Name-code: _____

Part B: Optional Problems

9. A particle with mass M is constrained to slide on a frictionless parabolic wire defined by $y = kx^2$, where k is a constant. The only forces acting on the particle are gravity with magnitude Mg directed along the negative y-axis and the force of constraint generated by the wire. The x-axis is directed horizontally.

   a) Give the lagrangian of the particle, using x as the independent variable.
   b) Find the equation of motion for $x(t)$ using this lagrangian.
   c) What is the frequency of small oscillations around the point $x = 0$?
   d) In terms of the given parameters, what limit must be imposed on the amplitude of the oscillation for the answer in c) to be valid?