Physics 10154 - Exam #1B

Answer the following two questions. Be sure to clearly indicate your answer with a circle or box. Show all work. If I cannot see how you arrived at an answer, I will deduct points!

1. A driver takes a trip and moves 67 km/hr while driving. Along the way, he takes a 12 minute rest stop. When his trip is finished, the average speed is 58 km/hr. How far (in km) does the driver travel during the entire trip?

Part 1	Part 2	Total
$\Delta x_1 = ?$	$\Delta x_2 = 0$	$\Delta x_{tot} = ?$
$v_1 = 67\ km/hr$	$v_2 = 0$	$v_{Tot} = 58\ km/hr$
$t_1 = ?$	$t_2 = 0.2\ hr$	$t_{tot} = ?$

$$v_{Tot} = 58 = \frac{v_1 t_1 + v_2 t_2}{t_1 + t_2}$$

$$58 = \frac{67 t_1 + 0}{t_1 + 0.2}$$

$$58 t_1 + 11.6 = 67 t_1$$

$$11.6 = 9 t_1$$

$$t_1 = 1.29\ hr$$

So $\Delta x_1 = (67)(1.29) = \boxed{86\ km = \Delta x_{tot}}$

2. A child fires a model rocket from rest on the ground. It accelerates upwards at 18 m/s² for until it reaches a height of 450 feet above the ground. From there, it is in free fall, and it continues upward to a maximum height before falling straight back down to the ground.

From the point it reaches its maximum height until it hits the ground, how many seconds elapse?

Part 1

$\Delta x_1 = 137.2\ m$

$v_{01} = 0$

$v_1 = ?$

$a_1 = 18\ m/s^2$

$t_1 = ?$

Part 2

$\Delta x_2 = 252\ m$

$v_{02} = 70.28\ m/s$

$v_2 = 0$

$a_2 = -9.8\ m/s^2$

$t_2 =$

Part 3

$\Delta x_3 =$

$v_{03} = 0$

$v_3 = ?$

$a_3 = -9.8\ m/s^2$

$t_3 = ?$

Find v_1:

$$v_1^2 = v_{01}^2 + 2a_1\Delta x_1 \Rightarrow v_1^2 = 0 + 2(137.2)(18)$$

$$v_1 = 70.28\ m/s$$

Use $v_1 \rightarrow v_{02}$ + find Δx_2

$$v_2^2 = v_{02}^2 + 2a_2\Delta x_2 \Rightarrow 0^2 = (70.28)^2 + 2(-9.8)\Delta x_2$$

$$\Delta x_2 = 252\ m$$

Use $\Delta x_1 + \Delta x_2 \Rightarrow \Delta x_3 = -389.2$ + find t_3

$$\Delta x_3 = v_{03}t_3 + \frac{1}{2}a_3t_3^2$$

$$-389.2 = 0 - 4.9t_3^2 \Rightarrow \boxed{t_3 = 8.9\ s}$$