



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

**UNIVERSITY EXAMINATION 2012/2013**

**1<sup>ST</sup> YEAR 1<sup>ST</sup> SEMESTER EXAMINATION FOR BACHELORS  
DEGREE (REGULAR)**

**COURSE CODE: SMA 3111**

**TITLE: MATHEMATICS I**

**DATE: 29 /4/2013**

**TIME: 9.00-11.00AM**

**DURATION: 2 HOURS**

**INSTRUCTIONS**

- 1. This paper contains SIX (6) questions**
- 2. Answer question 1 (Compulsory) and ANY other 2 Questions**
- 3. Write all answers in the booklet provided**

**QUESTION ONE (30 marks)**

- a. The following information refers to the functions  $f$  and  $g$  :

$$f : x \rightarrow 3x - 2$$

$$g : x \rightarrow \frac{5}{x-2}, x \neq k$$

Find (i) the value of  $k$ , (1 marks)

(ii)  $fg(x)$  (4 marks)

- b. Exhibit the set that is described by the given statement below (where  $n$  is a positive integer):

$$\{x \mid x = n^2 + 10 < 40\}. \text{ (4 marks)}$$

Hence find its cardinality. (1 marks)

- c. If  $\tan \theta = \frac{3}{4}$  and  $\sin \theta < 0$ , find the exact value of each of the remaining trigonometric functions of  $\theta$ . (7 marks)

- d. Solve the equation:  $\log_5(x^2 + x + 4) = 2$ . (5 marks)

- e. Find the ratio of the term in  $x^3$  to the term in  $x^4$  in the expansion of  $(2x+3)^7$  (5 marks)

- f. How many four-digit numbers can be formed using the digits 0,1,2,3,4,5,6,7,8, and 9 if the first digit cannot be 0? (3 marks)

**QUESTION TWO (20 marks)**

- a. Let  $A = \{0, 2, 4, 6, 8, 10\}$ ,  $B = \{0, 1, 2, 3, 4, 5, 6\}$ , and  $C = \{4, 5, 6, 7, 8, 9, 10\}$ .

Find: (i)  $A \cap B \cap C$ ; (2 marks)

(ii)  $(A \cap B) \cup C$  (3 marks)

- b. Prove that  $(A \cap B)^c = A^c \cup B^c$  (6 marks)

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

$$(A \cap B^c) \cup (A \cap C^c) \text{ (9 marks)}$$

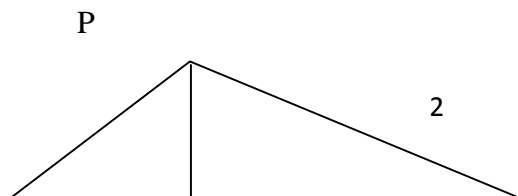
**QUESTION THREE (20 marks)**

- a. Solve  $\tan^2 \theta = \frac{3}{2} \sec \theta$  on the interval  $0 \leq \theta \leq 2\pi$ . (4 marks)

- b. Establish the identity

$$\frac{1 - 2\cos^2 \theta}{\sin \theta \cos \theta} = \tan \theta - \cot \theta. \text{ (4 marks)}$$

- c. The figure below shows a roof truss  $PQR$  with rafter  $PQ = 3m$ ,  $\angle PQR = 40^\circ$ , and  $\angle PRQ = 32^\circ$ . Calculate the length of (i) the roof rise  $PP'$ , (ii) the rafter  $PR$ , and (iii) the roof span  $QR$ . Hence determine the cross-sectional area of the roof of truss. (12 marks)



3m

Q    \    □    /    R  
         P'

**QUESTION FOUR (20 marks)**

- a. The first, twelfth and last term of an arithmetic progression are 4,  $31\frac{1}{2}$ , and  $376\frac{1}{2}$  respectively.

Determine:

- i. the number of terms in the series, (4 marks)
  - ii. the sum of all term, and (4marks)
  - iii. the 80<sup>th</sup> term. (4 marks)
- b. If *Kshs.*250,000 is invested at compound interest of 6% per annum, determine:
- i. the value after 15 years, (4 marks)
  - ii. the time, correct to the nearest year, it takes to reach *Kshs.*750,000. (4 marks)

**QUESTION FIVE (20 marks)**

From the following observations prepare a frequency distribution starting with 5–10 (5 marks)

12 36 40 30 28 20 19 10 10 16

19 27 15 26 20 19 7 45 33 21

26 37 6 20 11 17 37 30 20 5

Hence:

- a. compute mean and standard deviation from the above data, (10 marks)
- b. draw the ogive curve from the above data. (5 marks)