Date
NO

Homework #10

1. (a) $I = \sum_i m_i r_i^2 = \int_0^R r^2 dm$

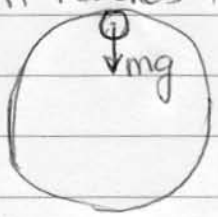
$= \int_0^R r^2 dr \frac{M}{R} = \frac{M}{R} \int_0^R r^2 dr$

$= \frac{M}{R} \cdot \frac{R^3}{3} = \frac{MR^2}{3}$

(b) $I = \int_0^R dr \int_0^\theta d\varphi \; r \cdot r^2 \cdot \frac{M}{\frac{\theta}{2} R^2}$

$= \frac{M}{\frac{\theta}{2} R^2} \cdot \theta \int_0^R r^3 dr = \frac{2M}{R^2} \cdot \frac{R^4}{4} = \frac{MR^2}{2}$

2. "In order to make it around the loop without falling off" means when it reaches the top of the circle $N \geq 0$



Suppose it's released at height h:

Energy conservation:

$$mgh = \frac{1}{2} mv^2 + mg \cdot 2R$$

Newton's second law:

$$N + mg = m \frac{v^2}{R}$$

and $N \geq 0$

then $h \geq \frac{5}{2} R$