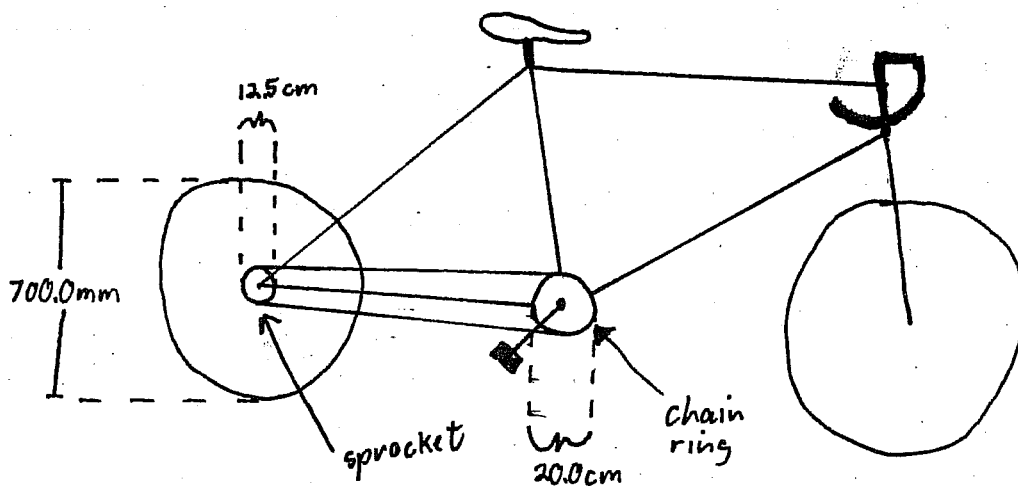


Yann wants to ride his fixie at 30.0 km/h at what rate must he pedal (in rev/min) to achieve this speed.



$$V = 30.0 \frac{\text{km}}{\text{h}} \left(\frac{1 \text{ h}}{60 \text{ min}} \right) = 0.500 \frac{\text{km}}{\text{min}} \left(\frac{1000 \text{ m}}{1 \text{ km}} \right) = 500 \frac{\text{m}}{\text{min}}$$

$$r_{\text{wheel}} = \frac{700.0 \text{ mm}}{2} = 350.0 \text{ mm} = 0.3500 \text{ m}$$

$$r_{\text{sprocket}} = \frac{12.5 \text{ cm}}{2} = 6.25 \text{ cm} = 0.0625 \text{ m}$$

$$r_{\text{chain ring}} = \frac{20.0 \text{ cm}}{2} = 10.0 \text{ cm} = 0.100 \text{ m}$$

So

$$V_{\text{wheel}} = \omega_{\text{wheel}} r_{\text{wheel}}$$

$$\omega_{\text{wheel}} = \frac{V_{\text{wheel}}}{r_{\text{wheel}}} = \frac{500 \text{ m/min}}{0.3500 \text{ m}} = \frac{10000}{7} \text{ rad/min} \doteq 1429 \frac{\text{rad}}{\text{min}}$$

Note: $\omega_{\text{wheel}} = \omega_{\text{sprocket}}$

So

$$V_{\text{chain}} = \omega_{\text{sprocket}} r_{\text{sprocket}} = \left(\frac{10000}{7} \right) (0.0625) = \frac{625}{7} \frac{\text{m}}{\text{min}} \doteq 89.29 \frac{\text{m}}{\text{min}}$$

and

$$V_{\text{chain}} = \omega_{\text{chainring}} r_{\text{chainring}}$$

$$\omega_{\text{chainring}} = \frac{V_{\text{chain}}}{r_{\text{chainring}}} = \frac{\frac{6.25 \text{ m}}{7 \text{ min}}}{0.100 \text{ m}} = \frac{6.250 \text{ rad}}{7 \text{ min}} \left(\frac{1 \text{ rev}}{2\pi \text{ rad}} \right)$$
$$= 142. \frac{\text{rev}}{\text{min}}$$