§11-2 Uniform Circular Motion

- constant speed on a circular path
- since the direction changes, then there must be acceleration
- if there is acceleration, there must be a net force

acceleration => centripetal acceleration

$$a_c = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2} = 4\pi^2 r f^2$$

net force => centripetal force

$$\vec{F}_{net} = m\vec{a}$$

- Draw a FBD
- Do not draw a force called F_c since F_c is really F_{net}!
- Other forces (i.e. the ones in the same dimension as the acceleration) make up the net force or centripetal force.

MP|565

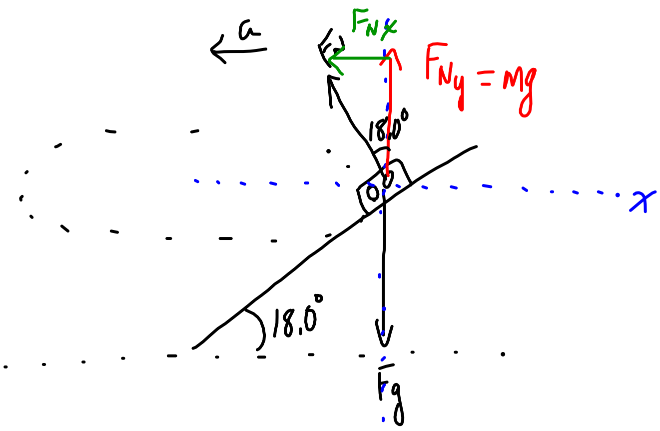
$v = 378.11\ km/h$

$\theta = 18.0^\circ$

$r = 382m$

a) $v_{max} = ?$ (no friction)

b) did he rely on friction to reach 378.11 km/h



$\tan\theta = \frac{F_{Nx}}{F_{Ny}}$

$F_{Nx} = mg\tan\theta$

$\vec{F}_{net} = m\vec{a}$

$F_{Nx} = m\frac{v^2}{r}$

$mg\tan\theta = \frac{mv^2}{r}$

$v^2 = gr\tan\theta$

$v^2 = (9.81 m/s^2)(382m)\tan 18.0^\circ$

$v = 34.9 m/s$

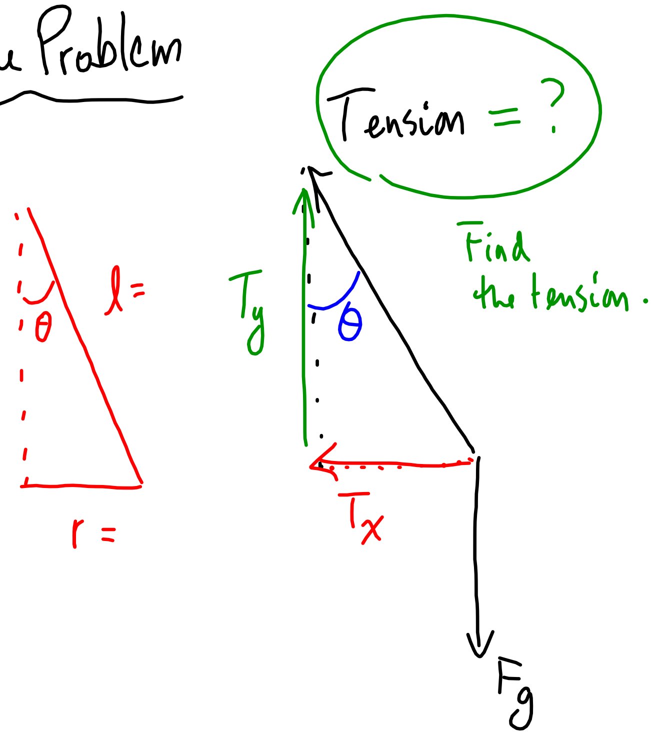
$v = 126\ km/h$

b) Since the speed (378 km/h) reached is significantly greater than the speed (126 km/h) that could be reached if no friction were present, friction was important.

TO DO

1. Find the tension in the string for the toy plane + the period of rotation
2. PP|566
3. Review p571|21-28

Plane Problem



Need

r =

l =

m = 84.6g

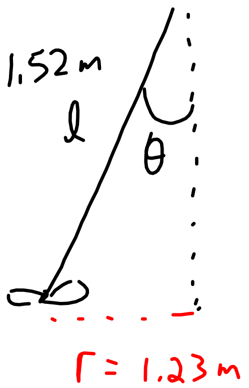
① Find the tension $(F_g = T_y) \longrightarrow$ Tension

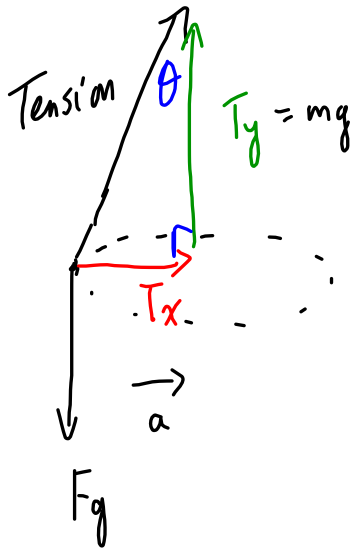
② Find what the period should have been and compare to the value we got (1.87s)

$$\vec{F}_{net} = m\vec{a}$$

$$T_x = m\frac{4\pi^2 r}{T^2}$$

Plane Problem (B)





① Tension ⇒ $T_y = mg$ → find Tension

② Period ⇒

$$\vec{F}_{net} = m\vec{a}$$

$$T_x = ma$$

$$T_x = m\frac{4\pi^2 r}{T^2}$$

$m = 84.6g$

↑ period (≈1.86 s)

Compare to the measured period

$$\frac{7.04\,s}{5} = 1.4\,s$$