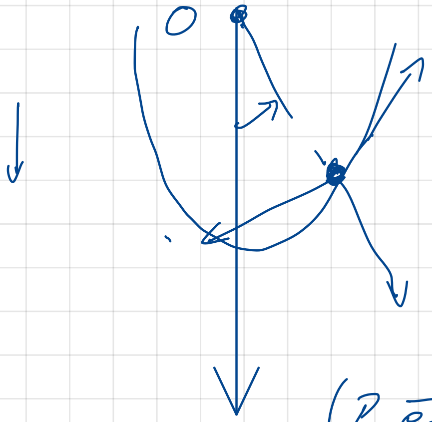
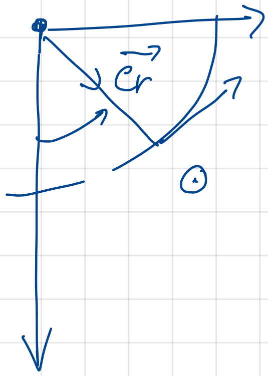
Glissière hémisphérique

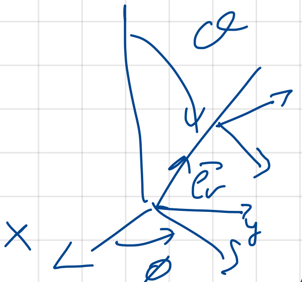
Lagrange I

γ

Ph. Müllhaupt.







Contrainte

$\phi(t) =$

avec $\omega =$

$\omega =$ $[rad/s]$.

$(P, \vec{e_r}, \vec{e_\theta}, \vec{e_\phi})$

Vitesse du point P:

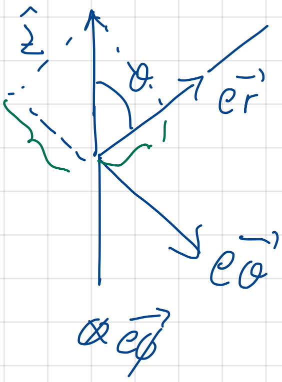
$\vec{OP} = \qquad \vec{e_r}$

$\dot{\vec{OP}} = \qquad \vec{e_r}' +$

$= \qquad + \qquad \wedge \vec{e_r}$

$\vec{\omega}$ du repère: $\vec{\omega} = \omega \hat{z} + \dot{\theta} \vec{e_\phi}$

$= \omega \cos\theta \, \vec{e_r} - \omega \sin\theta \, \vec{e_\theta} + \dot{\theta} \vec{e_\phi}$



$\hat{z} = \boxed{\qquad \vec{e_r} \qquad \vec{e_\theta}}$ (par projections)

$\vec{\omega} \wedge \vec{e_r} =$

$= \qquad \vec{e_\phi} \qquad \vec{e_\theta}$

$\boxed{\dot{\vec{OP}} = \qquad}$

On aurait pu poser directement $\dot{\phi} = \omega$ dans les coordonnées sphériques.

Énergie cinétique

$T = \frac{1}{2} \qquad = \frac{1}{2} \cdot \qquad =$

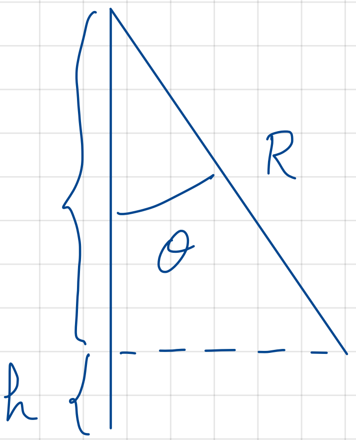
$\frac{1}{2} m \left(\qquad \right)$

contrainte $r = R \implies \dot{r} = 0$

$T = \frac{1}{2} m \left(R^2 \omega^2 \sin^2\theta + R^2 \dot{\theta}^2 \right)$

Energie potentielle: $mgh = mg$

$= mg \quad - mg$



$h =$

$L = T - V = \frac{1}{2} m (\qquad)$

$- \qquad +$

1 coordonnée généralisée θ

$\frac{d}{dt}(\qquad) - \qquad = 0$

$=$

$=$

(Remarque c'est un moment cinétique
mom. Inertie × vit. angulaire)

$\frac{d}{dt}(\qquad) =$

$\longrightarrow$ dynamique

$= 0$

$\boxed{\qquad}$

interprétation points d'équilibre : $\ddot{\theta} = 0 \quad \dot{\theta} = 0$

$$\boxed{\cos\theta = \frac{g}{K\omega^2}}$$