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EECS 215   HW 1

3. b. $i(t) = (2t + 5)$ mA ; $q(0) = 0$

$$i = \frac{dQ}{dt}$$

$$Q = \int i \, dt = \boxed{t^2 + 5t \ mC}$$

c. $i(t) = 20\cos\left(10t + \frac{\pi}{6}\right)$ NA , $q(0) = 2$ NC

$$Q = \int i \, dt = 2\sin\left(10t + \frac{\pi}{6}\right) + C \ \text{NC}$$

$$2 = 2\sin\left(10(0) + \frac{\pi}{6}\right) + C$$

$$2 = 2\sin\left(\frac{\pi}{6}\right) + C$$

$$C = 2 - 2(0.5) = 1$$

$$\boxed{Q = 2\sin\left(10t + \frac{\pi}{6}\right) + 1 \ mC}$$

7. $i = \frac{dQ}{dt}$
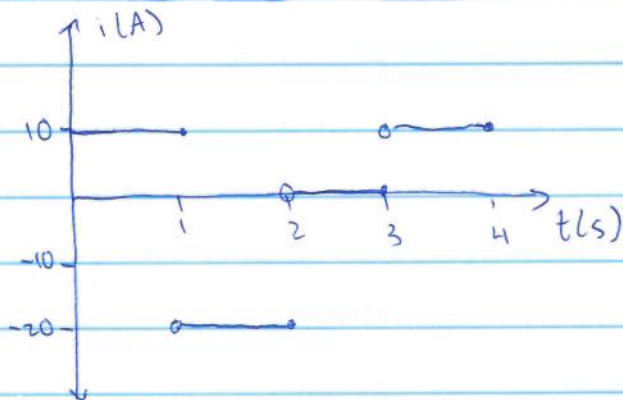
9. a. $Q = \int i\,dt$

$$\boxed{Q = 10\,C}$$

b. $10 + 5 + 7.5 = \boxed{22.5\,C}$

c. $10 + 7.5 + 5 + 5 + 2.5 = \boxed{30\,C}$

13. a. $q = 5\sin(4\pi t)\;mC$

$v = 3\cos(4\pi t)\;V$

~~$i = 5\cos(4\pi t)\;mA$~~
~~4π~~

$i = 20\pi\cos(4\pi t)\;mA$

$v(0.3) = 3\cos(4\pi\,(0.3)) = -2.427\,V$

$i(0.3) = 20\pi\cos(4\pi\,(0.3)) = -50.832\,mA$

$P = iV = \boxed{123.4\;mW}$

b. $w = \displaystyle\int_a^b p\,dt = \int_a^b vi\,dt =$

$= \displaystyle\int_0^{0.6} 3\cos(4\pi t)\cdot 20\pi\cos(4\pi t)\,dt$

Using Wolfram Alpha,

$Q(t) = \boxed{58.75\;mJ}$

12.
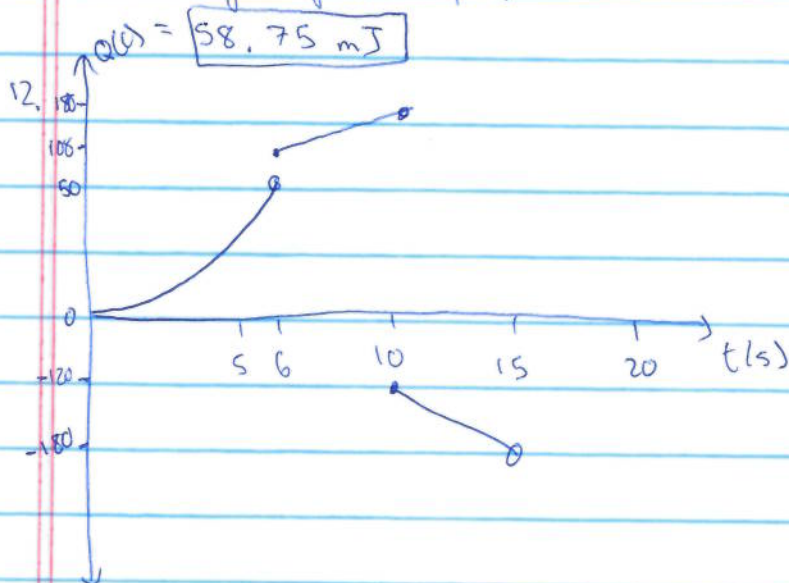
$\displaystyle\int 3t\,dt = \frac{3t^2}{2}$

$\displaystyle\int 18\,dt = 18t$

$\displaystyle\int -12\,dt = -12t$

14. a. $i = \dfrac{dQ}{dt}$

$Q = \int i \, dt = \int 10 + 10 e^{-2t} \, dt = \cancel{} \; 10t + 5e^{-2t}$

$Q(1) = 10(1) - 5e^{-2(1)} = \boxed{10 - \dfrac{5}{e^2} \quad mC}$

b. $P = iv = 20 \sin(4t) \cdot 10(1 + e^{-2t})$

$\qquad = 20 \sin(4) \cdot (10 + 10 e^{-2})$

$\qquad = \boxed{-171.85 \; mW}$

19.
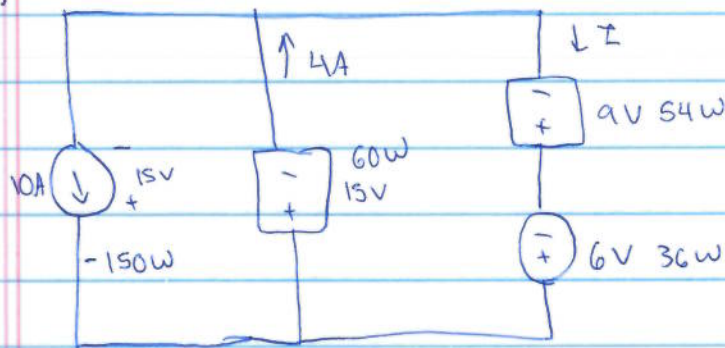
KCL: $4 = 10 + I$

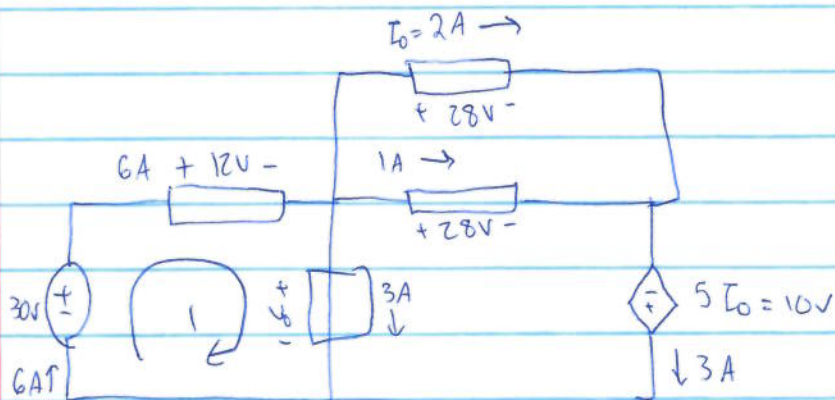$-10(150) = -150 w$

$4(15) = 60 w$

$-9I - 6I - 150 + 60 = 0$

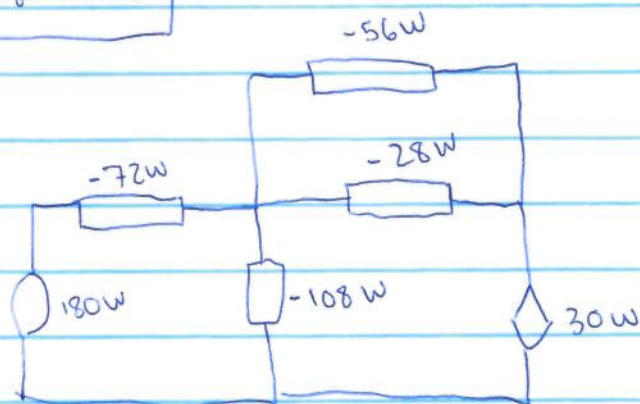$-15I = 90$

$I = -6 A$

$-6(-9) = 54 w$

$-6(-6) = 36 w$

20.

$+6 \cdot 30 - 6 \cdot 12 - 3v = 0$

$180 - 72 - 3v = 0$

$v = 36$

$\boxed{V_0 = 36 \text{ V}}$

25. $\require{cancel}\cancel{1.2 kW} \cdot \cancel{4min} \cdot 6$

$\dfrac{60 \text{min}}{}$

4 minutes $\cdot 2 \cdot 14 = 4 \cdot 28 = 112$ minutes $= 1.87$ hrs

$1.2 kW \cdot 1.87 hrs \cdot \dfrac{9 \text{cents}}{kWh}$ $\boxed{\$0.21}$

26. a. $P = IV =$

150 = 120 I

$I = \dfrac{150}{120} = \dfrac{5}{4} = \boxed{1.25 \text{ A}}$

b. $\dfrac{12 \text{ hrs}}{\text{day}} \cdot 365 \text{ days} = 4380 \text{ hours}$

$4380 \text{ hrs} \cdot 0.15 \text{kW} \cdot \dfrac{9.5 \cancel{\text{¢}}}{\text{kWhr}} = \boxed{\$ 62.42}$