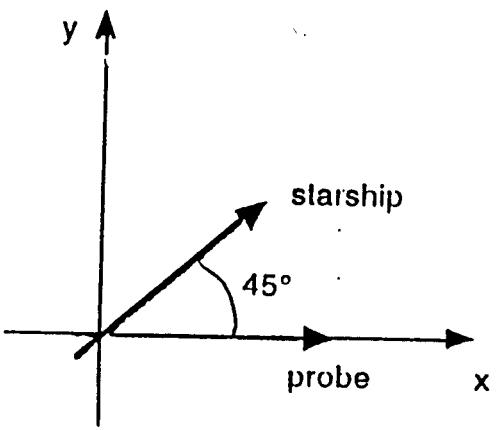
CM 7a11 97B

You are watching a spaceship travel along at a speed $v_S = 0.5c$. As it passes you, it sends out a probe to collect intergalactic dust samples; you observe that the probe has a speed $v_P = c/\sqrt{2}$ and is moving in a direction 45 degrees from the direction of the spaceship. For convenience, let the probe be moving along your x-axis, so that the relative orientations of the velocity vectors in your frame are as shown in the accompanying diagram.




(a) How fast, and in what direction, is the spaceship moving from the point of view of the probe?

(b) After 1 hour has elapsed, as measured by the probe, it sends a dust sample to the spaceship. The probe sends the sample at a speed of $v_D = 0.9c$, as measured by the probe. How much time elapses *on the spaceship* from the time the probe is sent out to the time the first dust sample is received?