University of Swaziland

Supplementary Examination May 2009

Dip. Env. Health I, BSc. Env. Health IV

Title of Paper : Calculus for Health Sciences

Course Number : HSM115

Time Allowed : Two (2) hours

Instructions :

1. This paper consists of SIX questions.
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) $\lim_{t \to -2} \dfrac{(3t-2)^2}{2-t2}$ [4 marks]

(ii) $\lim_{x \to -3} \dfrac{1+2x-3x^2}{1-2x-x^2}$ [3 marks]

(b) Differentiate

(i) $H(v) = \dfrac{v^2-2v+8}{v}$ [4 marks]

(ii) $F(s) = \dfrac{s}{s-2}$ [7 marks]

(c) Integrate

$$\int_1^e \frac{\mathrm{d}x}{x}.$$ [7 marks]

Question 2

(a) Differentiate

(i) $h(\xi) = 3\xi^2 \left(\dfrac{1}{2\xi^3} - 8\xi \right)$ [3 marks]

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

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

$$f(x) = 2 - 3x.$$ [8 marks]

(c) Evaluate

$$\int \frac{2x\,\mathrm{d}x}{(x^2+4)}.$$ [9 marks]

Question 3

(a) For the function

$$y = 3 + 6x - x^2,$$

find

i. the intervals in which the graph is increasing/decreasing [3 marks]

ii. intervals in which the graph is concave up/down [3 marks]

iii. stationary points and classify them [3 marks]

inflexion points [3 marks]

Hence make a sketch of the graph of y. [5 marks]

(b) Integrate

i. $\int \left(3 - x^2 - 6\sin 2x\right) \mathrm{d}x$ [4 marks]

ii. $\int_{-2}^{2} \left(t^2 - \frac{2}{t^4}\right) \mathrm{d}t$ [4 marks]

Question 4

(a) Integrate

i. $\int \left(2 - e^{-2x}\right) \mathrm{d}x$ [4 marks]

ii. $\int x\left(3 - 2x^3\right) \mathrm{d}x$ [4 marks]

(b) A farmer needs to construct a rectangular holding for his livestock. If the holding is to be constructed against an existing fence, find the dimensions of the largest

holding that can be constructed using 800 metres of fence.

[17 marks]

Question 5

(a) Find the indicated derivatives:

i. $R(x) = xe^{-x}$, R' [4 marks]

ii. $H(\varphi) = \ln \varphi$, H^{iv} [8 marks]

(c) Find the area enclosed by the curves $y = x^2$ and $y = x + 12$. [13 marks]

Question 6

(a) Differentiate and simplify

i. $G(\lambda) = \sin^2 \lambda + \cos^2 \lambda + 2$ [4 marks]

ii. $y = \left(3 - 4x^2\right)^{20}$ [5 marks]

(b) Integrate

$$\int x \sin 2x \mathrm{d}x$$ [8 marks]

(c) Use partial fractions to integrate

$$\int \frac{x \, \mathrm{d}x}{(x-1)(x+2)}.$$

[8 marks]