

CHUKA



UNIVERSITY

## UNIVERSITY EXAMINATIONS

**SECOND YEAR EXAMINATION FOR THE DEGREE OF BACHELORS OF  
SCIENCE IN MATHEMATICS AND BACHELOR OF EDUCATION SCIENCE**

MATH 122: BASIC MATHEMATICS

STREAMS: BSC. MATH &amp; B. ED

TIME: 2 HOURS

DAY/DATE: MONDAY 27/09/2021

5.00 P.M. – 7.00 P.M.

**INSTRUCTIONS:**

- Answer question one and any other two questions
- Adhere to the instructions on the answer booklet.

**QUESTION ONE Compulsory.**

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

4marks

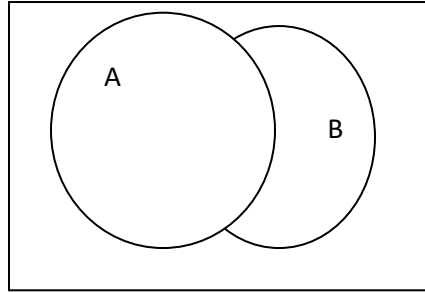
- $3 + 2 = 6$  and  $4 + 4 = 8$
- Paris is in England or  $3 + 4 = 7$
- $2 + 2 = 4 \rightarrow 1 + 1 = 5$
- Paris is in England if and only if  $2 + 2 = 5$

b. Given that  $z_1 = 2 + i$  and  $z_2 = -3 + 2i$  Evaluate  $\left(\frac{z_1}{z_2}\right)$  in modulus argument form [5 marks]c. Prove that  $\sim p \vee \sim q = \sim (p \wedge q)$  [4 marks]d. Obtain the constant term in the expansion of  $\left(2x - \frac{1}{10x}\right)^{100}$  [4 marks]e. let  $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$  and let,  $A = \{x \in U : x \text{ is a prime number}\}$ ,  $B = \{x \in U : x \text{ is an even number}\}$ . Find the set  $(A \cup B)^c$  [4 marks]

f. In the Venn diagrams below shade

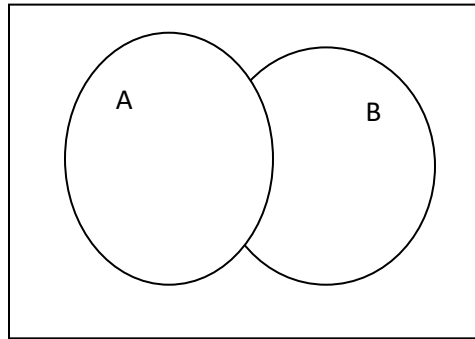
i.  $(A \cup B)^c$

[2 marks]



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

[2 marks]



- g. The average of the second and 3<sup>rd</sup> terms of an arithmetic sequence is 4 and the first term is -2. Find the 6<sup>th</sup> term. [5 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).  $f \circ g(1)$

[1 mark]

(iii).  $(g \circ h(x))^{-1}$

[4 marks]

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

[1 mark]

- b. Obtain the first 4 terms in the binomial expansion of  $(1+x)^{-1}$ , hence approximate  $(3.95)^{-1}$  [5 marks]
- c. The sum of the first 8 terms of an Arithmetic progression is 220. If the 3<sup>rd</sup> term is 17. Find the sum of the first 6 terms. [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. Solve the equation  $\cos(x+20) - \cos(x+80) = 0.5$ ,  $0 \leq x \leq 360$

5marks

- c. The sum of the 3 terms of a geometric progression is 26. If the common ratio is 3, find the sum of the first 6 terms. [4 marks]
- d. Prove that  $\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$  [5 marks]

**QUESTION FOUR**

- a. In how many ways can a committee consisting of 3 men and 2 women, be chosen from 7 men and 5 women? [4 marks]
- b. Given that  $5p_x = 20$ , find the value of x [5 marks]
- c. Solve the equation  $\sin 3x + \sin 2x = 0$ ,  $(-180 \leq x \leq 180)$  [6 marks]
- d. Given that  $z_1 = (3, 52)$  and  $z_2 = (2, 15)$ , obtain  $(z_1 \cdot z_2)^2$  in Cartesian coordinates [5 marks]

**QUESTION FIVE**

- a. Given,  $\sin A = \frac{3}{5}$ ,  $\sin B = \frac{4}{5}$  Find
- i.  $\sin(A - B)$  [3 marks]
- ii.  $\cos(A - B)$  [3 marks]
- iii.  $\tan(A + B)$  [3 marks]

b. Prove that  $p \rightarrow (q \wedge r) \equiv (p \rightarrow q) \wedge (p \rightarrow r)$  [6 marks]

c. In how many ways can 4 boys and 2 girls be seated in a row when

i. The boys and the girls can sit anywhere [2 marks]

ii. The two girls must be together [2 marks]

iii. The two girls must be separated [1 mark]

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