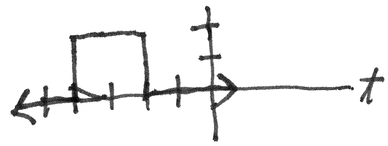
EE3032 HWK 1 Solutions – Dr. Durant – Sept., 2019

1.20(c), 1.21(b,c), 1.23(c), 1.24(b), 1.28(c), 1.30(a,b)

1.20(c) $x_3(t) = -2u(t+2) + 2u(t+4)$




1.21 (b) $x_2(t) = \underbrace{-2u(t+2)}_{\substack{\text{turn on } (-2) \\ @\, t=-2}} + \underbrace{2u(t-2)}_{\substack{\text{turn off } (-2+2=0) \\ @\, t=+2}}$

(c) $x_3(t) = \underbrace{2u(t)}_{\substack{\text{step to} \\ 2 @ t=0}} + \underbrace{2u(t-2)}_{\substack{\text{step up 2 more} \\ @\, t=2}} + 2u(t-3)$

1.23 (c) $x_3(t) = \underbrace{2r(t)}_{\substack{\text{establishes} \\ \text{slope}=2 \\ @\, t>0}} ~~\cancel{\phantom{8}}~~u(t-2) - \underbrace{2r(t-4)}_{\substack{\text{changes slope} \\ \text{for } t>4}}$

slope $= \underbrace{2-2}_{\text{old}\ \ \text{offset here}} = 0$ ← new

1.24 (b) $x_2(t) = \sin(2t)\cos(2t) = f_o(t) \cdot f_e(t) = f_o'(t)$

odd · even = odd

OR: use trig. identity

ALSO: Plot it

1.28(c) $y_3(t) = \int_{-3}^{-1} t^5 \underbrace{\delta(3t+2)}_{\delta\left(3\left(t+\frac{2}{3}\right)\right)} dt = \left(\frac{-2}{3}\right)^5 \cdot \frac{1}{3} = \frac{-2^5}{3^6} = \boxed{\frac{-32}{729}}$

↑ compresses width & area to 1/3 of original

sample function @ $t = \frac{-2}{3}$

check inside: is this limits of integration? …s

correction: NO ∴ $\boxed{y_3(t) = 0}$

$\boxed{*}$ Note: Correct copy of book has $\delta(t+2)$ instead, so no time scale & $-3 < -2 < -1$, in limits gives $t^5 = (-2)^5 = -32 \rightarrow \boxed{y_3(t) = -32}$

1.30(a) $x_1(t) = 6\cos\left(\frac{2\pi}{3}t\right) + 7\cos\left(\frac{\pi}{2}t\right)$; $\omega_1 = \frac{2\pi}{3}$, $\omega_2 = \frac{\pi}{2}$; $\omega_0 = GCF(\omega_1, \omega_2) = \pi\, GCF\left(\frac{2}{3}, \frac{1}{2}\right) = \frac{\pi}{6}$

$\omega_0 = 2\pi f_0 \rightarrow f_0 = \frac{1}{12}\,Hz$; $T_0 = 1/f_0 = \boxed{12s}$; OR $T_1 = \frac{2\pi}{\omega_1} = 3s$; $T_2 = \frac{2\pi}{\omega_2} = 4s$; $T_0 = LCM(T_1, T_2) = 12s$

1.30 (b) Now, $\omega_1 = \frac{2\pi}{3}$ but $\omega_2 = \pi\sqrt{2}$; $\omega_1/\omega_2 = \frac{2}{3\sqrt{2}} = \sqrt{2}/3$ is <u>irrational</u>, so <u>no</u> finite $T_0$

→ Not periodic, no period (finite) exists