# Chapter 10 Answers to Assigned Homework

(These are my answers but they are not guaranteed to be right. Please report any errors you find.)
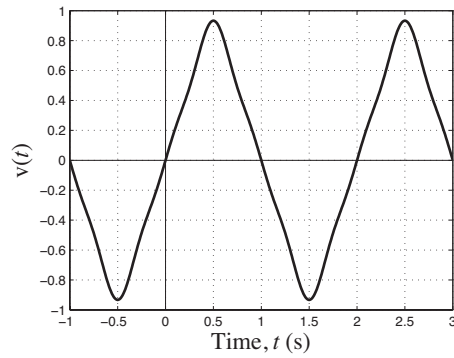
2.   (a) $10.12\cos(50t - 164.6°)$

      (b) $17.142\sin(100t + 50°)$

4.   (a) v_1 lags i_1 by -125°

      (b) v_1 lags i_1 by -205° or better +155°

      (c) v_1 lags i_1 by -165°

      (d) v_1 lags i_1 by -85°

      (e) v_1 lags i_1 by -234 or better +126°

5.   (a)   sin lags cosine by 90°

      (b) $\cos(4t - 80°)$ lags $\cos(4t)$ by 80°

      (c) $\cos(4t)$ lags $\cos(4t + 80°)$ by 80°

      (d) $\cos(5t + 2°)$ lags $-\sin(5t)$ by 88°

      (e)   Neither is lagging; they are in phase

8.   (a) $v(0.25) = 0.5$

      (b) $v(0.25) = 0.573$

      (c) $v(0.25) = 0.4865$

      (d)
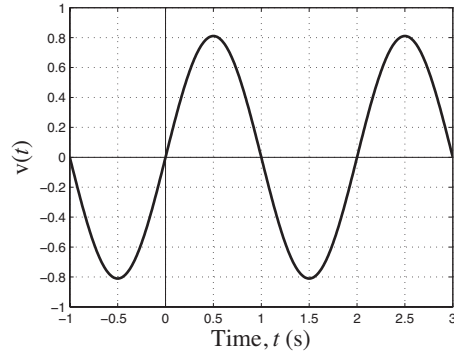
(e)
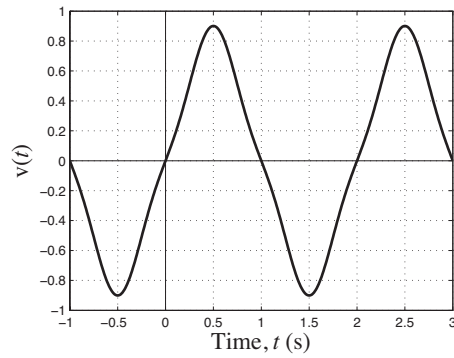
(f)

9. (a)   Proof

    $$110 \text{ V}_{rms} \Rightarrow V_m = 155.56$$

    (b) $115 \text{ V}_{rms} \Rightarrow V_m = 162.63$

    $$120 \text{ V}_{rms} \Rightarrow V_m = 169.71$$

16. (a) $50\angle -75° = 12.941 - j48.3$

    (b) $19e^{j30°} = 16.45 + j9.5$, $2.5\angle -30° + 0.5\angle 45° = 2.519 - j0.896$

(c) $(2 + j2)(2 - j2) = 8\angle0°$

(d) $(2 + j2)(5\angle22°) = 14.142\angle1.169 = 14.142\angle67°$

17. (a) $2 + e^{j35°} = 2.877\angle11.5°$

(b) $(j)(j)(-j) = j = 1\angle90°$

(c) $1 = 1\angle0°$

(d) $2 + e^{j35°} = 2.8192 + j0.5736$

(e) $-j9 + 5\angle55° = 2.867 - j4.904$

19. (a) $3(3\angle30°) = 7.794 + j4.5$

(b) $2\angle25° + 5\angle-10° = 6.737 - j0.023$

(c) $(12 + j90) - 5\angle30° = 7.67 + j87.5$

(d) $\dfrac{10 + j5}{8 - j} + 2\angle60° + 1 = 3.154 + j2.501$

(e) $(10 + j5)(10 - j5)(3\angle40°) + 2 = 289.27 + j241.05$

21.
$$v_C(t) = 0.383e^{-j175.6°}e^{j20t} = 0.383e^{j(20t-175.6°)}$$

$$i_C(t) = 0.9958e^{j(20t-85.6°)}$$

24. $i_L(t) = 1.1288e^{j(35t+108.3°)}$

25. (a) $75.928\angle0°$

(b) $5\angle-42°$

(c) $1\angle104°$

(d) $8.04\angle-78.44°$

27.   (a) $9\cos(2000\pi t + 65°)$ V

       (b) $0.5\cos(2000\pi t + 6°)$ A

       (c) $14.669\cos(2000\pi t + 3.7726°)$

34.   (a)   The element must be an inductor for the voltage to lead the current by 90°.

       (b)   20 mH

35.   (a)   A resistor of $2.5\ \Omega$.

       (b) $V_s = 100\angle 35°$.

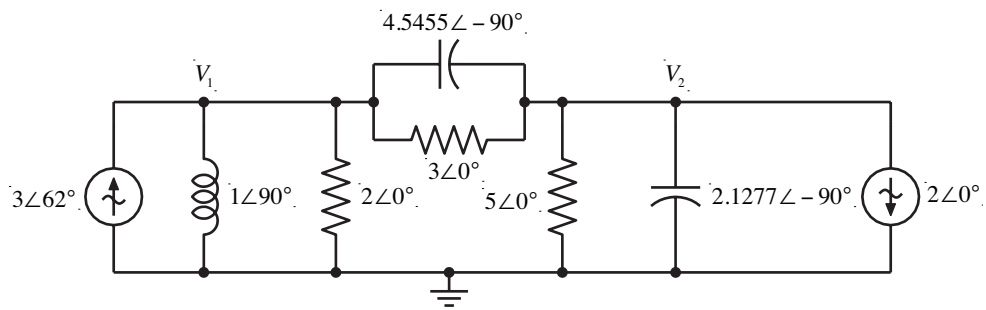36.   (a) $Z_{eq} = 1 + j0.01\omega$

(b) and (c)
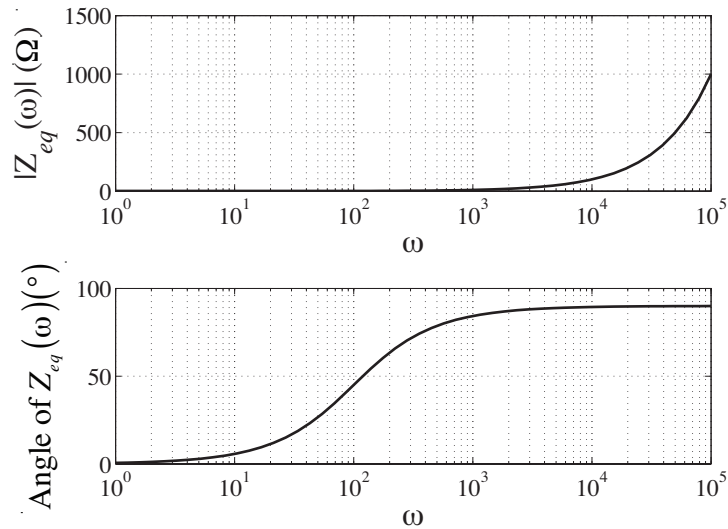
39.   (a) $31.23\angle - 38.66°$ mS

       (b) $64\angle - 51.34°$ mS

       (c) $19.95\angle 89.89°$ S

       (d) $1\angle - 89.94°$ mS

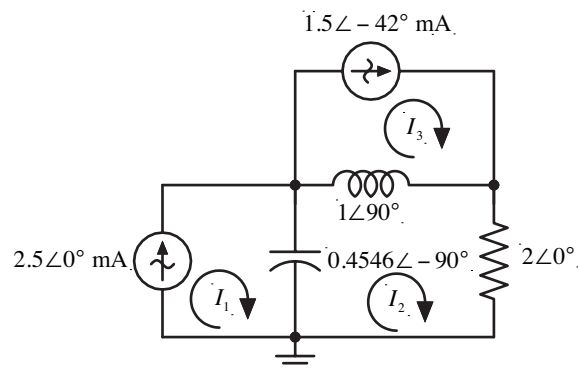   (e) $999.999\angle 89.94°$ S

40.   (a) $23.25\angle - 12.9°$

(b) $12.09\angle-13.82°$

(c) $11.145\angle1.576°$

43.   (a) $29.99\angle-0.294°$

(b) $25.43\angle22.75°$

(c) $30\angle0.025°$

(d) 30

(e) 30

44. $i(t)=2.981\cos(100t-46.57°)$

47.

$$v_1(t)=2.838\cos(100t+131.08°) \text{ and } v_2(t)=3.562\cos(100t+122.11°)$$

48.

$$i_1(t)=2.5\cos(10t) \text{ mA} \;,\; i_2(t)=0.4843\cos(10t-16.5°) \text{ mA} \;,\; i_3(t)=1.5\cos(10t-42°) \text{ mA}$$

52.

$$\begin{bmatrix} I_1 \\ I_2 \end{bmatrix} = \begin{bmatrix} 0.349\angle 11.5° \\ 0.4024\angle 38.07° \end{bmatrix}$$

$$i_1(t) = 0.349\cos(10t + 11.5°) \text{ and } i_2(t) = 0.4024\cos(10t + 38.07°)$$

56. $i_x(t) = 1.1358\cos(20t + 12.161°)$

59.   (a) $\dfrac{V_o}{V_s} = -\dfrac{j\omega AR_fC_1}{A + j\omega R_fC_1 + 1}$

$$\lim_{A\to\infty}\dfrac{V_o}{V_s} = -j\omega R_fC_1$$

(b) $\dfrac{V_o}{V_s} = -\dfrac{j\omega AR_fC_1}{A\left(j\omega R_fC_f + 1\right) + j\omega R_fC_1 + j\omega R_fC_f + 1}$

$$\lim_{A\to\infty}\dfrac{V_o}{V_s} = -\dfrac{j\omega R_fC_1}{j\omega R_fC_f + 1}$$

64.

$$V_{Th} = 9.619\angle 64.55°$$

$$Z_{Th} = 4.773\angle 34.37°$$

$$I_1 = 0.654\angle - 58.57°$$

66.   (a) $V_{Th} = 295.68\angle 112.88°$ V $Z_{Th} = 13.44\angle 82.88°$ Ω

(b) $I_N = 22\angle 30°$ A

(c) $I_{ab} = 20.72\angle 60.28°$ A

73.

$$I_L = 57.26\angle - 76.76°$$

$$I_R = 25.607\angle - 140.19°$$

$$I_C = 51.213\angle - 50.25°$$

$$V_L = 143.15\angle 13.24°$$

$$V_R = V_C = 51.214\angle - 140.19°$$