CHUKA   **UNIVERSITY**

UNIVERSITY EXAMINATION
RESIT/SUPPLEMENTARY / SPECIAL EXAMINATIONS
EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE, BACHELOR OF EDUCATION AND BACHELOR OF ARTS

MATH 122: BASIC MATHEMATICS

STREAMS: BSC, BED, BA   **TIME: 2 HOURS**

DAY/DATE: TUESDAY 10/08/2021   **8.30 A.M - 10.30 A.M.**

INSTRUCTIONS

- **Answer ALL Questions.**
- **Adhere to the instructions on the answer booklet**

QUESTION ONE

a. Determine the truth value of each of the following statements

(4 marks)

    i. $3 + 2 = 7$ and $4 + 4 = 8$

    ii.   Paris is in England or $3 + 4 = 7$

    iii.   It is false that $2 + 2 = 4$ and $1 + 1 = 5$

    iv.   Paris is in England if and only if $2 + 2 = 5$

b. Given that $z_1 = 2 + i$ and $z_2 = \sqrt{3} + 2i$, Evaluate $\left(\dfrac{z_1}{z_2}\right)^4$ in modulus argument form.

(4 marks)

c. . Obtain the constant term in the expansion of $\left(2x - \dfrac{1}{10x}\right)^{100}$ (4 marks)

d. Prove that $p \rightarrow (q \wedge r) \equiv (p \rightarrow q) \wedge (p \rightarrow r)$ (4 marks)
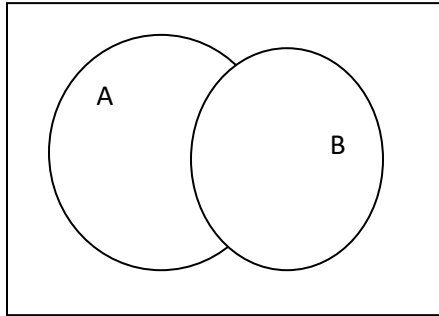
e. let U = {1,2,3,…..,12} and let, A = {x ∈ U : x is a prime number}**,** B = {x ∈ U : x is an even   number}**,** C = {x ∈ U : x is divisible by 3}**.** Find   the set $(A \cup B)^c$ (4 marks)

f. In the Venn diagrams below shade
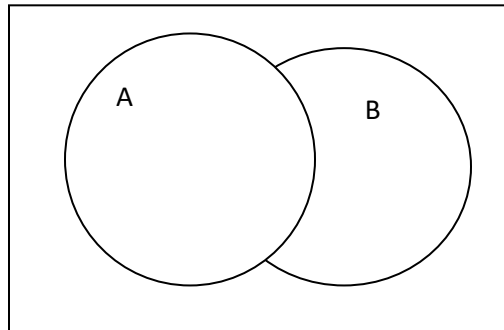
  i. $(A \cup B)^c$ (2 marks)

  ii. $(A^c \cap B^c)$ (2 marks)

g. *Prove that* $\sqrt{3}$ *not a rational number* (4 marks)

QUESTION TWO

a. Given that $f(x)=2^x$, $g(x)=x+3$ and $h(x)=x^2$, obtain

  (i). $f \circ g(x)$ (4 marks)

  (ii). $f \circ g(0)$ (1 mark)

  (iii). $\left(g \circ h(x)\right)^{-1}$ (4 marks)

  (iii). $\left(g \circ h(7)\right)^{-1}$ (1 mark)

b. Obtain the first 4 terms in the binomial expansion of $(1+x)^{-1}$, hence approximate $(3.95)^{-1}$

(5 marks)

c. Prove using mathematical induction that for all $n \geq 1$, $2^{3n} - 1$ is divisible by 7, for all natural numbers

(5 marks)

QUESTION THREE

a. In a college, 200 students are randomly selected. 140 like tea, 120 like coffee and 80 like both tea and coffee.

    i). How many students like only tea?   (2 marks)

    ii). How many students like only coffee?   (2 marks)

    iii). How many students like neither tea nor coffee?   (2 marks)

b. Prove using mathematical induction that for all $n \geq 1$, $1 + 5 + 9 + ... + (4n - 3) = n(2n - 1)$ for all natural numbers n

(5 marks)

c. Solve the equation $\cos(x+20) - \cos(x+80) = 0.5, \ 0 \leq x \leq 360$

(5 marks)

d. In how many ways can a committee consisting of 3 men and 2 women, be chosen from 7 men and 5 women?

(4 marks)

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