

EE 321 - Exam 1

September 23, 1993

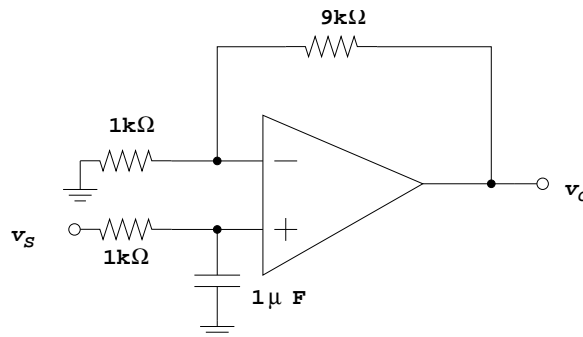
Closed book. One page of notes and a calculator are allowed. Show all work. Partial credit will be given. No credit will be given if an answer appears with no supporting work.

1. The relationship between the output voltage v_o and the input voltage v_i of an amplifier is given by

$$v_o = 5 - 10^{-10} e^{40v_i}$$

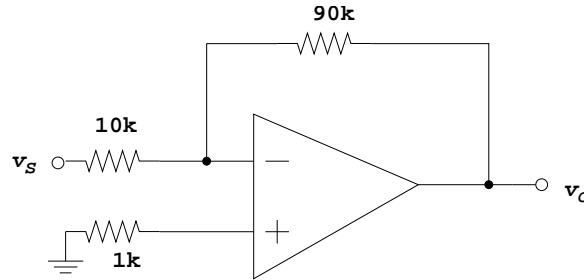
The amplifier is biased so $V_O = \frac{5}{2} \text{V}$.

- (a) Find the input bias voltage needed, V_I .
 (b) Find the small-signal voltage gain v_o/v_i for the amplifier.
2. Consider the following circuit:



- (a) Find the transfer function v_o/v_s .
 (b) Plot the magnitude $|v_o(\omega)/v_s(\omega)|$ (in dB) vs. the log of the frequency ω .

3. Consider the op amp circuit below. For parts a) through c), consider the op amp to be ideal.



- Find the gain v_o/v_i .
- What is the input resistance R_{in} ?
- What is the output resistance R_{out} ?

For the rest of this problem, assume the op-amp to be non-ideal with following characteristics: DC gain of 10^5 , 3 dB frequency of 10 Hz, SR = $0.5 \text{ V}/\mu\text{s}$, and $V_{omax} = \pm 12 \text{ V}$.

- Find the unity gain bandwidth of the op amp.
- Find the 3 dB frequency of the (closed loop) amplifier circuit.
- Find the full power bandwidth of the circuit.