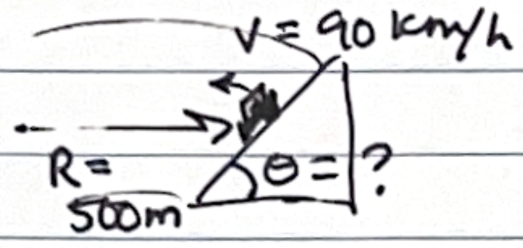
p.199 # 10

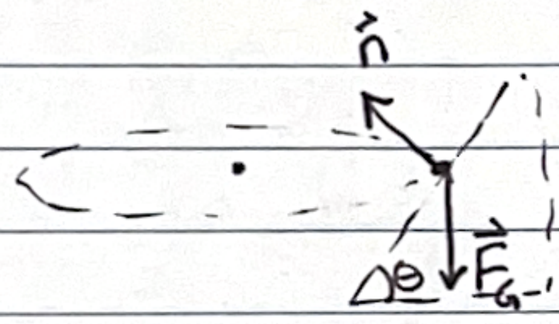
Sketch + translate



$$V = 90\frac{km}{h}\left(\frac{1000\,m}{1\,km}\right)\left(\frac{1\,h}{3600\,s}\right) = 25\ m/s$$

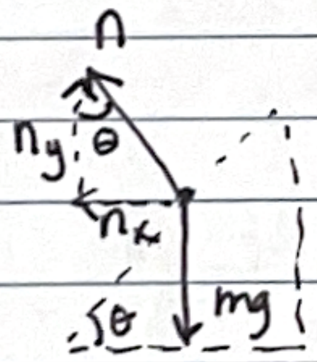
Simplify + diagram

correct angle of banking means we are not relying on friction to make the turn



$n_x = n\sin\theta$

$n_y = n\cos\theta$



$$\tan\theta = \frac{n_x}{n_y}$$

Represent mathematically

$\Sigma F_r = ma_r$

$n_x = m\left(\frac{v^2}{r}\right)$

$\Sigma F_y = ma_y$

$n_y - mg = m(0)$

$n_y = mg$

$$\tan\theta = \frac{n_x}{n_y}$$

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

$$\tan\theta = \frac{v^2}{rg}$$

$$\tan\theta = \frac{(25\,m/s)^2}{(500m)(9.8\,m/s^2)}$$

$$\tan\theta = .12755$$

$$\theta = 7.3°$$

Alternate math

$n_x = m\left(\frac{v^2}{r}\right)$

$n_y = mg$

$n\cos\theta = mg$

$n = \frac{mg}{\cos\theta}$

$n\sin\theta = m\left(\frac{v^2}{r}\right)$

$\left(\frac{mg}{\cos\theta}\right)\sin\theta = m\left(\frac{v^2}{r}\right)$

$mg\tan\theta = m\left(\frac{v^2}{r}\right)$

$$\tan\theta = \frac{v^2}{rg}$$