4.2 MATHEMATICS ALT. B (122)

4.2.1 Mathematics Alt.B Paper 1 (122/1)

SECTION I (50 marks)

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

1. Two numbers p and q are such that p is the largest prime number between 50 and 100 and q is the smallest prime number between 50 and 100. Find p + q. (2 marks)

2. Three points A(1, 7), B(2, 5) and C(K, 1) lie on a straight line. Determine:

(a) the value of K (2 marks)

(b) the equation of the line (2 marks)

3. Simplify (2 marks)

$$\frac{12q^8 \times 3q^2}{2q^4}.$$

4. The size of each interior angle of a regular polygon is 140°. Calculate the number of sides of the polygon. (3 marks)

5. Auma poured a litre of juice into 3 glasses. The first glass contained $\frac{3}{5}$ of a litre and the second glass contained $\frac{1}{4}$ of a litre. Determine the fraction of the juice contained in the third glass. (3 marks)

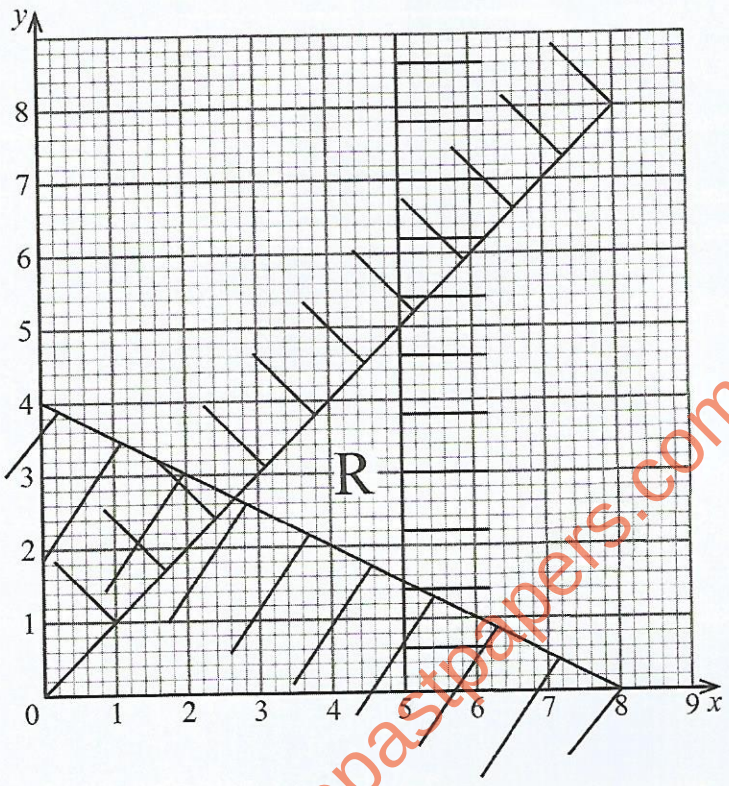
6. Kaige was in a car travelling at 81 km/hr. The car took one second to go past a building on the side of a road. If the length of the car was 4.5 m, calculate the length of the building in metres. (3 marks)

7. The angle of elevation of the top T of a building from a point B on the ground is 37.1°. A cable of length 730 m was fixed from T to B. Find the height of the building, correct to the nearest metre. (2 marks)

8. A shopkeeper bought 8 trays of 30 eggs each at Ksh 300 per tray. He repacked the eggs into smaller trays of 6 eggs each and sold them at Ksh 72 per tray. Calculate his profit. (4 marks)

9. A health awareness meeting was attended by men, women and children. The ratio of men to women was 9:7 and the ratio of men to children was 3:5. A total of 180 children attended the meeting. Find the number of women who attended. (3 marks)

10. In the diagram below, the region R is defined by three inequalities.



Write down the three inequalities. (4 marks)

11. The area of the curved surface of a cone is 308 cm^2. The slant height of the cone is equal to its diameter. Determine the diameter of the cone. (3 marks)

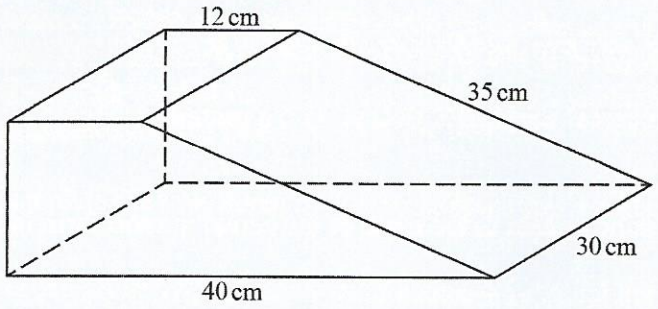
12. Line AB shown below is a side of a parallelogram ABCD in which BC = 6 cm and $\angle ABC = 120°$.

(a) Use a pair of compasses and ruler only to complete the parallelogram. (3 marks)

(b) Measure AC. (1 mark)

13. Without using a calculator, evaluate $\dfrac{3(4^2+2^2)-5\times 6\div 2}{3\times 5}$. (3 marks)

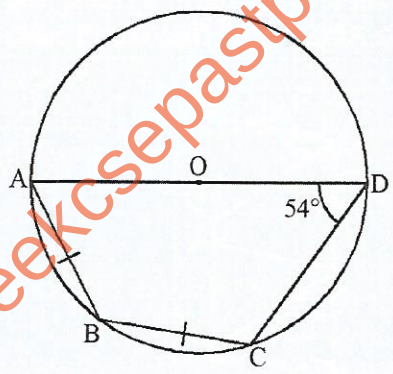
14. The figure below represents a solid prism.



Calculate the volume of the prism. (3 marks)

15. An institution bought 2 bags of maize and a bag of beans from a store and paid a total of Ksh 7 600. Another institution bought 3 bags of maize and 2 bags of beans from the same store and paid Ksh 13 400. Find the cost of a bag of maize and a bag of beans. (4 marks)

16. In the figure below, AD is a diameter of the circle centre O. A, B, C and D are points on the circumference of the circle. Angle ADC = 54° and AB = BC.



Calculate the size of angle BAD. (3 marks)

SECTION II (50 marks)

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

17. A 100 g of a certain cereal contains 338 Kcal, 11.5 g protein, 10.0 g fibre and 0.65 g salt among other nutrients.

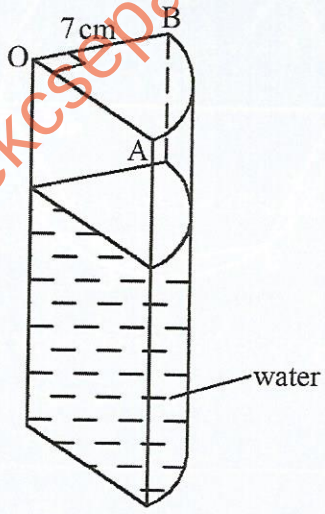
(a) Express mass of protein to the mass of the cereal in ratio form in its simplest form. (2 marks)

(b) Find the percentage of salt in 100 g of the cereal. (2 marks)

(c) A packet contains 225 g of the cereal. Calculate the mass of fibre in the packet. (2 marks)

(d) The Recommended Daily Amount (RDA) of calories of the cereal for an adult is 2 Kcal. Calculate the percentage of the RDA in 37.5 g of the cereal, correct to 1 decimal place. (4 marks)

18. The figure below shows a vessel in the shape of a prism. The cross section OAB, is a sector of a circle of radius 7 cm and angle AOB = 90°. The vessel contains 600 cm^3 of water.



(a) Calculate:

(i) the perimeter of the sector OAB (3 marks)

(ii) the height of the water in the vessel, correct to 1 decimal place (3 marks)

(b) Given that the vessel is $\frac{4}{5}$ full of water, calculate:

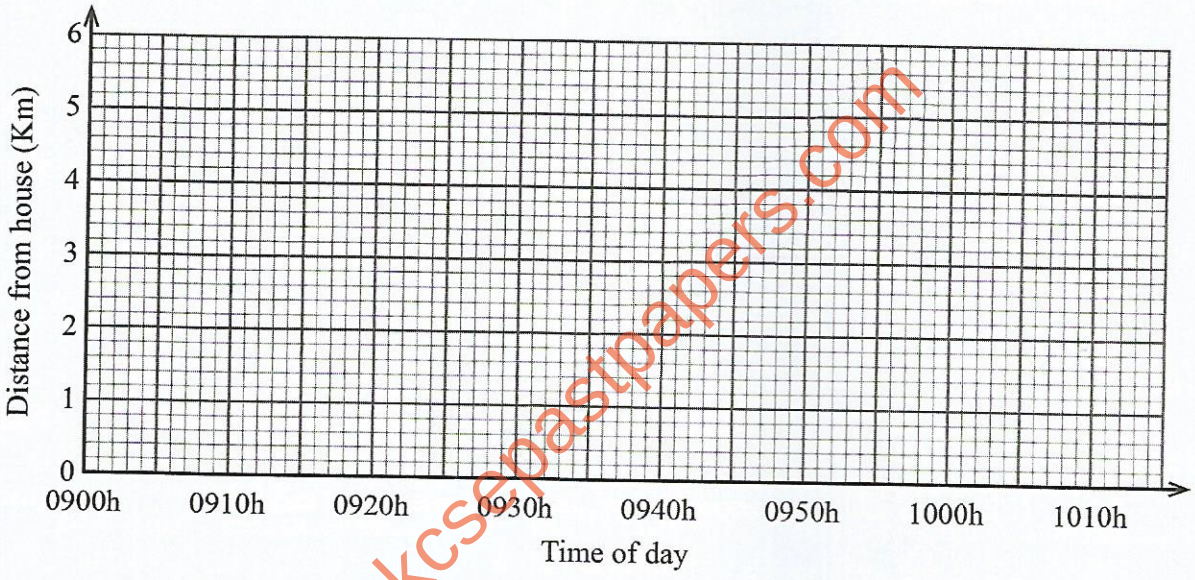
(i) the height of the vessel, correct to one decimal place (2 marks)

(ii) the capacity of the vessel (2 marks)

19. Two friends, Walter and Cyrus, decided to go to a market which is 6 km from their house. Walter left the house at 0900h and walked towards the market at a constant speed of 5 km/h. Cyrus left the house 10 minutes later and cycled along the same road at a constant speed of 20 km/h. He stayed at the market for 14 minutes and then cycled back to the house along the same road at a constant speed of 20 km/h.

(a) (i) Calculate the time taken by Walter to reach the market. (2 marks)

(ii) On the grid provided, draw the distance-time graph for Walter's journey. (2 marks)



(b) (i) Determine the time of day that Cyrus reached the market. (2 marks)

(ii) On the same axes draw the distance-time graph for Cyrus's journey. (3 marks)

(c) Use the graph to find the time of day when Cyrus, on his return journey, met with Walter. (1 mark)

20. During a soccer training session, 3 players (Peter, John and Ahmed) were positioned such that John was 10 metres away from Peter and Ahmed was 15 metres away from John.

(a) Peter passed the ball to John and the ball travelled at an average speed of x m/s. Write an expression in terms of x for the time taken, in seconds, for the ball to travel from Peter to John. (1 mark)

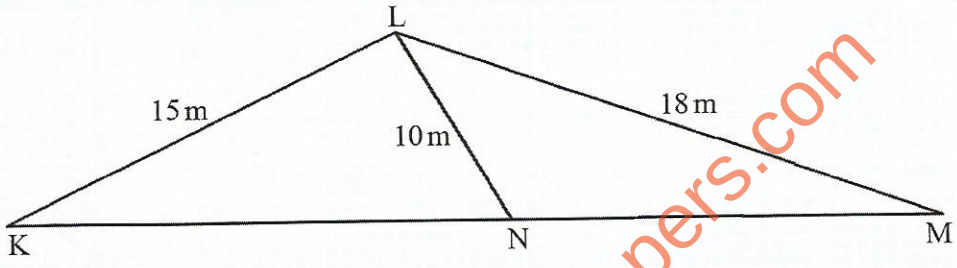
(b) John then passed the ball to Ahmed and the ball travelled at an average speed of 5 m/s faster than the ball's average speed from Peter to John. Write an expression in terms of x for the time taken, in seconds, for the ball to travel from John to Ahmed. (2 marks)

(c) The total time taken for the ball to travel from Peter to John then to Ahmed was 6 seconds.

(i) Form a quadratic equation in terms of x to show the total time taken by the ball to travel from Peter to John then to Ahmed. (3 marks)

(ii) Find the average speed of the ball as it travelled from John to Ahmed. (4 marks)

21. Figure KLMN below represent a vegetable garden divided into two triangles. KL = 15 m, LM = 18 m and LN = 10 m. Triangle KLM is similar to triangle LNM.



(a) Write:

(i) two pairs of the corresponding sides of triangles KLM and LNM (2 marks)

(ii) one pair of corresponding angles of triangles KLM and LNM (1 mark)

(b) Calculate the length of:

(i) KM (2 marks)

(ii) KN (3 marks)

(c) Determine the area scale factor of triangle KLM to triangle LNM (2 marks)

22. Three towns P, Q and R are such that Q is 115 km on a bearing of 150° from P. R is 180 km from P and 90 km on the eastern side of Q.

(a) Using a scale of 1 cm to represent 25 km, show the relative positions of towns P, Q and R. (4 marks)

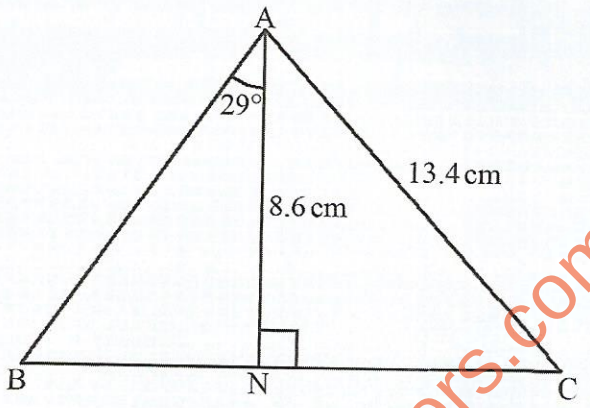
(b) Use the scale drawing to find:

(i) the compass bearing of R from P (2 marks)

(ii) bearing of Q from R (2 marks)

(c) On a map the distance QR is represented by 4.5 cm. Determine the scale of the map in the form 1 : n. (2 marks)

23. A welder cut out a triangular metal sheet ABC as shown below. AC = 13.4 cm, AN = 8.6 cm and is perpendicular to BC. Angle BAN = 29°.



(a) Calculate, correct to 1 decimal place:

(i) the length of AB (2 marks)

(ii) the length of NC (2 marks)

(iii) the size of angle CAN (2 marks)

(b) The welder cut out 8 triangular metal sheets of the same dimensions as ABC and used them to decorate the corners of a metal box.

Calculate the area of the metal sheet needed to decorate the metal box. (4 marks)

24. (a) Solve for x in $\frac{x+4}{2}+\frac{2x-5}{3}=5$. (3 marks)

(b) Four neighbours A, B, C and D decided to raise money to help a needy child. A raised $\frac{1}{3}$ of what C raised. B raised Ksh 100 less than the total amount raised by A and C. D raised Ksh 200 more than C. The total amount raised was Ksh 6 700.

By letting the amount raised by C to be y find:

(i) the amount of money raised by C (4 marks)

(ii) the amount of money raised by B more than D (3 marks)

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

$27.4 \times (3.28 - 1.6 \times 0.98)$, correct to 3 significant figures. (2 marks)

2. A fruit vendor saved Ksh 1000 in the first month. On each subsequent month, the vendor saved Ksh 150 more than the previous month.

(a) Find the amount of money the vendor saved in the 12th month. (2 marks)

(b) Calculate the total savings in the first 12 months. (2 marks)

3. The roots of a quadratic equation are $x = -2.5$ and $x = 3$. Determine the equation in the form $ax^2 + bx + c = 0$. (3 marks)

4. A quantity P is partly constant and partly varies as the cube root of a quantity Q. When Q = 8, P = 13 and when Q = 64, P = 23. Find the equation connecting P and Q. (3 marks)

5. A company mixed two types of flour, A and B and sold the mixture at Ksh 60 per kilogram. Type A flour costs Ksh 80 per kilogram and type B flour costs Ksh 50 per kilogram. Determine the ratio A : B in the mixture. (3 marks)

6. The coordinates of two points X and Y on the earth's surface are X(40 °S, 126 °E) and Y(50 °N, 126 °E). Determine the distance between X and Y.

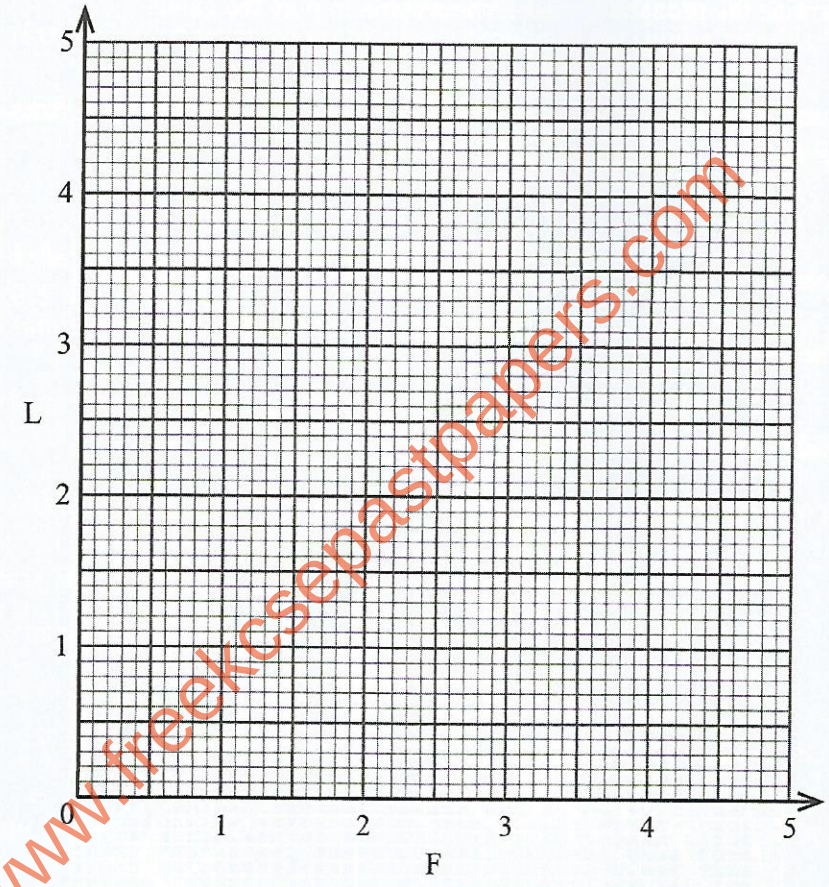
(Take the radius of earth to be 6370 km and $\pi = \frac{22}{7}$). (3 marks)

7. Solve for θ in, $2\tan(\theta + 90°) = 1.5$, for $0° \leq \theta \leq 180°$. (3 marks)

8. The values obtained from an experiment were as shown in the table below.

F	1	2	3	4	5
L	1.6	2.4	3.5	4.1	4.8

(a) On the grid provided, draw a line of best fit for the data. (2 marks)



(b) Determine the gradient of the line of best fit, correct to 1 decimal place. (2 marks)

9. At the beginning of a certain year, a car was valued at Ksh 800 000. The value of the car depreciated at a rate of 10% p.a. Calculate the value of the car at the end of 4 years. (2 marks)

10. The numbers 8, 20, 14, 12 and 11 have a mean of t and the numbers 11, P, 20, 8, 14 and 12 have a mean of $t + 2$. Find the value of P. (3 marks)

11. Given that $\mathbf{OM} = 6\boldsymbol{i} + \boldsymbol{j}$, $\mathbf{ON} = 4\boldsymbol{i} + 2\boldsymbol{j}$ and $\mathbf{OR} = 18\boldsymbol{i} + 7\boldsymbol{j}$.

Determine the value of h and k such that $h\mathbf{OM} + k\mathbf{ON} = \mathbf{OR}$, where h and k are constants. (3 marks)

12. In order to decide who of two boys Meso and Bwana starts to play a game, they toss two coins.

Meso starts if the two coins show a head. Bwana starts if the first coin shows a head and the second coin shows a tail.

(a) Draw a tree diagram to represent the possible outcomes. (2 marks)

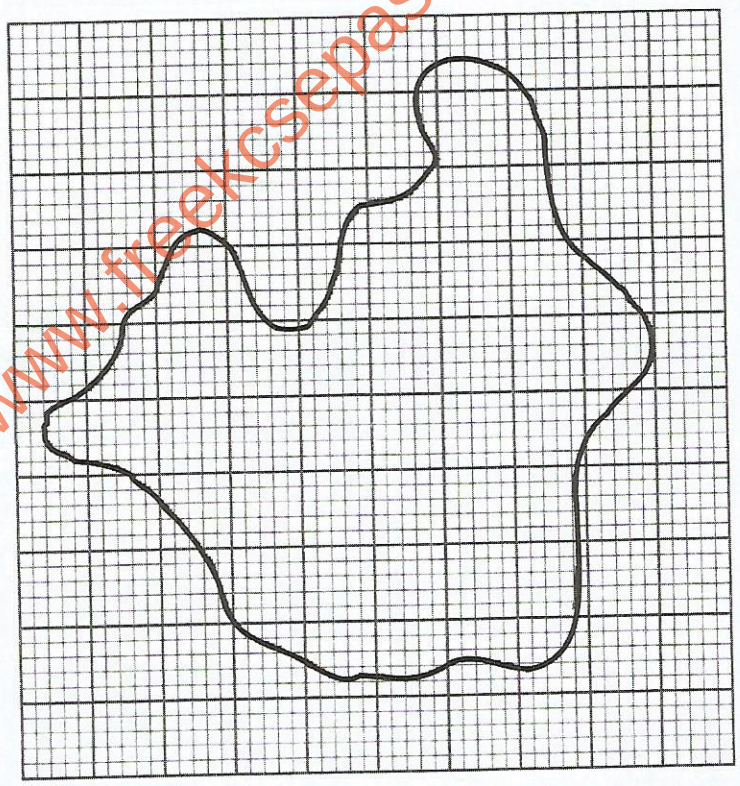
(b) Determine the probability that Bwana starts to play the game. (2 marks)

13. A line TP, 8 cm long, is a tangent to a circle at T. The radius of the circle is 6 cm. Calculate the distance of P from the centre of the circle. (2 marks)

14. A singular matrix **M** is such that $\mathbf{M} = \mathbf{QP}$, where $\mathbf{Q} = \begin{pmatrix} 2 & -1 \\ 3 & k \end{pmatrix}$ and $\mathbf{P} = \begin{pmatrix} k & 1 \\ 2 & 0 \end{pmatrix}$.

Determine the value of k. (3 marks)

15. The figure below represents the map of a swamp.



Given that the scale on the map is 1:50 000, estimate the area of the swamp in square kilometres. (4 marks)

16. A quadrilateral ABCD with vertices A(2,1), B(3,1), C(4, 3) and D(1, 2) is mapped onto quadrilateral A′B′C′D′ with vertices A′(–4,–2) B′(–6,–2), C′(–8,–6) and D′(–2,–4).

Determine the matrix of the transformation. (4 marks)

SECTION II (50 marks)

*Answer only **five** questions from this section in the spaces provided.*

17. The fifth and eighth terms of a Geometric Progression (GP) are $\frac{1}{2}$ and $\frac{1}{16}$ respectively.

Find:

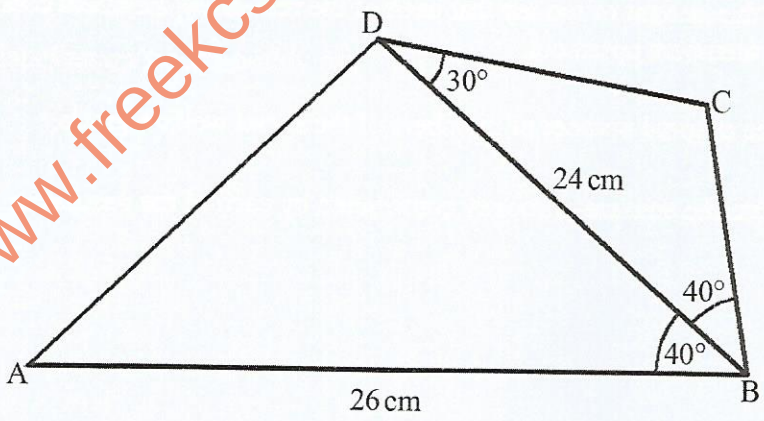
(a) the common ratio and the first term of the GP (4 marks)

(b) the sum of the first 10 terms of the GP, correct to 2 decimal places (2 marks)

(c) the least value of n such that the sum of the progression is 15 (4 marks)

18. The figure ABCD below represents a map of a piece of land divided into two portions.

AB = 26 cm , BD = 24 cm, ∠ABD = ∠DBC = 40° and ∠BDC = 30°.



(a) Calculate, correct to 1 decimal place:

(i) the length of AD (2 marks)

(ii) the length of BC (3 marks)

(b) The scale on the map was 1:2500. Calculate the area of the land, in metres squared, correct to 1 decimal place. (5 marks)

19. The ages in years of 36 pupils who attended a birthday party were recorded as follows:

9	8	10	12	9	6	8	11	8
7	10	9	9	12	9	10	11	9
6	9	10	7	9	11	8	7	10
7	9	9	8	10	6	9	9	13

(a) Make a frequency distribution table for the data. (3 marks)

(b) Calculate the mean age of the pupils. (3 marks)

(c) Calculate the standard deviation of the data. (4 marks)

20. Members of a social welfare group decided to raise Ksh 120 000 to start a chicken rearing project. Before they could start the contributions, 6 members opted out and as a result the remaining members had to contribute each Ksh 1 000 more in order to raise the required amount of money.

(a) Taking the original number of the members of the group to be x, write expressions for:

(i) the amount of money each member would have contributed before the 6 members opted out (1 mark)

(ii) the amount of money that each of the remaining members contributed after the 6 members opted out (1 mark)

(b) Find the original number of members of the social welfare group. (5 marks)

(c) Calculate the amount of money contributed by each of the remaining members. (3 marks)

21. In a certain year, the monthly income tax rates were as shown in the table below.

Monthly Taxable Income (Ksh)	Rate %
Up to 24 000	10
24 001 – 40 667	15
40 668 – 57 334	20
Above 57 334	25

In that year, Waswa earned a basic salary of Ksh 68 450 per month. In addition, he was given a house allowance of Ksh 14 000 per month and a commuter allowance of Ksh 6 084 per month. The tax relief per month was Ksh 2 400.

(a) Calculate:

(i) Waswa's taxable income per month (2 marks)

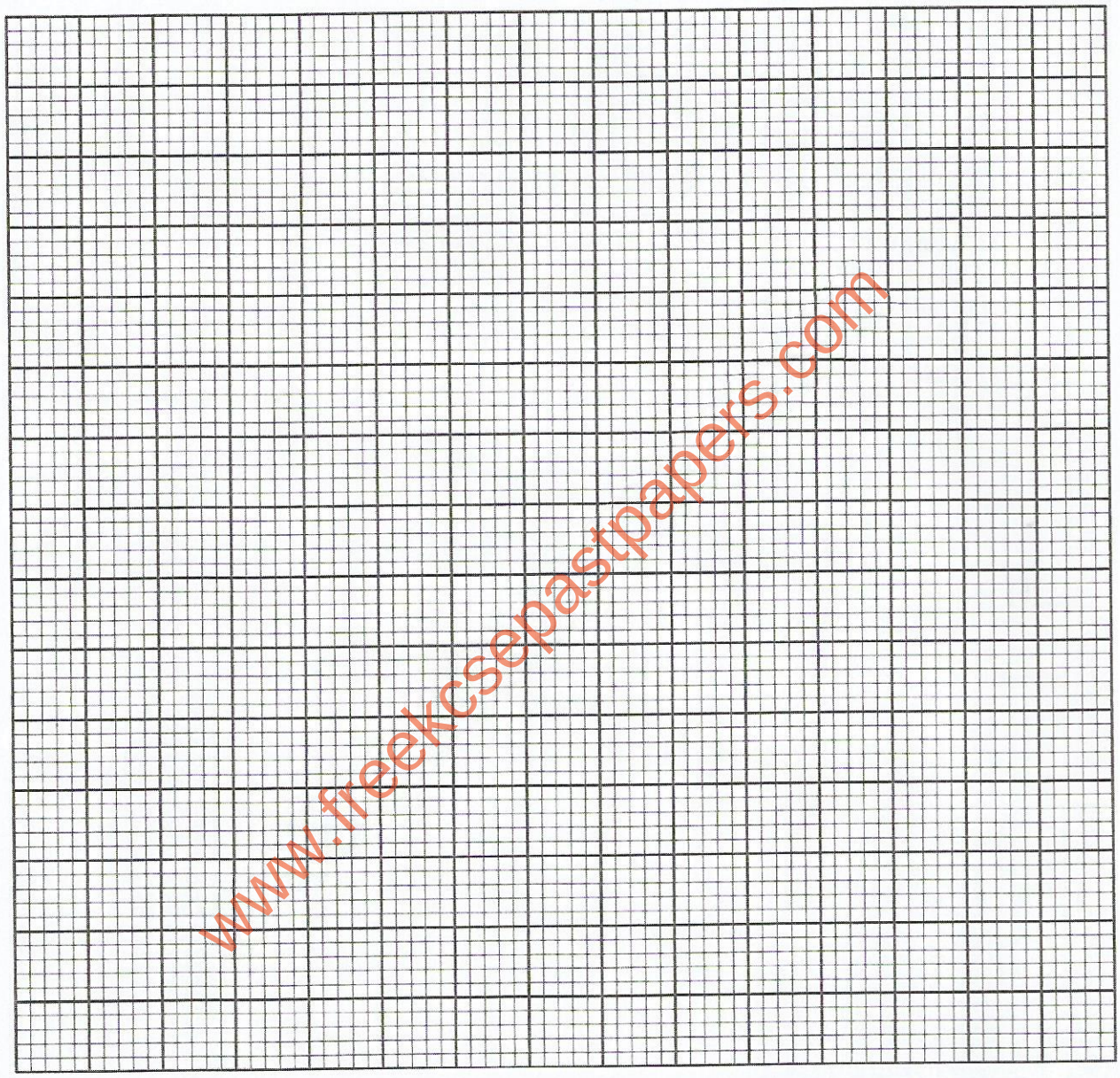
(ii) the income tax he paid per month (5 marks)

(b) In addition, the following deductions were made from Waswa's earnings per month. WCPS – 10% of basic salary, NHIF – Ksh 1 500, NSSF – Ksh 200 and Cooperative shares – Ksh 8 000.

Calculate Waswa's net monthly pay. (3 marks)

22. ABCD is a kite with vertices at A(3,6), B(2,3), C(3,1) and D(4,3).

(a) On the grid provided, draw the kite. (1 mark)



(b) A′B′C′D′ is the image of ABCD under a transformation matrix. $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$.

(i) Find the coordinates of A′B′C′D′. (2 marks)

(ii) On the same grid, draw A′B′C′D′. (1 mark)

(c) A″B″C″D″ is the image of A′B′C′D′ under a reflection on the line $y = x$.

Draw A″B″C″D″. (3 marks)

(d) Find a single transformation matrix, **T**, that maps ABCD onto A″B″C″D″. (3 marks)

23. A curve is defined by the equation $y = x^3 + 3x^2 + 7$.

(a) Complete the table below for $y = x^3 + 3x^2 + 7$ for $-4 \leq x \leq 2$.

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

(2 marks)

(b) On the grid provided, draw the graph of $y = x^3 + 3x^2 + 7$ for $-4 \leq x \leq 2$. Use the scale 2 cm to represent 1 unit on the horizontal axis and 2 cm to represent 5 units on the vertical axis. (3 marks)

(c) Use the graph to determine:

(i) the average rate of change between $x = -4$ and $x = -2$ (2 marks)

(ii) the instantaneous rate of change of the curve at $x = 1$ (3 marks)

24. The coordinates of points A, B and C are A(2,5), B(4,1) and C(8,2).

(a) Find:

(i) **AB** (2 marks)

(ii) Magnitude of **AB**, correct to 2 decimal places (2 marks)

(b) A point D is the midpoint of **AC**. Find the coordinates of D. (2 marks)

(c) A translation vector **T** maps **BC** onto $\begin{pmatrix} 7 \\ 3 \end{pmatrix}$. Find the translation vector **T**. (4 marks)