Differential Equations
Test 1

Answer FOUR questions and show all work.

1. Solve the differential equation \((1 + y^2)dx + (1 + x^2)dy = 0\). [Recall from trigonometry the formula \(\tan(a - b) = (\tan a - \tan b)/(1 - \tan a \tan b)\).]

2. Solve the equation 
\[
x \frac{dy}{dx} = x - y - xy \cot x.
\]

3. Solve the equation 
\[
\frac{x \, dx}{(x^2 + y^2)^{3/2}} + \frac{y \, dy}{(x^2 + y^2)^{3/2}} = 0.
\]

4. Solve the equation 
\[
(x - y)dx - (x + y)dy = 0.
\]

5. Solve the initial value problem 
\[
x \frac{dy}{dx} + y = xy^2; \quad y(1) = 1.
\]