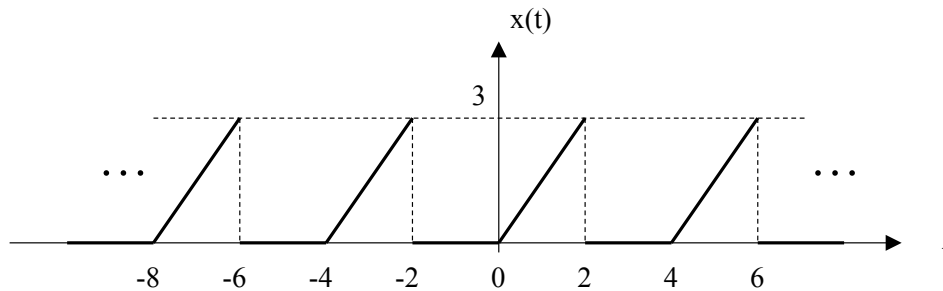1. Consider the periodic signal shown in the figure below.

   (a) Use the differentiation property of the Fourier series expansion, and the Fourier series coefficients of a train of rectangular pulses, to find the Fourier coefficients x_k of $x(t)$.

   (b) Sketch the discrete amplitude spectrum $|x_k|$ in the interval $-2 \leq k \leq 2$.

   (c) Determine the THD (total harmonic distortion) of $x(t)$.

2. (Based on problem 2.47 of the textbook) The Fourier transform (FT) $X(f)$ of a signal $x(t)$ is shown in the figure below. Determine and sketch carefully the FT $Y(f)$ of the signal

$$y(t) = -x(t) + x(t)\,\cos(2000\pi t) + 2\,x(t)\,\cos(3000\pi t).$$
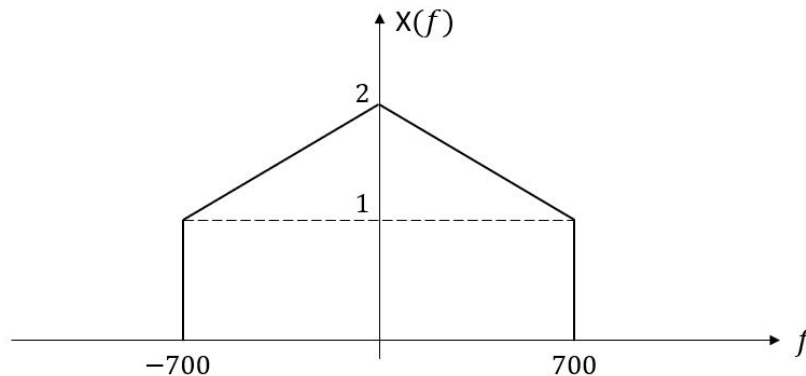
3. For each of the signals $x(t)$ below. find an expression of the Fourier transform and sketch carefully the amplitude spectrum $|X(f)|$.

   (a) $x(t) = 10\,\text{sinc}(2000t)\cos(4000\pi t)$

   (b) A periodic train of rectangular pulses $x(t)$ of amplitudes $\{0, 10\}$, duty cycle 20% and fundamental frequency 1 kHz. For the amplitude spectrum plot, use the range $|f| \leq 10$ kHz.