Math 397 Solutions Quiz 10

Name: Caleb McWhorter

1. (5 points) Find the gradient vector field of the function

$$f(x,y) = \frac{y^2+2y-1}{y^3-2x^2+5}$$

$$\nabla f(x,y) = \left\langle \frac{-(y^2+2y-1)}{(y^3-2x^2+5)^2} \cdot -4x \;,\; \frac{(2y+2)(y^3-2x^2+5) - (3y^2)(y^2+2y-1)}{(y^3-2x^2+5)^2} \right\rangle$$

$$= \left\langle \frac{4x(y^2+2y-1)}{(y^3-2x^2+5)^2} \;,\; \frac{(2y+2)(y^3-2x^2+5) - 3y^2(y^2+2y-1)}{(y^3-2x^2+5)^2} \right\rangle$$

2. (5 points) A particle moves in a velocity field $\mathbf{V}(x,y) = \langle x+y^2, 2x-y \rangle$. If it is at position $(5,4)$ at time $t=0$, estimate its location at time $t=0.01$.

$V(5,4) = \langle 5+4^2, 2(5)-4 \rangle$

$V(5,4) = \langle 21, 6 \rangle$

$(5,4) + .01(21,6)$

$(5,4) + \frac{1}{100}(21,6)$

$(5,4) + \left(\frac{21}{100}, \frac{6}{100}\right)$

$\left(5+\frac{21}{100}, 4+\frac{6}{100}\right)$

$(5.21, 4.06)$

The particle is approximately at $(5.21, 4.06)$.