## Answer on Question \#51493, Physics, Mechanics | Kinematics | Dynamics

A student project required the design of a projectile launcher to launch a cricket ball from the ground vertically upward as fast as possible. One particular test saw the ball launch with an initial velocity of $18.0 \mathrm{~m} / \mathrm{s}$. Determine the time (in seconds) it took for the ball to reach the teacher on its upward journey if she was standing on top of a 14.0 m high building.

Take gravitational acceleration to be $9.81 \mathrm{~m} / \mathrm{s}^{2}$.

## Solution:

Kinematics equation

$$
y=y_{0}+v_{0} t-\frac{1}{2} g t^{2}
$$

where $y_{0}=0$ and $y=14.0 \mathrm{~m}$ is distance, $v_{0}=18.0 \mathrm{~m} / \mathrm{s}$ is initial velocity.
Hence,

$$
\begin{gathered}
y=v_{0} t-\frac{1}{2} g t^{2} \\
\frac{9.81}{2} t^{2}-18 t+14=0 \\
9.81 t^{2}-36 t+28=0 \\
t_{1,2}=\frac{36 \pm \frac{36^{2}-4 * 9.81 * 28}{2 * 9.81}}{2}=\frac{36 \pm 14.046}{19.62} \\
t_{1}=1.119 \approx 1.12 \mathrm{~s} \\
t_{2}=2.55 \mathrm{~s}
\end{gathered}
$$

we choose the smaller period of time (motion upward)

Answer: $\quad t=1.12 \mathrm{~s}$

