VI. (30 pts): Consider the circuit below used to build an oscillator. The op-amp is assumed to be ideal, i.e., it has an infinite impedance resistance looking into the positive and negative terminals of the op-amp. Determine the expression for the frequency of oscillation. Find the relation between \(R_1\) and \(R_2\) for the circuit to oscillate.

Hint: Calculate \(v_+\) and \(v_-\) as a function of \(v_0\) and force \(v_+\) to be equal to \(v_-\).

\[
\begin{align*}
N_+ &= \frac{Z_1}{Z_1 + Z_2} & N_0 &= \frac{1}{1 + \frac{1}{Y_1} Z_2} \\
Z_2 &= R + \omega L & \frac{1}{Y_1} &= \frac{1}{R} + \frac{1}{\omega L} \\
N_- &= \frac{R_1}{R_1 + R_2} N_0 \\
N_+ &= \frac{\sqrt{N_0}}{1 + \left(\frac{1}{R} + \frac{1}{\omega L}\right) (R + \omega L)} = \frac{N_0}{1 + 1 + \frac{\omega L}{R} + \frac{R}{\omega L} + 1} \\
N_+ &= \frac{\sqrt{N_0}}{3 + \left(\frac{\omega L}{R} - \frac{R}{\omega L}\right)} = \frac{N_0}{3 + j \left(\frac{\omega L}{R} - \frac{R}{\omega L}\right)} \\
N_+ &= \frac{1}{N_-} = \frac{R_1}{R_1 + R_2} \Rightarrow \frac{1}{3 + j \left(\frac{\omega L}{R} - \frac{R}{\omega L}\right)} = \frac{R_1}{R_1 + R_2} \\
\text{Oscillations occur when } \frac{R_1}{R_1 + R_2} = \frac{1}{3} \Rightarrow R_2 = 2R_1
\end{align*}
\]