

STEP II, 2019, Q9

9 A particle P is projected from a point O on horizontal ground with speed u and angle of projection α , where $0 < \alpha < \frac{1}{2}\pi$.

(i) Show that if $\sin \alpha < \frac{2\sqrt{2}}{3}$, then the distance OP is increasing throughout the flight.

Show also that if $\sin \alpha > \frac{2\sqrt{2}}{3}$, then OP will be decreasing at some time before the particle lands.

(ii) At the same time as P is projected, a particle Q is projected horizontally from O with speed v along the ground in the opposite direction from the trajectory of P . The ground is smooth. Show that if

$$2\sqrt{2}v > (\sin \alpha - 2\sqrt{2} \cos \alpha)u,$$

then QP is increasing throughout the flight of P .



NextStepMaths.com

To view mark schemes, fully worked solutions and examiner's comments, and for more details about tutoring and other services offered, go to [NextStepMaths.com](https://www.NextStepMaths.com)