AIMS TEACHER TRAINING PROGRAM (TTP) IN PARTNERSHIP WITH MASTERCARD FOUNDATION AND THE GOVERNMENT OF CAMEROON

MATHEMATICS OLYMPIAD

LEVEL: NATIONAL

DATE:

DURATION OF PAPER: 2 hours

CANDIDATES: Form 5 students

PART B

INSTRUCTIONS TO CANDIDATES:

- Mobile phones are **NOT ALLOWED** in the examination room
- You should attempt to answer all questions.
- You are reminded of the necessity for orderly presentation and good English in your work.
- In calculations, you are advised to show all steps in your work, and show answers at each stage.
- Each question is 15 marks.
- Non-programmable electronic calculators are allowed
- Graph paper will be provided.

1. Three matrices $\mathbf{M}$, $\mathbf{N}$ and $\mathbf{T}$ are given by:

$$\mathbf{M} = \begin{pmatrix} a & 1 \\ 1 & a \end{pmatrix}, \quad \mathbf{N} = \begin{pmatrix} b & 1 \\ 1 & b \end{pmatrix} \text{ and } \mathbf{T} = \begin{pmatrix} x & y \\ y & x \end{pmatrix}$$

Given that $\mathbf{MN} = \mathbf{T}$,

a) verify that $(a+1)(b+1) = x + y$, and express $(a-1)(b-1)$ in terms of x and y.

b) express $(a^2 - 1)(b^2 - 1)$ in terms of x and y, and hence, express $(17^2 - 1)(21^2 - 1)$ as the difference of the squares of two integers.

2. (i) In a Mini Agro Pastoral show in one Region in Cameroon, farmers can exhibit any or all of the food crops: Cassava(C), Plantains(P) and/or Yams(Y). The Venn diagram in figure 1 shows the number of farmers and the crop type on exhibition.

Given that $n(Y) = 27$, 8 farmers exhibit plantains only and that 5 farmers exhibit cassava only, determine:

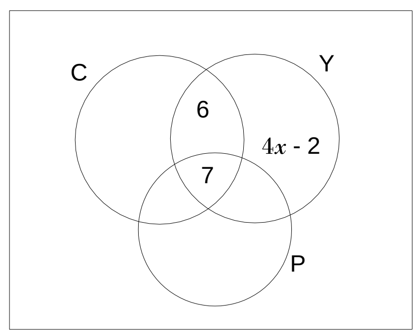

Fig: 1

a) The value of x
b) How many farmers exhibit only cassava and plantains?
c) Find the number of farmers who exhibit cassava.
d) How many farmers were present?
e) In ordinary English, describe the set $P' \cap C \cap Y$

(ii) A square of side 16cm is drawn. Another square is drawn inside by joining the midpoints of the sides of the first square, a third square is drawn by joining the midpoints of the sides of the second square and a forth square is drawn by joining midpoints of the sides of the third square and this process continues indefinitely. Find the sum of the areas of all the squares

3 A line L passes through points (-2, 3) and (-1,6) and is perpendicular to a line P at (-1,6).
a) Find the equation of L.
b) Find the equation of P in the form ax + by = c, where a, b and c are constant.
c) Given that another line Q is parallel to L and passes through point (1,2) find the x and y intercepts of Q.

Find the point of intersection of lines P and Q.

4 Figure 4 shows two lines l_1 and l_2 in the Cartesian plane where the unit of length is the cm.

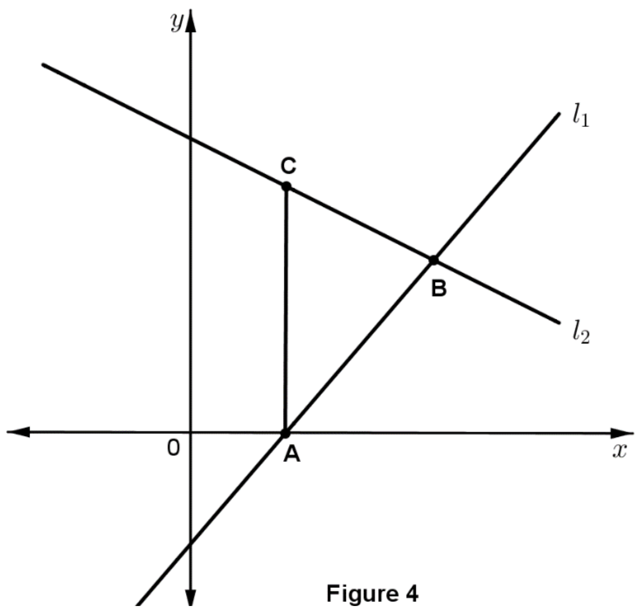

Figure 4

The equations of l_1 and l_2 are $7x - 6y - 9 = 0$ and $x + 2y - 8 = 0$ respectively. The point **A** is on the $x - \text{axis}$ and the line segment, $[\mathbf{AC}]$ is parallel to the $y - \text{axis}$.

Find the area of triangle **ABC.**

ii) In the given figure below, AB || DE and the area of the parallelogram ABFD is 24 cm^2. Find the areas of triangles AFB, AGB, and AEB: