MATH 202 Quiz 6 – Version B

October 13, 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) $\int \tan x \, dx =$ $-\ln|\cos x| + C$ or $\ln|\sec x| + C$ (b) $\int \sec x \, dx =$ $\ln|\sec x + \tan x| + C$ (c) $\int \ln x \, dx =$ $x\ln x - x + C$

(d) $\int \sin^2 x \, dx =$ $\frac{1}{2}(x - \frac{1}{2}\sin 2x) + C$ (e) $\int \sec^3 x \, dx =$ $\frac{1}{2}(\sec x \tan x + \ln|\sec x + \tan x|) + C$ (f) $\int \cos^2 x \, dx =$ $\frac{1}{2}(x + \frac{1}{2}\sin 2x) + C$

2. Complete the following table of trig substitutions:

Expression	Substitution	Identity
$\sqrt{a^2 - x^2}$	$x = a\sin\theta$ or $x = a\cos\theta$	$1 - \sin^2\theta = \cos^2\theta$ or $1 - \cos^2\theta = \sin^2\theta$
$\sqrt{x^2 + a^2}$	$x = a\tan\theta$	$1 + \tan^2\theta = \sec^2\theta$
$\sqrt{x^2 - a^2}$	$x = a\sec\theta$	$\sec^2\theta - 1 = \tan^2\theta$

3. What is the integration by parts formula?: $\int u\,dv = uv - \int v\,du$

4. What mnemonic is used to choose the parts in the above formula? LIATE

5. Integrate the following:

(a) $\int_1^9 e^{\sqrt{x}} \, dx =$ $4e^3$ (b) $\int \frac{x^3}{\sqrt{3^2 + x^2}} \, dx =$ $\frac{(9+x^2)^{3/2}}{3} - 9\sqrt{9+x^2} + C$

(c) $\int \frac{1 - \tan^2\theta}{\sec^2\theta} \, d\theta =$ $\frac{1}{2}\sin 2\theta + C$ (d) $\int \frac{x^2}{\sqrt{x^2+3}} \, dx =$ $\frac{x\sqrt{x^2+3}}{2} - \frac{3}{2}\ln\left|\frac{\sqrt{x^2+3}}{\sqrt{3}} + \frac{x}{\sqrt{3}}\right| + C$

(e) $\int t\cos^2 t \, dt =$ $\frac{t^2}{4} + \frac{t}{4}\sin 2t + \frac{1}{8}\cos 2t + C$ (f) $\int \tan^{-1}\frac{1}{x} \, dx =$ $x\tan^{-1}\frac{1}{x} + \frac{1}{2}\ln|1+x^2| + C$

(g) $\int \sin^2 x \cos^3 x \, dx =$ $\frac{\sin^3 x}{3} - \frac{\sin^5 x}{5} + C$

Bonus:

1. $\int \frac{x^2 - 1}{x^2 + 1} dx =$ $x - 2\tan^{-1}x + C$ (b) $\int \frac{1}{x^2 + 5x + 6} dx =$ $\ln|x+2| - \ln|x+3| + C$

2. Write down the partial fractions decomposition of $\frac{3}{x^2(x^2+1)^2(x^2-4)}$. You need not find the arbitrary constants. $\frac{A}{x} + \frac{B}{x^2} + \frac{Cx+D}{x^2+1} + \frac{Ex+F}{(x^2+1)^2} + \frac{G}{x-2} + \frac{H}{x+2}$