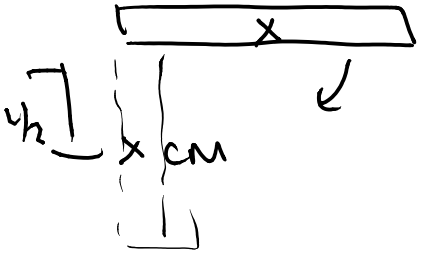
# Rotating Rod Again

Wednesday, April 2, 2014 9:31 AM

A uniform rod of length L and mass M is free to rotate on a frictionless pin passing through one end. The rod is released from rest in the horizontal position.

- What is its angular speed when the rod reaches its lowest position?
- Determine the tangential speed of the center of mass and the tangential speed of the lowest point on the rod when it is in the vertical position.




→ acc not constant

→ can use cons of E

$KE_i + PE_i = KE_f + PE_f$

$0 + mgh = \frac{1}{2} I \omega^2 + 0$

$Mg\frac{L}{2} = \frac{1}{2} I \omega^2$

$\omega^2 = \frac{MgL}{I}$

$\omega = \sqrt{\frac{MgL}{I}} = \sqrt{\frac{MgL}{\frac{1}{3}ML^2}} = \sqrt{\frac{3g}{L}}$

$v_{cm} = r\omega = \frac{L}{2} \cdot \omega = \frac{1}{2}\sqrt{3g/L}$

$= \frac{1}{2}\sqrt{3gL}$

at lowest pt r is twice what it is for CM so lowest point has tangential v down

twice as big

$v = v_{cm} \cdot 2 = \sqrt{3gL}$