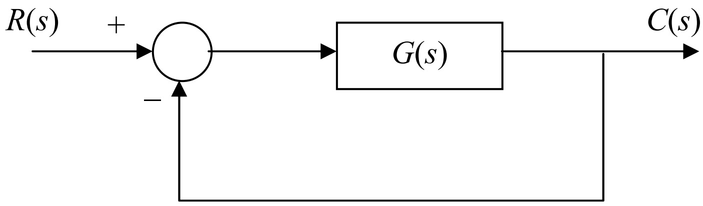
بسم الله الرحمن الرحيم

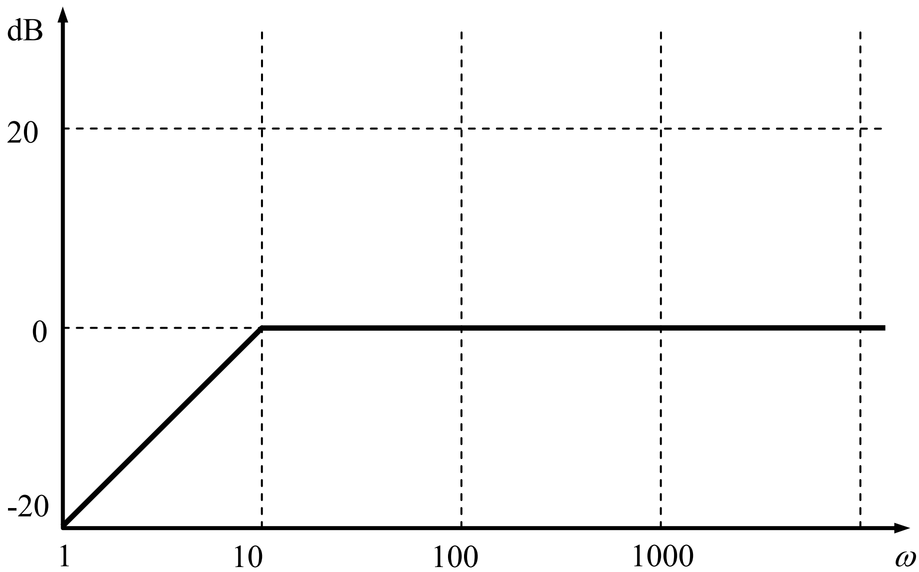
Automatic Control	Closed Book Exam
MENG366	Time 1 ½ hrs
Third Exam	Wednesday: 23/10/1424 H

Student Name:			Sec. No.:	ID No.:
Q1: /10	Q2: /10	Q3: /10	Q4: /10	Total: /40

1. The feedforward transfer function, $G(s)$ of the unity feedback system shown in Fig.1a is represented in frequency domain by the asymptotic Bode diagram shown in Fig.1b.
   a) Find the open-loop transfer function of the system, $G(s)$.
   b) Find the closed-loop transfer function of the system, $C(s)/R(s)$.
   c) Find the response of this system to a unit step input (i.e. $R(s) = 1/s$).
   d) Sketch the response, $c(t)$, of the system.



(a)



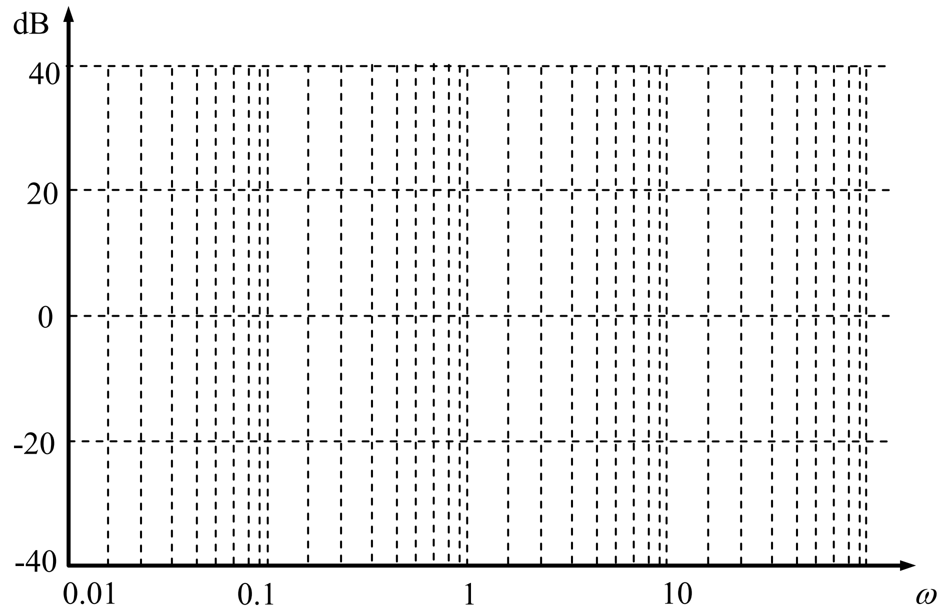
(b)

Fig.1

2. Consider the unity-feedback system with the following $G(s)$:

$$G(s) = \frac{1}{s+1}$$

a) Calculate the magnitude and phase of $G(s)$ for ω=0.1, 0.2, 0.5, 1, 2, 5, and 10 rad/sec.
b) Sketch the asymptotic Bode plots for $G(s)$.
c) From the Bode plots, determine the magnitude and the phase of $G(s)$ for ω=0.1, 0.2, 0.5, 1, 2, 5, and 10 rad/sec.
d) Sketch the Nyquist plot for $G(s)$.
e) On the Nyquist plot, locate $G(s)$ for ω=0.1, 0.2, 0.5, 1, 2, 5, and 10 rad/sec.
f) Comment on your results.



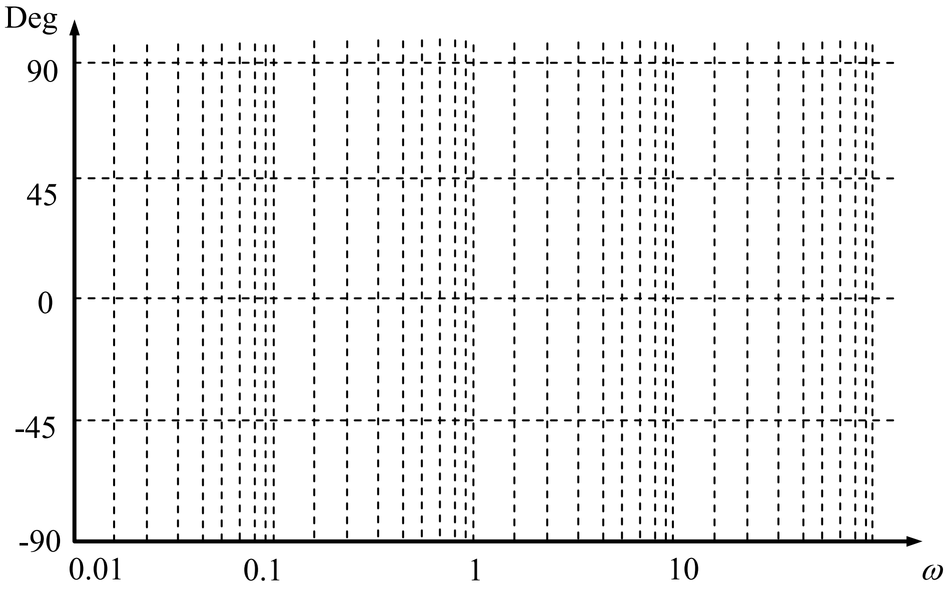
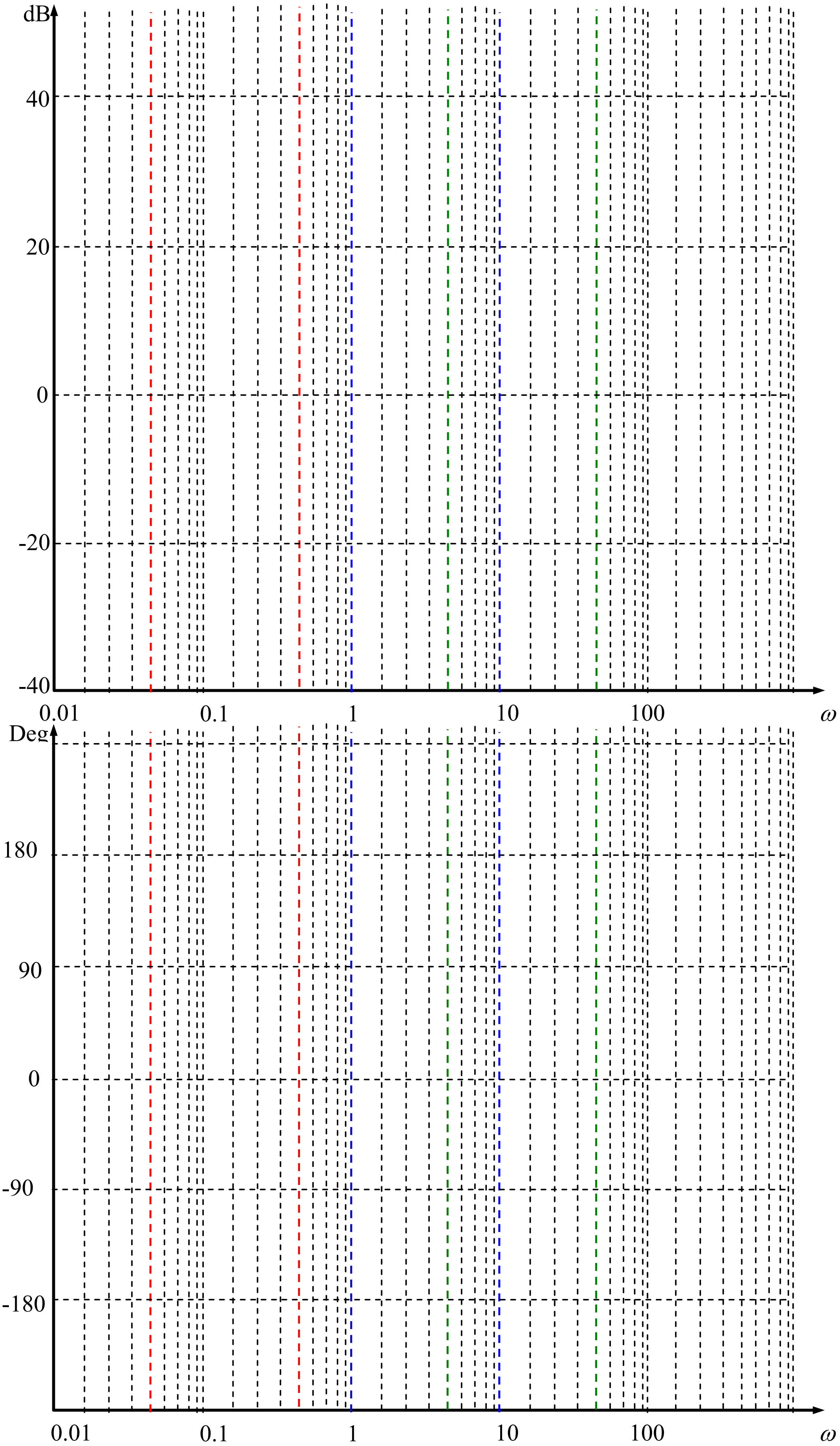


Fig.2

3. Consider the following transfer function:

$$G(s) = \frac{1000(s+0.5)}{s(s+10)(s+50)}$$

a) Plot the Bode magnitude and phase for the system.
b) Find the gain margin and the phase margin of the system.
c) Is the system stable? Why?


dB
40
20
0
-20
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180
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1
10
100
ω

4. Consider the unity-feedback control system having the following open-loop transfer function:

$$G(s)H(s) = \frac{K(s+3)}{s(s-1)} \qquad (K > 1)$$

The Nyquist plot (polar plot) of the open-loop frequency response is shown in Fig.4. Investigate the stability of the closed-loop system.

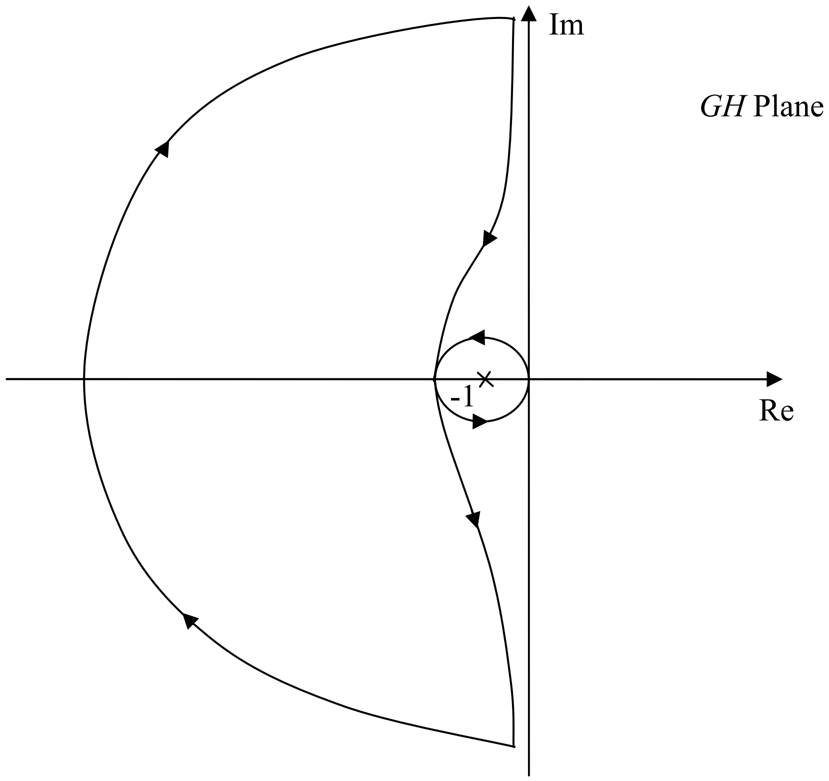

Fig.4

مع دعواتنا لكم بالتوفيق

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