Math 109 HW5

Fall 2018

1. Problem 3-6 on Page 598 of the textbook. Match the differential equation with its direction field. See the equations and graphs in the textbook.

2. Solve the differential equations

a) $\frac{dy}{dx} = x^3 y$.

b) $x\frac{dy}{dx} = (x^2+1)y$, $y(1) = 1$.

3. Solve the differential equation for the modified population model

$$\frac{dP}{dt} = P(1 - \frac{P}{M})$$

by separation of variable, and graph the general solution.

4. Find the orthogonal trajectories of the family of curves $x^2+3y^2 = k^2$. Draw several members of each family (both the family of curves and the orthogonal trajectories) on the xy-plane.

5. Find the orthogonal trajectories of the family of curves $y = \frac{1}{k+x}$. Draw several members of each family (both the family of curves and the orthogonal trajectories) on the xy-plane.

6. (a) Solve the solution of the logistic population model $\frac{dP}{dt} = P(1 - \frac{1}{1000}P)$, with $P(0) = 300$. Is this solution increasing or decreasing?

(b) Solve the solution of the logistic differential equation $\frac{dP}{dt} = P(1 - \frac{1}{1000}P)$, with $P(0) = 1500$. Is this solution increasing or decreasing?

7. Solve the differential equation $(x \ln x) \cdot y' + y = xe^x$.

8. Solve the differential equation $xy' = x^2 + y$.

9. Solve the initial value problem $xy' + 4xy = e^{-4x} \ln x$, $y(1) = 1$.

10. Solve the initial value problem $t^3\frac{du}{dt} + 4t^2u = 1$, $u(1) = 1$.