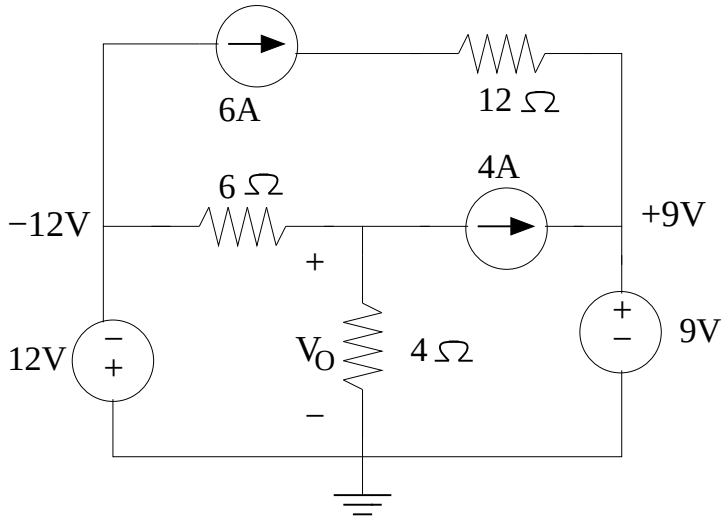
Solutions for Quiz #1

Problem 1: This is a subset of Problem 1.29 from the book.
(a) Valid only if V=0
(b) Valid only if I=0
(c) If R is not infinite, this circuit is valid for any values of I_1 and I_2, since those currents, whatever they are, can always go across the resistor. If R is infinite however, then this circuit is valid only if $I_1 = -I_2$. However I will accept the answer that this circuit is valid for all values of I_1, I_2 and R since that is the answer the book gives. The book's answer ignores the possibility that R is infinite.
(d) If R is infinite, then this circuit is valid only if the current sources are zero. If R is not infinite, then this circuit is valid only for $I_1 = I_2$. Again the book ignore the case of infinite R, so I'll accept the answer without that.
(e) If $R = 0$, then we must have $V_1 = V_2 = 0$ to be a valid circuit. If $R \neq 0$ then we must have $V_1 = V_2$. The book ignores the possibility that $R = 0$, so I'll accept the answer that $V_1 = V_2$.
(f) Valid for all V and I.

Problem 2: This was problem 1.39 from homework set 1. Solution already posted.

Problem 3: We put the ground node at the bottom, and then the left hand node has a value of -12V and the right hand node has a value of 9V, so there is only one unknown node, which is V_o.



The KCL equation for node V_o is:

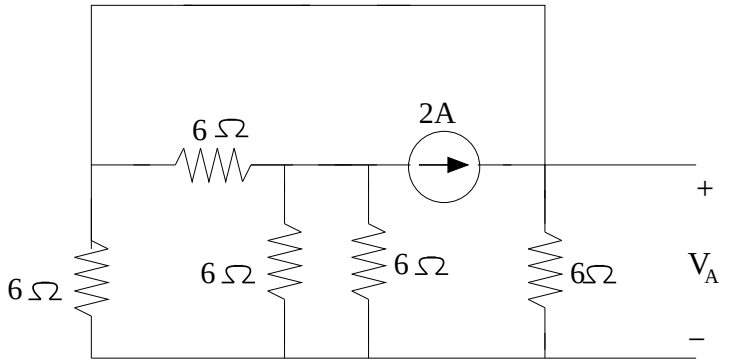
$$\frac{-12 - V_o}{6} = \frac{V_o}{4} + 4$$

and we can directly solve this equation for V_o. We multiply both sides by 12:

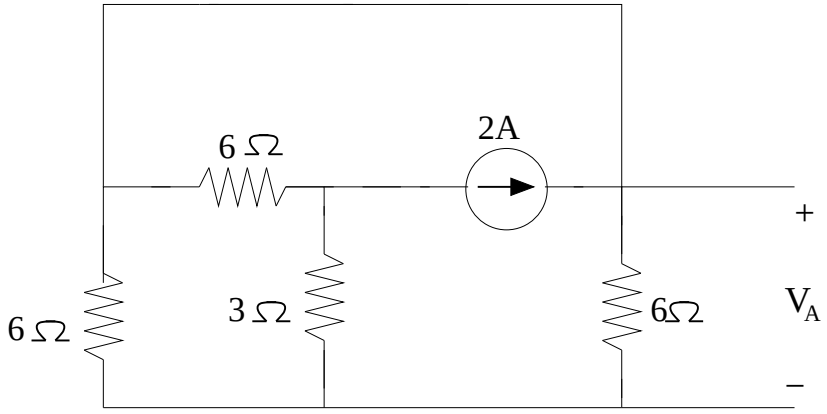
$$-24 - 2V_o = 3V_o + 48$$

$$-72 = 5V_o \qquad \text{so} \qquad V_o = \frac{-72}{5} Volts$$

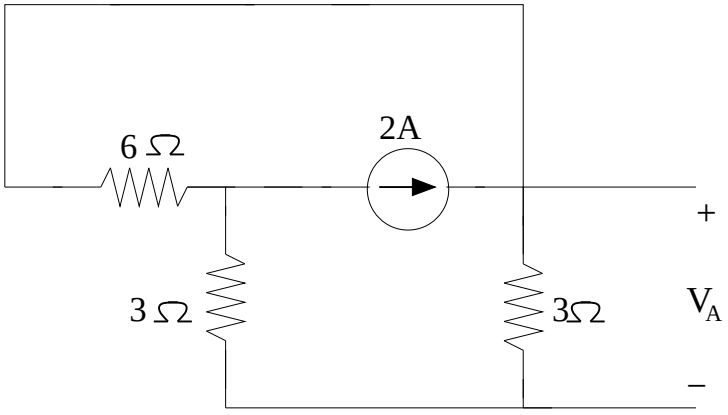
Problem 4: To find the portion V_A due to the current source, we zero out the voltage source:



The two 6Ω resistors in the middle are in parallel, so we can combine them (remove one branch entirely, and relabel the other one as 3Ω).



But we can also notice that the two 6Ω resistors at the left and right ends are also in parallel, because they are connected to the same two nodes. So we can combine them also:



We now see that the 2A source has two identical paths to which it supplies current. Each path has 6Ω of resistance on it. So 1A of current will go in each direction. Therefore $V_A = 3$V.