

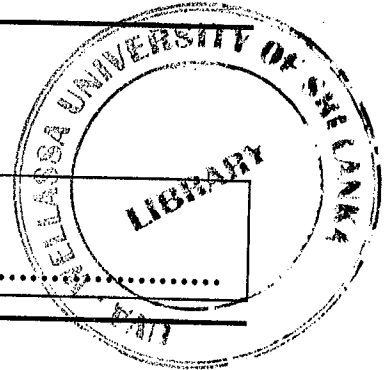
Mathematics for Biological Sciences EAG 102-0/ AAS 104-0

Instructions

Answer **all** questions

- No. of questions : Four (04)
No. of pages : Two (02)
Time : Two (02) Hours
Total marks allocated : 100 %

Index No:



- 1.
- a. Derive the formula for the solutions to the quadratic equation $ax^2 + bx + c = 0$;
 $a \neq 0$ (10 Marks)
- b. Solve for x by using quadratic formula $36x^2 + 12ax + (a^2 - b^2)$
(10 Marks)
- c. Express as a single logarithm. (5 Marks)

$$\ln a - \frac{1}{3} \ln c + \ln b$$

- 2.
- a. Plot the below graph.

$$f(x) = \begin{cases} x^2 & \text{if } x \leq 1 \\ 2x + 1 & \text{if } x > 1 \end{cases} \quad (10 \text{ Marks})$$

- b. If $X = \begin{vmatrix} 2 & 1 & 0 \\ -1 & 0 & 3 \end{vmatrix}$ and $Y = \begin{vmatrix} 3 & -1 & 2 \\ 1 & 2 & 0 \\ -2 & 0 & 1 \end{vmatrix}$ find the product of XY .
(10 Marks)

- c. What quantity of a 60% acid solution must be mixed with a 20% solution to produce 250ml of a 50% solution?
(5 Marks)

3.

a. Find the **derivative** of functions given below with respect to x .

i. $y = 3x^3 + 8x + 2$ (5 Marks)

ii. $y = e^x \cdot \ln x$ (10 Marks)

b. The number of bacteria in a refrigerated food is given by

$$N(t) = 20t^2 - 20t + 120; -2 \leq t \leq 14,$$

where t is the temperature of the food in Celcius.

i. At what temperature will the number of bacteria be minimal? Find the number of bacteria at that temperature? (6 Marks)

ii. Find the number of bacteria in the refrigerated food at the minimum temperature. (4 Marks)

4.

a. Find each of the following limits, if they exist:

i. $\lim_{x \rightarrow 3} \left(\frac{x^3 - 27}{x - 3} \right)$ (5 Marks)

ii. $\lim_{x \rightarrow \infty} \left(\frac{4x - 3}{8x + 7} \right)$ (5 Marks)

b. Integrate the following equations.

i. $\int (\sin x + 5e^x) dx$ (5 Marks)

ii. $\int x \cos x dx$ (10 Marks)