_____ / 15 total points

Quiz #2

Name: ___________________________________

Math 181, Section 4, Prof. Beydler

Wednesday, October 11, 2017

Directions: Show all work. No books or notes. A **scientific calculator** is allowed. Your desk and lap must be clear (no phones, no smart watches, no notebooks, etc.). Write your answers in the indicated places, or box your answers. Good luck!

1. (5 points) Evaluate the following integral.

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

Answer: $2\ln|x| - \tan^{-1}x + C$

$$\frac{2x^2-x+2}{x(x^2+1)} = \frac{A}{x} + \frac{Bx+C}{x^2+1}$$

$$\begin{aligned}2x^2-x+2 &= A(x^2+1)+(Bx+C)x\\ &= Ax^2+A+Bx^2+Cx\\ &= (A+B)x^2+Cx+A\end{aligned}$$

$A+B=2$

$C=-1 \quad \rightarrow B=0$

$A=2$

$$\int \frac{2x^2-x+2}{x^3+x}\,dx = \int\left(\frac{2}{x} - \frac{1}{x^2+1}\right)dx$$

$$= 2\ln|x| - \tan^{-1}x + C$$

2. (5 points) Evaluate the following integral.

$\int \sqrt{x}e^{\sqrt{x}}\,dx$

$u = \sqrt{x}$

$du = \frac{1}{2\sqrt{x}}dx$

$2u\,du = dx$

$= \int u e^{u} \cdot 2u\,du$

$= 2\int u^2 e^{u}\,du$

u^2	e^u
$2u$ (+)	e^u
2 (−)	e^u
0 (+)	e^u

$= 2(u^2e^u - 2ue^u + 2e^u) + C$

Answer: $2xe^{\sqrt{x}} - 4\sqrt{x}e^{\sqrt{x}} + 4e^{\sqrt{x}} + C$

3. (5 points) Use Simpson's Rule with $n = 4$ steps to approximate $\int_0^4 e^x\,dx$ and estimate the error in the approximation (i.e. find an upper bound for $|E_S|$). Write both answers to 6 decimal places.

$$\int_a^b f(x)\,dx \approx \frac{\Delta x}{3}[f(x_0) + 4f(x_1) + 2f(x_2) + 4f(x_3) + \cdots + 2f(x_{n-2}) + 4f(x_{n-1}) + f(x_n)]$$

$$|E_S| \le \frac{M(b-a)^5}{180n^4}$$

$\Delta x = \frac{4-0}{4} = 1$

Approximation: 53.863846

Estimated error: 1.213292

x_i	0	1	2	3	4
$f(x_i)$	1	e	e^2	e^3	e^4

$\int_0^4 e^x dx \approx \frac{1}{3}\left(1 + 4(e) + 2(e^2) + 4(e^3) + e^4\right)$

≈ 53.863846

$f(x) = e^x$

$f'(x) = e^x$

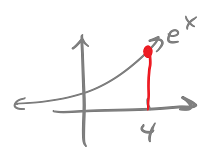
$f''(x) = e^x$

$f'''(x) = e^x$

$f^{(4)}(x) = e^x$

$|f^{(4)}(x)| = e^x$

$|f^{(4)}(4)| = e^4 \leftarrow M$



$|E_S| \le \frac{e^4(4-0)^5}{180(4)^4} \approx 1.213292$