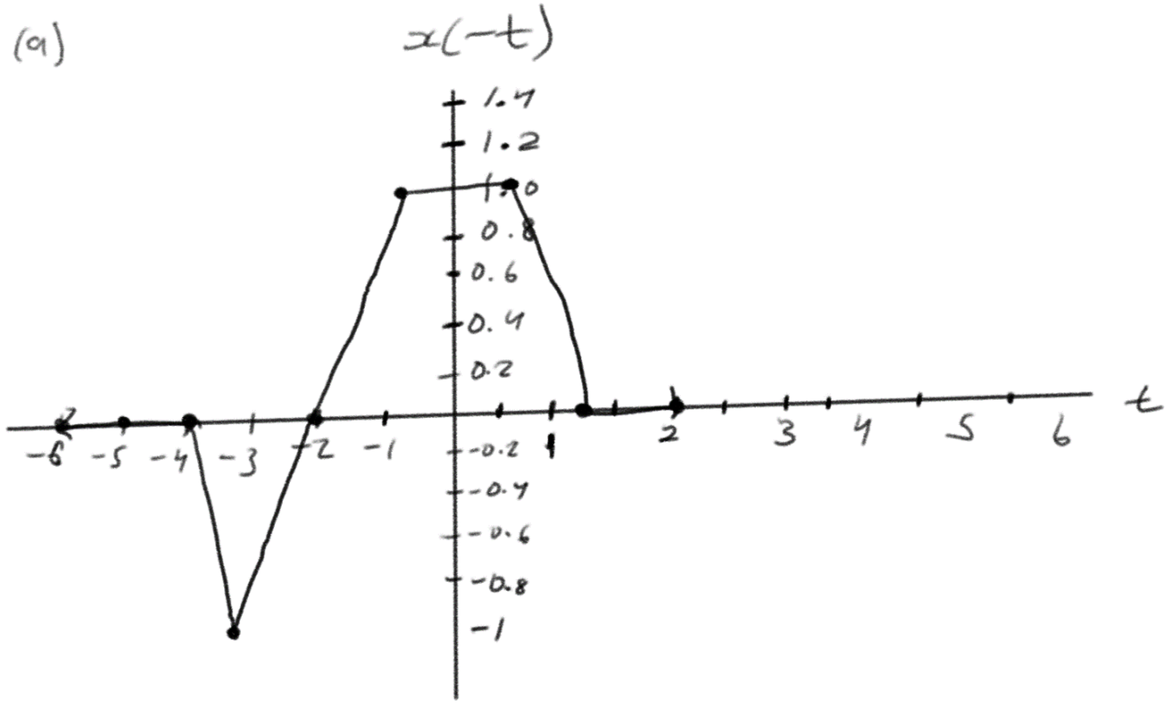
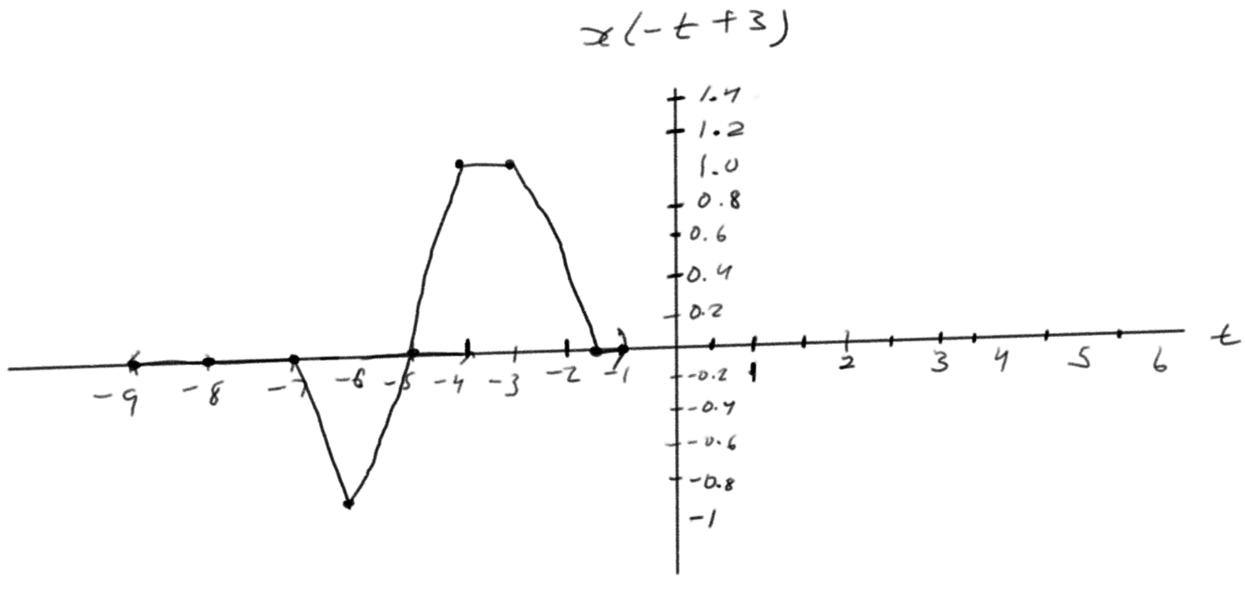
1. (a)

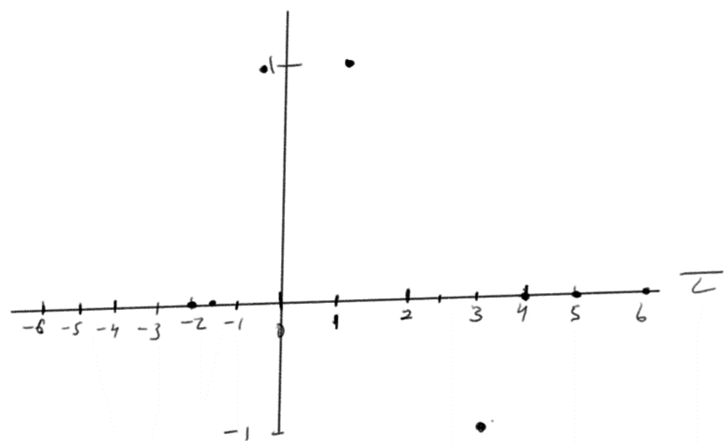


x(-t)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
-0.2
-0.4
-0.6
-0.8
-1
-6
-5
-4
-3
-2
-1
1
2
3
4
5
6
t



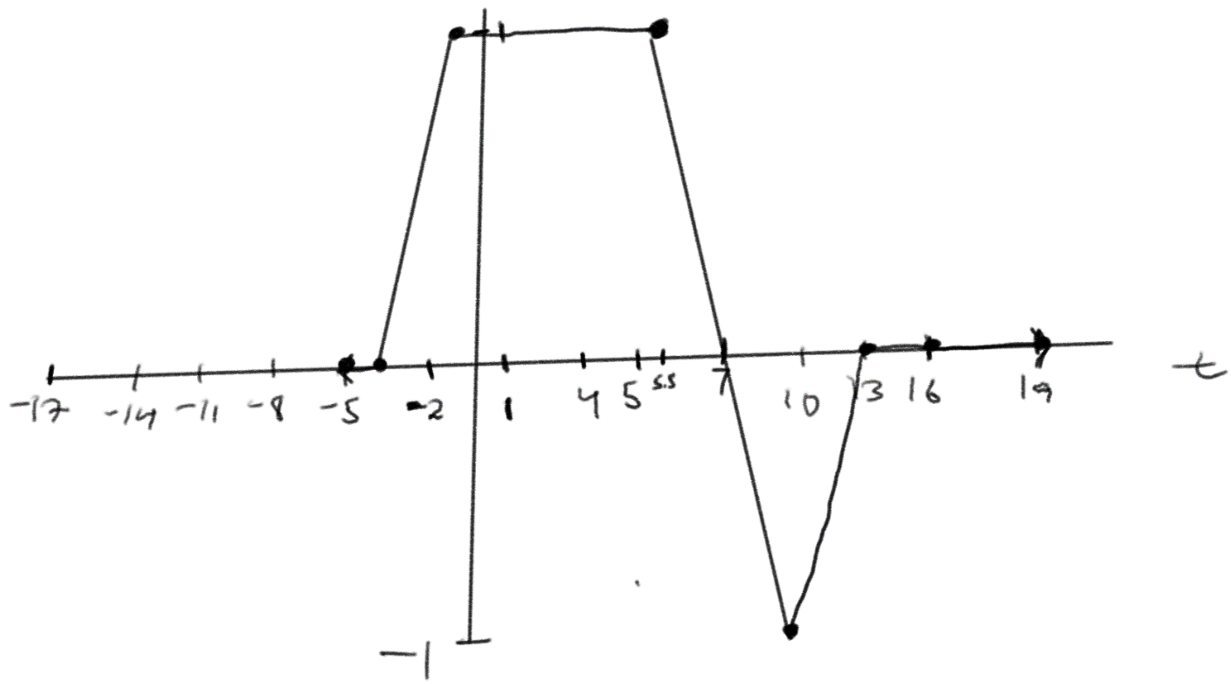
x(-t+3)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
-0.2
-0.4
-0.6
-0.8
-1
-9
-8
-7
-6
-5
-4
-3
-2
-1
1
2
3
4
5
6
t

(b)



$\tau = \frac{t-1}{3}$

$3\tau + 1 = t$



2. (a) $x_a(t) = 3\cos(2t + \pi/10)\, u(t)$

— this function is periodic but this is determined by the time the unit step function turns on.

$A\cos(kx \pm \omega t + \phi_0)$

$3\cos(2t + \pi/10)$

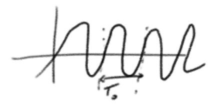
$\omega = 2\pi f$

$\therefore \quad 2 = 2\pi f$

$f = 1/\pi \qquad T = \pi$

Periodic vs non periodic

Periodic : $x(t+T_0) = x(t) \rightarrow$ Signal repeats every T_0



also $x(t+kT_0) = x(t)$, for any integer k

fundamental frequency $= \frac{1}{T_0}$

(b) $x_b(t) = e^{j(2t+\pi/10)}$

$x_b(t) = \cos(2t + \pi/10) + j\sin(2t + \pi/10)$

$\downarrow$

Take the real part

$2 = 2\pi f$

$f = 1/\pi$

$\tilde{x}(t) = Ae^{j(\omega t + \phi_0)}$

$= Ae^{j\phi_0} e^{j\omega t}$

$= \tilde{A} e^{j\omega t}$

$\downarrow$

$= 1 * [\cos(\pi/10) + j\sin(\pi/10)] = .951 + j.309$

$\tilde{A} = \sqrt{(.951)^2 + (.309)^2}$

$\tilde{A} = 1$

$\theta = \tan^{-1}\left(\frac{.309}{.951}\right) = 0.314 \text{ rad} =$

$\hat{x}(t) = \cos(2t + 0.314)$

$2 = 2\pi f$

$$\boxed{\frac{1}{\pi} = f_0 \qquad \pi = T_0}$$

don't need eulers formula

(c) $x_c(t) = e^{(-1+j2)t}$

$$\underbrace{\cos((-1+j2)t)}_{\text{real}} + j\sin((-1+2j)t)$$

real

$\omega = -1 + j2 = 2\pi f$

$$\boxed{\frac{-1+j2}{2\pi} = f_0 \, , \quad T_0 = \frac{2\pi}{-1+j2}}$$

3.

$$x(t) = \cos(10\pi t) - 3\sin(30\pi t + \pi/4)$$

$$T_0 = m_1 T_1 = m_2 T_2$$

$$\frac{1}{f_0} = \frac{m_1}{f_1} = \frac{m_2}{f_2}$$

$.37581 - .17581 = 0.2$

$\omega_1 = 10\pi$

$10\pi = 2\pi f_1$

$5 = f_1$

$T_1 = \frac{1}{5}$

$\omega_2 = 30\pi$

$30\pi = 2\pi f_2$

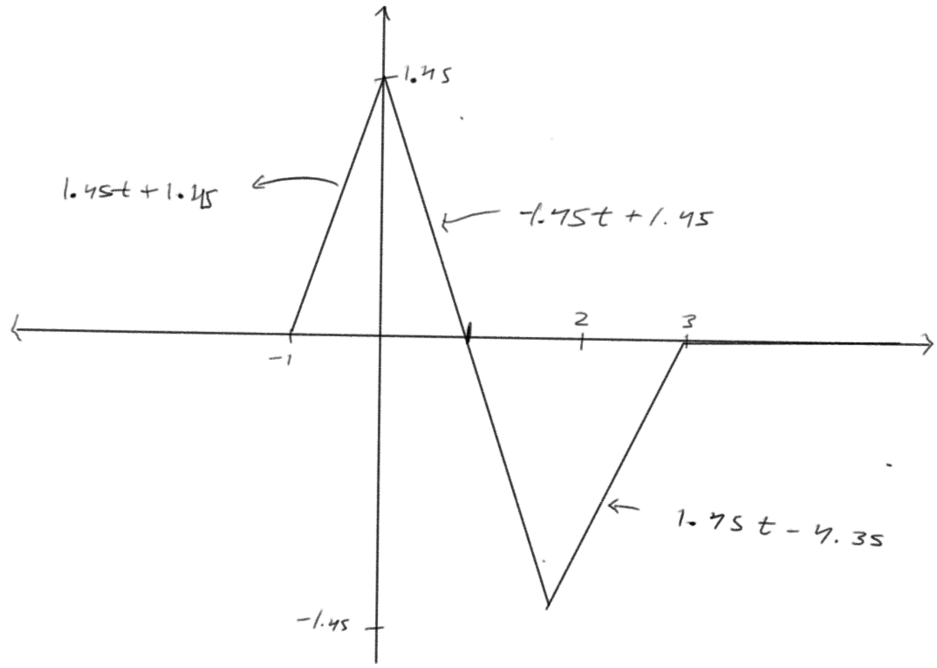
$15 = f_2$

$T_2 = \frac{1}{15}$

LCM = 1

$$\boxed{\begin{array}{l} T_0 = 1\text{ s} \\ f_0 = 1\text{ hz} \end{array}}$$

4.



for
as

area under : $-1 < t < 1$

$$A = \frac{(1.45 * 2)}{2} = 1.45$$

area under : $1 < t < 3$

$$A = \frac{(-1.45 * 2)}{2} = -1.45$$

total area = $1.45 - 1.45 = 0$

$\therefore$ $\boxed{\text{normalised energy is } 0}$

5. $\frac{1}{T_0}\int_{-T_0/2}^{T_0/2} x^2(t)\,dt \longrightarrow$ periodic signals

$$\int_{-1/2}^{1/2} (t+1)^2\,dt \qquad T_0 = 1$$

$$\int_{-1/2}^{1/2} t^2 + 2t + 1 \quad dt$$

$$\frac{t^3}{3}\Big|_{-1/2}^{1/2} + t^2\Big|_{-1/2}^{1/2} + t\Big|_{-1/2}^{1/2}$$

$$= (.041667) + (\cancel{.0}41664)$$

$$= 0.0833 \quad + \ .125 \ = 1$$

normalized avg Power $= \boxed{1.2083\ \text{W}}$

6. (a) even (b) odd (c) even

(d) even (e) odd (f) niether