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GCSE MATHEMATICS • GEOMETRY

Angle Rules

Worked Solutions

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • No calculator

Full worked solutions for the free Angle Rules worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Angle Rules worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

Question sheet

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A**Your turn answers**

Compare each line of your working with the solution. Every angle needs a reason.

FOUNDATION

A1 Angles at a point add up to 360° : $360 - 140 - 95 = 125^\circ$

A2 Co-interior angles add up to 180° : $180 - 115 = 65^\circ$

A3 Base angles of an isosceles triangle are equal: $180 - 52 - 52 = 76^\circ$

HIGHER

A4 Exterior = $360 \div 12 = 30^\circ$ Interior = $180 - 30 = 150^\circ$

A5 $360 \div 18 = 20$ sides

A6 $145 + 180 = 325^\circ$

A7 Angles in a triangle add up to 180° : the angle at the bottom right is $180 - 70 - 52 = 58^\circ$
Alternate angles are equal: $x = 58^\circ$

B**Fluency solutions**

One mark for each correct part. The notes in italics explain why each sequence was chosen.

FOUNDATION

B1 (a) straight line: 145° (b) at a point: 140° (c) vertically opposite: 47° (d) $3x + 60 = 180$: 40°

B2 (a) alternate: 58° (b) corresponding: 58° (c) co-interior: 122° (d) vertically opposite the co-interior angle: 122°

The same 58° angle, with x moved to each position in turn.



B3 (a) 60° (b) $(180 - 30) \div 2 = 75^\circ$ (c) $90 - 35 = 55^\circ$ (d) exterior angle = sum of the opposite interior angles: $110 - 45 = 65^\circ$

B4 (a) $360 - 285 = 75^\circ$ (b) $3 \times 180 = 540^\circ$ (c) $4 \times 180 = 720^\circ$ (d) $540 - 425 = 115^\circ$

B5 (a) 090° (b) 225° (c) $40 + 180 = 220^\circ$

B6 (a) alternate angles: equal (b) corresponding angles: equal (c) co-interior angles: add up to 180° (d) vertically opposite angles: equal

HIGHER

B7 (a) $360 \div 8 = 45^\circ$ (b) 135° (c) $360 \div 24 = 15^\circ$ (d) exterior 20° , $360 \div 20 = 18^\circ$

B8 (a) $(n - 2) \times 180 = 1440$, $n - 2 = 8$: 10° (b) exterior 50° and $360 \div 50 = 7.2$, not a whole number: no (c) exterior = $180 \div 6 = 30^\circ$, $360 \div 30 = 12^\circ$ (d) $5x + 100 = 540$, $x = 88$; largest = 128°

B9 (a) 295° (b) 120° (c) bearing of A from B is 230° ; $230 - 140 = 90^\circ$ (d) 130°

B10 (a) $3x = 2x + 25$: 25° (b) $6x = 180$: 30° (c) $2x = 50$: 25° (d) $2x = 20$: 10°

Decide first whether the angles are equal or add up to 180° .

C

Reasoning solutions

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

C1 Alternate angles are equal. It is co-interior angles that add up to 180°

C2 No: $60 + 70 + 60 = 190$, but the angles in a triangle add up to 180°

C3 A diagonal splits the quadrilateral into two triangles. Each triangle's angles add up to 180° , so the total is $2 \times 180 = 360^\circ$



- C4** The angle below x is 72° (alternate angles are equal). $x = 180 - 72 = 108^\circ$ (angles on a straight line add up to 180°)

HIGHER

- C5** The exterior angle would be $180 - 100 = 80^\circ$. The number of sides would be $360 \div 80 = 4.5$, which is not a whole number.
- C6** A back bearing differs by 180° , because the North lines are parallel: $80 + 180 = 260^\circ$
- C7** $a + b + c = 180$ (angles in a triangle) and $c + d = 180$ (angles on a straight line). So $a + b + c = c + d$, which gives $d = a + b$
- C8** (a) Each interior angle is 108° . Triangle ABC is isosceles ($AB = BC$), so angle $BCA = (180 - 108) \div 2 = 36^\circ$
- (b) Angle $ACD = 108 - 36 = 72^\circ$
- (c) Angle $ACD +$ angle $CDE = 72 + 108 = 180^\circ$. These are co-interior angles between AC and ED , and they add up to 180° , so AC is parallel to ED

D**Problem solving solutions**

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

- D1** The exterior angle of a triangle equals the sum of the two opposite interior angles: $x = 115 - 48 = 67^\circ$
- D2** (a) At B , the bearing back to A is 240° . Angle $ABC = 240 - 150 = 90^\circ$
- (b) 240°
- D3** Draw a third parallel line through the corner. Alternate angles give 35° and 48° either side of it: $x = 35 + 48 = 83^\circ$
- D4** The interior angle of a regular hexagon is 120° , and $3 \times 120 = 360$, so three meet exactly at a point. The interior angle of a regular pentagon is 108° , and $360 \div 108$ is not a whole number, so pentagons leave gaps.



HIGHER

- D5** (a) Interior angle 120° . Triangle ABC is isosceles: $(180 - 120) \div 2 = 30^\circ$
 (b) Angle $ACD = 120 - 30 = 90^\circ$
- D6** The angles at the point add up to 360° : $360 - 90 - 135 = 135^\circ$. The interior angle of a regular octagon is $180 - 360 \div 8 = 135^\circ$, so the third polygon is a regular octagon.
- D7** Angle $BAC = 130 - 70 = 60^\circ$. The bearing of A from B is 250° , and C is due south of B (180°), so angle $ABC = 250 - 180 = 70^\circ$
 Angle $ACB = 180 - 60 - 70 = 50^\circ$
- D8** (a) Angles on a straight line: $(x + 110) + (2x + 40) = 180$, so $3x = 30$ and $x = 10$
 (b) The angle $(2x + 40)^\circ = 60^\circ$ and the angle $(5x + 10)^\circ = 60^\circ$. They are alternate angles and they are equal, so the lines are parallel.

E

Exam practice solutions

Marks are shown on the right of each line.

FOUNDATION

Foundation and Higher crossover

- E1** $x = 180 - 128 = 52^\circ$ B1
 $y = 128^\circ$ (vertically opposite) B1
- E2** (a) 74° B1
 (b) Corresponding angles are equal B2
- E3** (a) $180 - 64 - 64 = 52^\circ$ M1
A1
 (b) Two sides are equal, so the angles opposite them are equal C1
- E4** (a) $360 \div 24 = 15$ M1
A1
 (b) $180 - 24 = 156^\circ$ M1
A1



- E5** (a) $70 + 180$ M1
 $= 250^\circ$ A1
 (b) The North lines at A and B are parallel, so the angles are co-interior C1

HIGHER

- E6** Angle $PQR = 52^\circ$ (alternate angles) B1
 Angle $PRQ = 52^\circ$ (isosceles triangle) B1
 $x = 180 - 104 = 76^\circ$ (angles in a triangle) B1

- E7** Interior + exterior = 180, so $5 \times$ exterior = 180 M1
 Exterior = 36° A1
 $360 \div 36 = 10$ sides A1

- E8** (a) Co-interior angles: $(3x + 10) + (5x - 30) = 180$ M1
 $8x - 20 = 180$ M1
 $x = 25$ A1
 (b) 85° and 95° B1

- E9** (a) Interior angles: $180 - \frac{360}{n}$ and $180 - \frac{360}{2n} = 180 - \frac{180}{n}$ M1 M1
 Difference = $\frac{360}{n} - \frac{180}{n} = \frac{180}{n}$ A1 as required
 (b) $\frac{180}{n} = 15$ M1
 $n = 12$ A1

