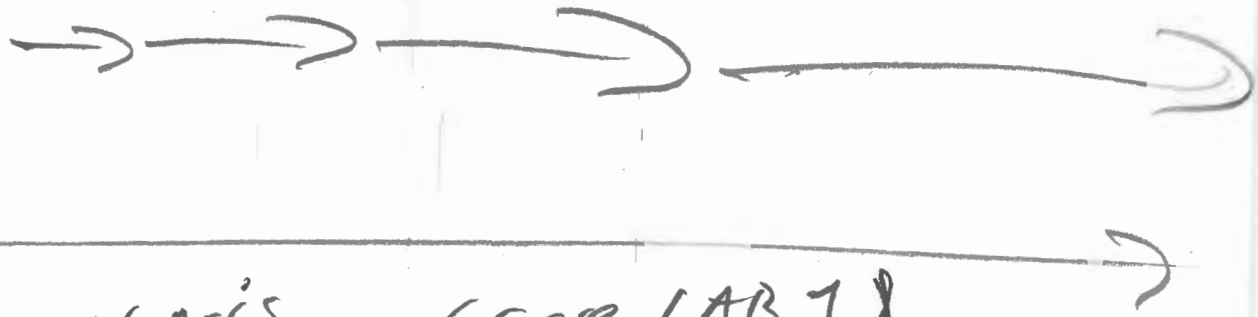
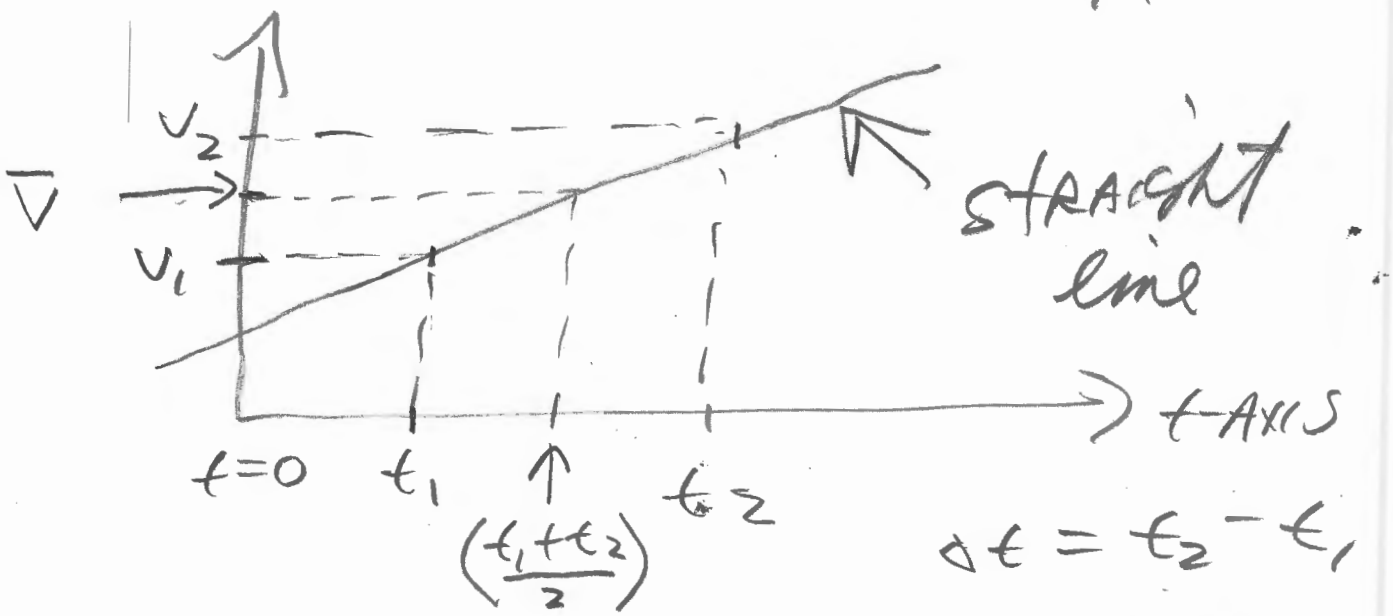
— Sec 2.4 9-4-13 (1

a = constant

$\rightarrow \bar{a} = a$ $\quad v > 0$



V-AXIS (see LAB 1) x



$\Delta t = t_2 - t_1$

$\rightarrow v > 0$

$\leftarrow v < 0$

$v_2 = v_1 + \text{slope} \cdot \Delta t$

$$\boxed{v_2 = v_1 + a \cdot \Delta t}$$

$\bar{V} = \frac{v_1 + v_2}{2} \Rightarrow$ $\boxed{\Delta x = \left(\frac{v_1 + v_2}{2}\right) \cdot \Delta t}$

$a = \bar{a} =$ constant only

$$\Delta x = v_1 \cdot \Delta t + \frac{1}{2} a \Delta t^2$$ ✓

$$v_2^2 = v_1^2 + 2 \cdot a \cdot (x_2 - x_1)$$

Derivation:

$\Delta x = v_1 \cdot \Delta t + \frac{1}{2} a \Delta t^2$

Derivation: $\Delta x = \left(\frac{v_1 + v_2}{2} \right) \cdot \Delta t$

$$\Delta x = \left(\frac{v_1 + (v_1 + a \cdot \Delta t)}{2} \right) \cdot \Delta t$$

$$\Delta x = \left(\frac{2v_1 + a\Delta t}{2} \right) \cdot \Delta t$$

$$\Delta x = v_1 \cdot \Delta t + \frac{1}{2} a \Delta t^2$$

Derivation: $v_2^2 = v_1^2 + 2 \cdot a \cdot (x_2 - x_1)$

Eliminate Δt from: $\Delta x = v_1 \cdot \Delta t + \frac{1}{2} a \Delta t^2$

$$\Delta x = v_1 \cdot \left(\frac{v_2 - v_1}{a}\right) + \frac{1}{2} a \left(\frac{v_2 - v_1}{a}\right)^2$$

$$\vdots \quad \text{algebra}$$

$$\Delta x = v_1 \cdot \left(\frac{v_2 - v_1}{a}\right) + \frac{1}{2} \frac{(v_2 - v_1)^2}{a}$$

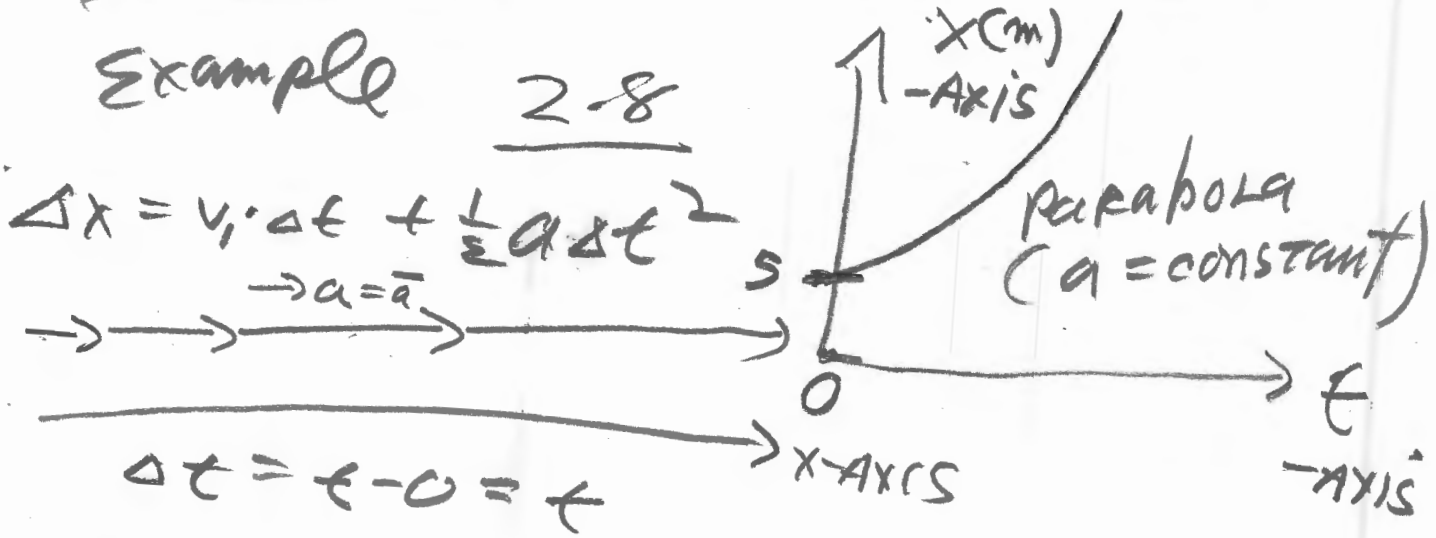
clear fractions, simplify &

$$\boxed{v_2^2 = v_1^2 + 2 \cdot a \cdot \Delta x}$$

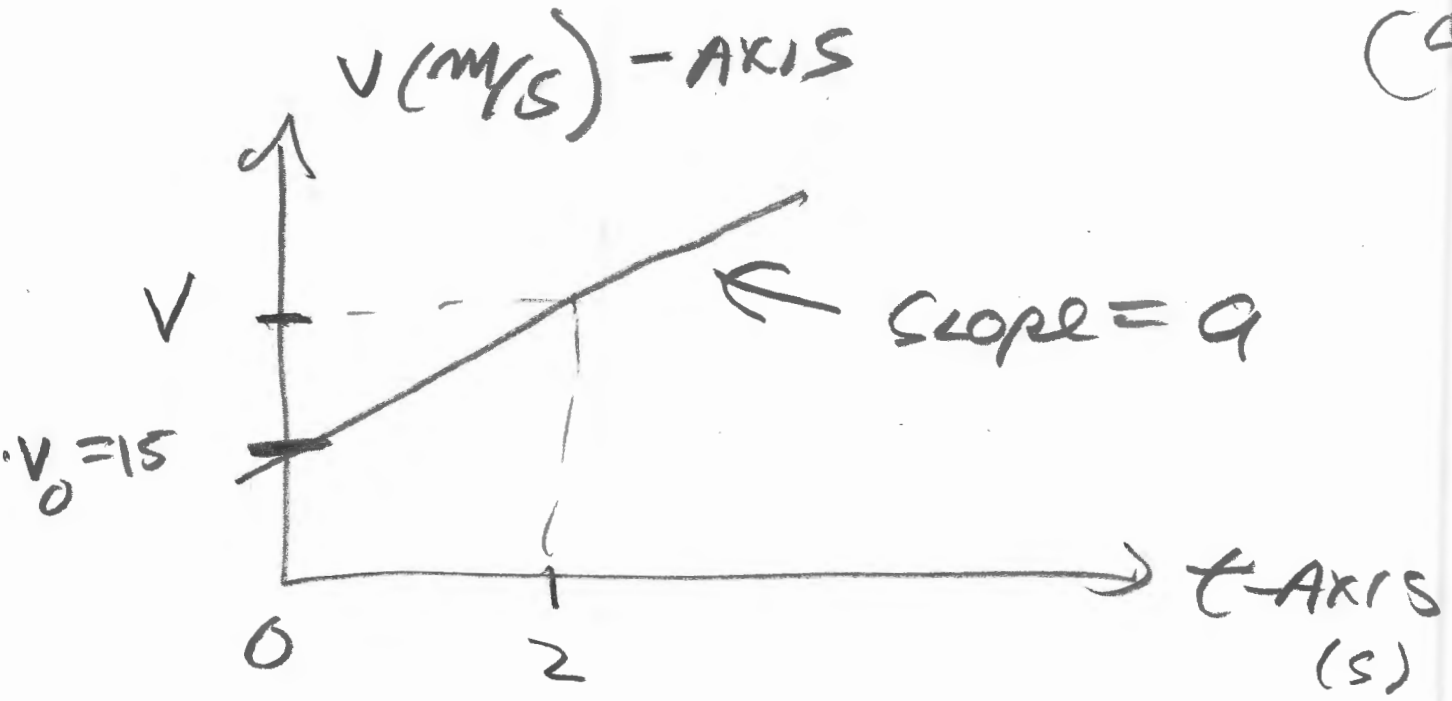
Example 2.8

$\Delta x = v_1 \cdot \Delta t + \frac{1}{2} a \Delta t^2$

$\rightarrow a = \bar{a}$



$\Delta t = t - 0 = t$



(a) find Δx and V at

$t = 2.0\,(s) = \Delta t = t - 0$

$$v = v_0 + a \cdot \Delta t$$

$$v = 15\frac{m}{s} + \left(4.0\frac{m}{s^2}\right) \cdot (2-0)\,s$$

$$v = 15\frac{m}{s} + 8.0\frac{m}{s}$$

$$= 23\frac{m}{s} \text{ at } 2 \text{ sec}$$

$$\Delta x = x_2 - x_1 = v_1 \cdot \Delta t + \frac{1}{2} a \cdot \Delta t^2$$

$$x_2 - 5\,m = 15\frac{m}{s} \cdot (2s) + \frac{1}{2}\left(4\frac{m}{s^2}\right)(2s)^2$$

note: $x_1 = x(0)$

(a) $x_2 - x(0) = \left(15\frac{m}{s}\right)(2s) + \frac{1}{2}\left(4\frac{m}{s^2}\right)(2s)^2$

$x_2 = 5(cm) + 30(cm) + 8(cm)$

$x_2 = \boxed{43(cm)}$

(b) $v_B^2 = v_A^2 + 2 \cdot a \cdot (x_B - x_A)$

$\left(25\frac{m}{s}\right)^2 = \left(15\frac{m}{s}\right)^2 + 2\left(4\frac{m}{s^2}\right)(x_B - x_A)$

$x_A = 5(m)$

$x_B = ?$

$\downarrow$

$625\frac{m^2}{s^2} = 225\frac{m^2}{s^2} + 8\frac{m}{s^2} \cdot (x_B - x_A)$

$x_B - x_A = \frac{400\ m^2/s^2}{8\ m/s^2} = \boxed{50m}$

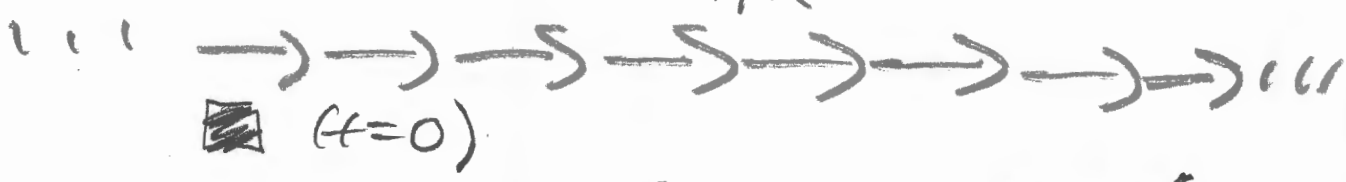
$x_B = x_A + 50 = 55(m)$

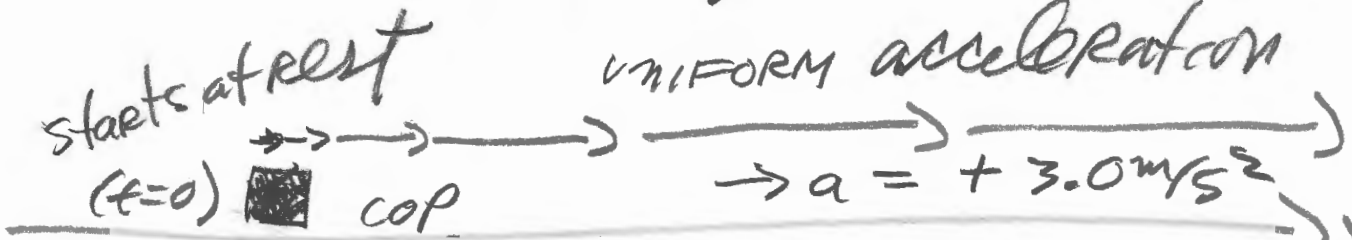
Example 2.8

(c) Do at home

EX 2.9 (p 49)

CAR IS MOVING UNIFORMLY ($a=0$)





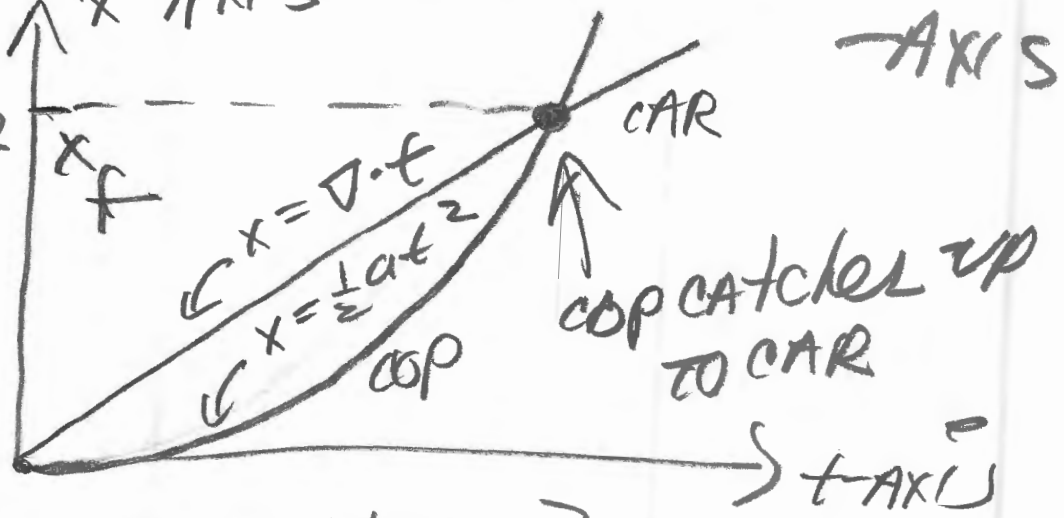
COP:

$\Delta x = v_i \cdot \Delta t + \frac{1}{2} a \Delta t^2$

($v_i = 0$)

$\boxed{\Delta x = \frac{1}{2} a t^2}$

$\Delta t = t$



CAR: $\Delta x = v_i \cdot \Delta t + \frac{1}{2} a \Delta t^2 = v_i \cdot \Delta t$ ($a=0$)

$\Delta t = t = t - 0$ $= v_i \cdot t = v \cdot t$

(a) When does cop catch up with car?

$$x_{cop} = x_{car} \quad \text{(catchup)}$$

$$\frac{1}{2}at^2 = v \cdot t$$

$$\frac{1}{2}\left(3\frac{m}{s^2}\right) \cdot t^2 = \left(15\frac{m}{s}\right) t$$

$$\frac{1}{2}\left(3\frac{m}{s^2}\right) t^2 - \left(15\frac{m}{s}\right) t = 0$$

$$t \cdot (1.5t - 10) = 0$$

$$t = 0 \quad \text{OR} \quad t = \frac{15}{1.5} = 10(s)$$