Problem 12.1: The Fourier series coefficients for the signal $x(t)$ shown in Figure 1 are given by

$$a_k = \begin{cases} \frac{2T_1}{T}, & k = 0 \\ \frac{\sin(k\omega_0 T_1)}{k\pi}, & k \neq 0 \end{cases}.$$

Use this result and properties of Fourier series to determine b_k: the Fourier series coefficients of $g(t)$ shown in Figure 1. Use your result to find the magnitude and phase of b_1. List all the properties that you use at the time of using them.

Problem 12.2: Use Fourier series and the multiplication property of Fourier series to prove the trigonometric identity (double-angle formula)

$$\sin(2t) = 2\sin t \cos t.$$

Problem 12.3* Suppose you are given the following information about a signal $x(t)$:

(I.) $x(t)$ is real and odd.

(II.) $x(t)$ is periodic with period $T = 2$ and has Fourier series coefficients a_k.

(III.) $a_k = 0$ for $|k| > 1$.

(IV.) $\frac{1}{2}\int_0^2 |x(t)|^2 dt = 1$.

Specify two different signals that satisfy these conditions.

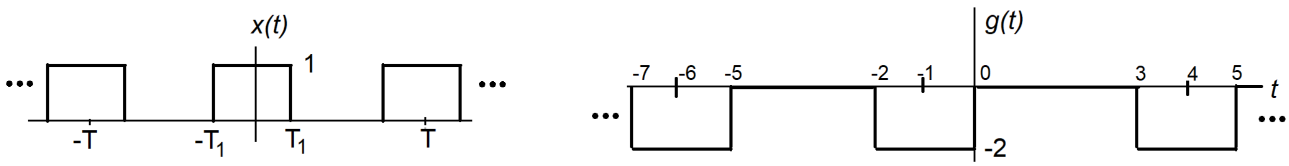

Figure 1

Optional, but testable, problems: From the textbook, Problems 3.23, 3.24, 3.26.