67. (a) It is possible to use $v^2 = v_0^2 + 2a\Delta y$ as we did for free-fall problems in Chapter 2 because the acceleration can be considered approximately constant over this interval. However, our approach will not assume constant acceleration; we use energy conservation:

$$\frac{1}{2}mv_0^2 - \frac{GMm}{r_0} = \frac{1}{2}mv^2 - \frac{GMm}{r} \quad \Longrightarrow \quad v = \sqrt{\frac{2GM(r_0 - r)}{r_0\, r}}$$

which yields $v = 1.4 \times 10^6$ m/s.

(b) We estimate the height of the apple to be $h = 7\,\text{cm} = 0.07\,\text{m}$. We may find the answer by evaluating Eq. 14-10 at the surface (radius $r$ in part (a)) and at radius $r + h$, being careful not to round off, and then taking the difference of the two values, or we may take the differential of that equation – setting $dr$ equal to $h$. We illustrate the latter procedure:

$$|da_g| = \left| -2\frac{GM}{r^3}\, dr \right| \approx 2\frac{GM}{r^3}\, h = 3 \times 10^6 \text{ m/s}^2 \ .$$