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:

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

Then,

$$T_{\rm H} = -T_{\rm U}\cos\theta + m\omega^2 r = -(1502)\cos(53) + 120(15.08^2)12 = \frac{326,561}{326,561}$$

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