Your Name

Your Signature

Student ID #

Quiz Section

Professor's Name

TA's Name

- This exam contains 9 problems. CHECK THAT YOU HAVE A COMPLETE EXAM.
- This exam is closed book. You may use one $8\frac{1}{2} \times 11$ sheet of notes and a non-graphing, scientific 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.
- Raise your hand if you have a question.

Problem	Total Points	Score
1	10	
2	12	
3	10	
4	12	
5	10	

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

1. (10 points) Consider the vector function $\mathbf{r}(t) = \langle 6t, 8t, 5t^2 \rangle$. Find the coordinates of the points where the graph has curvature equal to $\frac{1}{80}$.

2. (12 points) Let ℓ be the line of intersection of the planes $x + y = 0$ and $x - y + z = 1$. Find the equation of the plane that contains ℓ and is perpendicular to the line

$$\frac{x-1}{7} = 2 - y = \frac{z-3}{4}.$$

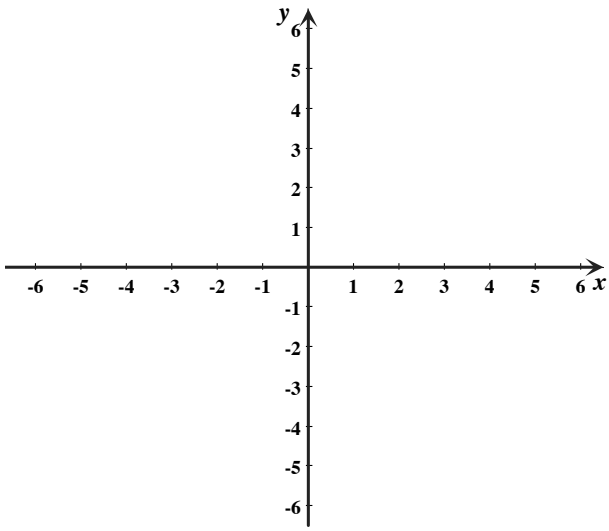
3. (10 points) Find the point of intersection of the lines tangent to the curve given by

$$\mathbf{r}(t) = \langle \sin \pi t, 2 \sin \pi t, 5 \cos \pi t \rangle$$

at the points where $t = 0$ and $t = \dfrac{1}{2}$.

4. (12 points) Let $z = f(x, y) = \dfrac{\sqrt{4 - x^2}}{\sqrt{y^2 - 9}}$.

   (a) Find and sketch the domain of $f(x, y)$ on the axes below.



   (b) Use the total differential to approximate the change in z if x changes from 0 to 0.1 and y changes from 5 to 5.2.

5. (10 points) Evaluate the double integral $\int_0^{\sqrt{2}} \int_{y^2}^{2} y^3 e^{x^3}\, dx\, dy$

6. (10 points) Let R be the region in the xy-plane which lies in the second quadrant (that is, $x \leq 0$ and $y \geq 0$) and is inside the circle $x^2 + y^2 = 4$. Find the volume of the solid above R and below the surface $z = x^2 + y^2 + y$.

7. (12 points) You are standing on a surface where the height is given by

$$f(x, y) = 50 + xy - 3x - \frac{1}{4}y^4.$$

Assume the postive x-axis points east and the positive y-axis points north.

(a) Find and classify all critical points of f.

(b) You are standing at a particular point (x_0, y_0, z_0) on the surface. At this point, if you face due EAST the slope is -1 and if you face due NORTH the slope is 2. Find the equation for the tangent plane to the surface at the point.

8. (12 points) Consider the function $f(x) = x^2 \sin(x)$.

   (a) Find the Taylor series for $f(x)$ based at $b = 0$. Write your answer using sigma notation.

   (b) Find the Taylor series based at $b = 0$ for

   $$F(x) = \int_0^x f(t)dt.$$

   Write your answer using sigma notation.

   (c) Find the sixth Taylor polynomial of $F(x)$ based at $b = 0$.

9. (12 points) Consider the function $f(x) = \ln\left(\frac{x+2}{5}\right) + x^3$.

   (a) Find the second Taylor polynomial $T_2(x)$ for $f(x)$ based at $b = 3$.

   (b) Find an upper bound on the error $|T_2(x) - f(x)|$ on the interval $[1, 5]$.

   (c) What is the smallest value of $|T_2(x) - f(x)|$ on the interval $[1, 5]$?