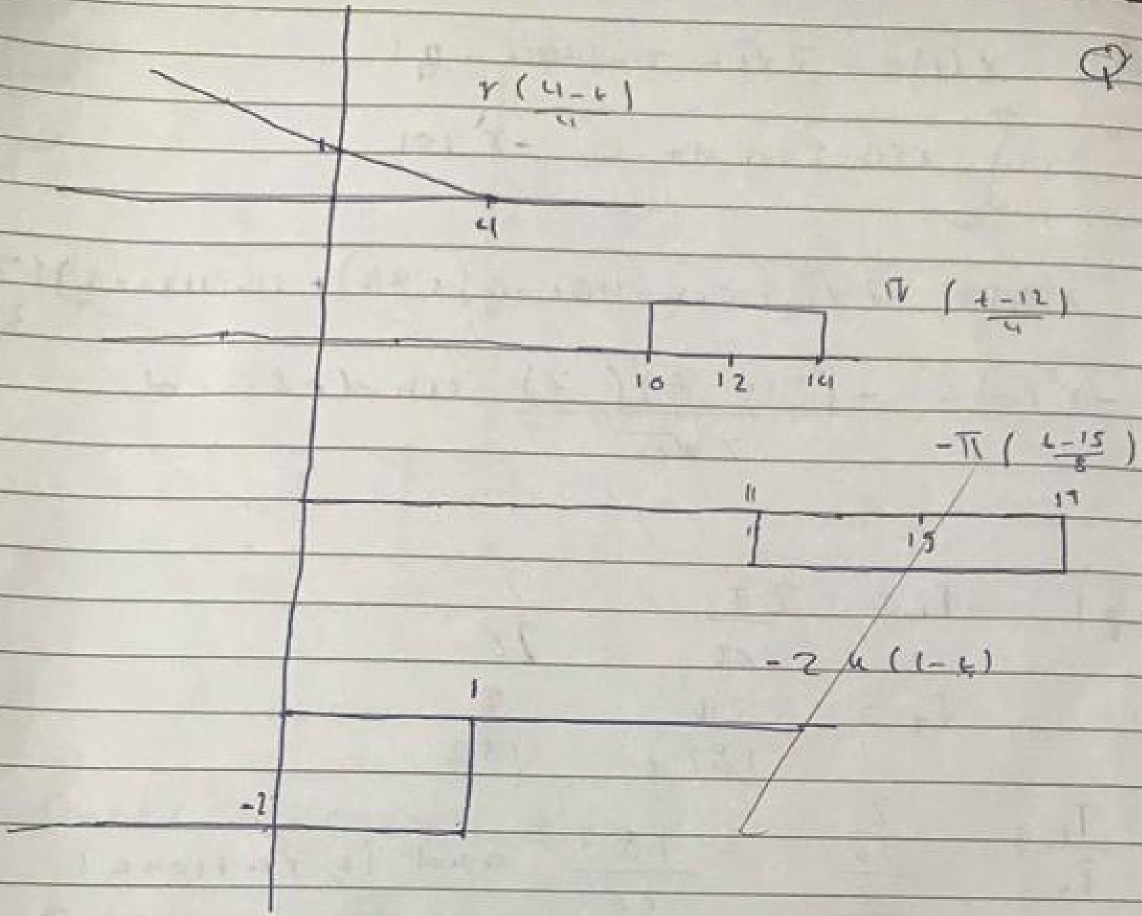
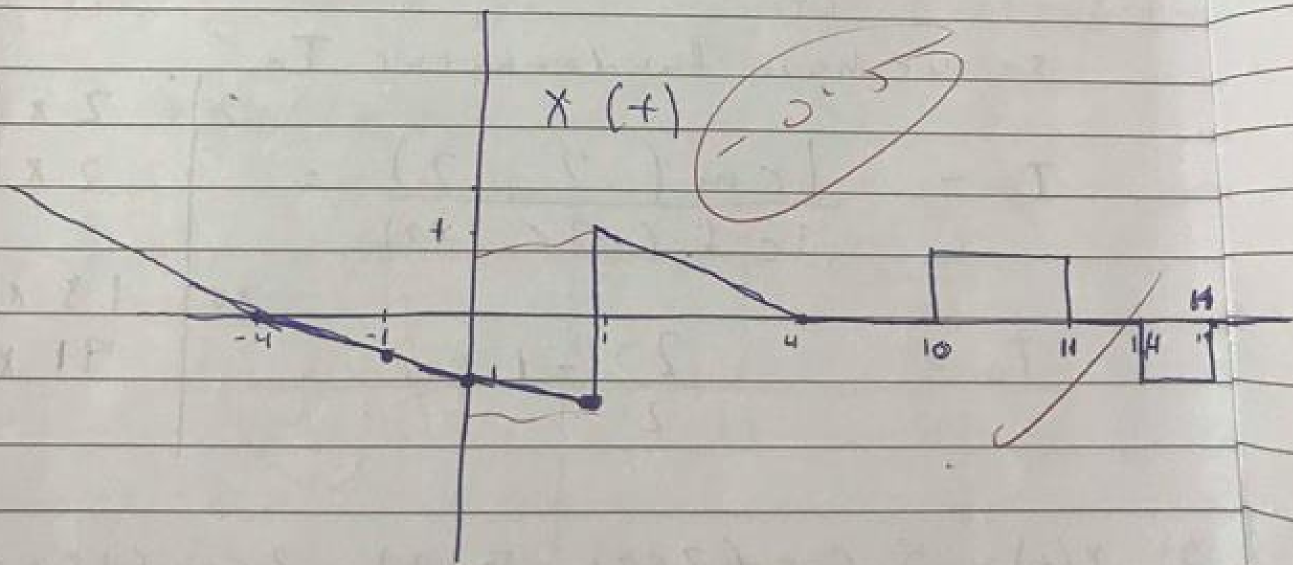
Q1





2) $x(t) = 7\sqrt{t} \cdot \sin(4\pi t + \frac{\pi}{4})$

$$\int_{-\infty}^{\infty} x(t)\, \dot{\delta}(t)\, dt = -x'(0)$$

$x'(t) = 7\sqrt{t}\left(\cos(4\pi t + \frac{\pi}{4}) \times 4\pi\right) + \sin(4\pi t + \frac{\pi}{4})\left(\frac{7}{2\sqrt{t}}\right)$

$-x'(0) = -\dfrac{(\sin\frac{\pi}{4})(7)}{2\sqrt{0}}$ undefined

Q2) $T_1 = \dfrac{2\pi}{26\pi} = \dfrac{2}{26}$

$T_2 = \dfrac{2\pi}{182\pi} = \dfrac{2}{182}$

$\dfrac{T_1}{T_2} = \dfrac{\frac{2}{26}}{\frac{2}{182}} = \dfrac{182}{26}$ and it rational

so we have fundemantal T_0

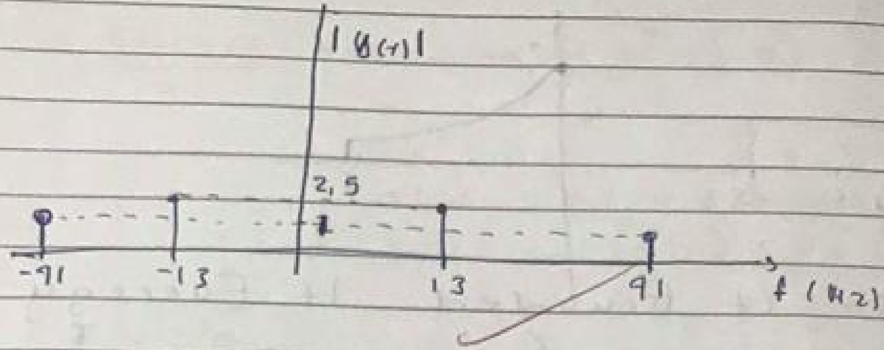
$T_0 = \dfrac{lcm(2, 2)}{lcf(26, 182)} =$

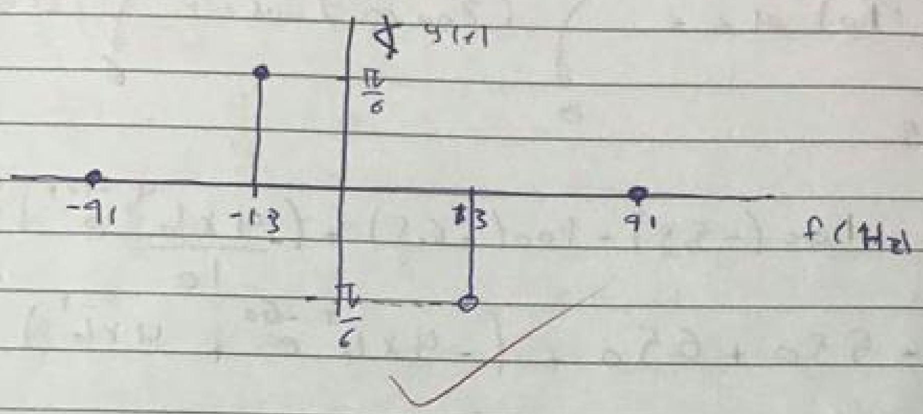
2	2×1
	2×1
26	$13 \times 2 \times 1$
	$91 \times 2 \times 1$

$T_0 = \dfrac{2}{2} = 1$ sec

2) $x(t) = 5\cos(26\pi t + \frac{\pi}{3} - \frac{\pi}{2}) + 2\cos(182\pi t)$

$\frac{2\pi}{6} - \frac{3\pi}{6} = -\frac{\pi}{6}$

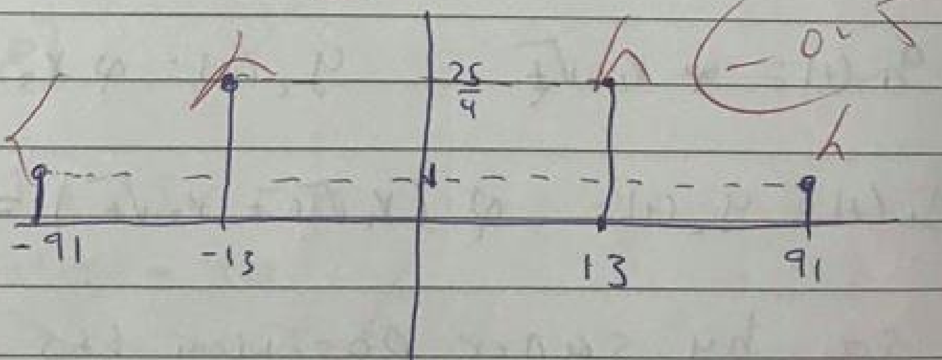


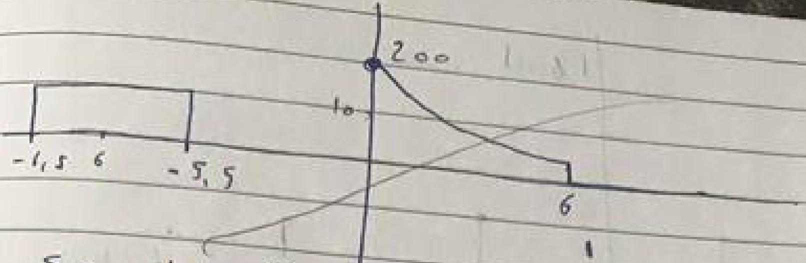


Power spectral or g

$$g(x) = \frac{25}{4}\,\delta(f-13) + \frac{25}{4}\,\delta(f+13) + \frac{4}{4}\,\delta(f-91)$$

$$+ \frac{4}{4}\,\delta(f+91)$$





so it Bounded it Eneregy Signal

$$\lim_{T\to\infty} \int_{-6,5}^{-5,5} (10)^2 \, dt + \int_{0}^{6} (200 e^{-5t})^2 \, dt + \int_{6}^{T} 0 \, dt$$

$$100(-5,5) - 100(-6,5) + \left(-\frac{4\times10^4}{10} e^{-10t}\right)\Big|_{0}^{6}$$

$$-550 + 650 + \left(-4\times10^3 e^{-60} + 4\times10^3\right)$$

$$100 - 4\times10^3 \left(e^{-60} - 1\right)$$

The Energe $\approx$ 100 + 4000 = 4100 Joul

Q3) 1- the system is linear

$y_1(t) = \varphi x_1 \sqrt{t}$ $\quad y_2(t) = \varphi x_2 \sqrt{t}$

$y_1(t) + y_2(t) = \varphi(x_1\sqrt{t} + x_2\sqrt{t}) = y(t)$

so by super position its linear

$y(\frac{1}{4}) = x(\frac{1}{2})$ so its not causal

becaus it depends on future

$$\frac{d^2y(t)}{dt^2} + 5\frac{dy(t)}{dt} + 4y(t) = 8\,\ddot{\delta}(t-2)$$

we solve as $\ddot{\delta}(t)$ and shifted finaly becuse it (LTI)

$r^2 + 5r + 4 = 0$

$\left(r + \frac{5}{2}\right)^2 - \frac{25}{4} + 4 = 0$

$\left(r + \frac{5}{2}\right)^2 - \frac{9}{4} = 0$

$r + \frac{5}{2} = \pm\frac{3}{2}$

$r_1 = -\frac{5}{2} + \frac{3}{2}$

$r_1 = -1$

$r_2 = -\frac{5}{2} - \frac{3}{2} = -\frac{8}{2} = -4$

$g(t) = Ae^{-t} + Be^{-4t}$

$h(t) = g(t)u(t) + C\,\ddot{\delta}(t)$

$h'(t) = g(0)\,\delta(t) + g'(t)u(t) + C\,\dddot{\delta}(t)$

$h''(t) = g(0)\,\dot{\delta}(t) + g'(0)\,\delta(t) + g''(t)u(t) + C\,\ddddot{\delta}(t)$

$\boxed{C = 8}$

$g(0) + 5C = 0$

$g(0) = -40$

$g'(0) + 5g(0) + 4C = 0$

$g'(0) - 200 + 32 = 0$

$g'(0) = 168$

$g(t) = Ae^{-t} + Be^{-4t}$

$g(0) = -40$ $\qquad A + B = -40$ $\qquad A = -40 - B$

$\cancel{B = -40 - A}$

$g'(t) = -Ae^{-t} - 4Be^{-t}$ $\qquad g'(0) = 168$

$-A - 4B = 168$

$40 + B - 4B = 168$

$-3B = 128$ $\qquad B = -42{,}6$

$A = -40 + 42{,}6 = 2{,}6$

$h(t) = (2{,}6e^{-t} - 42{,}6e^{-4t})u(t) + 8\,\delta(t)$

$h(t-2) = (2{,}6e^{-t+2} - 42{,}6e^{-4t+8})u(t-2) + 8\,\delta(t-$

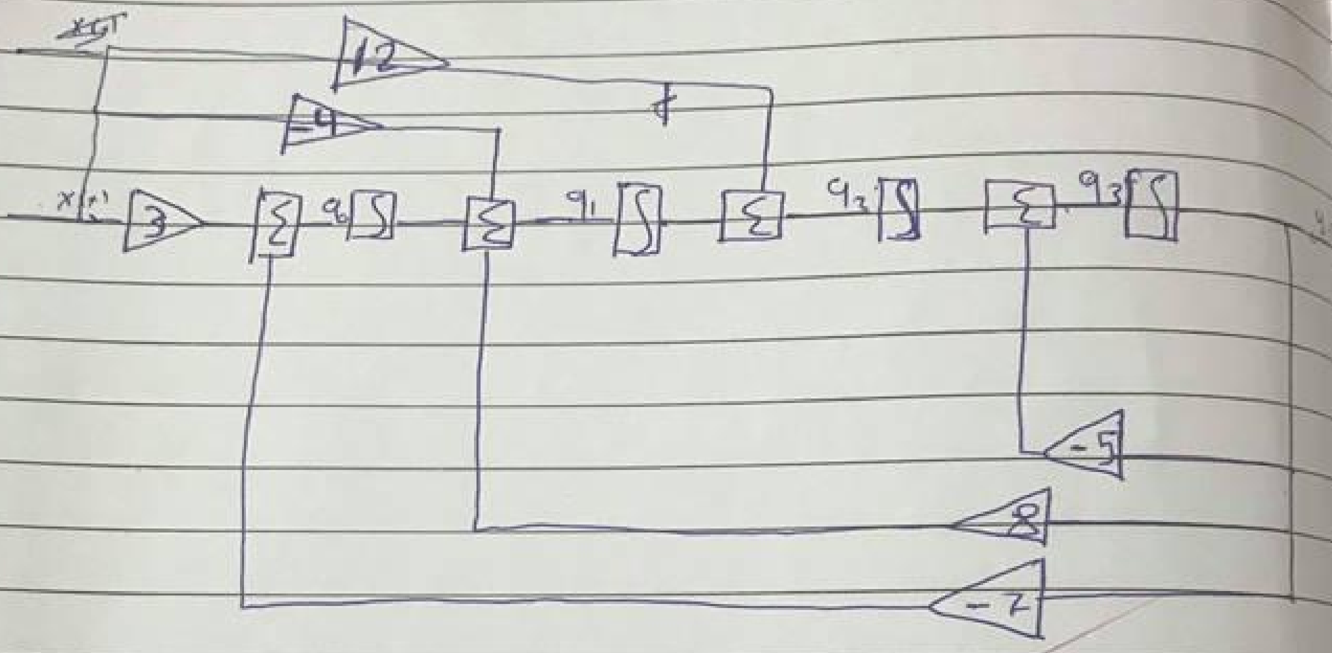
3) $\frac{dy^4}{dt^4} + \frac{5d^3y}{dt^3} - 8\frac{dy}{dt} - 12\frac{d^2x}{dt} + \frac{4dx(t)}{dt} = 3x($ $-7y$ $= q_0$

$\frac{dy^3}{dt^3} + \frac{5dy^2}{dt^2} - \frac{12dx}{dt} = 8y(t) - 4x(t) + \int q_0 = q$

$\frac{dy^2}{dt} + \frac{5dy}{dt} = 12x(t) + \int q_1 \quad = q_2$

$\frac{dy}{dt} = -5y(t) + \int q_2 \quad = q_3$

$y(t) = \int q_3 = q_4$



12
-4
3
Σ
q_0
∫
q_1
q_2
q_3
-5
8
-7