Module 2.3: Linear Transformations

Understanding **T(x) = A x** is crucial for grasping how matrices transform vectors in various ways, including scaling, rotation, and shear effects.

Understanding Linear Transformations

Module 2.3: Linear Transformations Explained

Common Linear Transformations Explained

Here are key types of linear transformations:

- Scaling changes the size of objects
- Rotation turns objects around a point
- Shear slants the shape of objects
- Reflection flips objects across a line
- Projection reduces dimensions of vectors

Understanding Scaling Transformations

Scaling is a **fundamental linear transformation** represented by the formula S(k) = [[k, 0],[0, k]], which alters the size of a shape uniformly in all directions.

Rotation Transform Explained

The **rotation transformation** $R(\theta) = [[\cos \theta, -\sin \theta],[\sin \theta, \cos \theta]]$ effectively rotates a vector around the origin by an angle θ, demonstrating its impact on coordinate systems.

Understanding Shear Transformations

Shear transformations, represented by **H = [[1, k],[0, 1]]**, skew the shape of objects, altering their dimensions while preserving their area. This is commonly applied in graphics and design.

Composition of transforms allows us to combine multiple transformations into one, greatly enhancing our ability to manipulate vectors through matrix multiplication and achieve complex effects efficiently.