CENTRIPETAL FORCE

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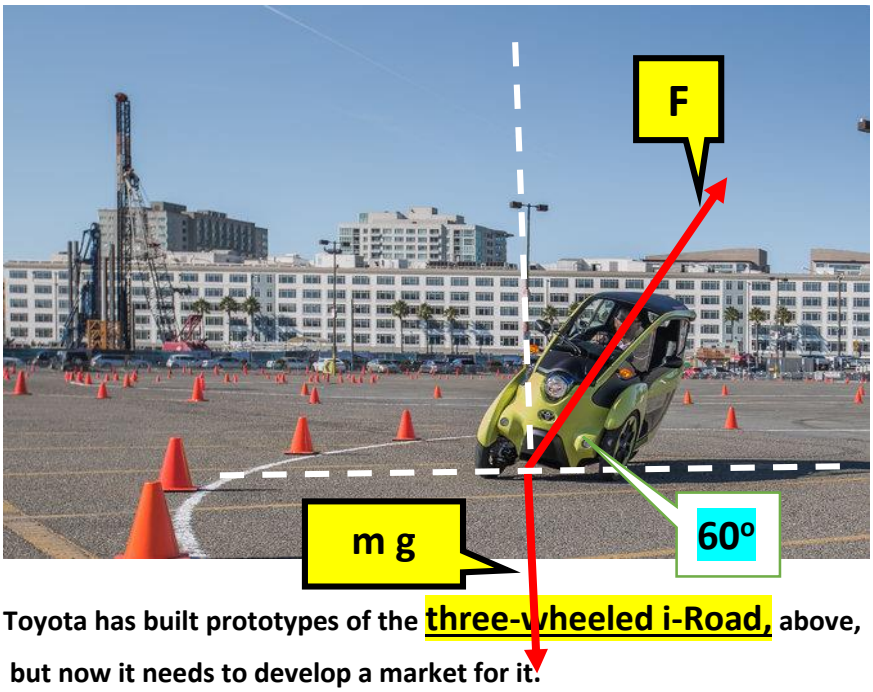
Toyota Asks for Ideas About How to Use an Ultrasmall Vehicle



Toyota has built prototypes of the three-wheeled i-Road, above, but now it needs to develop a market for it.

INTRODUCTION: This one person car tilts on turns. In the case at left the angle of tilt is 60º to the horizontal. The radius of the turn is 20 ft. The acceleration is centripetal toward center of circle. The acceleration toward center is supplied by the centripetal force due to the horizontal component of F (road force back on i-Road car) on car. Vertically NO acceleration exists, thus net force vertically = zero. Vertically exists the vertical component of F UP and down the weight m g.

QUESTIONS: (a) Set up the working Equation in the horizontal direction? (b) Set up the working equation in the Vertical direction?

AS a rush of innovation reshapes the automotive industry, from ride-hailing apps to autonomous driving technology, automakers have joined in rethinking the future of transportation.

Toyota, in one venture, is thinking small: **a pint-size, three-wheeled electric vehicle called the i-Road. It has built prototypes of the vehicle,** but now it needs to develop a market for it.

At a demonstration last month outside AT&T Park in San Francisco, the futuristic **i-Road was put through its paces, zigzagging between orange cones, its two front wheels pivoting like the legs of a downhill skier. A pair of electric motors, which push the vehicle to a top speed of 37 miles per hour,** emitted a soft whine. Toyota is not the first company to explore the idea of ultrasmall electric vehicles for urban commuters. Two recent concepts, Honda's three-wheeled 3R-C andHyundai's egg-shaped E4U, take aim at the same territory. When a licensed driver turns on the i-Road, software in the driver's smartphone communicates with the **vehicle's software, allowing the i-Road to be driven up to its top speed of 37 m.p.h. If the user is 16 or older but does not have a driver's license, the software limits the i-Road's output to 4 horsepower and its speed to 20 m.p.h., effectively turning the i-Road into what the California Vehicle Code defines as a motorized bicycle.**

(c) From (a) & (b) find sin 60º / cos 60º ? (d) Find speed (in ft./s. & mph) i-Road car is turning at?

HINT: $F_{CENTRIPETAL} = m V^2/R$, $g = 32$ ft./s.^{2} , $\sin \Theta / \cos \Theta = \tan. \Theta$, 60 mph = 88 ft./s.

ANSWERS: (a) $F \cos. 60^o = m V^2 / R$, (b) $F \sin. 60^o = m g$, (c) $\sin. 60^o / \cos. 60^o = \tan. 60^o = r g / V^2 = 1.732$
(d) 19.22 ft./s. or ~ 13.1 mph

COMMENT: The solution for speed being ~ 13.1 mph fits the range of speeds the i-Road car is designed for mentioned In the article for users under16 years old.