MATHEMATICSII

LEVEL: SENIOR SIX (S6)

On 9th February 2026

SECOND TERM KABACUZI SECTOR MID-TERM TEST.

DURATION: 3HOURS

SECOND TERM ADVANCED LEVEL SECTOR TEST, 2025 -2026

SUBJECT: MATHEMATICS II (SENIOR SIX) **Max: 100Marks**

Combinations: -MATHEMATICS CHEMISTRY AND BIOLOGY (MCB)

-MATHEMATICS ECONOMICS AND GEOGRAPHY (MEG)

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.
- Answering on your question paper, un necessary steps is not crucial

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	20 questions
Marks																					Total 100

SECTION A: Answer all questions: 55 marks

1. Answer by **TRUE (T)** whether the statement is correct and **False (F)** Whether is incorrect (**form letter a-d every question has 0.5 mark**)

a) Given that Matrix $P = \begin{bmatrix} sin^2x & 4 & 5 \\ 6 & 0 & -1 \\ 8 & 9 & cos^2x \end{bmatrix}$,Trace of P is equal 1

b) The vector $\vec{u}$ =$(1 \quad -1 \quad 0)$, $\vec{v}$ =$(1 \quad 3 \quad -1)$ and $\vec{w}$ =$(5 \quad 3 \quad -2)$ are linearly dependent

c) Two vectors $\vec{a}$ and $\vec{b}$ are perpendicular whether $\vec{a}.\vec{b}$ =$\|\vec{a}\|.\|b\|$

d) Consider the Two lines $L_1 \equiv \begin{cases} x = 2 + r \\ y = 1 + 2r \\ z = 3 + 3r \end{cases}$ and $L_2 \equiv \begin{cases} x = 3 + 2r \\ y = 3 + 4r \\ z = 6 + 6r \end{cases}$ are parallel

e) Given the set $S = \{1 , -1 , i , -i\}$ and Binary operation " · " where i· $i = -1$ According to the Cayley table for $S(\cdot)$ the Binary operation is commutative group, in case is true or false Prove your answer. **(3marks**)

·	1	-1	i	-i
1	1	-1	i	-i
-1	-1	1	i	-i
I	i	-i	-1	1
-i	-i	i	1	-1

2) Solve the trigonometric equation $2cos^2x - \sin x = 0 \;\; for \; x \in [0, \pi]$ **(2marks)**

a. $\left\{\frac{\pi}{2}, \frac{5}{\pi}\right\}$

b. $\left\{\frac{-\pi}{3}, \frac{\pi}{4}\right\}$

c. $\left\{\frac{\pi}{6}, \frac{5\pi}{6}\right\}$

a. All the above

3) The solution setoff complex number equation $z^2 + (5 - i)z + 8 - i = 0$ is **(3marks)**

a. $s = \{-2 + i, 3 - i\}$

b. $s = \{-2 + i, -3 + 2i\}$

c. $s = \{-2 - i, -3 + 2i\}$

d. $s = \{3 + 2i, -2 + 2i\}$

4) The harmonic Means of Two number is 4 their Arithmetic Mean A and Geometric Mean G satisfy the relation $2A + G = 27$ **(3marks)**

a. Numbers are 4 and 6

b. Numbers are 9 and 18

c. Numbers are 3 and 6

5) Calculate the following limits:

a. $\lim_{x \to 1^+} \left(\frac{1}{\ln x} - \frac{1}{x-1} \right)$ **(2marks)**

b. $\lim_{x\to\infty}\left(\frac{n+2}{n+4}\right)^{4n}$ **(2marks)**

6) The solution of the logarithmic equation $\ln(x+1) - \ln(x-1) = 1$ is **(3marks)**

a. $x = \frac{e+1}{e-1}$

b. $x = \frac{e-1}{e+1}$

c. $x = e$

d. x=1

7) Determine if $\int_{-\infty}^{+\infty} xe^{-x^2}\, dx\ is$Convergence or divergence **(4marks)**

8) Given that $\ln(1+x) = x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \cdots$ the Maclaurin expansion of the function$f(x) = \ln\left(\frac{1+x}{1-x}\right)$ is **(3marks)**

a. $2\left(x + \frac{x^2}{2} + \frac{x^3}{3} + \frac{x^5}{5} \ldots\right)$

b. $x + \frac{x^2}{2} + \frac{x^3}{3} + \frac{x^5}{5} \ldots$

c. $x - \frac{x^2}{2} + \frac{x^3}{3} + \frac{x^5}{5} \ldots$

d.$2\left(x - \frac{x^2}{2} + \frac{x^3}{3} + \frac{x^5}{5} \ldots\right)$

9) Consider the function $f(x) = \frac{ax^2}{bx^2+6x+c}$ where $\boldsymbol{x-1, x-2 \text{ and } y+4}$ are asymptotes to the curve find the value of a, b and c **(3marks)**

10) Consider the three vectors in Euclidian space $\mathbb{R}^3$

$\vec{u} = -3\vec{\imath} + 4\vec{\jmath} + 12\vec{k}$, $\vec{v} = 4\vec{\imath} - 3\vec{\jmath} + 2\vec{k}$and $\vec{w} = m\vec{\imath} + 3\vec{\jmath} - n\vec{k}$

a.The value of **m** and **n** if $\vec{u} = \vec{v} \times \vec{w}$ are equal **(3marks)**

i. $\begin{cases} m = 0 \\ n = 1 \end{cases}$

ii. $\begin{cases} m = 1 \\ n = 0 \end{cases}$

iii. $\begin{cases} m = 4 \\ n = 12 \end{cases}$

iv. $\begin{cases} m = 12 \\ n = 4 \end{cases}$

b. The area of triangle $(0, \vec{u}, \vec{v})$is **(3marks)**

i. 4.5 units Area

ii. 6.5units Area

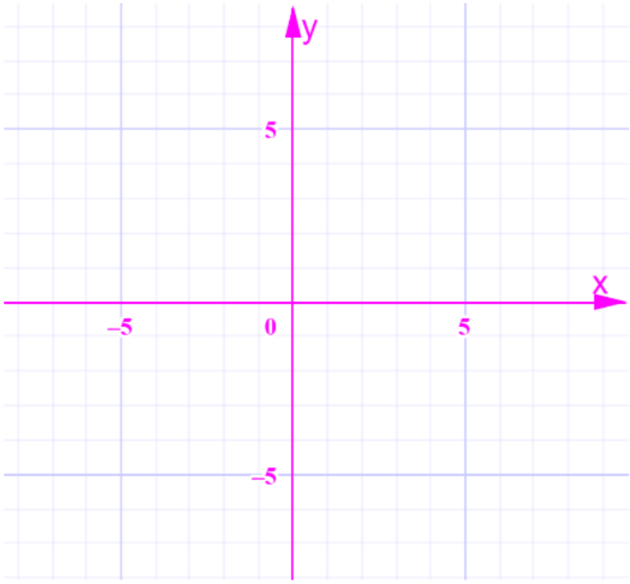
iii. 9units Area

iv. 3 units Area

11) Given the equations of straight lines $\begin{cases} y = 4 - x \\ y = 3x \\ 3y = x \end{cases}$

a. Find the coordinates of intersection of above lines **(2marks)**

b. Plotting all the three straight lines on the same Cartesian plane **(2marks)**



c. By using integration find the area bounded (enclosed) by the three straight lines **(3marks)**

12) Show that $\left(1+\frac{i}{\sqrt{3}}\right)^m-\left(1-\frac{i}{\sqrt{3}}\right)^m=\frac{2^{m+1}}{(\sqrt{3})^m}i\sin\frac{m\pi}{6}$ **(3marks)**

13) Solve the following equation

$\tan(arc\tan 3x - arc\tan 2) + \tan(arc\tan 3 - arc\tan 2x) = \frac{3}{8}$ **(2marks)**

14) The n^{th} of Derivative of $\cos 2x$ is **(2marks)**

a.$\cos\left(2x + \frac{n\pi}{2}\right)$

b. $\cos\left(x + \frac{n\pi}{2}\right)$

c.$\sin\left(x + \frac{n\pi}{2}\right)$

d. $2\cos\left(2x + \frac{n\pi}{2}\right)$

15. Linearize the function $f(x) = sin^4 x cos^2 x$, Hence find it anti- derivative **(4marks)**

SECTION B: Answer only three questions in this section **45marks**

16)a. Given the point $A(2,-3,-1)$ $B(3,-4,2)$ and $C(4,-5,2)$ Find

i.$\overrightarrow{AB} \times \overrightarrow{AC}$ **(3marks)**

ii. The area of triangle ABC **(2marks)**

b) The point A and B have coordinates $(2,1,1)$ and $(0,5,3\ )$ respectively

i. Find the equation of the line AB in terms of parameter **(3marks)**

ii. If C is the point with coordinate (5,-4,2) find the coordinate of point D on AB such that CD is perpendicular **(5marks)**

iii. Find the equation of plane π containing the line AB and parallel to CD **(2marks)**

17) a. Given that $Z = x + yi\ and\ \left|\frac{z-1}{z+1}\right| = 2$ find the Cartesian equation of the locus Z and Represent this locus by Sketch on the A grand diagram **(5marks)**

b. Given that $I_n = \int_0^{\frac{\pi}{2}} cos^n x\, dx \quad ,(n \geq 2)$

i. Find I_0 , I_1 , I_2 **(4marks)**

ii. Write down the relationship between $I_n$and I_{n-2} **(4marks)**

iii. Deduce $I_4\ and\ I_5$ **2marks**

18) a Given that $I = \int_0^{\ln 16} \frac{e^x+3}{e^x+4} dx$ and $J = \int_0^{\ln 16} \frac{dx}{e^x+4}$

calculate the value of $I + J\ and\ I - 3J$
(5marks)

b. Consider the two equations $C_1 \equiv x^2 + y^2 = 4$ and $C_2 \equiv x^2 + y^2 = 9$

i. Find the surface area bounded by the two Circle **(5marks)**

ii. If the surface Area is revolved about x-axis find the volume of revolution **(5marks)**

19) Show that $\frac{12^2+23^2+\cdots+n(n+1)^2}{1^2 2+2^2 3+\cdots+n^2(n+1)} = \frac{3n+5}{3n+1}$ **(7marks)**

b. Given that A,B and C in the same space are such that A and B are mutually exclusive events while A and D are independent events Given that :

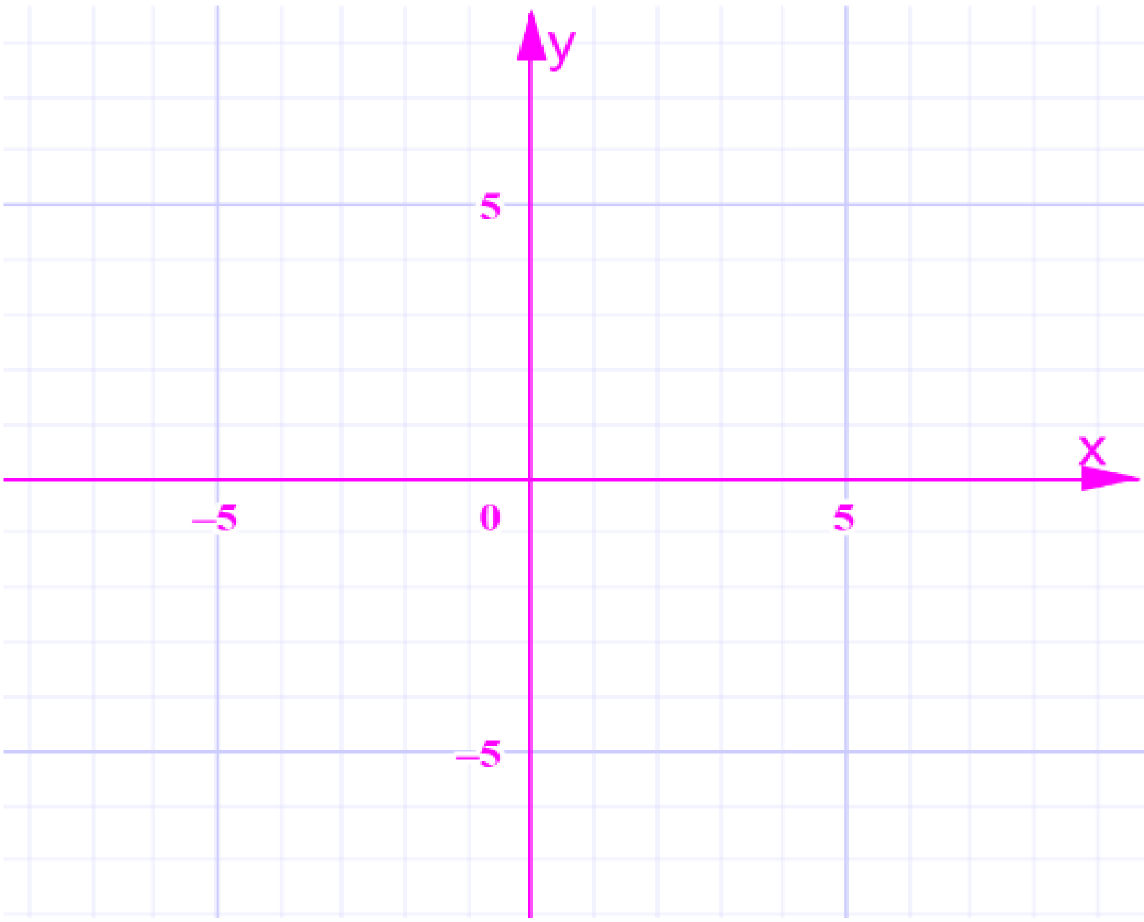
P(A)=$\frac{2}{3}$, $P(C) = \frac{1}{5}$, $P(A \cup B) = \frac{4}{5}$,$P(B \cup C) = \frac{13}{25}$

i. Find $P(A \cup C)$, $P(B)\ and\ P(A \cap B)$ **(6marks)**
ii. Are B and C independent events? justify your answer **(2marks)**

20) Given that matrix $A = \begin{pmatrix} 1 & 1 & 1 \\ 2 & 1 & -1 \\ 3 & 2 & 1 \end{pmatrix}$

i. Find the inverse of matrix A **(7marks)**

ii. Use the inverse of A^{-1}solve the simultaneous equation $\begin{cases} x + y + z = 6 \\ 2x + y - z = 1 \\ 3x + 2y + z = 10 \end{cases}$ **(8marks)**



A SUCCESS COMES FROM HARD WORKING