



EP.M120 Nets and 3D Shape Reasoning

GL ASSESSMENT GL-11PLUS-MATHS · Calculators not allowed · about 55 minutes

Total Marks

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Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

1 Which of the following nets will fold to make a triangular prism?

- ☐ A) Two triangles separated by a gap, and three rectangles attached end-to-end in a row not touching the triangles
- ☐ B) Two equal triangles attached to opposite ends of a straight strip of three rectangles so each triangle meets one rectangle along a full side
- ☐ C) Two equal triangles joined along one edge with three rectangles attached around the other sides of the joined triangles
- ☐ D) One triangle and four rectangles arranged in a cross so that only one rectangle touches the triangle
- ☐ E) Three triangles in a row with three rectangles attached to the middle triangle only

(Total for Question 1 is 1 mark)

2 Which of these nets cannot fold to make a cube?

- ☐ A) A row of four squares with one square attached above the second square and one square attached below the second square
- ☐ B) A cross shape: one central square with four squares attached to each side and one added to one of those side squares
- ☐ C) Two separate groups of three squares not connected to each other
- ☐ D) A column of four squares with one square attached to the left of the second square and one square attached to the right of the second square
- ☐ E) A row of four squares with one square attached above the third square and one square attached below the third square

(Total for Question 2 is 1 mark)

3 A net shows six rectangles where opposite rectangles are different sizes (two small, two medium, two large). Which solid could this net make?

- ☐ A) Cube
- ☐ B) Cuboid (rectangular prism)
- ☐ C) Square-based pyramid
- ☐ D) Triangular prism
- ☐ E) Tetrahedron

(Total for Question 3 is 1 mark)

4 How many faces does a square-based pyramid have?

- ☐ A) 3
- ☐ B) 4
- ☐ C) 5
- ☐ D) 6
- ☐ E) 8

(Total for Question 4 is 1 mark)

5 How many edges does a triangular prism have?

- ☐ A) 6
- ☐ B) 7
- ☐ C) 8
- ☐ D) 9
- ☐ E) 10

(Total for Question 5 is 1 mark)

6 A regular tetrahedron (triangular pyramid with all equal faces) has how many vertices?

- ☐ A) 3
- ☐ B) 4
- ☐ C) 5
- ☐ D) 6
- ☐ E) 8

(Total for Question 6 is 1 mark)

7 Which net will fold to make a cube if the faces are labelled so that face 1 is opposite face 6?
(Descriptions only.)

- ☐ A) Six squares in a straight row labelled 1 to 6
- ☐ B) A cross with central square 3, squares 1 and 5 attached opposite sides and 2 attached above and 4 below central square, 6 attached to the right of square 5
- ☐ C) A 2x3 rectangle of squares labelled 1 to 6 left-to-right top row then bottom row
- ☐ D) A row of four squares labelled 2, 1, 4, 6 from left to right, with a square labelled 3 attached above the second square (labelled 1) and a square labelled 5 attached below the second square (labelled 1)
- ☐ E) Two L-shaped groups of three squares joined at one corner

(Total for Question 7 is 1 mark)

8 A net shows two equilateral triangles and three rectangles arranged so that the two triangles are attached to the opposite ends of the strip of three rectangles. It folds to make a solid.
Name the solid. Then give the number of faces, edges and vertices.

(Total for Question 8 is 3 marks)

9 Consider this net: six equal squares in a straight row labelled 1 to 6. Can this net fold to make a cube? Give your answer and a brief reason.

(Total for Question 9 is 2 marks)

10 A cuboid has dimensions 2 cm by 3 cm by 4 cm. Work out its total surface area in square centimetres.

(Total for Question 10 is 3 marks)

- 11** A triangular prism has 5 faces and 9 edges. Use Euler's formula $V - E + F = 2$ to find the number of vertices V .

(Total for Question 11 is 2 marks)

- 12** A polyhedron has 8 vertices and 12 edges. Use Euler's formula to work out how many faces it has.

(Total for Question 12 is 3 marks)

- 13** A cuboid measures 2 cm by 3 cm by 6 cm. Calculate its total surface area. Then state how many faces, edges and vertices the cuboid has.

(Total for Question 13 is 4 marks)

- 14** A polyhedron has 10 faces and 16 vertices. Use Euler's formula to find the number of edges.

(Total for Question 14 is 4 marks)

Mark scheme · EP.M120 Nets and 3D Shape Reasoning

Question 1

- **B1** correct option B cao
- **Answer: B) Two equal triangles attached to opposite ends of a straight strip of three rectangles so each triangle meets one rectangle along a full side (correct net for a triangular prism).**

Question 2

- **B1** correct option C cao
- **Answer: C) Two separate groups of three squares not connected to each other (cannot fold to form a single cube - a valid net must be six squares joined edge-to-edge in one connected piece; every other option is six squares that do fold to a cube).**

Question 3

- **B1** correct option B cao
- **Answer: B) Cuboid (rectangular prism).**

Question 4

- **B1** correct option C (5 faces) cao
- **Answer: C) 5 faces**

Question 5

- **B1** correct option D (9 edges) cao
- **Answer: D) 9 edges**

Question 6

- **B1** correct option B (4 vertices) cao
- **Answer: B) 4 vertices**

Question 7

- **B1** correct option D cao
- **Answer: D) Folding the row so square 1 is the base: square 6 (attached beyond square 4) becomes the top, directly opposite square 1. (Squares 2 and 4 become the other pair of opposite side faces, and squares 3 and 5 become the last pair.)**

Question 8

- **M1** Name given as 'triangular prism' oe
- **M1** Number of faces stated as 5 and number of edges stated as 9 (method or statement)
- **A1** Number of vertices stated correctly as 6 cao
- **Answer: Triangular prism; faces = 5, edges = 9, vertices = 6. (2 triangular faces and 3 rectangular faces.)**

Question 9

- **M1** Correct decision stated: 'No' (cannot fold to a cube) oe
- **A1** Reason given that three squares in a straight row would place faces opposite each other incorrectly so opposite faces would be adjacent or separated incorrectly cao
- **Answer: No. A straight row of six squares cannot fold to a cube because opposite faces on a cube would not be correctly positioned; the row forces faces that should be opposite to be adjacent when folded.**

Question 10

- **M1** Areas of opposite faces shown: 2×3 , 3×4 and 2×4 seen or equivalent method
- **M1** Sum inside brackets $6 + 12 + 8 = 26$ seen
- **A1** Total surface area $2 \times 26 = 52 \text{ cm}^2$ cao
- **Answer: 52 cm^2**

Question 11

- **M1** Euler's formula stated or used: $V - 9 + 5 = 2$ or equivalent
- **A1** $V = 6$ cao
- **Answer: 6 vertices.** ($V - 9 + 5 = 2$ so $V = 6$.)

Question 12

- **M1** Euler's formula used: $V - E + F = 2$ seen
- **M1** Substitution $8 - 12 + F = 2$ or equivalent seen
- **A1** $F = 6$ cao
- **Answer: 6 faces.** ($8 - 12 + F = 2$ so $F = 6$.)

Question 13

- **M1** Areas of opposite faces seen: 2×3 , 3×6 and 2×6 (6, 18, 12) or equivalent
- **M1** Sum inside brackets $6 + 18 + 12 = 36$ seen
- **A1** Total surface area $2 \times 36 = 72 \text{ cm}^2$ cao
- **B1** Faces = 6, edges = 12, vertices = 8 stated correctly
- **Answer: Total surface area = 72 cm^2 ; faces = 6; edges = 12; vertices = 8.**

Question 14

- **M1** Euler's formula used: $V - E + F = 2$
- **M1** Substitute $16 - E + 10 = 2$ seen
- **M1** Rearrangement to find E shown: $26 - E = 2$ or $E = 24$
- **A1** $E = 24$ cao
- **Answer: 24 edges.** ($16 - E + 10 = 2$ so $E = 24$.)