Name: Key

EE322 Fall 2012 Quiz 5

$$\cos\theta = \frac{e^{j\theta}+e^{-j\theta}}{2}, \quad \sin\theta = \frac{e^{j\theta}-e^{-j\theta}}{2j}$$

1. If $x = 0.25e^{j0.25\pi}$, find the magnitude and phase of x.

$|x| = 0.25$

$\angle x = 0.25\pi = \pi/4$

Now find the real and imaginary parts of x.

$Re\{x\}$ $0.25\cos(\pi/4)$

$Im\{x\}$ $0.25\sin(\pi/4)$

2. Write $2\sin(2\pi 75t)$ in terms of complex exponentials.

$$2\left(\frac{e^{j2\pi 75t} - e^{-j2\pi 75t}}{2j}\right) = \frac{1}{j}e^{j2\pi 75t} - \frac{1}{j}e^{-j2\pi 75t}$$

$$= -je^{j2\pi 75t} + je^{-j2\pi 75t}$$

3. If $X(f) = 3f + j4f$, find the real and imaginary parts of $X(f)$.

$Re\{X(f)\} = 3f$

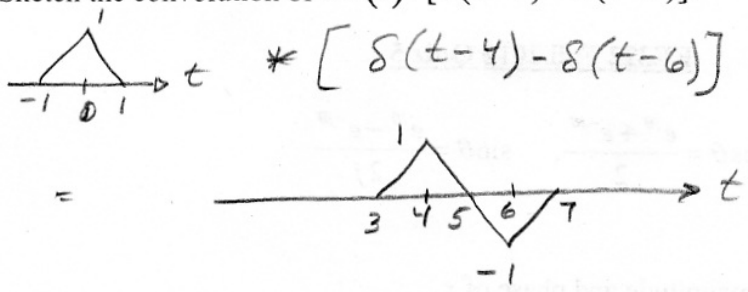
$Im\{X(f)\} = 4f$ NOT used

Now find the magnitude and phase of $X(f)$.

$$|X(f)| = \sqrt{(3f)^2+(4f)^2} = \sqrt{25f^2} = |5f|$$

$$\angle X(f) = \tan^{-1}\left(\frac{4f}{3f}\right) = \begin{cases} \tan^{-1}\left(\frac{4}{3}\right) & \text{if } f \geq 0 \\ -\tan\left(\frac{4}{3}\right) & \text{if } f < 0 \end{cases}$$

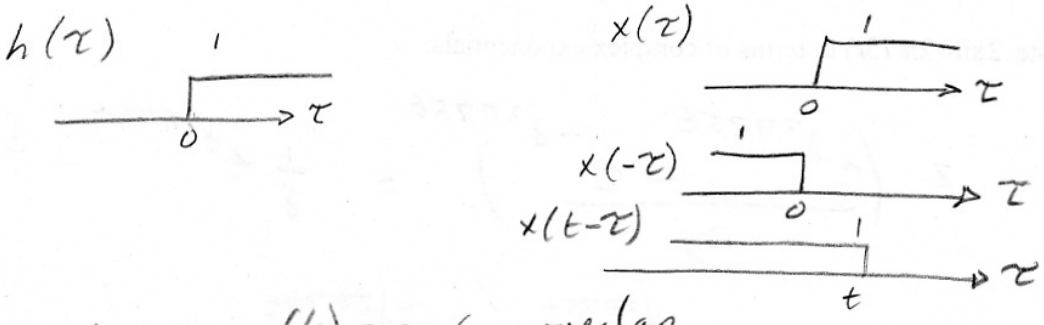
4. Sketch the convolution of $tri(t)*[\delta(t-4)-\delta(t-6)]$.



5. A system has impulse response $h(t) = \text{sgn}(t)$. Is the system BIBO stable? Why or why not?

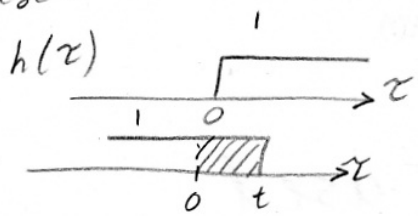
no - $\int_{-\infty}^{\infty} |h(t)|\,dt = \int_{-\infty}^{\infty} 1\,dt = \infty$

6. A system has impulse response $h(t) = u(t)$. If the input to the system is $x(t) = u(t)$, what is the output? Show your work.



case 1: $t \le 0$ $y(t) = 0$ (no overlap

case 2: $t \ge 0$



$y(t) = \int_0^t 1\,d\tau = \tau\Big|_0^t = t$

$$y(t) = \begin{cases} 0, & t \le 0 \\ t, & t \ge 0 \end{cases}$$

OR $\boxed{y(t) = \text{ramp}(t)}$

Bonus: What was the name of the US aircraft carrier that was sunk during the Battle of Coral Sea in WWII? Hint: my uncle (USNA Class of '39) was a dive-bomber pilot on it, and he survived.

USS Lexington