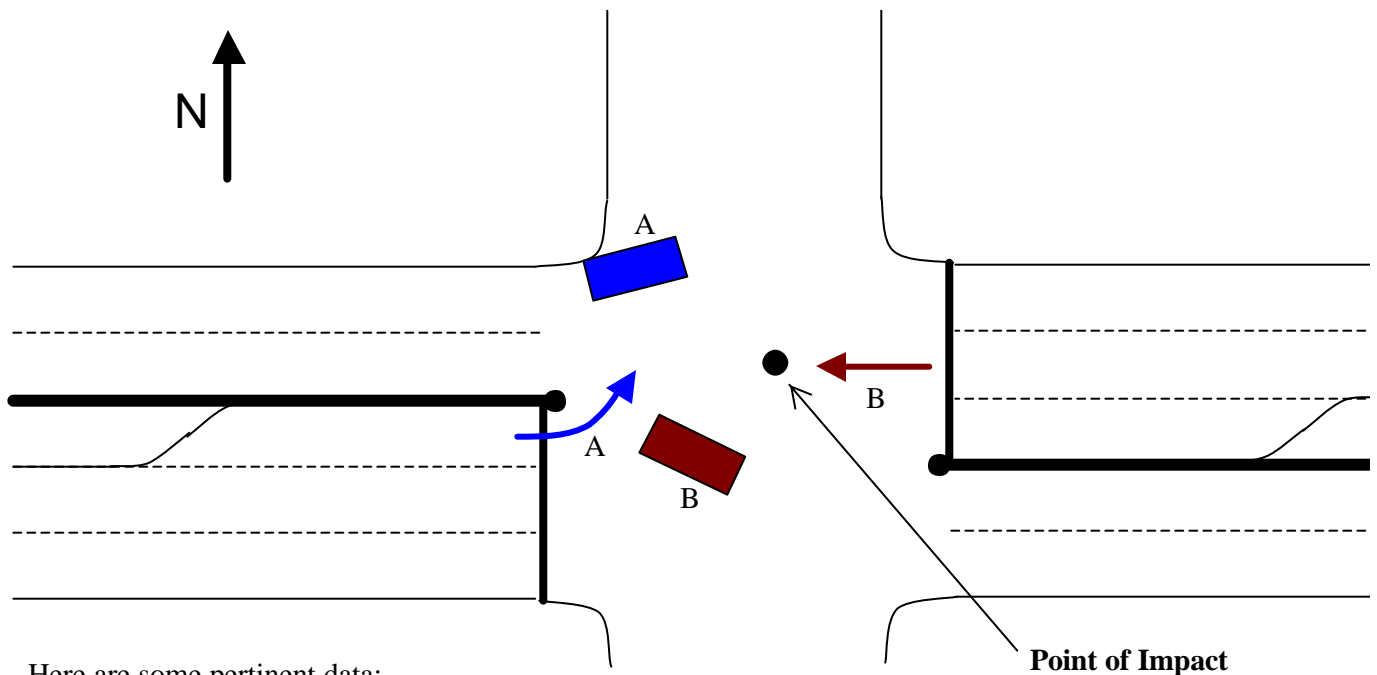


**CE 467 / 567 Highway Safety and Operations**  
**Homework 7**

Due by the end of the day, Wednesday, December 6, 2006

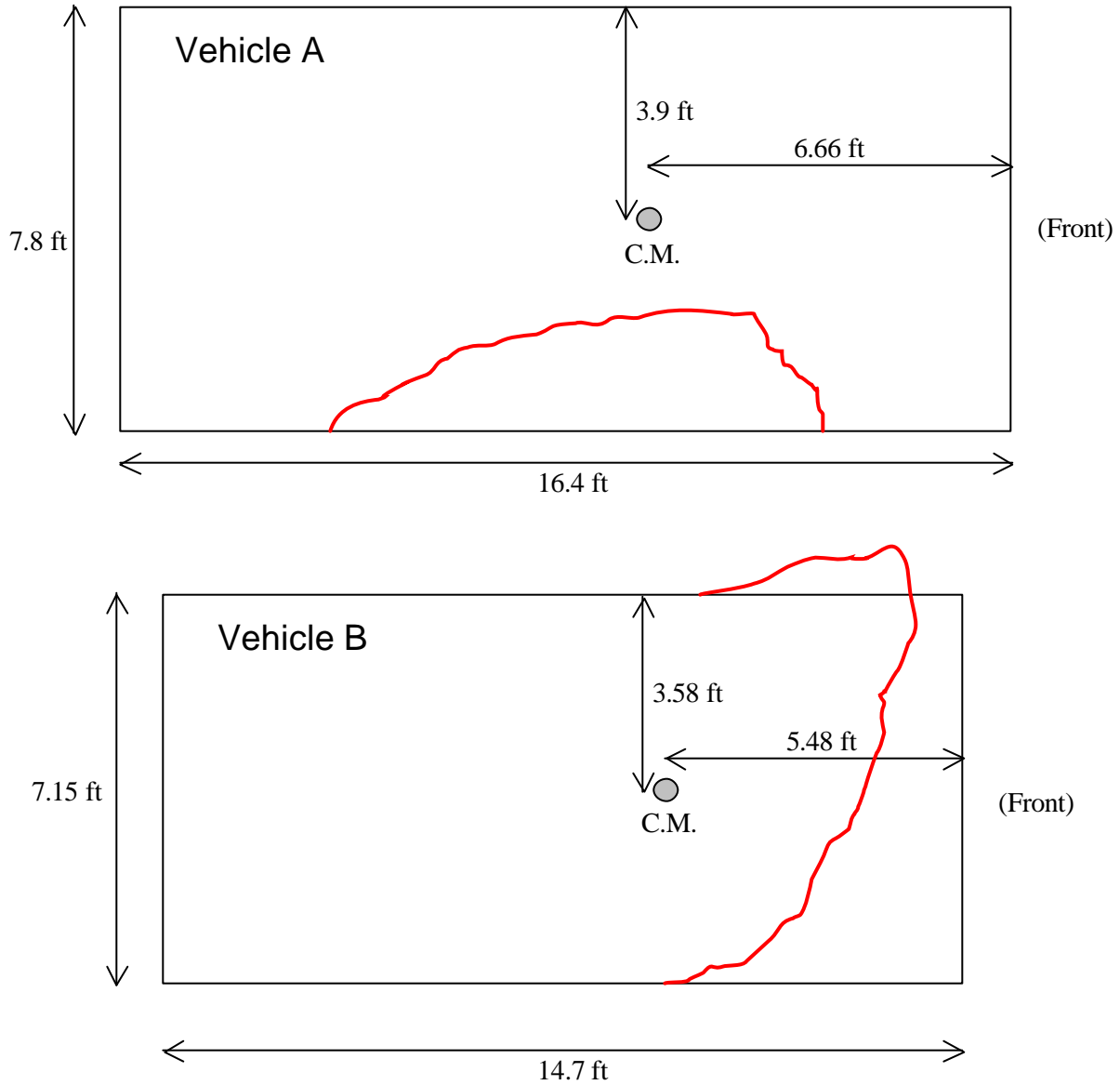
Two passenger cars were involved in what appears to have been an angle crash at an intersection. Passenger car A was making a left turn, eastbound to northbound, and passenger car B was approaching from the leftmost through lane in the opposing direction (westbound). The diagram below indicates the intention of the two vehicles as they approached the intersection, the approximate location of the impact (based on debris at the scene), and the final position of the vehicles. [In color, vehicle A is blue; vehicle B is brown.]



Here are some pertinent data:

- The intersection slopes at  $-1\%$  from west to east (i.e., a car moves downhill as it moves from west to east).
- From the point of impact, the front bumper of car B has traveled a total of 21 feet, at an angle of  $-117^\circ$  (counterclockwise) relative to North. The side of car A has traveled a total of 33 feet, at an angle of  $-59^\circ$  (counterclockwise) relative to North.
- Vehicle A is now oriented with the front pointing  $+83^\circ$  (clockwise) from North. Vehicle B is now oriented with the front pointing  $-70^\circ$  (counterclockwise) from North
- There are no skid marks for vehicle A on its approach. Vehicle B left skid marks beginning 74 feet before the point of impact.
- The crash occurred on a day with clear weather, suggesting a coefficient of road adhesion before the crash of about 0.68 (in a skid) for vehicle B.
- Both vehicles slid across the pavement to their final resting place, after impact. Vehicle A had a broken axle from the crash, and hence has a high coefficient of drag of approximately 0.80. Vehicle B slid sideways intact, with a coefficient of drag of about 0.55.
- The curb weight of vehicle A is 2650 lbs, and the vehicle had a driver (male) and a passenger (female) on board during the crash. The curb weight of vehicle B was 3175 lbs, and only a driver (male) was on board.

Damage occurring to each vehicle is shown in the following rough sketch (drawn to scale):



Answer the following questions:

- Estimate the speed and orientation of each vehicle at the moment of the crash.
- Estimate the orientation of each vehicle at the point of maximum engagement in the crash. Illustrate this in a diagram, showing the two vehicles at maximum engagement.
- Estimate the approach speed of vehicle B before going into the skid.