Short Problem 1:

Two masses (one mass m. the other mass 2m) are connected by a string on a fixed, massless pulley. At time t = 0 the mass 2m is moving upward with speed V_0 and mass m is moving downward with speed V_0. **What is the acceleration of the blocks?**

Short Problem 2:

A mass M slides on a horizontal table with frictional coefficient μ is given an initial velocity $V=V_0$ at a starting point (x=0). It reaches a frictionless ramp with an incline of incline 45˚ and it slides up a distance L along the ramp before stopping and beginning to slide back down. What was the distance the object travelled on the table from its starting point before reaching the foot of the ramp?

Long Problem 1:

A pendulum of mass m at the end of a weightless rod of length L is submerged in an oil with a resistive force given by

$$F_{Res} = 2m\sqrt{\frac{g}{L}}\left(L\dot{\theta}\right) \tag{1}$$

The pendulum is pulled back at time $t = 0$ to a small angle α and released from rest. Calculate $\theta(t)$ and $\dot{\theta}(t)$ as well as the constants associated with the initial conditions.

Hint: Acceleration in polar coordinates can be written as

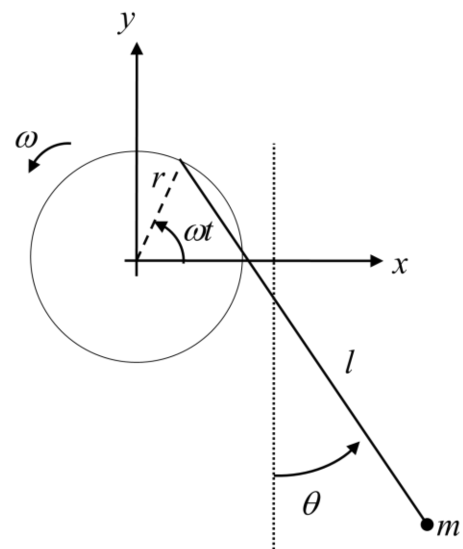
$$a_r = \ddot{r} - r\dot{\theta}^2$$

$$a_\theta = r\ddot{\theta} + 2\dot{r}\dot{\theta}$$

Long Problem 2

(a) The point of support of a simple pendulum of length l moves on a massless rim of radius r with a constant angular velocity ω. Using the Lagrangian equation, obtain the angular acceleration (for θ) of the pendulum.

(b) Given the answer from (a), show that the equation of motion for a simple pendulum is a special case of (a).



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