
University of Eswatini



Final Examination – November 2018

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.** i. State 3 properties (laws) of logarithms. [3 marks]
 ii. Express the equation $4 + \log_2 x = n$ in exponential form. [3 marks]
 iii. Without using a calculator, evaluate $\log 75 + 3 \log 2 - \log 6$. [5 marks]
- b.** Evaluate the determinant $\begin{vmatrix} -4 & 2 & 3 \\ 5 & -1 & 0 \\ 6 & 9 & -7 \end{vmatrix}$. [6 marks]
- c.** Evaluate $3 + 4i + \frac{8}{1+i}$ and leave your answer in the form $a + ib$. [5 marks]
- d.** Find the equation of the straight line passing through $(-6, -2)$ and *perpendicular* to the straight line $4x - 2y = 7$. [7 marks]
- e.** Find the remainder when $P(x) = x^4 - 2x^2 - 7x + 17$ is divided by
 i. $x - 3$ [2 marks]
 ii. $x + 2$ [2 marks]
- f.** In the binomial expansion of $\left(x + \frac{1}{x}\right)^{16}$, find the first 3 terms. [7 marks]
- g.** Given the vectors $A = 7\hat{i} - 4\hat{j} + 3\hat{k}$ and $B = -\hat{i} + 4\hat{j} + 5\hat{k}$ find
 i. $|A + B|$ [3 marks]
 ii. $A \cdot B$ [3 marks]
- h.** Given that $\sin \theta = -\frac{5}{13}$ while $\tan \theta > 0$, find the *exact* values of $\cos \theta$ and $\tan \theta$. [4 marks]

Section B

Answer ANY 2 Questions in this section

- B.1** a. Given the matrices $A = \begin{pmatrix} 2 & -3 & 1 \\ 4 & 0 & -2 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & -1 \\ 4 & 2 \\ -2 & 1 \end{pmatrix}$, work out
- i. $3A^T - 2B$ ii. $5A^T + 4B^T$ iii. AB iv. $A^T B$ [7 marks]
- b. Given the vectors $A = 5\hat{i} + 6\hat{j} - 2\hat{k}$ and $B = 5\hat{i} - 12\hat{k}$, find
- i. $A \times B$ [6 marks]
- ii. the angle between the vectors A and B (correct to 1 d.p.) [6 marks]
- c. Prove that
- $$\tan A + \frac{\cos A}{1 + \sin A} = \sec A. \quad [6 \text{ marks}]$$

- 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* [4 marks]
- ii. the interior angle \hat{A} [4 marks]
- iii. the perimeter of the triangle [4 marks]
- iv. the EXACT area of the triangle [2 marks]
- b. Consider the quadratic function
- $$y = 85 - 24x - 4x^2.$$
- i. Find the coordinates of the x - and y -intercepts. [4 marks]
- ii. Find the coordinates of the turning point. [3 marks]
- iii. Make a sketch of the graph of the function. [4 marks]

B.3 a. Solve for x given

i. $7^{2x-5} = 97$ (correct to 2 d.p.) [3 marks]

ii. $\log_3(x^2 + 2) = 3$ [4 marks]

- b. On 01 January 2015, a photocopier is bought valued at E120,000. If it depreciates continuously at 9.8% 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. [4 marks]

- c. Find the quotient and remainder of

$$\frac{x^4 - 4x^3 + 3x - 11}{x^2 - 2}. \quad [6 \text{ marks}]$$

- d. Given that both
- $x - 2$
- and
- $x + 3$
- are factors of
- $P(x) = x^3 + Ax^2 + Bx - 12$
- , find the values of
- A
- and
- B
- . [6 marks]

B.4 a. Find the value of each sum

i. $\sum_{n=5}^{1000} (8n - 3)$

ii. $\sum_{n=0}^{500} 50(1.01)^n$ (correct to 1 d.p.)

[3,3 marks]

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

$$x - 1, x + 3, 2x^2 + 1$$

forms an arithmetic progression. [5 marks]

- c. A child is given one big push on the swing, riding through a 4m swing. If each subsequent swing is 1.5% shorter than the previous, find

i. the length of the 50th swing (in cm correct to 2 d.p.) [2 marks]

ii. the total distance travelled by the child before the swing stops. [3 marks]

- d. In the binomial expansion of

$$\left(x^2 - \frac{y^2}{x^3}\right)^{19},$$

find

i. the 11th term [3 marks]

ii. the term involving x^{-42} [6 marks]

END OF EXAMINATION