
ASSIGNMENT 1**Due: 2pm, Monday, 30 January 2012**

This assignment is worth 5% of the assessment for this unit of study.

Your assignment must be stapled with an assignment cover sheet inside a manilla folder with your name on it.

1. (a) A certain radioactive material decays at a rate proportional to the amount present. Initially there are 100 milligrams of the material present, and after two hours the material has lost 10% of its original mass.
 - (i) [3 marks] Find an expression for $X(t)$, the mass remaining in milligram at any time t (in hours), in terms of t .
 - (ii) [1 mark] Find the mass of the material after six hours.
 - (iii) [1 mark] Find the half-life of the material.
 - (b) According to Newton's law of cooling, the rate of decrease of temperature of a body is proportional to the difference between its temperature and that of its environment. The temperature of the environment is 20°C and the body cools from 80°C to 60°C in 1 hour.
 - (i) [1 mark] Write the differential equation for $T(t)$, the temperature of the body (in $^{\circ}\text{C}$) at time t (in hours).
 - (ii) [2 marks] Find the particular solution for the above differential equation.
 - (iii) [2 marks] Show that it will take somewhat over 4 hours to cool to 30°C .
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2. A store has decided to start stocking a new brand of biscuits. They start with 200 biscuits and notice that after 1 month, half of the biscuit packets they stocked have been sold. They add 500 packets to their stock.
 - (a) [3 marks] Assuming such selling/restocking pattern continues, write down a difference equation for B_n , the number of biscuit packets n months after their introduction.
 - (b) [3 marks] Solve your difference equation to find an expression for B_n (in terms of n).
 - (c) [2 marks] According to your model, what do you expect to happen to biscuit packet number of the new brand? Justify your answer using your solution from (b).
 - (d) [2 marks] How many biscuit packets would they have after 4 months and after 12 months?