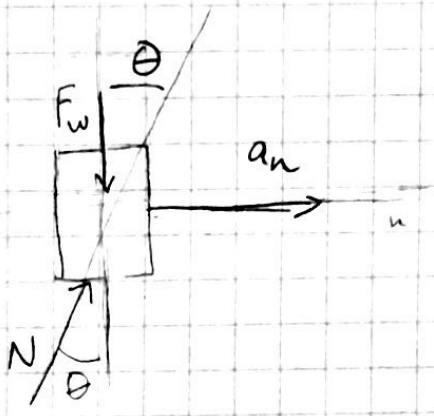
20-P-FA-AF-011

EoM Tangential/Normal Components: Intermediate

Q. A motorcycle w/ a mass of M kg travels along a path described as $y = x^2$. When $x = 'X'$, the motorcycle and cyclist are tilted as in the diagram below θ = 'theta'. What is the velocity of the motorcycle?

A:



$F_w = mg$

$a_n = \frac{v^2}{\rho}$

$\rho = \frac{[1 + (dy/dx)^2]^{3/2}}{d^2y/dx^2}$

$dy/dx = 2x$

$d^2y/dx^2 = 2$

$\rho = \frac{[1 + (2x)^2]^{3/2}}{2}$

$+\uparrow \sum F_b = N\cos\theta - W = 0$

$W/\cos\theta = N$

$\xrightarrow{+} \sum F_n = N\sin\theta = M\,a_n$

$\Rightarrow a_n = \frac{N\sin\theta}{M}$

$\Rightarrow v^2 = \rho N\sin\theta / M$

$\Rightarrow v = \sqrt{\frac{\rho N\sin\theta}{M}}$

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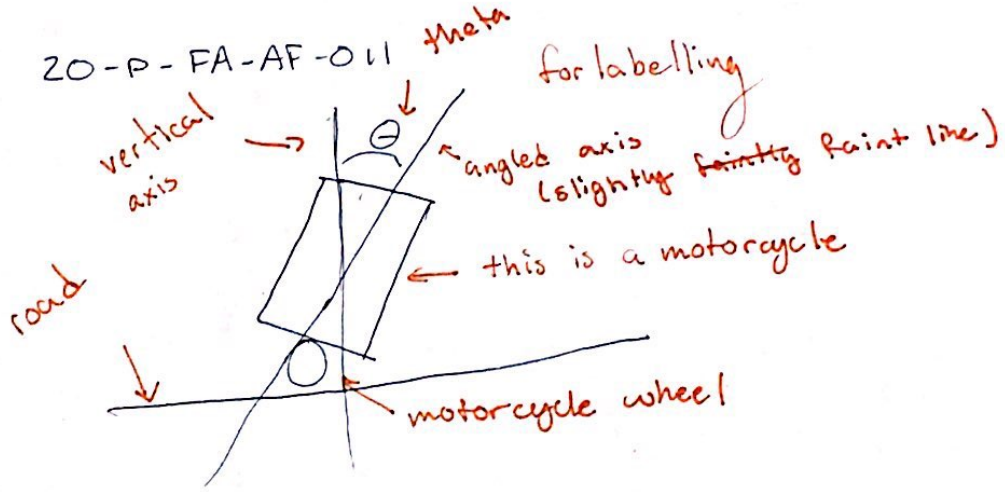
20-P-FA-AF-011



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