KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

MAIN CAMPUS

SECOND SEMESTER, 2017/2018 ACADEMIC YEAR

MATH 110: BASIC MATHEMATICS

STREAM: Y1S1 **TIME: 11.00-1.00P.M**

EXAMINATION SESSION: APRIL **DATE: 12/04/2018**

INSTRUCTIONS

- Instructions to candidates: Attempt **Question one** and any two other questions

Do Not write on the question paper.

QUESTION 1 **(30 MARKS)**

a. Define the following terms: (6mks)
   i. Union of sets
   ii. Finite sets
   iii. Combination

b. If $A = \{1,2,8\}$ and $B = \{q, r, s\}$. Find $A \times B$, $A \cap B$ and power set of A (4mks)

c. Differentiate $f(x) = (2x^2 - x + 1)^2$ (3mks)

d. Use the 1st principles of differentiation to solve the $f(x) = x^2 + 4x$ (3mks)

e. Safcom (Kenya Ltd) surveyed 400 of its customers to determine the way they learned about the new Jibambie tariff. The survey shows that 180 learned about the tariff from radio, 190 from television, 190 from newspapers, 80 from radio and television, 90 from radio and newspapers, 50 from television and newspapers, and 30 from all three forms of media.

   (a). Draw a Venn diagram to represent this information (2mks)

   Using your Venn diagram, determine

   (b). the number of customers who learned of the tariff from at least two of the three media. (2mks)

   (c). the number of customers who learned of the tariff from exactly one of the three media. (2mks) (d). the number of customers who did not learn of the tariff any of the three media. (2mks)

f. Prove that $\sqrt{3}$ is an irrational number. (3mks)

g. Evaluate the following $\lim_{x\to 2} \frac{x^2-4}{x-2}$ (3mks)

h. In how many ways can a class of 10 children be split into two groups of 4 and 6 respectively if there are two twins in the class who must not be separated? (4mks)

i. The quadratic equation $2x^2 + 3x + 5 = 0$ has roots α *and* β. Find the new quadratic equation with the following roots $\frac{1}{\alpha}$ and $\frac{1}{\beta}$ (4mks)

j. Solve the inequality $|x+8| < 3$ (3mks)

QUESTION 2 **(20 MARKS)**

a. Kabarak university Mathematics club constitute a committee of 10 members who are to be chosen from 9 gentlemen and 6 ladies. In how many ways this can be done if (8mks)
   i. The is to be a majority of gentlemen
   ii. The committee contains exactly 4 ladies
   iii. There are at least 4 ladies
   iv. There are at most 7 gentlemen

b. The number of bacteria in a refrigerated food is given by $N(T) = 20T^2 - 80T + 500, \quad 2 \leq 7 \leq 14$, Where T is the Celcius temperature of food. When the food is removed from refrigeration, the temperature is given by $T(t) = 4t + 2, \ 0 \leq t \leq 3$, where t is the time in hours. Find the following (6mks)
   i. The composite function $N(T(t))$. What does this function represent?
   ii. The number of bacteria in the food when $t = 2hrs$
   iii. The time when the bacteria reaches 2000

c. Show that the functions are inverse of each other $f(x) = 2x^3 - 1$ and $g(x) = \sqrt[3]{\frac{x+1}{2}}$

(6mks)

QUESTION 3 **(20 MARKS)**

a. Find $\lim_{x\to 1} \frac{x^2-1}{x^2-3x+2}$ (3mks)

b. Find ${dy}/{dx}$ of the following (9mks)
   i. $y = \frac{(2x^2-3x)^3}{x+5}$

ii. $f(x) = (8x - x^2)^5(x^2+1)^0$

iii. $f(x) = \sqrt[5]{x^2} + 14x$

c. Find the area between the graph of $f(x) = x^2 - 2x$ and the $x - axis$ over the indicated interval (8mks)

i. $[1,2]$

ii. $[-1,1]$

QUESTION 4 **(20 MARKS)**

a. Simplify the following, leaving your answer in the form $a + bi,\ \ a, b \in \mathbb{R}$. (4mks)

i. $3i^3$

ii. $\frac{2+6i}{5+i}$

b. Given that $f(x) = x^3 + 3x^2 - 2x - 2$ and $g(x) = x - 1$, find $\left(\frac{f}{g}\right)(x)$ (5mks)

c. Given $f(x) = 3x^2 + 2x + 1$ and $g(x) = 2x - 3$, find $(f \circ g \circ f)(x)$ (4mks)

d. Use mathematical induction to show that the following is true $1 + 2 + 3 + \cdots + n = \frac{n}{2}(n+1)$ (7mks)

QUESTION 5 **(20 MARKS)**

a. Let p be the proposition 'Today is Sunday' and q be 'I will go to church'. Use the truth tables to deduce it. (6mks)

b. Use the binomial theorem to expand and simplify $(1+x)^6$. Use your result to approximate $(1.1)^5$. (4mks)

c. In how many ways can the letters of the following be arranged (4mks)

i. BONDO

ii. ARRANGING

d. Show that $Tan(A - B) = \frac{Tan\,A - Tan\,B}{1 + Tan\,A\,Tan\,B}$ (5mks)

e. Define a set. (1mk)

KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

FIRST SEMESTER, 2017/2018 ACADEMIC YEAR

EXAMINATION FOR THE BACHELOR OF EDUCATION SCIENCE/ARTS

UNIT CODE: MATH 110

UNIT NAME: BASIC MATHEMATICS

STREAM: Y1S1 **DATE:26/11/2018**

EXAMINATION SESSION: DECEMBER **TIME: 2:00-4:00PM**

VENUE:SMHS **COPIES 12**

INSTRUCTIONS

(i) **Answer ONE and any other TWO questions**
(ii) **Do not write on the question paper**
(iii) **Show your working clearly**

QUESTION ONE (30MARKS)

a) Define cardinality of a set. (2marks)

b) If $A = \{2, 5, 8\}$ and $B = \{0, 2, 6, 9\}$ find $A \cap B$ (2marks)

c) A girl wanted to invite 8 friends but there is only room for 4 of them.In how many ways can she chose whom to invite if two of them are sisters and must not be separated (4marks)

d) A survey was conducted on a sample of 200 new cars being sold at a local auto dealer was conducted to see which of the three popular options, air conditioning(A), Radio (R) and power window (W), were already installed. The survey found

120 had air conditioning, 96 had radio, 40 had air conditioning and power windows, 72 had air-conditioning and radio, 32 had radio and power windows, 24 had all three options and 16 had no option
Find the number of cars that had

i) Only power option (1 mark)

ii) Only air conditioning (1 mark)

iii) Only radio (1 mark)

iv) Radio and power windows but not air- conditioning (2 marks)

v) Air- conditioning and radio but not power windows (2 marks)

vi) Only one of the option (2 marks)

i) $\tan^2\theta\cos^2\theta+\cot^2\theta\sin^2\theta$ (3marks)

ii) $\tan\theta+\frac{\cos\theta}{1+\sin\theta}$ (3marks)

f) Find the number of permutations of the following words

i)PARRAMMATTTA

ii)0722536948 (4Marks)

g) Find the number of terms of the series 2 + 6 + 10 + 14 + 18 + … that will give a sum of 800.

(3marks)

QUESTION TWO [20 MARKS]

a)The first,the 12^{th} and the last term of an arithmetic progression are 4, 31.5 and 376.5 respectively.
Determine:

i) The number of terms in the series (3 marks)

ii) Sum of all the terms (3 marks)

iii) The 80_{th} term (3 marks)

b) Prove the following identities,

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

c) Solve the equation $xP_2=6$ (3 marks)

d) Find the general solution for the equation $24\sec^2 x-26\tan x-18=0$ (4marks)

QUESTION THREE (20MARKS)

a) A committee of20 member is to be chosen from 18 Lecturers and 12 students. In how many ways this can be done if

i) The committee contain exactly 4 students (2marks)

ii) There is to be majority of lecturers (2 marks)

iii) There are at least 4 students (3 marks)

iv) There are at most 7 lecturers (3 marks)

b) Evaluate $\frac{(n+2)!}{n!}$ (2 marks)

c) Expand $(2 + x)^5$ in ascending powers of x up to the term in x^3

Hence, approximate the value of $(2.03)^5$ to 4s.f. (4marks)

d) Solve the equation $2\sin^2 x + 3\cos x - 3 = 0$ (4marks)

QUESTION FOUR (20MARKS)

a) Find the values of $(0.99)^5$ correct to 4 decimal places (4marks)

b) i)Solve the equation $\tan\theta = 2\sin\theta$ for the values of $0 \leq \theta \leq 360$ (3marks)

ii) Verify the Identity $\frac{\sec^2\theta - 1}{\sec^2\theta} = \sin^2\theta$ (3marks)

c) If ${}^nP_r = 60$ and ${}^nC_r = 10$, then find n and r (4 marks)

d) Given $f(x) = x + 2$ *and* $g(x) = 4 - x^2$ find $(fog)(x)$ (3marks)

e) Which term of the sequence 2187, 729, 243……. is $\frac{1}{9}$ (3marks)

QUESTION FIVE (20MARKS)

a) Given the following functions $f(x) = -8x + 2$ *and* $g(x) = 3 - 2x$. Determine

i) $(fog)(x)$ (2 marks)

ii) $(gof)(x)$ (2marks)

iii) $(f^{-1}og(x))$ (3marks)

b)Simplify each of the following trigonometric expression

$$\frac{2\sin^2\theta + \sin\theta - 3}{1 - \cos^2\theta - \sin\theta}$$ (4marks)

c) Solve the equation n-1C $_2$ =28 (4marks)

d) Expand and simplify the Binomial expression $\left(10 + \frac{2}{x}\right)^5$ hence use your expansion to find the value of 14^5 (5marks)

KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

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FIRST SEMESTER, 2017/2018 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

UNIT CODE: **MATH 110:**

UNIT NAME: **BASIC MATHEMATICS**

STREAM: **Y1S1**

EXAMINATION SESSION: DEC. **TIME: 2HRS** **DATE: 2017**

INSTRUCTIONS:

- **Answer question ONE and any other TWO questions.**

QUESTION ONE **(30MARKS)**

a) Define cardinality of a set. (2marks)

b) Differentiate between an null set and a universal set. (2marks)

c) If A = {2 , 5 ,8} and B = {0 , 2 , 6 , 9} find,

(i) $A \cup B$ (1mark)

(ii) $A \cap B$ (1mark)

d) Construct truth tables for the following compound proposition.

(i) $\sim P \vee \wedge Q$

(ii) $\sim P \wedge \vee \ \sim Q$

(iii) $\sim Q \Rightarrow P$

(iv) $\sim p \ \Leftrightarrow \ \sim Q$ (8marks)

e) How many distinguishable arrangements are there of the word MASSASSAUGA.

(5marks)

f) Let f , g : $\mathbb{R} \rightarrow \mathbb{R}$ is defined by f(x) = 2x – 3 and g(x) = $\frac{x+1}{5}$, respectively. Find f^{-1} and g^{-1} (5marks)

g) Simplify $\sin^2 x \cos^2 x + \cos^4 x$ (3marks)

h) Find the 18th and 25th term of the sequence defined by,

$$a_n = \begin{cases} n(n+3), if\ n \in \mathbb{N}\ and\ n\ is\ even \\ \frac{2n}{n^2+1}\ ,\ if\ n \in \mathbb{N}\ and\ n\ is\ odd \end{cases}$$ (3marks)

QUESTION TWO **(20MARKS)**

a) State the basic counting principle. (4marks)

b) Define permutation. (2marks)

c) A club has 20 members. The offices of chairman, vice chairman, secretary and treasurer are to be filled , and no member may serve in more than one office. How many different states of candidates are possible.

(5marks)

d) (i) Define combination. (2marks)

(ii) In how many ways can a class of 24 children be split into two groups of 10 and 14 respectively if there are two twins in the class who must not be separated. (7marks)

QUESTION THREE **(20MARKS)**

a) Show that $\sim(P \vee Q) \vee (\sim P \wedge Q) = \sim P$ (5marks)

b) Given the function g(x) = $5x^2 + 4$ and f(x) = 3x – 7, find;

(i) g o f(x) (3marks)

(ii) g o f(-1) (2marks)

(iii) $g^{-1}(x)$ (2marks)

c) Given the G.P. , 81 , 27 , 9 , - - - , $\frac{1}{27}$ find the

(i) number of terms. (5marks)

(ii) Sum of the terms in (i) above (3marks)

QUESTION FOUR **(20MARKS)**

a) Prove by mathematics induction that for every positive integer n,

$1 + 2 + 3 + - - - + n = \frac{n(n+1)}{2}$ (7martks)

b) Simplify each of the following trigonometric expressions.

(i) $\frac{\cot(-\theta)}{cosec(-\theta)}$ (5marks)

(ii) $\frac{2sin^2\theta+sin\theta-3}{1-cos^2\theta-sin\theta}$ (8marks)

QUESTION FIVE **(20MARKS)**

a) Define the following properties of relations.

(i) Reflexive (2marks)

(ii) Symmetric (2marks)

(iii) Anti-symmetric (2marks)

(iv) Transitive (2marks)

(v) Equivalence relation (2mark)

b) Find the range of $f : \mathbb{R} \rightarrow \mathbb{R}$ defined by $f(x) = \frac{3x}{x^2+1}$ (7marks)

c) Let $f : \mathbb{R} \rightarrow \mathbb{R}$ and $g : \mathbb{R} \rightarrow \mathbb{R}$ by defined by $f(x) = x^2$ and $g(x) = x + 5$ find (gof)(x) (3marks)

KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

SECOND SEMESTER, 2016/2017 ACADEMIC YEAR

EXAMINATION FOR THE BACHELOR OF SCIENCE IN COMPUTER SCIENCE

UNIT CODE: MATH 110

UNIT NAME: BASIC MATHEMATICS

STREAM: Y1S1

EXAMINATION SESSION: APRIL **TIME: 11.00-1.00 PM** **YEAR: 13/04/017**

INSTRUCTIONS

- **(i)** **Answer ONE and any other TWO questions**
- **(ii)** **Do not write on the question paper**
- **(iii)** **Show your working clearly**

QUESTION ONE (30MARKS)

a) Define cardinality of a set. (2marks)

b) If $A = \{2, 5, 8\}$ and $B = \{0, 2, 6, 9\}$ find $A \cap B$ (2marks)

c) Prove by the elements Argument method that,

$$A - (A \cap B) = A \cap \bar{B}$$ (4marks)

d) Each of the 100 students in the first year of Kabarak university's computer science department studies at least one of the subsidiary subjects namely mathematics, electronics and accounting. Given that 65 study mathematics, 45 study electronics , 42 study accounting, 20, study mathematics and electronics, 25 study mathematics and accounting and 15 study electronics and accounting, find the number who study,

(i) All the three subsidiary subjects. (3marks)

(ii) Mathematics and electronics but not accounting. (3marks)

e) Let ∪ = **R** and I = **N** for each $n \epsilon \mathbf{N}$ let $A_n = [\,-2n\,,\,3n\,]$ determine

(i) $\bigcap_{n=1}^{7} A_n$ (3marks)

(ii) $\bigcup_{n\epsilon I} A_n$ (3marks)

f) Find the principal value and the argument of the complex number,

$Z = \frac{2-i}{1+i}$ (5marks)

g) Determine whether each of the following is a tautology, contradiction or neither.

(i) $P \Rightarrow (P \vee Q)$ (2marks)

(ii) $(P \Rightarrow Q) \wedge (\sim P \vee Q)$

(3marks)

<u>QUESTION TWO (20MARKS)</u>

a) Write the first three terms in a sequence whose n^{th} term is given by,

$C_n = \frac{n(n+1)(2n+1)}{6}$ (3marks)

b) Find the smallest positive integer n such that t_n of the arithmetic sequence,

$20, \quad 19\frac{1}{4}, \quad 18\frac{1}{2}, \; - - -$ is negative. (4marks)

c) An amount of £ 500 is deposited in a bank which pays annual interest at the rate of 10% compounded annually. What will be the value of this deposit at the end of 10^{th} year? (5marks)

d) Let a , ar , ar^2 , - - - , ar^n be a geometric sequence where $r \neq o$ is the common ratio. Show that the sum of the first n terms of this sequence is ,

$S_n = \frac{a(1-r^n)}{1-r}$, when $r \neq 1$ (5marks)

e) A geometric series consist of four terms and has a positive common ration. The sum of the first two terms is 8 and the sum of the last two terms is 72. Find the series. (3marks)

QUESTION THREE (20MARKS)

a) Find the domain and range of the following function,

f : R → R , defined by f(x) = $\sqrt{2x^2 + 5x - 12}$ (4marks)

b) Let f , g and h be the functions defined as follows,

(i) g (h (4)) (4marks)

(ii) f o (h o g) (-7) (5marks)

c) Write down the binomial expansion for $(1 + x)^{20}$, and use it to approximate $(1.01)^{20}$ leaving your answer in 5 decimal places. (7marks)

QUESTION FOUR (20MARKS)

a) Define permutation. (2marks)

b) How many distinguishable arrangements are there of the word,

MASSASAUGA. (4marks)'

c) A carton contains 24 light bulbs, one of which is defective.

(i) In how many ways can three bulbs be selected? (3marks)

(ii) In how many ways can three bulbs be selected if one is defective. (4marks)

d) How many committees of five people can be chosen from 20 men and 12 women,

(i) If exactly 2 men must be on each committee (3marks)

(ii) If at least four women must be on each committee? (4marks)

QUESTION FIVE (20MARKS)

a) Simplify each of the following trigonometric expressions.

(i) $\frac{\cot(-\theta)}{cosec(-\theta)}$ (3marks)

(ii) $\frac{2sin^2\theta+sin\theta-3}{1-cos^2\theta-sin\theta}$ (3marks)

b) Prove the following identities,

(i) $1 + \sin2\theta = (\sin\theta + cos\theta)^2$ (5marks)

(ii) $\frac{1}{(cosec\theta-sin\theta)(sec\theta-cos\theta)} = \tan\theta + cot\theta$ (5marks)

c) Find the general solution of the equation,

$12\sec^2\theta - 13tan\theta - 9 = 0$ (4marks)