Show all of your work for full credit.

1. Solve the differential equation

\[ y' + y^2 = 0 \quad \text{with} \quad y(0) = y_0 \]

Determine how the interval in which the solution exists depends on the initial value, \( y_0 \).

2. For the following ODE: Find the critical points; sketch the phase-line; determine which critical points are stable, unstable and semi-stable; Give sketches of the solution for a representative set of initial conditions.

\[ \frac{dy}{dt} = y - b\sqrt{y}, \quad b > 0, \quad y_0 \geq 0 \]