

Derivatives of Trigonometric Functions

Introduction

Example 1.

Use the fact that $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$ to prove $\lim_{\theta \rightarrow 0} \frac{\cos \theta - 1}{\theta} = 0$.

Example 2.

Find $\lim_{x \rightarrow 0} \frac{\sin 7x}{4x}$.

Example 3.

Find $\lim_{x \rightarrow 0} x \cot x$.

Derivatives

Example 4.

Calculate the derivative of $\sin x$.

Example 5.

Differentiate $y = x^2 \sin x$.

Example 6.

Find the derivative of $\tan x$.

Derivative of Trigonometric Functions

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

$$\frac{d}{dx}(\csc x)$$

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

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

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

$$\frac{d}{dx}(\cot x)$$

Example 7.

Differentiate $f(x) = \frac{\sec x}{1 + \tan x}$. For what values of x does the graph of f have a horizontal tangent?

Example 8.

An object at the end of a vertical spring is stretched 4 cm beyond its rest position and released at time $t = 0$. Its position at time t is

$$s(t) = 4 \cos t$$

Find the velocity and acceleration at time t and use them to analyze the motion of the object.

Example 9.

Find the 27th derivative of $\cos x$.