These are a regular pentagon, a regular hexagon and a regular octagon.



Example 4

A regular hexagon has sides of 6 cm. What is its perimeter?

A hexagon has 6 sides, all equal because it is regular. Perimeter = 6 × 6 cm = **36 cm**.

Key fact: triangles

An **equilateral** triangle has three equal sides. An **isosceles** triangle has two equal sides. A **scalene** triangle has no equal sides. A **right-angled** triangle has one angle of 90°.

Example 5

A regular polygon has a perimeter of 56 cm and each side is 7 cm long. How many sides does it have and what is it called?

56 ÷ 7 = 8, so it has 8 sides. A polygon with 8 sides is an **octagon**.

Did you know?

The word "polygon" comes from Greek words meaning "many angles". The Greek mathematician Euclid wrote a famous book about geometry over 2,300 years ago. The degree is probably based on the Babylonian idea of 360 parts in a circle, since 360 can be divided by so many numbers. Honeybees build their honeycomb out of regular hexagons because hexagons fit together without leaving any gaps.

Otto's tip

Always make a quick estimate of an angle before you measure it. If the angle looks smaller than a corner of a book, it must be acute. If your protractor says 130° for that angle, you have read the wrong scale!