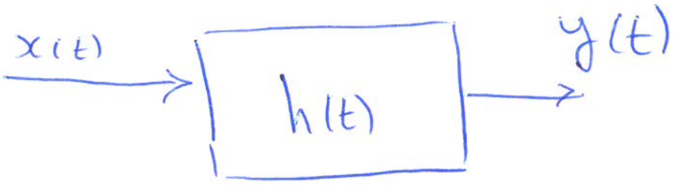
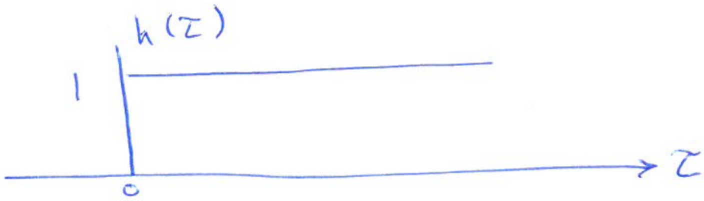
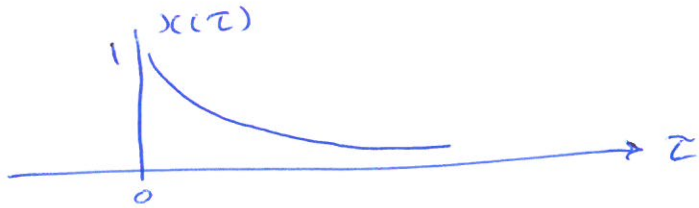
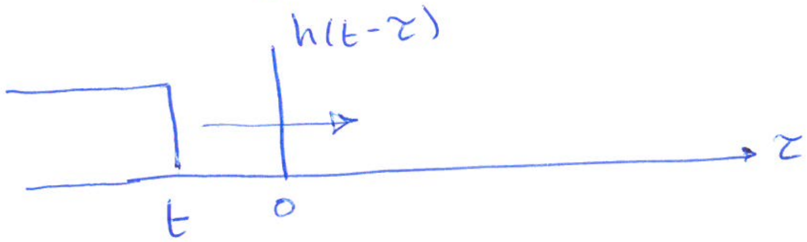
$x(t) = e^{-at}u(t)$ $\quad$ $h(t) = u(t)$



$$y(t) = \int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau$$



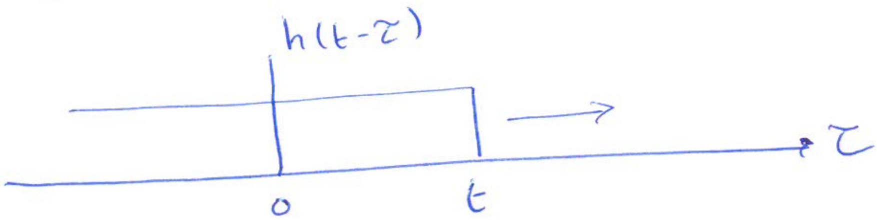




$t<0$

$\underline{t<0}$

$y(t) = 0$



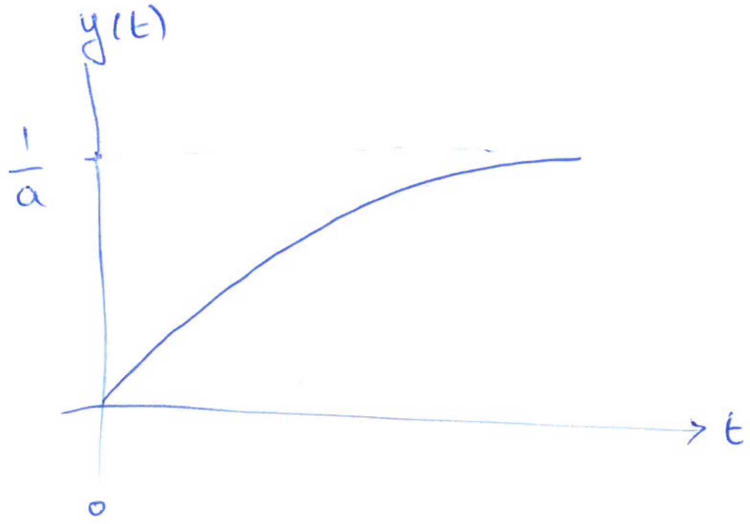
$\underline{t>0}$

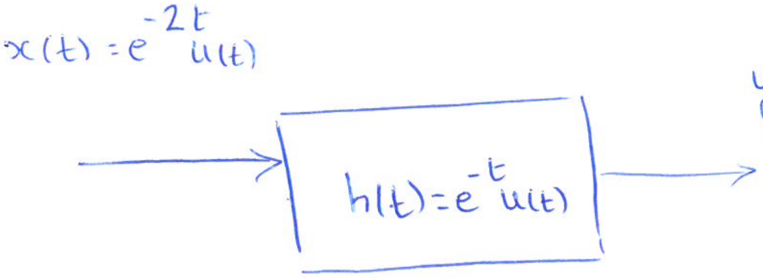
$$y(t) = \int_0^t e^{-a\tau}d\tau$$

$$= -\frac{1}{a}e^{-a\tau}\Big|_0^t = \frac{1}{a}\left(1-e^{-at}\right)$$

Therefore

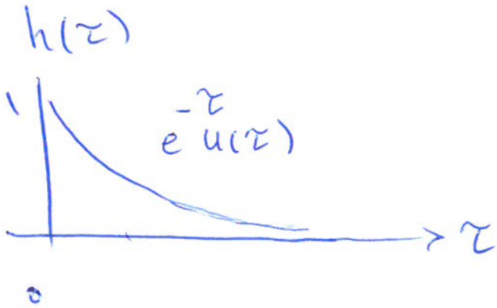
$$y(t) = \frac{1}{a}\left(1 - e^{-at}\right)u(t)$$

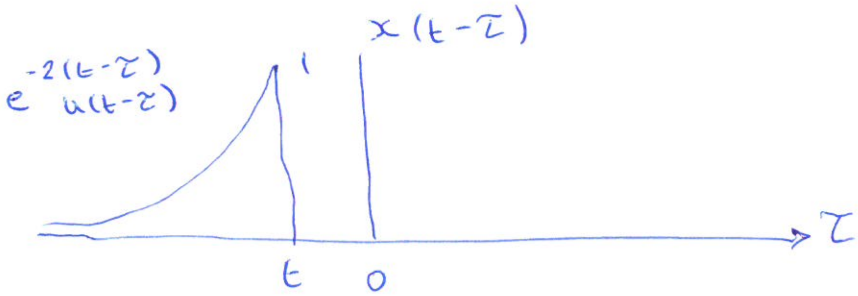




$$y(t) = \int_{-\infty}^{\infty} x(\tau) h(t-\tau)\, d\tau$$

$$= \int_{-\infty}^{\infty} h(\tau) x(t-\tau)\, d\tau$$





$t < 0$

$$y(t) = 0$$

$t > 0$

$$y(t) = \int_0^t e^{-\tau} e^{-2(t-\tau)}\, d\tau$$

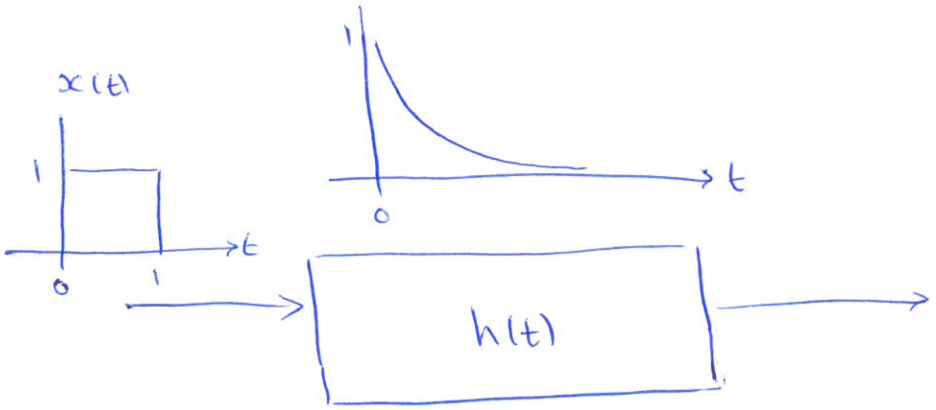
$$= e^{-2t} \int_0^t e^{\tau}\, d\tau = e^{-2t} \left[e^{\tau} \right]_0^t$$

$$= e^{-2t} \left[e^{t} - 1 \right]$$

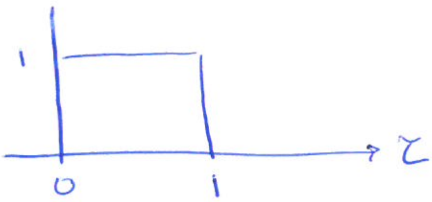
Therefore

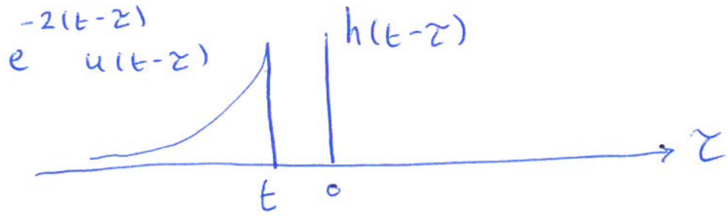
$$y(t) = e^{-2t} \left[e^{t} - 1 \right] u(t)$$

$h(t) = e^{-2t}u(t)$



$$y(t) = \int_{-\infty}^{\infty} x(\tau)h(t-\tau)\,d\tau$$





$\underline{t<0}$ $\quad y(t) = 0$

$\underline{0<t<1}$

$$y(t) = \int_0^t e^{-2(t-\tau)}\,d\tau$$

$$= \int_0^t e^{-2t}e^{2\tau}\,d\tau$$

$$= e^{-2t}\int_0^t e^{2\tau}\,d\tau$$

$$= e^{-2t}\left[\tfrac{1}{2}e^{2\tau}\right]_0^t$$

$$= \tfrac{1}{2}e^{-2t}\left[e^{2t} - 1\right]$$

$$= \tfrac{1}{2}\left[1 - e^{-2t}\right]$$

$t > 1$

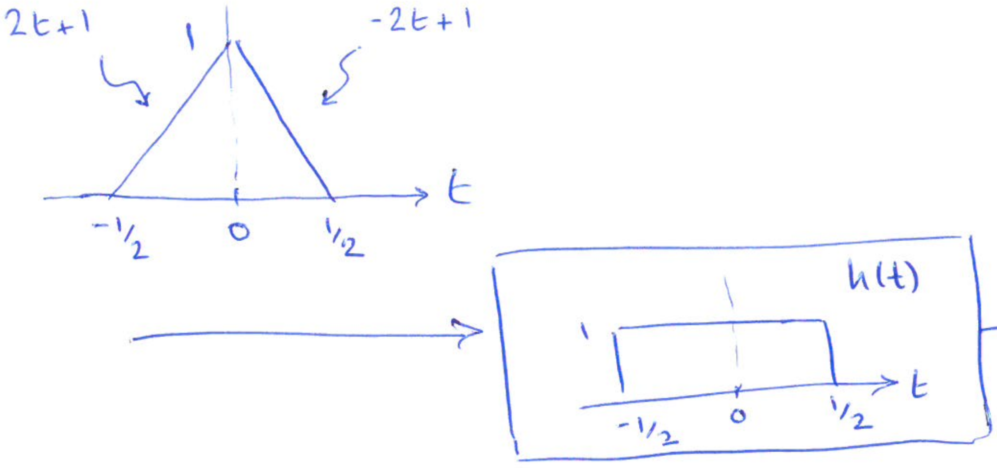
$$y(t) = \int_0^1 e^{-2(t-\tau)}\, d\tau$$

$$= e^{-2t} \int_0^1 e^{2\tau}\, d\tau$$

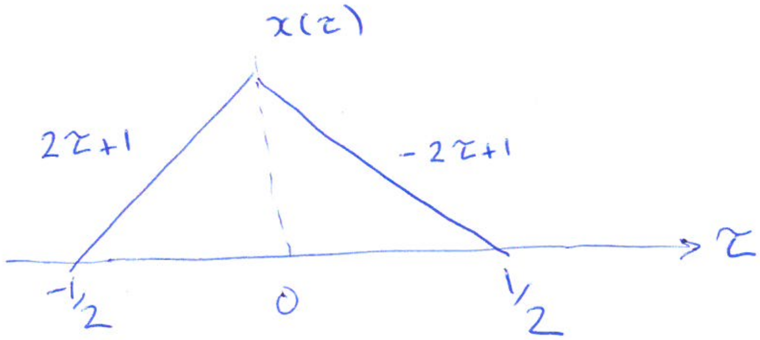
$$= e^{-2t} \left[\frac{1}{2} e^{2\tau} \right]_0^1$$

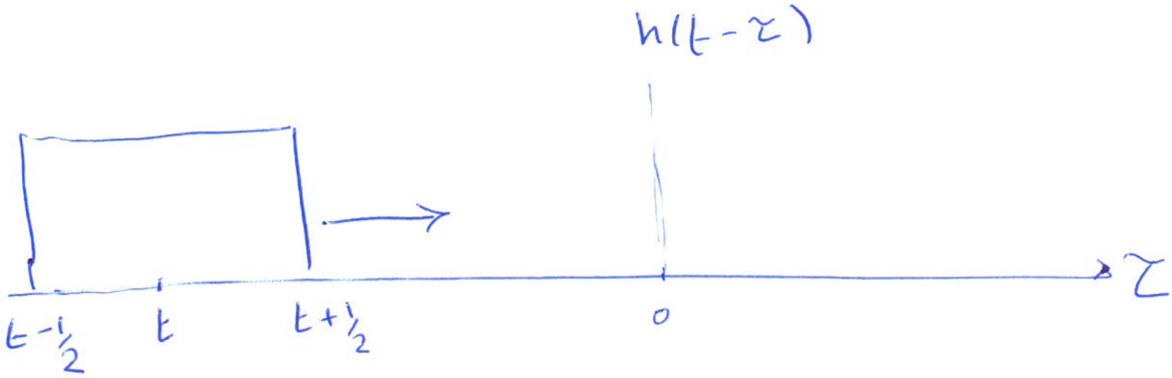
$$= \frac{e^{-2t}}{2} \left[e^2 - 1 \right]$$

$$= \frac{e^{-2(t-1)}}{2} \left[1 - e^{-2} \right]$$



$$y(t) = \int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau$$





$\underline{t < -1}$ $\qquad y(t) = 0$

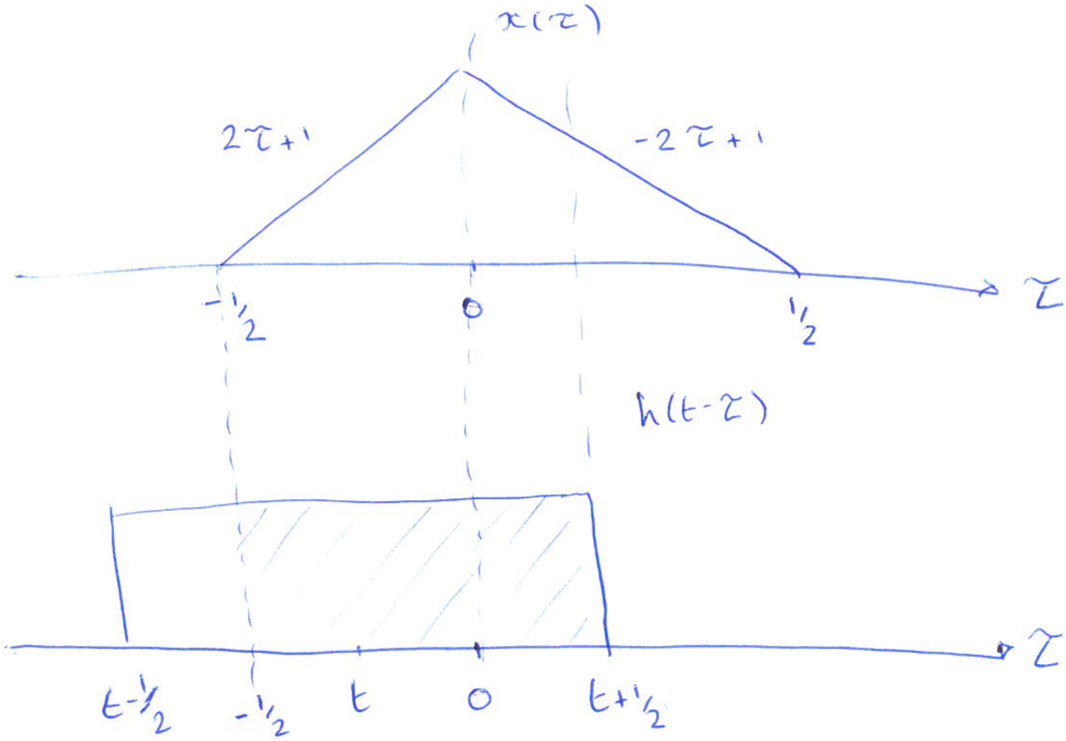
$\underline{-1 < t < -\tfrac{1}{2}}$

$$y(t) = \int_{-1/2}^{t+1/2} (2\tau+1)\,d\tau$$

$$= \tau^2 + \tau \Big|_{-1/2}^{t+1/2}$$

$$= (t+\tfrac{1}{2})^2 + t + \tfrac{1}{2} - \tfrac{1}{4} + \tfrac{1}{2}$$

$$= 1 + 2t + t^2$$



$-\frac{1}{2} < t < 0$

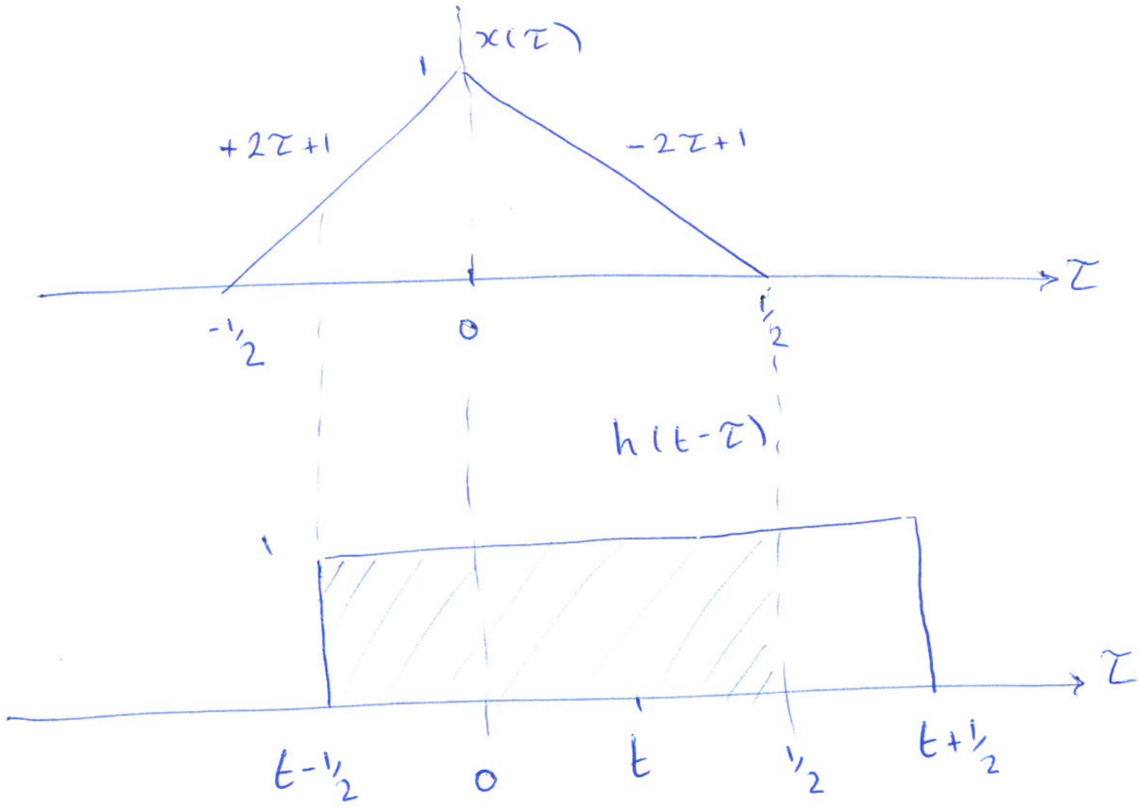
$$y(t) = \int_{-1/2}^{0} (2\tau + 1)\,d\tau \quad + \int_{0}^{t+1/2} (-2\tau + 1)\,d\tau$$

$$= \left[\tau^2 + \tau\right]_{-1/2}^{0} + \left[-\tau^2 + \tau\right]_{0}^{t+1/2}$$

$$= -\frac{1}{4} + \frac{1}{2} - \left(t + \frac{1}{2}\right)^2 + t + \frac{1}{2}$$

$$= -\frac{1}{4} + \frac{1}{2} - t^2 - t - \frac{1}{4} + t + \frac{1}{2}$$

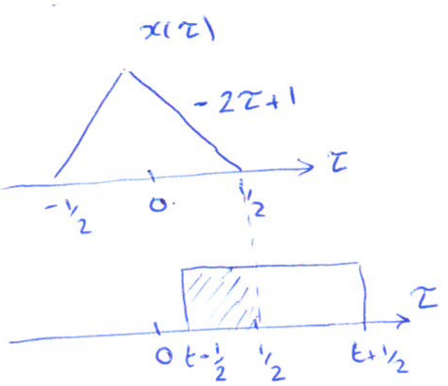
$$= -t^2 + \frac{1}{2}$$



$0 < t < 1/2$

$$y(t) = \int_{t-1/2}^{0} (2\tau + 1)\, d\tau + \int_{0}^{1/2} (-2\tau + 1)\, d\tau$$

$$= \frac{1}{2} - t^2$$



$1/2 < t < 1$

$$y(t) = \int_{t-1/2}^{1/2} (-2\tau + 1)\, d\tau$$

$$= 1 - 2t + t^2$$