Derivatives and Integrals Reference Page-Math 106 D. Benedetto

Derivatives

$\frac{d}{dx} constant = 0$

$\frac{d}{dx} \sin x = \cos x$

$\frac{d}{dx} \cos x = -\sin x$

$\frac{d}{dx} x^n = nx^{n-1}$ Power Rule

$\frac{d}{dx} \tan x = \sec^2 x$

$\frac{d}{dx} \sec x = \sec x \tan x$

$\frac{d}{dx} e^x = e^x$

$\frac{d}{dx} e^{u(x)} = e^{u(x)} \cdot u'(x)$ Chain Rule

$\frac{d}{dx} \ln x = \frac{1}{x}$

$\frac{d}{dx} \ln(u(x)) = \frac{1}{u(x)} \cdot u'(x)$ Chain Rule

Identities

$\sin^2 \theta + \cos^2 \theta = 1$ $\quad 1 + \tan^2 \theta = \sec^2 \theta$

Antiderivatives

$\int constant \; dx = constant \cdot x + C$

$\int x^n \; dx = \frac{x^{n+1}}{n+1} + C$ (for $n \neq -1$) Power Rule

$\int \cos x \; dx = \sin x + C$

$\int \sin x \; dx = -\cos x + C$

$\int \sec^2 x \; dx = \tan x + C$

$\int \sec x \tan x \; dx = \sec x + C$

$\int e^x \; dx = e^x + C$

$\int e^{kx} \; dx = \frac{1}{k} e^{kx} + C$ (constant $k \neq 0$) $(k-$ rule)

$\int \frac{1}{x} \; dx = \ln|x| + C$

$\int \ln x \; dx$ not known in Calculus I

Expnential and Log Algebra Rules

$e^x \cdot e^y = e^{x+y}$ $\quad \ln(ab) = \ln a + \ln b$ Products

$\frac{e^x}{e^y} = e^{x-y}$ $\quad \ln\left(\frac{a}{b}\right) = \ln a - \ln b$ Quotients

$(e^x)^y = e^{xy}$ $\quad \ln\left(a^b\right) = b \ln a$ Powers

$\frac{1}{e^x} = e^{-x}$ $\quad \ln(a \pm b)$ does **not** simplify

Values

$\sin 0 = 0$	$\sin \frac{\pi}{2} = 1$	$\sin \frac{3\pi}{2} = \sin\left(-\frac{\pi}{2}\right) = -1$	$\sin \pi = \sin 2\pi = 0$
$\sin \frac{\pi}{6} = \frac{1}{2}$	$\sin \frac{\pi}{3} = \frac{\sqrt{3}}{2}$	$\sin \frac{\pi}{4} = \frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$	
$\tan 0 = 0$	$\tan \frac{\pi}{4} = 1$	$\tan \frac{\pi}{3} = \sqrt{3}$	$\tan \frac{\pi}{6} = \frac{1}{\sqrt{3}}$
$\cos 0 = 1$	$\cos \frac{\pi}{2} = \cos \frac{3\pi}{2} = 0$	$\cos \pi = -1$	$\cos 2\pi = 1$
$\cos \frac{\pi}{6} = \frac{\sqrt{3}}{2}$	$\cos \frac{\pi}{3} = \frac{1}{2}$	$\cos \frac{\pi}{4} = \frac{\sqrt{2}}{2} = \frac{1}{\sqrt{2}}$	

Exponential and Log Values

$e^0 = 1$ $\qquad$ $e^1 = e$

$\ln 1 = 0$ $\qquad$ $\ln 0$ **undefined**

$e^{\ln x} = x$ for $x > 0$ $\qquad$ $\ln e^x = x$ for all x

Simplify

$\ln e^5 = 5$

$e^{\ln 6} = 6$

$e^{-\ln 9} = e^{\ln(9^{-1})} = \frac{1}{9}$

$e^{-2\ln 7} = e^{\ln(7^{-2})} = 7^{-2} = \frac{1}{7^2} = \frac{1}{49}$