
University of Swaziland



Re-sit Examination – July 2016

BSc in Environmental 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 in Section B.
4. Show all your working.

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. $\sum_{n=-51}^{51} (45 - 15n)$ [5 marks]

ii. $\sum_{n=0}^9 3^n$ [5 marks]

b. Find the first 4 terms of the binomial expansion of

$$\left(x - \frac{1}{x}\right)^{10}. \quad [8 \text{ marks}]$$

c. Evaluate and leave your answer in the form $a + ib$.

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

ii. $\frac{4i - 3}{3i + 4}$ [6 marks]

d. Consider the straight line with equation $4x - 3y = -15$. Find the

i. gradient of the line [3 marks]

ii. angle of inclination of the line (correct to 1 d.p.) [3 marks]

iii. y -intercept of the line [1 mark]

e. Solve for x

i. $\log_7(5x - 1) = 2$ [4 marks]

ii. $e^{x-2} = 4237$ [4 marks]

f. Given the matrices $A = \begin{pmatrix} 1 & 2 & -1 \\ -2 & 0 & 3 \end{pmatrix}$ and $B = \begin{pmatrix} 5 & -4 \\ 3 & 7 \end{pmatrix}$, find the value of

i. $|B|$ [2 marks]

ii. $A^T B$ [6 marks]

Section B

Answer ANY 2 Questions in this section

B.1 a. Use Cramer's rule to solve

$$\begin{aligned}x &+ 6z = 18 \\2x + y + z &= 3 \\3x - y &= 5.\end{aligned}$$

[17 marks]

b. Given the vectors $A = 4\hat{i} - 3\hat{j}$ and $B = -5\hat{i} + 12\hat{k}$, find

- i. $|A| + |B|$ [3 marks]
ii. $|A + B|$ [5 marks]
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B.2 a. In the GP $18, -12, 8, \dots$, find the position of the term $\frac{2948}{6561}$ [5 marks]

b. Find the value of

$$\sum_{n=0}^{\infty} 75 \left(-\frac{2}{3}\right)^n$$

[3 marks]

c. Find the value(s) of x such the the sequence

$$3x^2 + x + 1, 2x^2 + x, 4x^2 - 6x + 1$$

is a arithmetic progression. [7 marks]

d. A parent sets up a fund for their son by making monthly deposits. If they deposit E500, E510, E520 at the end of the first, second, and third months, respectively, (the amounts increasing by E10 every month), find

- i. the instalment after 3 years [2 marks]
ii. the time when the instalment will reach E2,000 [3 marks]
iii. the *total amount* deposited after 15 years (ignoring interest accrued). [5 marks]
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- B.3** a. Consider two straight lines with equations $\ell_1 : 4x - 7y = 29$ and $\ell_2 : 9x + 5y = 3$, respectively. Find
- i. the *point* of intersection of ℓ_1 and ℓ_2 [7 marks]
 - ii. the *angle* of intersection of ℓ_1 and ℓ_2 (correct to 1 d.p.) [8 marks]
- b. Find the equation of the circle with centre $C(-12, 5)$ passing through the origin, leaving your answer in *general form*. [5 marks]
- c. Given that $P(-\sqrt{5}, -2)$ is on the terminal side of the angle θ , find the *exact* values of $\sin \theta$, $\cos \theta$ and $\tan \theta$. [5 marks]
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B.4

- a. Solve for x (expressing non-exact answers correct to 3 s.f.)
- i. $e^{2x-1} = 9000$ [6 marks]
 - ii. $\ln(9 - 2x) - \ln(3x - 1) = 0$ [6 marks]
- b. Express as a single logarithm

$$2 \ln(ab^2c^3) - \ln(a^3b^4c^{-6}). \quad [5 \text{ marks}]$$

- c. The number of people infected by an airborne infection in a city is given by

$$P(t) = 2,500(1 - e^{-0.08t})$$

where t is the number of days after the initial infection. Find

- i. the number of people infected after 7 days [2 marks]
 - ii. how long it takes before 75% of the population is infected. [6 marks]
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