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Student ID

```
ID = 316098052;  
disp(ID)
```

316098052

1 Sketch a Bode plot

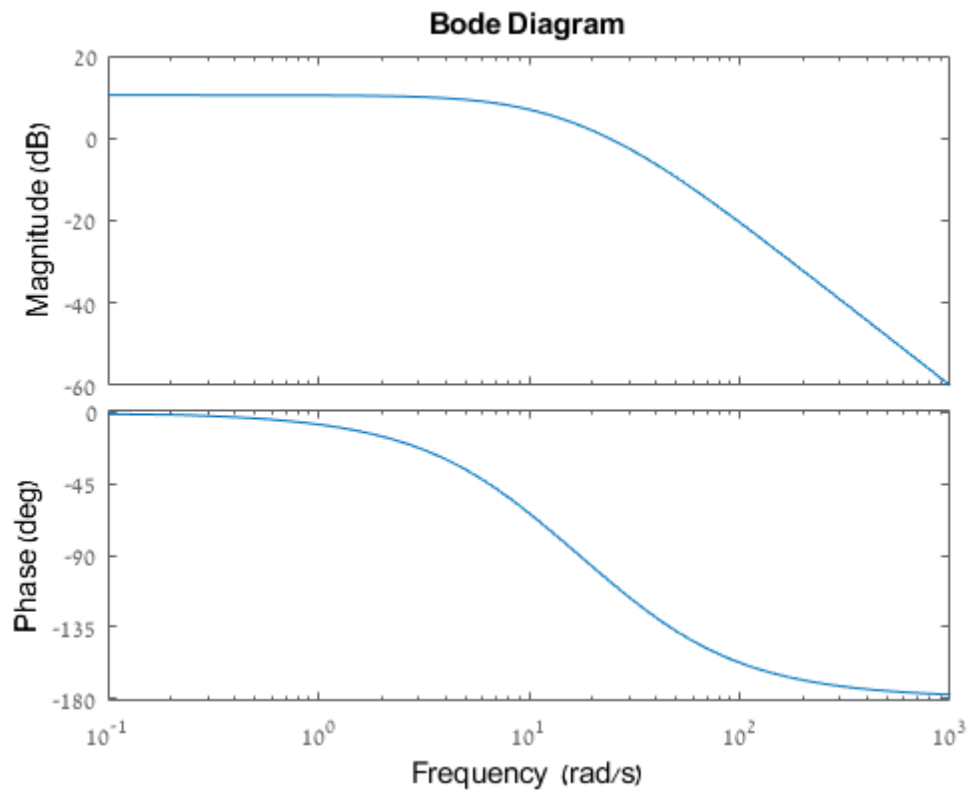
The crossover frequency is the frequency in which the equation satisfy:

$$20\log_{10}|G(jw)| = 0dB$$

```
G_0 = tf([0 0 1000],[1 40 300]);  
bode(G_0)  
cross_freq = allmargin(G_0);  
cross_freq.PMFrequency
```

ans =

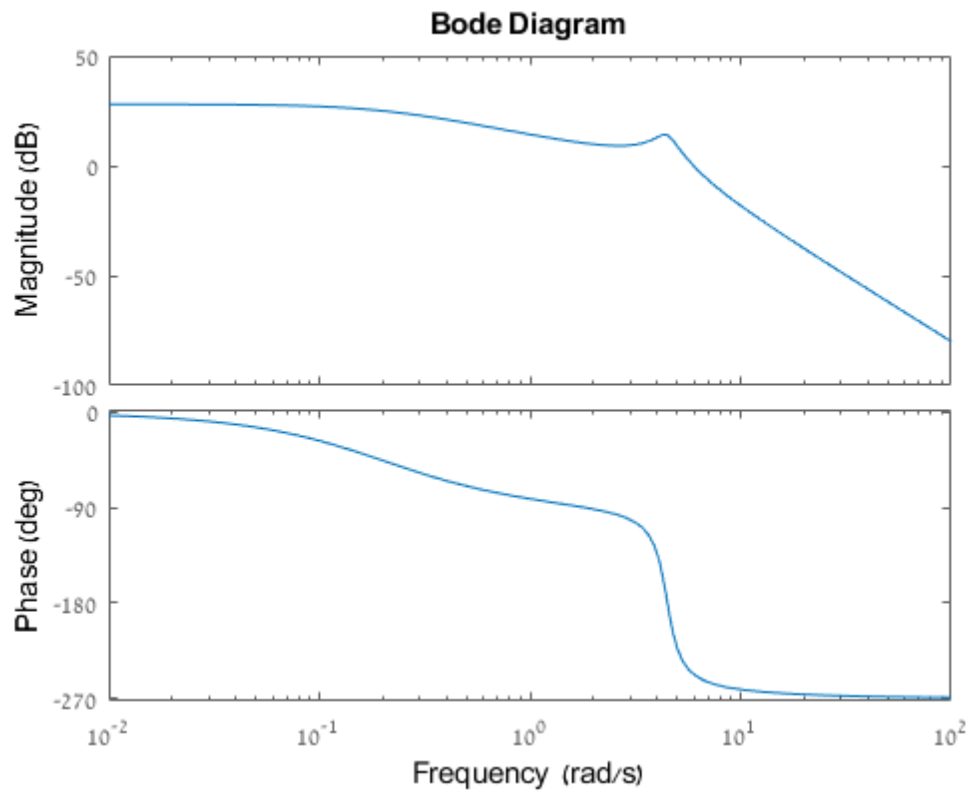
24.0214



```
G_1 = tf([0 0 100],[1 1.2 20.2 4]);  
bode(G_1)  
cross_freq = allmargin(G_1);  
cross_freq.PMFrequency
```

ans =

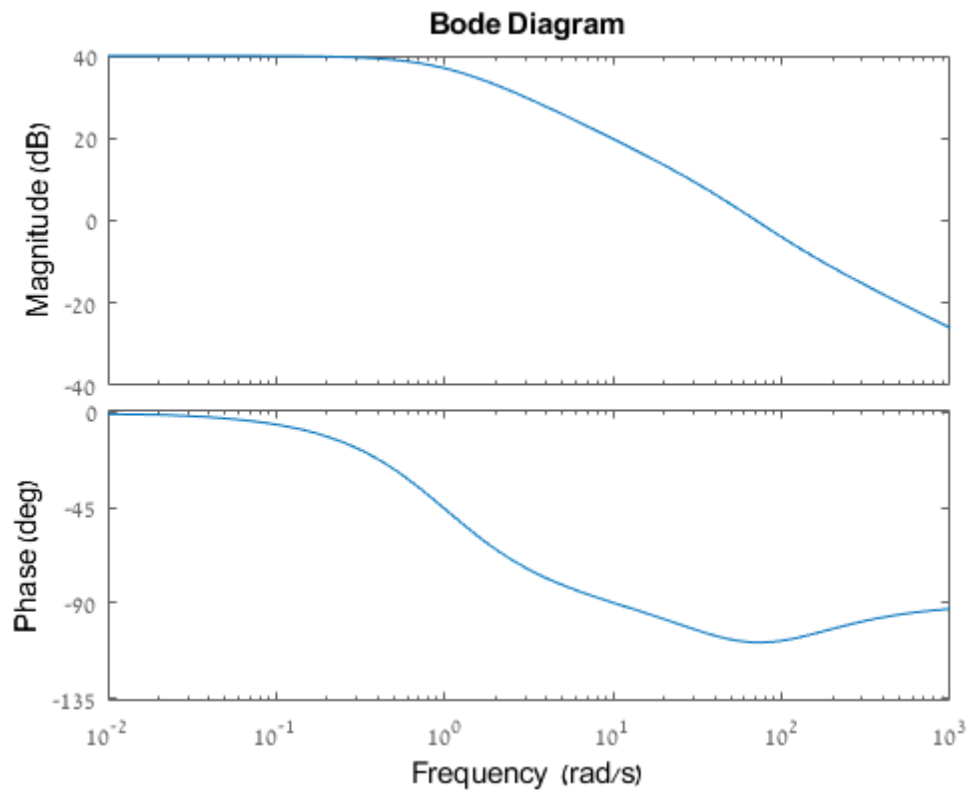
5.9700



```
G_2 = tf([0 50 5000],[1 51 50]);  
bode(G_2)  
cross_freq = allmargin(G_2);  
cross_freq.PMFrequency
```

ans =

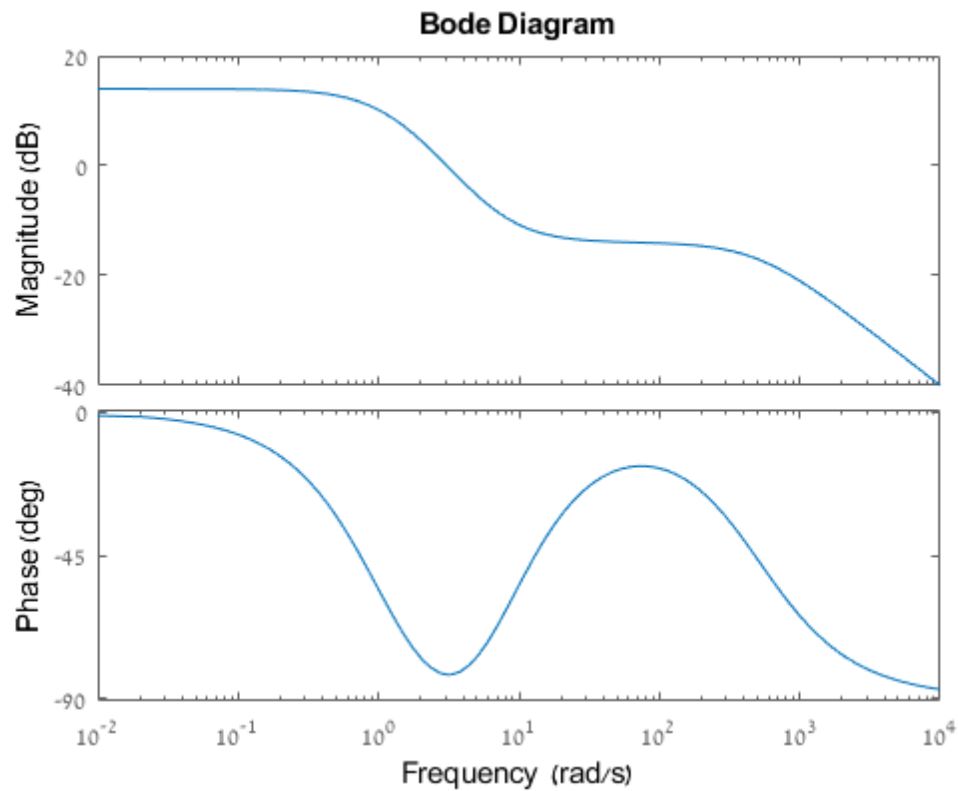
70.7054



```
G_3 = tf([100 1400 5000],[1 503 1502 1000]);  
bode(G_3)  
cross_freq = allmargin(G_3);  
cross_freq.PMFrequency
```

ans =

3.0682



2 Space robot

1. The Bode diagram of the system:

$$G_c G(s) = \frac{781(s + 10)}{s^2 + 22s + 484}$$

```
G_c = tf([0 781 7810],[1 22 484]);
bode(G_c)
[mag,phase,wout] = bode(G_c);
[M,I] = max(mag);
max_mag = M
freq_at_max_mag = wout(I)
phase_at_max_mag = phase(I)
```

max_mag =

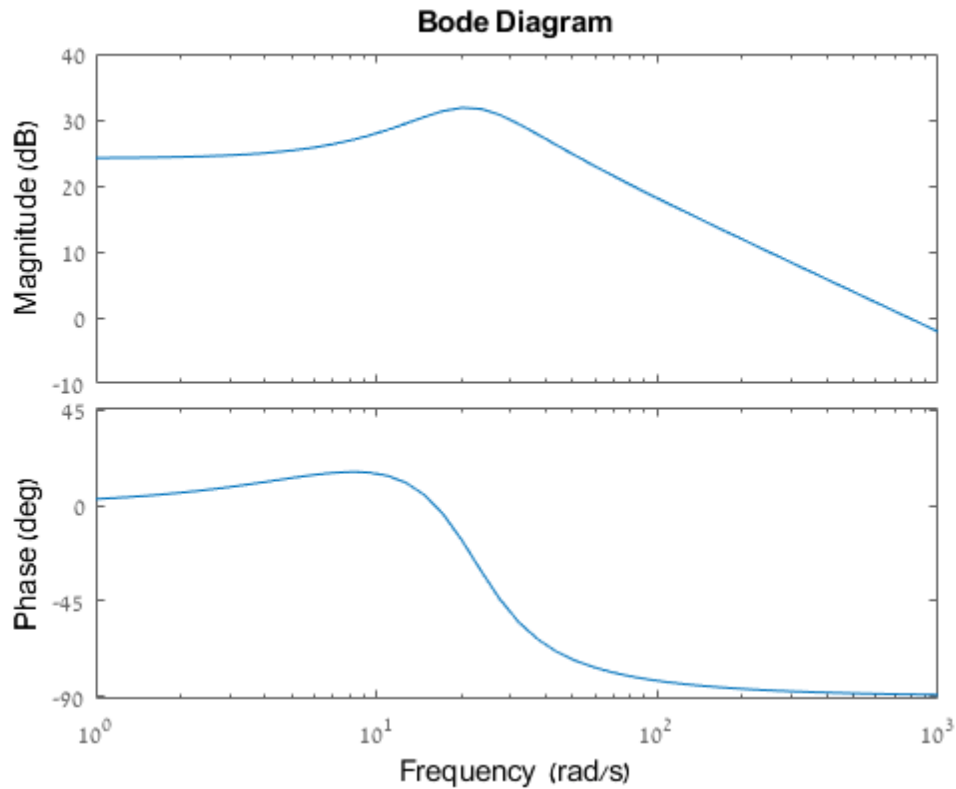
39.0387

freq_at_max_mag =

20.1742

phase_at_max_mag =

-16.5243



3 Closed loop system

1. Velocity error coefficient:

The steady state of ramp input is:

$$e(\infty) = \frac{1}{\lim_{s \rightarrow 0} s G_C G(s)} = \frac{4}{K}$$

$$\frac{4}{K} = \frac{1}{K_v}$$

Therefore the required K is:

$$K = 40$$

2. Bode plot of the open-loop system:

The transfer system is:

$$G_C G(s) = \frac{40s + 200}{s^4 + 12s^3 + 22s^2 + 20s}$$

```
G_c = tf([0 40 200],[1 12 22 20 0]);
bode(G_c)
cross_freq = allmargin(G_c);
cross_freq.PMFrequency
```

ans =

2.7733

