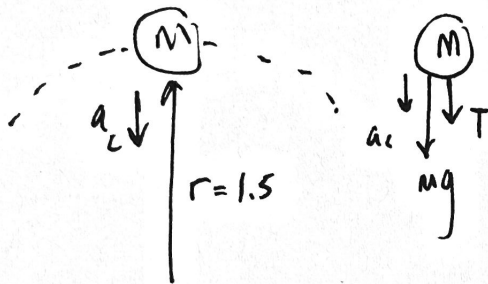


# Challenge Questions

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. When you whirl a ball on a cord in a vertical circle, you find a critical speed at the top for which the tension in the cord is zero. This is because the force of gravity on the object itself supplies the necessary centripetal force. How slowly can you swing a 2.5 kg ball like this so that it will just follow a circle with a radius of 1.5 m?

[ Ans: 3.8 m/s ]



$$\Sigma F = ma_c$$

$$T + mg = \frac{mv^2}{r}$$

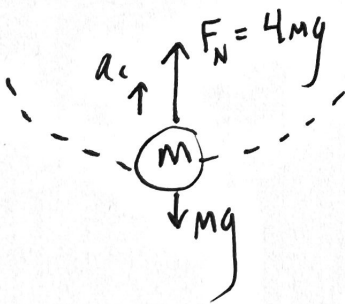
@ min speed  $T = 0$

$$mg = \frac{mv^2}{r}$$

$$v = \sqrt{gr} = 3.8 \text{ m/s} \checkmark$$

2. Snoopy is flying his vintage war plane in a "loop the loop" path chasing the Red Baron. His instruments tell him the plane is level (at the bottom of the loop) and traveling with a speed of 180 km/h. He is sitting on a set of bathroom scales, and notes that they read four times the normal force of gravity on him. What is the radius of the loop? Answer in metres. (SIN '75)

[ Ans: 85 m ]



$$\Sigma F = ma_c$$

$$F_N - mg = \frac{mv^2}{r}$$

$$r = \frac{mv^2}{(F_N - mg)}$$

$$= \frac{mv^2}{(4mg - mg)}$$

$$180 \frac{\text{km}}{\text{h}} = 50 \text{ m/s}$$

$$r = \frac{v^2}{3g} \approx 85 \text{ m} \checkmark$$