

P7.65

$$V_o(0) = \frac{120}{120} (80) = 80V$$

$$V_o(\infty) = -6(25) = -150V$$

$$\tau = 25 \times 10^3 (40 \times 10^{-9}) = 10^{-3} \text{ s}, \quad \frac{1}{\tau} = 1000$$

$$V_o(t) = -150 + (80 + 150)e^{-1000t} = -150 + 230e^{-1000t} \text{ V}, t \geq 0.$$

P7.88 a)

$$V_p = 3 + (0 - 3)e^{-t/\tau}$$

$$\tau = (125 \times 10^3)(8 \times 10^{-9}) = 10^{-3}, \quad \frac{1}{\tau} = 1000$$

$$V_p = 3 - 3e^{-1000t} \text{ V}$$

$$V_n = V_p$$

$$\frac{V_n}{5} + \frac{V_n - V_o}{20} = 0$$

$$\therefore V_o = 5V_n = 5V_p = 15 - 15e^{-1000t} \text{ V}$$

$$15 - 15e^{-1000t} = 10, \quad \therefore e^{+1000t} = 3$$

$$\therefore t = \frac{1}{1000} \ln 3 = 1.10 \times 10^{-3} \text{ s} = 1.10 \text{ ms}$$

$$b) V_p = 3 + (-2 - 3)e^{-1000t} = 3 - 5e^{-1000t}$$

$$V_o = 5V_p = 15 - 25e^{-1000t} \text{ V}$$

$$15 - 25e^{-1000t} = 10, \quad \therefore e^{1000t} = 5$$

$$\therefore t = \frac{1}{1000} \ln 5 = 1.61 \times 10^{-3} \text{ s} = 1.61 \text{ ms}$$

P 9.1 a)

2/3

$$i = 10 \cos(\omega t + \theta)$$

$$\frac{di}{dt} = -10\omega \sin(\omega t + \theta)$$

$$\therefore 10\omega = 20000\pi, \quad \omega = 2000\pi \text{ rad/s}$$

$$b) \quad f = \frac{\omega}{2\pi} = 1000 \text{ Hz}$$

$$T = \frac{1}{f} = 1 \text{ ms} = 1000 \mu\text{s}$$

$$\frac{150}{1000} = \frac{3}{20}, \quad \therefore \theta = \frac{3}{20} \times 360 = 54^\circ$$

$$\therefore i = 10 \cos(2000\pi t + 54^\circ) \text{ A}$$

P 9.3

$$a) 170 \text{ V} \quad b) 2\pi f = 120\pi, \quad \therefore f = 60 \text{ Hz}$$

$$c) \omega = 120\pi = 376.99 \text{ rad/s}$$

$$d) \theta(\text{rad}) = \frac{\pi}{180}(60) = \frac{\pi}{3} = 1.05 \text{ rad} \quad e) \theta = 60^\circ$$

$$f) T = \frac{1}{f} = \frac{1}{60} = 16.67 \text{ ms}$$

$$g) 120\pi t - \frac{\pi}{3} = 0, \quad \therefore t = \frac{1}{360} = 2.78 \text{ ms}$$

$$h) v = 170 \cos \left[ 120\pi \left( t + \frac{0.125}{18} \right) - \frac{\pi}{3} \right]$$

$$= 170 \cos \left[ 120\pi t + \frac{15\pi}{18} - \frac{\pi}{3} \right]$$

$$= 170 \cos \left[ 120\pi t + \frac{\pi}{2} \right] = -170 \sin 120\pi t \text{ V}$$

$$i) 120\pi(t - t_0) - \frac{\pi}{3} = 120\pi t - \frac{\pi}{2}$$

$$\therefore 120\pi t_0 = \frac{\pi}{6}, \quad \therefore t_0 = \frac{25}{18} \text{ ms}$$

$$j) 120\pi(t - t_0) - \frac{\pi}{3} = 120\pi t$$

$$\therefore 120\pi t_0 = \frac{\pi}{3}, \quad \therefore t_0 = \frac{25}{9} \text{ ms}$$

P 9.6 a)

$$Y = 100 \angle 45^\circ + 500 \angle -60^\circ = 483.86 \angle -48.48^\circ$$

$$y = 483.86 \cos(300t - 48.48^\circ)$$

$$b) Y = 250 \angle 30^\circ - 150 \angle 50^\circ = 120.51 \angle 4.8^\circ$$

$$y = 120.51 \cos(377t + 4.8^\circ)$$

$$c) Y = 60 \angle 60^\circ - 120 \angle -125^\circ + 100 \angle 90^\circ = 152.88 \angle 32.94^\circ$$

$$y = 152.88 \cos(100t + 32.94^\circ)$$

$$d) Y = 100 \angle 40^\circ + 100 \angle 160^\circ + 100 \angle -80^\circ = 0$$

$$y = 0$$

$$P 9.8 \quad V_m = \sqrt{2} V_{rms} = \sqrt{2} (120) = 169.71 \text{ V}$$