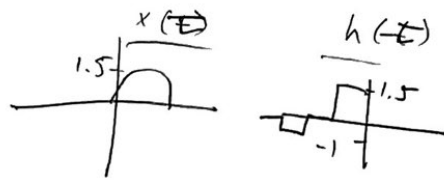


B1 manual calculation (CH2MP4.m)



Region 1

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

Region 2

$$0 \leq t < 1$$



$$y(t) = \int_0^t (1.5)(1.5 \sin(\pi \tau)) d\tau = \int_0^t 2.25 \sin(\pi \tau) d\tau = \left[-\frac{2.25 \cos(\pi \tau)}{\pi} \right]_0^t$$

$$= \frac{2.25}{\pi} (-\cos(\pi t) + 1)$$

Region 3

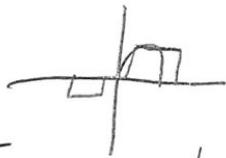


$$\left. \begin{array}{l} t - 1.5 \leq 0 \\ t > 1 \end{array} \right\} 1 \leq t < 1.5$$

$$y(t) = \int_0^1 (1.5)(1.5 \sin(\pi \tau)) d\tau = 2.25 \cdot \frac{1}{\pi} [-\cos(u)]_0^\pi = \frac{2.25}{\pi} \cdot 2$$

$$= \frac{4.5}{\pi}$$

Region 4



$$\left. \begin{array}{l} 0 \leq t - 1.5 < 0.5 \\ 1.5 \leq t < 2 \end{array} \right\}$$

$$y(t) = \int_{t-1.5}^1 (1.5)(1.5 \sin(\pi \tau)) d\tau = \left[-\frac{2.25}{\pi} \cos(\pi \tau) \right]_{t-1.5}^1$$

$$= \frac{2.25}{\pi} [\cos(\pi(t-1.5)) + 1]$$

Region 5



$$\left. \begin{array}{l} 0 \leq t - 2 \\ t - 1.5 < 1 \end{array} \right\} \Rightarrow 2 \leq t < 2.5$$

Same as region 4

$$y(t) = \int_0^{t-2} (-1)(1.5 \sin(\pi \tau)) d\tau + \int_{t-1.5}^1 (1.5)(1.5 \sin(\pi \tau)) d\tau$$

do this here

$$= \frac{1.5}{\pi} [\cos(\pi(t-2)) - 1] + \frac{2.25}{\pi} [\cos(\pi(t-1.5)) + 1]$$

Region 6

$$\left. \begin{array}{l} 0 \leq t-2.5 \\ t-2 \leq 1 \end{array} \right\} \Rightarrow 2.5 \leq t < 3$$

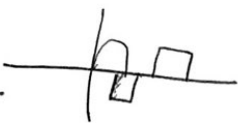


$$y(t) = \int_{t-2.5}^{t-2} (-1)(1.5 \sin(\pi \tau)) d\tau = \frac{1.5}{\pi} \cos(\pi \tau) \Big|_{t-2.5}^{t-2}$$

$$= \frac{1.5}{\pi} [\cos(\pi(t-2)) - \cos(\pi(t-2.5))]$$

Region 7

$$\left. \begin{array}{l} t-2.5 \leq 1 \\ 1 \leq t-2 \end{array} \right\} \Rightarrow 3 \leq t < 3.5$$



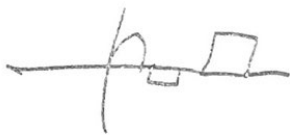
$$y(t) = \int_{t-2.5}^{t-2} (-1)(1.5 \sin(\pi \tau)) d\tau = \frac{1.5}{\pi} \cos(\pi \tau) \Big|_{t-2.5}^{t-2}$$

$$= \frac{1.5}{\pi} [-\cos(\pi(t-2.5)) - 1]$$

Region 8

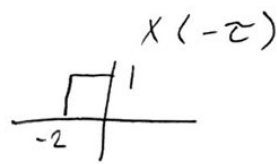
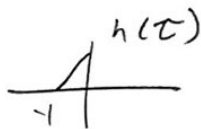
$$t \geq 3.5$$

$$y(t) = 0$$



$$y(t) = \begin{cases} 0, & t < 0 \\ \frac{2.25}{\pi} (-\cos(\pi t) + 1), & 0 \leq t < 1 \\ 4.5/\pi, & 1 \leq t < 1.5 \\ \frac{2.25}{\pi} [\cos(\pi(t-1.5)) + 1], & 1.5 \leq t < 2 \\ 1.5/\pi [\cos(\pi(t-2)) - 1] + \frac{2.25}{\pi} [\cos(\pi(t-1.5)) + 1], & 2 \leq t < 2.5 \\ 1.5/\pi [\cos(\pi(t-2)) - \cos(\pi(t-2.5))], & 2.5 \leq t < 3 \\ 1.5/\pi [-\cos(\pi(t-2.5)) - 1], & 3 \leq t < 3.5 \\ 0, & 3.5 \leq t \end{cases}$$

B2 manual calculation



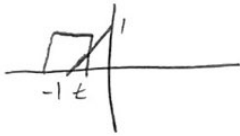
Region 1

$$\boxed{t < -1} \quad \boxed{y(t) = 0}$$



Region 2

$$\boxed{-1 \leq t < 0}$$



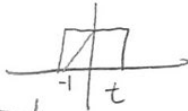
$$y(t) = \int_{-1}^t (\tau + 1)(1) d\tau = \int_{-1}^t \tau d\tau + \int_{-1}^t 1 d\tau$$

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

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

Region 3

$$\left. \begin{array}{l} t < 1 \\ t \geq 0 \end{array} \right\} \Rightarrow \boxed{0 \leq t < 1}$$

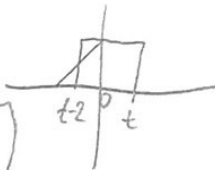


$$y(t) = \int_{-1}^0 (\tau + 1) d\tau = \left[\frac{\tau^2}{2} + \tau \right]_{-1}^0$$

$$= \frac{1}{2} - 1 = \boxed{-0.5}$$

Region 4

$$\left. \begin{array}{l} t - 2 < 0 \\ -1 \leq t - 2 \end{array} \right\} \Rightarrow \boxed{1 \leq t < 2}$$



$$y(t) = \int_{t-2}^0 (1)(\tau + 1) d\tau = \left[\frac{\tau^2}{2} + \tau \right]_{t-2}^0$$

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

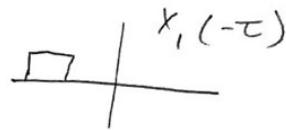
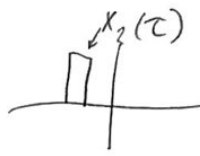
Region 5

$$\boxed{t \geq 2}$$
$$\boxed{y(t) = 0}$$

$$y(t) = \begin{cases} 0, & t < -1 \\ \frac{t^2}{2} + t + \frac{1}{2}, & -1 \leq t < 0 \\ -0.5, & 0 \leq t < 1 \\ - \left[\frac{(t-2)^2}{2} + (t-2) \right], & 1 \leq t < 2 \\ 0, & t \geq 2 \end{cases}$$

B3 a) manual calculation

$A=0.25, B=0.5$



Region 1

$t-4 \leq -5$

$t \leq -1 \quad y(t) = 0$



Region 2

$-5 \leq t-4 < -4 \rightarrow -1 \leq t < 0$

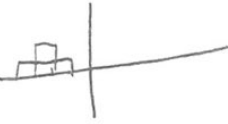


$$y(t) = \int_{-5}^{t-4} (0.5)(0.125) d\tau = 0.125 \tau \Big|_{-5}^{t-4} = 0.125(t-4) + 0.125(5)$$

$$= 0.125(t) - (0.125 \cdot 4) + 0.125(5)$$

$$= 0.125t + 0.125$$

Region 3



$t-4 \geq 4$
 $t-6 \leq 5 \quad 0 \leq t < 1$

$$y(t) = \int_{-5}^{-4} 0.125 d\tau = 0.125(-4) - 0.125(-5) = 0.125$$

Region 4



$t-6 < -4$
 $t-6 \geq -5 \quad 1 \leq t < 2$

$$y(t) = \int_{t-6}^{-4} 0.125 d\tau = 0.125(-4) - 0.125(t-6) = -0.125t + 0.25$$

Region 5

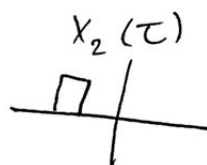


$t \geq 2 \quad y(t) = 0$

$$y(t) = \begin{cases} 0, & t < -1 \\ 0.125t + 0.125, & -1 \leq t < 0 \\ 0.125, & 0 \leq t < 1 \\ -0.125t + 0.25, & 1 \leq t < 2 \\ 0, & t \geq 2 \end{cases}$$

B3 b) manual calculations

$$A=0.25, B=0.5$$



Region 1

$$t-3 < -5 \Rightarrow \boxed{t < -2} \quad \boxed{y(t) = 0}$$

Region 2

$$t-3 < -3, t-3 \geq -5$$



$$\boxed{-2 \leq t < 0}$$

$$y(t) = \int_{-5}^{t-3} 0.125 d\tau = 0.125(t-3) - 0.125(-5)$$

$$\boxed{= 0.125t + 0.25}$$

Region 3

$$t-5 \geq -5, t-5 < 3$$



$$\boxed{0 \leq t < 2}$$

$$y(t) = \int_{t-5}^{-3} 0.125 d\tau = 0.125(-3) - 0.125(t-5)$$

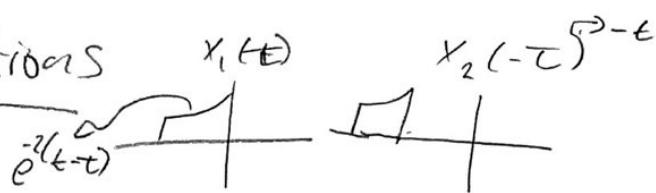
$$\boxed{= -0.125t + 0.25}$$

Region 4

$$\boxed{t \geq 2} \quad \boxed{y(t) = 0}$$

$$y(t) = \begin{cases} 0, & t < -2 \\ 0.125t + 0.25, & -2 \leq t < 0 \\ -0.125t + 0.25, & 0 \leq t < 2 \\ 0, & t \geq 2 \end{cases}$$

B3 h) manual calculations



Region 1

$t \leq -2$ $y(t) = 0$

Region 2

$t > -2$
 $t-1 \leq -2$ $\} -2 \leq t < -1$

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

$$= e^{-2t} \left[\frac{1}{3} e^{3\tau} \right]_{-2}^t = \frac{1}{3} e^{-2t} [e^{3t} - e^{3(-2)}]$$

$$= \frac{1}{3} [e^t - e^{-2(t+3)}]$$

Region 4

$t-1 \leq 0$
 $t \geq 0$ $\} 0 \leq t < 1$

$$y(t) = \int_{t-1}^0 e^{\tau} e^{-2(t-\tau)} d\tau = e^{-2t} \int_{t-1}^0 e^{3\tau} d\tau = e^{-2t} \left[\frac{1}{3} e^{3\tau} \right]_{t-1}^0$$

$$= \frac{1}{3} [e^{-2t} - e^{-2(t-1)}]$$

Region 5

$t-1 > 0 \rightarrow t \geq 1$
 $y(t) = 0$

$$y(t) = \begin{cases} 0, & t \leq -2 \\ \frac{1}{3} [e^t - e^{-2(t+3)}], & -2 \leq t < -1 \\ \frac{1}{3} [e^t - e^{t-3}], & -1 \leq t < 0 \\ \frac{1}{3} [e^{-2t} - e^{t-3}], & 0 \leq t < 1 \\ 0, & t \geq 1 \end{cases}$$