KAMONYI DISTRICT

ADVANCED LEVEL HOLYDAYS WORK, 2025

SUBJECT: MATHEMATICS S_4

COMBINATIONS: -MATHEMATICS-ECONOMICS-GEOGRAPHY(MEG)

- **MATHEMATICS-COMPUTER-ECONOMICS(MCE)**

INSTRUCTIONS: This paper has **2** sections **A** and **B**

SECTION A: Attempt **ALL** questions **(55 marks)**

SECTION B: Attempt any **THREE (3)** questions **(45 marks)**

SECTION A: Attempt all the questions (55 marks)

1. State whether each of the following statements is **True** or **False**.
   a) A binary operator or a binary operation combines two elements to give a unique third element. **(1 mark)**
   b) A compound proposition identically true for all possible truth values of its components is called a contradiction. **(1mark**)
2. If all $\overrightarrow{AB}$ = a and $\overrightarrow{CD}$ = 3a which of the following statements is true? **(1mark)**
   a) $\overrightarrow{AB}$ equal to $\overrightarrow{CD}$
   b) $\overrightarrow{AB}$ is three times as long as $\overrightarrow{CD}$
   c) $\overrightarrow{CD}$ is three times as long as $\overrightarrow{AB}$
3. Study parity function and Match the following: **(3marks)**

FUNCTIONS (COLUMN A)	**PARITY FUNCTION (COLUMN B)**
1. $f(x) = x^3-1$	a) Odd function
2. $g(x) = \frac{CosX}{X}$	b) even function
3. $h(x) = \frac{SinX}{X}$	c) neither even nor odd function

4. a) State the Cosine and Sine laws which are used to solve practical problems involving triangle and angles. **(3marks)**

   b) A right triangle ABC, is rectangle in A such that AB = 22 cm and AC = 50 cm. Find the measure of the angle $A\hat{C}B$. **(2marks)**

5. a) Show that $p \Rightarrow q$ and $\sim pVq$ are logically equivalent. Justify your answer **(2maks)**

   b) how do we call this tautology? **(1mark)**

6. By showing your working steps, choose the best answer of the following:

   a) $7\log(\frac{16}{15}) + 5\log(\frac{25}{24}) + 3\log(\frac{81}{80})$ is equal to: **(3marks)**

      i) 0
      ii) 1
      iii) $\log 2$
      iv) $\log 3$

   b) $\log_{5\sqrt{5}} 5$ is equal to: **(3marks)**

      i) $\frac{2}{3}$
      ii) $\frac{1}{3}$
      iii) $\frac{1}{2}$
      iv) 2
      v) $\frac{3}{2}$

   c) $(\frac{1}{tanx} + \frac{1}{cotx})\, sinxcosx$ is equal to: **(2marks)**

      i) $\cos x$
      ii) -1
      iii) sin^2x
      iv) 1

7. If α and β are the roots of the equation, X^2- X - 3=0, without solving the equation, find the value of $\alpha^3 + \beta^3$. **(3marks)**

8. Solve the inequality $|2x + 3| \geq |x - 4|$. **(3marks)**

9. Evaluate the following limits:

   a) $\lim_{x\to-\infty} \frac{\sqrt{x^2+2}}{3x-6}$ **(2marks)**

   b)

   c) $\lim_{x\to 1} \frac{x^{20}-1}{x^{10}-1}$ **(2marks)**

$2 \quad 1$

d) $\lim_{x \to 0} (x \cos \frac{1}{x})$ **(2marks)**

10. **T** is a tangent line to the curve $y = x^2 + 6x - 4$ at (1,3) and **N** is a normal line to the curve $Y = X^2 - 6X + 18$ at (4,10). Find the coordinates of the point of intersection of **T** and **N**. **(6marks)**

11. Find the value of K if the angle between $\vec{u}$ = (k,3) and $\vec{v}$ = (4,0) is 45^0. **(3marks)**

12. a) Rationalize the denominator and simplify the expression $\frac{2\sqrt{6}+5\sqrt{32}}{-1-2\sqrt{3}}$ **(2marks)**

    b) Transform to simple radical of $\sqrt{6-2\sqrt{5}}$. **(3marks)**

13. a) If f(x) = 3x and $g(x) = x^2 + 1$, find (gof)(4) . **(2maks)**

    b) find the inverse of the function f(x) = $\frac{2x+3}{x-1}$ **(2marks)**

14. solve : $(\frac{1}{8})^{x-2} = 4^{3-2x}$ **(3marks)**

SECTION B: ATTEMPT ONLY THREE (3) QUESTIONS (45 MARKS)

15. a) solve the following equations in set of real numbers:

    i) $4+\sqrt{3x-1} = 9$ **(5marks)**

    ii) $x^4 - 3x^3 + 4x^2 - 3x + 1 = 0$ **(5marks)**

    b) Find $\frac{dy}{dx}$ in terms of X and Y of the function, $\frac{x-y}{x+y} = \frac{x^2}{y} + 1$ **(5marks)**

16. a) Suppose that the profit (P) obtained in selling X units of certain item each week is given by $P = 50\sqrt{X} - 0.5X - 500$ where $0 \leq X \leq 800$. Find the rate of change of P with respect to X when X = 1600 **(5marks)**

    b) Solve the following simultaneous equation: $\begin{cases} x^2 + y^2 = \frac{37}{4} \\ xy = \frac{3}{2} \end{cases}$ **(5marks)**

    c) Find the value for P and q so that the function is continuous of $f(x) = \begin{cases} x-2, & if\ x \geq 2 \\ \sqrt{P-x^2}, & if\ -2 \leq x < 2 \\ q-x, & if\ x \leq -2 \end{cases}$ **(5marks)**

17. a) The operation $*$ is defined in set of real numbers by a* b = a + b - ab

    i) calculate the (-2) *(4 * 1) and (-2* 4) *1 and give the conclusion. **(4marks)**

    ii) Find the identity element. **(3marks)**

    iii) Determine the inverse element under this operation and hence calculate the inverse of -3. **(3marks)**

    b) i) Write down the Cayley table for addition modulo 5 on the set $\mathbb{Z}$ or $(\mathbb{Z}_5, +) = ((\text{mod}_5), +)$ **(2marks)**

    ii) Verify if $(\mathbb{Z}_5, +)$ Cayley table found in **b) i)** above is a commutative group. **(3marks)**

18. Given the function **f** of real variable x defined by: f(x) = $\frac{x^2-1}{x^2-4}$

a) Determine the domain of definition of f(x). **(2marks)**

b) Calculate the limits at the boundaries of the domain. **(3marks)**

c) State any asymptotes. **(2marks)**

d) Make the variation table to indicate the interval of increasing or decreasing. **(3marks)**

e) Find the X-intercepts and y-intercept for the graph of **f**. **(2marks)**

f) Sketch the graph of **f** in a Cartesian plane. **(3 marks)**

19. Using graph, determine the image of the triangle of ABC with A(1,2), B(4,1) and C(3,4) under a reflection in the line Y= 0 (x-axis) followed by enlargement of scale factor -2 and Centre of enlargement (0, -2) of triangle **A′ B′ C′** to give triangle **A″ B″ C″**. Hence state the coordinates of triangles **A′ B′ C′** and **A″ B″ C″**. **(15marks)**

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