



**TECHNICAL UNIVERSITY OF MOMBASA**  
**Faculty of Applied & Health**  
**Sciences**

DEPARTMENT OF MATHEMATICS & PHYSICS

AMA 1050: FUNDAMENTALS OF MATHEMATICS

**END OF SEMESTER EXAMINATION**

**SERIES: DECEMBER 2013**

**TIME ALLOWED: 2 HOURS**

**Instructions to Candidates:**

You should have the following for this examination

- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FIVE** questions

Answer question **ONE (COMPULSORY)** and any other **TWO** questions

Maximum marks for each part of a question are as shown  
This paper consists of **FOUR** printed pages

### Question One (Compulsory)

a) Solve the following simultaneous equation:

$$y - 2x = 0$$

$$x^2 + y^2 - 2x - 3y = -3$$

(4 marks)

b) Find the value of x

(3 marks)

$$3^{2x+5} = 17$$

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

c) Given that  $2x - 3y = 5$  and  $2y = -3 + x$  find the value of AB hence or otherwise solve the equation:

$$2x - 3y = 5 \quad \text{and} \quad 2y = -3 + x$$

(3 marks)

d) Convert:

(i)  $(11100111)_2$  to hexadecimal

(2 marks)

$$(A3D9)_{16}$$

(ii)  $(177.523)_{10}$  to binary

(2

marks)

$$(177.523)_{10}$$

(iii)  $(177.523)_{10}$  to octal 3 d.p

(2 marks)

e) (i) Differentiate between a sequence and a series.

(2 marks)

(ii) The 3<sup>rd</sup> term of a G.P is 9 and the 6<sup>th</sup> term is 243. Find the first term and the common ratio.

(3 marks)

$$\cos^2 \theta + 3 \cos \theta = 3 \quad 0 \leq \theta \leq 360^\circ$$

f) Solve for  $\theta$  if  $\cos^2 \theta + 3 \cos \theta = 3$  and  $0 \leq \theta \leq 360^\circ$

(4 marks)

g) (i) The blood groups of 200 people is distributed as follows: 50 have type A, 65, type B, 70 are of O group and 15 are type AB. If a person from this group is selected at random, what is the probability that this person has blood group O

(2 marks)

(ii) Draw a pie chart to represent the 4 blood groups above.

(3 marks)

### Question Two

a) Derive the cosine formulae

(3 marks)

b) A triangle XYZ is such that  $x = 13.4\text{cm}$   $z = 5\text{cm}$  and  $\angle XYZ = 57.7^\circ$ . Solve the triangle.

(7 marks)

$$y = 2 \cos \theta \quad y = \sin \frac{1}{2} \theta$$

- c) Complete the table below for the trigonometric function and **(2 marks)**

$\theta$	0	30	60	90	120	150	180	210	240	270	300	330	360
$y = \sin \frac{1}{2} \theta$	0												
$y = 2 \cos \theta$	2												

$$y = \sin \frac{1}{2} \theta \quad y = 2 \cos \theta$$

- (i) Using the table below the graph of and on the same axes **(5 marks)**

(scale: 1cm rep  $30^\circ$  on x-axis and 2cm rep 1 unit on y axis)

$$\sin \frac{1}{2} \theta - 2 \cos \theta = 0$$

- (ii) Use your curve to find solution to the equation **(1 mark)**

$$y = 2 \cos \theta$$

- (iii) State amplitude of curve **(1 mark)**

$$y = \sin \frac{1}{2} \theta$$

- (iv) State period of curve **(1 mark)**

### Question Three

$$(3n + 5)$$

- a) The nth term of sequence is given by:

- (i) Write down the first 6 terms of the sequence **(2 marks)**

- (ii) Find the sum of the first 18 terms of the series **(2 marks)**

$$S_n = \frac{1}{2}(13n + 3n^2)$$

- (iii) Show that the sum of n terms is given by **(2 marks)**

$$S_n > 445$$

- (iv) Determine the least value of n for which **(4 marks)**

- b) A ball is allowed to drop from a height of 3m onto a horizontal ground. It rebounds to  $\frac{3}{4}$  of its previous height. Find to the nearest metres the total distance the ball will have travelled when it hits the ground for the 8<sup>th</sup> time. **(3 marks)**

- c) Two arithmetic series are such that their common differences are 9 and 3 respectively. If their first terms are 2 and 5 respectively. Find the number of terms of each series that would give a common sum. **(7 marks)**

### Question Four

- a) (i) What is statistics **(1 mark)**  
 (ii) State THREE method of collecting data **(3 marks)**

(iv) At a police check, the speed in km/h of the first 50 vehicles were recorded as shown below:

Speed	No. of Vehicles
10 – 19	3
20 – 29	1
30 – 39	2
40 – 49	5
50 – 59	6
60 – 69	11
70 – 79	9
80 – 89	8
90 – 99	3
100 – 109	2

- (i) Draw a histogram for the data **(4 marks)**  
(ii) On the same diagram, draw a frequency polygon **(2 marks)**

- b) (i) Differentiate between an independent event and a mutually exclusive event. **(2 marks)**  
(ii) A family has 2 children (not twins) what is the probability that the younger child is a girl given that at least one of the children is a girl (assume that boys and girls are equally liked to be born) **(3 marks)**
- c) Ten percent of transistors manufactured by a company are defective. If three transistors are chosen at random. Find the probability (using a tree diagram) that:  
(i) 1 will be defective  
(ii) 2 will be defective **(5 marks)**

### Question Five

- a) Differentiate between bits and bytes. **(2 marks)**  
b) Name the FOUR number systems **(2 marks)**  
c) Convert  $11010.01_2$  to decimal **(2 marks)**  
d) Convert ADC16 to Binary **(2 marks)**  
e) Convert  $98.125_{10}$  to octal to 1 dp **(2 marks)**

$$(\sqrt{p} + \sqrt{q})^2 = p + q + 2\sqrt{pq}$$

- f) Show that **(2 marks)**

$$p = \begin{pmatrix} a & 2a \\ a-1 & a+1 \end{pmatrix}$$

- g) Given is a singular matrix find the two possible values of a **(3 marks)**

- h) Solve for Y without using tables:

$$2 + \log_2^3 + \log_2 y = \log_2 5 + 1$$

**(3 marks)**

$$p(t) = 100e^{rt}$$

- i) Population growth rate is governed by formula  $p(t) = 100e^{rt}$  where  $p(t)$  is population after time  $t$ ,  $r$  is rate of population growth and  $t$  is the time in years. How long does it take for the population to triple if the rate of growth is 10% p.a

**(2 marks)**