

Name:

PID:

Discussion Section - No:

Time:

TA's name:

### Quiz 4, Math 10C - Lecture A (Winter 2007)

*Duration: 20 minutes*

*Please close your books, turn your calculators off and put them away. You can use one page of notes. To get full credit you should support your answers.*

1. Let  $f(x, y) = \frac{9}{x^2 + 2y^2}$ .

a) (2 points) Calculate the gradient vector  $\nabla f(1, 1)$ .

b) (1 point) Find the directional derivative  $f_{\vec{v}}(1, 1)$  in the direction of  $\vec{v} = -\frac{2}{\sqrt{5}}\vec{i} + \frac{1}{\sqrt{5}}\vec{j}$ .

**c) (2 points)** Find the unit vector  $\vec{v}$  such that the directional derivative in the direction of  $\vec{v}$ ,  $f_{\vec{v}}(1, 1)$  is maximized, that is for any unit vector  $\vec{u}$ ,  $f_{\vec{u}}(1, 1) \leq f_{\vec{v}}(1, 1)$ .

**d) (3 points)** Find the equation of the tangent plane for  $f(x, y)$  at  $x = 1$  and  $y = 1$ . Use the equation of the tangent plane to approximate  $f(1.1, 0.9)$ .