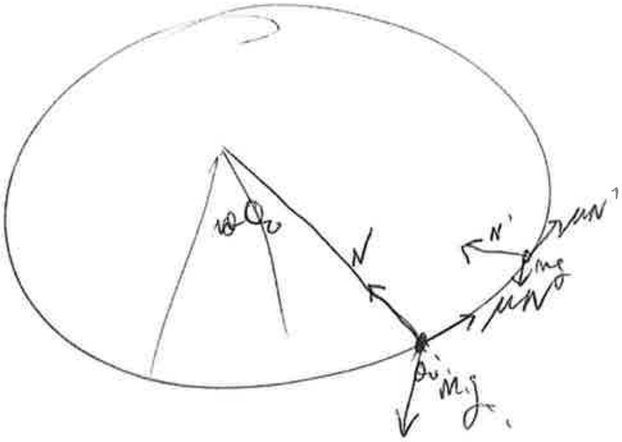
M12m3



equilibrium θ_0

SH motion ω.

at θ_0, forces balance

$e^{ix} e^{-iy}$ $\sin(x-y)$

$- \cos x \sin y + \sin x \cos y$

$N = mg \cos\theta_0$

$\mu N = mg \sin\theta_0$

$\mu = mg \tan\theta_0 \rightarrow \tan\theta_0 = \frac{\mu}{mg}$. determines N too.

~~$N_2 = mg\cos(\theta + d\theta)$~~

~~μN_2~~

at $\theta \neq \theta_0$, $\theta > \theta_0$ wlog,

$\mu N - mg\sin\theta = \vec{F} = mr\ddot{\theta}$

$mg(\sin\theta_0 - \sin\theta) = mr\ddot{\theta}$

$\sin(\theta_0 - \theta + \theta)$

$\sin(\theta_0 - \theta)\cos\theta + \sin\theta\cos(\theta_0 - \theta)$ (small)

$(\theta_0 - \theta)\cos\theta = \frac{r\ddot{\theta}}{g}$

$\sin((\theta - \theta_0) + \theta_0)$

$(\theta_0 - \theta)\cos\theta_0 = \frac{r}{g}\ddot{\theta}$

$\sin\theta = \sin(\theta - \theta_0)\cos\theta_0 + \sin\theta_0\cos(\theta - \theta_0)$

$\simeq (\theta - \theta_0)\cos\theta_0 + \sin\theta_0$

~~$\frac{r}{g\cos\theta_0}\ddot{\theta} + \theta$~~

$\cos((\theta - \theta_0) + \theta_0)$

$\ddot{\theta} + \frac{g\cos\theta_0}{r}\theta = \theta_0\cos\theta_0$

$\cos(\theta - \theta_0)\cos\theta_0 - \sin(\theta - \theta_0)\sin\theta_0$

$\cos\theta_0 - (\theta - \theta_0)\sin\theta_0$

$W^2 = \frac{g\cos\theta_0}{r}$

where $\tan\theta_0 = \frac{\mu}{mg}$

$= \frac{g\, mg}{r\sqrt{(mg)^2 + \mu^2}}$