Name: ____________

Date: ____________

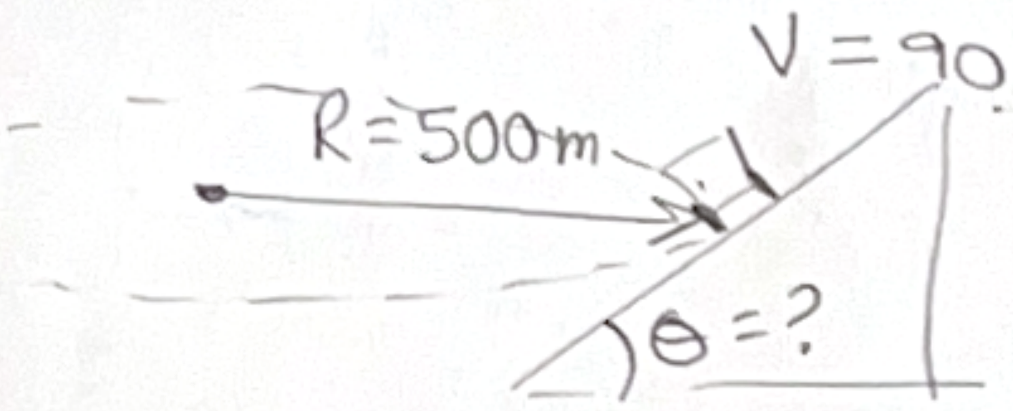
# Circular Motion Practice 4

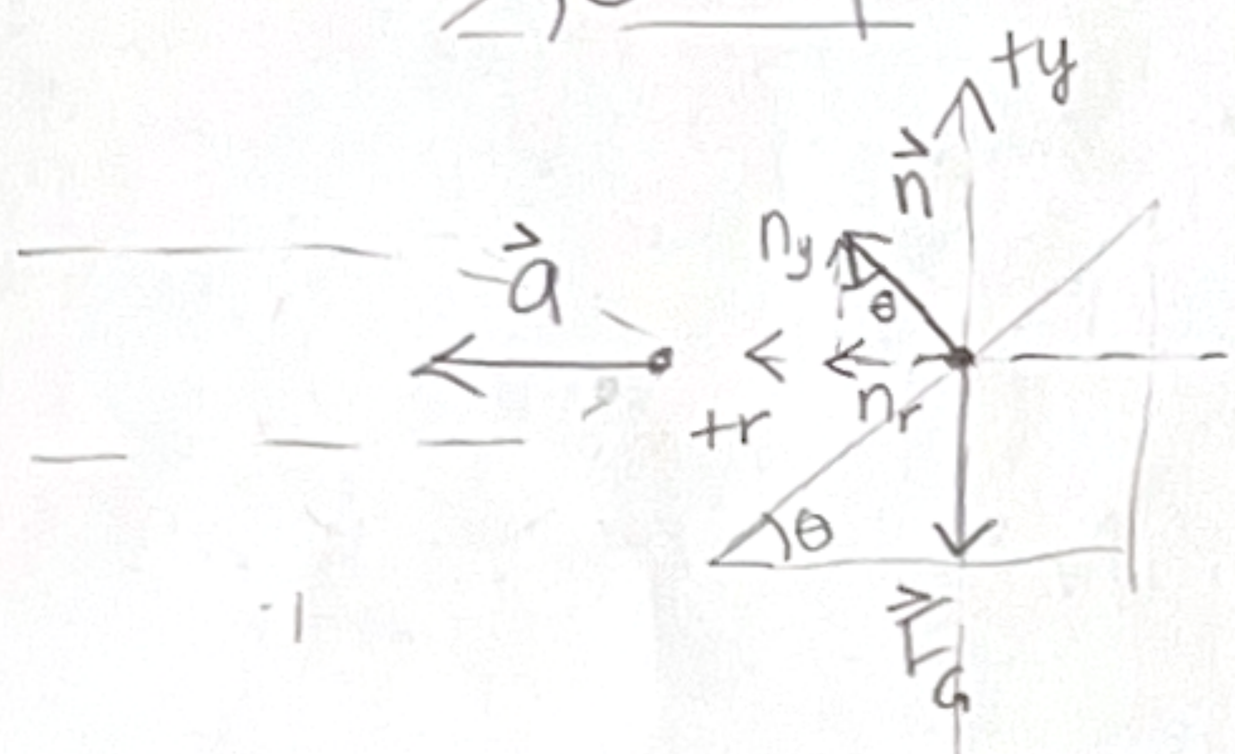
*(Solutions posted)*

Show the problem-solving steps.

## Ch 8 p. 199 #10 - Banked curve

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




| $\vec{F}$ | $F_r$ | $F_y$ |
| --- | --- | --- |
| $\vec{F}_G$ | $F_{Gr} = 0$ | $F_{Gy} = -mg$ |
| $\vec{n}$ | $n_r = +n\sin\theta$ | $n_y = +n\cos\theta$ |

radial direction, find θ:

$a_r = \frac{\Sigma F_{on\,s\,r}}{m_s}$

$\frac{V^2}{R} = \frac{+(n)\sin\theta}{m}$

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

$\frac{V^2}{R} = g\tan\theta$

$\theta = \tan^{-1}\left(\frac{V^2}{Rg}\right) = \tan^{-1}\left(\frac{(25\,m/s)^2}{(500m)(10\,m/s^2)}\right) = \boxed{7.1°}$

y-direction

$a_y = \frac{\Sigma F_{on\,s\,y}}{m_s}$

$0 = \frac{-mg + n\cos\theta}{m}$

$0 = -mg + n\cos\theta$

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

substitute

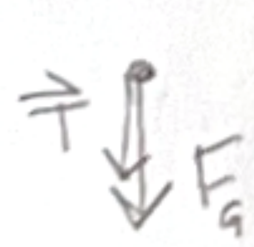
## Ch 8 p.201 #52 - String to not go slack

$\omega_{min} = ?$

for String to not go slack


| $\vec{F}$ | $F_r$ |
| --- | --- |
| $\vec{F}_G$ | $+F_G = +mg$ |

a.


In general, these are the forces, but since we want $\omega_{min}$, the tension $\vec{T} \to 0$, so the only force is $F_G$:


radial direction, find $\omega_{min}$:

$a_r = \frac{\Sigma F_{on\,s\,r}}{m_s}$

$\omega_{min}^2 r = \frac{+mg}{m}$

$\omega_{min}^2 = \frac{g}{L}$

$\omega_{min} = \sqrt{\frac{g}{L}}$

b) $\omega_{min} = \sqrt{\frac{g}{L}}$

$= \sqrt{\frac{10\,N/kg}{1m}}$

$= 3.1\,rad/s$

convert to rpm:

$3.1\,\frac{rad}{s}\left(\frac{1\,rev}{2\pi\,rad}\right)\left(\frac{60s}{1\,min}\right)$

$= \boxed{29.6\,rpm}$