# TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

**UNIVERSITY EXAMINATION FOR:**

DIPLOMA IN NAUTICAL SCIENCES

AMA2113 : MATHEMATICS 1

END OF SEMESTER EXAMINATION

**SERIES:** APRIL 2016

**TIME:** 2 HOURS

**DATE:** 9 May 2016

**Instructions to Candidates**

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

This paper consists of **FIVE** questions. Attempt question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**

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**Question ONE**

a) Find the values of

(i) $(8/27)^{-2/3}$ (2 marks)

(ii) $\dfrac{27^{1/2} \text{ x } 243^{1/2}}{243^{4/5}}$ (2 marks)

(iii) (a) Find the roots for the following $3x^2 - 11x - 4 = 0$ (3 marks)

(b) -4 and 2 are roots to a quadratic equation, find the equation5x (3 marks)

(iv) Solve for x to the nearest whole number

$\text{Log } 2x^3 - \log x = \log 16 + \log x$ (3 marks)

(b) Find the shortest distance between points C(80°N,45°E) and D (80°N,17°E) in nautical miles (2 marks)

(c) The 1st, 12th and last term of an arithmetic progression are 4, 31.5, and 376.5 respectively. Determine

(a) The number of terms in the series (3 marks)

(b) The sum of all the terms (2 marks)

(c) The 80th term (2 marks)

(d) The first term of a geometric progression is 12 and the 5th term is 55. Determine the 8th term and the 11th term? (4 marks)

(e) Determine the value of $4\frac{5}{8} - 3\frac{1}{4} + 1\frac{2}{5}$ (2 marks)

(f) An alloy is made up of metals A and B in the ratio 2.5 : 1 by mass. How much of A has to be added to 6 kg of B to make the alloy? (2 marks)

**Question TWO**

(i) If $A = \begin{bmatrix} -3 & 0 \\ 7 & -4 \end{bmatrix}$ $B = \begin{bmatrix} 2 & -1 \\ -7 & 4 \end{bmatrix}$ and $C = \begin{bmatrix} 1 & 0 \\ -2 & -4 \end{bmatrix}$

Find A+ B-C (2 marks)

(ii) A ship leaves Mombasa ($4^oS, 40^o$ E) and sails due east for 30 hours to point Q ($4^oS.51^o$ 2'E) in the indian ocean. Find the average speed in knots and kilometres per hour (4 marks)

(iii) Solve for Θ in the following where $-360 \leq \Theta \leq 360$

a) $\tan(\Theta + 30) = 10.5$ (5marks)

b) $\sin \Theta + 60 = -\frac{\sqrt{3}}{2}$ (4 marks)

**Question THREE**

a) The frequency distribution for the values of resistance in ohms of 48 resistors is as shown. Calculate correct to 3 significant figures.

(i) The mean (3 marks)

(ii) The variance (3 marks)

(iii) The standard deviation from the mean of the resistors ( 2 marks)

| Class limits | frequency |
|---|---|
| 20.5–20.9 | 3 |
| 21.0–21.4 | 10 |
| 21.5–21.9 | 11 |
| 22.0–22.4 | 13 |
| 22.5–22.9 | 9 |
| 23.0–23.4 | 2 |

b) The frequency distribution given below refers to the overtime worked by a group of craftsmen during each of 48 working weeks in a year.

| class | frequency |
|---|---|
| 25–29 | 5 |
| 30–34 | 4 |
| 35–39 | 7 |
| 40–44 | 11 |
| 45-49 | 12 |
| 50–54 | 8 |
| 55–59 | 1 |

(i) Calculate the cumulative frequency (1 mark)
(ii) Draw an ogive for this data (3 marks)
(iii) determine the quartile values (3 marks)

**Question FOUR**

a) If an angle of $125^{\circ}$ is subtended by an arc of a circle of radius 8.4 cm, find the length of
   (i) the minor arc ( 2 marks)
   (ii) the major arc ( 2 marks)

b) Use matrices to solve the simultaneous equation (6 marks)

$$3X + 5y - 7 = 0$$

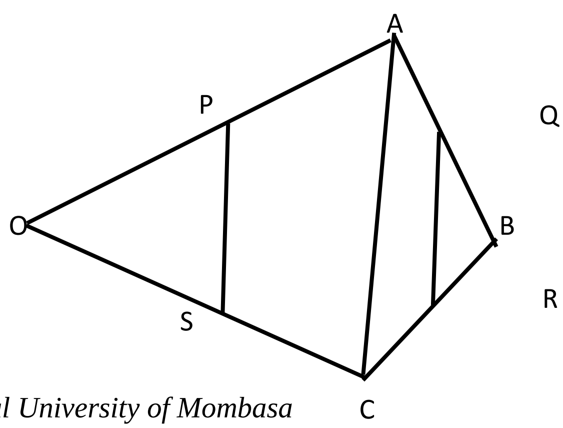
$$4X - 3y - 19 = 0$$

c) Solve triangle XYZ, and find its area given that Y=128◦, XY=7.2cm and YZ=4.5cm (5 marks)

**Question FIVE**

a) The weight (w) of an astronaut varies inversely as the square of his distance d from the center of the earth. If an astronaut's weight on earth is 792 N: Find
   (i) His weight at 230km above the earth (3 marks)
   (ii) The height above the earth at which his weight would be halved (3 marks)
   Take radius of the earth as 6370km

b) O, A, B, C is a quadrilateral and PQR and S are the mid points of the sides OA, AB, BC and CO respectively. Given that OA=**a,** OB= **b** and OC= **c**, express the following vectors in terms of **a, b** and **c**



(i) PS (2 marks)
(ii) AC (2 marks)
(iii) QR (5marks)