## 4.2.2 Mathematics Alt.B Paper 2 (122/2)

**SECTION I** (50 marks)

*Answer **all** the questions in this section in the spaces provided.*

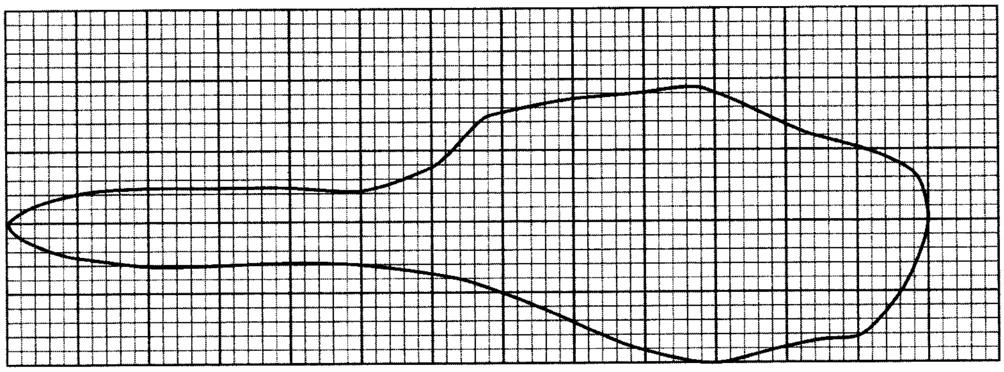
1. Evaluate $\sqrt{\dfrac{9.61+2.15}{8.04-7.11}}$ (2 marks)

2. Make P the subject of the formula. $N=\dfrac{PM^2}{P+M}$ (3 marks)

3. Use the quadratic formula to solve the equation $3x^2 - 8x^3 = 0$. (3 marks)

4. An Arithmetic Progression (AP) is given as $3 + 12 + 21 + 30 + \ldots$
Determine the sum of the first 11 terms. (2 marks)

5. The figure below is a map of a pond on a $1\ \text{cm}^2$ grid.



(a) Estimate the area of the map in square centimetres. (2 marks)

(b) If the scale on the map is 1:5000 determine the area of the pond, in hectares. (2 marks)

6. Wanyama deposited Ksh 480,000 in a financial institution which paid a simple interest of R% per annum. At the end of four years the total amount of money in Wanyama's account was Ksh 796,800. Calculate the simple interest rate R. (3 marks)

7. Four people take 10 hours to tile a floor of $135\ \text{m}^2$. Determine the area of the floor that 3 people working at the same rate would take to tile if they worked for 12 hours. (2 marks)

8. Two matrices $\underset{\sim}{A}$ and $\underset{\sim}{B}$ are such that $\underset{\sim}{A} = \begin{pmatrix} 3 & 2 \\ -1 & -1 \end{pmatrix}$ and $\underset{\sim}{B} = \begin{pmatrix} -1 & -2 \\ 5 & 4 \end{pmatrix}$.
Find the determinant of $\underset{\sim}{AB}$. (3 marks)

9. A tailor has 4 yellow buttons and 5 black buttons in his bag. The buttons are identical except for the colour. The tailor picks two buttons at random, one at a time, without replacement.

(a) Using a tree diagram, show all the possible outcomes. (2 marks)

(b) Find the probability that the two buttons picked are yellow. (2 marks)

10. The local time at point A(43°S, 28°W) is 1730 hours. Find the local time at point B(43°S, 13°E) (4 marks)

11. Draw a circle with centre O and radius 2 cm. Construct a tangent to the circle from a point P, 5 cm from O. (3 marks)

12. The mass of 50 new born calves in a ranch was recorded as shown in the table.

| Mass (kg) | 15–18 | 19–22 | 23–26 | 27–30 | 31–34 | 35–38 | 39–42 |
|---|---|---|---|---|---|---|---|
| Frequency | 2 | 6 | 9 | 11 | 12 | 7 | 3 |

Calculate the mean mass. (4 marks)

13. A triangular plot PQR is such that PQ = 74 m; PR = 40 m and angle RPQ = 82°. Determine, correct to 2 decimal figures:

(a) the length RQ; (2 marks)

(b) the size of angle PQR. (2 marks)

14. The vertices of a trapezium ABCD are A(1,1), B(5,1), C(5,4) and D(1,3). The trapezium is mapped onto A'B'C'D' by transformation matrices $\underset{\sim}{P} = \begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$ followed by $\underset{\sim}{Q} = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$.

Find the coordinates of A'B'C'D'. (3 marks)

15. Given that $\underset{\sim}{m} = \begin{pmatrix} -6 \\ 2 \end{pmatrix}$ and $\underset{\sim}{n} = \begin{pmatrix} 18 \\ -7 \end{pmatrix}$, determine the magnitude of $\underset{\sim}{m} + \underset{\sim}{n}$. (3 marks)

16. Two variables V and t are connected by the equation $V = t^2 - 2$, find the average rate of change of V between t = 2 and t = 5. (3 marks)

## SECTION II (50 marks)

*Answer any **five** questions in this section in the spaces provided.*

**17.** At the beginning of a certain year, Amanda deposited Ksh 600 000 in a financial institution. The institution offered a compound interest at a rate of 10% p.a.

(a) Calculate the accumulated amount on Amanda's deposit after 3 years. (2 marks)

(b) After 3 years, the interest was then compounded semi annually for 2 years.

(i) Calculate, to the nearest shilling, the accumulated amount on the deposit at the end of five years. (4 marks)

(ii) Find the interest earned in the five years. (2 marks)

(c) Kipanga invested some money in the same financial institution as Amanda. The money earned 10% compound interest p.a. for 5 years. The interest earned by Kipanga was equal to the interest earned by Amanda.

Determine, to the nearest shilling, the amount of money invested by Kipanga. (2 marks)

**18.** The second term of an Arithmetic Progression (AP) is 10 and fifth term is 28.

(a) Find the first term and the common difference. (3 marks)

(b) Find the sum of the first 13 terms. (2 marks)

(c) Find the value of $n$ such that the sum of the first $n$ terms is 884. (2 marks)

(d) The first term, the third term and the eleventh term of the AP form the first three terms of a Geometric Progression (GP). Write the first three terms of the GP. (3 marks)

**19.** (a) Complete the table below for $y = x^2 - x - 6$ for $-3 \leq x \leq 4$.

| $x$ | $-3$ | $-2$ | $-1$ | $0$ | $1$ | $2$ | $3$ | $4$ |
|---|---|---|---|---|---|---|---|---|
| $y$ | $6$ | | | | $-6$ | $-4$ | | |

(2 marks)

(b) On the grid provided, draw the graph of $y = x^2 - x - 6$ for $-3 \leq x \leq 4$. Use the scale 1 cm for 1 unit on the horizontal axis and 1 cm for the 2 units on the vertical axis. (3 marks)

(c) Use the graph to determine:

(i) the average rate of change between $x = 1$ and $x = 3$. (3 marks)

(ii) the instantaneous rate of change at $x = 1$. (2 marks)

**20.** Given that $\underset{\sim}{a} = \begin{pmatrix} 3 \\ 1 \end{pmatrix}$, $\underset{\sim}{b} = \begin{pmatrix} 9 \\ 5 \end{pmatrix}$ and $\underset{\sim}{c} = \begin{pmatrix} 6 \\ 5 \end{pmatrix}$;

Find:

(a) $2\underset{\sim}{a} + 3\underset{\sim}{b} - \underset{\sim}{c}$ (2 marks)

(b) the scalar values of $m$ and $n$ such that $m\underset{\sim}{a} + n\underset{\sim}{c} = 3\underset{\sim}{b}$ (4 marks)

(c) the midpoint of $5\underset{\sim}{c} - 2\underset{\sim}{a}$ (4 marks)

**21.** Dona and Sona bought some sugar, beans and fruits on Monday and Friday of a certain week. On Monday Dona bought 1 kg of sugar and 3 kg of fruits while Sona bought 2 kg of sugar, 1 kg of beans and 1 kg of fruits. On Friday Dona bought 1 kg of sugar, 2 kg of beans and 2 kg of fruits while Sona bought 1 kg of sugar, 3 kg of beans and 2 kg of fruits.

(a) Using a $2 \times 3$ matrix:

(i) represent the items bought by Dona and Sona on: (I) Monday; (II) Firday (4 marks)

(ii) find the total number of each type of item bought by Dona and Sona as a $2 \times 3$ matrix. (2 marks)

(b) The items were available in two shops L and M. The prices, in shillings per kilogram, of sugar, beans and fruits were Ksh 100, Ksh 70 and Ksh 30 respectively in shop L. In shop M the prices, in shillings per kilogram, of sugar, beans and fruits were Ksh 110, Ksh 50 and Ksh 40 respectively.

(i) Represent the prices of the items as a $3 \times 2$ matrix. (1 mark)

(ii) Determine the total expenditure Dona and Sona would each incur if they bought the items as a $3 \times 2$ matrix. (3 marks)

**22.** (a) Complete the table below for the function $y = x^2 + x + 5$ in the range $-4 \leq x \leq 2$.

| $x$ | $-4$ | $-3$ | $-2$ | $-1$ | $0$ | $1$ | $2$ |
|---|---|---|---|---|---|---|---|
| $y$ | | | | | | | |

(2 marks)

(b) On the grid provided draw the graph of $y = x^2 + x + 5$ for $-4 \leq x \leq 2$. (3 marks)

(c) Use the trapezium rule with 6 strips to estimate the area bounded by the curve $y = x^2 + x + 5$, the lines $x = -4$, $x = 2$ and the $x$-axis. (3 marks)

(d) Given that the actual area is 48 square units, calculate the percentage error made when the trapezium rule is used. (2 marks)

**23.** A curve is represented by the equation $y = \cos x$

(a) Complete the table below for $y = \cos x$ (2 marks)

| $x^{\circ}$ | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 |
|---|---|---|---|---|---|---|---|---|---|---|
| $y = \cos x$ | 1 | | | | | $-0.87$ | | | $-0.5$ | |

(b) On the grid provided draw the graph of $y = \cos x$ for $0° \leq x \leq 270°$. (4 marks)

(c) Use the graph to:

(i) determine the value of $x$ when $y = -0.4$. (2 marks)

(ii) Solve the equation $4 \cos x = 1$ (2 marks)

**24.** Three variables P, Q and R are such that P varies directly as QR. When $P = 12$, $Q = 6$ and $R = 8$.

(a) Find:

(i) the constant of proportionality; (3 marks)

(ii) the equation connectiong P, Q and R; (1 mark)

(iii) the value of R when $P = 28$ and $Q = 8$. (2 marks)

(b) Determine percentage change in P when Q is increased by 12% and R is decreased by 10%. (4 marks)