MATH 1325-104 FINAL EXAM

INSTRUCTOR: DAVID MILOVICH

Name: _____

- Two sheets of notes (each double-sided) are allowed.
- A calculator is recommended.
- Show your work.

Date: Thursday, December 8, 2011.

Exercise	Point Possible	Score
1	16	
2	16	
3	17	
4	17	
5	17	
6	17	
Total	100	

1. **[16 points]** Use differentials to estimate $\sqrt[3]{1003}$.

2. **[16 points]** Find an equation for the line tangent to the curve $y = \ln(5x^2 - 4)$ at $x = 1$.

3. **[17 points]** Given $z = x^2 \mathrm{e}^{-3y} + 5y + 4$, compute the partial derivatives $\partial z/\partial x$ and $\partial z/\partial y$.

4. [17 points] The annual labor and automated equipment cost (in millions of dollars) for a company's production of HDTV's is given by

$$C(x, y) = 3x^2 + 2xy + 2y^2 - 18x - 16y + 54$$

where x is the amount spent per year on labor and y is the amount spent per year on automated equipment (both in millions of dollars).

(a) Determine how much should be spent on each per year to minimise this cost.

(b) What is the minimum cost?

5. [17 points] The unemployment rate U is the fraction $(L - E)/L$ where L is the number of people that are in the labor force and E is the number of people that are employed. (The labor force is those who are employed or are actively looking for a job.)

The Bureau of Labor Statistics recently estimated that in the US last month (November 2011), the labor force numbered 153,883,000 and was *decreasing* at a rate of 315,000 per month, while the employed population numbered 140,580,000 and was *increasing* at a rate of 278,000 per month. Given this data,

(a) what was the unemployment rate last month, and

(b) what was its (instantaneous) rate of change?

6. **[17 points]** Let T be the triangle in the xy-plane (where $z = 0$) with corners $A = (0, 0, 0)$, $B = (5, 0, 0)$, and $C = (5, 4, 0)$. Let P be a triangular pyramid with T as its bottom face and $D = (5, 4, 3)$ as its top point.

(a) Find an equation for the plane of the top face of the pyramid, which is bounded by the points A, B, and D.

(b) Find the volume of the pyramid P.