HW 12

$a(t) = t - 1.5$ for $0 \le t \le 3.25$; t is in minutes

① $v(t) = 0.5t^2 - 1.5t + C$ we are given that $v(1) = 0.4$

$v(1) = 0.5 - 1.5 + C = 0.4$

$-1 + C = 0.4$

$C = 1.4$

$\boxed{v(t) = 0.5t^2 - 1.5t + 1.4 \text{ miles per minute}}$

$s(t) = 0.1\overline{6}\,t^3 - 0.75t^2 + 1.4t + D$ we are given that $s(0) = 0$

$\boxed{s(t) = 0.1\overline{6}\,t^3 - 0.75t^2 + 1.4t \text{ miles}}$

② $v(0) = 1.4 \frac{\text{miles}}{\text{min.}} \rightarrow 1.4(60) = \boxed{84 \text{ miles per hour}}$

$v(3.25) = 1.80625 \frac{\text{miles}}{\text{min.}} \rightarrow 1.80625(60) = \boxed{108.375 \text{ miles per hour}}$

minimum velocity occurs when $v'(t) = 0$ this happens when $a(t) = 0$ or simply when $t = 1.5$ minutes. Use 1st derivative test to verify.

$v(1.5) = 0.275 \frac{\text{miles}}{\text{min.}} \rightarrow 0.275(60) = \boxed{\begin{array}{c}16.5 \text{ miles per hour} \\ \text{min. velocity}\end{array}}$

③ He slowed down until he reached the top of the hill after which he sped up. He reached the top of the hill when his velocity was a minimum. This occured after $\boxed{1.5 \text{ minutes}}$

④ $s(3.25) = \boxed{2.349479167 \text{ miles}}$

(5) $65 \frac{\text{miles}}{\text{hour}} = \frac{65}{60} = 1.08\overline{3} \frac{\text{miles}}{\text{minute}}$

suppose that $v(0) = 1.08\overline{3}$ instead of $v(0) = 1.4$
then $v(t) = 0.5t^2 - 1.5t + 1.08\overline{3}$ and $v(1.5) = -1/24$. Since the velocity is negative at $t = 1.5$, the car must not have made it over the hill and must have slid backwards. (lack of power)

To clear the hill we must have an initial velocity V_0 so that $v(t) = 0.5x^2 - 1.5x + V_0$ and $V(1.5) > 0$; together this implies that $V_0 > 1.125$ miles per minute. In other words to clear the hill your initial velocity must be greater than 67.5 miles per hour.

(6) After 6 minutes, $V(6) = 10.4$ which means he was traveling at 624 miles per hour. This is much to fast for a car.