'Spiderman’ Mugger Flee From Cops

NEW YORK (AP) – As if following a scriptwriter’s cue, a mugger chased by police ran into an office building, jumped out a 19th-floor window to the building next door, stole a delivery man’s uniform and vanished through a busy lobby. “Spiderman. That’s what we call him,” said Anthony McGrath, manager of the building where the suspect landed.

Police sparked the stunning chase when they responded to a report of a street knife robbery in midtown just before noon Tuesday. Officers chased the suspect six blocks until he ran into an office building and jumped into an elevator. He arrived at the 19th floor a step ahead of police, who had to take another elevator.

The mugger, who is believed to have committed seven other knifepoint robberies and a stabbing since Saturday, darted through an office and jumped out an open window. Witnesses thought he had plummeted to his death. Instead, the nimble crook landed on an air conditioner unit on the 18th-floor setback of the adjacent building. It was a 15-foot leap across and a 35-foot drop, said McGrath. “The air conditioner is totally smashed to pieces,” he said.

McGrath said the man went to a slightly opened window in a law office, climbed inside and dashed to an elevator. There, he encountered a delivery man from Checkerboard Gourmet deli, took the delivery man’s hat, shirt and apron by knifepoint, and put them on in the elevator, police said. He emerged in the lobby in his disguise and sauntered out of the building. “I think the most incredible part is that there was a whole lobby full of police looking for him and he walked right out through them,” McGrath said. The delivery man, who would only give his name as Salvador, had been hired just for the day and would not comment. “I don’t think he’ll come back to this job,” Checkerboard manager Seth Novak told The New York Times.

1. With what speed might the mugger have hit the air conditioner? You may ignore air resistance and may give the answer in either English or MKS (metric) units. Note that the acceleration due to gravity in English units is approximately 32 feet/second². Clearly, the mugger must jump with some initial horizontal component of velocity, or he will fall 18 stories and perish. You may assume that he jumps with an initial velocity that is entirely horizontal. This turns out not to be exactly optimal, but it is very close.

2. Cutnell and Johnson state on page 48 that the range of a projectile on flat ground in a constant gravitational field, if air resistance can be neglected, is maximized when the initial velocity makes a 45° angle with respect to the horizontal. Prove this generally (not with respect to a single example). This can be done with or without calculus. The trigonometric identity sin(2θ) = 2sin(θ)cos(θ) may be helpful. I remember reading somewhere that a species of Amazonian frog tends to launch at a 45° angle when jumping.

3. For a fixed initial firing angle, it should be obvious that air resistance will shorten the range. If we wish to maximize the range, as in problem 2, taking account of air resistance, will θ be greater than, smaller than, or equal to 45°? Assume that the drag force in the air is larger the greater the speed and always directed opposite to the current velocity. For a quantitative discussion (going well beyond the qualitative argument I’m expecting at this level), see Giordano and Nakanishi, Computational Physics, second edition, 2006 [sic].

4. An object slides, without friction, on a plane inclined an angle θ with respect to the horizontal. (For example, a horizontal plane would have θ = 0, a vertical one θ = π/2.) What is its acceleration along the plane? Galileo used inclined planes as a way artificially to reduce the gravitational acceleration g, thus slowing down experiments that were too fast to time with freely falling objects.

3.41, 3.46; 4.1, 4.4, 4.10, 4.16, 4.18, 4.26, 4.33, 4.34, 4.36