4.2 Matrices and Geometric Transformations: 1-hour Pack

Total Marks

AQA 8365 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 N = [[5, 2], [-3, 4]].

(a) Write down the 2 x 2 identity matrix, I. **(1)**

.....

(b) Calculate NI and IN, and comment on your results. **(3)**

.....

(Total for Question 1 is 4 marks)

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2 U = [[0, 1], [1, 0]] represents a reflection in the line y = x. S = [[1, 0], [0, -1]] represents a reflection in the x-axis (as before).

(a) Find the matrix representing a reflection in the line y = x followed by a reflection in the x-axis. **(2)**

.....

(b) Find the matrix representing a reflection in the x-axis followed by a reflection in the line y = x. **(2)**

.....

(c) Describe fully the single transformation represented by each of your answers to parts (a) and (b), and state what this shows about combining transformations. **(2)**

.....

.....

(Total for Question 2 is 6 marks)

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3 A transformation maps (1, 0) to (-1, -3) and (0, 1) to (3, 3). Write down the matrix of the transformation and find the image of the point (-5, 4).

(Total for Question 3 is 4 marks)

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4 Write down the matrix that represents a reflection in the line y = -x.

(Total for Question 4 is 2 marks)

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5 The matrix [[-1, -2], [-2, -3]] maps the point A to the point (0, -1). Find the coordinates of A.

(Total for Question 5 is 3 marks)

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6 The matrix [[5, 1], [0, -3]] maps triangle T, of area 15 square units, onto triangle T'. Work out the area of T'.

(Total for Question 6 is 4 marks)

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7 The matrix [[-1, 0], [0, -1]] represents a single transformation. Describe the transformation fully.

(Total for Question 7 is 2 marks)

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8 Transformation S is an enlargement with scale factor -3 and centre the origin. Transformation T is a reflection in the line y = x. Find the single matrix that represents S followed by T.

(Total for Question 8 is 3 marks)

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9 A transformation maps (1, 0) to (0, -2) and (0, 1) to (-1, 4). Write down the matrix of the transformation and find the image of the point (-4, 5).

(Total for Question 9 is 4 marks)

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10 Write down the matrix that represents an enlargement with scale factor 4 and centre the origin.

(Total for Question 10 is 2 marks)

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11 The matrix [[-2, -2], [3, -1]] maps the points P(3, 5) and Q(5, -1) to P' and Q'. Find the coordinates of P' and Q'.

(Total for Question 11 is 3 marks)

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12 The matrix [[2, 5], [5, 2]] maps triangle T, of area 5 square units, onto triangle T'. Work out the area of T'.

(Total for Question 12 is 4 marks)

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13 The matrix [[-3, 0], [0, -3]] represents a single transformation. Describe the transformation fully.

.....

.....

(Total for Question 13 is 2 marks)

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14 A transformation maps (1, 0) to (-4, 3) and (0, 1) to (5, 5). Write down the matrix of the transformation and find the image of the point (5, 5).

(Total for Question 14 is 4 marks)

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15 A transformation is represented by matrix T = [[a, b], [c, d]]. Under this transformation, (1, 0) maps to (2, 5) and (0, 1) maps to (-3, 4).

(a) Find the matrix T. **(3)**

.....

(b) Use your matrix to find the image of the point (-1, 3). **(3)**

.....

(Total for Question 15 is 6 marks)

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Mark scheme · 4.2 Matrices and Geometric Transformations: 1-hour Pack

Question 1

(a) [[1, 0], [0, 1]] cao **B1**

(a) Answer: [[1, 0], [0, 1]]

(b) finds NI or IN correctly **M1**

(b) both equal [[5, 2], [-3, 4]] **A1**

(b) comment: multiplying any matrix by I, in either order, leaves it unchanged, so I is the multiplicative identity oe **B1**

(b) Answer: NI = IN = [[5, 2], [-3, 4]] = N

Question 2

(a) forms S x U with a correct multiplication attempt **M1**

(a) [[0, 1], [-1, 0]] cao **A1**

(a) Answer: [[0, 1], [-1, 0]]

(b) forms U x S with a correct multiplication attempt **M1**

(b) [[0, -1], [1, 0]] cao **A1**

(b) Answer: [[0, -1], [1, 0]]

(c) (a) is a rotation of 90 degrees clockwise about the origin, (b) is a rotation of 90 degrees anticlockwise about the origin **B1**

(c) the two matrices are different, so combining transformations is not commutative (the order matters) oe **B1**

(c) Answer: (a) rotation of 90 degrees clockwise about the origin; (b) rotation of 90 degrees anticlockwise about the origin; the order of combining transformations matters

Question 3

columns are the images of (1, 0) and (0, 1) **B1**

[[-1, 3], [-3, 3]] **B1**

multiplies matrix by position vector **M1**

(17, 27) **A1**

Answer: [[-1, 3], [-3, 3]], image (17, 27)

Question 4

first column shows the image of (1, 0) **B1**

[[0, -1], [-1, 0]] cao **B1**

Answer: [[0, -1], [-1, 0]]

Question 5

finds the inverse matrix or sets up simultaneous equations **M1**

det = -1 or one equation correct **A1**

(2, -1) cao **A1**

Answer: (2, -1)

Question 6

uses the determinant as the area scale factor **M1**

determinant = -15 **A1**

|-15| x 15 **M1**

225 square units cao **A1**

Answer: 225 square units

Question 7

uses the images of (1, 0) and (0, 1) from the columns **M1**

rotation of 180 degrees about the origin cao **A1**

Answer: rotation of 180 degrees about the origin

Question 8

matrix of S = [[-3, 0], [0, -3]] and matrix of T = [[0, 1], [1, 0]] **B1**

multiplies in the correct order: TS, not ST **M1**

[[0, -3], [-3, 0]] cao **A1**

Answer: [[0, -3], [-3, 0]]

Question 9

columns are the images of (1, 0) and (0, 1) **B1**

[[0, -1], [-2, 4]] **B1**

multiplies matrix by position vector **M1**

(-5, 28) **A1**

Answer: [[0, -1], [-2, 4]], image (-5, 28)

Question 10

first column shows the image of (1, 0) **B1**

[[4, 0], [0, 4]] cao **B1**

Answer: [[4, 0], [0, 4]]

Question 11

multiplies the matrix by a position vector **M1**

P' correct **A1**

Q' correct **A1**

Answer: P' = (-16, 4), Q' = (-8, 16)

Question 12

uses the determinant as the area scale factor **M1**

determinant = -21 **A1**

|-21| x 5 **M1**

105 square units cao **A1**

Answer: 105 square units

Question 13

uses the images of (1, 0) and (0, 1) from the columns **M1**

enlargement with scale factor -3 and centre the origin cao **A1**

Answer: enlargement with scale factor -3 and centre the origin

Question 14

columns are the images of (1, 0) and (0, 1) **B1**

[[-4, 5], [3, 5]] **B1**

multiplies matrix by position vector **M1**

(5, 40) **A1**

Answer: [[-4, 5], [3, 5]], image (5, 40)

Question 15

(a) recognises that the first column of T is the image of (1, 0) **M1**

(a) recognises that the second column of T is the image of (0, 1) **M1**

(a) T = [[2, -3], [5, 4]] cao **A1**

(a) Answer: T = [[2, -3], [5, 4]]

(b) sets up T x [[-1], [3]] **M1**

(b) correct multiplication **M1**

(b) (-11, 7) cao **A1**

(b) Answer: (-11, 7)

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