

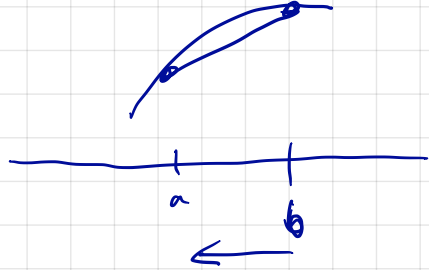
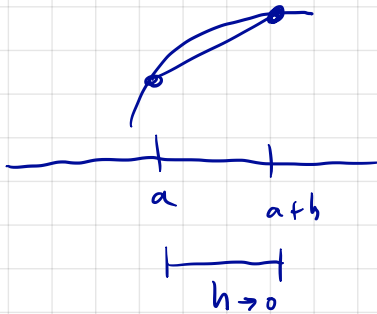
last class:

$$f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h} = \lim_{b \rightarrow a} \frac{f(b) - f(a)}{b - a}$$

1) derivative of f at a

2) instantaneous rate of change of f at a

3) slope of tangent line of graph of f at a .



How to think about the derivative.

Population $P(t)$

$$P'(a) = \lim_{b \rightarrow a} \frac{P(b) - P(a)}{b - a} \quad \frac{\Delta P}{\Delta t} \quad \Delta t \text{ small.}$$

$$P'(a) \approx \frac{\Delta P}{\Delta t} \quad \Delta t \text{ small}$$

$$\Delta P \approx P'(a) \Delta t \quad \Delta t \text{ small}$$

If time changes by a little Δt from $t = a$
the population will change by ΔP .

$$\Delta P = P(b) - P(a) \quad \text{so}$$

$$P(b) \approx \boxed{P(a) + P'(a) \Delta t}$$

↳ only involves stuff at a .

(You'll do this on worksheet)

Alas, not every function has a derivative at every point.

eg. $f(x) = |x|$

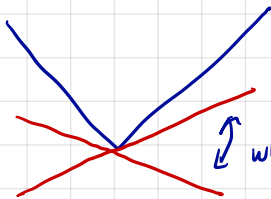


$$f'(0) = \lim_{h \rightarrow 0} \frac{f(0+h) - f(0)}{h} = \lim_{h \rightarrow 0} \frac{f(h)}{h} = \lim_{h \rightarrow 0} \frac{|h|}{h}$$

For $h > 0$, $|h| = h$ so $\lim_{h \rightarrow 0^+} \frac{|h|}{h} = \lim_{h \rightarrow 0^+} \frac{h}{h} = 1$

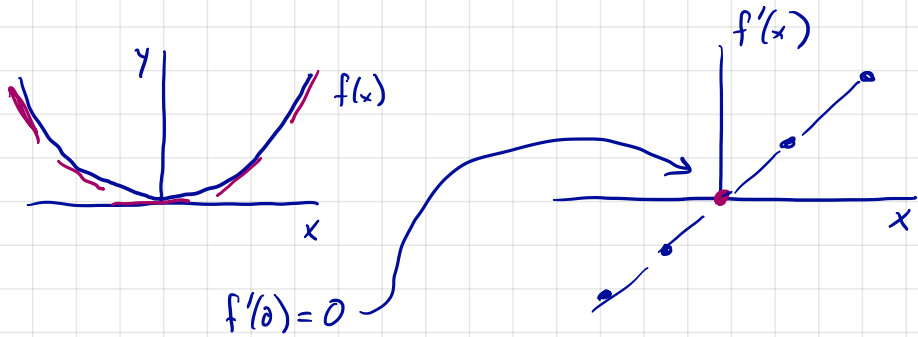
and $\lim_{h \rightarrow 0^-} \frac{|h|}{h} = \frac{-h}{h} = -1$.

↪ ≠



↪ who gets to be tangent line?

A perspective on the derivative



The function $f'(x)$ is called the derivative of f .