MTHSC 208, HW 5

(1) Section 2.5: # 6, 7, 9, 11-13.

(2) Section 2.9: # 16, 20, 22.

(3) Sketch a slope field for the equation $y' = y(1-y)$ and use this to sketch several solution curves.

(4) On the same diagram, sketch the solutions to $y' = y(1-y)$ and $y' = 0.3y(1-y)$ both satisfying the initial condition $y(0) = 0.5$.

Explain how the difference in the equation explains the difference in these two curves.

(5) Let $y' = ky(1 - \frac{y}{10})$ and $y'(0) = 2$ and $y(0) = 5$.

a. What is k? *Hint: No need to solve for $y(t)$ yet!*

b. What is $y(3)$?

(6) The population of a certain planet is believed to be growing according to the logistic equation. The maximum population the planet can hold is 10^{10}. In year zero the population is 50% of this maximum, and the rate of increase of the population is 10^9 per year.

a. What is the logistic equation satisfied by the population, $P(t)$?

b. How many years until the population reaches 90% of the maximum?

(7) A colony of bacteria is growing in a petri dish which has a maximum capacity of 100 mg. The mass of bacteria is increasing at a rate given by the logistic equation. Initially there is 2 mg of bacteria and the rate of increase is 1 mg per day.

a. Write down the logistic equation satisfied by the mass, $M(t)$.

b. When will the mass of bacteria be 50 mg?

c. What is the mass of bacteria 10 days after the mass was 2mg?