Worksheet #5: Regular perturbation

Consider the first order differential equation

$$\begin{cases} y' & = -y + \epsilon y^2 \\ y(0) & = 1. \end{cases}$$

(a) Plug $y(t) = y_0(t) + \epsilon y_1(t) + \epsilon^2 y_2(t) + \dots$ into the ODE.

(b) Collect the ϵ^0 terms. What initial condition does y_0 satisfy?

(c) Collect the ϵ^1 terms. What initial condition does y_1 satisfy? [Hint: plug series into original initial condition.]