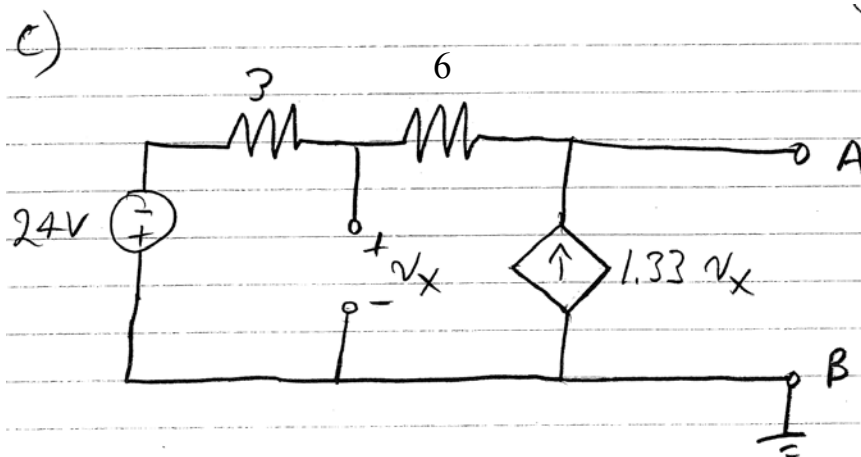
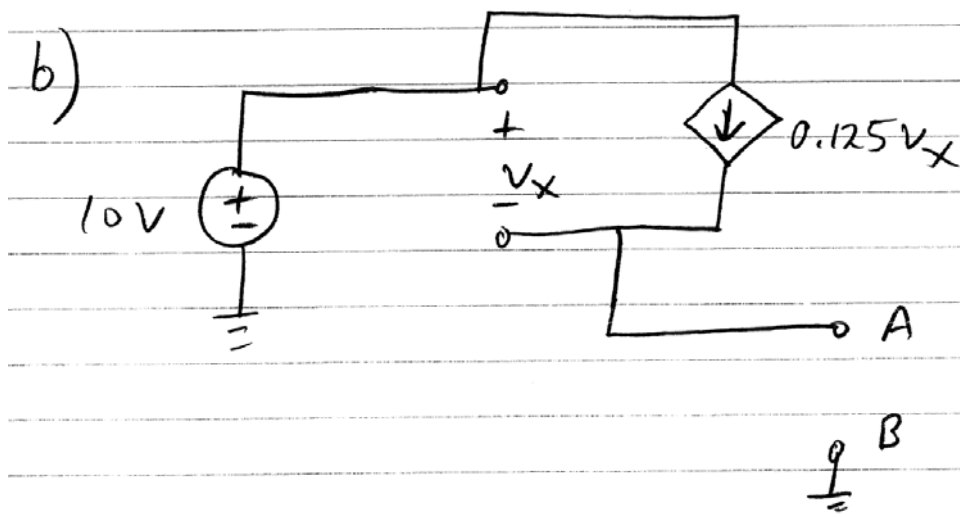
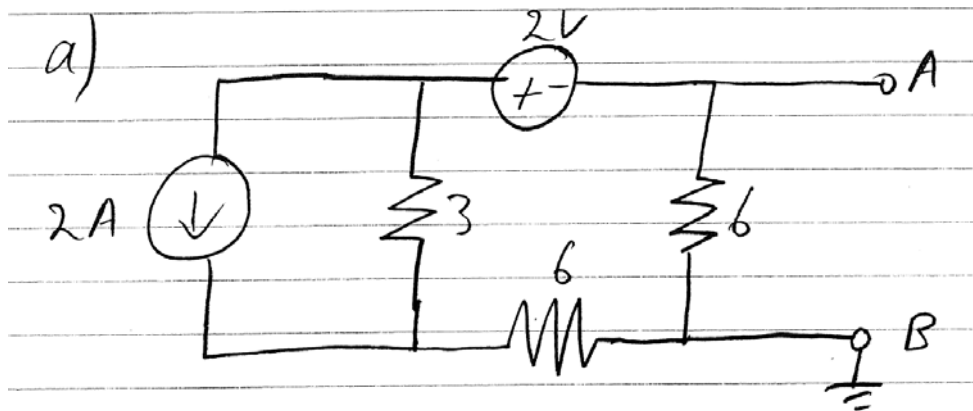


- 1) Find the voltage source equivalent and current source equivalent circuits for the following circuits at nodes A-B.



5.4 An NMOS transistor that is operated with a small v_{DS} is found to exhibit a resistance r_{DS} . By what factor will r_{DS} change in each of the following situations?

- (a) V_{OV} is doubled.
- (b) The device is replaced with another fabricated in the same technology but with double the width.
- (c) The device is replaced with another fabricated in the same technology but with both the width and length doubled.
- (d) The device is replaced with another fabricated in a more advanced technology for which the oxide thickness is halved and similarly for W and L (assume μ_n remains unchanged).

5.9 An NMOS transistor with $k_n = 1 \text{ mA/V}^2$ and $V_t = 1 \text{ V}$ is operated with $V_{GS} = 2.5 \text{ V}$. At what value of V_{DS} does the transistor enter the saturation region? What value of I_D is obtained in saturation?

5.12 With the knowledge that $\mu_p \approx 0.4\mu_n$, what must be the relative width of n -channel and p -channel devices if they are to have equal drain currents when operated in the saturation mode with overdrive voltages of the same magnitude?

5.34 An NMOS transistor is fabricated in a $0.8\text{-}\mu\text{m}$ process having $k'_n = 130 \mu\text{A/V}^2$ and $V'_A = 20 \text{ V}/\mu\text{m}$ of channel length. If $L = 1.6 \mu\text{m}$ and $W = 16 \mu\text{m}$, find V_A and λ . Find the value of I_D that results when the device is operated with an overdrive voltage of 0.5 V and $V_{DS} = 2 \text{ V}$. Also, find the value of r_o at this operating point. If V_{DS} is increased by 1 V , what is the corresponding change in I_D ?

5.39 A p -channel transistor for which $|V_t| = 1 \text{ V}$ and $|V_A| = 50 \text{ V}$ operates in saturation with $|v_{GS}| = 3 \text{ V}$, $|v_{DS}| = 4 \text{ V}$, and $i_D = 3 \text{ mA}$. Find corresponding signed values for v_{GS} , v_{DS} , v_{SD} , V_t , V_A , λ , and $k'_p(W/L)$.

5.76 For the NMOS amplifier in Fig. P5.76, replace the transistor with its T equivalent circuit, assuming $\lambda = 0$. Derive expressions for the voltage gains v_s/v_i and v_d/v_i .

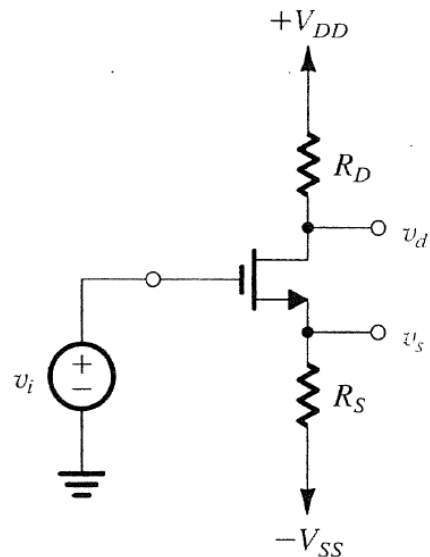


Figure P5.76