Math 126D **Midterm II** **Autumn 2010**

Your Name ______________________________

TA's Name ______________________________

HONOR STATEMENT

"I affirm that work upholds the highest standards of honesty and academic integrity at the University of Washington, and that I have neither given nor received any unauthorized assistance on this exam."

SIGNATURE: ______________________________

- Your exam should consist of this cover sheet, followed by SIX problems. Check that you have a complete exam.
- All work must be on the attached pages. If you cannot complete a problem in the given space, then continue your work on the back of the page or on the back of the preceding page. *If you do continue your work any place other than the given space for the problem, make sure you note where it is so the grader can find it.* Place your final answer in the box provided.
- Answers with insufficient work shown may not get full credit. Show enough work on each problem for the grader to tell how you obtained your answer. This may also help you get some partial credit if your answer is incorrect or incomplete. Using a few words of English may help the grader understand your work. You should show enough work so that a grader can give you partial credit if your final answer is not complete.
- Your answers should be exact values rather than decimal approximations. (For example, $\frac{\pi}{4}$ is an exact answer, and its decimal approximation 0.7854 is not an exact answer.)
- You may use a scientific calculator and one 8.5×11-inch sheet of handwritten notes (writing on both sides). All other electronic devices (including graphing calculators) are forbidden.
- Turn your cell phone OFF and put it AWAY for the duration of the exam.

Good luck!

PROBLEM	SCORE
1 (16 points)	
2 (16 points)	
3 (16 points)	
4 (18 points)	
5 (18 points)	
6 (16 points)	
TOTAL	

 # 1. (16 points) The trajectory of a particle along a curve C is given by the parametric equation $\mathbf{r}(t) = 5t\,\hat{\mathbf{i}} + (t^2/2)\hat{\mathbf{j}} + (t^2/2)\hat{\mathbf{k}}$.

(a) Find $\dfrac{d^2s}{dt^2}$.

$\dfrac{d^2s}{dt^2} =$ [ ]

(b) Find the curvature of C at the point $(0, 0, 0)$.

Curvature = [ ]

 # 2. (16 points) Find the equation for the tangent plane to the surface $z = f(x, y)$ at the point $(-3, 1, f(-3, 1))$, where $f(x, y) = \exp(x + y) + \tan^{-1}(x + y^2)$.

Tangent plane:

 # 3. (16 points) Find the partial derivative $f_{xy}(x, y)$ of the function

$$f(x, y) = \sin^{-1}(y^2) + e^{xy} - \frac{1}{x^4 + 4x^2} + \cos(x)\,.$$

$f_{xy}(x, y) =$

 # 4. (18 points) Consider the function $f(x,y) = \frac{1}{2}y^4 - y^2 + \frac{1}{3}x^3 - x^2$.

(a) The point $(x, y) = (0, 1)$ is a critical point of f. Explain why.

Explanation:

(b) Circle the correct answer: At the point $(0, 1)$ the function f achieves...

(i) a local minimum. (ii) a local maximum. (iii) neither .

Explain your answer, using the second derivative test for a function of two variables.

Justification:

 # 5. (18 points) Evaluate the iterated integral $\int_0^1 \int_{\sqrt{x}}^1 \frac{1}{y^3+1}\, dy dx$ by changing the order of integration and then evaluating.

Answer:

 # 6. (16 points) Find the volume of the solid V defined in polar coordinates by the following conditions:

$$0 \leq z \leq \sin(\theta)\,, \quad 0 \leq r \leq \cos(\theta)\,, \quad \frac{\pi}{4} \leq \theta \leq \frac{\pi}{3}\,.$$

Volume of V =

126D. Answers to Midterm II.

1.(a) $d^2s/dt^2 = \boxed{2t/\sqrt{25+2t^2}}$,

1.(b) Curvature: $\boxed{\sqrt{2}/25}$

2. $\boxed{z = (e^{-2} - \tan^{-1}(2)) + (e^{-2} + 1/5)(x+3) + (e^{-2} + 2/5)(y-1)}$

3. $\boxed{f_{xy}(x,y) = (1+xy)e^{xy}}$

4.(a) $\boxed{\text{Critical point because } f_x(0,1) = f_y(0,1) = 0.}$

(b) $\boxed{\text{Saddle point because } D(0,1) = -8 < 0.}$

5. $\int_0^1 \int_{\sqrt{x}}^1 1/(y^3+1)dydx = \int_0^1 \int_0^{y^2} \frac{1}{y^3+1} dxdy = \int_0^1 \frac{y^2}{y^3+1}\, dy = \boxed{\ln(2)/3}$.

6. $\int_{\pi/4}^{\pi/3} \int_0^{\cos(\theta)} \sin(\theta) r\, dr\, d\theta = \frac{1}{2} \int_{\pi/4}^{\pi/3} \cos^2(\theta)\sin(\theta) d\theta = \boxed{\frac{1}{12\sqrt{2}} - \frac{1}{48}}$