MATH 321: Written Assignment 2 **Due: Thursday, September 21, 2017**

Show all appropriate work.

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1. Solve the following differential equations. Explicitly solve for $y(x)$ or $x(t)$ when possible.

   (a) $x\frac{dy}{dx} = (1+y)^2$.

   (b) $\tan x \, dy + 2y \, dx = 0$.

   (c) $(x^2-1)y' + 2xy^2 = 0$, $y(\sqrt{2}) = 1$.

   (d) $x\frac{dx}{dt} + t = 1$.

2. Find the solution of $3y^2y' + 16x = 2xy^3$ such that $y(x)$ is bounded as $x \to \infty$.

3. Suppose the population, $N(t)$, of a given species is not always zero and varies at a rate proportional to its current value. If we call the constant of proportionality λ and assume the initial population is $N(0) = N_0 > 0$, then find $N(t)$. Discuss the behavior of the solution as $t \to \infty$ for different values of λ.