MATH 202 Quiz 4 – Version A
September 17, 2015

Name: ANSWERS

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

1. Complete the following rules:

(a) $\frac{d}{dx}e^u =$ $u'e^u$ (b) $\frac{d}{dx}\ln u =$ $\frac{u'}{u}$ (c) $\frac{d}{dx}a^x =$ $a^x \ln a$

(d) $(f^{-1})'(x) =$ $\frac{1}{f'(f^{-1}(x))}$ (e) $\frac{d}{dx}\log_a u =$ $\frac{u'}{u \ln a}$ (f) $\int a^x dx =$ $\frac{a^x}{\ln a} + C$

(g) $\log_a b = c \Leftrightarrow$ $a^c = b$ (h) $\log_a(AB) =$ $\log_a A + \log_a B$ (i) $a^{\log_a x} =$ x

(j) $\log_a a^x =$ x (k) $\log_a\left(\frac{A}{B}\right) =$ $\log_a A - \log_a B$ (l) $\frac{d}{dx}a^u =$ $u'a^u \ln a$

2. Differentiate:

(a) $\frac{d}{dx}(\sin(5^{x^2})) =$ $\cos(5^{x^2}) \cdot 2x \cdot 5^{x^2} \ln 5$ (b) $\frac{d}{dx}(\log_2 x)^x =$ $\left(\frac{\ln x + 1}{\ln 2}\right)(\log_2 x)^x = \left(\log_2 x + \frac{1}{\ln 2}\right)(\log_2 x)^x$ etc.

(c) $\frac{d}{dx}(\ln 3^{\sin x} + 5^{\cos x}) =$ $\cos x \cdot \ln 3 - \sin x \cdot 5^{\cos x} \cdot \ln 5$

3. Integrate:

(a) $\int_2^e 7^x \, dx =$ $\frac{7^e - 49}{\ln 7}$ (b) $\int \frac{\log_5(x+1)}{x+1} dx =$ $\frac{\ln 5}{2} \cdot (\log_5(x+1))^2 + C$

(c) $\int \frac{\pi^x}{\pi^x + 4} dx =$ $\frac{1}{\ln \pi} \ln|\pi^x + 4| + C$

Bonus:

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

2. 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: $P' = rP$

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