Differentiation Practice

1. Find $\dfrac{dy}{dx}$ for each of the following *and simplify*:

$y = \ln(x) + 2\log(x)$ $\qquad$ $y = 5\log_2(x^3 + 2)$ $\qquad$ $y = \ln[4x - 3] + \ln[\sin(x)]$

2. Find $\dfrac{dy}{dx}$ for each of the following *and simplify*:

$y = \ln(x) + \log(x^2)$ $\qquad$ $y = \log_2[(x^3 + 2)^5]$ $\qquad$ $y = \ln[(4x - 3)\sin(x)]$

3. Notice any similarities between the answers to 1 and the answers to 2?

4. Is there any precalculus/algebra tools you can use to modify the problems in 1 to get the problems in 2?

   If you don't remember your logarithm properties from precalculus check out Appendix G on page A51 and try to reanswer the above question.

Logarithmic Differentiation

Let b be a positive real number. Recall the properties of logarithms:

$\log_b(xy) = \log_b x + \log_b y$

$\log_b\left(\frac{x}{y}\right) = \log_b x - \log_b y$

$\log_b(x^y) = y \log_b x$

Note: you need to *know* these for quizzes and exams as they will not be provided for you!!!

1. Use any method you like to find $\frac{dy}{dx}$.

   $y = \sqrt{\frac{x-1}{x^4+1}}$ $\qquad\qquad$ $y = x^{\sqrt{x}}$

2. Let $y = (\sin x)^{\ln x}$.

   - True or False: $\frac{dy}{dx} = \ln(x)(\sin x)^{\ln x - 1}$.

   - Use logarithmic differentiation to find $\frac{dy}{dx}$.