MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science

6.003: Signals and Systems — Spring 2004

Tutorial 5 Solutions

Tuesday, March 9, 2004

Problem 5.1

(a) No

(b) No

Problem 5.2

(a) Unstable, non-causal, linear, time variant

(b) Stable, causal, linear, time variant

(c) Unstable, causal, non-linear, time invariant

Problem 5.3

(a)

$$y_a(t) = \begin{cases} 0\,, & t < -1 \\ \frac{2\cos(\pi t)+\pi\sin(\pi t)+2e^{-2(t+1)}}{4+\pi^2}\,, & -1 \le t \le 3 \\ \frac{e^{-2t}(e^{-2}-e^{6})}{4+\pi^2}\,, & t > 3 \end{cases}$$

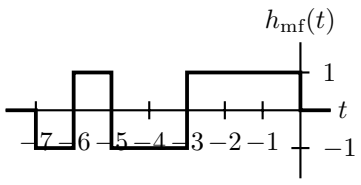
(b)

$$y_b(t) = \begin{cases} 0\,, & t < -3 \\ \frac{1}{3} + (2+t)^2 + \frac{4}{3}(2+t)^3\,, & -3 \le t \le -1 \\ \frac{8}{3}\,, & t > -1 \end{cases}$$

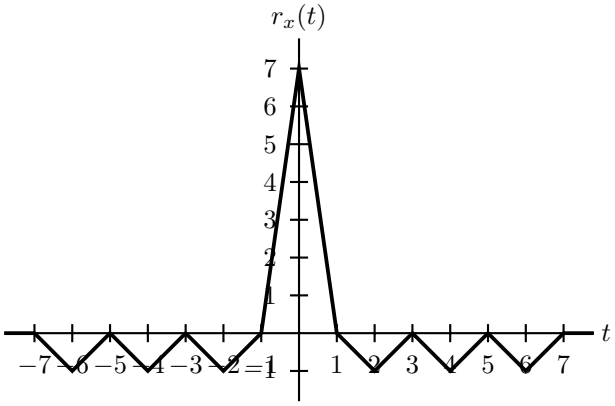
Problem 5.4

(a) $h_{\text{mf}}(t) = x(-t)$.

(b)



(c)



Problem 5.5 $y[n] = A\sin(\frac{2\pi}{3}n + B) + \left[\frac{1-\frac{1}{2}^{n-1}}{1-\frac{1}{2}}\right] u[n-2]$
$A = \frac{2}{\sqrt{7}}$
$B = -\tan^{-1}\left(\frac{\sqrt{3}}{5}\right)$

Problem 5.6

(a) $h_a[n] = \delta[n] - \frac{1}{3}\delta[n-1]$

(b) $h_b(t) = u(t+1) - u(t-2) - 3\delta(t-2)$

(c) $h_c(t) = u(t+1) - u(t-2)$.

Problem 5.7 Use example 3.5 in O&W and Parseval's to show that:

$$\sum_{k=-\infty}^{+\infty} \left(\frac{\sin(k\pi/2)}{k\pi}\right)^2 = \frac{1}{2}.$$

Problem 5.8

$$x[n] = 2\cos\left(\frac{2\pi}{5}n\right)$$