
University of Swaziland



Supplementary Examination July 2013

BSc in Environmental Health Sciences I

Title of Paper : Calculus for Health Sciences

Course Number : EHM107

Time Allowed : Two (2) hours

Instructions :

1. This paper consists of SIX questions printed on THREE pages.
2. Each question is worth 25%.
3. Answer ANY FOUR questions.
4. Show all your working.

THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GIVEN BY THE INVIGILATOR.

Question 1

(a) Evaluate

(i) $\lim_{x \rightarrow 1} \frac{x^2 - x}{x^2 - 1}$ [6 marks]

(ii) $\lim_{x \rightarrow \infty} \frac{x^2 - x}{x^2 - 1}$ [6 marks]

(b) Use the *limit definition* of the derivative to find $f'(x)$ given

$$f(x) = 2x - x^2. \quad [13 \text{ marks}]$$

Question 2

(a) Differentiate

(i) $y = 2^{-x}$ [5 marks]

(ii) $F(x) = (1 + 4x)^{15}$ [5 marks]

(iii) $H(x) = \ln(\cos x)$ [5 marks]

(b) Integrate

$$\int 24x^2 e^{-x} dx \quad [10 \text{ marks}].$$

Question 3

(a) Find y''' for the function $y = e^{-2x}$. [6 marks]

(b) Evaluate find

(i) $\int \left(4x + \frac{1}{x} - \frac{6}{x^2} \right) dx$ [3 marks]

(ii) $\int (1 + e^x - \cos x) dx$ [4 marks]

(iii) $\int_1^9 \left(6X^{\frac{3}{2}} - X^{-\frac{1}{2}} \right) dX$ [6 marks]

(iv) $\int \frac{x}{x+2} dx$ [6 marks]

Question 4

(a) Differentiate

(i) $y = \ln x - \cos x + e^{2x} - \frac{5}{x}$ [4 marks]

(ii) $y = \frac{x}{2-3x}$ [7 marks]

(b) You have been assigned you to design a *closed* rectangular box with a square base and a capacity of 250 cubic centimetres.

(i) Show that its external surface area S is given by

$$S(x) = 2x^2 + \frac{500}{x}$$

where x is the length of the base. [5 marks]

(ii) Find the value of x for which the surface area is minimum. [9 marks]

Question 5

(a) Evaluate

(i) $\int \frac{x^3 - 2}{x^2} dx$ [4 marks]

(ii) $\int 20(4x - 2)^{\frac{2}{3}} dx$ [7 marks]

(b) Find the *exact* area of the region enclosed by the curves $y = x + 1$ and $y = x^2 - 5$. [16 marks]

Question 6

(a) Find y^{iv} for the function $y = 4x^5 - \frac{1}{x}$. [6 marks]

(b) Consider the function

$$f(x) = x^3 - 3x^2 + 2.$$

Locate the stationary points of $f(x)$ and classify them. [9 marks]

(c) Use partial fractions to evaluate

$$\int \frac{x + 1}{x(x - 4)} dx. \quad [10 marks]$$
