

## Math 170 Common Formula Sheet

### Trigonometric Derivatives

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

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

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

$$\frac{d}{dx} \cot x = -\csc^2 x$$

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

$$\frac{d}{dx} \csc x = -\csc x \cot x$$

### Inverse Trigonometric Derivatives

$$\frac{d}{dx} \sin^{-1} x = \frac{1}{\sqrt{1-x^2}} \quad |x| < 1$$

$$\frac{d}{dx} \cos^{-1} x = \frac{-1}{\sqrt{1-x^2}} \quad |x| < 1$$

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

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

$$\frac{d}{dx} \sec^{-1} x = \frac{1}{|x|\sqrt{x^2-1}} \quad |x| > 1$$

$$\frac{d}{dx} \csc^{-1} x = \frac{-1}{|x|\sqrt{x^2-1}} \quad |x| > 1$$

### Hyperbolic Function Derivatives

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

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

$$\frac{d}{dx} \tanh x = \operatorname{sech}^2 x$$

$$\frac{d}{dx} \coth x = -\operatorname{csch}^2 x$$

$$\frac{d}{dx} \operatorname{sech} x = -\operatorname{sech} x \tanh x$$

$$\frac{d}{dx} \operatorname{csch} x = -\operatorname{csch} x \coth x$$

### Inverse Hyperbolic Derivatives

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

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

$$\frac{d}{dx} \tanh^{-1} x = \frac{1}{1-x^2} \quad |x| < 1$$

$$\frac{d}{dx} \coth^{-1} x = \frac{1}{1-x^2} \quad |x| > 1$$

$$\frac{d}{dx} \operatorname{sech}^{-1} x = \frac{-1}{x\sqrt{1-x^2}} \quad 0 < x < 1$$

$$\frac{d}{dx} \operatorname{csch}^{-1} x = \frac{-1}{|x|\sqrt{1+x^2}} \quad x \neq 0$$

### Volume Formulas

Volume of a solid with cross section  $A(x)$

$$V = \int_a^b A(x) dx$$

Volume by disk, revolved around x-axis

$$V = \int_a^b \pi[R(x)]^2 dx$$

Volume by washers, revolved around x-axis

$$V = \int_a^b \pi[R(x)]^2 - \pi[r(x)]^2 dx$$

Volume by cylindrical shells, revolved about vertical line

$$V = \int_a^b 2\pi \left( \begin{array}{c} \text{shell} \\ \text{radius} \end{array} \right) \left( \begin{array}{c} \text{shell} \\ \text{height} \end{array} \right) dx$$