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Quiz (G-1)

Linear Algebra for Informatics
Fall semester 2024
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Problem

Consider V, the set of all invertible 3×3 matrices

is V subspace of $R^{3\times 3}$?

Solution

Consider just I_3 and $-I_3$,

both are invertible but their sum is not.. so its not a subspace

Problem

Find a basis of the space of all 2×2 matrices A such that

$$A\begin{pmatrix}1 & 1\\ 1 & 1\end{pmatrix} = \begin{pmatrix}0 & 0\\ 0 & 0\end{pmatrix}$$

Solution

Let's say that $A = \begin{pmatrix}a & b\\ c & d\end{pmatrix}$ then $\Rightarrow \begin{pmatrix}a & b\\ c & d\end{pmatrix}\begin{pmatrix}1 & 1\\ 1 & 1\end{pmatrix} = \begin{pmatrix}a+b & a+b\\ c+d & c+d\end{pmatrix} = \begin{pmatrix}0 & 0\\ 0 & 0\end{pmatrix}$

so from here we get that $a = -b$ and $c = -d \iff A = \begin{pmatrix}-b & b\\ -d & d\end{pmatrix}$

We can express A as $b\begin{pmatrix}-1 & 1\\ 0 & 0\end{pmatrix} + d\begin{pmatrix}0 & 0\\ -1 & 1\end{pmatrix}$. thus:

$\begin{pmatrix}-1 & 1\\ 0 & 0\end{pmatrix}$ and $\begin{pmatrix}0 & 0\\ -1 & 1\end{pmatrix}$ is a basis and dimension is just 2