4. Figure 4 shows a long, straight wire of negligible resistance bent into a V shape, with its two arms making an angle α with each other, and placed horizontally in a vertical uniform magnetic field of strength B. A rod of total mass m, and resistance R per unit length, is placed on the V-shaped conductor, at a distance x_0 from its vertex A, and perpendicular to the bisector of the angle α.

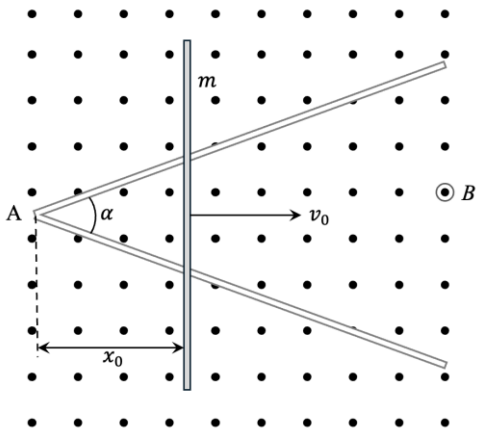

Figure 4 (Top view)

The rod started off with an initial velocity v_0 in the direction along the bisector, and away from A. The rod is long enough not to fall off the wire during the subsequent motion, and the electrical contact between the two is perfect, while friction between them is negligible.

Show that the rod will stop at $x = \sqrt{x_0^2 + \frac{mv_0R}{B^2 \tan\frac{\alpha}{2}}}$. [10 marks]