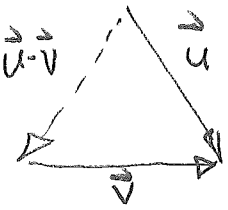
PHYC303 Quiz 4 Name SOLUTIONS

1 a) A car is traveling 40 m/s east. On the ground, there is a 40 m/s wind coming from 30° west of north.
What is the speed and direction of the wind in the frame of the car?

$\vec{u}' = \vec{u} - \vec{V}$



40 m/s, coming from 30° east of N.

b) The Reynolds' number is large. With no wind, the air resistance on the car is 200 N (when the car goes 40 m/s.) What is the *total* air resistance on the car with the 40 m/s wind in part a?

Same speed, same force 200N

c) Does the car's gas mileage go up or down with this particular wind (compared to driving 40 m/s with no wind.)

the gas mileage depends on the component of force along $\hat{x}$. This is smaller, so gas mileage is better. (up)

-OVER-

2a) A freight car rolling at speed v_0, mass M_0, is being loaded with sand dropped from a hopper at a constant rate k kg/s. A constant force F is applied to slow the car. Find the time that it takes for the car to come to a stop, in terms of M_0, v_0, k, and F.

$$\int F\,dt = |\Delta p| \qquad p_f = 0 \qquad p_i = M_0 v_0$$

$$t = \frac{M_0 v_0}{F}$$

b) After the car stops, the force is removed. (We're not trying to push the car backwards.) Make a rough sketch of the car's speed vs. time as it slows to a stop.