## 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 $3 \mathrm{~m} / \mathrm{s}$ 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

$$
h(t)=h_{0}+v_{0} t-g t^{2} / 2
$$

Equation for velocity is

$$
v(t)=v_{0}-g t
$$

We know that at the moment $t_{1}$ when it touches the frisbee rock must has speed of $3 \mathrm{~m} / \mathrm{s}$. Hence we have system

$$
\begin{gathered}
6.5=1.3+v_{0} t_{1}-g t_{1}^{2} / 2 \\
3=v_{0}-g t_{1}
\end{gathered}
$$

From this we can easily find $v_{0}$, the initial speed:

$$
\begin{gathered}
t_{1}=\frac{v_{0}-3}{g} \\
6.5=1.3+v_{0} \frac{v_{0}-3}{g}-g / 2\left(\frac{v_{0}-3}{g}\right)^{2} \\
v_{0}^{2}=2 \cdot 9.7 g \\
v_{0} \approx 13.7 \mathrm{~m} / \mathrm{s}
\end{gathered}
$$

