MATHEMATICS

MAT 01

28/07/2022 08:30 AM – 11:30 AM

NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

TTC NATIONAL EXAMINATIONS, 2021-2022

SUBJECT: MATHEMATICS

OPTION: EARLY CHILDHOOD AND LOWER PRIMARY EDUCATION **(ECLPE)**

DURATION: 3 HOURS

INSTRUCTIONS:

1) Write your names and index number on the answer booklet as written on your registration form, and **DO NOT** write your names and index number on additional answer sheets if provided.
2) Do not open this question paper until you are told to do so.
3) This paper consists of **two** sections: **A** and **B**.
   Section A: Attempt **all** questions. **(55 marks)**
   Section B: Attempt **any three** questions. **(45 marks)**
4) Geometrical instruments and silent non-programmable calculators may be used.
5) Show your working.
6) Use only a **blue** or **black** pen.

SECTION A: ATTEMPT ALL QUESTIONS (55 marks)

1) Find the value of the polynomial $\frac{5}{6}p^2q-2p+q-4r$ *if* $p=12, q=7$ and $r=9$

(3 marks)

2) Solve in set of real numbers $\log x=2\log 2x$ **(3 marks)**

3) Simplify the expression $\sqrt{45}+2\sqrt{20}$ **(3 marks)**

4) a) What is the degree of a non zero constant? **(1 mark)**

b) What is the degree of a term with zero coefficient? **(1 mark)**

c) Determine the value of **a**, **b** and **c** if the following polynomial are equal:

$$\frac{(x-1)^2}{2x} \text{ and } ax+b+\frac{c}{x}$$ **(3 marks)**

5) Given E = {1, 4, 8, 11, 16, 25, 49, 53, 75}, list the elements of the following subsets:

a) Even numbers. **(2 marks)**

b) Odd numbers. **(2 marks)**

6) The fifth term of an Arithmetic Progression is 23 and the twelveth term is 37.

a) Find the first term. **(1 mark)**

b) Find the common difference. **(1 mark)**

c) Find the sum of the first eleven terms. **(2 marks)**

7) In a class of 40 students, 26 play football and 20 play volleyball. 17 students play both games. How many students play none of the games at all? **(4 marks)**

8) Gashugi, Musoni and Nduwayo shared 60,000 Frw in the ratio 11: 10: 9. How much money did each get? **(4 marks)**

9) Determine a number such that when it is divided by 3 and added by 2, the result is 17. **(3 marks)**

10) Find an equation of a straight line that passes through $(3,-1)$ *and* $(7,2)$. **(3 marks)**

11) Solve the following inequality and give the solution in interval notation. **(3 marks)**

$$3-7x \leq 2x+21$$

12) Show that $(p \Rightarrow q) \vee (q \Rightarrow p)$ is a tautology. **(4 marks)**

13) Solve the following system of equations using matrix or Cramer's method: $\begin{cases} x+y=8 \\ x-y=2 \end{cases}$ **(4 marks)**

14) Solve for **x** : $\log_2\left[(2^x-5)^{\log_3^2}\right]+\log_3\left[2^{(x-3)}\right]=1$ **(4 marks)**

15) Suppose that x is between 0 *and* $\frac{\pi}{2}$; and $\sin x = \frac{3}{5}$, and $\cos x = \frac{4}{5}$,

a) Find $\tan x$. **(2 marks)**

b) $\sec^2 x - \tan^2 x$. **(2 marks)**

SECTION B: ATTEMPT ANY THREE QUESTIONS (45 marks)

16) A survey was carried out in a shop to find the number of customers who bought bread or milk or both or neither. Out of a total of 79 customers in a day, 52 bought milk, 32 bought bread and 15 bought neither.

a) Represent the information using a venn diagram. **(9 marks)**

b) Find the number of customers who:

(i) Bought bread and milk. **(2 marks)**

(ii) Bought bread only. **(2 marks)**

(iii) Bought milk only. **(2 marks)**

17) Let $3x^2+(4h-2)x+3h+\frac{1}{3}$ be a parametric equation. Determine the values of h such that the equation admits:

a) 2 distinct roots. **(2 marks)**

b) No real roots. **(2 marks)**

c) Two negative roots. **(2 marks)**

d) One root is zero another is not zero. **(2 marks)**

e) Double roots. **(2 marks)**

f) Two positive roots. **(5 marks)**

18) Given the following system of equations:

$$\begin{cases} 3x-2y+4y=4 \\ 4x-3y+2z=1 \\ 5x+y-4z=9 \end{cases}$$

a) Solve the given system by using elimination method. **(6 marks)**

b) i) Use the coefficients of the given system to write a matrix $A_{3\times3}$.

(1 mark)

ii) Find the determinant of the matrix A found in (i) above. **(2 marks)**

iii) Is the matrix A a singular matrix or regular matrix?
Explain your answer. **(2 marks)**

iv) Calculate the transpose A^T of matrix A. **(1 mark)**

v) Find the minor and the cofactor of an entry at $i=2$ *and* $j=3$.

(3 marks)

19) The table below is a variation table of a mathematical function. Study it and answer the questions that follow.

X	$-\infty$	-2	-1	0	$+\infty$
f'(x)		+ 0 -		- 0 +	
f(x)	$-\infty$	↗ -2 ↘		↘ 2 ↗	$+\infty$

If f is in the form: $f(x)=ax+b+\frac{c}{x+1}$ where **a**, **b** and **c** are real numbers

a) Calculate $f'(x)$ **(3 marks)**

b) Using the above results, find the real coefficients **a**, **b** and **c**.

(5 marks)

c) Prove that the curve representing f admits D$\equiv y=x+1$ (where x tends to $+\infty$ or $-\infty$) as an asymptote. **(7 marks)**

20) The data below represents marks of 25 students in a given test marked out of 10.

7, 3, 4, 0, 2, 0, 5, 4, 4, 6, 1, 7, 2, 3, 3, 5, 1, 4, 0, 3, 6, 4, 0, 2, 5.

a) Construct a frequency table of the data above. **(6 marks)**

b) Determine the range of the data. **(1 mark)**

c) Calculate the mean of these data. **(2 marks)**

d) Find the median of the data. **(1 mark)**

e) Find the mode of the data. **(1 mark)**

f) Calculate the variance and the standard deviation. **(4 marks)**

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