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# University of Eswatini



## Re-sit Examination – January 2019

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### 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. Without using a calculator, showing all your steps, find the value of

i.  $\frac{9!}{4! \times 5!}$

ii.  $2 \log 5 + \log 28 - \log 7$  [3,3 marks]

b. Consider the straight line with equation

$$8x + 2y = 9.$$

i. Find the gradient  $m$  and  $y$ -intercept  $c$  for the line [3 marks]

ii. Make a sketch of the line [2 marks]

c. Evaluate the determinant

$$\begin{vmatrix} -3 & 2 & -4 \\ 0 & 0 & 3 \\ 2 & -1 & 5 \end{vmatrix}. \quad [7 \text{ marks}]$$

d. Consider the *arithmetic progression*

$$2, 7, 12, 17, \dots$$

Find the

i. formula for the  $n$ -th term [4 marks]

ii. 312th term [2 marks]

iii. sum of the first 200 terms [3 marks]

e. In the binomial expansion of

$$(x + y^2)^{20},$$

find the first 3 terms. [7 marks]

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

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

g. The **pH** of an aqueous solution is given by  $\text{pH} = -\log[H^+]$ , where  $[H^+]$  is the concentration of hydronium ions. Copy the following table and calculate the missing values in the cells labelled i. and ii. (correct to 2 d.p.). [2,4 marks]

Item	pH	$[H^+]$
Grapefruit	i.	$5.01 \times 10^{-3} M$
Bleach	12.3	ii.

h. Simplify

$$5i + 6 + 2i(2 - 3i). \quad [3 \text{ marks}]$$

## Section B

**Answer ANY 2 Questions in this section**

**B.1 a.** Given the matrices

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

work out

i.  $2A - 3B$  [3 marks]

ii.  $5A + 2B^T$  [3 marks]

iii.  $AB^T$  [3 marks]

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

$$\begin{aligned} 2x - 3y + z &= -1 \\ 5y - 3z &= 0 \\ -4x + 5z &= 19. \end{aligned}$$

[16 marks]

**B.2 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  $\hat{A}$  [4 marks]

iii. the perimeter of the triangle [4 marks]

iv. the area of the triangle [3 marks]

**b.** Consider the binomial expansion of

$$\left(x^2 - \frac{y^2}{x}\right)^{18}.$$

Find

i. the *first four (4)* terms and simplify term by term [6 marks]

ii. the *11th term* [3 marks]

**B.3** a. Express in terms of  $\log a$ ,  $\log b$  and  $\log c$ .

$$\log \left( \frac{a^2 \sqrt{b}}{c^4} \right). \quad [3 \text{ marks}]$$

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

i.  $7^{2x-9} = 785$  [5 marks]

ii.  $\log_3(4x + 231) - \log_3 x = 4$  [5 marks]

c. On 01 January 2019, a sum of E12,000 is invested in an account that pay 7.3% interest p.a. compounded monthly. The amount grows according to the formula

$$A = 12000 \left( 1 + \frac{0.073}{12} \right)^{12t},$$

where  $t$  is the number of years from 01 January 2019. 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 investment. [5 marks]

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

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

**B.4** a. Find the value of each sum

i.  $\sum_{n=1}^{100} (7n + 2)$  [4 marks]

ii.  $2 + 6 + 18 + \dots + 354, 294$  [5 marks]

b. Find the value(s) of  $x$  for which the sequence

$$x - 1, 2x - 2, 3x - 1$$

forms a *geometric progression*. [7 marks]

c. A parent opens a saving account for their child by making monthly deposits, beginning on 31 January 2018. The following table shows the first few deposits.

Month	Jan '18	Feb '18	March '18	April '18	May '18
Deposit	200	210	220	230	240

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

i. the monthly deposit on 31 December 2021 [3 marks]

- ii. the month when the montly deposit will be E1,000 [3 marks]
- iii. the *total* deposited in 10 years [3 marks]

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END OF EXAMINATION

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