Year 9 Angles and Pythagoras – Revision Notes

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Year 9 · Maths · Angles, Polygons and Pythagoras' Theorem · Key ideas and worked examples

For grown-ups and learners: read each part and try the worked example. Then work through the sheets: Foundation, Developing, Challenge, then Mixed Practice to revise everything. Show your working: it earns marks in tests and helps you spot mistakes.

1. Interior angles of a polygon

From one corner of an n-sided polygon you can draw diagonals that split it into **n – 2 triangles**. Each triangle has 180°, so the interior angles add up to **(n – 2) × 180°**. A heptagon (7 sides) has (7 – 2) × 180 = 900°. In a **regular** polygon every interior angle is the same: sum ÷ n.

Example: Find the sum of the interior angles of a pentagon.
→ Sum = (n – 2) × 180°, with n = 5
→ (5 – 2) × 180 = 3 × 180 = 540°
Answer: 540°

2. Exterior angles

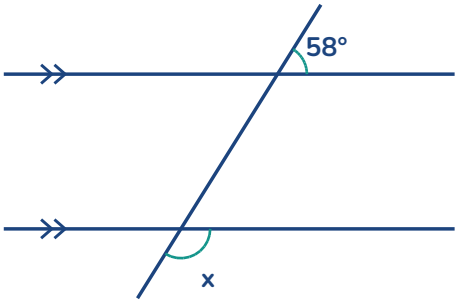
Walk all the way round a polygon and you turn through every exterior angle once, ending up facing the way you started: the exterior angles of any polygon add up to **360°**. For a regular polygon each exterior angle is **360 ÷ n**, and **interior + exterior = 180°**. Working backwards, an exterior angle of 24° means n = 360 ÷ 24 = 15 sides.

Example: Each exterior angle of a regular polygon is 40°. How many sides does it have?
→ The exterior angles add up to 360°
→ n = 360 ÷ 40 = 9
Answer: 9 sides

3. Angle reasoning

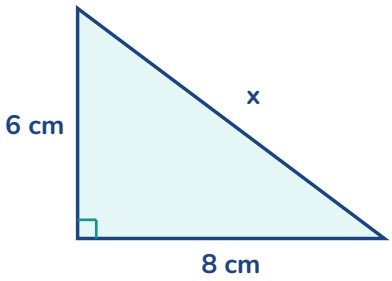
Use the facts and **say which one you use**: angles on a straight line add up to 180°; vertically opposite angles are equal; corresponding and alternate angles are equal and **co-interior angles add up to 180°**; the angles of a triangle add up to 180° and of a quadrilateral to 360°; the base angles of an isosceles triangle are equal. Most Year 9 problems need two or three steps, each with its reason.

Example: The lines marked with arrows are parallel. Find the angle x. Give a reason for each step.
→ At the upper crossing, the angle in the same position as x is 122° (angles on a straight line add up to 180°)
→ Corresponding angles are equal, so x = 122°
Answer: x = 122°

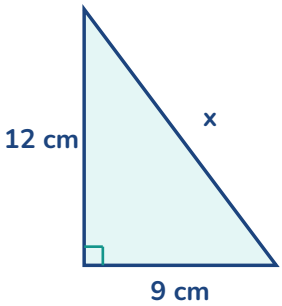


4. Pythagoras' theorem

In a right-angled triangle the longest side, opposite the right angle, is the **hypotenuse c**. For the other sides a and b: **$a^2 + b^2 = c^2$**. To find the hypotenuse, add the squares and take the square root; to find a shorter side, **subtract**: $a^2 = c^2 - b^2$. With sides 6 and 8, $c^2 = 36 + 64 = 100$, so c = 10. If $a^2 + b^2 = c^2$, the triangle is right-angled; if not, it is not.



Example: Find the length of the side marked x.
→ Hypotenuse: $x^2 = 9^2 + 12^2 = 81 + 144 = 225$
→ $x = \sqrt{225} = 15$ cm
Answer: x = 15 cm



5. Constructions

With a ruler and compasses only: draw a line, then arcs with the **same radius as the line** from both ends. They meet at the third corner of an **equilateral triangle**, so the angle is **60°**. Bisect 60° to get **30°**. Construct a perpendicular (90°) and bisect it to get **45°**. For a **regular hexagon**, step the compasses round a circle at the radius: the angle at the centre is 360 ÷ 6 = 60°. For other regular polygons, mark angles of 360 ÷ n at the centre.

Think like a mathematician: test a few cases (**specialising**), look for the rule that always works (**generalising**), and explain why you are sure (**convincing**). When you check someone's working, say what is wrong and how to **improve** it.

Common mistakes: using $n \times 180$ instead of $(n - 2) \times 180$. Giving the exterior angle $360 \div n$ as the interior angle. Adding the squares when the hypotenuse is already known. Forgetting the square root. Saying co-interior angles are equal.