

Lecture 30

Linear Transformations

Without Coordinates: no matrix

With Coordinates: MATRIX

Example 1: Projection

Example 2: Rotation

$$T: \mathbb{R}^2 \rightarrow \mathbb{R}^2$$

$$\begin{array}{ccc} v & \longrightarrow & T(v) \\ \{ \text{Matrix} \} & & \{ \text{Matrix} \} \end{array}$$

Linear Transformation

$$\rightarrow T(v+w) = T(v) + T(w)$$

$$\rightarrow T(cv) = cT(v)$$

$$\Downarrow$$
$$\boxed{T(cv + dw) = cT(v) + dT(w)}$$

Example 3: Matrix A

$$T(v) = Av$$

$$T: \mathbb{R}^3 \rightarrow \mathbb{R}^2$$

Information needed to know $T(v)$ for all inputs

$T(v_1), T(v_2), \dots, T(v_n)$ for any basis v_1, \dots, v_n

