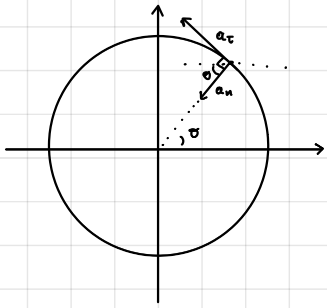
ESERCITAZIONE

ES. 1

$s(t) = 2t^2 + 3t + 3$ $\qquad a_n$? $\quad a_\tau$?

$\vec{a} = \frac{dv}{dt}\hat{u}_\tau + \frac{v^2}{R}\hat{u}_N$ $\qquad a_\tau = \frac{d^2 s(t)}{dt^2} = 4\ m/s^2$

$a_n = \frac{(4t^2+3)^2}{R} =$



$$\begin{cases} a_{nx} = -a_n \cos\vartheta \\ a_{ny} = \ominus a_n \sin\vartheta \end{cases} \qquad \begin{cases} a_{\tau x} = -a_\tau \sin\vartheta \\ a_{\tau y} = +a_\tau \cos\vartheta \end{cases}$$

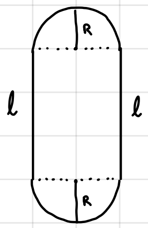
non è orientato nella stessa direzione dell'asse

$\Downarrow$

$$\begin{cases} a_x = -\frac{(4t+3)^2}{R}\cos\vartheta - 4\sin\vartheta \\ a_y = -\frac{(4t+3)^2}{R}\sin\vartheta + 4\cos\vartheta \end{cases}$$

ES. 2

$L = 400\ m \qquad \ell = 120\ m \qquad T = 71\ s \qquad d = 1\ Km = 10^3\ m$



$L = 2\pi R + 2\ell \quad \to \quad R = \frac{L - 2\ell}{2\pi}$

$v = \frac{d}{T} \cong 14{,}1\ m/s$

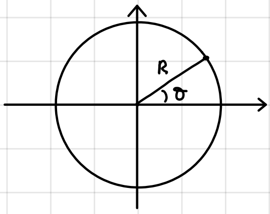
$a_\tau = \frac{dv}{dt} = 0 \quad ; \quad a_n = \frac{v^2}{R} = \frac{(14{,}1)^2}{L - 2\ell} \cdot 2\pi = 7{,}81\ m/s$

$w = \frac{V}{R} = \ldots = 0{,}55\ rad/s$

ES. 3

R, α const $\qquad \vec{v}_i$? $\quad \vec{v}_F$?

$\qquad \vec{a}_i$? $\quad \vec{a}_F$?



$w(t) = \int_0^t \alpha\, dt = \alpha t \qquad \vartheta(t) = \int_0^t w(t)\,dt = \frac{1}{2}\alpha t^2 \quad \to \quad 2\pi = \frac{1}{2}\alpha T^2 \to T = \sqrt{\frac{4\pi}{\alpha}}$

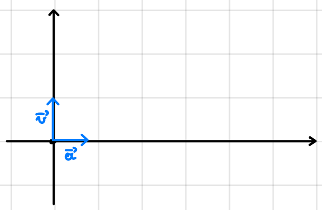
$v(t) = wR = \alpha R t \quad \to \quad \vec{v}_i = \vec{0}, \quad \vec{v}_F = \alpha R T \cdot \hat{u}_\tau = \sqrt{4\pi\alpha} \cdot \hat{u}_T$

$\vec{a}(t) = \frac{dv(t)}{dt}\hat{u}_T + \frac{v^2}{R}\hat{u}_N = \alpha R\,\hat{u}_\tau + \frac{\alpha^2 R^{\cancel{2}} t^2}{\cancel{R}}\hat{u}_N \quad \to \quad \vec{a}_i = \alpha R\,\hat{u}_\tau \qquad a_F = \alpha R\,\hat{u}_\tau + \frac{4\pi}{\cancel{\alpha}} \cdot \alpha^{\cancel{2}} R \cdot \hat{u}_N = \alpha R\,\hat{u}_\tau + 4\pi\alpha R\,\hat{u}_N$

ES. 4

$A = 10\ m/s^2 \qquad B = 15\ m/s$

$\vec{a}(0) = A\,\hat{u}_x \qquad r(0) = \vec{0} \qquad v(0) = B\,\hat{u}_y$



$$\begin{cases} x(t) = \frac{1}{2}At^2 \\ y(t) = Bt \end{cases}$$

$\vec{r}(t) = \frac{1}{2}At^2\,\hat{u}_x + Bt\,\hat{u}_y$

$\vec{v}(t) = \frac{d\vec{r}(t)}{dt} = At\,\hat{u}_x + B\,\hat{u}_y \quad \to \quad |v(t)| = \sqrt{A^2t^2 + B^2}$

$\vec{a}(t) = \frac{d|v(t)|}{dt}\hat{u}_T + \frac{|v(t)|}{\rho}\hat{u}_N$

$\vec{a}_t = \frac{1}{2}\frac{1}{\sqrt{A^2t^2 + B^2}} \cdot 2A^2 t \quad \to \quad a_t(2) = 8\ m/s$

$\vec{a}_n = \frac{|v(t)|}{\rho} = \vec{a}(t) - \vec{a}_\tau \quad \to \quad a_n(2) = \sqrt{a^2(2) + a_\tau^2(2)} = \sqrt{10^2 + 8^2} = 6\ m/s^2$