Math 10C  
Midterm Exam 2  
May 22, 2012  

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Version A  

Instructions  
1. You may use any type of calculator, but no other electronic devices during this exam.  
2. You may use one page of notes, but no books or other assistance during this exam.  
3. Write your Name, PID, and Section on the front of your Blue Book.  
4. Write the Version of your exam on the front of your Blue Book.  
5. Write your solutions clearly in your Blue Book  
   (a) Carefully indicate the number and letter of each question and question part.  
   (b) Present your answers in the same order they appear in the exam.  
   (c) Start each question on a new page.  
6. Read each question carefully, and answer each question completely.  
7. Show all of your work; no credit will be given for unsupported answers.  

1. (6 points) Consider the vectors  
   \[ \overrightarrow{v} = 4 \overrightarrow{i} + 3 \overrightarrow{j} + \overrightarrow{k} \quad \text{and} \quad \overrightarrow{w} = 4 \overrightarrow{i} + 6 \overrightarrow{j} + \overrightarrow{k}. \]  
   (a) Compute the dot product of \( \overrightarrow{v} \) and \( \overrightarrow{w} \). Are these two vectors orthogonal?  
   (b) Find a vector which is orthogonal to both \( \overrightarrow{v} \) and \( \overrightarrow{w} \).  

2. (6 points) Given \( f(x, y) = \ln(x^2 + 1) + y^2 \). Find an equation for the tangent plane to the graph \( z = f(x, y) \) at the point \((0, 2, 4)\).  

3. (6 points) Given \( f(x, y) \) with \( \nabla f(0, 0) = 5 \overrightarrow{i} - 12 \overrightarrow{j} \). (Note: \( 5^2 + 12^2 = 13^2 \).)  
   (a) Find a unit vector \( \overrightarrow{u} \) so the directional derivative \( f_{\overrightarrow{u}}(0, 0) \) is maximum.  
   (b) Find a unit vector \( \overrightarrow{u} \) so the directional derivative \( f_{\overrightarrow{u}}(0, 0) \) is zero.  

4. (6 points) The graph on the back of this page represents the contour plot of a function \( f(x, y) \).  
   (a) For each of the points \( A \) and \( B \), state whether the partial derivatives \( f_x \) and \( f_y \) are positive, negative or zero at that point and briefly justify your answer  
   (b) For the point \( C \), state whether the directional derivative in the direction indicated on the plot is positive, negative or zero and briefly justify your answer.