MACHAKOS UNIVERSITY

University Examinations 2017/2018

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

FIRST YEAR FIRST SEMESTER EXAMINATIONS FOR DIPLOMA IN AGRICULTURE

MAT 0100: BASIC MATHEMATICS

DATE: 6/12/2017 **TIME: 2.00-4.00 PM**

INSTRUCTIONS

Attempt question **one** which is a compulsory question and any other **two** questions.

Show all your working

1. a) For each of the following relations defined over a set X and codomain Y state whether

The relation is "into" or "onto". State also whether it is "one-one", "one-many" or "many-many"

i) "is the square root of" $X = \{-1,0,1\}$, $Y = \{y: 0 \ll y \ll 1\}$ (3 marks)

ii) "is equal to" $X = \{1,2,3\}$, $Y = \{y: 1 \ll y \ll 3\}$ (3 marks)

iii) $x \rightarrow 3x + 2$ (3 marks)

b) For the following functions find a domain for the given range

i) $f_1: x \rightarrow x^2$ range $= \{y: 1 \ll y \ll 4\}$ (2 marks)

ii) $f_2: x \rightarrow log_{10}x$ range $= \{y: 0 \ll y \ll 2\}$ (2 marks)

c) Solve for $0^0 \ll \theta \ll 360^0$ given

i) $\sin\theta = 0.25$ (2 marks)

ii) $5 - 8\cos\theta = 0$ (4 marks)

d) Find the inverse of each of the following functions assuming that a suitable subset of R has been defined for the domain.

i) $f : x \rightarrow \frac{1}{3}x - 5$

ii) $f : x \rightarrow \frac{x+3}{x-2}$

iii) fg given that $f : x \rightarrow 7x + 2$ and $g : x \rightarrow \frac{x-2}{7}$

2. a) Find the inverse of the following functions

i) $f: x \rightarrow 3x - 5$ (2 marks)

ii) $f: x \rightarrow \sqrt{x+1}$ (2 marks)

iii) $f: x \rightarrow \frac{x-2}{7}$ (2 marks)

iv) $f: x \rightarrow \frac{1}{x} + 1$ (2 marks)

b) If $\epsilon = [natural\ numbers\ less\ than\ 20]$, A = $[prime\ numbers]$ and B = $[odd\ numbers]$

i) Show the sets in a venn diagram

ii) List the elements of $A \cap B$, $(A \cup B)'$ and $A \cap B'$ (5 marks)

c) In each of the following, find the range of the composite functions fg for the given domain X :

i) If $f : x \rightarrow 3x + 5$ and $g: x \rightarrow 7x - 2$ given X = [2,3,4]

ii) If $f : x \rightarrow x^2 + 1$ and $g : x \rightarrow 2x + 3$ given X = [0,1,2]

iv) If $f : x \rightarrow x^2 + 1$ and $g : x \rightarrow 2x + 3$ given $X = -2 \leq x \leq 2$

3. a) solve for $0^0 \ll \theta \ll 360^0$

i) $1 + cos\theta = 2sin^2\theta$ 4 marks)

ii) $cos^2\theta + cos\theta + 1 = 1$ (4 marks)

b) The first three terms of a G.P are the first fourth and tenth terms of an A.P. Given that the first term is six and that all the terms of the G.P are different, Find the common ratio. (6 marks)

c) The second term of a geometric sequence is 64. The fifth term is $\frac{1}{8}$. Find the first four terms of the sequence. (7 marks)

4. a) Find the inverse of the function.

i) $f ; x \rightarrow \frac{x+1}{x-2}$ $(x \neq 2)$ (3 marks)

ii) $g ; x \rightarrow 2 + \frac{3}{x}$ $(x \neq 0)$ (3 marks)

b) At recent school prize day 18 O-level certificate were awarded in History, 17 in Geography and 20 in Economics. 3 candidates received all three certificates, while 5received only History and Geography, 2 received only Geography and Economics, and 9 received only History and Economics. How many candidates were awarded at least one of the certificates. (6 marks)

c) Solve the following equations for $0 \leq \theta \leq 360$

i) $3-3\cos\theta = 2sin^2\theta$ (4 marks)

ii) $sec^2\theta = 3tan\theta - 1$ (4 marks)

5. a) Prove the following identities

i) $\tan\theta + \cot\theta = \frac{1}{sin\theta cos\theta}$ (4 marks)

ii) $\frac{cos\theta}{\sqrt{1+tan^2\theta}} + \frac{sin\theta}{\sqrt{(1+cot^2\theta)}} = 1$ (4 marks)

b) In triangle ABC lengths AB=9.8cm, BC=12.7cm and the area of the triangle is 53.5cm^2, calculate;

i) the included acute angle.

ii) the length of the third side. (7 marks)

c) Find without using tables or calculator the value of ;

i) $\sin(120^0 + 45^0)$

ii) $\cos 105^0$ leaving surds in your answer. (5 marks)