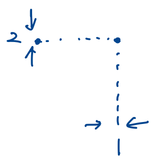
: 극한

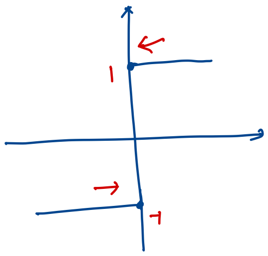
: x가 a로 접근할 때, y가 L에 수렴한다.



: 좌극한, 우극한

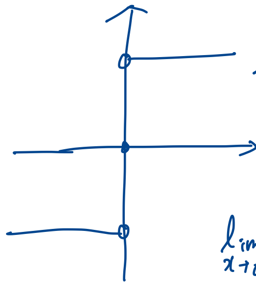
: 극한값의 정의는 위해!

$y = \begin{cases} 1, & x \ge 0 \\ -1, & x < 0 \end{cases}$



좌극한:

우극한:

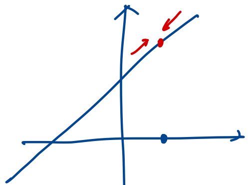


$\lim_{x \to 0^+} f(x) = 1$

$\lim_{x \to 0^-} f(x) = -1$

: 극한값의 존재 조건

연속이기 위한 조건
① 극한값 = 함수값



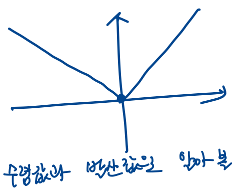
$\lim_{x \to 1^+} f(x) = \lim_{x \to 1^-} f(x)$

ㄴ극한값과 함수값이 같을 때, 연속이다

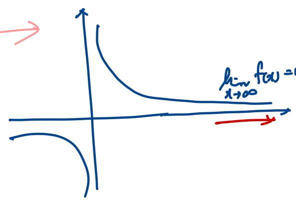
$x_1 \le x \le x_2$

연속함수

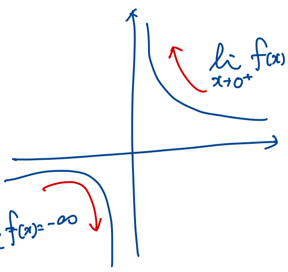
$y = |x| = \begin{cases} x, & x \ge 0 \\ x, & x < 0 \end{cases}$



: 점근선을 따져볼 때, 수렴값과 발산값을 알아볼 수 있다.

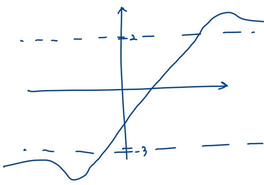


$\lim_{x \to \infty} f(x) = 0$



$\lim_{x \to 0^+} f(x) = \infty$

$\lim_{x \to 0^-} f(x) = -\infty$



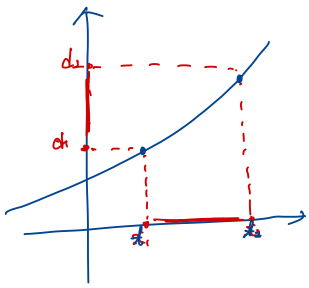
$\lim_{x \to \infty} f(x) = 2$

$y=2$

$\lim_{x \to -\infty} f(x) =$ $y=-3$

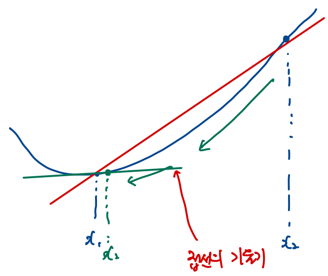
평균 변화율

순간변화율 : 접선에서의 기울기

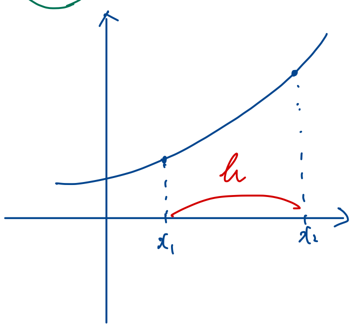


$\dfrac{d_2 - d_1}{t_2 - t_1}$: 평균의 변화량

$= \dfrac{f(x_2) - f(x_1)}{x_2 - x_1}$



미분계수 : 2 점에서 순간 변화율



$\dfrac{f(x_2) - f(x_1)}{x_2 - x_1} = \dfrac{f(x_1+h) - f(x_1)}{(x_1+h) - x_1} = \lim_{h \to 0} \dfrac{f(a+h) - f(a)}{h}$

: 도함수

도함수에 x 값을 넣으면 미분계수 값이 나온다.

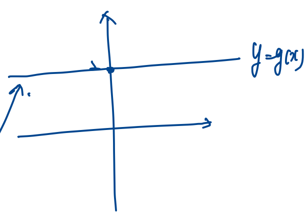
ex)

$y = 2x$

$f(x+h) = 2(x+h)$

$\lim_{h \to 0} \dfrac{2(x+h) - 2x}{h}$

$= \lim_{h \to 0} \dfrac{2\cancel{h}}{\cancel{h}} = \lim_{h \to 0} 2$



$\Rightarrow y = 2x$

$y' = 2$

자연상수는 simple한 결과를 만들 수 있음

$$\Rightarrow \begin{cases} f(x) = e^x \longrightarrow f'(x) = e^x \cdot \cancel{\ln(e)}^{\,1} \\ \qquad\qquad\qquad\quad = e^x \\ g(x) = \ln(x) \rightarrow g'(x) = \dfrac{1}{x \cdot \cancel{\ln e}^{\,1}} = \dfrac{1}{x} \end{cases}$$

$$= \frac{1}{\cos^2 x}$$

: 도함수가 그대로 상수배.

합성함수의 미분

$f(g(x))$: 합성함수 ⇒ $x \to \boxed{g} \to \boxed{f} \to y$

$$\Rightarrow \frac{dy}{dx} = \frac{dy}{\cancel{dv}} \cdot \frac{\cancel{dv}}{\cancel{du}} \cdot \frac{\cancel{du}}{dx}$$

$$\triangle \quad \frac{du(x)}{dx} = \frac{du}{dx} \qquad \square \quad \triangle \quad \frac{dg(u)}{du} = \frac{dv}{du} \qquad \square \quad \frac{df(v)}{dv} = \frac{dy}{dv}$$

ex) $\overbrace{(\underbrace{e^x+x^2}_{g(x)})^3}^{f(x)} = f(g(x)) \to f'(g(x)) \cdot g'(x)$

$e^x+x^2 = g(x) \longrightarrow u = e^x+x^2 \to \frac{dy}{dx} = e^x+2x$

$x^3 = f(x) \longrightarrow y = u^3 \to \frac{dy}{dx} = 3u^2 = 3(e^x+x^2)$

$$\Rightarrow \frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx} = 3(e^x+x^2)\cdot(e^x+2x)$$

$=$