1.2 Matrices: 30-minute Pack

EDEXCEL 9FM0 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 R is the matrix representing a reflection in the line y = x. S is the matrix representing a rotation of 90 degrees anticlockwise about the origin O.

(a) Write down the matrix R. **(1)**

(b) Write down the matrix S. **(1)**

(c) Find the matrix RS, representing rotation by S followed by reflection by R. **(3)**

(d) Describe fully the single geometrical transformation represented by RS, and find the image of the point (3,-2) under this transformation. **(2)**

(Total for Question 1 is 7 marks)

2 The matrix A is given by A = ((3, -2, -2), (k, 0, 3), (1, 0, 3)), written row by row, where k is a constant.

(a) Show that det A = 6k - 6. **(3)**

(b) Find the value of k for which A is singular. **(2)**

(c) State the value of det A when k = 2, and hence state whether A is invertible when k = 2. **(2)**

(Total for Question 2 is 7 marks)

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3 The matrix A is given by A = ((2, -1, 2), (2, 4, -2), (-2, k, 2)), written row by row, where k is a constant.

(a) Show that det A = 8k + 32. **(3)**

(b) Find the value of k for which A is singular. **(2)**

(c) State the value of det A when k = 3, and hence state whether A is invertible when k = 3. **(2)**

(Total for Question 3 is 7 marks)

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4 The transformation T_1 is an anticlockwise rotation through 180 degrees about the origin. The transformation T_2 is a reflection in the x axis.

(a) Write down the 2 x 2 matrices M_1 and M_2 representing T_1 and T_2. **(2)**

(b) Find the matrix representing the transformation T_1 followed by T_2. **(2)**

(c) Find the image of the point (2, 1) under T_1 followed by T_2. **(2)**

(d) A triangle of area 6 is transformed by T_1 followed by T_2. Find the area of its image. **(2)**

(Total for Question 4 is 8 marks)

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Mark scheme · 1.2 Matrices: 30-minute Pack

Question 1

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

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

(b) S = [[0,-1],[1,0]] cao **B1**

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

(c) attempt at product RS with at least one correct entry, ft their R, S **M1**

(c) two correct entries **A1**

(c) RS = [[1,0],[0,-1]] cao **A1**

(c) Answer: RS = [[1,0],[0,-1]]

(d) reflection in the x-axis (ft their RS if of the form [[1,0], [0,-1]]) **B1**

(d) image (3,2) cao **B1**

(d) Answer: RS represents a reflection in the x-axis; image of (3,-2) is (3,2).

Question 2

(a) expands the determinant along a row or column **M1**

(a) evaluates the 2 x 2 minors correctly **A1**

(a) det A = 6k - 6 (cso) **A1**

(a) Answer: det A = 6k - 6

(b) sets det A = 0 **M1**

(b) k = 1 **A1**

(b) Answer: k = 1

(c) det A = 6 **B1**

(c) invertible **B1**

(c) Answer: 6; invertible

Question 3

(a) expands the determinant along a row or column **M1**

(a) evaluates the 2 x 2 minors correctly **A1**

(a) det A = 8k + 32 (cso) **A1**

(a) Answer: det A = 8k + 32

(b) sets det A = 0 **M1**

(b) k = -4 **A1**

(b) Answer: k = -4

(c) det A = 56 **B1**

(c) invertible **B1**

(c) Answer: 56; invertible

Question 4

(a) M_1 = ((-1, 0), (0, -1)) **B1**

(a) M_2 = ((1, 0), (0, -1)) **B1**

(a) Answer: M_1 = ((-1, 0), (0, -1)), M_2 = ((1, 0), (0, -1))

(b) multiplies in the correct order: M_2 M_1 **M1**

(b) ((-1, 0), (0, 1)) **A1**

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

(c) multiplies the combined matrix by the position vector **M1**

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

(c) Answer: (-2, 1)

(d) area scale factor = |det of the combined matrix| **M1**

(d) |-1| x 6 = 6 **A1**

(d) Answer: 6

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