Centripetal Acceleration

Any object that changes direction on curved path experiences centripetal acceleration. We are dealing with uniform circular motion in order to use: $a_c = \frac{v^2}{r}$ If the motion is not uniform then you would have to use $\vec{a} = \frac{\Delta \vec{v}}{\Delta t}$

(+ solve using vector subtraction)

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

period

frequency

$$T = \frac{1}{f}$$

Think of centripetal force as being your net force. There are forces that contribute to the centripetal force.

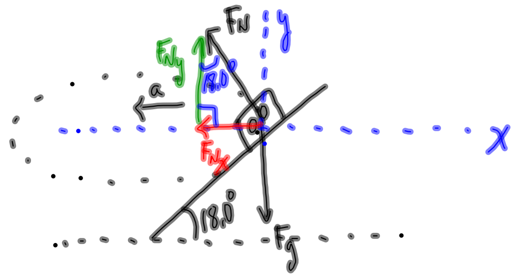
DRAW a FBD ..... do not draw F_c in your FBD

(F_c is like F_{net})

Curve Banking

$r = 382\,m$

$\theta = 18.0^\circ$



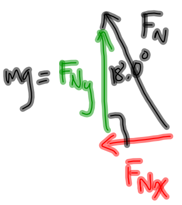
a) $v_{max} = ?$

b) If $v = 378.11\,km/h$, was friction needed?

Vertically:

$F_{Ny} = F_g$

$F_{Ny} = mg$



Horizontally:

$F_{net} = ma$

$F_{Nx} = \frac{mv^2}{r}$

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

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

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

$\cancel{m}g\tan\theta = \frac{\cancel{m}v^2}{r}$

$v^2 = gr\tan\theta$

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

maximum speed without relying on friction → $v = 34.9\,m/s$

$34.9\,\frac{m}{s}\left(\frac{3600\,s}{1\,h}\right)\left(\frac{1\,km}{1000\,m}\right) = 126\,km/h$

b) friction played a significant role in reaching speeds of 378.11 km/h.

TO DO

① PP | 566

② Review: p571 | 21-28