1.) a.) $\tau = RC = 1000 \times 4 \times 10^{-6} = 4 \times 10^{-3}$ seconds

$q = CV\left(1 - e^{-t/\tau}\right) = 3.03 \times 10^{-5}$ coulombs

b.) $i = \frac{dq}{dt} \quad \therefore i = C^2 VR\left(t - e^{-t/RC}\right)$

$i = -5.211 \times 10^{-7}$ amps

2.) a.) $\frac{-q}{C} + iR = 0 \quad \therefore -q = +iRC$

$q = -iRC$ where $i = \frac{dq}{dt}$ therefor $q = -RC\frac{dq}{dt}$

b.) $q = q_0 e^{-t/RC}$ where $q_0 = CV$

$q = CV e^{-t/RC} \qquad q' = -\frac{V}{R}\left(e^{-t/RC}\right)$

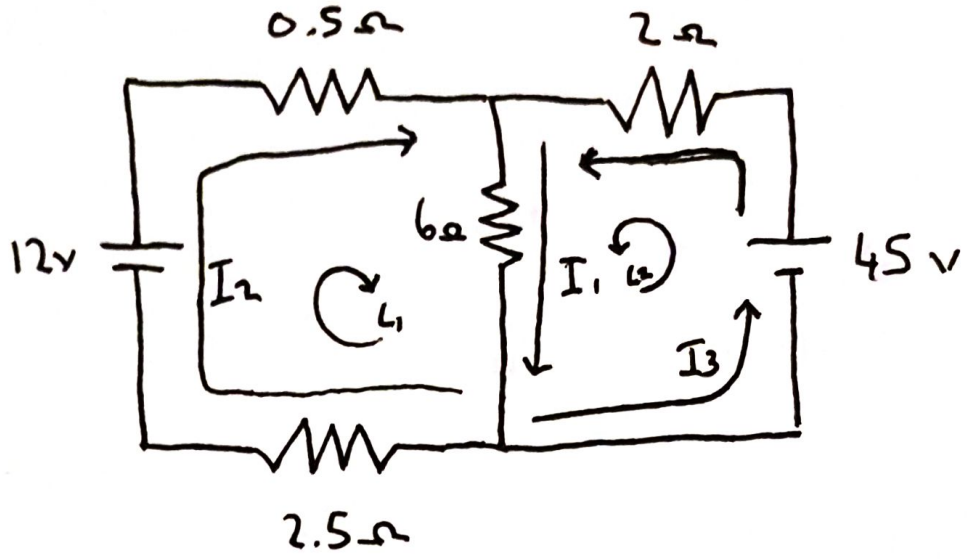
$CV e^{-t/RC} = -RC\left(-\frac{V}{R} e^{-t/RC}\right)$

$CV e^{-t/RC} = CV e^{-t/RC}$ They are the same

c.) $i = \frac{-q}{RC}$ (assuming capacitor is fully charged, $-q = -q_0$)

$i = \frac{-q_0}{RC} = \frac{-4 \times 10^{-6} \times 12}{1000 \times 4 \times 10^{-6}} = -0.012$ amps

3.)



$$-2.5I_2 + 12 - 0.5I_2 - 6I_1 = 0$$

$$12 = 3I_2 + 6I_1$$

$$45 - 2I_3 - 6I_1 = 0$$

$$45 = 2I_3 + 6I_1$$

$$I_3 = I_1 + I_2$$

$$6I_1 + 3I_2 \quad 0 = 12$$

$$6I_1 + \quad 2I_3 = 45$$

$$I_1 + I_2 - I_3 = 0$$

$I_1 = 9.25$ amps

$I_2 = -14.5$ amps

$I_3 = -5.25$ amps