# Root locus diagram

```
clc;
a = [36];
b = [1 6 11 6]
sys = tf(a,b)
figure(1)
rlocus(sys)
grid;
title('root locus of 36/(s^3+6s^2+11s+6)')
```

## Addition of pole at -1

```
a1 = [36];
b1 = [1 7 17 17 6];
sys1 = tf(a,b)
figure(2)
rlocus(sys1)
grid;
title('root locus of 36/(s^3+6s^2+11s+6)(s+1)')
```

## Addition of pole at +1

```
a2 = [36];
b2 = [1 5 5 -5 -6];
sys2 = tf(a2,b2)
figure(3)
rlocus(sys2)
grid;
title('root locus of 36/(s^3+6s^2+11s+6)(s-1)')
```

## Addition of zero at -1

```
a3 = [36 36];
b3 = [1 6 11 6];
sys3 = tf(a3,b3)
figure(4)
rlocus(sys3)
grid;
title('root locus of 36(s+1)/(s^3+6s^2+11s+6)')
```

## Addition of zero at +1

```
a4 = [36 -36];
b4 = [1 6 11 6];
sys4 = tf(a4,b4)
figure(5)
rlocus(sys4)
grid;
title('root locus of 36(s-1)/(s^3+6s^2+11s+6)')
```

# Nyquist plot

```
a5 = [1];
b5 = [1 3 2 0];
sys5=tf(a5,b5)
figure(6);
nyquist(sys5);
title('Nyquist plot for 1/(s(s+1)(s+2))')
```

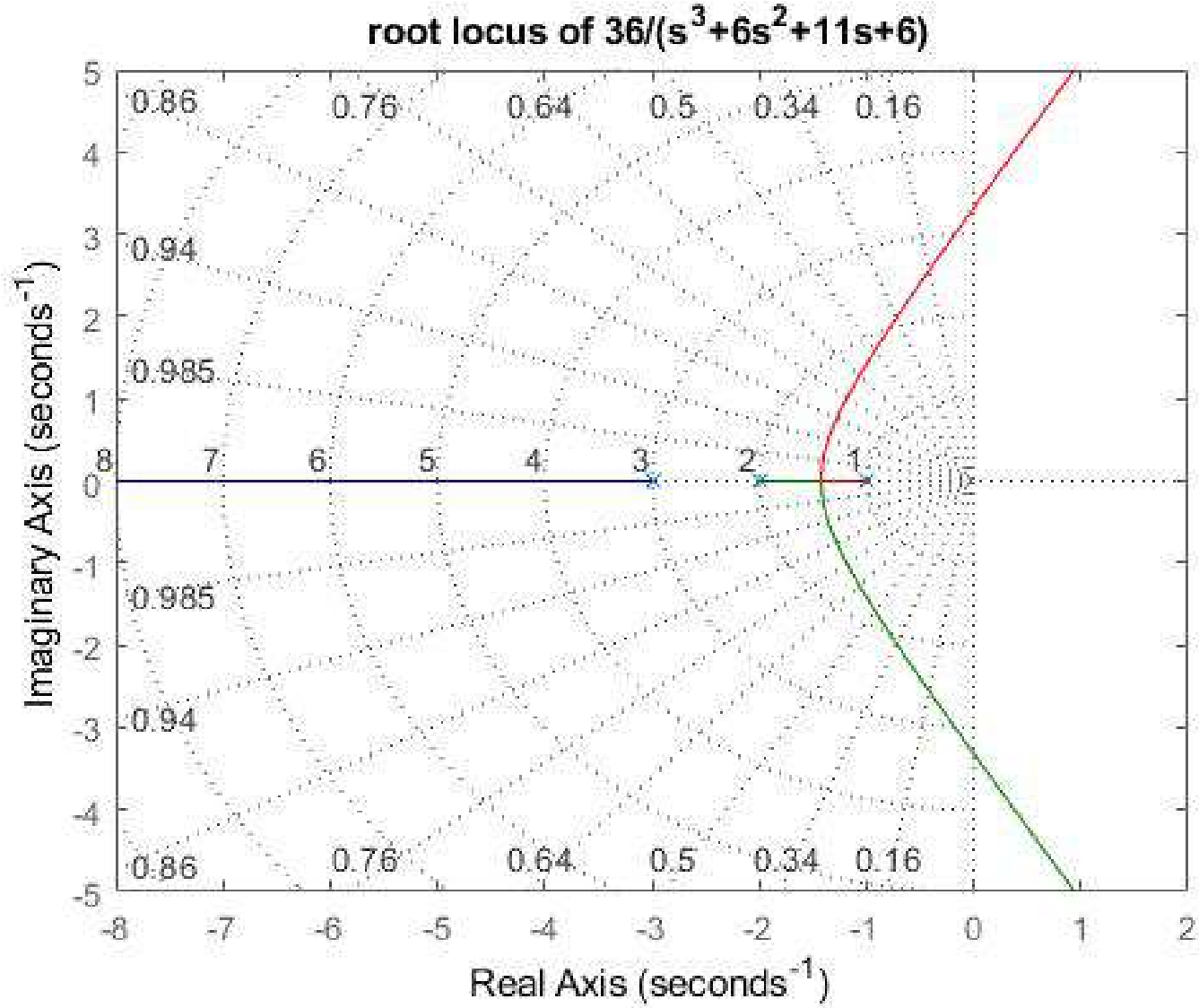
## Bode plots

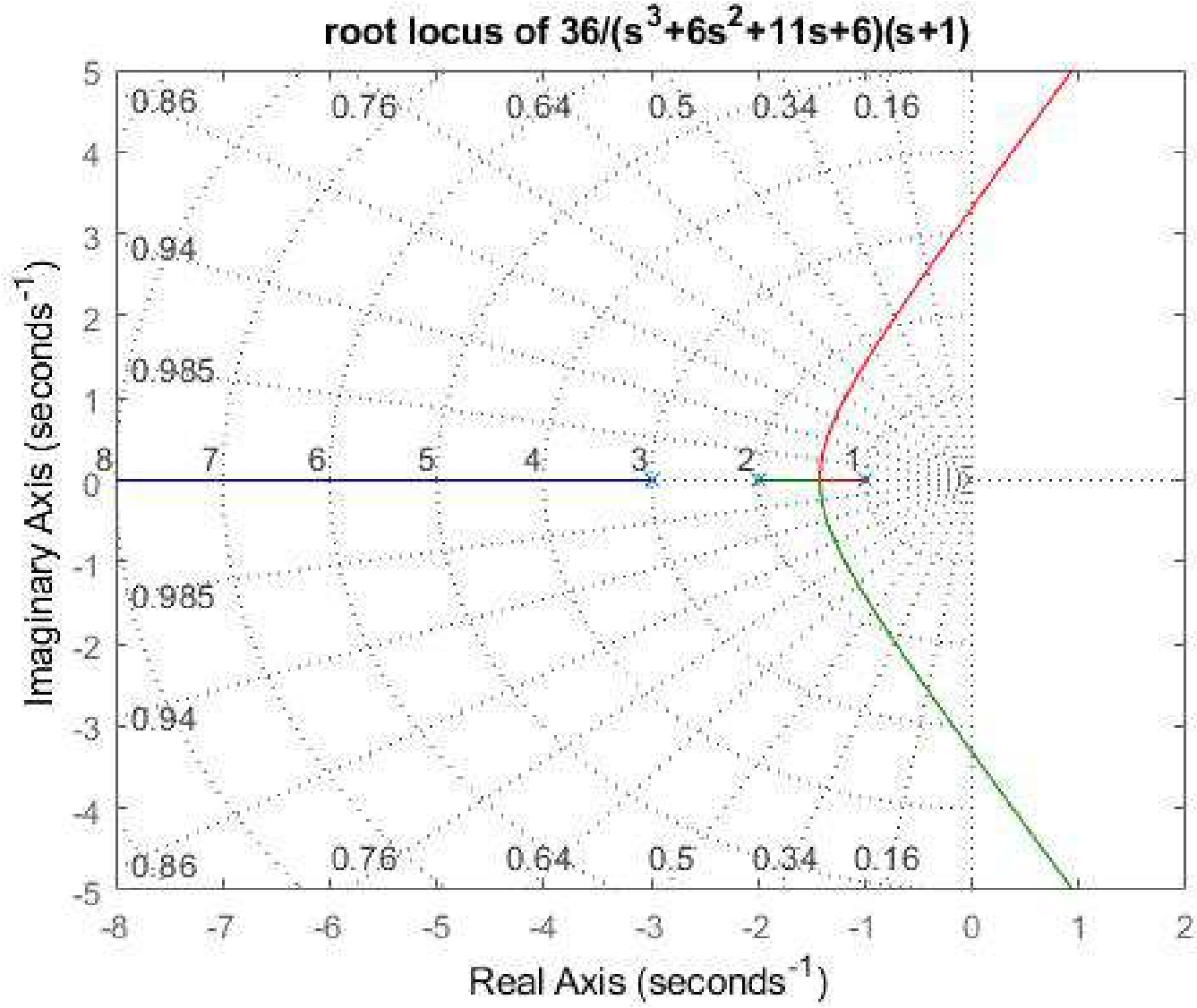
## Bode plot for transfer function 10/s(1+0.4s)(1+0.1s)

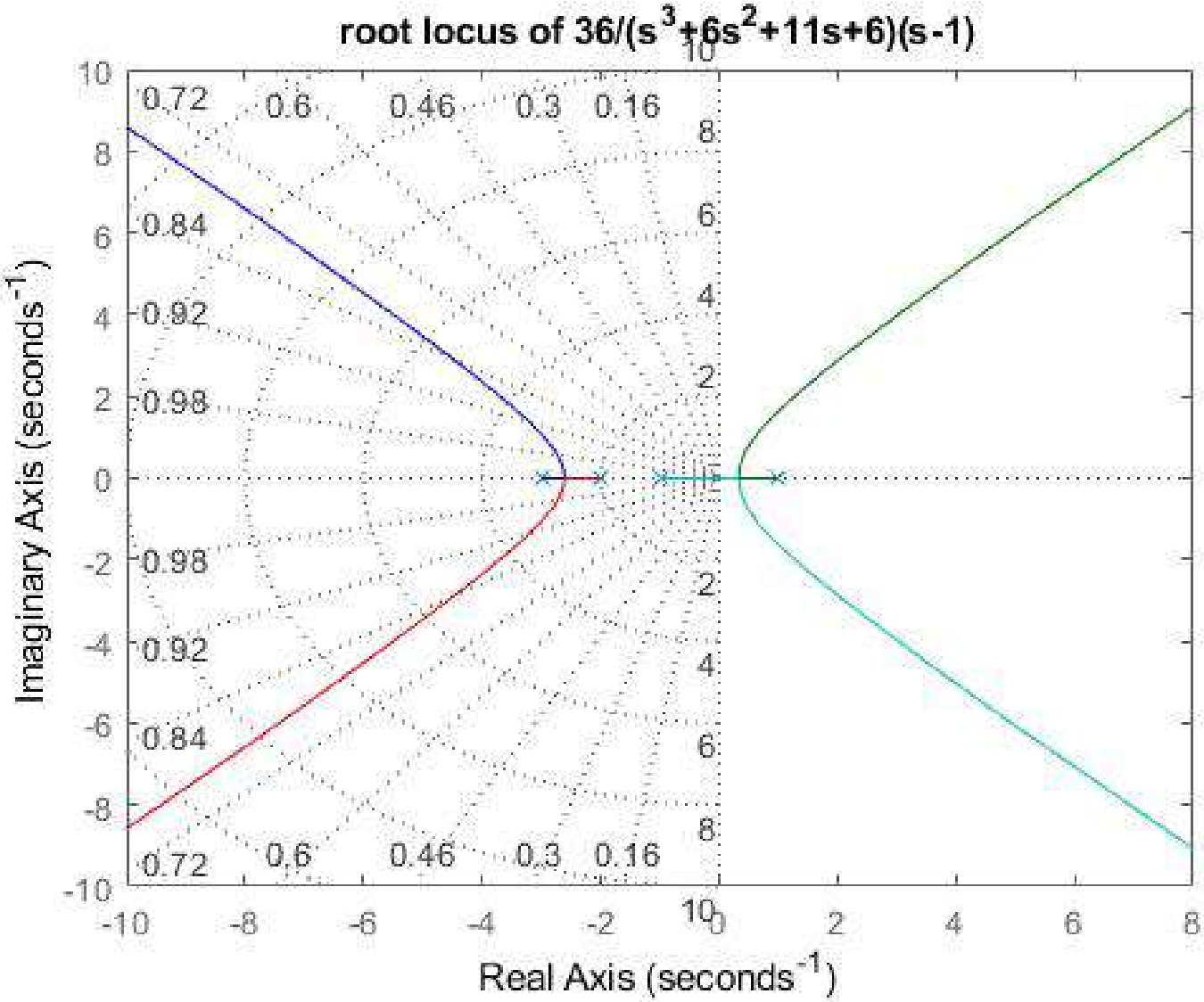
```
a6 = [10];
b6 = [0.04 0.5 1 0];
sys6 = tf(a6,b6)
figure(7);
bode(sys6);
margin(sys6);
title('Bode plot for 10/s(1+0.4s)(1+0.1s)')
```

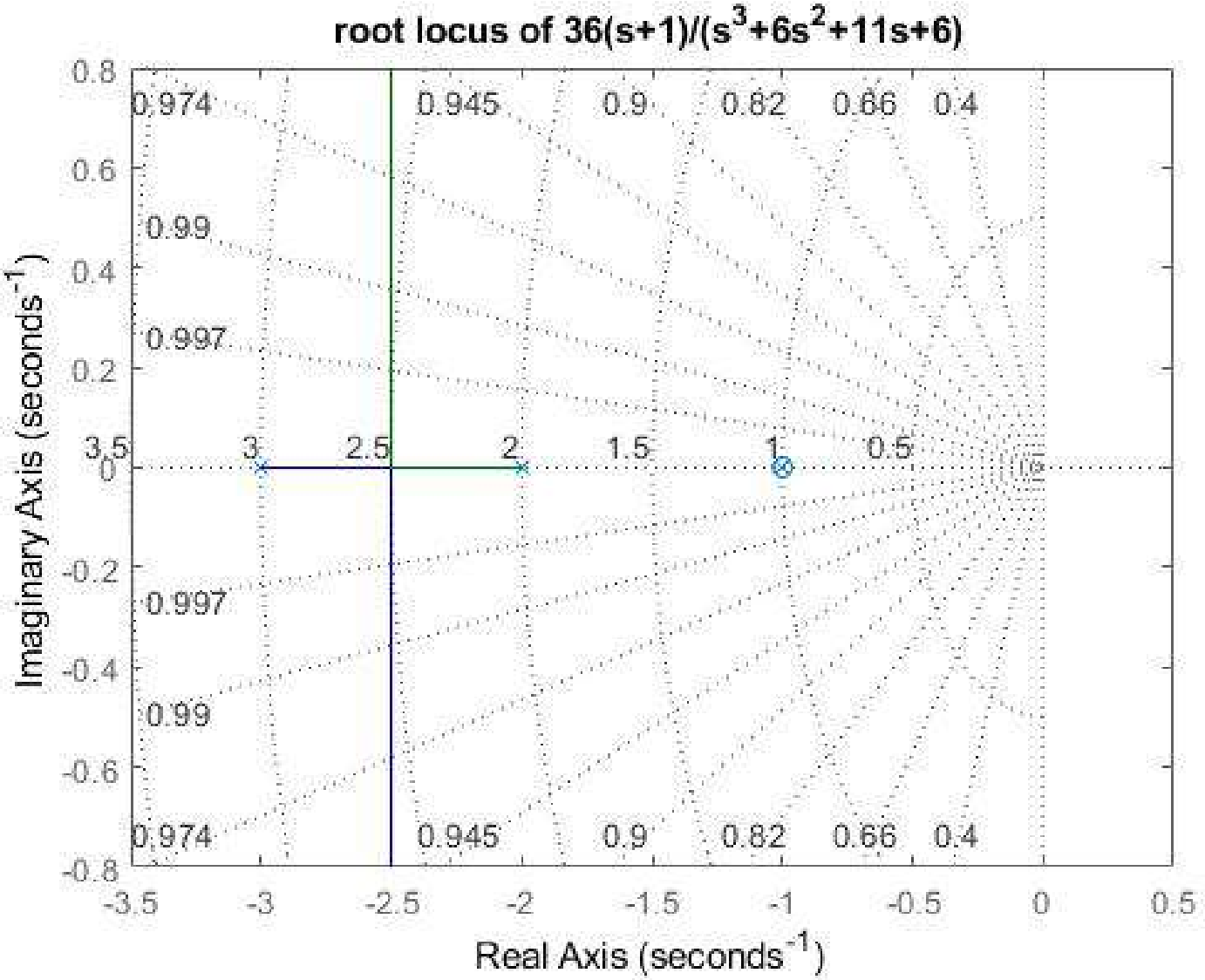
## Bode plot for transfer function 36/(s^3+6s^2+11s+6)

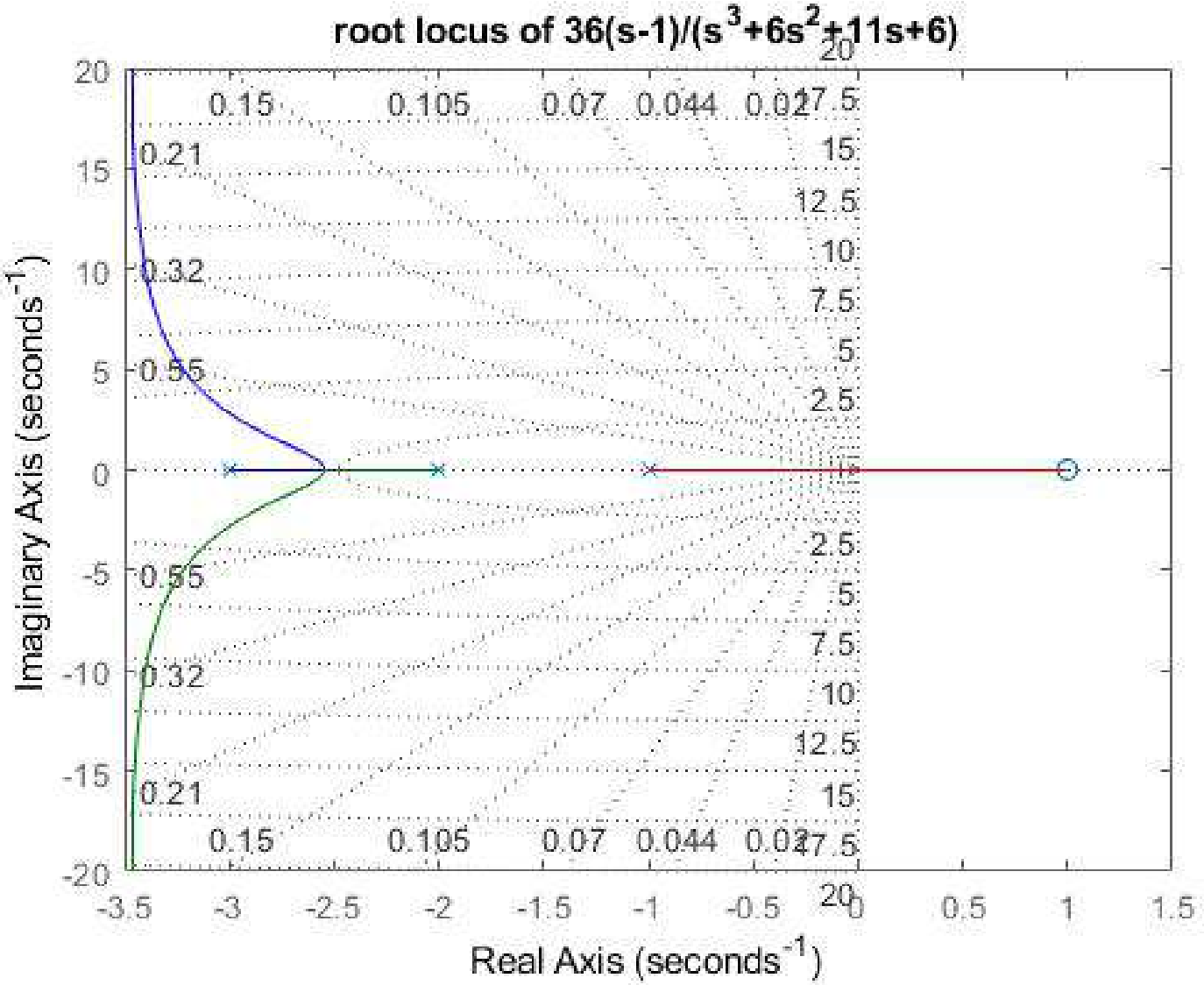
```
a7 = [36];
b7 = [1 6 11 6];
sys7 = tf(a7,b7)
figure(8);
bode(sys7);
margin(sys7);
title('Bode plot for 36/(s^3+6s^2+11s+6)')
```

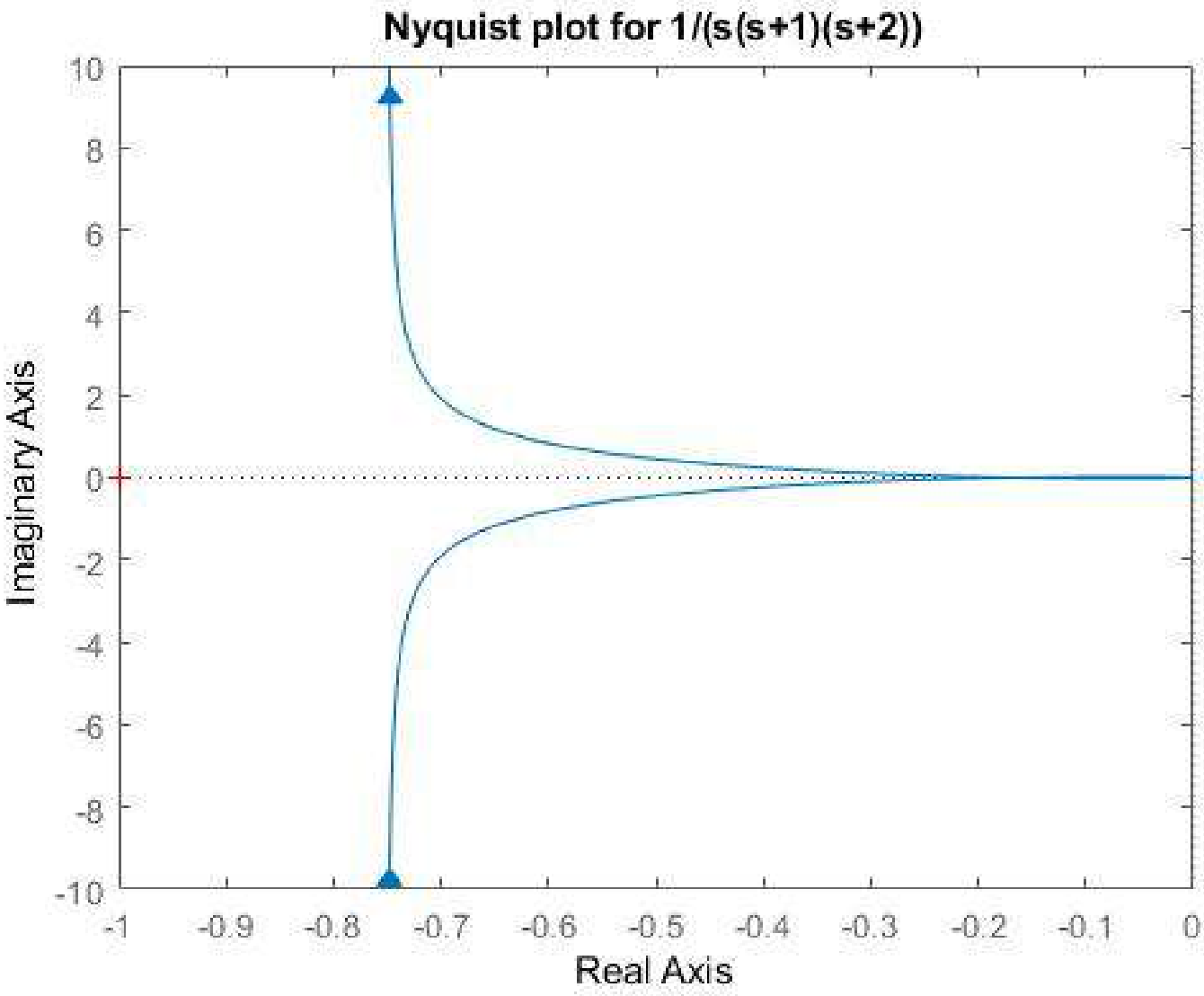

root locus of 36/(s^3+6s^2+11s+6)
0.86
0.76
0.64
0.5
0.34
0.16
0.94
0.985
0.985
0.94
0.86
0.76
0.64
0.5
0.34
0.16
8
7
6
5
4
3
2
1
Imaginary Axis (seconds^-1)
Real Axis (seconds^-1)
5
4
3
2
1
0
-1
-2
-3
-4
-5
-8
-7
-6
-5
-4
-3
-2
-1
0
1
2

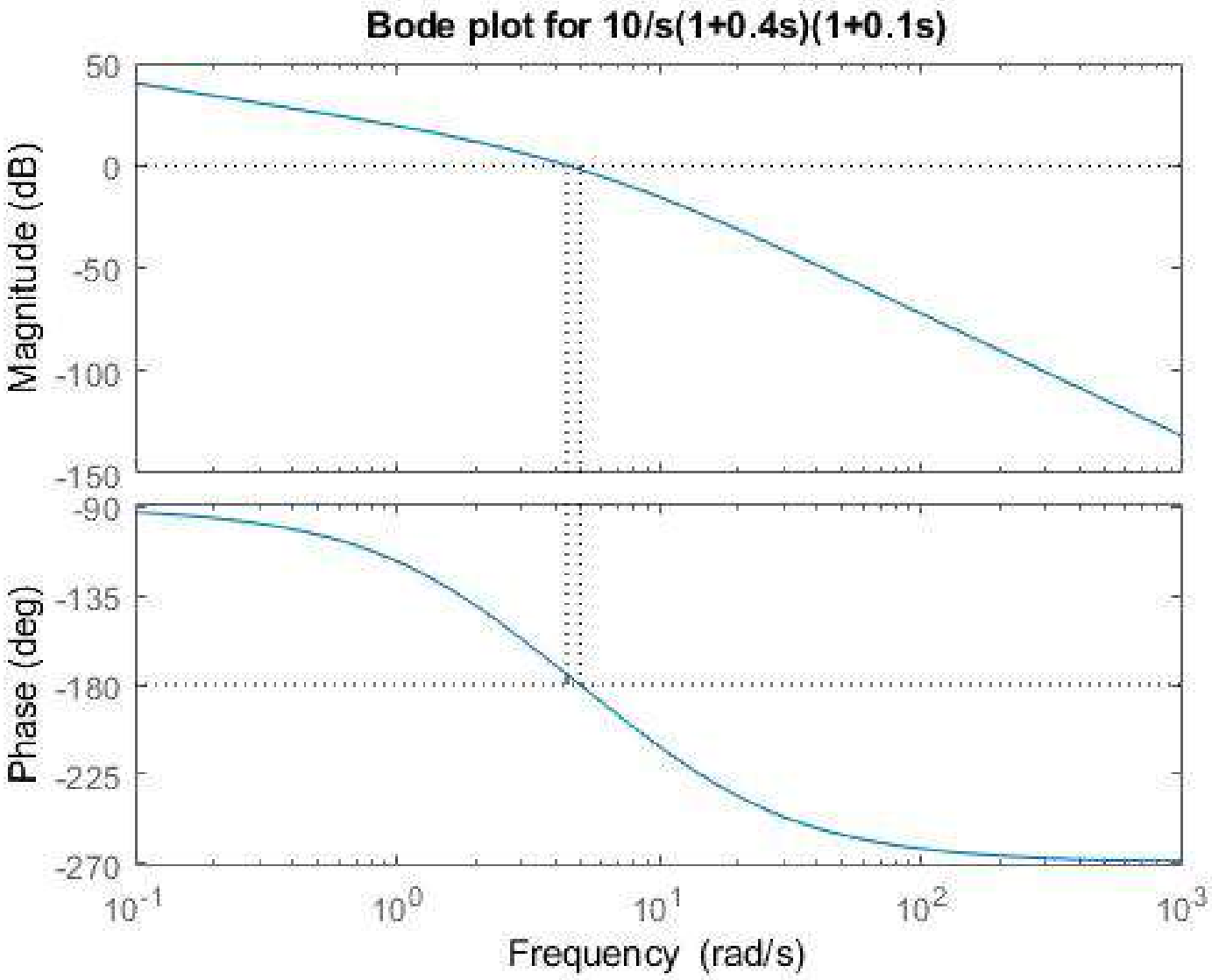

root locus of 36/(s^3+6s^2+11s+6)(s+1)
0.86
0.76
0.64
0.5
0.34
0.16
0.94
0.985
0.985
0.94
0.86
0.76
0.64
0.5
0.34
0.16
8
7
6
5
4
3
2
1
Imaginary Axis (seconds^-1)
Real Axis (seconds^-1)
5
4
3
2
1
0
-1
-2
-3
-4
-5
-8
-7
-6
-5
-4
-3
-2
-1
0
1
2

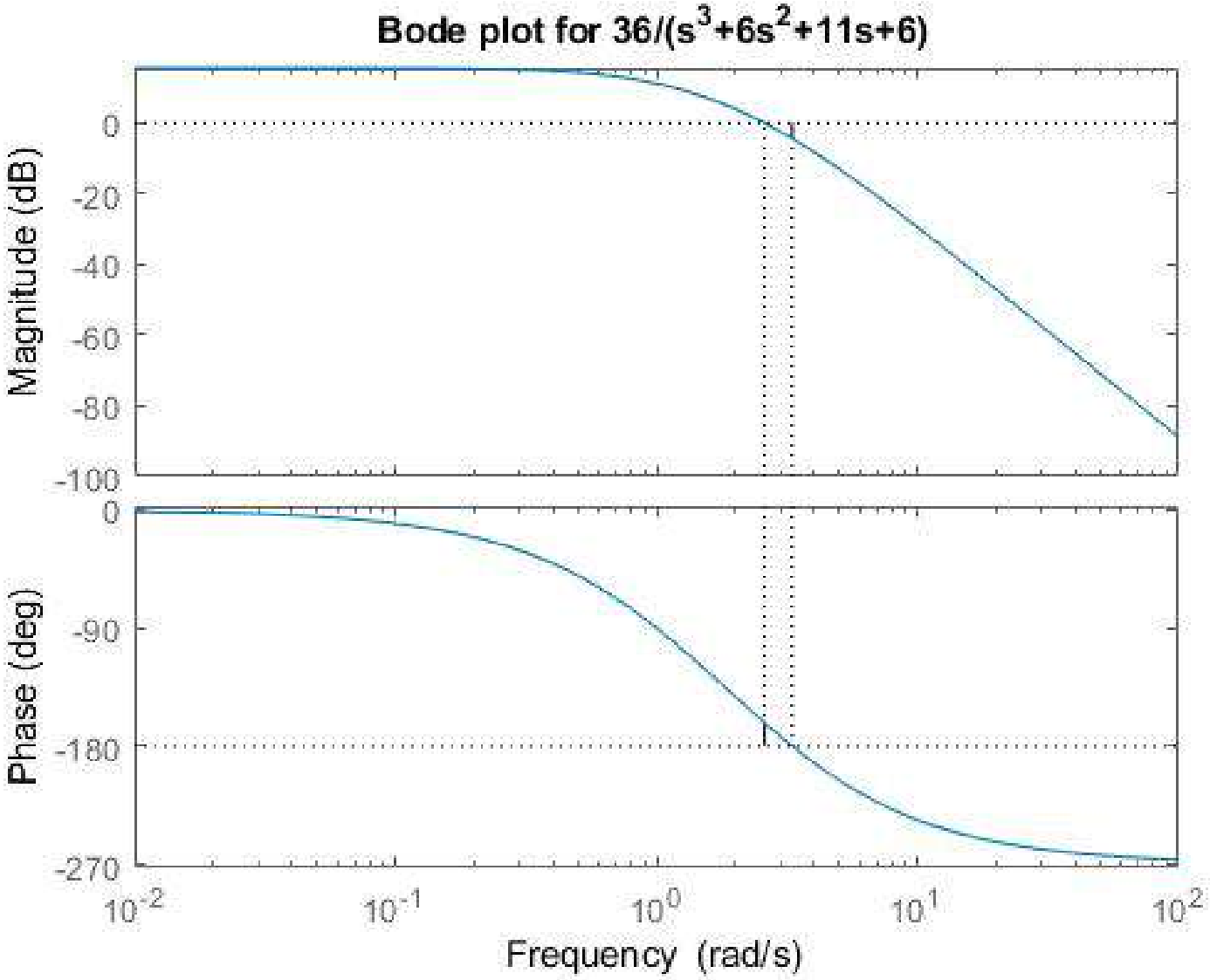

root locus of 36/(s^3+6s^2+11s+6)(s-1)
Imaginary Axis (seconds^-1)
Real Axis (seconds^-1)
0.72
0.6
0.46
0.3
0.16
0.84
0.92
0.98
0.98
0.92
0.84
0.72
0.6
0.46
0.3
0.16
10
8
6
4
2
0
-2
-4
-6
-8
-10
-10
-8
-6
-4
-2
0
2
4
6
8
10


root locus of 36(s+1)/(s^3+6s^2+11s+6)
Imaginary Axis (seconds^-1)
Real Axis (seconds^-1)
0.974
0.945
0.9
0.82
0.66
0.4
0.99
0.997
3.5
3
2.5
2
1.5
1
0.5
0
0.8
0.6
0.4
0.2
-0.2
-0.4
-0.6
-0.8
-3.5
-3
-2.5
-2
-1.5
-1
-0.5
0
0.5


root locus of 36(s-1)/(s^3+6s^2+11s+6)
Imaginary Axis (seconds^-1)
Real Axis (seconds^-1)
0.15
0.105
0.07
0.044
0.021
0.21
0.32
0.55
0.55
0.32
0.21
0.15
0.105
0.07
0.044
0.021
20
15
12.5
10
7.5
5
2.5
1
2.5
5
7.5
10
12.5
15
17.5
20
-3.5
-3
-2.5
-2
-1.5
-1
-0.5
0
0.5
1
1.5
20
15
10
5
0
-5
-10
-15
-20


Nyquist plot for 1/(s(s+1)(s+2))
Imaginary Axis
Real Axis
10
8
6
4
2
0
-2
-4
-6
-8
-10
-1
-0.9
-0.8
-0.7
-0.6
-0.5
-0.4
-0.3
-0.2
-0.1
0


Bode plot for 10/s(1+0.4s)(1+0.1s)
Magnitude (dB)
50
0
-50
-100
-150
Phase (deg)
-90
-135
-180
-225
-270
10^-1
10^0
10^1
10^2
10^3
Frequency (rad/s)


Bode plot for 36/(s^3+6s^2+11s+6)
Magnitude (dB)
0
-20
-40
-60
-80
-100
Phase (deg)
0
-90
-180
-270
10^-2
10^-1
10^0
10^1
10^2
Frequency (rad/s)