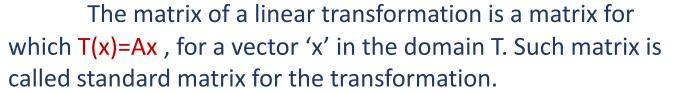


# LINEAR ALGEBRA AND ITS APPLICATIONS UE19MA251

#### Transformations Represented by Matrices





#### Note:

1.Such matrix can be found for any Linear transformation T from R<sup>n</sup> to R<sup>m</sup>.

#### **Transformations Represented by Matrices**

The standard matrix of transformation

T:RN > RM has estumns

T(e1), T(e2), ... T(en) where e1, e2...en

represent the Standard ban's, 10

T(x)=Ax () A=[T(e1), T(e2)... T(en)]



#### Transformations Represented by Matrices

Examples: 
$$T \begin{bmatrix} \chi_1 \\ \chi_2 \\ \chi_3 \end{bmatrix} = \begin{bmatrix} \chi_1 - \chi_2 \\ \chi_3 \end{bmatrix}$$

Here  $T : \mathbb{R}^3 \to \mathbb{R}^3$ .

Bon's for  $\mathbb{R}^3 = \begin{cases} e_1 = \begin{pmatrix} 1 \\ 0 \end{pmatrix}, e_2 = \begin{pmatrix} 0 \\ 1 \end{pmatrix}, e_3 = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \end{cases}$ 
 $T(e_1) = T \begin{pmatrix} 1 \\ 0 \end{pmatrix} = \begin{pmatrix} 1 - 0 \\ 2(0) \end{pmatrix} = \begin{pmatrix} 1 \\ 2(0) \end{pmatrix} = \begin{pmatrix} 1 - 0 \\ 2(0) \end{pmatrix} = \begin{pmatrix} 1 - 1 \\ 2(0) \end{pmatrix} = \begin{pmatrix}$ 



#### Transformations Represented by Matrices

The standard matrix for T is  $A = \begin{bmatrix} 1 & -1 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ 

Compare this to the rule for T from the problem  $T\begin{pmatrix} \chi_1 \\ \chi_2 \\ \chi_3 \end{pmatrix} = \begin{pmatrix} \chi_1 - \chi_2 \\ 2\chi_3 \end{pmatrix}$ .



#### **Transformations Represented by Matrices**

#### Matrix Representation of Differentiation:



•Consider differentiation that goes from P<sub>3</sub> to P<sub>2</sub>.

P3=
$$\{blt\}=ao+qit+azt^2+azt^3\}$$
  $ao, ai, az, az\in R$  Baris is  $\{9i=1, 2i=t, 2i=t^3\}$   $P_2=\{qlt\}=bo+bit+bzt^2\}$   $bo, bi, bz\in R$   $baris$  is  $\{u=1, uz=t, uz=t^2\}$   $baris$  is  $\{u=1, uz=t, uz=t^2\}$ 

#### Transformations Represented by Matrices

### Matrix Representation of Differentiation:



$$\frac{d}{dt}(24) = \frac{d}{dt}(1) = 0 = 0.41 + 042 + 043 - 3(0,0,0)$$

$$\frac{d}{dt}(v_2) = \frac{d}{dt}(t) = (-1.440.42+0.43-5(1.010)$$

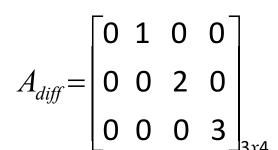
$$\frac{d}{dt}(u_3) = \frac{d}{dt}(t^2) = 2t = 0.41 + 2.42 + 0.43 \rightarrow (0,2,0)$$

$$\frac{d}{dt}(vu) = \frac{d}{dt}(t^3) = 3t^2 = 0.u_1 + 0.u_2 + 3.u_3 \rightarrow (0,0,3)$$



#### **Transformations Represented by Matrices**

We thus get the matrix of differentiation as





#### Transformations Represented by Matrices

Verification! Let 
$$p(t) = 3 + 6t - 7t^2 + 2t^3$$

$$9(2) = \begin{pmatrix} 3 \\ 6 \\ -7 \\ 2 \end{pmatrix}$$

$$Adit(1) = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 3 \end{bmatrix} \begin{pmatrix} 3 \\ 6 \\ -1 \\ 2 \end{pmatrix} = \begin{pmatrix} 6 \\ -14 \\ 6 \end{pmatrix}$$

$$\frac{d}{dt} \begin{bmatrix} p(t) \\ p(t) \end{bmatrix} = 6 - 7 \cdot 2 \cdot t - 2 \cdot 3t^2 - 3 \cdot \begin{pmatrix} -14 \\ 6 \\ 6 \end{pmatrix}$$





## **THANK YOU**