Your Name

Your Signature

Student ID #

Quiz Section

Professor's Name

TA's Name

- CHECK that your exam contains 8 problems on 9 pages.
- This exam is closed book. You may use one $8\frac{1}{2} \times 11$ sheet of notes and a scientific calculator with no graphing, programming, or calculus capabilities. Do not share notes or calculators.
- Unless otherwise specified, you should give your answers in exact form. (For example, $\frac{\pi}{4}$ and $\sqrt{2}$ are in exact form and are preferable to their decimal approximations.)
- In order to receive full credit, you must show all of your work.
- **Place a box around YOUR FINAL ANSWER to each question.**
- If you need more room, use the backs of the pages and indicate to the reader that you have done so. DO NOT USE SCRATCH PAPER.
- Raise your hand if you have a question.

Problem	Total Points	Score
1	15	
2	8	
3	10	
4	11	

Problem	Total Points	Score
5	12	
6	20	
7	12	
8	12	
Total	100	

1. (15 points) Suppose $\mathbf{a}$ and $\mathbf{b}$ are vectors about which we know:

$$|\mathbf{a}| = 3,\ |\mathbf{b}| = 2, \text{ and } \mathbf{a} \times \mathbf{b} = < 1, 5, 1 >.$$

Compute the following quantities, if possible. If you cannot find a particular value because there is not enough information, indicate this. Place a box around your final answer.

(a) $\mathbf{a} \cdot \mathbf{b}$

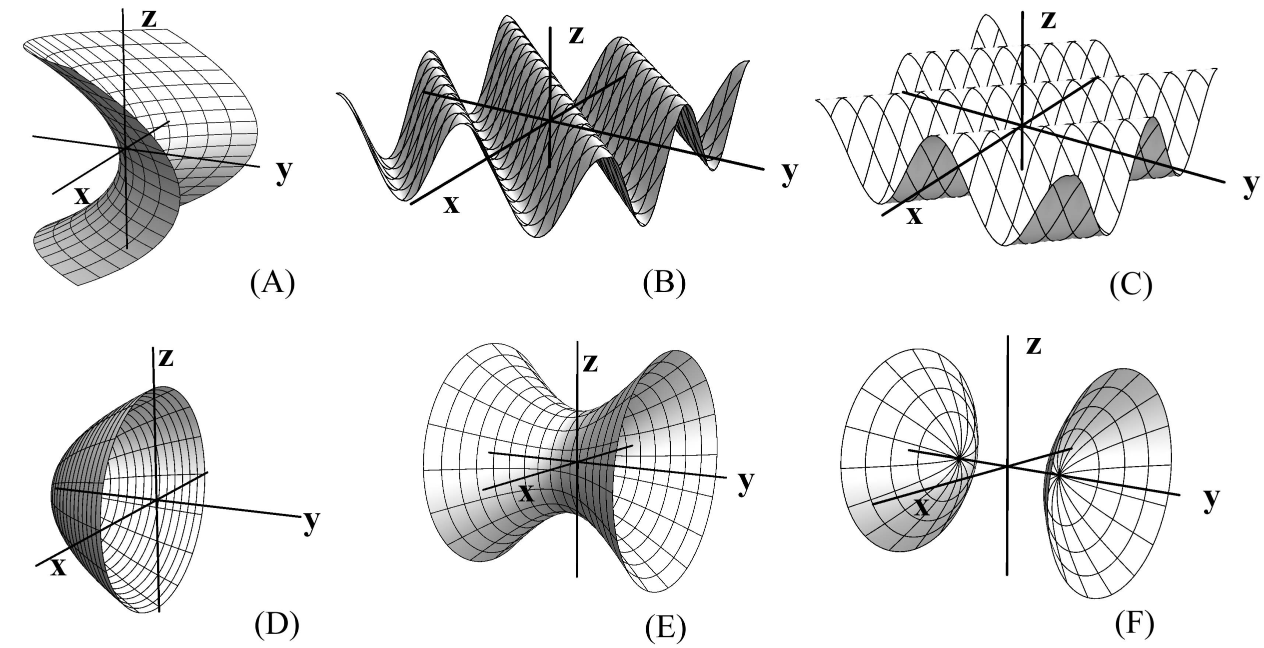
(b) $|\mathbf{a} \cdot \mathbf{b}|$

(c) the acute angle between a line in the direction of $\mathbf{a}$ and a line in the direction of $\mathbf{b}$

(d) $|\mathrm{comp}_{\mathbf{a}}\mathbf{b}|$

(e) an equation of the plane through the origin parallel to both $\mathbf{a}$ and $\mathbf{b}$

2. (8 points) Consider the graphs below. Determine which picture each equation listed below describes, and write your answer next to the equation. No need to justify your answers.



(a) Equation $x^2 - y + z^2 = 1$ corresponds to graph: ______

(b) Equation $x^2 - y - z^2 = 0$ corresponds to graph: ______

(c) Equation $-x^2 + y^2 - z^2 = 1$ corresponds to graph: ______

(d) Equation $z = \cos(x - y)$ corresponds to graph: ______

3. (10 points) Find parametric equations for the line that is tangent to the curve

$$\vec{r}(t) = \left\langle \frac{8}{t}, -\frac{1}{2}t^2, \frac{1}{8}t^3 \right\rangle$$

and parallel to the plane $x = y$.

4. (11 points) Consider the vector function

$$\vec{r}(t) = \left\langle \frac{2\sqrt{6}}{3} t^{3/2}, t\sin(3t), t\cos(3t) \right\rangle.$$

Suppose that a is a positive number and that the length of $\vec{r}(t)$ from $t = 0$ to $t = a$ is 160. Find the value of a.

5. (12 points) Find the absolute minimum and maximum values of the function

$$F(x, y) = 2x^2 + y^2 + 8y$$

on the region $D = \{(x, y) : y \geq 0, x^2 + y^2 \leq 25\}$.

6. (20 points) Evaluate the double integrals.

   (a) $\displaystyle\int_0^4 \int_{\sqrt{y}}^2 \ln\left(x^3+1\right)\, dx\, dy$

(b) $\displaystyle\int_0^{\sqrt{2}} \int_x^{\sqrt{4-x^2}} 3x + y^2 \; dy\, dx$

7. (12 points) Let $f(x) = 4\sqrt{x}$.

   (a) Find $T_2(x)$, the second Taylor polynomial for $f(x)$ based at $b = 1$.

   (b) Use Taylor's inequality to find an upper bound for $|f(x) - T_2(x)|$ on the interval $\left[\frac{1}{4}, \frac{7}{4}\right]$.

8. (12 points) Let

$$f(x) = \frac{x^2}{x^2 - e^2} + x\sin(\pi x - x).$$

(a) Find the Taylor series for $f(x)$ based at $b = 0$. Write the series using one Σ and give its interval of convergence.

(b) Calculate $f^{(674)}(0)$, the 674^{th} derivative of $f(x)$ at $x = 0$.