University of Eswatini

Final Examination – November 2019

BSc in Env. Health Sciences I

Title of Paper : Algebra for Health Sciences
Course Number : EHS101
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 (out of 4) 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 a. Using the calculator, find the value of

i. $4e^{\pi} + \dfrac{\log 890}{\ln 0.2}$ ii. ${}_{20}C_{16} + \dfrac{12! - 11!}{10!}$ [2,2 marks]

b. Find the equation of the straight line through $(2, -5)$ and $(-2, 3)$. [4 marks]

c. Given the matrices

$$A = \begin{pmatrix} 1 & -2 \\ 3 & 4 \end{pmatrix}, \; B = \begin{pmatrix} 3 & -2 \\ 0 & 1 \\ 4 & 5 \end{pmatrix}, \; C = \begin{pmatrix} 3 & 0 \\ -2 & 4 \end{pmatrix},$$

evaluate

i. $3A^T + 2C$
ii. AB
iii. AB^T

[8 marks]

d. Find the value of the sum

$$\sum_{n=0}^{150}(7n + 1).$$ [5 marks]

e. In the binomial expansion of

$$\left(x^2 + 2y\right)^{24},$$

find the first 3 terms. [7 marks]

f. Use *long division* to find the quotient and remainder of

$$\frac{x^3 - x^2 + 14}{x - 2}.$$ [7 marks]

g. Solve for x correct to 2 d.p. given

$$5^{x-2} = 325.$$ [5 marks]

Section B

Answer ANY 2 Questions in this section

B.2 Use Cramer's rule to solve the simultaneous system

$$\begin{aligned} 4x - 2y - z &= 21 \\ x + y - z &= 0 \\ -2x - z &= 1. \end{aligned}$$

[25 marks]

B.3 a. Consider the triangle whose vertices are given by $A(4,-2)$, $B(-3,12)$ and $C(7,2)$. Find

i. the equation of side AB, expressing it in *general form* [5 marks]

ii. the interior angle $\hat{A}$ correct to 2 d.p. [4 marks]

iii. the perimeter of the triangle correct to 2 d.p. [4 marks]

iv. the *exact* area of the triangle [3 marks]

b. Consider the binomial expansion of

$$\left(x^2 + \frac{1}{x^3}\right)^{29}.$$

Find (and simplify)

i. the 27th term [3 marks]

ii. the term involving x^{-27} [6 marks]

B.4 a. Without using a calculator, showing all your steps, evaluate

$$2\log_3 6 + \log_3 75 - 2\log_3 10. \qquad \text{[4 marks]}$$

b. Solve for x (correct to 2 d.p. for non-exact answers) given

$$\log x - \log(x - 54) = 1. \qquad \text{[7 marks]}$$

c. On 01 January 2019, a machine was bought for E150 000. If it deoreciates at a rate of 10.5% p.a. its subsequent value is given by

$$V(t) = 150\,000e^{-0.105t},$$

where t is its age in years. Find

i. the value of the machine on 31 December 2022 [2 marks]

ii. the date corresponding to the *half-life* of the machine. [5 marks]

d. Use the method of *synthetic division* to find the quotient and remainder for

$$\frac{x^4 - 3x^3 + 5x - 7}{x + 2}. \qquad \text{[7 marks]}$$

B.5 a. Find the value of each sum

i. $7 + 14 + 21 + 28 + \cdots + 112\,686$ [4 marks]

ii. $7 + 14 + 28 + 56 + \cdots + 114\,688$ [4 marks]

b. A parent opens a saving account for their child by making monthly deposits, as shown in the table below.

Month	1	2	3	4	5
Deposit	200	210	220.5	231.53	243.10

If the deposits follow the trend shown above for 5 years, find

i. the monthly deposit on month 12 [3 marks]

ii. the month when the montly deposit will be E530.66 [4 marks]

iii. the *total* amount deposited in 5 years [3 marks]

c. Evaluate and express your answr in the form $a + ib$

i. $(2 - 5i)(4 + 3i)$ [2 marks]

ii. $\dfrac{5 - 20i}{1 + 3i}$ [5 marks]

END OF EXAMINATION