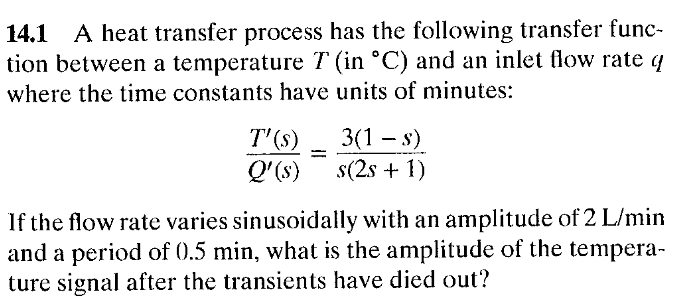
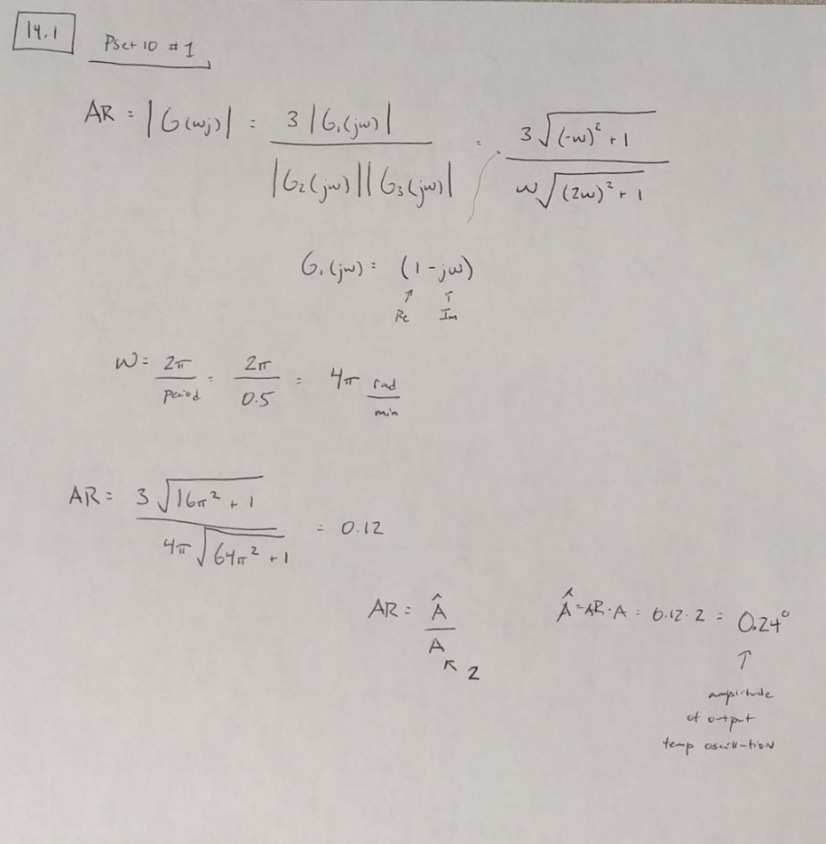
**PSET 10 – Due 11.6.2018 at start of class**

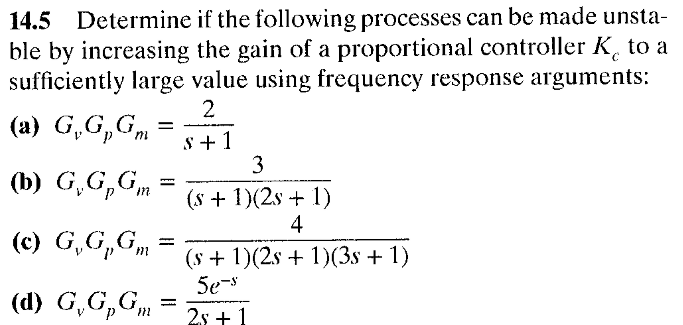
**NOTE:** This is the last PSET for UNIT 1. EXAM 2 will be given on Nov 13 in class. It will cover chapters 8, 9, 10, 11, 12, and 14.

**Question 1:**



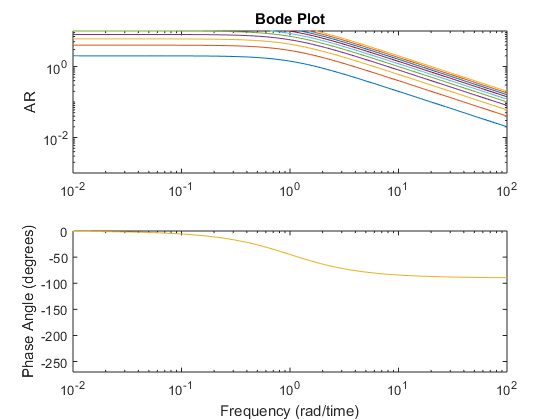


**Question 2:**

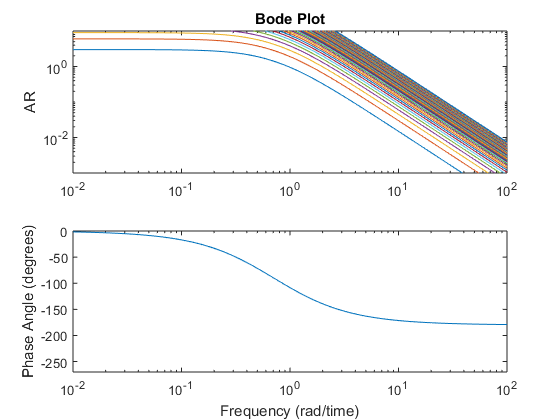


My answer – plot BODE diagrams with increasing Kc values…

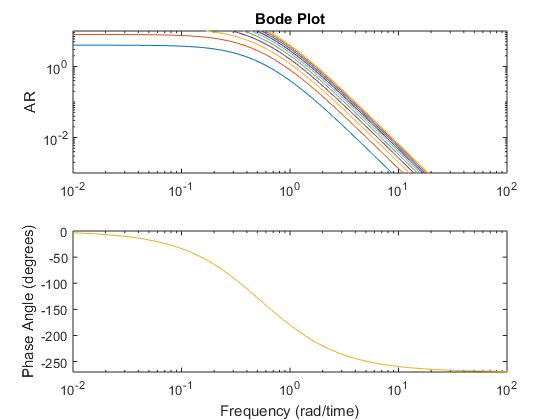
1. Phase angle never reaches -180



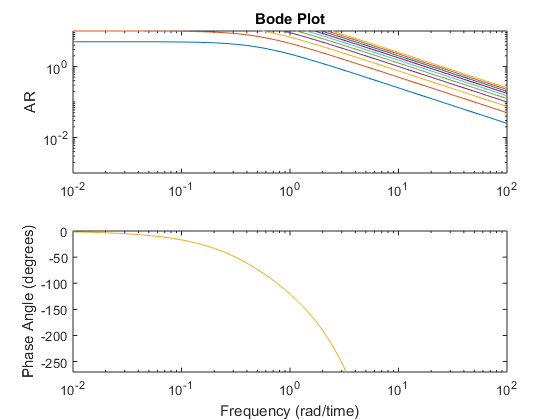
1. Phase angle never quite reaches -180’, looks like very large AR never > 1 even at high Kc values



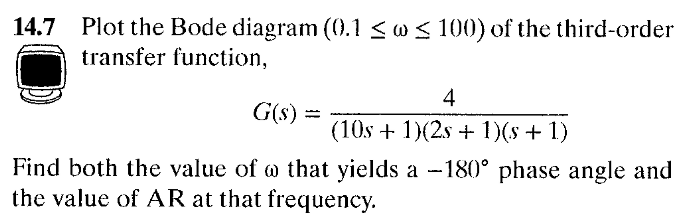
c) Critical frequency is 1rad/time, at this frequency AR can go above one, so this system can be made unstable with sufficiently large Kc values

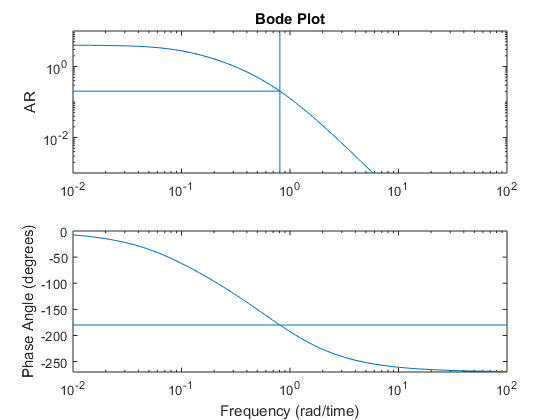


d) Yes, this can be made unstable with increasing Kc values



**Question 3:**





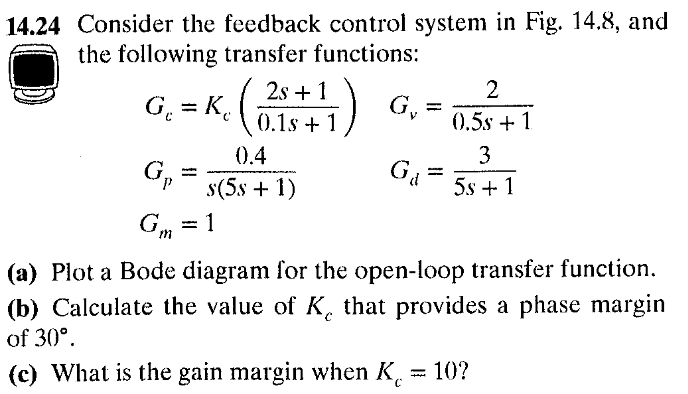
By inspection

Critical frequency = 0.806 rad/time

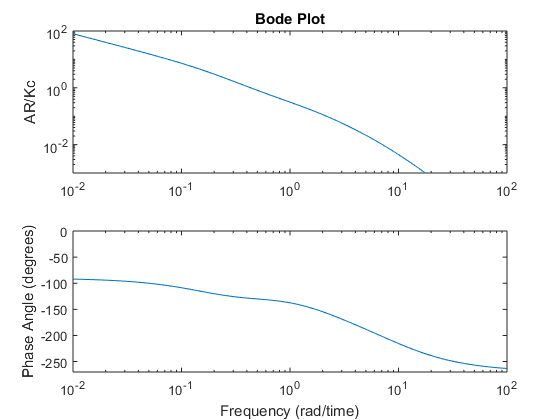
AR = 0.202

[Note: this system is stable!]

Question 4:



1. Bode plot. Note that we do NOT use the disturbance variable transfer function in G –open loop



Part (b) I used fminunc to solve for Kc where PM = 30, code for this:

Kc\_opt = fminunc(@func1,1)

Where fminunc is defined as:

function F = func1(Kc)

s = tf('s');

G = Kc\*(2\*s+1)/(0.1\*s+1)\*2/(0.5\*s+1)\*(0.4/s/(5\*s+1))\*1;

[GM, PM, Wc, Wg] = margin(G);

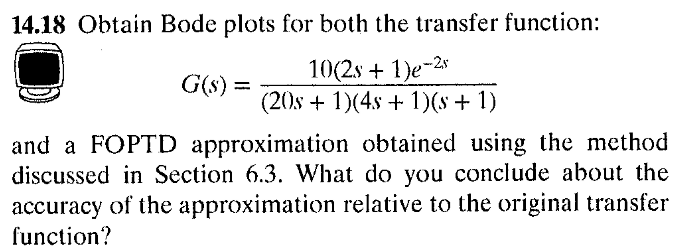
F = (PM-30)^2;

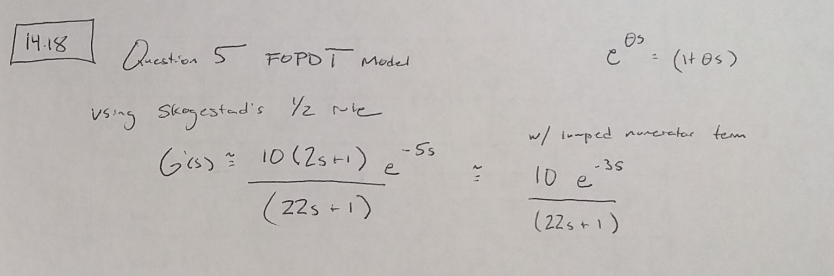
end

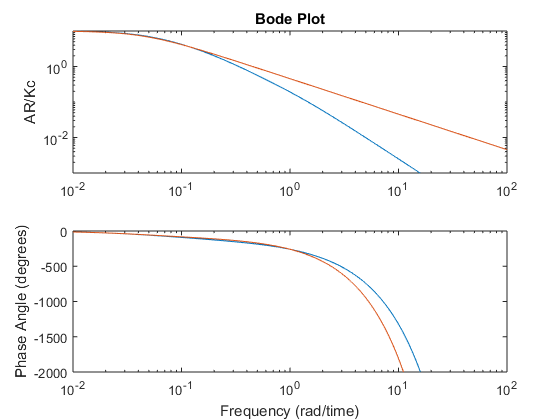
Part (c) Solve graphically with BODE plot or use the margin function in Matlab.

GM = 3.0673

**Question 5:**

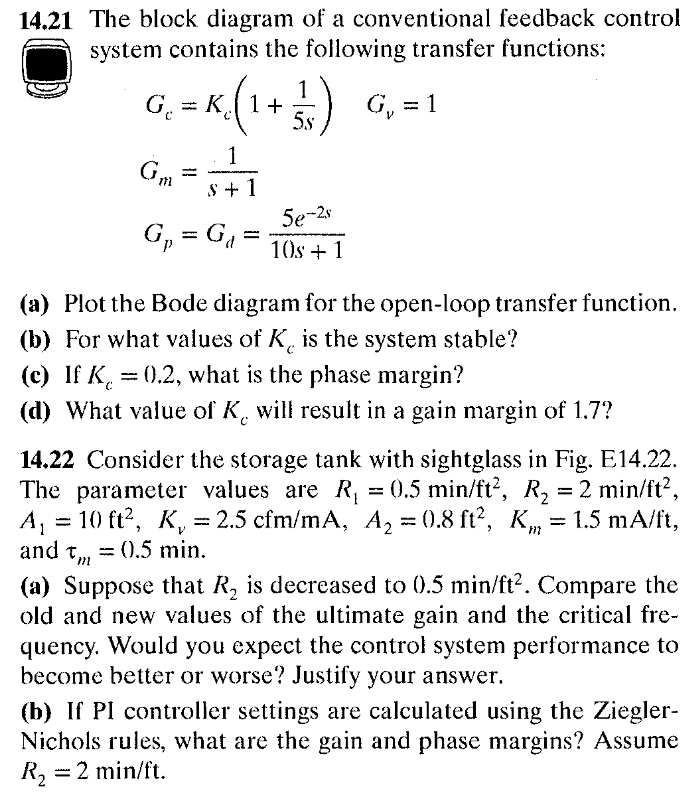




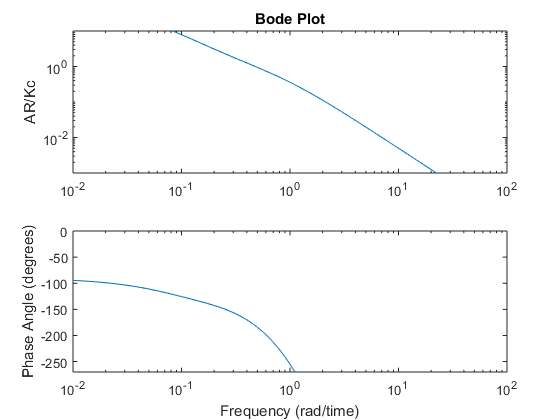


The approximation is good at low frequencies but NOT high frequencies.

**Group Problem 1:**



Part a)

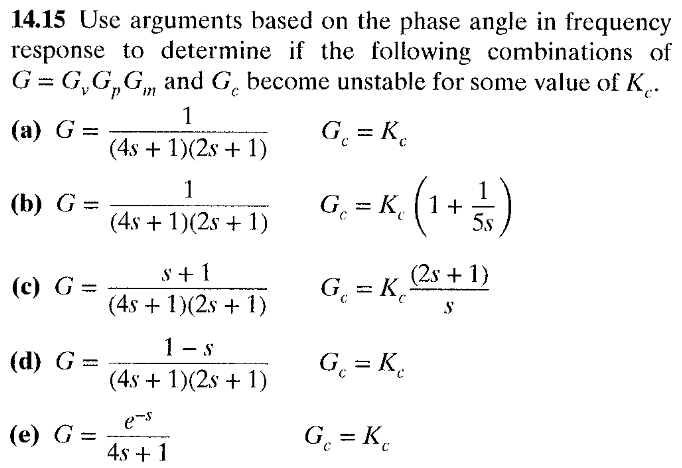


Part b) Kc < 0.9753 the system is stable

Part c) With Kc = 0.2, the phase margin is 46.5°

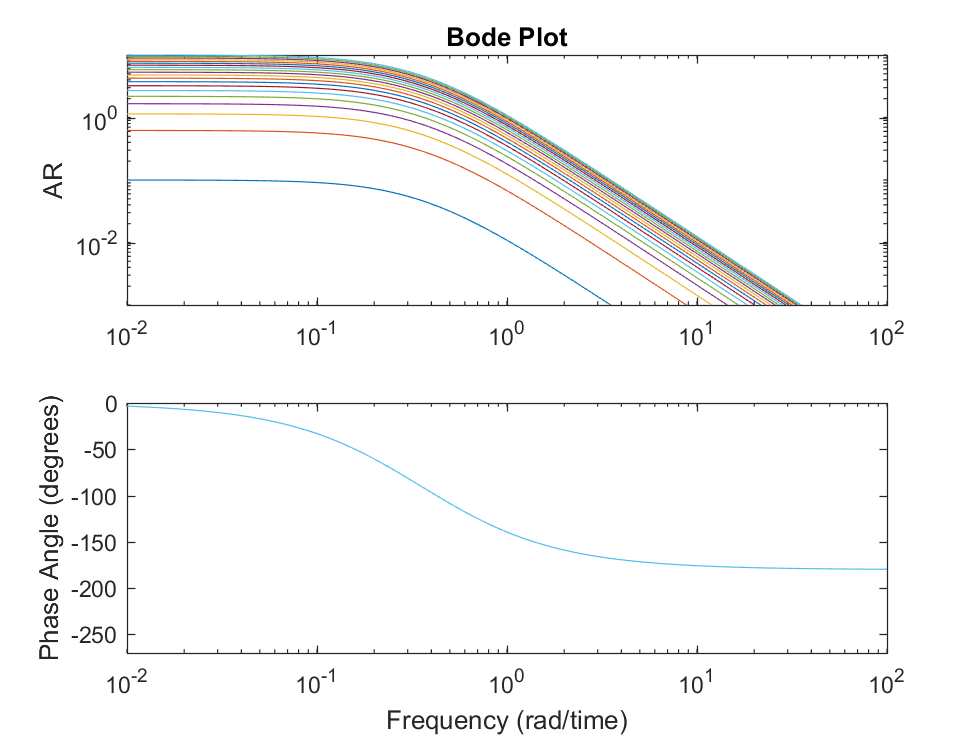
Part d) Use fminunc to solve (like in problem 4), Kc = 0.57

**Group Problem 2:**

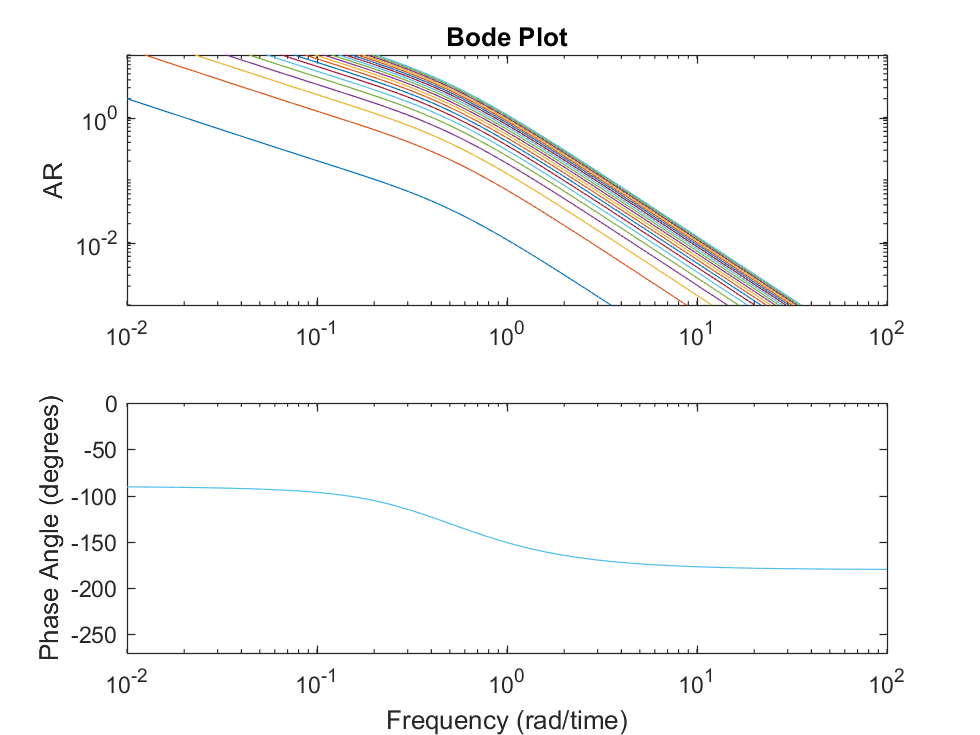


Answer – plot response to Kc values ranging from 0.1 to 10:

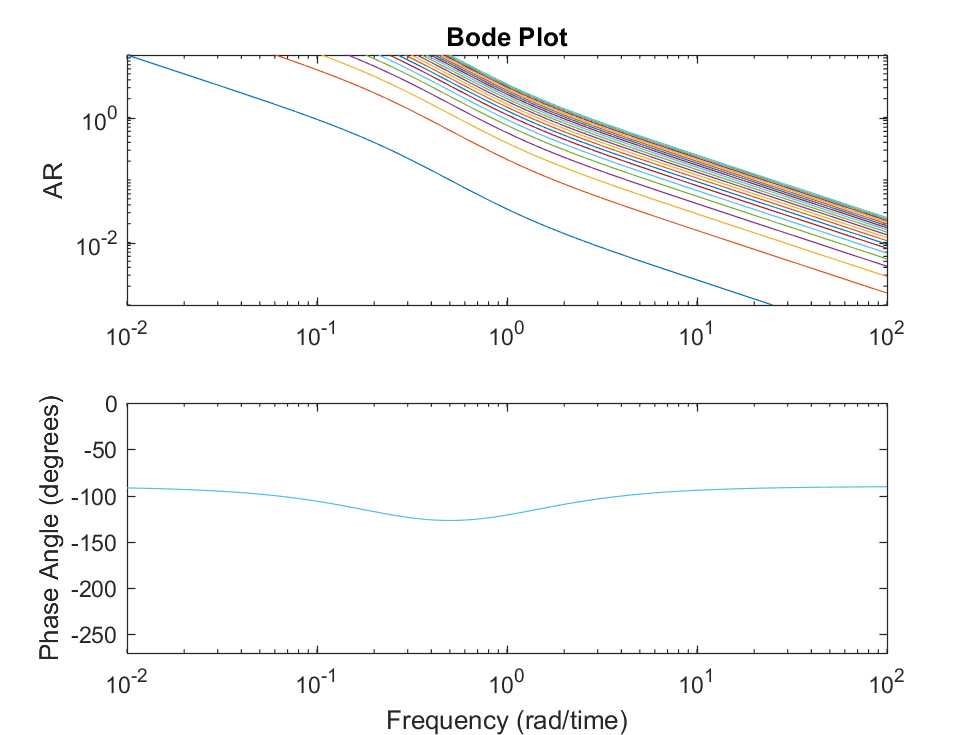
Part a) The phase angle never reaches -180’ for any Kc, so it is always stable.



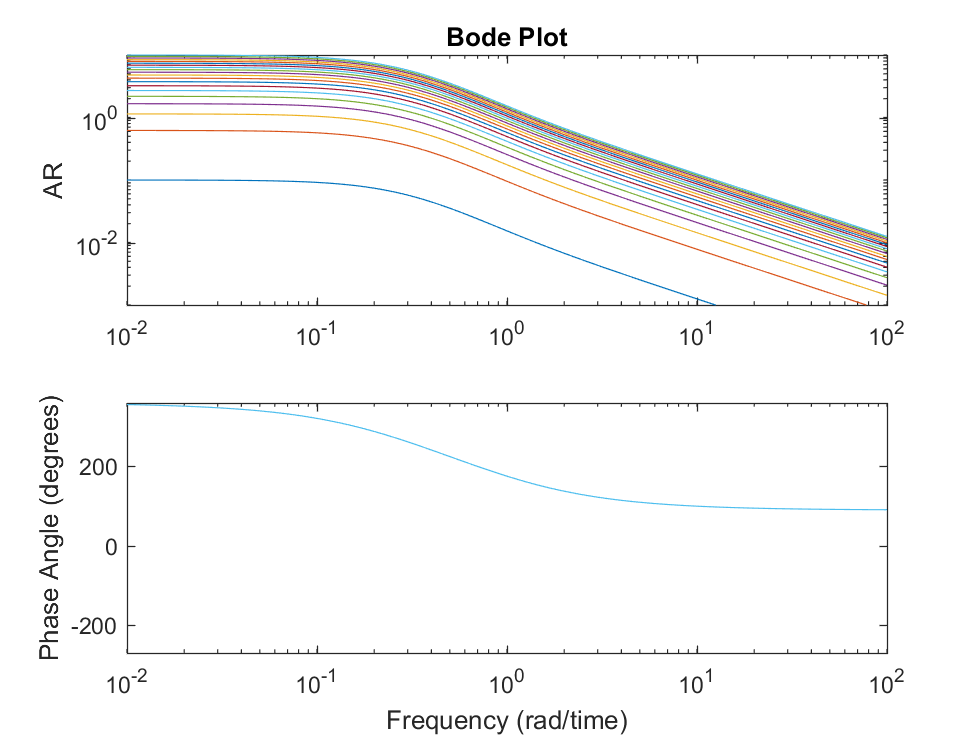
Part b) Same reason as above. Always stable.



Part c) Again, the phase angle never reaches -180’, so it is stable for all Kc



Part d) Very high phase angle, not close to the -180’ marl for any of the Kc values



Part e) Yes! At phase angle = -180’, thee are Kc values that can make this system unstable.

