

## STEP II, 2014, Q10 EC

### Question 10

This was the most popular of the mechanics questions and also the one that had the best average score, although candidates did struggle to get very high marks on the question particularly on the final parts. The first part of the question asks for a derivation of the equation for the trajectory which was familiar to many candidates, although in some cases the result was obtained by stating that it is a parabola and knowledge of the maximum value and the range. Many candidates who successfully obtained the Cartesian equation then struggled with the differentiation with respect to  $\lambda$ , instead finding the maximum height for a constant value of  $\lambda$ . Unfortunately, this made the remainder of the question insoluble. Some candidates decided to differentiate with respect to  $\theta$  instead, which did not cause any serious problems, although it did require more work. A few candidates used the discriminant rather than differentiation, but did not provide any justification of this method.

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Candidates were able to draw the graph, but many did not label the area that was asked for in the question. Those who reached the final part of the question and considered the distance function for the position during the flight used differentiation to work out the greatest distance. However, many did not realise that the maximum value of a function can be achieved at an end-point of the domain even with a derivative that is non-zero.



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