Math 126 - Winter 2016
Exam 2
March 1, 2016

Name: ______________________________

Section: ______________________________

Student ID Number: ______________________________

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- There are 4 pages of questions. Make sure your exam contains all these questions.
- You are allowed to use a Ti-30x IIS Calculator model ONLY (**no other calculators allowed**). And you are allowed one **hand-written** 8.5 by 11 inch page of notes (front and back).
- You must show your work on all problems. The correct answer with no supporting work may result in no credit. **Put a box around your FINAL ANSWER for each problem and cross out any work that you don't want to be graded.** Give exact answers wherever possible.
- Leave your answer in exact form. Simplify standard trig, inverse trig, natural logarithm, and root values. For example, don't leave your answer in the form $\sqrt{4}$ or $\cos(\pi/4)$ or $\frac{7}{2} - \frac{3}{5}$ instead write $\sqrt{4} = 2$ and $\cos(\pi/4) = \sqrt{2}/2$ and $\frac{7}{2} - \frac{3}{5} = \frac{29}{10}$.
- There may be multiple versions of the test. Cheating will not be tolerated. We report all suspicions of cheating to the misconduct board. If you are found guilty of cheating by the misconduct board, then you will get a zero on the exam (and likely face other academic penalties). Keep your eyes on your exam!
- You have 50 minutes to complete the exam. Use your time effectively, spend less than 10 minutes on each page and make sure to leave plenty of time to look at every page. Leave nothing blank, show me what you know!

GOOD LUCK!

1. (12 pts) The acceleration of a particle is given by $\mathbf{a}(t) = \langle 0, 3\sin(t), 3\cos(t)\rangle$. In addition, the initial velocity and position are given by $\mathbf{v}(0) = \langle 1, -3, 0\rangle$ and $\mathbf{r}(0) = \langle 3, 2, 1\rangle$.

   (a) Find the position vector function, $\mathbf{r}(t)$. (Please double-check your initial conditions).

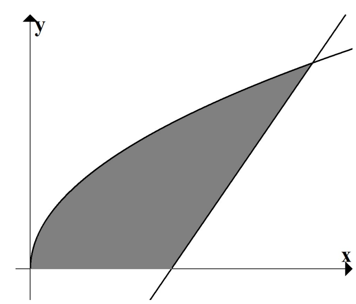
   (b) For $\mathbf{r}(t)$ above, find the unit tangent, $\mathbf{T}(t)$, and the principal unit normal, $\mathbf{N}(t)$, at time t.

2. (10 pts) Let $f(x,y) = 4xy - 3y + \frac{1}{x} - \frac{1}{4}\ln(y)$. Find and classify all the critical points of $f(x,y)$. **Clearly** show your work in using the second derivative test. (Put a box around your critical points and clearly write the words 'local max', 'local min' or 'saddle point' appropriately next to each point).

3. (14 pts) **The two problems below are not related. Simplify your answer in <u>exact form</u>.**

(a) Find the linear approximation, $L(x, y)$, to $z^3 + e^{3y} = 1 + x^4 + z\sin(y)$ at $(x, y, z) = (-1, 0, 1)$. (Hint: First, use implicit differentiation to find $\frac{dz}{dx}$ and $\frac{dz}{dy}$).

(b) Let D be the region in the first quadrant of the xy-plane bounded by $y = 2x - 1$ and $y^2 = x$ (as shown). Evaluate $\iint_D 4x \, dA$.



4. (14 pts) **The two problems below are not related. Simplify your answer in exact form.**

(a) Reverse the order of integration and evaluate $\int_0^2 \int_{2y}^4 8\sqrt{x^2+1}\,dx\,dy$.

(b) Let R be the region in the first quadrant between the circle $x^2 + y^2 = 9$ and the circle $x^2 + y^2 = 2x$ (as shown). Using polar coordinates, evaluate $\iint_R \frac{y}{x^2+y^2}\,dA$.