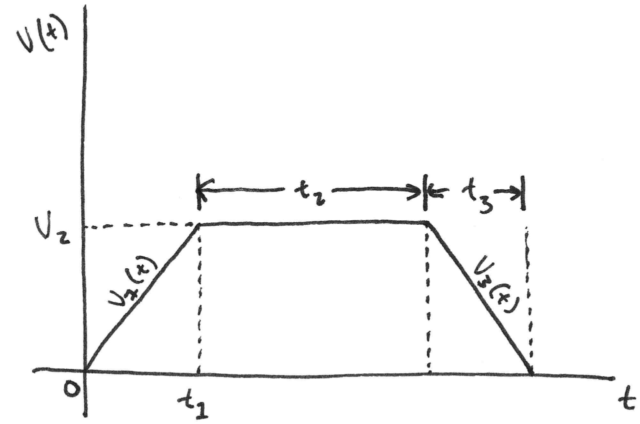

known: a, x_{tot}, t_{tot}

$$x_{tot} = x_1 + x_2 + x_3$$

initial acceleration:

$$v_1(t) = at \Rightarrow x_1 = \int_0^{t_1} at\,dt = \frac{1}{2}at_1^2$$

constant velocity:

$$v_2 = v_2 \Rightarrow x_2 = \int_0^{t_2} v_2\,dt = v_2 t_2$$

final deceleration:

$$v_3(t) = v_2 - at \Rightarrow x_3 = \int_0^{t_3} (v_2 - at)\,dt = v_2 t - \frac{1}{2}at^2\Big|_0^{t_3} = v_2 t_3 - \frac{1}{2}at_3^2$$

assume $t_1 = t_3$:

$$x_{tot} = \cancel{\tfrac{1}{2}at_1^2} + v_2 t_2 + v_2 t_1 - \cancel{\tfrac{1}{2}at_1^2}$$

$$= v_2(t_1 + t_2)$$

since $t_{tot} = 2t_1 + t_2$:

$$x_{tot} = v_2(t_1 + t_{tot} - 2t_1) = v_2(t_{tot} - t_1)$$

and $v_2 = at_1$:

$$x_{tot} = v_2 t_{tot} - \frac{v_2^2}{a} \Rightarrow \underline{v_2^2 - at_{tot}v_2 + ax_{tot} = 0}$$

Solve for const. velocity term:

$$\boxed{v_2 = \frac{at \pm \sqrt{a^2t^2 - 4ax}}{2}}$$

only real when determinant > 0 so:

$$a^2 t_{min}^2 - 4ax = 0$$

$$\Rightarrow \boxed{t_{min} = \sqrt{\frac{4x}{a}}}$$

$$\boxed{v = \frac{at - \sqrt{a^2t^2 - 4ax}}{2}}$$

use these two