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a) $\vec{M}_A = \overline{AP} \wedge \vec{F}$

$= (r\cos\alpha\, \hat{e}_x + r\sin\alpha\, \hat{e}_y) \wedge F\hat{e}_y$

$= r\cos\alpha \cdot F\, \hat{e}_z$

$$\frac{d\vec{L}_A}{dt} = \vec{M}_A$$

$$\vec{L}_A = \vec{r} \wedge m\vec{v}$$

$$\vec{L}_A = I \cdot \vec{\omega}$$

Si $\alpha \in \left[-\frac{\pi}{2} ; \frac{\pi}{2}\right]$, $\frac{d\vec{L}_A}{dt}$ est positif selon $\hat{e}_z$,

donc $\vec{\omega}$ est selon $\hat{e}_z$

donc la rotation est antihoraire

Si $\alpha \in [\frac{\pi}{2}, \frac{3\pi}{2}]$, $\frac{d\vec{L_A}}{dt}$ est négatif selon $\hat{e_z}$, donc $\vec{\omega}$ est selon $-\hat{e_z}$ donc la rotat° est horaire.

(b) L'accélérat° angulaire est proportionnelle au moment de force.

$$\vec{L} = I\,\vec{\omega}$$

$$\frac{d\vec{L}}{dt} = I \cdot \dot{\alpha}$$

$$\vec{M} = I \cdot \dot{\alpha}$$

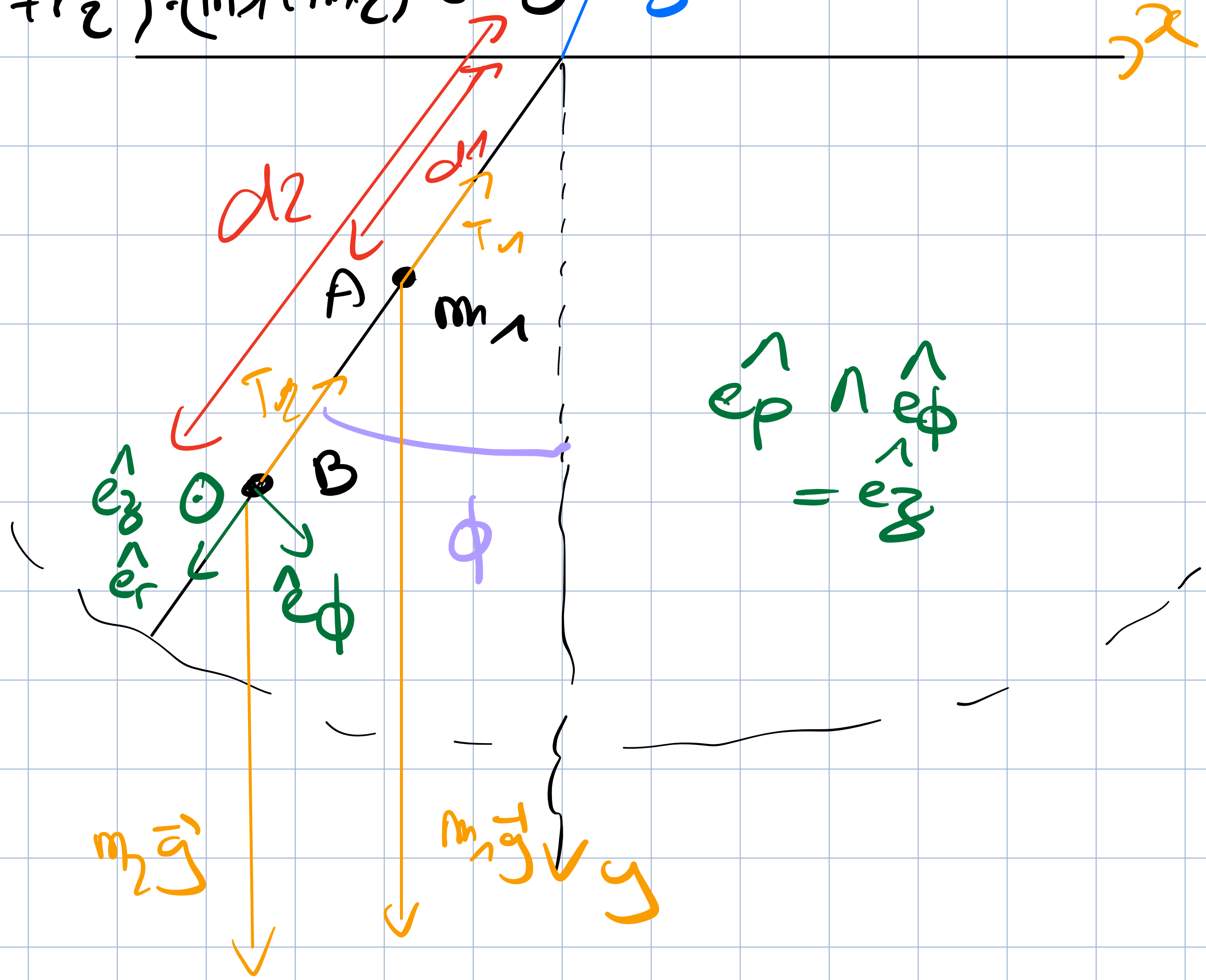
$$\dot{\vec{L}}_A = \vec{M}_A$$

$$= r\cos\alpha \cdot F\,\hat{e_z}$$

F fixé $\Rightarrow$ $\cos\alpha$ max quand $\alpha = 0$ ou $\alpha = \pi$.

c $\quad \alpha = \frac{\pi}{2}$ or $\alpha = -\frac{\pi}{2}$

② $(r_1+r_2)\cdot(m_1+m_2)\cdot \sin(-)$




$$\vec{M}_O(\vec{S}) = \vec{OO} \wedge \vec{S} = \vec{0}.$$

$$\vec{M}_O(m_1\vec{g}) = \vec{OA} \wedge m_1\vec{g}$$

$$= -\,OA \cdot m_1 g \cdot \sin\phi \cdot \hat{e}_z$$

$$\vec{M}_O(m_2\vec{g}) = \vec{OB} \wedge m_2\vec{g}$$

$$= OB \cdot m_2 g \cdot \sin\phi \cdot \hat{e}_z$$

$$\vec{M}_0(\vec{T}_1) = \vec{OA} \wedge \vec{T} = 0$$

$$\vec{M}_0(\vec{T}_2) = \vec{OB} \wedge \vec{T} = 0$$

$$\vec{L_0} = \vec{L}_{0,m_1} + \vec{L}_{0,m_2}$$

$$= \vec{OA} \wedge m_1 \vec{v}_1 + \vec{OB} \wedge m_2 \vec{v_2}$$

$$= d_1 m_1 \dot{\phi} d_1 \hat{e_z} + d_2 m_2 d_2 \dot{\phi} \hat{e_z}$$

$$= (d_1{}^2 m_1 + d_2{}^2 m_2) \dot{\phi} \hat{e_z}$$

$$\frac{d\vec{L_0}}{dt} = \vec{M_0}$$

$$= (d_1{}^2 m_1 + d_2{}^2 m_2) \ddot{\phi} \hat{e_z}$$

$$\left(d_1^2 m_1 + d_2^2 m_2\right)\ddot{\phi} =$$

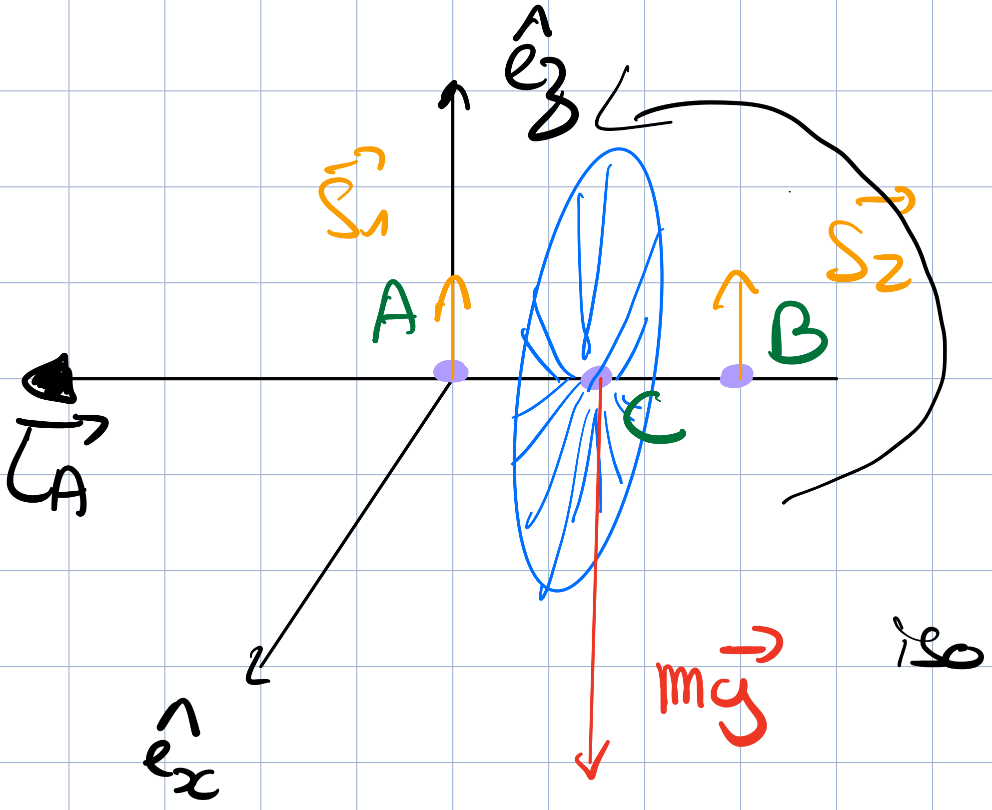
$$- d_1 \cdot m_1 g \cdot \sin\phi - d_2 m_2 g \sin\phi$$

$$\Leftrightarrow \left(d_1^2 m_1 + d_2^2 m_2\right)\ddot{\phi}$$

$$= -\left(d_1 \cdot m_1 + d_2 m_2\right) g \sin\phi$$

$$\Leftrightarrow \ddot{\phi} + \underbrace{\frac{\left(d_1^2 m_1 + d_2^2 m_2\right)}{\left(d_1 m_1 + d_2 m_2\right)}}_{\omega_0^2} g \sin\phi = 0$$

③




$$\frac{d\vec{L_A}}{dt} = \vec{M_A}$$

$$\vec{M_A}(\vec{S_1}) = \vec{AA} \wedge \vec{S_1} = \vec{0}$$

$$\vec{M_A}(m\vec{g}) = \vec{AC} \wedge m\vec{g} = -AC \cdot mg \cdot \hat{e}_x$$

$$\vec{M_A}(\vec{S_2}) = AB \wedge \vec{S_2} = AB \cdot N \cdot \hat{e}_x$$

$$\left(AB \cdot N - AC \cdot mg\right) \cdot \hat{e}_x = 0$$

$$\frac{d\vec{L_A}}{dt} = - AC \cdot mg \cdot \hat{e}_x$$

elle va tourner autour de l'origine