TRINITY COLLEGE

Year 11 Specialist Mathematics Units 1,2
Test 5 2021

Section 1 Calculator Free

Matrices

STUDENT'S NAME _____

DATE: Monday 30 August **TIME:** 25 minutes **MARKS**: 24

INSTRUCTIONS:

Standard Items: Pens, pencils, drawing templates, eraser

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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1. (7 marks)

Consider the matrices below.

$$A=\begin{bmatrix}1 & -5\\ -1 & 3\end{bmatrix} \quad B=\begin{bmatrix}4 & 0 & -2\\ 0 & 1 & 6\end{bmatrix} \quad C=\begin{bmatrix}7 & -9\\ 0 & 5\\ 4 & -1\end{bmatrix} \quad D=\begin{bmatrix}6 & -4 & 0\\ 2 & 11 & -3\end{bmatrix}$$

(a) Determine $3D-2B$. [2]

(b) Matrices ABC can be multiplied, in that order to form another matrix. Give two other possible orders of multiplying matrices A, B and C that will form another matrix. [2]

(c) Matrix W is such that $AW-B=D$. Determine matrix W. [3]

2. (5 marks)

Consider the matrices below.

$$A = \begin{bmatrix} k & 5 \\ k-1 & 7 \end{bmatrix} \qquad B = \begin{bmatrix} 7 & -5 \\ 1-k & k \end{bmatrix}$$

(a) Determine the value/s of k if A^{-1} is singular. [2]

(b) Determine the value/s of k if matrices A and B are the inverse of each other. [3]

3. (7 marks)

Let A be a non-singular square matrix such that $4A^2 + 6A = I$ where I is the identity matrix .

(a) Prove that $2A^3 - 5A + 0.75I = 0$ where O is the zero matrix. [4]

(b) Hence determine the value of c such that $cA^{-1} = 10I - 4A^2$. [3]

4. (5 marks)

Given $B^3 = \begin{bmatrix} 2 & 4 \\ 1 & 0 \end{bmatrix}$ and $A = \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix} = Q^{-1}$ determine $(ABQ)^3$.

TRINITY COLLEGE

Year 11 Specialist Mathematics Units 1,2
Test 5 2021

Section 2 Calculator Assumed
Matrices

STUDENT'S NAME _____

DATE: Wednesday 31st March **TIME:** 25 minutes **MARKS**: 29

INSTRUCTIONS:

Standard Items:	Pens, pencils, drawing templates, eraser
Special Items:	Three calculators, notes on one side of a single A4 page (these notes to be handed in with this assessment)

Questions or parts of questions worth more than 2 marks require working to be shown to receive full marks.

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5. (3 marks)

Determine the matrix that transforms $A(-1,5)$ to $A'(7,14)$ and $B(4,2)$ to $B'(-6,32)$.

6. (6 marks)

A pair of linear equations in x and y is determined by

$$\begin{bmatrix} 3 & -4 \\ 3 & -5 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -34 \\ -44 \end{bmatrix}$$

(a) Use an inverse matrix to determine x and y. [3]

(b) Hence solve the equation $\begin{bmatrix} 3 & -4 \\ 3 & -5 \end{bmatrix} \begin{bmatrix} x+5 \\ x^2+1 \end{bmatrix} = \begin{bmatrix} -34 \\ -44 \end{bmatrix}$ [3]

7. (5 marks)

Let S be a shear transformation matrix of factor $\frac{1}{2}$ parallel to the x-axis.

(a) State matrix S. [1]

(b) What does S^{-1} represent? [2]

(c) Show mathematically that if ANY shear matrix is applied to ANY geometric figure, the area of the image will always be equal to the area of the original figure. [2]

8. (5 marks)

All the points on the line $y = 2x - 5$ are transformed by the matrix $\begin{bmatrix} 1 & 2 \\ 1 & 0 \end{bmatrix}$. Determine the equation of the image of the line.

9. (10 marks)

The parallelogram $PQRS$ with coordinates $P(2,1)$, $Q(5,2)$, $R(6,7)$ and $S(3,6)$ is transformed to parallelogram $P'Q'R'S'$ with coordinates $P'(1,-2)$, $Q'(2,-5)$, $R'(7,-6)$ and $S'(6,-3)$.

(a) Describe the geometrical effect of the transformation and give the appropriate transformational matrix. [3]

Parallelogram $P'Q'R'S'$ is then transformed by the matrix $\begin{bmatrix} 2 & 0 \\ 0 & -3 \end{bmatrix}$ to $P''Q''R''S''$.

(b) Determine the coordinates of P'', Q'', R'' and S''. [2]

(c) If the area of $PQRS$ is 12 units^2, calculate the area of $P''Q''R''S''$. [2]

(d) Determine a single matrix which will map parallelogram $P''Q''R''S''$ to parallelogram $PQRS$. [3]