Question 33179

Let h denote the height of the building. For motion upward until stop, $y=h+v_0 t-\frac{g t^2}{2}$. At the moment of stop, $v=v_0-g t_s=0$, therefore t_s -time of movement until stop at maximum height is $t_s=\frac{v_0}{g}$. Plugging in this expression into coordinate, obtain $y_s=h+\frac{v_0^2}{2g}$ - the height at the moment of stop.

Then, motion down is without acceleration. Hence, $v=g t$, and $y=y_s-\frac{g t^2}{2}$. When ball reaches the ground ($y=0$), from here obtain the time of movement from highest point to the ground - $t_f=\sqrt{\frac{2 y_s}{g}}=\sqrt{\frac{2}{g}\left(h+\frac{v_0^2}{2g}\right)}$. Thus, velocity at which the ball hits the ground is $v=g t_f=\sqrt{2g\left(h+\frac{v_0^2}{2g}\right)}=28.28\frac{m}{s}$.

Total time of the journey is $t=t_s+t_f=\frac{v_0}{g}+\sqrt{\frac{2}{g}\left(h+\frac{v_0^2}{2g}\right)}\approx 4.83 s$.