C.1 Assuming the connecting wires and the battery have negligible resistance, the voltage across the 25-Ω resistance in Figure C.1 is

a. 25 V b. 60 V c. 50 V d. 15 V e. 12.5 V

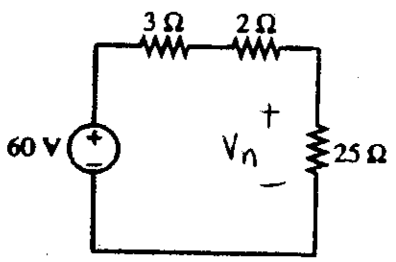


Figure C.1

Voltage Division - valid for series circuits

$$V_n = \frac{V_s R_n}{R_{eq}}$$

$$V_n = \frac{60V(25\Omega)}{3\Omega + 2\Omega + 25\Omega} = \underline{\underline{50V}}$$

C.2 Assuming the connecting wires and the battery have negligible resistance, the voltage across the 6-Ω resistor in Figure C.2 is

a. 6 V b. 3.5 V c. 12 V d. 8 V e. 3 V

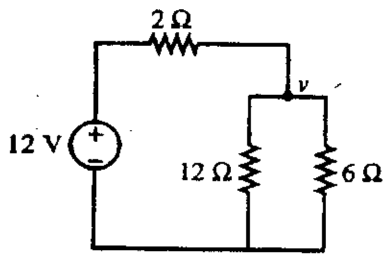
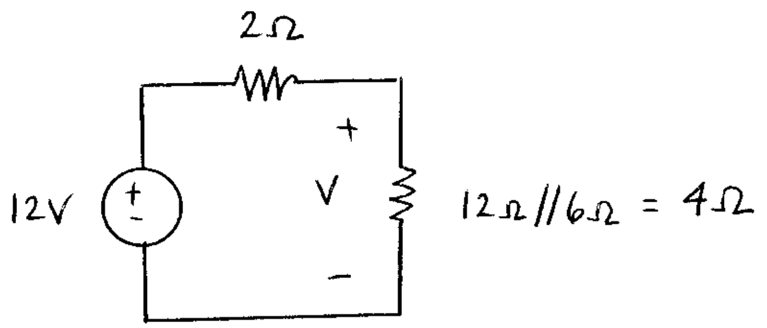


Figure C.2

Let's use this example to review the circuit analysis methods.

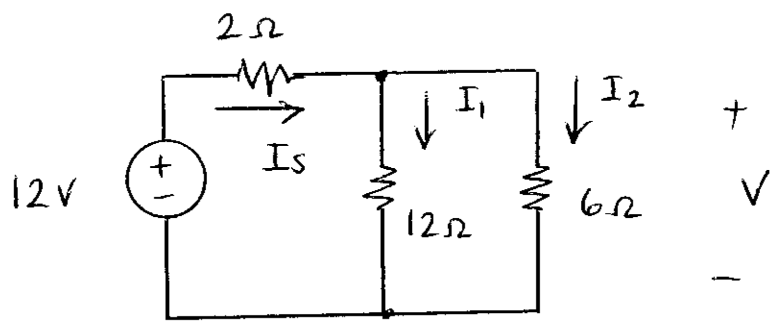
1) Voltage Division
2) Current Division
3) Node Method
4) Mesh Method
5) Thévenin Equivalent

Voltage Division - valid for series circuits



$$V = \frac{12V(4\Omega)}{2\Omega + 4\Omega} = \underline{\underline{8\ Volts}}$$

Current Division - valid for parallel circuits



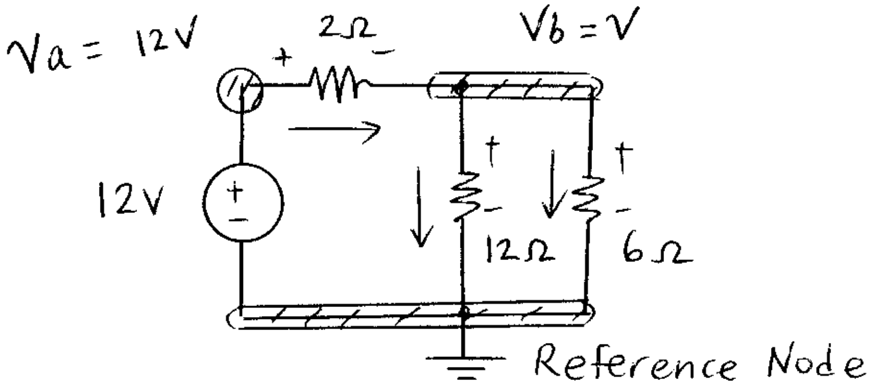
$$I_s = \frac{12V}{2\Omega + (12\Omega // 6\Omega)} = \frac{12V}{6\Omega} = 2A$$

Current Division $\quad I_n = \dfrac{I_s(1/R_n)}{1/R_{eq}}$

$$I_1 = \frac{2A(1/12)}{1/12 + 1/6} = 0.67A \qquad V = 0.67A(12\Omega) = \underline{\underline{8V}}$$

$$I_2 = \frac{2A(1/6)}{1/12 + 1/6} = 1.33A \qquad V = 1.33A(6\Omega) = \underline{\underline{8V}}$$

Node-Voltage Method



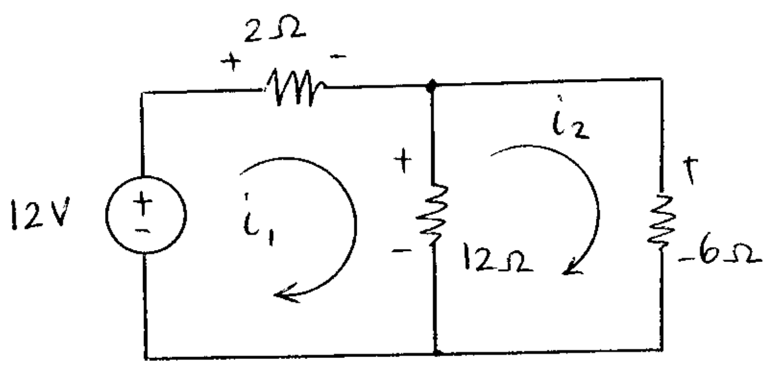
By Inspection $V_a = 12V$

KCL @ Node b : $\dfrac{12 - V}{2} = \dfrac{V}{12} + \dfrac{V}{6}$

$$72 - 6V = V + 2V$$

$$72 = 9V \qquad \underline{\underline{V = 8 \text{ Volts}}}$$

Mesh-Current Method



KVL around Mesh 1 : $-12 + 2i_1 + 12(i_1 - i_2) = 0$

$$\underline{14i_1 - 12i_2 = 12} \quad ①$$

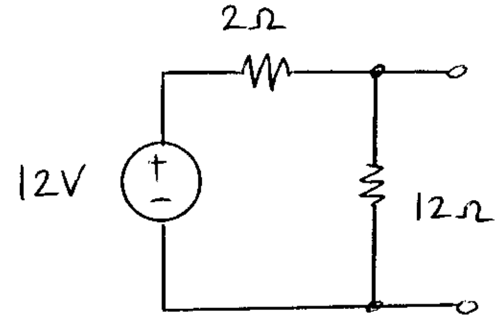
KVL around Mesh 2 : $-12(i_1 - i_2) + 6i_2 = 0$

$$\underline{-12i_1 + 18i_2 = 0} \quad ②$$

Solving gives $i_1 = 2A$, $i_2 = 1.33A$

$$V = 12(i_1 - i_2) = 12(2 - 1.33) = \underline{\underline{8 \text{ Volts}}}$$

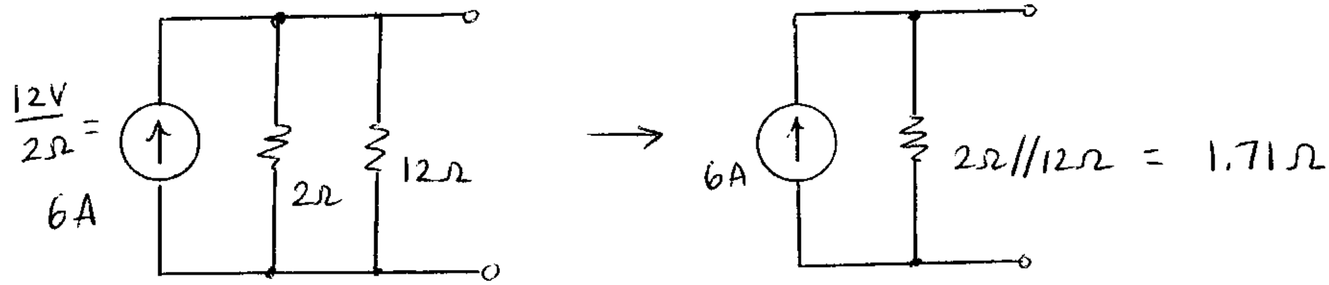
Thévenin Equivalent - One-port Network Theory

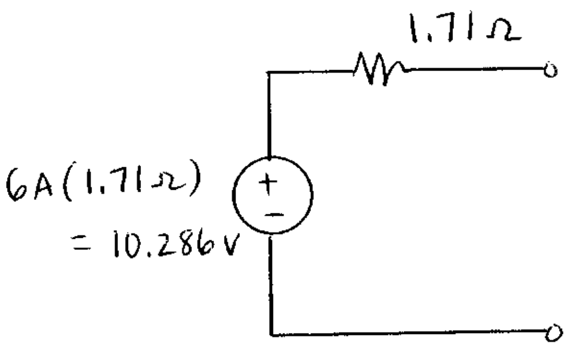


Temporarily set aside the 6Ω resistor.

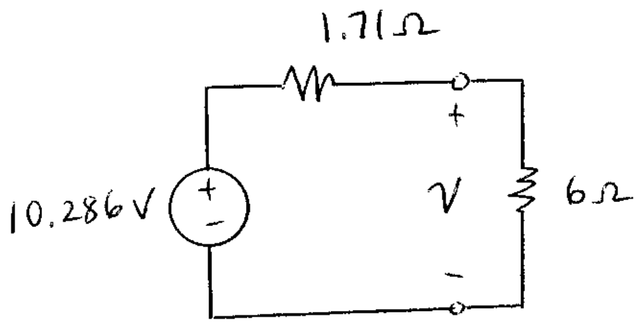
This forms a one-port network.

Use Source Transforms to Reduce to the Simplest Form





Reattach the 6Ω resistor. As far as it is concerned the system is equivalent.



$$V = \frac{10.286\,(6\Omega)}{6\Omega + 1.71\Omega} = \underline{\underline{8\,V}}$$

C.3 A 125-V battery charger is used to charge a 75-V battery with internal resistance of 1.5 Ω. If the charging current is not to exceed 5 A, the minimum resistance in series with the charger must be

a. 10 Ω   b. 5 Ω   c. 38.5 Ω   d. 41.5 Ω   e. 8.5 Ω

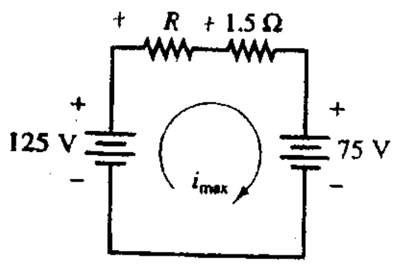


Figure C.3

KVL

$$-125 + i_{max} R + i_{max} 1.5\Omega + 75 = 0$$

$$-125 + (5A)R + (5A)1.5 + 75 = 0$$

$$R = 8.5\Omega$$

C.4 A coil with inductance of 1 H and negligible resistance carries the current shown in Figure C.4. The maximum energy stored in the inductor is

a. 2 J   b. 0.5 J   c. 0.25 J   d. 1 J   e. 0.2 J

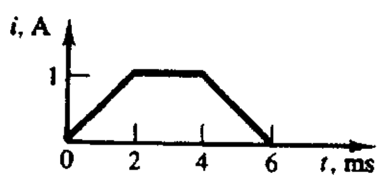


Figure C.4

$$W_L = \frac{1}{2} L i^2$$

$$= \frac{1}{2}(1H)(1A)^2$$

$$= 0.5 J$$

C.5 The maximum voltage that will appear across the coil is

a. 5 V   b. 100 V   c. 250 V   d. 500 V   e. 5,000 V

$$V_L(t) = L \frac{di_L(t)}{dt} \qquad V_L = L\frac{\Delta i}{\Delta t} = \frac{1H\,(1A)}{2mS} = 500V$$

C.6 A voltage sine wave of peak value 100 V is in phase with a current sine wave of peak value 4 A. When the phase angle is 60° later than a time at which the voltage and the current are both zero, the instantaneous power is most nearly

a. 250 W b. 200 W c. 400 W d. 150 W e. 100 W

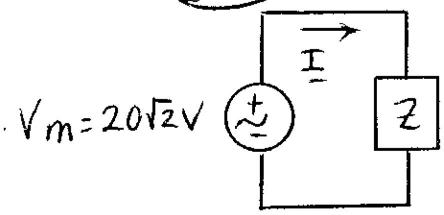
$$p(t) = \frac{V_m I_m}{2}\cos\theta\,(1+\cos 2\omega t) + \frac{V_m I_m}{2}\sin\theta \sin 2\omega t$$

$$p(t) = \frac{100V(4A)}{2}\cos 0^\circ(1+\cos 2(60^\circ)) + \frac{100V(4A)}{2}\sin 0^\circ \sin 2(60^\circ)$$

$$= \underline{\underline{100\,W}}$$

C.7 A sinusoidal voltage whose amplitude is $20\sqrt{2}$ V is applied to a 5-Ω resistor. The root-mean-square value of the current is

a. 5.66 A b. 4 A c. 7.07 A d. 8 A e. 10 A



$$|I| = \frac{V_m}{|Z|} = \frac{20\sqrt{2}\,V}{5\Omega} = 4\sqrt{2}\,A$$

$$I_{rms} = I_m/\sqrt{2} = \underline{\underline{4\,A}}$$

C.8 The magnitude of the steady-state root-mean-square voltage across the capacitor in the circuit of Figure C.5 is

a. 30 V b. 15 V c. 10 V d. 45 V e. 60 V

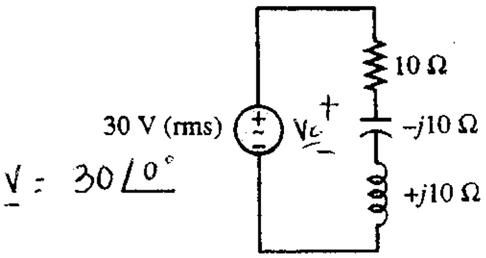


Figure C.5

Voltage Division

$$\underline{V_c} = \frac{30\angle 0^\circ(-j10\Omega)}{10\Omega - j10\Omega + j10\Omega}$$

$$= \underline{\underline{30\angle -90^\circ\ V}}$$

The next set of questions (Exercises C.9 to C.28) pertain to single-phase AC power calculations and refer to the single-phase electrical network shown in Figure C.6. In this figure, $\mathbf{E}_S = 480\angle 0°$ V; $\mathbf{I}_S = 100\angle -15°$ A; $\omega = 120\pi$ rad/s. Further, load A is a bank of single-phase induction machines. The bank has an efficiency η of 80 percent, a power factor of 0.70 lagging, and a load of 20 hp. Load B is a bank of overexcited single-phase synchronous machines. The machines draw 15 kVA, and the load current leads the line voltage by 30°. Load C is a lighting (resistive) load and absorbs 10 kW. Load D is a proposed single-phase capacitor that will correct the source power factor to unity.

$f = 60\,Hz$

$\omega = 2\pi f$

$= 120\pi$ rad/s

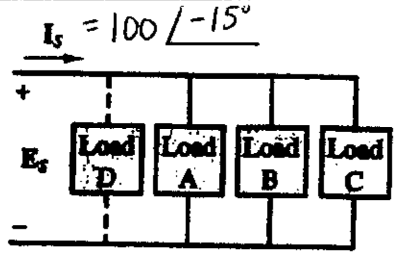


Figure C.6

+ $\underline{E_s} = 480\angle 0°$ V −

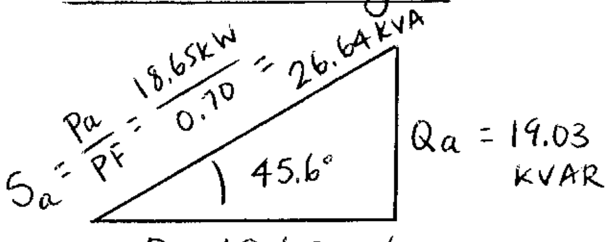
Power Triangles

$\eta = \frac{P_{out}}{P_{in}} = 0.8$ $\quad PF = \cos\theta = 0.7$ lag

$P_{out} = 20hp\,(0.746\,kW/hp)$

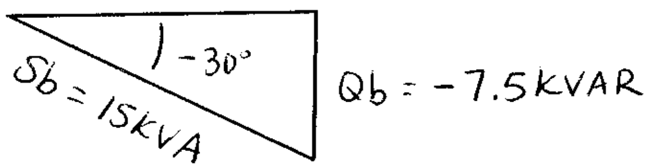
$P_{in} = \frac{P_{out}}{\eta} = \frac{20hp(0.746\,kW/hp)}{0.8} = 18.65\,kW$

$Q_a = \sqrt{S_a^2 - P_a^2}$



A) Induction Motors

$P_b = 15\,kVA(\cos 30°) = 12.99\,kW$



B) Synchronous Machine

$P_c = 10\,kW$ $\quad Q_c = 0$

C) Lighting Load

$Q_D = -11.53\,kVAR$

D) Capacitor

C.9 The root-mean-square magnitude of load A current, denoted by I_A, is most nearly

a. 44.4 A b. 31.08 A c. 60 A d. 38.85 A e. 55.5 A

$\underline{S} = \underline{V}\,\underline{I}^*$ $\qquad$ $\underline{S}_a = 26.64\text{ kVA} \angle 45.6^\circ = 480\angle 0^\circ \text{ V}\,(\underline{I}_a^*)$

$$\underline{I}_a^* = \underline{\underline{55.5}} \angle 45.6^\circ \text{ A}$$

C.10 The phase angle of $\mathbf{I}_A$ with respect to the line voltage $\mathbf{E}_S$ is most nearly

a. 36.87° b. 60° c. 45.6° d. 30° e. 48°

$\underline{I}_a^* = 55.5 \angle 45.6^\circ \text{ A}$ $\qquad$ $\underline{I}_a = \underline{\underline{55.5 \angle -45.6^\circ}} \text{ A}$

C.11 The power absorbed by synchronous machines is most nearly

a. 20,000 W b. 7,500 W c. 13,000 W d. 12,990 W e. 15,000 W

$\underline{\underline{P_b = 12{,}990\text{ W}}}$ (See Power Triangle)

C.12 The power factor of the system before load D is installed is most nearly

a. 0.70 lagging b. 0.866 leading c. 0.866 lagging
d. 0.966 leading e. 0.966 lagging

$S_T = S_a + S_b + S_c = 26.64\angle 45.6^\circ \text{ kVA} + 15\angle -30^\circ \text{ kVA} + 10\angle 0^\circ \text{ kVA}$

$= 43.20 \angle 15.49^\circ \text{ kVA}$ $\qquad$ $PF = \cos 15.49^\circ$

$= \underline{\underline{0.96 \text{ lagging}}}$

C.13 The capacitance of the capacitor that will give a unity power factor of the system is most nearly

a. 219 μF b. 187 μF c. 132.7 μF d. 240 μF e. 132.7 pF

$$Q_{cap} = -\omega C V^2$$

$$-11.53\text{ kVAR} = -377\, C\, (480\text{ V})^2$$

$$\underline{\underline{C = 133\,\mu\text{F}}}$$

C.14 The expression for the current in the 2-Ω resistor in Figure C.7 for time greater than zero is

a. $-3e^{-0.5t}+3$ A b. $3e^{-0.5t}+3$ A c. $-3e^{0.5t}+3$ A
d. $-6e^{0.5t}+6$ A e. $6e^{-0.5t}+6$ A

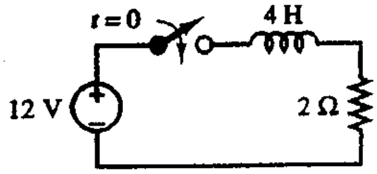


Figure C.7

First-Order Circuit with switched dc source

For $t \geq 0$ $i(t) = I_\infty + (I_0 - I_\infty)e^{-t/\tau}$

$\tau = L/R = 4H/2\Omega = 2\text{sec}$

$I_0 = 0$ $I_\infty = \dfrac{12V}{2\Omega} = 6A$

$i(t) = 6 - 6e^{-t/2}A = \underline{\underline{6-6e^{-0.5t}A}}$ (not a choice)

C.15 A three-phase circuit is shown in Figure C.8. Load resistors (66 Ω) are connected in delta and supplied by a 220-V balanced three-phase source through three lines of 2-Ω resistance. The magnitude of the root-mean-square, line-to-line voltage across each 66-Ω resistor is most nearly

a. 198 V b. 110 V c. 201 V d. 220 V e. 120 V

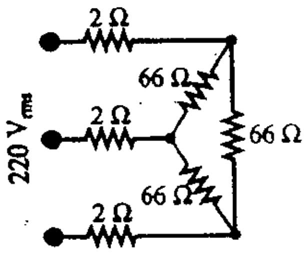
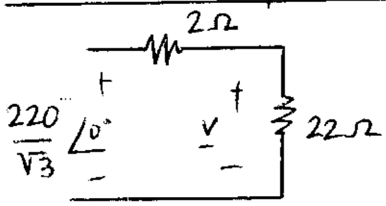


Figure C.8

Δ-Y Conversion for balanced systems

$Z_Y = \dfrac{Z_\Delta}{3} = \dfrac{66\Omega}{3} = 22\Omega$

Per-Phase Equivalent Circuit



$\underline{V} = \dfrac{\frac{220}{\sqrt{3}}\angle 0^\circ (22\Omega)}{22+2}$

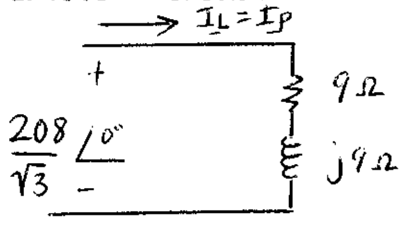
$\underline{V} = 116.4\angle 0^\circ$ $V_L = \sqrt{3}(116.4) = \underline{\underline{201.7}}$

C.16 A three-phase load is composed of three impedances of $9.0 + j9.0$ Ω and connected in wye. The balanced three-phase source is 208 V (line to line). The current in each line is most nearly

a. 40 A b. 16.3 A c. 13.3 A d. 9 A e. 6 A

Wye $I_L = I_P$

$|V_L| = \sqrt{3}|V_P|$



$I_L = \dfrac{\frac{208}{\sqrt{3}}\angle 0^\circ}{(9+j9)\Omega} = \underline{\underline{9.44\angle -45^\circ A}}$

The next four exercises refer to a three-phase system with line-to-line voltage of 220 V rms, with *ABC* phase sequence and with phase reference V_{AB} shown in the phase diagram of Figure C.10. The load is a balanced delta connection, shown in Figure C.11 with branch impedances $Z = 30 - j40\ \Omega,\ j = \sqrt{-1}$.

$$Z = (30 - j40)\,\Omega = 50\angle -53.13^\circ\ \Omega$$

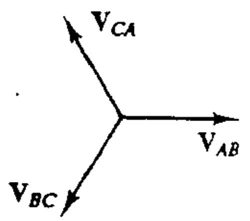


Figure C.10

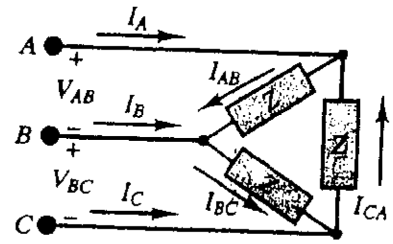


Figure C.11

C.17 The phase current is most nearly

a. $4.4\angle 53.13^\circ$ A b. $2.4\angle 53.13^\circ$ A c. $4.4\angle 0^\circ$ A
d. $4.4\angle -53.13^\circ$ A e. $2.4\angle -53.13^\circ$ A

$$V_{AB} = 220\angle 0^\circ\ \text{V} \qquad I_{AB} = \frac{V_{AB}}{Z} = \frac{220\angle 0^\circ\ \text{V}}{50\angle -53.13^\circ\ \Omega} = 4.4\angle 53.13^\circ\ \text{A}$$

C.18 The line current I_A (in amperes) is most nearly

a. $4.4\angle -186.87^\circ$ b. $4.4\angle 23^\circ$ c. 7 d. $7.6\angle 23^\circ$ e. $7\angle -186.87^\circ$

DELTA

$$I_L = \sqrt{3}\angle -30^\circ\, I_P = \sqrt{3}\angle -30^\circ\,(4.4\angle 53.13^\circ\ \text{A}) = 7.62\angle 23.13^\circ\ \text{A}$$

C.19 The power factor is most nearly

a. 1.0 b. 0.6 leading c. 0.866 leading d. 0 e. 0.8 lagging

$$PF = \cos\theta = \cos(-53.13) = 0.60 \text{ leading}$$

C.20 The total real power delivered from the source to the load is most nearly

a. 1,496 W b. 580 W c. 1,742 W d. 2,904 W e. 850 W

$$P_T = \sqrt{3}\, V_L I_L \cos\theta = \sqrt{3}(220\text{V})(7.62\text{A})\cos(-53.13)$$

$$= 1742\ \text{W}$$

C.21 The circuit of Figure C.13 is a

a. Peak detector
b. Half-wave rectifier
c. Bridge rectifier
d. Voltage doubler
e. Full-wave rectifier

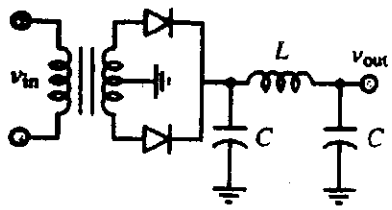


Figure C.13

C.22 The inductor L and the capacitor C serve the function of

a. Converting the AC input to DC output
b. Increasing the peak value of the output voltage
c. Protecting the diodes
d. A high-pass filter
e. Reducing the ripple component of the output voltage

C.23 The ideal diode D in Figure C.14 will always conduct if

a. V_1 is greater than V_2.
b. V_2 is greater than V_1.
c. V_1 is greater than 1 V.
d. R_2 is an open circuit.
e. R_1 is an open circuit.

Diode Models

ON - Model as a short-circuit

OFF - Model as an open-circuit

Check Assumptions

ON : $i_D > 0$ OFF : $V_D < 0$

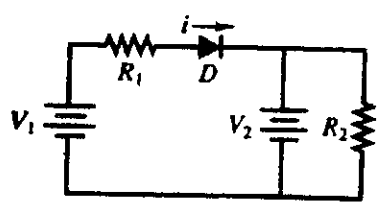
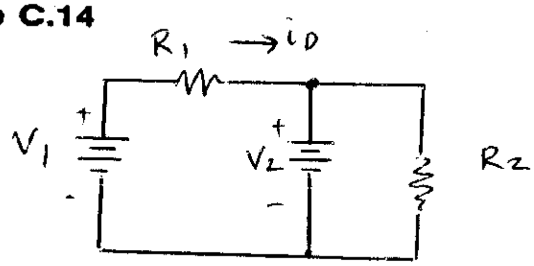


Figure C.14



$i_D = \frac{V_1 - V_2}{R_1}$

$i_D > 0$ IF $V_1 > V_2$

C.24 In the circuit of Figure C.15, which value is closest to v_3 if $R_1 = 2.2\ \text{k}\Omega$, $R_2 = 1.5\ \text{k}\Omega$, $R_3 = 18\ \text{k}\Omega$, $v_1 = 120$ mV, and $v_2 = -40$ mV?

a. −250 mV b. 500 mV c. −500 mV d. 1.46 V e. −1.46 V

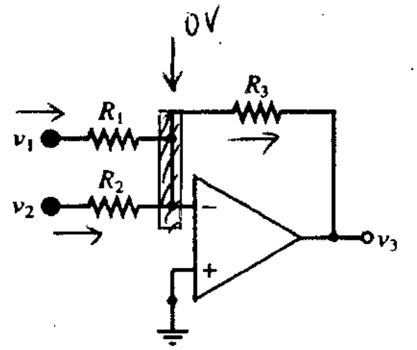


Figure C.15

Ideal OP-Amp Assumptions
(negative feed back)

$R_{in} \to \infty$, $R_{out} = 0$, $A_{V(OL)} \to \infty$

input currents are zero (Virtual Open)

input difference voltage is zero (Virtual Short)

KCL @ −input : $\frac{V_1}{R_1} + \frac{V_2}{R_2} = \frac{-V_3}{R_3}$

$$V_3 = -\left(\frac{R_3}{R_1}V_1 + \frac{R_3}{R_2}V_2\right)$$

$$V_3 = -\left(\frac{18\text{k}\Omega}{2.2\text{k}\Omega}(0.12\text{V}) + \frac{18\text{k}\Omega}{1.5\text{k}\Omega}(-0.04)\right) = -0.5\text{V}$$

C.25 In Figure C.15, if $R_1 = 2.2\ \text{k}\Omega$, $R_3 = 18\ \text{k}\Omega$, $v_1 = 120$ mV, and $v_2 = -40$ mV, choose the value of R_2 such that $v_3 = 0$.

a. 1.2 kΩ b. 5 kΩ c. 7.33 kΩ d. 0.733 kΩ e. 0.5 kΩ

Same Formula As Above

$$0 = -\left(\frac{18\text{k}\Omega}{2.2\text{k}\Omega}(0.12\text{V}) + \frac{18\text{k}\Omega}{R_2}(-0.04\text{V})\right) \Rightarrow R_2 = 733\Omega$$

C.26 Which of the following is a true characteristic of magnetic flux lines?

a. They cross each other.
b. They begin and end on electric charges.
c. They are parabolic.
d. They are continuous.
e. None of the above.

C.27 For the circuit of Figure C.16, where $i = 2$ A, $\phi = 1 \times 10^{-3}$ Wb, cross-sectional area $= 5$ in^2, and the mean flux path length $= 2$ in, the total reluctance $\mathcal{R}$ of the magnetic circuit in (A-turns)(in^2)/Wb is

a. 1×10^5 b. 2×10^5 c. 1.5×10^5 d. 3.5×10^4 e. 2×10^5

Assume $N = 100$ turns

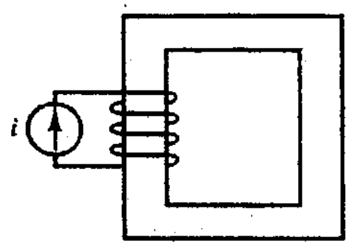


Figure C.16

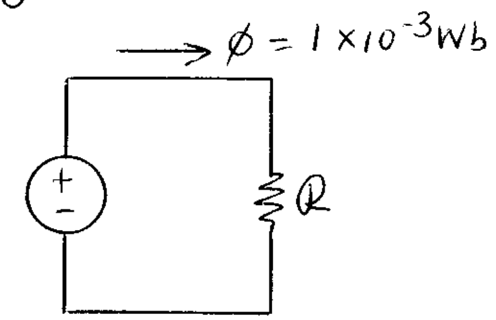
Magnetic Circuit Analogies

emf $\rightarrow$ mmf ($\mathcal{F}$)

current $\rightarrow$ flux (ϕ)

resistance $\rightarrow$ Reluctance ($\mathcal{R}$)

Magnetic Circuit



$\mathcal{F} = Ni$

$= 100(2A)$

$= 200 A \cdot t$

$$\mathcal{F} = \phi \mathcal{R}$$

$$\mathcal{R} = \frac{200 A\cdot t}{1 \times 10^{-3} Wb} = 2 \times 10^5 \frac{A \cdot t}{Wb}$$

PC1. **A dc current of 3 A flows through an initially uncharged capacitor. After two microseconds, the magnitude of the net electric charge on one plate of the capacitor is most nearly:**

a. 3 μC
b. 6 μC
c. 0 μC
d. 0.667 μC

$$i = dq/dt = \Delta Q/\Delta t$$

$$\Delta Q = 3A(2\mu Sec) = \underline{\underline{6\mu C}}$$

PC2. For the circuit of Figure PC.2, the power dissipated in the 10-Ω resistor is most nearly:

a. 22.5 W
b. 8.27 W
c. 1.84 W
d. 7.35 W

$$V = \frac{15V\,(10\|20)}{5 + 10\|20} = 8.57V$$

$$P = V^2/R = \frac{(8.57\,V)^2}{10\Omega} = \underline{\underline{7.35W}}$$

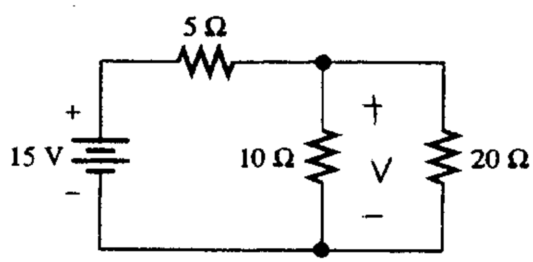


Figure PC.2

PC3. Two initially uncharged capacitors have values of 6 μF and 12 μF. The capacitors are connected in series, and a 200-V dc source is applied to the combination. The charge taken from the source is most nearly:

a. 800 μC
b. 3600 μC
c. 600 μC
d. 1200 μC

$$C_{eq} = \frac{1}{\frac{1}{6\mu F} + \frac{1}{12\mu F}} = 4\mu F$$

$$q = CV$$

$$q = 4\mu F(200V) = \underline{\underline{800\mu C}}$$

PC4. A 2-hp 220-V-rms single-phase induction motor operates at full load with 80% efficiency and 0.75 lagging power factor. The magnitude of the rms motor current is most nearly:

a. 4.07 A

b. 11.3 A

c. 6.35 A

d. 8.78 A

$P_{out} = 2\,hp\,(746\,W/hp) = 1492\,W$

$P_{in} = 1492\,W / 0.8 = 1865\,W$

$S = P/PF = \frac{1865\,W}{0.75} = 2487\,VA$

$\underline{S} = \underline{V}\,\underline{I}^* \qquad |S| = |V|\,|I|$

$|\underline{I}| = 2487\,VA / 220\,V = \underline{\underline{11.3\,A}}$

PC5. A 30-Ω resistor, a pure capacitance having a reactance magnitude of 80 Ω, and a pure inductance having a reactance magnitude of 40 Ω are in series. The impedance magnitude of the series combination is most nearly:

a. 150 Ω

b. 50 Ω

c. 14.1 Ω

d. 17. 1 Ω

$Z_{eq} = Z_R + Z_L + Z_C$

$= 30\,\Omega + j40\,\Omega - j80\,\Omega$

$Z_{eq} = (30 - j40)\,\Omega$

$= \underline{\underline{50\angle -53.13^\circ\,\Omega}}$

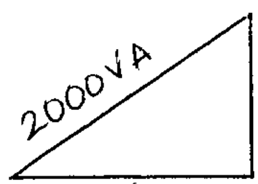
PC6. The apparent power supplied to a load in an ac circuit is 2000 volt-amperes with a power factor of 0.6 lagging. The reactive power is most nearly:

a. 1200 VAR

b. 3333 VAR

c. 1600 VAR

d. 2500 VAR



$Q = \underline{\underline{1600\,VAR}}$

$2000(0.6) = 1200\,W$

PC7. A 150-microfarad capacitor has been charged to a potential of 100 V. A 50-Ω resistor is placed across the capacitor. After 20 time constants, the total energy delivered to the resistor is most nearly:

a. 1.5 J

b. 0 J

c. 0.75 J

d. 15×10^{-3} J

Transient Behavior lasts $\approx 5\tau$

$$W_C = \frac{1}{2} C v^2 = \frac{1}{2} 150\,\mu F (100V)^2$$

$$= \underline{\underline{0.75J}}$$

PC8. The current through the 50-Ω resistor for the circuit shown in Figure PC.8 is most nearly:

a. 1.56 A rms

b. 1.10 A rms

c. 2.20 A rms

d. 0.52 A rms

$Z_R = R$

$Z_R = 50\Omega$

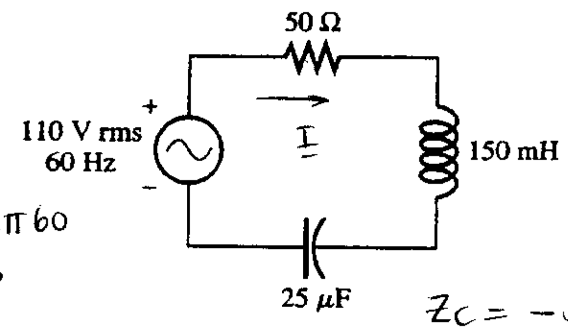


Figure PC.8

$\omega = 2\pi 60$

$= 3$

$Z_L = j\omega L$

$Z_L = j(377)(0.15H)$

$= j56.55\Omega$

$Z_C = -j/\omega C$

$$Z_C = \frac{-j}{(377)(25\mu F)}$$

$$= -j106.1\Omega$$

$$\underline{I} = \frac{110V\angle 0^\circ}{50\Omega + j56.55\Omega - j106.1\Omega} = \underline{\underline{1.56\angle 44.74^\circ A}}$$

PC9. For time t greater than zero, the mathematical expression of the current through the 25-Ω resistance of Figure PC.9 is:

a. $1 - \exp(-2t)$ A

b. $1 - \exp(-t/2)$ A

c. $\exp(-2t)$ A

d. $\exp(-t/2)$ A

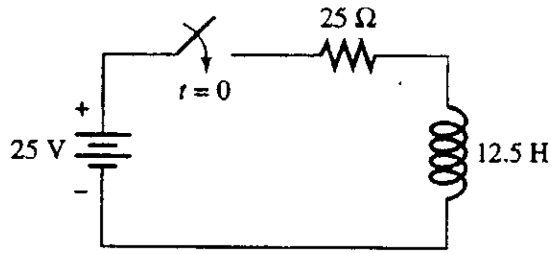


Figure PC.9

$$i(t) = I_\infty + (I_0 - I_\infty)e^{-t/\tau}$$

$$\tau = L/R = \frac{12.5\,H}{25\,\Omega} = 0.5\ \text{sec}$$

$$I_0 = 0 \qquad I_\infty = 25V/25\,\Omega = 1\,A$$

$$i(t) = (1 - e^{-2t})\,A$$

PC10. The output voltage v_o in the ideal op-amp circuit shown in Figure PC.10 is:

a. $5v_1 + 2.5v_2$

b. $10v_1 + 5v_2$

c. $-5v_1 - 2.5v_2$

d. $-10v_1 - 5v_2$

KCL @ inverting input

$$\frac{V_1 - 0}{1\,k\Omega} + \frac{V_2 - 0}{2\,k\Omega} = \frac{-V_o}{10\,k\Omega}$$

$$V_o = -10V_1 - 5V_2$$

0 Volts

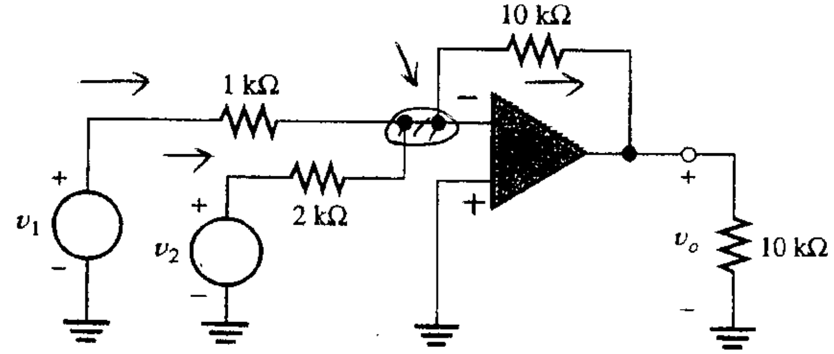


Figure PC.10

PC11. The output voltage v_o in the ideal op-amp circuit shown in Figure PC.11 is most nearly:

a. 4 V

b. 6 V

c. 2 V

d. 8 V

KCL @ inverting input

$$\frac{V_o - 2}{2k\Omega} = \frac{2}{1k\Omega} \qquad V_o = 6V$$

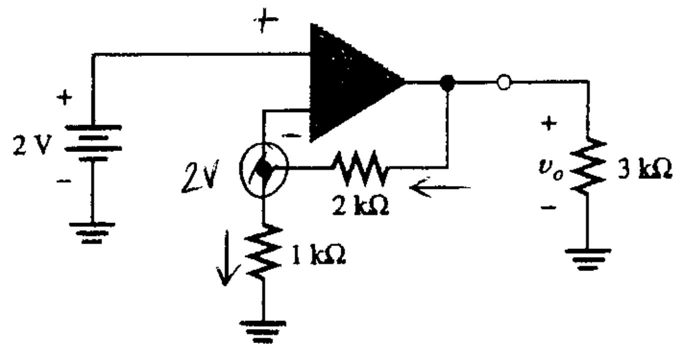


Figure PC.11

PC12. The voltage v_o shown in Figure PC.12 is best described as:

a. 21.2 V dc

b. 15 V dc

c. 15 V ac

d. a half-wave rectified sine wave

$T = 1/60 = 16.7\,mSec$

$\tau = RC = 10k\Omega(1000\mu F)$

$= 10\,sec$

$\tau >> T$

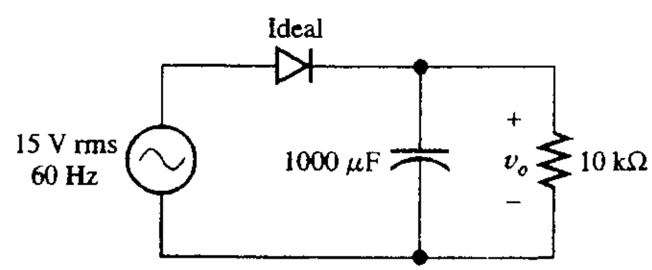
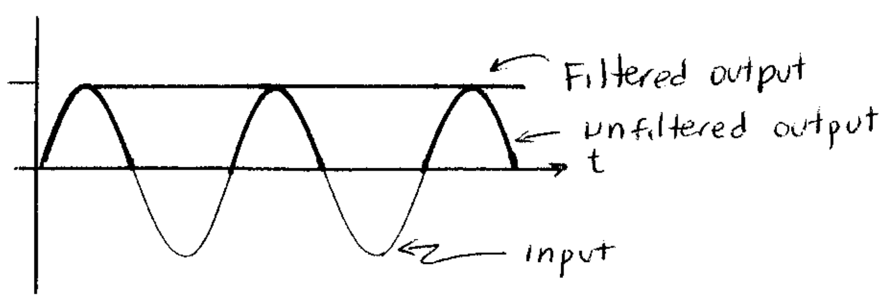


Figure PC.12

$V_m = \sqrt{2}(15V)$
$= 21.2V$



PC13. The voltage v_o shown in Figure PC.13 is most nearly:

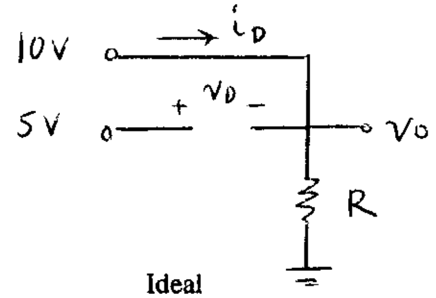
a. 5 V

b. 7.5 V

c. 0 V

d. 10 V

Both Cannot be ON !



$i_D = \frac{10}{R}$ ($i_D > 0$, OK)

$V_D = 5 - 10 = -5$

($V_D < 0$, OK)

$V_o = 10V$

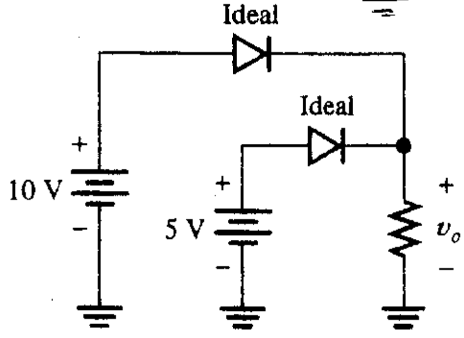


Figure PC.13

PC14. The current flowing through the 5-Ω resistor in Figure PC.14 is most nearly:

a. 2 A rms

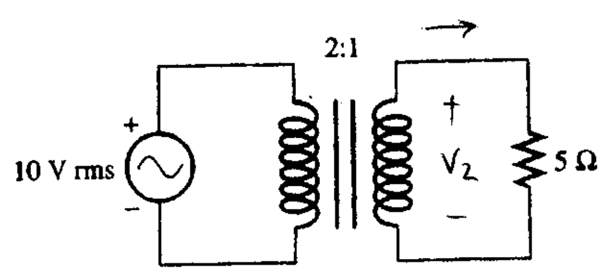
b. 4 A rms

c. 1 A rms

d. 0 A rms

$$\frac{V_1}{V_2} = \frac{N_1}{N_2}$$

$$V_2 = \frac{N_2}{N_1} V_1 = \frac{1}{2}(10V) = 5V$$



$I = \frac{5V}{5\Omega} = 1A$

Figure PC.14