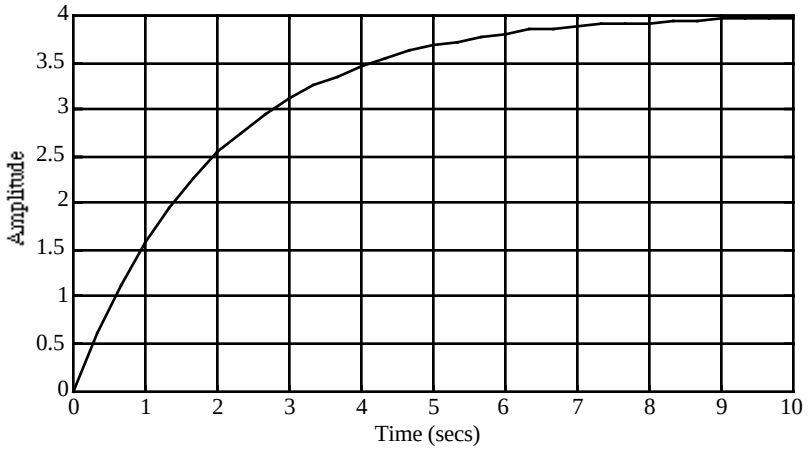
1.) Given a system with the response, c(t), to a unit step, u(t) shown in the graph below,



(5pts) a) Find the system's time constant. (Write your result in the box provided)

Time Constant (sec)

(5 pts) b) Find the 2% settling time. (Write your result in the box provided)

2% Settling Time (sec)

(5 pts) c) What is the steady-state gain of this system based on the unit step input?

Steady-State Gain

(5 pts) d) What is the minimum order is the system transfer function based on the characteristics of the time response? (Write your result in the box provided)

Minimum System Order

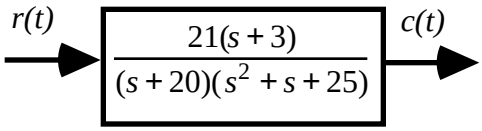
(5 pts) e) For a system model of the minimum order in part d), Find the transfer function, $C(s)/U(s)$, between the system output, *c(t)*, and the system input, *u(t)*. (Write your result in the box provided)

$$\frac{C(s)}{U(s)} =$$

Transfer Function

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2. For the system in the block diagram below,



(5 pts) a) If $r(t) = 3u(t)$, find the steady state value, $c(\infty) = \lim_{t \to \infty}[c(t)]$.

$c(\infty) =$

(5 pts) b) The longest lasting component of the system response is due to which of the three terms in parentheses in the system transfer function?

Longest LastingTerm

(5 pts) c) At approximately what frequency would you expect any oscillatory components of the system response to occur?

(rad/sec)

Oscillation Frequency

(10 pts) 3) For a system with transfer function $G(s) = \frac{C(s)}{R(s)} = \frac{10}{s^2 + 4s + 4}$, what is the magnitude and phase angle of the system frequency response at $\omega = 1$ rad/sec

Magnitude

Phase Angle (degrees)

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4. Use the Routh-Hurwitz criterion to determine whether each system characteristic polynomial below is stable.

(5 pts) a) $s^4 + s^3 + 5s^2 + 5s + 2$

Stable? Yes / No
Why?

(5 pts) a) $s^3 + s^2 + 5s - 10$

Stable? Yes / No
Why?

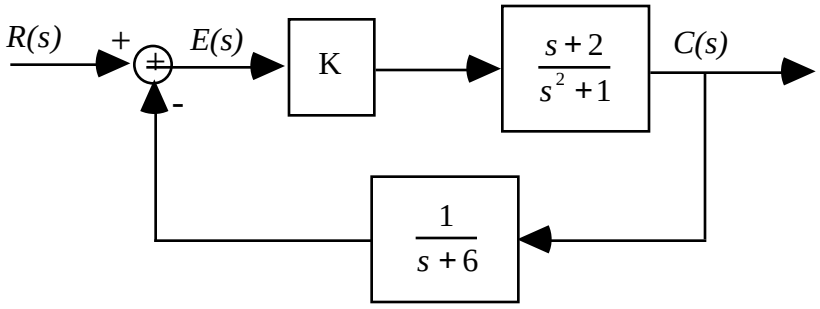
(5 pts) a) $s^4 + Ks^3 + 5s^2 + 10s$

Stable? Yes / No
Why?

(10 pts) 5. For the characteristic equation below, use Routh-Hurwitz to determine the stable range of the parameter, K.

$$s^3 + Ks^2 + 5s + 10 = 0$$

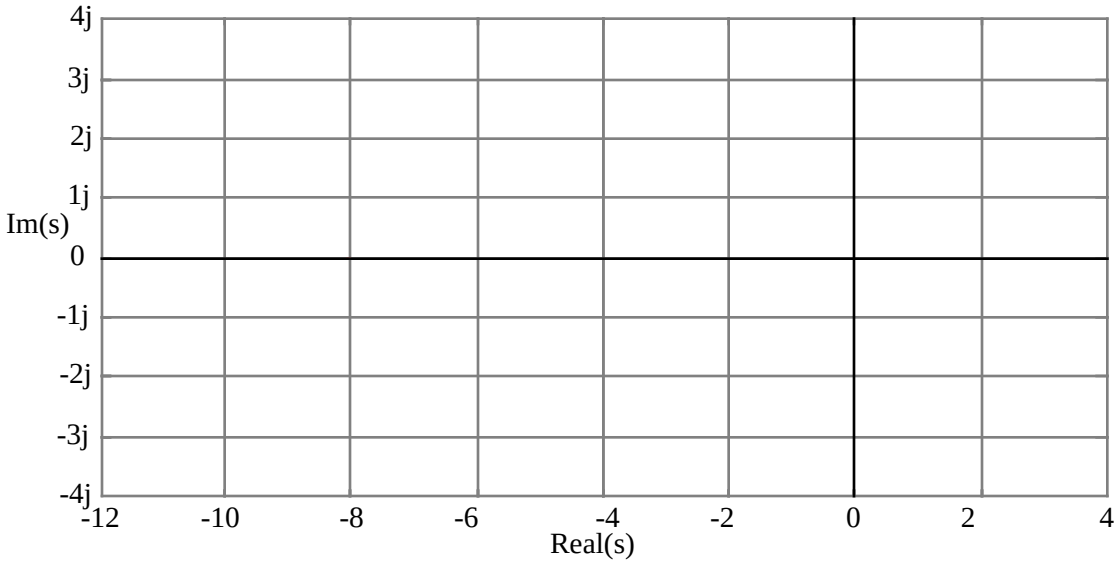
6. For the system shown below,



(5 pts) a) For K = 3,what is the steady state error, *e(t)*, for a unit step input, *r(t)* ?

Steady State Error, e(∞)

(20 pts) b) Draw the root locus for K≥0 noting were possible, range of stable gain, breakaway/breakin points, angles of departure/arrival, asymptotes, etc.



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