4.2 Matrices and Geometric Transformations: 30-minute Pack

Total Marks

AQA 8365 · Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A = [[1, 2], [0, -1]] and B = [[3, 1], [2, 4]].

(a) Calculate AB. **(3)**

.....

(b) Calculate BA. **(3)**

.....

(c) State, giving a reason, whether matrix multiplication is commutative. **(1)**

(Total for Question 1 is 7 marks)

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2 A matrix of the form [[k, 0], [0, k]] represents an enlargement, centre the origin, scale factor k.

(a) Write down the matrix that represents an enlargement, centre the origin, scale factor 4. **(1)**

.....

(b) Under the transformation represented by [[k, 0], [0, k]], the point (2, 3) maps to (-6, -9). Find the value of k. **(2)**

.....

(c) Describe fully the single transformation represented by the matrix in part (b). **(2)**

.....

.....

(Total for Question 2 is 5 marks)

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3 A transformation is represented by matrix M = [[3, -2], [2, -2]].

(a) Show that the origin is an invariant point under this transformation. **(1)**

(b) Find M - I, where I is the 2 x 2 identity matrix. **(1)**

.....

(c) By finding the determinant of M - I, determine whether the transformation has any invariant points other than the origin. **(3)**

(Total for Question 3 is 5 marks)

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

(Total for Question 4 is 4 marks)

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

(Total for Question 5 is 2 marks)

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6 Transformation S is an enlargement with scale factor 2 and centre the origin. Transformation T is a rotation of 90 degrees clockwise about the origin. Find the single matrix that represents S followed by T.

(Total for Question 6 is 3 marks)

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Mark scheme · 4.2 Matrices and Geometric Transformations: 30-minute Pack

Question 1

(a) attempts row by column method, at least one correct entry	**M1**
(a) two correct entries	**A1**
(a) [[7, 9], [-2, -4]] cao	**A1**
(a) Answer: [[7, 9], [-2, -4]]	
(b) attempts row by column method, at least one correct entry	**M1**
(b) two correct entries	**A1**
(b) [[3, 5], [2, 0]] cao	**A1**
(b) Answer: [[3, 5], [2, 0]]	
(c) AB is not equal to BA (compare answers to (a) and (b)), so matrix multiplication is not commutative	**B1**
(c) Answer: Not commutative, since AB is not equal to BA	

Question 2

(a) [[4, 0], [0, 4]] cao	**B1**
(a) Answer: [[4, 0], [0, 4]]	
(b) sets up 2k = -6 or 3k = -9	**M1**
(b) k = -3 cao	**A1**
(b) Answer: k = -3	
(c) enlargement	**B1**
(c) centre the origin, scale factor -3	**B1**
(c) Answer: Enlargement, centre (0, 0), scale factor -3	

Question 3

(a) shows M x [[0], [0]] = [[0], [0]] (answer printed)	**B1**
(a) Answer: M x [[0], [0]] = [[0], [0]] (shown)	
(b) [[2, -2], [2, -3]] cao	**B1**
(b) Answer: [[2, -2], [2, -3]]	
(c) 2(-3) - (-2)(2)	**M1**
(c) -2 cao	**A1**
(c) dependent: since det(M - I) is not 0, the origin is the only invariant point oe	**B1**
(c) Answer: det(M - I) = -2, so the origin is the only invariant point	

Question 4

uses the determinant as the area scale factor	**M1**
determinant = -18	**A1**
|-18| x 15	**M1**
270 square units cao	**A1**
Answer: 270 square units	

Question 5

uses the images of (1, 0) and (0, 1) from the columns	**M1**
reflection in the y-axis cao	**A1**
Answer: reflection in the y-axis	

Question 6

matrix of S = [[2, 0], [0, 2]] and matrix of T = [[0, 1], [-1, 0]]	**B1**
multiplies in the correct order: TS, not ST	**M1**
[[0, 2], [-2, 0]] cao	**A1**
Answer: [[0, 2], [-2, 0]]	

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