MAT 175 HOMEWORK #6

DUE NOVEMBER 16 (WEDNESDAY)

Note: *Please indicate you are in* **Section C01**. *Numbering of problems is as in the textbook.*

(12.3.**4**) Find the indicated limit or state that the limit does not exist.

$$\lim_{(x,y)\to(1,2)} \frac{x^3 - 3x^2y + 3xy^2 - y^3}{y - 2x^2}$$

(12.3.**10**) Find the indicated limit or state that the limit does not exist.

$$\lim_{(x,y)\to(0,0)} \frac{x^4 - y^4}{x^2 + y^2}$$

(12.3.**12**) Find the indicated limit or state that the limit does not exist.

$$\lim_{(x,y)\to(0,0)} \frac{xy}{(x^2 + y^2)^2}$$

(12.3.**24**) Describe the largest set S on which it is correct to say that the function

$$f(x, y) = (4 - x^2 - y^2)^{-1/2}$$

is continuous.

(12.4.**12**) Find the gradient vector of the function

$$f(x, y) = x^3y + 3xy^2$$

at the point $\mathbf{p} = (2, -2)$. Then find the equation of the tangent plane at $\mathbf{p}$.

(12.4.**14**) Find the gradient vector of the function

$$f(x, y) = \frac{x^2}{y}$$

at the point $\mathbf{p} = (2, -1)$. Then find the equation of the tangent plane at $\mathbf{p}$.

(12.5.**2**) Find the direction derivative of $f(x, y) = y^2 \ln(x)$ at the point $\mathbf{p} = (1, 4)$ in the direction of $\mathbf{a} = \mathbf{i} - \mathbf{j}$.

(12.5.**14**) In what direction $\mathbf{u}$ does $f(x, y) = \sin(3x - y)$ decrease most rapidly at $\mathbf{p} = (\pi/6, \pi/4)$?

(12.5.**16**) Sketch the level curve of $f(x, y) = x^2+4y^2$ that goes through $\mathbf{p} = (2, 1)$. Calculate the gradient $\nabla f(\mathbf{p})$ and draw this vector, placing the initial point at $\mathbf{p}$. What should be true about $\nabla f(\mathbf{p})$?

(12.5.**18**) Find the directional derivative of $f(x, y) = e^{-x} \cos y$ at $(0, \pi/3)$ in the direction towards the origin.