HIGHER

IG.M17 Geometric Transformations: Reflection, Rotation, Enlargement and Translation

Total Marks

EDEXCEL 4MA1 · Calculator allowed · about 45 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Draw the image of triangle ABC with A(1,1), B(4,1) and C(1,3) after reflection in the line y = x on the coordinate grid. Give the coordinates of A', B' and C'.

(Total for Question 1 is 3 marks)

2 Find the image of the point P(3, -2) after a rotation of 90 degrees anticlockwise about the origin, for the coordinate geometry context.

(Total for Question 2 is 3 marks)

3 Describe fully the single transformation which is equivalent to first rotating a shape 90 degrees anticlockwise about the origin and then reflecting in the y-axis. State the type of transformation and the precise line or centre and angle.

(Total for Question 3 is 3 marks)

4 Find the image of point A(3, 4) under an enlargement about the centre (1, 1) with scale factor -2.5 in the coordinate plane.

(Total for Question 4 is 3 marks)

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5 Draw the image of triangle DEF with D(-1,2), E(1,2) and F(-1,-1) after the translation by vector (4, -3). Give coordinates of D', E' and F'.

(Total for Question 5 is 3 marks)

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6 Describe fully the single transformation equivalent to first translating by the vector (5, -2) and then rotating 180 degrees about the point (2, 3). State the type, centre and angle.

(Total for Question 6 is 3 marks)

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7 Find the image of point Q(-2, 5) after reflection in the line x = 1, in the coordinate geometry setting.

(Total for Question 7 is 3 marks)

8 Describe fully the single transformation equivalent to first reflecting in the x-axis (y = 0) and then rotating 90 degrees clockwise about the origin. State the transformation type and the exact line or centre and angle.

(Total for Question 8 is 3 marks)

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9 Find the image of point R(2, 7) after an enlargement with centre (0, 0) and scale factor 1/2, as a fractional enlargement in the coordinate plane.

(Total for Question 9 is 3 marks)

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10 Draw the image of the triangle GHI with G(0,0), H(3,0), I(0,3) after a rotation of 270 degrees anticlockwise (which is equivalent to 90 degrees clockwise) about the origin. Give coordinates of G', H' and I'.

(Total for Question 10 is 3 marks)

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11 Find the image of point S(5, -1) after a combined transformation: first translate by (-3, 2) then reflect in the line y = -1. Give S' coordinates.

(Total for Question 11 is 3 marks)

12 Describe fully the single transformation equivalent to reflecting in the line y = x and then reflecting in the line y = -x. State type and exact lines or centre and angle if applicable.

(Total for Question 12 is 3 marks)

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13 Find the image of point T(-1/2, 4) under a rotation of 180 degrees about the point (2, 1). Give exact coordinates.

(Total for Question 13 is 3 marks)

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14 A quadrilateral has vertices U(2,1), V(5,1), W(5,4) and X(2,4). Find the image of this quadrilateral after an enlargement with centre (2,1) and scale factor 2. Give coordinates of U', V', W' and X'.

(Total for Question 14 is 3 marks)

Mark scheme · IG.M17 Geometric Transformations: Reflection, Rotation, Enlargement and Translation

Question 1

- **M1** Uses reflection rule for y = x, e.g. swaps coordinates or shows method applied to at least one vertex
- **A1** A' = (1, 1) cao
- **A1** B' = (1, 4) and C' = (3, 1) both correct, cao
- **Answer: A' (1,1), B' (1,4), C' (3,1)**

Question 2

- **M1** Applies the 90 degrees anticlockwise rule (x, y) -> (-y, x) correctly
- **A1** Gives image (2, 3) cao
- **B1** States final answer as P' = (2, 3) with coordinates correct
- **Answer: P' = (2, 3)**

Question 3

- **M1** Shows composite mapping algebraically, e.g. (x, y) -> (-y, x) after rotation then -> (y, x) after reflection in y-axis
- **A1** Identifies the single transformation type, reflection, cao
- **A1** Gives the exact line: reflection in the line y = x cao
- **Answer: Reflection in the line y = x**

Question 4

- **M1** Subtracts centre: shows vector from centre to A as (2, 3) or equivalent
- **M1** Multiplies vector by -2.5 to get (-5, -7.5) and adds back to centre, oe
- **A1** A' = (-4, -6.5) cao
- **Answer: A' = (-4, -6.5)**

Question 5

- **M1** Adds the translation vector (4, -3) correctly to at least one vertex
- **A1** D' = (3, -1) cao
- **A1** E' = (5, -1) and F' = (3, -4) both correct, cao
- **Answer: D' (3,-1), E' (5,-1), F' (3,-4)**

Question 6

- **M1** Forms composite mapping: (x,y) -> translate to (x+5, y-2) then 180 rotation gives (4 - (x+5), 6 - (y-2)) simplified to (-1 - x, 8 - y) or equivalent
- **M1** Matches composite form to 180 rotation formula (x,y) -> (2a - x, 2b - y) and solves for a and b
- **A1** States single transformation is rotation 180 degrees about centre (-1/2, 4) cao
- **Answer: Rotation through 180 degrees about the point (-1/2, 4)**

Question 7

- **M1** Uses rule for reflection in vertical line x = 1, i.e. distance to the line preserved horizontally
- **A1** Computes image x-coordinate: reflect -2 across x=1 gives x' = 4 cao
- **A1** States Q' = (4, 5) cao
- **Answer: Q' = (4, 5)**

Question 8

- **M1** Shows composite mapping: reflect (x,y)->(x,-y) then rotate 90 clockwise (u,v)->(v,-u) giving (x,y)->(-y,-x) or equivalent
- **A1** Identifies transformation as a reflection cao
- **A1** Gives exact line y = -x cao
- **Answer: Reflection in the line y = -x**

Question 9

- **M1** Multiplies coordinates by scale factor 1/2 from centre (0,0) correctly
- **A1** Gives x' = 1 cao
- **A1** Gives R' = (1, 3.5) cao
- **Answer: R' = (1, 3.5)**

Question 10

- **M1** Uses correct rotation rule for 270 anticlockwise, (x,y)->(y,-x), or equivalent
- **A1** G' = (0,0) cao
- **A1** H' = (0,-3) and I' = (3,0) both correct, cao
- **Answer: G' (0,0), H' (0,-3), I' (3,0)**

Question 11

- **M1** Performs the translation: (5, -1) + (-3, 2) = (2, 1)
- **M1** Applies reflection in horizontal line y = -1 correctly, using vertical distance
- **A1** Final S' = (2, -3) cao
- **Answer: S' = (2, -3)**

Question 12

- **M1** Shows composite mapping or recognises that two reflections in intersecting perpendicular lines equals a rotation through twice the angle between the lines, e.g. gives algebraic mapping (x,y) -> (-x,-y) or describes method
- **A1** Identifies the single transformation as a rotation cao
- **A1** Gives exact rotation: rotation through 180 degrees about the origin cao
- **Answer: Rotation through 180 degrees about the origin**

Question 13

- **M1** Uses 180 rotation rule about (2,1): (x,y) -> (4 - x, 2 - y) or shows method of reversing vector from centre
- **M1** Substitutes T coordinates correctly to get (4 - (-1/2), 2 - 4) = (4.5, -2)
- **A1** States T' = (9/2, -2) cao
- **Answer: T' = (9/2, -2)**

Question 14

- **M1** Uses enlargement from centre (2,1): vector from centre to a vertex doubled, at least applied correctly to one vertex
- **M1** Applies the same method to find remaining vertices consistently
- **A1** Gives U'(2,1), V'(8,1), W'(8,7) and X'(2,7) all correct, cao
- **Answer: U' (2,1), V' (8,1), W' (8,7), X' (2,7)**