Salahaddin University-Erbil
College of Engineering
Department of Water Resources Engineering
2022/2023

Mathematics II
Transcendental Function
Chapter Six

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6.3. Derivative of Inverse Trigonometric Function

- Derivatives:

$$\frac{d}{dx}(\sin^{-1} u) = \frac{1}{\sqrt{1-u^2}}\frac{du}{dx}$$

$$\frac{d}{dx}(\cos^{-1} u) = -\frac{1}{\sqrt{1-u^2}}\frac{du}{dx}$$

$$\frac{d}{dx}(\tan^{-1} u) = \frac{1}{1+u^2}\frac{du}{dx}$$

$$\frac{d}{dx}(\cot^{-1} u) = -\frac{1}{1+u^2}\frac{du}{dx}$$

$$\frac{d}{dx}(\sec^{-1} u) = \frac{1}{|u|\sqrt{u^2-1}}\frac{du}{dx}$$

$$\frac{d}{dx}(\csc^{-1} u) = -\frac{1}{|u|\sqrt{u^2-1}}\frac{du}{dx}$$

6.3. Derivative of Inverse Trigonometric Function

Differentials:

$$d(\sin^{-1} u) = \frac{du}{\sqrt{1-u^2}}$$

$$d(\cos^{-1} u) = -\frac{du}{\sqrt{1-u^2}}$$

$$d(\tan^{-1} u) = \frac{du}{1+u^2}$$

$$d(\cot^{-1} u) = -\frac{du}{1+u^2}$$

$$d(\sec^{-1} u) = \frac{du}{|u|\sqrt{u^2-1}}$$

$$d(\csc^{-1} u) = \frac{du}{|u|\sqrt{u^2-1}}$$

6.3. Derivative of Inverse Trigonometric Function

Examples:

$$y = \sin^{-1} x$$

$$y = \sec^{-1} x$$

Integral Formula:

$$\int \frac{du}{\sqrt{1-u^2}} = \sin^{-1} u + c$$

$$\int -\frac{du}{\sqrt{1-u^2}} = \cos^{-1} u + c$$

$$\int \frac{du}{1+u^2} = \tan^{-1} u + c$$

$$\int -\frac{du}{1+u^2} = \cot^{-1} u + c$$

$$\int \frac{du}{u\sqrt{u^2-1}} = \sec^{-1} u + c$$

$$\int -\frac{du}{u\sqrt{u^2-1}} = \csc^{-1} u + c$$

Example:

Find *dy/dx* for the followings:

1. $y = \sin^{-1} x^2$

2. $y = \tan^{-1} \sqrt{x+1}$

3. $y = \sec^{-1} 3x$

Evaluate

$\int_0^1 \frac{dx}{1+x^2}$

$\int \frac{x^2 dx}{\sqrt{1-x^6}}$

$\int \frac{dx}{\sqrt{9-x^2}}$