

**Problem 1:**

Consider the filter with impulse response  $h(t) = e^{-t}u(t-1)$ .

1. Find the transfer function
2. Find the Laplace transform of the output when  $x(t) = \sin(5t)u(t)$
3. Find the output by taking the inverse Laplace transform of your answer to part 2.
4. Can you obtain the same result using Fourier Transforms?

**Problem 2:**

Consider the continuous time causal filter with transfer function

$$H(s) = \frac{3(s+1)}{(s+2)(s-1)}$$

1. Compute the response of the filter to  $x[t] = u[t]$
2. Compute the response of the filter to  $x[t] = u[-t]$
3. Repeat parts 1 and 2 for a stable system with the same transfer function.

**Problem 3:**

Consider the discrete time stable filter with transfer function

$$H(z) = \frac{z-1}{(z-0.5)(z-1.5)}$$

1. Compute the response of the filter to  $x[n] = u[n]$ .
2. Repeat part 1 for a causal filter with the same transfer function.