Closed book and notes. There is room to do your work and give your answers on the quiz. Show reasoning for full credit. **Be sure to put your name on your paper.** There are 2 questions and 50 points (*approximate point values are given*). You may use a calculator.

1. (15 points) Find $V_a$ in the circuit below.

\[ V_a = 10 \text{V} \times \frac{R}{3 \Omega + R} \quad R = \frac{6 \Omega \times 3 \Omega}{6 \Omega + 3 \Omega} = 2 \Omega \]

\[ = 10 \text{V} \times \frac{2 \Omega}{5 \Omega} = 4 \text{V} \]
2. (35 points)

(a) Find $V_x$ in the circuit below. Note that $i_4 = 0$. (Hint: well-suited to nodal analysis.)

(b) Find $V_a$.

(c) Here, $V_a \equiv V_{oc}$ for the Thévenin equivalent of the circuit with output terminals $a$ and $b$. Find $R_0$, the resistance in the Thévenin equivalent circuit.

\[
\begin{align*}
\text{(a) Nodal analysis at point } X: \\
i_1 + i_2 &= i_3. \text{ Note } i_2 &= 18A \text{ since } i_4 = 0. \\
\frac{18V - V_x}{2\Omega} + 18A &= \frac{V_x}{3\Omega} \\
3(18 - V_x) + 6 \times 8 &= 2V_x \\
5V_x &= 9 \times 18 \\
V_x &= 32.4V
\end{align*}
\]

\[
\begin{align*}
\text{(b) } V_a &= V_y \text{ (see diagram).} \\
\text{Since voltage drop across the 3 \Omega resistor connected to point } a \text{ is } \Delta V = 3\Omega \times i_y = 0. \\
V_y - V_x &= 18A \Rightarrow V_y = V_x + 18V = 32.4V + 18V = 50.4V
\end{align*}
\]

\[
\begin{align*}
\text{(c) Set independent sources to zero (voltage source becomes short circuit, current source becomes open circuit). Network becomes:} \\
\begin{align*}
R_0 &= 4 \Omega + 2 \frac{13\Omega}{2} = 4\Omega + \frac{65\Omega}{2} \\
R_0 &= 5.2 \Omega
\end{align*}
\end{align*}
\]