Math 2300-007: Quiz 12

Name: _____ Score: _____

1. (6 points) A population $P(t)$ grows according to a logistic model and satisfies the logistic differential equation

$$\frac{dP}{dt} = \frac{4}{10}P\left(1 - \frac{P}{400}\right), \quad P(0) = 10,$$

where t is measured in years.

(a) What is the carrying capacity in this situation?

(b) What is $P'(0)$?

(c) Interpret the meaning of $P'(0)$. Mention the units in your answer.

2. (4 points) Suppose $P(t)$ represents the size of a population in millions t years since 2000 and we know that

   - the birth rate is 0.05 births per person per year;
   - the death rate is 0.02 deaths per person per year;
   - 3 million immigrants join the population each year.

   Write (**but do not solve**) a differential equation for $\frac{dP}{dt}$, the rate of change of the population at time t.