NESA NATIONAL EXAMINATION AND SCHOOL INSPECTION AUTHORITY

Mathematics

MAT 02

11/07/2025 08:30 AM – 11:30 AM

Names: .....

Index number: .....

SUBJECT : MATHEMATICS

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

DURATION: 3 HOURS

S6 QUESTIONS and ANSWERS BOOKLET

TTC NATIONAL EXAMINATIONS, 2024-2025

Instructions to candidates:

1) Write your names and index number on the answer booklet as written on your registration form.
2) Do not open this question paper until you are told to do so.
3) This paper consists of **two** sections: **A** and **B**.

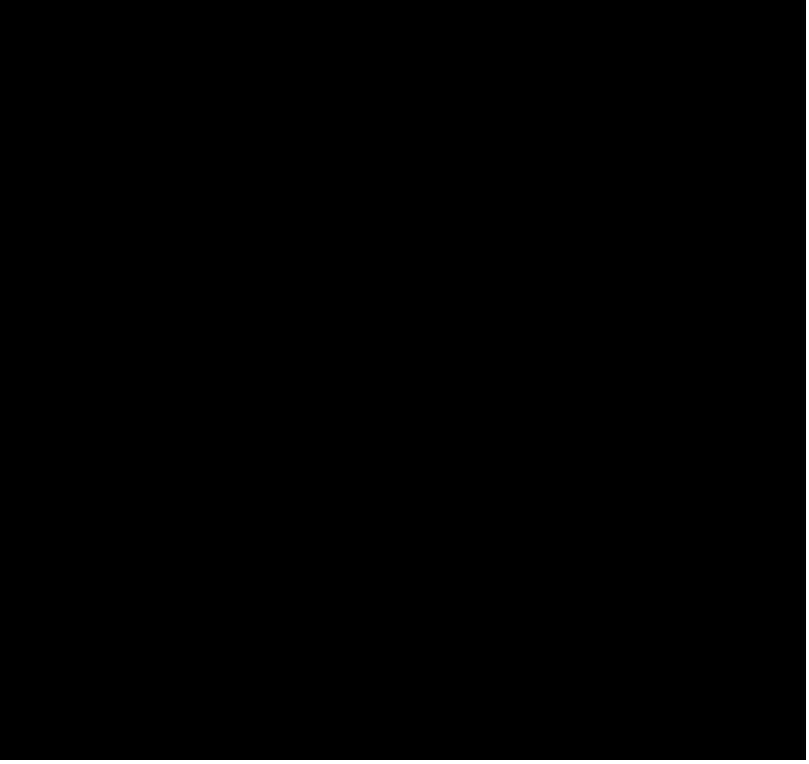
   Section A: Attempt **all** questions. **(55 marks)**

   Section B: Attempt any **three** questions. **(45 marks**)
4) Geometrical instruments and silent non-programmable calculators may be used.
5) Show your all-working steps where they are needed.
6) Use only a **blue** or **black** pen.

TOTAL MARKS...../100

FOR EXAMINER'S USE ONLY

Questions	Marks	Questions	Marks
1		16	
2		17	
3		18	
4		19	
5		20	
6		21	
7		22	
8		23	
9		24	
10		25	
11		26	
12		27	
13		28	
14		29	
15		30	

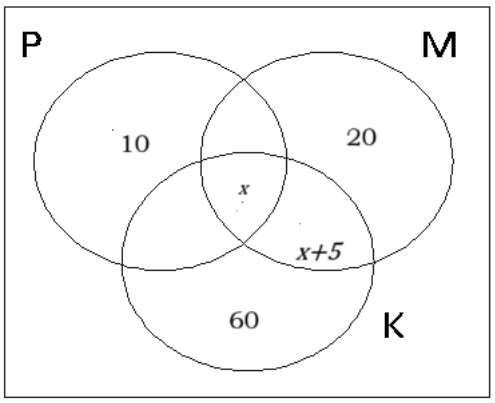


Section A: Attempt all questions (55 marks)

1) Choose the best answer and circle the letter corresponding to it.
Given that $\{2,3,5,7,x\} \cap \{9,3,7,4\} = \{3,4,y\}$; the values of x *and* y are:

a) $x = 7$ *and* $y = 4$
b) $x = 4$ *and* $y = 7$
c) $x = 9$ *and* $y = 3$ **(3 marks)**
d) $x = 3$ *and* $y = 9$

2) The Venn diagram below shows the number of senior one students in a school who like Mathematics (M), Physics (P) and Kinyarwanda (K). Some like more than one subject and in total 55 students like Mathematics.



a) Choose the right answer.

All students who like the three subjects are:

(i) 15
(ii) 25
(iii) 30
(iv) 35 **(2 marks)**

b) Choose the correct answer.

The total number of senior one students in the school is:

(i) 65
(ii) 90
(iii) 125
(iv) 155 **(2 marks)**

c) Choose the best answer.

The students who like Mathematics and Kinyarwanda only are:

(i) 15

(ii) 20

(iii) 45

(iv) 60 **(2 marks)**

3) Choose the right answer: $\sum_{k=3}^{k=6}(-1)^k k^2 =$ **(3 marks)**

a) 85

b) 21

c) 18

d) 76

4) Choose the right answer:

a) $\sqrt{-81} =$ **(2 marks)**

(i) 0

(ii) 9

(iii) $9i$

(iv) -9

b) If $Z = -1 + i$, then the trigonometric form of Z is equal to: **(3 marks)**

(i) $\sqrt{2}\left(\cos\frac{\pi}{4} + i\sin\frac{\pi}{4}\right)$

(ii) $\sqrt{2}\left(\cos 3\frac{\pi}{4} + i\sin 3\frac{\pi}{4}\right)$

(iii) $\sqrt{2}\left(\cos 4\frac{\pi}{3} + i\sin 4\frac{\pi}{3}\right)$

(iv) $\left(\cos 3\frac{\pi}{4} + i\sin 3\frac{\pi}{4}\right)$

5) Read and state if the events are not mutually exclusive or mutually exclusive. **(4 marks)**

a) Getting an odd number and getting an even number.

b) Getting a 3 and getting an odd number.

c) Getting an odd number and getting a number less than 4.

d) Getting a number greater than 4 and getting a number less than 4.

6) Use true or false for the following affirmation. Recall the quadratic equation $az^2 + bz + c = 0$. If the coefficients a, b *and* c are all real, then the roots depend upon the discriminant, $\Delta = b^2 - 4ac$. **(3 marks)**

a) If $\Delta > 0$, then there are two distinct real roots.
b) If $\Delta = 0$, then there is no real root.
c) If $\Delta < 0$, then there is one pair of complex conjugate roots

7) Choose the right answer:

By simplifying, $\frac{2\sqrt{6}+5\sqrt{32}}{-1-2\sqrt{3}}$ equals to: **(3 marks)**

a) $\frac{38\sqrt{6}-8\sqrt{2}}{11}$

b) $\frac{38\sqrt{6}+8\sqrt{2}}{-11}$

c) $\frac{8\sqrt{2}-38\sqrt{6}}{-11}$

d) $\frac{38\sqrt{6}-8\sqrt{2}}{-11}$

8) Choose the best answer:

Give three positive numbers such that the ratio of first and second is 4:7 and the ratio of the second and third is 2:3. If the product of first and third is 4200, then the sum of the three numbers equals: **(3 marks)**

a) 196

b) 205

c) 215

d) 182

9) Choose the best answer:
The solution of the inequality $(1-x)(x-2)>0$ is : **(3 marks)**

a) $S=(1,2)$

b) $S=[1,2]$

c) $S=\mathbb{R}\backslash(1,2)$

d) $S=\mathbb{R}\backslash[1,2]$

10) Choose the best answer:
What does a scatter plot represent? **(3 marks)**

a) Distribution of a single variable
b) Relationship between two variables
c) Summary statistics of a dataset
d) Frequency distribution of a variable

11) Choose the right answer:
The equation of the tangent line to the curve $y=\ln(4x-11)$ at the point where $x=3$ is : **(3 marks)**

a) $T\equiv y=x+3$

b) $T\equiv y=x-3$

c) $T\equiv y=2x-1$

d) $T\equiv y=x+1$

12) Match the following sequences with their corresponding types:

(3 marks)

Sequences		**Type of sequences**
a) $10, 2, \frac{2}{5}, \frac{2}{25}, \ldots$		(i) Arithmetic sequence
b) $\frac{1}{20}, \frac{1}{16}, \frac{1}{8}, \ldots$		(ii) Geometric sequence
c) $5, 8, 11, 14, \ldots$		(iii) Harmonic sequence

13) Choose the right answer:

The partial fraction of the expression $\frac{3x}{x^2+x-2}$ is equal to: **(3 marks)**

a) $\frac{2}{x-1}+\frac{1}{x+2}$

b) $\frac{1}{x-1}+\frac{2}{x+2}$

c) $\frac{3}{x-1}+\frac{1}{x+2}$

d) $\frac{1}{x-1}+\frac{3}{x+2}$

14) Verify and respond with either **true** or **false**: **(5 marks)**

a) $\sin(\alpha+\beta)=\sin\alpha+\sin\beta$ .....

b) $\tan(\alpha+\beta)=\frac{\tan\alpha+\tan\beta}{1-\tan\alpha\tan\beta}$ .....

c) $\cos(\alpha+\beta)=\cos\alpha\cos\beta+\sin\alpha\sin\beta$ .....

d) $\sin 2\beta=\frac{1}{2}\sin\beta\cos\beta$ .....

e) $\cos\frac{\beta}{2}=\pm\sqrt{\frac{1+\cos\beta}{2}}$ .....

15) A surveyor measures the angle of elevation to the top of a building as 30 degrees. If the surveyor is standing 50 meters away from the building, calculate the height of the building. **(5 marks)**

Section B: Attempt any three questions only (45 marks)

16) A football team of 11 is to be chosen from 15 players.

a) How many different teams can be selected? **(5 marks)**

b) How many teams can be selected if the Captain must be in the team?

(5 marks)

c) How many teams can be selected if the Captain must be in the team and one of the other players is injured and cannot play? **(5 marks)**

17) In a partially destroyed laboratory record of an analysis of correlation data, the following results only are legible: Variance of x is 9 , Equations of regression lines are: $8x-10y+66=0$ and $40x-18y-214=0$. What were

a) the mean values of x and y ; **(5 marks)**

b) the coefficient of correlation between x and y ; **(7 marks)**

c) the standard deviation of y . **(3 marks)**

18) The given function y is defined as $y = e^{(-x^2)}$ where $x \in \mathbb{R}$.

a) Find the domain of definition for y. **(2 marks)**

b) Find the coordinates of the turning point of the function y. **(4 marks)**

c) Find the points of inflection of the function y. **(5 marks)**

d) Sketch the graph of the function y. **(4 marks)**

19) a) Find the volume of the solid of revolution formed by rotating the area enclosed by the curve $y = x + x^2$, about the $x-$axis, between $x = 2$ and $x = 3$ **(10 marks)**

b) Find the area mentioned in a). **(5 marks)**

20) a) Given the points $A(2,3,1)$ and $B(3,-1,4)$

(i) Calculate the distance between the two points. **(2 marks)**

(ii) Write the vector, parametric and symmetric equations of the line through points. **(4 marks)**

b) Find the distance between

$$L_1 \equiv \begin{cases} x = 3 + 2t \\ y = -2t \\ z = 4 - t \end{cases} \quad \text{and} \quad L_2 \equiv \begin{cases} x = 4 - t \\ y = 3 + 5t \\ z = 2 - t \end{cases}$$ **(9 marks)**

Space in which to answer the three chosen questions from Section B.