PROBLEM:

Let $h(t) = \delta(t+10) + 2\delta(t) + \delta(t-10)$.

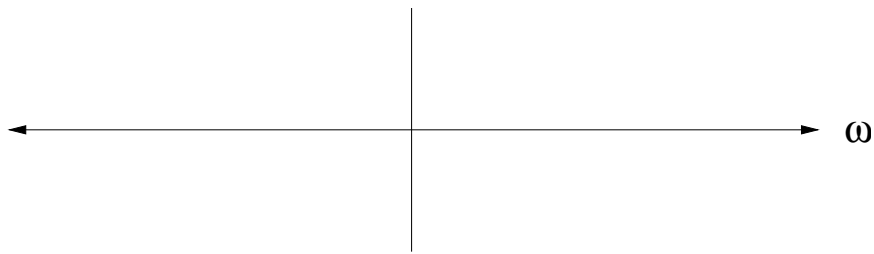
(a) Find $H(j\omega)$.

$H(j\omega) =$

(b) Let $y(t) = h(t-10)$. Find the phase of $Y(j\omega)$, the Fourier transform of $y(t)$.

$\angle Y(j\omega) =$

(c) If $x(t) = \dfrac{\sin 100\pi t}{\pi t} - \dfrac{\sin 50\pi t}{\pi t}$, plot $X(j\omega)$. Carefully label your plot.



McClellan, Schafer and Yoder, *Signal Processing First*, ISBN 0-13-065562-7.
Prentice Hall, Upper Saddle River, NJ 07458.

SOLUTION

Let $h(t) = \delta(t+10) + 2\delta(t) + \delta(t-10)$.

(a) Find $H(j\omega)$.

$H(j\omega) = e^{+j10\omega} + 2 + e^{-j10\omega}$

Simplify:

$H(j\omega) = 2 + 2\cos(10\omega)$

(purely real)

(b) Let $y(t) = h(t-10)$. Find the phase of $Y(j\omega)$, the Fourier transform of $y(t)$.

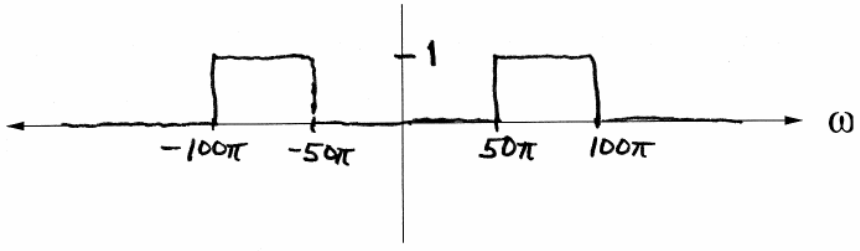
$\angle Y(j\omega) = -10\omega$

$Y(j\omega) = e^{-j10\omega} H(j\omega)$

$= e^{-j10\omega}\,(2 + 2\cos(10\omega))$

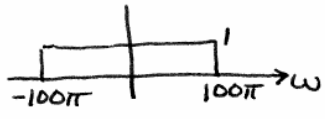
phase: $e^{-j10\omega}$ Magnitude: $(2 + 2\cos(10\omega))$

(c) If $x(t) = \dfrac{\sin 100\pi t}{\pi t} - \dfrac{\sin 50\pi t}{\pi t}$, plot $X(j\omega)$. Carefully label your plot.



Each "sinc" transforms to a rectangle, so you must subtract the two rectangles

$\dfrac{\sin 100\pi t}{\pi t}$ F.T. →



$\dfrac{\sin 50\pi t}{\pi t}$ F.T. →