



UNIVERSITY OF SWAZILAND
Faculty of Health Sciences

DIPLOMA IN ENVIRONMENTAL HEALTH
MAIN EXAMINATION PAPER 2010/2011

TITLE OF PAPER	:	ALGEBRA FOR HEALTH SCIENCES
COURSE TITLE	:	HSM 111
DURATION	:	2 HOURS
MARKS	:	80
INSTRUCTIONS	:	READ 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

1. (a) Use the synthetic division method to divide

$$x^5 - 3x^3 + 4x - 3 \quad \text{by} \quad x + 2$$

[5 marks]

- (b) Find all the roots of the polynomial

$$x^4 - x^3 - 19x^2 + 49x - 30 = 0$$

[10 marks]

- (c) Determine the centre and radius of the circle

$$x^2 - 6x + y^2 + 10y + 25 = 0$$

[5 marks]

QUESTION 2

2. (a) The population count in a bacterial culture was 400 after 2 hours and 25 600 after 6 hours. Assuming that the population growth is exponential (i.e of the form $P = P_0e^{kt}$),

i. What is rate of growth of the population of the bacteria? [4 marks]

ii. What is the initial population at time $t = 0$ hours? [2 marks]

iii. When will the number of bacteria exceed 100 000? [4 marks]

- (b) Solve each of the following equations for x

i. $4^{2x-3} = 64$ [5 marks]

ii. $\log_2(x - 1) + \log_2(x - 2) = \log_2(2x - 4)$ [5 marks]

QUESTION 3

3. (a) i. Prove the following identity

$$\frac{\sin x}{1 + \cos x} + \frac{1 + \cos x}{\sin x} = 2 \csc x$$

[5 marks]

- ii. Solve the following trigonometric equations giving all solutions between 0° and 360°

$$2 \cos^2 x - \sin x - 1 = 0$$

[5 marks]

- (b) Find an equation of the line parallel to the line $y + 2x = 3$ and passing through the point (1,3) [4 marks]
- (c) Find the equation of a straight line passing through the intersection of $3x - y = 9$ and $x + 2y = -4$, parallel to $3 = 4y + 8x$ [6 marks]

QUESTION 4

4. (a) Expand $(2x + y^2)^6$ and simplify term by term. [8 marks]
- (b) Find the middle term of $\left(\frac{1}{x} - x^2\right)^{12}$ [4 marks]
- (c) By using the formula for the r th term of a general binomial expansion, find the term involving x^{14} in the expansion of $\left(\frac{2}{x} - x^2\right)^{10}$ [8 marks]

QUESTION 5

5. (a) Use the long division method to divide

$$x^5 + 4x^4 - 3x^3 + 3x^2 + 4x - 3 \quad \text{by} \quad x^2 + x + 1$$

[6 marks]

- (b) The population of Mbabane varies according to the equation

$$P = 100000e^{0.15t}$$

where t is time in years. Find the time it will take for the population to double.

[7 marks]

- (c) Find the interest rate needed for E6 000 to grow to E8 000 in 3 years if the interest is compounded annually. [7 marks]

QUESTION 6

6. (a) Find the sum of the following series

$$-21, -9, 3, \dots, 219$$

[7 marks]

- (b) Convert the repeating decimal $1.21212121\dots$ into an equivalent common fraction.

[7 marks]

- (c) If the 8th term of a geometric progression is 243 and the 5th term is 9, find the first three terms of the geometric progression.

[6 marks]

QUESTION 7

7. (a) If the matrices A and B be given by

$$A = \begin{pmatrix} 1 & -2 \\ 6 & 5 \\ 3 & 1 \end{pmatrix}, \quad B = \begin{pmatrix} 1 & 5 \\ 1 & 3 \\ 3 & 1 \end{pmatrix}$$

calculate the following

i. A^T [2 marks]

ii. $A^T B$ [4 marks]

- (b) Use Cramer's rule to solve the following system of equations

$$x + 2y + z = 1 \quad [14 \text{ marks}]$$

$$x - y - z = 0$$

$$2x + y + z = 3$$

END OF EXAMINATION
