
University of Swaziland



Supplementary Examination – July 2014

BSc in Environmental Sciences I

Title of Paper : Calculus for Health Sciences

Course Number : EHM107

Time Allowed : Two (2) hours

Instructions:

1. This paper consists of 2 sections.
2. Answer ALL questions in Section A.
3. Answer ANY 2 questions in Section B.
4. Show all your working.

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

Section A
Answer ALL Questions in this section

A.1 a. With the aid of graphical sketches and formulae, give a concise explanation of the term *inflexion point* of a graph. [2 marks]

b. List the conditions that must be met for the limit

$$\lim_{x \rightarrow a} f(x)$$

to be defined.

[3 marks]

c. Evaluate

i. $\lim_{x \rightarrow -1} \left(\frac{1 + 3x}{x^2 - 7x + 1} \right)$ [2 marks]

ii. $\lim_{x \rightarrow 0} \left(\frac{x}{x^2 + \frac{1}{2}x} \right)$ [4 marks]

iii. $\lim_{x \rightarrow \infty} \left(\frac{2x - 1}{3 - x} \right)$ [3 marks]

A.2 a. State *limit definition* of the derivative of the function $f(x)$. [2 marks]

b. Use the limit definition to find $\frac{df}{dx}$ given

$$f(x) = 7 - 3x. \quad [7 \text{ marks}]$$

c. Find y' if

i. $y = x^3 - 2x^2$ [2 marks]

ii. $y = 5 - \frac{1}{x^2}$ [3 marks]

iii. $y = 20\sqrt{X} - 7X$ [3 marks]

iv. $y = e^{2x}$ [2 marks]

v. $y = \ln(2x)$ [3 marks]

A.3 a. State the *Fundamental Theorem of Calculus*. [3 marks]

b. Integrate

i. $\int_{-1}^2 (1 - 4x) dx$ [5 marks]

ii. $\int \left(\frac{1}{x} - \frac{4}{x^3} \right) dx$ [3 marks]

iii. $\int \cos 2x dx$ [3 marks]

Section B

Answer ANY 2 Questions in this section

B.4 a. Find the value of the limit

$$\lim_{x \rightarrow 0} \frac{1 - \sqrt{x+1}}{x} \quad [7 \text{ marks}]$$

b. Find the indicated derivative

i. $y = (2x - 1)e^{-2x}$ y' [4 marks]

ii. $y = \frac{x+1}{1-2x}$, y' [5 marks]

iii. $y = x^3 - \frac{2}{x}$, y^{iv} [4 marks]

iv. $y = \cos 2x$, y^v [5 marks]

B.5 a. Consider the function

$$y = 4x^2 - 2x + 1.$$

i. Find the equation of the *tangent* to the curve of y when $x = -\frac{1}{2}$. [7 marks]

ii. Find the *stationary point* of the function and determine its nature. [6 marks]

b. A retail shop has determined that the price demand function for its product is

$$p = 10 - 0.001x$$

where p is the unit price and x is the number of units sold per week. If the cost of each units is E2 which the weekly fixed costs stand at E8,500, find

i. the number of units to sell to obtain the maximum profit per week [9 marks]

ii. the maximum weekly profit. [3 marks]

B.6 a. Evaluate

i. $\int \frac{4x}{(x^2 + 1)^2} dx$ [7 marks]

ii. $\int x^2 e^x dx$ [8 marks]

b. Find the area of the region enclosed by the parabolas $y = x^2$ and $y = 32 - x^2$. [10 marks]

B.7 a. Use the method of partial fractions to evaluate

$$\int \frac{4x}{x^2 - 9} dx. \quad [10 \text{ marks}]$$

b. After the launch of a new TV game, the rate at which the sales grow is given by

$$S'(t) = \frac{6}{\sqrt{1 + 3t}}$$

thousand units per month, where t is the number of months after the launch. Find the number of units sold

i. in the first 2 months [10 marks]

ii. during months 3 and 4 [5 marks]
