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Derivatives of Trig Functions and Chain Rule
AP Readiness Session 2

Answers to examples posted on my website

Derivative Rules

Examples : For each function, find $f'(x)$

Derivatives of Trigonometric Functions:

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

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

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

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

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

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

$$f(x) = 3\cos x - 5\cot x$$

$$f'(x) = -3\sin x + 5\csc^2 x$$

$$f(x) = \frac{x^2}{x + sec\, x}$$

$$f'(x) = \frac{(x + secx)(2x) - (x^2)(1 + secxtanx)}{(x + secx)^2}$$

$$f'(x) = \frac{2x^2 + 2xsecx - x^2 + x^2 secxtanx}{(x + secx)^2}$$

$$f'(x) = \frac{x^2 + 2xsecx + x^2 secxtanx}{(x + secx)^2}$$

Derivative of the composition of two functions

Chain Rule

$$\frac{d}{dx} f(g(x)) = f'(g(x))g'(x)$$

$$f(x) = \sqrt{x^4 - 6x^2 + 3}$$

$$f'(x) = \frac{1}{2}(x^4 - 6x^2 + 3)^{\frac{-1}{2}}(4x^3 - 12x)$$

$$f'(x) = \frac{2x^3 - 6x}{\sqrt{x^4 - 6x^2 + 3}}$$

$$f(x) = (x^3 - 5)^4(\tan(2x))$$

$$f'(x) = (x^3 - 5)^4\left(sec^2(2x)(2)\right) + \tan(2x)(4)(x^3 - 5)^3(3x^2)$$

$$f'(x) = 2(x^3 - 5)^4\left(sec^2(2x)\right) + 12x^2(x^3 - 5)^3(\tan(2x))$$

Chain Rule with Trigonometric Functions:	$f(x) = \cos(x^3)$
Differentiate outside function first	$f'(x) = -\sin(x^3)(3x^2)$
	$f(x) = cos^3(x)$
	$f'(x) = 3\,cos^2(x)(sinx)$
Multiple functions inside of functions	$f(x) = 3\sin^4(x^3 - 2x)$
Work from outside to inside	$f'(x) = 12\sin^3(x^3 - 2x)\cos(x^3 - 2x)(3x^2 - 2)$
Multiply by each derivative	$f'(x) = (36x^2 - 24)sin^3(x^3 - 2x)cos(x^3 - 2x)$