EE 3 Quiz 1 Spring '15 10 Name Callen [illegible]

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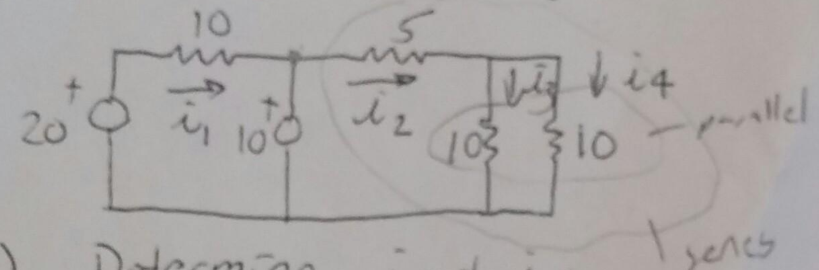
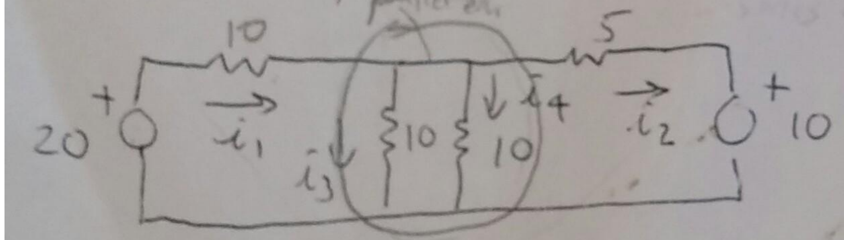
Instructions: attempt all parts. A sheet of useful formulae is attached. Calculators are permitted.

a) By means of series and parallel resistor relations, reduce the following circuit to a simple form and then determine the currents i_1 & i_2



b) Determine i_3 & i_4.

c) Reduce the following circuit as far as you can using series + parallel resistor relations



d) Using node or mesh equations, solve for the currents in the reduced circuit, and then use those results to solve for all the currents in the original circuit.

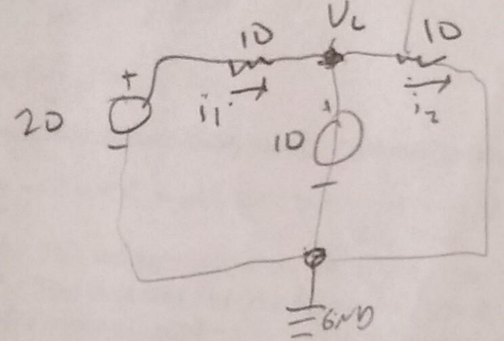
1a) parallel 10Ω resistors

$\frac{1}{R} = \frac{1}{10} + \frac{1}{10}$

$R = 5\Omega$

→ series 5Ω resistors:

$5\Omega + 5\Omega = 10\Omega = R_{eq}$



$V_C = 10V$

$i_2 = \frac{V_C - 0}{10} = 1A = i_2$

$i_1 = \frac{20-10}{10}$

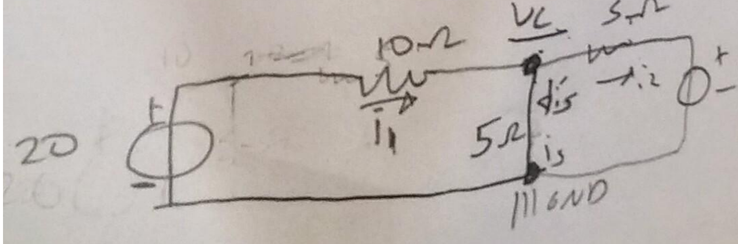
$i_1 = 1A$

b) since $i_3 + i_4$ combined recieve the same amount of current as i_2, and the have equivalent resistors $i_3, i_4 = .5 i_2$

$i_3 = .5A$
$i_4 = .5A$

c) parallel 10Ω resistors (see 1a)

$R = 5\Omega$



$i_1 = \frac{20-8}{10} = 1.2A$

$i_2 = \frac{8-10}{5} = -\frac{2}{5}A$

$i_5 = \frac{8}{5}A$

for same reasons in 1B, 10Ω resistors currents are each half of i_5

$i_3 = .5 i_5 = \frac{4}{5}A$

$i_4 = .5 i_5 = \frac{4}{5}A$

d) $i_1 = i_5 + i_2$

$i_1 - i_5 - i_2 = 0$

Node eqn.:

$i_1 = \frac{20 - V_C}{10\Omega}$ $\quad i_5 = \frac{V_C}{5\Omega}$ $\quad i_2 = \frac{V_C - 10}{5\Omega}$

$\frac{20 - V_C}{10\Omega} - \frac{V_C}{5\Omega} - \left(\frac{V_C - 10}{5\Omega}\right) = 0$

$2 - \frac{V_C}{10} - \frac{V_C}{5} - \frac{V_C}{5} + 2 = 0$

$4 - \frac{V_C}{2} = 0$

$V_C = 8V$