11.2 a) $10\cos(10t)$ mA $\qquad P_{avg} = \frac{R}{T}\int_0^T (.01)^2 \cos^2(10t)\,dt$ watts.

$T = 2\pi/10$

$$= \frac{1000\pi \cdot 10}{2\pi}(.01)^2 \int_0^{2\pi/10} \cos^2(10t)\,dt$$

$$= \frac{1}{2\pi}\,\frac{1}{40}\left(20t + \sin 20t\right)\Big|_0^{2\pi/10}$$

$$= \frac{1}{80}\left(20 \cdot 2\pi/10\right) = \boxed{50\text{ mW}}$$

---

b) $10\,|\cos(10t)|$ mA

$$P_{avg} = \frac{R}{T}\int (.01)^2\,|\cos^2 10t|\,dt$$

→ same as above → $\boxed{50\text{ mW}}$

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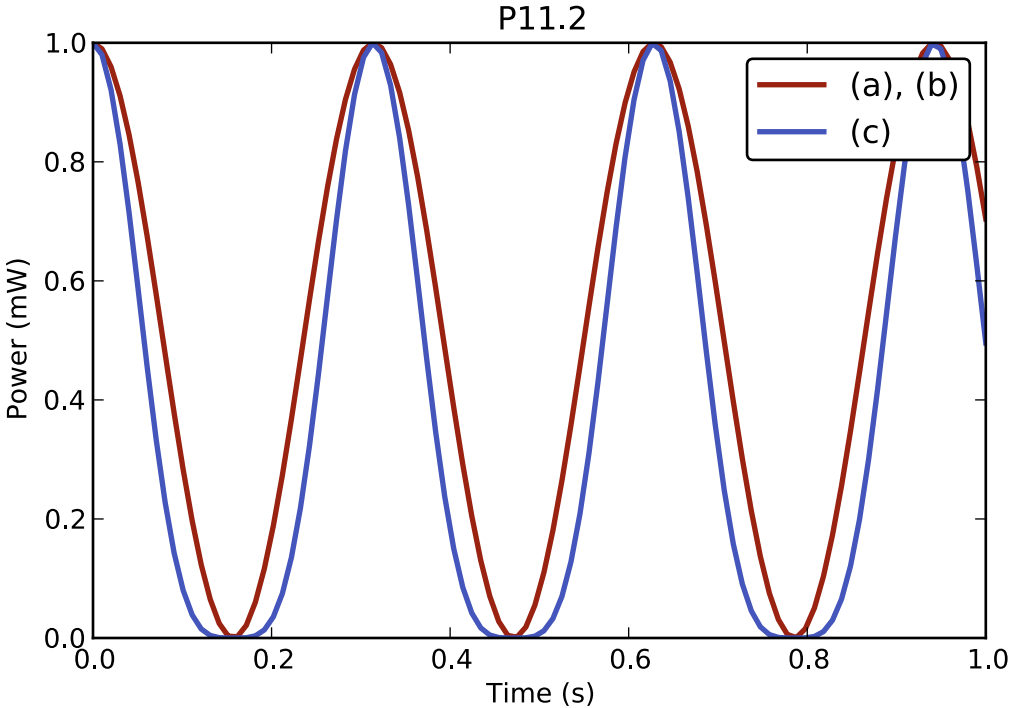
c) $10\cos^2(10t)$ mA. $\qquad P_{avg} = \frac{R}{T}\int_0^T (.01)^2 \cos^4(10t)\,dt$

$$= \frac{1000 \cdot 10 \cdot (.01)^2}{2\pi}\int \cos^4 10t\,dt$$

$$= \frac{1}{2\pi}\,\frac{1}{320}\left[120t + 8\sin 20t + 40\sin 40t\right]_0^{2\pi/10}$$

$$= \frac{1}{640\pi}\left[24\pi + 0 + 0) - (0)\right] = 3/80 = \boxed{37.5\text{ mW}}$$

d) SEE PLOT


P11.2
(a), (b)
(c)
Power (mW)
Time (s)
0.0
0.2
0.4
0.6
0.8
1.0

11.3 a) $P = \frac{1}{2}\int_0^2 V^2/R\, dt = \frac{1}{2}\int_0^1 20^2/10\Omega\, dt + \frac{1}{2}\int_1^2 (-10)^2/10\Omega\, dt$

$= \frac{1}{2}(40) + \frac{1}{2}(10) = \boxed{25\ W}$

b) $P = \frac{1}{1}\int_0^1 (20t)^2/10\Omega\, dt = \int_0^1 \frac{400}{10}t^2 = 40\,\frac{t^3}{3}\Big|_0^1$

$= \boxed{40/3\ W}$

SEE PLOT ATTACHED.

11.5

a) (i) $i_{rms} = \sqrt{\frac{1}{T}\int i^2(t)\,dt}$

$= \sqrt{\frac{1}{9}\left[\int_0^3 3^2\,dt + \int_3^6 4^2\,dt + \int_6^9 0^2\,dt\right]} = \sqrt{\frac{1}{9}(9\times3 + 16\times3)}$

$= \sqrt{\frac{75}{9}} = 2.89\ A_{rms}$

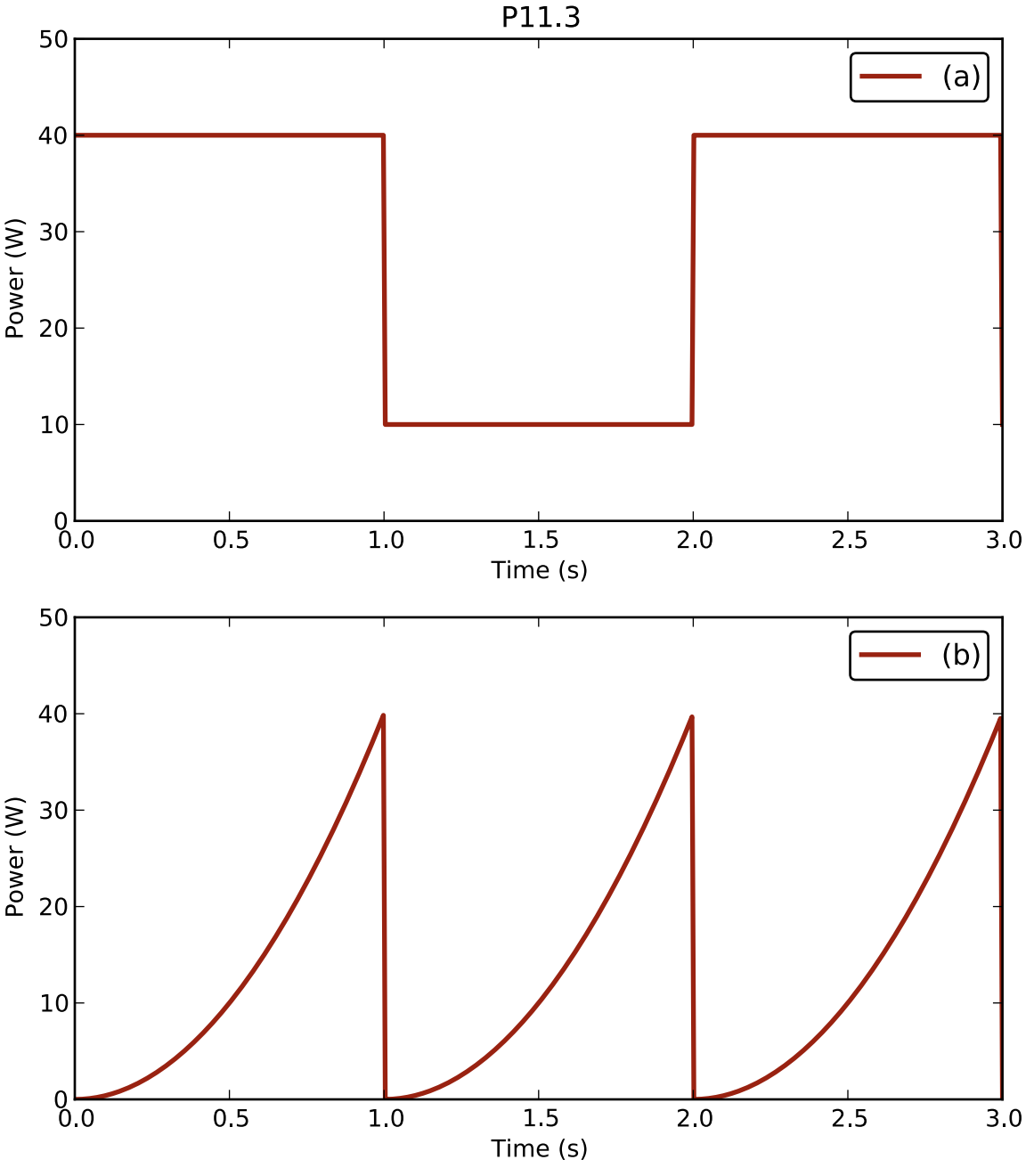
(ii) $\sqrt{\frac{1}{4}\left[\int_0^1 3^2\,dt + \int_1^2 0\,dt + \int_2^3 (-4)^2\,dt + \int_3^4 0\,dt\right]} = \sqrt{\frac{1}{4}(9+16)}$

$= 2.5\ A_{rms}$

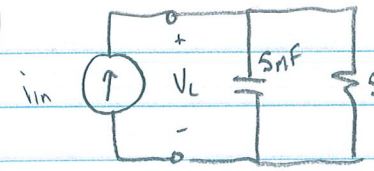
b) $P = (i_{R_L})^2 (R_L)$

$= \left[i_{rms}\left(\frac{60}{60+30}\right)\right]^2 (30\,\Omega) = \left[2.89\left(\frac{2}{3}\right)\right]^2 (30) = 111.4\ W$

c) $P = \left[(2.5)\left(\frac{2}{3}\right)\right]^2 (30) = 83.33\ W$


P11.3
(a)
Power (W)
Time (s)
0
10
20
30
40
50
0.0
0.5
1.0
1.5
2.0
2.5
3.0
(b)
Power (W)
Time (s)

11.9



i_{in}

$i_{in}(t) = 5\cos 30t = 5 + j0$

a)

$V_L = i_{in} Z_{eq}$. $Z_{eq} = 5mF \,//\, 5\Omega = \frac{-j}{30(.005)} \,//\, 5 = \underline{3.2 - j2.4}$

$V_L = 5(3.2 - j2.4) = 16 - j12 = \boxed{20\cos(30t - 36.87°) \text{ Volts}}$

b) $P_{Avg} = \frac{V_m I_m}{2}\cos(\theta_v - \theta_i) = \frac{20 \cdot 5}{2}\cos(-36.87° - 0) = \boxed{40 \text{ W}}$