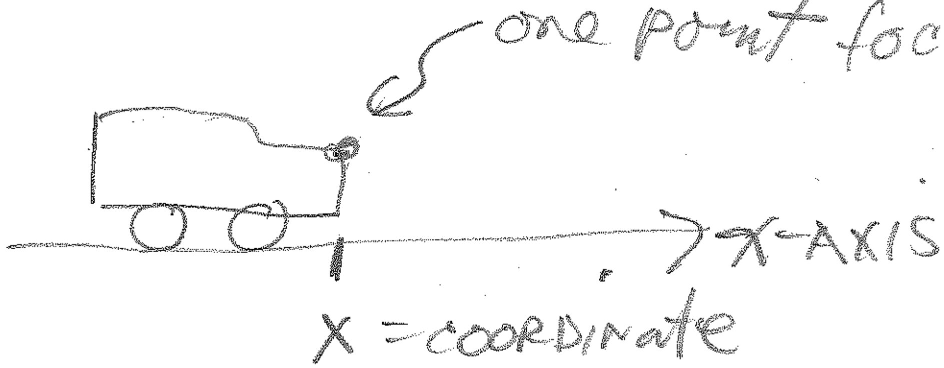
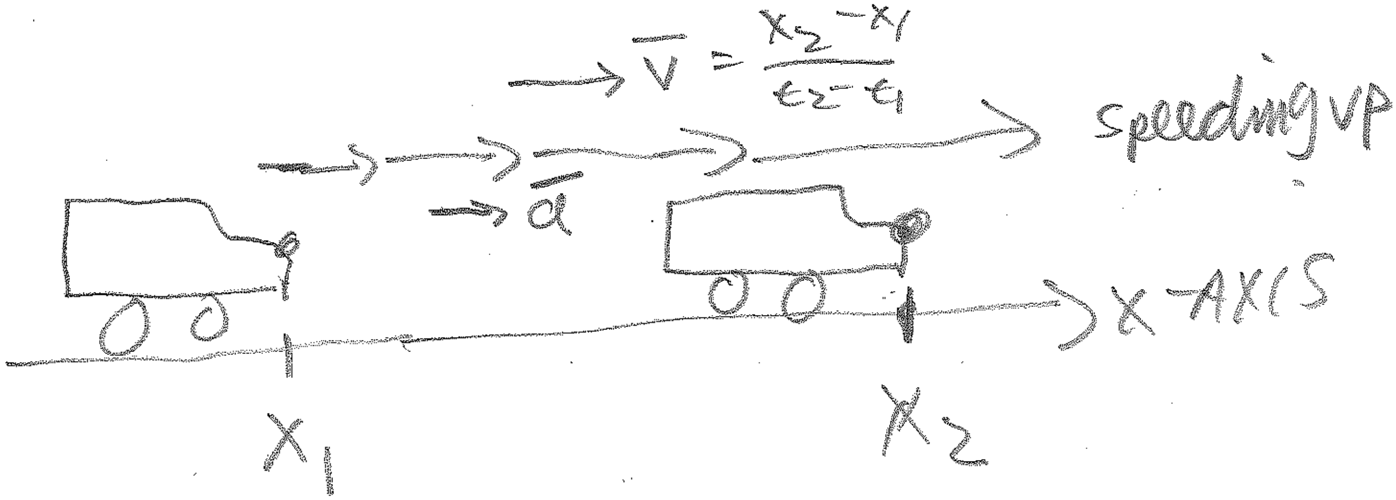
2A: 8-28-13

one dimensional motion





displacement $= x_2 - x_1 > 0$

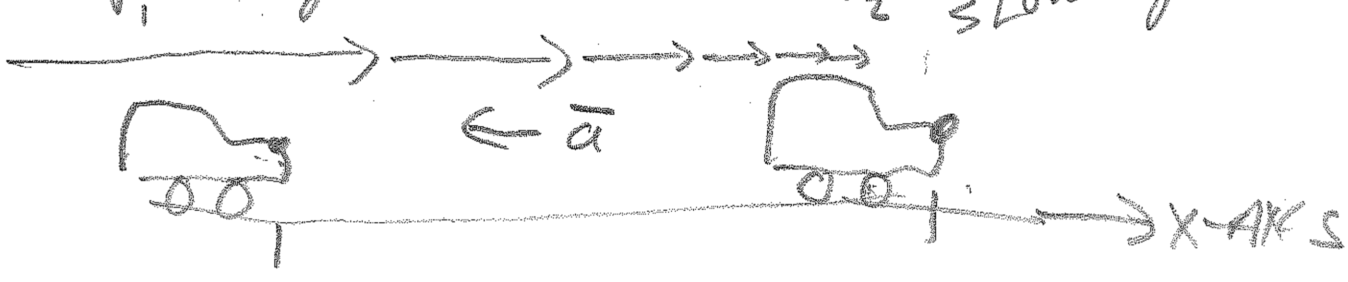
Average velocity $= \bar{v} = \dfrac{x_2 - x_1}{t_2 - t_1} > 0$

NOTE: $\vec{v}$
v = instantaneous velocity at some time t.

NOTE: $\bar{a}$ = average acceleration
$= (v_2 - v_1)/(t_2 - t_1)$

could be slowing down.

fig 2.1 $\rightarrow \bar{v}$



$x_1 = 19\,(m)$ $\qquad$ $x_2 = 277\,(m)$

$$\bar{v} = \frac{x_2 - x_1}{t_2 - t_1} = \frac{(277 - 19)\,m}{4.0(s) - 1.0(s)}$$

$$= \frac{258\,m}{3\,s}$$

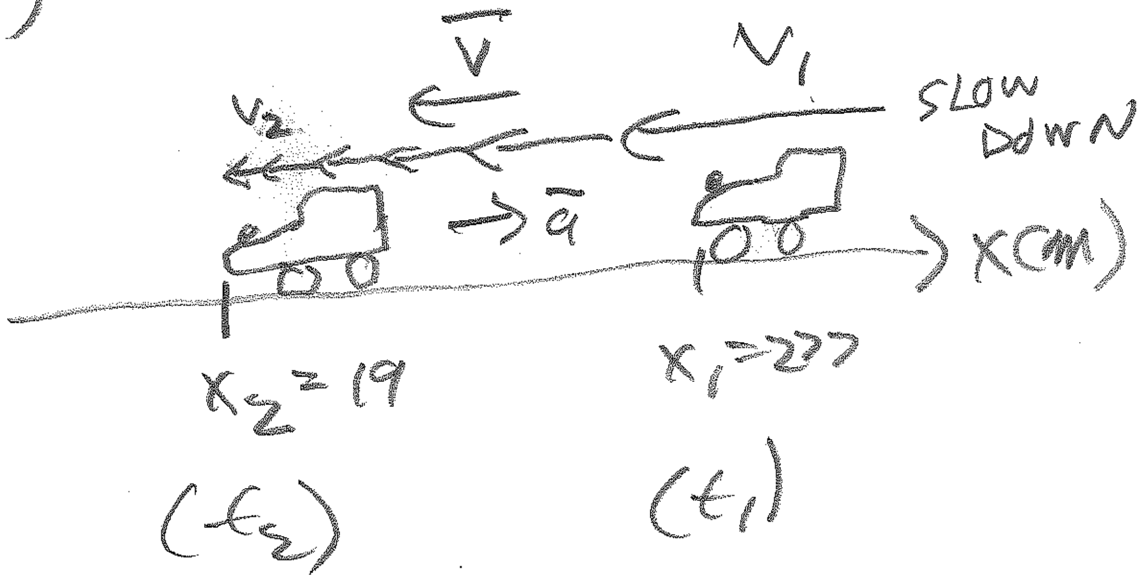
$$= 86\,\frac{m}{s}$$

$$\begin{array}{r} 86 \\ \times\ 3 \\ \hline 258 \end{array}$$

NOTE: $\bar{a}$ = AVERAGE acceleration

$$\bar{a} = \frac{v_2 - v_1}{t_2 - t_1}$$

moving Backwards



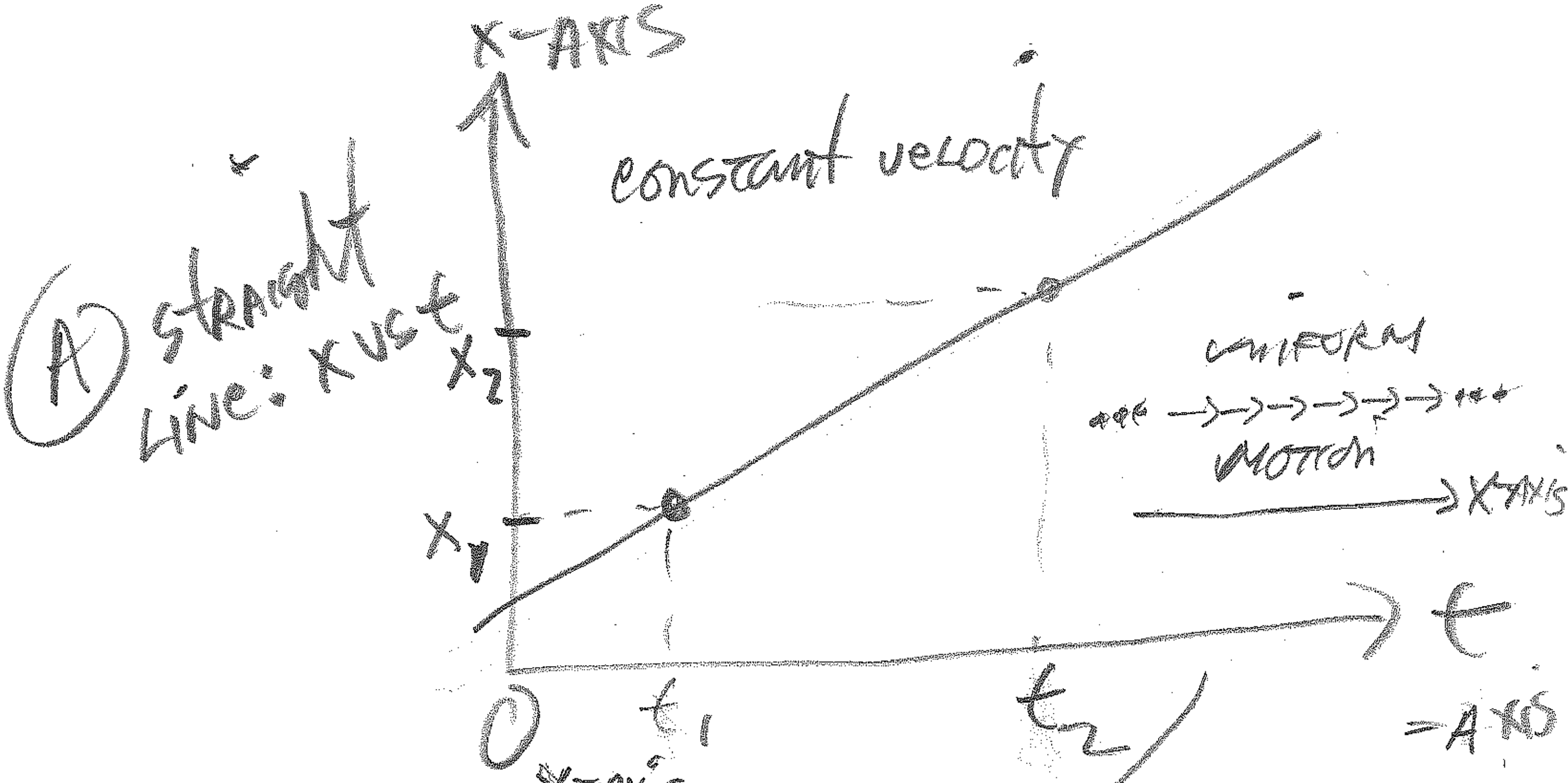
$$t_2 \geq t_1$$

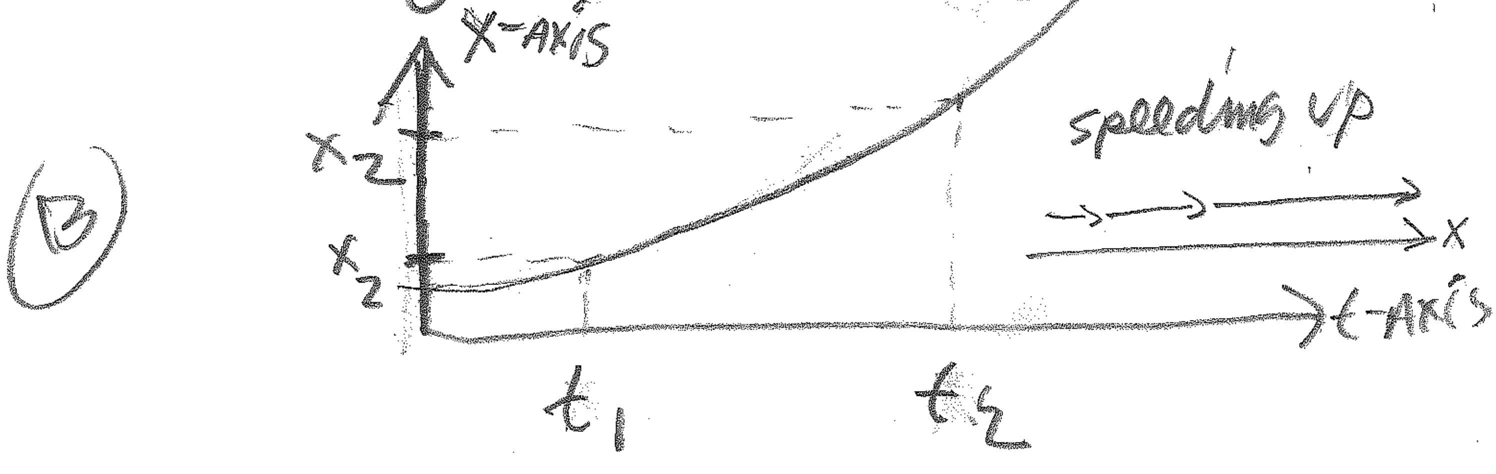
$$\bar{a} = \frac{v_2 - v_1}{t_2 - t_1} > 0$$

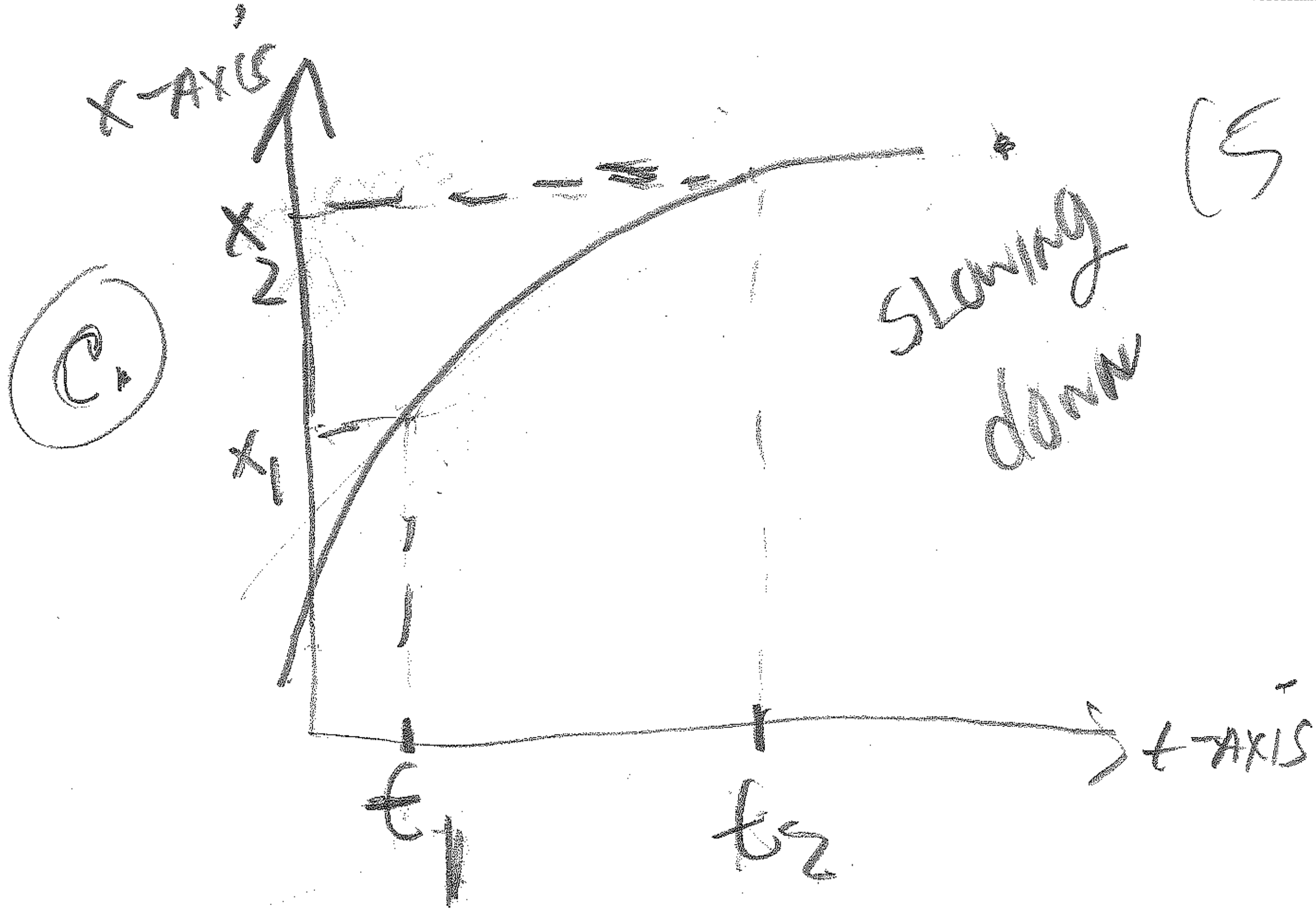
$$\bar{V} = \frac{(19 - 277)(cm)}{(4.0 - 1.0)(s)} = -86 \frac{m}{s}$$

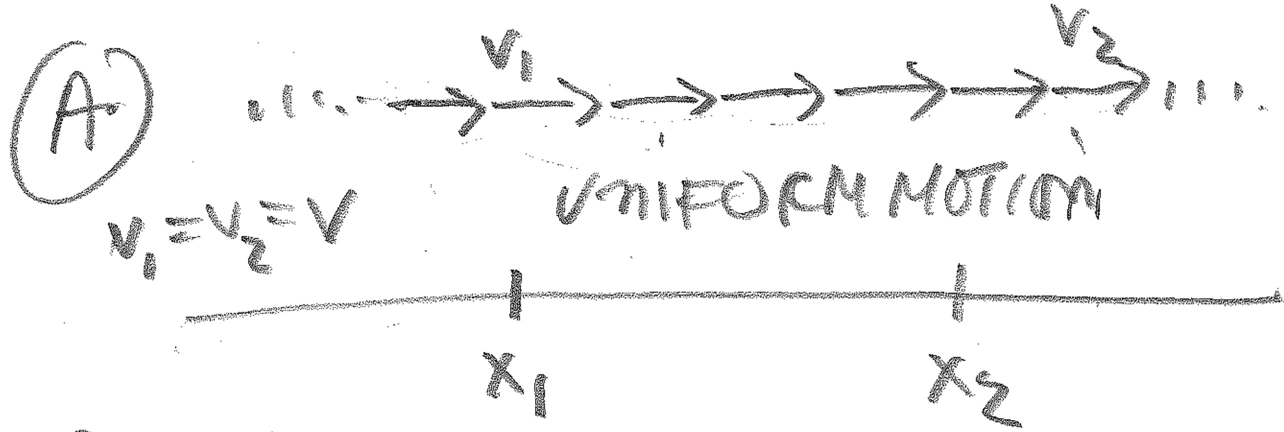
note: details between x_1 and x_2 are UNKNOWN.

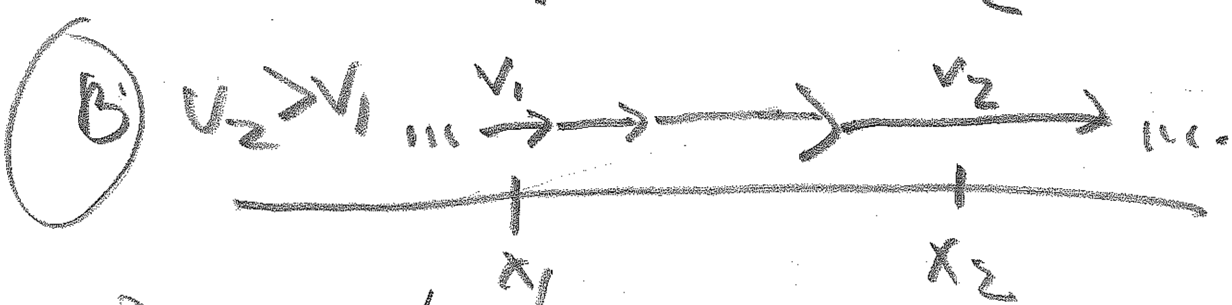
TYPICAL possibilities

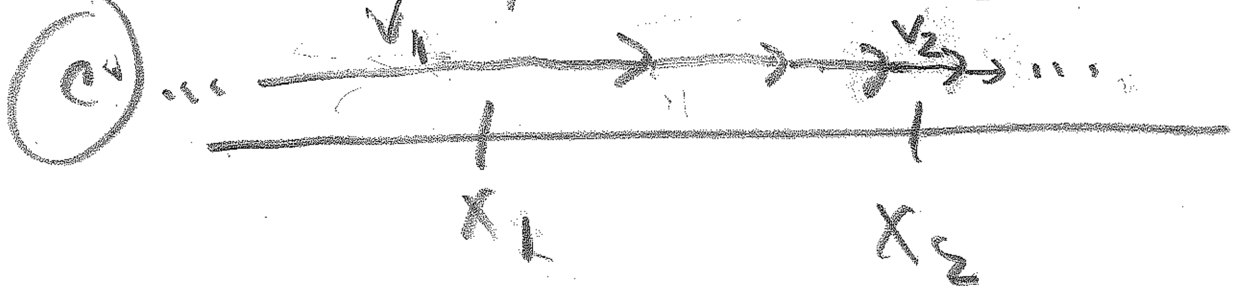





C.
x-AXIS
x2
x1
t1
t2
t-AXIS
Slowing down

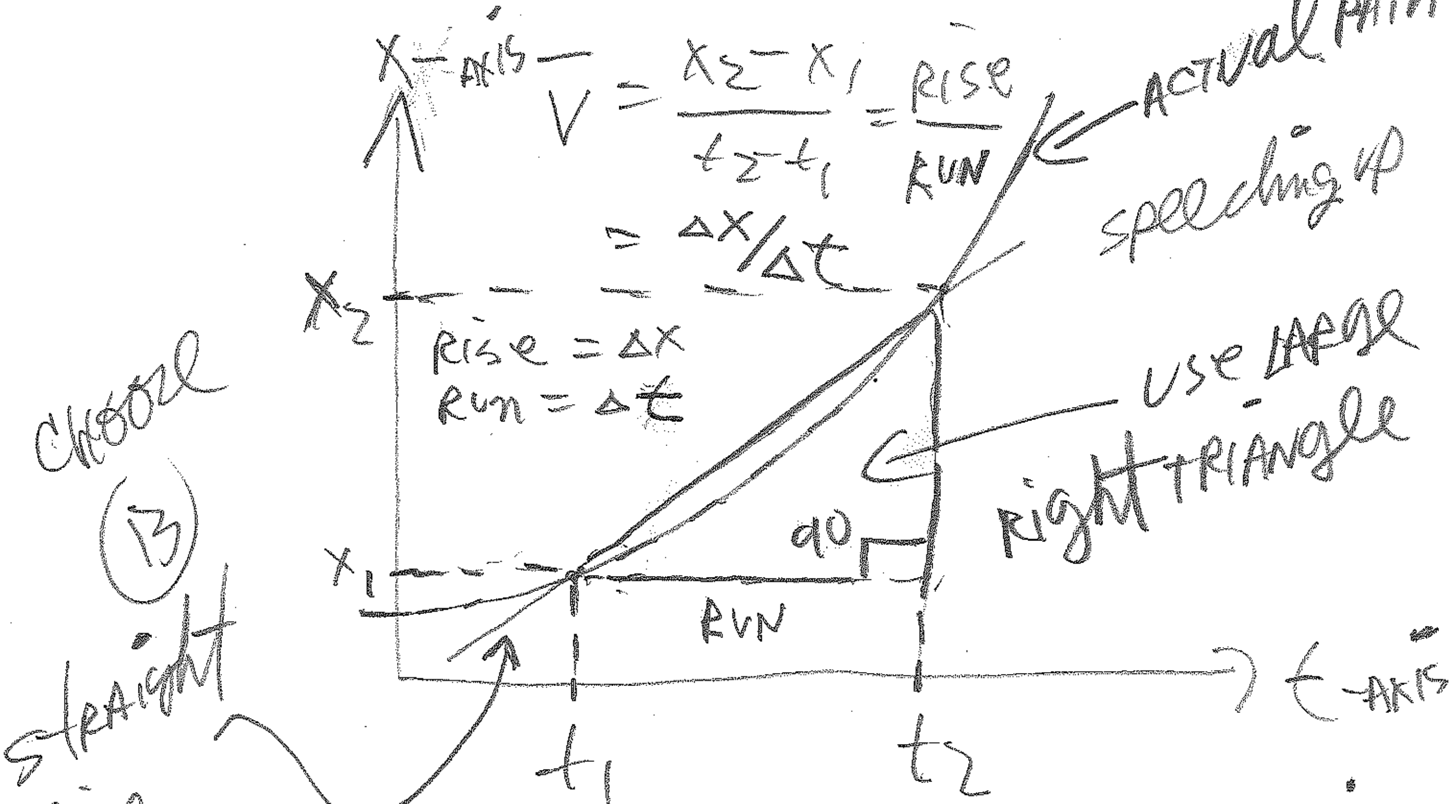

A
v1
v2
v1=v2=v
UNIFORM MOTION
x1
x2

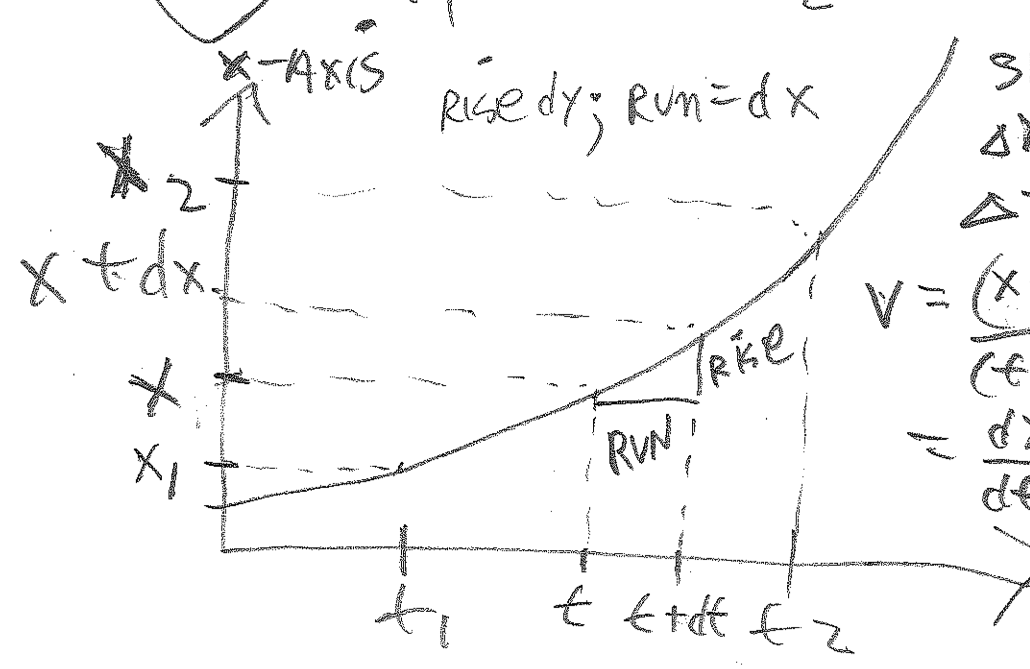

B
v2>v1
v1
v2
x1
x2


C
v1
v2
x1
x2

calculate V = instantaneous velocity

FIRST, review $\bar{V}$ calculation:





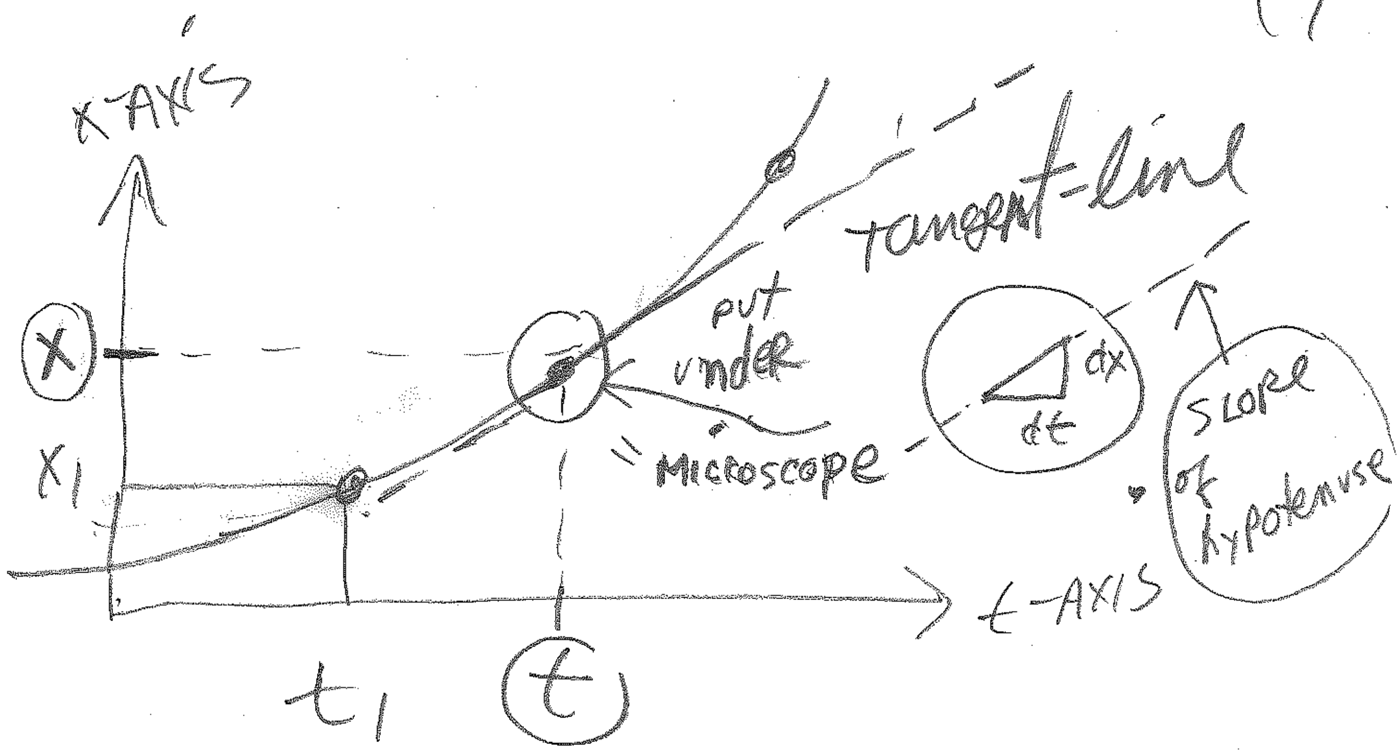
SMALL TRIANGLE

$\Delta x \to dx$

$\Delta t \to dt$

$$V = \frac{(x + dx) - x}{(t + dt) - t}$$

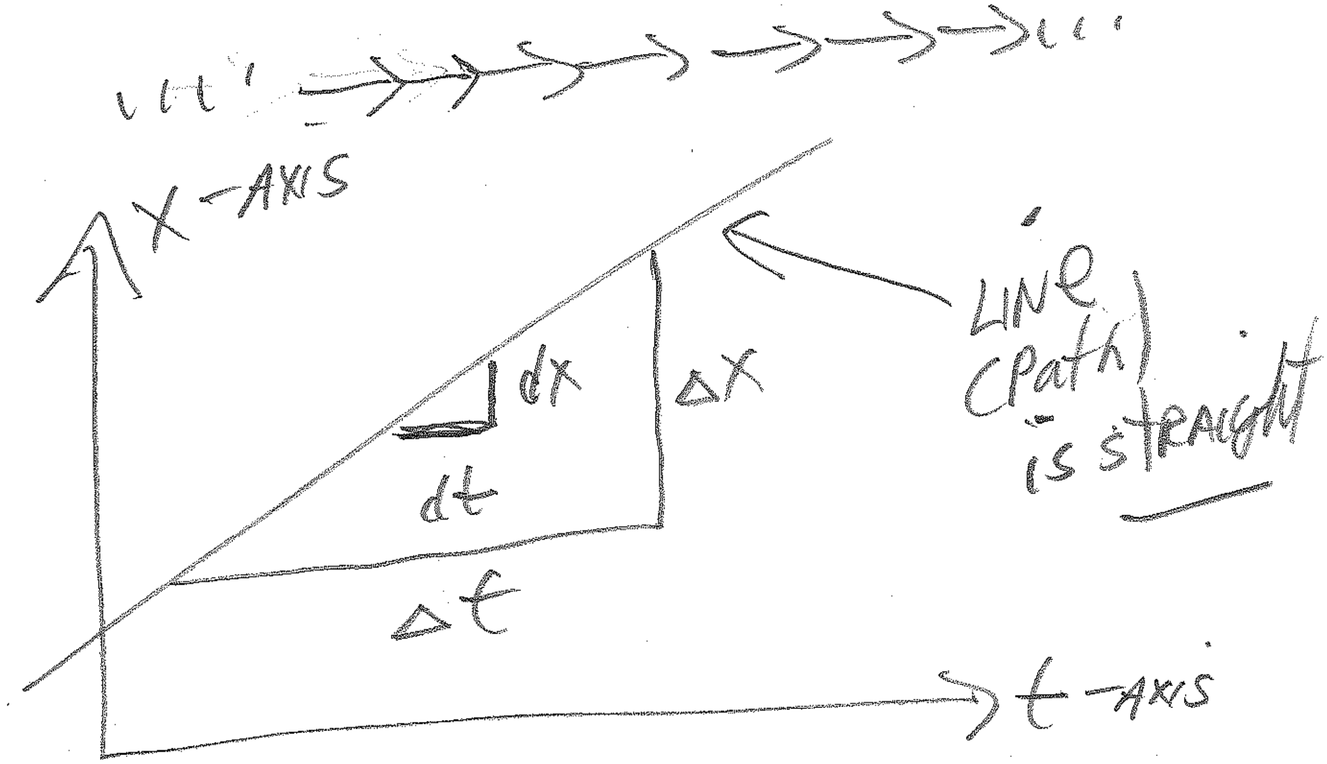
$$= \frac{dx}{dt} = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t}$$



$$v = \frac{dx}{dt} = \text{slope of tangent at } x \text{ and } t.$$

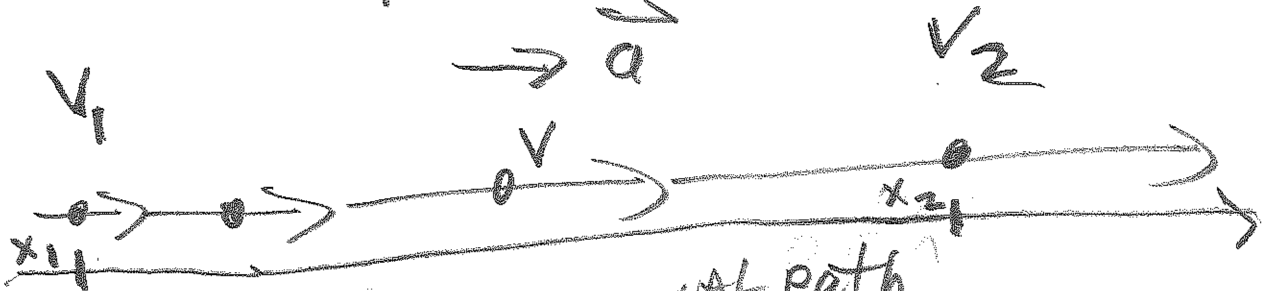
$$v = \frac{dx}{dt} = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t}.$$

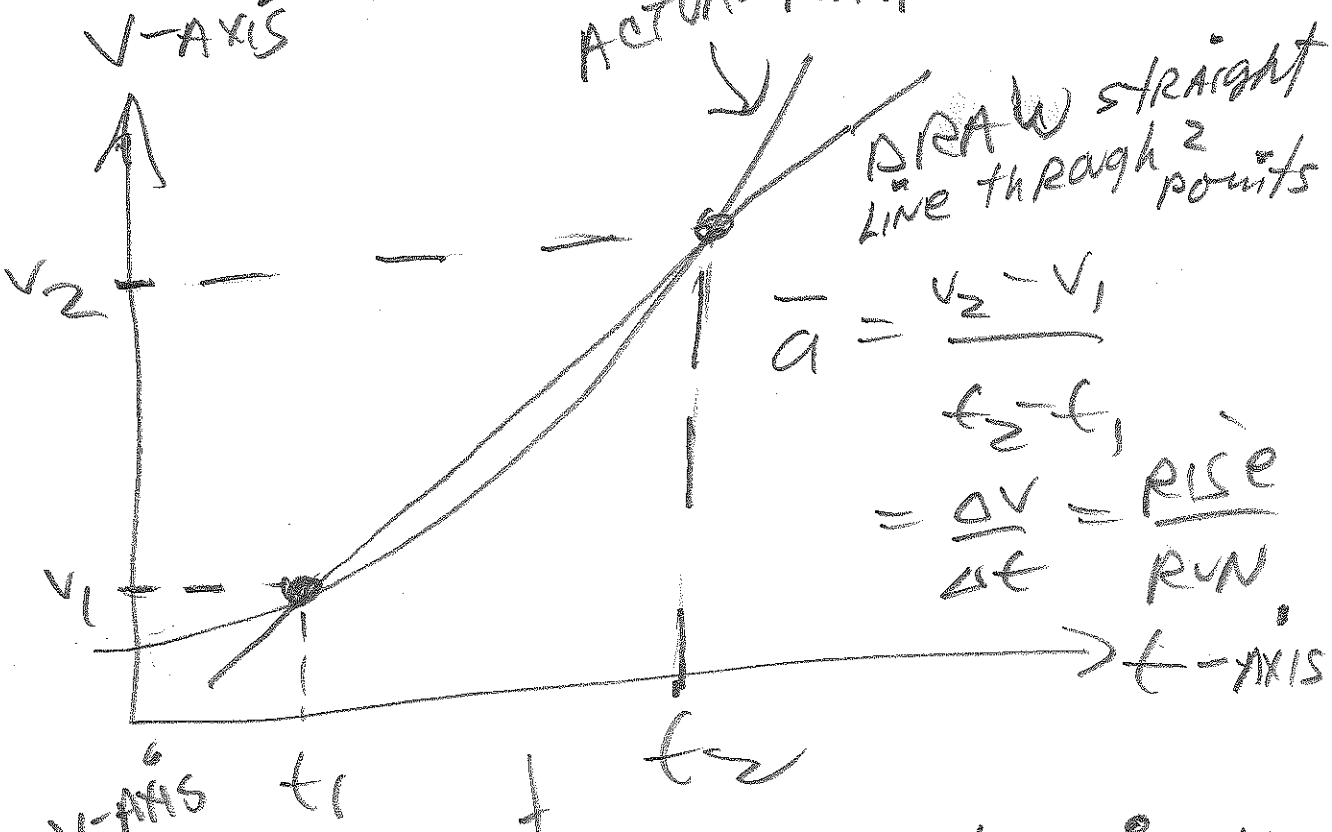
NOTE: uniform motion



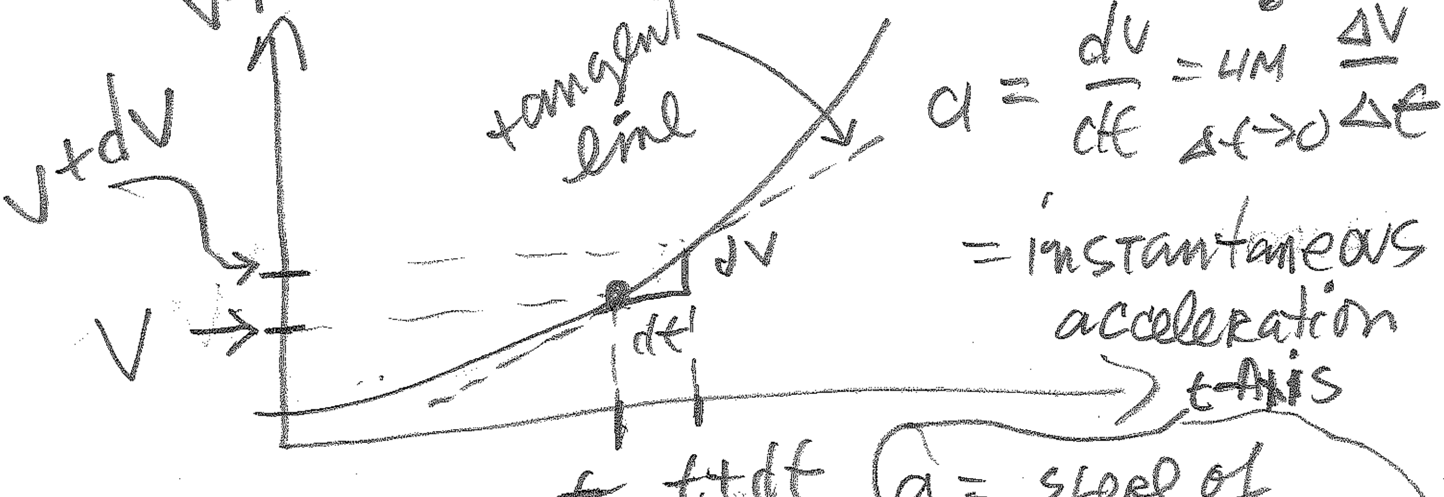
$$\frac{dx}{dt} = \frac{\Delta x}{\Delta t} = v = \bar{v} = \frac{\Delta x}{\Delta t}$$

Speed UP





$$\bar{a} = \frac{v_2 - v_1}{t_2 - t_1} = \frac{\Delta v}{\Delta t} = \frac{\text{RISE}}{\text{RUN}}$$



$$a = \frac{dv}{dt} = \lim_{\Delta t \to 0} \frac{\Delta v}{\Delta t}$$

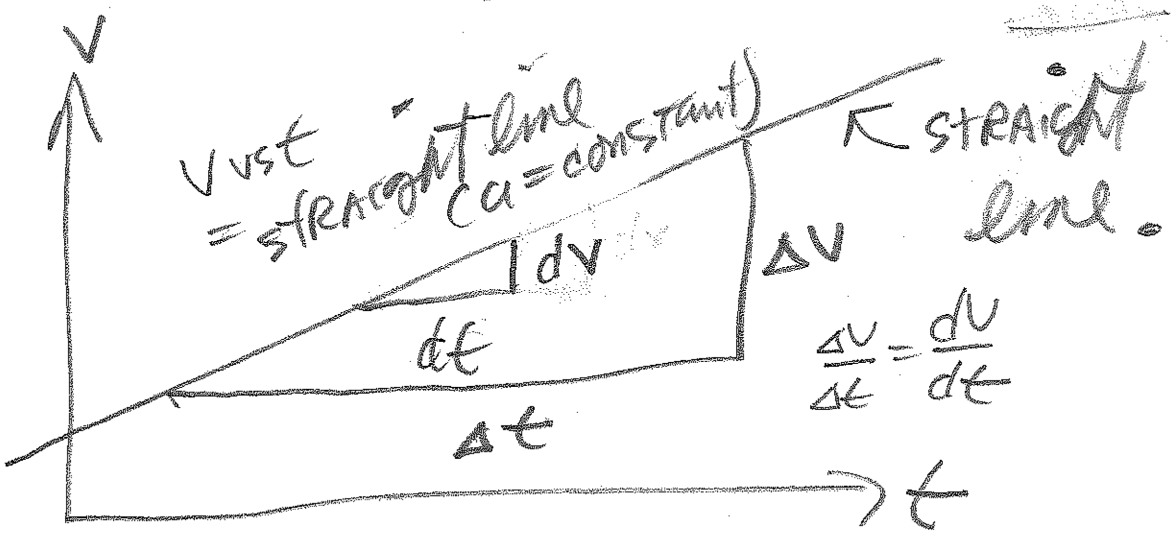
= instantaneous acceleration

a = slope of tangent line

Special case: good for sec. 2.4 and 2.5.

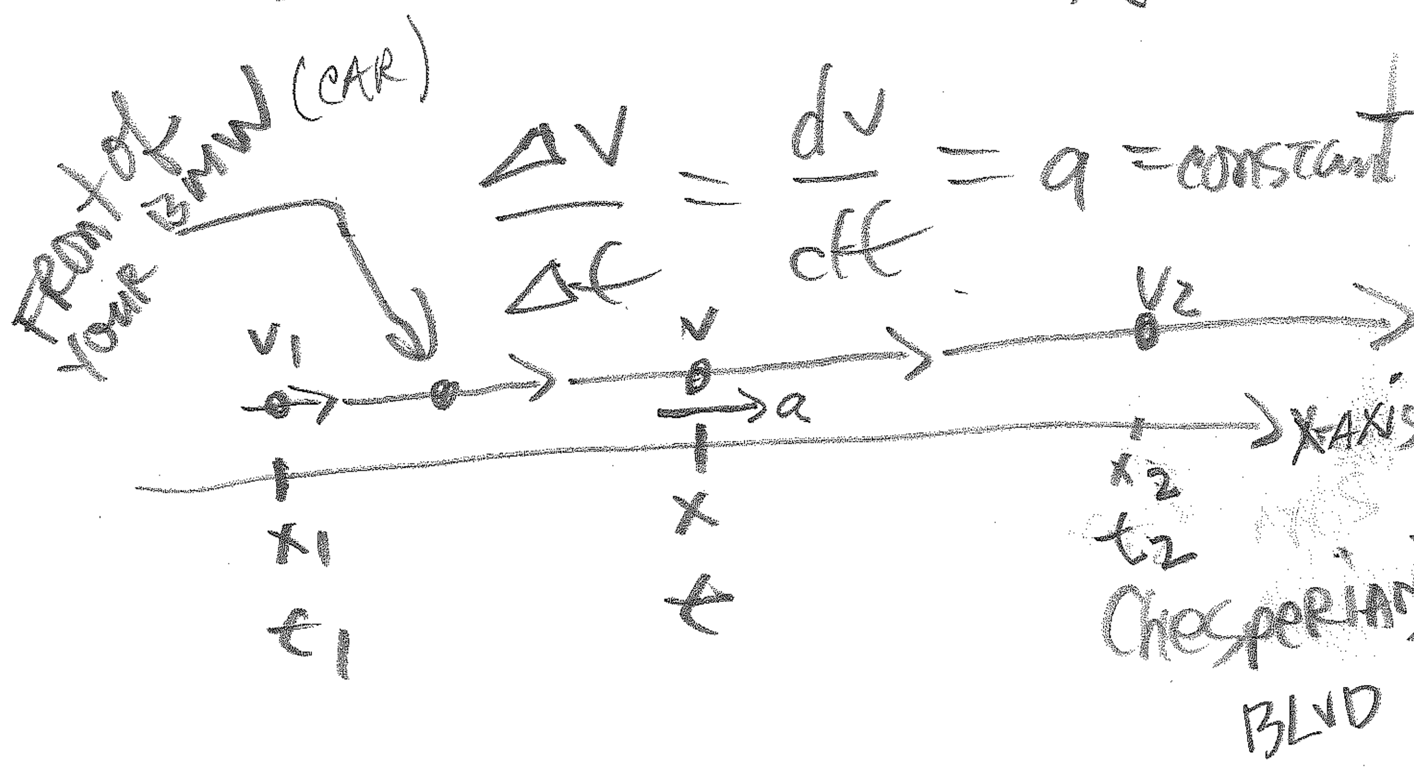
$\bar{a} = a =$ constant.

uniformly accelerated motion.



$$\frac{\Delta v}{\Delta t} = \frac{dv}{dt}$$

$$\frac{\Delta v}{\Delta t} = \frac{dv}{dt} = a = \text{constant}$$



AFTER BREAK: DERIVE EQNS.

for UNIFORMLY accelerated

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

simple example: uniformly accelerated

$v_2 = 60 \frac{m}{s} \approx 135 \frac{mi}{h}$

$v_1 = 2 \frac{m}{s} \approx 4.5 \frac{mi}{h}$

x-AXIS

x_1 $\qquad$ x_2

$t_1 = 5.0(s)$ $\qquad$ $t_2 = 25(s)$

$60 \frac{m}{s} \times \frac{1\ mi}{1.6\ km} \cdot \frac{1\ km}{1000\ m} \cdot \frac{1\ h}{3600\ s} = \boxed{135 \frac{mi}{h}}$

$\bar{a} = a = \frac{(60-2)\ m/s}{(25-5)\ s} = 2.9 \frac{m}{s^2} \approx 3g$

$(g = 9.8\ m/s^2)$

$2 \frac{m}{s} \cdot \frac{1}{1.6} \frac{3600}{1000} \frac{mi}{h} = 4.5 \frac{mi}{h}$

Lab FRIDAY 8-30-13 (12)
on Picket Fence

Read: sec 2.4, 2.5

Quick Example: slowing down in negative direction