P1 2.19

a). $V(t) = [5t]\mu(t) - [5t]\mu(t-1) + 5\mu(t-1) - 5\mu(t-3)$

b). $V_2(t) = \sum_{k=-\infty}^{\infty} V(t-4k)$

P2.

2.13.

To determine whether $x(t)$ is periodic, we must see if the ratios of the periods of ~~each~~ each functions are ratio of integer. (rational number)

Sinusoidal signal with period T and phase θ.
$\cos(2\pi/T \cdot t + \theta)$

a). $T_1 = \frac{2\pi}{3}$ $T_2 = \frac{2\pi}{5}$.

$x(t)$ period $= \frac{\text{Lowest common multiple of numerators of } T_1 \,\&\, T_2}{\text{Greatest common divisior of denominator of } T_1 \,\&\, T_2}$.

$T_0 = \frac{2\pi}{1} = 2\pi$.

$f_0 = \frac{1}{T_0} = \frac{1}{2\pi}$

* LCM(fraction1, fraction2) = LCM(num1, num2)/GCD(den1,

* LCM(a/b, c/d) = LCM(a,c) / GCD(b,d)

* common period, $T_0 = LCM(T_1, T_2 \cdots)$

2.13

b) $x(t) = \cos(6t) + \sin(8t) + \cos(2t) + i\sin(2t)$

$$T_1 = \frac{2\pi}{6} \quad T_2 = \frac{2\pi}{8} \quad T_3 = \frac{2\pi}{2} \quad T_4 = \frac{2\pi}{2}$$

$$\frac{T_1}{T_2} = \frac{4}{3} \quad \frac{T_1}{T_3} = \frac{1}{3} \quad \frac{T_1}{T_4} = \frac{1}{3}. \quad \frac{T_2}{T_3} = \frac{1}{4} \dots$$

$$T_0 = \frac{2\pi}{2} = \pi$$

$$f_0 = \frac{1}{T_0} = \frac{1}{\pi}.$$

c). $x(t) = \cos t + \sin \pi t.$

$$T_1 = \frac{2\pi}{1} \quad T_2 = \frac{2\pi}{\pi} = 2.$$

since π is irrational.

$\frac{T_1}{T_2}$ is irrational.

$x(t)$ is NOT periodic.

2.13

d) $x(t) = \sin(\frac{\pi}{6}t) + \sin(\frac{\pi}{3}t)$

$$T_1 = \frac{2\pi}{\frac{\pi}{6}} = 12 \qquad T_2 = \frac{2\pi}{\frac{\pi}{3}} = 6.$$

$$T_0 = 12 \qquad f_0 = \frac{1}{12}$$

2.27

	a.	b.	c.	d.
memoryless	N depends on $x(t-1)$	N $x(3t+3)$	Y	Y
invertible.	N cos^-1 is a multivalued function.	Y	Y	Y
causal	Y	N depends on $(3t+3)$ future value of 't'	Y	Y
stable.	Y	Y	Y	N. for bounded $x(t)$ $t*x(t)$ is unbounded when $t \to$ inf
time-invariant	Y	Y	Y	N ~~T(x(t-to)=exp(t*x~~ $T(x(t-t_0)) = \exp(t*x(t-t_0))$ but $y(t-t_0) = \exp((t-t_0)*x(t-t_0))$
linear.	N say $x=45$ deg $\cos(2*45) \neq 2\cos(45)$	Y	N $\ln(2*25) \neq 2*\ln(25)$	N $\exp(2*25) \neq 2*\exp(25)$

2.23

a) $$y(t) = T_2(T_1[x(t)]) \cancel{+T_4(}$$
$$+ T_4(T_3(T_1[x(t)]) + T_5[x(t)])$$

b) $$y(t) = T_5(T_1[x(t)])$$
$$+ T_3(T_2(T_1[x(t)]))$$
$$+ T_4(T_2(T_1[x(t)]))$$

c) $$y(t) = T_2(T_1[x(t)])$$
$$+ T_4(T_3(T_1[x(t)]) \times T_5[x(t)])$$

d) $$y(t) = T_5(T_1[x(t)])$$
$$\times T_3(T_2(T_1[x(t)]))$$
$$\times T_4(T_2(T_1[x(t)]))$$

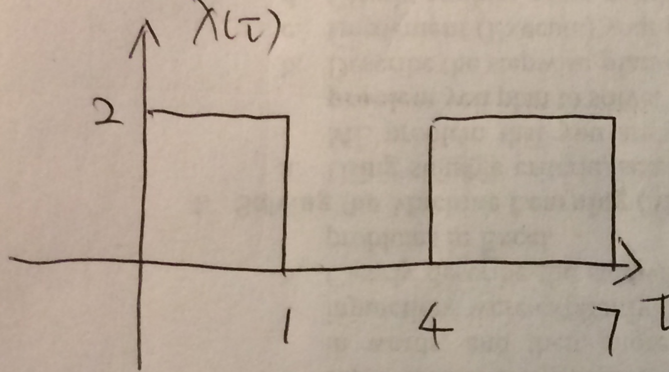
Q5 3.6.

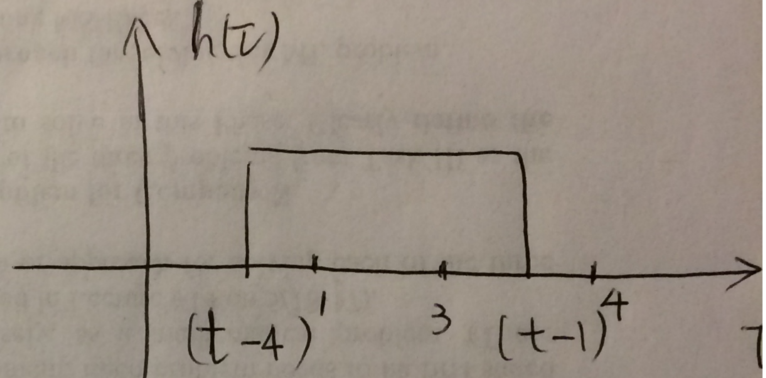
$$y(t) = x(t) * h(t) = \int_{-\infty}^{+\infty} x(\tau)\, h(t-\tau)\, d\tau .$$

$$x(\tau) = 2\mu(\tau) - 2\mu(\tau-1) + 2\mu(\tau-2) - 2\mu(\tau-3)$$

$$h(t-\tau) = \mu[(t-\tau)-1] - \mu[(t-\tau)-4]$$

$$= \mu[-\tau+(t-1)] - \mu[-\tau+(t-4)]$$





a.) for $4 \le t \le 5$

$$y(t) = \int_{t-4}^{1} 2\, d\tau = 2 \times [1-(t-4)] = 10 - 2t$$

b) $\max\ y(t) = 2 \times 3 = 6.$

c) range : when $y(t) = 0$

$$t = \{(-\inf, 1] \cup \{5\} \cup [11, +\inf)\}$$

d).

3.6

d) ~~t~~

$t-1 \le 0 \rightarrow t<1 \rightarrow y(t)=0$

$0<t-1\le 1 \rightarrow 1<t\le 2 \rightarrow y(t)=2\times(t-1)=2t-2$

$(t-1>1) \& (t-4\le 0) \rightarrow 2<t\le 4 \rightarrow y(t)=2\times 1=2.$

$0<t-4\le 1 \rightarrow 4<t\le 5 \rightarrow y(t)=2\times[1-(t-4)]=10-2t$

$4<t-1\le 7 \rightarrow 5<t\le 8 \rightarrow y(t)=2\times[(t-1)-4]=2t-10$

$4<t-4\le 7 \rightarrow 8<t\le 11 \rightarrow y(t)=2\times[7-(t-4)]=22-2t$

$7<t-4 \rightarrow 11<t \rightarrow y(t)=0$