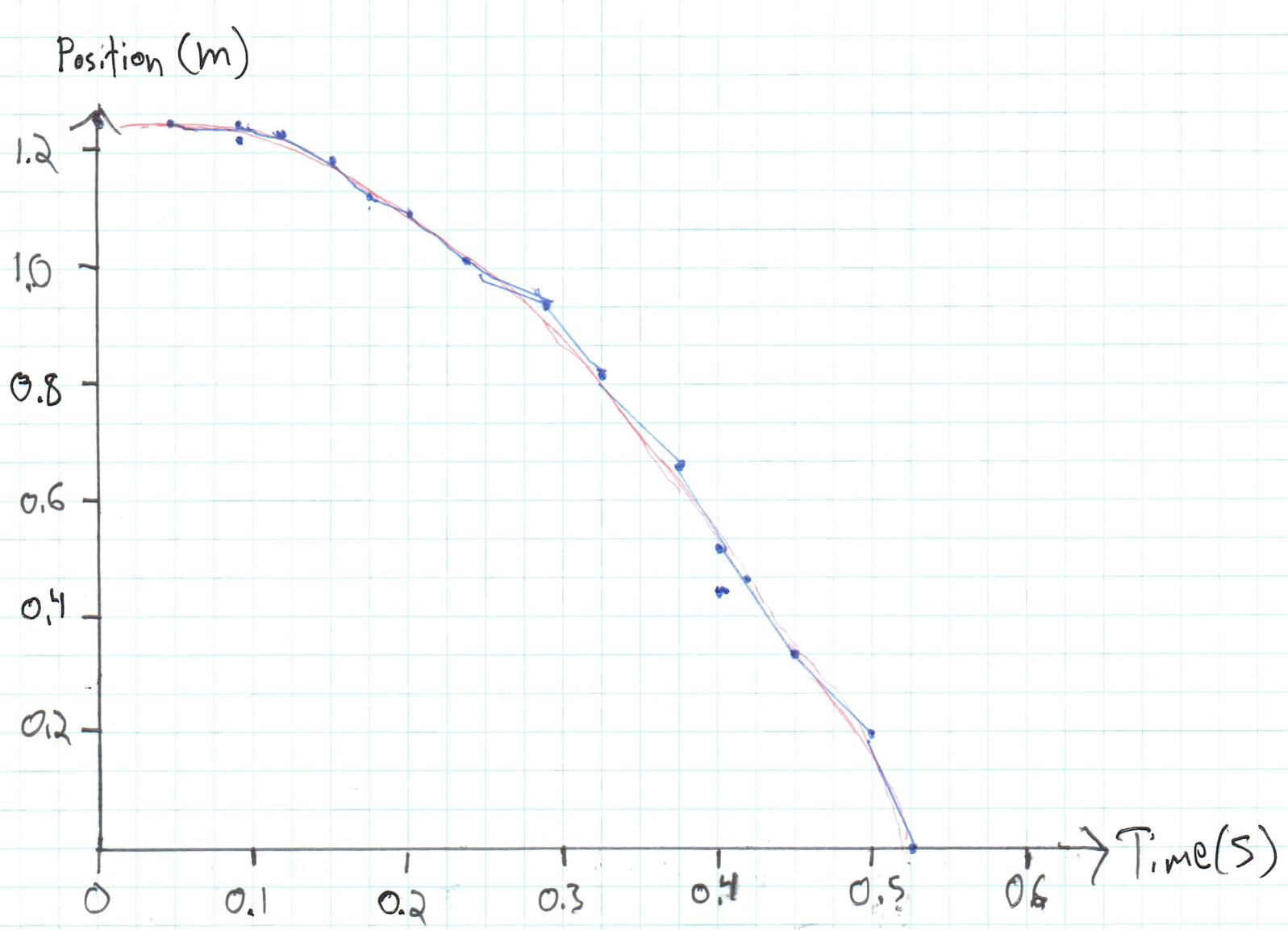
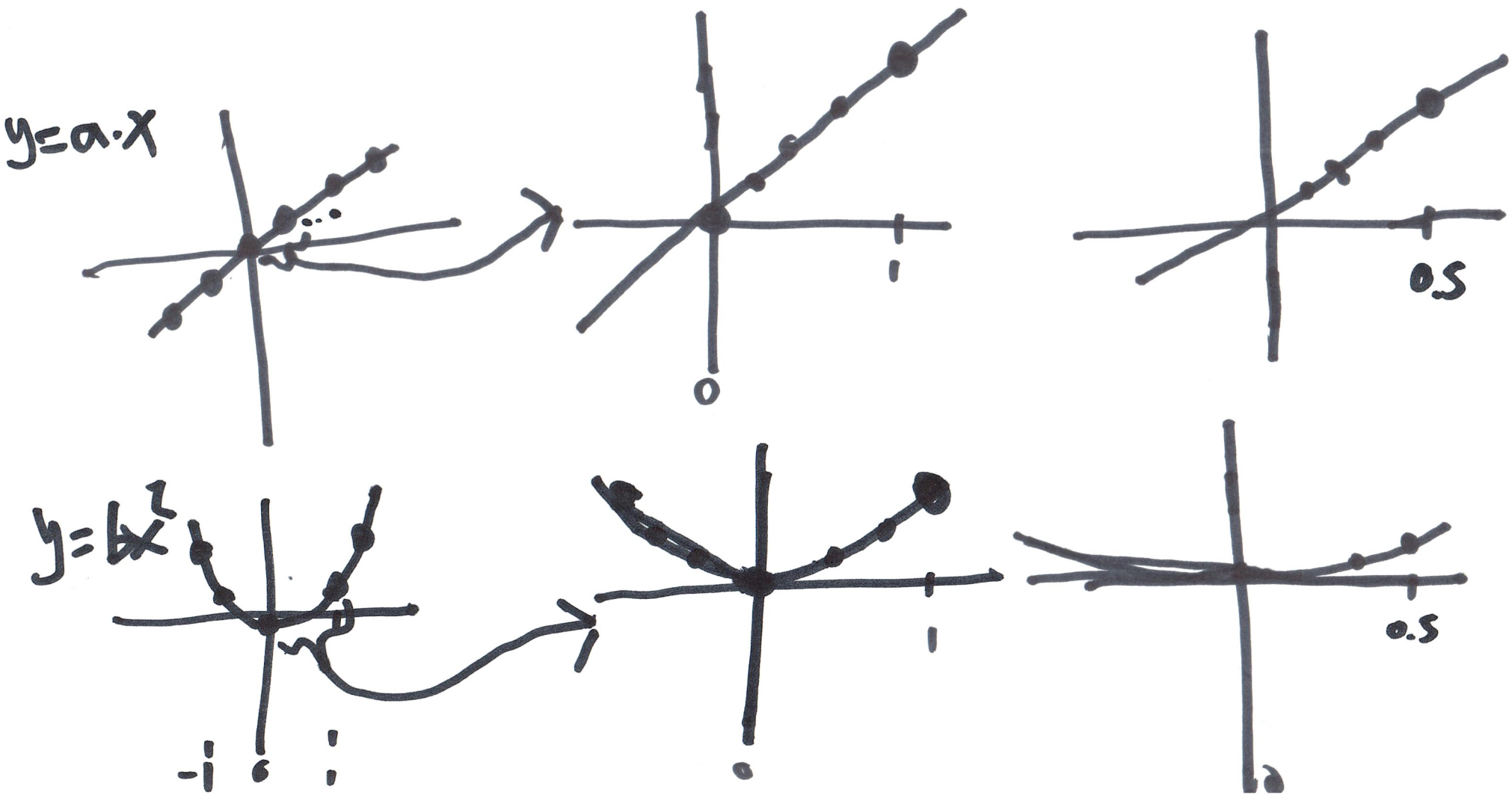
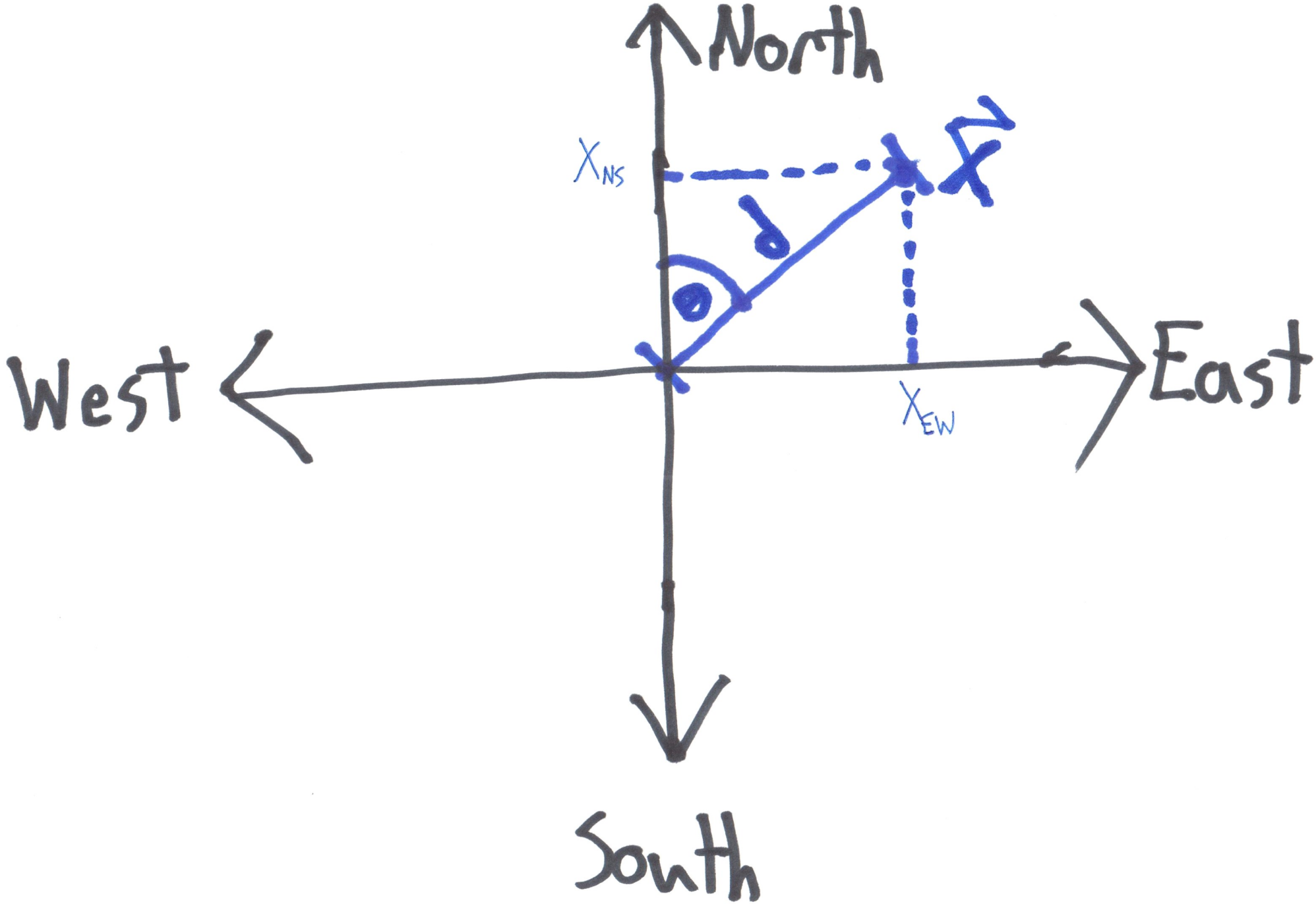
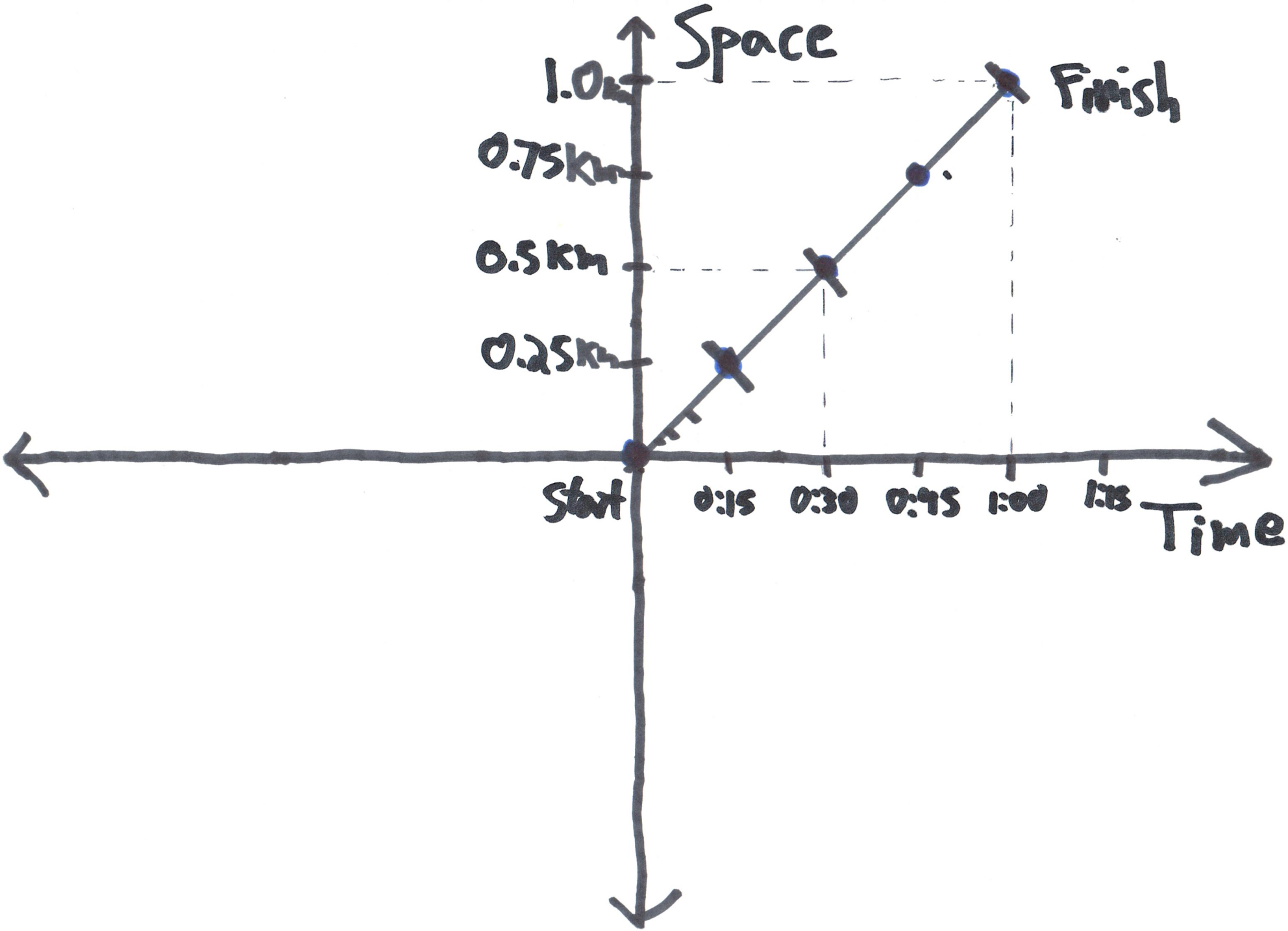

Position (m)
1.2
1.0
0.8
0.6
0.4
0.2
0
0.1
0.2
0.3
0.4
0.5
0.6
Time(s)

$y(x)$ is just math, no data,
can keep zooming in




North
West
East
South
X_{NS}
X_{EW}
d
θ


Space
1.0km
0.75km
0.5km
0.25km
Finish
Start
0:15
0:30
0:45
1:00
1:15
Time

$y = a \cdot x$ is easy

$$f(x) = a \cdot x \rightarrow \frac{d}{dx} f(x) = \frac{a \cdot (x+\delta) - a \cdot x}{\delta} = \frac{a\delta}{\delta}$$

$$= a$$

$$f(x) = bx^2 \rightarrow \frac{d}{dx} f(x) = \frac{b \cdot (x+\delta)^2 - b \cdot x^2}{\delta}$$

$$= \frac{bx^2 - bx^2 + 2 \cdot b \cdot \delta x + b \cdot \delta^2}{\delta} = 2bx + b \cdot \delta = 2 \cdot b \cdot x$$

($b \cdot \delta \rightarrow 0$, $\lim_{\delta \to 0}$)

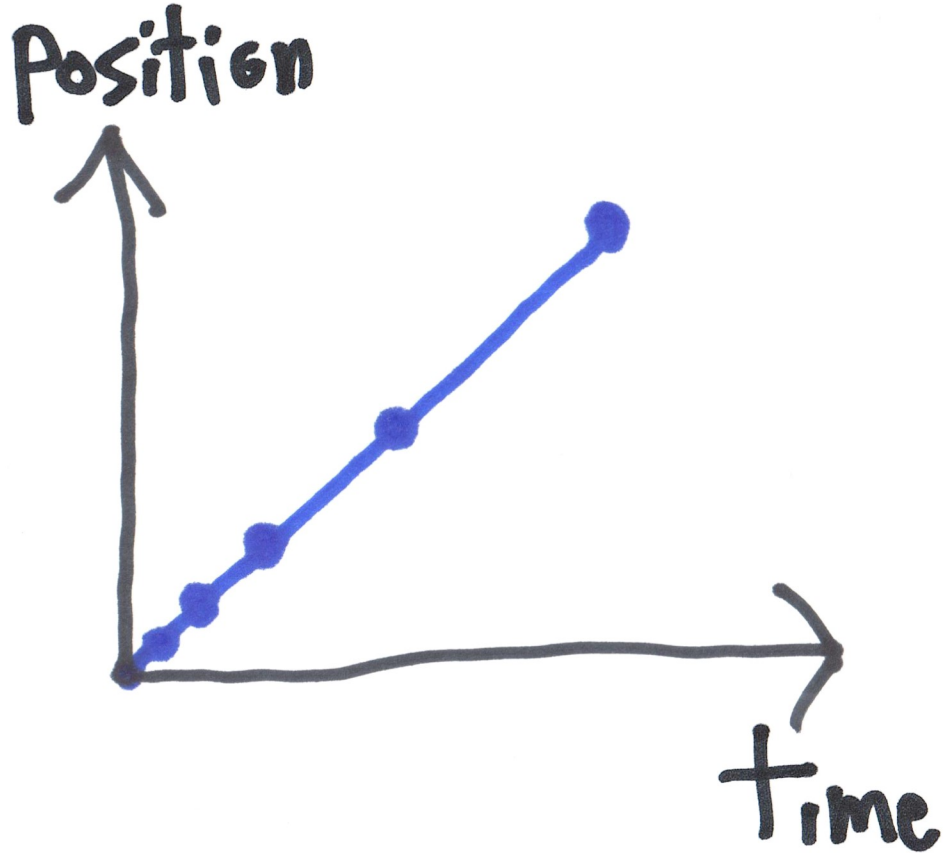
What if I tell you $\vec{V}$ (or s) but not $\vec{X}$, the position...

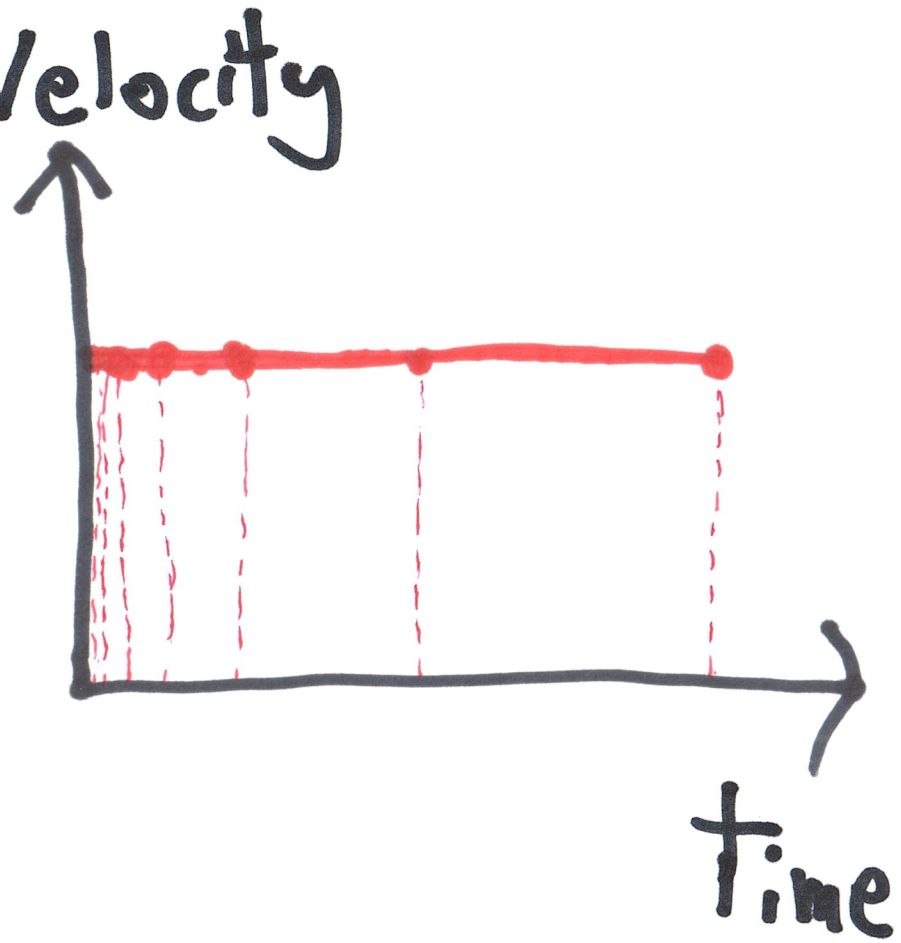
well

$$\vec{V} = \frac{\vec{X}}{t} \quad \text{so} \quad \vec{X} = \vec{V} \cdot t$$

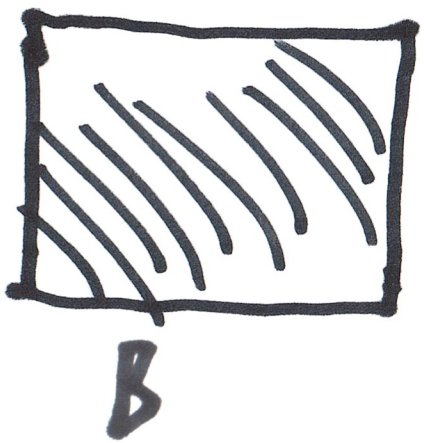
or

$$s = \frac{d}{t} \quad \text{so} \quad d = s \cdot t$$

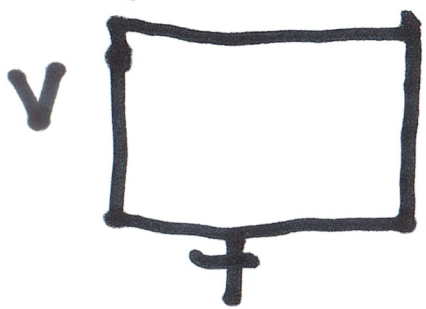


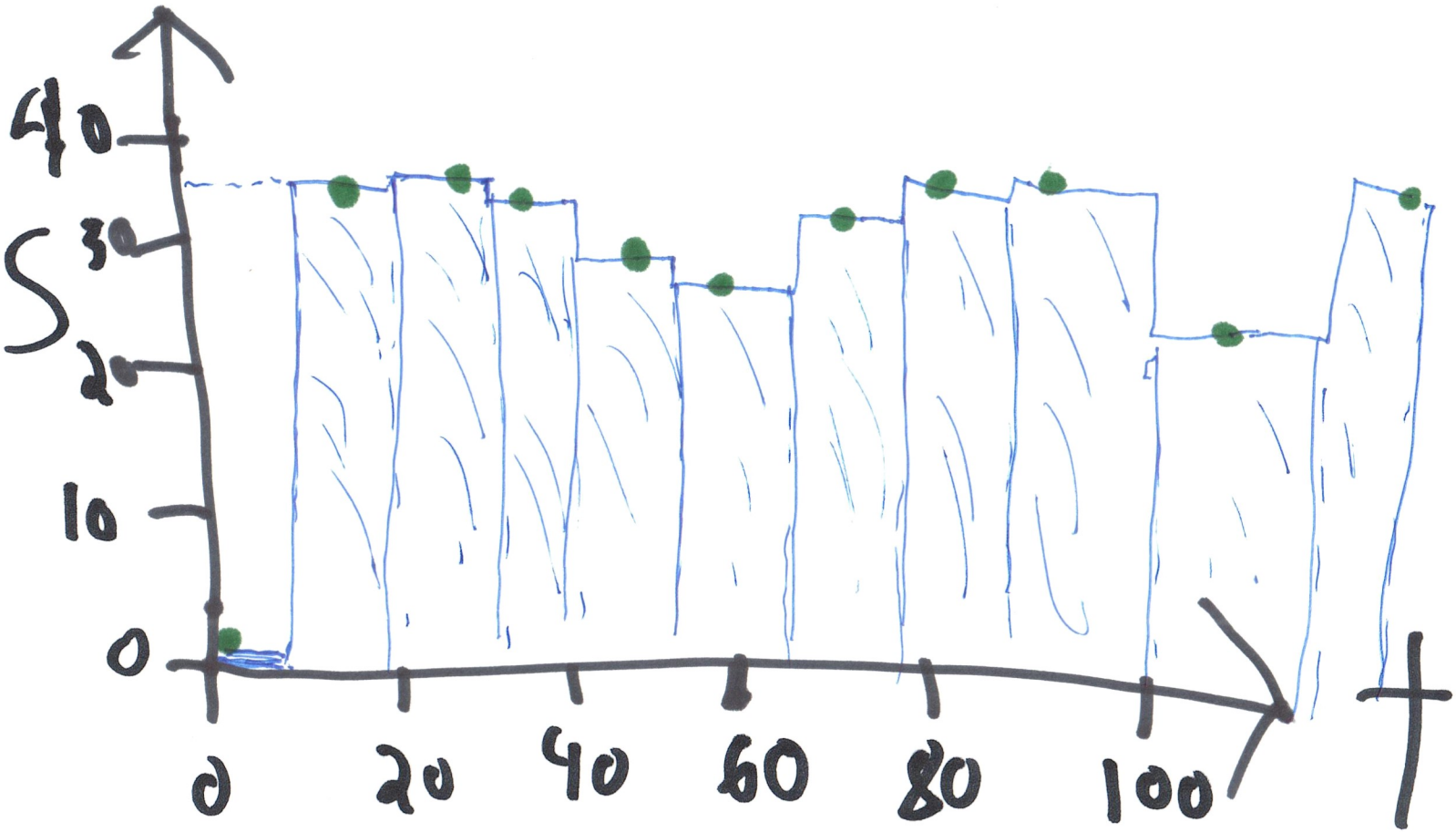


area = A · B

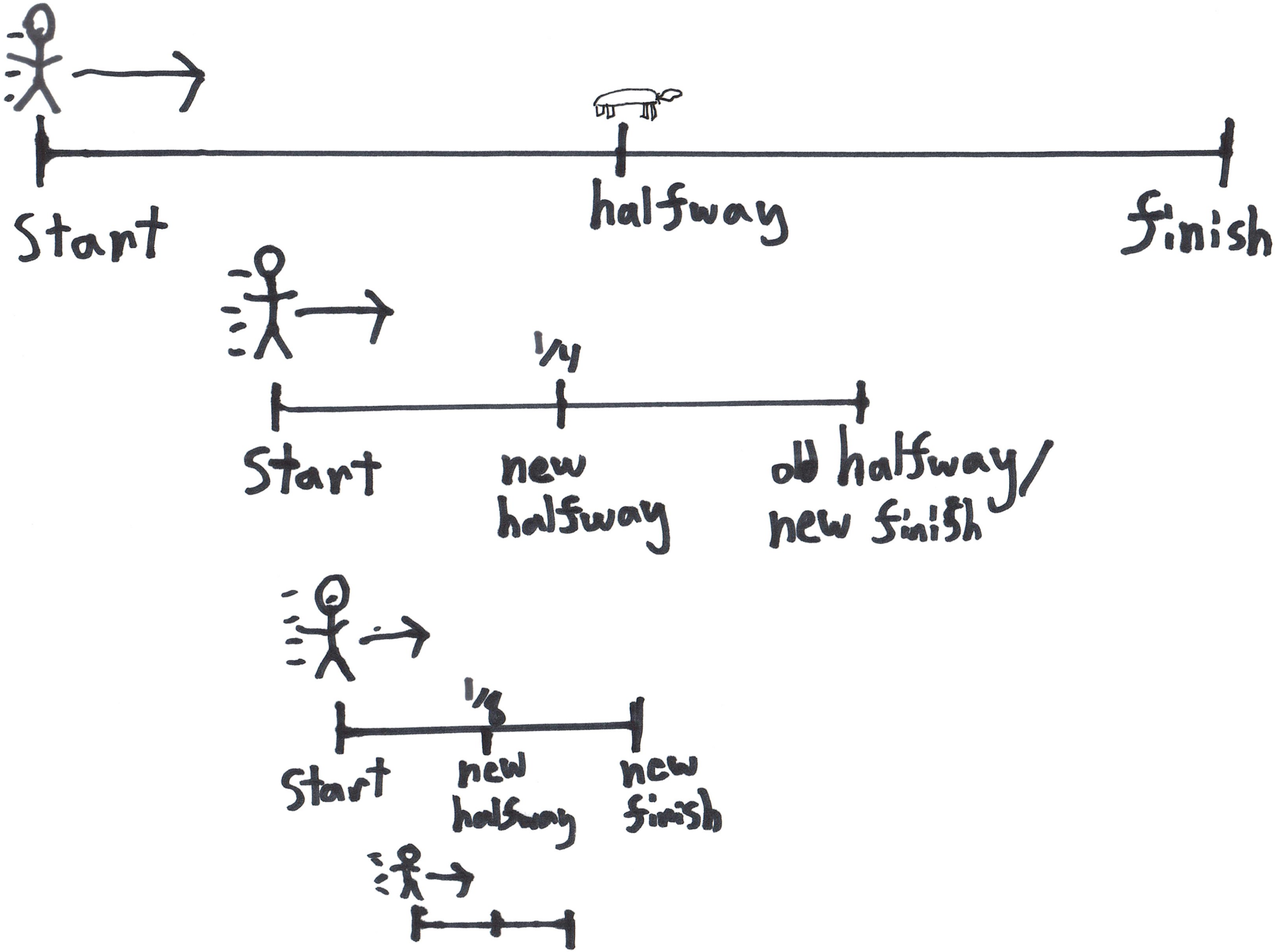


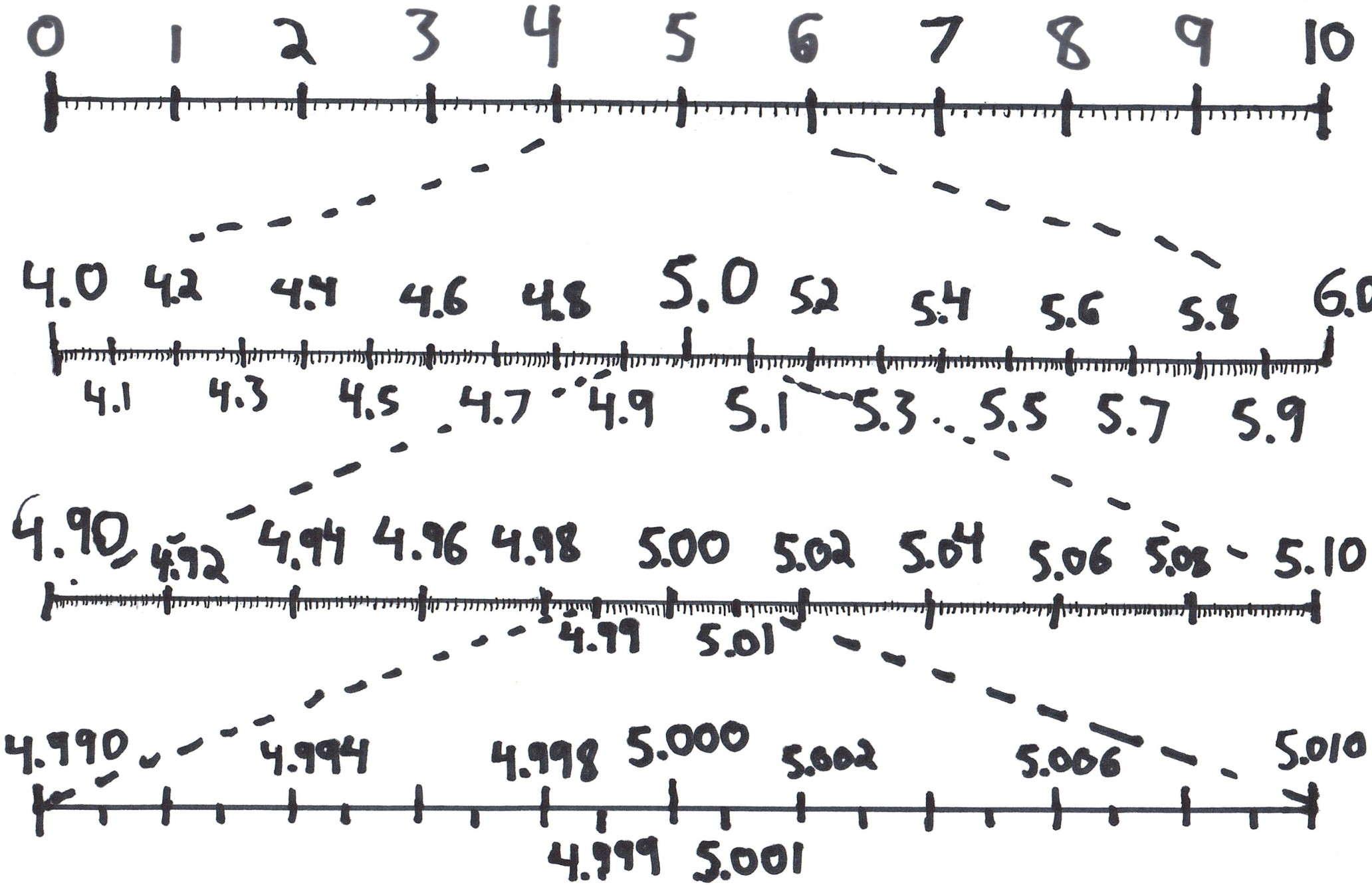
→ ~~area~~ position = v · t





$$d(t) = \sum_{t'=t}^{t'=t} s(t') \cdot \Delta t$$


Start
halfway
finish
1/4
Start
new halfway
old halfway/ new finish
1/8
Start
new halfway
new finish


0 1 2 3 4 5 6 7 8 9 10
4.0 4.2 4.4 4.6 4.8 5.0 5.2 5.4 5.6 5.8 6.0
4.1 4.3 4.5 4.7 4.9 5.1 5.3 5.5 5.7 5.9
4.90 4.92 4.94 4.96 4.98 5.00 5.02 5.04 5.06 5.08 5.10
4.99 5.01
4.990 4.994 4.998 5.000 5.002 5.006 5.010
4.999 5.001

but speed $\equiv \frac{\text{distance}}{\text{time}} \neq$ constant

Speed?

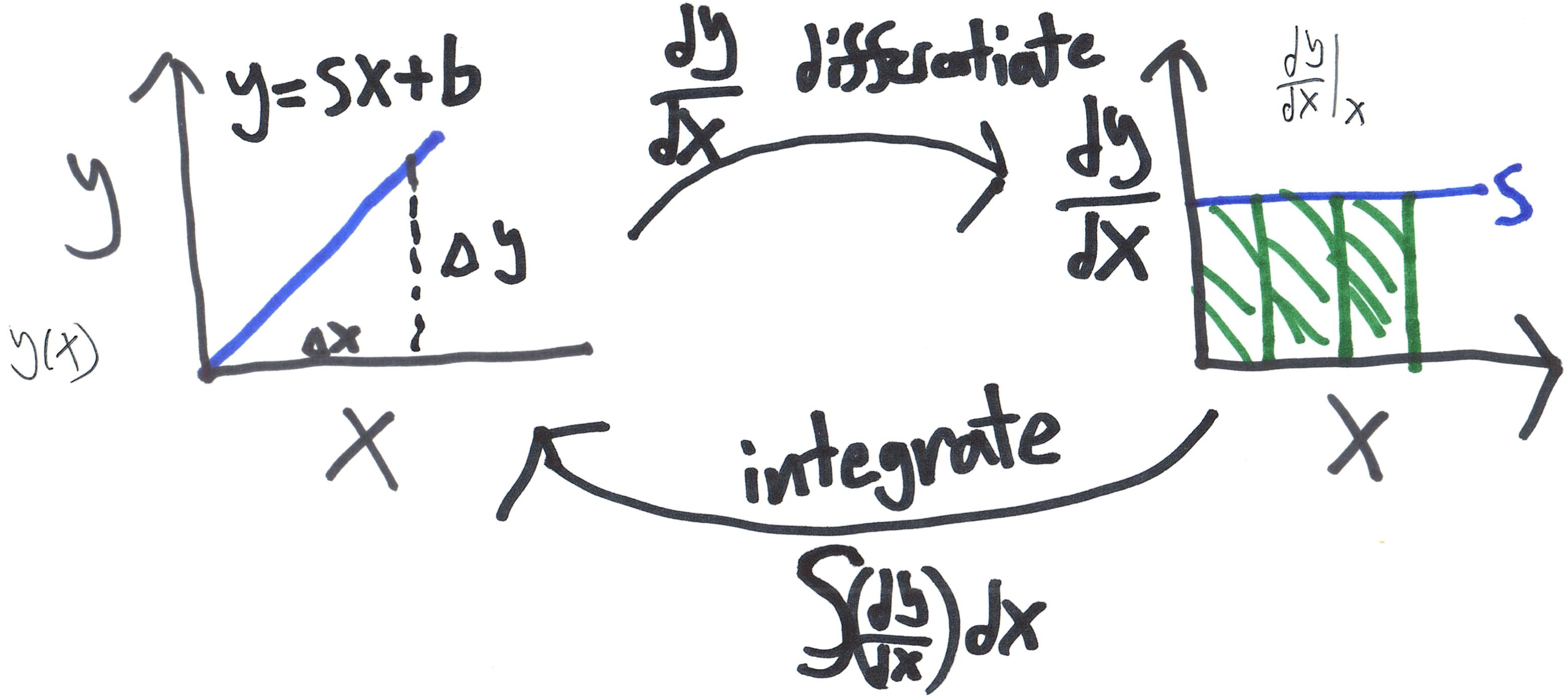
$d = 2 \cdot t$

d	2	4	6	8
t	1	2	3	4
	2✓	2✓	2✓	2✓

$d = 2t^2$

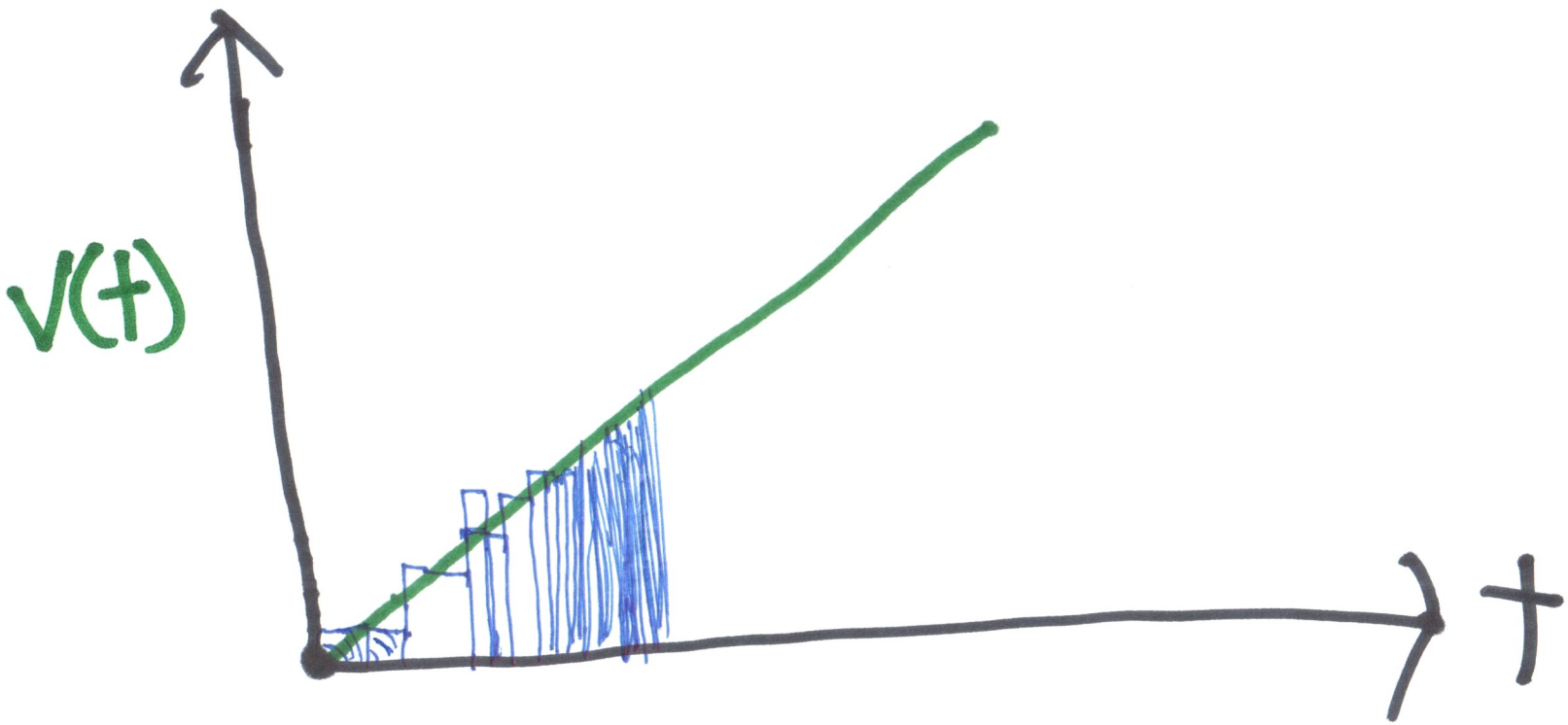
d	2	8	18	32
t	1	2	3	4
	2✓	4✗	6✗	8✗

Speed?



$$\Delta y = \left(\frac{\Delta y}{\Delta x}\right) \cdot \Delta x \rightarrow \frac{dy}{dx} \cdot \Delta x \approx \Delta y$$

$$\Delta y = \sum (\Delta x) \cdot \frac{dy}{dx}\bigg|_{x'} \equiv \int_0^x \left(\frac{dy}{dx}\right) dx' = y(x)$$



$$\vec{x} = \int_0^t V(t)\,dt' \equiv \lim_{\Delta t \to 0} \sum_0^t V(t) \cdot \Delta t$$

$$\vec{F} = m\vec{a} \rightarrow$$