29 August 2013 **Math 2173: Quiz 1** Name: KEY Rec. Time

Problem 1. [20 points]

$$f(x,y) = x^2 + xy^2 - 2x + 1$$

(a) Compute each of the following.

$f_x(x,y) =$	$2x + y^2 - 2$	$f_y(x,y) =$	$2xy$
$f_{xx}(x,y) =$	2	$f_{yy}(x,y) =$	$2x$
$f_{xy}(x,y) =$	$2y$	$\nabla f(1,1) =$	$\langle 2+1-2, 2\cdot1\cdot1\rangle = \langle 1, 2\rangle$

(b) Determine the critical point(s) of f.

$2x + y^2 - 2 = 0$ AND $2xy = 0$.

$x = 0$ or $y = 0$

If $x = 0$, then $2x + y^2 - 2 = 0 \Rightarrow y^2 - 2 = 0 \Rightarrow y = \pm\sqrt{2}$

If $y = 0$, then $2x + y^2 - 2 = 0 \Rightarrow 2x - 2 = 0 \Rightarrow x = 1$

So critical points are $(0, \sqrt{2})$, $(0, -\sqrt{2})$ and $(1, 0)$.

(c) Use the Second Derivative Test to classify each critical point of f.

At $(0,\sqrt{2})$, $D = f_{xx} f_{yy} - f_{xy}^2 = 2\cdot(0) - (2\sqrt{2})^2 = -8 < 0$

Saddle point at $(0, \sqrt{2})$.

At $(0,-\sqrt{2})$, $D = f_{xx} f_{yy} - f_{xy}^2 = 2\cdot(0) - (-2\sqrt{2})^2 = -8 < 0$

Saddle point at $(0, -\sqrt{2})$.

At $(1,0)$, $D = f_{xx} f_{yy} - f_{xy}^2 = 2\cdot(2) - (0)^2 = 4 > 0$, $f_{xx} = 2 > 0$

Local min at $(1,0)$