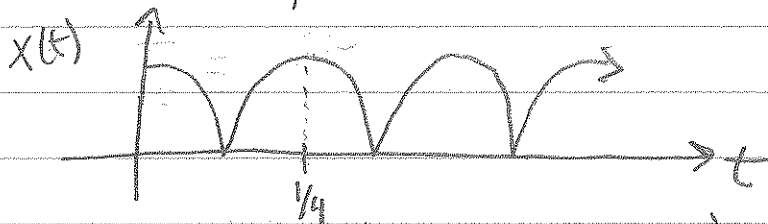


ECE 366 HW 2, Solutions

page 1

#1 a) $X(t) = \cos^4(4\pi t) = (\cos(4\pi t))^4$ is periodic because cosine is periodic.



$$T_0 = \frac{1}{2} \cdot (\text{Period of } \cos(4\pi t)) = \frac{1}{2} \cdot \frac{2\pi}{4\pi} = \boxed{\frac{1}{4} \text{ sec.}}$$

$$\boxed{\text{Frequ.} = 4 \text{ Hz}}$$

b. $X(t) = \cos^2(3\pi t) + \sin(3t)$

$$T_{0,1} = \frac{1}{2} \cdot \frac{2\pi}{3\pi} = \frac{1}{3}$$

$$T_{0,2} = \frac{2\pi}{3}$$

$$\frac{T_{0,1}}{T_{0,2}} = \frac{1/3}{2\pi/3} = \frac{1}{2\pi} \Rightarrow \text{Not rational} \Rightarrow \boxed{\text{Not periodic}}$$

c. $X(t) = \exp(\sin t)$. $x \mapsto \exp$ is invertible!

Thus, the period of $\exp(\sin t) =$ the period of $\sin t = \boxed{2\pi}$

The frequency is $\boxed{\frac{1}{2\pi} \text{ Hz}}$

d. $X(t) = \cos(4t) + 3 \exp(-i 12t) = \cos(4t) + 3 \cos(12t) - i 3 \sin(12t)$

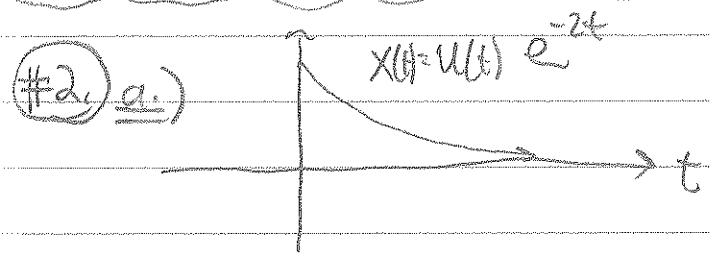
$$T_{0,1} = \frac{2\pi}{4} = \pi/2 \quad \& \quad T_{0,2} = T_{0,3} = \frac{2\pi}{12} = \pi/6$$

#1. d) continued: $\frac{T_{0,1}}{T_{0,2}} = \frac{T_{0,1}}{T_{0,3}} = \frac{\pi/2}{\pi/6} = 3 \Rightarrow$ rational

The sum is periodic! The period is $\pi/2$ sec.

freq. is $2/\pi$ Hz

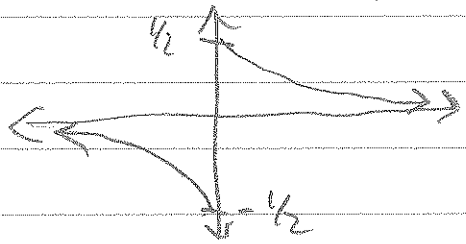
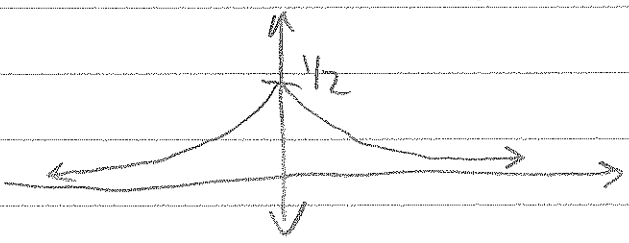
#1. e) $T_0 = 4$ sec, and freq. is $1/4$ Hz



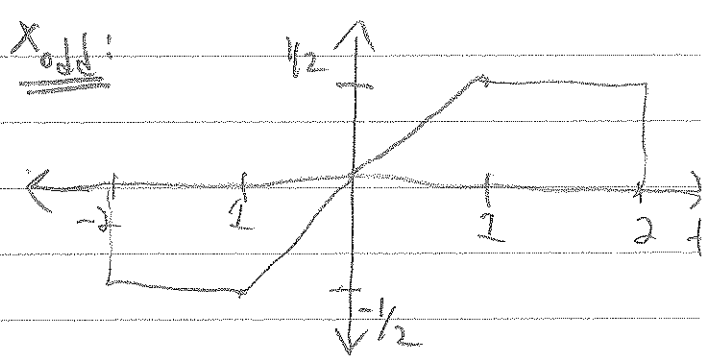
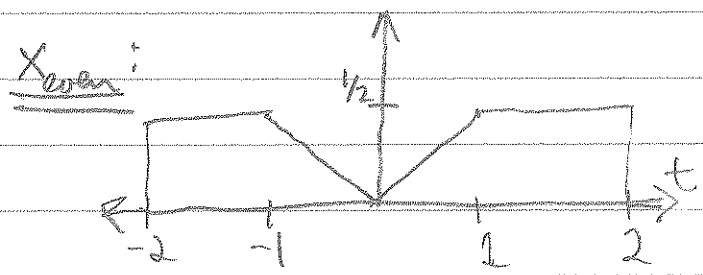
Neither even nor odd!

$$x_{\text{even}}(t) = \frac{e^{-2t} u(t) + e^{+2t} u(-t)}{2}$$

$$x_{\text{odd}}(t) = \frac{e^{-2t} u(t) - e^{+2t} u(-t)}{2}$$

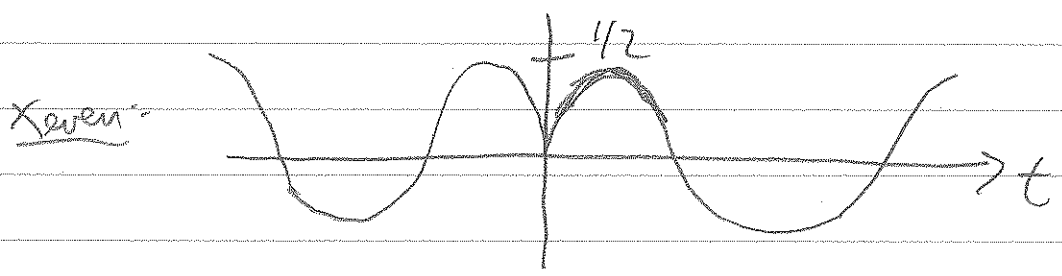


b.) Neither!

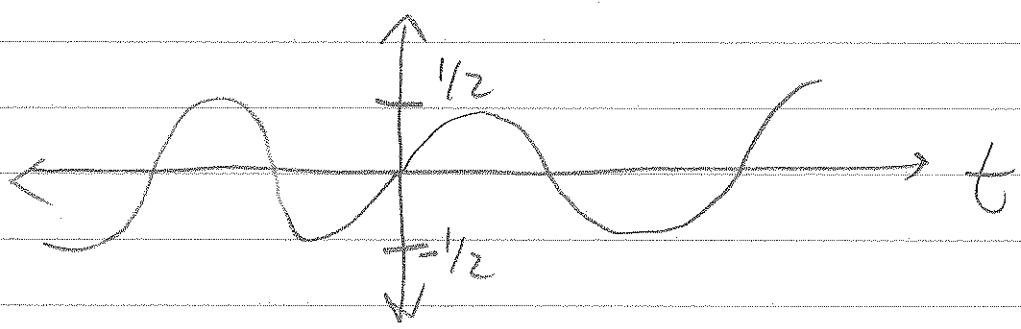


#2. c) $x(t) = \sin(\pi t) u(t)$ is neither

$$x_{\text{even}}(t) = \frac{\sin(\pi t) u(t) + \sin(-\pi t) u(-t)}{2}$$



$$x_{\text{odd}}(t) = \frac{\sin(\pi t) u(t) - \sin(-\pi t) u(-t)}{2}$$



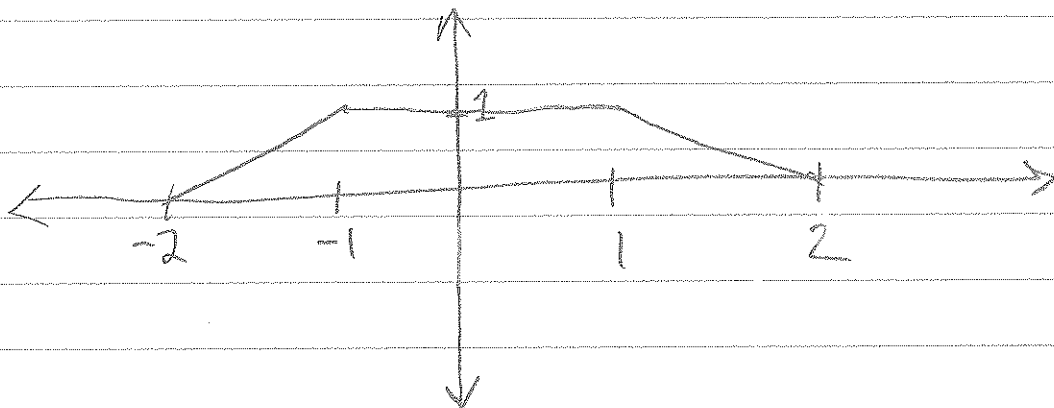
#2. d) Neither! $x_{\text{even}}(t) = \frac{\sin(t) + \cos(t) + \sin(-t) + \cos(t)}{2}$

$x(t) = \sin(t) + \cos(t)$ → $= \cos(t)!$

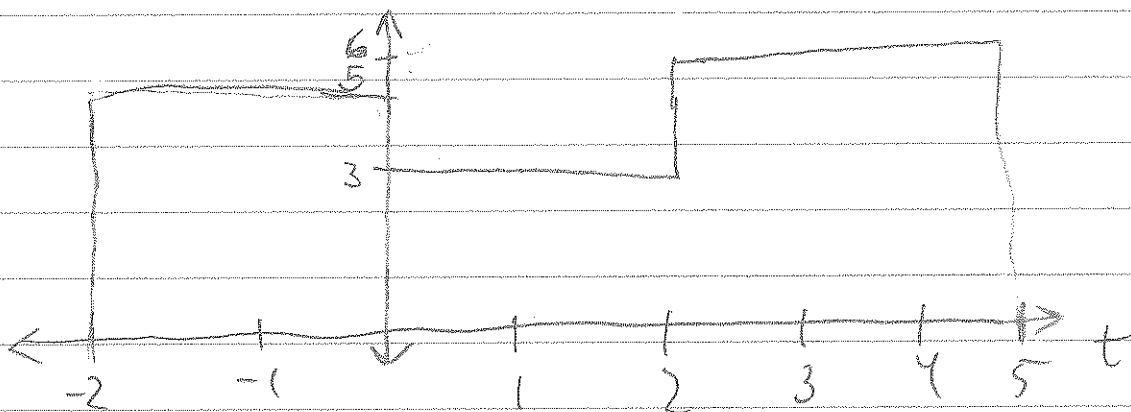
→ $x_{\text{odd}}(t) = \frac{\sin(t) + \cos(t) - \sin(-t) - \cos(-t)}{2}$
 $= \sin(t)!$

OVER ... →

#3) a) $x(t) = r(t+2) - r(t+1) - r(t-1) + r(t-2)$



#3) (b) $5u(t+2) - 2u(t) + 3u(t-2) - 6u(t-5)$



#3) (c) $f(t) \rightarrow$ see m-f/e

#4) a) $\frac{1}{2} r(t) + u(t) - \frac{1}{2} r(t) u(t-2) - u(t-2) + \frac{1}{2} r(-t) + u(-t) - \frac{1}{2} r(-t) u(-t-2) - u(-t-2)$

b) $r(t + \frac{3}{2}) - r(t + \frac{1}{2}) - r(t - \frac{1}{2}) + r(t - \frac{3}{2})$

c) $2r(t) - r(t-2) - r(t+4) - 2u(t-2) + 4u(t+4)$

d) $u(t+1) - r(t) + r(t-1)$