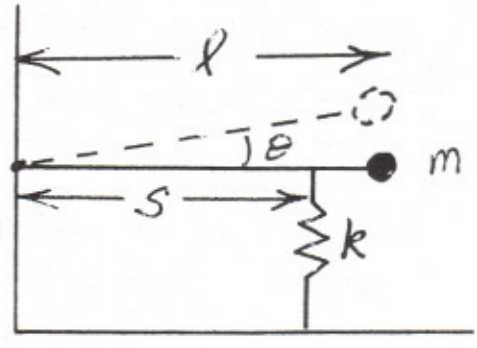
Candidacy Exam Fall 2001

Classical Mechanics

1. How far does a boat travel after shutting its engine off if its velocity just before shutting the engine off was constant at the value v_o? Assume that the force of friction of the boat in the water is directly proportional to the velocity of the boat. How long does it take the boat to stop?

2. A string of length l with a mass m attached on the end is attached to a vertical rod rotating with constant angular velocity ω. Find the angle the string makes with the vertical rod for equilibrium conditions.

3. Using Lagrange's equations, find the equation of motion for the angle θ for a mass m on the end of a massless rigid rod supported by a spring with spring constant k as shown below (for small θ only). Find the period of simple harmonic motion if the spring has been adjusted so that the rod is in static equilibrium for $\theta = 0$.



4. Consider the system of two masses hung by two springs as shown below. Assuming vertical motion only, determine the eigenfrequencies of small oscillations.