

3.4.1 MATHEMATICS ALTERNATIVE B (122)

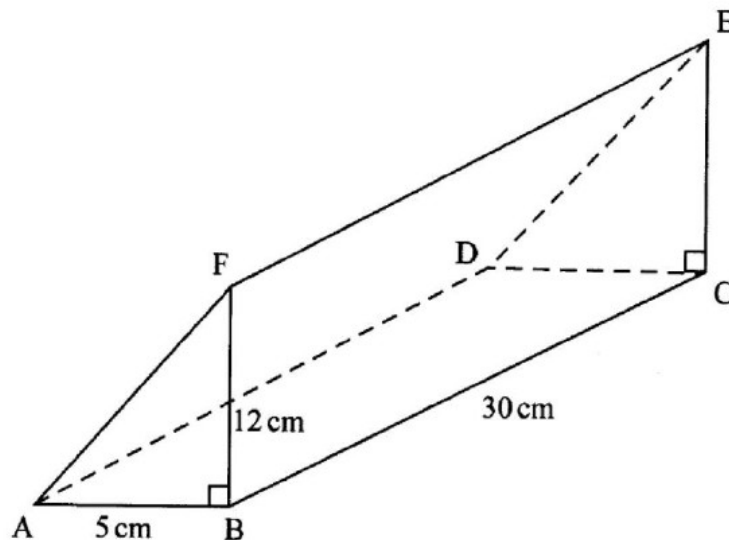
3.4.1 Mathematics Alt.B Paper 1 (122/1)

SECTION I (50 marks)

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

- 1 The population of a certain county was three hundred sixty eight thousand eight hundred and forty nine. Two reporters, A and B gave this figure correct to 3 significant figures and to the nearest hundreds respectively. Find the difference between the numbers given by the reporters. (2 marks)
- 2 A tailor had a ribbon which he intended to cut into equal lengths of either 28 cm, 16 cm or 40 cm. Determine:
 - (a) the shortest length of ribbon that he would use to obtain an exact number of pieces; (2 marks)
 - (b) the number of 16 cm pieces that can be obtained from the ribbon. (1 mark)
- 3 A metal bar with a cross-sectional area of 44 cm^2 has a mass of 5.06 kg. The density of the bar is 2.3 g/cm^3 . Calculate the length, in cm, of the bar. (3 marks)
- 4 Use logarithms, correct to 4 significant figures to evaluate:
$$\sqrt[3]{\frac{0.04068 \times 35.72}{0.2799}}$$
 (3 marks)
- 5 Given that $A = x^2 + 2xh$, find the positive value of x when $A = 360$ and $h = 13$. (3 marks)
- 6 A rectangular field ABCD is such that $AB = 90 \text{ m}$ and $BC = 70 \text{ m}$. A well, W in the field is located 30 m from A and angle $WAB = 45^\circ$. A tree, T also in the field is located 40 m from B and angle $TBA = 40^\circ$. Using a scale drawing:
 - (a) Draw the field and show the positions of W and T; (3 marks)
 - (b) find the distance, in metres, between the well and the tree. (1 mark)
- 7 A chord subtends an angle of 60° at the circumference of a circle of radius 3.5 cm. Determine the area of the minor segment correct to 4 significant figures. (Take $\pi = \frac{22}{7}$) (4 marks)
- 8 Given the inequalities $\frac{3}{2x-1} \geq 5$ and $x > -4$, find the integral values of x that satisfy the inequalities. (3 marks)
- 9 Kassam spent $\frac{1}{5}$ of his monthly salary on house rent, $\frac{3}{8}$ on loan repayment, Ksh 26 000 on domestic expenses and saved the rest. If he saved Ksh 8 000, calculate his monthly salary. (3 marks)

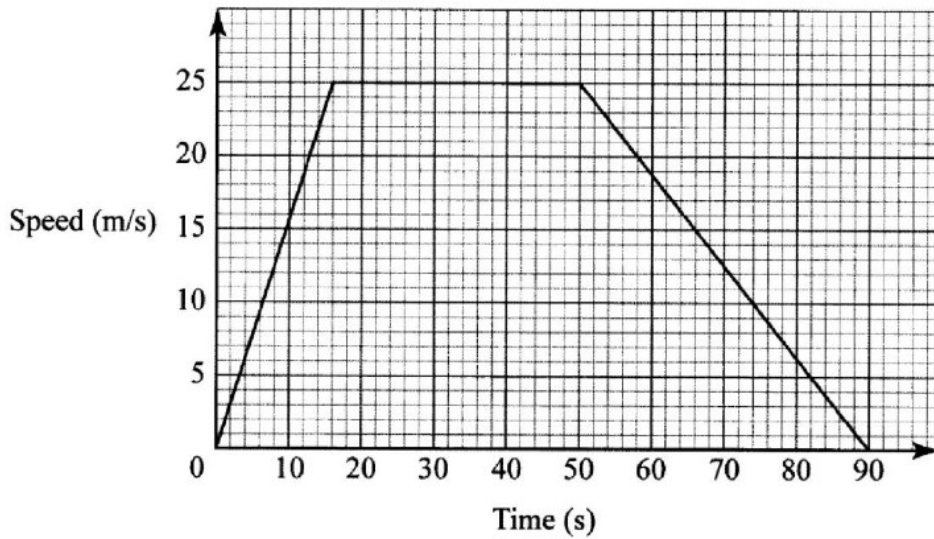
- 10 A line L_1 passes through $(3, -4)$ and is perpendicular to the line $y = 3x - 2$. Determine:
- the equation of L_1 in the form $ax + by = c$ where a, b and c are constants. (3 marks)
 - the x intercept of line L_1 . (1 mark)
- 11 The vertices of a triangle JKL are $J(2,1)$, $K(5,1)$ and $L(3,3)$. The triangle JKL is mapped onto $J'K'L'$ by a rotation of $+90^\circ$ about point $(1, -1)$. On the grid provided below, draw triangle JKL and its image $J'K'L'$. (3 marks)
- 12 Given that $\cos 60^\circ = \frac{1}{2}$, without using mathematical tables or a calculator, find:
- $\sin 60^\circ$ (2 marks)
 - $\tan 30^\circ$ (1 mark)
- 13 A builder used square tiles of side 34.2 cm to cover a rectangular floor of length 307.8 cm and width 236.7 cm. Determine the number of whole square tiles that were fitted on the floor. (3 marks)
- 14 The figure below represents a triangular prism. $AB = 5$ cm, $BC = 30$ cm, $BF = 12$ cm and angle ABF is a right angle.



Calculate the surface area of the prism. (4 marks)

- 15 The volume of a hemisphere is 41.2 cm^3 . Calculate, correct to one decimal place, the radius of the hemisphere. (2 marks)

- 16 The diagram below is a speed-time graph for a car that travelled between two stations in 90 seconds.



Calculate the average speed of the car correct to one decimal place. (3 marks)

SECTION II (50 marks)

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

- 17 A businessman transported bags of rice using 2 lorries and 5 pickups. Each lorry made 4 trips carrying 132 bags per trip. 3 pickups made 7 trips each and the remaining pickups made 6 trips each. The pickups carried the same number of bags each per trip. The ratio of the number of bags transported by the lorries to that transported by the pickups was 8:3.
- (a) Calculate:
- the total number of bags transported; (3 marks)
 - the number of bags carried by a pickup per trip. (4 marks)
- (b) The cost per trip for each lorry was Ksh 5 000 and that of a pickup was Ksh 1 500. Calculate the total cost of transporting the rice. (3 marks)
- 18 A rectangular piece of land has a perimeter of 84 m. Its length is 12 m longer than its width.
- (a) If the width is x m:
- write an expression for the perimeter of the land; (1 mark)
 - find the ratio of the length to the width. (4 marks)
- (b) The piece of land was fenced with 4 strands of barbed wire allowing 30 cm for binding at each end of a strand. A space of 3 m on one side of the land was left for the gate.
- Determine the length of barbed wire that was used. (3 marks)
 - If the fencing poles were 3 m apart, determine the number of poles used. (2 marks)

19 The base of an open rectangular tank is 3 m by 2.5 m and its height is 4 m.

(a) Calculate:

(i) the capacity of the tank in litres. (3 marks)

(ii) the surface area in m^2 of the tank. (2 marks)

(b) An open cylindrical tank has an equal capacity and same height as the rectangular tank in (a) above. Calculate, correct to one decimal place:

(i) the radius of the cylindrical tank; (3 marks)

(ii) the surface area in m^2 of the tank. (2 marks)

20 (a) Using a ruler and a pair of compasses only, construct triangles ABC and ABD on opposite sides of line AB below, such that $\angle DAB = \angle DBA = \angle ABC = \angle BAC = 60^\circ$. (2 marks)



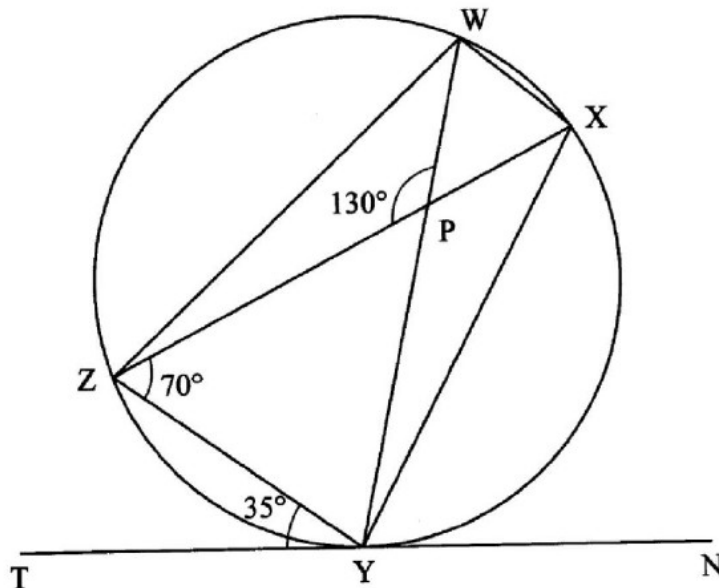
(b) (i) Name the quadrilateral ADBC. (1 mark)

(ii) State two properties of the quadrilateral. (2 marks)

(c) Construct a circle touching all the sides of the quadrilateral. (2 marks)

(d) Determine, correct to one decimal place, the area of the region enclosed by the quadrilateral but outside the circle. (3 marks)

21 In the figure below WXYZ is a cyclic quadrilateral and TYN is a tangent to the circle at Y. Angle $\text{TYZ} = 35^\circ$, angle $\text{YZX} = 70^\circ$ and angle $\text{WPZ} = 130^\circ$.



Giving reasons, find the size of:

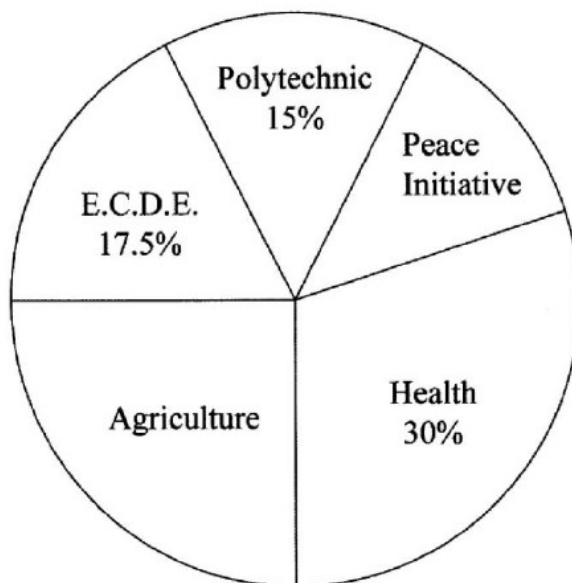
- (a) $\angle XYN$; (2 marks)
- (b) $\angle ZYX$; (2 marks)
- (c) $\angle ZXY$; (2 marks)
- (d) $\angle ZWY$; (2 marks)
- (e) $\angle WXZ$. (2 marks)
- 22** A salesman sold 300 bags of animal feeds to a retailer at Ksh 1 700 each. He was given a commission of 3% on 120 of the bags and 2% on the remaining bags. The salesman allowed a discount of 1.2% on $\frac{3}{5}$ of the bags sold. This discount was deducted from his commission.
- (a) Calculate:
- (i) the discount allowed; (2 marks)
- (ii) the net commission the salesman got. (3 marks)
- (b) The retailer sold all the bags at Ksh 1 850 each and paid Ksh 3 000 for transport. Calculate the profit made by the retailer. (3 marks)
- (c) In addition, a value added tax (VAT) of 16% was charged on the profit made by the retailer. Calculate the amount of tax collected. (2 marks)
- 23** A piece of wire is bent to form the sides of a rectangle whose length is 6 cm more than the width. The area of the rectangle formed is 567 cm².
- (a) Determine the length of the wire. (4 marks)
- (b) The same piece of wire could be bent to form a semi-circle. Determine the area that would be enclosed by the semi-circle, correct to one decimal place. (4 marks)
- (c) Express the area of the semi-circle as a percentage of the area of the rectangle, correct to 3 significant figures. (2 marks)
- 24** A cattle ranch is in the shape of a parallelogram. The length of one side is 600 m and the other is 500 m. The smaller angle between the sides is 30°.
- (a) Calculate the area, in hectares, of the ranch. (3 marks)
- (b) A water point in the shape of a regular hexagon of side 10 m is built in the ranch. Calculate:
- (i) the grazing area, in hectares, correct to 3 decimal places. (4 marks)
- (ii) the number of cattle that can be kept in the ranch if one animal requires a grazing area of 0.625 ha. (3 marks)

3.4.2 Mathematics Alt.B Paper 2 (122/2)

SECTION I (50 marks)

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

- 1 Use a calculator to evaluate $\frac{(3.84)^2 - \sqrt[3]{110.592}}{0.03885}$ (2 marks)
- 2 In a certain year, Odege's annual salary was Ksh 120 600. For the next seven years, his annual increment was Ksh 2 880. Determine:
- (a) Odege's annual salary in the 7th year; (2 marks)
- (b) the total salary that Odege earned during the first six years. (2 marks)
- 3 A curve crosses the x -axis at $x = 1\frac{1}{3}$ and $x = -\frac{1}{2}$. Determine the equation of the curve in the form $ax^2 + bx + c = 0$ where a , b and c are integers. (2 marks)
- 4 Sifa invested an amount of money in a financial institution which paid a simple interest rate of 5% per annum. After $3\frac{1}{2}$ years, the total amount of money in Sifa's account was Ksh 37 600. Calculate the amount of money that Sifa invested. (3 marks)
- 5 A county allocated funds for various projects as shown in the pie-chart below.



The allocation for Agriculture was twice that of Peace Initiative. Calculate the size of the angle of the sector that represents the Peace Initiative. (3 marks)

- 6 Given that matrix $A = \begin{pmatrix} 2 & 1 & 2 \\ 3 & 2 & 1 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix}$, determine $2(AB)$. (3 marks)

- 7 The table below shows the amount of milk, in litres, delivered to a milk processing plant, on a certain day, by 80 farmers.

Milk in litres	10–14	15–19	20–24	25–29	30–34	35–39	40–44	45–49
No. of farmers	2	6	14	24	13	10	8	3

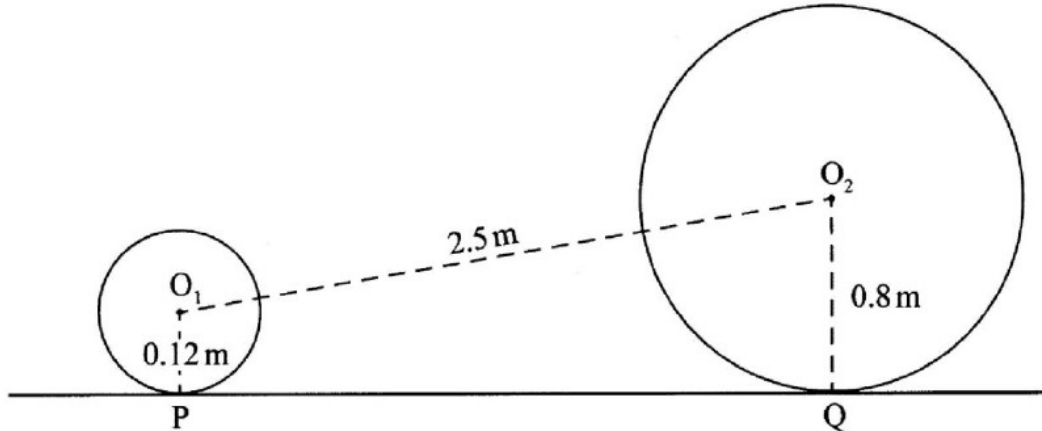
Estimate, by calculation, the median. (3 marks)

- 8 A point A is mapped onto $A'(4, -6)$ by a transformation whose matrix is $\begin{pmatrix} 2 & 0 \\ 0 & -2 \end{pmatrix}$.
Find the co-ordinates of A. (3 marks)

- 9 In a children's home, the amount of water in litres (L) used per month is partly constant and partly varies with the number n , of the children. In a certain month, there were 50 children and the amount of water used was 78 000 L. In another month, there were 70 children and 85 200 L of water was used.

- (a) Form an equation connecting L and n . (1 mark)
(b) Determine the amount of water used in a month when the number of children was 100. (3 marks)

- 10 The figure below shows two circles, centres O_1 and O_2 . PQ is a common tangent to the circles. The radius of the smaller circle is 0.12 m while the radius of the larger circle is 0.8 m. The distance between O_1 and O_2 is 2.5 m.



Calculate the length PQ, correct to 2 decimal places. (3 marks)

- 11 T and R are two towns on the equator. The longitude of T is 12°E and that of R is 5°W . If the local time at T is 2245 h, find the time at R in the 12-hour clock system. (4 marks)
- 12 Given that $4 \tan x - 5 = 0$, find the value of x correct to 2 decimal places for $0^\circ \leq x \leq 360^\circ$. (3 marks)

- 13 A box contains 13 balls which are identical except for the colour. Three of the balls are red while the rest are white. Two balls are picked at random from the box, one at a time, without replacement.
- (a) Using a tree diagram, show all the possible outcomes. (2 marks)
- (b) Find the probability that a red and a white ball are picked. (2 marks)
- 14 The x and y values of points on a curve are as shown in the table below.

x	0.5	1	1.5	2	2.5	3
y	1	3	6	10	15	21

- Using the trapezium rule, estimate the area bounded by the curve, the x -axis and the lines $x = 0.5$ and $x = 3$. (3 marks)
- 15 Points P, Q and R lie on a straight line, such that $PQ = \frac{3}{4}PR$. Given $P(2,5)$ and $R(6,1)$, express in terms of i and j :
- (a) the position vector of P; (1 mark)
- (b) PQ . (2 marks)
- 16 In an experiment, water was heated and its temperature changes recorded at intervals of 2 minutes as shown in the table below.

Time (min)	0	2	4	6	8	10	12	14	16
Temperature ($^{\circ}\text{C}$)	25	35	42.5	50	60	67.5	77.5	85	92.5

- (a) On the grid provided, plot the points and draw the line of best fit. (2 marks)
- (b) Use the line of best fit to estimate the time taken for the temperature of the water to reach 75°C . (1 mark)

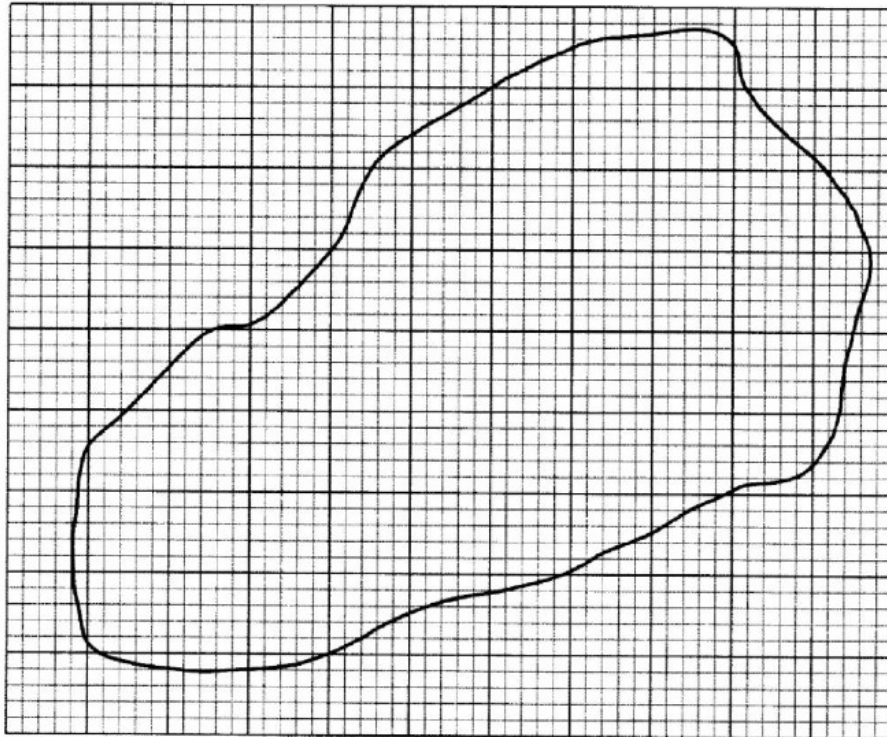
SECTION II (50 marks)

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

- 17 A factory blends three types of juice in the ratios $A:B = 3:4$ and $B:C = 1:2$.
- (a) Determine:
- (i) the ratio $A:B:C$; (1 mark)
- (ii) the amount of type A juice in a 20-litre mixture. (2 marks)
- (b) The cost of producing one litre of A is Ksh 80, one litre of B is Ksh 84 and one litre of C is Ksh 90.
- (i) Find the cost of producing one litre of the mixture. (2 marks)
- (ii) Calculate the selling price of one litre of the mixture if the factory makes a profit of 25%. (2 marks)

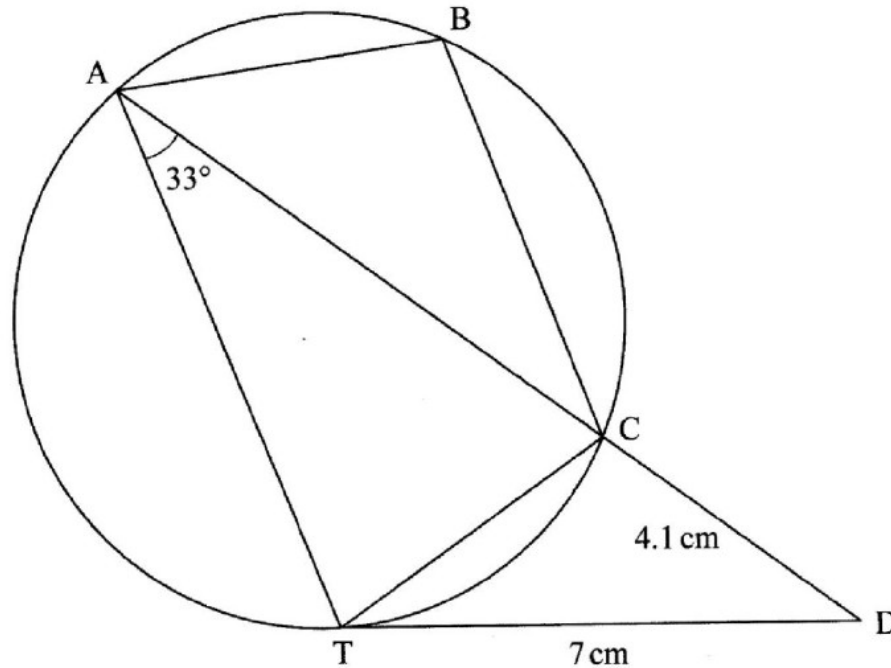
- (c) The factory uses two types of machines P and Q to blend the juices. Machine P takes 7 hours to blend 14 000 litres and Q takes 5 hours to blend 12 000 litres. Determine the time it would take the factory to blend 550 000 litres. (3 marks)

- 18 The diagram below represents a map of a settlement scheme. The map is drawn on a one centimetre square grid. The scale of the map is 1:50 000.



- (a) Estimate:
- the area of the map in square centimetres; (2 marks)
 - the area of the settlement scheme in square kilometres. (3 marks)
- (b) The settlement scheme was sub-divided into parcels of land each of 5 hectares.
- Find the number of the 5 hectare parcels of land obtained. (3 marks)
 - Determine the area in hectares of the settlement scheme that remained after the sub-division. (2 marks)

- 19 In the figure below, TD is a tangent to the circle at T. Chord AC produced intersects TD at D. CD = 4.1 cm, TD = 7 cm and angle TAC = 33° .



- (a) Giving a reason, find the size of angle CTD. (2 marks)
- (b) Calculate the length of AC correct to one decimal place. (3 marks)
- (c) Calculate to the nearest degree the value of:
- (i) the obtuse angle TCD; (3 marks)
- (ii) angle ABC. (2 marks)
- 20 (a) Complete the table below for values of $y = x^3 + 3x^2 + 5$ for $-4 \leq x \leq 2$, correct to 1 decimal place. (2 marks)

x	-4	-3.5	-3	-2.5	-2	-1.5	-1	-0.5	0	0.5	1	1.5	2
y		-1.1	5		9			5.6		5.9		15.1	

- (b) On the grid provided, draw the graph of $y = x^3 + 3x^2 + 5$ for $-4 \leq x \leq 2$. Use the scale: 2 cm for 1 unit on the x -axis and 2 cm for 5 units on the y axis. (3 marks)
- (c) Using the graph, determine:
- (i) the average rate of change between $x = 0.5$ and $x = 1.8$; (2 marks)
- (ii) the instantaneous rate of change of the curve at $x = -3$, correct to one decimal place. (3 marks)

- 21 A pavement is of length $(x - 1)$ m and width $(x - 8)$ m. The area of the pavement is 4.56 m^2 .
- (a) (i) Write a quadratic equation for the area of the pavement in the form $ax^2 + bx + c = 0$ where a , b and c are constants. (2 marks)
- (ii) Using the method of completing the square, find the actual length and width of the pavement. (6 marks)
- (b) The pavement is covered with rectangular tiles measuring 0.4 m by 0.3 m . Determine the number of tiles used to cover the pavement completely. (2 marks)
- 22 Omari bought a house valued for Ksh 4 000 000. The value of the house appreciated at 20% per annum for the first three years and then at 15% per annum for the next two years.
- (a) Calculate the value of the house after:
- (i) three years, (2 marks)
- (ii) five years. (2 marks)
- (b) After the five years, the value of the house depreciated for the next two years. At the end of the two years, Omari sold the house through an agent. Omari received Ksh 7 125 000 after paying a 5% commission to the agent.
- Calculate:
- (i) the value of the house after the two years; (2 marks)
- (ii) the annual rate of depreciation in the two years. (4 marks)
- 23 A quadrilateral ABCD has vertices $A(-3, 1)$, $B(-2, 3)$, $C(-3, 4)$ and $D(-4, 3)$.
- (a) (i) Find the co-ordinates of $A'B'C'D'$, the image of ABCD, under a transformation whose matrix is $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$. (2 marks)
- (ii) On the grid provided, draw the quadrilateral ABCD and its image $A'B'C'D'$. (2 marks)
- (b) $A''B''C''D''$ is the image of $A'B'C'D'$ under a transformation whose matrix is $\begin{pmatrix} 0 & -1 \\ -1 & 0 \end{pmatrix}$, followed by an enlargement scale factor 2, centre $(0,0)$.
- (i) Determine the co-ordinates of $A''B''C''D''$. (2 marks)
- (ii) On the same grid as in (a) (ii) above, draw $A''B''C''D''$. (1 mark)
- (iii) Find a single transformation matrix that maps $A''B''C''D''$ onto ABCD. (3 marks)

- 24 The masses, to the nearest kg, of 65 patients who attended a medical clinic are as shown in the table below:

Mass (kg)	26–30	31–35	36–40	41–45	46–50	51–55
Frequency (f)	9	13	20	15	6	2

Calculate:

- (a) the mean mass of the patients; (4 marks)
- (b) (i) the variance mass; (5 marks)
- (ii) the standard deviation. (1 mark)