ECE 102 HW3

LIANG, NEVIN

TOTAL POINTS

100 / 100

QUESTION 1

PROBLEM 1 20 pts

1.1 (a) **5 / 5**

✓ **- 0 pts Correct**

1.2 (b) **5 / 5**

✓ **- 0 pts Correct**

- 1 pts wrong reasoning

- 1 pts wrong conclusion

1.3 (c) **5 / 5**

✓ **- 0 pts Correct**

- 1 pts No conclusion

- 1 pts Wrong conclusion

- 1 pts Wrong reasoning

1.4 (d) **5 / 5**

✓ **- 0 pts Correct**

QUESTION 2

PROBLEM 2 13 pts

2.1 (a)(i) **2 / 2**

✓ **- 0 pts Correct**

- 0.5 pts wrong sign

- 0.5 pts wrong item

2.2 (a)(ii) **2 / 2**

✓ **- 0 pts Correct**

- 0.5 pts wrong scale

- 0.5 pts wrong item

- 1 pts wrong formula

2.3 (a)(iii) **3 / 3**

✓ **- 0 pts Correct**

- 1 pts wrong item

- 1 pts wrong scale

- 0.5 pts missing annotation

- 3 pts no answer

2.4 (b) **6 / 6**

✓ **- 0 pts Correct**

- 2 pts wrong proof

- 1 pts wrong conclusion

- 6 pts no answer

- 2 pts lack of proof

- 1 pts no conclusion

QUESTION 3

PROBLEM 3 38 pts

3.1 (a)(i) **5 / 5**

✓ **- 0 pts Correct**

- 0.5 pts arithmetic error

- 1 pts partially correct

- 1 pts incorrect or missing bounds

- 0.5 pts both unit step function and piecewise function are used

- 2 pts incomplete work

3.2 (a)(ii) **5 / 5**

✓ **- 0 pts Correct (full credit is given to everyone)**

3.3 (b)(i) **5 / 5**

✓ **- 0 pts Correct**

- 1 pts partially correct

- 1 pts incorrect bounds

- 0.5 pts arithmetic error

- 5 pts no answer

- 2.5 pts incorrect, some work shown

3.4 (b)(ii) **5 / 5**

✓ **- 0 pts Correct**

- 1 pts partially correct

- 5 pts no answer

3.5 (c)(i) **5 / 5**

✓ **- 0 pts Correct**

- 0.5 pts small mistake

- 1 pts distribution error

- 1 pts error in sifting property

- 0.5 pts not fully simplified

- 1 pts unit step function not used or bounds not specified

3.6 (c)(ii) **5 / 5**

✓ **- 0 pts Correct**

- 1 pts error in sifting property

- 0.5 pts small mistake

- 5 pts no answer

3.7 (d)(i) **4 / 4**

✓ **- 0 pts Correct (full credit is given to everyone)**

3.8 (d)(ii) **4 / 4**

✓ **- 0 pts Correct (full credit is given to everyone)**

QUESTION 4

PROBLEM 4 12 pts

4.1 (a) **4 / 4**

✓ **- 0 pts Correct**

- 2 pts wrong answer

- 4 pts no answer

4.2 (b) **4 / 4**

✓ **- 0 pts Correct**

- 2 pts wrong answer

- 4 pts no answer

4.3 (c) **4 / 4**

✓ **- 0 pts Correct**

- 1 pts wrong answer

- 4 pts no answer

QUESTION 5

PROBLEM 5 17 pts

5.1 (a) **7 / 7**

✓ **- 0 pts Correct**

- 3 pts wrong plot

- 7 pts no plot

5.2 (b) **5 / 5**

✓ **- 0 pts Correct**

- 5 pts no plot

- 2 pts wrong plot

5.3 (c) **5 / 5**

✓ **- 0 pts Correct**

- 5 pts no plot

- 1 pts wrong plot

5.4 (d)(optional) **0 / 0**

✓ **- 0 pts Correct**

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1. (a) $y(t) = \sin(t) \cdot x(t)$

$H(x(t)) = \sin(t) \cdot x(t)$

$H(ax+b\tilde{x}) = aH(x) + bH(\tilde{x})$

LHS: $\sin(t) \cdot [ax+b\tilde{x}]$

RHS: $a \cdot \sin(t) \cdot x(t) + b \cdot \sin(t) \cdot \tilde{x}(t)$

YES

(b) $y(t) = \frac{d}{dt}\left[\frac{1}{3}x(t)^3\right]$

$H(x) = \frac{d}{dt}\left[\frac{1}{3}x^3\right]$

$H(ax+b\tilde{x}) = aH(x) + bH(\tilde{x})$

LHS: $\frac{d}{dt}\left[\frac{1}{3}(ax+b\tilde{x})^3\right]$

RHS: $a \cdot \frac{d}{dt}\left[\frac{1}{3}x^3\right] + b\frac{d}{dt}\left[\frac{1}{3}\tilde{x}^3\right]$

NO

(c) $y(t) = e^{x(t)}$

$H(x) = e^x$

$H(ax+b\tilde{x}) = aH(x) + b(H(\tilde{x}))$

RHS: $a \cdot e^x + b \cdot e^{\tilde{x}}$

LHS: $e^{ax+b\tilde{x}}$ NO

(d) $H(x) = x + u(t+1)$

$H(ax+b\tilde{x}) = aH(x) + bH(\tilde{x})$

LHS: $ax+b\tilde{x}+u(t+1)$

RHS: $a[x+u(t+1)]$
$+ b[\tilde{x}+u(t+1)]$

NO

1.1 (a) **5 / 5**

✓ **- 0 pts** Correct

ECE Fall 2020 HW3 Nevin Liang

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LHS: $ax+b\tilde{x}+u(t+1)$

RHS: $a[x+u(t+1)]$
$+ b[\tilde{x}+u(t+1)]$

NO

1.2 (b) **5 / 5**

✓ **- 0 pts Correct**

- 1 pts wrong reasoning

- 1 pts wrong conclusion

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1. (a) $y(t) = \sin(t) \cdot x(t)$

$H(x(t)) = \sin(t) \cdot x(t)$

$H(ax+b\tilde{x}) = aH(x) + bH(\tilde{x})$

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RHS: $a \cdot \sin(t) \cdot x(t) + b \cdot \sin(t) \cdot \tilde{x}(t)$

YES

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NO

(c) $y(t) = e^{x(t)}$

$H(x) = e^x$

$H(ax+b\tilde{x}) = aH(x) + b(H(\tilde{x}))$

RHS: $a \cdot e^x + b \cdot e^{\tilde{x}}$

LHS: $e^{ax+b\tilde{x}}$ NO

(d) $H(x) = x + u(t+1)$

$H(ax+b\tilde{x}) = aH(x) + bH(\tilde{x})$

LHS: $ax+b\tilde{x}+u(t+1)$

RHS: $a[x+u(t+1)]$
$+ b[\tilde{x}+u(t+1)]$

NO

1.3 (c) **5 / 5**

✓ **- 0 pts Correct**

- 1 pts No conclusion

- 1 pts Wrong conclusion

- 1 pts Wrong reasoning

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1. (a) $y(t) = \sin(t) \cdot x(t)$

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$H(ax+b\tilde{x}) = aH(x) + bH(\tilde{x})$

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(c) $y(t) = e^{x(t)}$

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$H(ax+b\tilde{x}) = aH(x) + bH(\tilde{x})$

LHS: $ax+b\tilde{x}+u(t+1)$

RHS: $a[x+u(t+1)]$
$+ b[\tilde{x}+u(t+1)]$

NO

1.4 (d) **5 / 5**

✓ **- 0 pts** Correct

2.

(a) i. $u(t) - u(t-1) \rightarrow r(t) - 2r(t-1) + r(t-2)$

$-u(t-2) + u(t-3) \rightarrow -r(t-2) + 2r(t-3) - r(t-4)$

$$\boxed{r(t) - 2r(t-1) + 2r(t-3) - r(t-4)}$$

ii. $-u(t) + u(t-1) \rightarrow -r(t) + 2r(t-1) - r(t-2)$

$u(t+1) - u(t) \rightarrow r(t+1) - 2r(t) + r(t-1)$

$$\boxed{r(t+1) - 3r(t) + 3r(t-1) - r(t-2)}$$

iii. $u(t) - u(t-1)$

$$= \begin{cases} 1 & t \geq 0 \\ 0 & t < 0 \end{cases} - \begin{cases} 1 & t \geq 1 \\ 0 & t < 1 \end{cases}$$

$$= \begin{cases} 0 & t \geq 1 \\ 1 & 0 \leq t < 1 \\ 0 & t < 0 \end{cases} = \text{rect}(t - 0.5)$$

$$\frac{d}{dt}[u(t)] = \delta(t) \rightleftharpoons y_2(t) = \frac{d}{dt}[r(t) - 2r(t-1) + r(t-2)]$$

$$= \boxed{u(t) - 2 \cdot u(t-1) + u(t-2)}$$

(b) $u(t) \rightarrow \cos(t) \cdot u(t)$

$u(t+1) \rightarrow \cos(t+1) \cdot u(t+1)$

$\text{rect}(t + \frac{1}{2}) = u(t+1) - u(t)$

but $u(t+1) - u(t) \rightarrow \cos(t+1) \cdot u(t+1) - \cos(t)\, u(t)$

which doesn't equal $\cos(t)\,[u(t+1) - u(t)]$.

$$\boxed{\text{NO}}$$

2.1 (a)(i) **2 / 2**

✓ **- 0 pts** **Correct**

- 0.5 pts wrong sign

- 0.5 pts wrong item

2.

(a) i. $u(t) - u(t-1) \rightarrow r(t) - 2r(t-1) + r(t-2)$

$-u(t-2) + u(t-3) \rightarrow -r(t-2) + 2r(t-3) - r(t-4)$

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which doesn't equal $\cos(t)\,[u(t+1) - u(t)]$.

$$\boxed{\text{NO}}$$

2.2 (a)(ii) **2 / 2**

✓ **- 0 pts Correct**

- 0.5 pts wrong scale

- 0.5 pts wrong item

- 1 pts wrong formula

2.

(a) i. $u(t) - u(t-1) \rightarrow r(t) - 2r(t-1) + r(t-2)$

$-u(t-2) + u(t-3) \rightarrow -r(t-2) + 2r(t-3) - r(t-4)$

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which doesn't equal $\cos(t)\,[u(t+1) - u(t)]$.

$$\boxed{\text{NO}}$$

2.3 (a)(iii) **3 / 3**

✓ **- 0 pts Correct**

- 1 pts wrong item

- 1 pts wrong scale

- 0.5 pts missing annotation

- 3 pts no answer

2.

(a) i. $u(t) - u(t-1) \rightarrow r(t) - 2r(t-1) + r(t-2)$

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$$\boxed{\text{NO}}$$

2.4 (b) **6 / 6**

✓ **- 0 pts Correct**

- 2 pts wrong proof

- 1 pts wrong conclusion

- 6 pts no answer

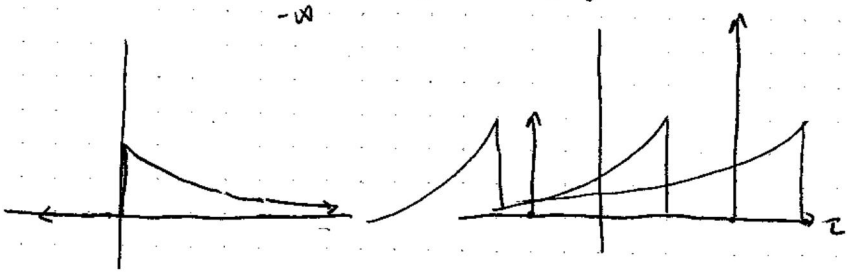
- 2 pts lack of proof

- 1 pts no conclusion

3. (a) i. $f(t) = \delta(t+1) + 2\delta(t-2)$ $\quad g(t) = e^{-t}u(t)$

$y(t) = (f * g)(t)$

$= \int_{-\infty}^{\infty} f(\tau)\, g(t-\tau)\, d\tau$



flip: e^{τ}

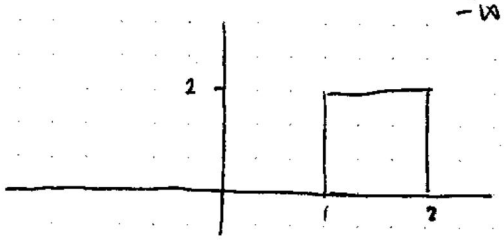
$e^{\tau - t}$

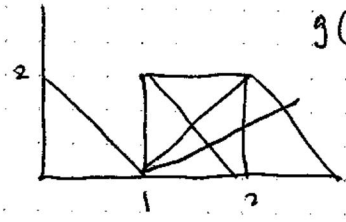
$y(t) = \begin{cases} 0 & t < -1 \\ \cancel{e^{t-t}} & -1 \le t < 2 \quad e^{-1-t} \\ & t \ge 2 \quad 2e^{2-t} + 1e^{-1-t} \end{cases}$

$$y(t) = \begin{cases} 0 & t < -1 \\ e^{-1-t} & -1 \le t < 2 \\ 2e^{2-t} + e^{-1-t} & t \ge 2 \end{cases}$$

ii. $f(t) = 2\,\mathrm{rect}\left(t - \frac{3}{2}\right)$ $\quad g(t) = 2r(t-1)\,\mathrm{rect}\left(t - \frac{3}{2}\right)$

$y(t) = (f * g)(t) = \int_{-\infty}^{\infty} f(\tau)\, g(t-\tau)\, d\tau$





$g(-\tau) = 2r(-\tau - 1)\,\mathrm{rect}\left(-\tau - \frac{3}{2}\right)$

$g(t-\tau) = 2r(t-\tau-1)\,\mathrm{rect}\left(t-\tau-\frac{3}{2}\right)$

$y(t) = \begin{cases} 0 & t < 2 \\ (t-2)^2 & 2 \le t < 3 \\ (t-3)^2 \ ? & 3 \le t < 4 \end{cases}$ $\quad \cancel{(t+2-1)^2}$ $(t-2)^2$

3.1 (a)(i) **5 / 5**

✓ **- 0 pts Correct**

- 0.5 pts arithmetic error

- 1 pts partially correct

- 1 pts incorrect or missing bounds

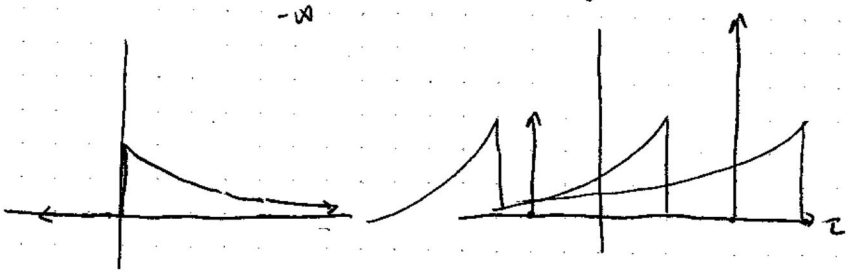
- 0.5 pts both unit step function and piecewise function are used

- 2 pts incomplete work

3. (a) i. $f(t) = \delta(t+1) + 2\delta(t-2)$ $\quad g(t) = e^{-t}u(t)$

$y(t) = (f * g)(t)$

$= \int_{-\infty}^{\infty} f(\tau)\, g(t-\tau)\, d\tau$



flip: e^{τ}

$e^{\tau - t}$

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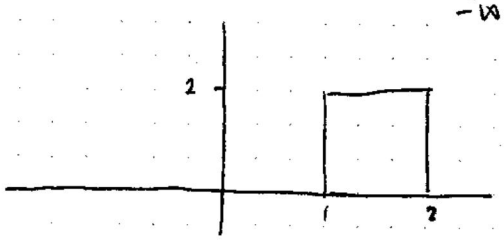
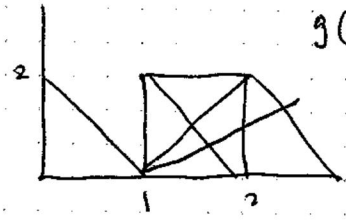
$$y(t) = \begin{cases} 0 & t < -1 \\ e^{-1-t} & -1 \le t < 2 \\ 2e^{2-t} + e^{-1-t} & t \ge 2 \end{cases}$$

ii. $f(t) = 2\,\mathrm{rect}\left(t - \frac{3}{2}\right)$ $\quad g(t) = 2r(t-1)\,\mathrm{rect}\left(t - \frac{3}{2}\right)$

$y(t) = (f * g)(t) = \int_{-\infty}^{\infty} f(\tau)\, g(t-\tau)\, d\tau$





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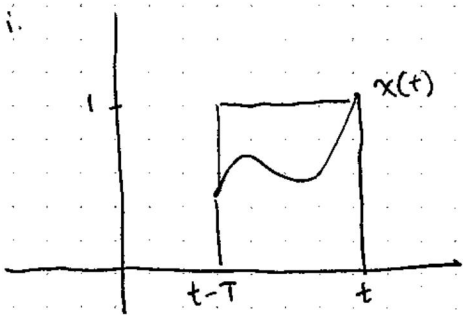
$g(t-\tau) = 2r(t-\tau-1)\,\mathrm{rect}\left(t-\tau-\frac{3}{2}\right)$

$y(t) = \begin{cases} 0 & t < 2 \\ (t-2)^2 & 2 \le t < 3 \\ (t-3)^2 \ ? & 3 \le t < 4 \end{cases}$ $\quad \cancel{(t+2-1)^2}$ $(t-2)^2$

3.2 (a)(ii) 5 / 5

✓ **- 0 pts** Correct (full credit is given to everyone)

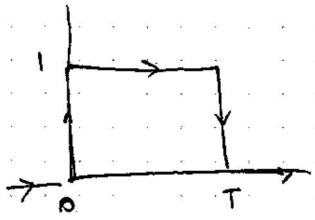
(b) i.



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

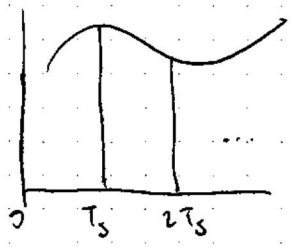
$h(t-\tau) = 1$ when τ btwn $(t-T, t)$

$h(x) = 1$ $\quad 0 \le x \le T$ $\qquad h(\tau) = 1$ $\quad 0 \le \tau \le T$



$$h = \frac{\text{rect}\left(\frac{t}{T}\right)}{\text{rect}\left(\frac{t-0.5}{T}\right)} = u(t) - u(t-T)$$

ii.



$$h(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT_s)$$

(c) i. $\delta(t-3) * e^{3t}u(-t) + \delta(t-3) * \delta(t+2) + \delta(t-3) * 2$

$+ \delta(t+2) * e^{3t}u(-t) + \delta(t+2) * \delta(t+2) + \delta(t+2) * 2$

$$\int_{-\infty}^{\infty} \delta(\tau+2)\cdot \delta(\tau+t+2)\, d\tau$$

$= e^{3(t-3)}u(3-t) + \delta(t-3+2) + 2 + 2 + \delta(t+2+2)$

$+ e^{3(t+2)}u(-t-2) = e^{3(t-3)}u(3-t) + e^{3(t+2)}u(-t-2)$

$+ 4 + \delta(t-1) + \delta(t+4)$

3.3 (b)(i) 5 / 5

✓ **- 0 pts Correct**

- 1 pts partially correct

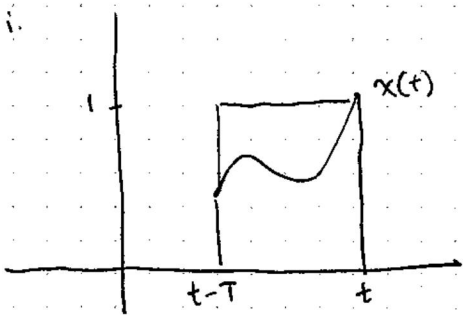
- 1 pts incorrect bounds

- 0.5 pts arithmetic error

- 5 pts no answer

- 2.5 pts incorrect, some work shown

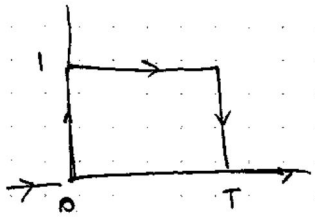
(b) i.



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

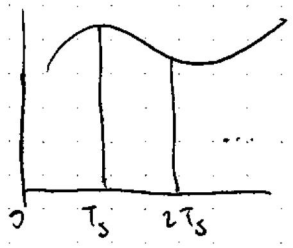
$h(t-\tau) = 1$ when τ btwn $(t-T, t)$

$h(x) = 1$ $\quad 0 \le x \le T$ $\qquad h(\tau) = 1$ $\quad 0 \le \tau \le T$



$$h = \frac{\text{rect}\left(\frac{t}{T}\right)}{\text{rect}\left(\frac{t-0.5}{T}\right)} = u(t) - u(t-T)$$

ii.



$$h(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT_s)$$

(c) i. $\delta(t-3) * e^{3t}u(-t) + \delta(t-3) * \delta(t+2) + \delta(t-3) * 2$

$+ \delta(t+2) * e^{3t}u(-t) + \delta(t+2) * \delta(t+2) + \delta(t+2) * 2$

$$\int_{-\infty}^{\infty} \delta(\tau+2)\cdot \delta(\tau+t+2)\, d\tau$$

$= e^{3(t-3)}u(3-t) + \delta(t-3+2) + 2 + 2 + \delta(t+2+2)$

$+ e^{3(t+2)}u(-t-2) = e^{3(t-3)}u(3-t) + e^{3(t+2)}u(-t-2)$

$+ 4 + \delta(t-1) + \delta(t+4)$

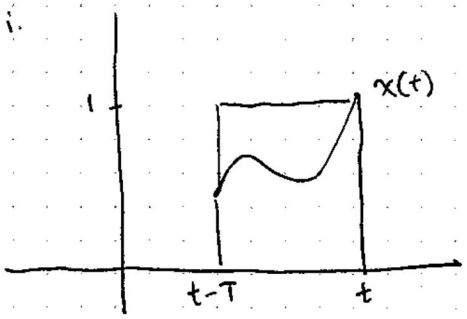
3.4 (b)(ii) **5 / 5**

✓ **- 0 pts** **Correct**

- 1 pts partially correct

- 5 pts no answer

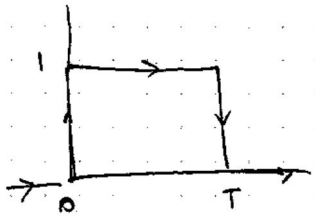
(b) i.



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

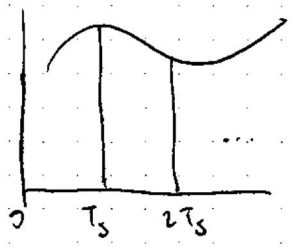
$h(t-\tau) = 1$ when τ btwn $(t-T, t)$

$h(x) = 1$ $\quad 0 \le x \le T$ $\qquad h(\tau) = 1$ $\quad 0 \le \tau \le T$



$$h = \frac{\text{rect}\left(\frac{t}{T}\right)}{\text{rect}\left(\frac{t-0.5}{T}\right)} = u(t) - u(t-T)$$

ii.



$$h(t) = \sum_{n=-\infty}^{\infty} \delta(t - nT_s)$$

(c) i. $\delta(t-3) * e^{3t}u(-t) + \delta(t-3) * \delta(t+2) + \delta(t-3) * 2$

$+ \delta(t+2) * e^{3t}u(-t) + \delta(t+2) * \delta(t+2) + \delta(t+2) * 2$

$$\int_{-\infty}^{\infty} \delta(\tau+2)\cdot \delta(\tau+t+2)\, d\tau$$

$= e^{3(t-3)}u(3-t) + \delta(t-3+2) + 2 + 2 + \delta(t+2+2)$

$+ e^{3(t+2)}u(-t-2) = e^{3(t-3)}u(3-t) + e^{3(t+2)}u(-t-2)$

$+ 4 + \delta(t-1) + \delta(t+4)$

3.5 (c)(i) 5 / 5

✓ **- 0 pts** **Correct**

- 0.5 pts small mistake

- 1 pts distribution error

- 1 pts error in sifting property

- 0.5 pts not fully simplified

- 1 pts unit step function not used or bounds not specified

ii.

$$\frac{d}{dt}\left[(u(t)-u(t-1)) * u(t-2)\right]$$

$$= \frac{d}{dt}\left[u(t) * u(t-2) - u(t-1) * u(t-2) \right]$$

$$= \frac{d}{dt}\int_{-\infty}^{\infty} u(t)\cdot u(t-\tau-2) - u(t-1)\cdot u(t-\tau-2)\, d\tau$$

$$u(t) * u(t) = \int_{-\infty}^{\infty} u(\tau)\cdot u(t-\tau)\, d\tau$$

$$= \int_{0}^{\infty} u(t-\tau)\, d\tau \rightarrow \begin{array}{l}\text{if } t<0,\ 0 \\ t\geq 0,\ t\end{array}$$

$$= r(t).$$

$$\frac{d}{dt}\left[u(t) * u(t-2) - u(t-1) * u(t-2) \right]$$

$$= \frac{d}{dt}\left[r(t-2) - r(t-3) \right]$$

$$= \boxed{u(t-2) - u(t-3)}$$

(d) i. $x(t) = -x(-t)$
$h(t) = -h(-t)$ → yes TRUE!

$$y(t) = y(-t)$$

ii. ~~$x(\tau) * h(t) + x(t) * h(t)$~~

=

3.6 (c)(ii) 5 / 5

✓ **- 0 pts Correct**

- 1 pts error in sifting property

- 0.5 pts small mistake

- 5 pts no answer

ii.

$$\frac{d}{dt}\left[(u(t)-u(t-1)) * u(t-2)\right]$$

$$= \frac{d}{dt}\left[u(t) * u(t-2) - u(t-1) * u(t-2) \right]$$

$$= \frac{d}{dt}\int_{-\infty}^{\infty} u(t)\cdot u(t-\tau-2) - u(t-1)\cdot u(t-\tau-2)\, d\tau$$

$$u(t) * u(t) = \int_{-\infty}^{\infty} u(\tau)\cdot u(t-\tau)\, d\tau$$

$$= \int_{0}^{\infty} u(t-\tau)\, d\tau \rightarrow \begin{array}{l}\text{if } t<0,\ 0 \\ t\geq 0,\ t\end{array}$$

$$= r(t).$$

$$\frac{d}{dt}\left[u(t) * u(t-2) - u(t-1) * u(t-2) \right]$$

$$= \frac{d}{dt}\left[r(t-2) - r(t-3) \right]$$

$$= \boxed{u(t-2) - u(t-3)}$$

(d) i. $x(t) = -x(-t)$
$h(t) = -h(-t)$ → yes TRUE!

$$y(t) = y(-t)$$

ii. ~~$x(\tau) * h(t) + x(t) * h(t)$~~

=

3.7 (d)(i) **4 / 4**

✓ **- 0 pts** Correct (full credit is given to everyone)

ii.

$$\frac{d}{dt}\left[(u(t)-u(t-1)) * u(t-2)\right]$$

$$= \frac{d}{dt}\left[u(t) * u(t-2) - u(t-1) * u(t-2) \right]$$

$$= \frac{d}{dt}\int_{-\infty}^{\infty} u(t)\cdot u(t-\tau-2) - u(t-1)\cdot u(t-\tau-2)\, d\tau$$

$$u(t) * u(t) = \int_{-\infty}^{\infty} u(\tau)\cdot u(t-\tau)\, d\tau$$

$$= \int_{0}^{\infty} u(t-\tau)\, d\tau \rightarrow \begin{array}{l}\text{if } t<0,\ 0 \\ t\geq 0,\ t\end{array}$$

$$= r(t).$$

$$\frac{d}{dt}\left[u(t) * u(t-2) - u(t-1) * u(t-2) \right]$$

$$= \frac{d}{dt}\left[r(t-2) - r(t-3) \right]$$

$$= \boxed{u(t-2) - u(t-3)}$$

(d) i. $x(t) = -x(-t)$
$h(t) = -h(-t)$ → yes TRUE!

$$y(t) = y(-t)$$

ii. ~~$x(\tau) * h(t) + x(t) * h(t)$~~

=

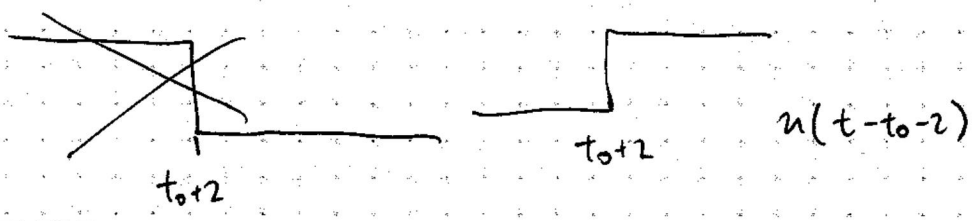
3.8 (d)(ii) 4 / 4

✓ - **0 pts** Correct (full credit is given to everyone)

4. (a) $y(t) = \int_{-\infty}^{t-t_0-2} x(\tau)\, d\tau$

we want $f(t-\tau) = 0$ for $\tau = t-t_0-2 \to \infty$

$f(t_0+2) = 0$



$$\boxed{h(t) = u(t-t_0-2)}$$

$$y(t) = \int_{-\infty}^{\infty} x(\tau)\cdot u(t-\tau-t_0-2)\, d\tau$$

(b) $S_1 = u(t-t_0-2)$

$S_2 = u(t+2)$

$S_3 = \delta(t-4)$

$S_2 * S_3 = \cancel{\delta(u(t+2)-4)}$

$$\int_{-\infty}^{\infty} u(t+2)\cdot\delta(t-\tau-4)\, d\tau$$

$$\int_{-\infty}^{\infty} \delta(t-4)\, u(t-\tau+2)\, d\tau$$

$$= \int_{-2}^{\infty} \delta(t-\tau-4)\, d\tau$$

$u(t-2)$

$$= \boxed{u(t-t_0-2) - u(t-2)}$$

4.1 (a) **4 / 4**

✓ **- 0 pts Correct**

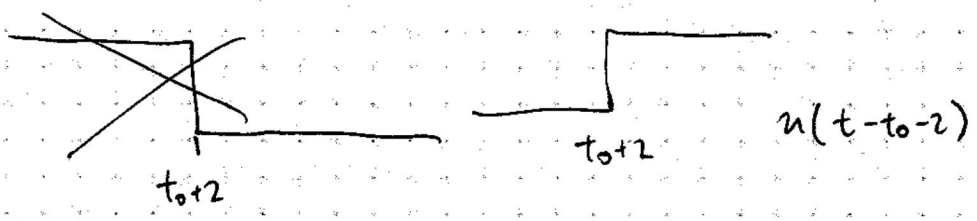
- 2 pts wrong answer

- 4 pts no answer

4. (a) $y(t) = \int_{-\infty}^{t-t_0-2} x(\tau)\, d\tau$

we want $f(t-\tau) = 0$ for $\tau = t-t_0-2 \to \infty$

$f(t_0+2) = 0$



$$\boxed{h(t) = u(t-t_0-2)}$$

$$y(t) = \int_{-\infty}^{\infty} x(\tau)\cdot u(t-\tau-t_0-2)\, d\tau$$

(b) $S_1 = u(t-t_0-2)$

$S_2 = u(t+2)$

$S_3 = \delta(t-4)$

$S_2 * S_3 = \cancel{\delta(u(t+2)-4)}$

$$\int_{-\infty}^{\infty} u(t+2)\cdot\delta(t-\tau-4)\, d\tau$$

$$\int_{-\infty}^{\infty} \delta(t-4)\, u(t-\tau+2)\, d\tau$$

$$= \int_{-2}^{\infty} \delta(t-\tau-4)\, d\tau$$

$u(t-2)$

$$= \boxed{u(t-t_0-2) - u(t-2)}$$

4.2 (b) **4 / 4**

✓ **- 0 pts** **Correct**

- 2 pts wrong answer

- 4 pts no answer

(c) $h_{eq} = u(t-t_0-2) - u(t-2)$

$$y(t) = \int_{-\infty}^{\infty} [0.5\,\delta(\tau-2) + \delta(\tau-3)]\,[u(t-\tau-t_0-2) - u(t-\tau-2)]\,d\tau$$

$$= 0.5\,u(t-t_0-4) - 0.5\,u(t-4)$$

$$+ u(t-t_0-5) - u(t-5)$$

4.3 (C) **4 / 4**

✓ **- 0 pts** **Correct**

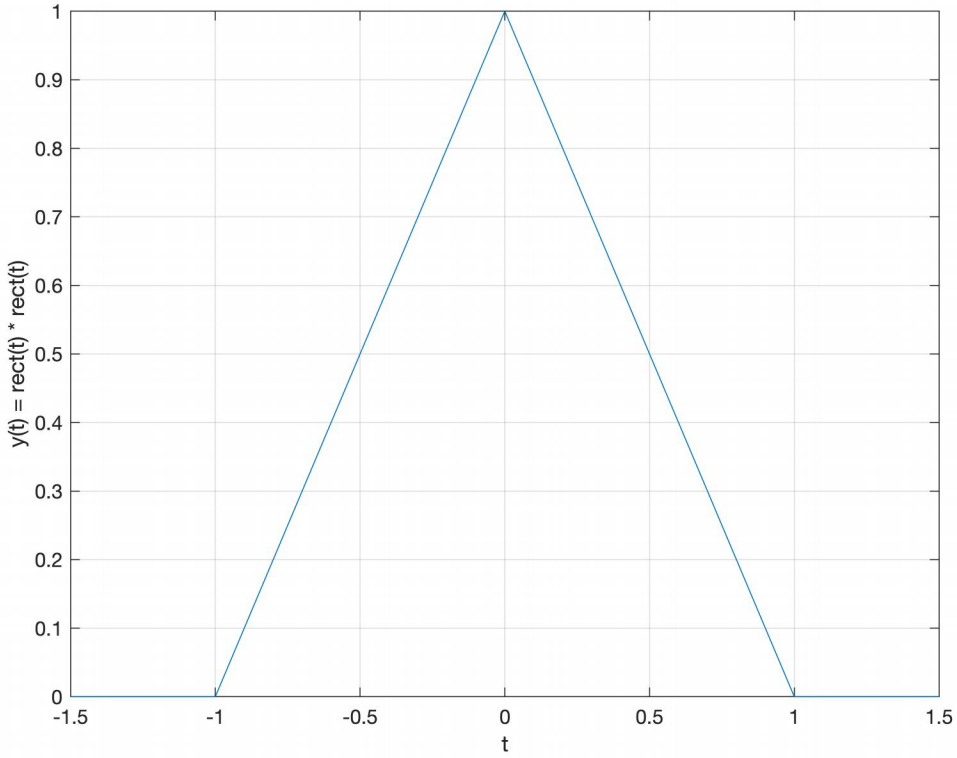
- 1 pts wrong answer

- 4 pts no answer

Homework 3 EE 102

Task 1 and Task 2:

```
% Task 1:
tx = -0.75:0.001:0.75;
rect = rectangularPulse(tx);
[y, ty] = nconv(rect, tx, rect, tx);
plot(ty, y)
xlabel("t"); ylabel("y(t) = rect(t) * rect(t)")
grid on
```




```
% Task 2:
[y, ty] = nconv(y, ty, rect, tx);
plot(ty, y)
xlabel("t"); ylabel("y(t) = rect(t) * rect(t)")
grid on
```

5.1 (a) **7 / 7**

✓ **- 0 pts** **Correct**

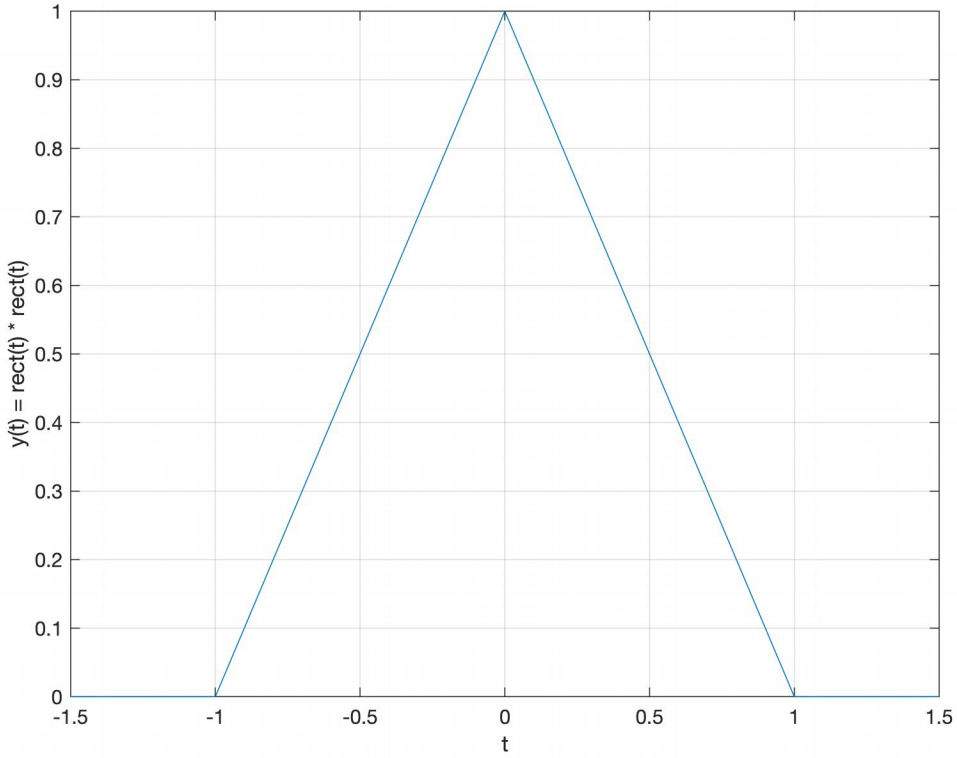
- 3 pts wrong plot

- 7 pts no plot

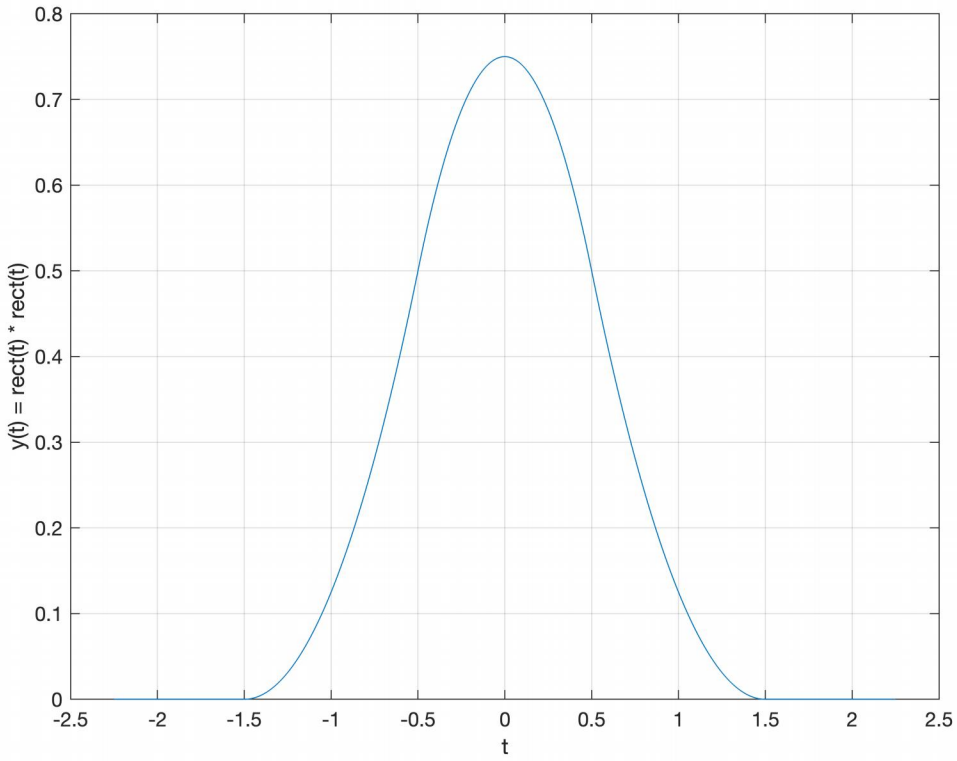
Homework 3 EE 102

Task 1 and Task 2:

```
% Task 1:
tx = -0.75:0.001:0.75;
rect = rectangularPulse(tx);
[y, ty] = nconv(rect, tx, rect, tx);
plot(ty, y)
xlabel("t"); ylabel("y(t) = rect(t) * rect(t)")
grid on
```




```
% Task 2:
[y, ty] = nconv(y, ty, rect, tx);
plot(ty, y)
xlabel("t"); ylabel("y(t) = rect(t) * rect(t)")
grid on
```



Task 3:

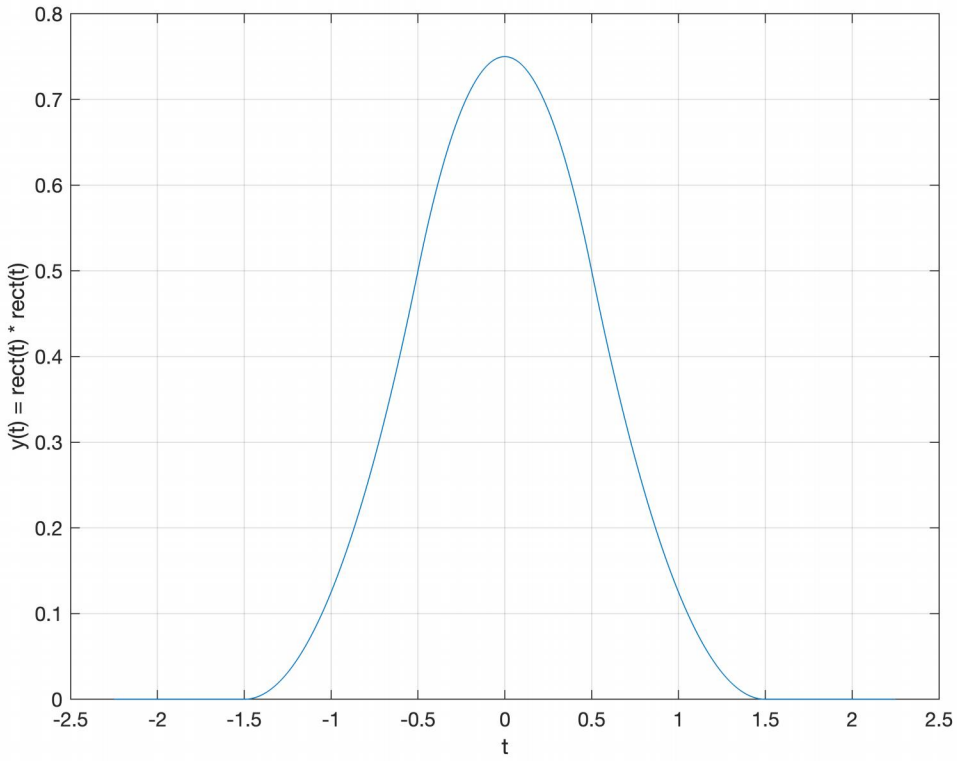
```
% Task 3:
N = 100;
tx = -0.75:0.001:0.75;
rect = rectangularPulse(tx);
[y, ty] = nconv(rect, tx, rect, tx);

for i = 1:N-1
    [y, ty] = nconv(y, ty, rect, tx);
end
plot(ty, y)
xlabel("t"); ylabel("y(t) = rect^{(N)}(t)")
grid on
```

5.2 (b) **5 / 5**

✓ **- 0 pts** **Correct**

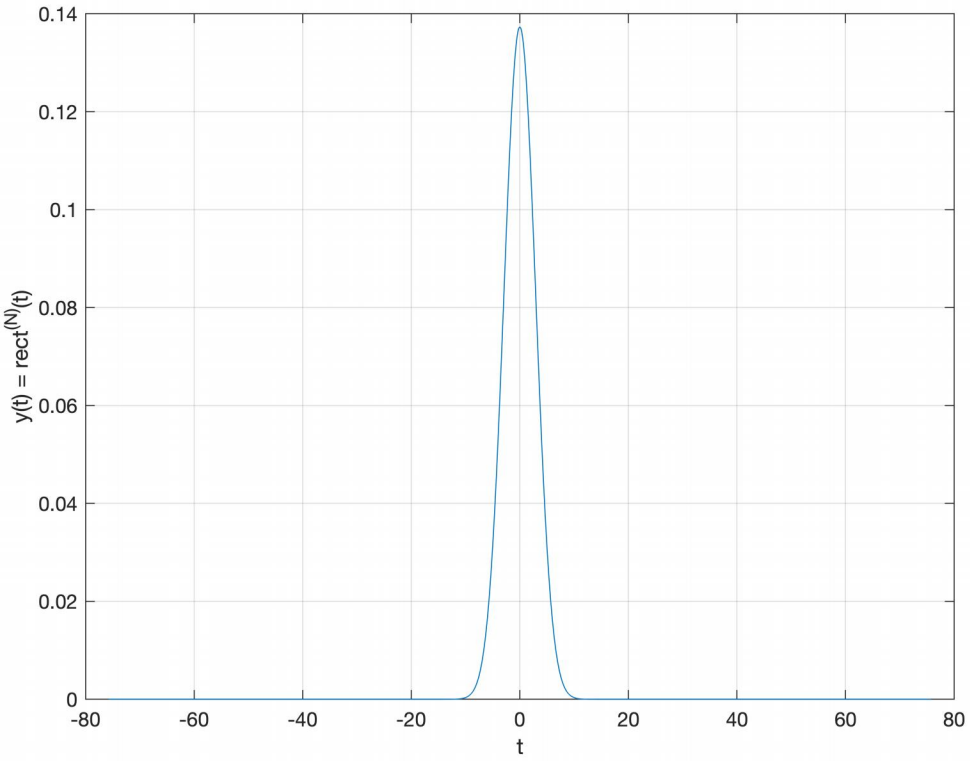
- 5 pts no plot

- 2 pts wrong plot



Task 3:

```
% Task 3:
N = 100;
tx = -0.75:0.001:0.75;
rect = rectangularPulse(tx);
[y, ty] = nconv(rect, tx, rect, tx);

for i = 1:N-1
    [y, ty] = nconv(y, ty, rect, tx);
end
plot(ty, y)
xlabel("t"); ylabel("y(t) = rect^{(N)}(t)")
grid on
```


0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
y(t) = rect^(N)(t)
-80
-60
-40
-20
0
20
40
60
80
t

5.3 (c) **5 / 5**

✓ **- 0 pts** **Correct**

- 5 pts no plot

- 1 pts wrong plot

5.4 (d)(optional) 0 / 0

✓ **- 0 pts** Correct