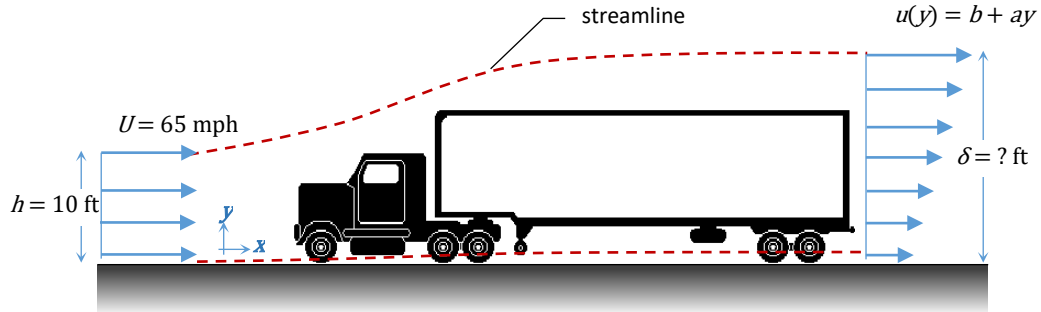## Problem 1

The figure below shows the flow of air around a semi-trailer. The flow is uniform as it comes in, and has a linearly changing velocity profile in the wake as shown. You may assume that the pressure is atmospheric on all surfaces of the system shown.



**Figure 1:** Flow around a semi-trailer. Note that the bottom streamline is close to, but not touching the road.

The constants in the velocity profile are $b$ = 10 mph and $a$ = 3.173 mph/ft. The width into the page is $w$ = 10 ft. You may assume that the pressure is atmospheric on all surfaces of the system shown.

(a) Find the height of the exit wake, $\delta$.
(b) Find the *rate* of $x$-direction linear momentum entering the system via airflow.
(c) Find the *rate* of $x$-direction linear momentum leaving the system via airflow.
(d) Find the net force the truck applies to the air. (Hint, be sure to draw your system clearly. Can the truck be in this system?)