MAT 303 Assignment 3.
Hand in to the instructor in class on Tuesday, October 14.

Problem 1. Let $P(t)$ be a rabbit population satisfying the extinction-explosion equation
\[
\frac{dP}{dt} = aP^2 - bP.
\]
The threshold population is $M = 540$ rabbits. In 1975 the population was 360 rabbits. In 1985 the population was 180 rabbits. Find the size of the population in 1995.

Problem 2. A fish population of a lake was attacked by a disease and the fishes cannot reproduce. The death rate per week per fish is proportional to $\frac{1}{\sqrt{P}}$. Initially there were 900 fishes. After 6 weeks the number of fishes decreased to 441. When the population will extinct?

Problem 3. A population of a certain country satisfying to the logistic equation was equal to 20 mln people and growing with the rate 0.2 mln per year in 1900. Also, this population was equal to 30 mln people and growing with the rate 0.15 mln per year in 1955. Find the limiting population and the predicted population for the year 2000.

Problem 4. Solve the differential equations:

1) \[ y' = 3y - 4y^2, \quad 2) \frac{dx}{dt} = x^2 - 1, \quad x(0) = 4. \]

Problem 5. Solve the differential equation
\[
\frac{dx}{dt} = x(x^2 - 1).
\]
Hint: you can either use partial fractions, or simplify the equation first by using an appropriate substitution.