Assignment 1:

1. An object is taken out of the oven that is set at a temperature of $370^{\circ}F$ and taken to a room that is at a temperature $70^{\circ}F$. After 5 minutes, the temperature of the object is $250^{\circ}F$.

a) Use the Newton's law of cooling to write a differential equation for this situation.

b) How many more minutes will it be when the temperature of this object comes down to $100^{\circ}F$?

2. Consider the population model

$$\frac{dP}{dt} = 0.15\left(1 - \frac{P}{250}\right)\left(\frac{P}{75} - 1\right)P$$

Where $P(t)$ is the population at time t

a) For what values of P is the population in equilibrium?
b) For what values of P is the population increasing?
c) For what values of P is the population decreasing?

3. For a certain logistic growth model, the growth rate parameter is $k = 0.35$ and the carrying capacity $N = 2700$. If 150 units of this population is harvested each year and the initial value of the population is 2100 i.e. $P(0) = 2100$, Use a qualitative analysis to predict the long term behavior of this model. Sketch a clear graph to support your answer.

4. Solve the initial value problem given below.

$$\frac{dy}{dt} = \frac{1}{ty + t + y + 1}, \quad y(0) = 4$$