No. Date

[8] $\vec{r} = a\cos\theta + \sqrt{L^2 - a^2\sin^2\theta}$

$= a\cos\theta + L\sqrt{1-(\frac{a}{L}\sin\theta)^2}$

$\fallingdotseq a\cos\theta + L(1 - \frac{a^2}{2L^2}\sin^2\theta)$

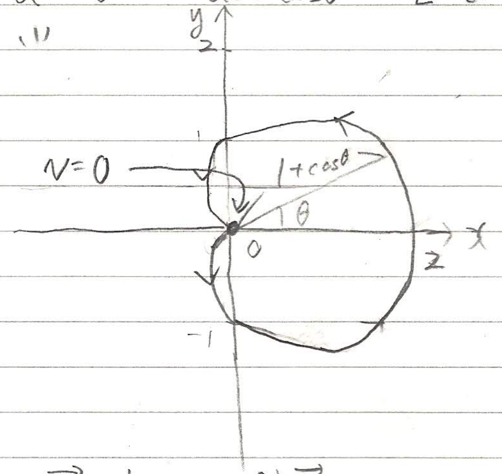
$= a\cos\theta + L - \frac{a^2}{2L}\sin^2\theta$

$\vec{v} = \dot{\vec{r}} = -a\omega\sin\theta - \frac{a^2\omega}{2L}\cdot 2\sin\theta\cos\theta$

$= -a\omega\sin\theta - \frac{a^2\omega}{2L}\sin 2\theta$

$\vec{a} = \dot{\vec{v}} = -a\omega^2\cos\theta - \frac{a^2\omega^2}{L}\cos 2\theta$

[9] (1)



(2) $\vec{r} = (1+\cos\theta)\vec{e_r}$

$\vec{v} = \dot{\vec{r}} = -\omega\sin\theta\,\vec{e_r} + (1+\cos\theta)\omega\,\vec{e_\theta}$

$\sin\theta = 0$ かつ $\cos\theta = -1$

$\theta = (2n+1)\pi \; (n = 0, 1, 2, 3 \cdots)$

(3) $\vec{a} = \dot{\vec{v}} = -\omega^2\cos\theta\,\vec{e_r} - \omega^2\sin\theta\,\vec{e_\theta} - \omega^2\sin\theta\,\vec{e_\theta} - \omega^2(1+\cos\theta)\vec{e_r}$

$= -\omega^2(2\cos\theta + 1)\vec{e_r} - 2\omega^2\sin\theta\,\vec{e_\theta}$ $\sin\theta = \frac{\sqrt{3}}{2}$

y座標は $y = (1+\cos\theta)\sin\theta$ $\cos\theta = \frac{1}{2}$

$\frac{dy}{d\theta} = -\sin\theta + (1+\cos\theta)\cos\theta$

$= \cos^2\theta - 1 + \cos\theta + \cos^2\theta$

$= 2\cos^2\theta + \cos\theta - 1$ $\sin\theta = -\frac{\sqrt{3}}{2}$ $\cos\theta = \frac{1}{2}$

$= (2\cos\theta - 1)(\cos\theta + 1)$

$\frac{dy}{d\theta} = 0$ とすると $\cos\theta = \frac{1}{2}, -1$ $(n = 0, 1, 2, \cdots)$

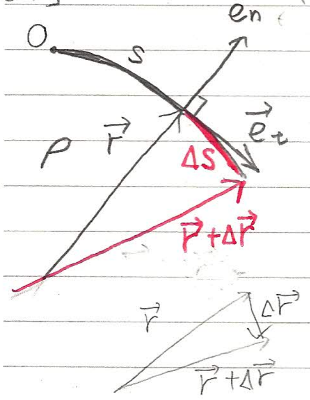
θ	$2n\pi$	$\cdots$	$\frac{\pi}{3}+2n\pi$	$\cdots$	$(2n+1)\pi$	$\cdots$	$\frac{5}{3}\pi+2n\pi$	$\cdots$	$(2n+1)\pi$
$\frac{dy}{d\theta}$		+	0	−	0	−	0	+	
y	0	↗	$\frac{3\sqrt{3}}{4}$	↘	0	↘	$-\frac{3\sqrt{3}}{4}$	↗	0

よって最も離れるときのθは $\frac{\pi}{3} + 2n\pi$, $\frac{5}{3}\pi + 2n\pi$ $(n = 0, 1, 2 \cdots)$

$\theta = \frac{\pi}{3} + 2n\pi$ のとき $\vec{a} = -2\omega^2\vec{e_r} - \sqrt{3}\omega^2\vec{e_\theta}$

$\theta = \frac{5}{3}\pi + 2n\pi$ のとき $\vec{a} = -2\omega^2\vec{e_r} + \sqrt{3}\omega^2\vec{e_\theta}$

[7]



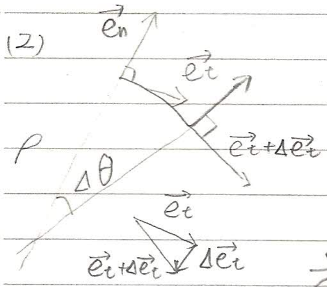
(1) $\vec{v}=\dot{\vec{r}}=\frac{d\vec{r}}{ds}\frac{ds}{dt}$

ここで $\frac{d\vec{r}}{ds}=\lim_{\Delta s\to 0}\frac{\Delta\vec{r}}{\Delta s}=\vec{e}_t$

$\therefore\ \vec{v}=v\vec{e}_t$

$v=\frac{ds}{dt}=\dot{s}$

(2)



$\Delta\vec{e}_t \fallingdotseq |\vec{e}_t|\sin\Delta\theta(-\vec{e}_n)$

$\fallingdotseq -\Delta\theta\,\vec{e}_n$

一方 $\Delta\theta$は動径ρがΔt時間に移動する角度であるから

$\rho\Delta\theta=\Delta s$

$\dot{\vec{e}}_t=\lim_{\Delta t\to 0}\frac{\Delta\vec{e}_t}{\Delta t}=\lim_{\Delta t\to 0}-\frac{\Delta\theta}{\Delta t}\vec{e}_n$

$=\lim_{\Delta t\to 0}\left(-\frac{\Delta s}{\rho\Delta t}\right)\vec{e}_n$

$=-\frac{v}{\rho}\vec{e}_n$

(3) $\vec{\alpha}=\dot{\vec{v}}=\dot{v}\vec{e}_t+v\dot{\vec{e}}_t$

$=\dot{v}\vec{e}_t-\frac{v^2}{\rho}\vec{e}_n$