Instruction: Please write your work clearly. Credits will not be given to the correct answers without proper derivations. You are allowed a 2-sided 8.5x11” sheet of notes. No calculator is allowed. Answers should not contain the symbols for integration or sum. You have 50 minutes to do the exam.

1. (35 pts) A certain reverberation effect can be modeled using the following LTI system with the following frequency response:

\[ H(j\omega) = \frac{1 - \omega}{1 + \omega^2} \]  \hspace{1cm} (1)

Let \( x(t) = 2 + \sin^2 \pi t \). Determine the output \( y(t) = h(t) * x(t) \).

2. (35 pts) Given \( h(t) = e^{-|t|} \), using the definition of Fourier transform, show that \( H(j\omega) = \frac{2}{1 + \omega^2} \).

3. (40 pts) Computing the appropriate Fourier representations of the following signals.

(a) Let \( x[n] = \sum_{m=0}^{\infty} (-\frac{1}{2})^m \delta[n - 2m] \) (30 pts)

(b) (Bonus question) Let \( x(t) = 2 + \cos 2\pi t \) (10 pts)