If $v_5(t) = 12\sin(t)$, find $v_o(t)$ and plot both waveforms. Assume the diode is ideal and show circuits for partial credit.

For $v_5 > 0$
- $D_1$ is **Forward Biased**
- $D_2$ is **Reverse Biased**

$$v_o = \frac{R}{R+2}v_5 = \frac{12}{2} \cdot \sin(t)$$

$$v_o = \frac{1}{2} v_5 = (0.5\sin(t))$$

For $v_5 < 0$
- $D_1$ is **Reverse Biased**
- $D_2$ is **Forward Biased**

$$v_o = \frac{3R}{3R+2}v_5 = \frac{3 \cdot 12}{4 \cdot 2} = 3\sin(t)$$

$$v_o = \frac{3}{4} v_5 = (0.75\sin(t))$$

$\omega = 1$

$$f = \frac{\omega}{2\pi} = \frac{1}{2\pi}$$

$$T = 2\pi$$
Problem 2

Find $V_o$ in terms of the resistors and sources assuming an ideal op-amp. Hint: Use KCL

\[ V^+ = V^- \quad V^+ = V_2 \]
\[ i_{in} = 0 \quad V^- = V_r = V_2 \]
\[ V_A = V^- = V_2 \]

\[ KCL : \frac{V_i - V_A}{R_1} + \left[ \frac{V_o - V_A}{R_2} \right] = 0 \]

\[ V_o = -\frac{V_i}{R_1} + \left[ \frac{1}{R_1} + \frac{1}{R_2} \right] V_A \]

\[ V_o = -\frac{R_2}{R_1} V_1 + \left( \frac{R_2}{R_1} + 1 \right) V_2 \]