University of Swaziland

Re-sit Examination – July 2018

BSc Env. Health I, BSc Comm. Health Nurs. 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 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.

A.1 a. Find the value of

i. $\log_{\frac{1}{2}} 76\,543$ [2 marks]

ii. $\sum_{n=0}^{50}(5n+7)$ [3 marks]

iii. $\sum_{n=0}^{40} 2\,000\left(\frac{9}{8}\right)^n$ (correct to 2 d.p.) [5 marks]

b. Solve for x

i. $\log_x 8 = -3$ [3 marks]

ii. $5^{x-3} = 800$ (correct to 2 d.p.) [3 marks]

c. Evaluate

$$(1-2i)(2i-1)+(3-4i)(4i+3)$$

and leave your answer in the form $a+ib$. [5 marks]

d. Consider the straight line segment from $A(-3,3)$ to $B(2,-7)$. Find the equation of a straight line perpendicular to AB and passing through $(3,-2)$. [5 marks]

e. Given the matrices

$$A=\begin{pmatrix} 3 & -2 & 1 \\ -1 & 0 & -4 \end{pmatrix},\ B=\begin{pmatrix} -3 & 2 & -1 \\ 2 & -7 & 2 \end{pmatrix},\ C=\begin{pmatrix} -1 & 2 \\ 1 & -3 \end{pmatrix},$$

find

$$AB^T-2C.$$ [6 marks]

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

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

g. In the binomial expansion of

$$(x^2+2y)^{16},$$

find the first 3 terms [8 marks]

h. Given that $\sin A=-\frac{1}{2}$ and $\cos A>0$, find the *exact* value of $\tan A$. [5 marks]

Section B

Answer ANY 2 Questions in this section

B.1 a. Given the vectors $\boldsymbol{A} = 2\hat{i} - \hat{i} + 3\hat{i}$ and $\boldsymbol{B} = -2\hat{i} + 5\hat{i}$ find

i. the angle made by the vectors $\boldsymbol{A}$ and $\boldsymbol{B}$. [5 marks]

ii. $\boldsymbol{A} \times \boldsymbol{B}$ [6 marks]

b. Use Cramer's rule to solve the simultaneous system

$$\begin{aligned} 3y - 2z &= -1 \\ x - 3y + z &= 0 \\ x + 3z &= 7. \end{aligned}$$

[14 marks]

B.2 a. Consider the triangle whose vertices are given by $A(3, -2)$, $B(-4, 2)$ and $C(-5, -5)$. Find

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

ii. the interior angle $\hat{A}$ [5 marks]

iii. the perimeter of the triangle [5 marks]

iv. the area of the triangle [3 marks]

b. Find the equation of the circle centred at $(5, -3)$, passing through the origin. [7 marks]

B.3 a. Solve for x given

i. $7^{x-3} = 9^{4-x}$ [6 marks]

ii. $\ln(7x - 19) - \ln x = \log_b 1$ [5 marks]

b. Copy the following table and calculate the missing values in the cells labelled i. and ii. (correct to 2 d.p.). [2,3 marks]

Item	*pH*	$[H^+]$
Vinegar	i.	$3.95 \times 10^{-4} M$
Blood	7.35	ii.

where $[H^+]$ stands for the concentration of hydronium ions.

c. On 01 January 2017, a new species of fish is introduced into a lake. Its population grows according to the formula

$$P(t) = \frac{400}{1 + 7e^{-0.015t}}$$

where t is the number of years after 01 January 2017. Find

i. population of the fish on 30 June 2021 [3 marks]

ii. the time required (in years and months) for the fish population to reach 350. [6 marks]

B.4 a. Find the value(s) of x for which the following sequence is an AP

$$x+2,\ x+3,\ 2x^2+1. \qquad \text{[6 marks]}$$

b. In the binomial expansion of

$$\left(x^2 - \frac{y^3}{x}\right)^{20},$$

find

i. the 6th term [4 marks]

ii. the middle term [4 marks]

c. A parent sets up a fund for his child by making deposits at the end of each month, starting in January 2017. The following table shows the first few deposits.

Month	Jan '17	Feb '17	March '17	April '17	May '17
Deposits	500	550	600	650	700

If the deposits follow the trend shown above for 10 years, find

i. the deposit at the end of February 2025 [2 marks]

ii. the total deposits in the first 5 years [4 marks]

iii. the total deposits during the years 6 to 10, inclusively [5 marks]

END OF EXAMINATION