Derivatives and Integrals Reference Page-Math 121 D. Benedetto

Derivatives

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\frac{d}{dx} \sinh x = \cosh x$$

$$\frac{d}{dx} \cosh x = \sinh x \quad \text{(Recall: no sign change here)}$$

$$\frac{d}{dx} \sinh^{-1} x = \frac{1}{\sqrt{1+x^2}} \quad \text{optional}$$

$$\frac{d}{dx} \cosh^{-1} x = \frac{1}{\sqrt{x^2-1}} \quad \text{optional}$$

$$\frac{d}{dx} \tanh^{-1} x = \frac{1}{1-x^2} \quad \text{optional}$$

Identities

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$1 + \tan^2 \theta = \sec^2 \theta$$

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

$$\sin(2\theta) = 2 \sin \theta \cos \theta$$

$$\cosh^2 x - \sinh^2 x = 1$$

Integrals

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\int \sinh x\ dx = \cosh x + C$$

$$\int \cosh x\ dx = \sinh x + C$$

$$\int \frac{1}{\sqrt{1+x^2}}\ dx = \sinh^{-1} x + C \quad \text{optional}$$

$$\int \frac{1}{1-x^2}\ dx = \tanh^{-1} x + C \quad \text{optional}$$

$$\int \frac{1}{\sqrt{x^2-1}}\ dx = \cosh^{-1} x + C \quad \text{optional}$$

Values

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