

STEP II, 2003, Q11

- 11 A particle P_1 is projected with speed V at an angle of elevation α ($> 45^\circ$), from a point in a horizontal plane. Find T_1 , the flight time of P_1 , in terms of α , V and g . Show that the time after projection at which the direction of motion of P_1 first makes an angle of 45° with the horizontal is $\frac{1}{2}(1 - \cot \alpha)T_1$.

A particle P_2 is projected under the same conditions. When the direction of the motion of P_2 first makes an angle of 45° with the horizontal, the speed of P_2 is instantaneously doubled. If T_2 is the total flight time of P_2 , show that

$$\frac{2T_2}{T_1} = 1 + \cot \alpha + \sqrt{1 + 3 \cot^2 \alpha}.$$



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