1. In the following network of capacitors, C₁ is 4 µF and C₂ is 2 µF. A 24-V battery is connected to the network as shown. The switch S is initially open.
   (a) (10 points) Find the charge on the C₂ capacitor that is already connected to the two C₁ capacitors;
   (b) (10 points) When the switch S is closed, find the charge on the same C₂ capacitor.

2. (20 points) In the following circuit, find the currents (direction and magnitude) through the three resistors.

3. (20 points) In the following circuit, find the power dissipated in the 4-Ω resistor.
4. In a uniform magnetic field $\mathbf{B} = 2T \hat{i}$, $q_1 = -2 \mu \text{C}$ and $q_2 = +2 \mu \text{C}$ are both moving straight out of the paper at same velocity of 200 m/s. $q_3 = -4 \mu \text{C}$ is moving in the plane of the paper with a velocity $\mathbf{v}_3$ of 100 m/s at an angle 45° from the direction of the magnetic field (as shown below).

(a) (10 points) Find directions and magnitudes of the magnetic forces on all three charges.

(b) (10 points) Let the mass of $q_2$ be $m_2 = 4 \times 10^{-9} \text{ kg}$. Find the cyclotron radius for $q_2$.

5. A piece of conducting wire $abc$ consists of two 0.5 m straight segments ($ab$ and $bc$) that are perpendicular to each other. The wire lies in the plane of the paper. A uniform magnetic field of 0.5 T is pointing out of paper. The wire carries a current $I = 2 \text{ A}$ in the direction as indicated.

(a) (10 points) Find the direction and magnitude of the magnetic force on the wire;

(b) (10 points) If a straight segment $ac$ (dotted line) carries the same current of 2A flowing from $a$ to $c$, show explicitly that the magnetic force on this straight segment equals to the force on the original bended wire.