

Derivatives of Trigonometric Functions

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

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

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

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

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

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

Example 1: Deriving the derivative of $\tan x$ and $\csc x$

a) Verify $\frac{d(\tan x)}{dx} = \sec^2 x$.

b) Verify $\frac{d(\csc x)}{dx} = -\csc x \cot x$.

Example 2: Derivative of trigonometric functions

Differentiate

a) $f(x) = \tan(4x^2 - 3x)$

b) $y = \frac{e^{2x}}{1 + \tan 2x}$

c) $f(x) = \frac{2 \sin(3x - 1)}{\cos(3x - 1)}$

d) $y = (\cos x - \tan x)^3$

Example 3: Derivative of other trigonometric functions

Differentiate

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

b) $y = 2 \csc^3(3x^2)$

c) $f(x) = \sec^2(\cot x)$

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

Example 4: Implicit differentiations with trigonometric functions

If $\tan y = x^2$, find the derivative of y with respect to x .

Example 5: Applications of Derivative of Trigonometric functions

Find the slope of the tangent line to $y = \tan(\csc x)$ when $\sin x = \frac{1}{\pi}$, x in the interval $\left(0, \frac{\pi}{2}\right)$.