Basic Calculus Derivative of Trig Funcs Cheat Sheet

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Trigonometric Identities

Reciprocal Trigonometric Identities

Sin θ = 1/Csc θ or Csc θ = 1/Sin θ

Cos θ = 1/Sec θ or Sec θ = 1/Cos θ

Tan θ = 1/Cot θ or Cot θ = 1/Tan θ

Pythagorean Trigonometric Identities

$\sin^2 a + \cos^2 a = 1$

$1+\tan^2 a = \sec^2 a$

$\mathrm{cosec}^2 a = 1 + \cot^2 a$

Ratio Trigonometric Identities

Tan θ = Sin θ/Cos θ

Cot θ = Cos θ/Sin θ

Sum and Difference of Angles Trigonometric Identities

sin(α+β)=sin(α).cos(β)+cos(α).sin(β)

sin(α–β)=sinα.cosβ–cosα.sinβ

cos(α+β)=cosα.cosβ–sinα.sinβ

cos(α–β)=cosα.cosβ+sinα.sinβ

Derivation Formula

Product Rule

(d/dx) (fg)= fg' + gf'

Quotient Rule

(d/dx) (f/g) = gf'-fg'/g^2

Chain Rule

y = f(g(x)), then y' = f'(g(x)). g'(x)

Derivatives of Trigonometric Functions

If f(x) = sin x, then f′(x) = cos x

If f(x) = cos x, then f′(x) = −sin x

If f(x) = tan x, then f′(x) = sec 2 x

If f(x) = cot x, then f′(x) = −csc 2 x.

If f(x) = sec x, then f′(x) = sec x tan x

If f(x) = csc x, then f′(x) = −csc x cot x

Example 1

$$f(x) = \tan x = \frac{\sin x}{\cos x}$$

$$f'(x) = \frac{\cos x \cdot \cos x - (-\sin x)\sin x}{\cos^2 x} = \frac{\cos^2 x + \sin^2 x}{\cos^2 x} = \frac{1}{\cos^2 x} = \sec^2 x$$

Example 2

$$y' = 3x^2 \cot x + x^3(-\csc^2 x) = 3x^2 \cot x - x^3 \csc^2 x$$

Examples

g (x) = 3 sec (x) − 10 cot (x)

Derivative of sin x

$$\frac{d(\sin x)}{dx} = \lim_{h\to 0} \frac{\sin(x+h) - \sin x}{(x+h) - x} = \lim_{h\to 0} \frac{\sin x \cos h + \cos x \sin h - \sin x}{h} = \lim_{h\to 0} \frac{\cos h - 1}{h}\sin x + \frac{\sin h}{h}\cos x = (0)\sin x + (1)\cos x = \cos x$$

Derivative of cos x

Derivative of sec x (cont)

sec x = 1/cos x

tan x = sin x/cos x

(cos x)' = -sin x

(sec x)' = (1/cos x)' = (-1/cos2x).(cos x)'

= (-1/cos2x).(-sin x)

= sin x/cos2x

= (sin x/cos x).(1/cos x)

= tan x sec x

Therefore, d(sec x)/dx = tan x sec x

Derivative of cot x

We will determine the derivative of cot x using the quotient rule. We will use the following formulas and identities to calculate the derivative:

(sin x)' = cos x

(cos x)' = -sin x

cot x = cos x/ sin x

cos2x + sin2x = 1

cosec x = 1/sin x

(cot x)' = (cos x/sin x)'

= [(cos x)' sin x - (sin x)' cos x]/sin2x

= [-sin x. sin x - cos x. cos x]/sin2x

= (-sin2x - cos2x)/sin2x

= -1/sin2x

= -cosec2x

Therefore, d(cot x)/dx = -cosec2x

Derivative of cosec x

We will determine the derivative of cosec x using the chain rule. We will use the following formulas and identities to calculate the derivative:

cosec x = 1/sin x

cot x = cos x/sin x

(sin x)' = cos x

(cosec x)' = (1/sin x)' = (-1/sin2x).(sin x)'

= (-1/sin2x).(cos x)

= -cos x/sin2x

= -(cos x/sin x).(1/sin x)

= -cot x cosec x

Therefore, d(cosec x)/dx = -cot x cosec x

$$\begin{aligned}\frac{\mathrm{d}(\cos x)}{\mathrm{d}x} &= \lim_{h\to 0}\frac{\cos(x+h)-\cos x}{(x+h)-x}\\ &= \lim_{h\to 0}\frac{\cos x\cos h-\sin x\sin h-\cos x}{h}\\ &= \lim_{h\to 0}\frac{\cos h-1}{h}\cos x-\frac{\sin h}{h}\sin x\\ &= (0)\cos x-(1)\sin x\\ &= -\sin x\end{aligned}$$

Derivative of sec x

We will determine the derivative of sec x using the chain rule. We will use the following formulas and identities to calculate the derivative: