Problem 1

For the circuit shown below, write the node and modified node equations. Assume $I_L(0) = I_0$ and $V_C(0) = V_0$.

Problem 2 (Chua, Pr. 12.6)

For the circuit shown below, find node equations. Assume $I_{L1}(0) = I_1$, $I_{L2}(0) = I_2$ and $V_C(0) = V_0$. 

![Circuit Diagram](image)
Problem 3 (Chua, Pr. 12.12)

The circuit given below contains a mutual inductor with the following defining equation.

\[
\begin{bmatrix}
V_{L1} \\
V_{L2} \\
V_{L3}
\end{bmatrix} =
\begin{bmatrix}
4 & 2 & 1 \\
2 & 4 & 2 \\
1 & 2 & 4
\end{bmatrix}
\frac{d}{dt}
\begin{bmatrix}
i_1 \\
i_2 \\
i_3
\end{bmatrix}
\]

The reference directions for \(i_1\), \(i_2\) and \(i_3\) are given on the circuit diagram. The other components are \(C_1 = 0.5\) F, \(C_2 = 0.25\) F, \(g_m = 2\), \(R_1 = 1\) \(\Omega\), \(R_1 = 2\) \(\Omega\).

Write mesh equations. Assume zero initial conditions.