HIGHER

2.8 Matrices: Solving Simultaneous Equations With the Inverse Matrix: 30-minute Pack

EDEXCEL 4MA1 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Solve the simultaneous equations

$-2y = 8$

$-3x + 5y = -35$

by writing them as a matrix equation and using the inverse of a matrix. You must show your working.

(Total for Question 1 is 5 marks)

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2 $M = [[-1, 1], [-3, 2]]$

Find M^{-1}, the inverse of M.

(Total for Question 2 is 3 marks)

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3 The simultaneous equations $4x + 6y = 5$ and $kx + 4y = 7$ do not have a unique solution.

Find the value of k.

(Total for Question 3 is 3 marks)

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4 Solve the simultaneous equations

$-3x + 4y = 15$

$-2x + 6y = 10$

by writing them as a matrix equation and using the inverse of a matrix. You must show your working.

(Total for Question 4 is 5 marks)

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5 $M = [[x, 4], [36, x]]$

Find the values of x for which M has no inverse.

(Total for Question 5 is 4 marks)

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6 Write down the condition on det(M) for a 2x2 matrix M to be invertible, and state why this is needed when solving $M x = c$.

(Total for Question 6 is 3 marks)

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Mark scheme · 2.8 Matrices: Solving Simultaneous Equations With the Inverse Matrix: 30-minute Pack

Question 1

writes [[0, -2], [-3, 5]] [x; y] = [8; -35]	**M1**
finds the inverse (1/6)[[-5, -2], [-3, 0]]	**M1**
pre-multiplies both sides by the inverse (inverse first, then the column vector)	**M1**
x = 5	**A1**
y = -4	**A1**

Answer: x = 5, y = -4

Question 2

determinant = (-1)(2) - (1)(-3) = 1	**M1**
swaps the leading diagonal and changes the signs of the other two entries	**M1**
M^{-1} = [[2, -1], [3, -1]]	**A1**

Answer: [[2, -1], [3, -1]]

Question 3

writes the coefficient matrix [[4, 6], [k, 4]]	**M1**
determinant = 16 - 6k = 0	**M1**
k = 8/3	**A1**

Answer: k = 8/3

Question 4

writes [[-3, 4], [-2, 6]] [x; y] = [15; 10]	**M1**
finds the inverse (1/10)[[-6, 4], [-2, 3]]	**M1**
pre-multiplies both sides by the inverse (inverse first, then the column vector)	**M1**
x = -5	**A1**
y = 0	**A1**

Answer: x = -5, y = 0

Question 5

M has no inverse when its determinant is 0	**M1**
x^2 - 144 = 0	**M1**
x^2 = 144, so takes both square roots	**M1**
x = 12 or x = -12	**A1**

Answer: x = 12 or x = -12

Question 6

det(M) not equal to 0 stated	**B1**
reason: inverse matrix M^{-1} exists only when det(M) not equal to 0	**B1**
reason: without M^{-1} you cannot form x = M^{-1} c to find a unique solution, oe	**B1**

Answer: det(M) must not equal 0, because only then does M^{-1} exist and x = M^{-1} c gives the unique solution.

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