8. (25 points) A signal has the continuous-time Fourier transform (CTFT) given by

\[ X(\omega) = \begin{cases} 
1; & -\frac{\omega_0}{2} \leq \omega \leq \frac{\omega_0}{2} \\
0; & \text{otherwise}
\end{cases} \]

(a) Sketch \( X(\omega) \) and determine the minimum sampling frequency to avoid aliasing for \( x(t) \).

(b) Sketch the CTFT of \( 2x(t) \) and determine the minimum sampling frequency to avoid aliasing for \( 2x(t) \).

(c) Sketch the CTFT of \( x(t/2) \) and determine the minimum sampling frequency to avoid aliasing for \( x(t/2) \).

(d) Sketch the CTFT of \( x(t - 2) \) and determine the minimum sampling frequency to avoid aliasing for \( x(t - 2) \).

(e) Sketch the CTFT of \( x(t) \cos(\omega_1 t) \) and determine the minimum sampling frequency to avoid aliasing for \( x(t) \cos(\omega_1 t) \).