

## Self Evaluation Quizzes

**Q 1.** Is sum and difference of two vectors  $\vec{a}$  and  $\vec{b}$  are perpendicular to each other. Find the relation between two vectors.

**Ans.** The sum  $\vec{a} + \vec{b}$  and difference  $\vec{a} - \vec{b}$  are perpendicular to each other. Hence, their dot product should evaluate to zero.

**Q 2.** Find a function  $f(t) = a + bt$  that is perpendicular to the another function  $g(t) = 1 - t$  in the interval  $[0, 1]$ .

**Ans.** If the functions are perpendicular to each other, then their dot product is zero.

$$\langle f, g \rangle = \int_0^1 (a + bt)(1 - t) dt$$

$$\int_0^1 (a + bt - at - bt^2) dt = 0$$

$$a + \frac{b}{2} - \frac{a}{2} - \frac{b}{3} = 0$$

$$\frac{a}{2} + \frac{b}{6} = 0$$

So, we can take  $f(t) = 1 - 3t$

**Q 3.** Determine the number of dimensions in the following sequences:

(a) (.....,0,0,4,5,3,1,6,0,0.....)

(b) (.....,0,0,4,0,0,1,0,9,6,0,0.....)

**Ans.**

(a) The dimension of a sequence is the the length of support of a sequence. In this example, a sequence has 5 nonzero samples and hence it has a dimension of 5.

(b) Since the dimension of a sequence is the length of support of a sequence, a sequence has a dimension 7. Note that this also considers the 3 zero samples which have nonzero samples on their either left or right hand sides.