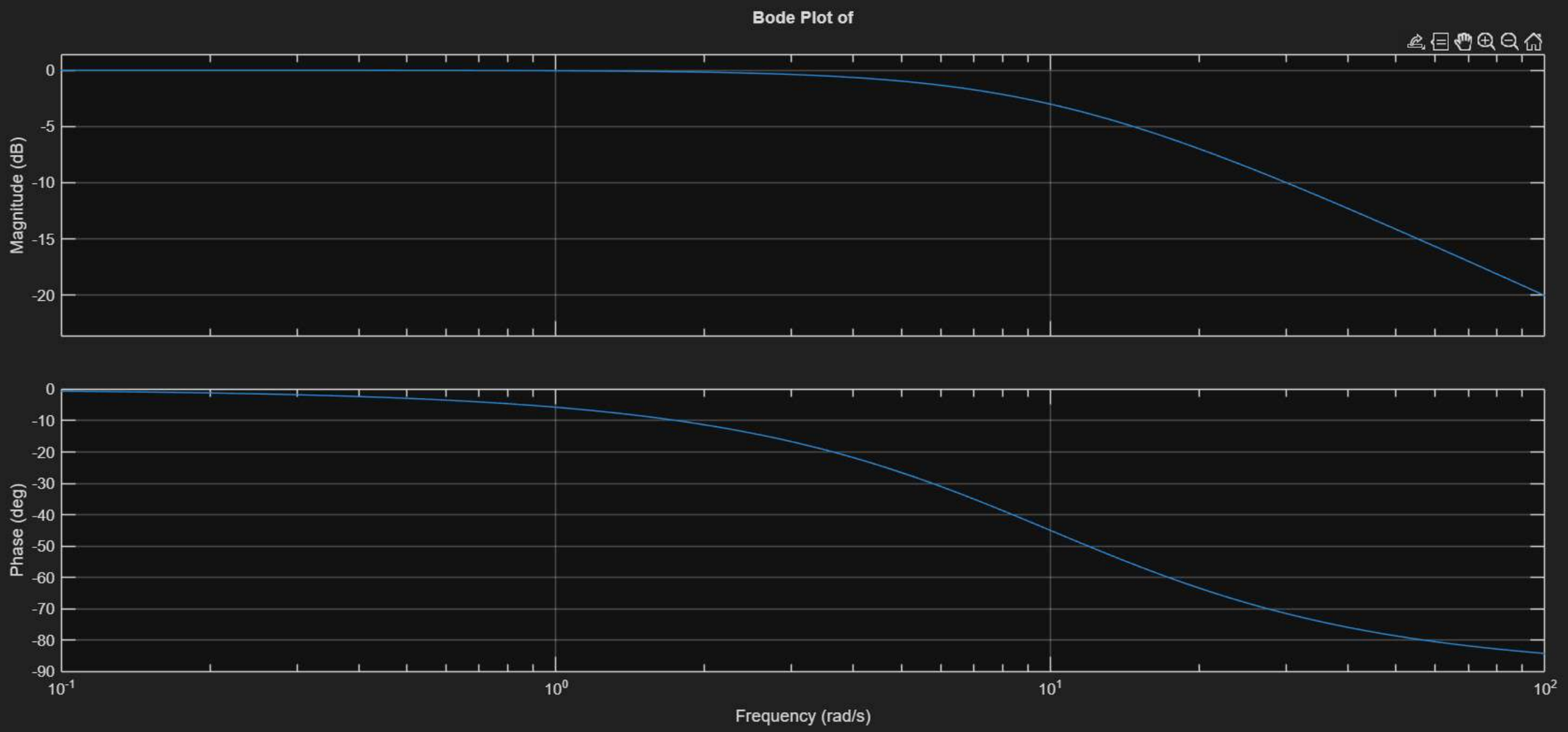

Bode Plot of
Magnitude (dB)
0
-5
-10
-15
-20
Phase (deg)
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (rad/s)

Assignment - 0

Problem A.1 $\frac{10}{s+10}$

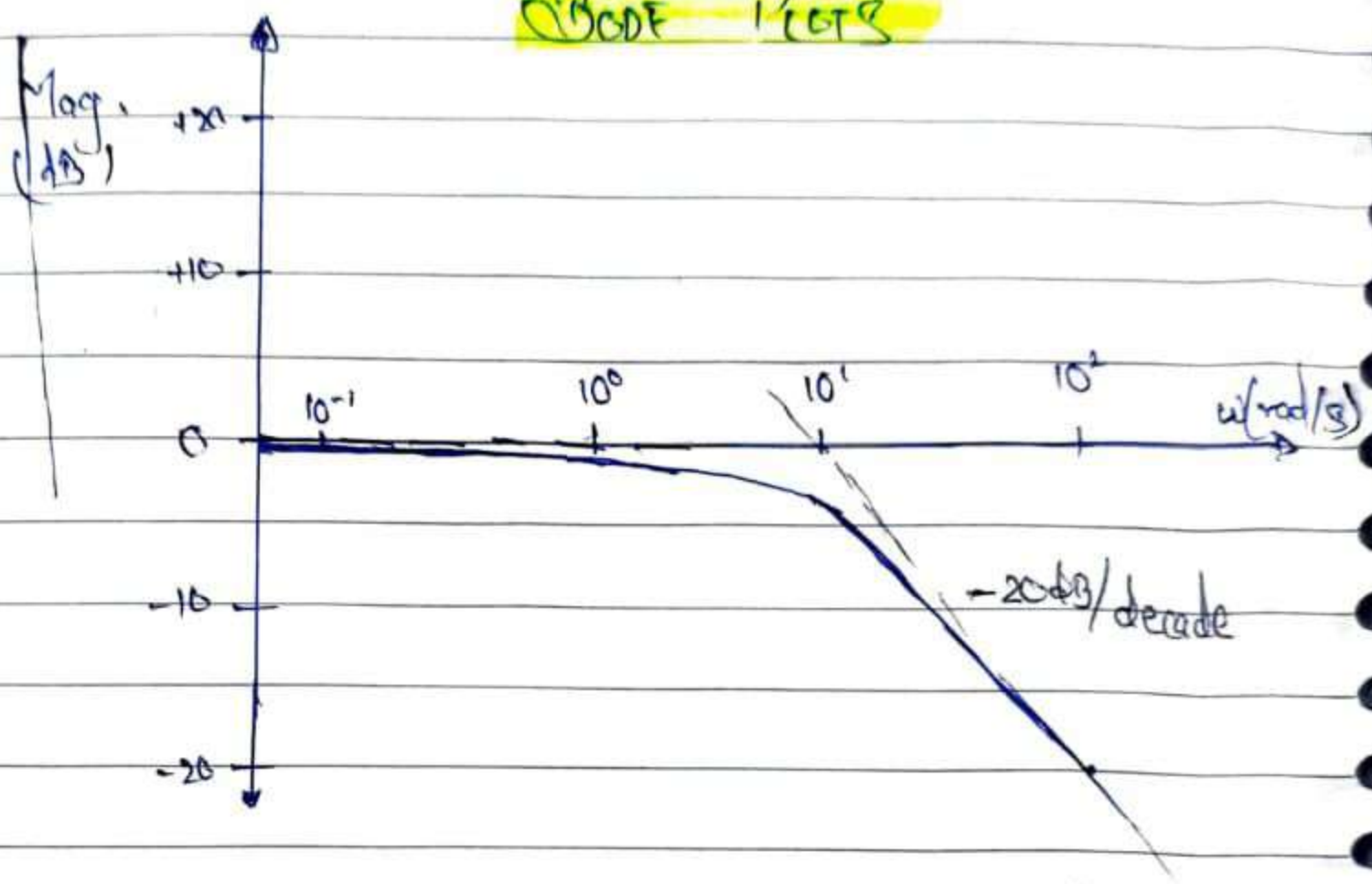
Poles $\Rightarrow -10 = s$

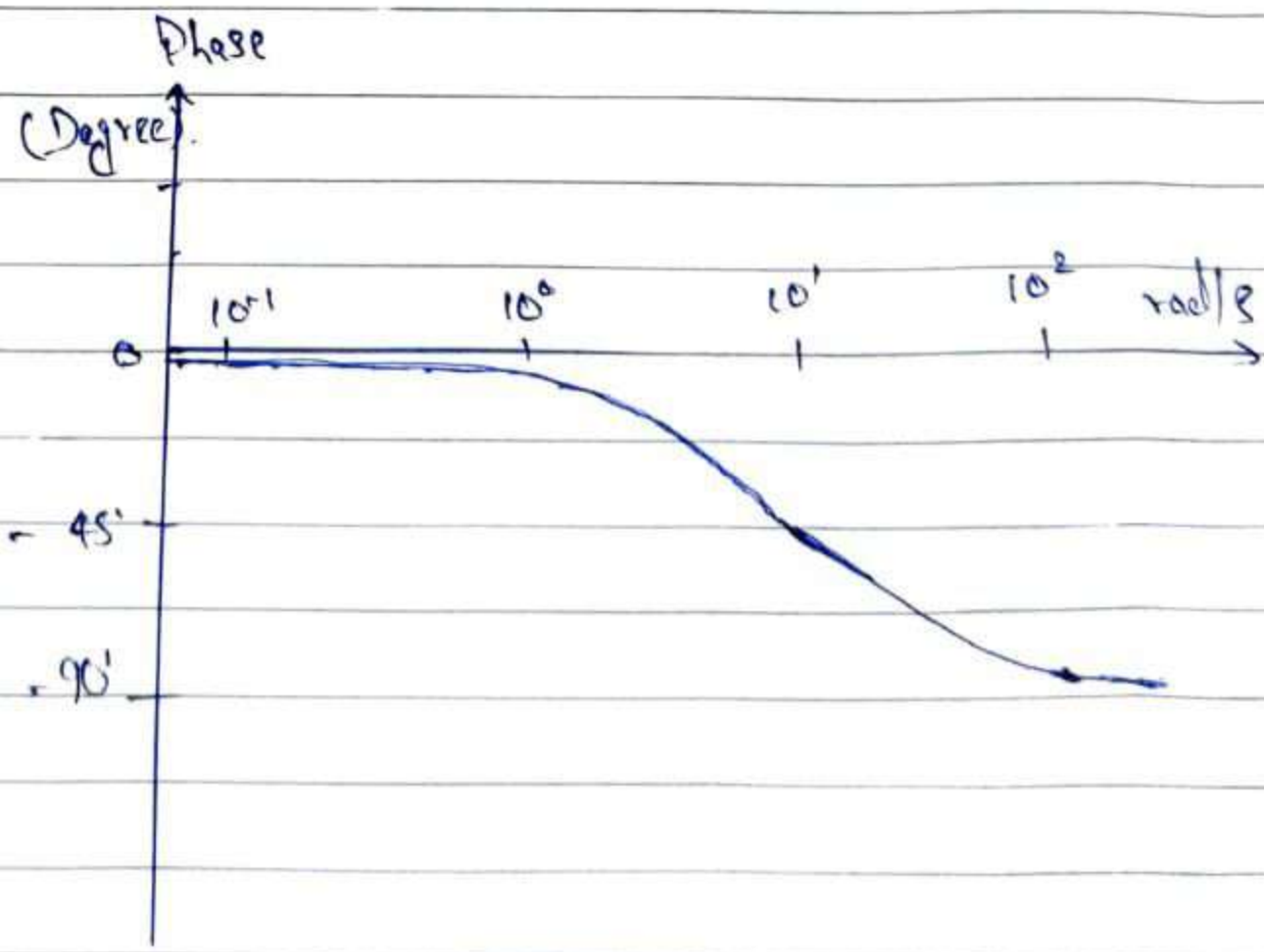
D.C. Gain or $G_1(0) = 1$

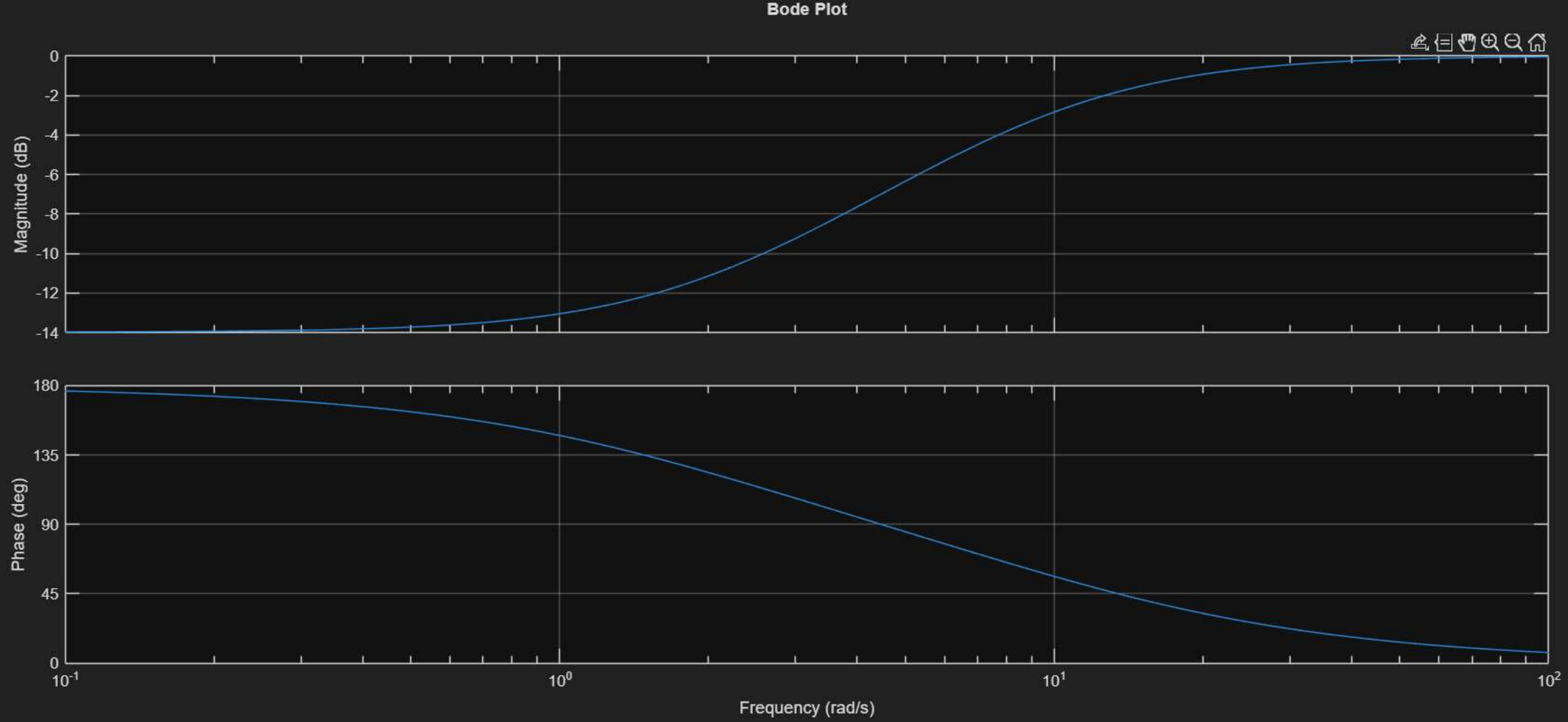
Abc,

Graph of format $\frac{1}{\left(\frac{s}{10}\right)+1}$.

BODE PLOTS






Bode Plot
Magnitude (dB)
0
-2
-4
-6
-8
-10
-12
-14
Phase (deg)
180
135
90
45
0
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (rad/s)

Problem A.2

$$G_2(s) = \frac{s-2}{s+10}$$

① Zero : $s = 2$

② Pole : $s = -10$

③ D.C. Gain $\Rightarrow \left(-\frac{1}{5}\right) = k$

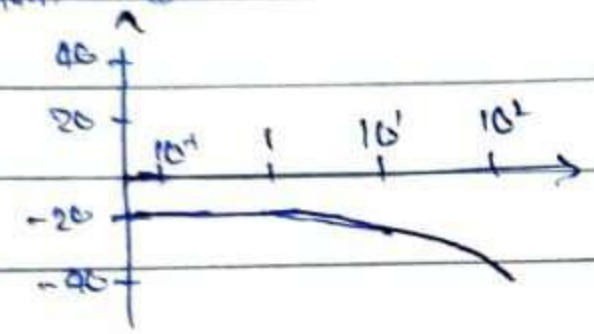
$G_2(s)$ can be expressed as

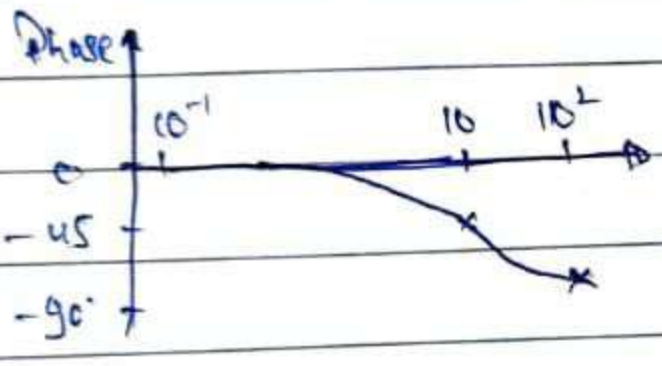
$$(s-2) + \left(\frac{1}{s+10}\right)$$

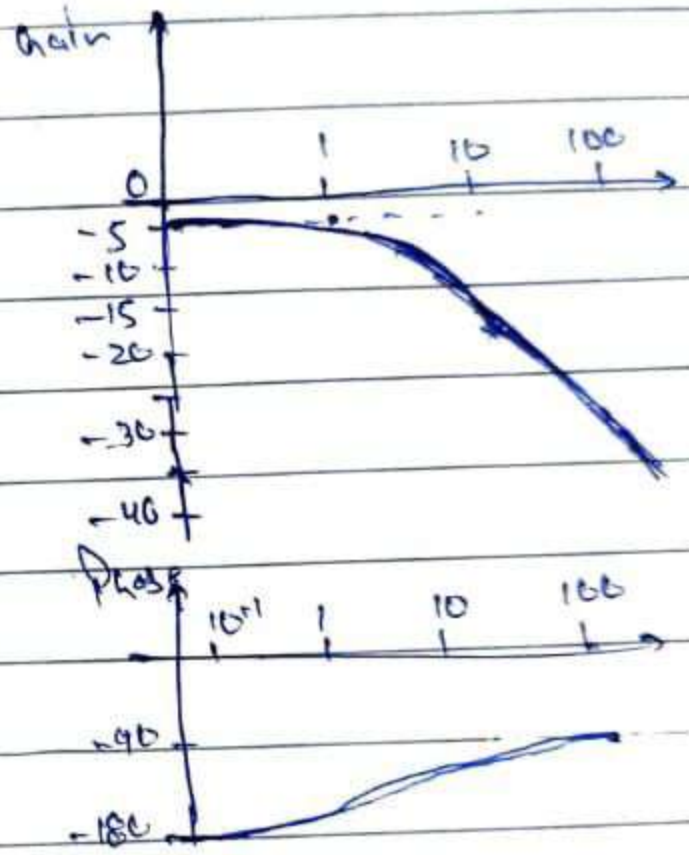
The graph will be sum of two curves $(s-2)$ & $\frac{1}{s+10}$

$\frac{1}{s-2}$ ← -ve of curve of $\frac{1}{s-2}$

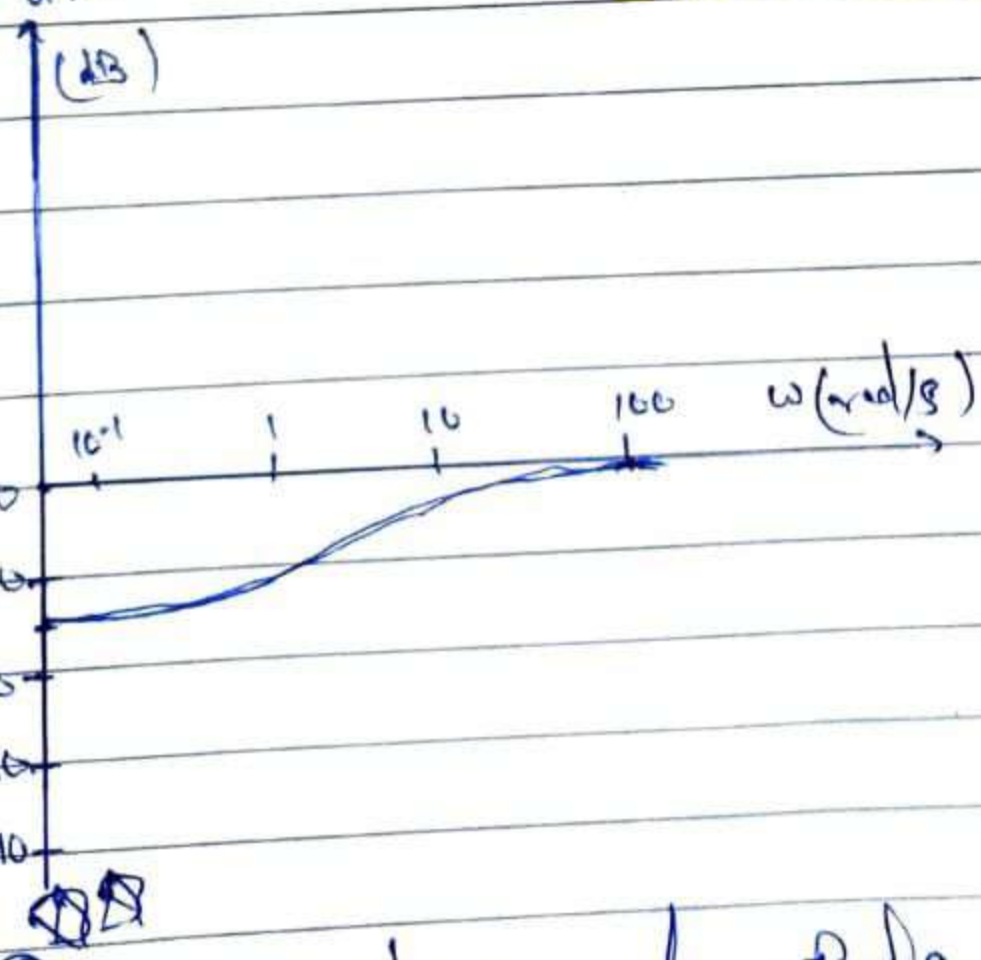
Gain $\frac{1}{s+10}$

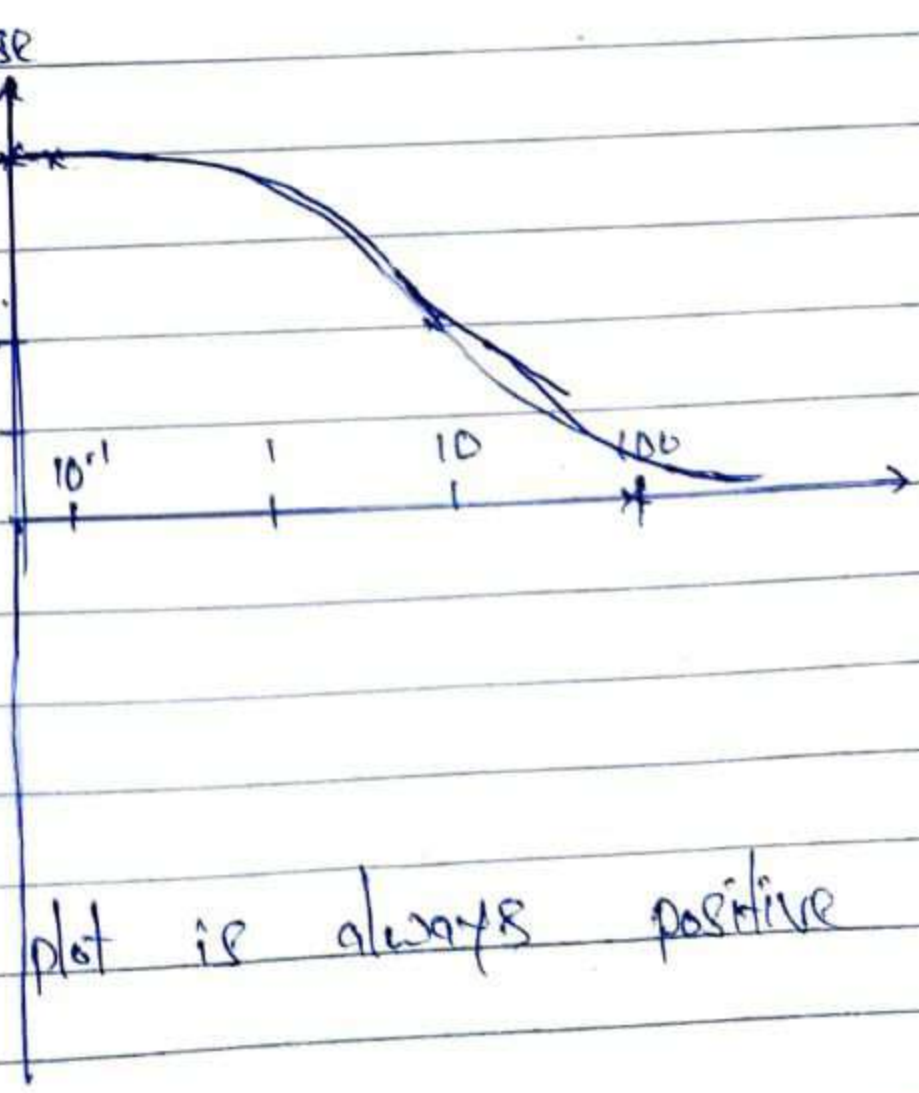




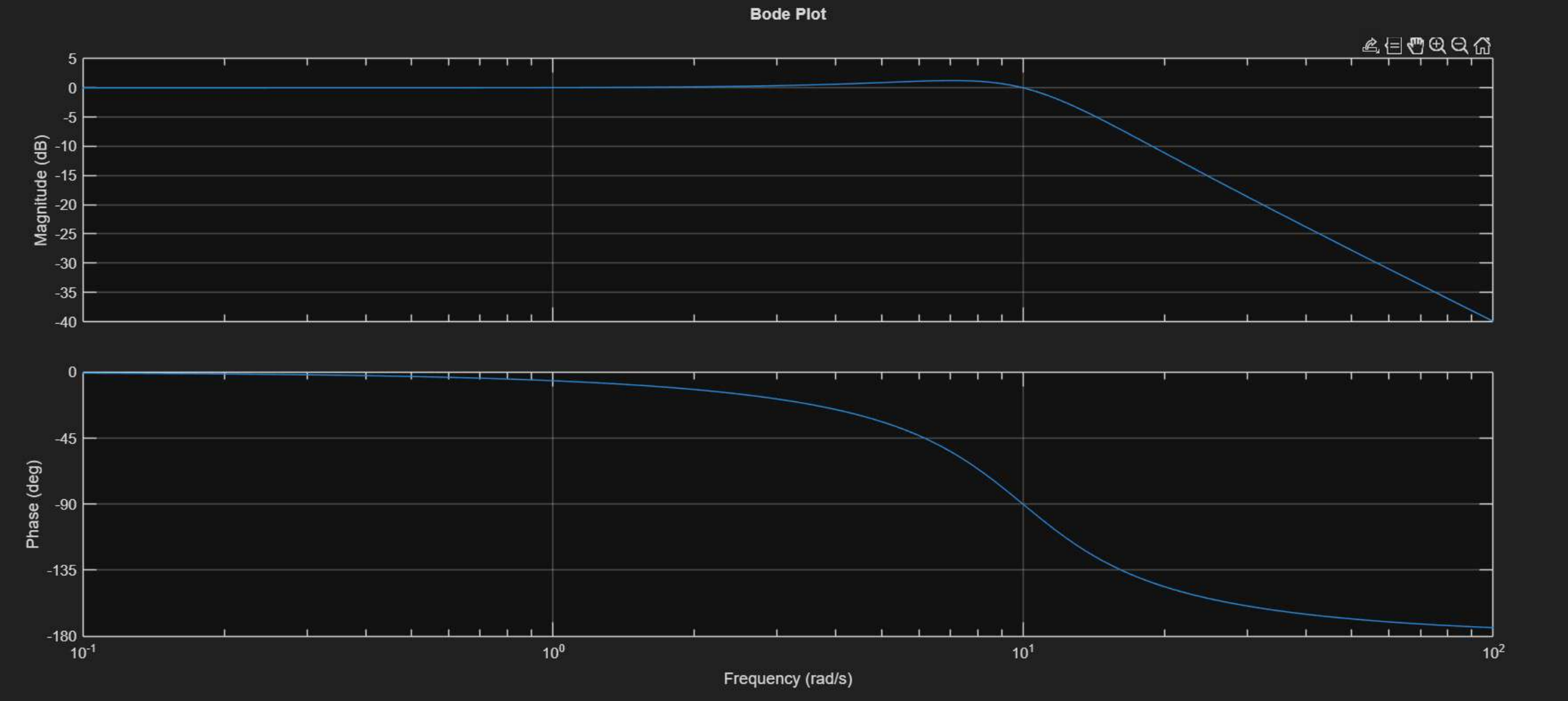


BODE PLOTS





④ The phase of Bode plot is always positive due to RHS zero.


Bode Plot
Magnitude (dB)
5
0
-5
-10
-15
-20
-25
-30
-35
-40
Phase (deg)
0
-45
-90
-135
-180
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (rad/s)

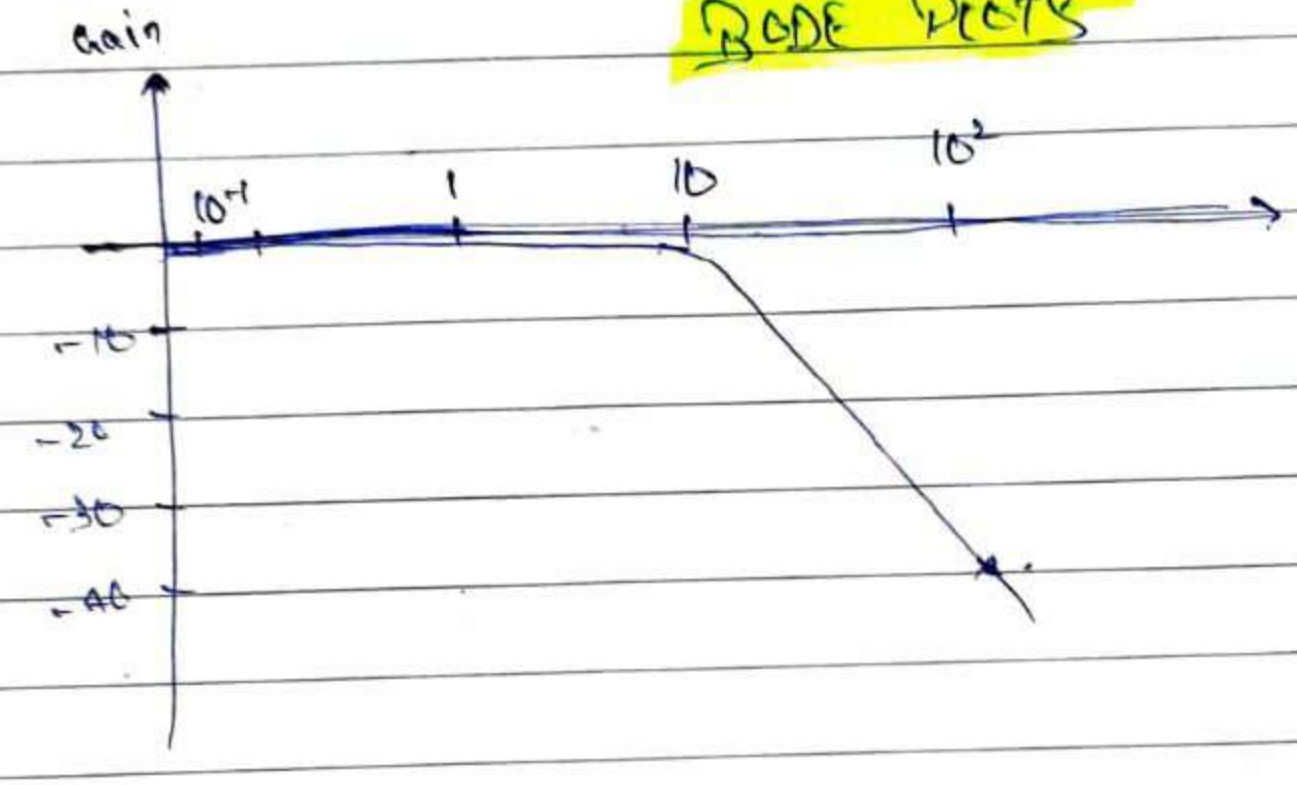
1.3 Problem A.3

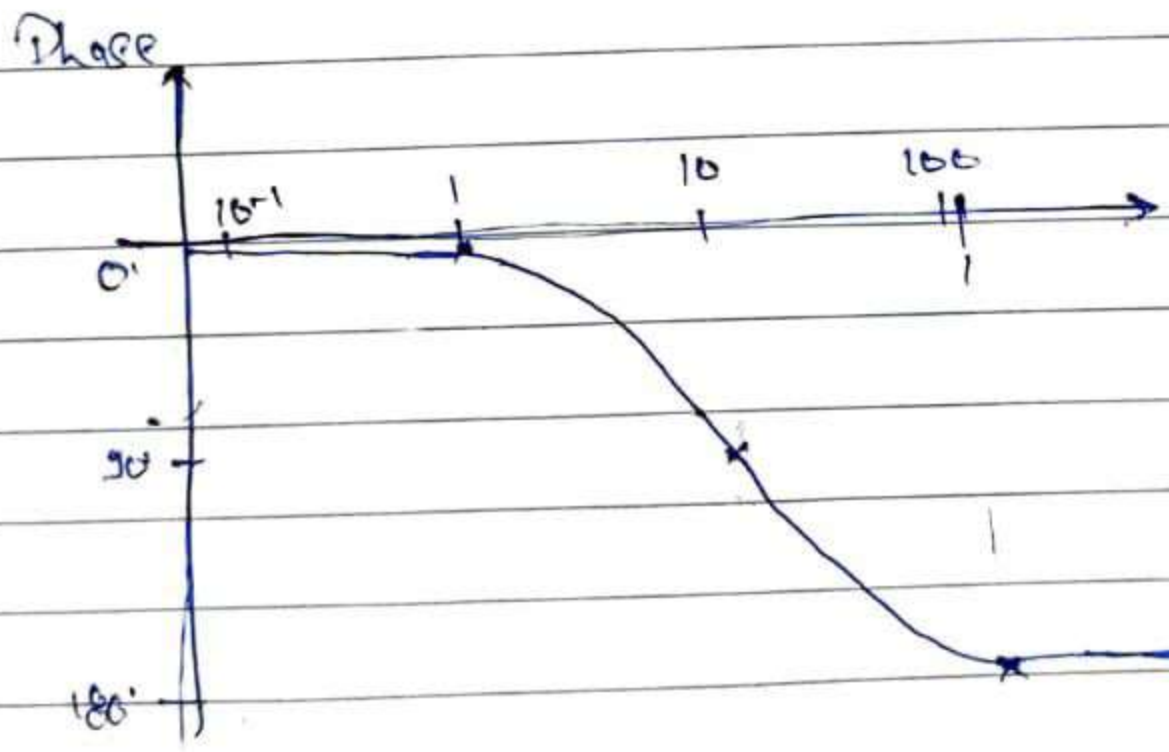
$$G_3(s) = \frac{100}{(s+10)^2} = \left(\frac{10}{s+10}\right)^2$$

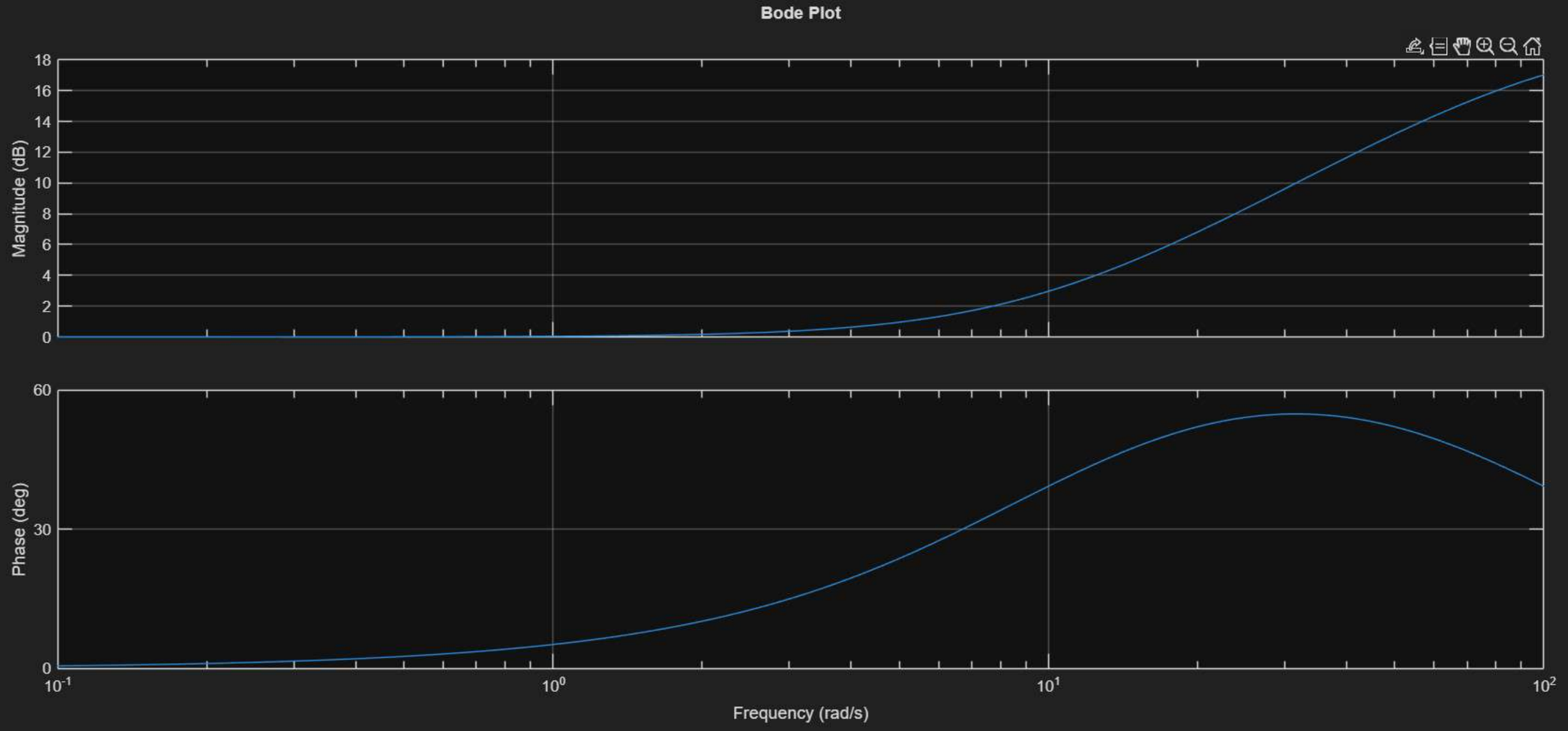
Poles $\longrightarrow$ $s_{1,2} = -10$

Changes wrt $\frac{10}{s+10}$ are: ① Phase becomes ×2
② Gain becomes ×2

BODE PLOTS





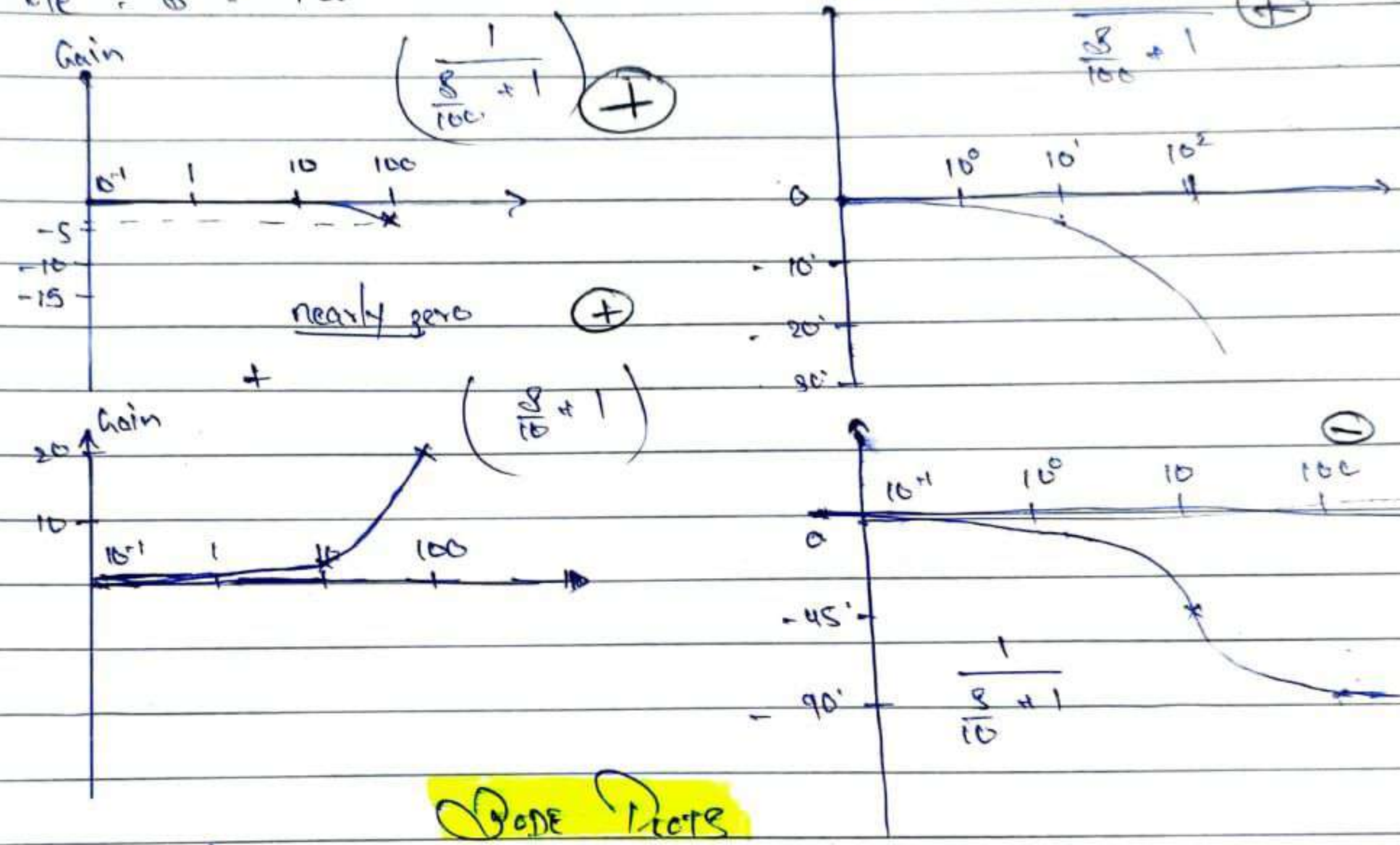

Bode Plot
Magnitude (dB)
18
16
14
12
10
8
6
4
2
0
Phase (deg)
60
30
0
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (rad/s)

Problem A.4

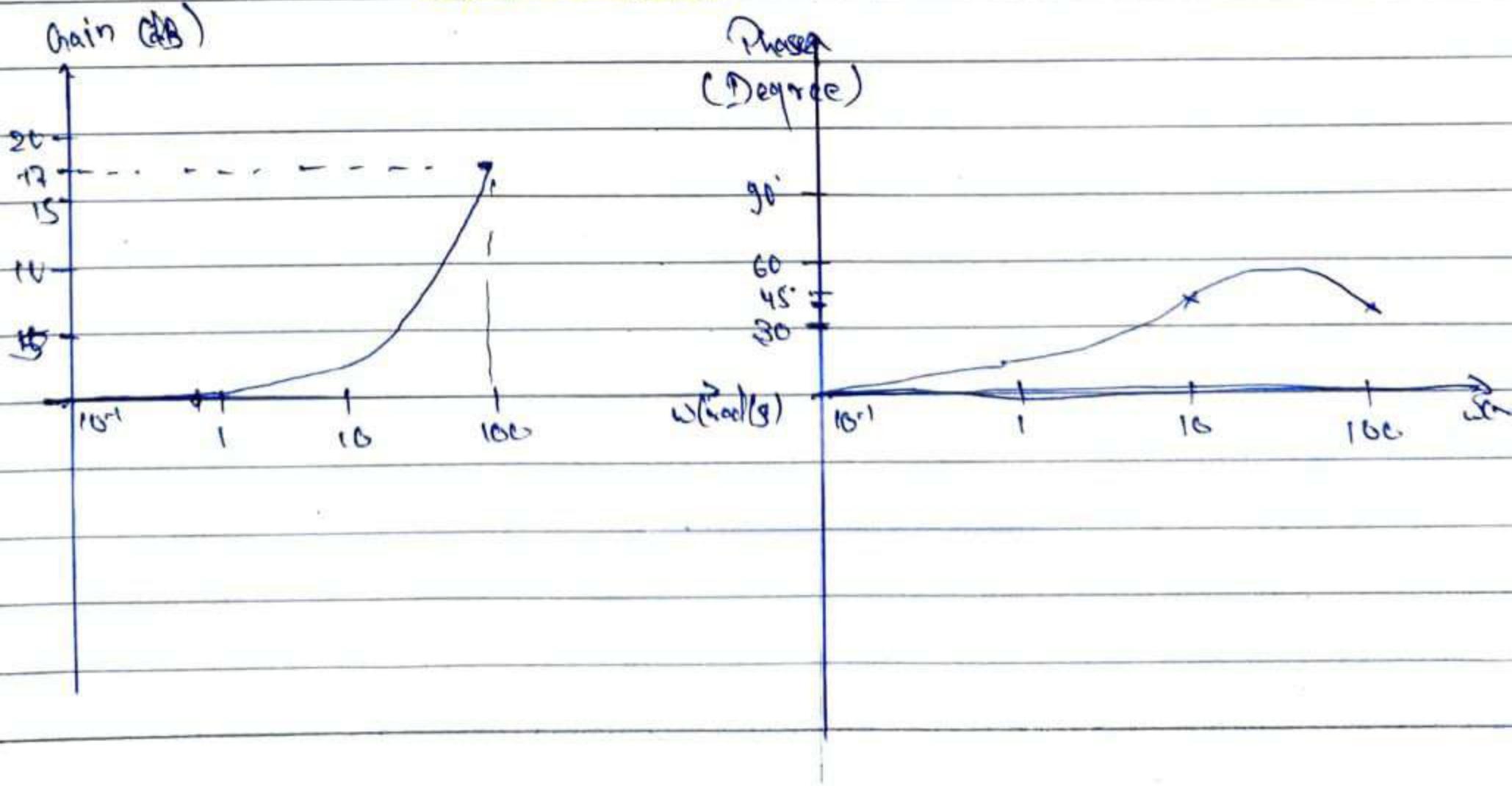
$$G(s) = \frac{\left(\frac{s}{10}+1\right)}{\left(\frac{s}{100}+1\right)}$$

Zero : $s = -10$

Pole : $s = -100$



Bode Plots

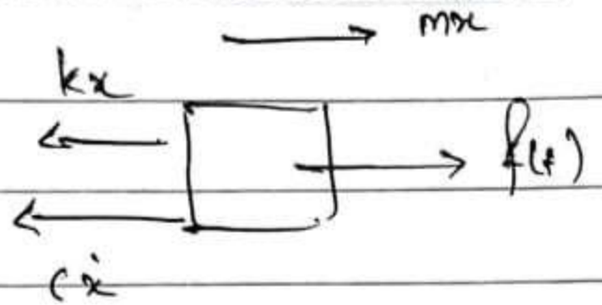


Damping System → PART-B

FBD

B.1

FBD



$$f(t) - kx - c\dot{x} = m\ddot{x}$$

Converting to frequency domain let $f(t) \rightleftharpoons F(s) = F$

$$x \rightleftharpoons X$$

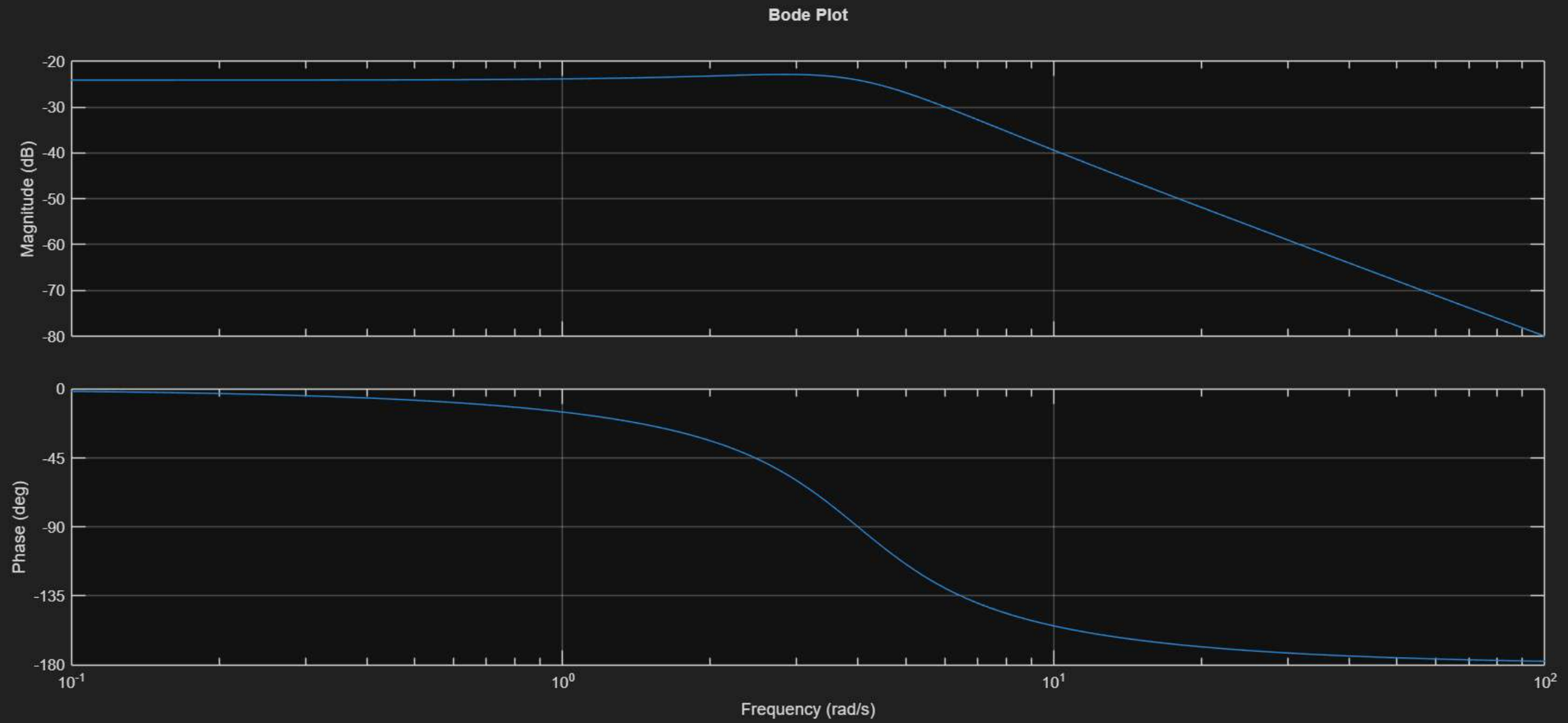
So, $\dot{x} \rightleftharpoons sX$ [initials = 0]

$$\ddot{x} \rightleftharpoons s^2X$$

Now, $F - kX - csX = ms^2X$

$$F = (k + cs + ms^2)X$$

$$G(s) = \frac{X}{F} = \frac{\text{output}}{\text{input}} = \left(\frac{1}{k + cs + ms^2}\right)$$


Bode Plot
Magnitude (dB)
-20
-30
-40
-50
-60
-70
-80
Phase (deg)
0
-45
-90
-135
-180
10^{-1}
10^{0}
10^{1}
10^{2}
Frequency (rad/s)

$$\text{Input} \quad \left(k + cs + ms^2\right)$$

B.2

$m = 1kg \qquad k = 16 N/m \qquad c = 4 Ns/m$

$$G(s) = \frac{1}{16 + 4(s) + s^2} = \frac{1}{(s+2)^2 + 12}$$

Poles : $-2 \pm 2\sqrt{3}i$