Problem 1 (10 points)
Find the voltage gain $V_{out}/V_{in}$ for the following circuit.
Assume that the opamp is ideal.

\[ V_{out}/V_{in} = \]
Problem 2 (10 points)
Find the output voltage $V_{out}$ as a function of input voltage $V_{in}$ and input current $I_{in}$.
Assume that the opamp is ideal.
Problem 2 (continued)

\[ V_{out} = f(V_{in}, I_{in}) = \]
Problem 3 (10 points)
Determine $I_1$, $V_2$ and the state of the diodes (on/off).

*Use the 0.7V constant-voltage drop model for the diodes. Verify diode assumptions (provide $v_D$ and $i_D$).*
Problem 3 (continued)

\[ D_1 = \quad D_2 = \quad D_3 = \quad I_1 = \quad V_2 = \quad \]
Problem 4 (15 points)
(a) Determine $v_{out}(t)$ if $v_{in}(t) = 5\sin(10\pi t)$ V.
(b) Sketch two periods of $v_{in}(t)$ and $v_{out}(t)$ to illustrate the circuit operation. Make sure you label the axes.
(c) Sketch the $v_{out}$ vs. $v_{in}$ transfer characteristics. Make sure you label the axes.

Use the 0.7V constant-voltage drop model for the diode. Verify diode assumptions (provide $v_D$ and $i_D$).
Problem 4 (continued)