Flipping Physics Lecture Notes:
Toy Car UAM Problem with Two Difference Accelerations

Example Problem: A toy car starts from rest and experiences an acceleration of 1.56 m/s^2 for 1.6 seconds and then brakes for 1.1 seconds and experiences an acceleration of -2.07 m/s^2. (a) How fast is the car going at the end of the braking period and (b) how far has it moved?

Knowns: $v_{1i} = 0;\ \Delta t_1 = 1.6s;\ a_1 = 1.56\frac{m}{s^2};\ \Delta t_2 = 1.1s;\ a_2 = -2.07\frac{m}{s^2};\ v_{2f} = ?;\ \Delta x_t = ?$

Part 1: $v_{1f} = v_{1i} + a_1\Delta t_1 = 0 + (1.56)(1.6) = 2.496\frac{m}{s} = v_{2i}$

Note: $v_{1f} = v_{2i}$ because they are at the same moment in time. The end of part 1 is the beginning of part 2.

Part 2: $v_{2f} = v_{2i} + a_2\Delta t_2 = 2.496 + (-2.07)(1.1) = 0.219\frac{m}{s} \approx \boxed{0.22\frac{m}{s}}$ [answer for part (a)]

In order to solve part (b), you need to realize that the total displacement is equal to the displacement for part 1 plus the displacement for part 2. (technically, the magnitudes of the displacements because we don't have direction.) So now we need to find each displacement individually and then add them together.

Part 1: $\Delta x_1 = \frac{1}{2}(v_{1f} + v_{1i})\Delta t_1 = \frac{1}{2}(2.496 + 0)(1.6) = 1.9968m$

Part 2: $\Delta x_2 = v_{2i}\Delta t_2 + \frac{1}{2}a_2(\Delta t_2)^2 = (2.496)(1.1) + \frac{1}{2}(-2.07)(1.1)^2 = 1.49325m$

Total: $\Delta x_t = \Delta x_1 + \Delta x_2 = 1.9968 + 1.49325 = 3.49005 \approx \boxed{3.5m}$ [answer for part (b)]

The following is an incorrect solution to part (b) …

$$\Delta x_t = \frac{1}{2}(v_{2f} + v_{1i})\Delta t_t = \frac{1}{2}(v_{2f} + v_{1i})(\Delta t_1 + \Delta t_2) = \frac{1}{2}(0.219 + 0)(1.6 + 1.1) = 0.29565 \approx 0.30m$$

Because the acceleration is not constant for the whole problem; it is only constant for each part individually, not as a whole.