35. $v(t) = s'(t) = \sin t - \cos t \quad\Rightarrow\quad s(t) = -\cos t - \sin t + C.\quad s(0) = -1 + C$ and $s(0) = 0 \quad\Rightarrow$ $-1 + C = 0 \quad\Rightarrow\quad C = 1$, so $s(t) = -\cos t - \sin t + 1$.

36. $a(t) = v'(t) = 5 + 4t - 2t^2 \quad\Rightarrow\quad v(t) = 5t + 2t^2 - \frac{2}{3}t^3 + C.\quad v(0) = 3 \quad\Rightarrow\quad C = 3$, so $v(t) = 5t + 2t^2 - \frac{2}{3}t^3 + 3.\quad v(t) = s'(t) \quad\Rightarrow\quad s(t) = \frac{5}{2}t^2 + \frac{2}{3}t^3 - \frac{1}{6}t^4 + 3t + D.\quad s(0) = 10 \quad\Rightarrow\quad D = 10$, so the particle's position after t seconds is given by $s(t) = \frac{5}{2}t^2 + \frac{2}{3}t^3 - \frac{1}{6}t^4 + 3t + 10$.

37. (a) We first observe that since the stone is dropped 450 m above the ground, $v(0) = 0$ and $s(0) = 450$. $v'(t) = a(t) = -9.8 \quad\Rightarrow\quad v(t) = -9.8t + C$. Now $v(0) = 0 \quad\Rightarrow\quad C = 0$, so $v(t) = -9.8t \quad\Rightarrow$ $s(t) = -4.9t^2 + D$. Last, $s(0) = 450 \quad\Rightarrow\quad D = 450 \quad\Rightarrow\quad s(t) = 450 - 4.9t^2$.

(b) The stone reaches the ground when $s(t) = 0$. $450 - 4.9t^2 = 0 \quad\Rightarrow\quad t^2 = 450/4.9 \quad\Rightarrow$ $t_1 = \sqrt{450/4.9} \approx 9.58$ s.

(c) The velocity with which the stone strikes the ground is $v(t_1) = -9.8\sqrt{450/4.9} \approx -93.9$ m/s.

(d) This is just reworking parts (a) and (b) with $v(0) = -5$. Using $v(t) = -9.8t + C$, $v(0) = -5 \quad\Rightarrow$ $0 + C = -5 \quad\Rightarrow\quad v(t) = -9.8t - 5$. So $s(t) = -4.9t^2 - 5t + D$ and $s(0) = 450 \quad\Rightarrow\quad D = 450 \quad\Rightarrow$ $s(t) = -4.9t^2 - 5t + 450$. Solving $s(t) = 0$ by using the quadratic formula gives us $t = (5 \pm \sqrt{8845})/(-9.8) \quad\Rightarrow\quad t_1 \approx 9.09$ s.

38. $v'(t) = a(t) = a \quad\Rightarrow\quad v(t) = at + C$ and $v_0 = v(0) = C \quad\Rightarrow\quad v(t) = at + v_0 \quad\Rightarrow\quad s(t) = \frac{1}{2}at^2 + v_0t + D$ $\Rightarrow\quad s_0 = s(0) = D \quad\Rightarrow\quad s(t) = \frac{1}{2}at^2 + v_0t + s_0$

43. Using Exercise 38 with $a = -32$, $v_0 = 0$, and $s_0 = h$ (the height of the cliff), we know that the height at time t is $s(t) = -16t^2 + h$. $v(t) = s'(t) = -32t$ and $v(t) = -120 \quad\Rightarrow\quad -32t = -120 \quad\Rightarrow\quad t = 3.75$, so $0 = s(3.75) = -16(3.75)^2 + h \quad\Rightarrow\quad h = 16(3.75)^2 = 225$ ft.

44. $v'(t) = a(t) = -40$. The initial velocity is 50 mi/h $= \frac{50 \cdot 5280}{3600} = \frac{220}{3}$ ft/s, so $v(t) = -40t + \frac{220}{3}$. The car stops when $v(t) = 0 \quad\Leftrightarrow\quad t = \frac{220}{3 \cdot 40} = \frac{11}{6}$. Since $s(t) = -20t^2 + \frac{220}{3}t$, the distance covered is $s\left(\frac{11}{6}\right) = -20\left(\frac{11}{6}\right)^2 + \frac{220}{3} \cdot \frac{11}{6} = \frac{605}{9} \approx 67.2$ ft.

45. $a(t) = k$, the initial velocity is 30 mi/h $= 30 \cdot \frac{5280}{3600} = 44$ ft/s, and the final velocity (after 5 seconds) is 50 mi/h $= 50 \cdot \frac{5280}{3600} = \frac{220}{3}$ ft/s. So $v(t) = kt + C$ and $v(0) = 44 \quad\Rightarrow\quad C = 44$. Thus, $v(t) = kt + 44 \quad\Rightarrow$ $v(5) = 5k + 44$. But $v(5) = \frac{220}{3}$, so $5k + 44 = \frac{220}{3} \quad\Rightarrow\quad 5k = \frac{88}{3} \quad\Rightarrow\quad k = \frac{88}{15} \approx 5.87$ ft/s^2.

46. $a(t) = -40 \quad\Rightarrow\quad v(t) = -40t + v_0$ where v_0 is the car's speed (in ft/s) when the brakes were applied. The car stops when $-40t + v_0 = 0 \quad\Leftrightarrow\quad t = \frac{1}{40}v_0$. Now $s(t) = \frac{1}{2}(-40)t^2 + v_0t = -20t^2 + v_0t$. The car travels 160 ft in the time that it takes to stop, so $s\left(\frac{1}{40}v_0\right) = 160 \quad\Rightarrow\quad 160 = -20\left(\frac{1}{40}v_0\right)^2 + v_0\left(\frac{1}{40}v_0\right) = \frac{1}{80}v_0^2 \quad\Rightarrow$ $v_0^2 = 12{,}800 \quad\Rightarrow\quad v_0 = 80\sqrt{2} \approx 113$ ft/s (about 77 mi/h).