1. A baseball pitcher can throw a ball with a speed of 40 m/s. He is in the back of a pickup truck that is driving away from you. He throws the ball in your direction and you measure the speed of the ball to be 10 m/s. What is the speed of the truck relative to you? Show your work.

2. A boat has an initial velocity of 2 m/s in the y-direction on a stream which is moving in the x-direction at 1 m/s. The boat is accelerating in its direction of motion at 1 m/s$^2$. What is the acceleration of the boat (in m/s$^2$) relative to the water?

3. A train travels due south at 30 m/s (relative to the ground) in a rain that is blown toward the south by the wind blowing due south. The path of each raindrop makes an angle of 70 degrees with the vertical, as measured by an observer stationary on the ground. An observer on the train, however, sees the drops fall perfectly vertically. Determine the speed of the raindrops.

4. A 1000-kg automobile moving with a speed of 24 m/s relative to the road collides with a 500-kg automobile initially at rest. If the two stick together, what is the velocity in m/s of the two cars after the collision according to an observer in a truck moving 10 m/s in the same direction as the moving cars?

5. Heather in her Corvette accelerates from rest at the rate of $\frac{2}{3} \hat{i} + 2.00 \hat{j}$ m/s$^2$ while Jill in her Jaguar accelerates from rest at $\frac{1}{3} \hat{i} - 3.00 \hat{j}$ m/s$^2$. They both start from rest at the origin of an $xy$ coordinate system. After 5.00 s,
   (a) What is Heather's acceleration relative to Jill?
   (b) Find the velocity of each driver and Heather's speed with respect to Jill,

6. At $t = 1.0s$, a firecracker explodes at $x = 10$ m in reference frame $S$. Four seconds later, a second firecracker explodes at $x = 20$ m. Reference frame $S'$ moves in the x-direction at a speed of 5.0 m/s. What are the positions and times of these two events in frame $S'$? (Assume that $S$ and $S'$ are coincident at $t = 0$ s)