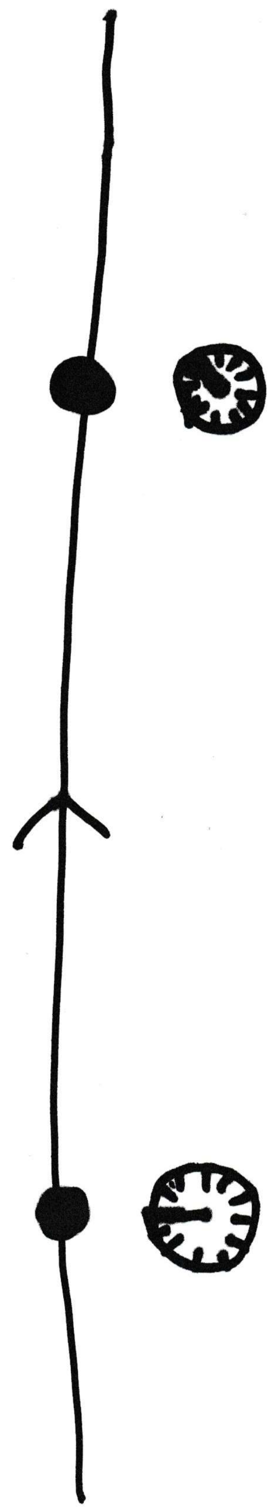


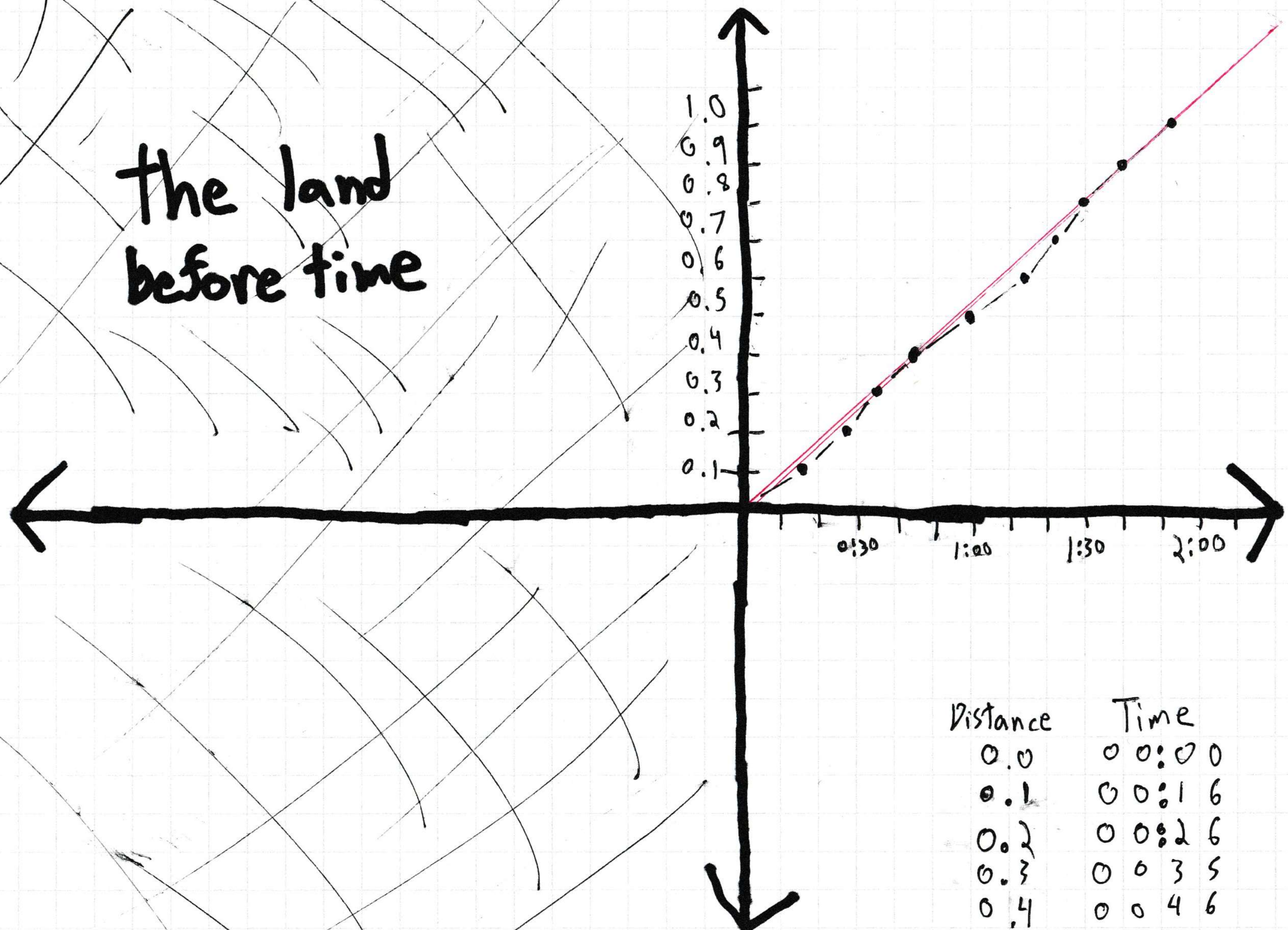
$$60.\ \frac{\text{km}}{\text{hr}} \cdot (0{:}15\ \text{min}) = 60. \times 0.25$$

$$= 15\ \text{km}$$

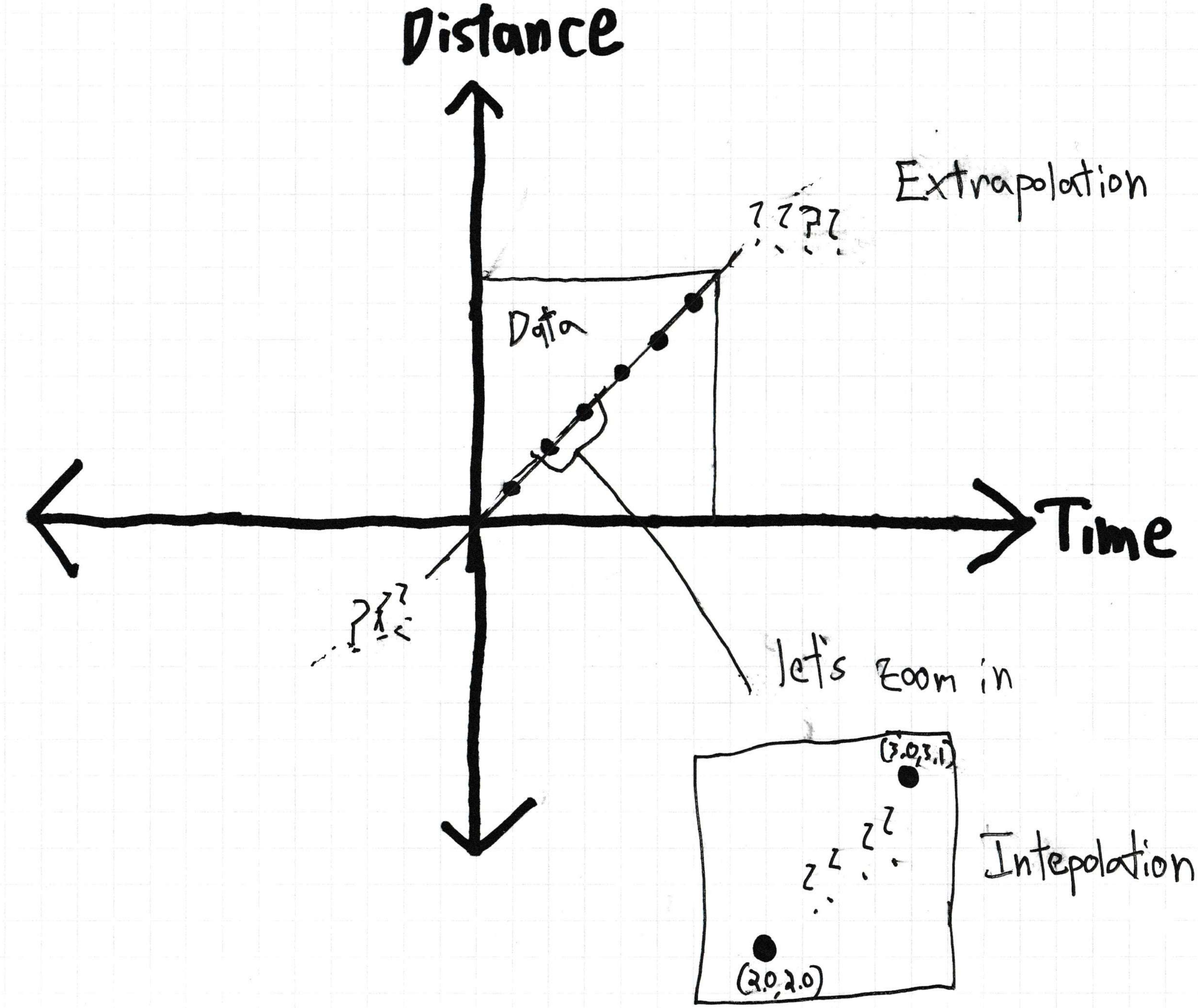
$$30.\ \text{km}/\text{hr} \cdot (0{:}15) = 30. \cdot 0.25 = 7.5\ \text{km}$$

now what?

the land before time

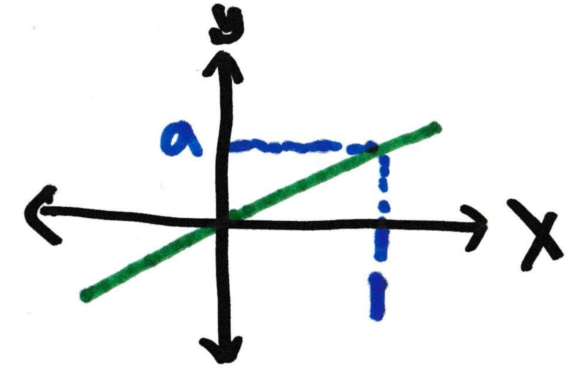


Distance	Time
0.0	00:00
0.1	00:16
0.2	00:26
0.3	00 35
0.4	00 46
0.5	0[illegible]:60
0.6	01:13
0.7	01:22
0.8	01:30
0.9	01:40
1.0	01:53

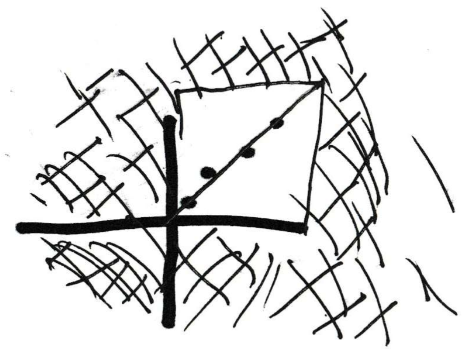

Distance
Time
Extrapolation
Data
let's zoom in
Intepolation
(3.0,3.1)
(2.0,2.0)

position/distance from some starting point such that the distance is proportional to the time elapsed multiplied by the velocity in the relevant units

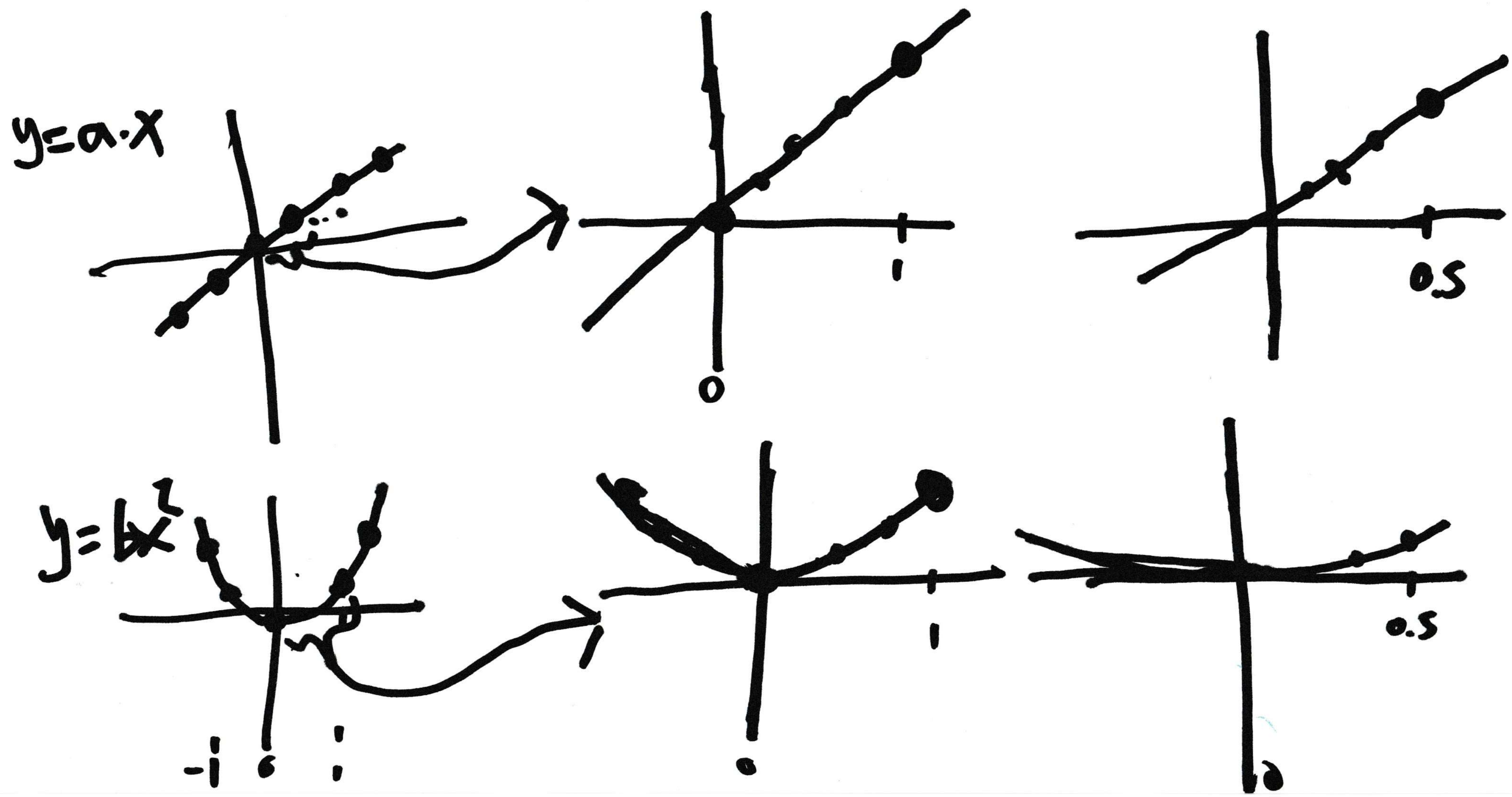
$$y = f(x) = a \cdot x$$



$$d = s \cdot t$$



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



$$y = f(x) = y(x) =$$ mathematical operations which can be done with variable "x" to get "y"

$$\text{distance}(\text{time}) = Z(t)$$

Can we calculate an object's position using the time since we last knew where it was? ...... yes we can!! .... ****

...

*with nom caveats

d? z? x? y? .....

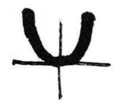
or even $\vec{x} = (x, y, z)$

for today

d = distance = scalar

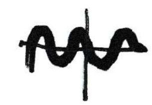
t = time

$\boxed{d = st \quad \text{simplest}}$

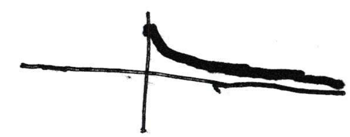
$d = ct^2$ 

$d = bt^3$  or even

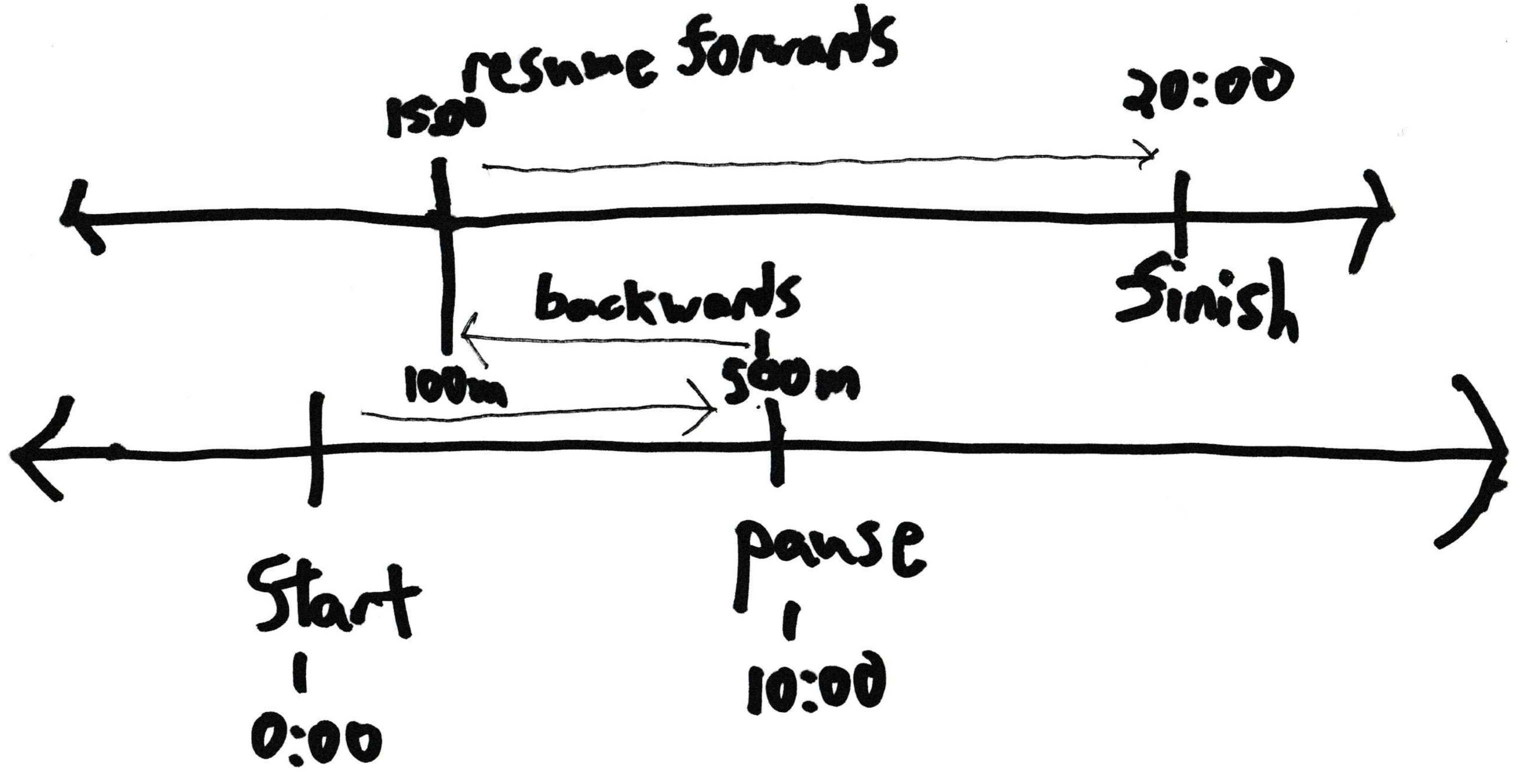
$d = at^4$ 

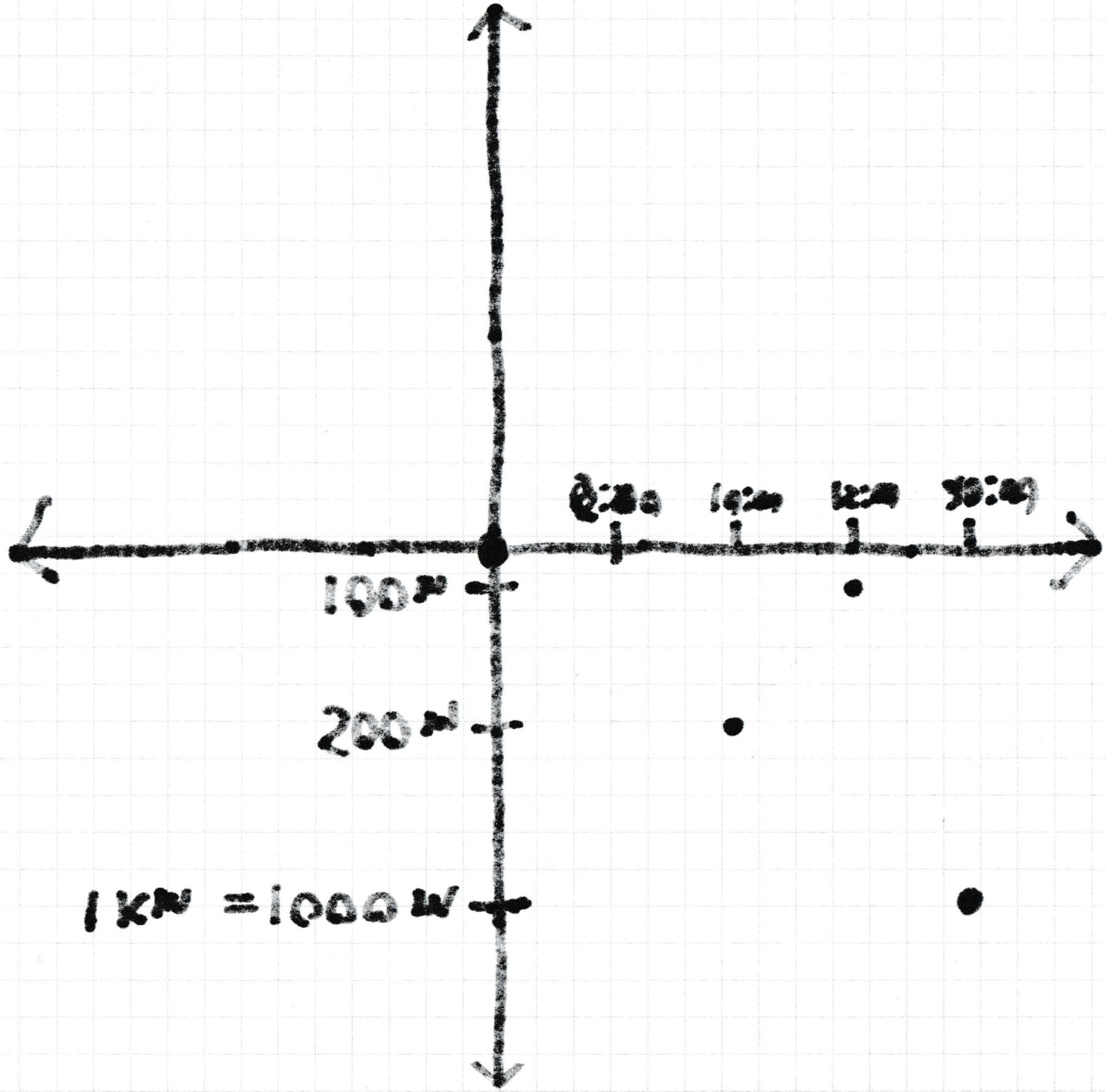
$d = \sin(t) \cdot a$ 

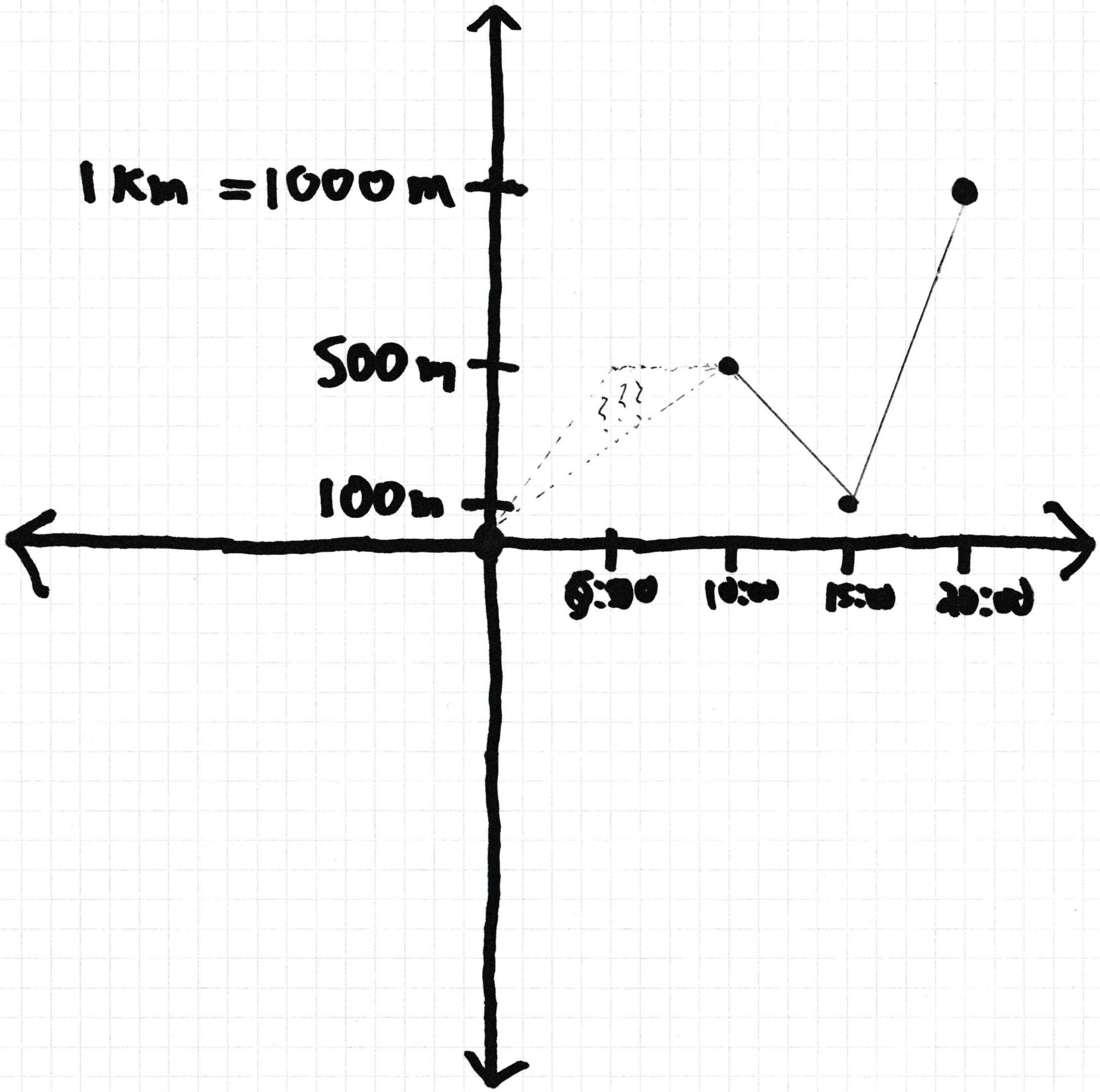
$d = \cos(t + s) \cdot b + c$

$d = e^{-x}$ 

.... etc


15:00
resume forwards
20:00
backwards
Finish
100m
500m
Start
0:00
pause
10:00


100 m
200 m
1 km = 1000 m


1 Km = 1000 m
500 m
100 m
5:00
10:00
15:00
20:00

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

speed?

$$d = 2 \cdot t = \frac{\begin{array}{cccc} d=2 & 4 & 6 & 8 \end{array}}{\begin{array}{cccc} t=1 & 2 & 3 & 4 \end{array}}$$

$$\begin{array}{cccc} 2\checkmark & 2\checkmark & 2\checkmark & 2\checkmark \end{array}$$

$$d = 2t^2 = \frac{\begin{array}{cccc} d=2 & 8 & 18 & 32 \end{array}}{\begin{array}{cccc} t=1 & 2 & 3 & 4 \end{array}}$$

speed?

$$\begin{array}{cccc} 2\checkmark & 4\times & 6\times & 8\times \end{array}$$

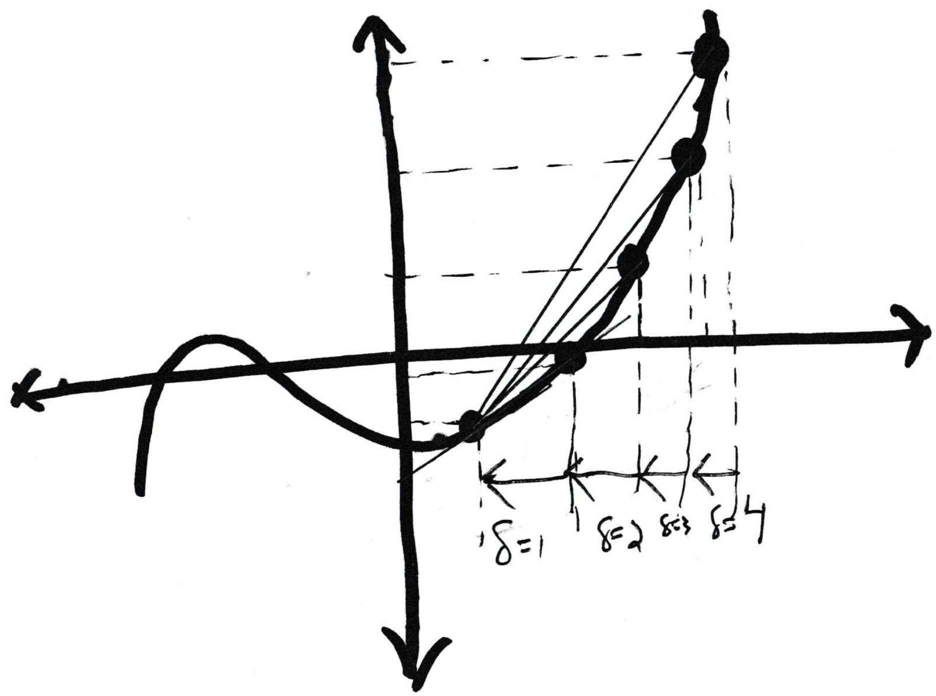
let's define

"$\frac{d}{dx}$" the derivative

$$\boxed{\frac{d}{dx} f(x)} = f'(x) \rightarrow \frac{d}{dt} f(t) = \dot{f}(t)$$

for time only

$$\frac{d}{dx} f(x) \equiv \lim_{\delta \to 0} \frac{f(x+\delta) - f(x)}{\delta}$$



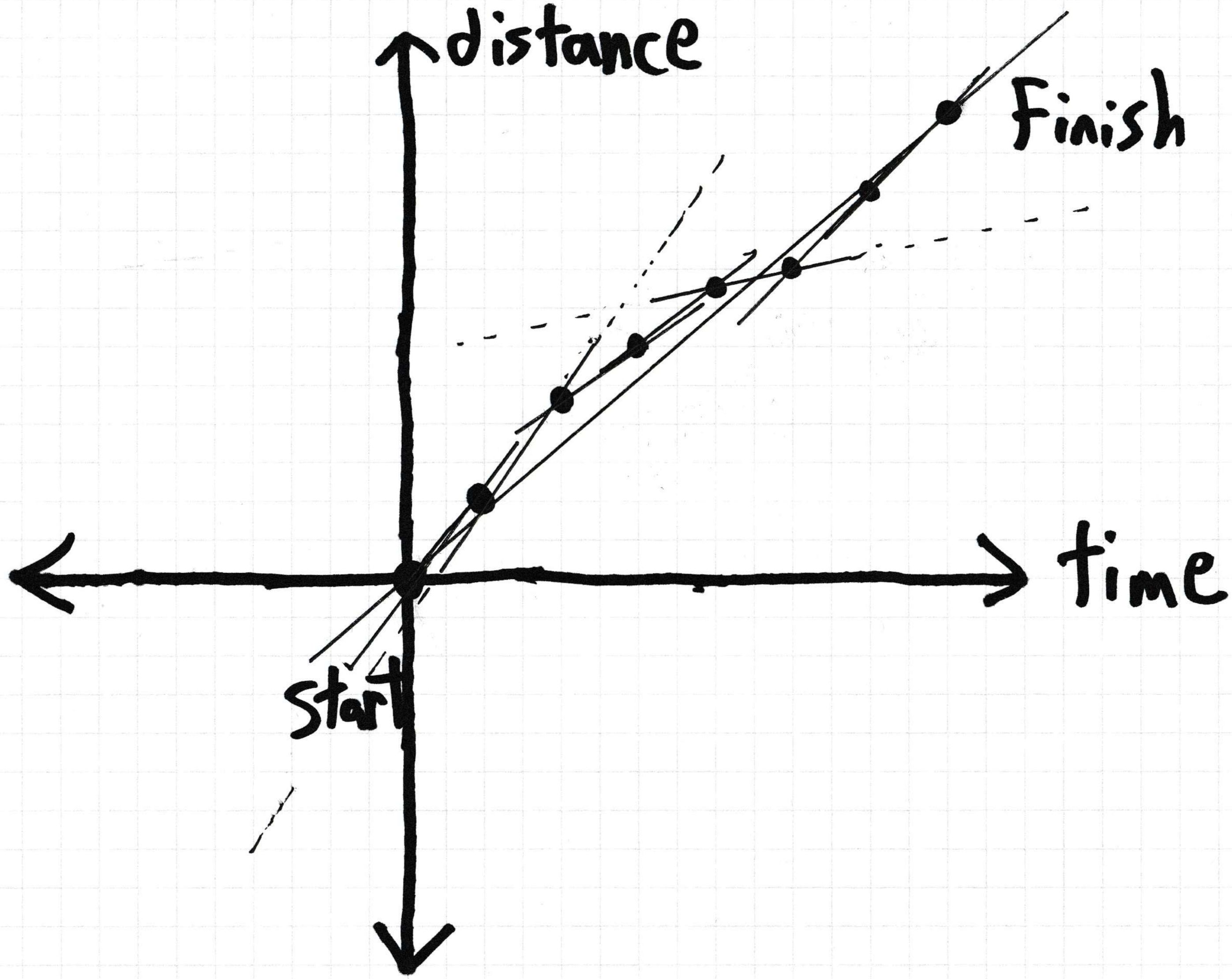
$y = a \cdot x$ is easy

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

$$= a$$

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

$$= \frac{bx^2 - bx^2 + 2 \cdot b \cdot \delta x + b \cdot \delta^2}{\delta} = 2bx + \cancel{b \cdot \delta} \; \underset{\lim_{\delta \to 0}}{0} = 2 \cdot b \cdot x$$


distance
Finish
time
Start