



UNIVERSITY OF SWAZILAND
Faculty of Health Sciences

DIPLOMA IN ENVIRONMENTAL HEALTH
FINAL EXAMINATION PAPER 2007/2008

TITLE OF PAPER	:	ALGEBRA FOR HEALTH SCIENCES
COURSE CODE	:	HSM 111
DURATION	:	2 HOURS
MARKS	:	80
INSTRUCTIONS	:	READ THE QUESTIONS & INSTRUCTIONS CAREFULLY
	:	ANSWER ANY FOUR (4) QUESTIONS
	:	EACH QUESTION CARRIES 20 MARKS
	:	WRITE NEATLY & CLEARLY
	:	SHOW ALL YOUR WORKING
	:	NO PAPER SHOULD BE BROUGHT INTO NOR OUT OF THE EXAMINATION ROOM
	:	BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY THE INVIGILATOR

Question 1

- (a) Use the method of long division to work out

$$\frac{x^5 + 2x^4 - 2x^2 + 2x - 8}{x^2 + 1}. \quad [10 \text{ marks}]$$

- (b) The number of people infected with flu in a certain university campus is given by

$$I(t) = 50,000(1 - e^{-0.008t}),$$

where t is the number of days after the initial outbreak.

- (i) How many people are infected after 10 days?
[3 marks]
- (ii) After how many days will 50% of the campus be infected?
[7 marks]

Question 2

- (a) Solve for x

i. $3^{4x-7} = \frac{1}{9}$ [6 marks]

ii. $\log_2(2x + 2) = 2$ [4 marks]

- (b) Prove that

$$\tan \alpha + \frac{\cos \alpha}{1 + \sin \alpha} = \sec \alpha. \quad [10 \text{ marks}]$$

Question 3

- (a) Find all roots of $x^3 - 6x^2 + 11x - 6 = 0$. [10 marks]

- (b) Find the middle term of the binomial expansion of
 $\left(x^2 - \frac{1}{x}\right)^{16}$. [6 marks]

- (c) If $\sin \alpha = \frac{3}{5}$ and the angle α lies in the second quadrant, find the exact value of $\cos \alpha$. [4 marks]

Question 4

- (a) Given the complex numbers $z_1 = 1 - i$, $z_2 = 3 - 4i$, $z_3 = -2i$, compute each of the following and express in the form $a + ib$.

i. $4z_1 - \bar{z}_2$ ii. $z_1 z_2$ iii. $|z_2|$ iv. $(z_3)^5$ v. $\frac{z_3}{z_1}$
[10 marks]

- (b) Find the coordinates of the centre and the radius of the circle

$$x^2 + y^2 - 10x + 8y + 5 = 0. \quad [10 \text{ marks}]$$

Question 5

- (a) Use the quadratic formula to solve

$$x^2 + 8x + 15 = 0. \quad [8 \text{ marks}]$$

- (b) Solve

$$\log_2(x + 2) + \log_2(x - 5) = 3. \quad [8 \text{ marks}]$$

- (c) Find the value of the infinite sum

$$4 - 2 + 1 - \frac{1}{2} + \dots \quad [4 \text{ marks}]$$

Question 6

- (a) Given the matrices

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

$$C = \begin{pmatrix} 6 & -2 \\ -1 & 4 \end{pmatrix}, D = \begin{pmatrix} 1 & -2 & 1 \\ 4 & 0 & 2 \end{pmatrix}.$$

Perform the following operations where possible. If an operation is impossible, clearly state so.

i. $A + 2B$ ii. $4B - 2C^T$, iii. CD , iv. DB ,
v. AD^T , vi. DA . [12 marks]

(b) Find the equation of a straight line that is perpendicular to $4y + 8x = 3$ and passes through the point $(5, -2)$.
[8 marks]

Question 7

Use Cramer's rule to solve for x , y and z , given

$$\begin{aligned}x + y + 2z &= 4 \\2x + 3y + 3z &= 5 \\3x + 3y + 7z &= 14\end{aligned}$$

[20 marks]
