

MTH 162

Formula Sheet - Exam 1

Hyperbolic Functions

$$\sinh x = \frac{e^x - e^{-x}}{2} \quad \cosh x = \frac{e^x + e^{-x}}{2} \quad \tanh x = \frac{\sinh x}{\cosh x}$$
$$\operatorname{csch} x = \frac{1}{\sinh x} \quad \operatorname{sech} x = \frac{1}{\cosh x} \quad \operatorname{coth} x = \frac{1}{\tanh x}$$

Inverse Hyperbolic Functions

$$\sinh^{-1} x = \ln(x + \sqrt{x^2 + 1}) \quad x \in \mathbb{R}$$
$$\cosh^{-1} x = \ln(x + \sqrt{x^2 - 1}) \quad x \geq 1$$
$$\tanh^{-1} x = \frac{1}{2} \ln\left(\frac{1+x}{1-x}\right) \quad -1 < x < 1$$

Derivatives of Inverse Trigonometric Functions

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

Derivatives of Inverse Hyperbolic Functions

$$\frac{d}{dx}(\sinh^{-1} x) = \frac{1}{\sqrt{1+x^2}} \quad \frac{d}{dx}(\cosh^{-1} x) = -\frac{1}{\sqrt{x^2-1}} \quad \frac{d}{dx}(\tanh^{-1} x) = \frac{1}{1-x^2}$$
$$\frac{d}{dx}(\operatorname{csch}^{-1} x) = -\frac{1}{|x|\sqrt{x^2+1}} \quad \frac{d}{dx}(\operatorname{sech}^{-1} x) = -\frac{1}{x\sqrt{1-x^2}} \quad \frac{d}{dx}(\operatorname{coth}^{-1} x) = \frac{1}{1-x^2}$$

Integrals of some Trigonometric Functions

$$\int \sin x \, dx = -\cos x + C \quad \int \tan x \, dx = \ln|\sec x| + C \quad \int \cot x \, dx = \ln|\sin x| + C$$
$$\int \cos x \, dx = \sin x + C \quad \int \sec x \, dx = \ln|\sec x + \tan x| + C \quad \int \csc x \, dx = \ln|\csc x - \cot x| + C$$

Some Trigonometric Identities

$$\sin^2 x + \cos^2 x = 1 \quad \tan^2 x + 1 = \sec^2 x \quad 1 + \cot^2 x = \csc^2 x \quad \cosh^2 x - \sinh^2 x = 1$$
$$\sin 2x = 2 \sin x \cos x \quad \cos 2x = 2 \cos^2 x - 1 = 1 - 2 \sin^2 x \quad \cos^2 x = \frac{1}{2}(\cos 2x + 1) \quad \sin^2 x = \frac{1}{2}(\cos 2x - 1)$$