MATHS7027 Mathematical Foundations of Data Science

Trimester 2, 2024

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July 11, 2024

Assignment 4 - Question 1

Consider $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$, to make $A^2 = \begin{bmatrix} 4 & -2 \\ 0 & 1 \end{bmatrix}$, we could write an expression below:

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \cdot \begin{bmatrix} a & b \\ c & d \end{bmatrix} = \begin{bmatrix} 4 & -2 \\ 0 & 1 \end{bmatrix}$$

$$\begin{bmatrix} a^2 + bc & ab + bd \\ ac + cd & bc + d^2 \end{bmatrix} = \begin{bmatrix} 4 & -2 \\ 0 & 1 \end{bmatrix}$$

And then we could get the relationships of a, b, c and d:

$$\begin{cases} a^2 + bc = 4 & (1) \\ ab + bd = -2 & (2) \\ ac + cd = 0 & (3) \\ bc + d^2 = 1 & (4) \end{cases}$$

from (2) and (3), we could learn that:

$$ac = -cd$$
$$ab = -2 - bd$$