HIGHER

4.11H Angles in Polygons: Higher Tier Practice

EDEXCEL Edexcel 1MA1 · Calculator allowed · about 70 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Work out the interior angle of a regular octagon.

(Total for Question 1 is 2 marks)

2 Find the sum of the interior angles of a regular 12-gon.

(Total for Question 2 is 3 marks)

3 Work out the exterior angle of a regular heptagon. Give your answer exactly and to 2 decimal places.

(Total for Question 3 is 3 marks)

4 A nonagon (9-sided polygon) has one interior angle equal to 150 degrees. The remaining eight interior angles are all equal. Work out the size of each of the eight equal angles.

(Total for Question 4 is 4 marks)

5 A regular polygon has interior angle 156 degrees. Find the number of sides of the polygon.

(Total for Question 5 is 4 marks)

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6 Show that the interior angle of a regular n-sided polygon is 180 - 360/n degrees. You must justify each step.

(Total for Question 6 is 5 marks)

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7 A convex 10-sided polygon has two interior angles equal to 120 degrees and 130 degrees. The other eight interior angles are all equal. Work out the size of each of the eight equal angles.

(Total for Question 7 is 5 marks)

8 Show that the sum of the exterior angles, taking one exterior angle at each vertex, of any convex polygon is 360 degrees. Give a clear justification.

(Total for Question 8 is 7 marks)

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9 A regular 12-sided polygon is altered so that the 12 interior angles alternate between $(3x + 10)$ degrees and $(2x + 20)$ degrees around the polygon (so six angles are $3x + 10$ and six angles are $2x + 20$). Find x and then work out the sizes of both types of angle. State whether the resulting polygon is convex.

(Total for Question 9 is 7 marks)

Mark scheme · 4.11H Angles in Polygons: Higher Tier Practice

Question 1

- **M1** use (n - 2) * 180 / n for a regular n-gon with n = 8
- **A1** 135 degrees cao
- **Answer: 135 degrees, since (8 - 2) * 180 / 8 = 6 * 180 / 8 = 1080 / 8 = 135 degrees. Check: interior + exterior = 180.**

Question 2

- **M1** use sum = (n - 2) * 180 with n = 12
- **M1** compute (12 - 2) * 180 = 10 * 180
- **A1** 1800 degrees cao
- **Answer: 1800 degrees, since (12 - 2) * 180 = 10 * 180 = 1800 degrees.**

Question 3

- **M1** use exterior angle = 360 / n with n = 7
- **A1** 360/7 degrees cao
- **B1** decimal 51.43 degrees awrt
- **Answer: 360/7 degrees, which is approximately 51.43 degrees (360/7 = 51.428571... so approximately 51.43 degrees).**

Question 4

- **M1** sum of interior angles = (9 - 2) * 180 = 7 * 180
- **M1** subtract the given 150 degrees: 1260 - 150
- **M1** divide the remaining sum by 8 to find each equal angle
- **A1** 138.75 degrees cao
- **Answer: Each of the eight equal angles is 138.75 degrees, since total = 7 * 180 = 1260; remaining = 1260 - 150 = 1110; each = 1110 / 8 = 138.75.**

Question 5

- **M1** set (n - 2) * 180 / n = 156
- **M1** rearrange: 180n - 360 = 156n
- **A1** n = 15 cao
- **B1** verify n is an integer and > 2
- **Answer: 15 sides, since (n - 2) * 180 = 156n gives 180n - 360 = 156n so 24n = 360 and n = 15.**

Question 6

- **dM1** state sum of interior angles = (n - 2) * 180
- **M1** divide sum by n to get each interior angle = (n - 2) * 180 / n
- **M1** expand/ rearrange (n - 2) * 180 / n = (180n - 360) / n
- **M1** simplify (180n - 360) / n to 180 - 360 / n
- **A1** final form 180 - 360/n cao and clear justification
- **Answer: Starting from sum = (n - 2) * 180, each interior angle = ((n - 2) * 180) / n = (180n - 360) / n = 180 - 360 / n, so interior angle = 180 - 360/n degrees. Exterior angle = 180 - interior = 360 / n, consistent with the result above.**

Question 7

- **M1** use sum of interior angles = (10 - 2) * 180 = 1440
- **M1** subtract the two given angles: 1440 - (120 + 130)
- **M1** compute remaining sum = 1440 - 250 = 1190
- **M1** divide by 8 to get each angle
- **A1** 148.75 degrees cao
- **Answer: Each equal angle is 148.75 degrees, since total 1440, remaining 1440 - 250 = 1190, so each = 1190 / 8 = 148.75.**

Question 8

- **dM1** define exterior angle at a vertex as 180 - interior angle (or state interior + exterior = 180)
- **M1** write sum of interior angles = (n - 2) * 180
- **M1** write sum of n exterior angles = n * 180 - sum of interior angles
- **M1** substitute sum of interior angles to get n * 180 - (n - 2) * 180
- **M1** simplify to (n * 180 - n * 180 + 360) = 360
- **A1** conclude sum of exterior angles = 360 degrees cao
- **B1** clear statement that this holds for any convex polygon using one exterior at each vertex
- **Answer: 360 degrees. Using exterior = 180 - interior and sum interior = (n - 2) * 180, sum exterior = n*180 - (n - 2)*180 = 360, so the sum is 360 degrees for any convex polygon taking one exterior angle at each vertex.**

Question 9

- **M1** set up equation: 6*(3x + 10) + 6*(2x + 20) = sum interior angles = (12 - 2) * 180
- **M1** simplify left side: 6*(5x + 30) = 30x + 180
- **M1** write equation 30x + 180 = 1800
- **M1** solve for x: 30x = 1620 so x = 54
- **M1** substitute x to find angles: 3x + 10 = 3*54 + 10 = 172, and 2x + 20 = 2*54 + 20 = 128
- **A1** state both angles: 172 degrees and 128 degrees cao
- **B1** state polygon is convex since all interior angles are less than 180 degrees
- **Answer: x = 54. The two angle sizes are 3x + 10 = 172 degrees and 2x + 20 = 128 degrees. The polygon is convex because all interior angles are less than 180 degrees.**