JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY SCHOOL OF MATHEMATICAL & ACTUARIAL SCIENCE

UNIVERSITY EXAMINATION FOR THE BACHELORS DEGREE

1ST YEAR 1ST SEMESTER 2013/2014 ACADEMIC YEAR

CENTRE: MAIN

COURSE CODE: SMA 3111

CO X URSE TITLE: MATHEMATICS 1

EXAM VENUE: AH **STREAM:**

DATE: 23/4/2014 **EXAM SESSION: 11.30 – 1.30 PM**

TIME: 2 HOURS

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 (30 marks)

a) The following information refers to the functions f and g:

$$g : x \to 7x - 6$$

$$f : x \to \frac{11}{2x-7}, x \neq k$$

Find

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

(ii) $gf(x)$. (4 marks)

b) Describe the following sets using the list method and give the set cardinality:

$\{x \mid x = 4n,\ n^2 < 34,\ n \text{ a positive integer}\}$ (5 marks)

c) Convert:

(i) 37.6471^o to $D^o M' S''$ form. Round your answer to the nearest second.(3 marks)

(ii) -330^o to radians. Express your answer as a multiple of ®. (3 marks)

d) Solve the equation: $\log_5(x+6) = 1 - \log_5(x+4)$ (4 marks)

e) Find the coefficient of the term $x^6 y^5$ in the expansion of $(2x-5y)^{11}$ (4 marks)

f) Compute the mean, median and mode(s) of the following set of data:

$\{4.72, 4.71, 4.74, 4.73, 4.72, 4.71, 4.73, 4.72\}$ (6 marks)

QUESTION TWO (20 marks)

a) Consider the following sets:

$U = \{1, 2, 3, ..., 10\}$, $P = \{1, 2, 3, 4, 5\}$, $Q = \{2, 4, 6, 8\}$, $R = \{1, 3, 5, 7, 9\}$, and $S = \{1, 2, 9, 10\}$

Find:

(i) $(P - (Q \cap R)) \cap S$ (4 marks)

(ii) $(P \cap Q) - (P \cup Q)'$ (4 marks)

b) Prove the following distributive law of set operations:

$F \cap (G \cup H) = (F \cap G) \cup (F \cap H)$ (6 marks)

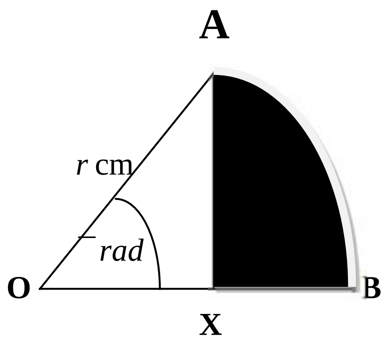
c) Draw the Venn diagram for the combination of the sets A, B, and C:

$(A^c \cup B) \cup C^c$ (6 marks)

QUESTION THREE (20 marks)

a) Solve $3(1-\cos ¯) = \sin^2 ¯$ on the interval $0 \le ¯ \le 2®$. (6 marks)

b) In the diagram, AB is an arc of a circle centre O and radius r cm, and angle $AOB = ¯$ radians. The point x lies on OB and AX is perpendicular to OB



(i) Show that the area, $A\,\text{cm}^2$, of the shaded region AXB is given by

$$A = \frac{1}{2} r^2 (¯ - \sin ¯ \cos ¯) \text{ (8 marks)}$$

(ii) In the case where $r = 12$ and $¯ = \frac{1}{6}®$, find the perimeter of the shaded region AXB, leaving your answer in terms of $\sqrt{3}$ and $®$. (6 marks)

QUESTION FOUR (20 marks)

a) The first three terms of an infinite geometric progression are $0.7, 0.07, 0.007$.

(i) Write down the common ratio of this progression. (2 marks)

(ii) Find, as a fraction, the sum to infinity of the terms of the progression. (4 marks)

(iii) Find the sum to infinity of the geometric progression $0.7 - 0.07 + 0.007 - \ldots$, and hence show that $\frac{7}{11} = 0.\dot{6}\dot{3}$. (6 marks)

b) A pendulum is set swinging. Its first oscillation is through an angle of 30^0 and each succeeding oscillation is through 95% of the angle of the one before it.

(i) After how many swings is the angle through which it swings less than 1^0? (4 marks)

(ii) What is the total angle it has swung through at the end of its tenth oscillation? (4 marks)

QUESTION FIVE (20 marks)

The following distribution gives the finishing times in minutes for male runners in a marathon:

Time	$110-119$	$120-129$	$130-139$	$140-149$	$150-159$	$160-169$	$170-179$	$180-189$
Runners	5	7	12	20	16	10	7	3

a) Compute mean and standard deviation from the above data, (10 marks)

b) Draw the ogive curve from the above data and estimate the median time. (10 marks)