

XX50215 Statistics for Data Science

Problem Sheet #1

This is not material we've covered in the lectures. We want to check how much you already know.

1. Consider the vector $v = \begin{bmatrix} 6 \\ 2 \\ 3 \end{bmatrix}$ in \mathbb{R}^3

a. Determine the equation of the line L through the origin and parallel to v .

b. Consider the vector $w = \begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix}$ in \mathbb{R}^3 and find $\text{proj}_L(w)$.

2. Is the following matrix invertible?

$$A = \begin{bmatrix} 2 & 1 & 0 \\ 1 & -1 & 3 \\ -1 & 0 & 1 \end{bmatrix}$$

Justify your answer. If A^{-1} exists, find it.

3. Consider the matrix,

$$A = \begin{bmatrix} 0 & -1 \\ 4 & 0 \end{bmatrix}$$

a. Find its eigenvalues and eigenvectors.

Write the vector $u(0) = \begin{bmatrix} 2 \\ 0 \end{bmatrix}$ as a combination of those eigenvectors.

b. Solve the equation $\frac{du}{dt} = Au$ starting with the same vector $u(0)$ at time $t = 0$.