

Unit 2 - Linear Algebra: Transformations, Eigenstuff,  
Diagonalization  
Week 1 - Abstract Vector Spaces

Dr. Chapman and Dr. Rupel

October 2024

Reading: LLM 4.1-4.5

**1**

- Prove that the set,  $F_T$  of real-valued functions with period  $T$ , meaning  $f(x + T) = f(x)$ , is a vector sub-space of the space of all real-valued functions.
- Prove that the set of all periodic functions is NOT a vector space

**2**

Give the matrix which corresponds to the derivative operator on the set of functions spanned by  $\{1, x, e^x, xe^x\}$ . Then compute that matrixes null space and column space.

**3**

LLM 4.5.20 variation:

Suppose  $\vec{v}_1, \dots, \vec{v}_n$  is a linearly dependent spanning set for a vector space  $V$ . Show that each  $\vec{w}$  in  $V$  can be expressed in more than one way as a linear combination of  $\vec{v}_1, \dots, \vec{v}_n$ .