MATHEMATICS: Content Knowledge & Teaching Methods

MAT 01

26/07/2021 **8:30 AM-11:30 M**

NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

TTC NATIONAL EXAMINATIONS, 2020-2021

SUBJECT: MATHEMATICS: Content Knowledge & Teaching Methods

OPTION: SCIENCE AND MATHEMATICS EDUCATION **(SME)**

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 **Three** sections: **A**, B and **C**.
   SECTION A: COMPULSORY (ATTEMPT ALL QUESTIONS) (45 marks)
   SECTION B: CHOOSE ONLY 3 QUESTIONS (30 marks)
   SECTION C: METHODOLOGY: (Choose one question) (25 marks)
4) Geometrical instruments and silent non-programmable calculators may be used.
5) Show your working.
6) Use a **blue** or **black** pen.

SECTION A: Attempt all questions (45 marks)

1) Rationalise the following :

a) $\frac{2}{\sqrt[3]{2}} =$ **(2 marks)**

b) What is the place value of 5 in the number 28.15 **(1 mark)**

2) Solve for n $x^n : x^4 = x^5$ **(3 marks)**

3) If the first and tenth terms of a geometric sequence are 1 and 4, respectively, find the nineteenth term. **(3 marks)**

4) Solve in $\mathbb{R}$ the equation $\frac{5}{x-2} = \frac{10}{x+3}$ **(3 marks)**

5) Calculate the following integral $\int (x - 11 + \frac{3}{\sqrt{3}})dx =$ **(3 marks)**

6) Prove that $1 + \tan^2 x = \sec^2 x$; $x \in \mathbb{R} \setminus \{\pm\frac{\pi}{2}, \pm\frac{3\pi}{2}, ...\}$ **(4 marks)**

7) How many permutations of 3 letters chosen from eight letters are there in the word RELATION? **(4 marks)**

8) Solve in $\mathbb{R}$ $5x^2 - 3x + 10x - 6 = 0$ **(4 marks)**

9) $f(x) = -3x + 2$ and $g(x) = x^2 + 1$

Find

a) $fog(x) =$ **(3 marks)**

b) $gof(x) =$ **(2 marks)**

10) The LCM of two numbers is 30. One of the numbers is 10. If the GCF is 5, find the second number. **(4 marks)**

11) If a man deposits \$130 000 in a bank at 7% interest compounded annually, how much will be in the bank 17 years later? **(4 marks)**

12) Given the matrix A such that $A=\begin{pmatrix} a & c \\ b & d \end{pmatrix}$

a) Write the formula of calculating the inverse of matrix A **(2 marks)**

b) Find the inverse of matrix A if $A=\begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix}$ **(3 marks)**

SECTION B: CHOOSE ONLY 3 QUESTIONS (30 marks)

13) a)Given the function $f(x)$ such that $f(x)=\frac{1}{x-2}$

i) Determine the domain of $f(x)$ **(2 marks)**

ii) Determine its range **(4 marks)**

b) Calculate the integral $\int xe^x dx$ **(4 marks)**

14) Given the data set of marks for students in a Physics test

4 , 10 , 7 , 7 , 6 , 9 , 3 , 8 , 9

Find:

a) the mode **(1 marks)**

b) the median **(1 marks)**

c) the mean **(2 marks)**

d) the sample standard deviation. **(6 marks)**

15) A pen is drawn from a basket containing 10 pens of which 5 are red and 3 are black. If A is the event: "a pen is red" and B is the event: "a pen is black", find:

a) $P(A)$ **(3 marks)**

b) $P(\text{B})$ **(3 marks)**

c) $P(\text{A}\cup\text{B})$ **(4 marks)**

16) Solve the following linear system by using inverse matrix Method.

$$\begin{cases} x+y-4=z \\ x-3y+1=-2z \\ -x+2y=z \end{cases}$$ **(10 marks)**

17) Jessica is a businesswoman. Her income in a year is 12,000,000 Frw. She calculated her business expenditure and found out that 1/5 of her income is spent on advertisement of her products.

She spends 3 /20 of her income on paying her staff. The goods that she bought cost 1/3 of her income. She saved the rest.

a) How much money does Jessica pay for advertising? **(2 marks)**

b) How much money does Jessica pay her staff? **(3 marks)**

c) What is the cost of the goods that Jessica buys? **(2 marks)**

d) How much does she save? **(3 marks)**

SECTION C: METHODOLOGY (Attempt only one question) (25 marks)

18) a) Discuss the principles underlying the teaching and learning of Mathematics **(15 marks)**

b) i) Explain with four clear steps how pupils should be guided to solve word problems. **(8 marks)**

ii) Provide two examples of word problems (one for addition and one for subtraction in P2). **(2 marks)**

19) You are given the following lesson" *perimeter of rhombus*" to be taught

a) Prepare an instructional objective to be achieved. **(5 marks)**

b) Suggest the appropriate teaching and learning resources for this lesson **(4 marks)**

c) Prepare the appropriate assessment activity to check the achievement of your objective. **(4 marks)**

d) What are the best active teaching and learning techniques that can be used to deliver this lesson effectively? **(3 marks)**

e) Show the generic competences that will be developed when applying such techniques and explain how they will be developed. **(5 marks)**

f) What are the cross-cutting issues mostly related to this lesson? Show how they will be addressed. **(4 marks)**