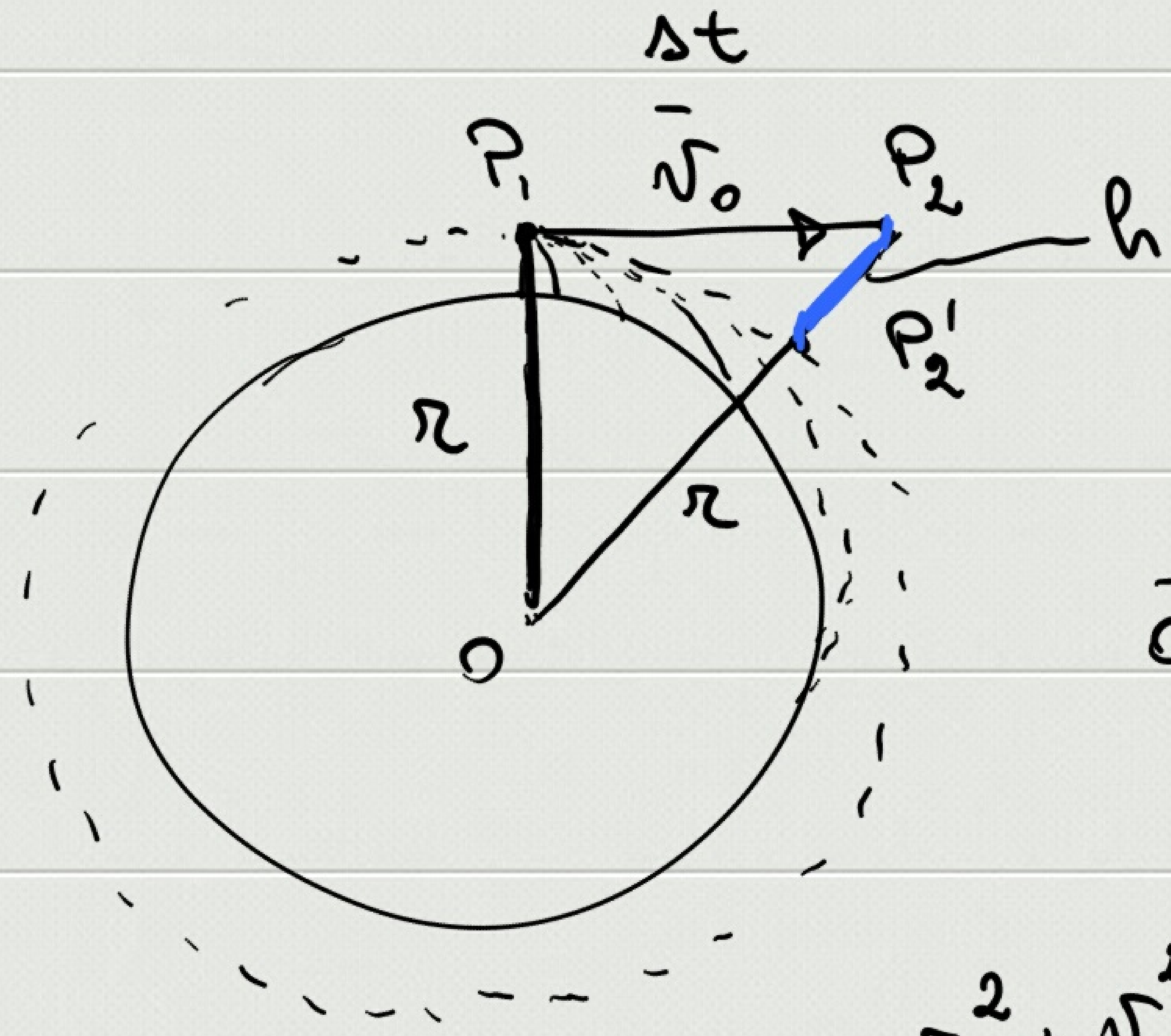


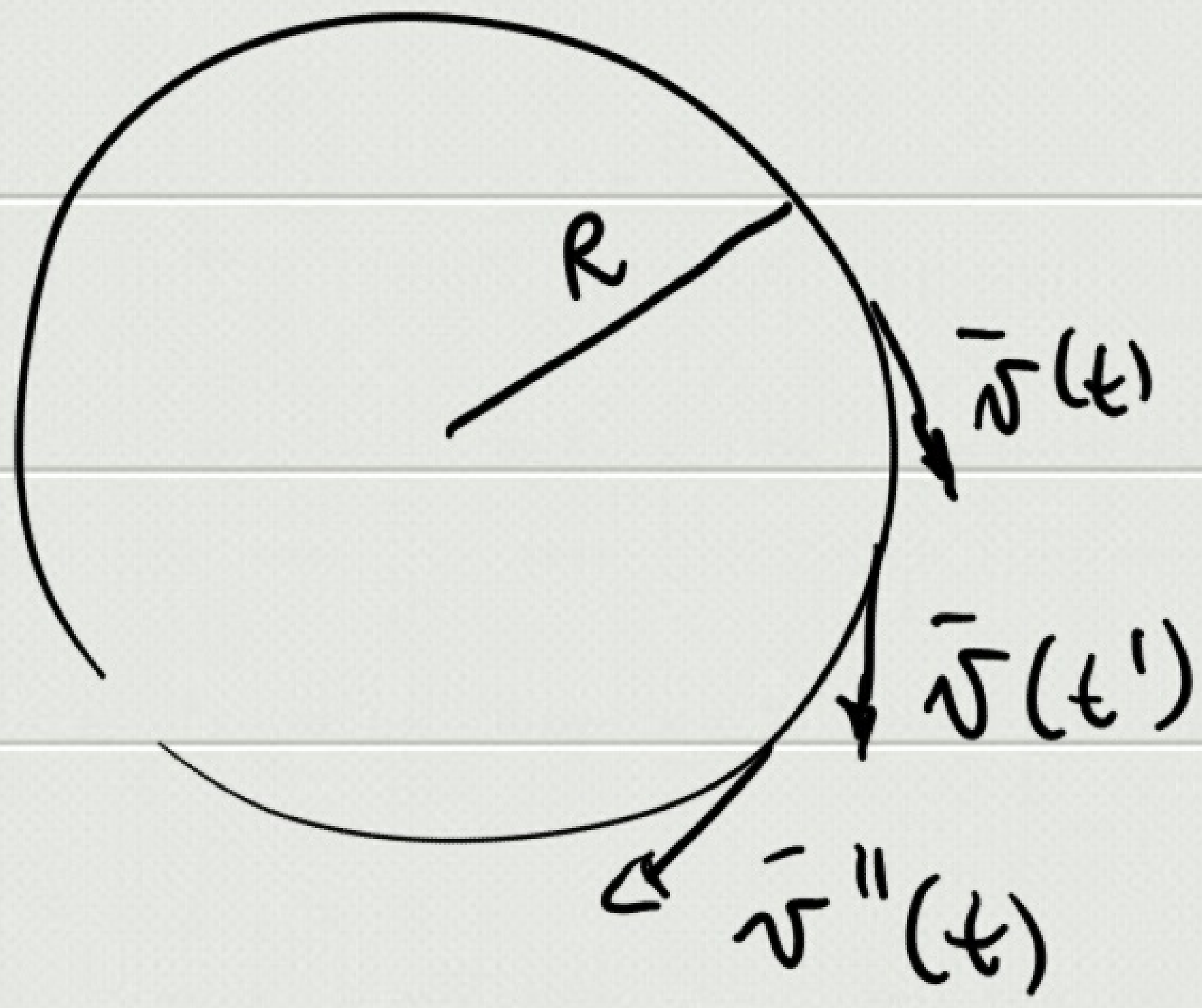
$$\overline{OP_1}^2 + \overline{P_1P_2}^2 = OP_2^2$$

$$r^2 + v_0^2 \Delta t^2 = (r+h)^2$$

$$\cancel{r^2} + v_0^2 \Delta t^2 = \cancel{r^2} + h^2 + 2rh$$

$$h(h+2r) = v_0^2 \Delta t^2 \qquad h \ll r \Rightarrow h + 2r \simeq 2r$$

$$\boxed{h = \frac{1}{2}\left(\frac{v_0^2}{r}\right)\Delta t^2} \qquad a = \frac{v_0^2}{r} = a_N$$



$\bar{v} \neq cost$

$\frac{d\bar{v}}{dt} \neq 0 \Rightarrow \boxed{\bar{a} \neq 0}$

$\bar{a} = \bar{a}_T + \bar{a}_N$

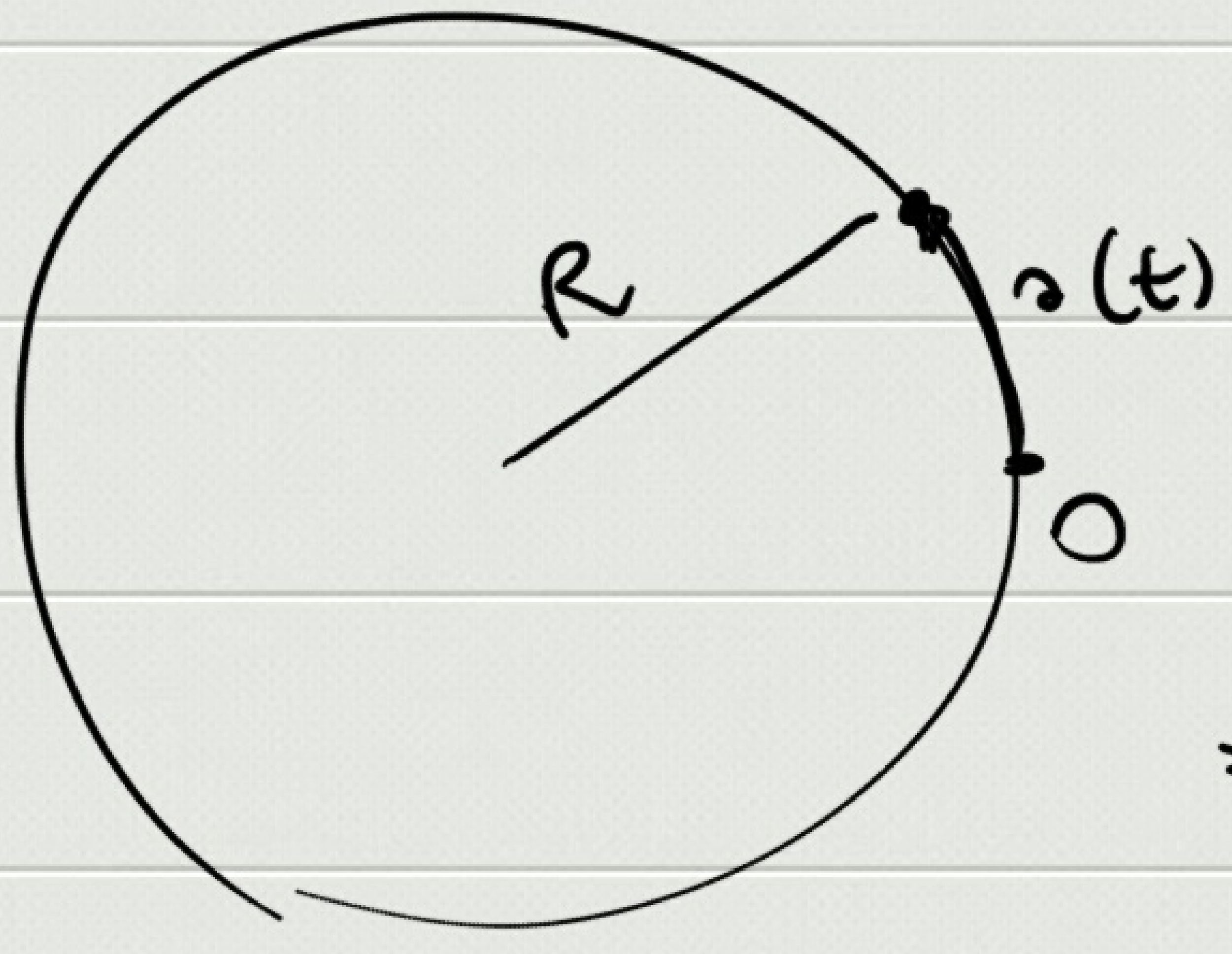
$\bar{a}_T = \frac{dv}{dt}\bar{u}_T \qquad \bar{a}_N = \frac{v^2}{r}\bar{u}_N$

Moto circolare : $r = R = cost$

Moto circolare uniforme : $v = |\bar{v}| = cost$

$\Rightarrow \bar{a}_T = 0$

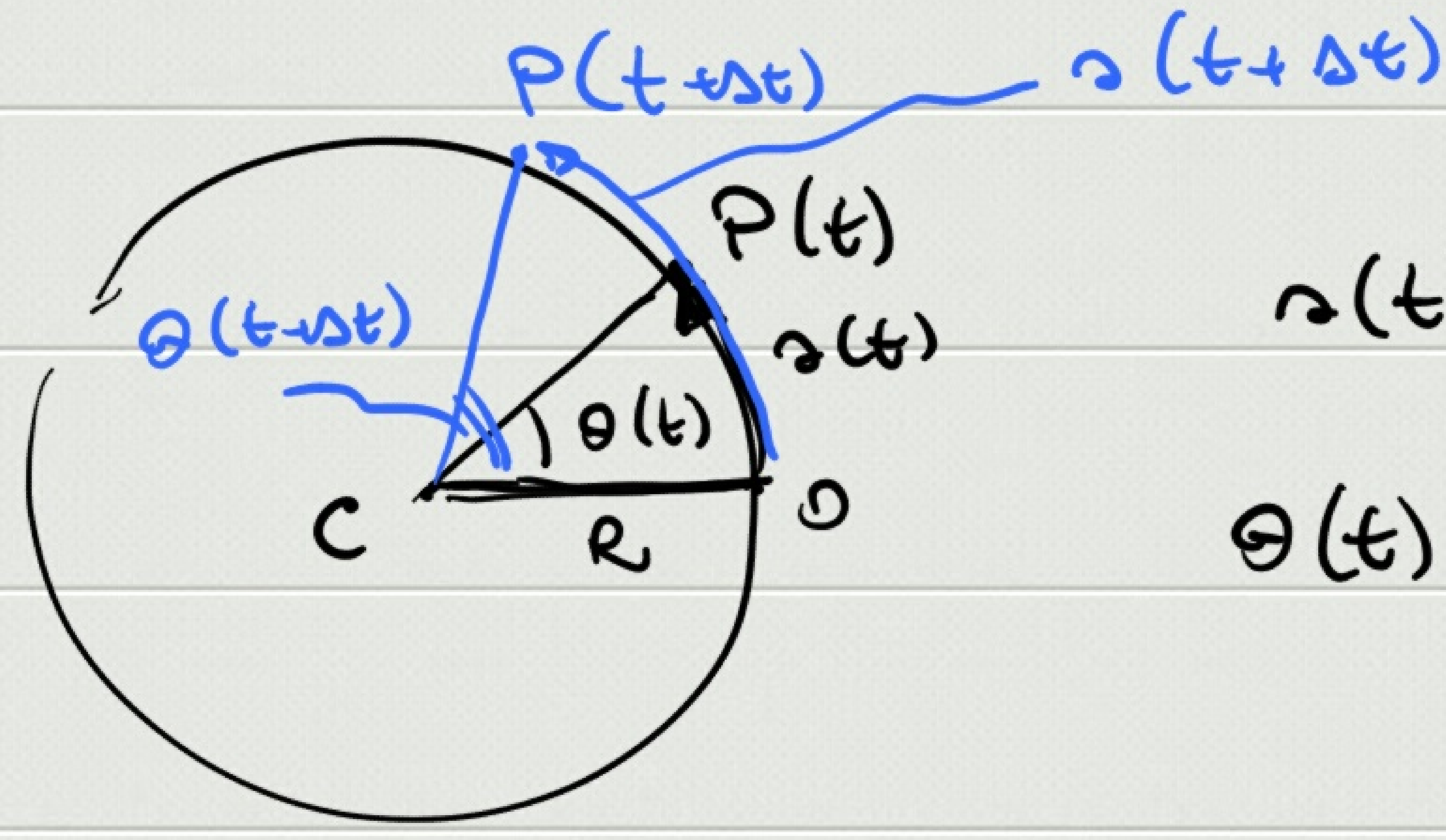
$\Rightarrow \bar{a} = \bar{a}_N = \bar{a}_N(t)$



$v = \frac{ds}{dt} = cost$

$\Rightarrow \int_{s_0}^{s(t)} ds = \int_0^t v\,dt \qquad s_0 = s(t=0)$

$\Rightarrow \boxed{s(t) = s_0 + v\,t}$



$$s(t) = R\,\theta(t)$$

$$\theta(t) = \frac{s(t)}{R}$$

$$\lim_{\Delta t \to 0} \frac{\theta(t+\Delta t) - \theta(t)}{\Delta t} = \lim_{\Delta t \to 0} \frac{\Delta\theta}{\Delta t} = \frac{d\theta}{dt} = \omega(t)$$

$\omega(t) \to$ velocità angolare

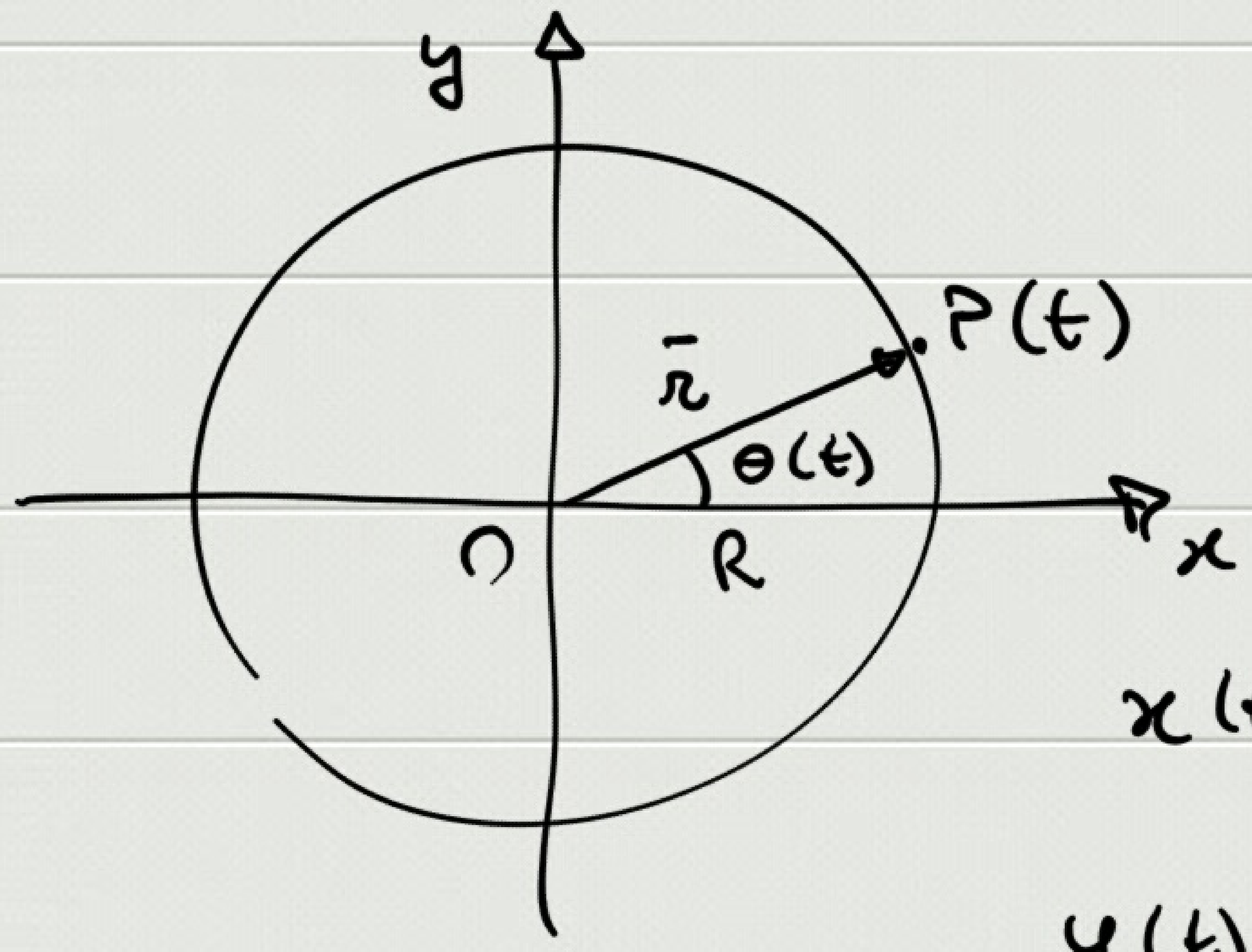
$$\omega(t) = \frac{d}{dt}\left(\frac{s(\theta)}{R}\right) = \frac{1}{R}\frac{ds}{dt} = \frac{v(t)}{R}$$

$$\boxed{\omega(t) = \frac{v(t)}{R}} \underset{v=\text{cost}}{\overset{\text{m.c. unif}}{\Longrightarrow}} \boxed{\omega = \frac{v}{R} = \text{cost}}$$

$$[\omega] = \text{rad}/s$$

$$\omega = \frac{d\theta}{dt} \Rightarrow \int_{\theta_0}^{\theta(t)} d\theta = \int_0^t \omega\, dt \Rightarrow \boxed{\theta(t) = \theta_0 + \omega t}$$

$$\bar{a}_N \neq 0 \qquad \boxed{a_N = |\bar{a}_N| = \frac{v^2}{R} = \omega^2 R = \text{cost}}$$



$$|\bar{r}| = R$$

$$\bar{r}(t) = x(t)\,\bar{u}_x + y(t)\,\bar{u}_y$$

$$t_0 = 0$$

$$x(t) = R\cos\theta(t) \overset{!}{=} R\cos[\theta_0 + \omega t]$$

$$y(t) = R\sin\theta(t) = R\sin[\theta_0 + \omega t]$$

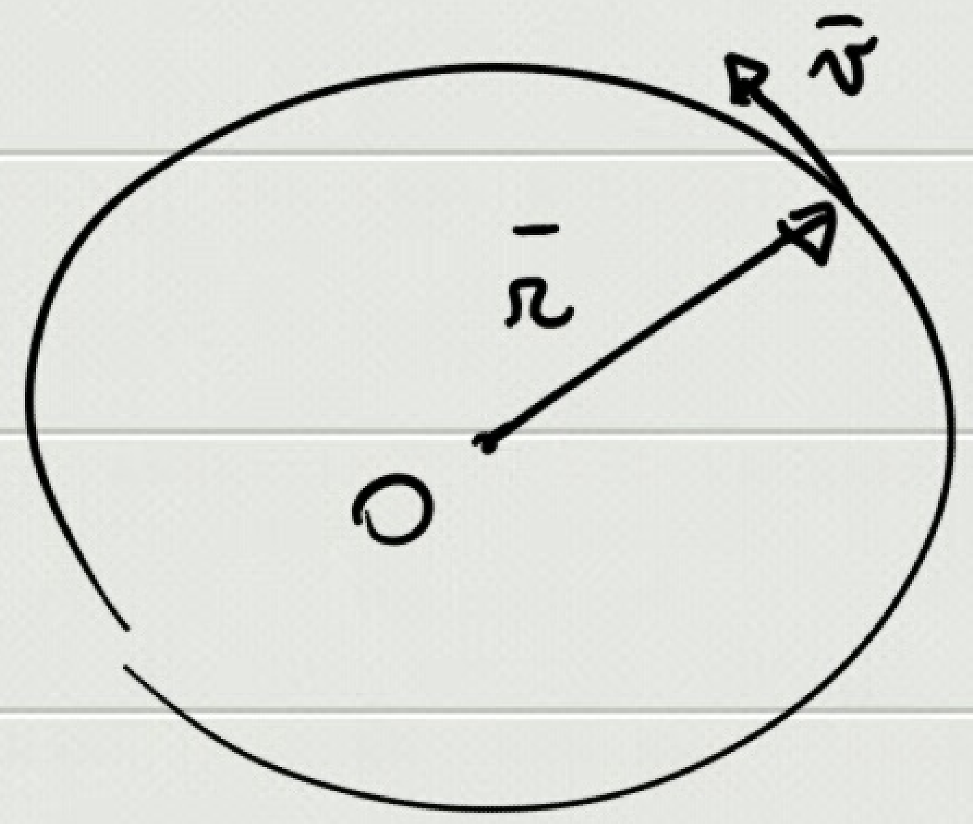
$$\bar{v} = \frac{d\bar{r}}{dt} = v_x(t)\,\bar{u}_x + v_y(t)\,\bar{u}_y$$

$$v_x(t) = \frac{dx}{dt} = -R\omega\sin(\theta_0 + \omega t)$$

$$v_y(t) = \frac{dy}{dt} = R\omega\cos(\theta_0 + \omega t)$$

$$v = |\bar{v}| = \sqrt{v_x^2 + v_y^2} = \omega R$$

$$T = \frac{2\pi}{\omega} = \frac{2\pi R}{v}$$



$$\bar{v} = \frac{d\bar{r}}{dt} = \frac{d}{dt}(r\,\bar{u}_r) =$$

$$= \frac{dr}{dt}\bar{u}_r + r\frac{d\theta}{dt}\bar{u}_\theta = \bar{v}_r + \bar{v}_\theta$$

$$\bar{r} = R\,\bar{u}_r \Rightarrow \frac{dr}{dt} = 0 \Rightarrow \bar{v}_r = 0$$

$$\left.\begin{aligned} v_\theta = r\frac{d\theta}{dt} &= R\omega \\ &\overset{!}{=} \frac{d}{dt}(R\theta) = \frac{ds}{dt} \end{aligned}\right\} v$$