

**Course 2E02 2015 (SF Engineers & MSISS & MEMS)****S h e e t 6**

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Due: at the end of the tutorial

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**Exercise 1**

Which of the following bases are orthogonal and which are orthonormal with respect to the standard dot product?

- (i)  $(-2, 0), (0, -1)$ ;
- (ii)  $(0, 0, 1), (-2, 2, 0), (-1, -1, 0)$ ;
- (iii)  $(1, 0, 0), (0, \frac{3}{5}, \frac{4}{5}), (0, \frac{4}{5}, -\frac{3}{5})$ .

**Exercise 2**

Calculate the coordinates of  $\mathbf{v} = (1, -1, -3)$  relative to the orthogonal basis

$$\{(3, 0, 0), (0, 2, 4), (0, 4, -2)\} :$$

- (i) with respect to the standard dot product;
- (ii) with respect to the inner product  $\langle \mathbf{u}, \mathbf{v} \rangle = 4u_1v_1 + u_2v_2 + u_3v_3$  (check that the given basis is still orthogonal with respect to this inner product).

**Exercise 3**

Find the orthogonal projection of vector  $\mathbf{v}$  onto the plane spanned by the orthogonal basis (with respect to the standard dot product)

$$\{(1, 2, 0), (-2, 1, 1)\} :$$

- (i)  $\mathbf{v} = (1, 0, -1)$ ;
- (ii)  $\mathbf{v} = (1, 1, -1)$ .