Your Name

Your Signature

Student ID #

Quiz Section

Professor's Name

TA's Name

- CHECK that your exam contains 9 problems on 9 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	12	
2	10	
3	12	
4	12	
5	12	

Problem	Total Points	Score
6	10	
7	10	
8	12	
9	10	
Total	100	

1. (12 points) Let P be the plane that goes through the points $A(1,3,2)$, $B(2,3,0)$, and $C(0,5,3)$. Let ℓ be the line through the point $Q(1,2,0)$ and parallel to the line $x=5$, $y=3-t$, $z=6+2t$. Find the (x,y,z) point of intersection of the line ℓ and the plane P.

2. (10 points) At time $t = 0$, a small object is thrown. The acceleration is given by

$$\mathbf{a}(t) = \langle 2e^{-t}, 0, -10 \rangle.$$

The initial velocity and positions are by $\mathbf{v}(0) = \langle 0, 3, 10 \rangle$ and $\mathbf{r}(0) = \langle 0, 0, 0 \rangle$, respectively. Find the point (x, y, z) at the time $t > 0$ at which the object intersects the xy-plane.

3. (12 points) Let $z = f(x, y)$ be a function determined by the equation

$$-z + e^{xyz-2} + (x-1)y = 0.$$

   (a) Use implicit differentiation to find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ at the point $(x, y, z) = (1, 2, 1)$.

   (b) Use linear approximation to estimate the value of $f(1.01, 1.99)$.

4. (12 points) Find **two** points on the surface

$$(z-1)^2 = x^2 - xy + y^2 + 1$$

that are closest to the point $(5, -5, 1)$.

5. (12 points) Set up and evaluate a double integral in polar coordinates to calculate the area enclosed by the curve $r = 2 + \sin(3\theta)$.

6. (10 points) Let R be the region in the plane bounded by the curves $y = 3 - x^2$ and $y = 2x$. Compute

$$\iint_R 4x \, dA.$$

7. (10 points) Evaluate the following integral.

$$\int_0^2 \int_{y^2}^4 y \sin(x^2)\, dx\, dy$$

8. (12 points)

(a) Find the Taylor series for $g(x) = \dfrac{1}{3+4x}$ based at $b = 0$.
Give your answer using sigma notation and list the first **three** non-zero terms.

(b) Find the Taylor series for $h(x) = \ln(3+4x)$ based at $b = 0$.
Give your answer using sigma notation and list the first **four** non-zero terms.

(c) Give the largest open interval on which the series you found in part (b) converges.

9. (10 points) Let $T_n(x)$ be the n^{th} Taylor polynomial for $f(x) = e^{3x}$ based at $b = 0$. Find a value of n such that

$$|f(x) - T_n(x)| < 0.01$$

for all x in the interval $\left[-\frac{1}{3}, \frac{1}{3}\right]$.

As always, show all work and justify your answer.