CENTRIPETAL FORCE

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Amtrak Train Derailed Going 106 M.P.H. on Sharp Curve; at Least 7 Killed

Wreckage from Train No. 188, which derailed in Philadelphia.

INTRODUCTION: **To make any turn an object needs a centripetal force of magnitude m V^2/R . Tracks are normally properly banked (tilted toward center of radius of curvature) by using this equation (derived from centripetal force concept):** $\text{Tangent } \Theta = V^2/R\,g$
Normal angle of banking is 12° . g = 32 ft./s.^{2}

QUESTIONS: **(a) How much larger should have been the centripetal force at 105 mph compared to recommended 50 mph in order to successfully (not crash) make the turn? (b)Convert 50 mph to ft./s.? (c) The curve was banked for 50 mph at 12° . Find R radius of curvature? (d) Looking at picture of curve at left does (c) seem reasonable?**

PHILADELPHIA — An engineer jammed on the emergency brakes just seconds before Tuesday's fatal Amtrak derailment, but the train — **traveling at 106 miles an hour, more than twice the speed limit** — slowed only slightly, federal authorities said, before hurtling off its tracks, killing at least seven people and injuring more than 200. Survivors who emerged battered and bloodied described a chaotic scene, with passengers thrown against walls, furniture and one another, and luggage and other items and falling on terrified riders. They were also studying video from a camera mounted on the locomotive, and they plan to interview the engineer, who "As we know, it takes a long time to decelerate a train," said Robert Sumwalt, the National Transportation Safety Board official who is leading the investigation, in a news conference. He added, **"You're supposed to enter the curve at 50 miles per hour**. He was already in the curve."

HINTS: **60 MPH = 88 ft./s.**

ANSWERS: **(a) 4.5 times larger the centripetal force should have been at 105 mph to have successfully made the curve. (b) ~ 73.33 ft./s. , (c) ~ 791 ft. or about a 1/6 mile is R , (d) Looking at the picture above it can be seen the curve is curving to the left at approximately with aradius of curvature of about 1/6 of a mile ~ 800 ft..**