ExamPath

CLASS 9 MATHEMATICS · FBISE · UNIT 9 · SECTIONS B AND C PRACTICE

Unit 9: Geometry and Polygons: short and long questions

Write your working in the boxes. Model answers are on the last pages. These are practice questions written by ExamPath, not official FBISE questions or marking schemes.

Section B style: short questions (3 marks each)

B1 · 3 marks · Angles of polygons

Find each interior angle and each exterior angle of a regular decagon (10 sides).

B2 · 3 marks · Similar solids

Two similar cones have heights 6 cm and 9 cm. The smaller cone has a volume of 48 cm^3. Find the volume of the larger cone.

B3 · 3 marks · Locus

Describe the locus of (a) points that are 3 cm from a fixed point O (b) points that are equidistant from two intersecting lines.

B4 · 3 marks · Inductive reasoning

$1 + 3 = 4$, $1 + 3 + 5 = 9$, $1 + 3 + 5 + 7 = 16$. Make a conjecture about the sum of the first n odd numbers, and test it for $n = 5$.

B5 · 3 marks · Angles of polygons

Each interior angle of a regular polygon is 156°. How many sides does it have?

B6 · 3 marks · Scale and similar figures

A map has a scale of 1 : 25 000. A field has an area of 8 cm^2 on the map. Find its real area in km^2.

Section C style: long questions (6 marks each)

C1 · 6 marks · Similar solids

Two spheres have radii 3 cm and 6 cm.

(a) Find the ratio of their surface areas. (2 marks)

(b) Find the ratio of their volumes. (2 marks)

(c) The smaller sphere has surface area 36π cm^2 and volume 36π cm^3. Find the surface area and volume of the larger sphere. (2 marks)

C2 · 6 marks · Angles of polygons

(a) Find the sum of the interior angles of a pentagon. (1 mark)

(b) The angles of pentagon ABCDE are x, 2x, 100°, 110° and 120°. Find x and the two unknown angles. (3 marks)

(c) Find each exterior angle of the pentagon and show that they add up to 360°. (2 marks)

C3 · 6 marks · Deductive reasoning and proof

Claim: “The sum of any two consecutive odd numbers is a multiple of 4.”

(a) Test the claim with three examples. (2 marks)

(b) Prove the claim using deductive reasoning. (3 marks)

(c) Explain why the examples in (a) are not a proof. (1 mark)

Model answers

B1.

1. Sum of interior angles = (10 − 2) × 180° = 1440°.
2. Each interior angle = 1440° ÷ 10 = 144°.
3. Each exterior angle = 180° − 144° = 36° (check: 360° ÷ 10 = 36°).

Answer: Interior 144°, exterior 36°

Watch out: The exterior angles of any polygon add up to 360°.

B2.

1. Linear scale factor k = 9 ÷ 6 = 1.5.
2. Volumes scale by $k^3 = 1.5^3 = 3.375$.
3. Larger volume = 48 × 3.375 = 162 cm^3.

Answer: 162 cm^3

Watch out: Lengths × k, areas × k^2, volumes × k^3.

B3.

1. (a) Every point exactly 3 cm from O lies on a circle with centre O and radius 3 cm.
2. (b) Points equidistant from two intersecting lines lie on the bisectors of the angles between the lines.
3. There are two such bisectors, and they are perpendicular to each other.

Answer: (a) A circle, centre O, radius 3 cm (b) The two angle bisectors of the lines

Watch out: A locus is the whole set of points that satisfy the rule, so describe it completely (here, both bisectors).

B4.

1. The sums 4, 9, 16 are 2^2, 3^2, 4^2.
2. Conjecture: the sum of the first n odd numbers is n^2.
3. Test n = 5: 1 + 3 + 5 + 7 + 9 = 25 = 5^2 ✓

Answer: Sum of the first n odd numbers = n^2

Watch out: Testing examples supports a conjecture (inductive reasoning) but does not prove it; a proof needs deduction.

B5.

1. Each exterior angle = 180° − 156° = 24°.
2. Number of sides = 360° ÷ 24° = 15.

Answer: 15 sides

Watch out: Work with the exterior angle; it is quicker than using the interior angle formula.

B6.

1. Areas scale by $25\,000^2 = 625\,000\,000$.
2. Real area = 8 × 625 000 000 = 5 000 000 000 cm^2.
3. 1 km = 100 000 cm, so 1 km^2 = 10 000 000 000 cm^2. Area = $5 \times 10^9 \div 10^{10}$ = 0.5 km^2.

Answer: 0.5 km^2

Watch out: Square the scale factor for areas; multiplying by 25 000 only gives a far too small answer.

C1.

1. All spheres are similar. Length ratio = 3 : 6 = 1 : 2.
2. (a) Surface area ratio = $1^2 : 2^2 = 1 : 4$.
3. (b) Volume ratio = $1^3 : 2^3 = 1 : 8$.
4. (c) Larger surface area = $36\pi \times 4 = 144\pi$ cm^2; larger volume = $36\pi \times 8 = 288\pi$ cm^3.
5. Check: $4\pi \times 6^2 = 144\pi$ and $(4/3)\pi \times 6^3 = 288\pi$ ✓

Answer: (a) 1 : 4 (b) 1 : 8 (c) 144π cm^2 and 288π cm^3

Watch out: Doubling the radius multiplies the volume by 8, not by 2.

C2.

1. (a) $(5 - 2) \times 180° = 540°$.
2. (b) $x + 2x + 100° + 110° + 120° = 540°$, so $3x + 330° = 540°$, $3x = 210°$ and $x = 70°$.
3. The angles are 70° and 140°.
4. (c) Exterior angles: $180° - 70° = 110°$, 40°, 80°, 70°, 60°.
5. $110° + 40° + 80° + 70° + 60° = 360°$ ✓

Answer: (a) 540° (b) x = 70°; angles 70° and 140° (c) 110°, 40°, 80°, 70°, 60°

Watch out: Each exterior angle is 180° minus its interior angle.

C3.

1. (a) 1 + 3 = 4, 5 + 7 = 12, 11 + 13 = 24; all are multiples of 4.
2. (b) Any odd number can be written 2n + 1, where n is a whole number. The next odd number is 2n + 3.
3. Sum = (2n + 1) + (2n + 3) = 4n + 4 = 4(n + 1), which is a multiple of 4 for every whole number n.
4. (c) Examples check only some cases. The algebra in (b) covers every possible pair, so it proves the claim.

Answer: Sum = 4(n + 1), so it is always a multiple of 4

Watch out: Use general symbols (2n + 1) in a proof, not particular numbers.

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