14.18

$\bar{\omega} = \frac{\Delta\theta}{\Delta t}$ (14.1) $\qquad \bar{\omega} = \frac{1}{2}(\omega_i + \omega_f)$ (14.8) ; $\qquad \bar{\alpha} = \frac{\Delta\omega}{\Delta t}$ (14.3)

$\Downarrow$

$\omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta$ (14.10)

démonstration :

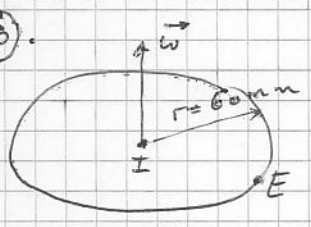
À partir de (14.1) : $\bar{\omega} = \frac{\Delta\theta}{\Delta t} = \frac{1}{2}(\omega_i + \omega_f) \overset{(14.13)}{=} \frac{\Delta\theta}{\Delta\omega}\bar{\alpha} = \frac{\Delta\theta}{\omega_f - \omega_i}\alpha$

$\Rightarrow \frac{1}{2}(\omega_i + \omega_f)(\omega_f - \omega_i) = \Delta\theta$

$\Rightarrow \frac{1}{2}(\omega_f^2 - \omega_i^2) = \Delta\theta$

$\Rightarrow \omega_f^2 - \omega_i^2 = 2\Delta\theta\alpha$ #

14.23.



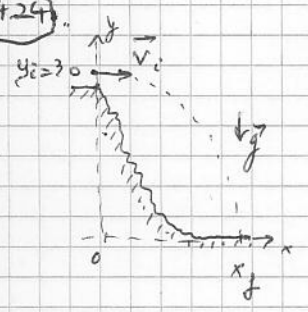
a). En position E, $v_t = \omega_E r_E = 60.10^{-3}.7\pi \simeq \underline{1,32\ m/s}$

$\omega_E = 3,5\ t/s \cdot 2\pi = 7\pi\ \frac{rad}{s}$

b). En position I, $\omega_I = \frac{v_t}{r_I} \simeq \underline{52,8\ \frac{rad}{s}}$

$r_I = 25.10^{-3}$

14.24.



$x_f = 30\ r$

$v_i = \omega r$

Mouvement balistique :

- $\Delta y = y_f - y_i = -4,9t^2 = -20$

$\Rightarrow t = \sqrt{\frac{20}{4,9}}$, temps de vol

- $\Delta x = x_f = v_i . t = \omega r \sqrt{\frac{20}{4,9}} = 30\ r$

$\Rightarrow \omega = 30 . \sqrt{\frac{4,9}{20}} \simeq \underline{14,8\ \frac{rad}{s}}$

14.25

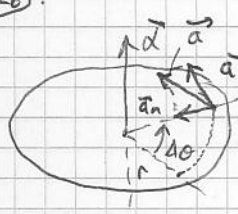
$\omega = 30\ \frac{tours}{min} = 30 . \frac{2\pi}{60s} = \pi\ \frac{rad}{s}$

- le rayon r du cercle est $r = \ell \sin\beta$
- en $t = 1s$, $\Delta\theta = \omega t = \pi$

$\Rightarrow \Delta\theta = \frac{\ell}{r} = \frac{\ell}{\ell \sin\beta} = \frac{1}{\sin\beta} = \pi$

$\Rightarrow \sin\beta = \frac{1}{\pi} \Rightarrow \beta = \arcsin\left(\frac{1}{\pi}\right) \simeq \underline{18,6°}$

14.26.



$a_n = \omega^2 r = 4r$

$a_t = \alpha r = 4r$

$\Rightarrow a = g = \sqrt{a_n^2 + a_t^2} = \sqrt{16r^2 + 16r^2} = \sqrt{32r^2} = r\sqrt{16.2} = 4r\sqrt{2}$

$\Rightarrow r = \frac{9,8}{4\sqrt{2}} \simeq \underline{1,73\ m}$

$\omega = \alpha\Delta t = 4.0,5 = 2\ \frac{rad}{s}$

$\alpha = 4\ \frac{rad}{s^2}$