Centripetal Force

Any object that changes speed and/or direction has acceleration. If there is acceleration, then there is a net force (unbalanced force) acting on the object.

For an object travelling around a circular path at a constant speed, that object will have centripetal acceleration. The net force is in the direction of the centripetal acceleration and is referred to as the centripetal force. The direction of the acceleration and thus the net force is always to the centre.

Do NOT draw F_c in your FBD..... it is essentially F_{net}.

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

period frequency

To do centripetal force problems:

1. Draw a FBD
2. Write the Fnet expression in $\vec{F}_{net} = m\vec{a}$
3. Sub in an expression for a

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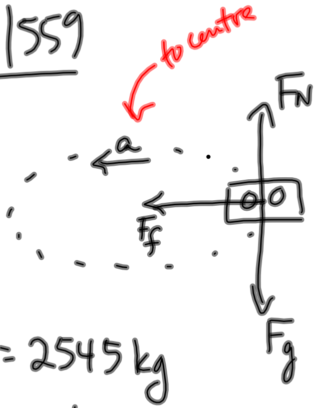


$m = 2545\,kg$
$v = 24\,m/s$
$r = ?$
$F_f = 1.75\times10^4\,N$

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

$F_f = \frac{mv^2}{r}$

$r = \frac{mv^2}{F_f}$

$r = \frac{(2545\,kg)(24\,m/s)^2}{1.75\times10^4\,N}$

$r \doteq 84\,m$

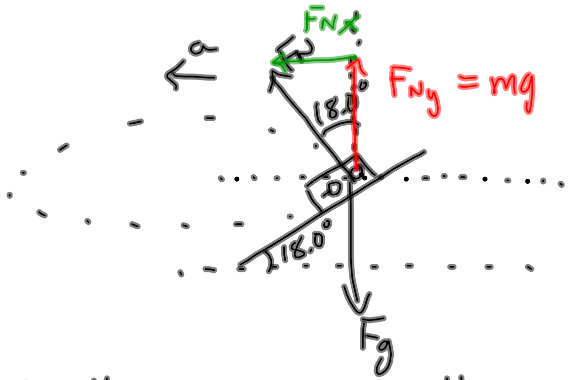
If you try to turn with a radius of less than 84m, you mp|565

$r = 382\,m$

$\theta = 18.0^\circ$

frictionless

$V = ?$



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

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

Vertically:

$F_{Ny} = F_g$

$F_{Ny} = mg$

Horizontally:

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

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

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

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

$v^2 = gr\tan\theta$

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

with no friction → $v = 34.9\,m/s$

$378.11 \frac{km}{h}\left(\frac{1000\,m}{1\,km}\right)\left(\frac{1\,h}{3600\,s}\right)$

$= 105 \frac{m}{s}$

↑

must be friction in order to reach this speed.

TO DO

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