

MA 371 8/28/03 Quiz 1.      **NAME:**

**You must show all work to receive full credit.**

1. Let  $\mathbf{u} = (1, -1, 3, 2)$ .

(a) Find a unit vector in the same direction as  $\mathbf{u}$ .

(b) Find  $k$  such that  $\mathbf{u}$  is orthogonal to the vector  $(k, -1, 1, 1)$ .

(c) Express  $\mathbf{u}$  as a linear combination of the standard basis vectors,  $\mathbf{e}_1 = (1, 0, 0, 0)$ ,  $\mathbf{e}_2 = (0, 1, 0, 0)$ ,  $\mathbf{e}_3 = (0, 0, 1, 0)$ ,  $\mathbf{e}_4 = (0, 0, 0, 1)$ , in  $\mathcal{R}^4$ .

2. Suppose that  $\mathbf{x}$  and  $\mathbf{y}$  are orthogonal unit vectors in  $\mathcal{R}^n$  where  $n$  is arbitrary.

(a) Show that the distance between  $\mathbf{x}$  and  $\mathbf{y}$  is  $\sqrt{2}$ . Hint: Express  $\|\mathbf{x} - \mathbf{y}\|$  in terms of the dot product.

(b) Draw a picture to represent the situation in  $\mathcal{R}^2$ .

**EXTRA:** Suppose that  $\mathbf{x} = (x_1, x_2)$  and  $\mathbf{y} = (y_1, y_2)$  are orthogonal in  $\mathcal{R}^2$ . Show that the line passing through the origin and the *point*  $(x_1, x_2)$  and the line passing through the origin and the *point*  $(y_1, y_2)$  are perpendicular.