DIOCESE OF KABGAYI
COLLEGE SAINTE MARIE REINE KABGAYI
END OF TERM I EXAMINATIONS, 2025-2026
SUBJECT: MATHEMATICS
CLASS: SENIOR 6 MCB/PCM/MEG/MCE

Names: ……
Class: ……

PART I. Circle the correct answer: Attempt all questions (Each question is out of 5 marks)

1. Which identity is correct
   a) $sin^2x + cos^2x = 2$
   b) $sin^2x - cos^2x = 1$
   c) $sin^2x + cos^2x = 1$
   d) $tan^2x + 1 = cos^2x$
2. Cos2x may be written as:
   a) $sin^2x - cos^2x$
   b) $1 - 2cos^2x$
   c) $1 - 2sin^2x$
   d) All of the above are correct
3. A matrix with determinant 0 is called:
   a) Singular
   b) Identity
   c) Scalar
   d) Invertible
4. A building casts a shadow of 20 m when the sun's angle of elevation is 30°. The height of the building is:
   a) 10 m
   b) 20 m
   c) $20\sqrt{3}\ m$
   d) $\frac{20}{\sqrt{3}}\ m$
5. An observer sees the top of a cliff at 30°. After walking 40 m closer, the angle becomes 60°. The height of the cliff is:
   a) 20 m
   b) 40 m
   c) $40\sqrt{3}\,m$
   d) $20\sqrt{3}\,m$
6. A rescue plane flies from A to B on a bearing of 290°, covering 60 km. The northward component is:
   a) $60\cos 70°$
   b) $60\sin 70°$

c) $60 \sin 20°$
d) $60 \cos 20°$

7. A statement that is always false is called a:
   a) Tautology
   b) Fallacy
   c) Contradiction
   d) Contingency
8. The converse of " If it rains, I stay home" is:
   a) If not rain, I do not stay home
   b) If I stay home, it rains
   c) It it rains, I do not stay home
   d) If I do not stay home, it rains
9. The line $4x + 3y = -k$ is tangent to the circle $x^2 + y^2 - 4 = 0$. Find the value of k
   a) K=10 or -10
   b) K=2 or 8
   c) K=-5 or 4
   d) No correct answer
10. If $A = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}, find\ \alpha\ and\ \beta\ so\ that\ (\alpha I + \beta A)^2 =$
    $A, where\ I\ is\ the\ identity\ matrix$
    a) $\alpha = \frac{1}{\sqrt{2}}\ and\ \beta = \frac{1}{\sqrt{2}}$
    b) $\alpha = -\frac{1}{\sqrt{2}}\ and\ \beta = -\frac{1}{\sqrt{2}}$
    c) $\alpha = 1\ and\ \beta = 2$
    d) $\alpha = -1\ and\ \beta = 1$
11. From the following data of marks in Mathematics and Physics obtained by four students out of thirty. Calculate the coefficient of variation:

Mathematics	14	45	27	38
Physics	35	40	20	21

    a) Coefficient of variation of Mathematics is 3.83% and the one of physics is 9.96%
    b) Coefficient of variation of Mathematics is 37.83% and the one of physics is 29.96%
    c) Coefficient of variation of Mathematics is 33.25% and the one of physics is 29.96%
    d) Coefficient of variation of Mathematics is 37.83% and the one of physics is 75.96%
12. The tangent to the graph of the function $f(x) = \frac{x^2+mx-3}{(m-1)x+1}$ at x=0 is parallel to the line y=5x-4. Find the value of m
    a) m= 5
    b) m=2
    c) m=3
    d) m=-1

13. A national commission of the young artisans is composed of 7 girls and 5 boys. 4 delegates chosen at random from the commission have an audience with MINICOM. What is the probability that at least one girl is chosen?

a) Probability is $\frac{490}{495}$

b) Probability is $\frac{49}{45}$

c) Probability is $\frac{495}{490}$

d) Probability is 0.12

14. Given the set S = {1, –1, i, –i} and the binary operation '.', where i.i = –1, construct a Cayley table for (S,.) and determine whether or not the (S,.) is a commutative group

15. Simplify: a) $\left(\frac{1}{2} + i\frac{\sqrt{3}}{2}\right)^{2001}$ b) $\frac{\left(1-i\sqrt{3}\right)^4}{(1+i)^3}$

16. Determine the resistance and series inductance (or capacitance) for each of the following impedances, assuming a frequency of 50 Hz: a) 4+j7Ω b) 12 cis(-60^0)Ω

PART II. ATTEMPT any 3 QUESTIONS (EACH QUESTION IS OUT OF 10 MARKS)

17. Consider a real valued numerical function defined as f: $R \to F: x \to \frac{1}{2}x^2e^{x+1}$

a) Find the domain of definition f(x)

b) Find the intersection with axis of coordinates

c) Find the asymptotes

d) Discuss the first and second derivatives of f(x)

e) Sketch the graph of f(x)

18. Solve the following:

a) $\begin{cases} 5x + 3y = 12 \\ 7x + 2y = 19 \end{cases}$

b) (x+3)(x-2)>0

c) $\begin{cases} y = x^2 \\ y = x + 12 \end{cases}$

19. If $\left|\frac{z+2}{z}\right| = 2$ and point P represents z in the Argand plane, show that P lies on a circle and find the centre and radius of this circle

20. Use logarithmic differentiation to find the derivative of each of the following functions:

a) $y = \frac{(x-2)(x+1)}{(x-1)(x+3)}$

b) $y = \frac{(2x-1)\sqrt{x+2}}{(x-3)\sqrt{(x+1)^3}}$

21. Evaluate the following integrals

a) $\int sec^6 x\, tanx\, dx$

b) $\int x^2 e^{3x} dx$

c) $\int_{-2}^{2} \frac{dx}{x^2+4}$