

參考用

1. (20%) Graph the given function, which is assumed to be zero outside the given interval. Find its Laplace Transform. (show the details of your work.)

$$f(t) = t^2, 0 < t < 3.$$

2. (20%) Show that the following functions form an orthogonal set; and show its corresponding orthonormal set:

$$y_m(x) = \cos mx, m = 0, 1, 2, 3, \dots; \text{ on the interval } -\pi \leq x \leq \pi.$$

3. Let  $A = \begin{bmatrix} 1 & 3 & 3 \\ -3 & -5 & -3 \\ 3 & 3 & 1 \end{bmatrix}$  and  $B = A^{10}$ .

(20%) a. Compute  $B$ .

(20%) b. Find the eigenvalues of  $B$ .

4. (20%) For a signal  $f(x)$  with a period  $P$ , i.e.,  $f(x) = f(x + P)$ , please find its Fourier series representation. The signal  $f(x)$  is shown as follows:

$$f(x) = 2 - 3x^2 \text{ with } -1 < x < 1 (P=2).$$