Math 20 Answer Key. **Quiz 7**

Name: **Date: 3/19/2014**

Directions: Calculators are allowed, but you shouldn't need to use your calculator. Use your equals signs! Use the back of the page if you run out of space.

1. *(4 marks)* Let

$$f(x,y) = y^2 e^{x+3y}.$$

Find the partial derivatives f_x and f_y.

$f(x,y) = y^2 e^{(x+3y)}$

$f_x(x,y) = y^2 e^{(x+3y)}$

Using the product rule,

$f_y(x,y) = 2ye^{x+3y} + y^2 e^{x+3y}(3)$

$= ye^{(x+3y)}(2+3y)$.

2. *(6 marks)* For the function $f(x,y) = 9xy - x^3 - y^3 - 6$, find

(a) The values of x and y for which $f_x = f_y = 0$. (Fun fact: there are two solutions!)

(b) f_{xx}, f_{yy}, and f_{xy}.

(a) $f(x,y) = 9xy - x^3 - y^3 - 6$

$f_x = 9y - 3x^2$

$f_y = 9x - 3y^2$

Let $f_x = 9y - 3x^2 = 0$ ... (1)

& $f_y = 9x - 3y^2 = 0$ ... (2).

From (1), $9y = 3x^2$

$y = \frac{x^2}{3}$.

Sub into (2): $9x - 3\left(\frac{x^2}{3}\right)^2 = 0$.

$9x - \frac{3x^4}{9} = 0$.

$81x - 3x^4 = 0$

$27x - x^4 = 0$.

$x(27 - x^3) = 0$.

So $x = 0$ or $x^3 = 27$

$x = 3$.

$\therefore y = 0$ or $y = \frac{9}{3} = 3$.

$(x,y) = (0,0)$ or $(3,3)$.

(b) $f_x = 9y - 3x^2$

$f_{xx} = -6x$

$f_y = 9x - 3y^2$

$f_{yy} = -6y$

$f_{xy} = 9$ $(= f_{yx}!)$