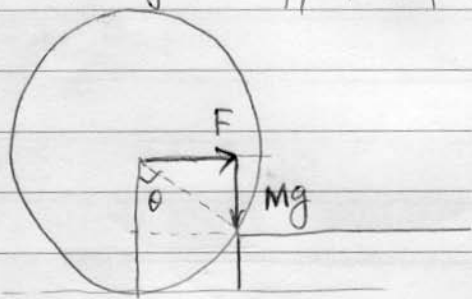


3. When F and Mg satisfy the following geometrical relation.



that is $\frac{F}{Mg} = \tan \theta$

$$\cos \theta = \frac{R-h}{R}$$

$$\begin{aligned} F &\geq Mg \tan \theta = Mg \frac{\sin \theta}{\cos \theta} = Mg \frac{\sqrt{1 - \left(\frac{R-h}{R}\right)^2}}{\frac{R-h}{R}} \\ &= Mg \frac{\sqrt{R^2 - (R-h)^2}}{R-h} = Mg \frac{\sqrt{2Rh - h^2}}{R-h} \\ &= \frac{Mg \sqrt{2Rh - h^2}}{R-h} \end{aligned}$$