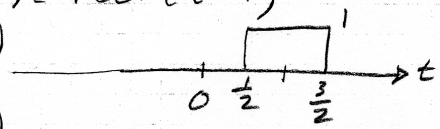
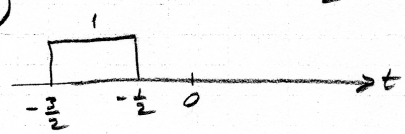
① Text, 2-55a

a) $x(t) = \text{rect}(t-1)$

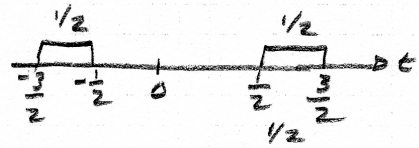
$x(t)$



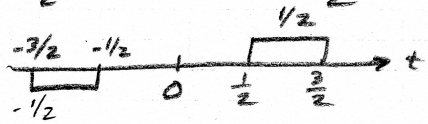
$x(-t)$



$x_e(t) = \dfrac{x(t)+x(-t)}{2}$;



$x_o(t) = \dfrac{x(t)-x(-t)}{2}$



② Text, 2-56c, j

c) $x(t) = 8 + 7t^2 \qquad x(-t) = 8 + 7t^2$

$x_e(t) = \dfrac{x(t)+x(-t)}{2} = 8 + 7t^2$

$x_o(t) = \dfrac{x(t)-x(-t)}{2} = 0$

j) $g(t) = (8+7t^2)\sin(2\pi 16t) \qquad g(-t) = -(8+7t^2)\sin(2\pi 16t)$

$g_e(t) = \dfrac{g(t)+g(-t)}{2} = 0$

$g_o(t) = g(t) - g_e(t) = (8+7t^2)\sin(2\pi 16t)$

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(3) Text, 2-59 d, f

d) $g(t) = 28\sin(2\pi 200 t) + 12\cos(2\pi 250\pi t)$

$f_1 = 200\ \text{Hz},\ T_1 = \frac{1}{200}\ \text{sec}$ $\qquad$ $f_2 = 250\ \text{Hz},\ T_2 = \frac{1}{250}\ \text{sec}$

$$T_0 = LCM\left(\frac{1}{200}, \frac{1}{250}\right) = \frac{LCM\left(\frac{1}{200}\cdot 1000, \frac{1}{250}\cdot 1000\right)}{1000}$$

$$= \frac{LCM(5,4)}{1000} = \frac{20}{1000} = \frac{2}{100} = \boxed{\frac{1}{50}\ \text{sec}}$$

$= 20\,\text{ms}$

f) $g(t) = 4\sin(3t) + 3\sin(\sqrt{3}\,t)$

$= 4\sin\left(\frac{3}{2\pi} 2\pi t\right) + 3\sin\left(\frac{\sqrt{3}}{2\pi} 2\pi t\right)$

$f_1 = \frac{3}{2\pi}\ \text{sec}$ $\qquad$ $f_2 = \frac{\sqrt{3}}{2\pi}$

$T_1 = \frac{2\pi}{3}\ \text{Hz}$ $\qquad$ $T_2 = \frac{2\pi}{\sqrt{3}}$

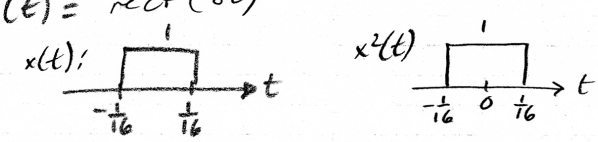
$$\frac{T_1}{T_2} = \frac{\frac{2\pi}{3}}{\frac{2\pi}{\sqrt{3}}} = \frac{\sqrt{3}}{3} = \frac{1}{\sqrt{3}}$$

irrational,

$\boxed{\text{not periodic}}$

(4) Text, 2-60 b

b) $x(t) = \text{rect}(8t)$



$$E = \int_{-1/16}^{1/16} x^2(t)\,dt = \frac{2}{16} = \boxed{\frac{1}{8}}$$

<u>note:</u> $P = \lim_{T\to\infty} \frac{1}{T}\int_{-T/2}^{T/2} x^2(t)\,dt = 0$

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(5) Bonus 2-61a

$x(t) = 2\sin(2\pi 100 t)$

$f_0 = 100,\ T_0 = \frac{1}{100}$

note: average power in a sinusoid is $\frac{(\text{amplitude})^2}{2}$,

so the answer is $P_x = 2$

$$P_x = \frac{1}{T}\int_{-T/2}^{T/2} \left[2\sin(2\pi 100 t)\right]^2 dt = \frac{4}{T}\int_{-T/2}^{T/2} \left[\frac{1}{2} - \frac{1}{2}\cos(2\pi 200 t)\right] dt$$

trig identity

$$= \frac{2}{T}\int_{-T/2}^{T/2} \left(1 - \cos(2\pi 200 t)\right) dt$$

$$= \frac{2}{T}\cdot t\Big|_{t=-T/2}^{t=T/2} - \frac{2}{T}\sin(2\pi 200 t)\cdot 2\pi 200\Big|_{t=-\frac{T}{2}}^{T/2}$$

$$= \frac{2}{T}\left(\frac{T}{2} - -\frac{T}{2}\right) - \frac{800\pi}{T}\left[\sin\left(2\pi 200 \frac{T}{2}\right) - \sin\left(2\pi 200\left(-\frac{T}{2}\right)\right)\right]$$

note: $T = \frac{1}{100}$

$$= \frac{2}{\cancel{T}}\cancel{T} - \frac{800\pi}{\frac{1}{100}}\left(\cancelto{0}{\sin 2\pi} + \cancelto{0}{\sin 2\pi}\right)$$

$$= \boxed{2}$$