# MASENO UNIVERSITY

## UNIVERSITY EXAMINATIONS 2016/2017

## FIRST YEAR SECOND SEMESTER EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE [PUBLIC HEALTH] WITH INFORMATION TECHNOLOGY

## CITY CAMPUS - DAY

## MMA 106: MATHEMATICS I

Date: 22nd November, 2016 Time: 9.00 - 12.00pm

INSTRUCTIONS:

- Answer Question ONE and any other TWO
- Observe further instructions on the answer booklet

**Question 1 (30 Marks)**

a) Simplify the following:

$$\frac{3\log_3 5 - \log_3 5}{\log_9 125 - \log_9 5}$$

(5 Marks)

b) Express with a rational denominator

$$\frac{4+\sqrt{2}}{3-\sqrt{2}}$$

(5 Marks)

c) Determine the values of the real number $a$ when the quadratic equation

$$x^2 + ax + a = 1$$

has distinct real roots? (5 Marks)

d) In a group of 200 high school students, 36 are taking biology, 52 are taking Spanish, and 126 are taking neither biology nor Spanish. If one of these 200 students is to be chosen at random, what is the probability that the student chosen is taking biology but not Spanish? (5 Marks)

e) On the graph paper provided, plot the graph $y = 2sin2\theta$. Use it to solve the equation $2sin2\theta = -1$ (10 Marks)

**Question 2 (20 Marks)**

a) State any four ways of describing whether a set of data is skewed

(4 Marks)

b) A restaurant owner is concerned about the amount of time customers have to wait before being served. He collects data on the waiting times, to the nearest minute, of 20 customers. These data are listed below:

**15, 14, 16, 15, 17, 16, 15, 14, 15, 16, 17, 16, 15, 14, 16, 17, 15, 25, 18, 16**

Find the median and inter-quartile range of the waiting time (5 Marks)

c) An outlier is an observation that falls either 1.5 × (inter − quartile range) above the upper quartile or 1.5 × (inter − quartile range) below the lower quartile. Draw a boxplot to represent these data, clearly indicating any outliers (7 Marks)

d) Determine the mean of these data (2 Marks)

e) Comment on the skewness of these data. Justify your answer. (2 Marks)

**Question 3 (20 Marks)**

a) Express in terms of the trigonometric ratio of an acute angle

i) $cos210^o$

ii) $sin1210^o$

iii) $tan300^o$

iv) $sin325^o$

(5 Marks)

b) Find the value of $\theta$ in the equation $cos(2\theta + 60^o) = -0.5$ for $0^o \leq \theta \leq 360^o$ (5 Marks)

c) Prove the identity

$$tan\theta + cot\theta = \frac{1}{sin\theta cos\theta}$$

(5 Marks)

d) If $sin\theta = 3/5$, find without using calculators the values of $cos\theta$ and $tan\theta$ (5 Marks)

**Question 4 (20 Marks)**

a) Expand the following binomial$(3-2x)^5$. Hence evaluate to 4 significant figures $2.998^5$ (10 Marks)

b) Solve the following equations giving your answer correct to 3 decimal places

i) $2^{x+1} = 3^{2x-1}$ (5 Marks)

ii) $4\log_2 x - \log_x 2 = 3$ (5 Marks)

**Question 5 (20 Marks)**

a) The $10^{th}$ term of a series in Arithmetic Progression (AP) is 24 and the sum of its first twenty terms is 510. Find

i) the first term and the common difference of the series (5 Marks)

ii) the sum of the first 16 terms of the AP (5 Marks)

b) Determine the number of terms in the series:

$$32 + 16 + 8 + 4 + 2 + \cdots + \frac{1}{1024}$$

Hence find the sum of the series. (10 Marks)