7. While driving to school one morning at a constant velocity of 60.0 km/h [East], Ms. Ryan sees a truck suddenly stop up ahead as a squirrel runs across the road. It takes Ms. Ryan 200.0 ms to react and put on the brakes. Her car accelerates uniformly at 2.5 m/s² [West] once the brake is applied.

a) Draw sketches of the velocity-time and displacement time graphs representing Ms. Ryan's motion.

b) If the truck was 60.0 m ahead of her when she first saw it stopped, will Ms. Ryan be able to stop in time? (Ans: Luckily yes!!)

Given: let [E]=+

$\vec{v}_1 = 60.0\ km/h\ [E] = 16.67\ m/s\ [E]$

$\Delta t_1 = 0.2000\ s$

$\Delta \vec{d}_1 = ?$

$\vec{a} = 2.5\ m/s^2\ [W]$

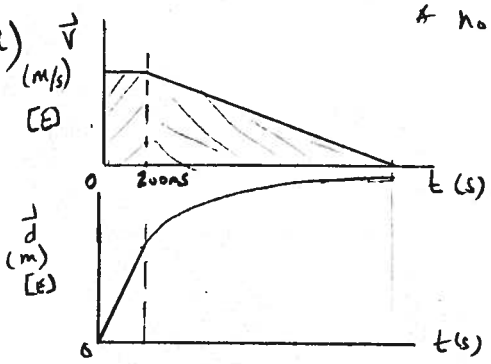
$\vec{v}_2 = 0.0$

$\Delta \vec{d}_2 = ?$

$\Delta \vec{d}_R = ?$

Analysis: $\Delta \vec{d}_R = \Delta \vec{d}_1 + \Delta \vec{d}_2$

a) * not to scale!



$\Delta \vec{d}_R$ = area under $\vec{v}$-t graph

$= \vec{v}_1 \cdot \Delta t_1 + \frac{\vec{v}_2^2 - \vec{v}_1^2}{2\vec{a}}$ ← * since we don't know how long the braking time was we'll use the 5th formula to find $\Delta \vec{d}_2$

$= (16.67\ m/s)(0.2000\ s) + \frac{0 - (16.67)^2}{2(-2.5\ m/s^2)}$

$= 3.333\ m + 55.556\ m = 58.89\ m$

∴ it takes Ms. R. 58.9 m to stop from when she first saw the truck - since the truck is 60.0 m away she will stop in time.

Combo Problems!

6. A car travels east along a straight road at a constant velocity of 18.0 m/s. After 5.0 seconds, it accelerates uniformly for 4.00 seconds. When it reaches a velocity of 24.0 m/s, the car proceeds with uniform motion for 6.00 seconds. Determine the car's total displacement during the trip. (Ans: 318 m [E])

Given: let [E]=+

$\vec{v}_1 = 18.0\ m/s,\ \Delta t_1 = 5.0\ s,\ \Delta \vec{d}_1 = ?$

$\vec{v}_1 = 18.0\ m/s,\ \vec{v}_2 = 24.0\ m/s,\ \Delta t = 4.00\ s,\ \Delta \vec{d}_2 = ?$

$\vec{v}_3 = 24.0\ m/s,\ \Delta t_3 = 6.00\ s,\ \Delta \vec{d}_3 = ?$

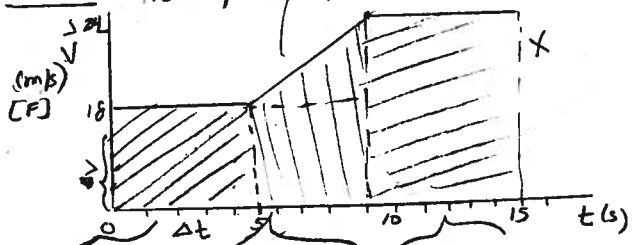
analysis:

$\Delta \vec{d}_R = \Delta \vec{d}_1 + \Delta \vec{d}_2 + \Delta \vec{d}_3$

$\Delta \vec{d}_R = ?$

$\Delta \vec{d} = \frac{1}{2}(\vec{v}_1 + \vec{v}_2)\Delta t$

Sketch: Velocity vs. Time



$\Delta \vec{d}_R = \vec{v}_1 \cdot \Delta t_1 + \vec{v}_1 \cdot \Delta t_2 + \frac{1}{2}(\vec{v}_2 - \vec{v}_1)(\Delta t_2) + \vec{v}_3 \Delta t_3$

$= (18.0\ m/s)(5.0\ s) + (18.0\ m/s)(4.0\ s) + \frac{1}{2}(24.0 - 18.0\ m/s)(4.0\ s) + (24.0\ m/s)(6.0\ s)$

$= 90.0\ m + 72.0\ m + 12.0\ m + 144\ m$

$= +318\ m$

$= 318\ m\ [E]$

∴ its total displacement was 318 m (E).