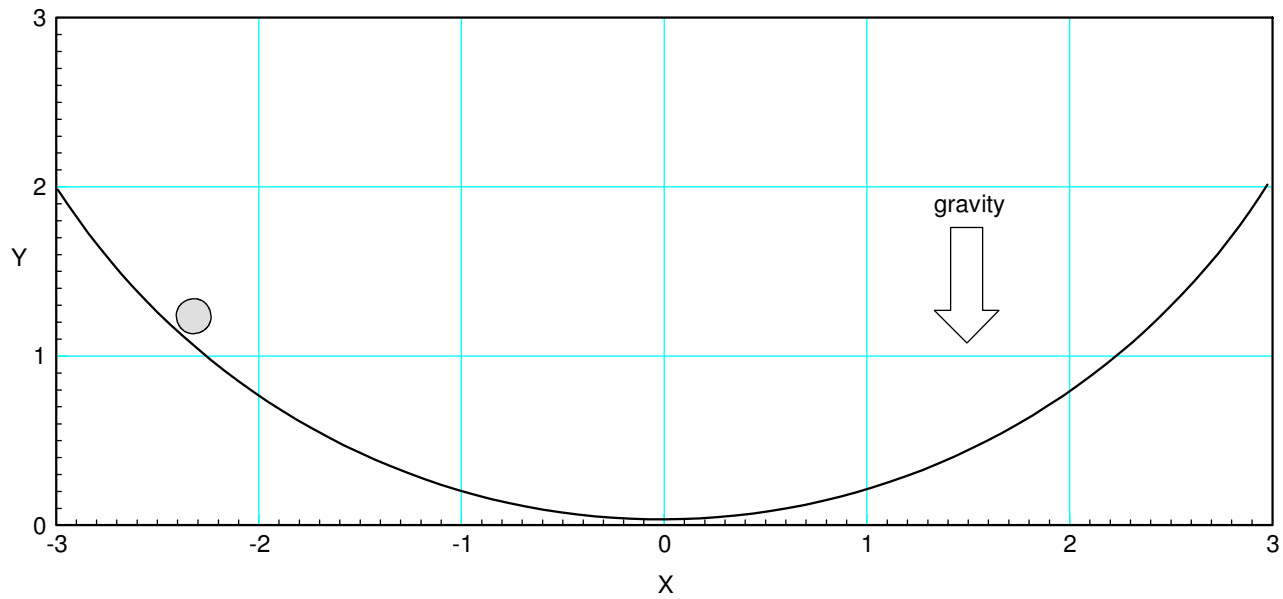


ECE 761 - Homework #9

LaGrangian Dynamics

A ball with a mass of 1kg is rolling in a bowl with a shape defined as

$$y = \frac{2}{27}|x|^3$$



- 1) Determine the potential energy of the ball
- 2) Determine the kinetic energy of the ball. Assume a solid sphere so that the rotational energy is

$$E = \frac{1}{2}J\dot{\theta}^2 = \frac{1}{5}m(\dot{x}^2 + \dot{y}^2)$$

- 3) Determine the dynamics of the ball

$$L = KE - PE$$

$$F_x = \mathbf{0} = \frac{d}{dt}\left(\frac{\partial L}{\partial \dot{x}}\right) - \left(\frac{\partial L}{\partial x}\right)$$

$$F_y = \mathbf{0} = \frac{d}{dt}\left(\frac{\partial L}{\partial \dot{y}}\right) - \left(\frac{\partial L}{\partial y}\right)$$

- 4) Simulate the ball rolling in the bowl in Matlab (modify program ball.m)