

Matrices and Systems of Equations: math test, Grade 12 – download the PDF

Suggested time: 45 minutes. Out of 20 points. Calculator allowed only when the problem says so.

1 Operations

/ 3 pts

Let $P = \begin{bmatrix} 4 & -1 \\ 2 & 0 \end{bmatrix}$ and $Q = \begin{bmatrix} 3 & 5 \\ -2 & 1 \end{bmatrix}$. Find $2P - Q$ and PQ .

2 Determinants

/ 3 pts

Find (a) $\det \begin{bmatrix} 7 & 3 \\ 2 & 1 \end{bmatrix}$ and (b) $\det \begin{bmatrix} 1 & 0 & 2 \\ 3 & 1 & -1 \\ 0 & 2 & 4 \end{bmatrix}$.

3 Inverse and system

/ 3 pts

Let $M = \begin{bmatrix} 5 & 2 \\ 7 & 3 \end{bmatrix}$. (a) Find M^{-1} . (b) Solve $M \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 9 \end{bmatrix}$.

4 Gaussian elimination

/ 4 pts

Solve by Gaussian elimination: $x + 2y + z = 4$, $2x - y + 3z = -3$, $3x + y - z = 6$.

5 Cramer's Rule

/ 3 pts

Use Cramer's Rule to solve $3x + 2y = 3$ and $5x - y = -8$.

6 A transformation of a square

/ 4 pts

The square $OABC$ has vertices $O(0, 0)$, $A(2, 0)$, $B(2, 2)$, $C(0, 2)$. Apply the shear $S = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$. (a) Find the images of the vertices. (b) Find the area of the image without drawing it, and explain.



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