

48. We neglect air resistance, which justifies setting  $a = -g = -9.8 \text{ m/s}^2$  (taking *down* as the  $-y$  direction) for the duration of the motion. We are allowed to use Table 2-1 (with  $\Delta y$  replacing  $\Delta x$ ) because this is constant acceleration motion. The ground level is taken to correspond to the origin of the  $y$  axis. The total time of fall can be computed from Eq. 2-15 (using the quadratic formula).

$$\Delta y = v_0 t - \frac{1}{2} g t^2 \implies t = \frac{v_0 + \sqrt{v_0^2 - 2g\Delta y}}{g}$$

with the positive root chosen. With  $y = 0$ ,  $v_0 = 0$  and  $y_0 = h = 60 \text{ m}$ , we obtain

$$t = \frac{\sqrt{2gh}}{g} = \sqrt{\frac{2h}{g}} = 3.5 \text{ s} .$$

Thus, “1.2 s earlier” means we are examining where the rock is at  $t = 2.3 \text{ s}$ :

$$y - h = v_0(2.3) - \frac{1}{2}g(2.3)^2 \implies y = 34 \text{ m}$$

where we again use the fact that  $h = 60 \text{ m}$  and  $v_0 = 0$ .