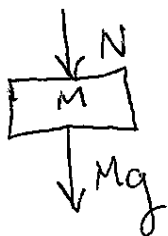


Conceptual Exercise 2 – PY105 – June 5-6, 2007

**Question 1.** [2 pts] You are upside-down on an roller coaster traveling very fast at the top of the loop-the-loop, but instead of having to be held up by your seatbelt, you actually feel pressed against your seat. Why?



Hint: Draw an appropriate free-body diagram and apply Newton's Second Law.



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

Suppose  $v$  is large  
(i.e.  $mg < m v^2 / R$ )

then  $N > 0$ .

If  $mg \ll m v^2 / R$  then

$$N \approx \frac{m v^2}{R}$$

That is, you feel a push from the normal force from your seat.

**Question 2.** [2 pts] The diagram shows two possible shapes for highway exits connecting two high-speed highways. Neither exit has banked turns. Which exit is safer, and why?

$$R_2 > R_1 > R_3$$

Friction causes the centripetal acceleration.

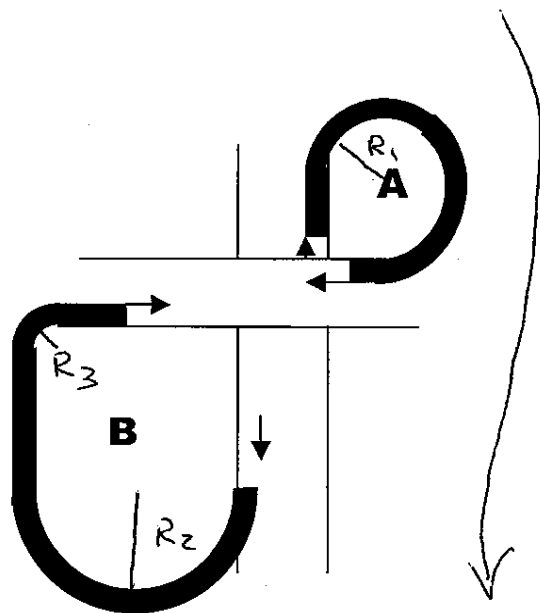
$$F_f^{\max} = \mu F_N = \mu mg$$

If

$v^2 / R > \mu mg$  then you will skid!

Since  $R_3 < R_1$

$$v_{\max}^B < v_{\max}^A \Rightarrow A \text{ is safer!}$$



Think like this, instead of a seat-belt pulling you down, you have the chair pushing up into you!