



## **STEP II, 1998, Q11**

- 11 A fielder, who is perfectly placed to catch a ball struck by the batsman in a game of cricket, watches the ball in flight. Assuming that the ball is struck at the fielder's eye level and is caught just in front of her eye, show that  $\frac{d}{dt}(\tan \theta)$  is constant, where  $\theta$  is the angle between the horizontal and the fielder's line of sight.

In order to catch the next ball, which is also struck towards her but at a different velocity, the fielder runs at constant speed  $v$  towards the batsman. Assuming that the ground is horizontal, show that the fielder should choose  $v$  so that  $\frac{d}{dt}(\tan \theta)$  remains constant.



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