Linear Algebra: Assessed Questions 2

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1 Assessed questions

A total of 10 marks is available.

Exercise 1.1. Let $M = \begin{pmatrix} -1/3 & 2/3 & 2/3 \\ 2/3 & -1/3 & 2/3 \\ 2/3 & 2/3 & -1/3 \end{pmatrix}$.

This matrix describes a rotation of 3-dimensional space. Find the axis and angle of rotation. **5 marks**

Exercise 1.2. True or false? In each case, give a proof or a counterexample.

(a) If $A^T = A$ and $A \neq 0$ then the reduced echelon form of A is the identity matrix. **1 marks**

(b) The reduced echelon form of any nonzero vector is $\begin{pmatrix} 1 \\ 0 \\ \vdots \\ 0 \end{pmatrix}$. **1 marks**

(c) If v and w are vectors in $\mathbb{R}^2$ with $v \cdot w = 0$ then $Cv \cdot Cw = 0$ for any 2-by-2 matrix C. **1 marks**

(d) If D represents a reflection of $\mathbb{R}^3$ along a plane through the origin then the system of simultaneous equations $Dv = v$ has a nonzero solution $v \neq 0$. **2 marks**