Instructions. Print your name in the spaces above. Place a box around any answer. Honor Code Statement: 
I have neither given nor received help on this quiz. 

1 of 2. (a) Solve for the differential equation for the voltage \( V \). Consider the current \( I \) to be an independent source. 
(b) Convert the differential equation into the transfer function \( T(s) = \frac{V}{I} \).

\[ i = \frac{1}{L} \int v dt + \frac{1}{R} v + C \frac{dv}{dt} \]
\[ \frac{di}{dt} = \frac{1}{L} v + \frac{1}{R} \frac{dv}{dt} + C \frac{d^2v}{dt^2} \]
\[ sI = \frac{1}{L} V + \frac{1}{R} sV + C s^2 V \]
\[ Z = \frac{V}{I} = \frac{s}{\frac{1}{L} + \frac{s}{R} + C s^2} = R \frac{L^s}{\frac{L}{R} s + 1} \]

2 of 2. For \( R_1 = 10 \, \text{k\Omega} \), \( R_2 = 20 \, \text{k\Omega} \), \( R_3 = 2 \, \text{k\Omega} \), and \( R_4 = 100 \, \text{\Omega} \), \( v_1 = 0.03 \, \text{V} \), and \( v_2 = -0.02 \, \text{V} \), solve for and label the voltage at each node in the circuit. (There are 7 node voltages to solve for.)

\[ v_{N1} = v_1 = 0.03 \, \text{V} \quad v_{N2} = v_2 = -0.02 \, \text{V} \]

\[ v_{O1} = \left(1 + \frac{R_3}{R_4}\right) v_1 - \frac{R_3}{R_4} v_2 = 21 \times 0.03 - 20 \times (-0.02) = 1.03 \, \text{V} \]

\[ v_{O2} = \left(1 + \frac{R_3}{R_4}\right) v_2 - \frac{R_3}{R_4} v_1 = 21 \times (-0.02) - 20 \times 0.03 = -1.02 \, \text{V} \]

\[ v_O = \frac{R_2}{R_1} (v_{O1} - v_{O2}) = 2 \times (1.03 + 1.02) = 4.1 \, \text{V} \]