

GOVERNMENT BILINGUAL HIGH SCHOOL YAOUNDE

School Year 2020/2021

DEPARTMENT: MATHEMATICS: Duration 1hr 30min

EVALUATION 5: SUBJECT TITLE: FURTHER MATHEMATICS

STUDENTNAME(S).....DATE.....LOWER SIXTH

SECTION A: Choose the letter corresponding to the correct answer

- One of the solutions of the congruence equation  $2x + 5 \equiv 2 \pmod{7}$  is  
[A] 3 [B] 4 [C] 5 [D] 9
- The cofactor of 3 in the matrix  $T = \begin{pmatrix} 9 & 3 & 5 \\ -1 & 7 & 4 \\ 6 & 0 & 2 \end{pmatrix}$  is  
[A] -26 [B] -12 [C] 12 [D] 26
- Which of the following sequence is convergent  
[A]  $\sum_{r=0}^{\infty} r \left(\frac{3}{r} + 2\right)$  [B]  $\sum_{r=1}^{\infty} \frac{1}{5^{r+1}}$  [C]  $\sum_{r=0}^{\infty} \frac{1}{2^{-r}}$  [D]  $\sum_{r=1}^{\infty} (-1)^{r+1}$
- Given the structure  $(\{a, b, c, d, e, f\}, *)$  is a group with identity element e, which one of the following structures is a sub-group?  
[A]  $(\{a, b\}, *)$  [B]  $(\{a, b, c, e\}, *)$  [C]  $(\{a, c, f\}, *)$  [D]  $(\{a, d, e\}, *)$
- Which one of the following equations has no solution in  $\mathbb{Z}$ ?  
[A]  $2x + 3y = 9$  [B]  $8x + 6y = 26$  [C]  $6x + 9y = 14$   
[D]  $15x + 20y = 50$

SECTION B: Answer all questions

- Two recursive sequences  $u_n$  and  $v_n$  are defined by  
 $u_0 = 9, u_{n+1} = \frac{1}{2}u_n - 3. \quad v_n = u_n + 6.$ 
  - Show that  $v_n$  is geometric sequence with common ratio  $r = \frac{1}{2}$  and  $v_0 = 15$
  - Calculate  $S_n = \sum_{k=1}^n v_k$  in terms of n.
  - Hence or otherwise find  $T_n = \sum_{k=0}^n u_k$  in terms of n.
  - Evaluate

$$\lim_{n \rightarrow \infty} S_n \quad \text{and} \quad \lim_{n \rightarrow \infty} T_n$$

Another sequence  $w_n$  is defined by  $w_n = \ln(v_n)$

Show that  $w_n$  is an arithmetic sequence with common difference  $-\ln 2$

vi) Calculate

$$T_n = \sum_{k=0}^{\infty} w_k$$

2. Given two matrices **A** and **B** where  $A = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{pmatrix}$  and

$B = \begin{pmatrix} 1 & -3 & 2 \\ -3 & 3 & -1 \\ 2 & -1 & 0 \end{pmatrix}$ . Find the matrix product **AB** and **BA**.

Hence solve the system of equations  $x + 2y + 3z = -5$

$$2x + 4y + 5z = 3$$

$$3x + 5y + 6z = 1$$

3. Find the value of  $x$  for which the matrix  $\begin{pmatrix} 2 & 1 & 1 \\ 3 & x & 3 \\ -1 & -2 & 4 \end{pmatrix}$  is singular.