



**UNIVERSITY OF SWAZILAND**  
**Faculty of Health Sciences**

**DIPLOMA IN ENVIRONMENTAL HEALTH**  
**SUPPLEMENTARY EXAMINATION PAPER 2010/2011**

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

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

### QUESTION 1

1. (a) Solve each of the following equations for  $x$

i.  $3^{3x} = 81$  [5 marks]

ii.  $\log_2(x + 6) = 2$  [5 marks]

(b) Find all the roots of the following polynomial.

$$x^3 - 5x^2 - 2x + 24 = 0$$

[10 marks]

### QUESTION 2

2. (a) Prove the trigonometric identity

$$\tan A + \cot A = \sec A \csc A$$

[5 marks]

(b) Solve the trigonometric equation

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

giving all solutions between  $0^\circ$  and  $360^\circ$ . [5 marks]

(c) The fourth term of an A.P. is 14 and the ninth term is 34.

Find the thirteenth term. [5 marks]

(d) Find the sum of the series  $3 + 7 + 11 + \dots + 123$  [5 marks]

### QUESTION 3

3. (a) Find the centre and radius of the circle described by the equation [7 marks]

$$x^2 + y^2 - 4x + 2y + 1 = 0$$

- (b) Given the points  $A = (-3,4)$  and  $B = (1,3)$ . Find the following;
- i. The equation of the line passing through  $A$  and  $B$ . [7 marks]
- ii. The equation of the circle with centre  $A$  and passing through the point  $B$ . [6 marks]

### QUESTION 4

4. (a) Expand and simplify  $(3x^2 + 2y)^5$  [9 marks]
- (b) Find the 20th term of the geometric progression 2, 10, 50, 250,.... [6 marks]
- (c) Convert  $1.414141\dots$  into an equivalent common fraction [5 marks]

### QUESTION 5

5. A scientist starts with 100 bacteria in an experiment. After 5 days, she discovers that the population has grown to 350. Given that the population after time  $t$  days is governed by the formula,  $P = P_0e^{kt}$  where  $P_0$  is the initial population.  $k$  is the growth rate.
- (a) Prove that the growth rate  $k = 0.25055$ . [7 marks]
- (b) Find the bacterial population after 15 days. [6 marks]
- (c) After how many days will the population reach 1000? [7 marks]

QUESTION 6

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

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

[6 marks]

- (b) Use the long division method to divide

$$x^6 + 7x^4 + 6x^2 - 6x - 10 \quad \text{by} \quad x^2 + 1$$

[6 marks]

- (c) How long will it take E2900 to grow to E5900 if the annual rate of interest is 16.5% and the interest is compounded monthly? [4 marks]

- (d) At what interest rate (compounded annually) will a sum of E4000 grow to E6000 in 5 years? [4 marks]

QUESTION 7

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

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

calculate the following

- i.  $A^T$  [3 marks]  
ii.  $A^T B$  [5 marks]

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

$$\begin{aligned} 2x_1 + x_2 - x_3 &= 5 \\ 3x_1 - 2x_2 + 2x_3 &= -3 \\ x_1 - 3x_2 - 3x_3 &= -2 \end{aligned}$$

[12 marks]

END OF EXAMINATION

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