## Math 46: Quiz 3

February 12, 2015

Please show all work and solve the following problems.

1. Solve the following ODE

$$y' + y = y^2$$

**Solution:** This is a Bernoulli Equation. We need to use the substitution  $z = y^{1-n} = \frac{1}{y}$  and we have that  $y = \frac{1}{z}$ . So we also have that  $z' = -z^2y'$ . Using our substitution, we have that

$$y' + y = y^{2}$$
$$-\frac{1}{z^{2}}z' + \frac{1}{z} = \frac{1}{z^{2}}$$
$$z' - z = -1$$
$$e^{-x}z' - e^{-x}z = -e^{-x}$$
$$\frac{d}{dx}(ze^{-x}) = -e^{-x}$$
$$ze^{-x} = e^{-x} + C$$
$$z = 1 + Ce^{x}$$
$$\frac{1}{y} = 1 + Ce^{x}$$

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