Answer on question #55000, Physics / Other

Question A Frisbee is lodged in a tree branch, 6.5 m above the ground. A rock thrown from below must be going at least 3 m/s to dislodge the Frisbee. How fast much such a rock be thrown upward, if it leaves the throwers hand 1.3 m above the ground?

Solution Equation of motion is

$$h(t) = h_0 + v_0 t - gt^2/2$$

Equation for velocity is

$$v(t) = v_0 - gt$$

We know that at the moment t_1 when it touches the frisbee rock must has speed of 3 m/s. Hence we have system

$$6.5 = 1.3 + v_0 t_1 - g t_1^2 / 2$$
$$3 = v_0 - g t_1$$

From this we can easily find v_0 , the initial speed:

$$t_{1} = \frac{v_{0} - 3}{g}$$

$$6.5 = 1.3 + v_{0} \frac{v_{0} - 3}{g} - g/2 \left(\frac{v_{0} - 3}{g}\right)^{2}$$

$$v_{0}^{2} = 2 \cdot 9.7g$$

$$v_{0} \approx 13.7 \, m/s$$