University of Swaziland

Re-sit Examination – July 2016

BSc in Environmental Sciences I

Title of Paper : Calculus for Health Sciences

Course Number : EHS102

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 Evaluate

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

ii. $\displaystyle \lim_{x \to -3} \left(\frac{3x + x^2}{x^2 - 9} \right)$ [5 marks]

iii. $\displaystyle \lim_{x \to \infty} \left(\frac{x^2 + 2}{x^2 - 2} \right)$ [3 marks]

A.2 a. Use the limit definition to find $\dfrac{\mathrm{d}f}{\mathrm{d}x}$ given

$$f(x) = 4x^2 - 7.$$ [10 marks]

b. Find y' if

i. $y = 7x^2 - 8 - 10\sqrt{x}$ [5 marks]

ii. $y = 4x - \dfrac{2}{x} + \dfrac{5}{x^3}$ [5 marks]

iii. $y = 2e^{3x} - 3e^{-2x} + \ln x$ [5 marks]

A.3 Integrate

i. $\displaystyle \int_1^9 \left(4x - 9\sqrt{x} + \frac{7}{x} \right) \mathrm{d}x$ (correct to 1 d.p.) [10 marks]

ii. $\displaystyle \int \left(2 - 6e^{-2x} + 9\sin 3x \right) \mathrm{d}x$ [4 marks]

Section B

Answer ANY 2 Questions in this section

B.1 a. Use the *limit definition* of the derivative to find $f'(x)$ given

$$f(x) = 4\sqrt{x}.$$ [10 marks]

b. Find the indicated derivative

i. $y = xe^{2x}$ y' [4 marks]

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

iii. $y = \sin 2x + \ln x$, y''' [6 marks]

B.2 a. Consider the function

$$y = 10 + 36x - 3x^2 - 2x^3.$$

i. Find the stationary points of y. [10 marks]

ii. Determine the nature of each stationary point. [6 marks]

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

$$p = 14 - 0.0015x$$

where p is the unit selling price and x is the number of units sold per week. If the cost of each units is E5 which the weekly fixed costs stand at E7,500, find the most profitable number of units to sell per week. [9 marks]

B.3 a. Evaluate

i. $\displaystyle\int \frac{x\,dx}{x^2+1}$ [7 marks]

ii. $\displaystyle\int xe^{0.5x}\,dx$ [9 marks]

b. The rate of seepage of toxic chemicals (in thousands of litres per year) from a dumping site is given by
$$R'(t) = 4e^{-0.5t}$$
where t is the number of years after dicovering the seepage. Find the total volume of toxic chemicals that seep during

i. the first 5 years [5 marks]

ii. the second 5 years. [4 marks]

B.4 a. Integrate

i. $\displaystyle\int_0^{\sqrt{3}} \frac{x\,dx}{\sqrt{x^2+1}}$ [6 marks]

ii. $\displaystyle\int \frac{dx}{x^2+x}$ [9 marks]

b. Find the area of the region enclosed by the curves
$y = x^2 - 3x - 9$ and $y = 1$. [10 marks]