

Instructions: Show all work. Answers without work required to obtain the solution will not receive full credit. Some questions may contain multiple parts: be sure to answer all of them. Give exact answers unless specifically asked to estimate.

1. A mass weighing 8 lbs stretches a spring 16 inches. If the mass is pushed upwards, contracting the spring a distance of 1 inch and then set in motion with a downward velocity of 4 ft/sec, and if there is no damping, and the system is driven by a force of $9\cos(2t)$ pounds, set up the differential equation that models the system. (7 points)

2. A series circuit has a capacitor of 10^{-5} F, a resistor of 500Ω and an inductor of 0.7 H. The initial charge on the capacitor is 10^{-7} C and there is no initial current. Find the charge Q on the capacitor at any time t. What is the **charge** of the system at any time t? (10 points)

3. When does resonance occur? Explain. Provide an example.