## 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 m/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  $9.81 \text{ m/s}^2$ .

## Solution:

**Kinematics** equation

$$y = y_0 + v_0 t - \frac{1}{2}gt^2$$

where  $y_0=0$  and y = 14.0 m is distance,  $v_0 = 18.0$  m/s is initial velocity. Hence,

$$y = v_0 t - \frac{1}{2}gt^2$$
  
$$\frac{9.81}{2}t^2 - 18t + 14 = 0$$
  
$$9.81t^2 - 36t + 28 = 0$$

$$t_{1,2} = \frac{36 \pm 36^2 - 4 * 9.81 * 28}{2 * 9.81} = \frac{36 \pm 14.046}{19.62}$$
$$t_1 = 1.119 \approx 1.12 \text{ s}$$
$$t_2 = 2.55 \text{ s}$$

we choose the smaller period of time (motion upward)

**Answer:** t = 1.12 s