Your Name

Your Signature

Student ID #

Your TA's name

Your Quiz Section Label and Time

Problem	Possible	Points
1	11	
2	9	
3	10	
4	10	
5	10	
Total	50	

- No books allowed. You may use a scientific calculator and one $8\frac{1}{2} \times 11$ sheet of **handwritten** notes.
- Do not share notes.
- In order to receive credit, you must show your work and explain your reasoning.
- **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 grader where to find your work.
- Raise your hand if you have a question or need more paper.

Don't open the test until everyone has a copy and the start of the test is announced.

1 (11 points total) All the parts of this problem concern the vector function $\mathbf{r}(t)$ that satisfies the following conditions: the acceleration is $\mathbf{a}(t) = 6t\mathbf{i} + \mathbf{j} - 12t^2\mathbf{k}$
and the initial position and velocity are given by $\mathbf{r}(0) = 2\mathbf{k}$ and $\mathbf{v}(0) = \mathbf{i} + \mathbf{j}$.

(a) (**4 points**) Find the vector function $\mathbf{r}(t)$.

(b) (**3 points**) Write an equation of the normal plane to the curve described by $\mathbf{r}(t)$ at the point where $t = 0$.

(c) (**4 points**) Compute the curvature of the curve described by $\mathbf{r}(t)$ at $t = 0$.

2 (9 points) Find the tangent plane to the surface given by the graph of

$$f(x, y) = \sqrt{22 - x^2 - 2y^2}$$

at $(2, 1)$. Use the linear approximation to estimate $f(1.98, 0.96)$.

3 (10 points) Find three positive numbers x, y, and z whose sum is 12 and for which the product

$$xyz^2$$

is a maximum.

4 (10 points total)

(a) (4 points) Change the order of integration in the following integral:

$$\int_0^2 \int_{y/2}^1 x^2 \sin(xy)\, dx\, dy$$

(b) (6 points) Evaluate the integral.

5 (10 points) Find the volume of the solid between the cylinders $x^2 + y^2 = 1$ and $x^2 + y^2 = 4$ in the first octant, bounded above by $z = x + y$ and below by $z = 0$.