1. In Teschl: 2.1, 2.4, 2.6

2. Consider the ODE

\[ \dot{x} = x^2, \quad x(0) = a \]

In the existence theorem, solutions exist over an interval \([-T_0, T_0]\) where \(T_0 = \min\{T, \delta/M\}\) where \(T, T_0, M\) are defined in the book. For this problem, choose a radius, \(\delta\) for your ball so as to maximize, \(T_0\) for given \(a > 0\). Solve the ODE and compare your estimated interval of existence to the actual one.

3. Let \(f(x) = Ax\) where \(A\) is a constant matrix. Show that each component of the \(n^{th}\) Picard iteration to any solution is a polynomial of degree at most \(n\). Can you guess a formula for \(x_n(t)\) and from this guess a formula for \(x(t)\)