

**problem 1 solution**

$$(a) i = dq/dt = [(-3) \cdot 2e^{-3t} - (-1) \cdot 4e^{-t}] \text{ nA} = (-6e^{-3t} + 4e^{-t}) \text{ nA}$$

$$(b) i = dq/dt = 50\pi \cdot 20 \cos 50\pi t \text{ pA} = 1000\pi \cos 50\pi t \text{ pA}$$

$$(c) i = dq/dt = [(-2) \cdot 30e^{-2t} \cos 60t - 60 \cdot 30e^{-2t} \sin 60t] \mu\text{A} \\ = -e^{-2t}(60 \cos 60t + 1800 \sin 60t)$$

**problem 2 solution**

$$(a) q(t) = \int_0^t i(t) dt + q(0) = (3t^2 + 4t) \text{ mC}$$

$$(b) q(t) = \int_0^t i(t) dt + q(0) = [2 \sin(20t + \frac{\pi}{6})]_0^t + 2 \mu\text{C} \\ = [2 \sin(20t + \frac{\pi}{6}) - 2 \sin \frac{\pi}{6} + 2] \mu\text{C} \\ = [2 \sin(20t + \frac{\pi}{6}) + 1] \mu\text{C}$$

**problem 3 solution**

$$(a) \text{ At } t = 4 \text{ ms, } i = dq/dt = 40/8 \text{ A} = 5 \text{ A}$$

$$(b) \text{ At } t = 12 \text{ ms, } i = dq/dt = 0/8 \text{ A} = 0 \text{ A}$$

$$(a) \text{ At } t = 20 \text{ ms, } i = dq/dt = (-40)/8 \text{ A} = -5 \text{ A}$$

**problem 4 solution**

$$q = \int_0^5 i dt = \frac{1}{2} \times (2+5) \times 15 \mu\text{C} = 52.5 \mu\text{C}$$

**problem 5 solution**

$$(a) q = \int_0^2 i dt = (1 \times 10 + \frac{1}{2} \times (5+10) \times 1) \text{ C} = 17.5 \text{ C}$$

$$(b) q = \int_0^4 i dt = (17.5 + 2 \times 5) \text{ C} = 27.5 \text{ C}$$

$$(c) q = \int_0^5 i dt = (27.5 + \frac{1}{2} \times 1 \times 5) \text{ C} = 30 \text{ C}$$

**problem 6 solution**

$$(a) i = \frac{dq}{dt} = 30\pi \cos 6\pi t \text{ mA}$$

$$p = vi = 30\pi \cos^2 6\pi t \text{ mW}$$

$$\text{At } t = 0.3 \text{ s}$$

$$p(0.3) = 30\pi \cos^2 1.8\pi \text{ mW} = 61.69 \text{ mW}$$

$$(b) W = \int p dt = 30\pi \int_0^{0.6} \cos^2 6\pi t dt = 15\pi \int_0^{0.6} (1 + \cos 12\pi t) dt$$

$$W = 15\pi [t + \frac{\sin 12\pi t}{12\pi}]_0^{0.6} \text{ J} = 27.54 \text{ mJ}$$

**problem 7 solution**

$$(a) q = \int idt = \int_0^1 8(1 - e^{-0.5t}) dt = 8(t + 2e^{-0.5t}) \Big|_0^1 = 8(1 + 2e^{-0.5} - 2)C = 1.704C$$

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

$$p(1) = 2 \cos 2 \cdot 8(1 - e^{-0.5}) = 2 \times (-0.4161) \times (3.148)W = -2.620W$$

**problem 8 solution**

$$(a) p = -vi = -3 \times 8 W = -24W$$

$$(b) p = vi = 3 \times 10 W = 30W$$

$$(c) p = vi = (-4) \times 6 W = -24W$$

**problem 9 solution**

$$\sum p = 0$$

$$p_3 = -p_1 - p_2 - p_4 - p_5 = (-105 + 70 - 60 + 30)W = -65W$$

**problem 10 solution**

$$(a) \text{ For the 11-V voltage source, } p = -4 \times 11W = -44W$$

$$\text{ For element 1, } p = 4 \times 4 W = 16W$$

$$\text{ For element 2, } p = 4 \times 7 W = 28W$$

$$(b) \text{ For the 12-V voltage source, } p = -3 \times 12W = -36W$$

$$\text{ For the current-controlled voltage source, } p = 3I_0 \times 3 W = 9 \times 3 W = 27W$$

$$\text{ For element 1, } p = 3 \times 2 W = 6W$$

$$\text{ For element 2, } p = 3 \times 1 W = 3W$$

**problem 11 solution**

$$\sum p = 0$$

$$-4 \times 9 + 1.5 \times 9 + 3I + 6I = 0$$

$$I = 2.5A$$

**problem 12 solution**

$$\sum p = 0$$

$$-6 \times 30 + 6 \times 12 + 2V_0 + 1 \times 28 + 3 \times 28 - 4 \times 10 \times 1 = 0$$

$$V_0 = 18V$$