

**MATHEMATICSII: 100 marks**

**LEVEL: S5 MCB**

**On 9<sup>th</sup> February 2026**

**GS KIBYIMBA**

**SECOND TERM SCHOOL MID TEST**

**Academic year 2025-2026**

**DURATION: 3HOURS**

**INSTRUCTIONS AND REGULATIONS (Please read it):**

- **SECTION A:** Attempt all questions [55marks]
- **SECTION B:** Attempt any three questions [45marks]
- For multiple choice questions, show clearly all the working steps and circle a letter corresponding to the correct answer. **Marks will not be awarded for the answer without all working steps.**
- Geometrical instruments and silent non-programmable calculators may be used.

<b>Question</b>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	20 questio ns	
<b>Marks</b>																						Total 100

**SECTION A: Answer all questions 55marks**

1. Given that  $\log 2 = x$  and  $\log 3 = y$ . find  $\log 2.25$  and circle the correct answer **(3marks)**

- A.  $2(x + y)$
- B.  $-2(x - y)$
- C.  $2(x - y)$
- D. Not enough information

2. The sum of the three numbers of an arithmetic sequence is 15 and the sum of their square is 83. Find the numbers and circle the correct answer. **(4marks)**

- a) 4,5,6
- b) 3,5,7
- c) 1,5,9
- d) 2,5,8

3. The root of  $f(x) = x^2 - x - 1$  lies in the interval **(2marks)**
- a.  $[0,1]$
  - b.  $[1,2]$
  - c.  $[2,3]$
  - d.  $[-1,0]$

4. The function  $f(x) = x \sin x$  is **(2marks)**
- a) Even
  - b) Odd
  - c) Neither
  - d) Periodic only

5. Solve  $e^{2x} - 5e^x + 6 = 0$  and circle the correct answer **(3marks)**
- a.  $x = \ln 2, \ln 3$
  - b.  $x = \ln 3, \ln 4$
  - c.  $x = \ln 3, \ln 6$
  - d.  $x = 0, \ln 5$

6. Express  $\sin 3x \cos 4x$  as a sum

**(2marks)**

a.  $\frac{1}{2}(\sin 7x + \sin x)$

b.  $\frac{1}{2}(\sin 7x - \sin x)$

c.  $\frac{1}{2}(\cos 7x + \cos x)$

d.  $\frac{1}{2}(\cos 7x - \cos x)$

7. Determine for what value is the sequence  $U_n = \frac{n^2 - 3n + 2}{2n^2 + 1}$  converge to **(3mark)**

a. 0

b.  $\frac{1}{2}$

c. 1

d.  $\infty$

8. The population of a city grows according to the formula  $P(t) = P(0).e^{kt}$  where  $P_0$  is the initial population,  $t$  is time in years, and  $k$  is the growth rate. If the Population double in 10 years, what is the value of  $k$ ? **(2 marks)**

a.  $\frac{\ln 2}{10}$

b.  $\frac{\ln 10}{2}$

c.  $\frac{10}{\ln 2}$

d.  $\frac{2}{\ln 10}$

9. Solve  $\ln(x - 1) + \ln(2x - 1) = 2\ln(x + 1)$  and circle the correct answer

a. 0,5

**(3marks)**

b. 5

c. 16

d. 10

10. If  $1, \log_9(3^{1-x} + 2), \log_3(4 \cdot 3^x - 1)$  are in arithmetic progression. Then  $x$  equals to **(3marks)**

- a.  $\log_3 4$
- b.  $1 - \log_3 4$
- c.  $1 - \log_4 3$
- d.  $\log_4 3$

11. Find the general solution of  $\sin 3x + \sin 2x + \sin x = 0$  and circle the correct answer **(4marks)**

a.  $x = \frac{n\pi}{2}, 2n\pi \pm \frac{2\pi}{3}$

b.  $x = n\pi, \frac{2n\pi}{3} \pm \frac{\pi}{3}$

c.  $x = \frac{n\pi}{3}, n\pi \pm \frac{\pi}{4}$

d.  $x = \frac{n\pi}{2}, \frac{2n\pi}{3}$

11. Find the value of  $x$  and  $y$   $\begin{cases} 4 \log_5 x + \log_5 y = 1 \\ 5 \log_5 x - 3 \log_5 y = 14 \end{cases}$  **(4marks)**

12.a Write the vector  $\vec{w}$  (1,6) as linear combination of the vector  $\vec{u}$ (2,3) and  $\vec{v}$ (-1,-2) **(2marks)**

b. Consider the vectors  $\vec{u}$ (1, -3, 2) and  $\vec{v}$  (2,-1,1) of  $\mathbb{R}^3$ , for what value of k, the vector (1,k,5) is linear combination of  $\vec{u}$  and  $\vec{v}$  **(4marks)**

13. Find the matrix  $\begin{bmatrix} x & y \\ u & v \end{bmatrix}$  such that  $\begin{bmatrix} 5 & 2 \\ 3 & 1 \end{bmatrix} \begin{bmatrix} x & y \\ u & v \end{bmatrix} = \begin{bmatrix} 7 & 6 \\ 5 & 4 \end{bmatrix}$  **(5marks)**

14. Find the derivative of the following functions

i.  $f(x) = \sin^3(x^2 + 4)$

**(2marks)**

ii.  $f(x) = \sin^{-1}(1 - x)$

**(2marks)**

15. Evaluate  $\lim_{x \rightarrow 0} \frac{\tan x - \sin x}{x^3}$

**(5marks)**

**SECTION B: Attempt any 3 questions of your choice**

**(45marks)**

16. a) Given  $1 - \cos x = 2\sin^2 x$

i) Show that the equation can be written as  $(2\cos x + 1)(\cos x - 1) = 0$  **(5marks)**

ii) Hence, determine the general solution of  $(2\cos x + 1)(\cos x - 1) = 0$  **(5marks)**

b) Given that  $\theta$  is acute and  $\sin \theta = \frac{5}{13}$  find exact value of  $\sin 2\theta$  **(5marks)**

17. Let consider a sequence with the general term  $U_n$  defined by

$$\begin{cases} U_0 = 1 \\ U_{n+1} = \frac{5U_n}{3U_n + 5} \quad \forall n \in \mathbb{N} \end{cases}$$

a) Calculate the exact value of  $U_1, U_2, U_3$  and  $U_4$  **(5marks)**

b) Let suppose that  $V_n = \frac{5}{U_n} \quad \forall n \in \mathbb{N}$

i) Calculate the value of  $V_0, V_1, V_2$  and  $V_3$  **(5marks)**

ii) Show that  $V_n$  is in arithmetic progression and express  $V_n$  in function of  $n$  **(3marks)**

iii) Express  $U_n$  in function of  $n$ . **(2marks)**

18. a) solve the following trigonometric equation

$$\arctan\left(\frac{x-5}{x-1}\right) + \arctan\left(\frac{x-4}{x-3}\right) = \frac{\pi}{4} \quad \textbf{(8marks)}$$

b) Show that  $\arctan\left(\frac{1}{3}\right) + \arctan\left(\frac{1}{5}\right) + \arctan\left(\frac{1}{7}\right) + \arctan\left(\frac{1}{8}\right) = \frac{\pi}{4}$  **(7marks)**

19. Jack operates an account with a certain bank which pays a compound interest rate of 13.5% per annum. He opened the account at the beginning of the year with 500,000FRW and deposits the same amount of money at the beginning of every year.

a. Calculate how much he will receive at the end of 9 years. **(5marks )**

b. After how long will the money have accumulated to FRW 3.32 million? **(5marks)**

c. Solve graphically the equation  $x - 1 = \sin x$  **(5marks)**

20. The vertices of triangle are A(1,2,3) B(-2,1,-4) and C(3,4,-2)

a. Find the perimeter of triangle ABC **(4marks)**

b. Find the angles of triangle ABC **(6marks)**

c. Find the area of triangle ABC **(5marks)**

















