Practice Exam for Midterm 2

1. A CT LTI system is described by the frequency response

$$H(j\omega) = \frac{e^{-j2\omega}}{2+\omega^2}.$$

Find the output of the system when the input is $\sin(3t + \pi/8)$.

2. A voice signal m(t) with the FT $M(j\omega)$ given below is modulated into an AM radio signal of the form

$$z(t) = (1 + m(t))\cos(10^6 \pi t).$$

Sketch the FT of z(t).



- 3. An LTI DT system has input x[n] and output y[n]. We observe that when $x[n] = \delta[n]$, $y[n] = 0.5\delta[n] + 0.5^n \cos(\frac{\pi n}{3})u[n]$. Find a difference equation relating x[n] and y[n].
- 4. Compute *directly*, showing all your work, the FT of x(t) below and plot its magnitude and phase.



- 5. We are given a DT FT $Y(e^{j\omega}) = 1 + \cos(\omega) 2\cos(4\omega)$.

 - (a) Find $\sum_{n=-\infty}^{\infty} y[n]$. (b) Find $\int_{0}^{4\pi} Y^{2}(e^{j\omega}) d\omega$.
 - (c) Determine the impulse response w[n] of another LTI system such that w[n] * y[n] is causal with minimum delay.
 - (d) Sketch $\operatorname{Od}\{y[n]\}$.
- 6. Find h[n] for

$$H(e^{j\omega}) = \frac{1 - e^{-j\omega}}{1 - 0.1e^{-j\omega} - 0.3e^{-2j\omega}}.$$