Math 173 - Quiz 8
April 2, 2015

Name key
Score _____

Show all work to receive full credit. Supply explanations when necessary.

1. (4 points) Let $f(x,y) = \sin(2xy) + xe^{-2xy}$. Find an equation of the plane tangent to the graph of f at the point where $(x,y) = (\pi, 0)$. Use your equation to approximate $f(3, 0.1)$.

$f_x(x,y) = 2y\cos(2xy) + e^{-2xy} - 2xye^{-2xy}$

$f_x(\pi,0) = 1$

$f_y(x,y) = 2x\cos(2xy) - 2x^2e^{-2xy}$

$f_y(\pi,0) = 2\pi - 2\pi^2$

$f(\pi,0) = \pi$

$z = \pi + 1(x-\pi) + (2\pi - 2\pi^2)(y-0)$

$\boxed{z = x + (2\pi - 2\pi^2)y}$

$f(3, 0.1) \approx 3 + 0.1(2\pi - 2\pi^2) \approx \boxed{1.6544}$

EXACT VALUE ≈ 2.211

2. (6 points) Find and classify the critical points of $f(x,y) = x^3 + 3xy^2 - 15x + y^3 - 15y$.

$f_x(x,y) = 3x^2 + 3y^2 - 15 = 0$

$f_y(x,y) = 6xy + 3y^2 - 15 = 0$

$3x^2 - 6xy = 0$

$3x(x - 2y) = 0$

$x = 0$ $\qquad$ $x = 2y$

$3y^2 = 15$ $\qquad$ $12y^2 + 3y^2 - 15 = 0$

$y = \pm\sqrt{5}$ $\qquad$ $y^2 = 1$

$y = \pm 1$

$x = \pm 2$

$(0, \sqrt{5})$

$(0, -\sqrt{5})$

$(2,1), (-2,-1)$

$$d(x,y) = \begin{vmatrix} 6x & 6y \\ 6y & 6x+6y \end{vmatrix} = 36x^2 + 36xy - 36y^2$$

$d(0,\sqrt{5}) = -180 \Rightarrow (0, \sqrt{5}, -10\sqrt{5})$ IS A SADDLE PT.

$d(0,-\sqrt{5}) = -180 \Rightarrow (0, -\sqrt{5}, 10\sqrt{5})$ IS A SADDLE PT

$d(2,1) = 180$ & $f_{xx}(2,1) > 0 \Rightarrow f(2,1) = -30$ IS A REL MIN.

$d(-2,-1) = 180$ & $f_{xx}(-2,-1) < 0 \Rightarrow f(-2,-1) = 30$ IS A REL MAX.