Physics 440, Autumn 2019 **Activity 12: Bead on a Hemisphere**

A particle of mass *m* start from rest very near the top of a frictionless hemisphere of radius *R*. Using Lagrange's λ −method, find the forces of constraint $Q_r = \lambda\frac{\partial f}{\partial r}$ and $Q_\theta = \lambda\frac{\partial f}{\partial \theta}$ and determine the angle θ at which the particle loses contact with the hemisphere. (You can solve this problem using a similar strategy as is used in example 3.1 on page 80-81.)