Name: Richard

QUIZ 11

MATH 200

September 26, 2024

1. $D_x\left[\ \ln|x^3| + (\ln|x|\,)^3 + x^3 \ln|x|\ \right] =$

$$\frac{3x^2}{x^3} + 3(\ln|x|)^3\frac{1}{x} + 3x^2\ln|x| + x^3\frac{1}{x}$$

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

2. $D_x\left[\ \ln\Big|\sin(x)\cos(x)\Big|\ \right] =$ $\dfrac{\cos(x)\cos(x) + \sin(x)(-\sin(x))}{\sin(x)\cos(x)}$

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

3. $D_x\left[\ \dfrac{\ln(x)}{e^x}\ \right] =$ $\dfrac{\frac{1}{x}e^x - \ln(x)e^x}{(e^x)^2} = \dfrac{\cancel{e^x}\left(\frac{1}{x} - \ln(x)\right)}{\cancel{e^x}\,e^x}$

$$= \boxed{\frac{\frac{1}{x} - \ln(x)}{e^x}}$$

4. Find all x for which the tangent line to the graph of $f(x) = \ln|x| - \dfrac{x}{8}$ at $\big(x, f(x)\big)$ is horizontal.

Solve $f'(x) = 0$

$$\frac{1}{x} - \frac{1}{8} = 0$$

$$\frac{1}{x} = \frac{1}{8}$$

$$x = 8$$

Answer: Tangent is horizontal for $x = 8$

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1. $D_x\Big[\ \ln|\sin(x)| + \sin\big(\ln|x|\big) + \sin(x)\ln|x|\ \Big] =$

$$\frac{\cos(x)}{\sin(x)} + \cos(\ln|x|)\frac{1}{x} + \cos(x)\ln|x| + \sin(x)\frac{1}{x}$$

$$= \boxed{\cot(x) + \frac{\cos(\ln|x|)}{x} + \cos(x)\ln|x| + \frac{\sin(x)}{x}}$$

2. $D_x\Big[\ \ln\big(x^2+3x-4\big)\ \Big] = \boxed{\dfrac{2x+3}{x^2+3x-4}}$

3. $D_x\Big[\ \dfrac{e^x}{\ln(x)}\ \Big] = \dfrac{e^x\ln(x) - e^x\frac{1}{x}}{(\ln(x))^2} = \boxed{e^x\dfrac{\ln(x)-\frac{1}{x}}{(\ln(x))^2}}$

4. Consider the function $f(x) = 3 + \ln(x-1)$. Find the equation of the tangent line to the graph of f at the point $(2, f(2))$ $= (2, 3+\ln(2-1)) = (2, 3-\ln(1)) = (2, 3)$

$f'(x) = 0 + \frac{1}{x-1}$

Point on line: $(x_0, y_0) = (2, 3)$

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

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

$y - 3 = 1(x-2)$

$\boxed{y = x + 1}$