Your Name

Your Signature

Student ID #

Quiz Section

Professor's Name

TA's Name

- CHECK that your exam contains 8 problems on 8 pages.
- This exam is closed book. You may use one $8\frac{1}{2} \times 11$ sheet of notes and a TI-30X IIS calculator. 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	10	
2	12	
3	12	
4	14	
5	14	

Problem	Total Points	Score
6	12	
7	12	
8	14	
Total	100	

1. (10 points) Each of the following multiple choice problems has one correct answer. Circle it. You do not need to show any reasoning.

   (a) Suppose $\mathbf{comp_a b} = \frac{1}{2}|\mathbf{b}|$. Then the angle between $\mathbf{a}$ and $\mathbf{b}$ is...

   (i) $30°$. (ii) $45°$. (iii) $60°$. (iv) $90°$.

   (b) Suppose $\mathcal{S}$ is the set of points P such that the distance from P to the x-axis is equal to 3. Then $\mathcal{S}$ is...

   (i) a plane. (ii) a cylinder. (iii) a sphere. (iv) a cone.

   (c) The surface $z = x^2 + 2xy$ is tangent to the plane $z = 6x + 4y - 8$ at the point...

   (i) $(-2, 3, -8)$ (ii) $(0, 2, 0)$. (iii) $(2, 1, 8)$. (iv) $(4, 0, 16)$.

   (d) The value of $\displaystyle\int_2^5 \int_3^5 \left(5 + \sin^2(yx^2 + y^3)\right) dy\, dx$ is between...

   (i) 0 and 10. (ii) 10 and 20. (iii) 20 and 30. (iv) 30 and 40.

   (e) The Taylor series for $f(x) = \dfrac{1}{2 - x^2}$ centered at $b = 0$ converges on the interval...

   (i) $(-1, 1)$. (ii) $(-2, 2)$. (iii) $(-4, 4)$. (iv) $(-\sqrt{2}, \sqrt{2})$.

2. (12 pts) Let L be the line of intersection of the two planes

$$x + y + 2z = c \qquad \text{and} \qquad x - cy - cz = -1$$

where c is some real number. Find a value of c for which L is perpendicular to the plane $3x - y - z = 0$.

3. (12 pts) Find the curvature of the ellipse

$$x = 3\cos(t), \quad y = 4\sin(t), \quad z = 1,$$

at the points $(3, 0, 1)$ and $(0, 4, 1)$.

4. (14 pts) Find and classify all the critical points of $f(x, y) = 4xy - 3y + \dfrac{1}{x} - \dfrac{1}{4}\ln(y)$. **Clearly** show your work in using the second derivative test and label your answers.

5. (14 pts) Compute the volume of the solid between the surface $x^2 + y + z = 4$ and the xy-plane above the first quadrant.

6. (12 pts) Compute

$$\iint_R e^{-(x^2+y^2)}\, dA$$

where $R = \{(x, y) : x^2 + y^2 \leq 9\}$.

7. (12 pts) Let $f(x) = 1 + x + x^2 + 3x^3$.

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

   (b) Determine an interval around $b = 1$ on which

$$|T_2(x) - f(x)| < 0.024.$$

8. (14 pts) Let $f(x) = \dfrac{x^3}{1+x^4}$.

   (a) Find the Taylor series for $f(x)$ based at zero. Express your answer using sigma notation.

   (b) Use the Taylor series you found in (a) to find the Taylor series for

   $$g(x) = x^2 \ln(1+x^4).$$

   Express your answer using sigma notation.