

Homework 10 Resubmission

- 1.
- a) Terminals must be equal
 $\therefore u_+ - u_- = 0$
- b) $V_x = V_{out} \frac{R_1}{R_1 + R_2}$ (Voltage Divider)
- c) $V_x = V_s$

Resistor 1

$$I_{R_1} = \frac{V_s}{R_1}$$

Resistor 2

$$\therefore \underline{I_{R_2} = I_{R_1} = \frac{V_s}{R_1}}$$

$$d) V_{out} = V_s + R_2 I_{R_1} = V_s + R_2 \frac{V_s}{R_1} = V_s \left(\frac{R_1 + R_2}{R_1} \right)$$

$$e) \text{ Current } I_L = \frac{V_{out}}{R}$$

$$f) V_{out} = A(u_+ - u_-) \\ = A(V_s - V_x)$$

$$\therefore V_x = \frac{V_s}{1 + \frac{R_1 + R_2}{AR_1}}$$

$$V_s = V_{out} \left(\frac{R_1}{R_1 + R_2} \right)$$

$$V_{out} = A \left(V_s - V_{out} \frac{R_1}{R_1 + R_2} \right) = V_s \left(\frac{1}{\frac{R_1}{R_1 + R_2} + \frac{1}{A}} \right)$$

g) The limits are the same.

$$h) V_{out} = V_s \left(\frac{1}{\frac{R_1}{R_1 + R_2} + \frac{1}{A}} \right)$$

$$= V_s \left(\frac{A(R_1 + R_2)}{R_1 + R_2 + AR_1} \right)$$

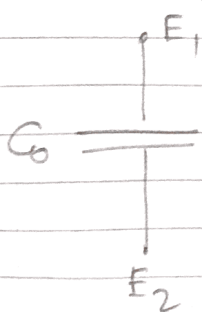
$$A_{min} = \frac{G_{min} (R_1 + R_2)}{R_1 + R_2 - G_{min} R_1}$$

$$G_{nom} = 1 + \frac{R_2}{R_1} :$$

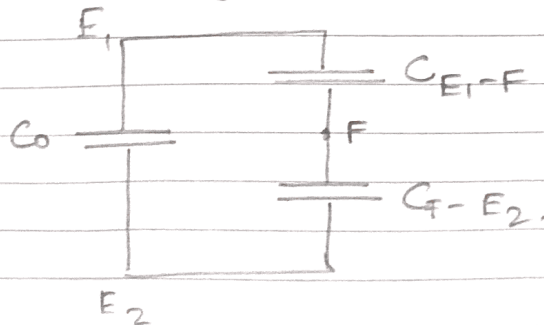
$$A_{min} = \frac{G_{min} G_{nom}}{G_{nom} - G_{min}} = \frac{(2)(1.98)}{2 - 1.98} = 198.$$

2.

a) No finger.



Finger.



$$b) \quad C_0 = \frac{\epsilon_0 \epsilon_2 W_1}{t_1} = 4.48 \times 10^{-14} \text{ F.}$$

$$C_{F-E1} = \frac{\epsilon_0 \epsilon_1 W_1}{t_2 - t_1} = 4.48 \times 10^{-13} \text{ F.}$$

$$C_{F-E2} = \frac{\epsilon_0 \epsilon_2 (W_2 - W_1)}{t_1} = 2.22 \times 10^{-14} \text{ F.}$$

c) When a finger is present, we get the capacitance

$$C_{F-E1} \parallel C_{F-E2} = 2.11 \times 10^{-14} \text{ F.}$$

3. I worked on this homework alone using the resubmission solutions given