1. An ideal op-amp is connected as shown below with \( R_1 = 10k\Omega \) and \( R_2 = 100k\Omega \). A symmetrical square-wave signal with levels of 0 V and 1 V is applied at the input. Sketch and clearly label the waveform of the resulting output voltage. What is its average value? What is its highest value? What is its lowest value?

2. The circuit shown below utilizes an ideal op amp.
   a) Find \( I_1, I_2, I_3, I_L \) and \( V_x \).
   b) If \( V_o \) is not to be lower than -13 V, find the maximum allowed value for \( R_L \).
   c) If \( R_L \) is varied in the range 100 \( \Omega \) to 1 \( k\Omega \), what is the corresponding change in \( I_L \) and in \( V_o \)?
3. Derive an expression for the voltage gain, $\frac{v_o}{v_i}$, of the circuit shown below.