January 25, 2010 Lecturer Dmitri Zaitsev Hilary Term 2010

Course 2E02 2010 (SF Engineers & MSISS & MEMS)

S h e e t 1

Due: at the end of the tutorial

Exercise 1

Find $\mathbf{v} + \mathbf{u}$, $2\mathbf{v}$, $\|\mathbf{u}\|$, $\|\mathbf{v}\|$, the dot product $\mathbf{u} \cdot \mathbf{v}$, the angle between $\mathbf{u}$ and $\mathbf{v}$ and determine whether $\mathbf{u}$ and $\mathbf{v}$ are orthogonal (or for which values of parameters $\mathbf{u}$ and $\mathbf{v}$ are orthogonal, if any are present):

(i) $\mathbf{u} = (1, -2, 0)$, $\mathbf{v} = (2, 1, 0)$;

(ii) $\mathbf{u} = (1, 0, 0, 1, 0)$, $\mathbf{v} = (1, 0, -2, 1, 0)$;

(iii) $\mathbf{u} = (2, k, 2, -k)$, $\mathbf{v} = (0, k, 1, 3)$;

(iv) $\mathbf{u} = (-a, c, 0, b, 0)$, $\mathbf{v} = (2c, a, -c, 0, b)$.

Exercise 2

Find the matrix for the linear transformations T defined by the equations

(i) $w_1 = x_1, \quad w_2 = x_1 - x_2,$

(ii) $w_1 = x - 5z, \quad w_2 = z, \quad w_3 = -2y,$

(iii) $w_1 = x_4, \quad w_2 = x_4 + x_3, \quad w_3 = x_4 + x_3 + x_2, \quad w_4 = x_4 + x_3 + x_2 + x_1,$

and by the formulas

(iv) $T(x_1, x_2) = (-x_1, x_2)$,

(v) $T(x_1, x_2, x_3) = (x_2, x_1, x_1 - x_2 + x_3, 5x_2, 2x_3)$.