

(C4) Differential Equations

P3 June 2002

7. The value £V of a car is to be modelled as a continuous variable. At time t years, the rate of decrease of V is proportional to the value of V .

(a) Write down the differential equation satisfied by V . [1]

(b) Given that $V = 12000$ when $t = 0$, show that

$$V = 12000 e^{-at},$$

where a is a positive constant. [5]

(c) After five years, the value of the car is £5400. Find the value of a , correct to three decimal places. [2]

P3 June 2003

4. Given that $y = 0$ when $x = 0$, solve the differential equation

$$\frac{dy}{dx} = \frac{x + 1 + \sin x}{\cos y}$$

[6]

P3 June 2004

8. The size N of a population is to be modelled as a continuous variable. At time t , the rate of increase of N is directly proportional to the value of N .

(a) Write down the differential equation that is satisfied by N . [1]

(b) Given that $N = 100$ when $t = 0$, show that

$$N = 100e^{kt},$$

where k is a positive constant. [5]

P4 June 2005

8. The size P of a population of bacteria at time t days is to be modelled as a continuous variable such that the rate of increase of P is directly proportional to P .

(a) Write down a differential equation that is satisfied by P . [1]

(b) Given that the initial size of the population is P_0 , show that $P = P_0 e^{kt}$, where k is a positive constant. [5]

(c) Two days after the start, the population is $1.2P_0$. Find when the population will be $2P_0$. [4]