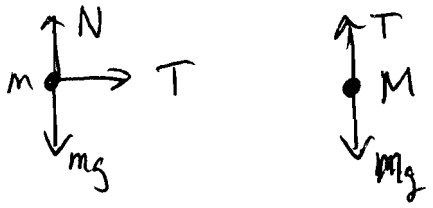
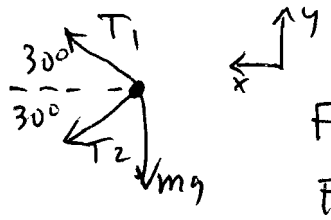
① 

$F_{net,y} = T - Mg = 0 \Rightarrow T = Mg$

$F_{net,x} = T = mv^2/r \qquad mv^2/r = Mg$

$v = \sqrt{\frac{rMg}{m}} = 3.7 \text{ m/s}$

② 

$F_{net,x} = T_1 \cos 30° + T_2 \cos 30° = mv^2/r$

$F_{net,y} = T_1 \sin 30° - T_2 \sin 30° - mg = 0$

(a) $T_2 = \frac{T_1 \sin 30° - mg}{\sin 30°} = 8.74 \text{ N}$

(b) $F_{net} = F_{net,x} = T_1 \cos 30° + T_2 \cos 30° = 37.9 \text{ N}$

(c) $v = \sqrt{\frac{r \cdot F_{net,x}}{m}} = 6.75 \text{ m/s}$

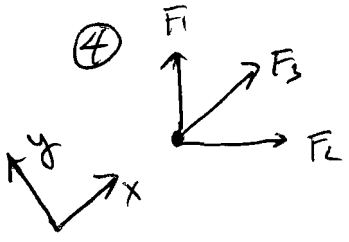
③ 

$F_{net,y} = N + mg = mv^2/r$

(a) $N = mv^2/r - mg = 8.7 \times 10^2 \text{ N}$

(b) contact is broken when $N = 0$ or $mg = mv^2/r$

$v = \sqrt{gr} = 5.7 \text{ m/s}$

④ 

$F_{net,x} = F_1 \cos 45° + F_2 \cos 45° + F_3$

$= \frac{Gm^2}{L^2}\frac{\sqrt{2}}{2} + \frac{Gm^2}{L^2}\frac{\sqrt{2}}{2} + \frac{Gm^2}{(\sqrt{2}L)^2} = \frac{Gm^2}{L^2}\left[\sqrt{2} + \frac{1}{2}\right]$

$F_{net,x} = \frac{mv^2}{r} \Rightarrow \frac{Gm^2}{L^2}\left[\sqrt{2} + \frac{1}{2}\right] = \frac{mv^2}{(L\sqrt{2}/2)}$

$v = \sqrt{\frac{Gm}{L}\left(1 + \frac{1}{2\sqrt{2}}\right)}$