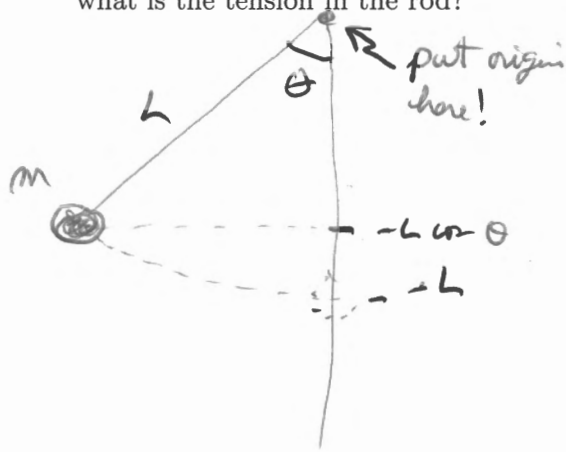


Problem 3: (30 pts.) A pendulum consists of a thin (massless) rod of length 4.0 m, with a ball of mass 7.0 kg attached to the end. The pendulum is pulled up to an angle of 40° away from the vertical and released from rest. At the bottom of the pendulum's swing, what is the tension in the rod?

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At bottom: $\Sigma F = ma$, and

$$a = v^2/L$$

\therefore find v^2 .

Use Energy conservation

$$E_i = E_f$$

$$U_i + K_i = U_f + K_f$$

$$mgy_i + 0 = mgy_f + \frac{1}{2}mv_f^2$$

$$mg(-L\cos\theta) = mg(-L) + \frac{1}{2}mv_f^2$$

$$mgL(1 - \cos\theta) = \frac{1}{2}mv_f^2$$

$$4.283 \text{ m/s} = v_f$$

Then

$$\Sigma F = ma$$

$$T - mg = \frac{mv^2}{L}$$

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

$$\boxed{100.7 \text{ N}}$$