HIGHER

2.3 Matrices and Matrix Transformations: 30-minute Pack

Total Marks

EDEXCEL 4MA1 · Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Allow 30 minutes.

1 A gardener uses a 2x1 column matrix to record a plant position. Calculate 4 times the column matrix v = [[2], [-1]] to scale coordinates for an enlargement.

(Total for Question 1 is 2 marks)

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2 The matrix P represents: rotation of 90 degrees anticlockwise about the origin.
The matrix Q represents: reflection in the y-axis.
P = [[0, -1], [1, 0]] and Q = [[-1, 0], [0, 1]].
Work out the single matrix that represents the transformation P followed by the transformation Q.

(Total for Question 2 is 3 marks)

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3 Write down the matrix that represents: reflection in the x-axis.

(Total for Question 3 is 2 marks)

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4 The matrix M = [[2x, 1], [4, 4]] has determinant 28.
Find the value of x.

(Total for Question 4 is 3 marks)

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5 A transformation is represented by a 2 x 2 matrix M. It maps the point (1, 0) to (0, -5) and the point (0, 1) to (2, -3).
Write down M.

(Total for Question 5 is 2 marks)

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6 A = [[-4, -2], [-1, -4]] and B = [[3, 3], [-2, -1]]
Work out AB.

(Total for Question 6 is 3 marks)

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7 Find the inverse of the non-singular 2x2 matrix N = [[4, 1], [3, 2]] to reverse a linear transformation used on coordinates.

(Total for Question 7 is 3 marks)

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8 Describe fully the single transformation that maps point A with position vector a = [[1], [0]] to A' with position vector [[0], [2]], and maps B with position vector b = [[0], [1]] to B' with position vector [[-2], [0]]. Use standard transformation language (rotation, reflection, enlargement, translation) and state centre or angle as needed.

(Total for Question 8 is 5 marks)

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Mark scheme · 2.3 Matrices and Matrix Transformations: 30-minute Pack

Question 1

multiplies both entries by 4	**M1**
4v = [[8], [-4]] cao	**A1**

Answer: [[8], [-4]]

Question 2

recognises the matrix for P followed by Q is QP (not PQ)	**M1**
multiplies Q by P correctly (at least two entries correct)	**M1**
[[0, 1], [1, 0]]	**A1**

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

Question 3

uses the images of (1, 0) and (0, 1) as the columns of the matrix	**M1**
[[1, 0], [0, -1]]	**A1**

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

Question 4

det M = 2x x 4 - 1 x 4	**M1**
sets 8x - 4 = 28	**M1**
x = 4	**A1**

Answer: x = 4

Question 5

the images of (1, 0) and (0, 1) are the first and second columns of M	**M1**
M = [[0, 2], [-5, -3]]	**A1**

Answer: [[0, 2], [-5, -3]]

Question 6

multiplies rows of the first matrix by columns of the second (at least two entries attempted)	**M1**
at least two entries correct	**A1**
[[-8, -10], [5, 1]]	**A1**

Answer: [[-8, -10], [5, 1]]

Question 7

calculates determinant correctly as 5	**M1**
forms adjugate matrix by swapping diagonal entries and negating off-diagonal entries	**M1**
N^{-1} = (1/5)[[2, -1], [-3, 4]] cao	**A1**

Answer: (1/5)[[2, -1], [-3, 4]]

Question 8

identifies mapping of basis vectors implies linear map corresponding to matrix [[0, -2], [2, 0]] or recognises rotation and scale	**M1**
shows that a maps to (0,2) and b maps to (-2,0) consistent with a 90 degree rotation combined with scale factor 2	**M1**
states the centre is the origin and gives angle and scale factor, e.g. rotation by 90 degrees anticlockwise and enlargement by factor 2 about the origin	**M1**
explains that this is equivalent to multiplying by matrix [[0, -2], [2, 0]] or alternatively enlargement by 2 then rotation by 90 degrees	**M1**
full correct description, e.g. 'enlargement by factor 2 with centre at the origin combined with a rotation of 90 degrees anticlockwise about the origin' or equivalent wording	**A1**

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