Assume the diodes are silicon with a 0.7V forward voltage drop.

1. The input voltage to the circuit below is shown at right (dotted line). Show the output voltage across the resistor. Make it accurate and label the important voltages and times. You can draw your answer right on my drawing, that’s why the input is shown as a dotted line.

2. The voltage waveform shown (dotted line) is applied to the circuit. Accurately draw the output voltage you expect to see across the 20 Ω resistor. Label the important voltages and times.
3. The voltage waveform shown below is applied to the circuit shown. Accurately draw the output voltage \( V_o \) you expect to see. The characteristic curve for the 3-V silicon zener diode is also shown. Label important times and voltage levels.
4. A voltage waveform (dotted line) is applied to the circuits shown. Accurately draw the output waveform ($v_o$) you expect to see. Label important times and voltage levels.
5. A voltage waveform (dotted line) is applied to the circuits shown. Accurately draw the output waveform ($v_o$) you expect to see. Label important times and voltage levels.

\[ V_{DC} = 2 \text{ V} \]
\[ R = 100 \Omega \]

**Answers**

1. Straight lines between the following points: (0ms,0V), (0.7ms,0V), (2ms,1.3V), (3.3ms,0V), (8.7ms,0V), then ramps up as between 0.7ms & 2ms.
2. Straight lines between the following points: (0ms,0V), (1ms,0V), (10ms,4.2V), (10ms,0V), (21ms,0V), then ramps up as between 0.7ms & 10ms.
3. Straight lines between the following points: (0ms,0V), (6ms,3V), (16ms,4.875V), (16ms,0V), (17.4ms,-0.7V), (32ms,-3.438V), (32ms,0V), (38ms,3V), then ramps up as between 6ms & 16ms.
4. Straight lines between the following points: (0ms,0), (2.86ms,2V), (10ms,2V), (10ms,-3V), (19ms,-0.7V), (22.86ms,2V), flat at 2
5. Straight lines between the following points: (0ms,1.3V), (0.2ms,1.3V), (0.4ms,3.3V), (0.4ms,1.3V), (1ms,1.3V).