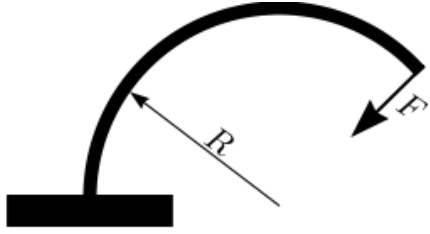
2. Pendulum (7 pts)

Consider an elastic rod, the mass and the compressibility of which (i.e. the length change) can be neglected in this problem. It can be assumed that if one end of the rod is firmly fixed, and a force F is applied to the other end of the rod, perpendicularly to the rod at the point of application, then the rod takes a form of a circle segment. The radius of that circle is inversely proportional to the force, $R = k/F$, where the factor k is a characteristic of the rod.



1) Let the rod be fixed vertically, at its bottom end, and a ball of mass m be attached to its upper end. Knowing the factor k, the length of the rod l, and the free fall acceleration g, find the period of small oscillations of the ball. In this question, you may assume that $gml \ll k$.

2) What is the maximal mass M of the ball, which can be stably held on such a vertical rod?

Remark: you may use approximate expressions $\sin x \approx x - x^3/6$ and $\cos x \approx 1 - x^2/2$ (for $x \ll 1$).