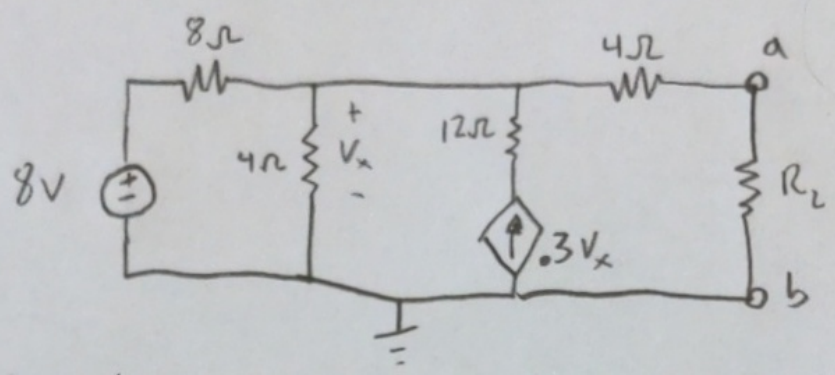
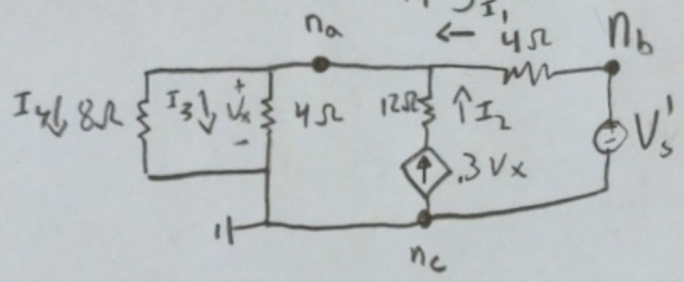
Chris Hunt ICA Dec 2nd ENGR201

1. Find the Norton Equivalent



R_N) Since there is a dependant current source we must turn off the independant source and apply a 1V source between a and b.



$V_{n_b} = 1V$ $V_{n_c} = 0V$

Find V_{n_a} $V_{n_a} = V_x$

@ n_a)

$I_1 + I_2 = I_3 + I_4$ $I_2 = .3V_{na}$

$I_1 + .3V_{na} = I_3 + I_4 \rightarrow \left(\frac{1 - V_{na}}{4\Omega} + .3V_{na} = \frac{V_{na} - 0}{4\Omega} + \frac{V_{na} - 0}{8\Omega} \right) 8\Omega$

$2 - 2V_{na} + 2.4V_{na} = 2V_{na} + V_{na} \rightarrow 2 + .4V_{na} = 3V_{na}$

$-.4V_{na}$

$2 = 2.6V_{na} \rightarrow V_{na} = \frac{1}{1.3}V$

$I_s' = \frac{1V - \frac{1}{1.3}V}{4\Omega} \rightarrow I_s' = 57.7\,mA$

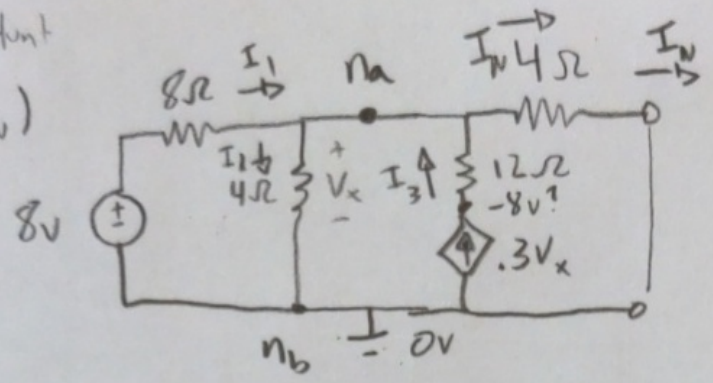
$R_N = \frac{V_s'}{I_s'}$

$\boxed{R_N = 17.33\Omega}$

$I_N \rightarrow$

Chris Hunt

1. I_N)



@ na) $I_1 + I_3 = I_N + I_2$

$I_N = I_1 + I_3 - I_2$

$\left(\frac{V_{na}}{4\Omega} = \frac{8 - V_{na}}{8\Omega} + .3V_{na} - \frac{V_{na}}{4\Omega}\right) 8\Omega$

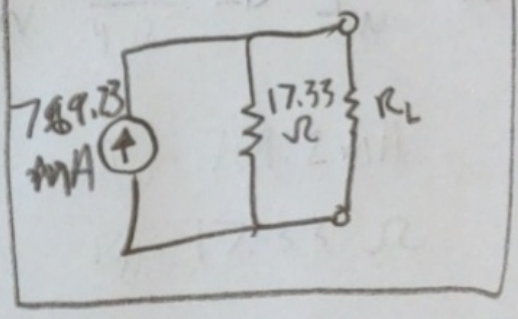
$2V_{na} = 8 - V_{na} + 2.4V_{na} - 2V_{na}$

$8_V = 2.6V_{na} \rightarrow V_{na} = \frac{4}{1.3}$

$I_N = \frac{\frac{4}{1.3}V}{4\Omega}$

$I_N = 769.23\,mA$

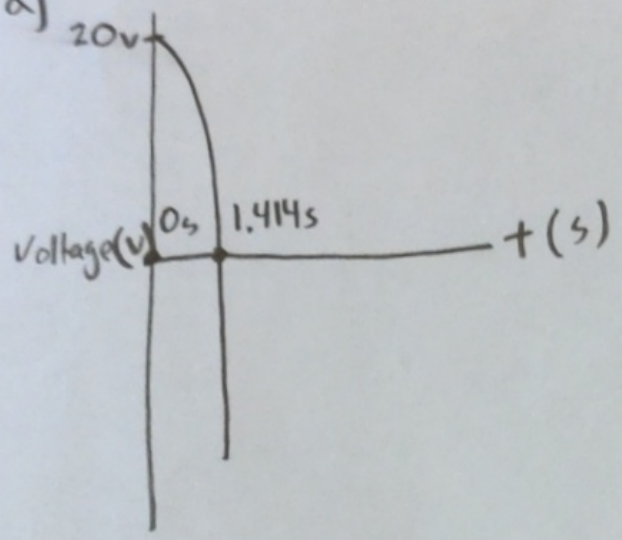
$R_N = 17.33\,\Omega$



Chris Hunt

2. $V_c(t) = 20 - 10t^2 V$ $\quad C = 220\,\mu F$

a)



b) $I_c = C\frac{dV_c(t)}{dt}$ $\quad \frac{dV_c(t)}{dt} = -20t$

$I_c = 220\,\mu F \cdot -20t\ v$

$I_c(3) = 220\,\mu F \cdot -20(3)\ v$

$I_c(3) = -13.2\ mA$

c) $P = Cv\left(\frac{dV}{dt}\right) \rightarrow P(3) = -13.2mA(20 - 10 \cdot 9)V$

$P(3) = +924\ mW$

d) $P(2) = 220 \cdot 10^{-6} \cdot -20 \cdot 2 \cdot (20 - 40)$

$P(2) = +176\ mW \rightarrow$ The capacitor is adding energy to the circuit