

SECTION I (50 marks)

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

- 1 Without using a calculator, evaluate:

$$270 \div (90 \times 2) + 7 \times 4 - 40 \div 5. \quad (2 \text{ marks})$$

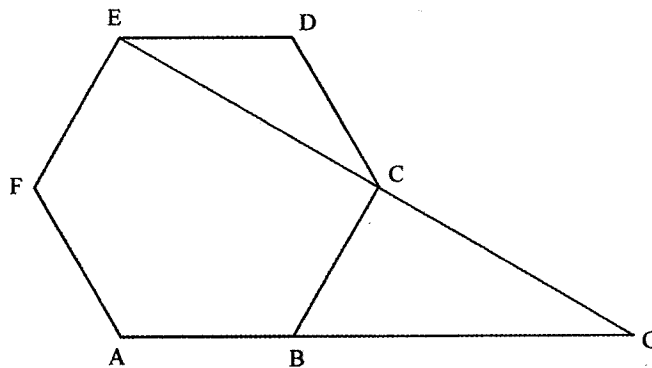
- 2 Use the prime factors of 7056 to find $\sqrt{7056}$ (2 marks)

- 3 Given that $x = -2$, $y = 3$ and $z = 5$, evaluate $\frac{2x + 3(y + z)}{4yz}$. (2 marks)

- 4 The length of a rectangular floor of a hall is 35.2m. If the diagonal of the floor is 37.7m, Calculate the area of the floor. (3 marks)

- 5 Use logarithms to evaluate $\frac{43.2 \times 0.015}{\sqrt[3]{0.00679}}$. (4 marks)

- 6 In the figure below, ABCDEF is a regular polygon. Line AB and EC are each extended to meet at G.



Calculate the size of angle BGC. (3 marks)

- 7 Without using a calculator, evaluate:

$$\frac{3\frac{1}{3} + \frac{6}{7} \text{ of } 5\frac{4}{9}}{4\frac{2}{5} - 3\frac{1}{2}} \quad (3 \text{ marks})$$

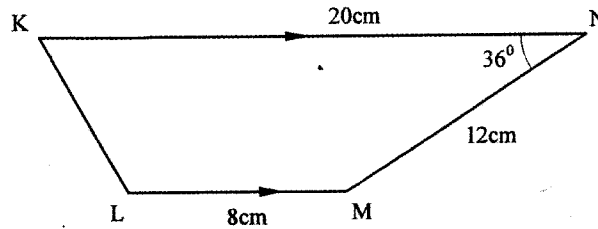
- 8 The base of a rectangular water tank is 4 m long and 3.5m wide. The tank contains 21 000 litres of water. Calculate the height of the water in the tank. (3 marks)

- 9 Using a pair of compasses and a ruler only, construct:

- (a) a triangle ABC such that $AB = 6 \text{ cm}$, $BC = 3.5 \text{ cm}$ and $CA = 4 \text{ cm}$; (1 mark)
- (b) a circle to pass through the vertices of the triangle ABC. (2 marks)

- 10 Solve the inequality $3x - 2 < 10 + x \leq 2 + 5x$. (3 marks)

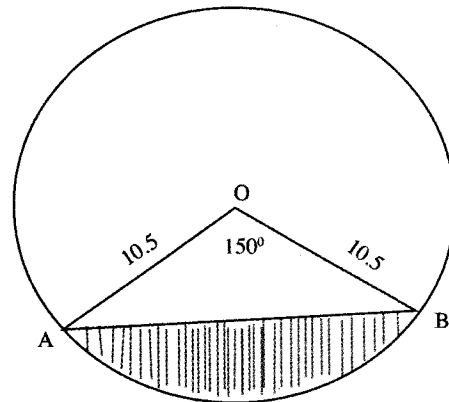
- 11 The figure below shows a trapezium KLMN in which KN is parallel to LM, $KN = 20 \text{ cm}$, $MN = 12 \text{ cm}$, $LM = 8 \text{ cm}$ and $\angle KNM = 36^\circ$.



Calculate the length of the perpendicular from M to KN and hence find the area of the trapezium. (4 marks)

- 12 The price of a shirt and that of a pair of trousers are increased in the same ratio. The price of the shirt is increased from Ksh 800 to Ksh 1 200. If the new price of the pair of trousers is Ksh 2 700, calculate its original price. (3 marks)

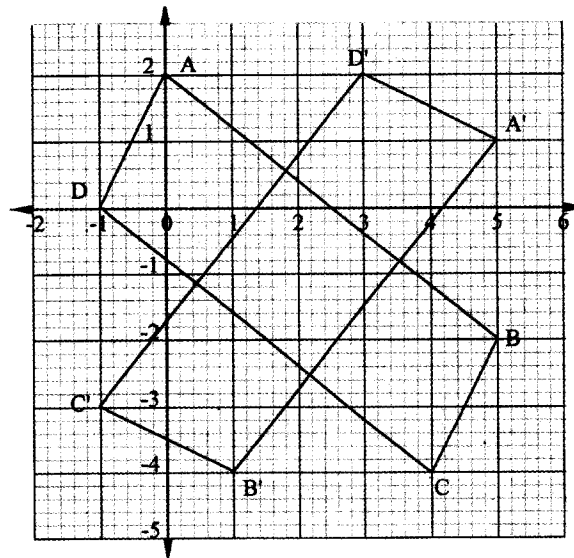
- 13 The figure below is a circle centre O of radius 10.5 cm. Angle AOB = 150°.



Calculate the area of the shaded part of the circle, correct to 4 significant figures. (4 marks)

- 14 Three alarms are programmed to sound at intervals of 25 minutes, 30 minutes and 35 minutes. Given that the three alarms sound together at a particular time, determine the time, in hours, it will take for them to sound together again. (4 marks)

- 15 The figure below shows a quadrilateral ABCD and its image A'B'C'D' under a rotation.



Determine:

- (a) the centre of rotation; (2 marks)
- (b) the angle of rotation. (1 mark)

- 16 A saleswoman was paid a basic salary of Ksh12 000 per month. She also received commission in two parts as follows:

2% for sales of up to Ksh 30 000,
3 ½% for sales above Ksh 30 000.

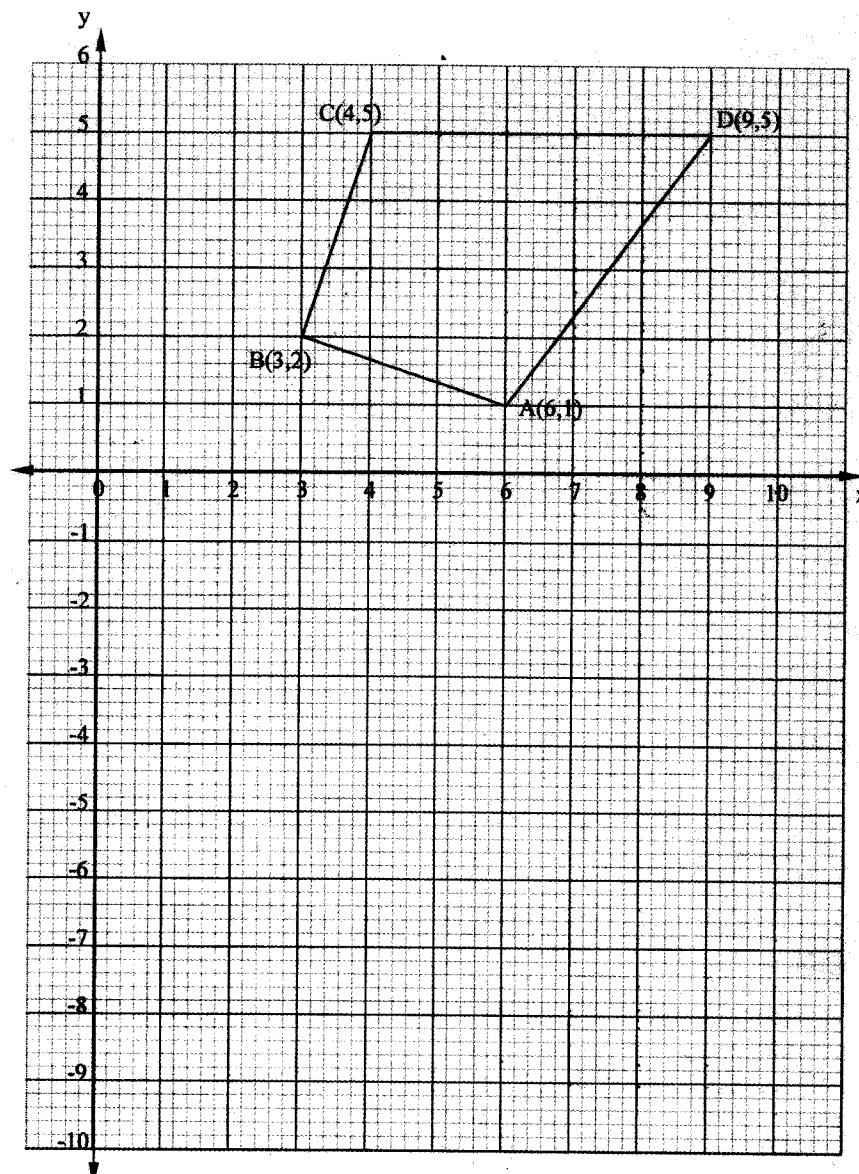
In one month she sold goods worth Ksh 84 000. Determine the saleswoman's total earnings that month. (4 marks)

Answer only FIVE questions in this section in the spaces provided.

- 17 A tourist from Britain had 2400 sterling pounds (£). On arrival in Kenya, he changed the money into Kenya shillings at the rate of £1 = Ksh120. He spent Ksh135 000 in Kenya, before proceeding to Tanzania, where he changed the remaining money into Tanzanian shillings at the rate of Ksh1 = Tsh 16.5. While in Tanzania, the tourist spent 40% of the money. He changed the remaining amount into sterling pounds at the rate of £1 = Tsh1980.

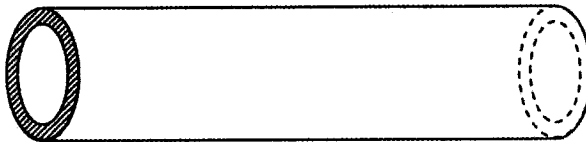
Calculate:

- (a) the amount of money, in Kenya shillings, the tourist received after exchanging £2400; (2 marks)
- (b) the amount of money, in Tanzanian shillings, the tourist spent while in Tanzania; (5 marks)
- (c) the amount of money, in sterling pounds, the tourist received after exchanging from Tanzanian shillings. (3 marks)
- 18 The points A(6,1), B(3,2), C(4,5) and D (9,5) are vertices of an object ABCD as shown in the figure below.



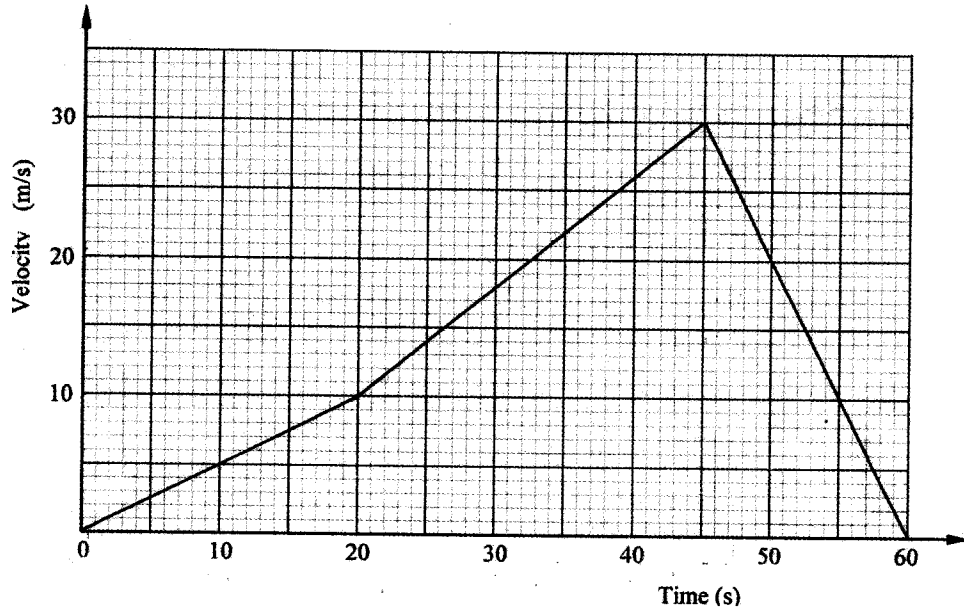
- (a) Draw the image $A'B'C'D'$ of ABCD under reflection in the mirror line $y = 0$. (2 marks)
- (b) The images of A' , B' , C' and D' under reflection are $A''(1, -6)$, $B''(2, -3)$, $C''(5, -4)$ and $D''(5, -9)$.
On the same diagram above, draw;
- (i) $A''B''C''D''$; (1 mark)
- (ii) the mirror line of the reflection. (2 marks)
- (c) Determine:
- (i) the equation of the mirror line of the reflection that maps $A'B'C'D'$ on to $A''B''C''D''$; (2 marks).
- (ii) the matrix of reflection that maps $A'B'C'D'$ onto $A''B''C''D''$. (3 marks)

- 19 The length and width of a rectangular plot of land are given as $(7x + 5)$ m and $(x + 10)$ m respectively.
- (a) Express the area of the plot in the form $ax^2 + bx + c$. (2 marks)
- (b) If the area of the plot is 600 m^2 , find the perimeter of the plot. (6 marks)
- (c) Trees are to be planted along the sides of the plot at intervals of 5m, with a tree at each corner.
Calculate the number of trees to be planted. (2 marks)
- 20 The diagram below represents a pipe whose cross-section is shaded. The pipe has internal radius of 0.26m and an external radius of 0.3m.



- (a) Calculate, to 2 decimal places, the cross-section area of the pipe. (3 marks)
- (b) The length of the pipe described above is 6.5m. Calculate to 2 decimal places:
- (i) the external surface area of the pipe; (3 marks)
- (ii) the internal surface area of the pipe; (2 marks)
- (iii) the total surface area of the pipe. (2 marks)
- 21 Towns A, B and C are located such that B is 400 km to the north of A and town C is 750 km on a bearing of 225° from town B.
- (a) Using a scale of 1 cm to represent 100 km, show by scale drawing the locations of towns A, B and C. (3 marks)
- (b) Determine the bearing and the distance of town A from town C. (4 marks)
- (c) Find the shortest distance from A to BC. (3 marks)
- 22 The volume of a cuboid is 64m^3 . The volume of a smaller similar cuboid is 512 cm^3 .
- (a) Express the volume of the larger cuboid in cm^3 . (2 marks)
- (b) Calculate the ratio of the surface area of the larger cuboid to that of the smaller cuboid. (5 marks)
- (c) To paint the smaller cuboid requires 0.004 litres of paint. If the cost of 1 litre of paint is Ksh120, calculate the cost of painting the larger cuboid. (3 marks)

- 23 The figure below is a velocity - time graph for a car that travelled from $t = 0$ to $t = 60$, where t is time in seconds.



Use the graph to calculate:

- the distance travelled by the car between $t = 0$ s and $t = 20$ s; (2 marks)
 - the average velocity of the car between $t = 0$ s and $t = 45$ s. (5 marks)
 - the acceleration of the car during the last 15 seconds. (3 marks)
- 24 The angle of elevation of the top of a vertical mast, viewed by an observer 50m away, was found to be 16.7° .
- Calculate to the nearest centimetre:
 - the height of the mast; (3 marks)
 - the length of a cable fixed at the point of the observer to the top of the mast. (3 marks)
 - Another observer, directly behind the first one, finds the angle of elevation of the top of the mast to be 8.35° . Find the distance between the two observers. (4 marks)

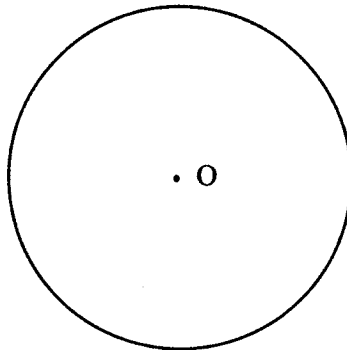
29.3.4 Mathematics Alt. B Paper 2 (122/2)

SECTION I (50 marks)

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

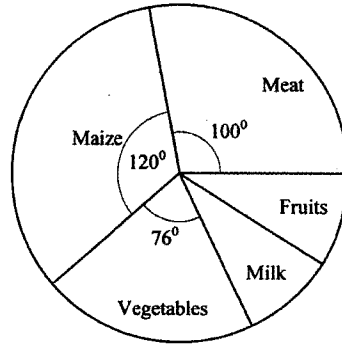
- 1 Use a calculator to evaluate $\frac{(0.52)^3 \times \sqrt{4.17}}{3.58911}$ and give the answer correct to 5 significant figures. (2 marks)
- 2 Given that $\mathbf{P} = \begin{pmatrix} 2 & 4 \\ -3 & -7 \end{pmatrix}$, $\mathbf{Q} = \begin{pmatrix} -1 & 2 \\ 0 & -3 \end{pmatrix}$ and $\mathbf{R} = \mathbf{P} - 2\mathbf{Q}$ find:
- (a) \mathbf{R} ; (2 marks)
- (b) \mathbf{PR} . (2 marks)
- 3 Solve by factorisation, the quadratic equation:
 $2x^2 - 3x - 5 = 0$ (3 marks)
- 4 Make n the subject of the formula. (3 marks)
- $$b = \sqrt{\frac{en}{n+p}}$$
- 5 The figure below shows a circle centre O and external point X .

X
•



- (a) Construct a tangent from X to touch the circle at a point P . (2 marks)
- (b) Measure the length of XP . (1 mark)
- 6 Given that $\mathbf{OA} = 6\mathbf{p} - 4\mathbf{q}$, $\mathbf{OB} = 2\mathbf{p} - 14\mathbf{q}$ and $\mathbf{AB} = m(2\mathbf{p} + 5\mathbf{q})$, find the value of m . (4 marks)
- 7 An inlet pipe fills an empty water tank in 8 hours while an outlet pipe empties the full tank in 5 hours. When the tank is full, the inlet and outlet pipes are opened at the same time. Calculate:
- (a) the fraction of the tank that is emptied in 1 hour; (2 marks)
- (b) the time it takes for the tank to be completely emptied. (1 mark)

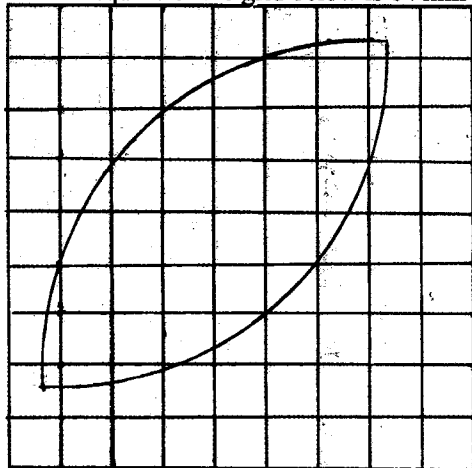
- 8 The pie-chart below represents the expenditure of a family in a certain month on maize, meat, vegetables, fruits and milk.



During that month, the family spent equal amounts of money on milk and fruits.

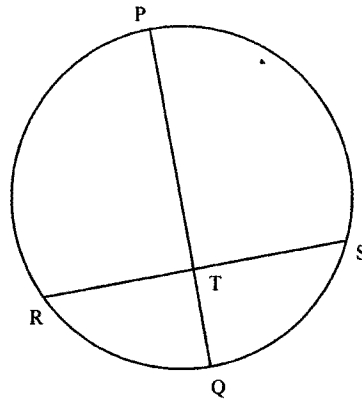
- (a) Calculate the size of the angle of the sector representing expenditure on milk. (2 marks)
- (b) If the cost of milk was Ksh 528, calculate the total expenditure on all the items. (2 marks)

- 9 The area of each small square of the grid below is 64 mm^2 .



Estimate in mm^2 , the area of the figure drawn on the grid. (3 marks)

- 10 (a) Find the determinant of the matrix $\begin{pmatrix} 3 & 1 \\ 1 & 1 \end{pmatrix}$. (1 mark)
- (b) A rectangle whose area is 15 cm^2 is transformed by the matrix $\begin{pmatrix} 3 & 1 \\ 1 & 1 \end{pmatrix}$. Determine the area of its image under the matrix of the transformation. (2 marks)
- 11 The second term of a geometric sequence is 24 and the fifth term is 192. Find the first term of the sequence. (3 marks)
- 12 In the figure below, PRQS is a circle of radius 17cm. Line PQ is a diameter of the circle and is perpendicular to chord RS at T.



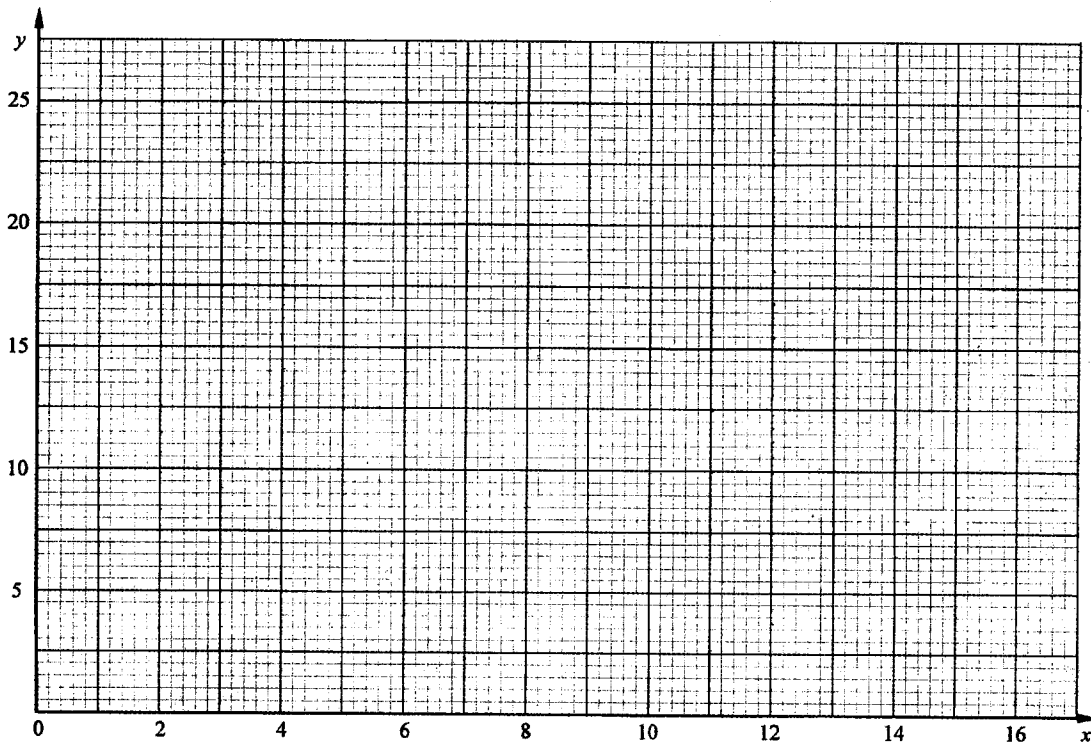
Given that $PT = 25$ cm, calculate the length of :

- (a) TQ ; (1 mark)
- (b) RS . (2 marks)

13 The table below gives values of two variables x and y obtained from an experiment.

x	4	8	10	11	13	16
y	24	17.5	14	12	9	4

- (a) On the grid provided below, plot the values of y against x and draw the line of best fit. (2 marks)



- (b) Use the graph to estimate the value of y when $x = 7$. (1 mark)

14 The positions of two points A and B on the surface of the earth are A(32.8°N , 26°E) and B(21.2°S , 26°E).

Calculate in kilometres the shortest distance between A and B.

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

(3 marks)

- 15 A building was valued at Ksh 720 000 on 1st January 2007. The value of the building appreciated at 2% per annum in the first year. The value of the building then depreciated at the rate of 5% for the next 2 years. Calculate the value of the building at the end of year 2009. (3 marks)
- 16 Below is a travel timetable for a bus travelling from town P to town S via towns Q and R.

Town	Arrival Time	Departure Time
P		11.30a.m
Q	12.15p.m	12.25p.m
R	1.05p.m	1.25p.m
S	2.15p.m	

If the distance between town P and town S is 220km, calculate the average speed at which the bus travels. (3 marks)

SECTION II (50 marks)

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

- 17 A shop sells a certain type of fridge at a cash price of Ksh 80 000. If the fridge is bought on Hire Purchase (H.P), a deposit of Ksh 24 000 is paid. A customer is also charged 15% per annum simple interest on the balance of the cash price after deposit is paid. Khamala bought one such fridge on H.P. He paid the balance plus the interest in 5 equal monthly instalments.
- (a) Calculate:
- the total simple interest charged over the 5 months; (3 marks)
 - his monthly instalment. (2 marks)
- (b) Fatuma bought the same type of fridge as Khamala from the same shop. She was offered a 4% discount on the cash price. Calculate how much more Khamala paid for the fridge than Fatuma. (5 marks)
- 18 The terms of an Arithmetic sequence are 2,5,8,11, ...
- (a) Find:
- the common difference of the sequence; (1 mark)
 - the next two terms of the sequence; (2 marks)
 - the 30th term of the sequence. (2 marks)
- (b) The sum of the first n terms of the sequence is 5430. Given that the last term is 179, find n , the number of terms of the sequence. (2 marks)
- (c) Calculate the sum of the first 50 terms of the sequence. (3 marks)

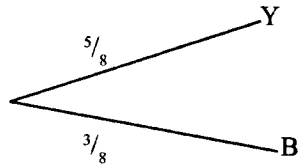
- 19 The table below represents the number of streams in 20 schools.

No. of streams	Frequency
(x)	(f)
3	5
4	4
5	3
6	4
7	2
8	2

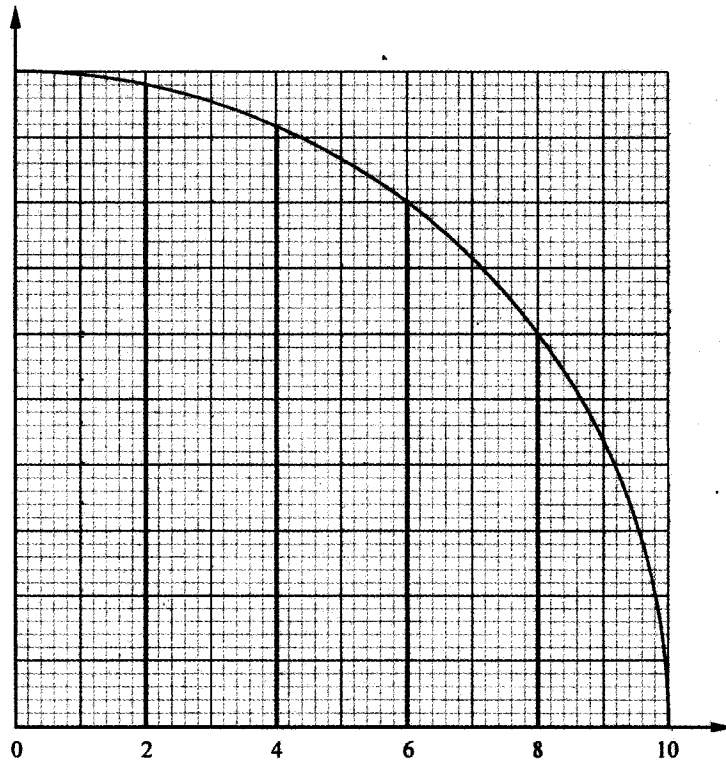
Calculate:

- (a) the mean number of streams per school; (3 marks)
- (b) the variance; (5 marks)
- (c) the standard deviation correct to 2 decimal places. (2 marks)
- 20 A bag contains 5 yellow (Y) balls and 3 blue (B) balls. All the balls are identical except for the colour. A ball is drawn at random from the bag without replacement and its colour noted. A second ball is drawn at random from the same bag and its colour also noted.

- (a) Complete the tree diagram below to represent the situation above. (2 marks)

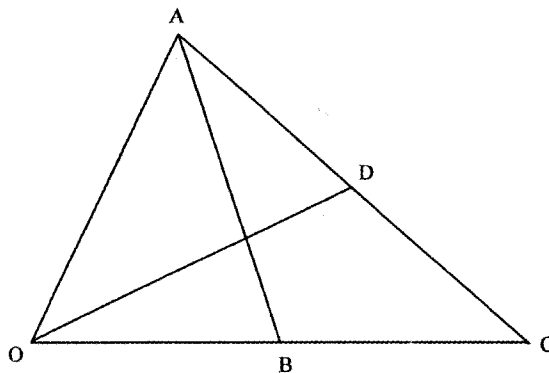


- (b) Calculate the probability that:
- (i) both balls are yellow; (2 marks)
- (ii) both balls are of the same colour; (3 marks)
- (iii) the two balls are of different colours. (3 marks)
- 21 Triangle ABC is such that $AB = 4$ cm, $BC = 7$ cm and angle $ABC = 100^\circ$. Calculate to 2 decimal places:
- (a) the area of triangle ABC; (2 marks)
- (b) the perimeter of triangle ABC; (4 marks)
- (c) the size of angle ACB. (4 marks)
- 22 A quadrant (a quarter of a circle) of radius 10 cm is drawn on the grid below. The quadrant is divided into 5 vertical strips.



- (a) Determine the lengths of the vertical lines passing through 2, 4, 6 and 8. (2 marks)
- (b) Use the trapezium rule with the five strips to estimate the area of the quadrant. (4 marks)
- (c) By taking $\pi = 3.142$, calculate to 4 significant figures, the exact area of the quadrant. (2 marks)
- (d) Express the estimated area in part (b) as a percentage of the area calculated in part (c), giving the answer to the nearest whole number. (2 marks)

- 23 The figure below shows a triangle OAC in which B is the mid-point of OC and D is the mid-point of AC.



Given that $\mathbf{OA} = 2\mathbf{i} + 5\mathbf{j}$ and $\mathbf{OB} = 4\mathbf{i} + \mathbf{j}$,

- (a) determine in terms of \mathbf{i} and \mathbf{j} :
- (i) \mathbf{AB} ; (2 marks)
- (ii) \mathbf{AC} . (3 marks)

- (b) Determine the magnitude of **OD**. (5 marks)

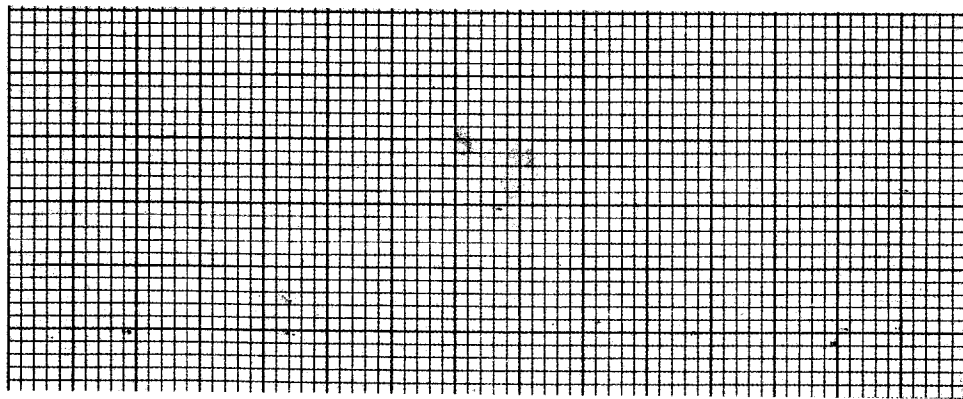
24 Some water is heated in a beaker and then left to cool for 12 minutes. After the heating is stopped, the relationship between the water temperature C , in degrees centigrade and the time t , after heating is given as $C = 100 - \frac{1}{2} t^2$.

- (a) Use the relationship $C = 100 - \frac{1}{2} t^2$ to complete the table below.

Time t (minutes)	0	2	4	6	8	10	12
Temperature ($^{\circ}\text{C}$)	100					50	

(2 marks)

- (b) On the grid provided, draw the graph of temperature against time.
Take the scale: 1 cm for 1 minute on x - axis and 1 cm for 10°C for y -axis. (4 marks)



- (c) Use the graph to determine:
- the average rate at which the water is cooling during the last five minutes; (2 marks)
 - the rate at which the water is cooling when $t = 3$. (2 marks)