Instructions

(1) Please submit your written solutions to crowdmark with each problem started on a separate page.
(2) Please list your collaborators on your assignment. It's important to give credit to those you have worked with.

Question 1 (Separable ODEs)**.** Find a one-parameter family of solutions for each differential equation.

a.

$$\frac{dy}{dt} = \frac{y}{(ty^2 + y^2 + t + 1)}$$

b.

$$\frac{dy}{dt} = 2e^{t+y}$$

c.

$$\frac{du}{dt} = -\frac{tu^2}{(t+3)(t-1)}$$

Note: For part a, it will not be possible to isolate for the state variable $y(t)$. Instead, write the solution in *implicit form*, where you isolate instead for the constant C.

Question 2 (1st order Autonomous ODEs)**.** Assume $y > 0$ and satisfies the autonomous differential equation

$$\frac{dy}{dt} = (9 - y^2)\ln(y)$$

a. Find all the equilibrium solutions
b. Find the stability of each equilibrium point
c. Draw a phase portrait (phase plot) for the differential equation