

Tutorial 1 for CAD

Sample Questions and Exercises

2018 Fall

- 1 The voltage 2,000,000 V can be expressed in powers of 10 as:
- (a) 2 mV (b) 2 kV (c) 2 MV (d) 2 GV
- 2 The unit of current is:
- (a) coulomb (b) ampere
(c) volt (d) joule
- 3 A 4-A current charging a dielectric material will accumulate a charge of 24 C after 6 s.
- (a) True (b) False

- 4 The voltage across a 1.1-kW toaster that produces a current of 10 A is:
- (a) 11 kV (b) 1100 V (c) 110 V (d) 11 V
- 5 How many coulombs are represented by these amounts of electrons?
- (a) 6.482×10^{17} (b) 1.24×10^{18}
(c) 2.46×10^{19} (d) 1.628×10^{20}

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Find the charge $q(t)$ flowing through a device if the current is:

(a) $i(t) = 3 \text{ A}$, $q(0) = 1 \text{ C}$

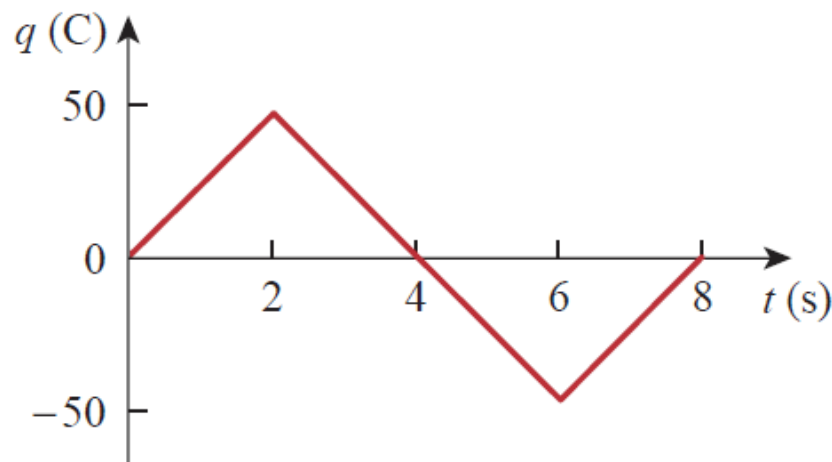
(b) $i(t) = (2t + 5) \text{ mA}$, $q(0) = 0$

(c) $i(t) = 20 \cos(10t + \pi/6) \mu\text{A}$, $q(0) = 2 \mu\text{C}$

(d) $i(t) = 10e^{-30t} \sin 40t \text{ A}$, $q(0) = 0$

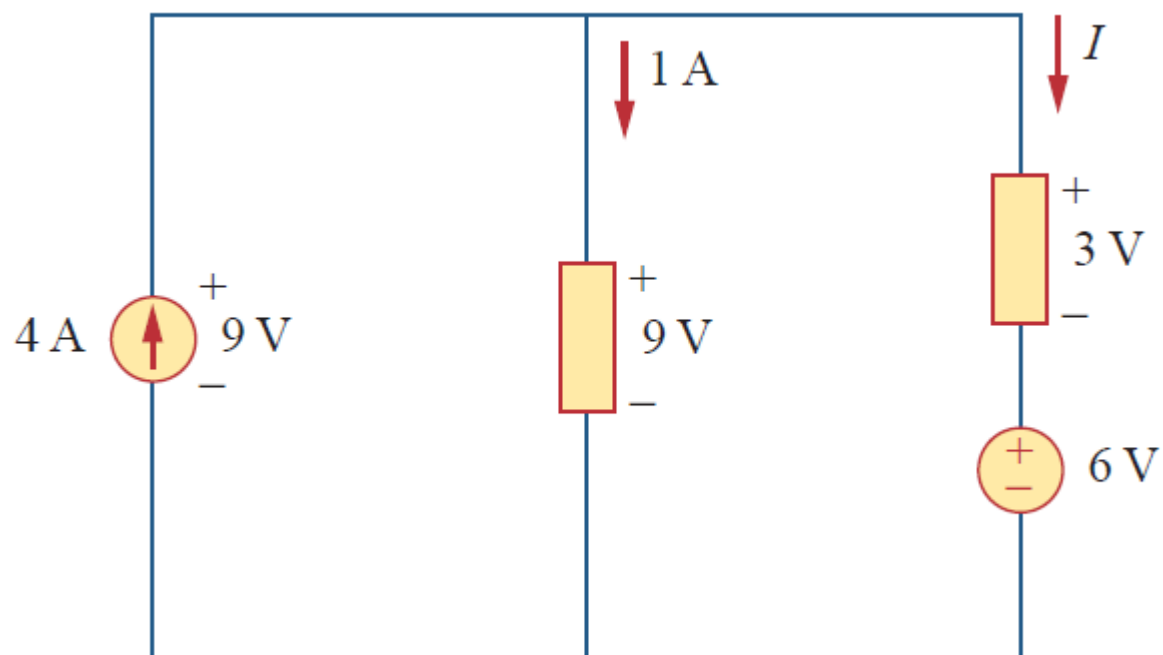
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The charge flowing in a wire is plotted in Fig. Sketch the corresponding current.



- 8 A rechargeable flashlight battery is capable of delivering 85 mA for about 12 h. How much charge can it release at that rate? If its terminal voltage is 1.2 V, how much energy can the battery deliver?
- 9 The current entering the positive terminal of a device is $i(t) = 3e^{-2t}$ A and the voltage across the device is $v(t) = 5di/dt$ V.
- (a) Find the charge delivered to the device between $t = 0$ and $t = 2$ s.
 - (b) Calculate the power absorbed.
 - (c) Determine the energy absorbed in 3 s.

10 Find I in the network of Fig.



- 11 A 60-W incandescent bulb operates at 120 V. How many electrons and coulombs flow through the bulb in one day?
- 12 A lightning bolt carried a current of 2 kA and lasted for 3 ms. How many coulombs of charge were contained in the lightning bolt?
- 13 A unit of power often used for electric motors is the horsepower (hp), which equals 746 W. A small electric car is equipped with a 40-hp electric motor. How much energy does the motor deliver in one hour, assuming the motor is operating at maximum power for the whole time?

14 A bar of silicon is 4 cm long with a circular cross section. If the resistance of the bar is $240\ \Omega$ at room temperature, what is the cross-sectional radius of the bar?

15 Find the number of branches and nodes in each of the circuits of Fig. 2.71.

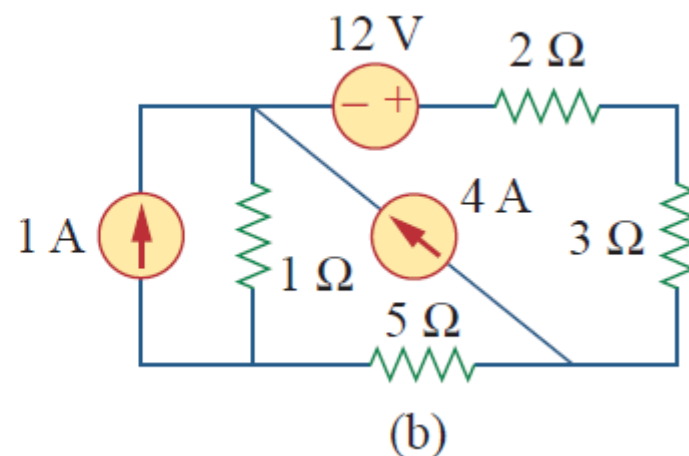
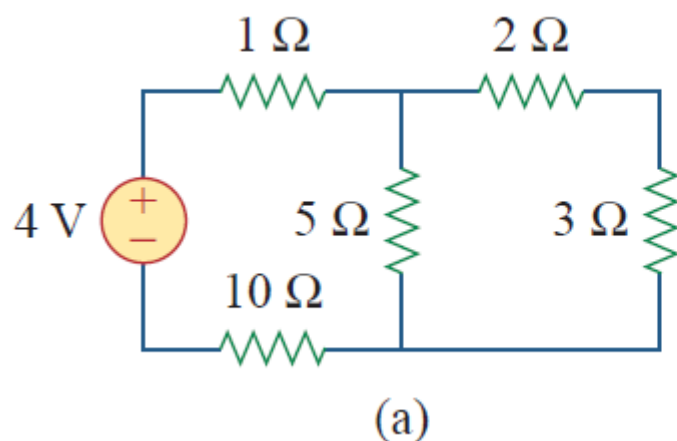


Fig. 2.71

16 Find i_1 , i_2 , and i_3 in Fig. 2.73.

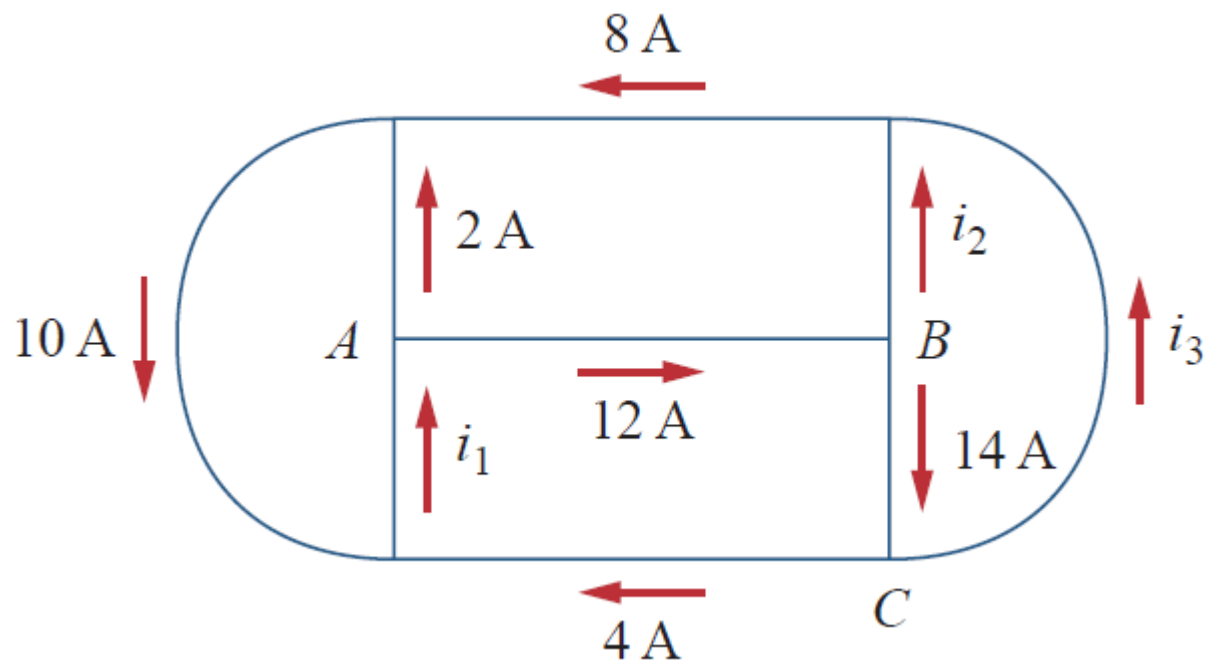


Fig. 2.73

17 Calculate v and i_x in the circuit of Fig. 2.79.

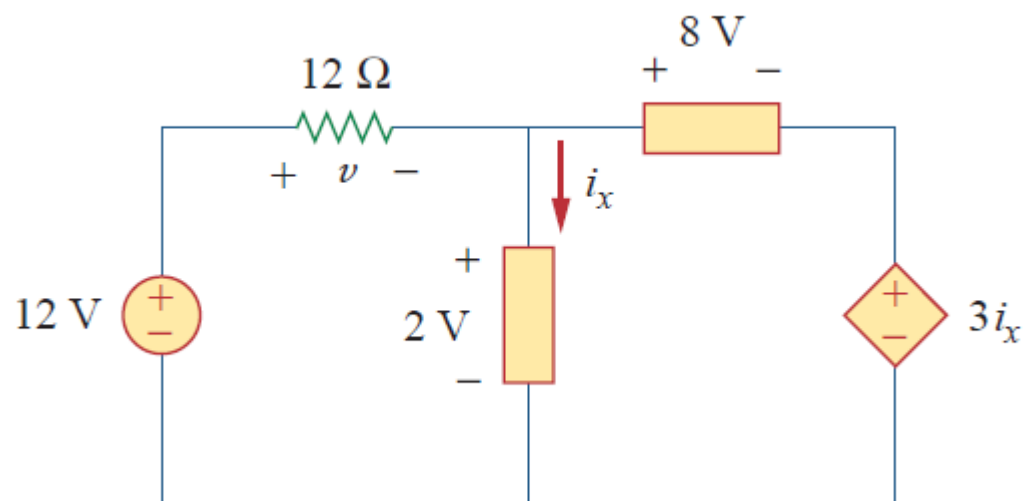


Fig. 2.79

- 18 For the network in Fig. 2.89, find the current, voltage, and power associated with the 20-k Ω resistor.

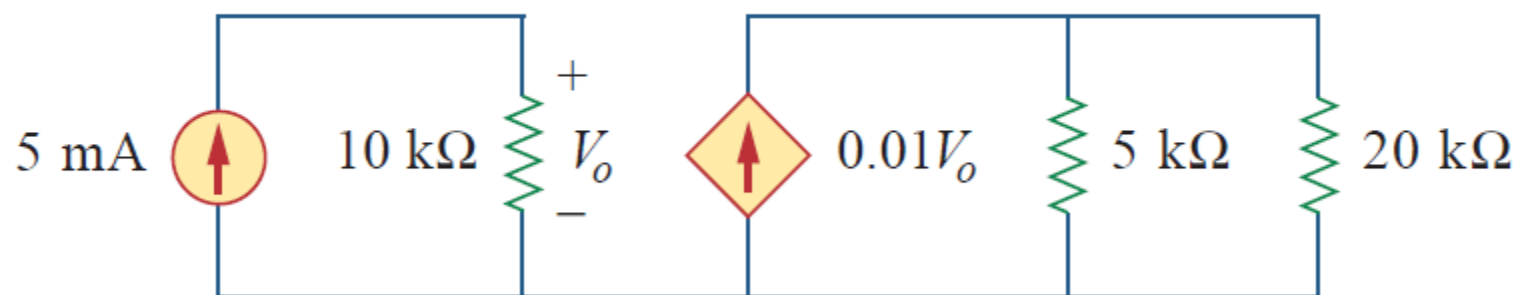


Fig. 2.89

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For the circuit in Fig. 2.95, determine i_1 to i_5 .

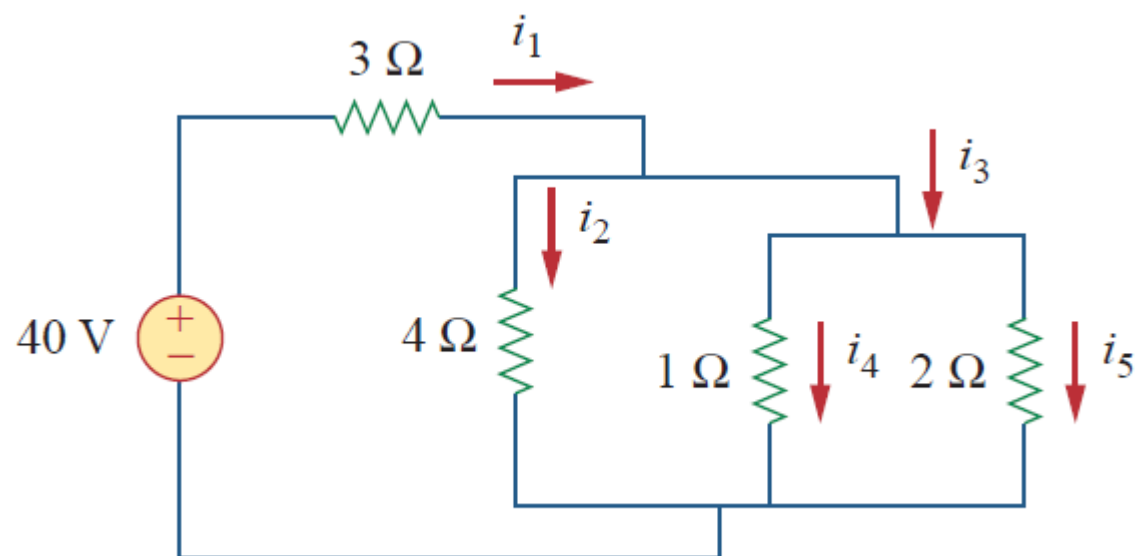


Fig. 2.95

Answers:

1 A

2 B

3 A

4 C

5 (a) -0.1038 C, (b) -0.19865 C, (c) -3.941 C, (d) -26.08 C

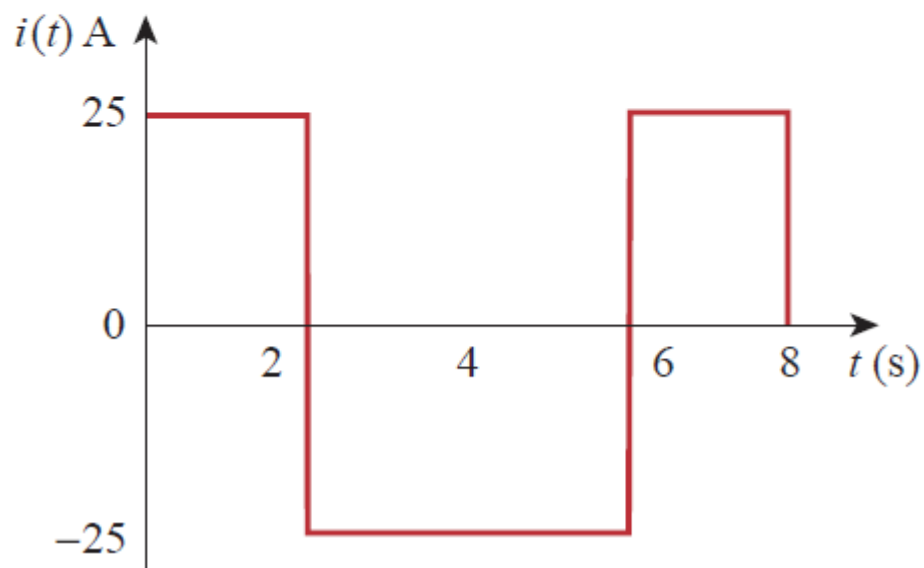
6 (a) $3t + 1$ C, (b) $t^2 + 5t$ mC,
(c) $2 \sin(10t + \pi/6) + 1 \mu\text{C}$,
(d) $-e^{-30t} [0.16 \cos 40t + 0.12 \sin 40t]$ C

Answers:

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$$i = \begin{cases} 25 \text{ A}, & 0 < t < 2 \\ -25 \text{ A}, & 2 < t < 6 \\ 25 \text{ A}, & 6 < t < 8 \end{cases}$$

See the sketch in Fig. G.1.



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3.672 kC, 4.406 kJ

Answers:

9 (a) 1.297 C, (b) $-90e^{-4t}$ W, (c) -22.5 J

10 3 A

11 2.696×10^{23} electrons, 43,200 C

12 6 C

13 29.84 kWh

14 184.3 mm

15 (a) 6 branches and 5 nodes, and (b) 7 b₁ and 5 nodes.

16 14 A, -2 A, 10 A

Answers:

17 $10\text{ V}, -2\text{ A}$

18 $0.1\text{ A}, 2\text{ kV}, 0.2\text{ kW}$