University of Swaziland

Re-sit Examination – July 2018

BSc Env. Health I, BSc Comm. Health Nurs. 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.
5. Begin each question on a new page.

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

a. $\lim_{x\to 0} \dfrac{3x - x^2}{x^2 - 2x}$ [5 marks]

b. $\lim_{x\to \infty} \dfrac{3x - 1}{2x + 9}$ [5 marks]

A.2 a. Use the limit definition to find $f'(x)$ if

$$f(x) = 7 - 5x.$$ [10 marks]

b. Find y' if

i. $y = 10x - 4\sqrt{x} - \dfrac{7}{x}$ [4 marks]

ii. $y = \ln \pi - 2e^{-2x} - \sin 2x - \ln 3x$ [4 marks]

iii. $y = 2x \ln x$ [5 marks]

iv. $y = \dfrac{1 + 2x}{1 - 2x}$ [5 marks]

A.3 Integrate

a. $\int_4^{16} \left(2x - \dfrac{3}{\sqrt{x}} - 2\right) \mathrm{d}x$ [6 marks]

b. $\int_{\frac{1}{2}}^{3} \left(6e^{-3x} - \dfrac{3}{x} - \dfrac{8}{x^3}\right) \mathrm{d}x$ (correct to 2 d.p.) [6 marks]

Section B

Answer ANY 2 Questions in this section

B.1 a. Consider the function

$$y = (x-2)^4 + \ln(x) + e^{1-x} + 2.$$

i. Find y' [4 marks]

ii. Find the equation of the tangent of y at $x = 1$. [5 marks]

b.

i. Find 2 numbers x and y whose sum is 600 such that

$$F = xy^3$$

is the largest. [8 marks]

ii. A farmer has 960m of fence with which to construct a rectangular holding for her livestock. If it will border an existing fence, find the dimensions of the largest possible enclosure. [8 marks]

B.2 a. Find the indicated derivative

i. $y = 16\sqrt{x} - \dfrac{3}{x}, \quad y'''$ [5 marks]

ii. $y = \dfrac{\sin x}{\cos x}, \quad y'$ [5 marks]

b. Consider the function

$$f(x) = 10 + x^3 - 12x.$$

i. Find the stationary points of $f(x)$ and determine the nature of each [9 marks]

ii. Find the inflexion point and y-intercept [2 marks]

iii. Make a sketch of the graph of $y = f(x)$. [4 marks]

B.3 a. Integrate

i. $\int 12x\sqrt{x^2-3}\,\mathrm{d}x$ [5 marks]

ii. $\int \dfrac{x^2-2x+7}{2x}\,\mathrm{d}x$ [5 marks]

iii. $\int xe^{-0.2x}\,\mathrm{d}x$ [5 marks]

b. Find the area of the region bounded by the parabola $y = 27 - 3x^2$ and the x-axis. [10 marks]

B.4 a. Evaluate

i. $\int \left(10x^{\frac{2}{3}} - 3\cos(0.1x)\right)\mathrm{d}x$ [5 marks]

ii. $\int \dfrac{10x\mathrm{d}x}{(x-2)(x+3)}$ [10 marks]

b. After the launch of a new product on 01 January 2018, the rate sales (in thousands per month) is given by

$$S'(t) = \frac{12}{1+\frac{2}{3}t},$$

where t is the number of months after 01 January 2018. Find

i. the total number of sales in the first year [5 marks]

ii. the total number of sales in the first year [5 marks]

END OF EXAMINATION