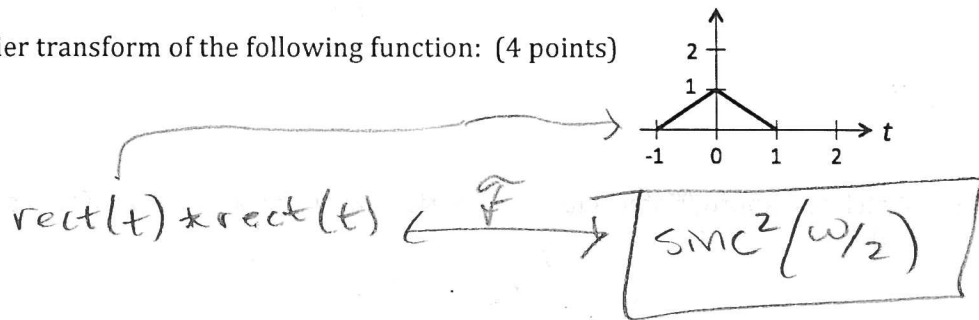SOLUTIONS

Quiz #2
ECEn 380: Signals & Systems
Fall 2015

Closed book, closed note, closed neighbor, no calculators allowed. *Time limit is 15 minutes.*
20 points + 2 extra credit points possible.

HOMEWORK SECTION:

1. Find the Fourier transform of the following function: (4 points)

$$\text{rect}(t) * \text{rect}(t) \xleftarrow{\ \mathcal{F}\ } \boxed{\text{sinc}^2\left(\omega/2\right)}$$

2. Find the Fourier series coefficients x_n of the following signal $x(t)$: (4 points)

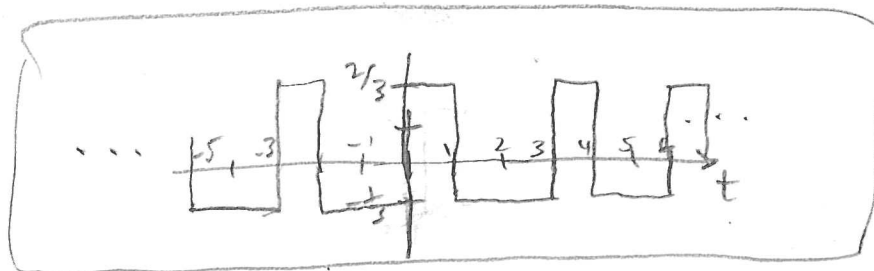$$\omega_0 = \frac{2\pi}{3}$$

$T_0 = 3$

$$x_n = \frac{1}{3}\int_0^1 e^{-jn\frac{2\pi}{3}t}\, dt$$

$$= \left. \frac{e^{-jn\frac{2\pi}{3}t}}{-3jn\frac{2\pi}{3}}\right|_0^1 = \frac{e^{-jn\frac{2\pi}{3}}-1}{-jn2\pi} = \begin{cases} \dfrac{1-e^{-j\frac{2\pi}{3}n}}{2\pi jn} & n \neq 0 \\[4mm] \dfrac{1}{3} & n = 0 \end{cases}$$

3. What is the D.C. bias of $x(t)$ shown in Problem 2? (1 points)
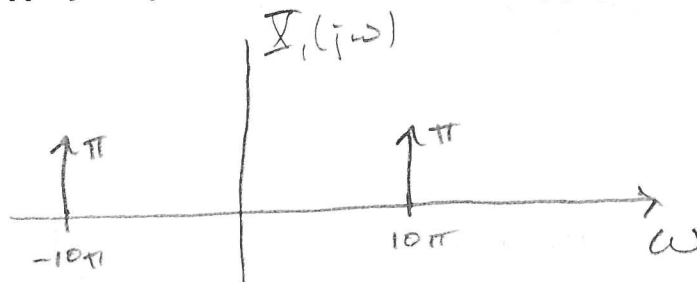
$$\boxed{\frac{1}{3}}$$

4. Sketch a signal with all of the same Fourier series coefficients as $x(t)$ shown in Problem 2
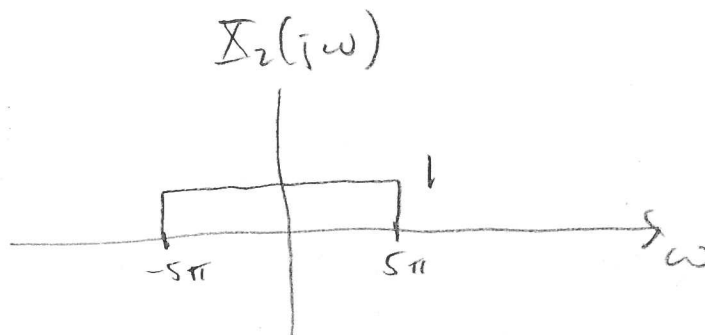except for x_0 (the D.C. bias), which you set to 0. (1 points)

LECTURE SECTION:

1. Sketch and appropriately label the Fourier transform $X_1(j\omega)$ of $x_1(t) = \cos(10\pi t)$. (4 pts)

$X_1(j\omega)$

$\uparrow \pi$ $\uparrow \pi$

-10π 10π

ω

2. Sketch and appropriately label the Fourier transform $X_2(j\omega)$ of $x_2(t) = \sin(5\pi t)/\pi t$. (4 pts)

$X_2(j\omega)$

1

-5π 5π

ω

3. Sketch and appropriately label the Fourier transform of $\cos(10\pi t) \sin(5\pi t)/\pi t$. (4 pts)

$\frac{1}{2}$ $\frac{1}{2}$

-15π -10π -5π 5π 10π 15π ω