

MATH 0121

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

EXAMINATION FOR THE AWARD OF DIPLOMA IN

MATH 0121: INTRODUCTORY MATHEMATICS

STREAMS: Y2 S2

TIME: 2 HOURS

DAY/DATE: THURSDAY 9/04/2020

11.30 A.M – 1.30 P.M.

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### INSTRUCTIONS

- Answer **ALL** questions in **Section A** and any other **TWO** in Section B.
- Do not write anything on the question paper
- Non-programmable electronic calculators may be used

### SECTION A

#### QUESTION ONE [30 MARKS]

(a) State the properties of real numbers in the equations below. [4 Marks]

- i)  $4(5 + 6) = 20 + 24$
- ii)  $7 + 6 = 6 + 7$
- iii)  $5 \times 1 = 5$
- iv)  $5 = 5 + 0$

b) Classify each of the following numbers. [3 Marks]

- i) 3
- ii) 4.632
- iii)  $-2 + 3i$

c) Find the modulus given  $z = 2 + 3i$  [2 Marks]

d) Show that  $A \cup B = B \cup A$  [5 Marks]

e) Use the following piecewise functions to evaluate for the given values of x.

$$f(x) \begin{cases} -x^2 + 2 & x < -2 \\ 2x + 1 & \text{for } -2 \leq x < 0 \\ x^2 + 2 & x \geq 0 \end{cases}$$

i)  $f(5)$  [2 Marks]

ii)  $f(-4)$  [2Marks]

iii)  $f(-2)$  [2 Marks]

f) Write down the series  $\sum_{j=-1}^s 2^j$  in full and evaluate it. [2 Marks]

g) In how many ways can the letters of word CELEBRATION be arranged in order for the vowels to come together. [3 Marks]

h) In an AP of 25 terms, the 4<sup>th</sup> term is 4 and the 22<sup>nd</sup> term is 5. Find the sum of the AP. [5 Marks]

## QUESTION TWO [20 MARKS]

a) Use long division method to obtain the quotient when

$4x^4 + 2x^3 - 7x^2 + x - 3$  is divided by  $x - 2$  [5 Marks]

b) Given  $f(x) = 3x - 1$   
 $h(x) = 2x + 2$

Show that in general  $foh(x) \neq hof(x)$  [5 Marks]

c) The first term of a sequence is 6. Each term is thrice the term before. Write down the first five terms of the sequence. [4 Marks]

d) Given  $\theta_1 = -2 - 3i$   
 $\theta_2 = 6 + 2i$

Evaluate i)  $\theta_2 \theta_1$  [2 Marks]

ii)  $\frac{\theta_1}{\theta_2}$  [4 Marks]

**QUESTION THREE [20 MARKS]**

- a) Expand  $(-3x + 2y)^7$  [5 Marks]
- b) Given that  $f(x) = x-2$  and  $g(x) = 3x^2 + 1$ . Evaluate
- i)  $f \circ g(2)$  [2 Marks]
  - ii)  $g \circ f(3)$  [2 Marks]
  - ii)  $f \circ f(x)$  [2 Marks]
- c) Solve for  $n$  in  $n C_2 = 28$  [5 Marks]
- d) Using examples justify the following statements.
- i) All natural numbers are intergers but all intergers are not natural numbers. [2 Marks]
  - ii) All intergers are rational numbers. [2 Marks]

**QUESTION FOUR [20 MARKS]**

- a) Given  $f(x) = 2x + 1$  [2 Marks]  
 $g(x) = -3 - 4x$
- Find (i)  $f(x) + g(x)$  [2 Marks]
- (ii)  $g(x) - f(x)$  [2 Marks]
- (b) Simplify  $\frac{\cos^2 \theta}{1 + \sin \theta} + \frac{\cos^2 \theta}{1 - \sin \theta}$  [5 Marks]
- (c) An AP has the 2<sup>nd</sup> term 5 and 5<sup>th</sup> term 9. Find the first term and common difference. [5 Marks]
- (d) Prove analytically that  $(A \cap B) \cap C = A \cap (B \cap C)$  [6 Marks]

**QUESTION FIVE****[20 MARKS]**

- a) A school committee of 9 members is to be chosen from 8 parents and six teachers and the principal. How many ways can the committee be formed in order to include:
- i) The Principal [1 Mark]
  - ii) The Principal and five parents. [2 Marks]
- b) The 2<sup>nd</sup> term of a GP is 2 and 4<sup>th</sup> term is 18. Find the possible values of the common ratio and the corresponding first terms. [5 Marks]
- c) Construct the truth table to verify if the statements in  $(P \vee Q)$  and  $\sim P \wedge \sim Q$  are equivalent. [5 Marks]
- d) Solve the trigonometric equation.  
 $2 \tan^2 \theta = \tan \theta + 1$   $0 \leq \theta \leq 360^\circ$  [5 Marks]
- e) Given  $A = \{b, c, d\}$   
 $B = \{c, d, e, f\}$   
 $C = \{d, g, h\}$   
 $U = \{a, b, c, d, e, f, g, h, i\}$

Find (i)  $A \cup B \cup C$ 

[1 Mark]

(ii)  $(A \cup B)^c$ 

[1 Mark]