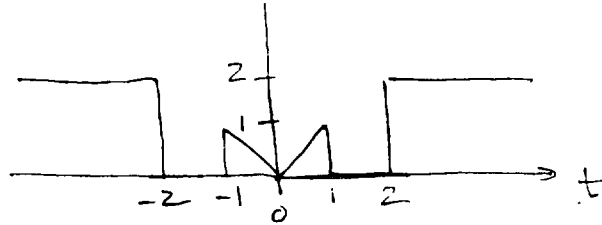


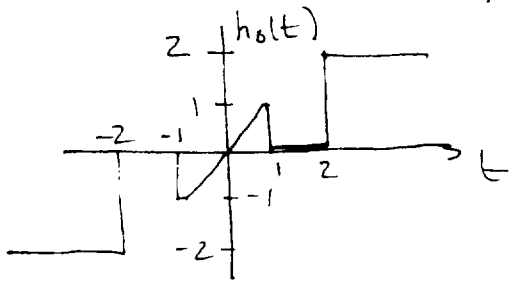
GEORGIA INSTITUTE OF TECHNOLOGY
 SCHOOL OF ECE
 EE 3230
 SOLUTIONS TO QUIZ # 1

① (a) $h_e(t)$ must be even.

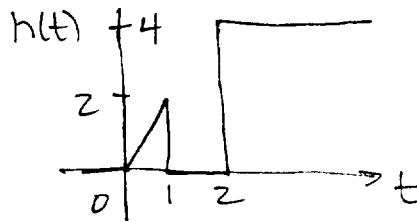


(b) $h(t) = h_e(t) + h_o(t)$ and $h(t) = 0$ for $t < 0$ (causal)

$\Rightarrow h_e(t) = -h_o(t)$ for $t < 0$

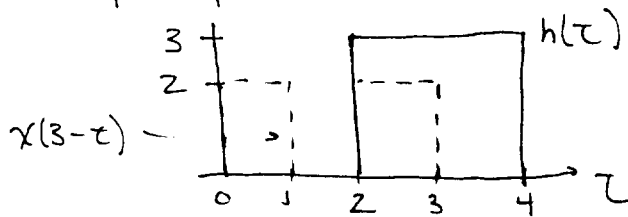


\Rightarrow



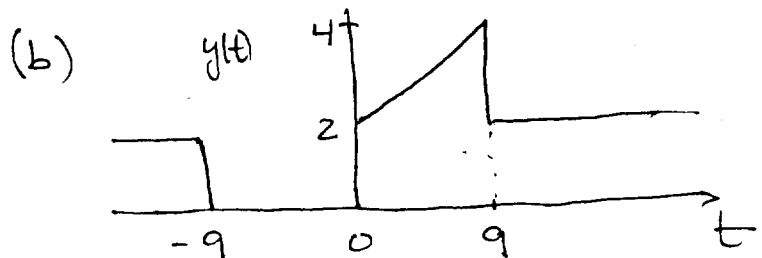
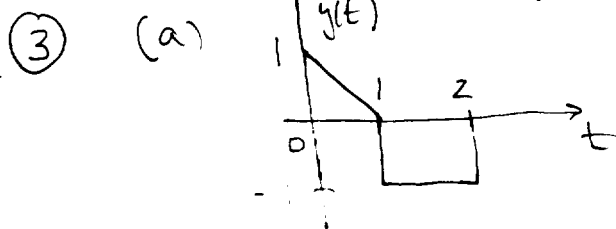
② (a) $y(t)$ reaches a maximum when the pulse from $h(t)$ completely covers a pulse from $x(t)$. For example:

$t=3:$



$\Rightarrow y_{max} = 6$

(b) $3 \leq t \leq 6$



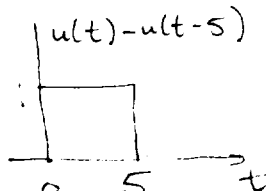
④ (a) Memoryless, Nonlinear, Time-varying, Causal, Unstable

(b) Has Memory, Linear, Time-varying, Noncausal, Unstable

⑤ (a) $x(t) = e^{2t} u(t) - e^{-10} [e^{-2(t-5)} u(t-5)]$

$$e^{2t} u(t) \leftrightarrow \frac{1}{2+j\omega} \quad \text{and} \quad y(t-t_0) \leftrightarrow e^{-j\omega t_0} Y(j\omega)$$

$$\Rightarrow X(j\omega) = \frac{1}{2+j\omega} - \frac{e^{-10} e^{-j5\omega}}{2+j\omega} = \frac{1 - e^{-10} e^{-j5\omega}}{2+j\omega}$$

(b)  $\leftrightarrow e^{-j\frac{5}{2}\omega} \cdot 2 \frac{\sin \frac{5}{2}\omega}{\omega}$ (time-shifted pulse)

Also $ty(t) \leftrightarrow j \frac{dY(j\omega)}{d\omega}$ (differentiation in frequency)

$$\Rightarrow X(j\omega) = j \frac{d}{d\omega} \left[2 e^{-j\frac{5}{2}\omega} \cdot \frac{\sin(\frac{5}{2}\omega)}{\omega} \right]$$

$$= j 5 \frac{e^{-j\frac{5}{2}\omega}}{\omega} - 2j e^{-j\frac{5}{2}\omega} \cdot \frac{\sin(\frac{5}{2}\omega)}{\omega^2}$$