Name: Richard

QUIZ 11

MATH 200
September 28, 2023

1. Differentiate: $f(x) = \ln\left|5x^3 + 3x^2 + x\right|$

$$\boxed{f'(x) = \frac{15x^2 + 6x + 1}{5x^3 + 3x^2 + x}}$$

2. Differentiate: $y = \dfrac{1}{\ln(x)}$ $= (\ln(x))^{-1}$

$$y' = -(\ln(x))^{-1-1}\frac{1}{x} = \boxed{\frac{-1}{x(\ln(x))^2}}$$

3. Differentiate: $g(x) = \ln\left(\dfrac{1}{x}\right)$

$$g'(x) = \frac{1}{1/x} D_x\left[\frac{1}{x}\right] = x\left(\frac{-1}{x^2}\right) = \boxed{-\frac{1}{x}}$$

4. Differentiate: $w = x - \dfrac{xe^x}{\ln(x)}$

$$\frac{dw}{dx} = 1 - \frac{D_x[xe^x]\ln(x) - xe^x D_x[\ln(x)]}{(\ln(x))^2}$$

$$= 1 - \frac{(1 \cdot e^x + xe^x)\ln(x) - xe^x\frac{1}{x}}{(\ln(x))^2} = \boxed{1 - \frac{e^x(1+x)\ln(x) - 1}{(\ln(x))^2}}$$

5. Find the equation of the tangent line to the graph of $f(x) = 2 + x\ln(x)$ at the point $(1, f(1))$.

Point: $(x_0, y_0) = (1, f(1)) = (1, 2 + 1 \cdot \ln(1)) = (1, 2+0) = (1, 2)$

$f'(x) = 0 + 1 \cdot \ln(x) + x\frac{1}{x} = \ln(x) + 1.$

Slope: $m = f'(1) = \ln(1) + 1 = 0 + 1 = 1$

Point-slope formula: $y - y_0 = m(x - x_0)$

$y - 2 = 1(x - 1)$

$\boxed{y = x + 1}$

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1. Differentiate: $y = \cos(x)\ln(x)$

$y' = \boxed{-\sin(x)\ln(x) + \cos(x)\frac{1}{x}}$

2. Differentiate: $f(x) = \cos(\ln(x))$

$f'(x) = -\sin(\ln(x))\frac{1}{x} = \boxed{-\frac{\sin(\ln(x))}{x}}$

3. Differentiate: $g(x) = \ln(\cos(x))$

$g'(x) = \frac{-\sin(x)}{\cos(x)} = \boxed{-\tan(x)}$

4. Differentiate: $y = 4 + \sqrt{x + x^2\ln(x)}$ $= 4 + (x + x^2\ln(x))^{\frac{1}{2}}$

$y' = 0 + \frac{1}{2}(x + x^2\ln(x))^{\frac{1}{2}-1} D_x[x + x^2\ln(x)]$

$= \frac{1}{2(x+x^2\ln(x))^{1/2}}\left(1 + 2x\ln(x) + x^2\frac{1}{x}\right) = \boxed{\frac{1+2x\ln(x)+x}{2\sqrt{x+x^2\ln(x)}}}$

5. Find the equation of the tangent line to the graph of $f(x) = \ln(2x-1)$ at the point $(1, f(1))$.

Point: $(x_0, y_0) = (1, f(1)) = (1, \ln(2\cdot1-1)) = (1, \ln(1)) = (1, 0)$

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

Slope: $m = f'(1) = \frac{2}{2\cdot1-1} = 2$

Point-slope formula: $y - y_0 = m(x - x_0)$

$y - 0 = 2(x-1)$

$\boxed{y = 2x - 2}$