10-10:50am

Midterm Exam 2

Spring 2012 Math 0220

100 points total **Your name:** _____

No calculators. Show all your work (no work = no credit). Explain every step. Write neatly.

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1. (15 points) Use differentials to estimate the amount of paint needed to apply a coat of paint 0.02 cm thick to a hemispherical dome with diameter 120 cm.

2. (15 points) A kite is flying at an angle of elevation of $\pi/6$. The kite string is being taken in at the rate of 2 foot per second. If the angle of elevation does not change, how fast is the kite losing altitude?

3. (15 points) Find the limit

$$\lim_{x \to \pi} \frac{\tan^{-1} x}{\tan^{-1} 2x}$$

Do not simplify your answer.

4. (10 points) Suppose that $f(0) = -3$ and $f'(x) = 5$ for all values of x. Use the Mean Value Theorem to show that $f(x) = 5x - 3$.

5. (15 points) Find the absolute maximum and absolute minimum values of the function

$$f(x) = \frac{x}{x^2 + 4} \quad \text{on the interval} \quad [-4, 1]$$

6. (15 points) If 1200 cm^2 of material is available to make a box with a square base and open top, find the largest possible volume of the box.

7. (15 points) Use Newton's method to approximate the number $\sqrt[5]{100}$. Take $x_1 = 2$ as the initial approximation and find the second approximation x_2 to the result.

bonus problem [10 points extra] Evaluate the limit $\lim_{x \to a} \frac{x^n - a^n}{x^{1/n} - a^{1/n}}$.