

THE CHINESE UNIVERSITY OF HONG KONG
DEPARTMENT OF MATHEMATICS

MATH1520C University Mathematics for Applications 2014-2015

Revision 2

Note: Questions will be discussed in lectures, no typed solution will be given.

1. In 2015, people from the city suffering from serious economical problems started to emigrate to other cities. Let $P(t)$ denote the population of the city in millions t years after 2015. Suppose that the rate of emigration is given by $0.004e^{0.04t} + 0.04$ millions per year after 2015 and the growth rate is 2.4% of the population. Find the population of the city at t years after 2015.
2. Suppose that a chemical reaction, substance A and substance B combine to form substance C in the ratio of 3:1. The reaction begins with 10 grams of A, 15 grams of B, and 0 grams of C. Let $y(t)$ be the amount of C present at time t . If the rate at which C is formed equals to the product of the amount of A and the amount of B, find $y(t)$.
3. A dead body was found in a room when the room's temperature was 70°F . Let $f(t)$ denote the temperature of the body t hours from the time of death. According to Newton's law of cooling, $f(t)$ satisfies a differential equation of the form

$$y' = k(T - y).$$

- (a) Find T .
- (b) After several measurements of the body's temperature, it was determined that when the temperature of the body was 80°F it was decreasing at the rate of 5°F per hour. Find k .
- (c) Suppose that at the time of death the body's temperature was about normal, say 98°F . Determine $f(t)$.
- (d) When the body was discovered, its temperature was 85°F . Determine how long ago the person died.