Homework assignment, Feb. 2, 2004.

To be collected Wed. 2/4.

1. Multiply:

a) $\begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{pmatrix} \begin{pmatrix} 1 \\ 3 \\ 2 \end{pmatrix}$;

b) $\begin{pmatrix} 1 & 2 \\ 0 & 1 \\ 2 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ 3 \end{pmatrix}$;

c) $\begin{pmatrix} 1 & 2 & 0 & 0 \\ 0 & 1 & 2 & 0 \\ 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \end{pmatrix}$;

d) $\begin{pmatrix} 1 & 2 & 0 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix} \begin{pmatrix} 1 \\ 2 \\ 3 \\ 4 \end{pmatrix}$;

2. Let a linear transformation in $\mathbb{R}^2$ be the reflection in the line $x_1 = x_2$. Find its matrix

3. For each linear transformation below find it matrix

a) $T : \mathbb{R}^2 \to \mathbb{R}^3$ defined by $T(x, y)^T = (x + 2y, 2x - 5y, 7y)^T$;

b) $T : \mathbb{R}^4 \to \mathbb{R}^3$ defined by $T(x_1, x_2, x_3, x_4)^T = (x_1 + x_2 + x_3 + x_4, x_2 - x_4, x_1 + 3x_2 + 6x_4)^T$;

c) $T : \mathbb{P}_n \to \mathbb{P}_n$, $Tf(t) = f'(t)$ (find the matrix with respect to the standard basis $1, t, t^2, \ldots, t^n$);

d) $T : \mathbb{P}_n \to \mathbb{P}_n$, $Tf(t) = 2f(t) + 3f'(t) - 4f''(t)$ (again with respect to the standard basis $1, t, t^2, \ldots, t^n$).

4. Find 3×3 matrices representing the transformations of $\mathbb{R}^3$ which:

a) project every vector onto x-y plane;

b) reflect every vector through x-y plane;

c) rotate the x-y plane through $30°$, leaving z-axis alone.