October 1, 2025

National Homemade Cookies Day

Today in History:

Yosemite National Park established (1890)

Pennsylvania Turnpike opens (1940)

Number of the Day: 403

403 = 13 x 31

It is the smallest semiprime whose factors form a pair emirps (13 and 31).

Fun Fact:

20252 is Smokey Bear's own zip code.

Quote of the Day:

"Strive not to be a success, but rather to be of value."

– Albert Einstein

Today's Weather:

Sunny, high 70^{o}

Math 121

Quiz #19

Find $f'(x)$ for

$$f(x) = \left(e^x + \sqrt{x + \sin x}\right)^3$$

$f'(x) = 3\left(e^x + \sqrt{x+\sin x}\right)^2 \left(e^x + \frac{1}{2}(x+\sin x)^{-\frac{1}{2}}(1+\cos x)\right)$

MPOD 19

(3) $f(x) = \dfrac{1}{(x^2+x+4)^3} = (x^2+x+4)^{-3}$

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

(7) $f(x) = \tan(3x^2+1)$

$f'(x) = 6x \sec^2(3x^2+1)$

$= \left[\sec^2(3x^2+1)\right] 6x$

(6) $f(x) = \sqrt{\sin^2 x + \cos^3 x}$

$(\sin^2 x + \cos^3 x)^{\frac{1}{2}}$

$$f'(x) = \frac{1}{2}\left(\sin^2 x + \cos^3 x\right)^{-\frac{1}{2}}\left[2\sin x\cos x + 3\cos^2 x\,(-\sin x)\right]$$

IMPLICIT DIFF.

$$y = x^3 \qquad \frac{dy}{dx} = 3x^2$$

$$x = y^3$$

$$\downarrow$$

$$y = x^{\frac{1}{3}} \qquad \frac{dy}{dx} = \frac{1}{3}x^{-\frac{2}{3}}$$

$$\frac{d}{dx}\left[x^3\right] = 3x^2$$

$$\frac{d}{dx}\left[y^3\right] = 3y^2\,\frac{dy}{dx}$$ ← CHAIN RULE

$$\frac{d}{dx}\left[x+3y\right] = 1 + 3\frac{dy}{dx}$$

$$\frac{d}{dx}\left[xy^2\right] = x(2y)\frac{dy}{dx} + y^2$$

$$\frac{d}{dx}\left[y^3 + y^2 - 5y - x^2 = -4\right]$$

$$\frac{dy}{dx} = ?$$

$$3y^2\frac{dy}{dx} + 2y\frac{dy}{dx} - 5\frac{dy}{dx} - 2x = 0$$

$$\frac{dy}{dx} = \frac{2x}{3y^2+2y-5}$$

$$\frac{d}{dx}\left(x^2+y^2 = 25\right)$$

$$2x + 2y\frac{dy}{dx} = 0$$

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

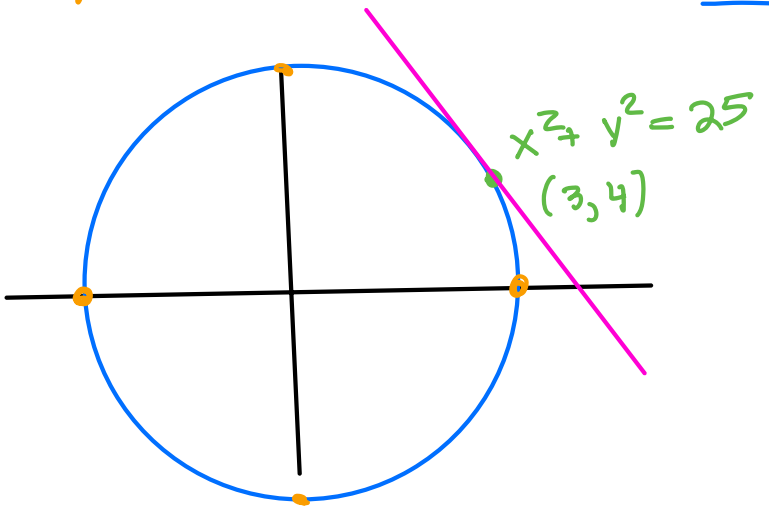
$$\boxed{\frac{dy}{dx} = -\frac{x}{y}}$$

$$x^2+y^2 = 25$$

$$y^2 = 25-x^2$$

$$y = \pm\sqrt{25-x^2}$$

$$\frac{dy}{dx} = \pm\frac{1}{2}(25-x^2)^{-\frac{1}{2}}(-2x) = \mp\frac{x}{\sqrt{25-x^2}}$$



$$\frac{dy}{dx} = -\frac{3}{4}$$

$$\frac{d}{dx}\left[3(x^2+y^2)^2 = 100xy\right]$$

EQU. TANG. LINE.
(3,1)

$x=3$, $y=1$

$$3(2)(x^2+y^2)^1\left(2x+2y\frac{dy}{dx}\right) = 100\left[x\frac{dy}{dx}+y\right]$$

$$\rightarrow (3)(2)(9+1)\left[6+2\frac{dy}{dx}\right] = 100\left[3\frac{dy}{dx}+1\right]$$

$$(60)\left[6+2\frac{dy}{dx}\right] = 300\frac{dy}{dx}+100$$

$$360+120\frac{dy}{dx} = 300\frac{dy}{dx}+100$$

$$260 = 180\frac{dy}{dx}$$

$$\frac{dy}{dx} = \frac{260}{180} = \frac{13}{9}$$

$$\boxed{y-1 = \frac{13}{9}(x-3)}$$

$$\frac{d}{dx}\left(x^2+y^2=25\right)$$

y'' $\qquad 2x+2y\frac{dy}{dx}=0$

$$\frac{dy}{dx} = -\frac{x}{y}$$

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

$$= \frac{-y^2-x^2}{y^3} = -\frac{(x^2+y^2)}{y^3} = -\frac{25}{y^3}$$

$$\frac{d}{dt}\left(x^2 + y^2 = 25\right)$$

$$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$$