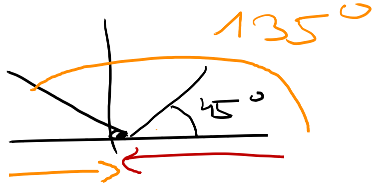
$$f'_+(a) = \lim_{h \to 0^+} \frac{f(a+h) - f(a)}{h}$$

$$f'_-(a) = \lim_{h \to 0^-} \frac{f(a+h) - f(a)}{h}$$



$$f(x) = |x|$$

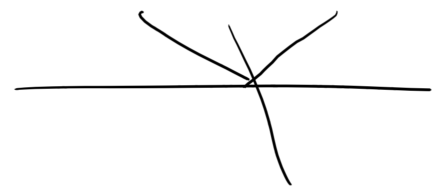
$$f(x) = \begin{cases} x & x \geq 0 \\ -x & x < 0 \end{cases}$$

$$f'_+(0) = \lim_{h \to 0^+} \frac{(0+h) - 0}{h} = \lim_{h \to 0^+} \frac{h}{h} = \lim_{h \to 0^+} 1 = 1$$

$$f'_-(0) = \lim_{h \to 0^-} \frac{-(0+h) - 0}{h} = \lim_{h \to 0^-} \frac{-h}{h} = \lim_{h \to 0^-} -1 = -1$$

$$\longrightarrow \quad f'(0) \nexists$$

$f = |x|$

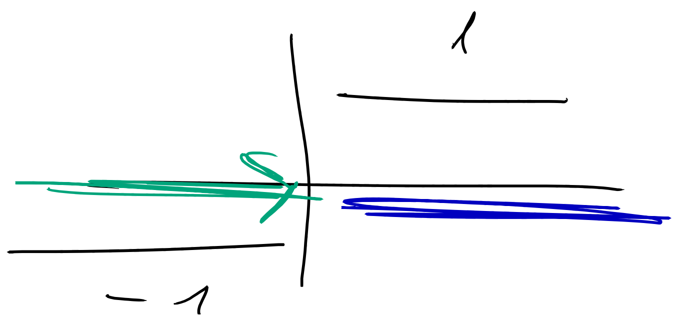


f continuous at $a = 0$ ✓

$f'(x)$?

$$f = \begin{cases} x & x > 0 \\ -x & x < 0 \end{cases}$$

$$f' = \begin{cases} 1 & x > 0 \\ -1 & x < 0 \end{cases}$$



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

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

$$\sqrt{x+1} \qquad \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

$$f = \begin{cases} \sqrt{x} & x > 0 \\ 0 & x = 0 \\ \sqrt{-x} & x < 0 \end{cases}$$

$$f'_+(0) = \lim_{h \to 0+} \frac{\sqrt{0+h} - \sqrt{0}}{h} =$$

$$= \lim_{h \to 0+} \frac{\sqrt{h}}{\sqrt{h^2}} = \lim \frac{\sqrt{h}}{\sqrt{h} \cdot \sqrt{h}}$$

$$= \lim_{h \to 0+} \frac{1}{\sqrt{h}} = \underline{\infty} \qquad \underline{f'_+(0) = \infty}$$

$$f'_-(0) = \lim_{h \to 0-} \frac{\sqrt{-(0+h)} - 0}{h}$$

Sedon f priu t a

$y = kx + q$

$y = f(a) + f'(a)(x - a)$

$f = x^2$

$a = -2 \qquad f(a) = 4$

$f'(x) = 2x \qquad f'(a) = f'(-2) = -4$

-2

$x + 2$

$y = 4 + -4(x - (-2))$

$\cancel{4 - 4x - 4\cdot(2)}$

$y = -4x - 4$

$f = x^3$ $\qquad \boxed{a = 1}$

- $f(a) = 1^3 = 1$
- $f'(x) = 3x^2 \qquad f'(1) = 3 \cdot 1^2 = 3$

$$y = f(a) + f'(a)(x - a)$$

$$y = 1 + 3(x - 1)$$

$$y = 1 + 3(x-1)$$

$$y = 3x - 2$$

$$\underbrace{x}_{f}\ \underbrace{\sqrt{x-1}}_{g}$$

$$\sqrt{x}\,' = \frac{1}{2}x^{-1/2} = \frac{1}{2\sqrt{x}}$$

$$\sqrt{x-1}\,' = \frac{1}{2\sqrt{x-1}}\cdot 1$$

$$(fg)' = f'g + fg'$$

$$= 1\sqrt{x-1} + x\frac{1}{2\sqrt{x-1}}$$