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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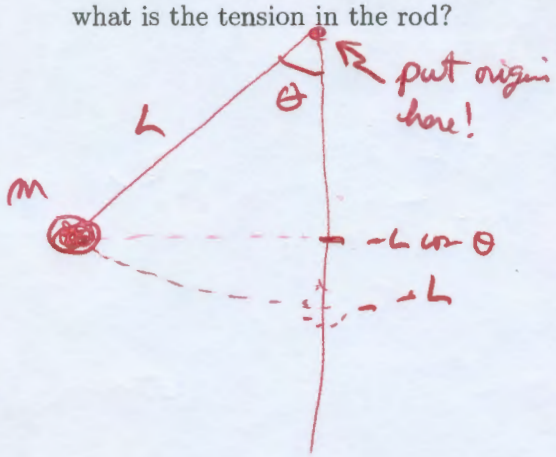


At bottom: $\Sigma F = ma$, and $a = v^2/L$.

∴ find v^2.

Use Energy conservation

$E_i = E_f$

$U_i + K_i = U_f + K_f$

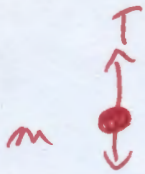
$mgy_i + 0 = mgy_f + \frac{1}{2}mv_f^2$

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

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

$4.283\ m/s = v_f$

Then $\Sigma F = ma$



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

$T = \frac{mv^2}{L} + mg = \boxed{100.7\ N}$