University of Swaziland

Final Examination – December 2017

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.

Section A

Answer ALL Questions in this section

A.1 a. Find the value of

i. $\log 10^m + \ln e^{2m-1}$ [3 marks]

ii. $\sum_{n=0}^{70}(7n+10)$ [3 marks]

iii. $\sum_{n=0}^{\infty} 20\left(\frac{4}{9}\right)^n$ [3 marks]

b. Solve for x

i. $\ln(4x-11)=0$ [3 marks]

ii. $3^{x-2}=700$ (correct to 2 d.p.) [3 marks]

c. Evaluate

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

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

d. Consider the straight line segment from $A(-6,3)$ to $B(5,-8)$. Find the equation of a straight line parallel to AB and passing through $(-6,-2)$. [4 marks]

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

$$\frac{3x^4-2x^2+17}{x+2}.$$ [5 marks]

f. In the binomial expansion of

$$\left(x+\frac{2}{x}\right)^{16},$$

find the first 3 terms. [7 marks]

g. Given the vectors $\boldsymbol{A}=7\hat{i}-4\hat{i}+3\hat{i}$ and $\boldsymbol{B}=-\hat{i}+4\hat{i}+5\hat{i}$ find

i. $|\boldsymbol{A}+\boldsymbol{B}|$ [3 marks]

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

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

Section B

Answer ANY 2 Questions in this section

B.1 a. Find the *exact* value of

$$\left(\sin 795^0 - \cos 795^0\right)^2. \qquad \text{[6 marks]}$$

b. Prove that

$$1 - \frac{\sin^2 A}{1 + \cos A} = \cos A. \qquad \text{[7 marks]}$$

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

$$\begin{aligned} 2x - y + z &= -3 \\ 3y + 2z &= 0 \\ -4x + 5z &= -19. \end{aligned}$$

[12 marks]

B.2 a. Consider the triangle whose vertices are given by $A(4, 2)$, $B(-4, 12)$ and $C(0, -5)$. 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 $(-4, 3)$, passing through the origin, and express it in *general form.* [7 marks]

B.3 a. Solve for x given

$$5^{2x-3} = e^{5-x}.$$ [6 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*	$[H^+]$
Baking Soda	i.	$3.85 \times 10^{-9} M$
Orange Juice	2.1	ii.

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

c. On 01 January 2017, a sum of E12,000 is invested in an account that pay 7.3% interest p.a. compounded monthly. Find

i. the total amount in the account on 30 June 2021 [2 marks]

ii. the time required (in years and months) when the total amount will be double the initial invesment. [5 marks]

d. On 01 January 2015, a photocopier is bought valued at E120,000. If it depreciates continuously at 9.1% p.a., its value is given by

$$V(t) = 120\,000e^{-0.098t},$$

where t is its age in years. Find

i. the book value of the photocopier on 30 June 2018 [2 marks]

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

B.4 a. Consider the polynomial

$$P(x) = x^4 + Ax^3 + Bx^2 + 4,$$

where A and B are constants. You are given that $x + 1$ is a factor of $P(x)$ while dividing $P(x)$ by $x + 3$ leaves a remainder of 40.

i. Find the values of A and B. [7 marks]

ii. Hence, factorise $P(x)$ [5 marks]

b. After the launch of a new product on 01 January 2017, the sales (in thousands) in the first few months are as shown

Month	Jan '17	Feb '17	March '17	April '17	May '17
Sales	100	90	81	72.9	65.61

If the sales follow the trend shown above for the first 10 years, find

i. the number of sales in February 2025 [3 marks]

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

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

END OF EXAMINATION