



ADVANCED DYNAMICS — PHY 4241/5227
HOME AND CLASS WORK – SET 3

(January 16, 2009)

(12) Use Lagrange multipliers for the following problems.

1. Determine the constraint force for the motion on a circle (no other forces acting) as function of the velocity and radius.
2. An inclined plane is given by the constraint $f = y - y_0 + ax = 0$. Gravity acts parallel to the y direction. Find the constraint forces in x and y directions. Compare the equations for \ddot{x} and \ddot{y} with those found from Newton's laws.

Due January 26 before class (5 points). Read M&T chapter 7.5.

(13) A cylinder is released at rest (and suitably positioned) at the top of a frictionless inclined plane. What happens? Multiple choice: (a) The cylinder rolls down the plane. (b) The cylinder slides down the plane. Due January 21 in class (1 point).

(14) The ladder of the figure is kept in equilibrium by constraint forces $F_y = \lambda_y \hat{y}$ and $F_x = \lambda_x \hat{x}$. Use Lagrange multipliers to show the relationship

$$mg = \lambda_y - (y_0/x_0)\lambda_x .$$

Discuss the special cases $\lambda_y = 0$ and $\lambda_x = 0$. Hint: Approximate the ladder by two masses $m+m$ at the endpoints, which are rigidly connected. Then, use three constraint functions, f_x , f_y and f . Due January 30 before class (10 points).