$K_{rot} = \frac{1}{2} I w^2 + \frac{1}{2} m v^2$

$w = \frac{\Delta \theta}{\Delta t}$ (rad/s)

$\alpha = \frac{\Delta w}{\Delta t}$

$v_t = r w$

$a_t = r \alpha$

.40 Earth radius 6.38×10^6 m , 23.9 h

(a) tagential speed of a people in Ecuador

$v_t = rw = R_E \left(\frac{2\pi}{23.9h}\right) = 46.6$ m/s

(b) At what attitude is the tangential speed 1/3 that of someone living in Ecuador?

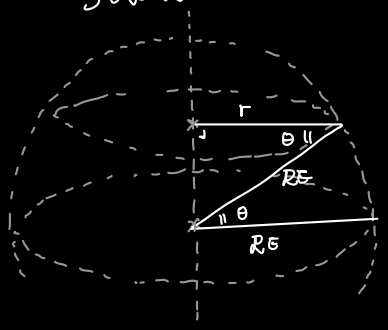
$v_t = \frac{1}{3} R_E w$, $rw = \frac{1}{3} R_E w$

$r = R_E \cdot \cos\theta$

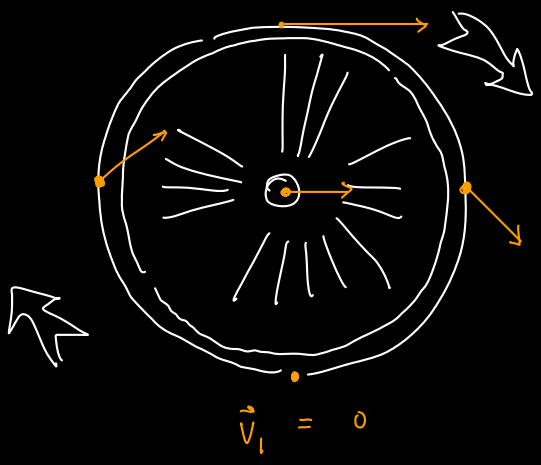
$R_E \cdot \cos\theta \, w = \frac{1}{3} R_E w$

$\cos\theta = \frac{1}{3}$

$\theta = 70.5°$



RHR ↑ direction of angular velocity



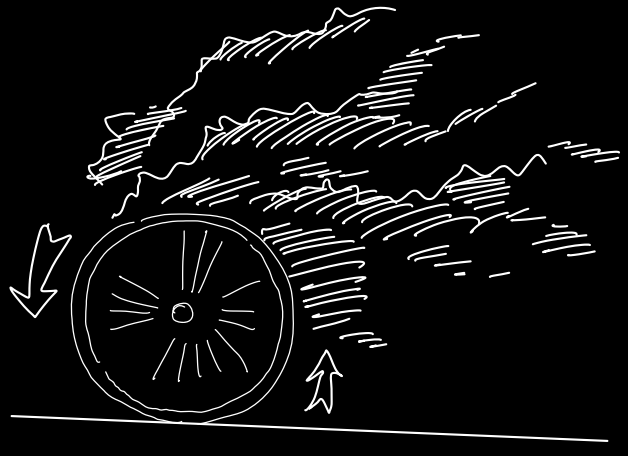
$\vec{V}_1 = 0$

Rolling without slipping (skidding)

$S_{cm} = r\theta$

$V_{cm} = rw$

$a_{cm} = r\alpha$



Rolling with slipping (skidding)

8.58 A dragster starts from rest and accelerates down a track. Each tire has a radius of 0.320 m and rolls without slipping. At a distance of 412 m down the track, the angular speed of the wheels is 290 rad/s. Determine **(a)** the linear speed of the dragster and **(b)** the magnitude of the angular acceleration of its wheels.

(a) $V = V_{cm} = rw = 0.320 * 290 = 92.8 \text{ m/s}$

(b) $\alpha = \frac{a_{cm}}{r} = \frac{a}{r}$ (a → entire dragster) $= \frac{1}{r}\frac{V^2}{2s} = 32.7 \text{ rad/s}^2$

$V^2 - V_0^2 = 2a\Delta x \implies a = \frac{V^2}{2s}$