University of Pennsylvania
Math 104 Section 3
Fall 2016

Name: _____

Penn ID#: _____

Midterm Examination #2

This exam contains eight questions. No calculators are allowed, but you may use one standard sized 8.5"x11" sheet with notes handwritten on both sides. Show your work in the space provided below, and circle your final answer. Little or no credit will be given for an answer with no supporting work, even if correct. If you change an answer, please either erase or cross out the answer you do not want to be considered.

My signature below certifies that I have complied with the University of Pennsylvania's Code of Academic Integrity in completing this examination. In particular, all the work on this test is my own.

_____
Signature

1. Evaluate $\int x \sin x \cos x \, dx$.

(A) $x\,(\sin x)^2 + \frac{1}{4}\sin x + C$

(B) $\frac{1}{2}x\,(\sin x)^2 + \frac{1}{8}\sin 2x - \frac{1}{4}x + C$

(C) $x\,(\sin x)^2 + \frac{1}{4}\sin 2x - \frac{1}{2}x + C$

(D) $\frac{1}{2}x\,(\sin x)^2 - \frac{1}{2}(\sin x)^2 + C$

(E) $\frac{1}{2}x\,(\sin x)^2 - \frac{1}{2}x + C$

(F) $-\frac{1}{2}x\cos 2x + \frac{1}{4}(\cos x)^2 + C$

(G) $\frac{1}{2}x\,(\cos x)^2 + \frac{1}{8}\cos 2x + C$

(H) $x\,(\cos x)^2 + \frac{1}{4}\cos 2x - \frac{1}{2}x + C$

2. Evaluate $\int \frac{x^3+1}{x^3-x}\,dx$.

(A) $\frac{1}{3}\sin^{-1} x - 3\ln|x| + C$ (B) $\frac{1}{3}x\sin^{-1}(x-1) + 3\ln|x-1| + C$
(C) $-\frac{1}{3}x - 3\ln|x| + C$ (D) $\ln|x-1| - \ln|x| + C$
(E) $x - \ln|x| + C$ (F) $x + \ln|x-1| - \ln|x| + C$
(G) $x - \ln|x-1| + \ln|x| + C$ (H) $x + \sec^{-1}|x-1| - \ln|x| + C$

3. Evaluate $\int \frac{8dv}{v^2\sqrt{4-v^2}}$

(A) $\frac{-2\sqrt{4-v^2}}{v} + C$ (B) $\frac{v}{-2\sqrt{4-v^2}} + C$ (C) $\frac{\sqrt{4-v^2}}{8v} + C$
(D) $2\cot v + C$ (F) $\frac{2\pi}{3}v + C$ (G) $\frac{-8\sqrt{4-v^2}}{v} + C$

4. Evaluate $\int (\sec x)^2 \, (\sin x)^3 dx$.

(A) $-\sin x + \sin x \tan x + C$

(B) $(\sec x)^2[1 - (\cos x)^2] + C$

(C) $3(\sec x)^2 \, (\sin x)^2 \cos x + C$

(D) $\frac{1}{6}(1 + (\tan x)^2) \cos x + C$

(E) $\frac{(\sin x)^2}{\cos x} + 2 \cos x + C$

(F) $\sin x \tan x + \cos x + C$

5. Solve the initial value problem $\frac{dy}{dx} = e^{-x-y-2}$ with $y(0) = -2$.

(A) $y = -e^{-(x+2)} + 2e^{-2}$

(B) $y = -e^{-(x+2)}$

(C) $y = 2e^{-2}$

(D) $y = -e^{-x+2} + 2e^{-2}$

(E) $y = e^{-(x+2)} - 2e^{2}$

(F) $y = \ln(-e^{-(x+2)} + 2e^{-2})$

(G) $y = \ln(e^{-(x+2)} - 2e^{-2})$

(H) $y = -2e^{-x-y-2}$

6. You are planning to use Simpson's Rule to estimate the value of the integral $\int_1^2 f(x)dx$ with an error magnitude less than 10^{-5}. You have determined that $|f^{(4)}(x)| \leq 3$ throughout the interval of integration. What is the smallest number of subintervals you should use to ensure the required accuracy? (Remember that for Simpson's Rule, the number of subintervals has to be even.)

(A) 7 (B) 12 (C) 10 (D) 8
(E) 6 (F) 4 (G) 20 (H) 16

7. Evaluate $\int_{-\infty}^0 x\, e^{3x} dx$.

(A) Diverges (B) 3 (C) π (D) 18
(E) 0 (F) $\frac{1}{9}$ (G) 6 (H) $-\frac{1}{9}$

8. Find the value of the constant c so that $f(x) = cx\sqrt{25 - x^2}$ is a probability density function on the interval $[0, 5]$.

(A) $\frac{20}{5\sqrt{2}}$ (B) 0

(C) $\frac{3}{125}$ (D) $-\frac{50}{3}$

(E) $\frac{50}{3(\pi+2)}$ (F) $\frac{-4}{3(\pi+8)}$

(G) $-\frac{10}{3}$ (H) $-\frac{20}{\sqrt{2}}$