1.13 Core Pure: Matrices and Transformations Depth: 30-minute Pack

Total Marks

EDEXCEL 9FM0 · Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 The matrices A and B are given by A = ((-2, -1), (4, -3)) and B = ((-3, 3), (0, -3)), where each matrix is written row by row.

(a) Find AB. **(2)**

(b) Find det A and, given that A is non-singular, find A^{-1}. **(4)**

(c) Use A^{-1} to solve the equations -2x - y = -9 and 4x - 3y = 3. **(3)**

(Total for Question 1 is 9 marks)

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2 The transformation T_1 is a reflection in the x axis. The transformation T_2 is a reflection in the line y = x.

(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 (5, 4) 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 2 is 8 marks)

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3 The matrix A is given by A = ((k, 2, 1), (4, -2, 0), (1, 4, 4)), written row by row, where k is a constant.

(a) Show that det A = -8k - 14. **(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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Mark scheme · 1.13 Core Pure: Matrices and Transformations Depth: 30-minute Pack

Question 1

(a) multiplies rows of A by columns of B	**M1**
(a) ((6, -3), (-12, 21))	**A1**
(a) Answer: ((6, -3), (-12, 21))	
(b) det A = ad - bc	**M1**
(b) det A = 10	**A1**
(b) uses the inverse formula (1/det)((d, -b), (-c, a))	**M1**
(b) A^{-1} = ((-3/10, 1/10), (-2/5, -1/5))	**A1**
(b) Answer: det A = 10, A^{-1} = ((-3/10, 1/10), (-2/5, -1/5))	
(c) writes as a matrix equation A(x, y) = (b1, b2) and multiplies by A^{-1}	**M1**
(c) x = 3	**A1**
(c) y = 3	**A1**
(c) Answer: x = 3, y = 3	

Question 2

(a) M_1 = ((1, 0), (0, -1))	**B1**
(a) M_2 = ((0, 1), (1, 0))	**B1**
(a) Answer: M_1 = ((1, 0), (0, -1)), M_2 = ((0, 1), (1, 0))	
(b) multiplies in the correct order: M_2 M_1	**M1**
(b) ((0, -1), (1, 0))	**A1**
(b) Answer: ((0, -1), (1, 0))	
(c) multiplies the combined matrix by the position vector	**M1**
(c) (-4, 5)	**A1**
(c) Answer: (-4, 5)	
(d) area scale factor = |det of the combined matrix|	**M1**
(d) |1| x 6 = 6	**A1**
(d) Answer: 6	

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 - 14 (cso)	**A1**
(a) Answer: det A = -8k - 14	
(b) sets det A = 0	**M1**
(b) k = -7/4	**A1**
(b) Answer: k = -7/4	
(c) det A = 10	**B1**
(c) invertible	**B1**
(c) Answer: 10; invertible	

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