MAC 2311: Worksheet #11 October 11th, 2016

Panther ID: ____________________ **NAME:** ____________________

1) Compute the following derivatives:

a) $\frac{d}{dx}\ln(x^2+1)$

b) $\frac{d}{dx}\ln(\sin(x))$

2) Use implicit differentiation to find the the slope of the line tangent to the curve $\ln(y) = x^2+x+1$ at the point $(1, e)$.

3) In this problem, we compute the derivative of $\log_b(x)$ for any number $b > 0$.

a) Show that the base change formula, $\log_b(x) = \ln(x)/\ln(b)$, holds by setting $y = \log_b(x)$, and simplifying $\ln(b^y)$ two different ways. (Hint: first simplify b^y, then apply a law of of logarithms to $\ln(b^y)$.)

b) Differentiate both sides of the base change formula and to find the derivative of $\log_b(x)$.

4) Use logarithmic differentiation to find the derivative of

$$f(x) = \frac{(2x+3)^5(3x-4)^4}{\sin^5(x)\cos^4(x)}.$$

5) Compute the following derivatives:

a) $\frac{d}{dx} e^{\tan(x)}$

b) $\frac{d}{dt} \sin(t)e^{t^2}$

6) We have shown that the power law, $\frac{d}{dx}x^r = rx^{r-1}$, holds whenever r is a *rational* number, that is $r = p/q$ where $p, q = \pm 1, \pm 2, \ldots$. To define $f(x) = x^r$ when r is not rational, we use the equality

$$x^r = e^{\ln(x^r)} = e^{r \ln(x)}.$$

Use this definition to show that the power rule holds for all real numbers r.