

## Derivatives and Integrals Reference Page-Math 121

### Derivatives

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

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

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

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

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

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

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

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

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

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

$$\frac{d}{dx} \arctan x = \frac{1}{1+x^2}$$

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

$$\frac{d}{dx} \arcsin x = \frac{1}{\sqrt{1-x^2}}$$

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

### Integrals

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

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

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

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

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

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

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

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

$$\int \frac{1}{\sqrt{1-x^2}} \, dx = \arcsin x + C$$

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

$$\int \frac{1}{1+x^2} \, dx = \arctan x + C$$

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

## 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

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

## Values

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