MATH 5000 Project02 on SIR Model and the Euler Method.

The project is due by class time Wednesday Nov. 3.

I recently presented a model of an infectious epidemic (see the class website for a pdf of the presentation). For this project we will use the Euler method to approximate solutions to this model (it's called the Kermack-McKendrick model).

$$\boxed{S = \text{susceptible}} \xrightarrow{\lambda IS} \boxed{I = \text{Infective}} \xrightarrow{\gamma I} \boxed{R = \text{Recovered + Deaths}}$$

We are assuming that the population is constant, that is, no other deaths than those due to the epidemic. So we have $S + I + R = N$ where N is constant. We assume that a patient who has recovered is no longer infectious so they can no longer transmit the disease. The equations relating these quantities are:

$$\frac{dS}{dt} = S' = -\lambda IS \quad (1)$$

$$\frac{dR}{dt} = R' = \gamma I \quad (2)$$

$$\frac{dI}{dt} = I' = (\lambda S - \gamma)I. \quad (3)$$

Let n denote the average number of contacts between individuals per day and α the probability that in an encounter between a susceptible and an infective that the susceptible catches the disease then the parameter λ is defined by:

$$\lambda = \frac{n\alpha}{N}.$$

The parameter γ is the rate at which infectious individuals become cured.

The project is to graph S, I and R verses time for the covid epidemic for the state of Alabama. Look up the data at some reputable site; I'll give you a link to the Alabama/Lee County site, but you may search the web for other information. Use the data of what has transpired so far to estimate the parameters of the equations. Then use your model to estimate the number of infections and deaths due to the covid epidemic a month from the turn in date. I'll give an extra credit boost to whoever is most accurate. You may modify the model, but you must logically justify any modifications.