ME EN 6200
Homework 5
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Problem 1

```
(stable) a roots:
  -1.6478 + 1.7214i
  -1.6478 - 1.7214i
  -0.7044 + 0.0000i

(unstable) b roots:
  -4.3981 + 0.0000i
   1.1991 + 1.7634i
   1.1991 - 1.7634i

(unstable) c roots:
   0.9237 + 2.1353i
   0.9237 - 2.1353i
  -1.8474 + 0.0000i
  -1.0000 + 0.0000i

(marginally stable) d roots:
  -1.0000 + 3.0000i
  -1.0000 - 3.0000i
   0.0000 + 1.0000i
   0.0000 - 1.0000i
  -0.0000 + 1.0000i
  -0.0000 - 1.0000i
```

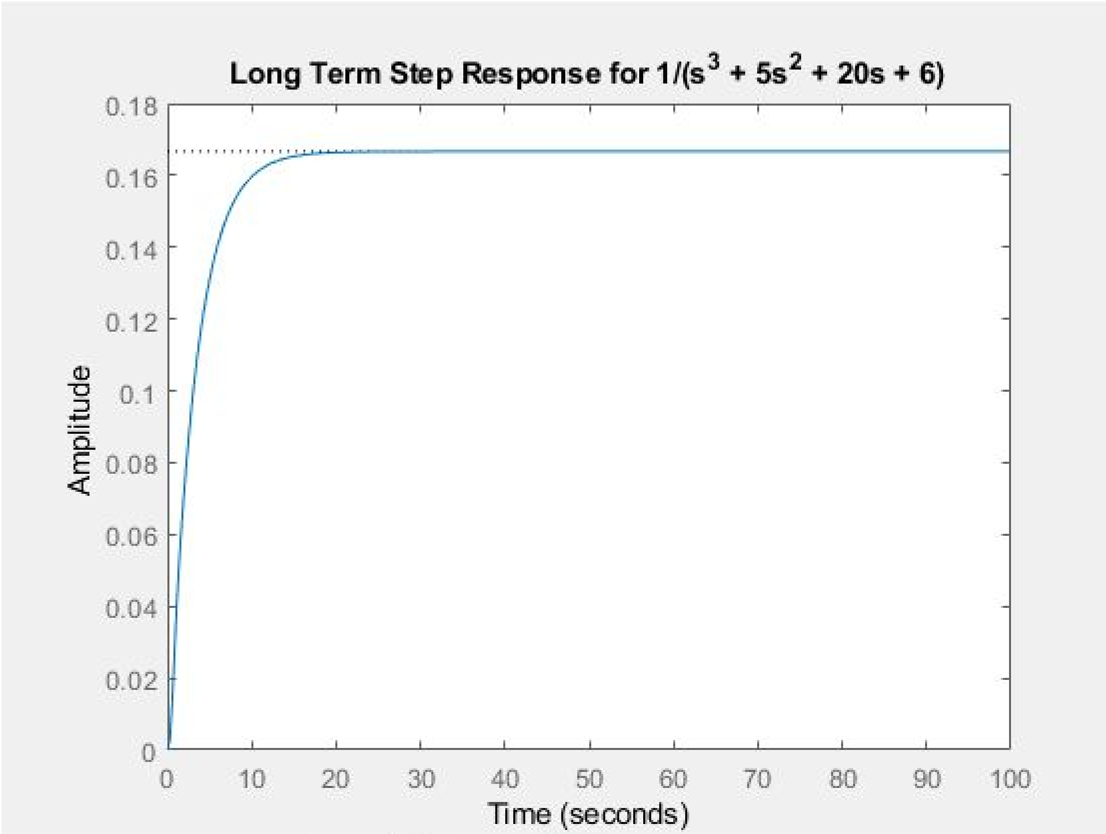
```
%% 1
% a
disp('(stable) a roots:');
disp(roots([1 4 8 4]));

% b
disp('(unstable) b roots:');
disp(roots([1 2 -6 20]));

% c
disp('(unstable) c roots:');
disp(roots([1 1 2 12 10]));

% d
disp('(marginally stable) d roots:');
disp(roots([1 2 12 4 21 2 10]));
```

Problem 4




```
%% 4
T = tf(1,[1 5 20 6]);
tFinal = 100; %s Will see long term step response
figure;
step(T, tFinal);
title('Long Term Step Response for 1/(s^3 + 5s^2 + 20s + 6)');
```

b) Looking at the step response of this closed loop feedback transfer function we can see a stable response where as time increases the amplitude of the response approaches a steady value. This is the behavior of a response which is stable and does not grow unbounded as time approaches infinity. This is directly in line with the results from the Routh–Hurwitz stability criterion which showed there were no sign changes in the first column of the completed Routh table. This implies that the system has no poles in the open right hand plane thus it is at least marginally stable. Thus this system is a stable system.