

Homework 6

① Find the Laplace transforms of the following functions, $x(t)$

A) $-2\delta(t)$

D) $-2\sin(3t)u(t)$

B) $u(t)[e^t + e^{-2t}]$

E) $u(t) - u(t-1)$

C) $\cos(t)u(t)$

F) $e^{-2t}\cos(t)u(t)$

What are the poles and zeros (if any)?

Plot the poles + zeros (if any) on the s-plane. Is it stable? (problem E requires L'Hopital's rule to check for poles, plus you can look at the function in time and say whether it is stable)

② Find $H(\omega)$ and $h(t)$ for the following system and plot its poles + zeros. Is it stable?

$$\frac{d^2 y(t)}{dt^2} + y(t) = x(t) \quad (\text{Hooke's Law})$$

Use partial fractions to simplify your answer to a trig function.

③ Given $x(t) = e^t u(t)$

A) graph $x(t)$

B) find $y(t) = \int_{-\infty}^t x(\tau) d\tau$, a system that integrates.

C) graph $y(t)$

D) since $h(t) = u(t)$ is the system that integrates,

$$x(t) * u(t) = y(t)$$

show that $X(s) H(s) = Y(s)$

(First, find $X(s)$, $H(s)$, and $Y(s)$)

④ Given a system

$$\frac{dy(t)}{dt} + \frac{1}{\tau} y(t) = b x(t)$$

A) Find $H(s)$

B) Find $h(t)$ and graph it

Assuming an input $x(t) = u(t)$...

C) Find $X(s)$

D) Find $Y(s)$

E) using partial fractions find $y(t)$ and graph it.