

HW5-9 Soln)

Let up be positive, and toward the center of the circle be positive. Use NII for the seat plus passenger. The tensions are T_H (horizontal) and T_U (upper). Let's convert omega right away:

$$\omega = \frac{2.4 \text{ rev}}{\text{sec}} \frac{2\pi \text{ rad}}{\text{rev}} = 15.08 \text{ rad/sec}$$

NII

$$c: + T_H + T_U \cos \theta = ma_c = m\omega^2 r$$

$$y: + T_U \sin \theta - gm = ma_y = 0$$

We can find T_U right away:

$$T_U \sin \theta = gm \rightarrow T_U = \frac{gm}{\sin \theta} = \frac{10(120)}{\sin(53)} = 1502 \text{ N}$$

Then,

$$T_H = -T_U \cos \theta + m\omega^2 r = -(1502) \cos(53) + 120(15.08^2)12 = 326,561 \text{ N}$$

This is pretty unrealistic; the centripetal acceleration corresponds to 270 g's. The rider would be crushed.