1. Solve each differential equation.

(a) \( \frac{dy}{dt} = 2 \cos(3t) \), where \( y(0) = 7 \).

(b) \( \frac{dy}{dx} = 2y + 1 \), where \( y_0 = 3 \) for \( x_0 = 5 \).

(c) \( \frac{dr}{ds} = \frac{\sin(s)}{e^r} \), where \( s_0 = 5 \) for \( r_0 = 7 \).

2. Solve the differential equation \( \frac{dN}{dt} = 5(N - 2)(N - 3) \), where \( N(0) = 7 \).

3. Suppose we know that \( \frac{dN}{dt} = N(N - 1)(N - 3) \). (Do not try to solve this equation.)

(a) Find the equilibria, and classify each equilibrium as stable or unstable.

(b) If \( N(0) = 2 \) then what value will \( \lim_{t \to \infty} N(t) \) have? Justify your answer.

4. That one pond in your home town has become contaminated with a (soluble) pollutant at concentration 3 grams/liter. The pond has volume of 50000 liters. Clean rainwater flows into the pond and the average flow rate of the stream leading out of its spillway is 4 liter/minute. How long will it take until the concentration lowers to 1 grams/liter?

5. Consider the difference equation

\[ x_{t+1} = \frac{10x_t^2}{9 + x_t^2}. \]

(a) Use the stability criteria to characterize the stability of its equilibria.

(b) Use cobwebbing to decide to which value \( x_t \) converges as \( t \to \infty \) if \( x_0 = 0.5 \), and if \( x_0 = 3 \).