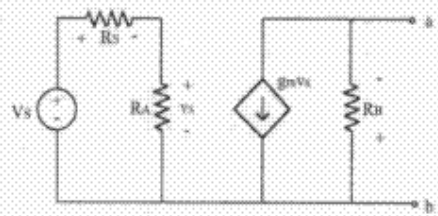
EE100 office hours - July 6th 2005

Question 1:

Midterm review from EE100 Summer 04 - ignore b & c

http://inst.eecs.berkeley.edu/~ee100/ee100_spring_05/webpage/ee100_fall_04/webpage/ee100_summer

5.) See the circuit below:

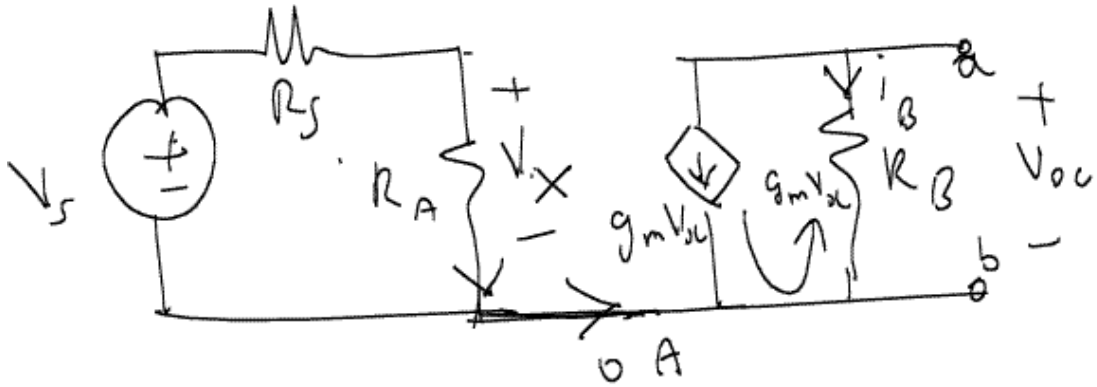


a.) Find the open circuit voltage, the short circuit current, and the equivalent resistance from the a-b terminal.

b.) Let $V_S = 24$ V and $R_A = 10$ kΩ. If the power delivered by the voltage source is 12 mW and the power delivered by the current source is 170 mW, find a value for:

i.) R_S; ii.) g_m; iii.) R_B

c.) From a and b, draw the Thévenin and Norton equivalent circuits, using the proper numerical values.



(a) $V_{oc} = i_B R_B$

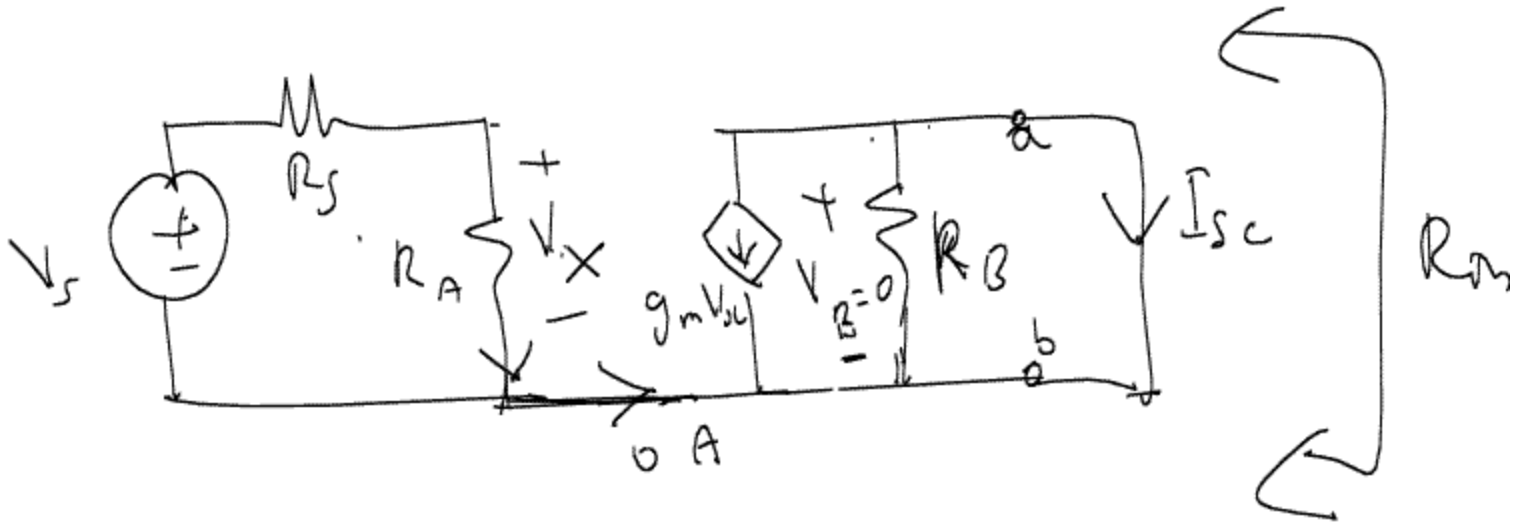
$= (-g_m V_x) R_B$

$V_x = \left(\frac{R_A}{R_A + R_S}\right) V_s$

(Voltage divider)

$$\boxed{V_{oc} = (-g_m R_B)\left[\frac{V_s R_A}{R_A + R_S}\right]}$$

$I_{sc} = ?$



$$I_{sc} = -g_m V_x$$

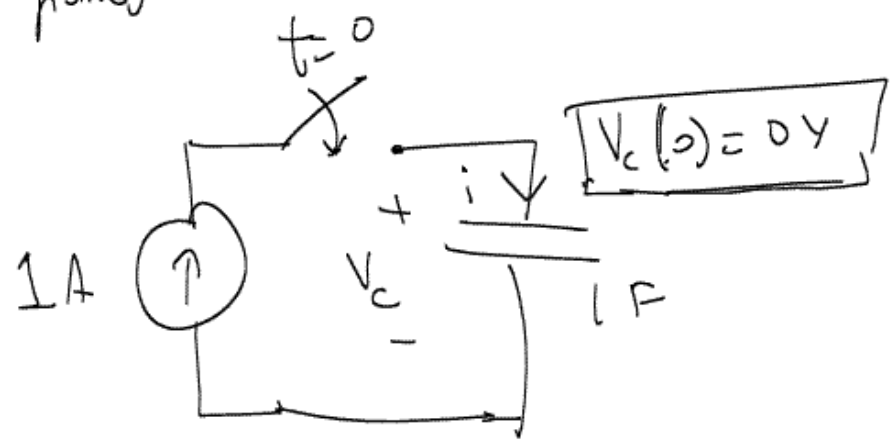
$$\boxed{I_{sc} = -g_m \left[\frac{R_A}{R_A + R_S} V_S \right]}$$

As an aside, $\boxed{R_{Th} = R_B = \frac{V_{oc}}{I_{sc}}}$

<u>Example</u>: This was going to be the hard problem on the test (worth 5 points)

Find & sketch $v_c(t)$

[All elements are ideal]



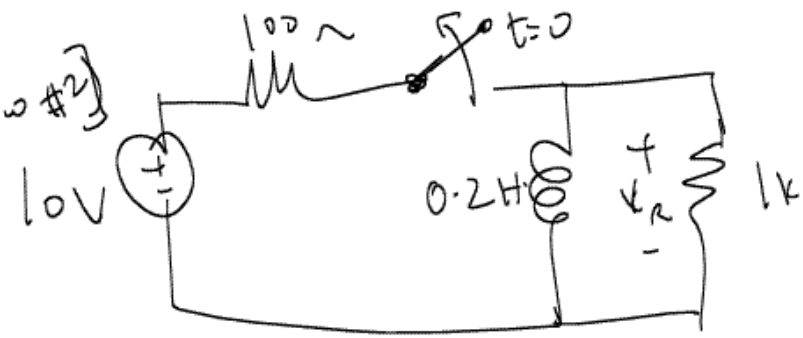
Sol: You can't use: $v_c(t) = v_{cf} + (v_{ci} - v_{cf})e^{-t/\tau}$, because τ is undefined!

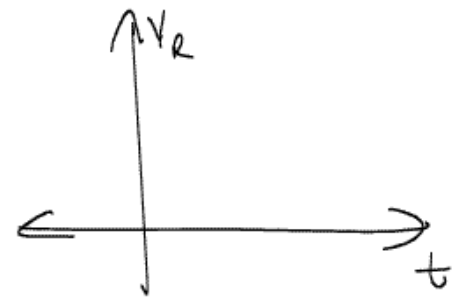
$\therefore$ Go back to first principles: $i = C\frac{dv}{dt} \Rightarrow 1 = 1\frac{dv}{dt}$

$\Rightarrow \frac{dv}{dt} = 1$

$\boxed{v(t) = t}$

(Q: 3) [from H.W #2]

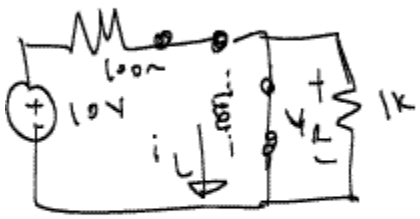




(Q:) Find V_R & sketch V_R

$$V_R(t) = V_{R_f} + (V_{R_i} - V_{R_f})\, e^{-t/\tau}$$

$t = 0^-$



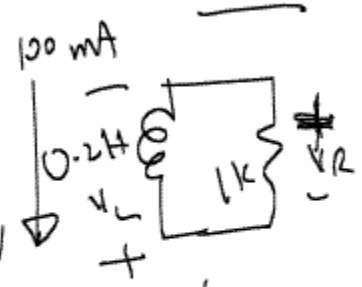
$v_R(0^-) = 0\ V$

(inductor is short circuited)

$i_L(0^-) = \frac{10V}{100\Omega}$

$\boxed{i_L(0^-) = 100\ mA}$

$t = 0^+$



$v_R(0^+) = ?$

Notice the direction of the 100 mA current:

$v_R(0^+) = -(1K)(100\ mA)$

$\boxed{v_R(0^+) = -100V}$

$t \to \infty$

$v_R(t \to \infty) = 0\ V$

(because inductor is fully discharged)

τ

$\tau = \frac{L}{R}$

$= \frac{0.2H}{1K}$

$= 0.2\ ms$

$\boxed{v_R(t) = -100 e^{\frac{-t}{0.2ms}}\ Volts}$

Q:) Are R_1 & R_2 in series or parallel?