MA322-001 Feb 10 Quiz Name: Key

1.8.1 (HW1.8#13) If $A = \begin{bmatrix} -1 & 0 \\ 0 & -1 \end{bmatrix}$ describe geometrically what $T(\vec{x}) = A\vec{x}$ does to $\vec{x}$?

"Reflects through origin" or "flips both horizontal and vertically"

or "Rotate 180 degrees"

1.8.2 (HW1.8#19) If $T : \mathbb{R}^2 \to \mathbb{R}^2$ is a linear transformation with $T(\vec{e}_1) = (2,5)$ and $T(\vec{e}_2) = (-1,6)$, then calculate $T(5,-3)$.

$(5,3) = 5e_1 + (-3)e_2$

or $T = \begin{bmatrix} 2 & -1 \\ 5 & 6 \end{bmatrix}$, $\begin{bmatrix} 2 & -1 \\ 5 & 6 \end{bmatrix}\begin{bmatrix} 5 \\ -3 \end{bmatrix} = \begin{bmatrix} 13 \\ 7 \end{bmatrix}$

$T(5,-3) = 5T(e_1) + (-3)T(e_2) = 5(2,5) + (-3)(-1,6) = (13,7)$

1.9.1 (HW1.9#1) If $T : \mathbb{R}^2 \to \mathbb{R}^4$ is a linear transformation with $T(\vec{e}_1) = (3,1,3,1)$ and $T(\vec{e}_2) = (-5,2,0,0)$ then what is the standard matrix of T?

$$T = \begin{bmatrix} 3 & -5 \\ 1 & 2 \\ 3 & 0 \\ 1 & 0 \end{bmatrix}$$

2.1.1 If $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 10 & 20 \\ 100 & 200 \\ 1000 & 2000 \end{bmatrix}$ then

(a) what is $A + B$?

undefined (size mismatch)

(b) what is $A + B^T$?

$$\begin{bmatrix} 11 & 102 & 1003 \\ 24 & 205 & 2006 \end{bmatrix}$$

(c) what is AB?

$$\begin{bmatrix} 1(10) + 2(100) + 3(1000) = 3210 & 6420 \\ 6540 & 13080 \end{bmatrix}$$

2.1: Matrix operations MA322-001 Feb 10 Worksheet

Matrix addition How do you add matrices?

Entry by entry. Sizes must agree.

Scalar multiplication How do you multiply a matrix by a number?

Multiply all the entries by that number. Size stays same.

Transpose What is the transpose of a matrix?

Flip it over diagonal $\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \longrightarrow \begin{bmatrix} 1 & 4 \\ 2 & 5 \\ 3 & 6 \end{bmatrix}$ Switch rows with columns

Matrix multiplication

We know how to change $\vec{x}$ to $B\vec{x}$: we just get a new vector $\vec{y}$. We could also do $A\vec{y}$ to get a new vector $\vec{z}$. Do this for $A = \begin{bmatrix} 10 & 100 & 1000 \\ 20 & 200 & 2000 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 2 \\ 3 & 4 \\ 5 & 6 \end{bmatrix}$ and $\vec{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$.

(a) $\vec{y} = \begin{bmatrix} x_1 + 2x_2 \\ 3x_1 + 4x_2 \\ 5x_1 + 6x_2 \end{bmatrix} = Bx = x_1 \begin{bmatrix} 1 \\ 3 \\ 5 \end{bmatrix} + x_2 \begin{bmatrix} 2 \\ 4 \\ 6 \end{bmatrix}$

(b) $\vec{z} = \begin{bmatrix} 5310x_1 + 6420x_2 \\ 10620x_1 + 12840x_2 \end{bmatrix} = Ay = \begin{bmatrix} 10 \\ 20 \end{bmatrix}(x_1 + 2x_2) + \begin{bmatrix} 100 \\ 200 \end{bmatrix}(3x_1 + 4x_2) + \cdots$

(c) Give a single matrix C so that $\vec{z} = C\vec{x}$. That is, $A(B\vec{x}) = C\vec{x}$. We call this matrix $C = AB$.

$$C = \begin{bmatrix} 5310 & 6420 \\ 10620 & 12840 \end{bmatrix}$$