October 3, 2025

World Smile Day

Today in History:

O.J. Simpson acquitted (1995)

First National Thanksgiving Day (1863)

Number of the Day: 300

300 = 2 x 2 x 3 x 5 x 5

300 is a triangular number.

Fun Fact:

In Arkansas, it's illegal to sound your horn at any place where cold drinks or sandwiches are served after 9 p.m.

Quote of the Day:

“The least I can do is speak out for those who cannot speak for themselves.”

-Jane Goodall

Today’s Weather:

Sunny very warm. high 79°

Math 121

Quiz #20

Find the equation of the tangent line at the point $(1,0)$ to the curve

$$\frac{d}{dx}\left(2x^3 + 3\sin y = x^2 y + 2 \right)$$

$$6x^2 + 3\cos y \frac{dy}{dx} = x^2\frac{dy}{dx} + 2xy \Big|_{(1,0)}$$

$$6 + 3\frac{dy}{dx} = \frac{dy}{dx}$$

$$6 = -2\frac{dy}{dx} \qquad \frac{dy}{dx} = -3$$

$$y - 0 = -3(x-1)$$

$$y = -3x + 3$$

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*4 $\qquad y = \sin(xy)$

$$\frac{dy}{dx} = \cos(xy)\left[x\frac{dy}{dx} + y\right]$$

$$\frac{dy}{dx} = x\cos(xy)\frac{dy}{dx} + y\cos(xy)$$

$$\frac{dy}{dx} - x\cos(xy)\frac{dy}{dx} = y\cos(xy)$$

$$\frac{dy}{dx}\left(1 - x\cos(xy)\right) = y\cos(xy)$$

$$\frac{dy}{dx} = \frac{y\cos(xy)}{1 - x\cos(xy)}$$

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$$y + \frac{1}{y} = x^2 + x$$

$$\frac{dy}{dx} - \frac{1}{y^2}\frac{dy}{dx} = 2x+1$$

$$\frac{dy}{dx}\left(1 - \frac{1}{y^2}\right) = 2x+1$$

$$\frac{dy}{dx}\left(\frac{y^2-1}{y^2}\right) = 2x+1$$

$$\frac{dy}{dx} = \frac{y^2(2x+1)}{y^2-1}$$

INVERSE TRIG FUNCTIONS

$y = \text{ARCSIN}\,x \qquad (\sin^{-1} x)$

$$\sin(y) = \sin(\text{ARCSIN}\,x)$$

$$\frac{d}{dx}\left[\sin y = x\right]$$

$$(\cos y)\frac{dy}{dx} = 1$$

$$\frac{dy}{dx} = \frac{1}{\cos y} = \frac{1}{\sqrt{1-x^2}}$$

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

$$\cos^2 y + x^2 = 1$$

$$\cos^2 y = 1 - x^2$$

$$\cos y = \sqrt{1-x^2}$$

$f(x) = \text{ARCSIN}\,x \qquad f'(x) = \dfrac{1}{\sqrt{1-x^2}}$

$y = \text{ARCCOS}\,x \qquad (\cos^{-1} x)$

$$\cos y = \cos(\text{ARCCOS}\,x)$$

$$\frac{d}{dx}\left[\cos y = x\right]$$

$$-\sin y \frac{dy}{dx} = 1$$

$$\frac{dy}{dx} = -\frac{1}{\sin y} = -\frac{1}{\sqrt{1-x^2}}$$

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

$$x^2 + \sin^2 y = 1$$

$$\sin^2 y = 1 - x^2$$

$$\sin y = \sqrt{1-x^2}$$

O $f(x) = \arccos x$ $\qquad f'(x) = -\frac{1}{\sqrt{1-x^2}}$

$y = \arctan x \qquad (\tan^{-1} x)$

$$\tan y = \tan(\arctan x)$$

$$\frac{d}{dx}\left[\tan y = x\right]$$

$$(\sec^2 y)\frac{dy}{dx} = 1$$

$$\frac{dy}{dx} = \frac{1}{\sec^2 y} = \frac{1}{1+x^2}$$

$$\frac{\cos^2 y + \sin^2 y}{\cos^2 y} = \frac{1}{\cos^2 y}$$

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

$$1 + x^2 = \sec^2 y$$

$$f(x) = \arctan x \qquad f'(x) = \frac{1}{1 + x^2}$$

$$y = \operatorname{arcsec} x \qquad (\sec^{-1} x)$$

$$\sec y = \sec(\operatorname{arcsec} x)$$

$$\frac{d}{dx}\left[\underline{\sec y = x}\right]$$

$$(\sec y \tan y)\frac{dy}{dx} = 1$$

$$\frac{dy}{dx} = \frac{1}{\sec y \tan y}$$

$$\frac{\cos^2 y + \sin^2 y = 1}{\cos^2 y}$$

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

$$\tan^2 y = \sec^2 y - 1$$

$$\tan^2 y = x^2 - 1$$

$$\tan y = \sqrt{x^2 - 1}$$

$$\frac{dy}{dx} = \frac{1}{\sec y \tan y} = \frac{1}{|x|\sqrt{x^2-1}}$$

$$f(x) = \operatorname{arcsec} x \qquad f'(x) = \frac{1}{|x|\sqrt{x^2-1}}$$

$$f(x) = \operatorname{arccot} x \qquad f'(x) = \frac{-1}{x^2+1}$$

$$f(x) = \operatorname{arccsc} x \qquad f'(x) = -\frac{1}{|x|\sqrt{x^2-1}}$$

$$f(x) = \arcsin(\text{JUNK})$$

$$f'(x) = \frac{\text{JUNK}'}{\sqrt{1-(\text{JUNK})^2}}$$

<u>EXAMPLE 1</u> $f(x) = \arcsin\left(e^{3x}\right)$

$$f'(x) = \frac{3e^{3x}}{\sqrt{1-(e^{3x})^2}}$$

$$f(x) = \arctan(\text{STUFF}) \qquad f'(x) = \frac{\text{STUFF}'}{1+(\text{STUFF})^2}$$

EXAMPLE 2

$$f(x) = \text{ARCTAN}(x^2+1)$$

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

$$f(x) = \text{ARCSEC}(\text{BLAH})$$

$$f'(x) = \frac{\text{BLAH}'}{|\text{BLAH}|\sqrt{(\text{BLAH})^2-1}}$$

EXAMPLE 3

$$f(x) = \text{ARCSEC}(\sin x)$$

$$f'(x) = \frac{\cos x}{|\sin x|\sqrt{\sin^2 x - 1}}$$

EXAMPLE 4

$$y = \sin(\text{ARCTAN}\, x)$$

$$\frac{dy}{dx} = \cos(\text{ARCTAN}\, x)\left(\frac{1}{1+x^2}\right)$$

EXAMPLE 5

$$y = \frac{(x + \tan x)}{\text{ARCSIN}\, x}$$

$$\frac{dy}{dx} = \frac{(\text{ARCSIN}x)(1+\text{SEC}^2 x) - (x+\text{TAN}x)\frac{1}{\sqrt{1-x^2}}}{(\text{ARCSIN}x)^2}$$