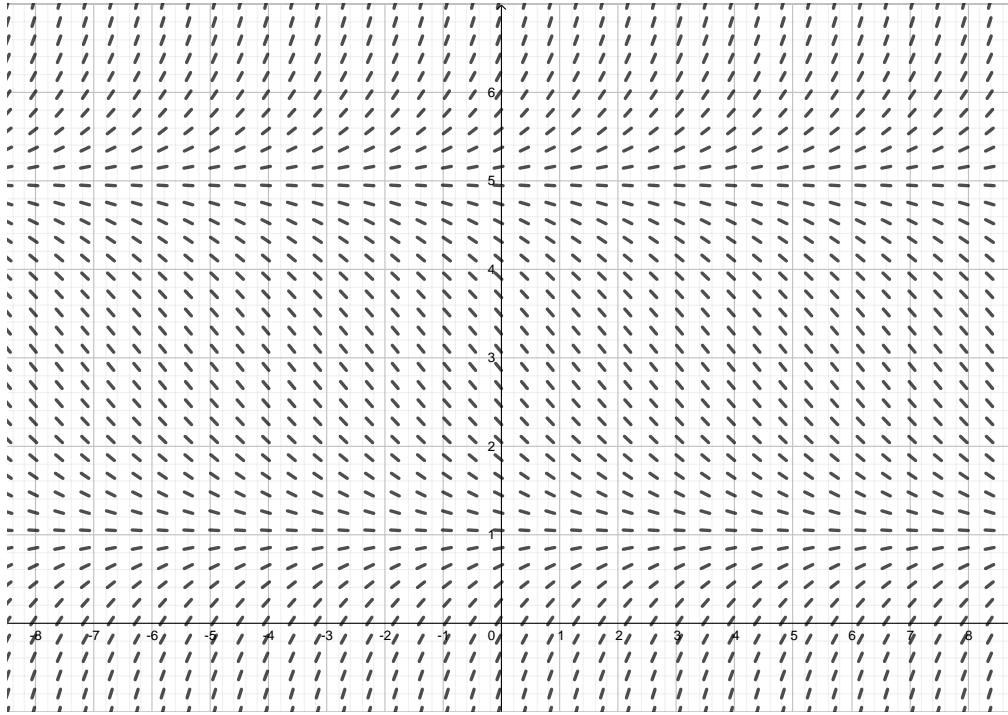


1. (6 points) The slope field for $y' = f(x, y)$ is given below. $f(x, y)$ and $f_y(x, y)$ are continuous everywhere in the plane. Sketch and label a solution for the initial condition $y(0)=2$. Now sketch and label all curves for which $0 = f(x, y)$; that is, draw and label the isocline $y'(x) = 0$.



2. (7 points) Suppose a water tank is being pumped out at 1 L/min. The water tank starts at 1 L of clean water. Water with toxic substance is flowing into the tank at 1 L/min, with concentration $\sin(t)$ g/L at elapsed time t . How many grams of toxic substance are in the tank (assuming perfect mixing) at any elapsed time t ?

3. (4 points) Find an **implicit** solution for $\frac{dy}{dx} = 1 + 2y - 8y^2, y(1) = 0$.

4. (4 points) Solve $\frac{dy}{dx} + \left(\frac{1}{x} + 1\right)y = \frac{\cos(x)\sin(x)}{xe^x}$ for y **explicitly** if $y(\pi) = 0$. Assume $x > 0$.

5. (4 points) Find all b so that the Existence-Uniqueness theorem guarantees a unique local solution for $y' = \frac{\ln(y^2 - 1)}{1 - t}, y(0) = b$. Defend your answer.