February 1, 2011 Lecturer Dmitri Zaitsev Hilary Term 2011

Course 2E02 2011 (SF Engineers & MSISS & MEMS)

S h e e t 2

Due: at the end of the tutorial

Exercise 1

Find $T(\mathbf{x}) = A\mathbf{x}$ for the matrix A and the vector $\mathbf{x}$ whenever the product makes sense (i.e. the sizes of A and $\mathbf{x}$ fit together):

(i) $A = \begin{pmatrix} 0 & -1 \\ 1 & -2 \end{pmatrix}$, $\mathbf{x} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}$,

(ii) $A = \begin{pmatrix} 0 & 2 & 1 \\ -3 & 0 & 2 \end{pmatrix}$, $\mathbf{x} = \begin{pmatrix} -1 \\ 1 \\ 0 \end{pmatrix}$,

(iii) $A = \begin{pmatrix} 1 & 2 & 0 \\ 1 & -4 & 1 \end{pmatrix}$, $\mathbf{x} = \begin{pmatrix} -5 \\ 1 \end{pmatrix}$.

Exercise 2

Use matrix multiplication to find:

(i) the reflection of the vector $(1, -3)$ about the x-axis;

(ii) the orthogonal projection of the vector $(1, -3)$ to the y-axis;

(iii) the image of the vector $(-1, 2)$ under rotation through the angle $\frac{\pi}{3}$ about the origin.

Exercise 3

Determine whether the vectors span $\mathbb{R}^3$:

(i) $\mathbf{v}_1 = (1, -2, -1)$, $\mathbf{v}_2 = (2, -1, 0)$, $\mathbf{v}_3 = (3, 0, 0)$;

Determine whether the vectors span $\mathbb{R}^4$:

(ii) $\mathbf{v}_1 = (1, 0, -3, 1)$, $\mathbf{v}_2 = (-1, 0, -2, 0)$, $\mathbf{v}_3 = (2, 0, 4, 0)$, $\mathbf{v}_4 = (0, 0, -3, 1)$.