CLASS 8 · MATHEMATICS

Exploring Some Geometric Themes

Sample paper · 15 questions · 22 marks

10 objective questions × 1 mark. Five written-response questions: 12 marks. Write your working where needed. Suggested time: 45 minutes. Answers and marking guidance follow the questions.

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Section A · Objective questions (10 marks)

1. The self-similarity of the Sierpinski fractals studied in this chapter means that:

A. It cannot be drawn

B. A small part looks like the whole

C. It is always a circle

D. It has no pattern

2. To build a Sierpinski Carpet, a square is divided into 9 equal squares and the centre square is removed. After one step, how many filled squares remain?

A. 8

B. 6

C. 9

D. 7

3. In the first step of a Sierpinski Gasket, a triangle is divided into 4 equal triangles and the middle one is removed. How many filled triangles remain?

A. 4

B. 3

C. 1

D. 2

4. A Koch Snowflake begins with which shape?

A. A hexagon

B. A circle

C. An equilateral triangle

D. A square

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5. How many edges does a cube have?

A. 12

B. 8

C. 6

D. 14

6. A pyramid with a square base has how many faces?

A. 8

B. 6

C. 4

D. 5

7. A convex polyhedron has 6 faces and 12 edges. Using faces +vertices -edges =2, how many vertices does it have?

A. 10

B. 6

C. 20

D. 8

8. A net of a solid is:

A. The shadow of the solid

B. A rope used to measure it

C. A flat pattern that folds up into the solid

D. A solid with no faces

9. A right prism whose two ends are hexagons has how many faces?

A. 7

B. 8

C. 6

D. 12

10. How many edges does a triangular prism have?

A. 12

B. 9

C. 5

D. 6

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Section B · Written responses (12 marks)

Attempt all five. Use a separate sheet if you need more space. The marks for each question are shown.

11. What is self-similarity? Name one fractal from your textbook and describe the rule that creates it. [2 marks]

12. How many squares make up a net of a cube? When arranging them, why must squares be joined along full edges? [2 marks]

13. Count the faces, edges and vertices of a triangular prism, and check that Euler's rule holds for it. [2 marks]

14. A square of area 81 cm2 is turned into the first step of a Sierpinski Carpet by removing the middle of 9 equal squares. What area remains? If the same removal is repeated on each remaining square (step 2), what area remains then? [3 marks]

15. A pyramid is built on a base with 10 sides. Find its number of faces, edges and vertices, and verify Euler's rule. [3 marks]

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Answers & marking guidance

Use these after attempting the paper. Accept equivalent correct reasoning and sensible units. These are Evater model answers, not an official marking scheme.

Section A · 1 mark each

1. B — The construction repeats at smaller scales; smaller parts resemble the whole pattern.

2. A — 9 - 1 = 8 filled squares remain after the centre is removed.

3. B — 4 - 1 = 3 filled triangles remain.

4. C — The Koch Snowflake starts from an equilateral triangle, with a smaller triangle bump added to each side at every step.

5. A — A cube has 6 faces, 12 edges and 8 vertices.

6. D — A square pyramid has 1 square base and 4 triangular side faces, so 5 faces in all.

7. D — Vertices = 2 + edges - faces = 2 + 12 - 6 = 8.

8. C — A net is a flat arrangement of faces that can be folded to form the solid.

9. B — It has 2 hexagonal ends and 6 rectangular side faces, so 8 faces in all.

10. B — A triangular prism has 5 faces, 9 edges and 6 vertices.

Section B · Model answers

11. Self-similarity means a small part of a shape looks like the whole shape. Example: in the Sierpinski Carpet, a square is divided into 9 equal squares and the middle square is removed; the same rule is then repeated on every remaining square. (The Sierpinski Gasket or Koch Snowflake with their rules is also acceptable.)

Marking: 1 mark for a correct meaning of self-similarity; 1 mark for a named fractal with its repeating rule.

12. A cube's net has 6 squares, one for each face. Squares must share full edges so that, when folded, the edges of the faces meet exactly; a square joined only at a corner or part of an edge would leave a gap or overlap.

Marking: 1 mark for 6 squares; 1 mark for the edge-joining reason.

13. A triangular prism has 5 faces (2 triangles and 3 rectangles), 9 edges and 6 vertices. Euler's rule: 5 + 6 - 9 = 2, so the rule holds.

Marking: 1 mark for the three correct counts; 1 mark for verifying 5 + 6 - 9 = 2.

14. Each small square has area 81 / 9 = 9 cm2, so after step 1 the remaining area is 81 - 9 = 72 cm2. At step 2, each of the 8 squares loses one ninth of its area, so the remaining area is 72 x 8/9 = 64 cm2.

Marking: 1 mark for 72 cm2 after step 1; 1 mark for recognising each remaining square loses one ninth; 1 mark for 64 cm2 after step 2.

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15. Faces: 1 base + 10 triangular sides = 11. Edges: 10 around the base + 10 rising to the apex = 20. Vertices: 10 on the base + 1 apex = 11. Check: 11 + 11 - 20 = 2, so Euler's rule holds.

Marking: 1 mark for each correct count (11 faces, 20 edges, 11 vertices), with the Euler check required for full marks.

Topic references

NCERT Class 8 Mathematics, Ganita Prakash, Chapter 11: Exploring Some Geometric Themes.

https://ncert.nic.in/textbook/pdf/hegp204.pdf

Concept reference only. Questions and model answers are original Evater practice material, not an official NCERT paper.

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