Ashleigh Reeves EE 330 Systems & Signals

Homework 1

EOCP 1.1

1. $v(t) = 10t\cos(2t+1)$
not periodic, amplitude increases w/ time

time period $(T_0) = 2\pi/\omega_0 = 2\pi/2 = \pi$

3. $v(t) = \cos(5t+1) + 10 + \sin(t)e^{-t}$
periodic

5. $v(t) = 10\cos(2t-1) - 100\sin(100t-30) + \cos t$ Periodic
$\omega_1 = 2 \quad \omega_2 = 100 \quad \omega_3 = 1$
$T_1 = \frac{2\pi}{2} \quad T_2 = \frac{2\pi}{100} \quad T_3 = \frac{2\pi}{1}$
$= \pi \quad = \pi/50 \quad = 2\pi$
$T_0 = LCM(T_1, T_2, T_3)$
$= LCM(\pi/1, \pi/50, 2\pi/1) \Rightarrow T_0 = \frac{2\pi}{1} = 2\pi$ rad

EOCP 1.2

6. $v(t) = \sin(t) + \cos(t), \quad 0 \le t \le 1$

$$
\begin{aligned}
E &= \int_0^1 (\sin t + \cos t)^2 \, dt \\
&= \int_0^1 (\sin^2 t + \cos^2 t + 2\sin t \cos t) \, dt \\
&= \int_0^1 (1 + \sin 2t) \, dt \\
&= \left[t + \left(\frac{-\cos 2t}{2} \right) \right]_0^1 \\
&= 1 - \frac{\cos\theta}{2} - \left(-\frac{\cos\theta}{2} \right) \\
&= 1 - \frac{\cos\theta}{2} + \frac{\cos\theta}{2} \\
&= 1 - (-0.20807) + 0.5 \\
&= 1.70807 \text{ W}
\end{aligned}
$$

8. $v(t) = 1 + \sin t, \quad 0 \le t \le 10$

$E = \int_0^{10} (1+\sin t)^2 \, dt$

$= \int_0^{10} 1 + \sin^2 t + 2\sin t \, dt$

$= \int_0^{10} (3/2 - \frac{\cos 2t}{2} + 2\sin t) \, dt$

$= [3t/2 - 1/2 \sin 2t/2 - 2\cos t]_0^{10}$

$= 3/2 (10) - 1/2 \frac{\sin 2(0)}{2} - 2\cos 10 - [0 - 1/2(0) - 2\cos 0]$

$= 15 - 0.22823 + 1.678 + 0.5 + 2$

$= 18.94977 \, W_{11}$

10. $v(t) = 1 - \cos(2t), \quad 0 \le t \le 1$

$E = \int_0^1 (1-\cos 2t)^2 \, dt$

$= \int_0^1 (1 + \cos^2 2t - 2\cos 2t) \, dt$

$= \int_0^1 (1 + 1/2 + \cos 4t/2 - 2\cos^2 2t) \, dt$

$= \int_0^1 (3/2 + \cos 4t/2 - 2\cos 2t) \, dt$

$= [3/2 \, t + \sin 4t/8 - 2\sin 2t/2]_0^1$

$= 3/2 + \frac{\sin 4}{8} - \frac{2}{2}\sin^2 - [0 + 0 - 0]$

$= 1.5 + (-0.0916) - 0.90424$

$= 0.49611 \, W_{11}$

EOCP 1.3

2. $v(t) = 1 + te^{-3t} \quad 0 \le t \le 10$

$P = \lim_{T \to \infty} \frac{1}{T} \int_0^T x^2 t \, dt$

$P = \lim_{T \to \infty} \frac{1}{T} \int_0^T (1 + te^{-3t})^2 \, dt$

$= \frac{1}{\infty}$

$= 0_{11}$

4. $v(t) = 1 - \sin(t-1) \quad -1 \le t \le 0$

$P = \lim_{T \to \infty} \frac{1}{T} \int_0^T (1 - \sin(t-1))^2 \, dt$

$= 0_{11}$

6. $v(t) = \sin t + \cos t \quad 0 \le t \le 1$

$P = \lim_{T \to \infty} \frac{1}{T} \int_0^T (\sin t + \cos t)^2 \, dt$

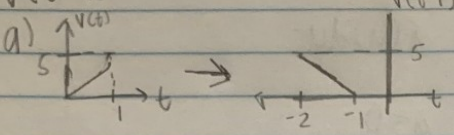
$= \frac{1}{\infty}$

$= 0_{11}$

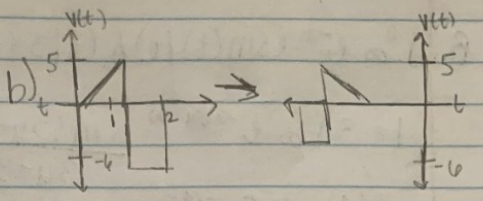
EOCP 1.5

1. $v(t-1)$

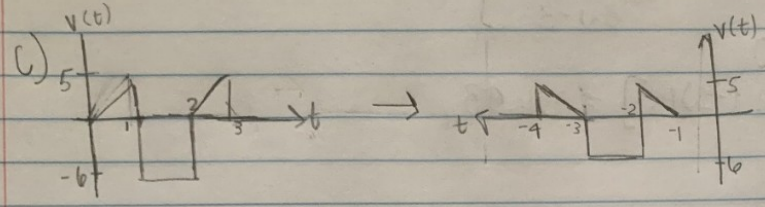
a)



b)

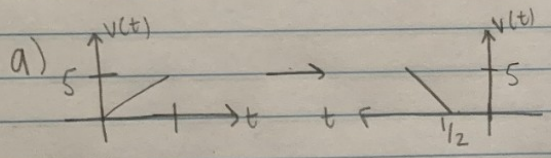


c)

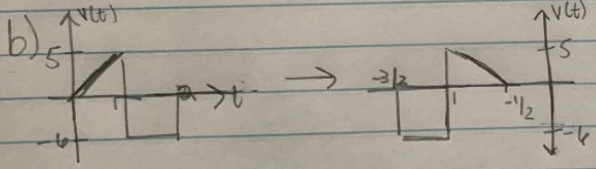


3. $v(-1 - t/2)$

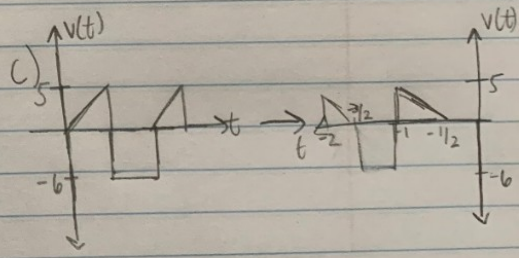
a)



b)



c)



EOCP 1.7

4. $\int_{-1}^{2} (t - \sin t) + \delta(2t + 1)\,dt$

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

$f(t) = t - (t - \sin\theta)$

$a = -1/2$

$I = F(t)\big|_{t=a} = (1/2\,(-1/2 - \sin(-1/2)))$

$= 1/4 + 1/2 \sin(-1/2)$

$= 1/4 - 0.24$

$I = 0.1$ //

6. $\int_{-\infty}^{\infty} (e^{-2t}) \sin t\, \delta(2t-1)\,dt$

$= \int_{-\infty}^{\infty} e^{-2t} \sin t\, \delta(t - 1/2)\,dt$

$f(t) = e^{-at} \sin t$

$a = 1/2$

$I = \frac{\sin(1/2)}{e} = 0.18$ //

8. $\int_{-\infty}^{0} e^{-2t}(\sin(t)/t)\,\delta(t/3+1)\,dt$

$I = 3\int_{-\infty}^{-3} e^{-2(3u-3)} \dfrac{\sin(3u-3)}{3u-3}\,\delta(u)\,du$

$\delta(4) = 3\left[e^{-6+6} \dfrac{\sin(3u-3}{3u-3}\right] \quad a=0$

$I = \delta(u)|_{u=0}$

$I = 3[e^{6}\ \sin(-3)/3] = 56.93_{11}$