UNIVERSITY OF VICTORIA
Department of Electrical and Computer Engineering
Course **ELEC 360**
Control Theory and Systems: **1**

FINAL EXAMINATION

Instructor: Dr. W. D. Little.	Date:	**Dec 11, 1997**
	Time:	9004200
	Place:	BGB **158**

This examination consists of 5 questions. Each question is of equal value. **Attempt all questions. You may use** a **one** page **"cheat"** sheet and **a calculator but no magnifying glass. Place all work** to be **marked on the same page as the question. Good luck!**

1. **A** dc motor is **modelled** by the following transfer function

$$G(s) = \frac{16}{s^2 + 5s + 25}$$

a) What does G(s) represent?
b) What is the dc gain, damping ratio and natural frequency of the motor?
c) Give an op-amp based circuit for G(s) that uses only integrators and summers?

2. **Draw a** root locus for G(S) that has **poles at s = -2 +j2, s = -2 -** j2 and s **= -1. Give** accurate values for important variables.

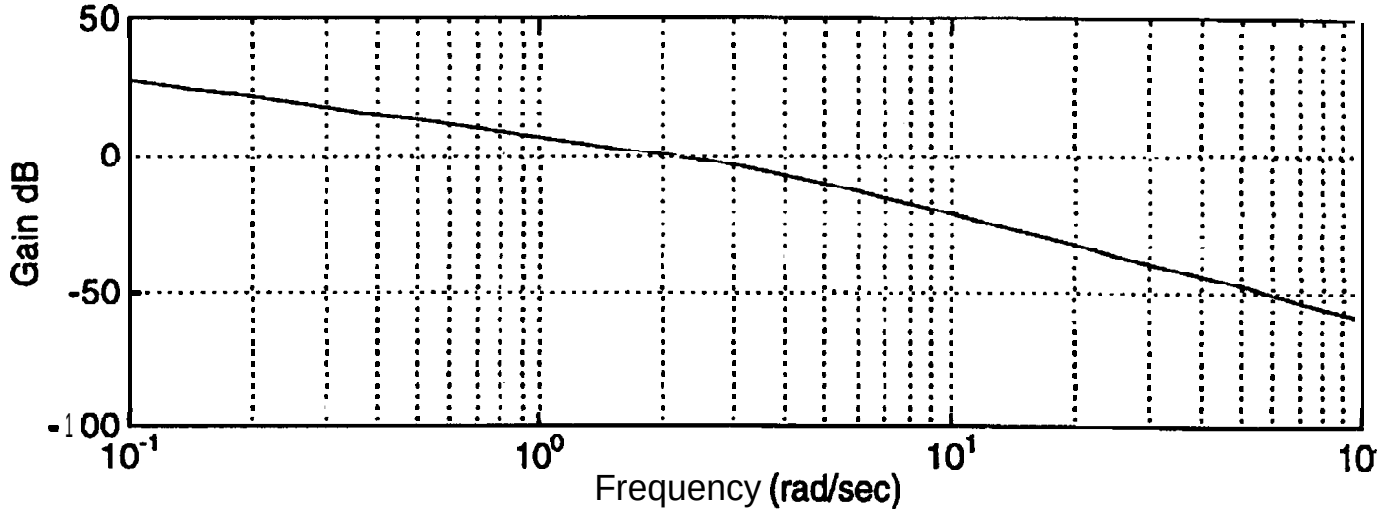
3. Draw a Nyquist plot of $G(s) = \frac{3}{s(s+2)}$

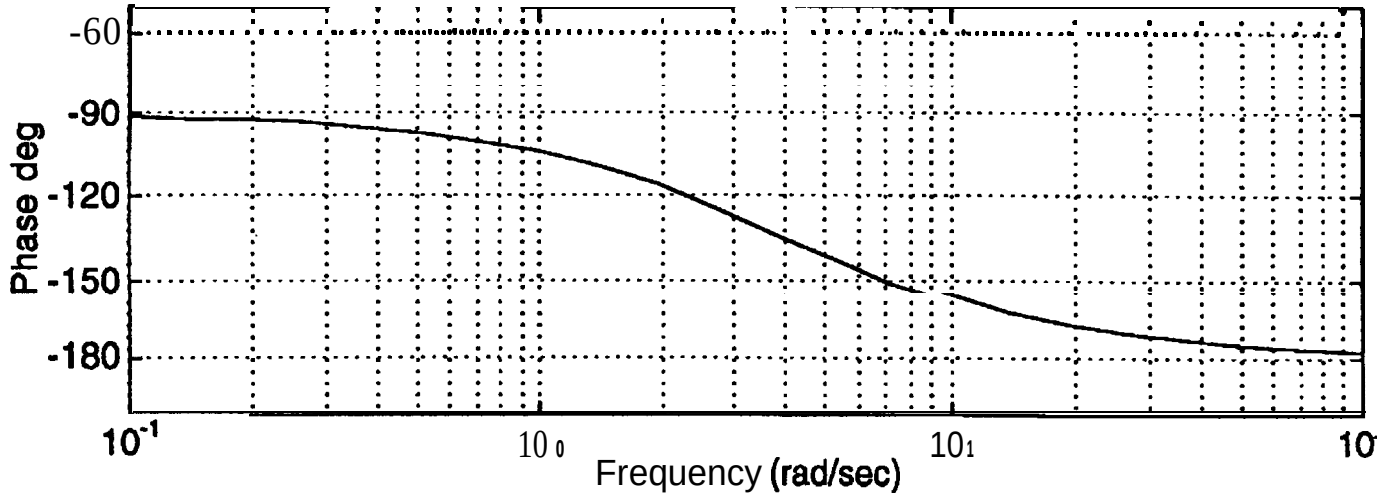
What is the real value of $G(jx)$ for x approaching O?

What is the exact value of the phase margin and gain margin for $K = 4$?

4. A **circuit** has a **pole** at s = -20 and a zero at s = -1. Is the circuit a **lead or a lag** circuit? If the circuit has unit dc gain, what is the transfer **function** of the circuit? What is the maximum phase of the circuit and at what frequency does the maximum phase occur?

5. Use the frequency method to design a lag compensator for a closed loop system with a process **modelled** by the Bode diagram given below. The compensated system should have an **error** constant of 60 and a damping ratio of about **.5.**





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