If f continuous at c and $\lim_{\Delta x \to 0} \frac{f(c+\Delta x) - f(c)}{\Delta x} = \pm\infty$, then there is a <u>vertical tangent line</u> at $(c, f(c))$

The <u>derivative</u> of f is given by:

@ x: $f'(x) = \lim_{\Delta x \to 0} \frac{f(x+\Delta x) - f(x)}{\Delta x}$ or

@ $x=c$: $f'(c) = \lim_{x \to c} \frac{f(x) - f(c)}{x - c}$

* This is also known as the <u>instantaneous rate of change</u>.

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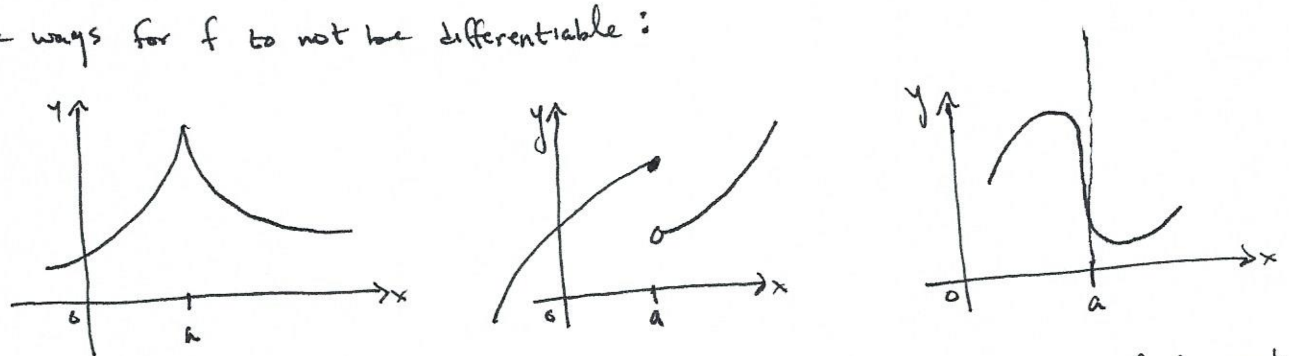
Notations for derivative: y' $f'(x)$ $\frac{dy}{dx}$ $\frac{d}{dx}[f(x)]$ $D_x y$

Three ways for f to not be differentiable:



corner break vertical tangent

Ex Compute $g'(t)$ for $g(t) = \frac{2}{t}$

$$g'(t) = \lim_{\Delta t \to 0} \frac{g(t+\Delta t) - g(t)}{\Delta t} = \lim_{\Delta t \to 0} \frac{\frac{2}{t+\Delta t} - \frac{2}{t}}{\Delta t} = \lim_{\Delta t \to 0} \frac{1}{\Delta t}\left[\frac{2t - 2t - 2\Delta t}{t(t+\Delta t)}\right] = \lim_{\Delta t \to 0} \frac{-2\cancel{\Delta t}}{t(t+\Delta t)} \frac{1}{\cancel{\Delta t}}$$

$$= \lim_{\Delta t \to 0} \frac{-2}{t(t+\Delta t)} = \frac{-2}{t^2}$$