1. (30pts) Given an LTI system with the impulse response:

\[ h(t) = \begin{cases} e^{-\pi t}, & 0 \leq t \leq 1 \\ 0, & \text{otherwise} \end{cases} \]

(a) (35pts) Find the frequency response \( H(j\omega) \)

(b) (25pts) Find the output \( y(t) \) given the input \( x(t) = e^{j\pi t} \cos(\pi t) \). (Hint: you might want to write \( x(t) \) in term of exponential functions first, then use the result in part (a)).

2. (35pts) Let \( x[n] = \cos(\frac{\pi}{2}n) + \sin(\frac{\pi}{3}n) \)

(a) (15pts) Determine the fundamental period of \( x[n] \).

(b) (25pts) Compute \( X[k] \).

3. (10pts) (**Bonus question**) Show that if \( x(t) \longleftrightarrow X(j\omega) \) then \( x(t - t_0) \longleftrightarrow e^{-j\omega t_0}X(j\omega) \)