

Exercise walk-through

4.1

Angles, parallel lines and polygons (G1–G3)

AQA · GCSE · Mathematics

2. Terms, angle facts and polygons

Terms, angle facts and polygons

Conventional notation: AB a side, angle ABC at vertex B; parallel and perpendicular lines named, never letter shapes (G1, G3). Angles at a point 360, on a line 180, vertically opposite equal; alternate and corresponding equal only when parallelism is STATED. A pentagon splits into three triangles: 540 degrees; a regular hexagon has 120-degree interiors and 60-degree exterior turns; exterior 45 means 8 sides.

Quadrilateral family (G4): square 4 axes order 4; rectangle opposite sides equal with equal bisecting diagonals; rhombus perpendicular bisecting diagonals; parallelogram opposite sides via an ASA diagonal split; kite adjacent pairs; trapezium one parallel pair.

3. Constructions, loci and transformations

Constructions, loci and transformations

Ruler and compass (G2): perpendicular bisector from equal endpoint arcs, perpendicular from or at a point, angle bisector, a 60-degree angle from two equal circles. Loci: equidistant from two points is the perpendicular bisector; fixed distance r is a circle; equidistant from two lines is an angle bisector. Keep the arcs as evidence.

Enlargement image $C + k(P - C)$ (G7): centre $(1,1)$, point $(3,2)$ - $k = 2$ gives $(5,3)$; the Higher $k = -2$ gives $(-3,-1)$, opposite side. Invariance under combinations (G8): isometries preserve lengths and angles; reflections in $x = 0$ then $x = 2$ send $(3,2)$ to $(-3,2)$ then $(7,2)$ - a translation by $(4,0)$.

4. Congruence, similarity and circle theorems

Congruence, similarity and circle theorems

Congruence by SSS, SAS, ASA, RHS (G5) - the June 2024 2H Q12 one-word reason is SSS; AAA gives similarity only. Proof chains (G6): isosceles ABC with midpoint D of BC gives SSS on ABD and ACD, so base angles ABC and BCA match; Pythagoras follows from four congruent triangles in an $(a+b)$ square: $(a+b)^2 = 4(ab/2) + c^2$.

Circle parts (G9): 2H Q1 names the segment between chord and arc and the sector between two radii. Theorems (G10): centre angle twice the circumference angle (proof via two isosceles triangles on equal radii); cyclic opposites 180; tangent perpendicular to radius; equal tangents from a point; centre-perpendicular bisects a chord; alternate segment. The 1H Q22 anchor: two tangents at 24 degrees give quadrilateral $360 - 90 - 90 - 24 = 156$ at the centre, so the circumference angle is 78.

Exercises 2.1·2.3

2.1 Two angles on a straight line: one is 112° . Find the other, and state the size of the angle vertically opposite the 112° one. [2]

2.2 With parallel lines, one corresponding angle is 68° . Write down the other, naming the angle fact used. [2]

2.3 Show that the interior angle sum of a pentagon is 540° . [2]

Exercises 2.1·2.3

2.1 Two angles on a straight line: one is 112° . Find the other, and state the size of the angle vertically opposite the 112° one. [2]

2.1 $180 - 112 = 68^\circ$; the vertically opposite angle is 112° .

2.2 With parallel lines, one corresponding angle is 68° . Write down the other, naming the angle fact used. [2]

2.2 68° – corresponding angles are equal.

2.3 Show that the interior angle sum of a pentagon is 540° . [2]

2.3 A pentagon splits into $5 - 2 = 3$ triangles, each 180° : $3 \times 180 = 540^\circ$.

Exercises 2.4·2.6

2.4 Find the interior angle of a regular hexagon. [2]

2.5 A regular polygon has an exterior angle of 45° . How many sides has it? [3]

2.6 A triangle has angles 54° and 61° . Find the third angle. [2]

Exercises 2.4·2.6

2.4 Find the interior angle of a regular hexagon. [2]

2.4 Interior sum $= 4 \times 180 = 720^\circ$; each angle $= 720 \div 6 = 120^\circ$.

2.5 A regular polygon has an exterior angle of 45° . How many sides has it? [3]

2.5 $360 \div 45 = 8$ sides.

2.6 A triangle has angles 54° and 61° . Find the third angle. [2]

2.6 $180 - 54 - 61 = 65^\circ$.

Exercises 3.1·3.3

3.1 (*Original.*) Two parallel lines are cut by a transversal; one angle is 74° . Find the other three angles at the crossing, giving a reason for each. [4]

3.2 (*Original.*) The interior angle of a regular polygon is 156° . Work out the number of sides. [3]

3.3 (*Original.*) Three angles around a point are in the ratio $2 : 3 : 4$. Find the size of the largest angle. [3]

Exercises 3.1·3.3

3.1 (*Original.*) Two parallel lines are cut by a transversal; one angle is 74° . Find the other three angles at the crossing, giving a reason for each. [4]

3.1 74° (vertically opposite); 106° (angles on a line with the 74°); 74° and 106° at the second crossing by alternate and corresponding equality.

3.2 (*Original.*) The interior angle of a regular polygon is 156° . Work out the number of sides. [3]

3.2 Exterior angle $= 180 - 156 = 24^\circ$; sides $= 360 \div 24 = 15$.

3.3 (*Original.*) Three angles around a point are in the ratio $2 : 3 : 4$. Find the size of the largest angle. [3]

3.3 Parts total $2 + 3 + 4 = 9$; largest $= \frac{4}{9} \times 360 = 160^\circ$.

Local review guidance: each value with its named reason – “Z-angles” scores nothing; the $n - 2$ triangle split or the exterior-angle route before the answer; exact degree values. This is authored classroom guidance.