Derivatives and Integrals Reference Page-Math 121 D. Benedetto

Derivatives

$\frac{d}{dx} constant = 0$ $\quad$ $\frac{d}{dx} x^n = nx^{n-1}$ Power Rule

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

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

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

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

$\frac{d}{dx}\arctan x = \frac{1}{1+x^2}$ $\quad$ $\frac{d}{dx}\arctan u(x) = \frac{1}{1+(u(x))^2} \cdot u'(x)$ Chain Rule

$\frac{d}{dx}\arcsin x = \frac{1}{\sqrt{1-x^2}}$ $\quad$ $\frac{d}{dx}\arcsin u(x) = \frac{1}{\sqrt{1-(u(x))^2}} \cdot u'(x)$ Chain Rule

Identities

- $\sin^2\theta + \cos^2\theta = 1$
- $1 + \tan^2\theta = \sec^2\theta$
- $\sin^2\theta = \frac{1-\cos(2\theta)}{2}$
- $\cos^2\theta = \frac{1+\cos(2\theta)}{2}$
- $\sin(2\theta) = 2\sin\theta\cos\theta$

Exponential and Log Algebra

- $e^x \cdot e^y = e^{x+y}$
- $\ln x + \ln y = \ln(xy)$
- $\frac{e^x}{e^y} = e^{x-y}$
- $\ln x - \ln y = \ln\left(\frac{x}{y}\right)$
- $(e^x)^y = e^{xy}$
- $\ln(x^y) = y\ln x$
- $e^{(x^y)}$ does not simplify
- $\ln(x+y)$ or $\frac{\ln x}{\ln y}$ does not simplify

Integrals

$$\int constant\ dx = constant \cdot x + C \qquad \int x^n\ dx = \frac{x^{n+1}}{n+1} + C \quad (\text{for } n \neq -1)$$

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

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

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

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

$$\int \frac{1}{\sqrt{1-x^2}}\ dx = \arcsin x + C \qquad \int \frac{1}{\sqrt{a^2-x^2}}\ dx = \arcsin\left(\frac{x}{a}\right) + C \quad (a - \text{rule})$$

$$\int \frac{1}{1+x^2}\ dx = \arctan x + C \qquad \int \frac{1}{a^2+x^2}\ dx = \frac{1}{a} \arctan\left(\frac{x}{a}\right) + C \quad (a - \text{rule})$$

Values

$\arcsin(0) = 0$	$\arcsin(1) = \frac{\pi}{2}$	$\arcsin(-1) = -\frac{\pi}{2}$
$\arcsin\left(\frac{1}{2}\right) = \frac{\pi}{6}$	$\arcsin\left(\frac{\sqrt{3}}{2}\right) = \frac{\pi}{3}$	$\arcsin\left(\frac{\sqrt{2}}{2}\right) = \arcsin\left(\frac{1}{\sqrt{2}}\right) = \frac{\pi}{4}$
$\arctan(0) = 0$	$\arctan(1) = \frac{\pi}{4}$	
$\arctan(\sqrt{3}) = \frac{\pi}{3}$	$\arctan\left(\frac{1}{\sqrt{3}}\right) = \frac{\pi}{6}$	
$e^0 = 1$	$\ln 1 = 0$	$\ln 0 \quad \text{undefined}$