MATH 202 Quiz 4 – Version B
September 17, 2015

Name: $\underline{ANSWERS}$

Instructions: No calculators! Use your own scrap paper and write your answers in the space provided.

1. Complete the following rules:

   (a) $(f^{-1})'(x) = \underline{\dfrac{1}{f'(f^{-1}(x))}}$ (b) $\dfrac{d}{dx}\log_a u = \underline{\dfrac{u'}{u\ln a}}$ (c) $\int a^x dx = \underline{\dfrac{a^x}{\ln a}} + C$

   (d) $\dfrac{d}{dx}e^u = \underline{u'e^u}$ (e) $\dfrac{d}{dx}\ln u = \underline{\dfrac{u'}{u}}$ (f) $\dfrac{d}{dx}a^x = \underline{a^x \ln a}$

   (g) $\log_a a^x = \underline{X}$ (h) $\log_a\left(\dfrac{A}{B}\right) = \underline{\log_a A - \log_a B}$ (i) $\dfrac{d}{dx}a^u = \underline{u'a^u \ln a}$

   (j) $\log_a b = c \Leftrightarrow \underline{a^c = b}$ (k) $\log_a(AB) = \underline{\log_a A + \log_a B}$ (l) $a^{\log_a x} = \underline{X}$

2. Differentiate:

   (a) $\dfrac{d}{dx}(\cos(3^{x^4})) = \underline{-\sin(3^{x^4})\cdot 4X^3\cdot 3^{x^4}\ln 3}$ (b) $\dfrac{d}{dx}(\ln 3^{\sin x} + 5^{\cos x}) = \underline{\cos x \cdot \ln 3 - \sin x \cdot 5^{\cos x}\cdot \ln 5}$

   (c) $\dfrac{d}{dx}(\log_5 x)^x = \underline{\left(\dfrac{\ln x + 1}{\ln 5}\right)(\log_5 x)^x = \left(\log_5 x + \dfrac{1}{\ln 5}\right)(\log_5 x)^x}$, etc.

3. Integrate:

   (a) $\displaystyle\int \dfrac{\log_4(x-3)}{x-3}dx = \underline{\dfrac{\ln 4}{2}\left(\log_4(x-3)\right)^2 + C}$ (b) $\displaystyle\int_2^e 4^x dx = \underline{\dfrac{4^e - 16}{\ln 4}}$

   (c) $\displaystyle\int \dfrac{\pi^x}{1+\pi^x}dx = \underline{\dfrac{1}{\ln \pi}\ln|1 + \pi^x| + C}$

Bonus:

1. A population, with an initial size of P_0, grows at a rate proportional to its current size, P. Assuming its relative growth rate is r, write down equations for:

   (i) The differential equation describing this growth: $\underline{P' = rP}$

   (ii) The formula for $P(t)$, the current size of the population at time t: $\underline{P(t) = P_0 e^{rt}}$

2. $e = \underline{\lim\limits_{n\to\infty}\left(1+\dfrac{1}{n}\right)^n}$ (limit) $\dfrac{d}{dx}\sin^{-1}x = \underline{\dfrac{1}{\sqrt{1-x^2}}}$