1. Find the charge on the capacitor in an \( LRC \) series circuit at \( t = 0.001 \) s when \( L = 0.05 \) henry, \( R = 2 \) ohms, \( C = 0.01 \) farad, \( v(t) = 0 \) volts, \( q(0) = 5 \) coulombs, and \( i(0) = 0 \) amperes. Determine the first time at which the charge on the capacitor is equal to zero. [Ans. 4.995, 0.0509]

2. Find the maximum charge on a capacitor in an \( LRC \) series circuit if \( L = \frac{5}{3} \) henry, \( R = 10 \) ohms, \( C = \frac{1}{39} \) farad, \( v(t) = 300 \) volts, \( q(0) = 0 \) coulombs, \( i(0) = 0 \) amperes. [Ans. 10.432 \((q(t) = 10 - 10e^{-3t}(\cos 3t + \sin 3t))\)]

3. Find the steady-state current in an \( LRC \) series circuit if \( L = 1 \) henry, \( R = 2 \) ohms, \( C = \frac{1}{4} \) farad, \( v(t) = 50 \cos t \) volts. [Ans. \( \frac{150}{13} \cos t + \frac{100}{13} \sin t \)]

4. Find the steady-state current, in the form \( I_0 \sin(\omega t - \theta) \), in an \( LRC \) series circuit if \( L = 0.5 \) henry, \( R = 20 \) ohms, \( C = 0.001 \) farad, \( v(t) = 100 \sin 60t \) volts. [Ans. \( 4.160 \sin(60t - 0.588) \)]

5. Find the charge on the capacitor in an \( LRC \) series circuit when \( L = 0.5 \) henry, \( R = 10 \) ohms, \( C = 0.01 \) farad, \( v(t) = 150 \) volts, \( q(0) = 1 \) coulomb, \( i(0) = 0 \) amperes. What is the charge on the capacitor after a long time? [Ans. \( q(t) = \frac{3}{2} - \frac{1}{2} e^{-10t}(\cos 10t + \sin 10t), \frac{3}{2} \)]

6. Find the current in an \( LC \) series circuit when \( v(t) = V_0 \cos \omega t \) volts, \( q(0) = q_0 \) coulombs, \( i(0) = i_0 \) amperes, if the circuit is not in resonance. [Ans. \( i(t) = i_0 \cos \omega_0 t - \omega_0 \left(q_0 - \frac{V_0 C}{1-\omega^2 LC}\right) \sin \omega_0 t - \frac{V_0 C \omega}{1-\omega^2 LC} \sin \omega t \), where \( \omega_0 = 1/\sqrt{LC} \)]