HOMEWORK DAY 34 SOLUTIONS

6A. $e^x = 16$

$\ln 16 = x$

$\approx x$

C. $e^{2x} = 125$

$\ln 125 = 2x$

$\frac{\ln 125}{2} = x$

$\approx x$

B. $\ln(x-1)^2 = 4$

$2\ln(x-1) = 4$

$\ln(x-1) = 2$

$x - 1 = e^2$

$x = e^2 + 1$

$x \approx$

D. $\ln x = 2$

$x = e^2$

$x \approx$

7. A. $y = \sqrt{\ln x}$

$y' = \frac{\frac{1}{x}}{2\sqrt{\ln x}} = \frac{1}{2x\sqrt{\ln x}}$

B. $\frac{d}{dx}\left[\frac{\ln x}{x^3}\right] = \frac{x^3\left(\frac{1}{x}\right) - \ln x\,(3x^2)}{x^6} = \frac{x^2 - 3x^2 \ln x}{x^6} = \frac{1 - 3\ln x}{x^4}$

C. $\frac{d}{dx}\left[\ln e^{3x}\right] = \frac{d}{dx}\left[3x\right] = 3$

D. $\frac{d}{dx}\left[\ln 6x + \ln 2x\right] = \frac{d}{dx}\left[\ln 12x^2\right] = \frac{24x}{12x^2} = \frac{2}{x}$

E. $\frac{d}{dx}\left[x^4 \ln x\right] = x^4\left(\frac{1}{x}\right) + \ln x\,(4x^3) = x^3 + 4x^3 \ln x$

F. $\frac{d}{dx}\left[\frac{\ln 6x}{\ln 2x}\right] = \frac{\ln(2x)\left(\frac{6}{6x}\right) - \ln 6x\left(\frac{2}{2x}\right)}{\left[\ln 2x\right]^2} = \frac{\ln 2x - \ln 6x}{x\left[\ln 2x\right]^2}$

#7.

F (continued)

$$\frac{\ln 2x - \ln 6x}{x[\ln 2x]^2} = \frac{\ln \frac{2x}{6x}}{x[\ln 2x]^2} = \frac{\ln(\frac{1}{3})}{x[\ln 2x]^2}$$

G. $\frac{d}{dx}\left[\ln 10x^8\right] = \frac{d}{dx}\left[\ln 10 + 8\ln x\right] = \frac{8}{x}$

H. $\frac{d}{dx}\left[\ln x + \ln x^2 + \ln x^3 + \ln x^4\right] = \frac{d}{dx}\left[\ln x^{10}\right] = \frac{10}{x}$

I. $\frac{d}{dx}\left[\ln(8x^2+2)^4\right] = \frac{d}{dx}\left[4\ln(8x^2+2)\right] = \frac{4}{8x^2+2} \cdot 16x = \frac{64x}{8x^2+2}$

J. $\frac{d}{dx}\left[\sqrt{e}\ln 3\right] = 0$

K. $\frac{d}{dx}\left[\ln 3x^7\right] = \frac{d}{dx}\left[\ln 3 + 7\ln x\right] = \frac{7}{x}$

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

$(3\ln x)e^{2x} \cdot 2$

$= \frac{3e^{2x}}{x} + 6e^{2x}\ln x$

11. State the domain . . . DOMAIN OF NAT. LOGS CANNOT BE NEGATIVE

A. $\ln x + 2$

$x > 0$

B. $\ln(x+2)$

$x > -2$

C. $\ln x^2$

$x > 0$

D. $1 - \ln x$

$x > 0$

13A. $\frac{d}{dx}\left[x^3 \ln 2x\right] = x^3 \frac{2}{2x} + \ln 2x\,(3x^2)$

$= x^2 + 3x^2 \ln 2x$

B. $\frac{d}{dx}\left[\ln 6x \ln 2x\right] = \ln 6x \left(\frac{2}{2x}\right) + \ln 2x \left(\frac{6}{6x}\right)$

$= \frac{\ln 6x}{x} + \frac{\ln 2x}{x}$

$= \frac{\ln 6x + \ln 2x}{x} = \frac{\ln 12x^2}{x}$

C. $\frac{d}{dx}\left[\frac{\ln x}{2x^3-4}\right] = \frac{(2x^3-4)\left(\frac{1}{x}\right) - (\ln x)(6x^2)}{(2x^3-4)^2}$

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

$= \frac{4x}{2x^2-3} - \frac{6x^2}{2x^3} = \frac{4x}{2x^2-3} - \frac{3}{x}$

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

F. $\frac{d}{dx}\left[\frac{\ln x}{(x+3)^3}\right] = \frac{(x+3)^3\left(\frac{1}{x}\right) - (\ln x)(3)(x+3)^2(1)}{(x+3)^6} = \frac{\frac{(x+3)}{x} - 3\ln x}{(x+3)^4}$

G. $\frac{d}{dx}\left[e^{x\ln x}\right] = e^{x\ln x}\left(x\left(\frac{1}{x}\right) + \ln x\right) = e^{x\ln x}(1+\ln x)$

H. $\frac{d}{dx}\left[3(\ln\sqrt{2x+3})^2\right] = 6(\ln\sqrt{2x+3})^1 \cdot \frac{1}{\sqrt{2x+3}} \cdot \left(\frac{2}{\cancel{2}\sqrt{2x+3}}\right) = \frac{6\ln(2x+3)^{\frac{1}{2}}}{2x+3}$

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

14. $y = \ln 2x \quad , x = \frac{e}{2}$ $\quad y(\frac{e}{2}) = \ln 2(\frac{e}{2}) = \boxed{1}$ (1)

$y = \ln 2 + \ln x$

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

$y'(\frac{e}{2}) = \frac{1}{\frac{e}{2}} = \boxed{\frac{2}{e} = m}$

$\boxed{\text{so } m = \frac{2}{e} \quad (\frac{e}{2}, 1)}$ (3)

$y - 1 = \frac{2}{e}(x - \frac{e}{2})$

$y - 1 = \frac{2}{e}x - 1$

$\boxed{y = \frac{2}{e}x}$ (4)

15. $y = \ln x^2$

$y = 2 \ln x$

$y' = \frac{2}{x}$

$y'(3) = 2/3$

$y(3) = 2\ln 3 = \ln 9$

$m = \frac{2}{3} \quad (3, \ln 9)$

$y - \ln 9 = \frac{2}{3}(x - 3)$

$y - \ln 9 = 2x - 2$

$y = 2x - 2 + \ln 9$