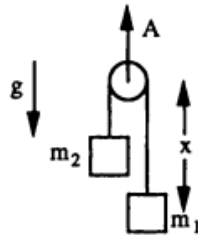


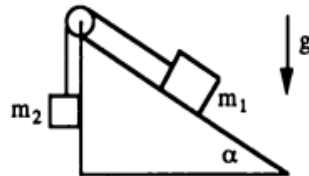
Lagrangian Mechanics: More Problems

1.



Use d'Alembert's principle to find the acceleration of m_1 . Note that in this case the pulley has an upward acceleration A . "Acceleration" means "acceleration relative to the earth."

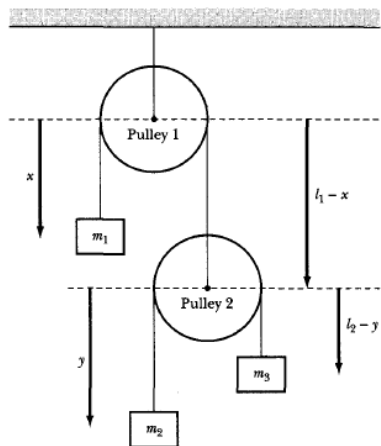
2.



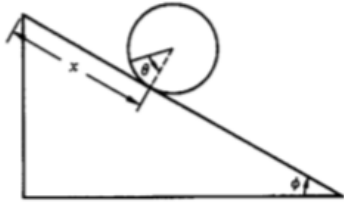
Use d'Alembert's principle to find the acceleration of m_1 down the (stationary) plane.

3. A particle of mass m starts at rest on top of a smooth fixed hemisphere of radius a . Write down the Lagrangian and find the equation of motion for the mass.

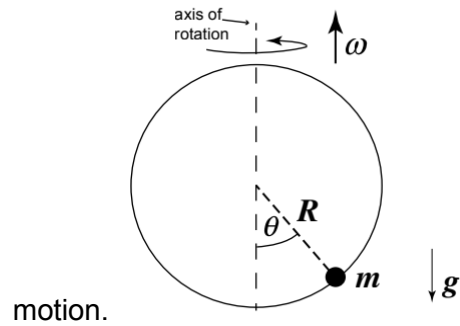
4. Find the Lagrangian and Lagrange's eq. of motion for the Pulley system shown below.



5. A disk of mass M is rolling without slipping down a frictionless inclined plane. Find the Lagrangian and the equation of motion.



6. A bead is sliding on a rotating hoop (frictionless). Find the Lagrangian. Find the equation of motion.



Answers:

1.

$$\ddot{x} = \frac{m_2 - m_1}{m_2 + m_1} (g + A)$$

2.

$$a = \frac{m_1 \sin \alpha - m_2}{m_2 + m_1} g$$

5.

$$L = \frac{3}{4} M r^2 \dot{\theta}^2 - M g (l - r \theta) \sin \phi$$