

First Practice Test, M221-01, Fall 2010

1. True or false? Justify your answers.

(a) The dot product of two vectors is 0 if they point in the same direction.

(b) A linear system of equations $A\mathbf{x} = \mathbf{b}$ with coefficient matrix A and right-hand side $\mathbf{b}$ always has exactly one solution.

(c) If the columns of A lie in a plane, then $A\mathbf{x} = \mathbf{b}$ only has a solution when $\mathbf{b}$ is in the same plane.

(d) If a matrix A is invertible, then $A\mathbf{x} \neq \mathbf{0}$ for every non-zero vector $\mathbf{x}$.

2. Find the angle between the vectors $\mathbf{v} = (3, 4, 0)$ and $\mathbf{w} = (2, 1, 2)$.

3. Which value of c will give linearly dependent columns?

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 1 & -1 \\ 1 & 2 & c \end{bmatrix}$$

4. Solve the following system of equations by elimination with matrices.

$$\begin{aligned} x - y &= 2 \\ -x + y + 2z &= 0 \\ 2x + y - z &= 1 \end{aligned}$$

5. Invert the matrix A by Gauss-Jordan elimination:

$$A = \begin{bmatrix} 1 & -1 & 0 \\ -1 & 1 & 2 \\ 2 & 1 & -1 \end{bmatrix}$$

6. What is the inverse of the block matrix

$$A = \begin{bmatrix} I & U \\ 0 & I \end{bmatrix}$$

where the blocks are 3 by 3 matrices?