

Matrices

Question Paper 4

Level	IGCSE
Subject	Maths (0580)
Exam Board	Cambridge International Examinations (CIE)
Paper Type	Extended
Topic	Matrices and Transformations
Sub-Topic	Matrices
Booklet	Question Paper 4

Time Allowed: 59 minutes

Score: /49

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	75%	60%	45%	35%	25%	<25%

1 (a)

$$\mathbf{A} = \begin{pmatrix} 2 & 3 \\ 4 & 5 \end{pmatrix}$$

$$\mathbf{B} = \begin{pmatrix} 2 \\ 7 \end{pmatrix}$$

$$\mathbf{C} = (1 \ 2)$$

Find the following matrices.

(i) **AB**

Answer(a)(i) [2]

(ii) **CB**

Answer(a)(ii) [2]

(iii) **A⁻¹**, the inverse of **A**

Answer(a)(iii) [2]

(b) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$.

Answer(b) [2]

(c) Find the 2 by 2 matrix that represents an anticlockwise rotation of 90° about the origin.

Answer(c) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

2 (a) **A** is a (2×4) matrix, **B** is a (3×2) matrix and **C** is a (1×3) matrix.

Which two of the following matrix products is it possible to work out?

A² **B**² **C**² **AB**

Answer(a) and [2]

(b) Find the inverse of $\begin{pmatrix} \frac{1}{2} & \frac{3}{4} \\ \frac{1}{8} & \frac{1}{4} \end{pmatrix}$.

Simplify your answer as far as possible.

Answer(b) $\begin{pmatrix} & \\ & \end{pmatrix}$ [3]

(c) Explain why the matrix $\begin{pmatrix} 4 & 2 \\ 6 & 3 \end{pmatrix}$ does not have an inverse.

Answer(c) [1]

3

$$\mathbf{M} = \begin{pmatrix} 6 & -3 \\ 4 & 5 \end{pmatrix} \begin{pmatrix} x \\ 1 \end{pmatrix}.$$

(a) Find the matrix \mathbf{M} .

Answer(a) $\mathbf{M} =$ [2]

(b) Simplify $(x \ 1) \mathbf{M}$.

Answer(b) [2]

4 $\mathbf{A} = \begin{pmatrix} 1 & 4 \end{pmatrix}$ $\mathbf{B} = \begin{pmatrix} 3 & -1 \\ -2 & 2 \end{pmatrix}$

Find

(a) \mathbf{AB} ,

Answer(a) $\mathbf{AB} =$ [2]

(b) the inverse matrix \mathbf{B}^{-1} ,

Answer(b) $\mathbf{B}^{-1} =$ [2]

(c) \mathbf{BB}^{-1} .

Answer(c) $\mathbf{BB}^{-1} =$ [1]

5

$$\mathbf{A} = \begin{pmatrix} 0 & \\ -8 & -4 \end{pmatrix} \quad \mathbf{B} = \begin{pmatrix} 7 & 1 \\ 0 & -5 \end{pmatrix}$$

Calculate the value of $5|\mathbf{A}| + |\mathbf{B}|$, where $|\mathbf{A}|$ and $|\mathbf{B}|$ are the determinants of \mathbf{A} and \mathbf{B} .

Answer [2]

6

$$\mathbf{A} = \begin{pmatrix} -2 & 3 \\ -4 & 5 \end{pmatrix}$$

Find \mathbf{A}^{-1} , the inverse of the matrix \mathbf{A} .

Answer $\left(\begin{array}{cc} & \\ & \end{array} \right)$ [2]

7

$$\mathbf{A} = \begin{pmatrix} x & 6 \\ 4 & 3 \end{pmatrix}$$

$$\mathbf{B} = \begin{pmatrix} 2 & 3 \\ 2 & 1 \end{pmatrix}$$

(a) Find \mathbf{AB} .

Answer(a) $\left(\begin{array}{cc} & \end{array} \right)$ [2]

(b) When $\mathbf{AB} = \mathbf{BA}$, find the value of x .

Answer(b) $x = \dots\dots\dots$ [3]

8

$$\begin{pmatrix} 1 & -2 \\ 0 & 1 \\ 5 & 6 \end{pmatrix} \begin{pmatrix} 3 & 4 & 8 \\ 1 & 3 & 3 \end{pmatrix}$$

The answer to this matrix multiplication is of order $a \times b$.

Find the values of a and b .

Answer $a =$ $b =$ [2]

9 Work out

$$\begin{pmatrix} 2 & 1 & 2 \\ 1 & 5 & 0 \\ 3 & -2 & 4 \end{pmatrix} \begin{pmatrix} 4 \\ -3 \\ -8 \end{pmatrix}.$$

Answer [3]

10

$$\mathbf{A} = \begin{pmatrix} 1 & 2 \\ 1 & 1 \end{pmatrix}$$

$$\mathbf{I} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$$

- (a) The matrix $\mathbf{B} = \mathbf{A}^2 - 2\mathbf{A} - \mathbf{I}$.
Calculate \mathbf{B} .
Show all your working.

Answer(a) $\mathbf{B} = \begin{pmatrix} & \\ & \end{pmatrix}$ [4]

- (b) Simplify $\mathbf{A}\mathbf{A}^{-1}$.

Answer(b) [1]

11 $\mathbf{M} = \begin{pmatrix} 1 & 1 \\ 1 & 2 \end{pmatrix}$

$$\mathbf{M}^2 = \begin{pmatrix} 2 & 3 \\ 3 & 5 \end{pmatrix}$$

$$\mathbf{M}^3 = \begin{pmatrix} 5 & 8 \\ 8 & 13 \end{pmatrix}$$

Find \mathbf{M}^4 .

Answer $\mathbf{M}^4 = \begin{pmatrix} & \\ & \end{pmatrix}$ [2]

12 $\mathbf{A} = \begin{pmatrix} x & 8 \\ 2 & x \end{pmatrix}$.

(a) Find $|\mathbf{A}|$, the determinant of \mathbf{A} , in terms of x .

Answer(a) [1]

(b) Find the values of x when $|\mathbf{A}| = 9$.

Answer(b) $x =$ or $x =$ [2]