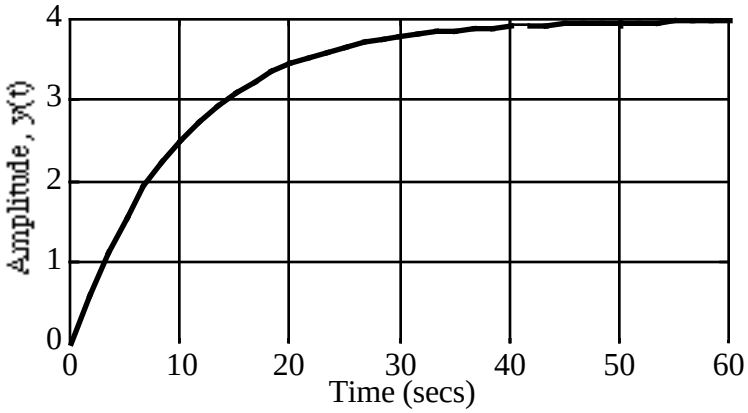
1.) A plant has the response, *y(t)*, to a unit step, *x(t) = u(t)* as shown below.





(15 pts) a) Estimate the system's time constant, 2% settling time and steady state gain. (Write results in boxes below)

Time Constant (sec) | 2% Settling Time | Steady-State Gain

(5 pts) b) 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

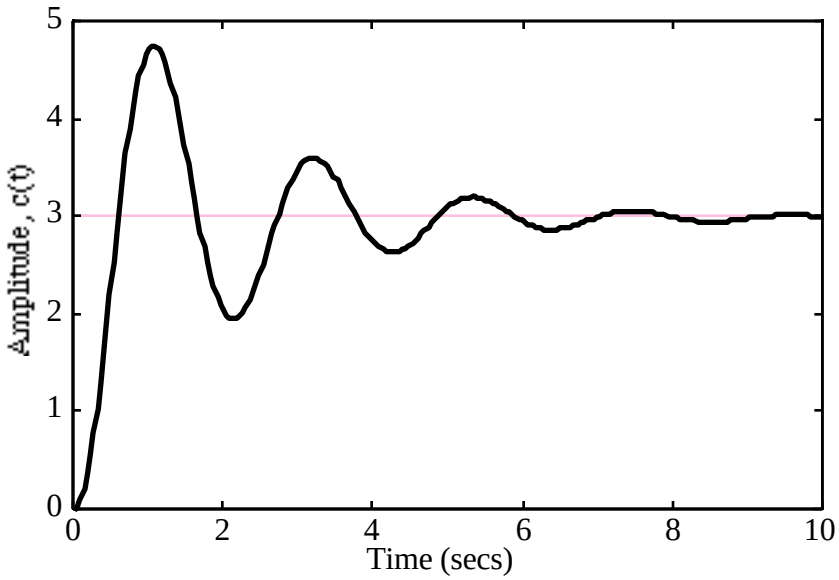
(5 pts) c) For a system model of the minimum order in part b), Find the transfer function *G(s) = Y(s)/X(s)* (Write your result in the box provided)

G(s) =

Transfer Function

_____/25

2.) A plant has the response, *c(t)*, to a unit step, *a(t) = u(t)* as shown below.





(20 pts) a) Estimate the system's time constant, 2% settling time, % overshoot and steady state gain. (Write results in boxes below)

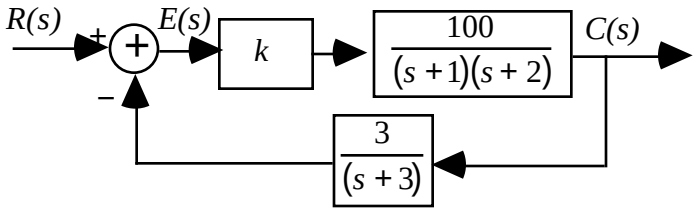
Time Constant (sec) | 2% Settling Time(sec) | % Overshoot | Steady-State Gain

(5 pts) b) Estimate the system's damped natural frequency and damping ratio.

Damped Natural Freq (rad/sec)

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3. For the controlled plant with Proportional controller shown below,



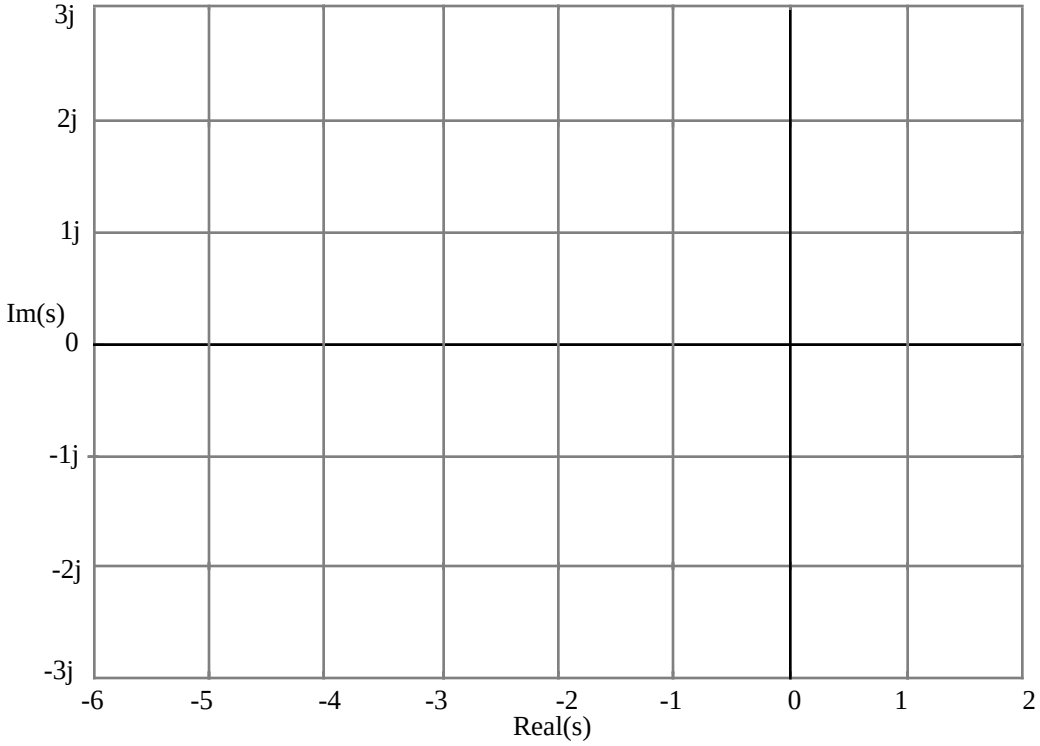
(5 pts) a) What is the closed-loop system characteristic polynomial?

Closed-Loop Characteristic Polynomial

(10 pts) b) For what range of gain k? is the system stable?

Range of stable gain k

(15 pts) c) Draw the root locus for $k \geq 0$ noting were possible, range of stable gain, breakaway/breakin points, angles of departure/arrival, asymptotes, etc.



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3. Continued

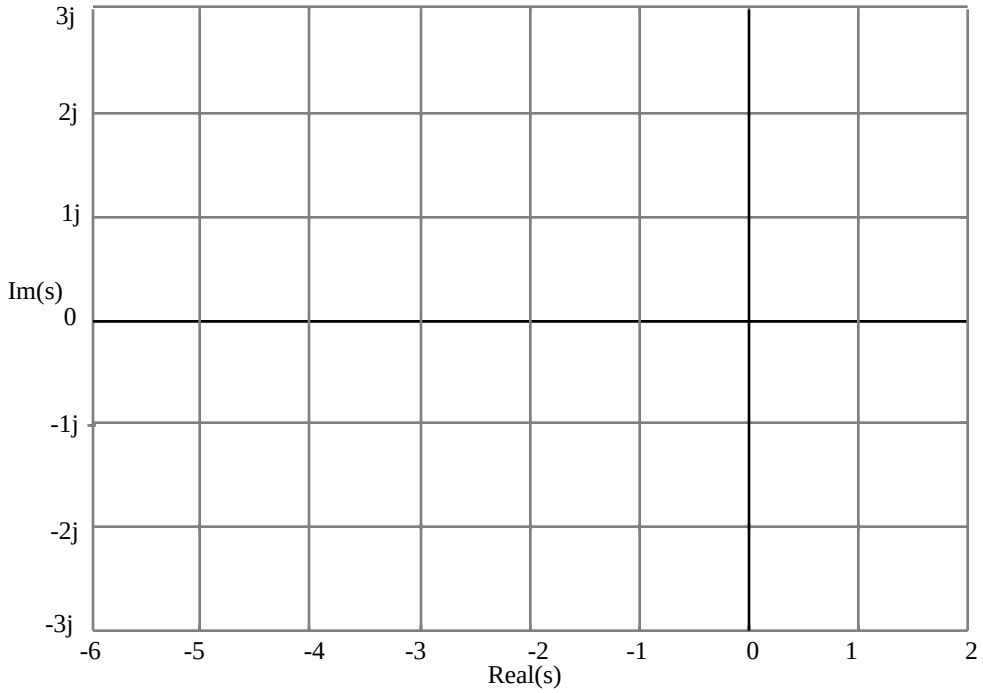
(5 pts) d) What is the steady-state system error maximum stable control gain k ?

Steady-State System Error

15 pts) e) Propose a new controller to reduce steady-state error then plot the redesigned system root locus

New Controller Transfer Function

(Hint: Keep it simple and make it easy on yourself)



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