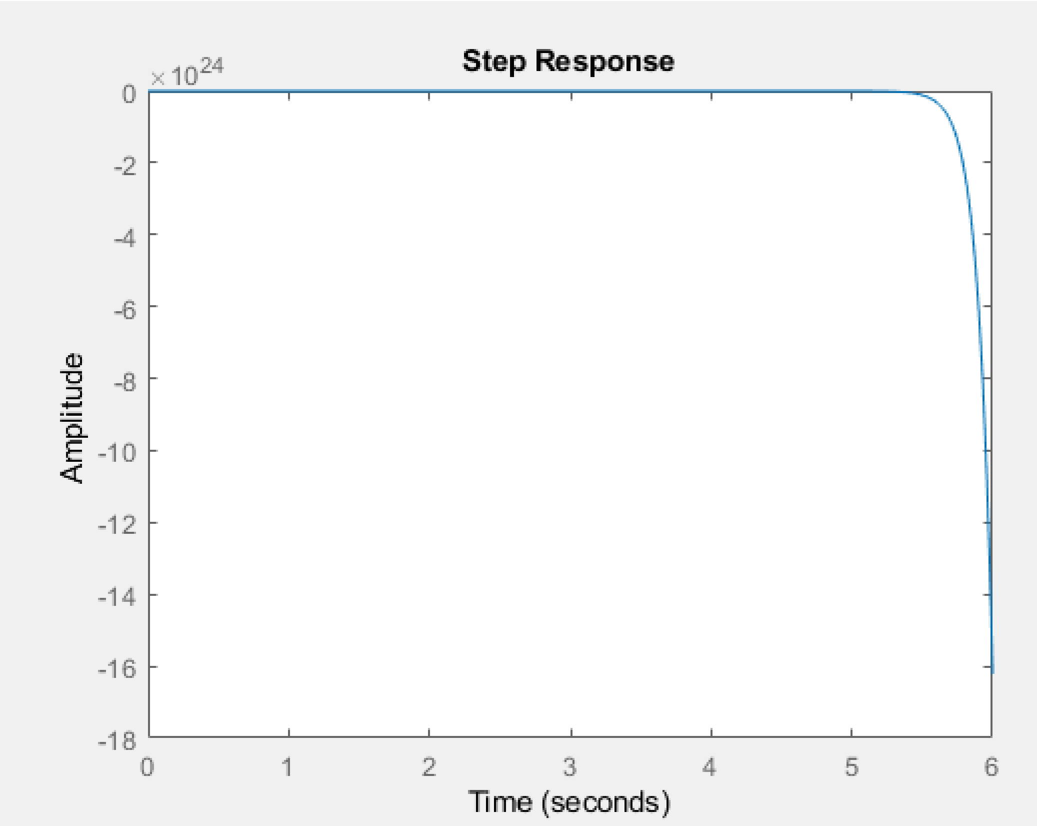
S2 laboratory cw8g19

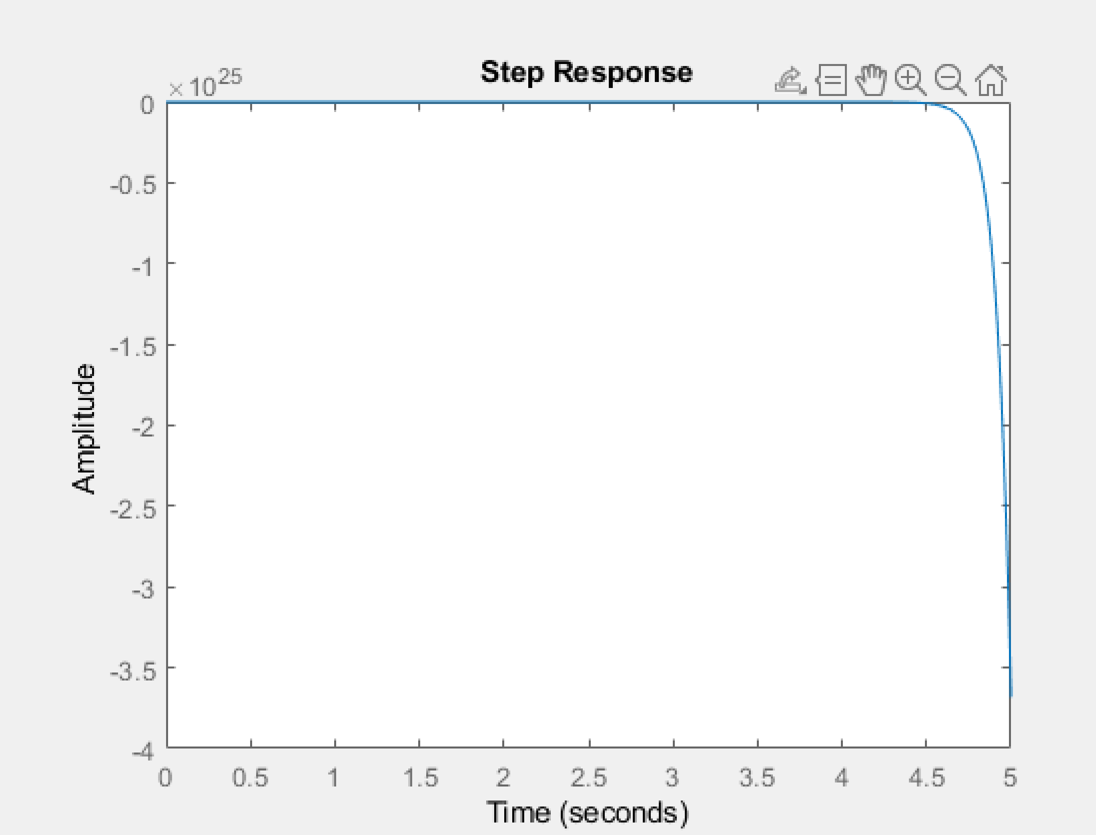
3.2

5.)

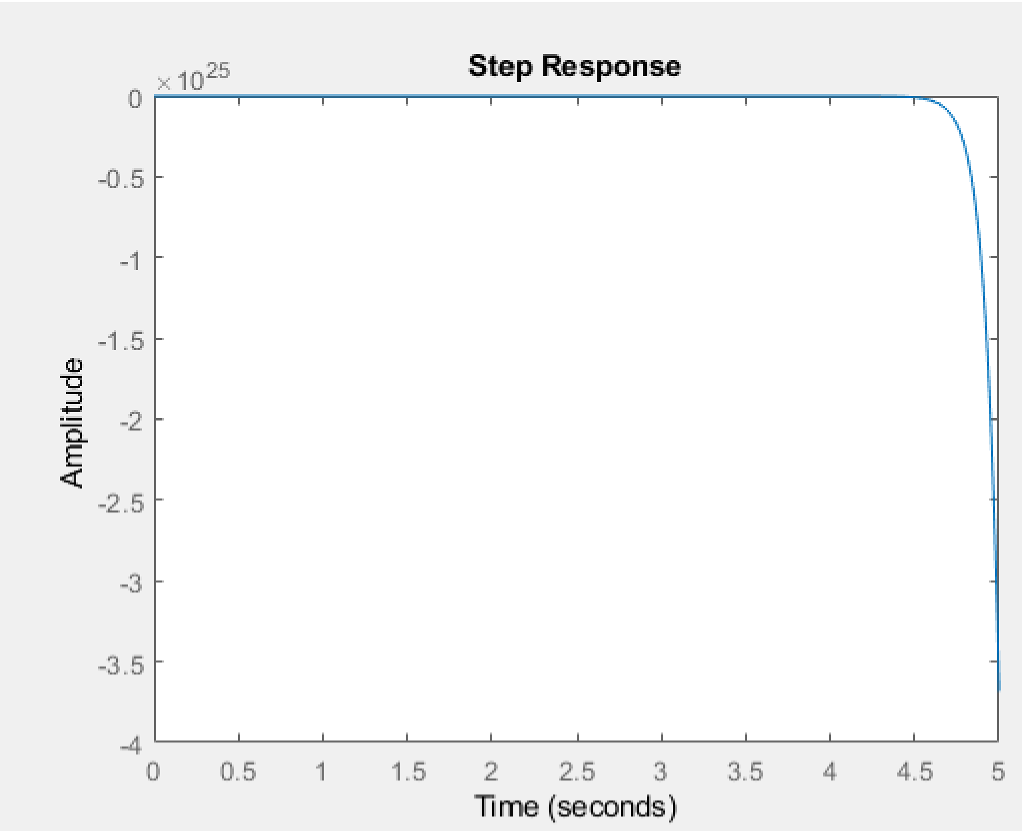
K=1



K=2



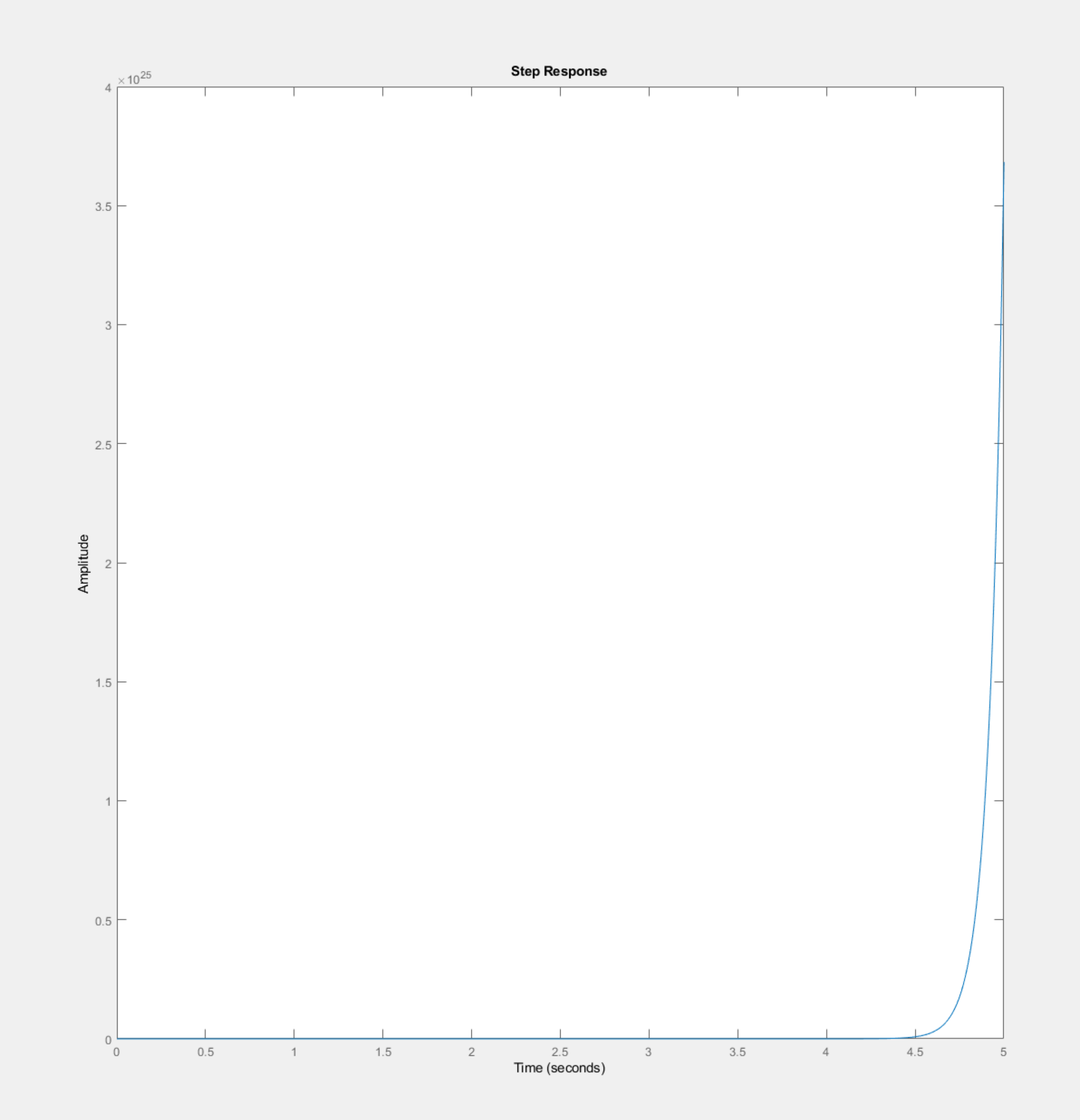
K=10



This graph show that proportional control isn't enough to control the system under negative feedback as it retains its instability.

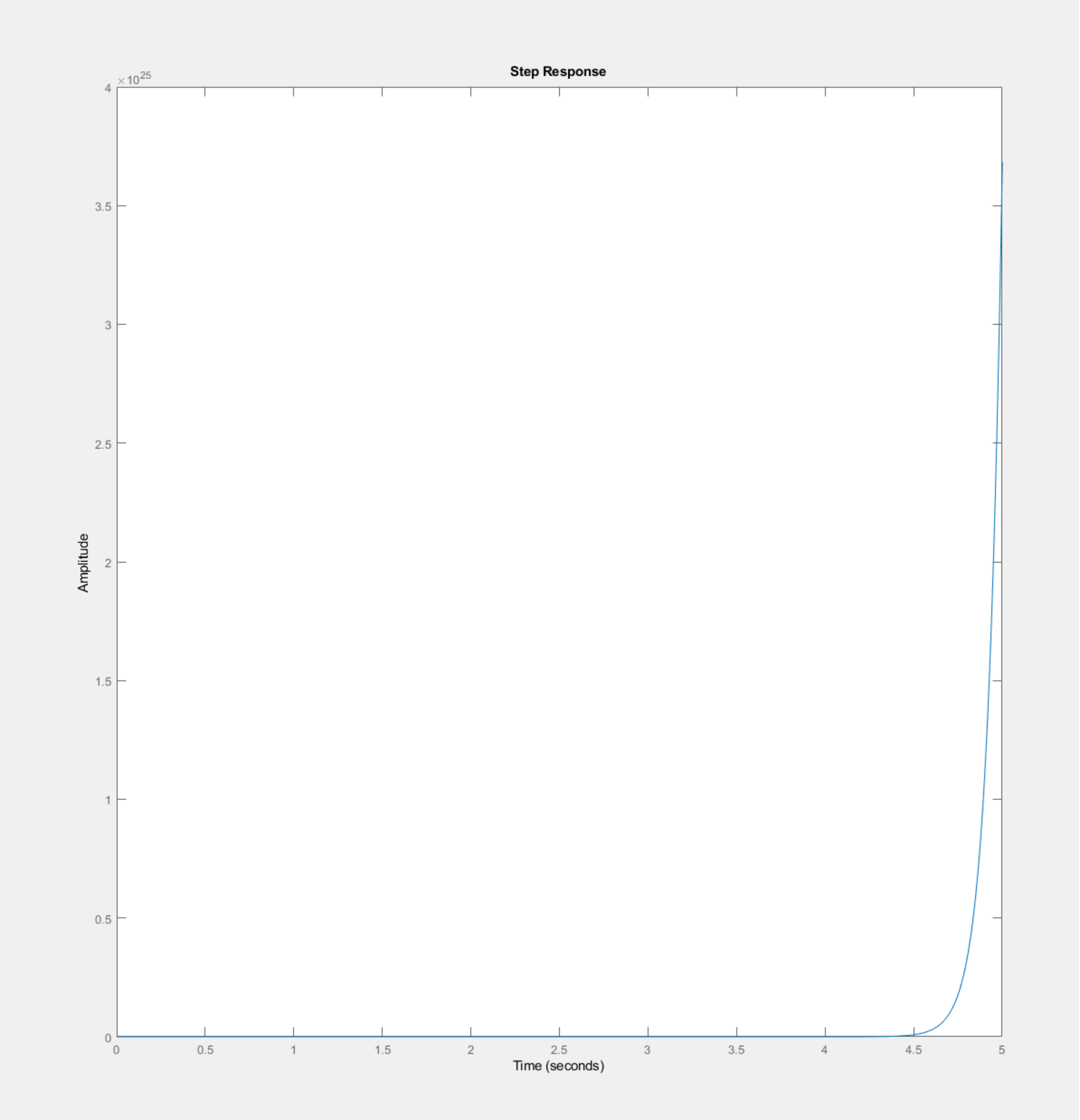
6.)

k=0



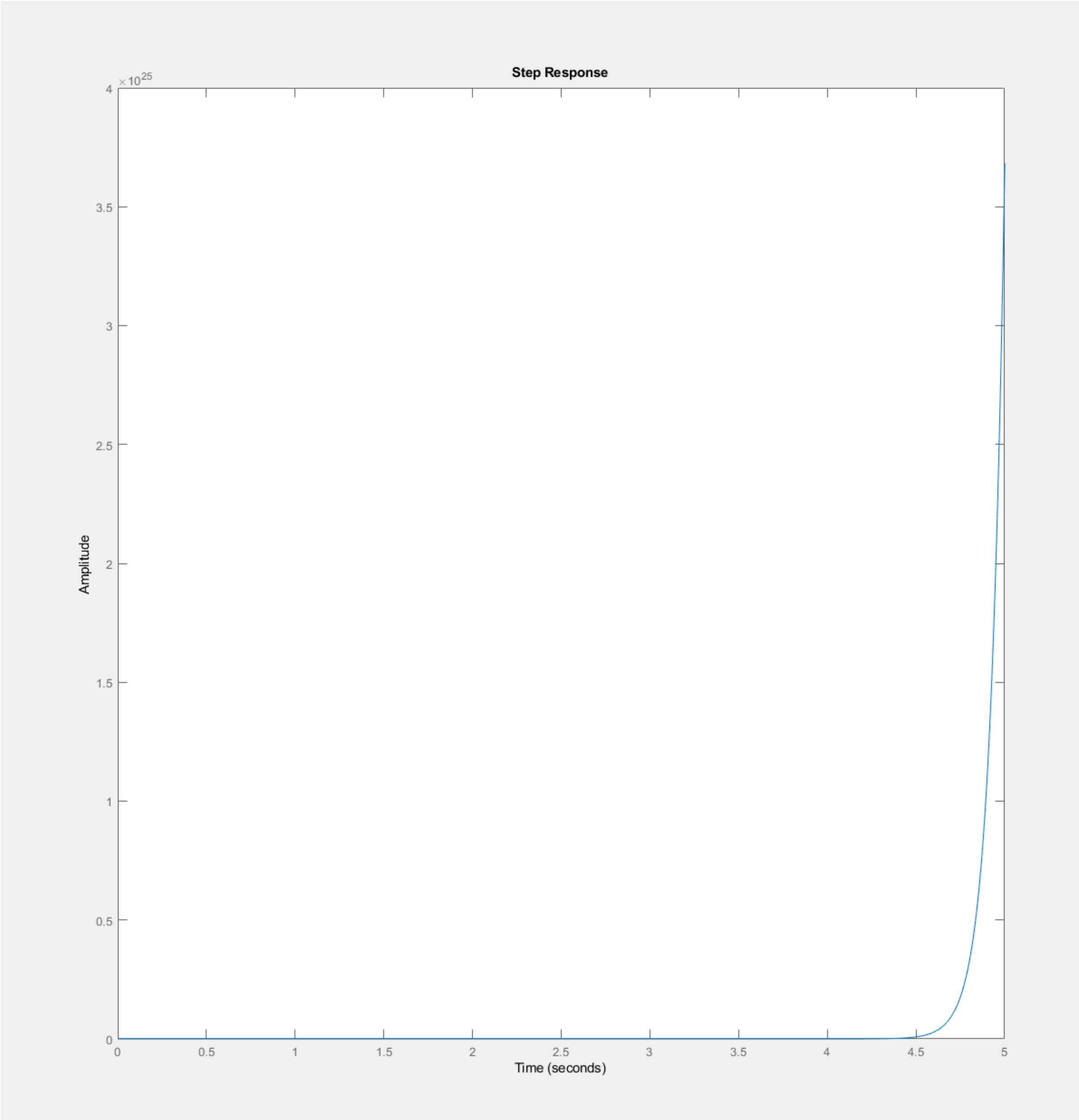
Step Response
$\times 10^{25}$
4
3.5
3
2.5
2
1.5
1
0.5
0
Amplitude
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Time (seconds)

k=1

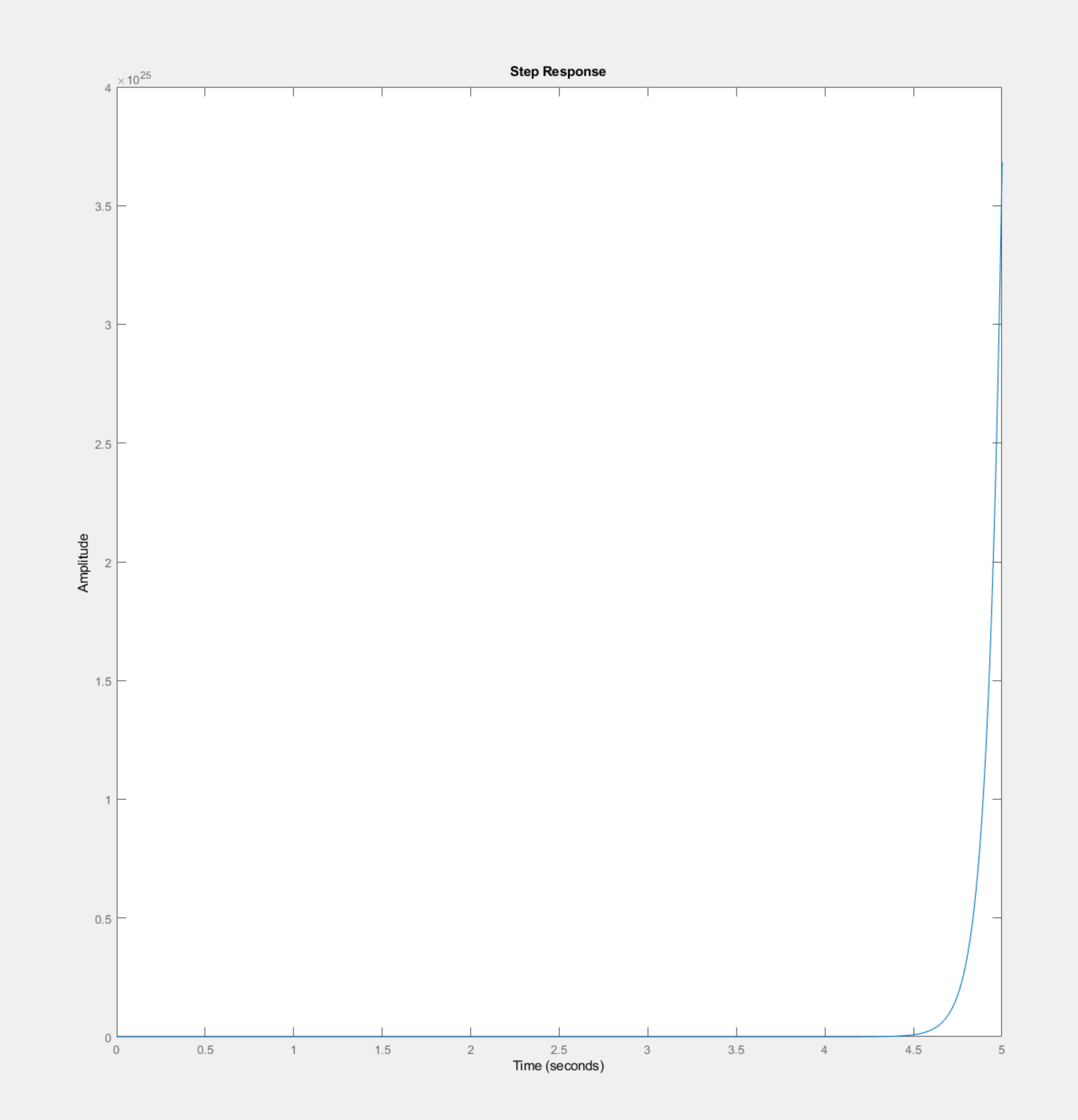


Step Response
$\times 10^{25}$
Amplitude
Time (seconds)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

K=2


Step Response
×10^25
Amplitude
Time (seconds)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5

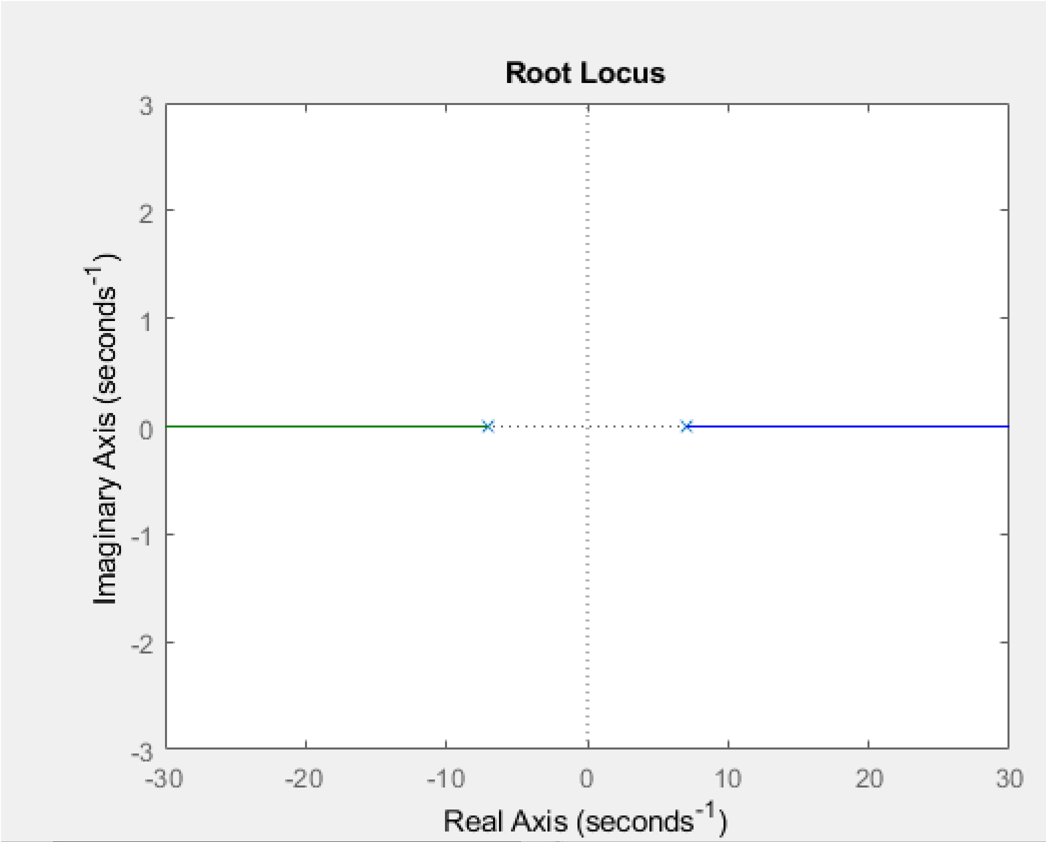
K=10

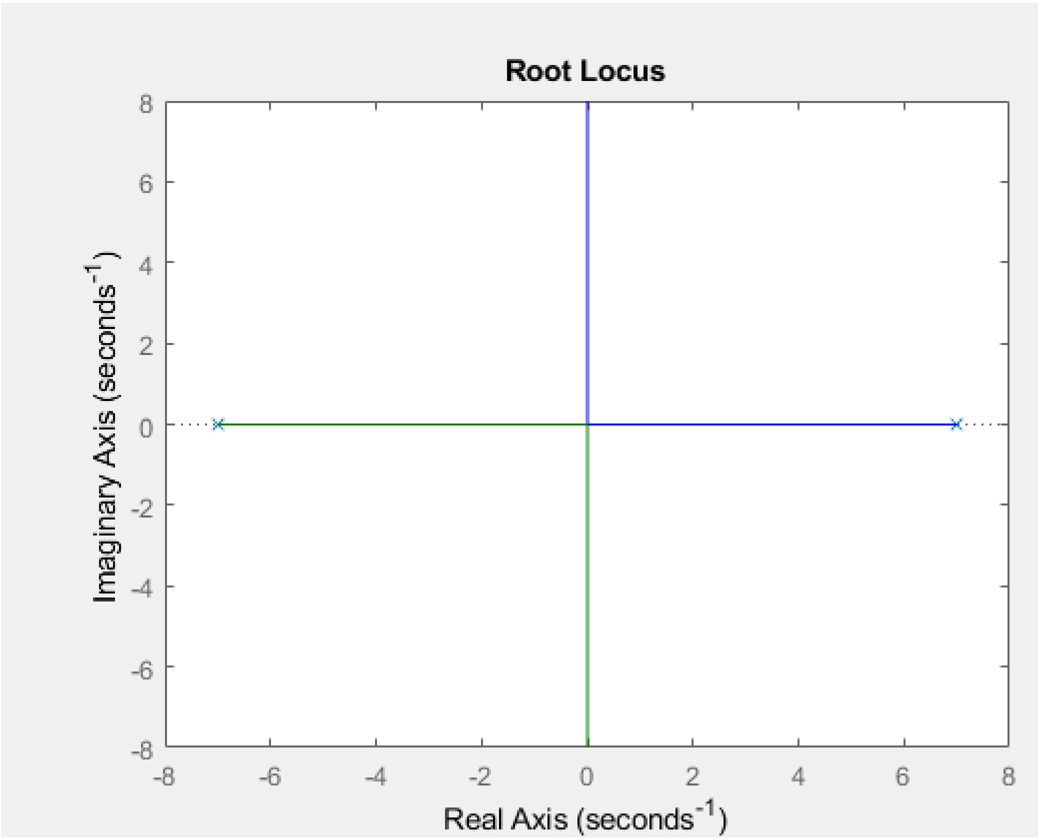


Positive feedback produces the same results as the negative feedback and that is the system is unstable.

7.)

This first graph is negative feedback, the second one is positive feedback.





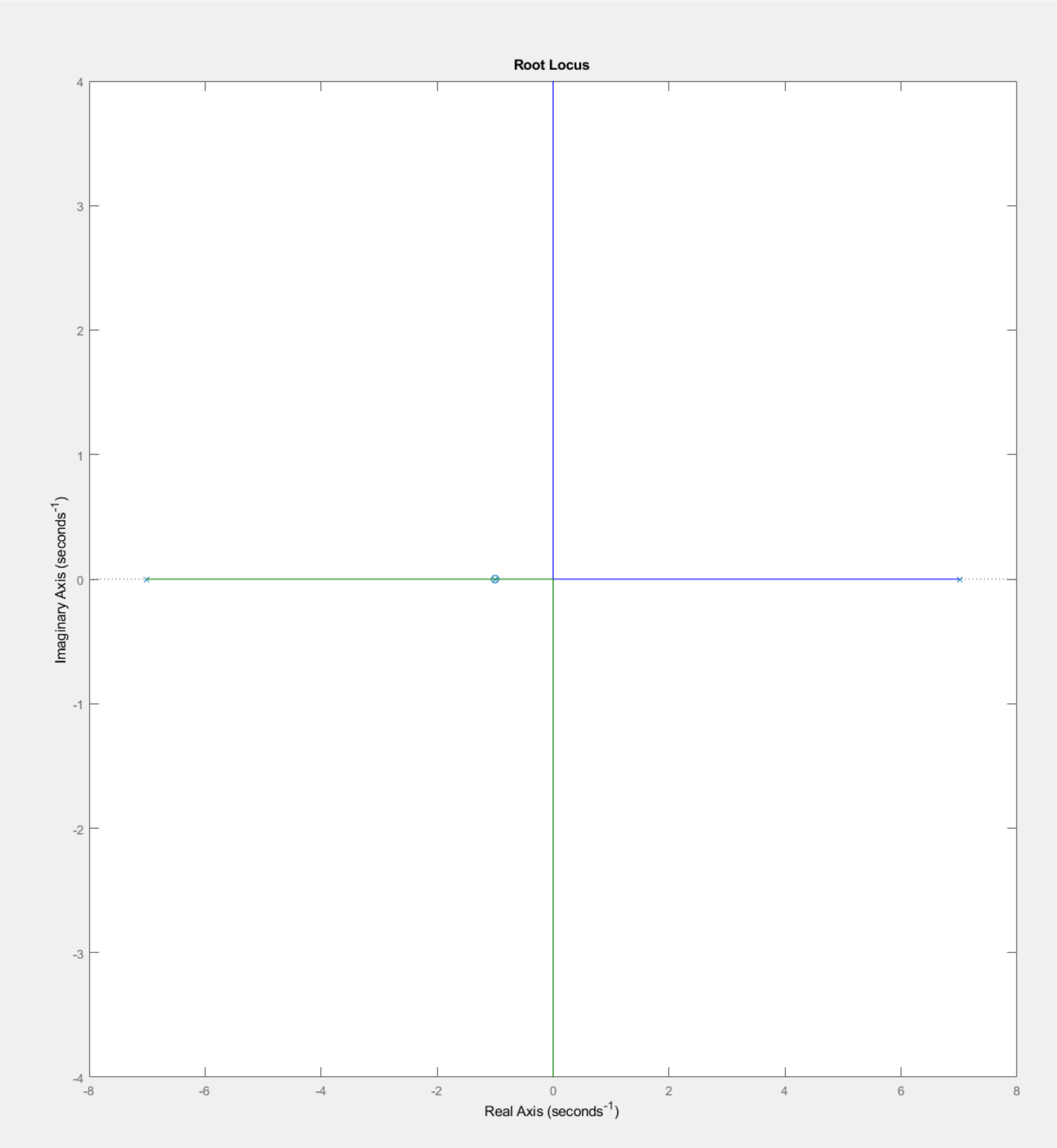
8.) No, it can't stabilise the system as solely with proportional as at the frequency required there is a hole.

9.) Yes, it is consistent with the predictions and it can't be stabilised via proportional means alone.

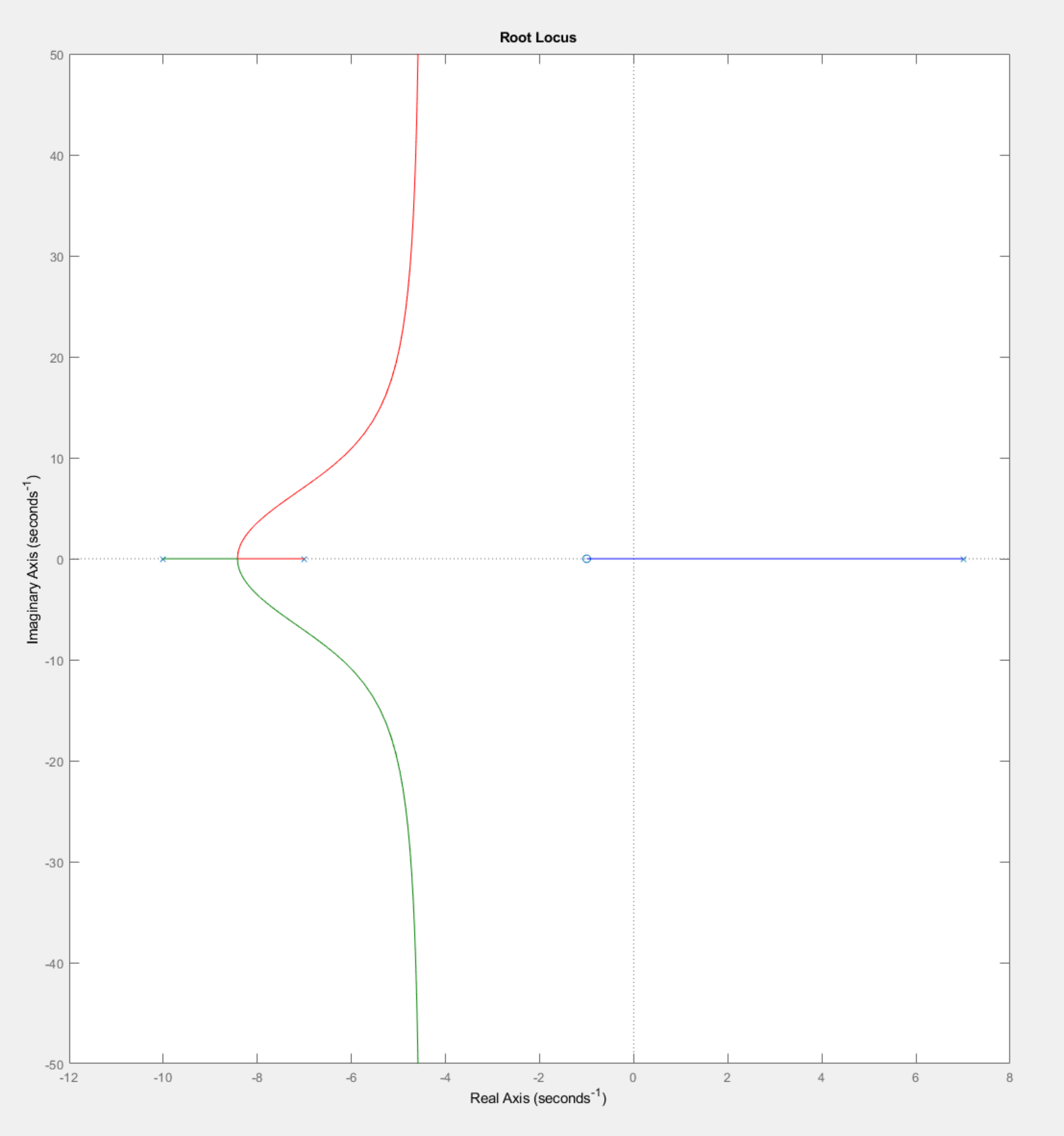
3.3

10.)

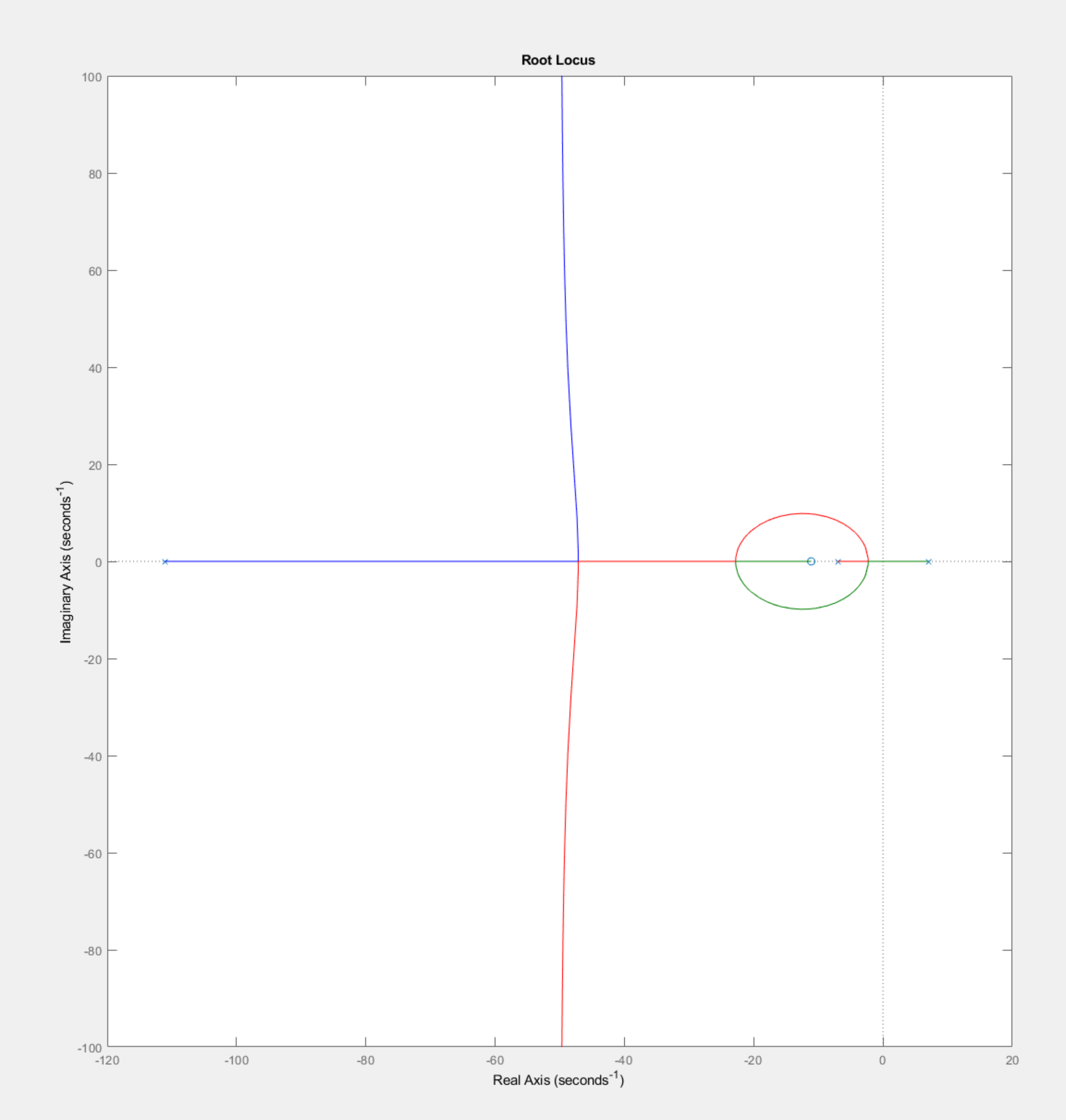
C = 1 and tau = 1 we ge this so we need to alter this.



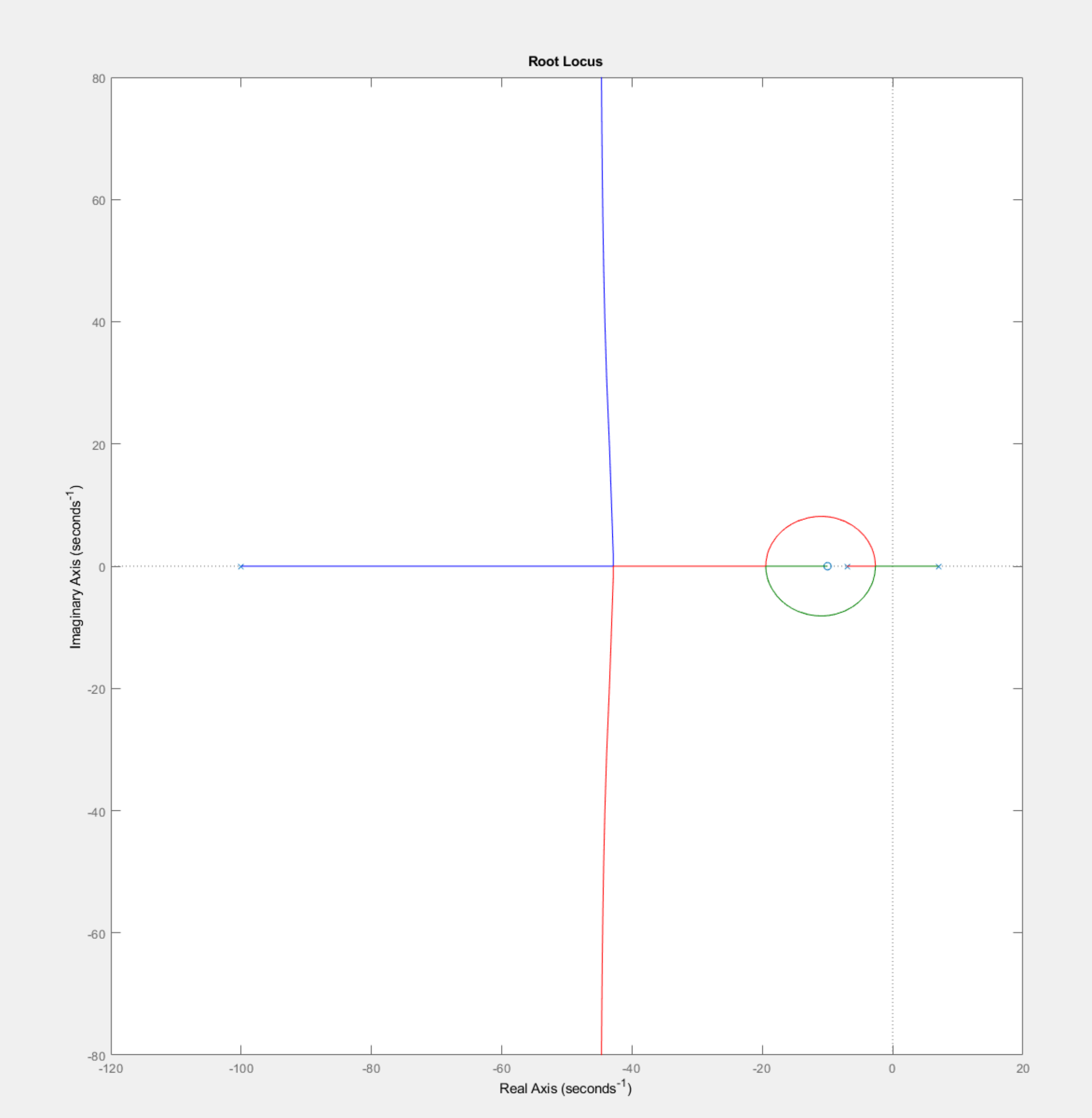
Setting it equal to c=10 and tau = 0.1 we get the lower result however we need the values of s to be to the left so we need to have c*tau is less than 0.1 as w = 1.



This is wil c=10 and tau = 0.009 and now it is stable.



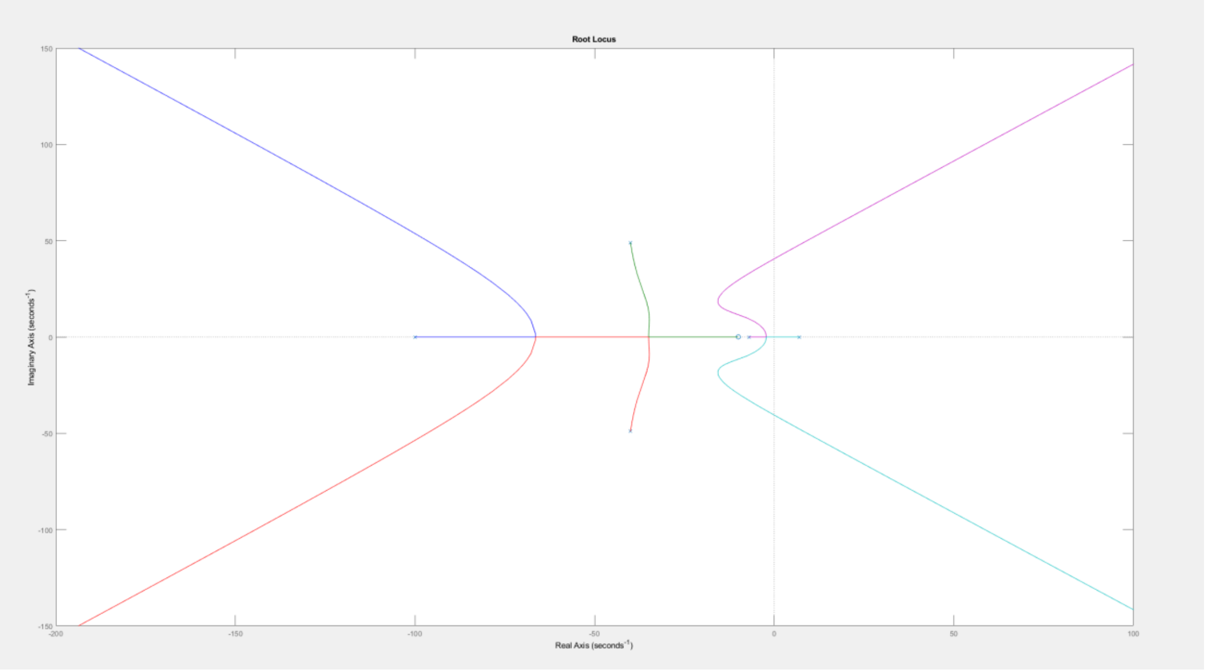
11.) It produces a stable response apart from between -11.1 and -7, also beyond 7 and below -111.



12.) there is no stable locus for small values of gain because the gain value is less than one.

3.4

13.)

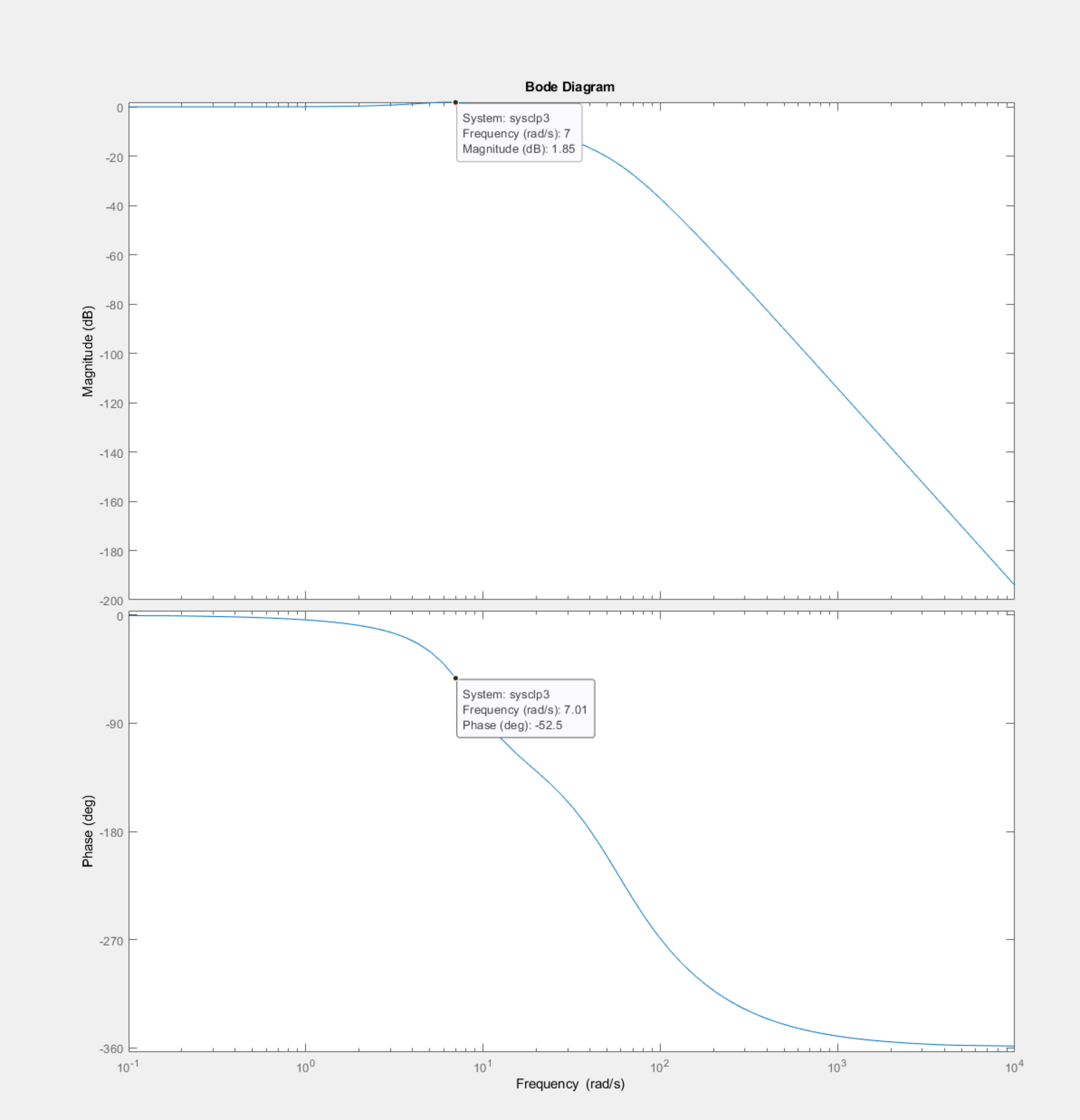


-100 to

3.5

14.) A stable gain for k is 1.85 db as this is the largest gain margin.

An estimation for gain margin is 1.85 and -52.5 degrees for phase margin.



15.) after moving the weight down the rod it was metastable, meaning it was stable however it was very violent in its oscillations and was working very hard to keep the inverted pendulum up right.

16.) Same as question 15 however it wasn't as violent and was able to maintain the oscillation better.

17.) 1.1 is when it becomes stable and has a "good" response.

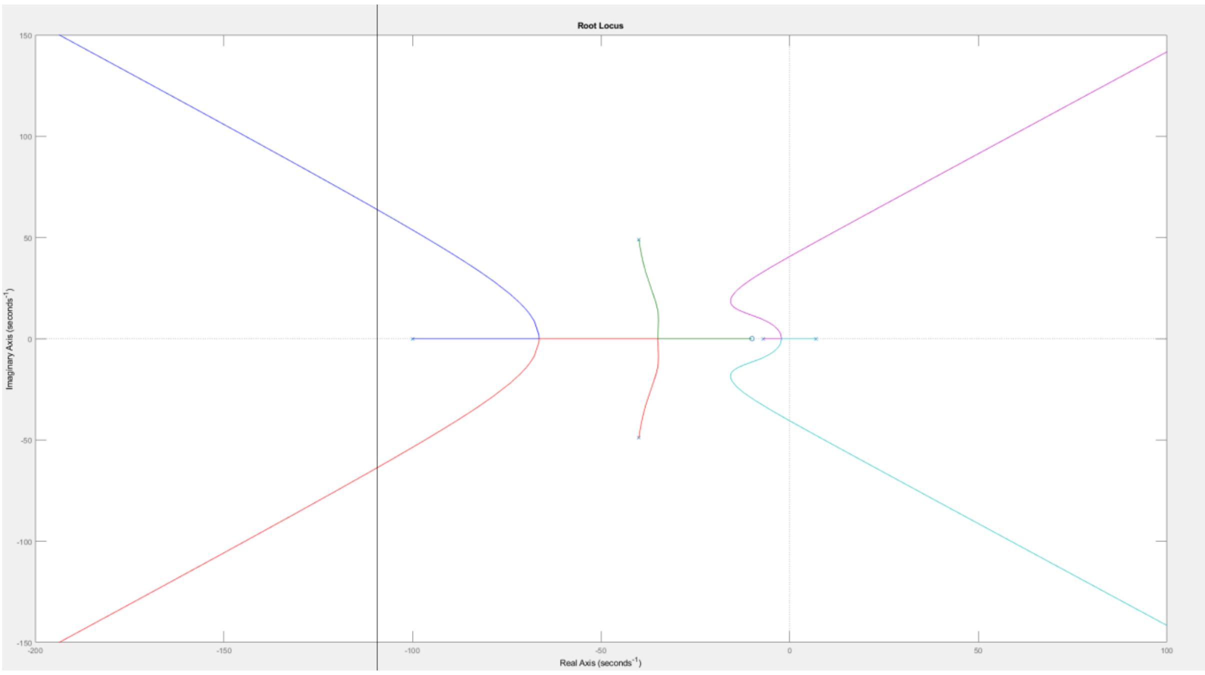
18.) it takes far to long to respond so it doesn't work appropriately however if given the distance I believe it could work appropriately.

Section 4

19.)/20.)

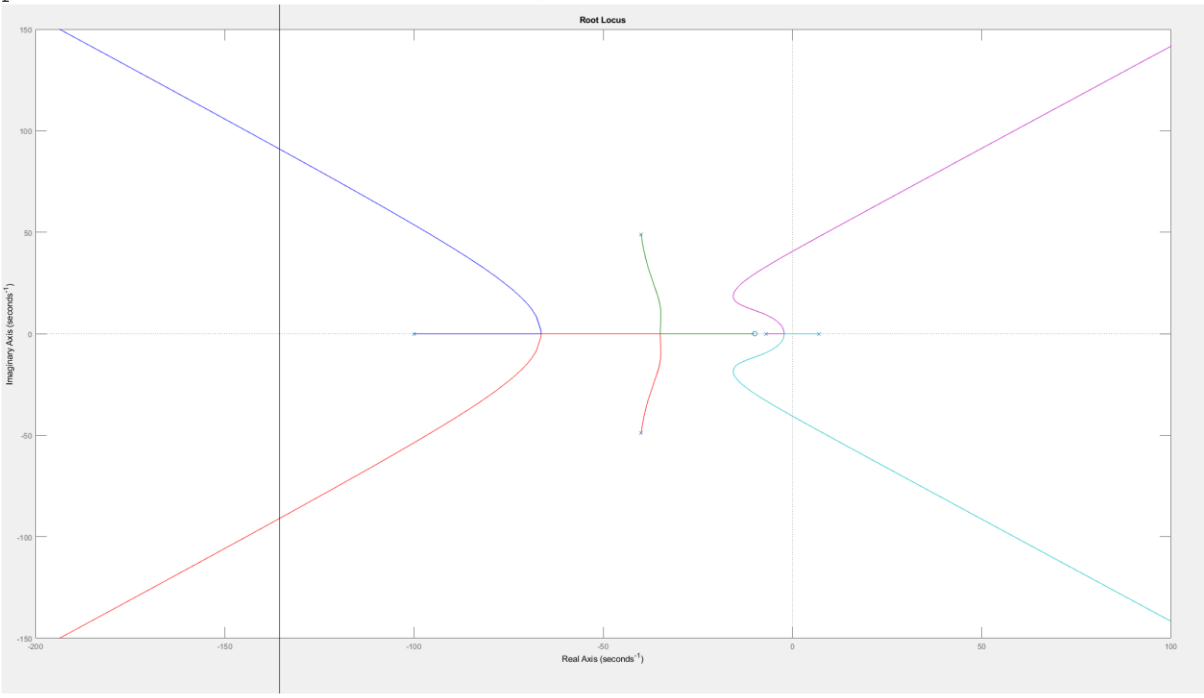
This is for question 15. L=0.1

```
pendulumTwo = -(9.81/0.01)/(s^2-(9.81/0.01));
```



This is for question 16. As the centre of mass is slightly above the base I made it very small to compensate, around 1cm.

```
pendulumOne = -(9.81/0.001)/(s^2-(9.81/0.001));
```



21.)