

Math 126, Section D, Winter 2010, Midterm II

February 25, 2010

Name \_\_\_\_\_

TA/Section \_\_\_\_\_

**Instructions.**

- There are 4 questions. The exam is out of 40 points.
- You are allowed to use one page of notes written only on one side of the sheet in your own handwriting.
- You may use a calculator which does not graph and which is not programmable. Even if you have a calculator, give me exact answers. ( $\frac{2\ln 3}{\pi}$  is exact, 0.7 is an approximation for the same number.)
- **Show your work.** If I cannot read or follow your work, I cannot grade it. You may not get full credit for a right answer if your answer is not justified by your work. If you continue at the back of a page, make a note for me. Please BOX your final answer.
- $\int \ln x dx = x \ln x - x + C$

Question	points
1	
2	
3	
4	
Total	

1. Answer the following questions about the vector function

$$\mathbf{r}(t) = \langle 3 \sin(t), t, 3 \cos(t) \rangle.$$

- (a) Find the length of the curve traced by this vector function from the point  $(0, 0, 3)$  to the point  $\left(\frac{3\sqrt{3}}{2}, \frac{\pi}{3}, \frac{3}{2}\right)$ .

- (b) Find the curvature at the point  $\left(\frac{3\sqrt{3}}{2}, \frac{\pi}{3}, \frac{3}{2}\right)$ .

2. Evaluate the following integrals.

(a)

$$\iint x (x^2 + y^2)^{3/2} dA$$

over the region  $R$  between the lines  $y = x$ ,  $y = \sqrt{3}x$  and the curve  $y = \sqrt{9 - x^2}$ .

(b)

$$\int_0^4 \int_{y/4}^1 y \ln(x^3 + 1) dx dy$$

3. Let

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

(a) Find the equation of the tangent plane to  $z = f(x, y)$  at the point  $(16, 100, 196)$ .

(b) Approximate  $(\sqrt{15} + \sqrt{99})^2$  using linear approximation.

4. Find and classify all critical points of the function

$$f(x, y) = 3x - x^3 - 6xy^2.$$