

Formula sheet

- Derivatives of inverse trigonometric functions.

$$\begin{aligned}\frac{d}{dx} \sin^{-1}(x) &= \frac{1}{\sqrt{1-x^2}} \\ \frac{d}{dx} \tan^{-1}(x) &= \frac{1}{1+x^2} \\ \frac{d}{dx} \sec^{-1}(x) &= \frac{1}{x\sqrt{x^2-1}}\end{aligned}$$

$$\begin{aligned}\frac{d}{dx} \cos^{-1}(x) &= -\frac{1}{\sqrt{1-x^2}} \\ \frac{d}{dx} \cot^{-1}(x) &= -\frac{1}{1+x^2} \\ \frac{d}{dx} \csc^{-1}(x) &= -\frac{1}{x\sqrt{x^2-1}}\end{aligned}$$

- Trigonometric identities.

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

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

$$1 + \cot^2 x = \csc^2 x$$

$$\sin^2 x = \frac{1}{2}(1 - \cos(2x))$$

$$\cos^2 x = \frac{1}{2}(1 + \cos(2x))$$

$$\sin x \cos x = \frac{1}{2} \sin(2x)$$

$$\sin x \sin y = \frac{1}{2} \cos(x-y) - \frac{1}{2} \cos(x+y)$$

$$\cos x \cos y = \frac{1}{2} \cos(x-y) + \frac{1}{2} \cos(x+y)$$

$$\sin x \cos y = \frac{1}{2} \sin(x-y) + \frac{1}{2} \sin(x+y)$$

$$\sin(x+y) = \sin x \cos y + \cos x \sin y$$

$$\cos(x+y) = \cos x \cos y - \sin x \sin y$$

$$\tan(x+y) = \frac{\tan x + \tan y}{1 - \tan x \tan y}$$

- Integrals of trigonometric functions.

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

$$\int \cot x \, dx = \ln |\sin x| + C$$

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

$$\int \csc x \, dx = -\ln |\csc x + \cot x| + C$$

- Trapezoidal Rule and Simpson's Rule.

$$T = \frac{\Delta x}{2} \left(y_0 + 2y_1 + 2y_2 + \dots + 2y_{n-1} + y_n \right)$$
$$S = \frac{\Delta x}{3} \left(y_0 + 4y_1 + 2y_2 + 4y_3 + \dots + 2y_{n-2} + 4y_{n-1} + y_n \right)$$

- Error estimates for Trapezoidal Rule and Simpson's Rule.

$$|E_T| \leq \frac{M(b-a)^3}{12n^2}, \quad \text{where } |f''(x)| \leq M \text{ for all } x \text{ in } [a, b]$$
$$|E_S| \leq \frac{M(b-a)^5}{180n^4}, \quad \text{where } |f^{(4)}(x)| \leq M \text{ for all } x \text{ in } [a, b]$$