1.1

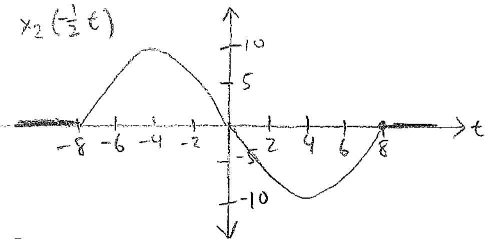
(a) Digital, discrete (b) Analog, continuous (c) Digital, discrete

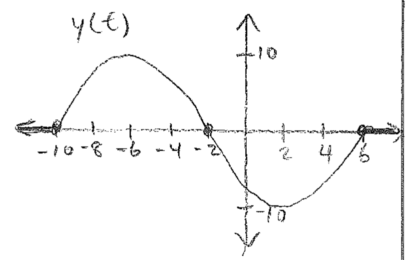
1.2

(a) Analog, continuous (b) Digital, discrete (c) Digital, discrete

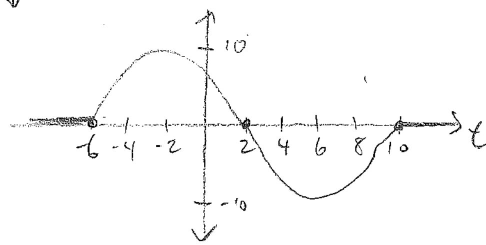
1.5

(a) $y(t) = x_2\left[-\frac{1}{2}(t+2)\right]$





(b) $y(t) = x_2\left[-\frac{1}{2}(t-2)\right]$



1.7

(a) $\left(\frac{t}{2}\right)^2 = \frac{1}{4}t^2$ $\quad \boxed{f(t) = \frac{1}{4}(t-6)^2}$ $\quad \left(\frac{0}{2}\right)^2 = 0 \quad \frac{1}{4}(6-6)^2 = 0 \quad \frac{1}{4}(2)^2 = 1$

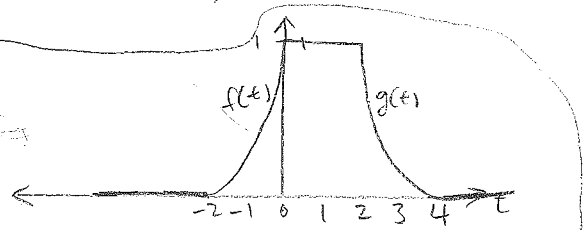
$\frac{1}{4}(4-6)^2 = 1 \quad \frac{1}{4}(1)^2 = \frac{1}{4} \quad \frac{1}{4}(5-6)^2 = \frac{1}{4}$

(b) $-(t-4) \le 0 \quad t-4 \ge 0 \quad t \ge 4 : 0 \qquad 0 \le -(t-4) \le 2 \quad 0 \ge t-4 \ge -2 \quad 4 \ge t \ge 2 : (t-4)^2$

$2 \le -(t-4) \le 4 \quad -2 \ge t-4 \ge -4 \quad 2 \ge t \ge 0 : 1 \qquad 4 \le -(t-4) \le 6 \quad -4 \ge t-4 \ge -6 \quad 0 \ge t \ge -2 : \frac{1}{4}(t-6)^2$

$-(t-4) \ge 6 \quad t-4 \le -6 \quad t \le -2 : 0$

$$x_4[-(t-4)] = \begin{cases} 0 & \text{for } t \le -2 \\ \frac{1}{4}(t+2)^2 & \text{for } -2 \le t \le 0 \\ 1 & \text{for } 0 \le t \le 2 \\ \frac{1}{4}(t-4)^2 & \text{for } 2 \le t \le 4 \\ 0 & \text{for } t \ge 4 \end{cases}$$

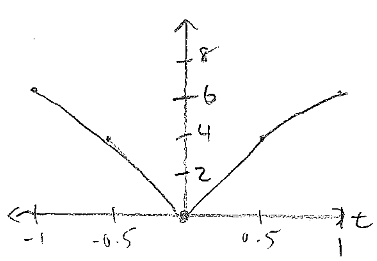


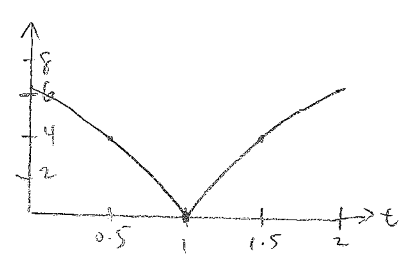
$f(t) = \frac{1}{4}(t+2)^2 \quad g(t) = \frac{1}{4}(t-4)^2 \quad \frac{1}{4}(-2+2)^2 = 0 \quad \frac{1}{4}(-1+2)^2 = \frac{1}{4} \quad \frac{1}{4}(0+2)^2 = 1$

$\frac{1}{4}(2-4)^2 = 1 \quad \frac{1}{4}(3-4)^2 = \frac{1}{4} \quad \frac{1}{4}(4-4)^2 = 0$

1.9

$x(t) = 10(1 - e^{-|t|})$ $\qquad x(-t+1) = x(-(t-1))$





1.21

(a) $4u(t+1)$ (b) $-2u(t+2)+2u(t-2)$ (c) $2u(t)+2u(t-2)+2u(t-3)$

(d) $6u(t)-2u(t-1)-2u(t-3)-2u(t-4)$

(e) $2u(t)+4u(t-1)-4u(t-3)-2u(t-4)$ (f) $4u(t)-6u(t-1)+6u(t-2)-4u(t-3)$

1.23

(a) $-2r(t)+2r(t-2)+2r(t-2)-2r(t-4)=\boxed{-2r(t)+4r(t-2)+2r(t-4)}$

(b) $2r(t)-2r(t-2)-2r(t-4)+2r(t-6)$

(c) $2r(t)-2r(t-2)-8u(t-2)+2r(t-2)-2r(t-4)$

1.24

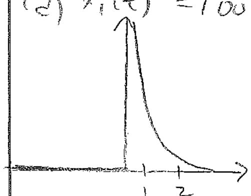
(a) $x_1(t)=u(t-3)+u(-t-3)$ $x_1(-t)=u(-t-3)+u(t-3)$ $x_1(-t)=x_1(t)$ Even

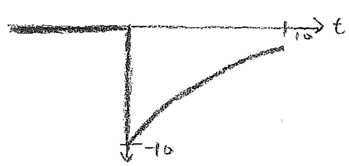
(b) $x_2(t)=\sin(2t)\cos(2t)$ sin is odd cos is even $\boxed{\text{odd}}$

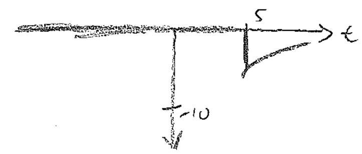
(c) $x_3(t)=\sin(t^2)$ sin is odd $\boxed{\text{odd}}$

1.25

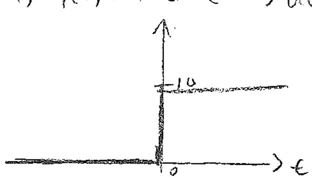
(a) $x_1(t)=100e^{-2t}u(t)$ (b) $x_2(t)=-10e^{-0.1t}u(t)$ (c) $x_3(t)=-10e^{-0.1t}u(t-5)$

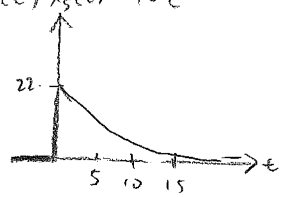


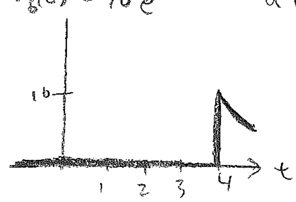




(d) $x_4(t)=10(1-e^{-10^3t})u(t)$ (e) $x_5(t)=10e^{-0.2(t-4)}u(t)$ (f) $x_6(t)=10e^{-0.2(t-4)}u(t-4)$







1.28

(a) $y_1(t)=\int_{-\infty}^{\infty}t^3\,\delta(t-2)\,dt=\int_{-\infty}^{\infty}2^3\,\delta(t-2)\,dt=8\int_{-\infty}^{\infty}\delta(t-2)\,dt=8\cdot 1=\boxed{8}$

(b) $y_2(t)=\int_{-\infty}^{\infty}\cos(t)\,\delta(t-\frac{\pi}{3})\,dt=\int_{-\infty}^{\infty}\cos(\frac{\pi}{3})\,\delta(t-\frac{\pi}{3})\,dt=\frac{1}{2}\int_{-\infty}^{\infty}\delta(t-\frac{\pi}{3})\,dt=\boxed{\frac{1}{2}}$

(c) $y_3(t)=\int_{-3}^{-1}t^5\,\delta(t+2)\,dt=\int_{-3}^{-1}-2^5\,\delta(t+2)\,dt=-32\cdot 1=\boxed{-32}$

$\boxed{1.29}$

(a) $y_1(t) = \int_{-\infty}^{\infty} t^3 \delta(3t-6)\,dt \quad \delta(3t-6) = \delta(3(t-2)) \quad y_1(t) \approx \int_{-\infty}^{\infty} t^3 \delta(t-2)\,dt = \boxed{8}$

(b) $y_2(t) = \int_{-\infty}^{\infty} \cos(t)\,\delta(3t-\pi)\,dt \quad \delta(3t-\pi) = \delta(3(t-\frac{\pi}{3})) \quad y_2(t) \approx \int_{-\infty}^{\infty} \cos(t)\,\delta(t-\frac{\pi}{3}) = \boxed{\frac{1}{2}}$

(c) $y_3(t) = \int_{-3}^{-1} t^5 \delta(3t+2)\,dt \quad \delta(3t+2) = \delta(3(t+\frac{2}{3})) \quad y_3(t) \approx \int_{-3}^{-1} t^5 \delta(t+\frac{2}{3})\,dt = \boxed{0}$

$\boxed{1.30}$

(a) $\omega_{01} = \frac{2\pi}{3} \quad \omega_{02} = \frac{\pi}{2} \quad T_{01} = 3 \quad T_{02} = 4 \quad 3 \cdot 4 \quad \boxed{T_0 = 12}$

(b) $\omega_{01} = \frac{2\pi}{3} \quad \omega_{02} = \pi\sqrt{2} \quad T_{01} = 3 \quad T_{02} = \sqrt{2} \quad$ $\boxed{\text{Non-periodic}}$

(c) $\omega_{01} = \frac{2\pi}{3} \quad \omega_{02} = \frac{2}{3} \quad T_{01} = 3 \quad T_{02} = 3\pi \quad$ $\boxed{\text{Non-periodic}}$

$\boxed{1.31}$

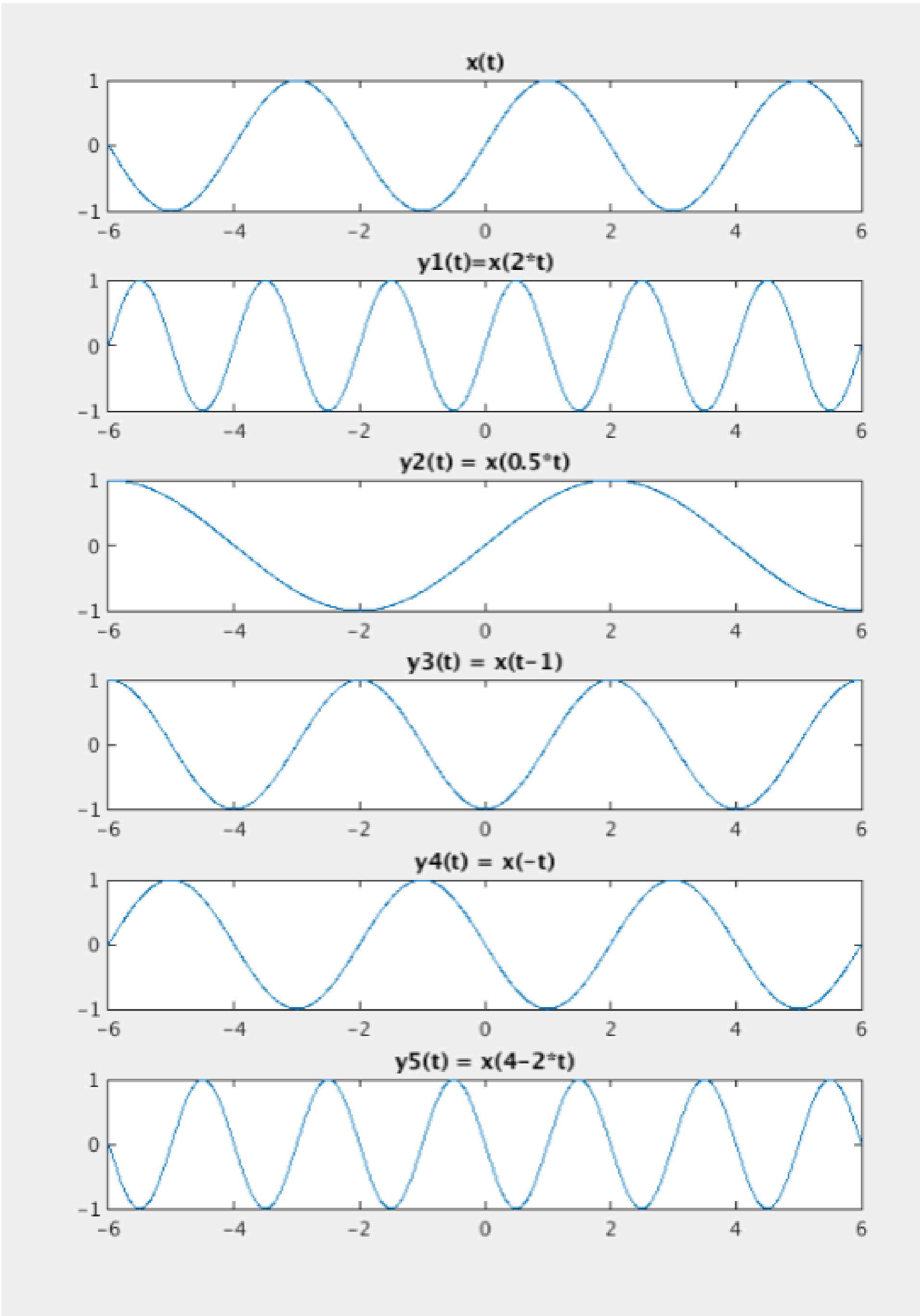
(a) $\omega_0 = \frac{\pi}{3} \quad T_0 = 2\pi \cdot \frac{3}{\pi} = \boxed{6}$

(b) $\omega_{01} = \frac{2\pi}{3} \quad \omega_{02} = \frac{2\pi}{6} \quad T_{01} = 3 \quad T_{02} = 6 \quad$ $\boxed{\text{period} = 6}$

(c) $\omega_{01} = \frac{1}{3} \quad \omega_{02} = \frac{1}{2} \quad T_{01} = 6\pi \quad T_{02} = 4\pi \quad$ $\boxed{\text{period} = 12\pi}$

$x(4-2t) = x(-2(t-2))$

1 & 2



3. (a) In 2(a) x(t) is compressed by 2. In 2(b) x(t) is expanded by 2.
(b) X is flipped over the y axis, then compressed by 2, then shifted to the right by 2.