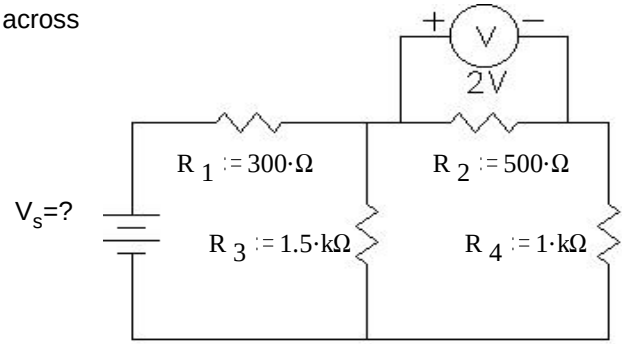
EE1050/60 Exam 1 given: Fall 01 (The space between problems has been removed.)

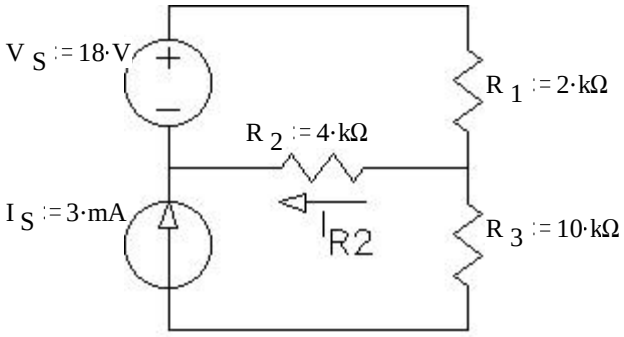
Remember, to get the most possible partial credit, always show all the intermediate values that you can calculate. If further calculations depend on a value that you can't figure out, just use a letter (like I_{R1}) in place of the value and proceed.

Note: feel free to show answers & work right on the schematic

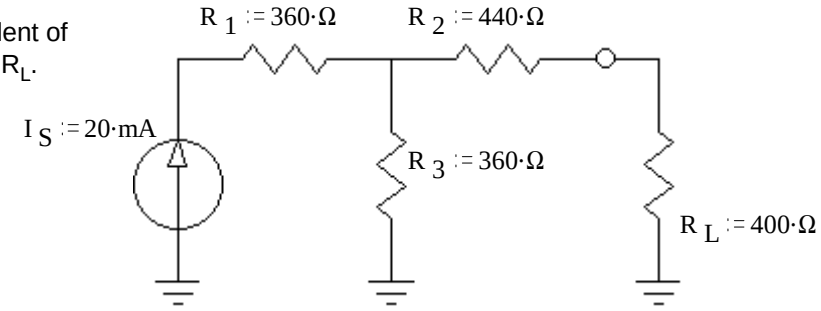
1. (16 pts) In the circuit shown we measure the voltage across R_2 as 2.0 V. What must the battery voltage (V_S) be?



2. (15 pts) a) Use the method of superposition to find the current through R_2. Be sure to clearly show and **circle** your intermediate results.



3. (23 pts)
   a) Find and draw the Thévenin equivalent of the circuit shown. The load resistor is R_L.



   b) Find and draw the Norton equivalent of the same circuit.

   c) Find the load voltage using either your Thévenin or Norton equivalent circuit.

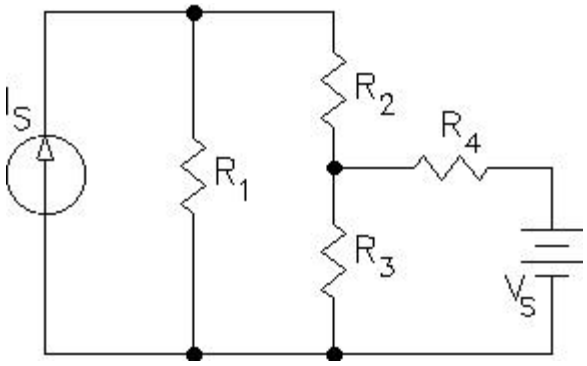
   d) Find the power dissipated in the load resistor.

4. (14 pts) Nodal analysis.
   a) Select a ground (reference) node and label it on the schematic (draw ground symbol).

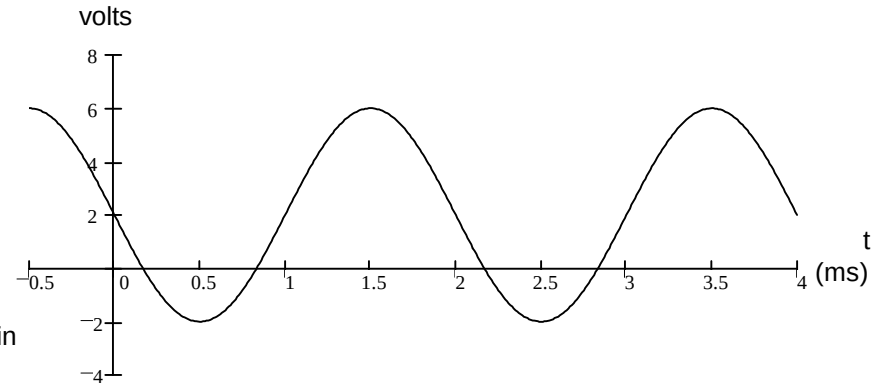
   b) Label other nodes and currents as necessary to perform nodal analysis.

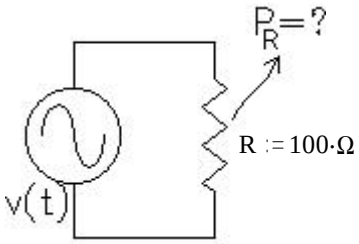
   c) How many simultaneous equations will you need to perform this analysis?

   d) Write all the necessary equations in terms of the resistors, the sources, and the unknown nodes. Just write and circle the equations, do not try to simplify or solve them.



5. (24 pts) For the waveform shown, find:
   a) peak-to-peak voltage or current, V_{pp}
   b) amplitude, A
   c) period, T
   d) frequency f in cycles/sec or Hz
   e) frequency ω in radians/sec
   f) the phase angle in degrees
   g) a complete expression for v(t), include numbers and units
   h) This waveform is used as the source in the circuit below. What is the average power dissipated by the resistor?



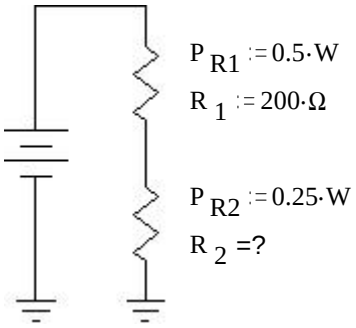


The questions below are similar to what you might see on the FE exam. They expect you to average about 2 minutes per question.

6. (4 pts)

In the circuit shown, the power loss in R_1 is 0.5 W and the power loss in R_2 is 0.25 W. What is the value of the resistor, R_2?

a) 100 Ω
b) 141 Ω
c) 283 Ω
d) 400 Ω



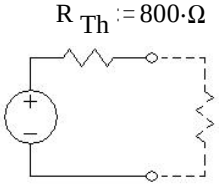
7. (4 pts)

In the circuit of problem 6, what is output power of the battery?

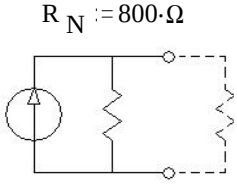
a) 0.25 W
b) 0.5 W
c) 0.75 W
d) 1 W

Answers

1. $8.4 \cdot V$ 2. $3 \cdot mA - 1 \cdot mA = 2 \cdot mA$ 3. a) $V_{Th} := 7.2 \cdot V$



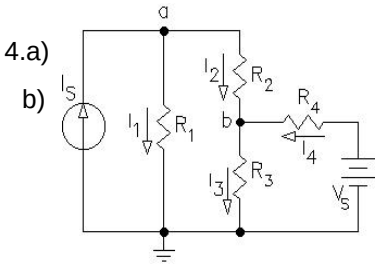
b) $I_N := 9 \cdot mA$



3 c) $2.4 \cdot V$ d) $14.4 \cdot mW$

4.a)

b)



4 c) 2

d) $I_S = \frac{V_a - 0}{R_1} + \frac{V_a - V_b}{R_2}$ $\qquad \frac{V_a - V_b}{R_2} + \frac{V_s - V_b}{R_4} = \frac{V_b - 0}{R_3}$

5. a) $V_{pp} = 8 \cdot V$ b) $A = 4 \cdot V$ c) $T = 2 \cdot ms$ d) $f = 500 \cdot Hz$ e) $\omega = 3142 \cdot \frac{rad}{sec}$

f) $\phi = 90 \cdot deg$ g) $v(t) := 4 \cdot V \cdot \cos\left(3142 \cdot \frac{rad}{sec} \cdot t + 90 \cdot deg\right) + 2 \cdot V$ h) $V_{RMS} = 3.464 \cdot V$