Evaluation 4 10/07/2020

1. $f(x) = 3\ln\sqrt[4]{x^5+2x^2+1}$

$3 \cdot \frac{1}{x^5+2x^2+1^4} \frac{d}{dx}(x^5+2x^2+1)$

$3 \cdot \frac{1}{x^5+2x^2+1^4}(5x^4+4x)$

$\boxed{\frac{3}{x^5+2x^2+1^4}(5x^4+4x)}$

b. $\ln\frac{x}{x^4+3}$

$\frac{1}{\frac{x}{x^4+3}} \frac{d}{dx}(\ln\frac{x}{x^4+3})$

$\frac{x^4+3}{x} \frac{d}{dx}(\ln\frac{x}{x^4+3})$ $\begin{matrix} u \\ v \end{matrix}$

$\frac{x^4+3}{x} \frac{x^4+3\frac{d}{dx}(x) - x\frac{d}{dx}(x^4+3)}{(x^4+3)^2}$

$\frac{x^4+3}{x} \cdot \frac{x^4+3(1)-x(4x^3)}{(x^4+3)^2} = \frac{x^4+3+x^4+3-4x^4}{x(x^4+3)^2}$

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

(c) $f(x) = \frac{\ln(5x)}{4x} \cdot \frac{1}{4}\frac{d}{dx}\frac{\ln(5x)}{x}\frac{u}{v}$

$$\frac{1}{4} \cdot \frac{x\frac{d}{dx}(\ln 5x) - \ln(5x)\frac{d}{dx}(x)}{x^2}$$

$$\frac{1}{4} \cdot \frac{x \cdot \frac{1}{5x} \cdot \frac{d}{dx}(5x) - \ln(5x)(1)}{x^2}$$

$$\frac{1}{4} \cdot \frac{\frac{x}{5x}(5)\frac{d}{dx}(x) - \ln(5x)}{x^2} = \frac{1}{4} \cdot \frac{1\frac{5x}{5x}(1) - \ln(5x)}{x^2}$$

$$\boxed{\frac{1-\ln(5x)}{x^2}}$$

a.) $x^3 \ln(4x) = x^3\frac{d}{dx}(\ln(4x)) + \ln(4x)\frac{d}{dx}(x^3)$

$$x^3\left(\frac{d}{dx}(\ln(4x))\frac{d}{dx}(4x)\right) + \ln(4x)(3x^2)$$

$$x^3\left(\frac{1}{4x} \cdot 4\right) + \ln(4x)(3x^2)$$

$$\frac{x^3}{4x}(4) + \ln(4x)(3x^2) = \frac{4x^2}{4} + \ln(4x)(3x^2$$

$$\boxed{x^2 + 3x^2\ln(4x)}$$

2. $f(x) = \ln\left(\sqrt[3]{\frac{x+2}{x-2}}\right)$

$$\frac{d}{dx}\left[\ln\left(\frac{x+2}{x-2}\right)^{\frac{1}{3}}\right] = \frac{1}{\left(\frac{x+2}{x-2}\right)^{\frac{1}{3}}} \cdot \frac{d}{dx}\left(\frac{x+2}{x-2}\right)^{\frac{1}{3}}$$

$$\frac{1}{\left(\frac{x+2}{x-2}\right)^{\frac{1}{3}}} \cdot \frac{1}{3}\left(\frac{x+2}{x-2}\right)^{-\frac{2}{3}} \frac{d}{dx}\left(\frac{x+2}{x-2}\right)^{\frac{1}{3}} \quad u \quad v$$

$$\frac{1}{\left(\frac{x+2}{x-2}\right)^{1/3}} \cdot \frac{1}{3}\left(\frac{x+2}{x-2}\right)^{-2/3} \frac{(x-2)\frac{d}{dx}(x+2) - (x+2)\frac{d}{dx}(x-2)}{(x-2)^2}$$

$$\frac{1}{\left(\frac{x+2}{x-2}\right)^{1/3}} \cdot \frac{1}{3}\left(\frac{x+2}{x-2}\right)^{-2/3} \frac{(x-2)(1) - (x+2)(1)}{(x-2)^2}$$

$$\frac{1}{\left(\frac{x+2}{x-2}\right)^{1/3}} \cdot \frac{1}{3}\left(\frac{x+2}{x-2}\right)^{-2/3} \frac{x-2-x-2}{(x-2)^2}$$

$$\frac{1}{\left(\frac{x+2}{x-2}\right)^{1/3}} \cdot \left(\frac{-4}{3(x-2)^2}\right) \cdot \left(\frac{x+2}{x-2}\right)^{-2/3}$$

$$\frac{1}{\left(\frac{x+2}{x-2}\right)^{1/3}} \left(\frac{-4}{3(x-2)^2}\right) \frac{1}{\left(\frac{x+2}{x-2}\right)^{2/3}}$$

b. $\ln\left(\frac{(x+2)^4\sqrt[3]{x^4+1}}{e^7\sqrt{x^2+1}}\right)$

$\frac{1}{\frac{(x+2)^4\sqrt[3]{x^4+1}}{e^7\sqrt{x^2+1}}} \frac{d}{dx}\left(\frac{(x+2)^4\sqrt[3]{x^4+1}}{e^7\sqrt{x^2+1}}\right)$

c. $f(x) = (x^2+5)\ln(x^2+5)$

$(x^2+5)\frac{d}{dx}(\ln(x^2+5)) + \ln(x^2+5)\frac{d}{dx}(x^2+5)$

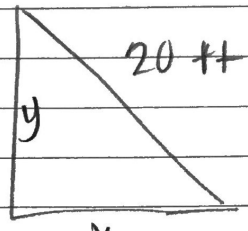
$(x^2+5)\left(\frac{1}{x^2+5}\frac{d}{dx}(x^2+5)\right) + \ln(x^2+5)(2x)$

$(x^2+5)\left(\frac{1}{x^2+5}\right)(1x) + \ln(x^2+5)(2x)$

$\boxed{(x^2+5)\left(\frac{2x}{x^2+5}\right) + 2x\ln(x^2+5)}$

3. 20ft ladder
rate = 6 ft/sec
12 ft away

$x^2 + y^2 = c^2$



$\frac{d}{dt}(x^2 + y^2 = 400)$ (20^2)

$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 400$

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

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

$-\frac{12}{y}(6) = -\frac{72}{16} = -\frac{18}{4} = \frac{9}{2}$

$20^2 - 12^2 = 400 - 144$

$y^2 = 256$

$y = 16$

$\boxed{\frac{9}{2}\text{ ft/s}}$

4. (a.) $v(t) = s'(t) = 3t^2 - 24t + 36$

(b.) $3(3)^2 - 24(3) + 36 = 0$

$3(9) - 72 + 36 = -9$

(c.) $3(0)^2 - 24(0) + 36 = \boxed{0}$

$3(-9)^2 - 24(-9) + 36 =$

$-729 + 216 + 36 = 437$

5 $2xy + x^2 y = 5x + 5$

$\frac{d}{dx}(2xy + x^2 y = 5x + 5)$

$2\left(2x \frac{d}{dx}(y) + y^2\right) + x^2 \frac{d}{dx}(y) + 2xy = 5$

$4xy \frac{d}{dx}(y) + 2y^2 + x^2 \frac{d}{dx}(y) + 2xy = 5$

$4xy \frac{dy}{dx}(y) + x^2 \frac{dy}{dx}(y) = 5 - 2y^2 - 2xy$

$\frac{dy}{dx}(4xy + x^2) = 5 - 2y^2 - 2xy$

C D

$\boxed{\frac{dy}{dx} = \frac{D}{C}}$

(1, 2)

$\frac{5 - 2y^2 - 2xy}{4xy + x^2}$