NAME : ______________________

SECTION : (circle one) Arkowitz Vatter

Math 8

February 20, 2009

Midterm 2

INSTRUCTIONS: This is a closed book exam and no notes are allowed. You are not to provide or receive help from any outside source during the exam except that you may ask the instructor for clarification of a problem. You have two hours and you should attempt all problems.

- ***Print*** your name in the space provided and circle your instructor's name.
- Mark your multiple choice answers on the final page of *this booklet*. The multiple choice booklet *will not* be collected.
- Sign the FERPA release on the next page *only if* you wish your exam returned in lecture.
- Calculators or other computing devices are not allowed.
- Use the blank page at the end of the exam for scratch work.
- **Except in the multiple choice section, you must show all work and give a reason (or reasons) for your answer. A CORRECT ANSWER WITH INCORRECT WORK WILL BE CONSIDERED WRONG.**

1. (6) Evaluate $\int x \ln x \, dx$.

2. (12) Evaluate $\displaystyle\int \frac{x^3}{\sqrt{x^2+4}}\,dx$.

3. (12) Find an equation for the plane which contains the point $(1, 2, 3)$ and the line

$$x = 3t, \quad y = 1 + t, \quad z = 2 - t.$$

4. (12) Determine whether the following pair of lines are parallel, intersecting, or skew.

$$\begin{cases} x = 3t - 2, & y = t + 3, \quad z = 5t - 3 \\ x = s - 4, & y = 2s, \qquad z = 4s - 6. \end{cases}$$

5. (8) Compute the arc length of the curve $\mathbf{r}(t) = \langle \ln t, t^2/2, t\sqrt{2} \rangle$ from $t = 1$ to $t = e$.

6. (5) In order to evaluate the integral $\int \frac{x^2 - 3}{\sqrt{4+9x^2}}\,dx$, which substitution would you make?

A. $x = 2\sec\theta$

B. $x = \frac{4}{9}\sec\theta$

C. $x = \frac{2}{3}\tan\theta$

D. $x = \frac{4}{9}\tan\theta$

E. $x = \frac{2}{3}\sec\theta$

7. (5) Suppose that $f(1) = 2$, $f(4) = 7$, $f'(1) = 5$, $f'(4) = 3$, and that f'' is continuous. What is $\int_1^4 x f''(x)\,dx$?

A. 0

B. 1

C. 2

D. 5

E. 12

8. (5) The scalar triple product $\mathbf{a} \cdot (\mathbf{b} \times \mathbf{c})$

A. is the area of the parallelogram determined by $\mathbf{a}, \mathbf{b}, \mathbf{c}$

B. $= \mathbf{a} \cdot (\mathbf{c} \times \mathbf{b})$

C. is the volume of the parallelopiped determined by $\mathbf{a}, \mathbf{b}, \mathbf{c}$

D. $= 0$ if $\mathbf{a} = \mathbf{b}$

E. is determined by the right-hand rule

9. (5) What is the area of the parallelogram with vertices $(0, 0, 0)$, $(1, 0, 0)$, $(0, 4, 3)$, and $(1, 4, 3)$?

A. $-3\mathbf{j} + 4\mathbf{k}$

B. $3\mathbf{j} - 4\mathbf{k}$

C. 5

D. 7

E. 9

10. (5) Suppose the scalar projection of $\mathbf{v}$ onto $\mathbf{w}$ is $2\sqrt{5}$. If $w = \langle 1, 0, 2\rangle$, then what is $\text{proj}_{\mathbf{w}}\mathbf{v}$?

A. $-2\sqrt{5}$

B. $2\sqrt{5}$

C. $\langle -2, 0, -4\rangle$

D. $\langle 2\sqrt{5}, 0, 4\sqrt{5}\rangle$

E. $\langle 2, 0, 4\rangle$

11. (5) Which of the following are true in 3-space?

I	Two lines either intersect or are parallel.
II	Two lines orthogonal to a third line are parallel.
III	Two planes orthogonal to a third plane are parallel.

A. None

B. I only

C. II only

D. III only

E. I and II only

F. I and III only

G. II and III only

H. I, II, and III

12. (5) Let $\mathbf{a} = \langle 3, -1, 2\rangle$ and $\mathbf{b} = \langle -2, 7, 3\rangle$. What is the angle between $\mathbf{a}$ and $\mathbf{b}$?

A. acute

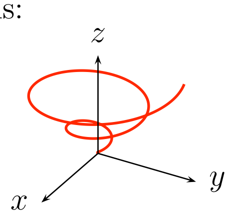
B. obtuse

C. right

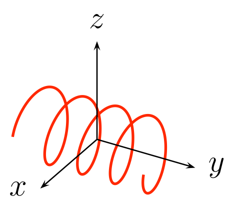
13. (5) Match the functions

$$\begin{aligned}\mathbf{r}(t) &= \langle \cos t, \sin t \cos 5t\rangle \\ \mathbf{u}(t) &= \langle t\cos t, t\sin t, t\rangle \\ \mathbf{v}(t) &= \langle \cos t, t, \sin t\rangle\end{aligned}$$

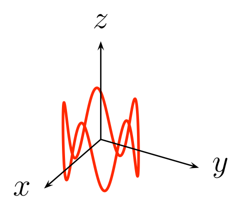
to their graphs:



I



II



III

A. The graph of $\mathbf{r}$ is I, the graph of $\mathbf{u}$ is II, the graph of $\mathbf{v}$ is III

B. The graph of $\mathbf{r}$ is I, the graph of $\mathbf{u}$ is III, the graph of $\mathbf{v}$ is II

C. The graph of $\mathbf{r}$ is II, the graph of $\mathbf{u}$ is I, the graph of $\mathbf{v}$ is III

D. The graph of $\mathbf{r}$ is II, the graph of $\mathbf{u}$ is III, the graph of $\mathbf{v}$ is I

E. The graph of $\mathbf{r}$ is III, the graph of $\mathbf{u}$ is I, the graph of $\mathbf{v}$ is II

F. The graph of $\mathbf{r}$ is III, the graph of $\mathbf{u}$ is II, the graph of $\mathbf{v}$ is I

14. (5) Compute the position vector for a particle which passes through the origin at time $t = 0$ and has velocity vector $\mathbf{v}(t) = \sin t\mathbf{i} + \cos t\mathbf{j} + t^2\mathbf{k}$.

A. $-\cos t\mathbf{i} + \sin t\mathbf{j} + (t^3/3)\mathbf{k}$

B. $\sin t\mathbf{i} + (\cos t - 1)\mathbf{j} + 2t\mathbf{k}$

C. $(\cos t - 1)\mathbf{i} - \sin t\mathbf{j} + 2t\mathbf{k}$

D. $(1 - \cos t)\mathbf{i} + \sin t\mathbf{j} + (t^3/3)\mathbf{k}$

E. $-\cos t\mathbf{i} + \sin t\mathbf{j} + (t^3/3)\mathbf{k} + 1$

15. (5) Let

$$\mathbf{r}(t) = \left\langle \frac{e^{3t} - 1}{t}, t^2 + 2, \frac{2t^3}{t^4 - t^3} \right\rangle$$

What is $\lim_{t \to 0} \mathbf{r}(t)$?

A. $\lim_{t \to 0} \mathbf{r}(t) = 3$

B. $\lim_{t \to 0} \mathbf{r}(t) = \langle 1, 2, -2 \rangle$

C. $\lim_{t \to 0} \mathbf{r}(t) = 2$

D. $\lim_{t \to 0} \mathbf{r}(t) = \langle 3, 2, -2 \rangle$

E. $\lim_{t \to 0} \mathbf{r}(t)$ does not exist