Hello! $\sin^{-1}$ (arcsin) $\cos^{-1}$ (arccos) $\tan^{-1}$ (arctan)

$$\frac{d}{dx}\sin^{-1}(x) \quad \frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}\cos^{-1}(x) = -\frac{1}{\sqrt{1-x^2}}$$

$$\frac{d}{dx}\tan^{-1}(x) = \frac{1}{1+x^2}$$

$$\frac{d}{dx}\cot^{-1}(x) = -\frac{1}{1+x^2}$$

$$\frac{d}{dx}\sin^{-1}(5x) = \frac{1}{\sqrt{1-(5x)^2}} \times 5 = \frac{5}{\sqrt{1-25x^2}}$$

$$\frac{d}{dx}\sin^{-1}(g(x)) = \frac{g'(x)}{\sqrt{1-(g(x))^2}}$$

$$\frac{d}{dx}\cos^{-1}(5x) = -\frac{(5x)'}{\sqrt{1-(5x)^2}} = -\frac{5}{\sqrt{1-25x^2}}$$

$$\frac{d}{dx}\cos^{-1}(g(x)) = -\frac{g'(x)}{\sqrt{1-[g(x)]^2}}$$

$$\frac{d}{dx}\tan^{-1}(5x) = \frac{1}{1+(5x)^2}(5x)' = \frac{5}{1+25x^2}$$

$$\frac{d}{dx}\tan^{-1}(g(x)) = \frac{g'(x)}{1+[g(x)]^2}$$

Practice test: $f(x) = 7 \arctan(8x)$

$$= 7\,\tan^{-1}(8x)$$

$$f'(x) = 7\left(\tan^{-1}(8x)\right) = 7\,\frac{(8x)'}{1+(8x)^2} = 7\,\frac{8}{1+64x^2}$$

$$= \boxed{\frac{56}{1+64x^2}}$$

Implicit differentiation

product rule

$(5x^2)' + (3x^3y)' - (4y^3)' = (36)'$ Find $\frac{dy}{dx}$ y'

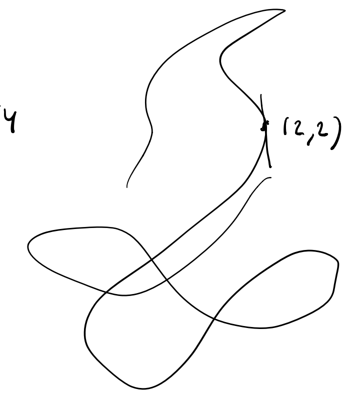
$10x + (3x^3)'y + 3x^3y' - 12y^2y' = 0$

$-10x \quad -9x^2y$

$\cancel{10x} + \cancel{9x^2y} + 3x^3y' - 12y^2y' = 0$

$-10x - 9x^2y$

Solve for y'



$3x^3y' - 12y^2y' = -10x - 9x^2y$

$\frac{y'(3x^3 - 12y^2)}{(3x^3 - 12y^2)} = \frac{-10x - 9x^2y}{3x^3 - 12y^2}$

$$\boxed{y' = \frac{-10x - 9x^2y}{3x^3 - 12y^2}}$$

LINE $y = mx + b$ m = slope = derivative at $\overset{x}{2},\overset{y}{2}$ $(2,2)$

$y' = \frac{-10(2) - 9(4)(2)}{3(8) - 12(4)} = \frac{-20 - 72}{24 - 48} = \frac{-92}{-24} = \boxed{\frac{23}{6}}$ slope

$y = \frac{23}{6}x + b$ plug in $(2,2)$ to find b
$\quad\quad\quad\quad\quad\quad\quad\quad\quad x \; y$

$2 = \frac{23}{\cancel{6}\,3} \cdot \cancel{x} + b$ $\quad b = 2 - \frac{23}{3} = \frac{6}{3} - \frac{23}{3} = \frac{-17}{3}$

$$\boxed{y = \frac{23}{6}x - \frac{17}{3}}$$

Review sheet #2 Find $\frac{dy}{dx}$ $(xe^y)' = (5xy + 4y^4)'$

product rule

$(x)'e^y + x(e^y)' = (5x)'y + (5x)y' + (4y^4)'$

$$\cancel{e^y} + \boxed{x e^y y'} = 5y + 5x\cancel{y'} + 16y^3\cancel{y'}$$

Solve for y'

$$-\cancel{e^y} \qquad -5xy' \qquad -16y^3y' \qquad -e^y \qquad -\cancel{5xy'} \qquad -\cancel{16y^3y'}$$

$$xe^y y' - 5xy' - 16y^3 y' = 5y - e^y$$

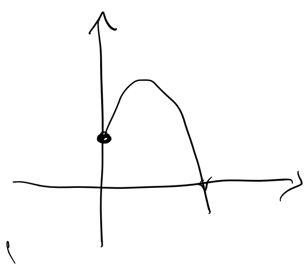
$$\frac{y'\left[xe^y - 5x - 16y^3\right]}{xe^y - 5x - 16y^3} = \frac{5y - e^y}{xe^y - 5x - 16y^3}$$

$$\boxed{y' = \frac{5y - e^y}{xe^y - 5x - 16y^3}}$$

#11 practice test

$y = -4.9t^2 + 9t + 3.5$ initial ht

initial velocity



a) $t=0$ 3.5 meters

b) $y'(t) = -4.9(2t) + 9 = \boxed{-9.8t + 9 = v(t)}$

$v(0) = 9$ m/s

c) acceleration $v'(t) = -9.8$ m/sec²

#4) Review sheet tangent line to $y = 5x\cos x$

at $(\pi, -5\pi)$

$y' = (5x)'\cos x + 5x(\cos x)' =$

product rule

$= 5\cos x + 5x(-\sin x) = 5\cos x - 5x\sin x$

slope $x = \pi$ $\quad y'(\pi) = 5\underbrace{\cos(\pi)}_{=-1} - \cancel{5\pi \underbrace{\sin(\pi)}_{=0}} = \boxed{-5}$

$y = mx + b \qquad m = -5 \qquad$ plug in $(\pi, -5\pi)$ to find b

$$\begin{aligned} -5\cancel{\pi} &= -5\cancel{\pi} + b \\ +\cancel{5}\pi \quad & \quad +\cancel{5}\pi \end{aligned} \qquad b=0$$

$$\boxed{y = -5x}$$

8 on review sheet $\quad y = x^{\tan x} \quad$ Find y'

logarithmic differentiation

$\ln y = \ln x^{\tan x} \qquad \ln a^b = b \ln a$

$(\ln y)' = (\tan x \ln x)'$ product rule

$(\ln x)' = \frac{1}{x}$

$(\ln g(x))' = \frac{g'(x)}{g(x)}$

y

$$\frac{y'}{y} = (\tan x)' \ln x + (\tan x)(\ln x)'$$

$$\cancel{y}\left[\frac{y'}{\cancel{y}}\right] = y\left[\sec^2 x \ln x + \tan x \frac{1}{x}\right]$$

$$y' = y\left[\sec^2 x \ln x + \frac{\tan x}{x}\right]$$

$$\boxed{y' = x^{\tan x}\left[\sec^2 x \ln x + \frac{\tan x}{x}\right]}$$

Review $\quad \frac{d}{dx} \ln(5x) = \frac{(5x)'}{5x} = \frac{\cancel{5}}{\cancel{5}x} = \frac{1}{x}$

$$\frac{d}{dx} \ln(5x+1) = \frac{(5x+1)'}{5x+1} = \boxed{\frac{5}{5x+1}}$$

$\frac{d}{dx} e^x = e^x \qquad \frac{d}{dx} 3^x = 3^x (\ln 3)$

$$\frac{d}{dx} e^{-x^2+3x+1} = e^{-x^2+3x+1}(-x^2+3x+1)' =$$

$e^{-x^2+3x+1} \quad (-2x+3)$

$$\boxed{\frac{d}{dx} e^{g(x)} = e^{g(x)} \; g'(x)}$$

7 on ww $\frac{d}{dx} \cos(u(x))$ a) $u(x) = 7 - x^2$

$$\frac{d}{dx} \cos(7-x^2) = -\sin(7-x^2)\,(7-x^2)' =$$

$$-\sin(7-x^2)(-2x) = \sin(7-x^2)\,2x$$

$$2x \sin(7-x^2)$$

b) $u(x) = x^{-2}$

$$\frac{d}{dx} \cos(x^{-2}) = -\sin(x^{-2})\,(x^{-2})'$$

$$= -\sin(x^{-2})(-2x^{-3})$$

$$= \boxed{\frac{2\sin(x^{-2})}{x^3}}$$

c) $u(x) = \tan x$

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

$$\boxed{-\sin(\tan x)(\sec^2 x)}$$