



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE**

**UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE ACTUARIAL**

**4<sup>TH</sup> YEAR SPECIAL RESITS – 2016**

**MAIN REGULAR**

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**COURSE CODE: SMA 100**

**COURSE TITLE: BASIC MATHEMATICS**

**EXAM VENUE: LAB 1**

**STREAM: (BSc. Actuarial)**

**DATE: 04/05/2016**

**EXAM SESSION: 9.00 – 11.00 AM**

**TIME: 2.00 HOURS**

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**Instructions:**

- 1. Answer question 1 (Compulsory) and ANY other 2 questions**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

### QUESTION ONE

- a) Find the sum of the following arithmetical progression:

$$1+3+5+\dots+101$$

(4 marks)

- b) Find the exact values of the remaining five trigonometric functions of  $\theta$ :

$$\cos \theta = \frac{-1}{3}, \quad 180^\circ < \theta < 270^\circ$$

(6 marks)

- c) Solve the following equation by factoring:

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

(6 marks)

- d) Find the middle term of the expansion of  $(2x+3)^8$ , and the value of this when  $x = \frac{1}{12}$  (5 marks)

- e) Given that  $z = 3+4i$  and  $w = 12+5i$ , write down the modulus and argument of  $(zw)^*$  (5 marks)

- f) Solve the following inequality, expressing your answer using set notation:

$$-3 < \frac{2x-1}{4} < 0 \quad (5 \text{ marks})$$

### QUESTION TWO

- a) The sum of three consecutive terms of an arithmetical progression is 36. Their product is 1428. Find the three terms. (10 marks)

- b) The fourth, seventh and sixteenth terms of an arithmetical progression are in geometrical progression. If the first six terms of the arithmetical progression have a sum of 12, find the common difference and the common ratio. (10 marks)

### QUESTION THREE

- a) Solve the following equation for the values of  $\theta$  from  $0^\circ$  to  $360^\circ$ , inclusive:

$$\cos(2\theta + 30^\circ) = 0.8$$

(6 marks)

- b) Eliminate  $\theta$  from the equations:

$$x = \tan \theta, \quad y = \tan 2\theta$$

(4 marks)

- c) Prove the following identity:

$$\frac{1 - \sin \theta + \cos \theta}{1 - \sin \theta} = \frac{1 + \sin \theta + \cos \theta}{\cos \theta}$$

(5 marks)

- d) Show that the length  $d$  of a chord of a circle of radius  $r$  is given by the formula

$$d = 2r \sin \frac{\theta}{2}$$

Where  $\theta$  is the central angle formed by the radii to the ends of the chord.

(5 marks)

#### QUESTION FOUR

- a) Exhibit in each case the set that is described by each of the given statements below, assuming that  $n$  is a positive integer:

i.  $\left\{ k \mid k = \frac{(-1)^n}{n} \right\};$  (2 marks)

ii.  $\{ y \mid 3y^2 + 2y + 7 = 0, \ y, \ a \ real \ number \}.$  (3 marks)

- b) Find the sets  $A$  and  $B$  if  $A - B = \{1, 5, 7, 8\}$ ,  $B - A = \{2, 10\}$  and  $A \cap B = \{3, 6, 9\}$ . (5 marks)

- c) Draw the Venn diagram for the combination of the sets  $A$ ,  $B$ , and  $C$ :

$$A \cap (B - C) \quad (5 \text{ marks})$$

- d) Prove the following distribution law of set operations:

$$A \cap (B \cup C) = (A \cap B) \cup (A \cap C) \quad (5 \text{ marks})$$

#### QUESTION FIVE

- a) Solve the following system of equations

$$\begin{cases} x + y + z + w = 4 \\ 2x - y + z = 0 \\ 3x + 2y + z - w = 6 \\ x - 2y - 2z + 2w = -1 \end{cases}$$

Using matrices (row operations). If the system has no solution, say that it is inconsistent.

(10 marks)

- b) Solve the system of equations

$$\begin{cases} 3x - y + 5z = -2 \\ -4x + y + 7z = 10 \\ 2z + 4y - z = 3 \end{cases}$$

using Cramer's Rule if it is applicable. If Cramer's Rule is not applicable, say so. (10 marks)