1. [2] Show the equation

\[(y + \frac{x - y}{x + y}) \, dx - (x - y) \, dy = 0.\]

is not exact.

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

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

2. [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.

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

\[
x = \frac{1}{2} \ln \left| x^2 + y^2 \right| + C
\]
Use the substitution \( z = y^{-1} \) to find an explicit general solution to the Bernoulli equation

\[ y' + x^{-1}y = xy^2. \]

**Note:** \( y = 0 \) is a solution.

\[
y^{-2} \frac{dy}{dx} \frac{1}{x} y^{-1} = x
\]

Let \( z = y^{-1} \)

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

\[
\frac{d^2z}{dx^2} - \frac{1}{x} z = -x
\]

\[
\mu(x) = e \int -\frac{1}{x} \, dx = \frac{1}{x}
\]

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

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

\[
z = Cx - x^2
\]

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