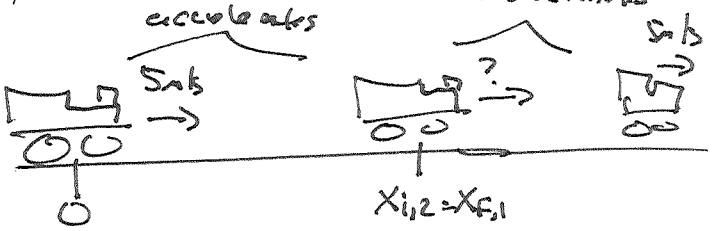
PHYSICS 151 TEST 2

Name: _____

A train, initially going $5\,m/s$, accelerates at $1.2\,m/s^2$ for $25\,s$. It then decelerates at $2.0\,m/s^2$ until its speed is $5\,m/s$ again.



(a.) How long did the entire trip take? *(3pts)*

Two motions:

Known for #1:
- $X_{i,1} = 0$
- $V_{i,1} = 5\,m/s$
- $a_1 = 1.2\,m/s^2$
- $\Delta t_1 = 25\,s$

Unknown:
- $V_{f,1} = ?$
- $X_{f,1} = ?$

Known for #2: (slowdown)
- $a_2 = -2\,m/s^2$
- $V_{f,2} = 5\,m/s$

Unknown:
- $X_{i,2} = ?$
- $V_{i,2} = ?$
- ⓐ $\Delta t_2 = ?$

FINAL ANSWER: $\Delta t_{TOTAL} = \Delta t_1 + \Delta t_2$

Also know that $X_{i,2} = X_{f,1}$ and $V_{i,2} = V_{f,1}$

$V_f = V_i + a\Delta t \Rightarrow V_{f,1} = 5\,m/s + 1.2\,m/s^2(25\,s)$

$\Rightarrow V_{f,1} = 35\,m/s \Rightarrow V_{i,2} = 35\,m/s$

Also $V_{f,2} = V_{i,2} + a_2 \Delta t_2$

$\Rightarrow 5\,m/s = 35\,m/s - 2\,m/s^2 \Delta t_2 \Rightarrow +2\,m/s^2 \Delta t_2 = 35\,m/s - 5\,m/s$

$\Rightarrow \Delta t_2 = \frac{30\,m/s}{2\,m/s^2} = 15\,s$

So $\Delta t_{TOTAL} = 25\,s + 15\,s = 40\,s$

(b.) What was the total distance traveled by the train? *(3pts)*

$X_f = X_i + V_i \Delta t + \frac{1}{2} a \Delta t^2$

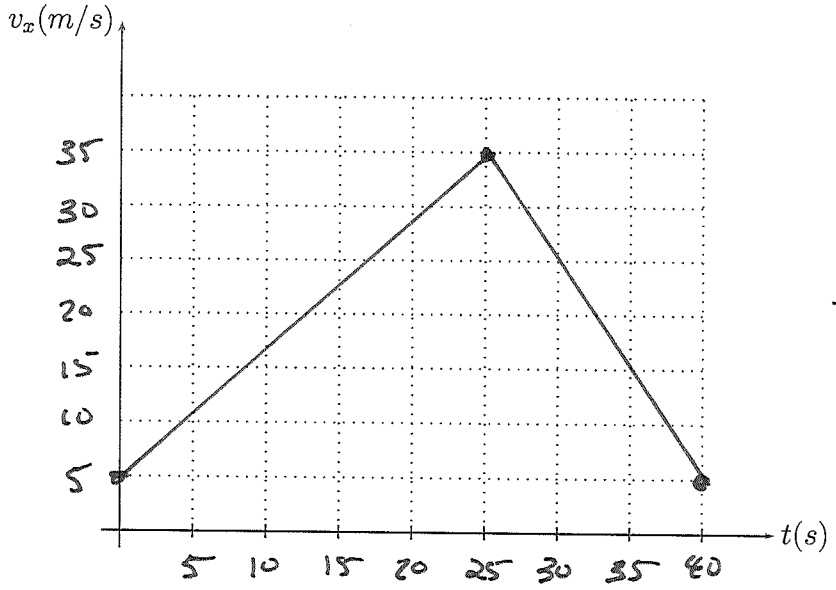
$\Rightarrow X_{f,1} = 0 + 5\,m/s(25\,s) + \frac{1}{2}(1.2\,m/s^2)(25\,s)^2 = 125\,m + 375\,m = 500\,m$

$\Rightarrow X_{i,2} = 500\,m$

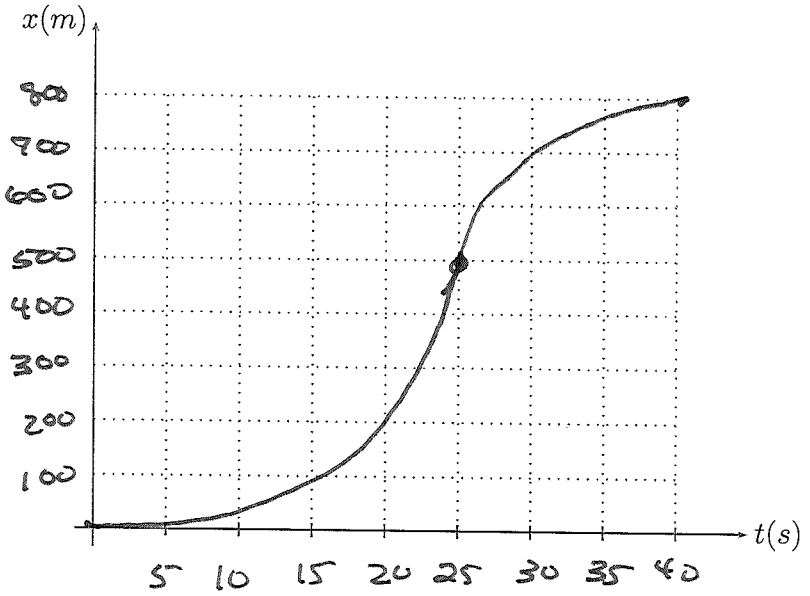
$X_{F,2} = X_{i,2} + V_{i,2}\Delta t_2 + \frac{1}{2} a_2 \Delta t_2^2 \Rightarrow X_{f,2} = 500\,m + (35\,m/s)(15\,s) + \frac{1}{2}(-2\,m/s^2)(15\,s)^2$

$\Rightarrow X_{f,2} = 500\,m + 525\,m - 225\,m \Rightarrow X_{f,2} = 800\,m$

(c.) On the axes provided, sketch the train's velocity-versus-time graph on top and its position-versus-time graph on the bottom. Each graph should have the correct values labeled. (Your position graph doesn't have to have every point correctly plotted, but it should have the basic shape correct.) Assume the train's initial position is zero. *(4pts)*



Constant Acceleration
⇒ Straight line for V_x
From $t=0$ to 25s, V_x goes from 5m/s to 35m/s
then from 25s to 40s ← Δt_{total}
V_x goes from 35m/s back to 5m/s



Constant Acceleration ⇒
x vs. t is a parabola.
When speeding up, we get ⌣ shape.
When slowing down, ⌢