Can a Car Really Jump That Far?
Read-ahead

Introduction
In the Force Decomposition video, Professor Robinson talks about how forces are often resolved into components parallel to and perpendicular to the direction of motion. This is also true of velocity; since gravity acts in the vertical direction we need to isolate that component of velocity to determine the effect of gravity on the motion of the object. In this set of problems, we will again attempt to determine whether or not a movie stunt is physically realistic.

Instructions
After reading through the *Can a Car Really Jump That Far?* context and questions below, you should complete the application reflection in Canvas. Note: *you will have a chance to talk further with your coach before answering the questions below in detail*. The point of the read-ahead is to "prime the pump" for further conversations with your coaches.

Can a Car Really Jump That Far?
In the problems that follow, we will use trigonometry together with equations for projectile motion to analyze the car jump in the movie clip.

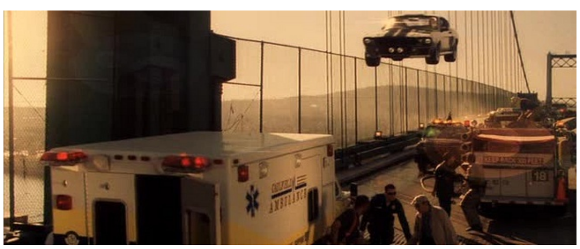

Figure 1: Still from "Gone in 60 Seconds."

Figure 2: Bus jump scene from "Speed."

Questions

1. The ramp in the clip is approximately 8 meters (two car lengths) long, and 4 meters high. Use these values to find the approximate angle of the ramp, in degrees.

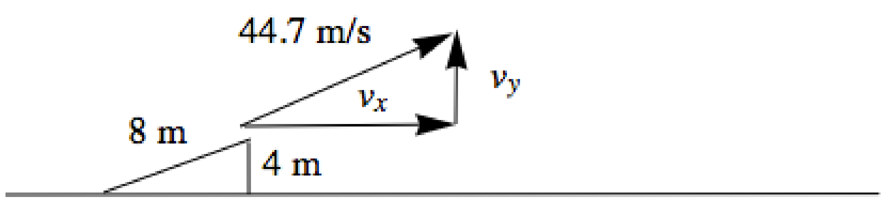

Figure 3: Horizontal and vertical components of velocity.

2. According to the speedometer, the car in the clip is traveling at about 100 miles per hour, or 44.7 meters per second when it leaves the ramp. Use this value to find the horizontal and vertical components of the cars velocity, i.e., v_x and v_y in Figure 3 above, in meters per second. Round your answers to two decimal places.
3. Given that vertical component of velocity is initially the value v_y you found in the previous part, how many seconds does it take for the car to return to its original height of 4 meters above the ground (the height from which it took off from the ramp)? Recall that the acceleration due to gravity is -9.8 m/s^2, and use the fact that an object launched from a point above the ground will take the same amount of time to fall from its maximum height as it took to reach that height. Note that we are ignoring the effects of air resistance. Again, round your answer to two decimal places.
4. During the time interval you computed in the previous problem, how far in meters will the car travel horizontally? Use the unrounded answers from the previous problems, and then round your answer to two decimal places.
5. From the point when the car returns to its original height, it still has 4 meters left to fall. The vertical velocity at that point is equal to the velocity v_y you calculated in Problem 2, only in the opposite direction. Suppose we take this velocity as fixed. In the time it takes the car to fall the final 4 meters, how far would the car move horizontally? Round your answer to two decimal places.
6. (Graded for completeness only.) Does the jump in the movie clip match your answers to the previous problems? If not, what about the jump is off? Explain.

Instructions, part deux

After reading and reflecting on these questions, complete the application reflection on Canvas. This will give your coach some insight on your thinking in order to best help you before you are required to formally answer these questions.