University of Swaziland

Supplementary Examination, July 2012

Dip. Env. Health I, Dip. Env. Health IV

Title of Paper : Algebra for Health Sciences
Course Number : HSM111/EHM106
Time Allowed : Two (2) hours
Instructions :

1. This paper consists of SIX questions.
2. Each question is worth 25%.
3. Answer ANY FOUR questions.
4. Show all your working.

THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GIVEN BY THE INVIGILATOR.

Question 1

(a) Express

$$\ln \sqrt{\frac{a^2 b^{-4}}{c^{-6}}}$$

in terms of $\ln a$, $\ln b$ and $\ln c$. [7 marks]

(b) Find the 15^{th} term in the binomial expansion of

$$\left(2x - \frac{1}{x}\right)^{18}.$$ [8 marks]

(c) Find all real roots of $x^3 + 3x^2 - 4 = 0$. [10 marks]

Question 2

(a) Solve for x

i. $\left(\frac{3}{2}\right)^{2x-1} = \frac{8}{27}$ [4 marks]

ii. $\log_3(x^2 - 16) = 2$ [4 marks]

(b) Expand and simplify term by term

$$\left(a^2 - \frac{1}{a}\right)^5.$$ [10 marks]

(c) Given that the second term of an AP is 11 while the fifth is -10, find the first term. [7 marks]

Question 3

(a) Consider the formula

$$R = A\left(1 - e^{-nt}\right).$$

i. Work out the value of R when $A = 400$, $n = 0.045$ and $t = 20$. [3 marks]

ii. Make t the subject of the formula. [8 marks]

(b) Consider the matrices

$$A = \begin{pmatrix} 2 & -1 & 1 \\ 3 & 0 & -4 \\ 1 & -2 & 5. \end{pmatrix}, \quad B = \begin{pmatrix} 1 & 0 & 3 \\ 2 & -1 & -2 \\ 8 & 3 & -4. \end{pmatrix}$$

Work out

i. AB [9 marks]

ii. $|B|$ [5 marks]

Question 4

(a) Find the exact values of

i. $\sin(-1980^0)$ [3 marks]

ii. $\cos(255^0)$ [6 marks]

(b) Find the value of

$$\sum_{n=0}^{\infty} \left(\frac{4}{5}\right)^n.$$ [8 marks]

(c) Find the centre and radius of the circle

$$x^2 + y^2 - 8y + 7 = 0.$$ [8 marks]

Question 5

(a) Use the quadratic formula to solve

$$x^2 + 2x + 5 = 0.$$ [8 marks]

(b) Find the value of

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

and express your answer in the form $a + ib$.

[8 marks]

(c) Simplify

$$\sin(A + 90^0) + \cos(A - 90^0).$$ [9 marks]

Question 6

(a) Find the equation of the striaght line perpendicular to the line $2x - y - 6 = 0$ and passing through the point $(-4, 3)$. [8 marks]

(b) Evaluate

$$1 + i - 2i^{10} + 3i^{19} - 4i^{29}$$

and express your answer in the form $a + ib$.

[8 marks]

(c) Use synthetic division to evaluate

$$(x^5 + x^3 + 2x - 10) \div (x - 2).$$ [9 marks]
