Math 126 - Spring 2017
Exam 2
May 16, 2017

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. (14 pts) **Part (a) and (b) below are not related.**

   (a) An object's position at time t (where $t > 0$) is $\mathbf{r}(t) = \langle 5t, t^{(3/2)}, \frac{1}{\sqrt{3}} \ln(t) \rangle$.

      i. Find the time(s) at which its acceleration vector is orthogonal to its velocity vector.

      ii. At the time(s) you found in previous part, the vector $\mathbf{r}''(t)$ is parallel to at least one of the vectors in the TNB-Frame at that same time. Which one?

      No work needed, just circle your answer: **T** **N** **B**.

   (b) Consider the curve of intersection of the surface $e^{3z} = x^2 z + \ln(y) + 5x - 10$ and the *fixed* plane $y = 1$. Find 3D parametric equations for the tangent **line** to this curve at the point $(2, 1, 0)$. (Hint: Start by using implicit differentiation to find a partial derivative).

2. (10 pts) The total surface area of a solid cone with radius r and height h is given by

$$A(r, h) = \pi r^2 + \pi r\sqrt{r^2 + h^2}.$$

(a) Find the equation for the tangent plane to $A(r, h)$ when $r = 3$ inches and $h = 4$ inches.

(b) Use the total differential to approximate the *change* in surface area if r is increased from 3 to 3.2 inches and h is increased from 4 to 4.1 inches.

3. (12 pts) **The two parts below are not related.**

(a) Let $f(x, y) = yx^2 + x^3 - 4y$. Find and classify all the critical points of $f(x, y)$. Show your work in using the second derivative test.

(b) Suppose that $f(x, y)$ is a continuous function and that $\iint_D f(x, y)dA = \int_1^3 \int_7^{16-x^2} f(x, y)dydx$. Sketch the region D and reverse the order of integration (i.e. rewrite the integral and give the bounds for the order $dxdy$).

4. (14 pts) **The two problems below are not related.**

(a) Find the volume of the solid bounded by $z = 9 - x^3$, $z = 1$, $x = 0$, $y = 0$, and $y = 3$.

(b) Evaluate $\iint_D xe^{(x^2+y^2)^{3/2}} dA$, where D is the region bounded by the semicircle $x = \sqrt{4 - y^2}$ and the y-axis. (Hint: Polar would be a good choice.)