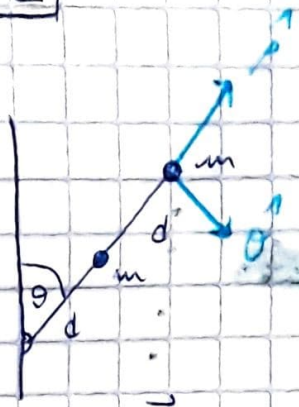
P2

a) Encontrar $\dot{\theta}$

b) Fuerza reacción para $\theta = \pi/2$



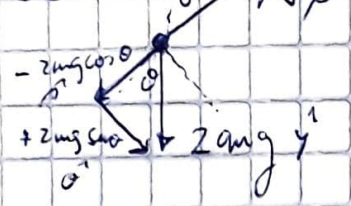
Ocupamos cilíndricos

Calculamos el Centro de Masa

$$\vec{r}_{cm} = \frac{1}{M}\sum_{i=1}^{n} m_i \vec{r}_i = \frac{(md + 2md)\hat{\rho}}{2m} = \frac{3}{2}d\hat{\rho}$$

$$\therefore \vec{V}_{cm} = \frac{3}{2}d\dot{\theta}\hat{\theta} \quad \text{y} \quad \vec{a}_{cm} = \frac{3}{2}d(\ddot{\theta}\hat{\theta} - \dot{\theta}^2\hat{\rho})$$

DCL: $N\hat{\rho}$ (de la rótula)



$$-2mg\sin\theta\,\hat{\theta} + -2mg\cos\theta\,\hat{\rho}$$

Dinámica $\hat{\rho}$:

$$-2m\cdot\frac{3}{2}d\dot{\theta}^2 = N - 2mg\cos\theta$$

$$\Rightarrow N = 2mg\cos\theta - 3md\dot{\theta}^2$$

$\hat{\theta}$:

$$2m\cdot\frac{3}{2}d\ddot{\theta} = +2mg\sin\theta$$

$$3d\ddot{\theta} = +2g\sin\theta \Rightarrow \ddot{\theta} = +\frac{2}{3}\frac{g}{d}\sin\theta$$

$$\ddot{\theta} = \frac{d\dot{\theta}}{dt} = \frac{d\dot{\theta}}{d\theta}\cdot\frac{d\theta}{dt} = \frac{d\dot{\theta}}{d\theta}\cdot\dot{\theta}$$

$$\Rightarrow \frac{d\dot{\theta}}{d\theta}\dot{\theta} = -\frac{2}{3}\frac{g}{d}\sin\theta$$

$$\int_0^{\dot{\theta}} \dot{\theta}\,d\dot{\theta} = +\frac{2}{3}\frac{g}{d}\int_0^{\theta}\sin\theta\,d\theta$$

$$\frac{\dot{\theta}^2}{2} = -\frac{2g}{3d}\cos\theta\Big|_0^{\theta} = -\frac{2g}{3d}[\cos\theta - 1]$$

$$\therefore \boxed{\dot{\theta} = \sqrt{\frac{-4g}{3d}(\cos\theta - 1)}} \Rightarrow N = 2mg\cos\theta + 3md\cdot\frac{4g}{3d}(\cos\theta - 1)$$

$$N = -2mg\cos\theta + 4mg\cos\theta - 4mg$$

$$\theta = \pi/2 \Rightarrow N = -2mg + 4mg - 4mg \Rightarrow \vec{N} = -2mg\,\hat{\rho}$$

→ Actúa como cualquier

$$\therefore \boxed{|N| = 2mg}$$

E1: Tiene velocidades angulares diferentes para c/masa
(-3.0)

E2: No plantea una ecuación para el CM
(-2.0)

E3: Impone que $\omega(0) = 0$ ∴ ∩

(-0.5)

E4: Integra de 0 a π
(-0.5)

E5: Incompleto
(-2.0)

E6: Hace mal el cambio de variable: $\ddot{\theta} = \frac{d\dot{\theta}^2}{d\theta} \cdot \dot{\theta}$
(-1.0)

E7: Plantea 2 Reacciones
(-1.0)

E8 Error dimensional
(-0.5)

E9 Error de cálculo menor.
(-0.5)