Math 274 Quiz 3 **Name:** _____

Sections: 2.6, Substitution Point values in $\boxed{\text{boxes}}$.

1 February 2019

1. $\boxed{2}$ Show the equation

$$\left(y + \frac{x-y}{x+y}\right) dx - (x-y)dy = 0.$$

is not exact.

$$\frac{\partial}{\partial y}\left(y + \frac{x-y}{x+y}\right) = 1 + \frac{(-1)(x+y) - (x-y)}{(x+y)^2} = 1 - \frac{2x}{(x+y)^2}$$

$$\frac{\partial}{\partial x}\left(-x + y\right) = -1$$

Since $1 - \frac{2x}{(x+y)^2} \neq -1$ the equation is not exact.

2. $\boxed{3}$ The equation

$$\left(\frac{x^2+y^2-x}{x^2+y^2}\right) dx - \left(\frac{y}{x^2+y^2}\right) dy = 0$$

is exact. Find an implicit general solution.

$$\left(1 - \frac{x}{x^2+y^2}\right)dx + \left(\frac{-y}{x^2+y^2}\right)dy = 0$$

$$x - \frac{1}{2}\ln|x^2+y^2| = C$$

CONTINUED ON THE REVERSE.

$\boxed{5}$ Use the substitution $z = y^{-1}$ to find an explicit general solution to the Bernoulli equation

$$y' + x^{-1}y = xy^2.$$

<u>Note:</u> $y = 0$ is a solution

$$y^{-2}\frac{dy}{dx} + \frac{1}{x}y^{-1} = x$$

let $z = y^{-1}$

$$\frac{dz}{dx} = -y^{-2}\frac{dy}{dx}$$

$$\frac{dz}{dx} - \frac{1}{x}z = -x \qquad \mu(x) = e^{\int -\frac{1}{x}dx} = \frac{1}{x}$$

$$\frac{1}{x}z' - \frac{1}{x^2}z = -1$$

$$\left(\frac{z}{x}\right) = \int -1\,dx = C - x$$

$$z = Cx - x^2$$

$$y = \frac{1}{Cx - x^2}$$