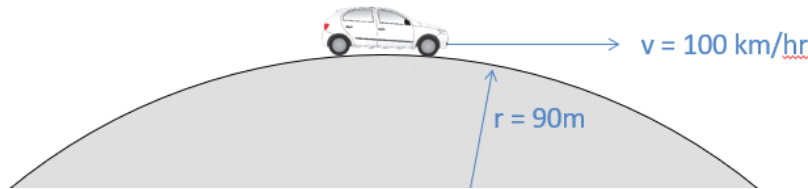


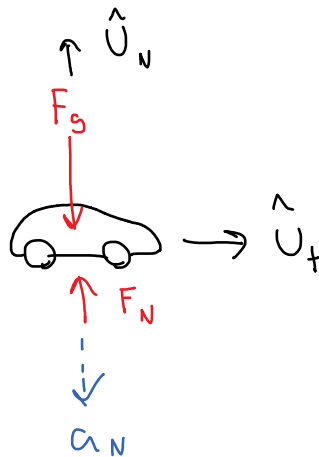
## Problem 1

### Kinetics with Normal Tangential Coordinates Worked Example

- A 1000kg car travels over a hill constant speed of 100 km/hr. The top of the hill can be approximated as a circle with a 90 m radius.
  - What is the normal force the road exerts on the car?
  - How fast would the car have to be going to get airborne?



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$$\begin{aligned} v &= 100 \text{ km/hr} \\ &= 27.78 \text{ m/s} \end{aligned}$$

a)

$$\sum F_N = F_N - F_g = m a_N$$

$$F_N - (1000)(9.81) = (1000) - \frac{v^2}{r}$$

$v \leftarrow 27.78 \text{ m/s}$   
 $r \leftarrow 90 \text{ m}$

$$F_N = 1235 \text{ N}$$

b)

$$F_N = 0$$

$$-F_g = m a_N$$

$$-(1000)(9.81) = (1000) - \frac{v^2}{r_0}$$

$$\begin{aligned} v &= 29.71 \text{ m/s} \\ &= 106.9 \text{ km/hr} \end{aligned}$$