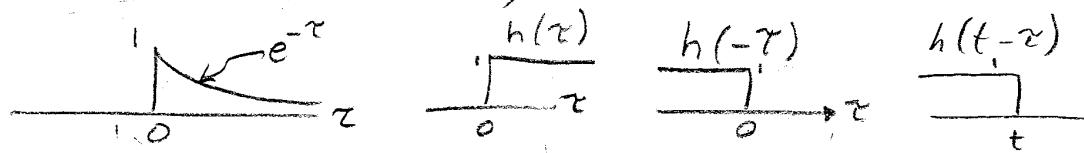


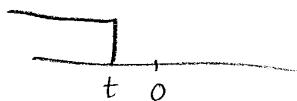
$$\textcircled{1} \quad g(t) = \underbrace{e^{-t} u(t)}_{x(t)} * \underbrace{u(t)}_{h(t)}$$



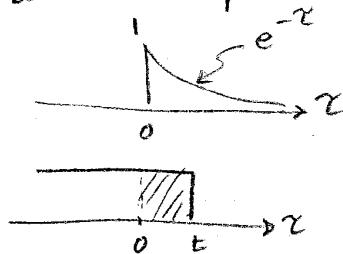
case 1: no overlap to the left



$$t < 0, \quad g(t) = \int_{-\infty}^{\infty} x(z) h(t-z) dz = 0$$



case 1: overlap



$$t > 0 \quad g(t) = \int_0^t e^{-z} dz = -e^{-z} \Big|_0^t = -e^{-t} - (-1) = \boxed{1 - e^{-t}}$$

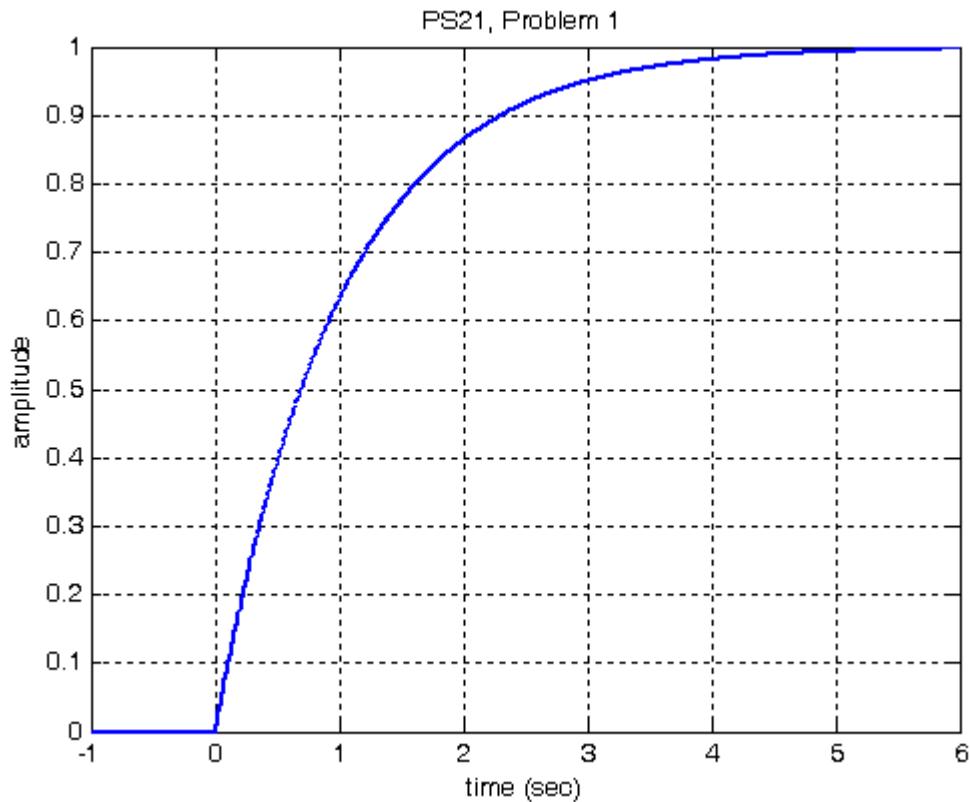
$$g(t) = \begin{cases} 0, & t < 0 \\ 1 - e^{-t}, & t \geq 0 \end{cases}$$

MATLAB on next page

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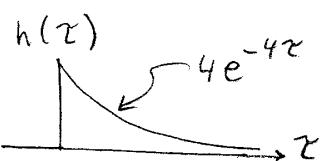
% ps 21, problem 1
% since the solution has two parts, divide the time vector into two pieces
t=-1:.01:6;
x=1-exp(-t);
x=x.*u(t); % use unit step function to turn on the function at t=0.
figure(1),plot(t,x,'linewidth',2), grid on
xlabel('time (sec)'), ylabel('amplitude'),title('PS21, Problem 1')

```

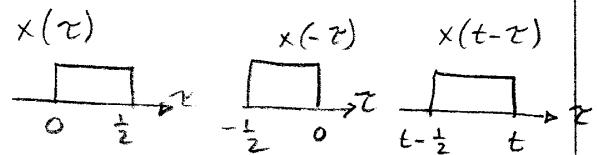


(2) $\int_{6-8}^{T_0x+}$ $g(t) = h(t) * x(t)$

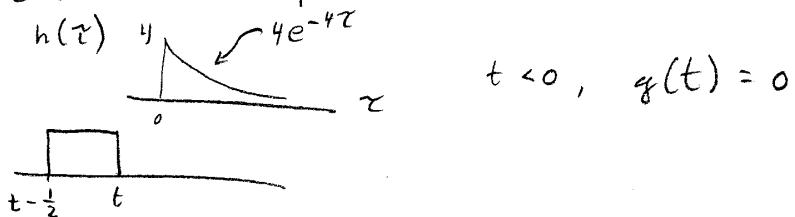
$$h(t) = 4e^{-4t}u(t) \quad x(t) = \text{rect}(2(t - \frac{1}{4}))$$



$$\text{rect}(t) \rightarrow \text{rect}(2t) \rightarrow \text{rect}(2(t - \frac{1}{4}))$$



case 1: no overlap to the left



case 2: partial overlap w/ leading edge

$$g(t) = \int_0^t 4e^{-4\tau} d\tau = -e^{-4\tau} \Big|_0^t = 1 - e^{-4t}$$

$$0 \leq t \leq \frac{1}{2}$$

case 3: full overlap

$$g(t) = \int_{t-\frac{1}{2}}^t 4e^{-4\tau} d\tau = -e^{-4\tau} \Big|_{t-\frac{1}{2}}^t$$

$$= -e^{-4t} - (-e^{-4(t-\frac{1}{2})})$$

$$= e^{-4t+2} - e^{-4t}$$

$$t \geq \frac{1}{2}$$