

Math 310, Fall 2020, Due: Fri, Sep 4

* Show all work and use proper notation!

① (a) Solve the initial value problem

$$\frac{dy}{dx} = y^2(1+5x) \quad , \quad y(0) = \frac{1}{4}$$

(b) Find the solution that passes through the point $(x, y) = (0, 1)$.

② Solve the IVP

$$\frac{dx}{dt} = x - x^2 \quad , \quad x(0) = 2.$$

} You need to derive the solution, not think of this as a special case of a solved problem.

③ For the differential equation $\frac{dx}{dt} = x^2(x^2 - 4)$

(a) Find all equilibrium points (by seeing where $\frac{dx}{dt} = 0$) and specify whether they are stable or unstable.

(b) Sketch graphs of some representative solution curves (including each equil. solution and nearby solns.)

[Note you do not have to solve the ODE. Think about the sign of $\frac{dx}{dt}$ in different regions.]