Name _____

By writing or printing my name in the space above, I hereby affirm that I have neither given nor received assistance in preparing solutions for this exam.

EE 2240

Exam #2

Due by 8:00AM, Tuesday, November 9, 2021

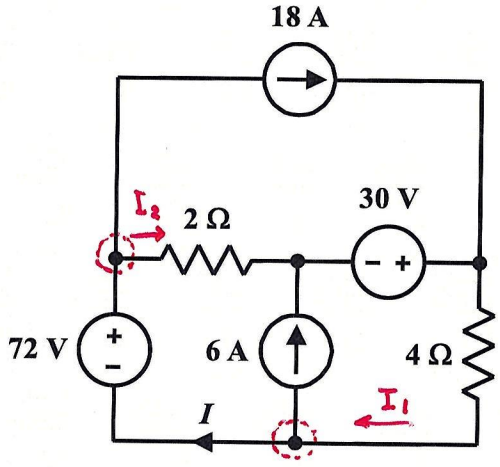
[open book, open notes, calculator and computer allowed – no internet access]

Work must be neat, orderly, and complete in order to receive partial credit.

LTspice solutions are not allowed.

***PLEASE* submit your solutions as a single PDF file.**

1. Determine the numerical value of the current I.



$I_1 = I + 6$ (KCL)

$I_2 = I - 18$ (KCL)

$-72 + 2I_2 - 30 + 4I_1 = 0$ (KVL)

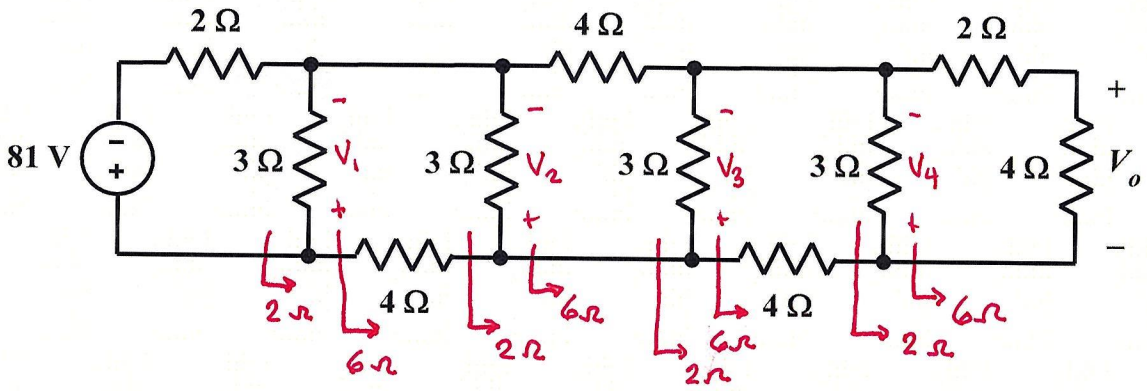
$\Rightarrow -72 + 2(I-18) - 30 + 4(I+6) = 0$

$6I = 114$

$I = 19$ A

2. Determine the numerical value of the voltage V_o.

Method 1



$$V_1 = \frac{2}{2+2}(81) = 40.5\,V$$

$$V_2 = \frac{2}{4+2}(40.5) = 13.5\,V$$

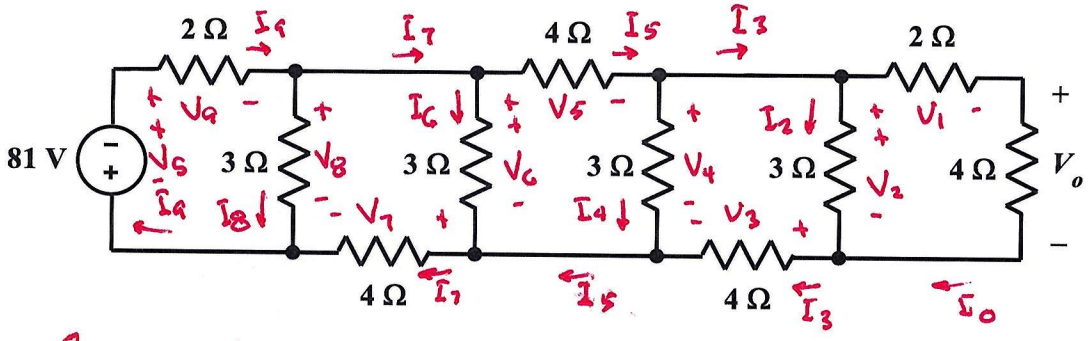
$$V_3 = \frac{2}{4+2}(13.5) = 4.5\,V$$

$$V_4 = \frac{2}{4+2}(4.5) = 1.5\,V$$

$$V_o = -\frac{4}{4+2}(1.5) = -1\,V$$

2. Determine the numerical value of the voltage V_o.

Method 2



Guess $V_o = 4\,V$

Then $I_o = 1\,A$

$V_1 = 2\,V$

$V_2 = 6\,V$

$I_2 = 2\,A$

$I_3 = 3\,A$

$V_3 = 12\,V$

$V_4 = 18\,V$

$I_4 = 6\,A$

$I_5 = 9\,A$

$V_5 = 36\,V$

$V_6 = 54\,V$

$I_6 = 18\,A$

$I_7 = 27\,A$

$V_7 = 108\,V$

$V_8 = 162\,V$

$I_8 = 54\,A$

$I_9 = 81\,A$

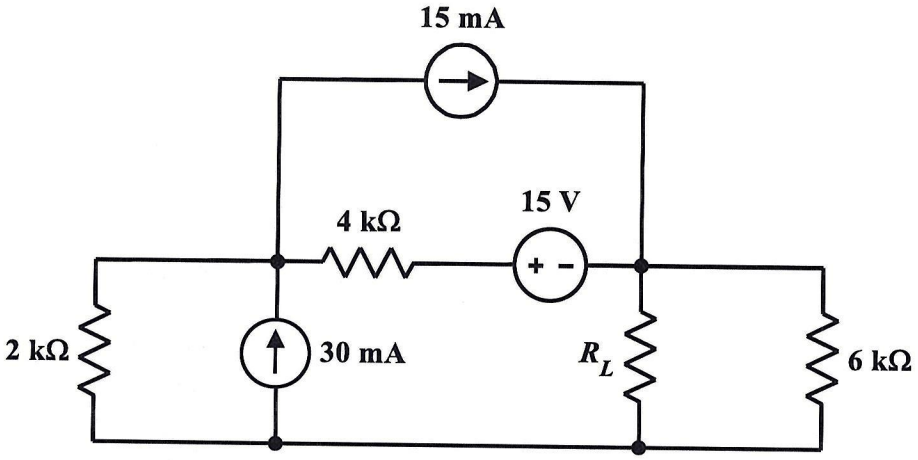
$V_9 = 162\,V$

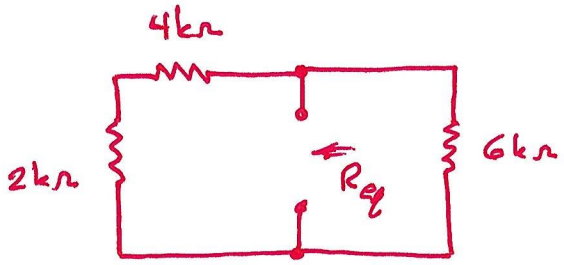
$V_s = 324\,V$

$$\frac{V_o}{4\,V} = \frac{-81\,V}{324\,V}$$

$$\Rightarrow \quad V_o = -1\,V$$

3. Determine the value of R_L that will absorb maximum power from the remainder of the circuit.

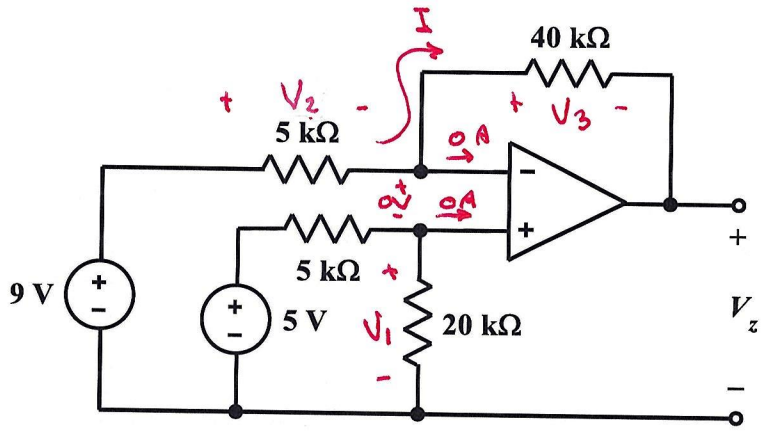




$R_L = R_N = R_T = 6k\Omega \| (4k\Omega + 2k\Omega)$

$= 3k\Omega$

4. Determine the numerical value of the voltage V_z.



$$V_1 = \frac{20k\Omega}{5k\Omega + 20k\Omega} \cdot 5V = 4V$$

$$V_2 = 9V - V_1 = 5V$$

$$I = \frac{5V}{5k\Omega} = 1mA$$

$$V_3 = (40k\Omega)\, I = 40V$$

$$V_z = -40 + 0 + 4 = -36\,V$$