

Section 3.3 Derivatives of trigonometric functions

Theorem. $\lim_{\theta \rightarrow 0} \sin \theta = 0.$

Theorem. $\lim_{\theta \rightarrow 0} \cos \theta = 1.$

Theorem. $\lim_{\theta \rightarrow 0} \frac{\sin \theta}{\theta} = 1$

Corollary. $\lim_{\theta \rightarrow 0} \frac{\cos \theta - 1}{\theta} = 0.$

Derivatives

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

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

$$\frac{d}{dx} \tan x = \frac{1}{\cos^2 x} = \sec^2 x$$

$$\frac{d}{dx} \cot x = -\frac{1}{\sin^2 x} = -\operatorname{csc}^2 x$$

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

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

Example 1. Find $\frac{dy}{dx}$

1. $y = \cos x - 2 \tan x$

2. $y = 2x(\sqrt{x} - \cot x)$

3. $y = x \csc x$

Example 2. Find the points on the curve $y = \frac{\cos x}{2 + \sin x}$ at which the tangent is horizontal.