Math 126 D - Spring 2015
Midterm Exam Number Two
May 19, 2015

Name: _____ Student ID no. : _____

Signature: _____ Section: _____

1	15	
2	12	
3	15	
4	18	
Total	60	

- This exam consists of FOUR problems on FIVE pages, including this cover sheet.
- Show all work for full credit. Show no work for zero credit.
- You do not need to simplify your answers.
- If you use a trial-and-error or guess-and-check method when a more rigorous method is available, you will not receive full credit.
- Write all of your work on the exam itself. If you use the back of the page, please indicate that you have done so!
- You may use a *scientific*, *non-programmable*, *non-graphing* calculator.
- You may use one hand-written double-sided 8.5" by 11" page of notes.
- You have 50 minutes to complete the exam.

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1. A particle begins at the origin at time $t = 0$. At time $t = 1$, its velocity vector is $\langle 0, 4, 4 \rangle$. After t seconds, its acceleration vector is $\mathbf{a}(t) = \left\langle -4, \dfrac{-16}{(t+1)^3}, \pi \sin(\pi t) \right\rangle$.

   (a) **[10 points]** Write a vector function $\mathbf{r}(t)$ for the particle's position after t seconds.

   (b) **[5 points]** Compute the curvature of the particle's path at time $t = 3$.

2. A *right square pyramid* with base side length x and height y has surface area given by the following formula:

$$f(x, y) = x^2 + x\sqrt{x^2 + 4y^2}$$

(a) **[8 points]** Give the equation of the tangent plane to $z = f(x, y)$ at the point $(8, 3, 144)$.

(b) **[4 points]** A right square pyramid has a surface area of 144.402 and a height of 2.998. Use linearization to estimate the side length of the base.

3. **[15 points]** Let $z = f(x, y) = 3e^x(x - xy^2)$.

   Find all critical points of f. Classify them as local minima, local maxima, or saddle points. Please list the (x, y, z) coordinates for each solution.

4. **[6 points each]** Compute each double integral.

(a) $\iint_R x^3 e^{x^2 y}\, dA$, where $R = [5, 6] \times [0, 2]$.

(b) $\int_0^1 \int_0^{\cos^{-1}(y)} \sqrt{6 \sin(x)}\, dx\, dy$

(c) $\int_{-\sqrt{3}}^0 \int_0^{\sqrt{3-y^2}} \frac{y}{1 + x^2 + y^2}\, dx\, dy$

Possibly useful hint: $a^2 = (a^2 + 1) - 1$