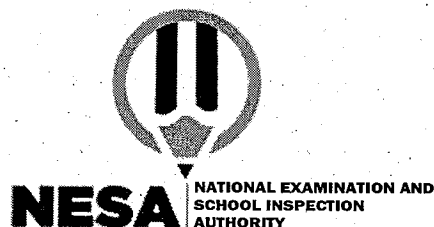


**MATHEMATICS: Content
Knowledge & Teaching Methods**

MAT 01

26/07/2021

8:30 AM-11:30 M



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 $1 + \tan^2 x = \sec^2 x$; $x \in \mathbb{R} \setminus \{\pm \frac{\pi}{2}, \pm \frac{3\pi}{2}, \dots\}$ (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) $f \circ g(x) =$ (3 marks)

b) $g \circ f(x) =$ (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) $P(B)$ (3 marks)

c) $P(A \cup B)$ (4 marks)

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

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

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

She spends $\frac{3}{20}$ of her income on paying her staff. The goods that she bought cost $\frac{1}{3}$ 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)