Edexcel A level Maths Differential equations

Topic assessment

1. Find y in terms of x given that $\dfrac{dy}{dx} = x(y-1)$. [4]

2. Solve $(x-1)\dfrac{dy}{dx} = xy$ for $x > 1$ and $y > 0$, given that $y = 1$ when $x = 3$. [5]

3. Obtain a particular solution to $(1 - e^{2y})\dfrac{dy}{dx} = e^{y}$ given that $y = 0$ when $x = 2$.

   (There is no need to express y in terms of x). [5]

4. Find an expression for y in terms of x given that $x^2 \dfrac{dy}{dx} - y^2 = 0$. [4]

5. At time t seconds the rate of increase in the concentration of flesh eating bugs in a controlled environment is proportional to the concentration C of bugs present. Initially $C = 100$ bugs and after 2 seconds there are five times as many.

   (i) Write down a differential equation connecting $\dfrac{dC}{dt}$, C and t and hence find an expression for C in terms of t. [7]

   (ii) How many bugs are present after 5 seconds? [2]

   (iii) When will the number of bugs exceed 5000? [3]

   (iv) Find the time at which the concentration of bugs has increased by 50% of the initial concentration. [3]

6. Water is pouring out of a small hole in the bottom of a conical container of height 25 cm. Initially the container is full.
   The rate at which the height x of the water remaining in the container is given by
   $$\frac{dx}{dt} = -\frac{50}{\pi} x^{-\frac{3}{2}}.$$

   (i) Solve the differential equation to find x in terms of t. [5]

   (ii) How long does it take for the container to empty completely? [2]

Total 40 marks