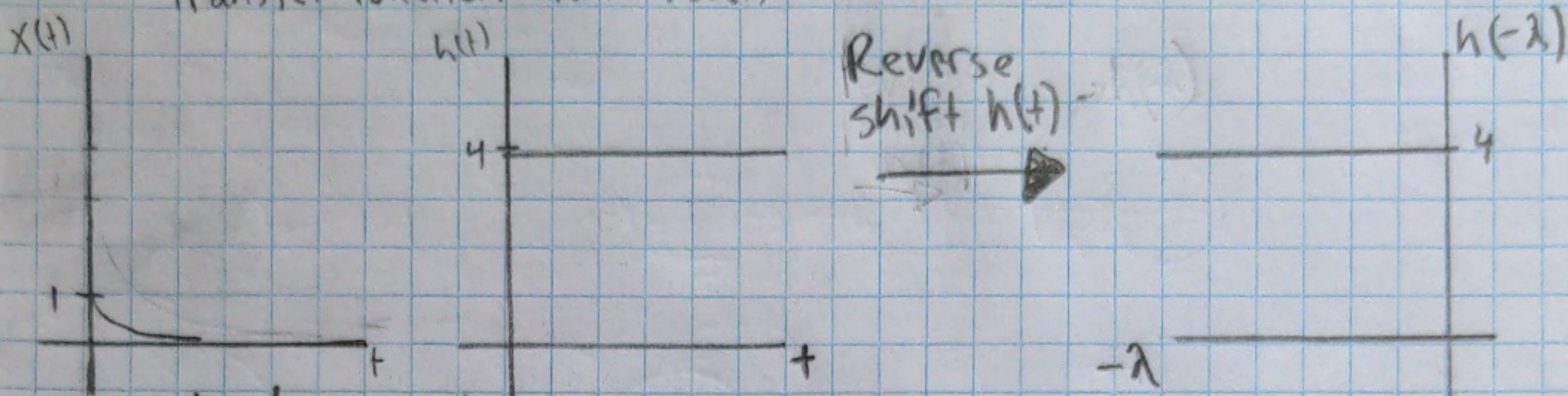


9.1) The signal $x(t) = e^{-2t} u(t)$ is fed into a network with transfer function $h(t) = 4u(t)$



Convolve!

$$\begin{aligned}
 x(t) * h(t) &= \int_0^t x(\lambda) h(t-\lambda) d\lambda \\
 &= \int_0^t e^{-2\lambda} \cdot 4 d\lambda \\
 &= 4 \int_0^t e^{-2\lambda} d\lambda \\
 &= 4 \left(-\frac{e^{-2\lambda}}{2} \right) \Big|_0^t \\
 &= 4 \left(-\frac{e^{-2t}}{2} + \frac{1}{2} \right) \\
 &= 2(1 - e^{-2t})
 \end{aligned}$$

Check using Laplace.

$$\mathcal{L}[x(t)] = \frac{1}{s+2}$$

$$\mathcal{L}[h(t)] = \frac{4}{s}$$

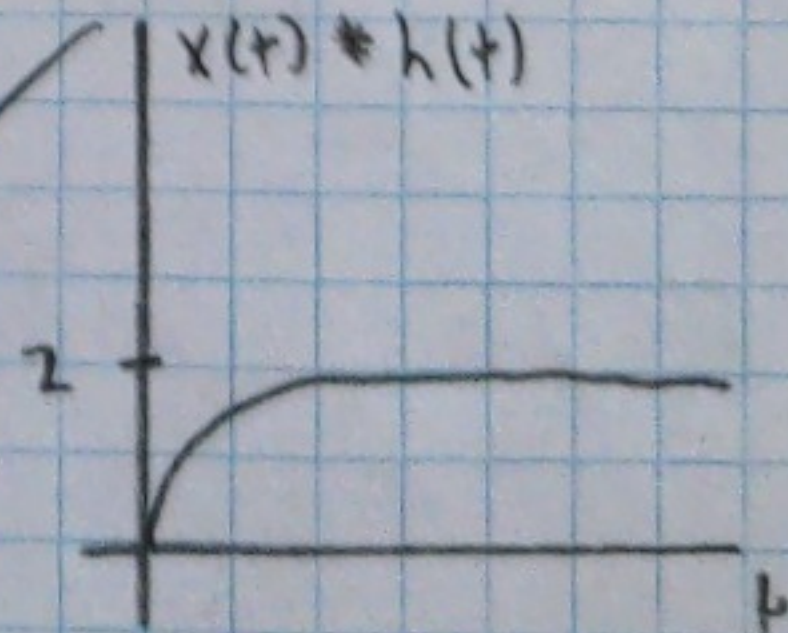
$$A = \frac{s4}{s(s+2)} \Big|_{s=0} = \frac{4}{2} = 2$$

$$B = \frac{(s+2)4}{s(s+2)} \Big|_{s=-2} = \frac{4}{-2} = -2$$

$$X(s)H(s) = \frac{1}{s+2} \cdot \frac{4}{s} = \frac{4}{s(s+2)} = \frac{A}{s} + \frac{B}{s+2} = \frac{2}{s} - \frac{2}{s+2}$$

$$\mathcal{L}^{-1}[X(s)H(s)] = 2 - 2e^{-2t} = x(t) * h(t) \quad \checkmark$$

$$x(t) * h(t) = 2(1 - e^{-2t})$$

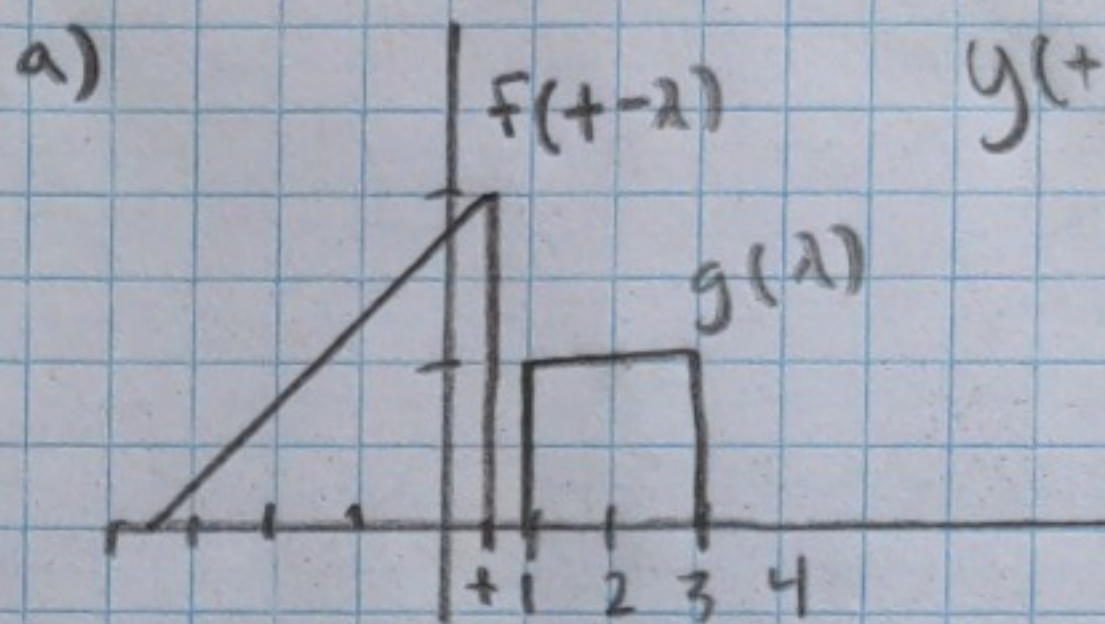
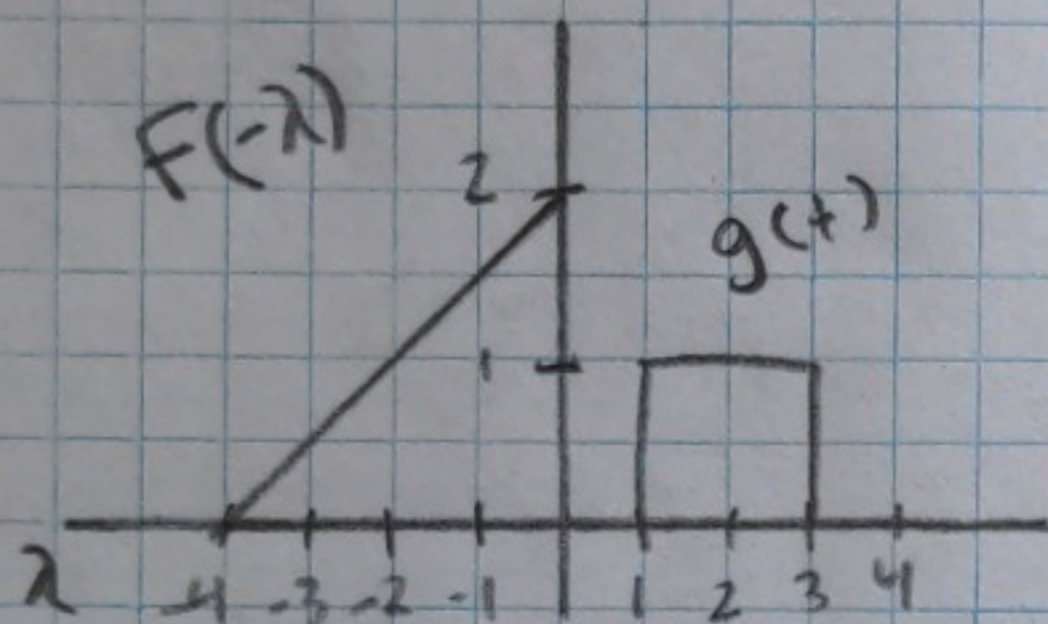
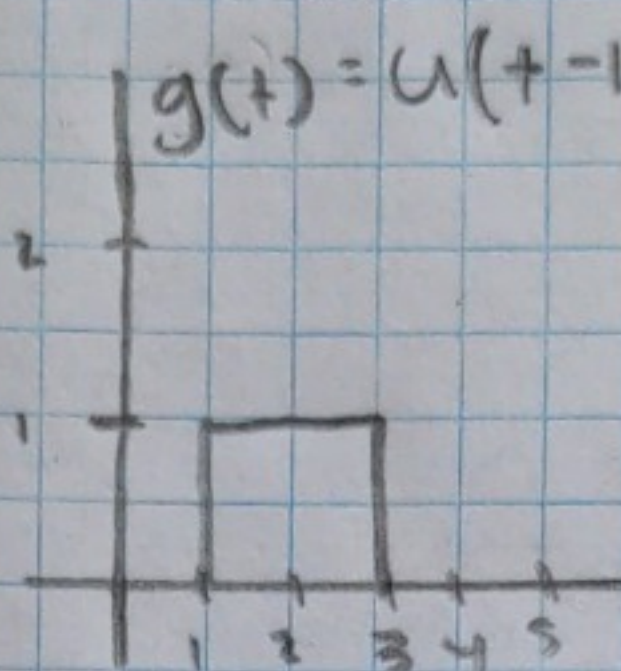
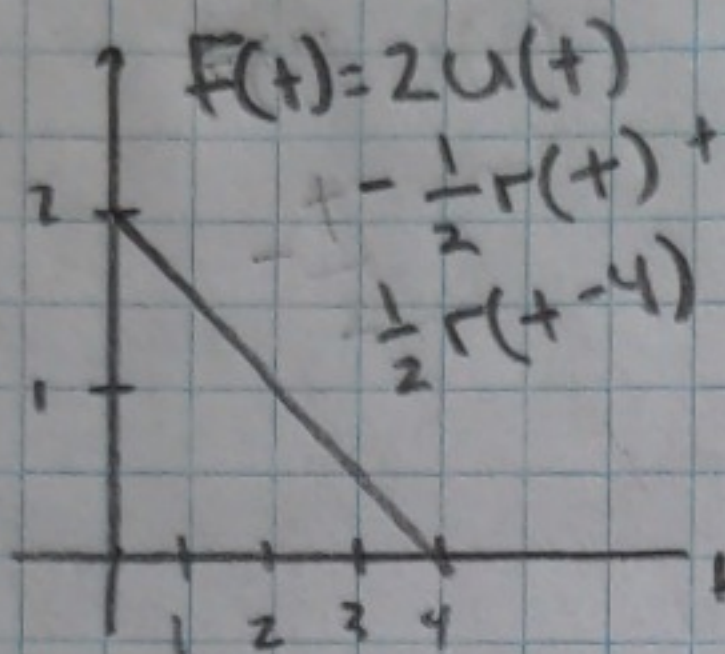


Chris Hunt

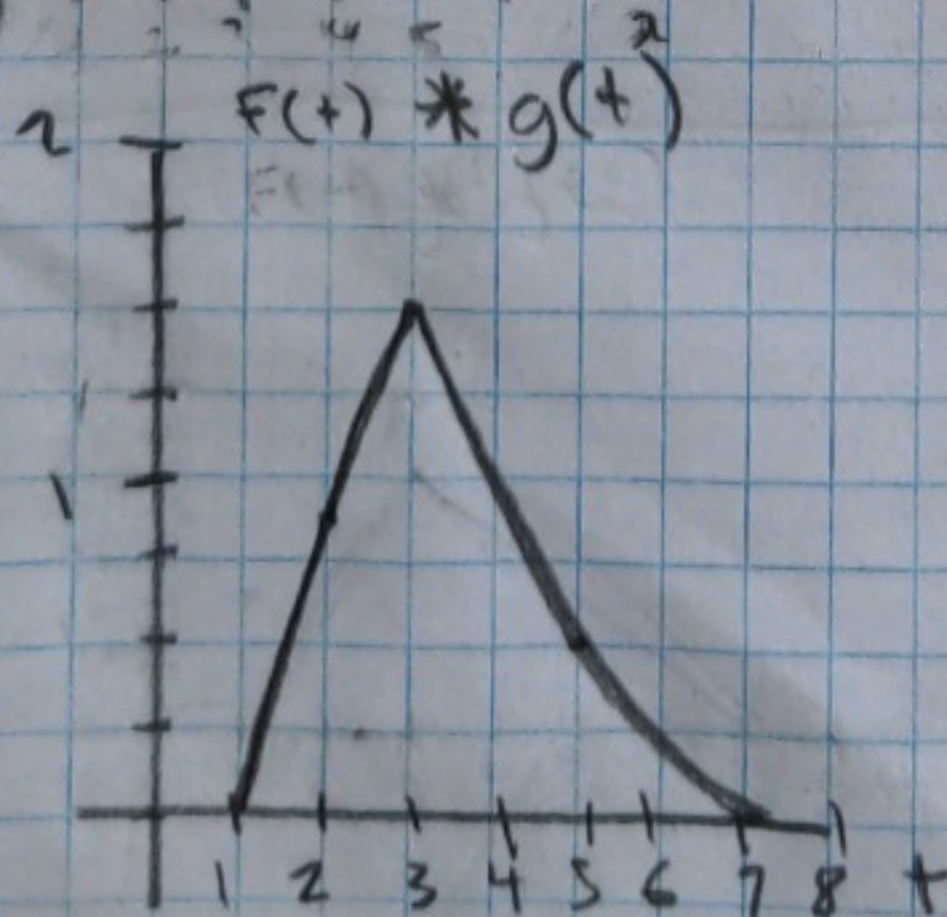
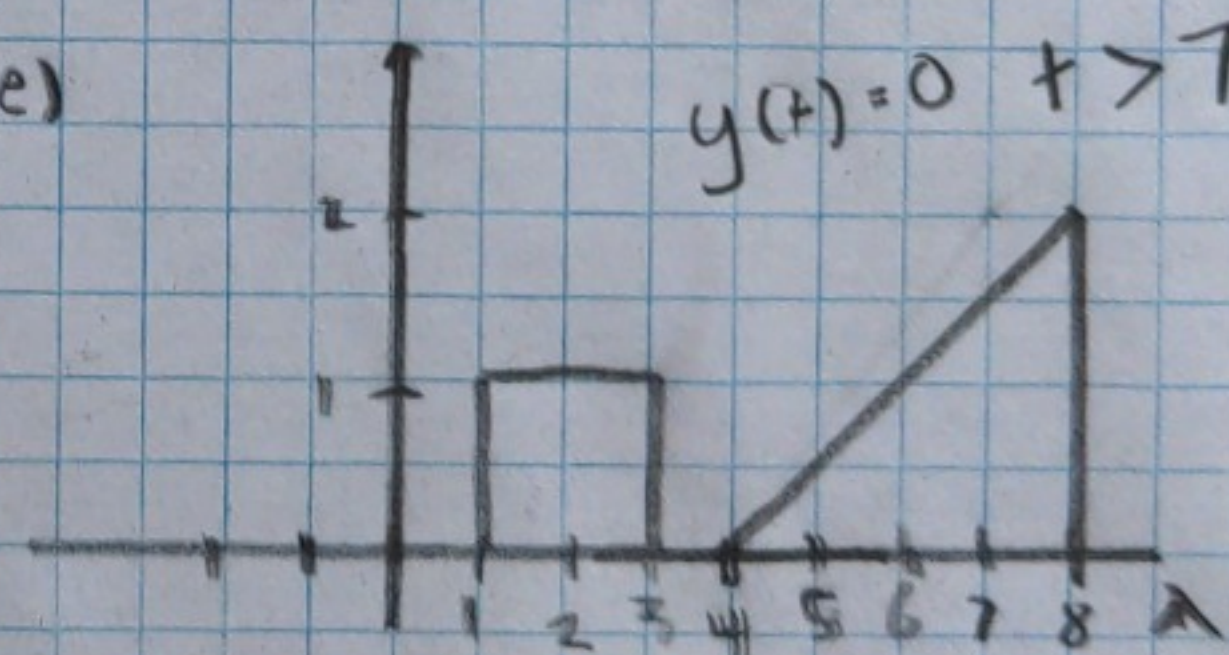
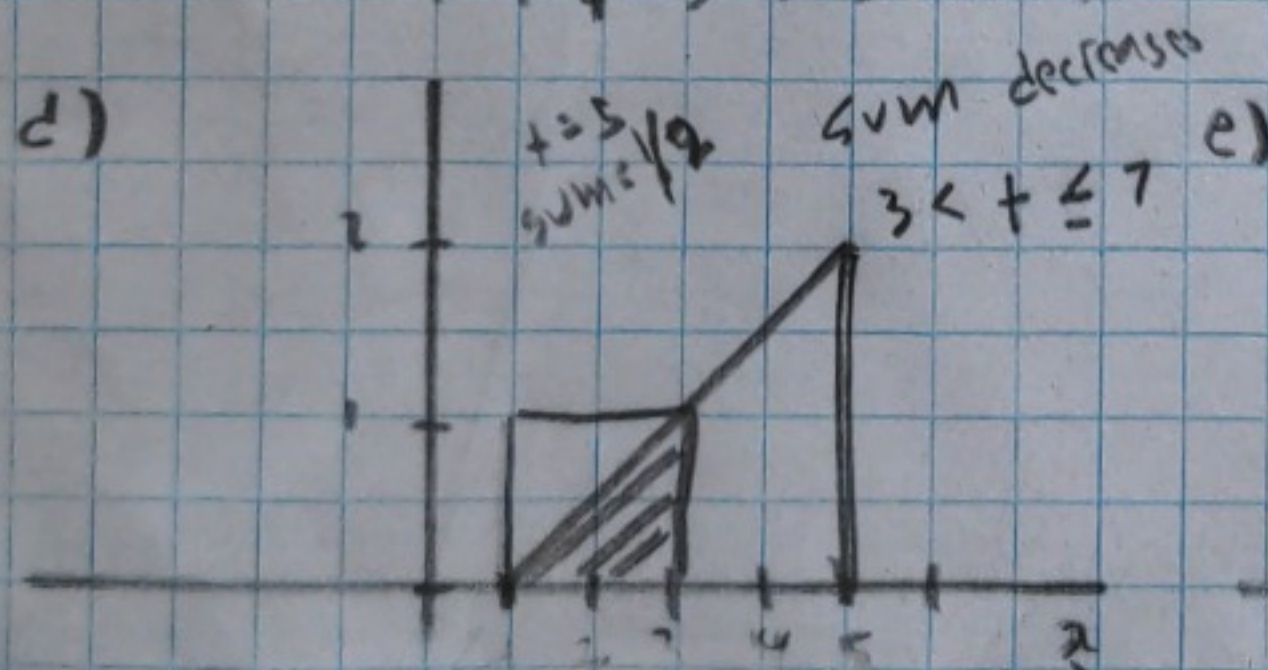
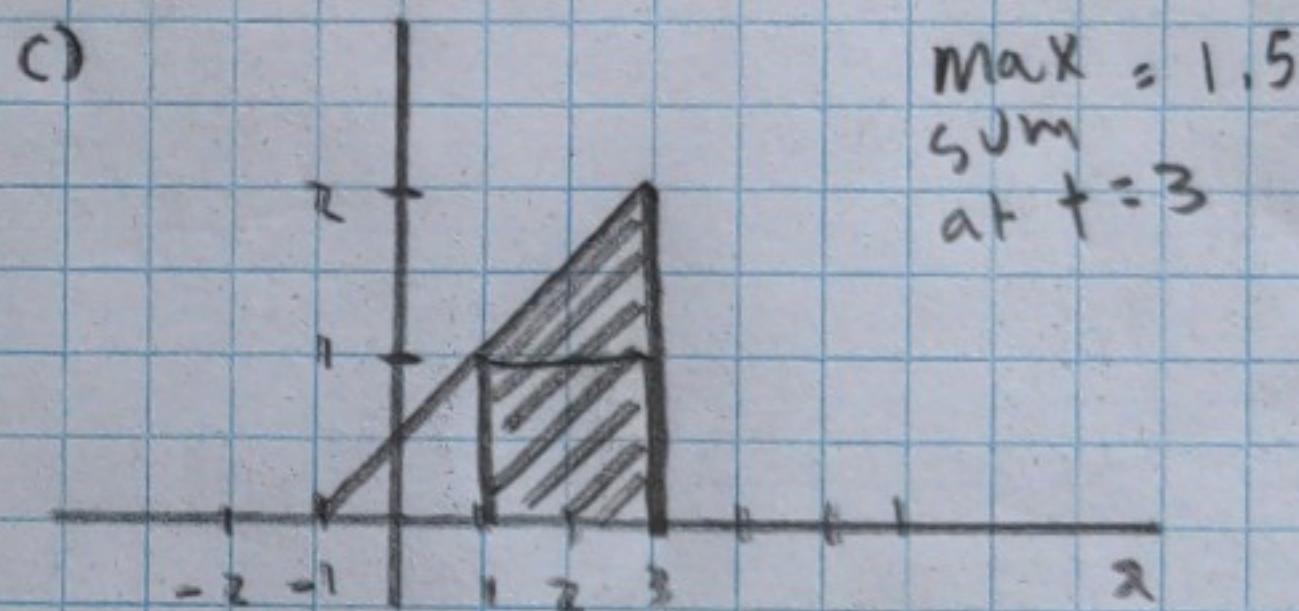
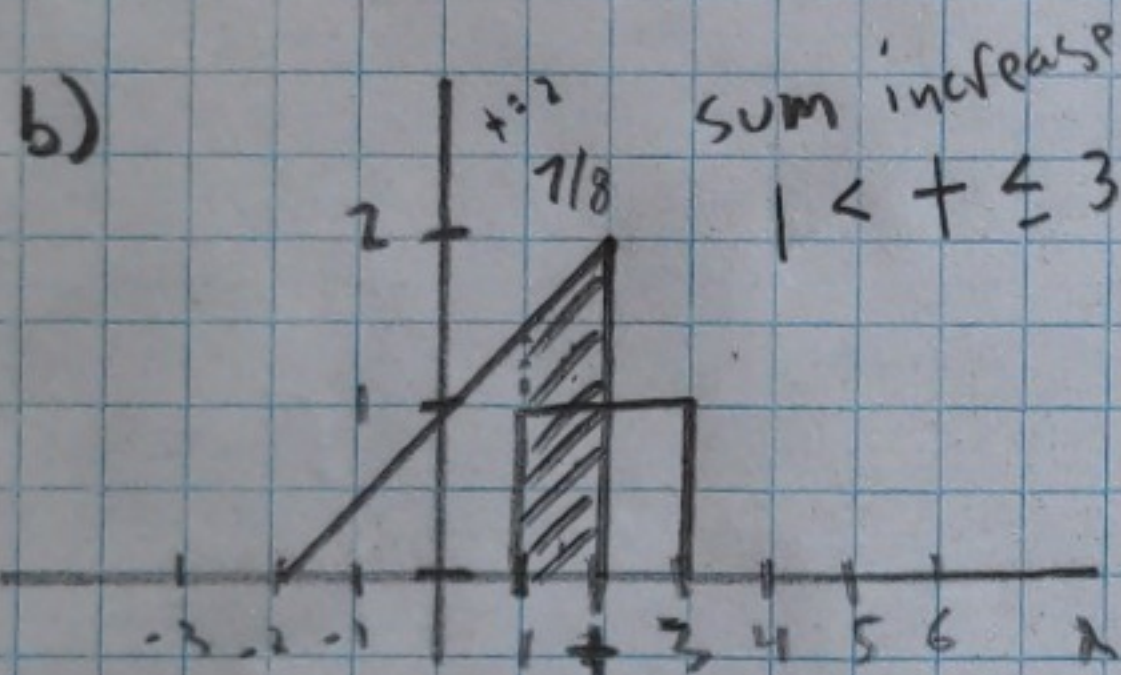
HW9

ENGR 203

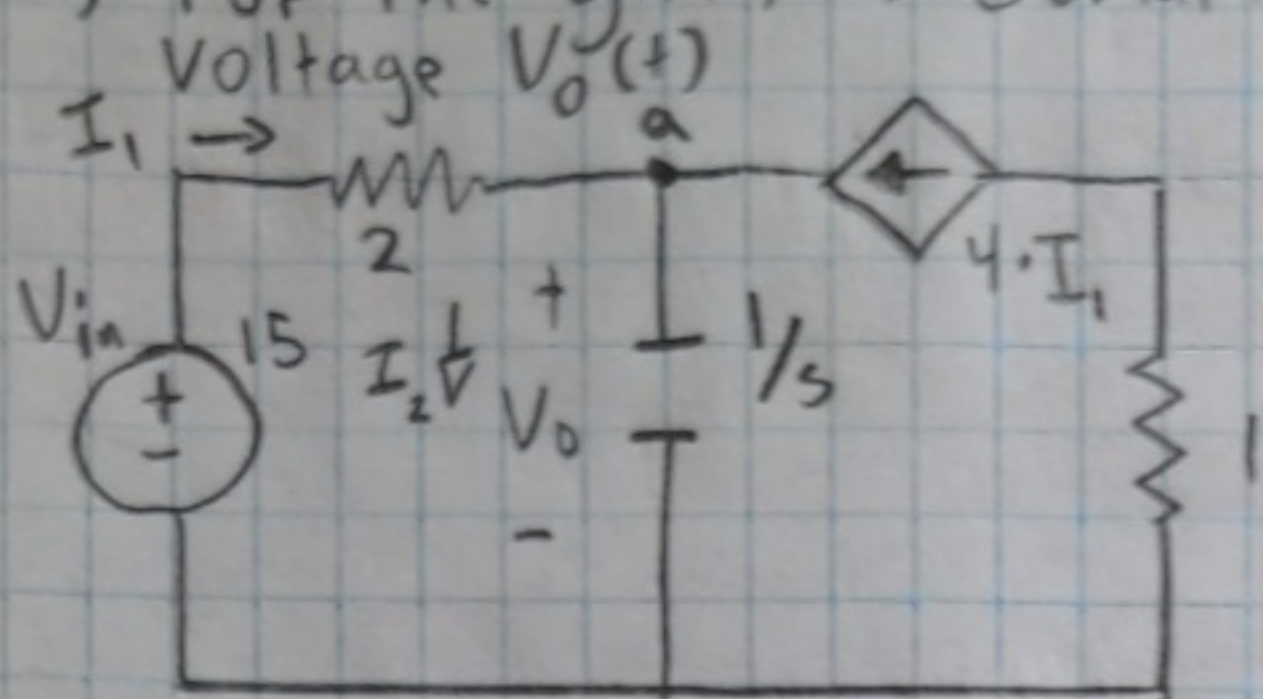
a.2) Graphically Convolute the two Functions $F(t)$ and $g(t)$



$y(t) = 0 \quad t < 1$



9.3) For the given s-domain circuit, Find the time-domain



$$V_{in} = 15V \quad R_1 = 2\Omega$$

$$R_2 = 1\Omega \quad I_d = 4 \cdot I_1$$

$$V_0 = V_a$$

@ a) $I_2 = I_1 + 4 \cdot I_1 \rightarrow I_2 = 5I_1$

$$\frac{V_a}{1/s} = 5 \left(\frac{15 - V_a}{2} \right)$$

$$sV_a = \frac{75 - 5V_a}{2}$$

$$2sV_a = 75 - 5V_a$$

$$75 = V_a(2s + 5)$$

$$V_a = \frac{75}{2s + 5}$$

$$V_a = \frac{75}{2} \cdot \frac{1}{s + \frac{5}{2}} = V_0(s)$$

$$\mathcal{L}^{-1}[V_0(s)] = \frac{75}{2} e^{-\frac{5}{2}t} V$$