Name: _____

Instructor: Bullwinkle

If Cao please indicate 10:40 or 11:45

Exam II
March 19, 2002

- The Honor Code is in effect for this examination. All work is to be your own.
- No calculators.
- The exam lasts for one hour.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 10 pages of the test.

Good Luck!

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!

| | | | | | |
|---|---|---|---|---|---|
| 1. | (a) | (b) | (c) | (d) | (e) |
| 2. | (a) | (b) | (c) | (d) | (e) |
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| 11. | (a) | (b) | (c) | (d) | (e) |
| 12. | (a) | (b) | (c) | (d) | (e) |

DO NOT WRITE IN THIS BOX!

Total multiple choice: _____

13. _____

14. _____

15. _____

**Total:** _____

## Multiple Choice

**1.**(5 pts.) Evaluate $\int_1^2 x^3 \ln x \, dx$.

(a) $4\ln 2 - \frac{15}{16}$ (b) $\frac{15}{16}$ (c) $4\ln 2 - \frac{1}{16}$ (d) $4\ln 2$ (e) $2\ln 2 - \frac{15}{16}$

**2.**(5 pts.) Compute $\int_0^{\pi/2} \sin(7x)\ \sin(3x)\, dx$

(a) $0$ (b) $\frac{1}{8}$ (c) $\frac{1}{7}$ (d) $\frac{1}{10}$ (e) $\frac{\pi}{2}$

**3.**(5 pts.) Evaluate $\int_0^{\pi/2} \cos^3 x \, dx$

(a) $0$ (b) $1$ (c) $\frac{\pi}{2}$ (d) $\frac{1}{3}$ (e) $\frac{2}{3}$

**4.**(5 pts.) Evaluate $\int_0^1 \frac{x}{(x^2+1)^{3/2}}\, dx$.

(a) $1-\sqrt{2}$ (b) $\sqrt{2}-1$ (c) $1-\frac{\sqrt{2}}{2}$ (d) $\pi$

(e) The integral diverges.

**5.**(5 pts.) Evaluate $\int_0^1 x\sqrt{1-x^2}\, dx$.

(a) $\frac{1}{6}$ (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{3}{4}$ (e) $0$

**6.**(5 pts.) Compute $\displaystyle\int_0^1 \frac{1}{(x+1)(x+2)}\,dx$.

(a) $\ln\frac{3}{2}$ (b) $\ln 2$ (c) $0$ (d) $\ln\frac{4}{3}$

(e) The integral diverges.

**7.**(5 pts.) Suppose that $\left|f''(x)\right| \le 1$ for $0 \le x \le 2$. If $E_M$ is the error in the Midpoint Rule using $n$ subintervals, then $|E_M|$ is less than

(a) $\frac{2}{3n^2}$ (b) $0$ (c) $\frac{1}{3n^2}$ (d) $\frac{1}{12n^2}$ (e) $\frac{1}{24n^2}$

**8.**(5 pts.) Evaluate the following integral $\displaystyle\int_0^{+\infty} xe^{-x^2}\,dx$.

(a) $1$ (b) $\frac{1}{2}$

(c) Diverges and the limit is not $\infty$ (d) Diverges and the limit is $\infty$

(e) $2e$

**9.**(5 pts.) You begin an experiment at 9am with a sample of 1000 bacteria. An hour later your population has doubled. Assuming exponential growth, what is the population at noon?

(a) $1000e^{-3}$ (b) $8000$ (c) $1000e^{3}$ (d) $4000$ (e) $32000$

**10.**(5 pts.) Compute the length of the curve $y = \frac{x^2}{2} - \frac{\ln x}{4}$, $1 \le x \le 2$.

(a) $6 + \frac{3\ln 2}{4}$ (b) $\frac{\ln 2}{2}$ (c) $2 + \frac{3\ln 2}{4}$ (d) $\frac{3}{2} + \frac{\ln 2}{4}$ (e) $+\infty$

**11.**(5 pts.) Find the area of the surface of revolution obtained by rotating the curve $y = 2\sqrt{x+1}$, $2 \le x \le 7$ about the $x$–axis.

(a) $\frac{152\pi}{3}$ (b) $\frac{8\pi}{3}$ (c) $+\infty$ (d) $\frac{3\pi}{2}$ (e) $0$

**12.**(5 pts.) Solve the initial value problem

$$\begin{cases} \dfrac{dy}{dx} = y^2 \\ y(0) = -1 \end{cases}$$

(a) $y = -x^2$ (b) $y = 0$ (c) $y = \dfrac{1}{x+1}$ (d) $y = \dfrac{-1}{x}$ (e) $y = \dfrac{-1}{x+1}$

**Partial Credit**

You must show your work on the partial credit problems to receive credit!

**13.**(13 pts.) Find the center of mass (centroid) of the region bounded by the curves $y = \cos x$, $y = 0$, $x = -\dfrac{\pi}{2}$ and $x = \dfrac{\pi}{2}$.
You may use symmetry as part of the justification for your answer.

**14.**(13 pts.) Solve the initial value problem

$$\begin{cases} xy' + xy + y = e^{-x} \\ y(1) = \dfrac{2}{e} \end{cases}$$

**15.**(14 pts.) Determine whether or not the improper integral $\displaystyle\int_1^{+\infty} \frac{2\cos(x^2) + 100}{x^{5/4}}\, dx$ is convergent. To receive credit for this problem you must justify your answer.

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