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.**

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 AUB = BUA   [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 $\sum_{j=-1}^{s} 2^i$ 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 4th term is 4 and the 22nd 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) $\dfrac{\theta_1}{\theta_2}$ [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) fog (2)   [2 Marks]
        ii) gof (3)   [2 Marks]
        ii) fof (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 $\dfrac{\cos^2\theta}{1+\sin\theta} + \dfrac{\cos^2\theta}{1-\sin\theta}$ [5 Marks]

  (c) An AP has the 2nd term 5 and 5th term 9. Find the first term and common difference.

                                                        [5 Marks]

  (d) Prove analytically that (A∩B)∩ C = A∩ (B∩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 2nd term of a GP is 2 and 4th 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 (PVQ) and $\sim P^\wedge \sim Q$ are equivalent.
                                                                                        [5 Marks]

d)   Solve the trigonometric equation.
    $2\,tan^2\theta = \tan\theta + 1$ O$\leq \theta \leq 360^0$ [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) AUBUC   [1 Mark]

   (ii) (AUB) ^{C} [1 Mark]