
University of Swaziland



Re-sit Examination – July 2017

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. $\lim_{x \rightarrow 2} \left(\frac{2x - x^2}{x^2 - 4} \right)$ [4 marks]

ii. $\lim_{x \rightarrow \infty} \left(\frac{2x^2 - 5}{2 + 3x^2 - x^3} \right)$ [4 marks]

A.2 a. Use the limit definition to find $\frac{df}{dx}$ given

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

b. Find y' if

i. $y = x^2 - \frac{2}{x} + 12\sqrt{x}$ [4 marks]

ii. $y = 30 - e^{2x} + \cos 3x - \ln(x)$ [5 marks]

iii. $y = (x^2 + 1)^{15}$ [5 marks]

c. Find y''' if

$y = e^{-2x} - \sin 2x.$ [6 marks]

A.3 Integrate

i. $\int_1^9 \left(\frac{7}{\sqrt{x}} - 2x + 3x^2 \right) dx$ [6 marks]

ii. $\int_1^9 \left(\frac{10}{x} + e^x - \frac{5}{x^2} \right) dx$ (correct to 2 d.p.) [6 marks]

Section B

Answer ANY 2 Questions in this section

B.1 a. Consider the graph of the function

$$y = \frac{x}{8 - 3x}$$

- i. Find the value(s) of x when $y = 1$. [4 marks]
- ii. Hence, find the equation of the tangent(s) and normal(s) at $y = 1$. [9 marks]

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

$$p = 15 - 0.0025x$$

where p is the unit selling price and x is the number of units sold per month. If each unit costs E3 while fixed monthly costs stand at E5,500, find

- i. the number of units per month that yield maximum profit [9 marks]
 - ii. the maximum profit [3 marks]
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B.2 a. Differentiate and simplify

i. $F(x) = (x^2 - 2x + 1)e^{2x}$ [7 marks]

ii. $G(x) = \ln\left(\frac{x}{x+1}\right)$ [6 marks]

b. Consider the function

$$f(x) = 12 + 12x - x^3.$$

- i. Find the stationary points of $f(x)$ and their nature. [6 marks]
 - ii. Find the inflexion points of $f(x)$ [2 marks]
 - iii. Make a sketch of the graph of $y = f(x)$. [4 marks]
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B.3 a. Evaluate

i. $\int_1^4 \frac{dx}{x(x+1)}$ [10 marks]

ii. $\int_0^{\sqrt{3}} \frac{2x dx}{\sqrt{x^2+1}}$ [7 marks]

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

$$S'(t) = \frac{12}{\sqrt{1+4t}},$$

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

- i. the first 6 months
- ii. the second half of the year

[8 marks]

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- B.4 a.** A car is travelling at 108km/h. At a certain instant the brakes are applied producing a constant deceleration of 0.8 m/s^2 . find

- i. the formula for the velocity of the car during the deceleration [4 marks]
- ii. the formula for the height of the car during the deceleration [4 marks]
- iii. the time taken before the car stops [3 marks]
- iv. the distance covered during the deceleration [3 marks]

- b. Find the area of the region bounded by the curves $y = x^2 - 4x$ and $y = 8x - x^2$. [10 marks]

END OF EXAMINATION
