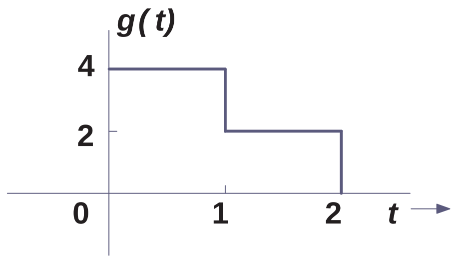
Electrical Engineering and Computer Science
Syracuse University

ELE 551, Fall 2010

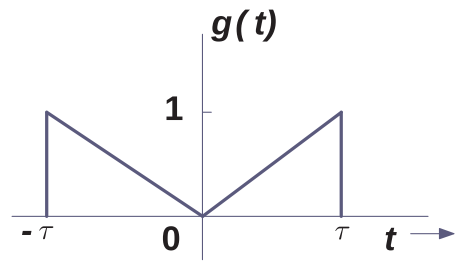
Homework #3

Due on **Sept. 23, 2010, Thursday** in class

1. [10 points](L&D Exercise 3.1-4) Compute the Fourier transforms of the signals shown below.



(a)



(b)

Hint: The function $g(t)$ in (b) can be expressed as

$$g(t) = \begin{cases} \frac{t}{\tau} & 0 \leq t \leq \tau \\ -\frac{t}{\tau} & -\tau \leq t \leq 0 \\ 0 & \text{otherwise} \end{cases}$$

You may also want to use $\int te^{at}dt = \frac{e^{at}}{a^2}(at - 1)$ for (b).

2. [10 points] (L&D Exercise 3.2-3) Show that

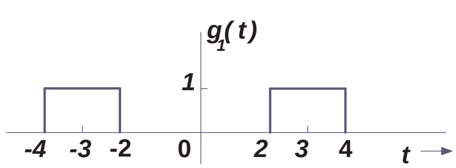
$$\sin(2\pi f_0 t + \theta) \Longleftrightarrow \frac{1}{2}\Big[\delta(f + f_0)e^{-j\theta + j0.5\pi} + \delta(f - f_0)e^{j\theta - j0.5\pi}\Big].$$

Hint: Use Euler's formula to express $\sin(2\pi f_0 t + \theta)$ in terms of exponentials.

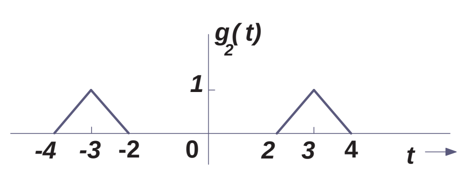
3. [10 points] (L&D Exercise 3.3-4) Use the time-shifting property to show that if $g(t) \Longleftrightarrow G(f)$, then

$$g(t + T) + g(t - T) \Longleftrightarrow 2G(f)\cos 2\pi fT.$$

Use this result and Fourier transforms for the rectangular and triangular functions to find the Fourier transforms of the signals shown below.



(a)



(b)

Hint: The functions $g_1(t)$ and $g_2(t)$ in the figure can be expressed as follows.

$$g_1(t) = \Pi\left(\frac{t-3}{2}\right) + \Pi\left(\frac{t+3}{2}\right)$$

$$g_2(t) = \triangle\left(\frac{t-3}{2}\right) + \triangle\left(\frac{t+3}{2}\right)$$