Math 1151, Logarithmic Differentiation Activity, Fall 2014 Name KEY

Instructions: Find y' for each of the functions below using logarithmic differentiation. Be sure your final answer is expressed in terms of x alone.

1. $y = \frac{x^2\sqrt{3x-2}}{(x+1)^2}$

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

$\frac{y'}{y} = \frac{2}{x} + \frac{1}{2}\cdot\frac{1}{3x-2}\cdot 3 - \frac{2}{x+1}$

$y' = \left[\frac{2}{x} + \frac{3}{2(3x-2)} - \frac{2}{x+1}\right]\frac{x^2\sqrt{3x-2}}{(x+1)^2}$

2. $y = x^x$

$\ln y = \ln x^x = \ln x \cdot x$ $\quad \frac{y'}{y} = \frac{1}{x}\cdot x + \ln x$

$y' = [1+\ln x]x^x$

3. $y = x^{2/x}$

$\ln y = \ln x^{2/x} = \frac{2}{x}\cdot\ln x$

$\frac{y'}{y} = \frac{-2}{x^2}\ln x + \frac{2}{x}\cdot\frac{1}{x} = \frac{-2\ln x + 2}{x^2}$

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

4. $y = \frac{(x+1)(x-2)}{(x-1)(x+2)}$

$\ln y = \ln\left[\frac{(x+1)(x-2)}{(x-1)(x+2)}\right] = \ln(x+1) + \ln(x-2) - \ln(x-1) - \ln(x+2)$

$\frac{y'}{y} = \frac{1}{x+1} + \frac{1}{x-2} - \frac{1}{x-1} - \frac{1}{x+2}$ $\quad y' = \left[\frac{1}{x+1} + \frac{1}{x-2} - \frac{1}{x-1} - \frac{1}{x+2}\right]\frac{(x+1)(x-2)}{(x-1)(x+2)}$

5. $y = \ln^x(x)$

$\ln y = \ln[\ln^x(x)] = x\ln(\ln(x))$

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

$y' = \left[\ln(\ln x) + \frac{1}{\ln x}\right]\ln^x(x)$