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Proof-Based Linear Algebra

Description: Linear algebra and the theory of finite-dimensional vector spaces is key to any student in physics or mathematics. This class will take a proof-based approach to vector spaces, linear maps, inner products, eigenvectors, and eigenvalues. Proof techniques will be taught along the way. Since each class will build on the previous class material, skipping classes is not recommended.

Prerequisites: High school algebra, willingness to learn proofs

Syllabus:

This is only a tentative outline of the topics we will cover in class. It is subject to change based on student preferences and pace.

Class 1:

- Introduction to proofs (by contradiction, induction, etc.)
- Define vector spaces and some properties

Class 2:

- Bases of finite-dimensional vector spaces
- Linear independence
- Introduction to linear maps and some properties

Class 3:

- Linear maps (continued)
- Matrix representation

Class 4:

- Eigenvalues and eigenvectors
- Upper-triangular and diagonal matrices

Class 5:

- Determinants: calculations and uses
- Cramer's rule

Class 6:

- Inner products
- Gram-Schmidt process
- (maybe adjoints)

Class 7:

- Random stuff
- Celebrate!

Books: There are no required books for this class, but we will roughly follow *Linear Algebra Done Right* by Sheldon Axler. However, this book is much more advanced, and is recommended for students who seek a deeper understanding of the subject.

Homework: Problems will be assigned weekly and are optional. However, it is strongly recommended that you attempt the problems. Problem-solving is an integral part of learning mathematics.