

2704: Signals and Systems

Quiz #1

February 1, 2006

Given the function

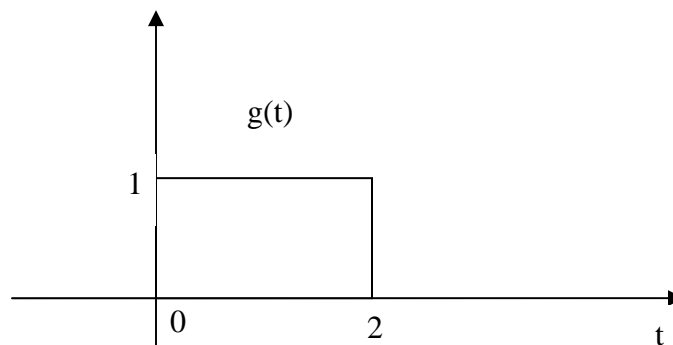
$$g(t) = u(t) - u(t-2)$$

sketch the function

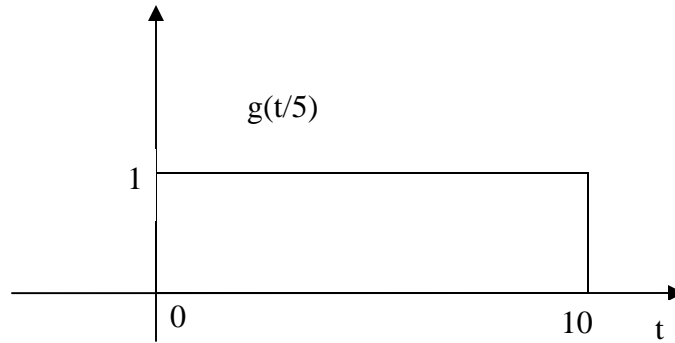
$$g\left(\frac{t-10}{5}\right)$$

Solution: There are two ways to tackle this problem. First, we can simply determine $g(t)$ and then perform the appropriate transformations.

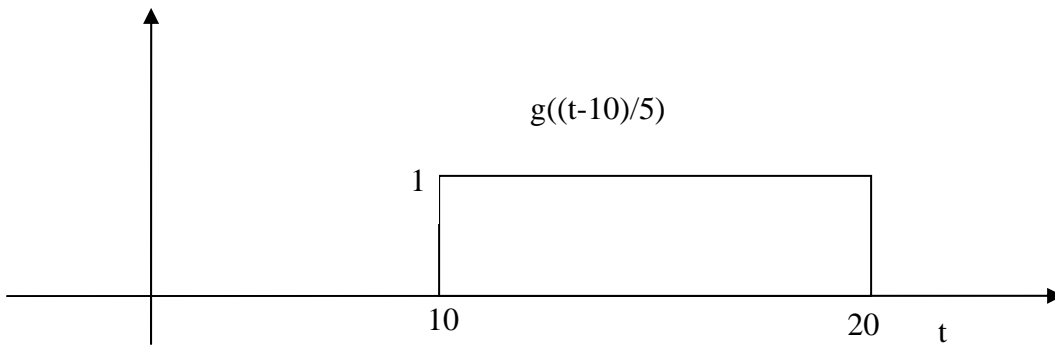
The function $g(t)$ is simply the sum of two unit step functions. The first turns on at $t=0$ while the second turns on at $t = 2$ but has negative amplitude. This results in a pulse of duration $T=2$:



First we time-scale this function by 5 or plot $g(t/5)$. This slows down the function by a factor of 5.



Next, we time shift by a factor of 10 or plot $(g((t-10)/5))$:



Which is the final answer.

A second way to determine the plot is to use the initial expression for $g(t)$:

$$u\left(\frac{t-10}{5}\right) - u\left(\frac{t-10}{5} - 2\right)$$

Recall that the definition of the unit step says that it returns a value of 0 when the argument is negative and a value of 1 when the argument is positive. The first step will turn on when $t=10$ (since this is when the argument is 0). The second step will turn on when $t=20$ since this is when its argument is zero. Thus, the function results in a pulse which turns on at $t = 10$ and turns off when $t = 20$.