

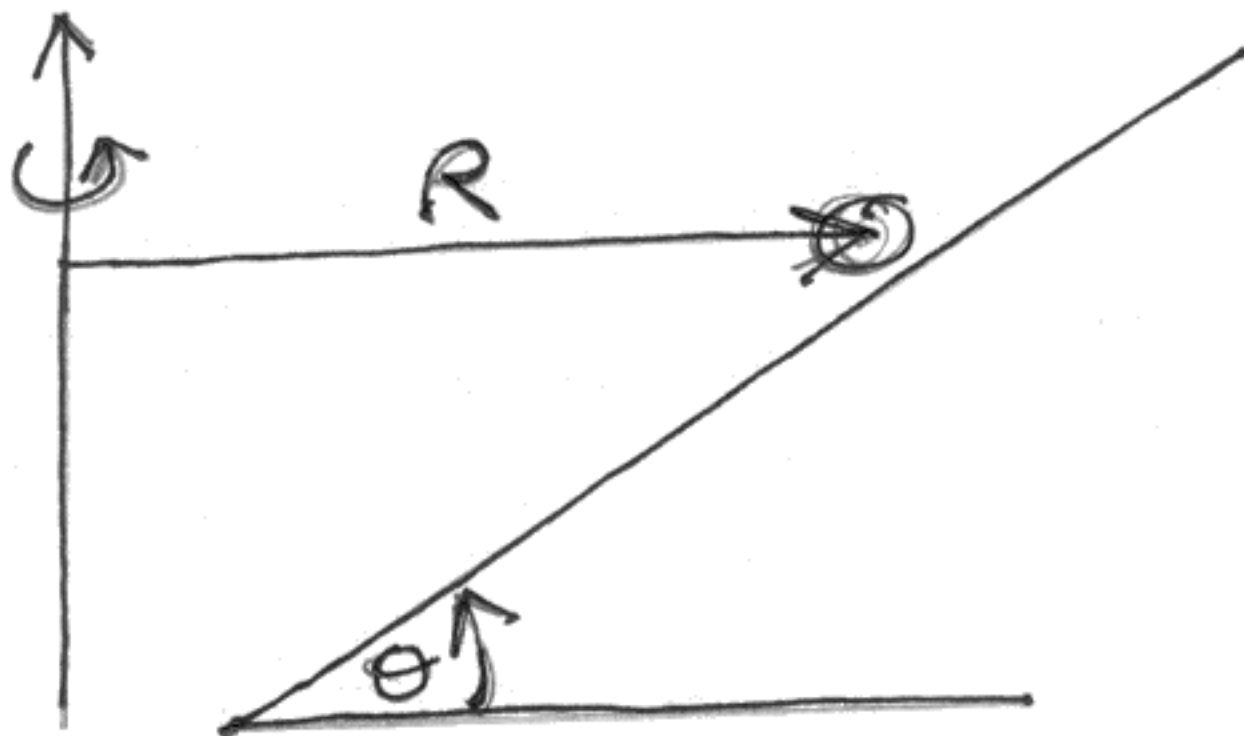
A:(12 pts) Speedway Bank

A car racing on a speedway must make a turn with radius $R=200m$ which is banked at an angle $\theta=30^\circ$. In the absence of friction between the tires and the road, what speed v_0 would enable the car to safely make the turn, i.e. staying at a fixed height, neither rising up the bank nor falling down the bank? Instead, the driver goes into the turn at speed $v=31m/s$, which is not equal to v_0 . In order to safely make the turn at this speed, the help of friction is required. So if the car hit an oil slick, the friction would not be there, and the car would not be able to safely make the turn. Would the car rise up or fall down the bank? Explain your answer... Does the frictional force required to help the car safely make the turn point up or down the bank? Explain your answer...

•(6pts) $v_0 =$ _____

•(3pts) (Circle your answer) Without friction, at speed v : Car goes UP or DOWN?

•(3pts) (Circle your answer) Friction required at speed v points UP or DOWN?



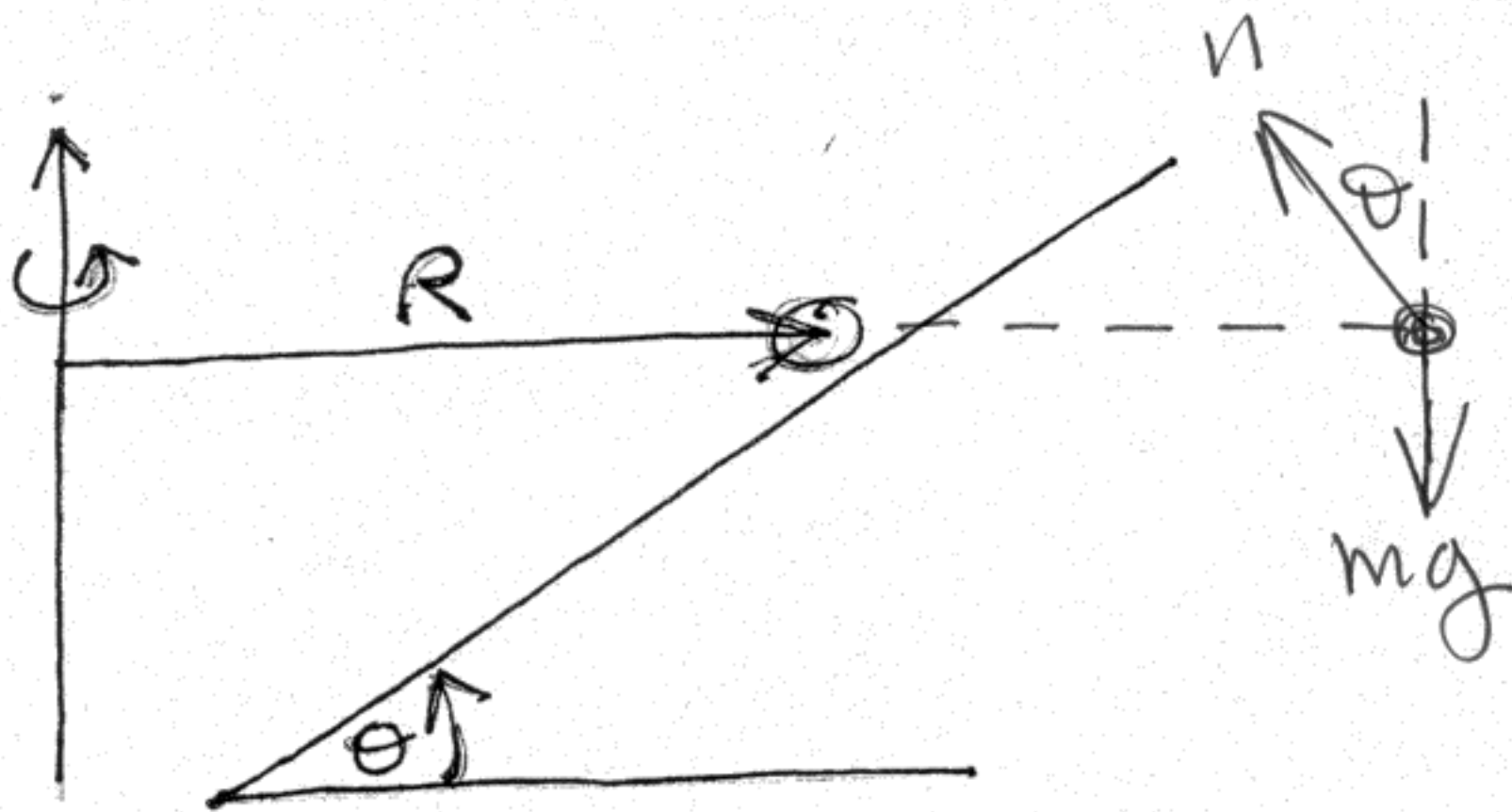
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•(6pts) $v_0 = \underline{33.6 \text{ m/s}}$

•(3pts) (Circle your answer) Without friction, at speed v : Car goes UP or DOWN?

•(3pts) (Circle your answer) Friction required at speed v points UP or DOWN?



$$\left. \begin{aligned} n \cos \theta &= mg \\ n \sin \theta &= m v_0^2 / R \end{aligned} \right\}$$

$$\Downarrow$$

$$\tan \theta = v_0^2 / Rg$$

$$v_0 = \sqrt{Rg \tan \theta}$$

$$= \underline{33.6394 \text{ m/s}}$$

• $v < v_0$, so for the same angle θ , we see that R must decrease. (In fact, the new value must be $R' \approx 170m$). R can only decrease if the car moves down the bank.

• To prevent this motion, the friction must point up the bank.

