The following situation arises in astronomical observations of luminous jets of plasma ejected from distant galaxies.

A plasma blob P is ejected with speed v from a source S. It is continually emitting light. The blob is seen by an observer O at a large distance D (so that D is much larger than the distance between S and P). The observer is stationary with respect to the source, and the blob is ejected at an angle θ to the line of sight of the observer (see diagram).

(a) The observer, who knows the distance D, wishes to estimate the speed of the blob by measuring the angle $\phi(t)$. This leads to an estimate for the transverse (y) component of the blob's velocity $v_\perp = D \, d\phi/dt$. Find $v_\perp$ in terms of v and θ.

(b) What is the maximum of $v_\perp$ with respect to θ if v $= 0.995c$?

(c) Does special relativity require $v_\perp < c$? Explain your answer briefly.