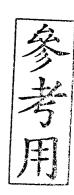
1. (20%) Graph the given function, which is assumed to be zero outside the given interval. Find its Laplace Transform. (show the details of your work.) $f(t) = t^2, \ 0 < t < 3.$



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

$$y_m(x) = \cos mx$$
, $m = 0,1,2,3,...$; on the interval $-\pi \le x \le \pi$.

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:

$$f(x) = 2 - 3x^2$$
 with $-1 < x < 1$ (P=2).