Derivatives Cheat Sheet

Ø For the following 'a' is a constant:

$f(x)$	$\frac{df}{dx}$
x^n	nx^{n-1}
a	0
$af(x)$	$a\frac{df}{dx}$
$f(x)g(x)$	$g(x)\frac{df}{dx} + f(x)\frac{dg}{dx}$
$\frac{f(x)}{g(x)}$	$\frac{g(x)\frac{df}{dx} - f(x)\frac{dg}{dx}}{g(x)^2}$
$f\big(g(x)\big)$	$\frac{df}{dg}\frac{dg}{dx}$
$\sin ax$	$a\cos ax$
$\cos ax$	$-a\sin ax$
$\tan ax$	$a\sec^2 ax$
$\cot ax$	$-a\csc^2 ax$
$\sec ax$	$a\sec ax\tan ax$
$\csc ax$	$-a\csc ax\cot ax$
$\sin^{-1}(\frac{x}{a})$	$\frac{1}{\sqrt{a^2 - x^2}}$
$\cos^{-1}(\frac{x}{a})$	$-\frac{1}{\sqrt{a^2 - x^2}}$
$\tan^{-1}(\frac{x}{a})$	$\frac{a}{a^2 + x^2}$
e^x	e^x
$\ln x$	$\frac{1}{x}$
a^x	$a^x \ln a$
$\log_a x$	$\frac{1}{x\ln a}$
$\ln(\sec ax + \tan ax)$	$a\ \sec ax$

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- $f(x)$ is differentiable if $\begin{cases} a)\ f\ is\ cotinuous \\ b)\ \lim\limits_{x\to a^+} f'(x) = \lim\limits_{x\to a^-} f'(x) \quad \text{for all } a \end{cases}$

- The definition of the derivative of a function

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

- The definition of the derivative of a function at $x = a$

$$f'(a) = \lim_{x\to a} \frac{f(x) - f(a)}{x - a}$$

Or

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

- The tangent line to the graph of function $y = f(x)$ at point $x = a$ in the slope-point format is:

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

- For horizontal tangent line set $f'(x) = 0$. For vertical tangent line $f'(x)$ must approach infinity.

- The derivative of absolute value function can be defined as:

$$(|f(x)|)' = f'(x).\frac{|f(x)|}{f(x)}$$

- Useful ln identities:

$$ln\, a + ln\, b = ln(ab)$$

$$ln\, a - ln\, b = ln\, (\frac{a}{b})$$

$$ln\, a^b = b\, ln\, a$$

$$e^{ln\, a} = a$$

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