Chapter 1, Solution 2

(a) $i = dq/dt = 3$ mA

(b) $i = dq/dt = (16t + 4)$ A

(c) $i = dq/dt = (-3e^{-t} + 10e^{-2t})$ nA

(d) $i = dq/dt = 1200\pi \cos 120\pi t$ pA

(e) $i = dq/dt = -e^{-4t}(80\cos 50t + 1000\sin 50t)\ \mu$A

Chapter 1, Solution 6

(a) At t = 1ms, $i = \frac{dq}{dt} = \frac{30}{2} =$ **15 A**

(b) At t = 6ms, $i = \frac{dq}{dt} =$ **0 A**

(c) At t = 10ms, $i = \frac{dq}{dt} = \frac{-30}{4} =$ **–7.5 A**

Chapter 1, Solution 8

$$q = \int i dt = \frac{10 \times 1}{2} + 10 \times 1 = \underline{15\ \mu C}$$

Chapter 1, Solution 12

For 0 < t < 6s, assuming q(0) = 0,

$$q(t) = \int_0^t i\,dt + q(0) = \int_0^t 3t\,dt + 0 = 1.5t^2$$

At t=6, $q(6) = 1.5(6)^2 = 54$

For 6 < t < 10s,

$$q(t) = \int_6^t i\,dt + q(6) = \int_6^t 18\,dt + 54 = 18t - 54$$

At t=10, q(10) = 180 – 54 = 126

For 10<t<15s,

$$q(t) = \int_{10}^t i\,dt + q(10) = \int_{10}^t (-12)\,dt + 126 = -12t + 246$$

At t=15, q(15) = -12x15 + 246 = 66

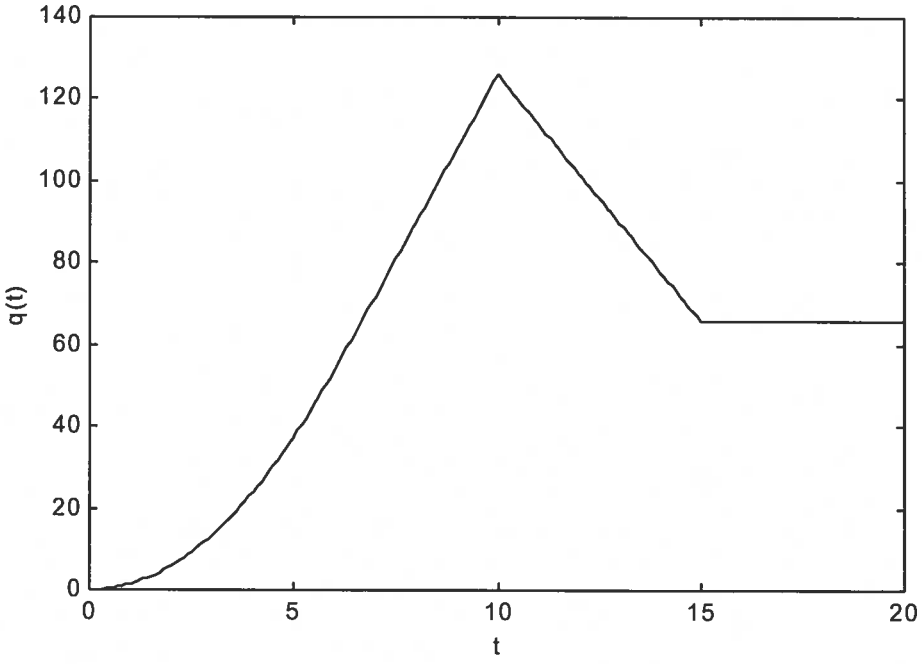
For 15<t<20s,

$$q(t) = \int_{15}^t 0\,dt + q(15) = 66$$

Thus,

$$q(t) = \begin{cases} 1.5t^2 \text{ C}, & 0 < t < 6\text{s} \\ 18t - 54 \text{ C}, & 6 < t < 10\text{s} \\ -12t + 246 \text{ C}, & 10 < t < 15\text{s} \\ 66 \text{ C}, & 15 < t < 20\text{s} \end{cases}$$

The plot of the charge is shown below.


140
120
100
80
60
40
20
0
q(t)
0
5
10
15
20
t

Chapter 1, Solution 14

(a) $q = \int i dt = \int_0^1 0.02\left(1 - e^{-0.5t}\right)dt = 0.02\left(t + 2e^{-0.5t}\right)\Big|_0^1 = 0.02\left(1 + 2e^{-0.5} - 2\right) = \mathbf{4.261\ mC}$

(b) $p(t) = v(t)i(t)$

$p(1) = 10\cos(2)\text{x}0.02(1 - e^{-0.5}) = (-4.161)(0.007869)$

$= \mathbf{-32.74\ mW}$