



MATH 1200/1250/2100/2200

DIFFERENTIATION RULES

General Formulas

<i>Constant</i>	$\frac{d}{dx}(c) = 0$
<i>Sum</i>	$\frac{d}{dx}(u + v) = \frac{du}{dx} + \frac{dv}{dx}$
<i>Difference</i>	$\frac{d}{dx}(u - v) = \frac{du}{dx} - \frac{dv}{dx}$
<i>Constant Multiple</i>	$\frac{d}{dx}(cu) = c \frac{du}{dx}$
<i>Product</i>	$\frac{d}{dx}(uv) = u \frac{dv}{dx} + v \frac{du}{dx}$
<i>Quotient</i>	$\frac{d}{dx}\left(\frac{u}{v}\right) = (v \frac{du}{dx} - u \frac{dv}{dx})/v^2$
<i>Power</i>	$\frac{d}{dx}(x^n) = nx^{n-1}$
<i>Chain Rule</i>	$\frac{d}{dx}(f(g(x))) = f'(g(x)) * g'(x)$

Properties of Limits

$\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$
$\lim_{x \rightarrow 0} \frac{x}{\sin x} = 1$
$\lim_{x \rightarrow 0} \frac{x}{\cos x} = 1$
$\lim_{x \rightarrow 0} \frac{1 - \cos x}{x} = 0$
$\lim_{x \rightarrow 0} \frac{\cos x}{x} = 1$
$\lim_{x \rightarrow 0} \frac{x}{\tan x} = 1$

Trigonometric Functions

$\frac{d}{dx} \sin x = \cos x$	$\frac{d}{dx} \cos x = -\sin x$	$\frac{d}{dx} \tan x = \sec^2 x$
$\frac{d}{dx} \csc x = -\csc x \cot x$	$\frac{d}{dx} \sec x = \sec x \tan x$	$\frac{d}{dx} \cot x = -\csc^2 x$

Inverse Trigonometric Functions

$\frac{d}{dx} \sin^{-1} x = \frac{1}{\sqrt{1-x^2}}$	$\frac{d}{dx} \cos^{-1} x = -\frac{1}{\sqrt{1-x^2}}$	$\frac{d}{dx} \tan^{-1} x = \frac{1}{1+x^2}$
$\frac{d}{dx} \csc^{-1} x = -\frac{1}{x\sqrt{x^2-1}}$	$\frac{d}{dx} \sec^{-1} x = \frac{1}{x\sqrt{x^2-1}}$	$\frac{d}{dx} \cot^{-1} x = -\frac{1}{1+x^2}$

Exponential and Logarithmic Functions

$\frac{d}{dx} e^x = e^x$	$\frac{d}{dx} a^x = a^x \ln a$	$\frac{d}{dx} \ln x = \frac{1}{x}$	$\frac{d}{dx} \log_a x = \frac{1}{x \ln a}$
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