



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Applied & Health Sciences

DEPARTMENT OF PURE & APPLIED SCIENCES

DIPLOMA IN NAUTICAL SCIENCES

AMA 2102: MATHEMATICS FOR SCIENCE II

END OF SEMESTER EXAMINATION

SERIES: AUGUST 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consist of **FIVE** questions in **TWO** sections **A & B**
 Answer **ALL** questions in section **A** and **THREE** questions in section **B**
 Maximum marks for each part of a question are as shown
 This paper consists of **THREE** printed pages
SECTION A (COMPULSORY)

Question One (40 marks)

$$0^\circ \leq \theta \leq 360^\circ$$

a) Solve the following equations for

i) $6 \cos \theta = 2$ (4 marks)

ii) $3 - 6 \sin^2 \theta = 0$ (4 marks)

iii) $\frac{1}{4} \tan^2 \theta = 2.1$ (4 marks)

iv) $3 \cos^2 \theta + \cos \theta - 2 = 0$ (4 marks)

b) Show that:

$$\frac{\sin^2(\sec x + \cos ecx)}{\cos x \tan x} = 1 + \tan x$$

i) (4 marks)

$$\tan\left(x + \frac{\pi}{4}\right) \tan\left(x - \frac{\pi}{4}\right) = -1$$

ii) (4 marks)

c) (i) Solve the following equations.

$$\frac{1}{2x} + \frac{3}{5y} = 4$$

$$\frac{4}{x} + \frac{1}{2y} = 10.5$$

(4 marks)

(ii) If $5x - \frac{3}{y} = 1$ and $x + \frac{4}{y} = \frac{5}{2}$, find the value of $\frac{xy+1}{y}$ (4 marks)

$$p = \frac{a^2x + a^2y}{r}$$

d) (i) Transpose the formula $p = \frac{a^2x + a^2y}{r}$ to make a the subject. (4 marks)

(ii) The sag S at the centre of a wire is given by the formula

$$S = \sqrt{\frac{3d(l-d)}{8}}$$

make l the subject of formula and evaluate l when $d = 1.75$ and $S = 0.80$

(4 marks)

SECTION B (Answer any TWO questions from this section)

Question Two (20 marks)

a) Solve the equation $3.5 \cos A - 5.8 \sin A = 6.5$ for $0^\circ \leq A \leq 360^\circ$ (8 marks)

b) Express $4 \cos 3\theta \cos \theta$ as a sum or difference (5 marks)

c) Show that $\frac{\cos 6x + \cos 2x}{\sin 6x + \sin 2x} = \cot 4x$ (3 marks)

d) Express $\sin 5\theta + \sin 3\theta$ as a product (2 marks)

e) Express the polar co-ordinates $(5, 143.1^\circ)$ in rectangular form (2 marks)

Question Three (20 marks)

a) Plot the polar graph of $r = 2 \sin \theta$ between $\theta = 0$ and $\theta = 360^\circ$ (10 marks)

b) Find the Cartesian equation of $r \cos(\theta - \alpha) = P$ (3 marks)

c) Determine the polar equation of $x^2 + y^2 - 2y = 0$ (4 marks)

d) Express in polar coordinates the position $(-5, 2)$ (3 marks)

Question Four (20 marks)

a) Find the polar equation of the following loci:
 i) A straight line perpendicular to the initial line at a distance a from the origin. (3 marks)
 ii) A circle, centre at the origin, radius a (2 marks)

b) Sketch the curve given parametrically by:
 $x = \sin \theta, y = \sin 2\theta$ for values of θ between 0° and 360° (10 marks)

- c) By substituting $y = tx$, find the parametric equations for the loci whose Cartesian equation is $x^3 + y^3 = 3xy$ (5 marks)

Question Five (20 marks)

- a) Find the locus of a point P whose distance from the point $A(-1,2)$ is twice its distance from the origin. (6 marks)

- b) Find the equation of the tangent and the normal to the curve $y = 3x^2 - 8x + 5$ at the point where $x = 2$ (8 marks)

- c) Show that the line given parametrically by the equations $x = \frac{2-t}{1+2t}$, $y = \frac{3+t}{1+2t}$ (6 marks)